CATALOGUE OF KEUFFEL & ESSER CO.

NEW YORK

BRANCHES:

CHICAGO. ST. LOUIS.

1900-01.

1900-1901.

CATALOGUE
AND PRICE-LIST
OF

KEUFFEL & ESSER CO.

MANUFACTURERS AND IMPORTERS
OF

DRAWING MATERIALS
AND
SURVEYING INSTRUMENTS

NEW YORK

127 FULTON STREET — 42 ANN STREET

BRANCHES:
CHICAGO: 111 MADISON STREET
ST. LOUIS: 708 LOCUST STREET

FACTORIES:
HOBOKEN N.J

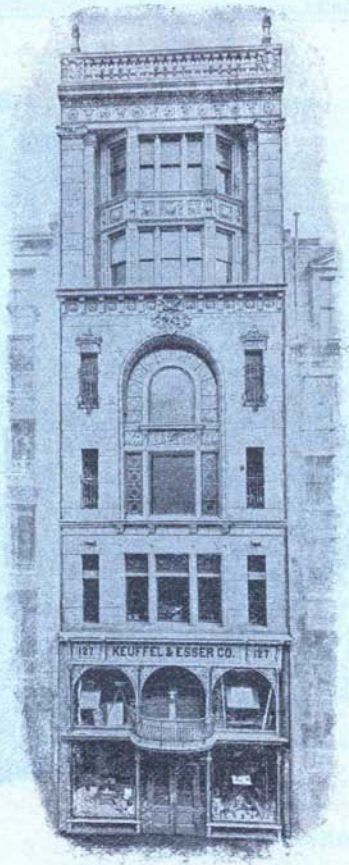
30TH EDITION.

PRICE 50 CENTS

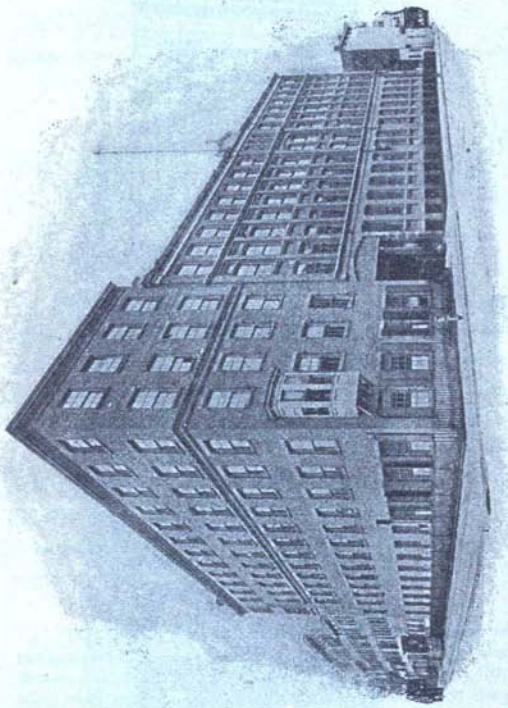
SPECIAL NOTICE.

WE beg to call attention to the fact that we have copyrighted this entire book, and have also separately copyrighted about four hundred illustrations contained in it, and much of the descriptive and explanatory matter concerning different instruments and appliances, although the general copyright of the book covers all of its contents. We have done this at considerable expense, for the purpose of protecting our patrons and the public generally from imposition at the hands of those unscrupulous dealers, who have reproduced our superior cuts and closely copied our descriptions for the purpose of making inferior articles appear to be ours or the same as ours.

This pocket edition is a photographic reduction of our general catalogue (large octavo edition, price 50 cents) Where sizes of articles are stated with the cuts in this book they apply to the larger edition from which they were photographed, and are therefore not correct for the cuts in this edition.



NEW YORK SALESROOMS,
127 FULTON STREET, EXTENDING TO 42 ANN ST.



FACTORY OF KEUFFEL & ESSER CO., HOBOKEN, N. J.

New York, October 1st, 1900

For this thirtieth edition of our Catalogue we respectfully bespeak the same kind reception with which the former editions have been favored. It contains a considerable amount of new matter in the shape of new goods and of additions to the descriptive matter.

The constantly increasing demand for Surveying Instruments of our make is undeniable proof, that our unceasing efforts to attain the highest standard in finish and accuracy for this class of instruments is appreciated by our Engineering friends. We publish separately a list of testimonials from Engineers of high standing throughout the country, who have used our Surveying Instruments in actual practice and we are satisfied to have these testimonials speak for themselves. We continue to make, and list in this catalogue, also a line of instruments for ordinary work at proportionately lower prices. We also make to order instruments of precision according to drawings and specifications. We attend to such orders as quickly as work already in hand will permit and our charges are as low as they can be made.

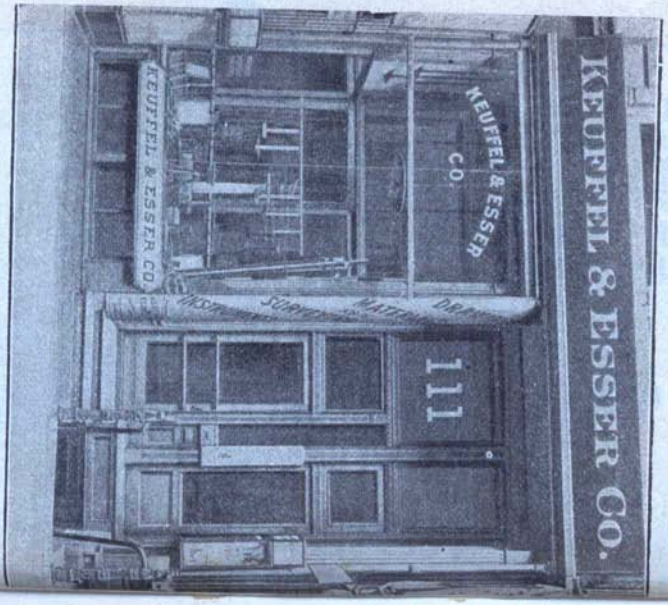
The views of some of the departments of our warehouse and of the more important departments in our factories shown in this catalogue, will serve to give those of our friends, who do not visit New York, an idea of our facilities for making and handling goods.

We have branch-houses in CHICAGO (at 111 Madison str.) and in ST. LOUIS (at 708 Locust str.), where we carry a full line of our goods. (See pages VI & VIII) **These branches are for the convenience of our friends and patrons in the West and South West, who can there obtain our genuine goods, in much quicker time, than from New York.**

It will be our endeavor, as in the past, to merit the liberal and constantly increasing patronage which we are enjoying.

Very Respectfully,

KEUFFEL & ESSER CO.



CHICAGO BRANCH: 111 MADISON STREET.

sumer not to accept any substitutes whatever may be claimed for them.

We either make or absolutely control those goods which we list as ours, and these are conceded since many years to be the best of their kind and grade.

Yours respectfully,

Keuffel & Esser Co.

NEW YORK.

CHICAGO. ST. LOUIS.

NOTICE.

This 30th edition of our catalogue supersedes all former editions.

The prices in this Catalogue are Net Cash, in New York, Chicago or St. Louis, and are subject to change without notice.

In ordering by this Catalogue it is necessary to give the number with the price of the article and in some cases the sub-number, size, color, etc.

Remittances can be made either by a bank-draft, payable to our order, by Cash sent through any of the Express-Companies, or by Post-Office Money-Order. If Cash is sent by mail, the letter should be registered.

Remittances are in all cases at the risk of the sender.

For goods ordered to be sent by express, the **bill to be collected on delivery,** a remittance to cover packing and expressage both ways, is required with the order. **Express-Charges for Collection will be added to the amount of the bill.**

By sending full remittance with the order, buyers will save the collection charges and have their goods delivered sooner.

For special goods to be made to order and not listed in our Catalogue, we invariably require payment when the order is placed.

Small articles can be sent by mail in open packages at one cent per ounce, and this postage must be added to the price of the goods so ordered, **but we are not responsible for goods lost or injured in transmission by mail.**

Registering mail matter lessens the risk of loss.

The "Home Ins. Co." of this city insures the delivery of mail packages at the rate of 5 cents per $5.00 of value. We insure in this way when so ordered or when insurance seems advisable.

As we use every precaution in packing goods, no allowance can be made if goods are damaged in direct shipments or in enclosures through other houses.

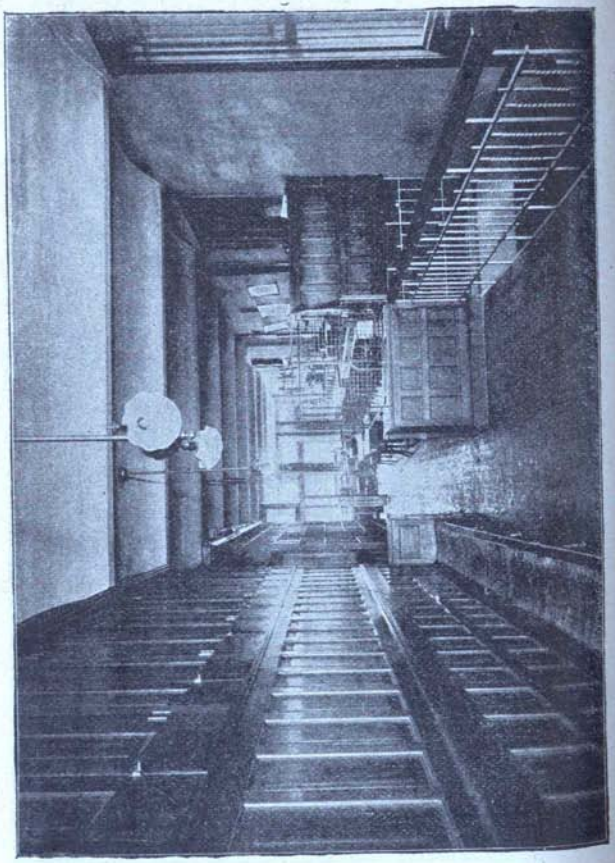
Boxes, which may be required for packing, will be charged at cost.

We must decline to send goods on approval, but we hold ourselves accountable for the correctness of the descriptions of our goods in this catalogue.

Should any of our goods not prove satisfactory, we solicit prompt information; all complaints shall have our careful attention, as we aim to satisfy our patrons in every respect, in order to maintain the reputation we are now enjoying.

ST. LOUIS BRANCH: 708 LOCUST STREET.

RETAIL DEPARTMENT, FULTON STREET.



MAIN OFFICE, NEW YORK.

KEUFFEL & ESSER CO. NEW YORK.

DRAWING PAPERS

IN SHEETS.

WHATMAN'S HAND-MADE.

Whatman's Drawing Papers "**Selected Best**" and "**Retree**" are made as one quality but are afterwards examined and separated at the mill. The sheets without imperfections are called" **Selected Best.**" Both bear either the watermark "WHATMAN" or "WHATMAN TURKEY MILLS."

These papers are made with three different styles of surface:

HP. signifies "**Hot Pressed**", has a smooth surface; mostly used for pencil and very fine line-drawings.

N. signifies "**Not Hot Pressed**", has a finely grained surface; used for general purposes and water-color drawing.

R. signifies "**Rough**", (Torchon Paper) has a coarsely grained surface; used for very bold drawing and sketching.

In ordering state Catalogue number, size, and surface wanted (HP. N. or R.).

1. Whatman's, with "**HP**" or "**N**" surface.

Cap	13 × 17 in.	per quire	$ 60
Demy	15 × 20 "	"	90
Medium	17 × 22 "	"	1 25
Royal	19 × 24 "	"	1 55
Super Royal	19 × 27 "	"	1 85
Imperial	22 × 30 "	"	2 60
Atlas	26 × 34 "	"	3 55
Double Elephant	27 × 40 "	"	4 80
Antiquarian	31 × 53 "	"	14 75
"	31 × 53 "	per sheet	80

1 A. Whatman's, with "**HP**" or "**N**"surface. **Selected Best.**

Cap	13 × 17 in.	per quire	$ 80
Demy	15 × 20 "	"	95
Medium	17 × 22 "	"	1 40
Royal	19 × 24 "	"	1 80
Super Royal	19 × 27 "	"	2 10
Imperial	22 × 30 "	"	3 00
Atlas	26 × 34 "	"	4 00
Double Elephant	27 × 40 "	"	5 75
Antiquarian	31 × 53 "	"	27 00
"	31 × 53 "	per sheet	1 50

For mounted Whatman's papers see page 14.

WHATMAN'S HAND-MADE, cont'd.

2. Whatman's, with "R" surface. **Selected Best only.**

Royal	19 × 24 in.	per quire	$ 1 80	per sheet	$ 10
Imperial	22 × 30 "	"	3 00	"	18
Double Elephant	27 × 40 "	"	5 75	"	30

3. Whatman's, Extra heavy, with surface as below. **Selected Best only.**

Royal	19 × 24 in. N. or R.	per quire	$ 3 45	per sheet	$ 20
Imperial	22 × 30 " HP., N. or R.	"	6 90	"	40
Double Elephant	27 × 40 " HP., N. or R.	"	10 35	"	60

The above is a reduced facsimile of the label of Universal Paper.

4. **Universal** Paper. (Each sheet watermarked *Universal*)

Our Universal Drawing Paper is of pure stock, free from adulterations and very carefully sized. A perfect, porous, soft and uniform pencil-mark can be produced on it. It takes ink and color well, and its erasing properties are perfect, making it the best and most popular paper for Colleges and Schools.

The several sizes are of different thickness, the smallest size being the thinnest and the others progressively thicker. See description, page 10.

Cap	14 × 17 in.	per quire	$ 33
Demy	15 × 20 "	"	50
Medium	17 × 22 "	"	66
Royal	19 × 24 "	"	84
Super Royal	19 × 27 "	"	1 00
Imperial	22 × 30 "	"	1 30
Double Elephant	27 × 40 "	"	2 50

5. **Normal** Paper (each sheet stamped)

This is a drawing paper of very superior quality with smooth surface for LINE DRAWINGS in ink or pencil. It stands erasing perfectly and is very tough.

We highly recommend this paper for elaborate or complicated drawings, on account of its hard and smooth surface, and for working drawings on account of its strength and durability.

Royal	19 × 24 in.	per quire	$ 1 65
Imperial	22 × 30 "	"	2 35
Double Elephant	27 × 40 "	"	3 60

Normal paper in boxes of 250 sheets (strong box with hinged front, for storing the paper flat).

Royal	19 × 24 in.	$ 14 20
Imperial	22 × 30 "	20 50
Double Elephant	27 × 40 "	31 50

Samples sent on application, or general sample book for 15c.

8. **Paragon** Paper, ☞ for description see page 11.

(Each sheet stamped)

Royal, thin, rough	19 × 24 in.	per quire	$ 1 80
Imperial " "	22 × 30 "	"	2 75
Double Elephant, medium, rough	27 × 40 "	"	5 25

9. **Paragon** Paper, ☞ for description see page 11.

(Each sheet stamped )

Double Elephant, medium, smooth, 27 × 40 in. per quire $ 5 25

The Paragon Paper is the finest and best drawing paper which can be made. It is superior to any other for any kind of work, pen, pencil or water color, will not turn brittle with age and has erasing qualities which are possible only in a paper of this high grade. We warrant every piece of Paragon paper to fully bear out our recommendation.

The Royal and Imperial sizes are both of the same thickness; the two kinds of paper of Double Elephant size are also both of the same thickness, but heavier than the smaller sizes.

10. **Duplex** Paper, cream color, ☞ for description see page 9

(Each sheet stamped )

Royal	19 × 24 in.	per quire	$ 1 10
Imperial	22 × 30 "	"	1 60
Double Elephant	27 × 40 "	"	2 60

11. **Duplex** Paper, drab color, ☞ for description see page 9.

(Each sheet stamped)

Double Elephant 27 × 40 in. per quire $ 3 10

16. K. & E. Bondpaper, white.

Royal	19 × 24 in.	per quire	$ 65
Imperial	22 × 30 "	"	1 00
Double Elephant	27 × 40 "	"	1 75

An exceedingly tough paper of light weight, permits of folding (creasing) to any extent and therefore specially well adapted for maps and drawings which are to be carried in the pocket.

17. Reynold's white Bristol Board, smooth surface.

			2 sheets.	3 sheets.	4 sheets.
Cap	12½ × 15½ in.	per doz.	$ 60	90	1 20
Demy	14⅜ × 18½ "	"	90	1 35	1 75
Medium	16½ × 20½ "	"	1 20	1 80	2 40
Royal	18½ × 22⅜ "	"	1 50	2 40	3 10
Imperial	21½ × 28½ "	"	— —	— —	6 00

Samples sent on application, or general sample book for 15c.

18. English Parchment, best quality. (Genuine parchment, made of animal skin.)

	14 × 18	16 × 20	18 × 24	23 × 31 in.
per doz	$ 5 50	7 20	9 00	14 00
per sheet . .	50	70	90	1 40

19. Gelatine or Glasspaper.

	thin	medium	thick
18 × 19 in., per sheet	$ 20	25	30
17 × 21 " " "	30	35	40

20. Polygraph Transfer Paper, black, blue, vermilion, graphite.
10 × 15 in. . . . . per quire $ 1 00, per sheet $ 05

KEUFFEL & ESSER CO.'S
SUPERIOR BRISTOL BOARDS.

No. 22.

Stamped with Trade-Mark:

This Bristol Board has a hard surface, possesses unlimited erasing properties and can be rolled without injury. It has the thickness, color, quality and size required by the U. S. Patent Office and is far preferable to other Bristol boards because it does not have their high glossy surface.

21. Patent Office Bristol Board, 3 sheet, blank,
10 × 15 in. (U. S. size) . . . . . per gross $ 6 50, per doz. $ 60
15 × 20 " (English size) . . . . " " 13 00, " " 1 20

22. Patent Office Bristol Board, 3 sheet, printed with border etc.
10 × 15 in. . . . . per gross $ 8 65, per doz. $ 85

23. Saragow Drawing Card, rough, 19 × 24 in. . . . per sheet $ 20
" " " " 22 × 30 " . . . " 35
" " " " 27 × 40 " . . . " 1 00

This excellent Drawing Card is adapted for fine drawings, perspectives, water-color drawings etc. The surface is similar to Whatman's "Not Hot Pressed."

24. Saragow Drawing Card, smooth, 19 × 24 in. . . per sheet $ 20
" " " " 22 × 30 " . . . " 35
" " " " 27 × 40 " . . . " 1 00

Like No. 23, but surface similar to Whatman's "Hot Pressed."

25. Tinted Cardboard, for drawings.

Grey	22 × 28 in.	per doz.	$ 2 50	per sheet	$ 25
Pearl . . .	22 × 28 "	"	2 50	"	25
Grey . . .	25 × 35 "	"	3 50	"	35
Pearl . . .	25 × 35 "	"	3 50	"	35
Black . . .	22 × 28 "	"	2 00	"	20

26. White Mounting Board.

	22 × 28 4 ply.	22 × 28 6 ply.	22 × 28 8 ply.	30 × 40 in. 10 ply.
per doz. . .	$ 75	1 00	1 20	3 00
per sheet .	08	10	12	30

Nos. 23 to 26 must be packed flat for shipment, as they would be injured by rolling them. Packing charges are about 5 cents per square foot.

28. Rubber Cloth, black, 36 in. wide . . . . . per yard $ 45

This fabric is impervious to moisture and pliable, so that it makes an excellent cover for the drawing board and a good wrapper for drawings.

30. Binding Strips, to protect the edges of paper from tearing
Gummed and folded, 36 in. long × 1 in. wide . . . per dozen $ 35

DETAIL PAPERS CONTINUOUS.

(For Drawing Papers see page 8.)

SMOOTH MANILLA PAPERS.

40. Smooth Manilla, three weights: X, XX, XXX, in rolls of about 100 pounds, 36, 40, 48, 54 in. wide, ... per pound $ 10

The smooth Manilla papers are occasionally used for detail and preliminary drawings. While we exercise all possible care in their selection, we can not assume any responsibility for their being suitable for drawing.

MANILLA TISSUE PAPER.

46. Manilla Tissue Paper

48 in. wide, per roll of 50 yards $1 60
48 " " 100 " 3 00

This Paper takes ink and pencil equally well, stands erasing, is strong and tough, and is a good paper for coarse tracings.

TRANSPARENT SKETCHING PAPER.

47. *Economy* Transparent Sketching Paper.

36 in. wide, in rolls of 50 yards. . . . . per roll $ 2 00
60 " " " " " 50 " . . . . . " 3 25

This paper is especially made for sketching, transferring etc. It is a white paper, sufficiently transparent to be used as a tracing paper for detail drawings.
It is strong and tough, stands erasing by rubber and knife, and takes pencil, ink and color well.
On account of its exceedingly low price it will often obviate the necessity of having to revert to manilla papers.

SIMPLEX DETAIL PAPER.

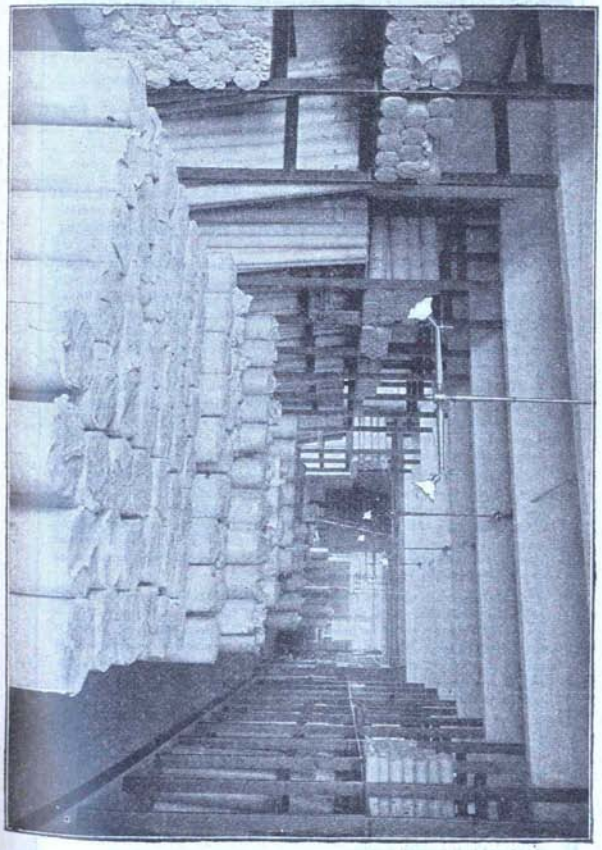
48. SIMPLEX Detail Paper, medium, in rolls of about 100 pounds,
36, 42, 48 or 54 in. wide, ... per pound $ 12

36 in. wide, per roll of 50 yards	$ 2 25	per roll of 100 yards	4 00
42 " " " " " "	2 60	" " " "	4 70
48 " " " " " "	2 95	" " " "	5 35
54 " " " " " "	3 25	" " " "	6 00

49. SIMPLEX Detail Paper, heavy, in rolls of about 100 pounds,
36, 42, 48 or 54 in. wide. . . . . per pound $ 12

36 in. wide, per roll of 50 yards	$ 2 75	per roll of 100 yards	5 00
42 " " " " " "	3 10	" " " "	5 75
48 " " " " " "	3 65	" " " "	6 75
54 " " " " " "	4 00	" " " "	7 50

The "Simplex" Detail Papers are especially made for us by one of the most expert manufacturers and possess the qualities of a drawing paper as far as they can be attained in manilla papers. The surface is slightly grained, rough enough to take the pencil readily and smooth enough to be adapted for ink work. The color is a shade deeper than that of ordinary manilla paper, to make it less liable to appear soiled. Special attention has been paid to the erasing qualities of these papers, and we recommend them as a considerable improvement over the common manilla papers.



ROLL PAPER LOFT, FULTON STREET.

DRAWING PAPER.

Good drawing paper must combine many different features, and these the buyer should be able to distinguish, to be in a position to discriminate between various kinds, so as to make a selection suitable to the purpose for which he intends to use the paper.

First in importance is the material from which it is made, and second the mode of manufacture, both of which become manifest when the finished article is used. Good drawing paper should be strong, of uniform thickness and surface, stretch evenly, neither repel nor absorb liquids, admit of considerable erasing without detriment to its surface, should not become either brittle or discolored by reasonable exposure and age, and should not buckle when stretched or when inks or colors are applied to it.

It is impossible to combine all these features in one paper, so that all may be apparent in their utmost degree of perfection; thus, the greatest strength cannot be combined with the finest surface, as is particularly exemplified in the case of manilla fibre, which, although one of the strongest materials used in the manufacture of paper, cannot be made into *drawing* paper.

The careful draughtsman is therefore under the necessity of selecting that paper which unites the greatest number of those qualities which are most adapted to his special requirements. To make a personal selection every time he is in need of paper is out of the question. He is therefore generally obliged to rely upon the descriptions of the papers offered him, and then to trust that the one selected will be as described, and will also possess the same qualities at any future time when it may be required again.

Each one of the papers listed in this catalogue possesses certain special and distinctive features of its own, which are set forth accurately and with a view to enabling the buyer to judge of its merits. **Every one of our papers is made solely and specially for us, and can in no case be procured except from us, or from dealers who purchase their supply from us.** The qualities and distinctive features of each paper are strictly maintained and successive orders can be given with the assurance that the same article will invariably be furnished.

The following assortment has been made after careful study of the draughtsman's wants, based on more than a quarter of a century's experience, and we believe it will be found to meet all requirements. It has been made comprehensive enough to answer all purposes, but no more so, in order that selection may be facilitated. No two of these papers possess all of the same features, nor are different designations and descriptions applied to the same paper, with a view to apparently increase the assortment. Each paper stands by itself, and each one will be found to give satisfaction, if selected with due regard to its special qualities.

The good results of such a policy are manifested by the reputation gained by our

Universal, Paragon, Duplex, Anvil and *Normal*

papers, whose trade-marks are looked upon by professionals all over the country as standards of excellence.

In consequence of this a great many imitations, especially of DUPLEX and PARAGON papers have been put on the market; they are offered under similar names and are palmed off as identical with or similar to our papers; to protect our customers, we here repeat, that our Papers cannot be obtained under another name.

DRAWING PAPERS

CONTINUOUS IN ROLLS.

Reduced facsimiles of labels of our Drawing Papers.

50—52. *Duplex* A Detail drawing paper, introduced by us, has met with great success. It is tough, hard, uniform in grain and finish, stands erasing very well and takes ink and water color perfectly. The buff or cream color is agreeable to the eye and permits of handling without soiling.
Nos. 10 and 11 (on page 2) are the same papers in sheets.

Each roll water-marked *Duplex*.

50. *Duplex*, medium, cream color.

30 in. wide, rolls 30 to 40 pounds,	per pound	$	29
	" 10 yard piece	1	15
	" yard		13
36 in. wide, rolls 30 to 40 pounds,	" pound		29
	" 10 yard piece	1	35
	" yard		15
42 in. wide, rolls 30 to 40 pounds,	" pound		29
	" 10 yard piece	1	70
	" yard		20
56 in. wide, rolls 30 to 40 pounds,	" pound		29
	" 10 yard piece	2	15
	" yard		25
62 in. wide, rolls 30 to 40 pounds,	" pound		29
	" 10 yard piece	2	50
	" yard		30

52. *Duplex*, thick, drab color.

36 in. wide, rolls 30 to 40 pounds,	per pound	$	29
	" 10 yard piece	1	60
	" yard		18
56 in. wide, rolls 30 to 40 pounds,	" pound		29
	" 10 yard piece	2	65
	" yard		30

Samples sent on application, or general sample book for 15c.

55. **Universal.** An almost pure white paper of good quality with slightly grained surface, suitable for work in ink, color, pencil or crayon. It is used for general office work, preliminary drawings, and probably more than all other papers in Technical Schools and Universities. Similar paper, generally offered under the name of "German Drawing Paper", should not be confounded with our "Universal."

No. 4 is the same paper in sheets, but of a thickness proportionate to each size.

Each roll water-marked Universal.

55. **Universal**, medium.

36 in. wide, rolls 30 to 40 pounds,	per pound	$ 40
	" 10 yard piece	1 70
	" yard	20
42 in. wide, rolls 30 to 40 pounds,	" pound	40
	" 10 yard piece	1 00
	" yard	24
56 in. wide, rolls 30 to 40 pounds,	" pound	40
	" 10 yard piece	3 00
	" yard	35
62 in. wide, rolls 30 to 40 pounds,	" pound	40
	" 10 yard piece	3 40
	" yard	40

60—62. **Anvil** A very tough and hard paper, matchless for working-drawings used out of doors or in the work shop, where drawings are subject to rough handling. This paper has a slightly grained surface, similar to Whatman's "Not" and stands erasing to the greatest extent.

Each roll water-marked Anvil.

60. **Anvil**, medium.

36 in. wide, rolls 30 to 40 pounds,	per pound	$ 45
	" 10 yard piece	2 15
	" yard	25
42 in. wide, rolls 30 to 40 pounds,	" pound	45
	" 10 yard piece	2 65
	" yard	30
62 in. wide, rolls 30 to 40 pounds,	" pound	45
	" 10 yard piece	4 00
	" yard	45

62. **Anvil**, thick.

62 in. wide, rolls 30 to 40 pounds,	per pound	$ 45
	" 10 yard piece	4 80
	" yard	50
72 in. wide, rolls 30 to 40 pounds,	" pound	50
	" 10 yard piece	5 75
	" yard	65

Samples sent on application, or general sample book for 15c.

70—76. **Paragon** papers are so well and favorably known, that there is but little to say about them; they are **universally acknowledged to be the best.**

We warrant Paragon Paper and exchange all which does not give perfect satisfaction.

70—71—72—73 have a sand-grained or pebbled surface (similar to eggshells), adapted for general drawings, either in lines or in wash. For elevations, perspectives and most kinds of finished drawings no better paper can be found.

We list some of these Paragon papers in sheets under Nos. 8 and 9.

Each roll water-marked Paragon.

70. **Paragon**, thin, rough.

58 in. wide, rolls 30 to 40 pounds,	per pound	$ 50
	" 10 yard piece	4 00
	" yard	45

71. **Paragon**, medium, rough.

36 in. wide, rolls 30 to 40 pounds,	per pound	$ 50
	" 10 yard piece	3 00
	" yard	33
42 in. wide, rolls 30 to 40 pounds,	" pound	50
	" 10 yard piece	3 50
	" yard	38
58 in. wide, rolls 30 to 40 pounds,	" pound	50
	" 10 yard piece	4 50
	" yard	50

72. **Paragon**, thick, rough.

58 in. wide, rolls 30 to 40 pounds,	per pound	$ 50
	" 10 yard piece	5 75
	" yard	65

73. **Paragon**, extra thick, rough.

58 in. wide, rolls 30 to 40 pounds,	per pound	$ 50
	" 10 yard piece	7 20
	" yard	80

75—76 have a grain like Whatman's "not hot pressed" on one side, while the other side is smooth, adapting them for drawings to be reproduced by a photographic or similar process.

75. **Paragon**, medium, smooth.

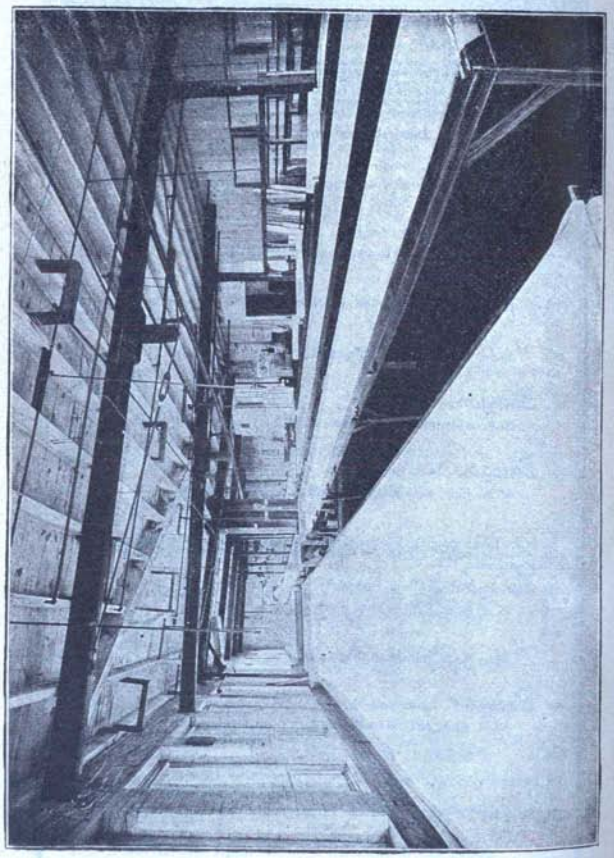
36 in. wide, rolls 30 to 40 pounds,	per pound	$ 50
	" 10 yard piece	3 00
	" yard	33
58 in. wide, rolls 30 to 40 pounds,	per pound	50
	" 10 yard piece	4 50
	" yard	50

76. **Paragon**, thick, smooth.

58 in. wide, rolls 30 to 40 pounds,	per pound	$ 50
	" 10 yard piece	5 75
	" yard	65

93.	Steinbach's Solar Printing and Crayon Paper, 53 in. wide, thin, per y'd	35
94.	" " " " " " 53 " " thick "	50
98.	Drawing Parchment, medium, 38 in. wide, per roll of 20 yards	3 00
99.	" " thick, 38 " " " " " 10 "	3 20

Samples sent on application, or general sample book for 15c.



PAPER MOUNTING LOFT, FACTORY.

KEUFFEL & ESSER CO. NEW YORK.

MOUNTED DRAWING PAPERS.

MOUNTED ON MUSLIN, IN ROLLS OF 10 OR 20 YARDS.

Reduced facsimiles of labels of our mounted papers.

Our papers are mounted stretched, and then air-dried. This refers also to 20 yard rolls and to papers in sheets of any size. They are therefore much superior to papers mounted by compression between rollers and dried by passing over heated rollers. The rollers distort and strain the paper, and the drying by heat injures the paper and the adhesive. The photograph of our mounting room, on the preceding page, shows our facilities for mounting papers.

As the mounting obscures the watermarks, and to protect our customers against faulty mounting or mounting on inferior muslin, we stamp our papers, when mounted by us, with their name as below in red ink along the edge of each roll and on the back.

			No. 100 is No. 55 mounted. For description see page 10.				
100.	Universal,	36 in.	wide, per 10 yard roll	$ 5 40	per yard	$	70
	do.	42	" "	6 80	"		85
	do.	56	" "	9 50	"	1	20
	do.	62	" "	11 80	"	1	50
			No. 103 is No. 50 mounted. For description see page 9.				
103.	Duplex,	36 in.	wide, per 10 yard roll	$ 5 10	per yard	$	65
	do.	42	" "	6 50	"		80
	do.	56	" "	8 65	"	1	10
	do.	62	" "	10 90	"	1	40
			No. 105 is No. 60 mounted. For description see page 10.				
105.	Anvil,	36 in.	wide, per 10 yard roll	$ 6 80	per yard	$	85
	do.	42	" "	8 20	"	1	00
	do.	62	" "	13 25	"	1	60
			No. 106 is No. 62 mounted. For description see page 10.				
106.	Anvil,	62 in.	wide, per 10 yard roll	$ 15 00	per yard	$ 1	90
	do.	72	" "	18 00	"	2	30
			Nos. 110, 111, 112, 115, 116, are Nos. 70, 71, 72, 75, 76, mounted. For description see page 11.				
110.	Paragon	58 in.	wide, per 10 yard roll	$ 11 40	per yard	$ 1	25
111.	do.	36	" "	7 50	"	1	00
	do.	42	" "	8 85	"	1	10
	do.	58	" "	11 75	"	1	40
112.	do.	58	" "	13 00	"	1	60
115.	do.	36	" "	7 50	"	1	00
	do.	58	" "	11 75	"	1	40
116.	do.	58	" "	13 00	"	1	60
119.	Paper Cloth, smooth,	38	" "	4 50	"		50

20 yard rolls cost double the price of 10 yard rolls.

Samples sent on application, or general sample book for 15c.

MOUNTED DRAWING PAPERS,

IN SHEETS.

MOUNTED ON MUSLIN.

125. *Unchangeable Drawing Board*

This Board consists of two sheets of drawing papers mounted on one side of strong muslin and so selected and chemically prepared that they form a flat and hard board which will neither contract nor expand under changing atmospheric conditions. For drawings that require extreme exactness or are to be preserved on record, there is no material that will equal our Unchangeable Board.

The drawing surface is the heaviest Paragon drawing paper.

19 × 24 in.		per sheet	$ 65
22 × 30 "		"	80
27 × 40 "		"	1 20
31 × 53 "		"	2 25

Intermediate sizes furnished at corresponding prices.

130. Whatman's Drawing Paper, mounted.

Royal	19 × 24 in.,	Selected Best,	per sheet	$ 38
Imperial	22 × 30 "	"	"	45
Double Elephant.	27 × 40 "	"	"	75
Antiquarian	31 × 53 "	"	"	1 80
	31 × 53 "	Retree	"	1 35

135. *Paragon* Drawing Paper, in sheets, mounted.

Our mounted Paragon papers in sheets are made of paper No. 71.

× 24 in.	per sheet	$ 32
22 × 30 "	"	40
27 × 40 "	"	70
31 × 53 "	"	1 10

The muslin on mounted paper in sheets is trimmed to the size of the paper. If sheets are wanted with muslin standing over on one or more sides, this must be stated in the order.

137. *Paragon* Drawing Paper, in sheets, mounted on both sides of the muslin ("muslin between") for record books, etc.

× 24 in.	per sheet	$ 55
22 × 30 "	"	70
27 × 40 "	"	1 15
31 × 53 "	"	1 50

Other sizes of mounted sheets furnished to order.

Large pieces for City, County or State-Maps mounted to order, by joining and overlapping the contiguous edges. Our facilities in this line are unequaled and we have furnished perfect sheets as large as 15 × 30 feet, which were highly satisfactory and proved durable in use.

Samples sent on application, or general sample book for 15c.

TRACING CLOTHS (VELLUM).

EXCELSIOR.

150. In rolls of 24 yards, one side glazed, the other dull.

	30	36	42	in. wide
per roll	$ 8 65	9 35	12 25	

The Excelsior Tracing Cloth is far superior to any other, extremely transparent, and very uniform. It is therefore particularly well adapted for tracing faint or complicated drawings, and it is superior to any other cloth for tracings which are intended for copying by the blue or black process.

CORRECTION.

No. 156. Imperial Cloth, 48 in., ...per Roll, $14 20

	30	36	42	in. wide
per roll	$ 6 90	7 60	10 50	

DOWSE'S.

159. In rolls of 24 yards, one side glazed, the other dull.

	30	36	42	in. wide
per roll	$ 6 00	7 00	9 35	

UNION.

160. In rolls of 24 yards, one side glazed, the other dull.

	30	37	40	43	in. wide
per roll	$ 6 00	6 80	8 00	9 50	

The Union Cloth is heavier and less transparent than the others. On account of its strength it is adapted for tracings which are intended for much handling.

POUNCE FOR TRACING CLOTH.

166. Pounce for Tracing Cloth, in tin shakers . . . . . each $ 15

When cloth will not take ink readily, apply a small quantity of the pounce to the surface of the cloth and distribute it evenly by rubbing with a piece of cotton waste, chamois, or similar material. The pounce must be thoroughly removed, before applying the ink.

Samples of Tracing-Cloth sent on application, or general sample book for 15c.

KEUFFEL & ESSER CO. NEW YORK.

TRACING PAPERS

in Sheets.

Reduced facsimiles of labels of our tracing papers.

170. *Vegetable* very tough and transparent.

Cap	13 × 17 in.	per quire	$ 90
Demy	16 × 20 "	"	1 25
Royal	19 × 25 "	"	2 00
Imperial	22 × 28 "	"	2 50
Double Elephant	29 × 42 "	"	10 00

176. *Cupola* very tough and transparent, well adapted for photo-printing, 28 × 39 in. . . . . per quire $ 4 00

178. *Hermes* one side with slight grain.

20 × 30 in.	per quire	$ 95
30 × 40 "	"	1 90

180. *Ceres* tough and transparent, thin.

20 × 27 in.	per quire	$ 80
27 × 40 "	"	1 50

182. *Corona* like No. 180 but medium thick.

27 × 40 in. . . . . per quire $ 2 00

The **Vegetable, Ceres** and **Corona** described above, and the **Alba, Lotus** and **Libra** Papers on the next page are **natural** tracing papers. They will not discolor nor become brittle with age, like the prepared papers.

Samples sent on application, or general sample book for 15c.

KEUFFEL & ESSER CO. NEW YORK.

TRACING PAPERS

continuous in rolls.

Reduced facsimiles of labels of our tracing papers.

190 *Parchment*, medium, very tough.
37 in. wide, in rolls of 20 yards . . . . . per roll $ 3 50

191 *Parchment*, thick, very tough.
37 in. wide, in rolls of twenty yards . . . . . " 4 30

192. *Mixcus*, very thin and transparent.
42 in. wide, in rolls of 10 yards . . . . . " 2 75

194. *Patera*, stout, very tough, suitable for machinists.
42 in. wide, in rolls of 20 yards . . . . . " 3 85

196. *Corinthian*, very tough and transparent, well adapted for photo-printing. 39 in. wide, in rolls of 20 yards " 4 00

198. *Gothic*, very tough and transparent.
42 in. wide, in rolls of 20 yards . . . . . " 3 40

200 *Doric*, medium.
42 in. wide, in rolls of 20 yards . . . . . " 2 60

202. *Alba*, (not prepared) for transferring.
54 in. wide, in rolls of 44 yards . . . . . " 4 60
54 " " " " " 22 " . . . . . " 2 30

204. *Lotus*, transparent and tough, thin.
42 in. wide, in rolls of 20 yards . . . . . " 1 50

206. *Libra*, like No. 204 but medium thick.
42 in. wide, in rolls of 20 yards . . . . . " 2 00

Samples sent on application, or general sample book for 15c.

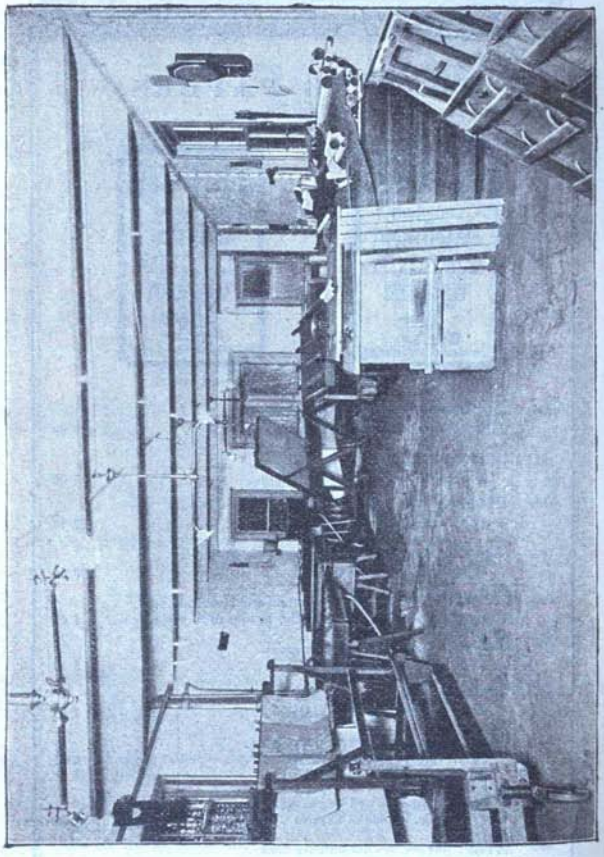


PHOTO PRINTING LOFT, NEW YORK.

PHOTO-PRINTING.

There are at present three different processes in actual use for copying drawings by the action of light, namely:

Blue Print Process, negative, giving **white lines** on a **blue background,**

Black Print Process, positive, giving **black lines** on a **white background** and

Brown Print Process, negative, giving **white lines** on a **brown background.**

All other processes are either too complicated in their manipulation, or require dark rooms and other appliances, forbidding their general use.

The results obtained by the above-named processes depend upon the careful selection of the chemicals and essentially upon the quality of the paper employed.

It has therefore been our endeavor for many years to improve our formulas for coating these papers, and to select papers best adapted for their purpose. The reputation which our different brands of photo-print paper enjoy, proves, that our efforts have been successful, and that our papers may be depended upon for the work for which we recommend them.

BLUE PRINT PAPERS AND CLOTH, NEGATIVE.

Helios Paper (see page 21) was the first Blue Print Paper introduced by us, and is still acknowledged to be the best and most reliable. For fine blue prints and photographic work, it has no equal.

E. E. Paper (see page 21) is of the same high quality as Helios, but is made very thin and tough. It is intended for prints for mailing, saving postage by its light weight.

Parchmine Papers, (see page 22) although not quite as good as Helios papers, will often be found useful on account of their great strength and toughness, which adapts them for prints intended to be filed for record, or to be handled roughly.

Columbia Papers (see page 22) are intended for the more general employment of blue prints; as for distribution, proposals, etc., where the price is of more importance than the quality of the print. They compare favorably with the papers generally put on the market as "first-class blue print paper."

Columbia Cloth (see page 22) gives prints inferior to those on paper, but is to be recommended for prints intended for very rough handling, especially out-door work.

BLACK PRINT PAPERS,

POSITIVE.

Nigrosine **Paper** (see page 23) gives a positive black copy of the original on a white background. These prints can be colored, added to, altered, etc. This paper requires a chemical developing bath.

Umbra **Paper** (see page 23) is essentially the same as Nigrosine Paper, except that no chemical bath is required, as the developer is added to the coating. For this reason the development can not be controlled as positively as that of the Nigrosine Paper, and the latter is to be preferred, where the appliances for a chemical bath can be had.

BROWN PRINT PAPER AND CLOTH,

NEGATIVE.

Maduro **Paper** (see page 24) gives a negative white copy of the original on a brown background. As the latter is impervious to light, these prints can, when made on **THIN MADURO PAPER**, be used as negatives, from which any number of **POSITIVE PRINTS** of the original can be taken. Where a great many prints have to be taken from one tracing, a few Maduro prints on thin paper can be made and used as negatives, and a large number of prints can by this method be turned out in proportionately shorter time.

Maduro **Cloth,** (see page 24) like Columbia Cloth, is very strong and tough, and adapted for out-door work.

Please note, that each roll of our Photo Print Papers bears a consecutive number. Should the results obtained with any of our papers not prove quite satisfactory, our customers are requested to send us a sample print together with a piece of unexposed paper ROLLED, not creased or folded, stating the NUMBER of the roll. This will enable us to ascertain where the fault lies and to adjust matters satisfactorily.

Our booklet "Photo-Printing" will be mailed on application.

BLUEPRINT PROCESS.

Negative Prints. White lines on blue ground

The usual coating of our blueprint papers requires an exposure from four to eight minutes in bright sunlight. When so ordered, we furnish any of the following blueprint papers also with the

QUICK-PRINTING PREPARATION,

the exposure of which is completed in from 1½ to 2 minutes, but unless the quick is specified, we send paper with the usual coating. While the quick-printing paper is of advantage in poor light, it is difficult to handle on bright days, on account of its great sensitiveness.

HELIOS PAPERS.

Reduced facsimiles of labels of prepared Helios and E. T. Papers.

Helios Paper, medium, **prepared,** continuous.

		24	27	30	36	42	54* in. wide,
220.	per roll of 10 yards	$ 1 15	1 25	1 40	1 70	2 00	3 00
220X.	" " " 50 "	5 50	6 00	6 75	8 25	9 75	12 50

Helios Paper, thick, **prepared,** continuous.

		24	27	30	36	42	54* in. wide,
221.	per roll of 10 yards	$ 1 35	1 50	1 65	2 00	2 35	3 50
221X.	" " " 50 "	6 50	7 25	8 00	9 75	11 50	15 00

E. T. PAPER.

E. T. Paper (extra thin, for mailing), **prepared,** continuous.

		24	30	36	42 in. wide,
225.	per roll of 10 yards	$ 95	1 20	1 45	1 65
225X.	" " " 50 "	4 40	5 60	6 80	8 00

* Paper marked (*) is not carried in stock, and will be furnished to order only.

For unprepared papers see page 25.

For description of papers see page 19.

PARCHMINE PAPERS.

PARCHMINE PAPER, medium thick, **prepared**, continuous.

		30	36	42 in. wide,
222.	per roll of 10 yards	$ 1 00	1 15	1 30
222X.	" 50 "	4 80	5 40	6 00

PARCHMINE PAPER, thick, **prepared**, continuous.

		30	36	42 in. wide
223.	per roll of 10 yards	$ 1 20	1 35	1 50
223X.	" 50 "	5 60	6 40	7 20

COLUMBIA PAPERS.

Reduced facsimile of label of prepared Columbia Paper.

COLUMBIA PAPER, medium, **prepared**, continuous

		24	30	36	42 in. wide,
224.	per roll of 10 yards	$ 75	87	1 00	1 15
224X.	" 50 "	3 55	4 10	4 70	5 30

COLUMBIA PAPER, thick, **prepared**, continuous.

		24	30	36	42 in. wide,
224½.	per roll of 10 yards	$ 85	1 00	1 15	1 30
224½X.	" 50 "	4 00	4 75	5 50	6 25

COLUMBIA PAPER, thin (mailing), **prepared**, continuous.

		24	30	36	42 in. wide,
225½.	per roll of 10 yards	$ 70	85	1 00	1 15
225½X.	" 50 "	3 25	3 75	4 25	4 75

COLUMBIA BLUEPRINT CLOTH.

228. COLUMBIA CLOTH, **prepared**, continuous.

	30	36	42 in. wide,
per roll of 10 yards	$2 90	3 30	4 40

238. COLUMBIA CLOTH **unprepared**, continuous.

	30	36	42 in. wide,
per roll of 10 yards	$2 15	2 65	3 50

For unprepared papers see page 25.

For description of papers see page 19.

BLACK PRINT PROCESSES.

Positive Prints. Black Lines on White Ground.

Reduced facsimile of label of Nigrosine Paper.

NIGROSINE PAPER.

Requiring a Chemical Bath.

226 *Nigrosine* Paper, **prepared**, continuous.

	30	36	42 in. wide,
per roll of 10 yards	$ 1 50	1 80	2 10

DEVELOPER

FOR NIGROSINE PROCESS.

227. Developer for Nigrosine Process (powder).

	4	8	16 ounce jar,
per jar	$ 50	90	1 60

UMBRA PAPER.

Requiring a Water Bath only.

Reduced facsimile of label of Umbra Paper.

227½. *Umbra* Black Process Paper (requires water bath only).

	30	36	42 in. wide,
per roll of 10 yards	$ 1 65	2 00	2 35

For description of papers see page 20.

BROWN PRINT PROCESS.

Negative Prints. White Lines on Brown Ground

Maduro Paper, medium, **prepared,** continuous.		30	36	42 in. wide.
229 M.	per roll of 10 yards,	$1 75	2 00	2 25
Maduro Paper, thin, **prepared,** continuous,		30	36	42 in wide.
229 T	per roll of 10 yards,	$1 75	2 00	2 25
Maduro **Cloth, prepared,** continuous.		30	36	42 in. wide.
229 C.	per roll of 10 yards.	$3 50	4 50	5 50
Maduro Fixing Salt.		4	8	16 oz. box.
229 S.	per box,	15	25	40

For description of papers, see page 20.

TUBES FOR PRESERVING PAPER.

No. 219.

These tubes are made of tin, with well fitting covers, and are the best and most practical receptacles for storing cut rolls of prepared paper, because they exclude both light and moisture. They are well adapted also for storing tracings, plans, drawings, &c.

Tubes for Preserving Paper.

		24	30	36	42 in.
219.	For 10 yard rolls, each	$ 1 00	1 15	1 25	1 35
219 X.	" 50 " " "	1 20	1 40	1 55	1 70

Unprepared Papers for Blue Printing.

Reduced facsimiles of labels of Helios and E. T. Papers.

230. Helios Paper, medium thick, **unprepared.**

	24	27	30	36	42	54 in. wide,
per roll of 50 yds	$ 3 20	3 50	4 00	4 75	5 25	7 00

231. Helios Paper, thick, **unprepared.**

	24	27	30	36	42	54 in. wide
per roll of 50 yds.	$ 4 70	5 25	6 00	7 00	8 00	10 50

235. E. T. Paper, very thin and tough, for mailing, **unprepared.**

	24	30	36	42 in. wide,
per roll of 50 yards	$ 2 25	2 80	3 35	4 00

232. PARCHMINE PAPER, medium thick, **unprepared.**

	30	36	42 in wide.
per roll of 50 yards	$ 3 50	$ 4 25	5 00

233. PARCHMINE PAPER, thick, **unprepared.**

	30	36	42 in. wide,
per roll of 50 yards	$ 4 25	$ 5 15	6 15

234. COLUMBIA PAPER, medium thick, **unprepared.**

	24	30	36	42 in. wide,
per roll of 50 yards	$ 2 10	2 65	3 20	3 75

234½. COLUMBIA PAPER, thick, **unprepared.**

	24	30	36	42 in. wide,
per roll of 50 yards	$ 2 60	3 25	3 90	4 60

No. 240

HELIOS ERASING FLUID.

For making Alterations and Additions on Blue Prints.

240 W.	HELIOS ERASING FLUID, white	per bottle	$ 20
240 R.	do. do. do.	red "	20
240 Y.	do. do. do.	yellow "	20

MADURO ERASING FLUID.

WHITE.

For making Alterations and Additions on Maduro Prints.

240 M. . . . . per bottle, 20

For white pencils for marking on blue-prints see page 276.

PRINT FRAMES AND BATH TRAYS.

FIRST QUALITY PRINT FRAMES OF HARDWOOD.

No. 245.

Print Frames made of hardwood, finely finished, brass trimmings:

			Frames only.	With pads.	With pad and double thick glass.	With pad and polished plate glass.
242.	20 × 24 in.	each	$ 6 25	$ 6 95	$ 7 50	$ 10 25
243.	24 × 30 "	"	8 00	9 10	10 50	12 50
244.	30 × 42 "	"	12 50	14 50	—	22 75
245.	36 × 60 "	"	20 00	23 25	—	43 00

Other sizes, also larger, made to order.

The above Print Frames are made of carefully selected, thoroughly seasoned hardwood, are of perfect workmanship and have brass trimmings. The springs are as heavy and as numerous as the glass will allow, and insure perfect contact. The spring-catches for the bars are protected by wooden casings, as shown in the cut. The frames are made to stand the exposure to the weather incidental to their use. The chief advantage in getting hardwood frames of best quality and workmanship, instead of the cheaper kind, is their lesser liability to warp and shrink and thereby break the glass.

For sizes larger than 24 × 30 only Plate Glass should be used, on account of its greater strength. It will be found more economical for the smaller sizes also.

Packing of Print Frames will be charged at cost, but we are not responsible for breakage of glass.

In ordering Print Frames please state whether pad is wanted and whether double-thick or polished plate glass, or none.

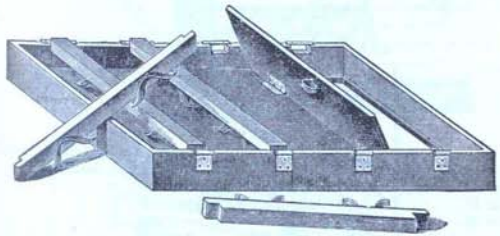
For smaller frames see next page.

FIRST QUALITY ZINC BATH TRAYS, WITH DRAIN-PIPE, STRONG WIRED RIM AND HARDWOOD BRACES.

No. 248 and 248D.

	Plain, for Blue Prints.			Asphalt-coated, for Nigrosine and Umbra Prints.		
246.	20 × 24 in.	each	$ 3 75	246 D. 20 × 24 in.	each	$ 3 75
247.	24 × 30 "	"	4 50	247 D. 24 × 30 "	"	4 50
248.	30 × 42 "	"	6 00	248 D. 30 × 42 "	"	6 00
249.	36 × 60 "	"	8 00	249 D. 36 × 60 "	"	8 00

PRINT FRAMES, SECOND QUALITY, OF PINEWOOD.



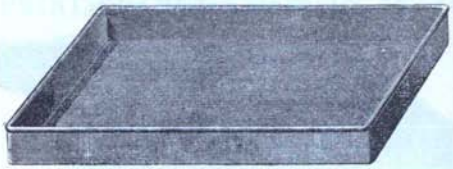
No. 243½.

			Frames only.	With Pads.	With pad and double thick glass.	With pad and polished plate glass.
242½.	20 × 24 in.	each.	$ 5 00	$ 5 70	$ 6 25	$ 9 05
243½.	24 × 30 "	"	6 40	7 50	8 90	10 90
244½.	30 × 42 "	"	10 00	12 00	—	20 25
245½.	36 × 60 "	"	16 00	19 25	—	39 00

PRINT FRAMES FOR PATENT OFFICE DRAWINGS, &c.

242½.	11 × 16 in., pinewood	with double thick glass and pad.	each $ 2 75
243½.	16 × 21 " "	" " " " " "	" 4 75

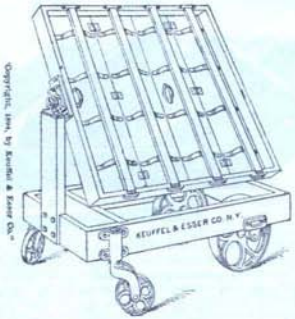
PLAIN BATH TRAYS OF ZINC, WIRED RIM.



No. 244½.

244 S.	Plain Bath Trays,	12 × 17 in.	. . . . .	each	$ 1 50
245 S.	" " "	17 × 22 "	. . . . .	"	2 00
246 S.	" " "	20 × 24 "	. . . . .	"	3 00
247 S.	" " "	24 × 30 "	. . . . .	"	3 60
248 S.	" " "	30 × 42 "	. . . . .	"	4 80
249 S.	" " "	36 × 60 "	. . . . .	"	6 40

PRINT FRAMES ON WHEEL CARRIAGES.



No. 248½.

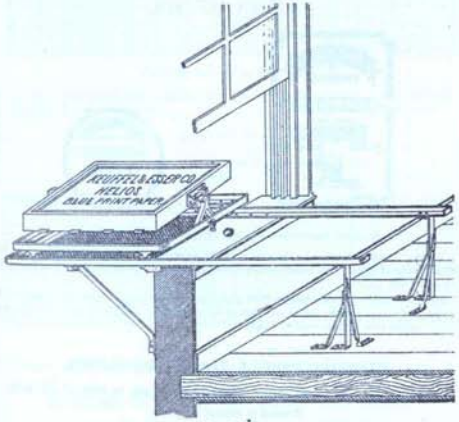
248½.	Frame on Carriage,	frame 30 × 42 in.,	no glass or pad	. .	each	$ 37 50
	" " "	" 36 × 60 "	do.	do.	"	50 00
	" " "	" 30 × 42 "	with polished plate glass and pad	. .	"	47 75
	" " "	" 36 × 60 "	do.	do.	"	73 00

These Print Frames on Wheel Carriages will be found the best and most practical device, where the printing room connects with a yard or roof suitable for exposing prints. Those carriages are made of hardwood in the best and most substantial manner. The frames can be reversed to insert or remove prints, and tilted and clamped at any angle.

PRINT FRAMES ON CARRIAGES AND RAILS

for

EXPOSING PRINTS OUTSIDE OF WINDOW.



No. 249½.

249½.	Frame and Mountings,	frame 30 × 42 in.,	no glass or pad,	. . . . .	each	$ 35 00
	"	" 36 × 60 "	"	"	"	47 50
	"	" 30 × 42 "	polished plate glass,	and pad . .	"	45 25
	"	" 36 × 60 "	"	"	"	70 00

This is the most practical and convenient arrangement for exposing print frames outside of a window. The rails are of angle iron, also the carriage which runs on iron wheels. The frame is pivoted in the carriage, so that it can be reversed to insert or remove prints, and tilted and clamped at any angle, to obtain the best light.

In ordering, please state clear aperture of window, height of window sill from floor width of window sill and thickness of wall.

SPRING CLIPS.

No. 249-3.

249-3. Spring clips for clamping prints when drying . . . . . doz. $ 25

STANDARD
PROFILE AND CROSS SECTION PAPERS AND CLOTHS.

Reduced facsimiles of labels of Standard Profile Papers

We beg to call attention to the **quality of the paper** we use for our "**Standard**" **Profile and Cross Section Papers** It is a fine, tough drawing paper The lines are more distinct than on other Profile Papers.

Standard Profile and Cross Section Cloth is recommended in preference to mounted Profile paper for outdoor work, as on account of its strength it will stand much rough handling and suffers less in unfavorable weather

STANDARD PROFILE PAPERS AND CLOTHS.

Unmounted in rolls of 50 yards. Mounted on muslin in rolls of 20 yards.
Printed in orange or green.

All our Profile Papers bear the trade-mark "Standard" along their edge.

Plate A. 4 × 20 to one inch.

250	Sheets, engraving 15 × 42 in.	per quire $ 8 50,	per sheet $	40
253.	Continuous, 20 in. wide		per yard	24
254.	" 10 "		"	15
255.	" 20 " mounted on muslin		"	65
256.	" 10 " " " "		"	40
257	" 20 " on **Tracing Paper** (orange only) . .		"	24
259	" 20 " " **Cloth**		"	60

Please state color when ordering above papers!

Plate B, 4 × 30 to one inch.

260.	Sheets, engraving 13½ × 42 in., per quire $ 8 50		per sheet $	40
263.	Continuous, 20 in. wide		per yard	24
264.	" 9 "		"	15
265.	" 20 " mounted on muslin		"	65
266.	" 9 " " " " "		"	40
267.	" 30 " on **Tracing Paper** (orange only)		"	24
269.	" 20 " " **Cloth,**		"	60

Plate C. 5 × 25 to one inch.

270 Sheets, engraving 15 × 42 in., per quire $ 8 50, ... per sheet $ 40

STANDARD CROSS SECTION PAPERS AND CLOTH
in sheets and continuous; printed.

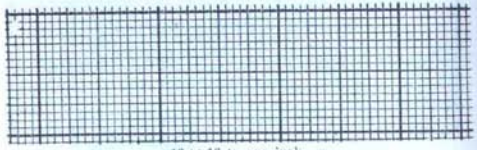
Sheets printed in orange, green and blue
Continuous printed in orange and green.

Unmounted in rolls of 50 yds. Mounted on Muslin, in rolls of 20 yds.

10 × 10 to one inch

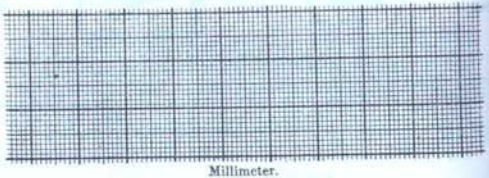
280.	Sheets, engraving 16 × 20 in.	per quire $ 3 50,	per sheet $	20
281.	" " 16 × 30 "			
	on **Tracing Paper,** (orange only)	" 3 50	"	20
288.	Continuous, 20 in. wide, ...		per yard	24
285.	" 20 " mounted on muslin		"	65
287.	" 20 " on **Tracing Paper,** (orange only)		"	24
289.	" 20 " " **Cloth,**		"	60

Samples sent



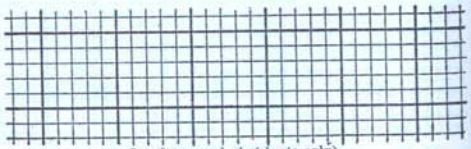
16 × 16 to one inch.

290. Sheets, engraving 17 × 22 in. . . . per quire $ 3 50, per sheet $ 20
291. " " 17 × 22 " . .
on **Tracing Paper,** (orange only) " 3 50, " 20
293. Continuous, 20 in. wide, ... per yard 24
295. " 20 " mounted on muslin . . . . . " 65



Millimeter.

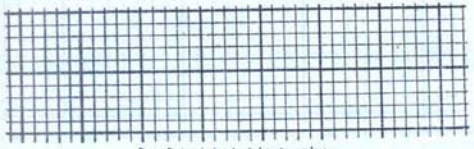
300. Sheets, engraving 40 × 50 cm. . . . per quire $ 3 50, per sheet $ 20
301. " " 40 × 50 "
on **Tracing Paper,** (orange only) " 3 50, " 20
303. Continuous, 50 cm. wide, ... per yard 24
305. " 50 " mounted on muslin . . . . . " 65
306. " 75 " . . . . . " 50
308. " 75 " mounted on muslin . . . . . " 1 00
307. " 50 " on **Tracing Paper,** (orange only) " 24



8 × 8 to one inch (sheets only).

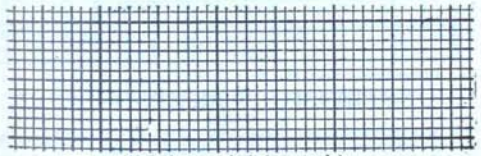
310. Engraving 16½ × 21⅝ in. . . . . per quire $ 3 50, per sheet $ 20
311 " 16½ × 21⅝ " .
on **Tracing Paper,** (orange only) " 3 50, " 20

Please state color when ordering above papers.



5 × 5 to ¼ inch (sheets only).

320. Engraving 16 × 20 in. . . . . per quire $ 3 50, per sheet $ 20
321. " 16 × 20 " .
on **Tracing Paper,** (orange only) " 3 50, " 20



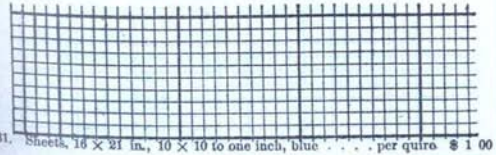
12 × 12 to one inch (green only).

322. Sheets, engraving 16 × 20 in., per quire $ 3 50, per sheet $ 20

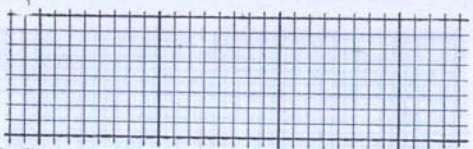
CROSS SECTION PAPERS

in sheets; ruled.

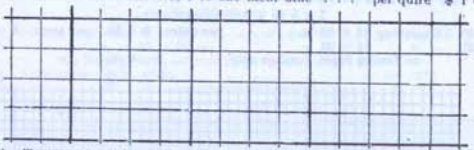
330. Sheets, 16 × 21 in., 5 × 5 to one inch, blue . . . per quire $ 1 00



331. Sheets, 16 × 21 in., 10 × 10 to one inch, blue . . . . per quire $ 1 00



332 Sheets, 16 × 21 in., 8 × 8 to one inch, blue . . . per quire $ 1 00



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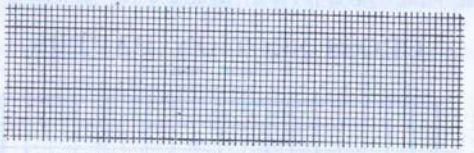
PRINTED.

This paper is printed in a neutral tint, so that ink or pencil marks stand out well. The lines are indelible, and it can be photo-printed.

We recommend it for the use of students and for mechanical engineers, &c.



334. Constructor's Sketchpaper, 10 × 10 to the half-inch, every 5th line heavy . . . . . .

" A. Imprint 5 × 7½ in., tracing paper . . . . . per quire, $ 25

" B. " 5 × 7½ in., drawing " . . . . . " " 25

" C. " 7½ × 10 in., tracing " . . . . . " " 30

" D " 7½ × 10 in., drawing " . . . . . " " 30

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336. Sheets, engraving, 10 × 10 in., ... per doz., $1 75; sheet, 18

On this paper the scales on each side are logarithmic instead of uniform as in other cross section papers. The numbers and divisions marked are placed at such points that their distances from the origin are proportional to the logarithm of such numbers instead of to the numbers themselves. Among the various relationships which may be represented by means of this paper, are: Circumferences and diameters of circles in terms of their radii or diameters, or the inverse; moments of inertia and radii of gyration in terms of a linear dimension, or the inverse; length of pendulum and time of oscillation; powers and roots of any and all indices; weights of a series of bodies of the same substance and form, but of varying size, in terms of a linear dimension, or the inverse; sizes of shafts, struts, tie-bars, etc., in terms of varying load or the inverse; shearing stress, bending moment, or deflection of beams in terms of load, or the inverse, etc etc

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Webb's Co-orjlinate paper is a convenient and accurate cross-section paper for draughting rooms, technical schools, laboratories, etc. It is a heavy, smooth paper of a bluish tint and the lines are of non-actinic olive tint, so that the paper can be photographed or blue-printed. The scale of the rulings is between the English and French (½ inches and centimetres). The lines are numbered in two directions for ready reference to any point on the paper. A table of natural tangents is printed on the margin for laying off angles.

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" " " " " 10⅔ × 15½ " " " 1 65

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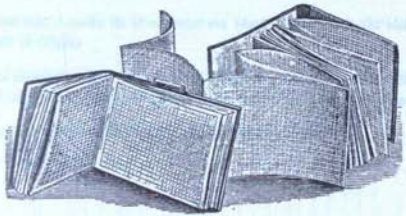

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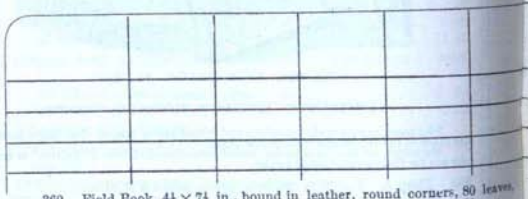

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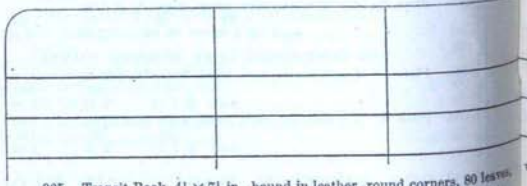

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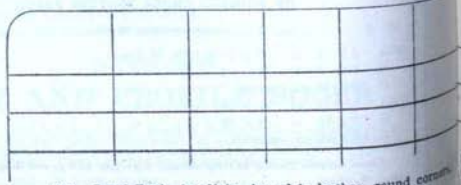

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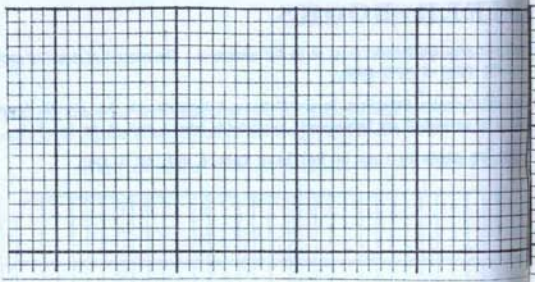

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376. do. 6½ × 8½ " " " " " "

Sta.	Eleva.	Grade	CUT OR FILL	
			Left	C. Right

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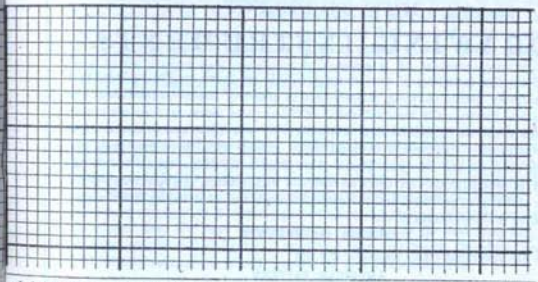

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Since the founding of our house (in 1867) we have sought to introduce progressively better drawing instruments in place of the often inefficient and unpractical instruments then offered. We described them in a manner until then unknown, we explained their advantages by word, pen and demonstration, and thus created for them a demand much greater then there had been previously even for the cheapest kinds. Our close study of the requirements and wishes of our patrons and their advice and suggestions, coupled with our intimate and expert practical and theoretical knowledge of drawing instruments, has led to the production of our

PARAGON INSTRUMENTS,

which are specifically and emphatically the

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Unfortunately for us, the quality of instruments, which is obvious and evident, when they are in actual use, can be determined from mere inspection of the goods by but very few experts, so that dealers, with rare exceptions, are unable to tell just what quality of tools they are handling, and are obliged to rely upon the assertions of those who supply them. To add to the difficulty, importers and dealers are sometimes met, who try to make illegitimate profits by misrepresenting their goods, and they always find it expedient to represent them as being identical with ours, or as good as ours. Furthermore, our cuts, illustrating our instruments, have been copied again and again, even by photo-process, our descriptions have been pirated, and the very appearance and arrangement of our Catalogue, which was unique when we originated it, has been imitated to the verge of counterfeiting.

This accumulation of untoward circumstances has compelled us therefore, in our own interest, and for the protection of our clients, to stamp each and every one of our best instruments with our name, quality trademark, etc., in accordance with the descriptions and particulars given further on.

Our position as the leading house in our line, and the nature of our business, which has grown to such great proportions, embracing large domestic and foreign markets, require us to make and keep in stock all kinds of instruments, —good, bad and indifferent, but we include *in our Catalogue* only what we can recommend, except the

LOW-PRICED INSTRUMENTS,

No. 1000S to No. 1091, which are unsuitable for professional work, but are intended for young learners only, thus, by reason of their moderate price, filling a recognized want. With this exception all instruments described and illustrated in this catalogue are good, *better*, and **best.** Under such circumstances we can not come under the suspicion of misrepresenting any particular style or grade of instruments; on the contrary, we describe all accurately, so that it may be at once apparent which instruments are best adapted to the particular requirements of each buyer.

It is, however, advisable and in the end more economical, to buy the best instruments one can afford. **Good instruments will meet all requirements,** and the saving of time and the satisfaction obtained by their use will soon compensate for the higher price. **Instruments, which on account of their inferior quality prove unfit for the intended work, are absolutely worthless to the purchaser,** who will then be obliged to replace them by better ones.

MATERIAL.

The metals usually employed for drawing instruments are German silver of varying quality, and steel or iron. While it is evident that the steel must be of good quality and properly tempered, a few remarks about the German silver seem more called for. Its quality depends not alone on the proportions of the ingredients of the alloy, but also on the density and hardness of the metal, which is usually obtained by hammering or swaging the casting, either on an anvil or in a steel die. To have German silver, however, in its best form and at its greatest density and elasticity, it must be *rolled;* we make, therefore, our best (**PARAGON**) instruments of rolled (sheet or plate) German silver.

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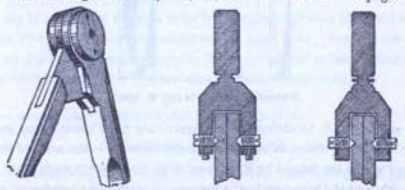
The finish of the finest mathematical instruments is so peculiar, that it is often referred to as "mathematical instrument finish", without any attempt at describing it. It is the *only* finish which leaves perfection of workmanship and form visible, because it hides no fault nor flaw, and thus it represents the acme of mechanical beauty. The finish produced by buffing of drawing instruments, which pretend to be of fine quality, is a barbarism which is excusable only when the obscuring effect of the glossy buffing is necessary to save appearances or to lessen the cost of production. Nobody who can appreciate mechanical beauty will consider it a proper finish, and the polished surfaces and partly effaced edges and angles produced by the buffing wheel give instruments a glossy and cheap appearance, which catches the eye of only those who are totally inexperienced.

The most important instruments are Compasses, (including Dividers), Ruling Pens and Bows, which we shall therefore describe in detail.

COMPASSES.

The most essential part of a pair of Compasses is the head, which forms the joint. There are two kinds of joints recognized: the **tongue joint,** in which the head of one leg has a tongue, generally of steel, which moves between two lugs on the other leg; and the **pivot joint,** described on the next page.



Tongue joint. Pivot joint. Esser's Patent Pivot joint.

ESSER'S PATENT PIVOT JOINT

(Pat'd March 14th and 28th, 1882.)

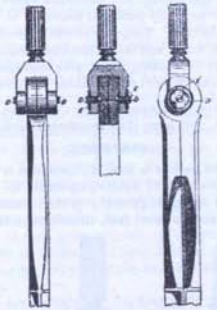
(Nos. 600 to 630.)

combines all the advantages of the usual pivot joint with some additional ones.

In the ordinary pivot joint the head of each leg is made in the form of a disc and the two discs are held in apposition in a brace (or fork) by means of two pivot-screws. This brace is provided with a handle, because its shape and bulk forbid holding the compass by its head in the usual manner. The two pivot-screws are held or locked by two very small screws passing through the free ends of the brace and *impinging against the threads of the pivot-screws.* The risk of breaking the small set screws, the *certainty of their gradually spoiling the thread of the pivot-screws* and their liability to collect dirt, are disadvantages of the ordinary pivot joint.

The essential features of Esser's Patent pivot joint, *applied only* to **PARAGON** *instruments,* are the following:

ESSER'S PATENT PIVOT JOINT.



(Patented, March 14 and 28, 1882.)

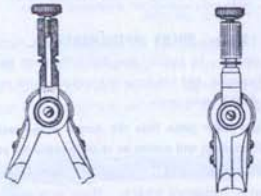
The pivots, *D, D,* as shown in the figure, are held securely by means of steel *lock nuts E, E,* which fit nicely in circular recesses in the arms of the brace (fork), and which are tapped to correspond with the screw threads of the pivots. By the sinking of the lock-nuts in the recesses as shown, the instrument presents

a tasty, well-proportioned and beautiful appearance, all risk of injuring the screw threads of the pivots or of breaking the set screws is avoided, there is no place for collecting dirt, and the lock nuts are much *more efficient* than the small set screws.

This pivot joint admits of applying a very practical device for locking or clamping the joint in any position.

PATENT LOCKING DEVICE.

(Patented Nov. 6, 1894.)



This is accomplished by means of two steel bands, each passing up from one of the legs, around the head and well beyond the median line, so that in the median line both bands overlap in opposite directions. At this point they can be firmly locked against each other by a screw operated by a milled head at its upper end beyond the handle.

Where the same opening of dividers is to be used repeatedly, or where great accuracy is required, this attachment will be found of value. It adds practically nothing to the bulk of the compass, nor does it in any way interfere with any of its uses, nor detract from its appearance.

We beg to call special attention to the fact, that Esser's Patent Pivot Joint and Locking Device have been very closely imitated in their outer forms. The essential and vital parts of our improvements are protected by letters patent, and imitations must therefore either be infringements, liable to prosecution, or faulty in construction.

The next feature to observe about a compass is its

WEIGHT AND SHAPE.

It should always be heavy enough to be absolutely rigid during all manipulations to which it is subjected, and the metal should be so distributed that it

will nowhere add to the weight without increasing the rigidity or stiffness. The quantity of metal, irrespective of its distribution, is determined by the hardness (toughness) of the German silver; the harder and tougher it is, the less of it is required.

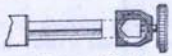
Our **PARAGON INSTRUMENTS** are made of best **rolled** German Silver of the greatest strength and density; the steel parts are made of finest steel, especially treated and tempered for the purpose; these instruments are to-day unsurpassed in quality, workmanship and finish.

The "**KEY**" () **BRAND INSTRUMENTS** are made of cast German Silver of a special alloy, which has been hammered or swaged after casting, and of tempered steel. They are very carefully made and finished and represent the best instruments that can be made of cast German Silver. They are superior to any others made of similar material.

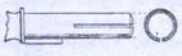
Our "**ARROW**" () **BRAND INSTRUMENTS** are also of cast German Silver, but of less density. In quality and finish they are one grade lower than the Key Brand Instruments, but render good services and are superior to similar instruments sold at the same price.

Instruments sold at a lower price than the Arrow Brand Instruments, must necessarily be made of soft castings and cannot be recommended for practical use.

Another important feature of a compass is the manner of interchanging the several points (parts) furnished with it. Here, as is generally the case, most makers recommend what costs least and is easiest to make. In the following illustrations are shown two good patterns for shanks, the long and strong pentagonal shank and the round shank with steel feather.



Pentagonal Shank.

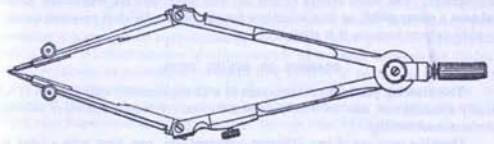


Round Shank with Steel Feather.

The former should engage in a socket of the same shape and size and be held there by a screw which presses the beveled part into the corresponding groove in the socket; the latter (the round shank) is held by the spring of the socket and kept in alignment by the steel feather, thus dispensing with the screws, which are easily lost, and giving an unobstructed sight when working.

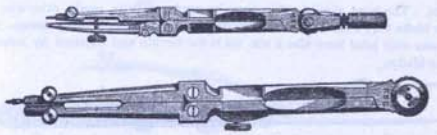
All joints in a compass and its parts should move in the same plane. This is readily tested by inserting the several parts and then bending

them as shown in cut below, when their points should meet. This is also a test for the alignment of the shank in the socket, and every good instrument should stand this test.



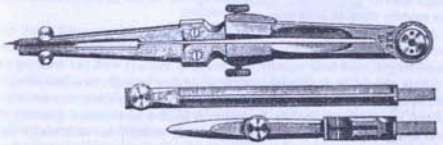
Compass in position for testing alignment.

There seems to be a preference for compasses with fixed needle point, that is, with only one or with no steel leg. The argument is that, as nearly all the better sets have separate dividers, the steel legs of the compasses are superfluous, because they come into use only when the compasses are used as dividers.



Compasses with fixed needle point.

There has also developed a demand for compasses with hairspring (as formerly applied only to dividers), and as some draughtsmen believe it to be easier to make minute adjustments with the Hairspring than to make them by careful setting of the main point, the idea is finding favor. We therefore now list and carry many patterns of *compasses also with hairspring*.



Compasses with hairspring.

To sum up, compasses should be of good material, proper hardness and of sufficient weight to insure stiffness in all positions; the metal should be judiciously distributed; all joints should move in one plane, the shanks of the insertion pieces should be properly made and the workmanship should be perfect throughout. The finish should be put on with care, and **the instruments should not have a glossy polish,** as this substitute for the proper finish is resorted to only to hide defects because it is cheaper.

DRAWING OR RULING PENS.

The drawing pen is that instrument of a Draughtsman's outfit which is in nearly constant use, and in which defects in quality would therefore become obvious most readily.

Drawing pens are of two different constructions, one kind with a joint to allow the blades to be thrown apart for cleaning and setting, the other without

Pen with joint.

Pen without joint.

a joint. The joint should, of course, be very carefully made, otherwise the upper blade very soon becomes shaky and the pen consequently useless. Most fine pens with joint have also a pin, set in the ferrule and exposed by screwing off the blades.

Pens without a joint, but in which the upper blade is made to spring open, possess many of the advantages of a pen with a good joint. A good pen without a joint is far preferable to one with an inferior joint, and it costs less.

The **Detail Drawing Pen** is a modification of this style of pens, which, although heavier and bulkier, is often preferred, as the greater width of their blades enables them to hold more ink.

A good drawing pen should be made of properly tempered steel, neither too soft nor hardened to brittleness. The nibs should be accurately set, both of the same length, and both equally firm when in contact with the drawing paper. The points should be so shaped that they are fine enough to admit of absolute control of the contact of the pen in starting and ending lines, but otherwise as broad and rounded as possible, in order to hold a convenient quantity of ink without dropping it. The lower (under) blade should be sufficiently firm to prevent approach of the blades of the pen, when using it against a straightedge. The spring of the pen, which separates the two blades, should be strong enough

to hold the upper blade in its position, but not so strong, that it would interfere with easy adjustment by the thumbscrew. The thread of the thumbscrew must be deeply and evenly cut so as not to strip.

Pens for close ruling (hatching pens) are also made with a pushing screw, *i. e.*, the spring of the blades holds their points together and the thumb screw, which applies against the lower (under) blade, forces them apart, thus lessening the danger of approximating the blades from pressure against the ruling edge. Another manner of adjustment is by a wedge between the blades, which separates or releases them according to as it is moved up or down by a rod with a thumbnut at the end of the handle. In such pens there is no danger of the thumbscrew displacing the blades sideways, as might happen in other pens from bending of the screw or uneven wear of the thread.

SPRING BOWS.

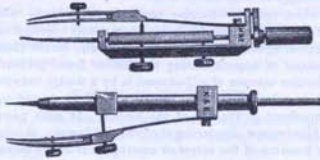
These were originally developed from the shape of compasses, but later the demand for small sizes made changes in the patterns necessary. Of the shapes still in use this cut shows the one probably nearest the original pattern.

Later, spring bows were made symmetrical, as shown here.

What is said in the description of ruling pens about the necessity of a sufficiently stiff spring, and about the relation between spring-pressure and thumb-screw, applies to bows of spring steel just as well as to blades of ruling pens. For those who use a bow instrument much, the latest form of thumbscrew will be a great convenience:

It will be seen from the cut that two threads, a right and a left, are moved by one central thumbscrew. In theory the main difference between a one-thread and a double-thread bow is, that in the latter the stiffness of the spring bow does not depend only on the strength of the spring, but both legs of the bow are held rigidly by the screw, without depending on counter-pressure from the spring. Such bows must be very carefully made to work well.

The two bows below represent another useful innovation, which is adapted specially for drawing very small circles.



No. 452.

No. 453.

In both the pen draws by its weight, but in number 452 the central pin rotates with the instrument, while in number 453 the central pin is stationary and the pen revolves on it. The latter has the advantage, that the paper will not be pierced, even if many circles are drawn from one centre. It is the best spring bow for drawing very small circles or arcs.

The instruments which we have described, compasses, ruling pens and bows, practically cover the field. What has been said of compasses and dividers applies equally to proportional, whole and half, pocket and three-legged dividers and to beam compasses, while the remarks about pens practically include border, curve, railroad and dotting pens, and of course the pen points of compasses. The various approved and recognized styles of all these drawing instruments are so well illustrated and so fully described in this Catalogue that it would be needless to say more about them here.

The proper repairing of Drawing Instruments requires much skill and experience. We are prepared to repair all our instruments in the best possible manner at reasonable charges.

In conclusion we beg to emphasize that our Paragon Instruments are in leed all that their name indicates, which is best proven by the fact that even the Genuine Swiss Instruments, which for many years held the American market, had to give way to them and have lately been entirely remodelled, so that they are now imitations of our **Paragon Instruments,** which are essentially the **American Pattern** produced and introduced by us.

In order to facilitate selection, we recapitulate the different qualities, indicating the numbers and page of the Catalogue where each brand may be found.

We publish a separate catalogue of instruments in sets, for schools etc.

PARAGON INSTRUMENTS

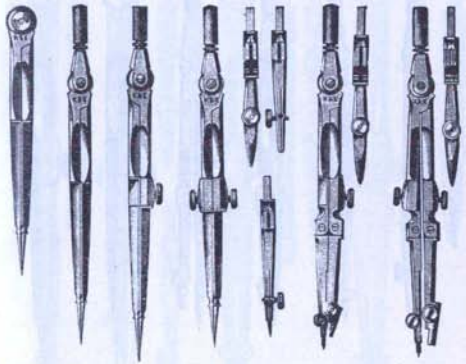
of best Rolled German Silver and Finest Steel.

THE VERY BEST INSTRUMENTS MADE.

(For description see page 42.)

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ⅔ size.



No. 400. 401. 402. 403. 404. 404 H.

400.	Plain Dividers 3½ in.	each	$ 1 75
401.	do. do. 3½ in., with Handle	"	2 00
402.	Hairspring Dividers, 3½ in., with Handle	"	2 60
403.	Compasses, 3½ in., with 2 Steel Points, Pen, Pencil and Needle Point.	"	6 00
404.	do. 3½ " " fixed Needle Point, Pen and Pencil Point	"	5 25
404 H.	do. 3½ " like No. 404, but with Hairspring . .	"	6 25
405.	do. 3½ " with fixed Needle Point, Pen, Pencil Point and Lengthening Bar	"	6 00

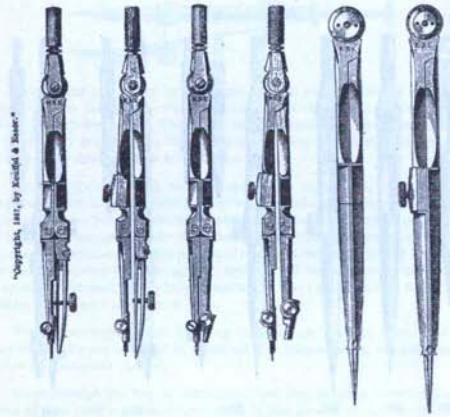
Compasses No. 403, 404, 404 H, 405 and 407, 407 H (see next page) can be furnished also with the same style of Pencil Point as illustrated under No. 415, but we recommend the style as above as more suitable for the small size compasses.

For Paragon Instruments as above, but with Pivot-joint see page 88.

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ⅔ size.



406. 406 H. 407. 407 H. 410. 412.

406.	Compasses, 3½ in.,	with fixed Needle and Pen Point	each	$ 3 50
406 H.	do. 3½ "	like No. 406, but with Hairspring	"	4 50
407.	do 3½ "	with fixed Needle and Pencil Point	"	3 50
407 H.	do. 3½ "	like No. 407, but with Hairspring	"	4 50
410.	Plain Dividers, 5 in.		"	3 20
411.	do. do. 6 "		"	2 50
412.	Hairspring Dividers, 5 in.		"	3 00
413.	do. do. 6 "		"	3 30

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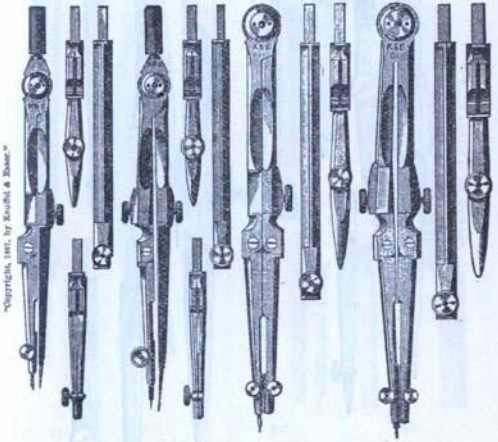
Illustrations ⅔ size.



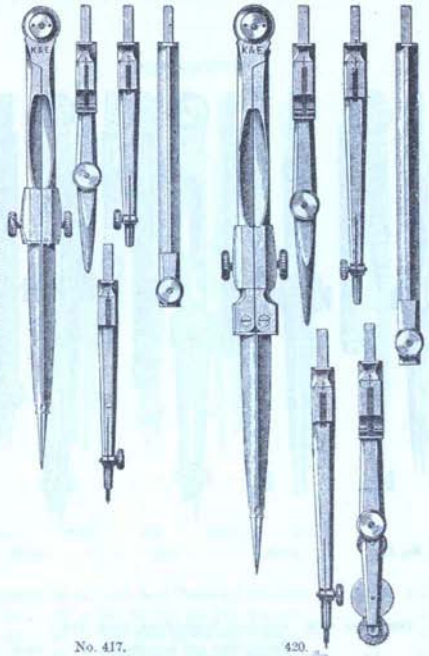
No. 414. 414 H. 415. 415 H.

414.	Compasses 4½ in.,	with fixed Needle Point, Steel, Pen, Pencil Point and Lengthening Bar	each	$ 7 25
414 H.	do. 4½ "	like No. 414, but with Hairspring	"	8 25
415.	do. 5½ "	with fixed Needle Point, Pen, Pencil Point and Lengthening Bar	"	7 00
415 H.	do. 5½ "	like No. 415, but with Hairspring	"	8 00

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ⅔ size.



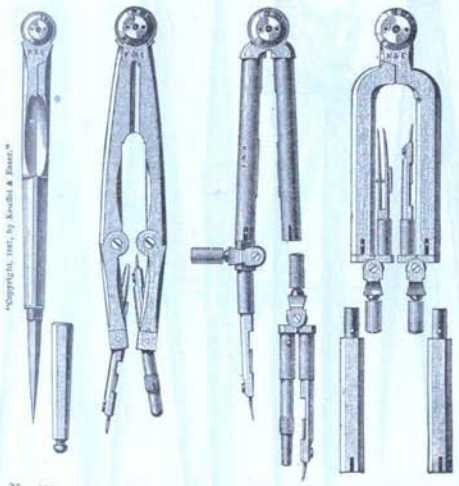
No. 417. 420.

417.	Compasses,	6	in.,	with Pen, Pencil, Needle Point and Lengthening Bar . . . . . each	$ 8 00
418.	do.	6½	"	with Joint in each leg, Pen, Pencil, Needle Point and Lengthening Bar "	9 25
419.	do.	7	"	with Joint in each leg, Pen, Pencil, Needle Point, Lengthening Bar and Dotting Pen . . . . . "	10 75
420.	do.	7	"	do. do. but Dotting Pen with 6 Wheels . . . . . "	12 00

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ⅔ size.



No. 425. 426. 427. 428

425.	Pocket Dividers with Sheath, 5 in.	each	$ 3 00
426.	Pocket Compasses, with Folding Points, 5 in.	"	8 75
427.	Pillar Compasses, 5 in., 2 Needle Points, Pen and Pencil Point with Handles, which can be withdrawn from the Compasses and used as small Bow-Pen and Pencil respectively	"	9 50
428.	do. 5 in. with 2 Lengthening Bars, similar to No. 427.	"	11 50

Morocco Cases, lined with silk velvet for:

No.	426	427	428
each	$ 80	80	90

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ⅞ size. ¼ size.

No. 430. 431. 432. 435. 437.

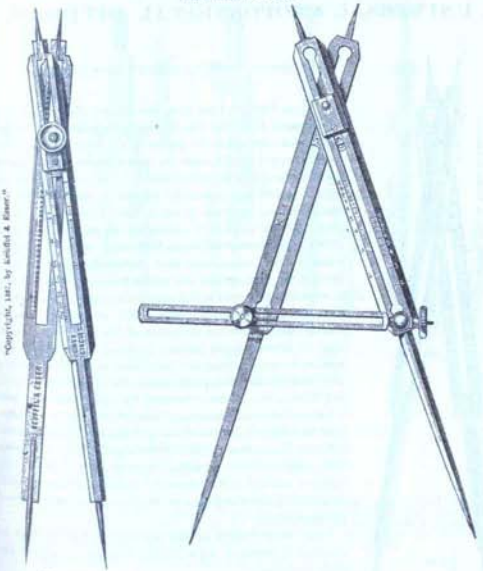
430.	Three-legged Dividers, for taking off three points.	6 in.	each	$ 5 00
431.	do. do. do. one leg adjustable for length,	6 "	"	5 75
432.	Whole and Half Dividers, 7½ in.		"	4 00
435.	Proportional Dividers, finely divided for lines and circles, 7½ in.		"	10 00
437.	Proportional Dividers, finely divided for lines and circles, 8½ in., with Rack-Movement		"	12 50

Morocco Cases, lined with silk velvet for:

	No. 430	431	432	435	437
each	$ 80	90	80	80	90

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ½ size.



No. 439. 441

439.	Proportional Dividers, finely divided for lines and circles 9 in., with Rack-Movement and movable points . .	each	$ 16 00

The four steel points are held firmly by screws so that they can be re-adjusted to their original length in case of breakage.

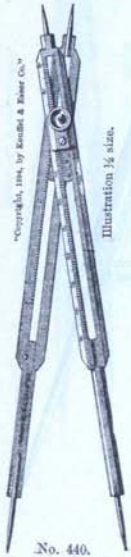
441.	Proportional Dividers, finely divided for lines, circles, planes and solids. 9 in., with Micrometer adjustment,	each	16 50

Morocco Cases, lined with silk velvet for:

	No. 439	441
each	$ 1 10	1 20

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

UNIVERSAL PROPORTIONAL DIVIDERS.



No. 440.

Registered, 1893, by KEUFFEL & ESSER CO.

These Dividers differ from the ordinary ones in that their whole length is divided into 200 **equal parts**, which are further subdivided into tenths by means of a vernier. These graduations are not carried over the entire length of the instrument, as those seen from the figure 0 to 100, reading with the vernier to 1000, are practically all that are necessary for the almost endless purposes to which these Dividers may be applied. By this method of graduation **any desired ratio** may be set off. Thus setting 483 (taken from many others in a table of settings which accompanies each instrument) gives the ratio between the diameter and the circumference of a circle, that is, when the slide is set to this number by means of the vernier, the opening at one end will take in the diameter of a circle, and the opening between the points of the other end gives at once its circumference reduced to lineal measure. In like manner we have settings for such ratios as the diameter of a circle and the side of an equal square, Feet and Metres, Yards and Metres, etc. A list of settings **for Lines, Planes and Solid** is inclosed with each instrument, which is much more complete than the series of fixed graduations on the best Dividers of the old style. The setting of the slide from such a table, is effected more easily and more accurately than it can be done by the ordinary method, and by means of the fully graduated scale very small departures from a given ratio can be both detected and ascertained.

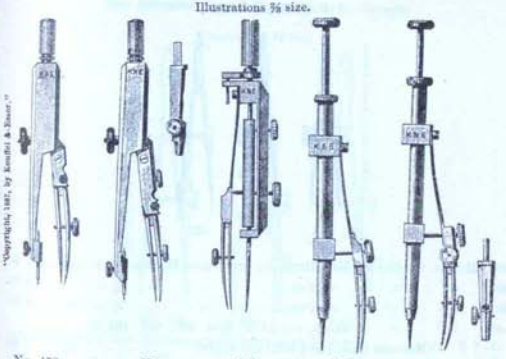
Any other desired setting, not found in the list, may be obtained by means of a very simple formula, given with the table of settings.

438. Universal Proportional Dividers, (Registered) 10 in., with Rack-Movement, in polished case, with table of settings . . . . . each $ 14 00

440. do. do. do 10 in., with Rack-Movement and movable points, in polished case, with table of settings . . . . . " 17 50

Each instrument stamped K. & E. Co. N. Y. Paragon.

Illustrations ⅔ size.

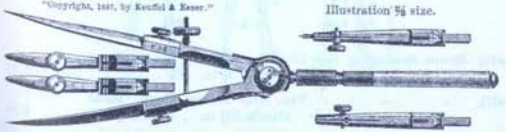


No. 450. 451. 452. 453. 454.

450. Bow Pen, 3½ in., with spring and adjusting screw . . . . each $ 2 50
451. do. 3½ " " " " " "
and Pencil Point . . . . . " 3 50
452. Drop Spring Bow Pen, 3½ in., with self-adjusting point, for very small circles . . . . . " 3 75
453. " Spring Bow Pen, 4 in., for very small circles . . . " 3 75
454. " Spring Bow Pen, and Pencil, 4 in. do. . . . " 5 00

Nos. 452, 453 and 454 are different from other bows and are the most suitable instruments for drawing small circles. A rod passes through the instrument serving as handle and needle point. In Nos. 453 and 454 this centre rod remains stationary while the instrument is turned and pen or pencil draw by their own weight, avoiding the slipping of the needle or scratching of the pen.

Morocco Cases for Nos. 452, 453 or 454 . . . . . each $ 60



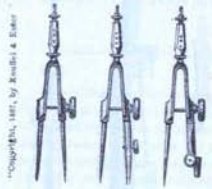
No. 458.

458. Spring Bow Compasses, 3½ in., with long Ivory Handle, Pencil and Needle Point and 2 Pen Points, (to use as railroad pen) . . . . . each $ 8 25

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped K. & E. Co. N. Y. Paragon.

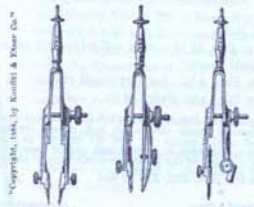
Illustrations ⅔ size.



No. 460. 461. 462.

460. Minute Steelspring Bow Dividers, with Metal Handle, 2¼ in., each $ 2 00
461. " " " Pen, " " " 2¼ " " 2 50
462. " " " Pencil, " " " 2¼ " " 2 50
463. " " Bows, set of 3, Nos. 460, 461, 462 in Morocco Case, lined with silk velvet . . . . . set 7 80

Illustrations ⅔ size.



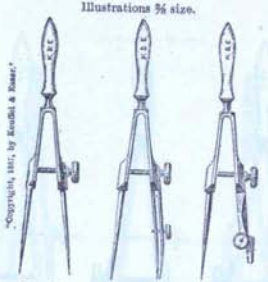
No. 460½. 461½. 462½.

460½. Minute Steelspring Bow Dividers, 2 Needle Points, Metal Handle, 2¼ in. . . . . each $ 2 85
461½. " " " Pen, with Needle Point, Metal Handle, 2¼ in. . . . . " 2 85
462½. " " " Pencil, with Needle Point, Metal Handle, 2¼ in. . . . . " 2 85
463½. " " Bows, set of 3, Nos. 460½, 461½, 462½ in Morocco Case, lined with silk velvet . . . . . set 9 35

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped K. & E. Co. N. Y. Paragon.

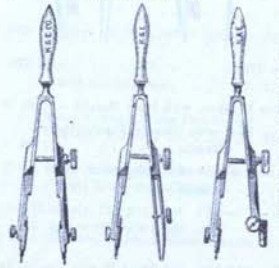
Illustrations ⅔ size.



No. 464. 465. 466.

464. Steelspring Bow Dividers, with Ivory Handle, 3 in. . . . . each $ 2 00
465. " " Pen, " " " 3 " . . . . " 2 50
466. " " Pencil, " " " 3 " . . . . " 2 50
467. " Bows, set of 3, Nos. 464, 465, 466 in Morocco Case, lined with silk velvet . . . . . set 7 90

Illustrations ⅔ size.

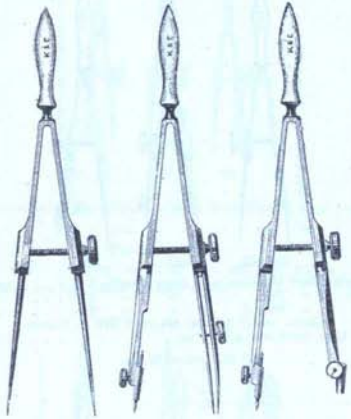


No. 468. 469. 470.

468. Steelspring Bow Dividers, 2 Needle Points, Ivory Handle, 3 in., each $ 2 85
469. " " Pen, with Needle Point, " " 3 " " 2 85
470. " " Pencil, " " " " " 3 " " 2 85
471. " Bows, set of 3, Nos. 464, 469, 470 in Morocco Case, lined with silk velvet . . . . . set 8 60
471½. " " set of 3, Nos. 468, 469, 470 in Morocco Case, lined with silk velvet . . . . . set 9 45

Each instrument stamped K. & E. Co. N. Y. Paragon.

Illustrations ⅜ size.



No. 476. 477. 478.

472.	Steelspring Bow Dividers, with Ivory Handle . .	3½ in.,	each	$ 2 20
473.	" " Pen, with Needle Point, Ivory Handle	3½ "	"	3 00
474.	" " Pencil, with Needle Point, Ivory Handle	3½ "	"	3 00
475.	" Bows, set of 3, Nos. 472, 473, 474, in Morocco Case, lined with silk velvet		set	9 20
476.	Steelspring Bow Dividers, with Ivory Handle . .	4¼ in.,	each	2 40
477.	" " Pen, with Needle Point, Ivory Handle	4¼ "	"	3 25
478.	" " Pencil, with Needle Point, Ivory Handle	4¼ "	"	3 25
479.	" Bows, set of 3, Nos. 476, 477, 478, in Morocco Case, lined with silk velvet		set	10 15

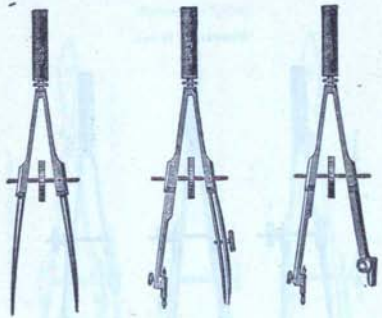
Each instrument stamped K. & E. Co. N. Y. Paragon.

Illustrations ⅜ size.

No. 480. 481. 482.

480.	Steelspring Bow Dividers, German Silver Handle,	3½ in.,	each	$ 2 00
481.	" " Pen, " " " and Needle Point, ...	3½ "	"	2 50
482.	" " Pencil, German Silver Handle and Needle Point, ...	3½ "	"	2 50
483.	" Bows, set of 3, Nos. 480, 481, 482, in Morocco Case, lined with silk velvet		set	8 00
480½.	Steelspring Bow Dividers, German Silver Handle,	3 in.,	each	1 75
481½.	" " Pen, " " " and Needle Point, ...	3 in.,	"	2 50
482½.	" " Pencil, German Silver Handle and Needle Point, ...	3 in.,	"	2 50
483½.	" Bows, set of 3, Nos. 480½, 481½, 482½, in Morocco Case, lined with silk velvet .		set	7 75

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

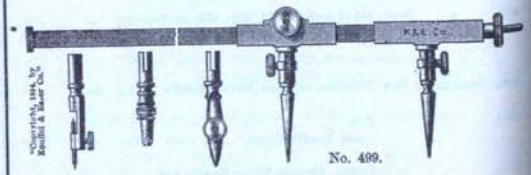


No. 485. 486. 487.

485. Steelspring Bow Dividers, German Silver Handle, 3½ in., each $ 2 60
486. " " Pen, " " " and Needle Point, 3½ " " 3 25
487. " " Pencil, do. do. " " " 3½ " " 3 25
488. " Bows, set of 3, Nos. 485, 486, 487, in Morocco Case, lined with silk velvet, ... set 10 35

Spring Bows Nos. 485, 486, 487 have a right and left thread operated by one thumbnut situated between the shanks of the instrument. They are opened or closed by the screw which holds the points rigidly in any position.

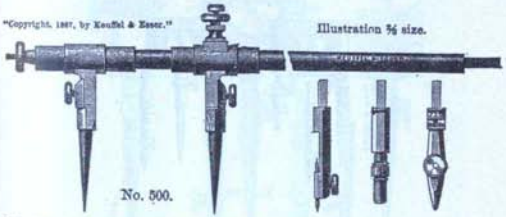
BEAM COMPASSES.



No. 499.

499. Tubular Beam Compasses, 12 inches, German Silver Bar, square, with 2 Steel Points, Pen, Pencil and Needle Point . . . . . each $ 7 50
Morocco Case, lined with silk velvet, for No. 499 . . 1 50

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

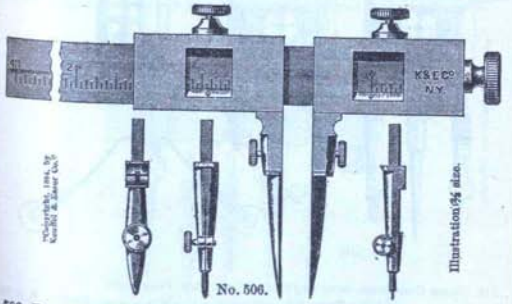


No. 500.

500. Tubular Beam Compasses, 18 in., 2 round German Silver Bars, 2 Steel Points, Pen, Pencil and Needle Point, each $ 10 50
501. do. do. do. do. 24 in., 3 Bars " 11 75
502. do. do. do. do. 36 " 3 " " 15 25

Morocco Cases for No. 500 501 502
each $ 1 50 1 75 2 25

503. Wheel Attachment for No. 500 or 501 . . . . . " 2 50
504. " " " " 502 . . . . . " 2 75

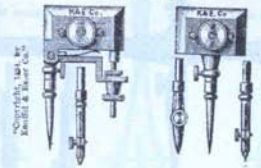


No. 506.

506. Beam Compasses with German Silver Bar, Pen, Pencil and Needle Point, 2 Steel Points, **Wheel Attachment**, Micrometer Adjustment. Rectangular Tubular Bar of German Silver, 44 in. long, divided to $\frac{1}{10}$ inch and by vernier to $\frac{1}{100}$ inch; and to 1 meter divided to millimeter and by vernier to $\frac{1}{10}$ millimeter. Instrument in polished mahogany Case . . . . . each $ 35 00

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustration ⅔ size.

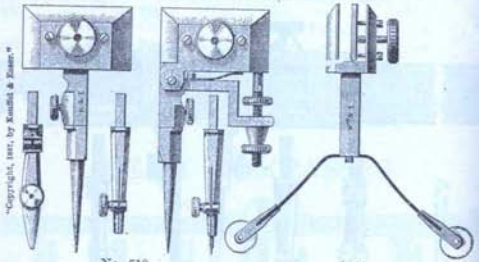


No. 509.

509. Minute Beam Compasses, with 2 Steel Points, Pen, Pencil and Needle Point . . . . . each $ 7 50

Morocco Case, lined with silk velvet, for No. 509 . . " 1 25

Illustrations ⅔ size.



No. 510. 511.

510. Beam Compasses, with two Steel Points, Pen, Pencil and Needle Point . . . . . each $ 9 00

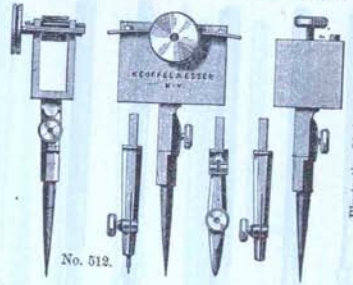
511. Wheel Attachment for No. 510 . . . . . " 2 25

Morocco Case for No. 510 . . . . . " 1 25

" " " " 510 and 511 . . . . . " 1 75

Wooden Bars for Beam Compasses see page 222

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 512.

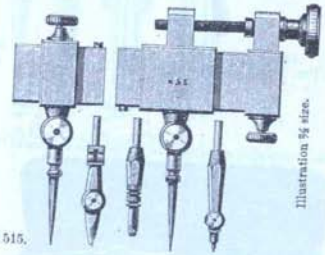
512. Beam Compasses, 2 Steel Points, Pen, Pencil and Needle Point . . . . . each $ 9 75

513. Wheel Attachment for No. 512 . . . . . " 2 75

Morocco Case for No. 512 . . . . . " 1 25

" " " " 512 and 513 . . . . . " 1 75

No. 512 has a pinion which is pressed against the bar by a spring and turned by a thumbscrew, as illustrated by above end-view. The pinion serves for micrometer adjustment, without interfering with the free sliding of the Compass-head along the bar.



No. 515.

515. Beam Compasses, Mc. Cord's pattern, Micrometer Adjustment, 2 Steel Points, Pen, Pencil and Needle Point each $ 14 00

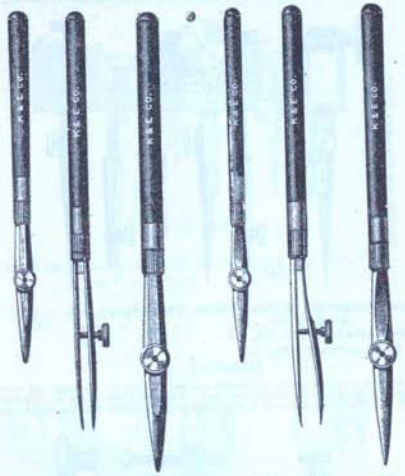
516. Wheel Attachment for No. 515 . . . . . " 3 00

Morocco Case for No. 515 . . . . . " 1 25

" " " " 515 and 516 . . . . . " 1 75

Wooden Bars for Beam Compasses see page 222

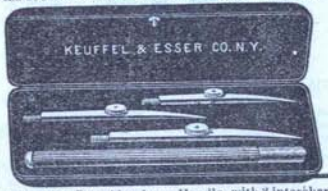
Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



Illustrations ⅔ size.

No.	520.	521.	521½.	522.	523.	523½.		
520.	Drawing Pen, Ebony Handle, 4½ in.						each	$ 1 00
521.	" " " " 5 "						"	1 10
521½.	" " " " 5½ "						"	1 25
522.	" " " " upper blade with spring, 4½ in.						"	1 10
523.	" " " " " " " " 5 "						"	1 20
523½.	" " " " " " " " 5½ "						"	1 35

Above pens can be furnished with aluminum handle at an advance of 15 cents each.

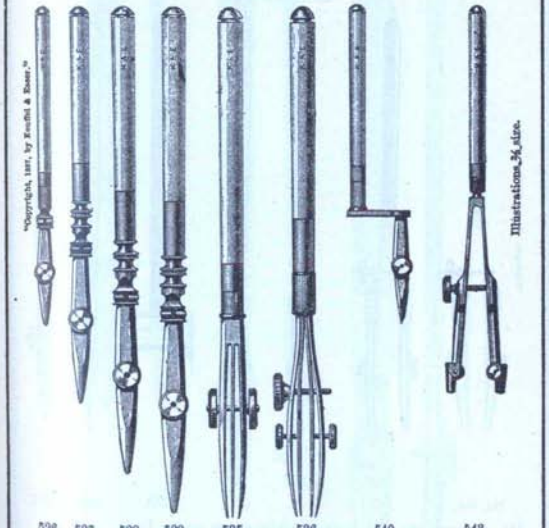


No. 525

525. Paragon Hatching Pen, Aluminum Handle, with 3 interchangeable pens of different sizes, upper blade of pens with spring, in Morocco, silk velvet lined Case. . . . . set $ 3 75

Drawing Pens carefully set and sharpened. . . . $ 15 to 20

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



Illustrations ¾ size.

526. 527. 528. 529. 535. 536. 540. 543.

526.	Drawing Pen with Joint, Ivory Handle, 4 in.	each	$ 1 40
527.	" " " " and Pin, Ivory Handle, 4½ in. . .	"	1 60
528.	" " " " " " " " 5½ " . .	"	1 80
529.	" " " " " " " " 6½ " . .	"	2 00
530.	" " " " " " " " German silver blades, for red ink, 5½ " . .	"	1 80
535.	Border Pen, for broad lines, Ivory Handle . . . 6½ " . .	"	3 00
536.	" " " " " " " improved 6½ " . .	"	3 50

Border Pen No. 536 may be used also as Railroad Pen by filling only the two outer pairs of blades with ink.

540.	Curve Pen, Ivory Handle, 4½ in.	each	$ 1 25
543.	Railroad Pencil, Ivory Handle, 5 in.	"	3 25

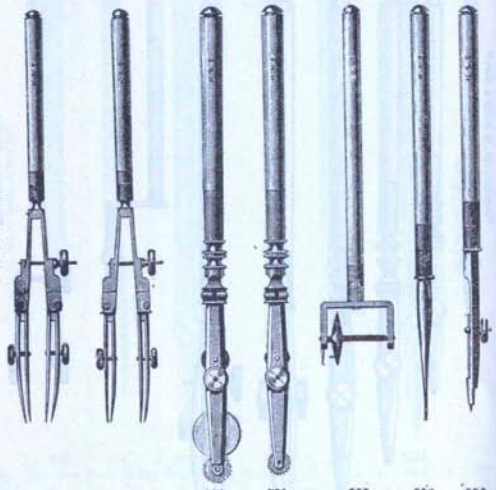
Above pens can be furnished with aluminum handle at an advance of 10 cents each.

Drawing Pens carefully set and sharpened . . . . . each $ 15 to 20

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ⅔ size.



No. 544. 545. 550. 551. 555. 556. 557.

544. Railroad Pen with Joints to blades and in shanks, Ivory Handle, 5½ in. . . . . each $ 3 50

545. do. do. with Joints to blades and in shanks, K. & E. Co.'s improved, Ivory Handle, 5½ in. . . . " 3 75

The improvement consists in having both pens bent in the same direction, so that lines can be drawn against a straight-edge or rule as readily as with a ruling pen.

550. Dotting Pen with 6 Wheels, Ivory Handle, 6 in. . . . . each $ 3 75

551 do. do. 6 " " " improved, 6 in. " 4 25

The improved Dotting Pen No. 551, is doubtless the best pen for the purpose, as it entirely prevents blotting, provided the ink be not too thin. The reservoir after being filled, is closed and supplies no more ink to the dotting wheel, than is actually needed.

555. Opisometer, Ivory Handle, for measuring curved lines . . each $ 1 80

556. Tracer, Ivory Handle . . . . . " 90

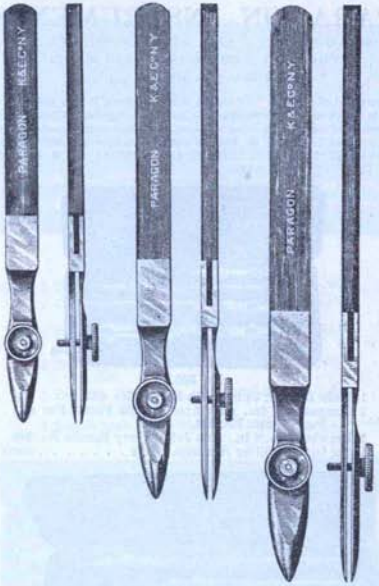
557. Pricker, Ivory Handle . . . . . " 1 75

Above instruments can be furnished with aluminum handle at an advance of 10 cts. each.

Drawing Pens carefully set and sharpened . . . . . each $ 15 to 20

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



Illustrations ⅔ size.

No. 558-1. 558-2. 558-3.

558-1. Detail Drawing Pen, 5 in., upper blade with spring, flat Ebony Handle . . . . . each $ 1 60

558-2. do. do. do. 6 in. . . . . " 1 70

558-3. do. do. do. 7 " . . . . . " 1 80

Aluminum handles for Nos. 558-1 to 558-3, extra . . . . . " 20

559. Fine German Silver Lead Box, screw cap, containing 6 leads . . . . . each $ 25

Drawing Pens carefully set and sharpened, each $ 15 to 20.

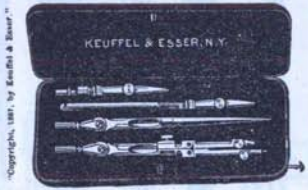
Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

PARAGON INSTRUMENTS

IN MOROCCO POCKET CASES, LINED WITH SILK VELVET.
THE VERY BEST INSTRUMENTS MADE.

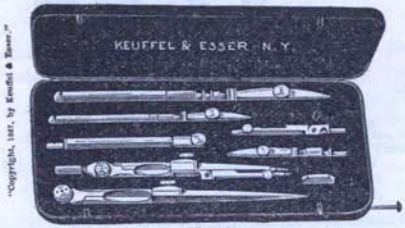
(For Description see page 42)

Our assortment of Paragon Instruments fitted in cases, is very complete and made with regard to the various requirements. The numerous inquiries we continually received as to assortments of instruments fitted in cases, and their cost, induced us to increase the collection in our Catalogue to give our patrons the benefit of our long experience. SHOULD OTHER SETS BE REQUIRED, WE CAN FURNISH THEM IN ANY COMBINATION TO SUIT THE PURCHASER.



No. 560.

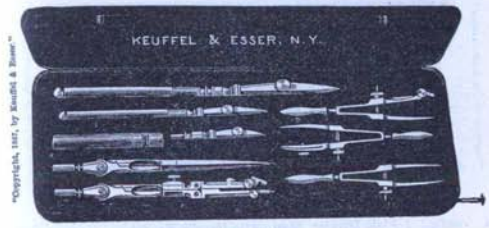
560. cont'g.: 1 Plain Divider, 3½ in., with Handle No. 401,
1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point No. 404,
1 Drawing Pen, 4 in., with Joint, Ivory Handle No. 526
1 fine German Silver Box with Leads . . . . . each $ 10 00



No. 561.

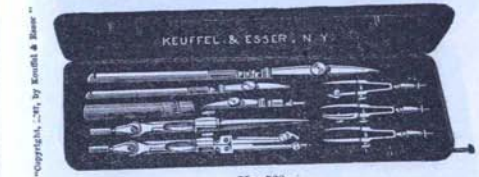
561. cont'g.: 1 Hairspring Divider, 5 in., No. 412.
1 Compass, 4½ in., with fixed Needle Point, Steel, Pen, Pencil Point and Lengthening Bar No. 414,
1 Drawing Pen, 4 in., with Joint, Ivory Handle No. 526,
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle No. 528,
1 fine German Silver Box with Leads . . . . . each $ 15 00

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 562.

562. cont'g.: 1 Plain Divider, 3½ in., with Handle No. 401,
1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point No. 404,
1 Set Steelspring Divider and Bows, No. 464, 465, 466,
1 Drawing Pen, 4 in., with Joint, Ivory Handle No. 526,
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle No. 528,
1 fine German Silver Box with Leads . . . . . each $ 19 35

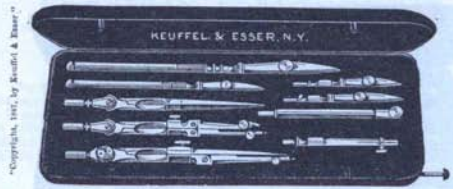


No. 563.

563. cont'g.: 1 Hairspring Divider, 3½ in., with Handle No. 402,
1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point No. 404,
1 Set Minute Steelspring Divider and Bows, No. 460, 461, 462,
1 Drawing Pen, 4 in., with Joint, Ivory Handle No. 526,
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle No. 528,
1 fine German Silver Box with Leads . . . . . each $ 20 00

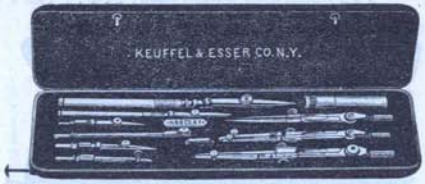
For cases for instruments see page 144

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 564.

564. cont'g.: 1 Plain Divider, 3½ in., with Handle No. 401,
1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point No. 404,
1 Compass, 4½ in., with fixed Needle Point, Steel, Pen, Pencil Point and Lengthening Bar, No. 414,
1 Drawing Pen, 4 in., with Joint, Ivory Handle No. 526,
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle No. 528,
1 fine German Silver Box with Leads . . . . . each $ 20 00

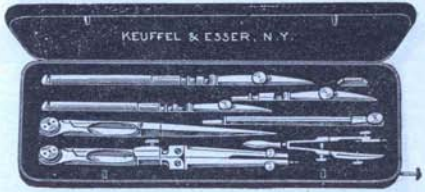


No. 564 H.

564 H. cont'g.: 1 Hairspring Divider, 3½ in., with Handle No. 402,
1 Compass, 3½ in., fixed Needle Point with Hairspring, Pen and Pencil Point No. 404 H,
1 Compass, 4½ in., with Handle, fixed Needle Point with Hairspring, Steel, Pen, Pencil Point and Lengthening Bar No. 414 H,
1 Drawing Pen, 4 in., with Joint, Ivory Handle No. 526,
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle No. 528,
1 fine German Silver Box with Leads . . . . . each $ 22 70

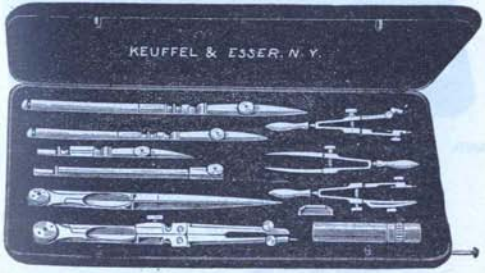
For cases for instruments see page 144

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 565.

565. cont'g.: 1 Plain Divider, 5 in., No. 410.
1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar No. 415,
1 Steelspring Bow Pen No. 469,
1 Drawing Pen, 4½ in., with Joint and Pin, Ivory Handle No. 527,
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle No. 528,
1 fine German Silver Box with Leads . . . . . each $ 17 50



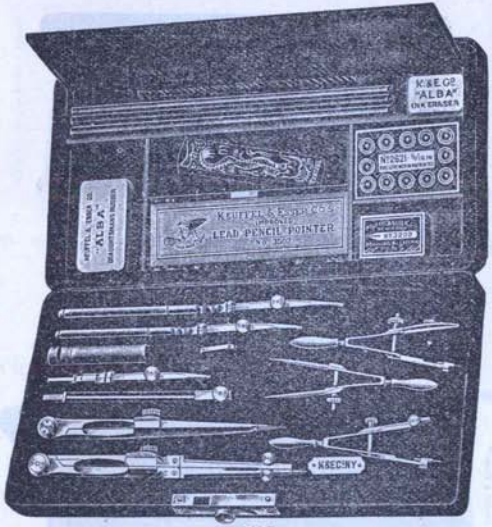
No. 566.

566. cont'g.: 1 Plain Divider, 5 in., No. 410,
1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar No. 415,
1 Set Steelspring Divider and Bows, 464, 469, 470,
1 each Drawing Pen, with Joint and Pin, Ivory Handle No. 527, 528,
1 fine German Silver Box with Leads . . . . . each $ 22 35

For cases for instruments see page 144

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 566 D.

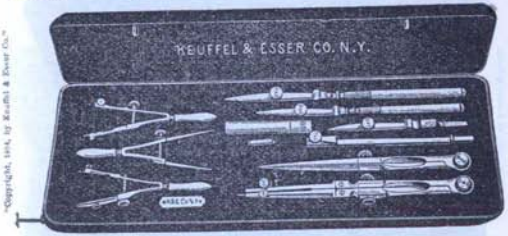
566D. Pocket Case with recessed and partitioned lid with hinged cushion (lid arranged for holding Pencils, Penholder, Pens, Tacks, Rubber, Pencil Pointer, India Ink, etc.) cont'g.:
1 Hairspring Divider, 5 in., No. 412.
1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 415.
1 Set Steelspring Divider and Bows, 464, 469, 470.
1 each Drawing Pen, with Joint and Pin, Ivory Handle No. 527, 528,
1 Fine German Silver Box, with Leads . . . . . each $ 24 65

566P. Pocket Case, with folding flaps, (as illustrated under No. 624P., page 97) cont'g.:
1 Hairspring Divider, 5 in., No. 412,
1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar No. 415.
1 Set Steel Spring Divider and Bows, 464, 469, 470.
1 each Drawing Pen, with Joint and Pin, Ivory Handle No. 527, 528,
1 Fine German Silver Box, with Leads . . . . . each $ 24 15

For cases for instruments see page 144

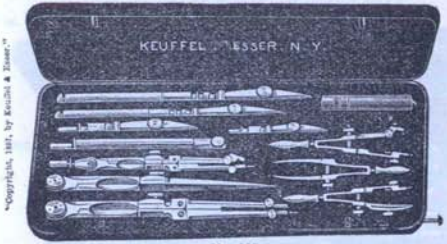
KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 566 H.

566 H. cont'g.: 1 Hairspring Divider, 5 in., No. 412,
1 Compass, 5½ in., fixed Needle Point with Hairspring, Pen, Pencil Point, Lengthening Bar No. 415 H,
1 Set Steelspring Divider and Bows No. 464, 469, 470,
1 each Drawing Pen, with Joint and Pin, Ivory Handle No. 527, 528,
1 fine German Silver Box with Leads . . . . . each $ 24 15

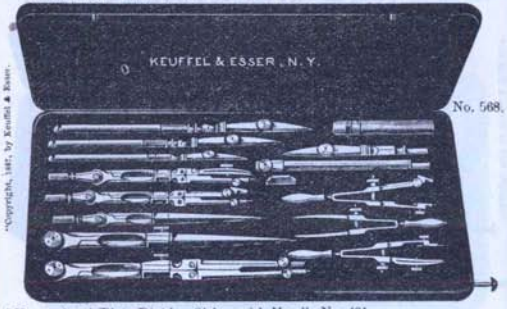


No. 567.

567. cont'g.: 1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point No. 404,
1 Hairspring Divider, 5 in., No. 412,
1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar No. 415,
1 Set Steelspring Divider and Bows No. 464, 469, 470,
1 each Drawing Pen, with Joint and Pin, Ivory Handle No. 527, 528,
1 fine German Silver Box with Leads . . . . . each $ 28 65

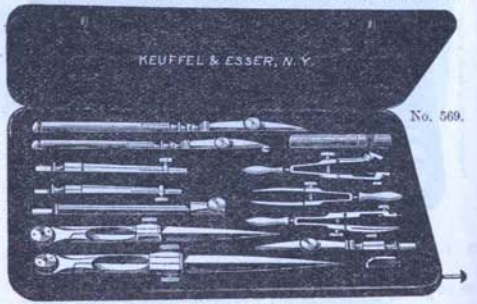
For cases for instruments see page 144

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 568.

568. cont'g.: 1 Plain Divider, 3½ in., with Handle No. 401,
1 Compass, 3½ in., fixed Needle and Pen Point, 406,
1 do. 3½ " " " " Pencil " 407,
1 Hairspring Divider, 5 in., No. 412,
1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar No. 415,
1 Set Steelspring Divider and Bows No. 464, 469, 470,
1 each Drawing Pen, Ivory Handle No. 526, 527, 528,
1 fine German Silver Box with Leads . . . . . each $ 34 80

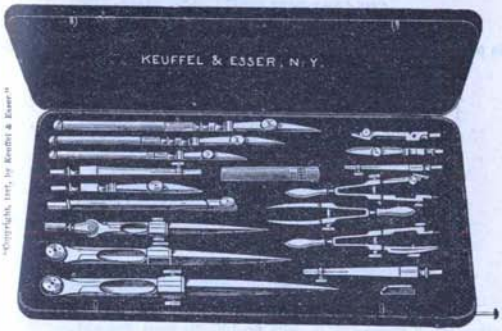


No. 569.

569. cont'g.: 1 Hairspring Divider, 5 in., No. 412,
1 Compass, 6 in., with Pen, Pencil, Needle Point and Lengthening Bar No. 417,
1 Set Steelspring Divider and Bows, No. 464, 469, 470,
1 each, Pen, Joint and Pin, Ivory Handle No. 527, 528,
1 fine German Silver Box with Leads . . . . . each $ 24 65

For cases for instruments see page 144.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 570.

570. cont'g.: 1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 403,
1 Hairspring Divider, 5 in., No. 412,
1 Compass, 6 in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 417,
1 Set Steelspring Divider and Bows, No. 464, 469, 470,
1 Drawing Pen, 4 in., with Joint, Ivory Handle, No. 526,
1 Drawing Pen, 4½ in., with Joint and Pin, Ivory Handle, No. 527,
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle, No. 528,
1 fine German Silver Box with Leads . . . . . each $ 32 80

For cases for instruments see page 144

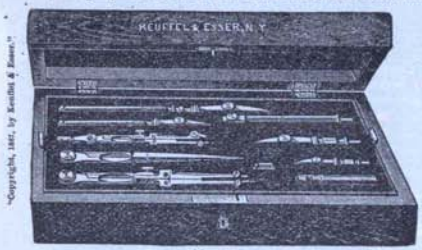
Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

PARAGON INSTRUMENTS

THE VERY BEST INSTRUMENTS MADE.

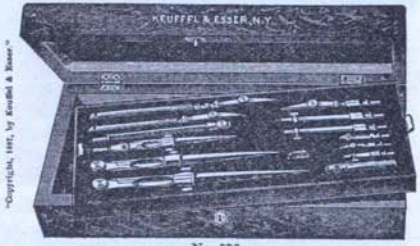
(For Description see page 42)

in polished Mahogany Cases lined with Silk Velvet, with Lock and Tray.



No. 575.

575. cont'g.: 1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point, No. 404,
1 Plain Divider, 5 in., No. 410,
1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 415,
1 each Drawing Pen, Ivory Handle, No. 526, 528,
1 fine German Silver Box with Leads . . . . . each $ 22 60

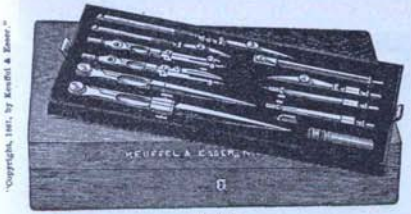


No. 576.

576. cont'g.: 1 Compass, 3½ in., Pen, Pencil, Needle Point, No. 403,
1 Hairspring Divider, 5 in., No. 412,
1 Compass, 6 in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 417,
1 each Drawing Pen, Ivory Handle, No. 526, 528,
1 fine German Silver Box with Leads . . . . . each $ 25 30

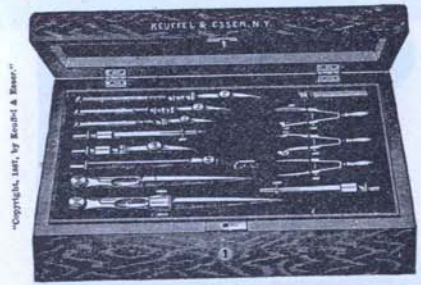
For cases for instruments see page 144

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 577.

577. cont'g.: 1 Compass, 3½ in., fixed Needle and Pen Point, 406,
1 do. 3½ " " " " Pencil " 407,
1 Plain Divider, 5 in., No. 410,
1 Compass, 6 in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 417,
1 each Pen with Joint, Ivory Handle, No. 526, 528,
1 fine German Silver Box with Leads . . . . . each $ 26 30

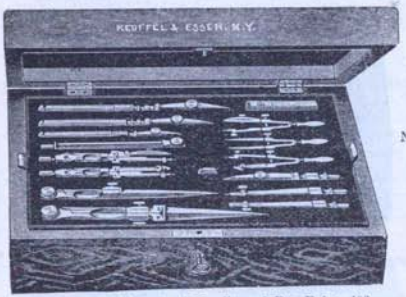


No. 578.

578. cont'g.: 1 Plain Divider, 5 in., No. 410,
1 Compass, 6 in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 417,
1 Set Steelspring Divider and Bows, No. 464, 469, 470
1 Drawing Pen, 4 in., Joint, Ivory Handle, No. 526,
1 do. 4½ " " Pin, Ivory Handle, No. 527,
1 do. 5½ " " " " " " 528,
1 fine German Silver Box with Leads . . . . . each $ 28 65

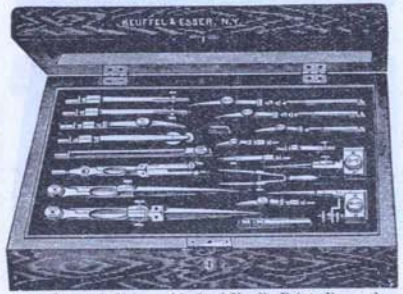
For cases for instruments see page 144

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 579.

579. cont'g.: 1 Compass, 3½ in., fixed Needle and Pen Point, 406,
1 do. 3½ " " " Pencil " 407,
1 Hairspring Divider, 5 in., No. 412,
1 Compass, 6½ in., with Joint in each leg, Pen, Pencil, Needle Point and Lenghtening Bar, No. 418,
1 Set Steelspring Divider and Bows, No. 464, 469, 470,
1 each Drawing Pen, Ivory Handle, No. 526, 527, 528,
1 fine German Silver Box with Leads . . . . . each $ 39 00

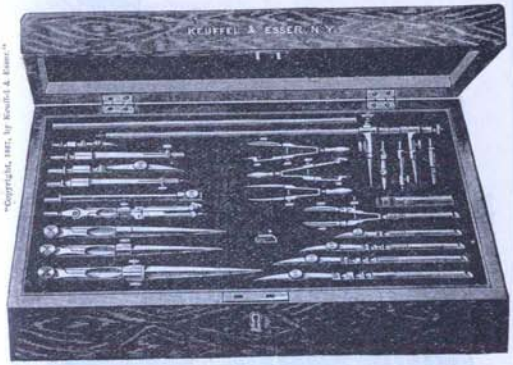


No. 580.

580. cont'g.: 1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point, No. 404,
1 Hairspring Divider, 5 in., No. 412,
1 Compass, 7 in., Joint in each leg, Pen, Pencil, Needle Point, Lengthening Bar and Dotting Pen, No. 419,
1 Steelspring Divider, No. 464,
1 Beam Compass, No. 510,
1 each Drawing Pen, Ivory Handle, No. 526, 527, 528,
1 fine German Silver Box with Leads . . . . . each $ 43 35

For cases for instruments see page 144

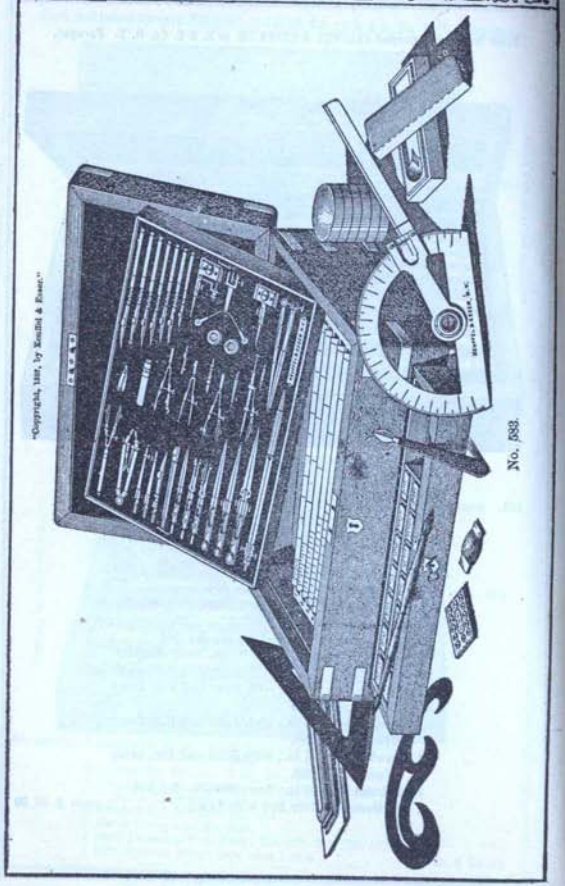
Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 581.

581. cont'g.: 1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point, No. 404,
1 Plain Divider, 5 in., No. 410,
1 Hairspring Divider, 5 in., No. 412,
1 Compass, 6 in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 417,
1 Set Steelspring Divider and Bows, No. 464, 469, 470,
1 Tubular Beam Compass, 18 in., No. 500
1 Drawing Pen, 4 in., with Joint, Ivory Handle, No. 526,
1 Drawing Pen, 4½ in., with Joint and Pin, Ivory Handle, No. 527,
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle, No. 528,
1 Drawing Pen, 6½ in., with Joint and Pin, Ivory Handle, No. 529,
1 Railroad Pen, 5½ in., Ivory Handle, No. 544,
1 fine German Silver Box with Leads . . . . . each $ 55 50

For cases for instruments see page 144



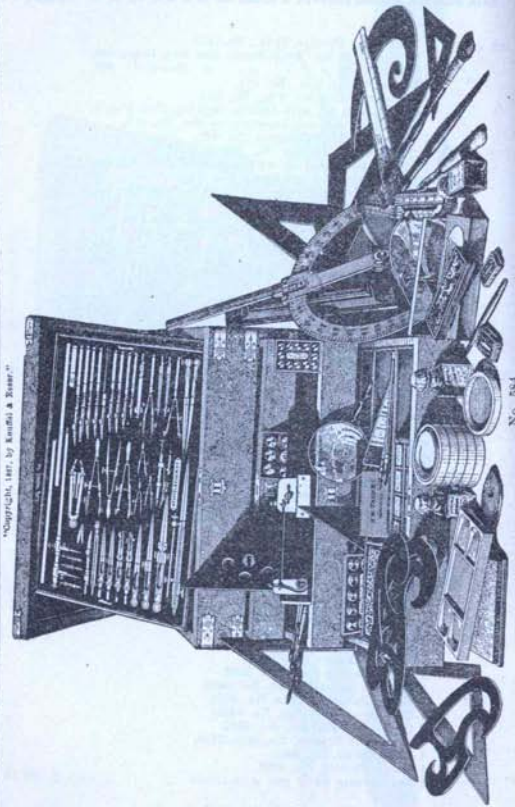
Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

582. cont'g.: 1 Hairspring Divider, 3½ in., No. 402,
1 Compass, 3½ in., fixed Needle and Pen Point, 406,
1 do. 3½ " " " " Pencil " 407,
1 Plain Divider, 6 in., No. 411,
1 Hairspring Divider, 6 in., No. 413,
1 Compass, 6½ in., with Joint in each leg, Pen, Pencil, Needle Point and Lengthening Bar, No. 418,
1 Pocket or Pillar Compass, No. 427,
1 Three legged Divider, No. 430,
1 Proportional Divider, with movable Points, No. 439,
1 Spring Bow Pen and Pencil, No. 454,
1 Set Steelspring Divider and Bows, No. 480, 481, 482,
1 Beam Compass, 510, with Wheel Attachment, 511,
1 Drawing Pen, 4 in., Joint, Ivory Handle, No. 526,
2 do. 4½ " " Pin, Ivory Handle, 527,
2 do. 5½ " " " " " 528,
1 do. 6½ " " " " " 529,
1 Railroad Pen, 5½ in., Ivory Handle, No. 544,
1 Dotting Pen, 6 " " " " 551,
1 Adjusting Key and Screw Driver, No. 825.
2 Horn Centres, with German Silver rim, No. 2691,
1 fine German Silver Box with Leads . . . . . each $ 115 50

583 Fine polished Rosewood Case, **with Tray and Drawer,** German Silver Straps and Corners, Lock,

cont'g.: The same instruments as No. 582; and in addition:
1 Set Paragon Scales like No. 1576P,
1 Paper Cutter, No. 2701,
1 Protractor, No. 1226,
1 German Silver Parallel Rule, No. 1750,
2 doz. each German Silver Thumb Tacks, 2622, 2625,
1 Tacklifter, No. 2680,
1 each Rubber Triangle, No. 1802, 5, 8, 12 in.,
1 " " " " 1804, 4, 7, 10 "
1 " " Curve, " 1820, 4, 13, 19 "
1 Set of 18 Technical Water Colors, No. 2900 and 2901. Full Pans,
1 Cake Chinese Ink, No. 3031, VIII.
1 doz. assorted Camel Hair Brushes, No. 3102,
1 each black Sable Brush, No. 3120, 1, 2, 6, 10, 14, 18,
1 " double Camel Hair Brush, No. 3135, 1, 3,
1 Camel Hair Brush, No. 3136, 3,
1 Patent Ink Slab, No. 3151,
1 Nest of Saucers, No. 3161,
1 doz. Lettering Pens, No. 3202,
3 Paragon Artist Pencils, No. 3320,
3 Boxes Paragon Leads, No. 3325,
1 Cake Sponge Rubber, No. 3412½,
2 Cakes Alba Rubber, No. 3415,
2 " Ink Erasers, No. 3418, 2419,
1 Steel Eraser, No. 3481,
1 Pencil Pointer, No. 3502,
1 fine German Silver Box with Leads . . . . . each $ 192 50

For cases for instruments see page 144



No. 584.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

584. Magazine Case. Polished Mahogany, with Tray and three Drawers, ornamental Brass Corners, Bands, Hinges, Shields and Name-Plate.

cont'g.:

1 Hairspring Divider, 3½ in., No. 402,
1 Plain Divider, 3½ in., No. 401,
1 Compass, 3½ in., with fixed Needle and Pen Point, No. 406,
1 do. 3½ " " " " " Pencil " " 407,
1 Plain Divider, 5 in., No. 410,
1 Hairspring Divider, 6 in., No. 413,
1 Compass, 7 in., with Joint in each leg, Pen, Pencil, Needle Point, Lengthening Bar and Dotting Pen, No. 419,
1 Pocket Compass No. 427,
1 Three legged Divider, No. 430,
1 Proportional Divider with Micrometer Adjustment, No. 441,
1 Drop Spring Bow Pen and Pencil, No. 454,
1 Set Steelspring Divider and Bows, No. 460, 461, 462,
1 " " do. " do. No. 476, 477 478,
1 Tubular Beam Compass, 36 in., No. 502,
1 Drawing Pen, 5 in., Ebony Handle, No. 521,
1 do. 4 " with Joint, Ivory Handle, No. 526,
2 do. 4½ " " " and Pin, Ivory Handle, No. 527,
2 do. 5½ " " " " " " " " 528,
1 do. 6½ " " " " " " " " 529,
1 Railroad Pencil, 5 in., Ivory Handle, No. 543,
1 " Pen, 5½ in., Ivory Handle, No. 544,
1 Improved Dotting Pen, 6 in., Ivory Handle, No. 551,
1 Pricker, Ivory Handle, No. 557,
1 Adjusting Key and Screwdriver, No. 825,
1 Casey's Section Liner, No. 1157,
1 Protractor with Arm and Vernier, No. 1226,
1 Set Paragon Scales, like No. 1576 P, 1 Scale Rule, No. 1730,
1 Parallel Rule, No. 1751, 1 Set Lettering Triangles, No. 1810,
1 each Rubber Triangle, No. 1802, 5, 8, 12 in.,
1 " do. do. " 1804, 4, 7, 10 "
1 " do. Curve, No. 1830, 4, 13, 19 and No. 1822,
1 " Steel Triangle No. 2002, 10½ in., No. 2003, 8 in.,
2 doz. each G. S. Tacks, No. 2622, 2626,
1 " Steel Tacks, No. 2600,
1 Tacklifter, No. 2680, 2 Horn Centres, No. 2691,
1 Set Technical Colors, No. 2900 and No. 2901, Full Pans,
1 Set Drawing Ink, No. 3011, 1 Cake India Ink, No. 3031, XL
1 doz. Brushes, No. 3102, 1 each Brush, No. 3123, 1, 2,
1 each Brush, No. 3120, 1, 2, 4, 6, 8, 10, 14, 18, 22,
1 " do. " 3133, 0, 3, No. 3135, 1, 3,
1 Slate Ink Slab, No. 3153, 1 Nest of Saucers, No. 3161,
1 Centre Slab, No. 3183, 1 Water Glass, No. 3187,
1 doz. each Pens, No. 3200, 3202,
1 each Penholder, No. 3220, 3221,
6 Paragon Artist's Pencils, No. 3320, 6 Boxes Leads, No. 3325,
1 Cake Sponge Rubber, No. 3408,
2 Cakes Alba Rubber, No. 3415,
1 each Ink Erasers, No. 3418, 3419,
1 Pencil Pointer, No. 3507, 1 Steel Eraser, No. 3480,
1 Reading Glass, No. 6970, 3 in.,
1 fine German Silver Box with Leads . . . . . each $ 300 00

For cases for instruments see page 144

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

PARAGON INSTRUMENTS

WITH ESSER'S PATENT PIVOT JOINT.

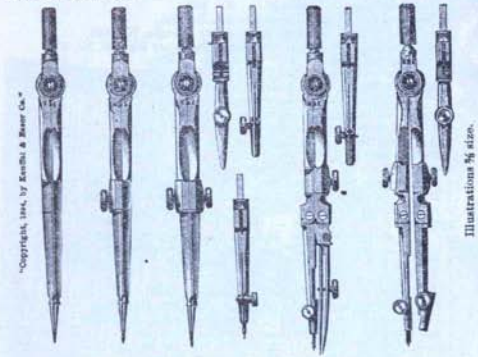
(Patented, March 14th and 28th, 1893.)

THE VERY BEST INSTRUMENTS MADE.

(For description see page 44.)

Corresponding in quality, workmanship and finish to our Paragon Instruments Nos. 400 to 557.

It should be born in mind that pivot-joint instruments are not an improved style over tongue-joint instruments, but only a different form. The choice between tongue-joint and pivot-joint instruments of the same grade and style is therefore largely a matter of fancy. This is easily lost sight of in selecting from a Catalogue which describes instruments of only one style of joint of the same grade. Our Catalogue being the only one which describes full assortments of instruments with both kinds of joint of the same make, grade, size and shape, affords the careful buyer an opportunity of indulging his preference in regard to style of joint.



Illustrations ⅔ size.

No. 600. 601. 602. 603. 603 H.

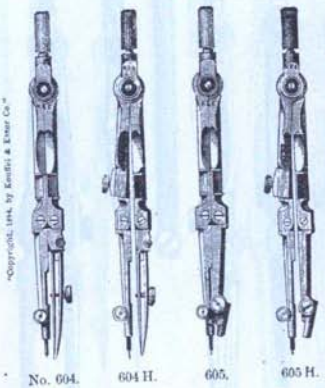
600.	Plain Dividers, 3½ in.			each	$ 2 25
601.	Hairspring Dividers, 3½ in.			"	3 00
602.	Compasses, 3½ in., with 2 Steel Points, Pen, Pencil and Needle Point			"	7 00
603.	do.	3½ "	" fixed Needle Point, Pen and Pencil Point	"	6 00
603 H.	do.	3½ "	like No. 603, but with Hairspring	"	7 00
603 L.	do.	3½ "	" " " Lengthening Bar	"	6 75

Compasses No. 602, 603, 603H and 603L can be furnished with the same style of Pencil Point as illustrated under No. 610, if so ordered, but we recommend the style shown above, as more suitable for the small size compasses.

For Paragon Instruments as above, but with Tongue-joint see page 51.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ⅔ size.



No. 604. 604 H. 605. 605 H.

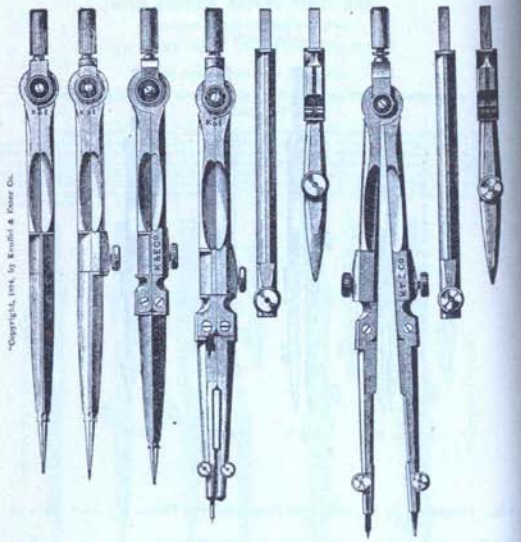
604.	Compasses, 3½ in.,		with fixed Needle and Pen Point	each	$ 4 00
604 H.	do.	3½ "	like No. 604, but with Hairspring	"	5 00
605.	do.	3½ "	with fixed Needle and Pencil Point	"	4 00
605 H.	do.	3½ "	like No. 605, but with Hairspring	"	5 00

Compasses Nos. 605 and 605 H can be furnished with the same style of Pencil Point as illustrated under No. 610 if desired, but we recommend the style above, as more suitable for the small size compasses.

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ⅔ size.



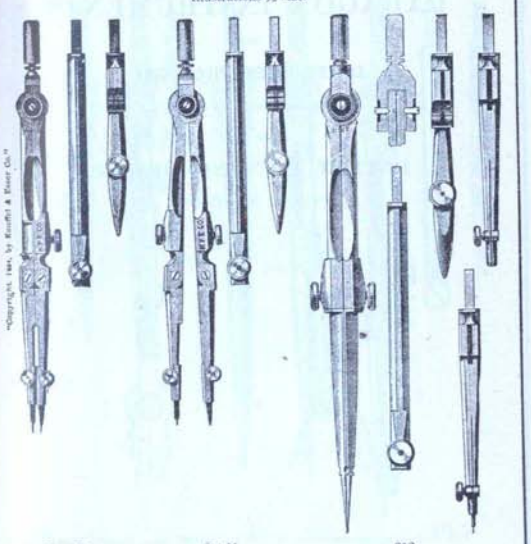
No. 606. 608. 608½. 610. 610 H.

606.	Plain Dividers, 5 in.	each	$ 2 50
607.	do. 6 "	"	3 00
608.	Hairspring Dividers, 5 in.	"	3 50
608½.	do. do. 5 " with joint in each leg	"	4 50
609.	do. do. 6 "	"	4 00
610.	Compasses, 6 in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar	"	7 50
610 H.	do. 6 " like No. 610, but with Hairspring	"	8 50

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

Illustrations ⅔ size.



No. 611 611 H. 612.

611.	Compasses, 4½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar	each	$ 7 25
611 H.	do. 4½ " like No. 611, but with Hairspring	"	8 25
612.	do. 6 " with Pen, Pencil, Needle Point and Lengthening Bar	"	8 50

PARAGON INSTRUMENTS

WITH

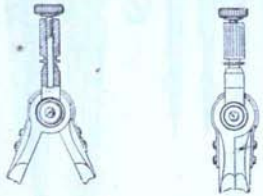
ESSER'S PATENT PIVOT JOINT,

(Patented March 14 & 28, 1893).

AND WITH

PATENT LOCKING DEVICE.

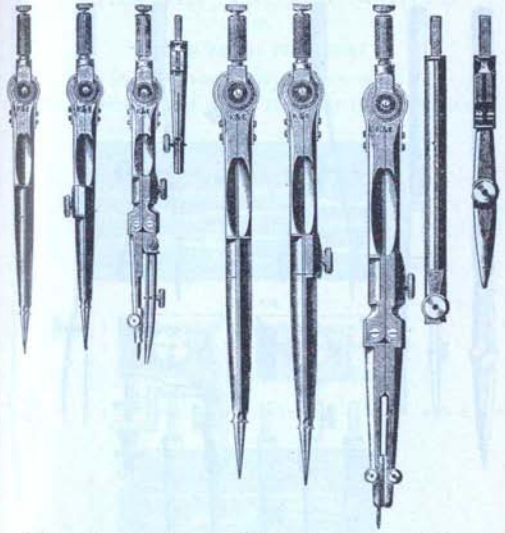
(Patented Nov. 6, 1894.)



The following instruments, Nos. 613 to 618H have Esser's Patent Pivot Joint, as described on pag 44 and in addition they have a device for locking or clamping the joint in any position. This is accomplished by means of two steel bands, each passing up from one of the legs, around the head and well beyond the median line, so that in the median line both bands overlap in opposite directions. At this point they can be firmly locked against each other by a screw operated by a milled head at its upper end beyond the handle.

Where the same opening of dividers is to be used repeatedly, or where great accuracy is required, this attachment will be found of value. It adds practically nothing to the bulk of the compass, nor does it in any way interfere with any of its uses, nor detract from its appearance.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

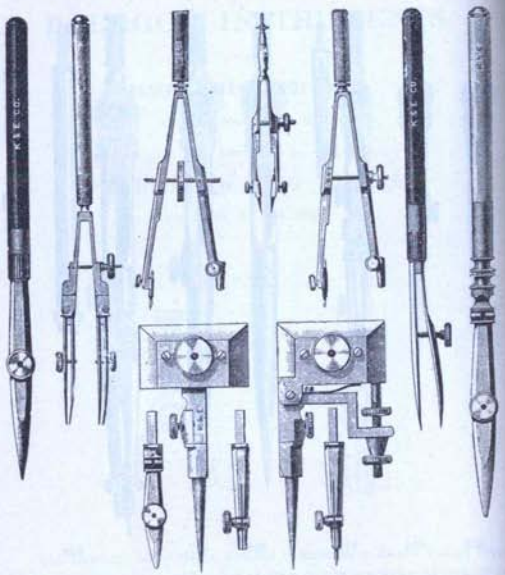


613. 614. 615. 616. 617. 618.

The following instruments, Nos. 613 to 618H have Esser's Patent Pivot Joint with Patent Locking Device:

613.	Plain Dividers, 3½ in.	each	$ 2 85
614.	Hairspring Dividers, 3½ in.	"	3 60
615.	Compasses, 3½ in., with fixed Needle Point, Pen and Pencil Point	"	6 60
616.	Plain Dividers, 5 in.	"	3 10
617.	Hairspring Dividers, 5 in.	"	4 10
618.	Compasses, 6 in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar	"	8 10
618H	Compasses, 6 in., like No. 618, but with Hairspring	"	9 10

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



Although we list such Paragon instruments as three-legged and proportional dividers, spring bows, beam compasses, ruling and dotting pens etc., in connection with tongue-joint compasses and dividers, they belong to the Pivot-joint compasses as much as to the tongue-joint, as they perfectly match either in quality, style and finish. Selections for sets of Paragon instruments with pivot-joint compasses can therefore be completed from the assortment of Paragon instruments on pages 55 TO 71

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

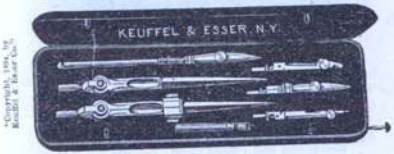
PARAGON INSTRUMENTS

WITH

ESSER'S PATENT PIVOT JOINT.

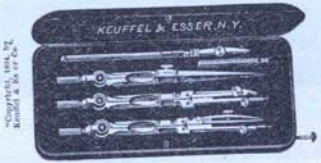
(Patented, March 14th and 28th, 1893.)

IN MOROCCO POCKET CASES, LINED WITH SILK VELVET



No. 620.

620. cont'g.: 1 Plain Divider, 3½ in., No. 600,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 602,
1 Drawing Pen, 4 in., with Joint, Ivory Handle, No. 526,
1 fine German Silver Box with Leads . . . . . each $ 12 00



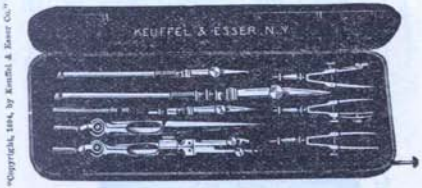
No. 621.

621. cont'g.: 1 Hairspring Divider, 3½ in., No. 601,
1 Compass, 3½ in., with fixed Needle and Pen Point, No. 604,
1 Compass, 3½ in., with fixed Needle and Pencil Point, No. 605,
1 Drawing Pen, 4 in., with Joint, Ivory Handle, No. 526,
1 fine German Silver Box with Leads . . . . . each $ 14 40

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

No. 621 H.

621 H. cont'g.: 1 Hairspring Divider, 3½ in., No. 601.
1 Compass, 3½ in., with fixed Needle Point with Hairspring and Pen Point, No. 604 H.
1 Compass, 3½ in., with fixed Needle Point with Hairspring and Pencil Point, No. 605 H.
1 Drawing Pen, 4 in., with Joint, Ivory Handle No. 526.
1 fine German Silver Box with Leads . . . . . each $ 16 40

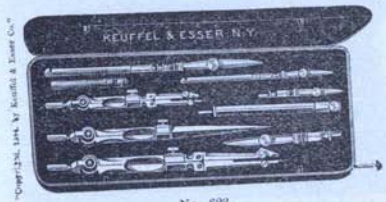


No. 622.

622. cont'g.: 1 Plain Divider, 3½ in., No. 600.
1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point, No. 603,
1 Set Minute Steelspring Divider and Bows, No. 460, 461, 462,
1 Drawing Pen, 4 in., with Joint, Ivory Handle, No. 526,
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle, No. 528,
1 fine German Silver Box with Leads . . . . . each $ 21 20

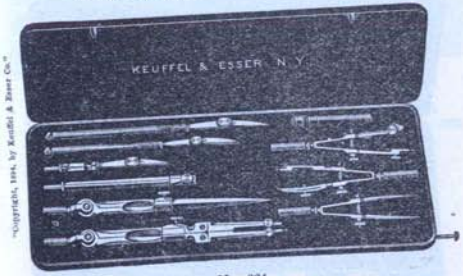
622L. cont'g.: the same assortment as No. 622, but Dividers No. 613 and compasses No. 615 with patent locking device, in place of Nos. 600 and 603 . . . . . each $ 22 40

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 623.

623. cont'g.: 1 Compass, 3½ in., with fixed Needle Point, Pen and Pencil Point, No. 603,
1 Hairspring Divider, 5 in., No. 608.
1 Compass, 6 in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 610.
1 Drawing Pen, 4 in., with Joint, Ivory Handle, No. 526.
1 Drawing Pen, 5½ in., with Joint and Pin, Ivory Handle, No. 528.
1 fine German Silver Box with Leads . . . . . each $ 22 25



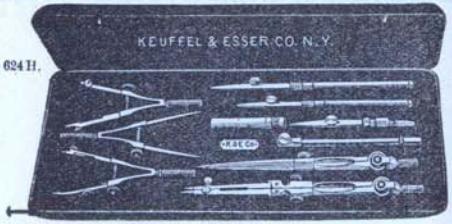
No. 624.

624. cont'g.: 1 Hairspring Divider, 5 in., No. 608,
1 Compass, 6 in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 610.
1 Set Steelspring Divider and Bows, No. 480, 481, 482
1 each Drawing Pen, Ebony Handle, No. 522, 523½,
1 fine German Silver Box with Leads . . . . . each $ 23 50

624L. cont'g.: the same assortment as No. 624, but Hairspring Dividers No. 617 and Compasses No. 618 with patent locking device, in place of Nos. 608 and 610 . . . . each $ 24 70

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

No. 624 H.

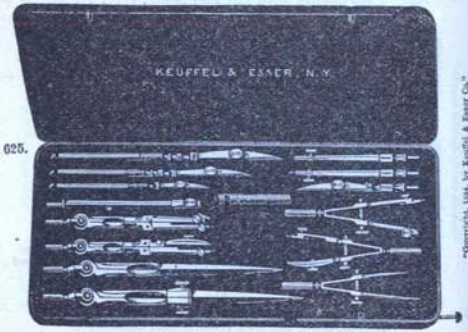


"Copyright, 1894, by Keuffel & Esser Co."

624 H. cont'g.: 1 Hairspring Divider, 5 in., No. 608.
1 Compass, 6 in., fixed Needle Point with Hairspring, Pen, Pencil Point and Lengthening Bar, No. 610H.
1 Set Steelspring Divider and Bows, No. 480. 481. 482,
1 each Drawing Pen, Ebony Handle, No. 522, 523½,
1 fine German Silver Box with Leads . . . . . each $ 24 50

624HL. cont'g.: the same assortment as No. 624H., but Hairspring Dividers No. 617 and Compasses with Hairspring No. 618H with patent locking device, in place of No. 608 and 610H. . . . each $ 25 70

No. 625.



"Copyright, 1894, by Keuffel & Esser Co."

625 cont'g.: 1 Compass 3½ in., fixed Needle and Pen Point, No. 604,
1 do. 3½ " " " " Pencil " " 605,
1 Plain Divider, 5 in., No. 606.
1 Compass, 6 in., with Pen. Pencil, Needle Point and Lengthening Bar, No. 612.
1 Set Steelspring Divider and Bows, No. 480. 481. 482,
1 each Drawing Pen, Ivory Handle, No. 526, 527, 528,
1 fine German Silver Box with Leads . . . . . each $ 36 00

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.

No 624 D. L.

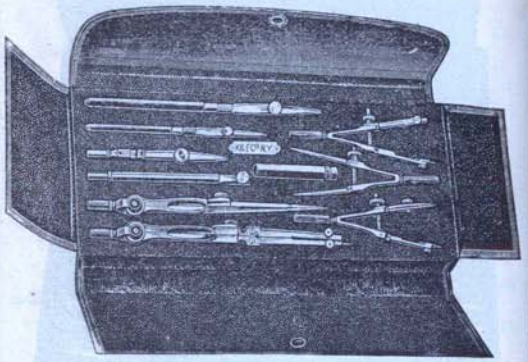
624 D Pocket Case with recessed and partitioned lid with hinged cushion (lid arranged for holding pencils, penholders, pens, tacks, rubber, pencil pointer, India Ink, etc.; see cut No. 624 D L,) containing :

1 Hairspring Divider, 5 in., No. 608,
1 Compass, 6 in., fixed Needle Point with Hairspring, Pen. Pencil Point and Lengthening Bar, No. 610H,
1 Set Steelspring Divider and Bows, Nos. 480, 481, 482
1 each Drawing Pen, Ebony Handle, Nos. 522, 523½,
1 fine German Silver Box with Leads . . . . . each $26 00

624 D L. Pocket Case like No. 624D, containing the same assortment as No. 624D, but Hairspring Dividers No. 617 and Compasses No. 618 with patent locking device, in place of Nos. 608 and 610H . . . . . each $27 20

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 624 P.

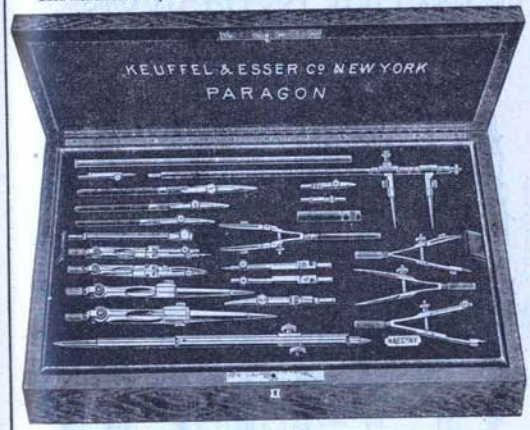
624 P. Pocket Case with folding flaps, containing:

1 Hairspring Divider, 5 in., No. 608.
1 Compass, 6 in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 610.
1 Set Steelspring Dividers and Bows, Nos. 480, 481, 482,
1 each Drawing Pen, Ebony Handle, No. 522, 523½,
1 fine German Silver Box with Leads . . . . . each $24 50

624 P.L. Pocket Case like 624P, containing the same assortment as No. 624P, but Hairspring Dividers No. 617 and Compasses No. 618, with patent locking device, in place of Nos. 608 and 610 . . . . . each $25 70

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y. Paragon.



No. 630.

630. Polished Mahogany Case, lined with Silk Velvet, with Lock and Tray, containing:

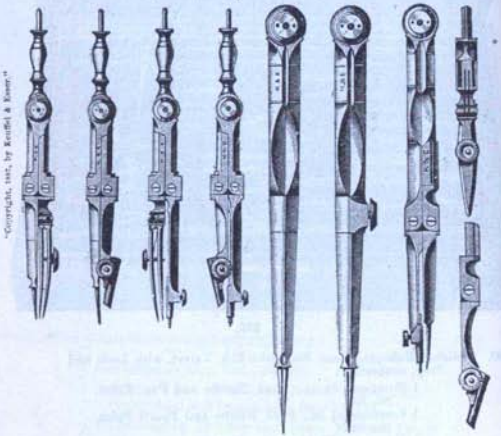
1 Compass, 3½ in., fixed Needle and Pen Point, No. 604,
1 Compass, 3½ in., fixed Needle and Pencil Point, No. 605,
1 Hairspring Divider, 5 in., No. 608.
1 Compass, 6 in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 612,
1 Universal Proportional Divider, No. 438.
1 Tubular Beam Compass, 18 in., 2 round German Silver Bars, 2 Steel Points, Pen, Pencil and Needle Point, No. 500.
1 Steelspring Divider, 3½ in., No. 480.
1 " Bow Pen, 3½ in. " 481.
1 " Bow Pencil, 3½ in., No. 482.
1 Drawing Pen, Ebony Handle, 4½ in., upper blade with Spring, No. 522,
1 Drawing Pen, Ebony Handle, 5 in., upper blade with Spring, No. 523,
1 Drawing Pen, Ebony Handle, 5½ in., upper blade with Spring, No. 523½,
1 Railroad Pen, K. & E. improved, Ivory Handle, 5½ in., No. 545.
1 fine German Silver Box with Leads . . . . . each $ 64 15

For Cases of Instruments see page 144.

ENGLISH INSTRUMENTS.

GERMAN SILVER, FINE FINISH, DOUBLE SECTOR-JOINT.

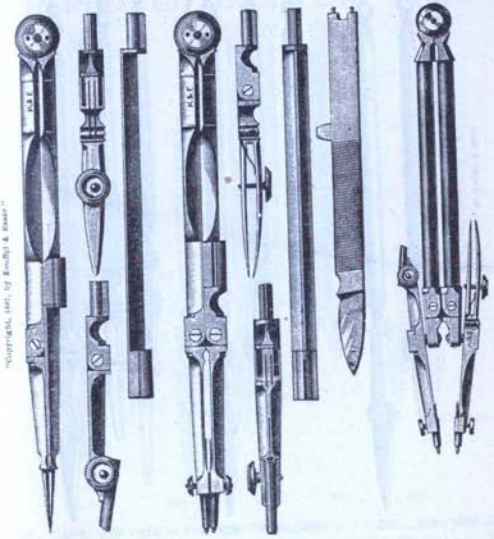
Illustrations ⅔ size. ½ size.



No. 640. 641. 642. 643. 644. 646. 650.

640.	Bow Pen, 3½ in. . . . . each	$ 3 50
641.	Bow Pencil, 3½ in. . . . . "	3 50
642.	Bow Pen, with Needle Point, 3½ in. . . . . "	4 30
643.	Bow Pencil, " " " 3½ " . . . . . "	4 30
644.	Dividers, 5 in. . . . . "	2 15
646.	Hairspring Dividers, 5 in. . . . . "	3 25
650.	Compasses, 5½ in., with Joint in each leg, fixed Needle Point, Pen and Pencil Point . . . . . "	10 75

Illustrations ⅔ size. ½ size.

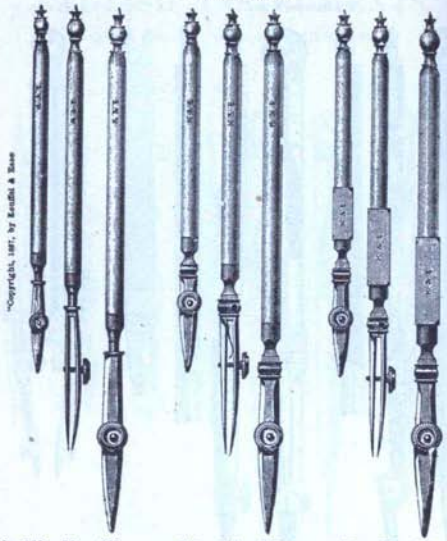


No. 651. 652. 653.

651.	Compasses, 6 in., with Pen, Pencil Point, Lengthening Bar and Knife Key . . . . . each	$ 10 75
652.	do. 6 in., with Joint in each leg, Pen, Pencil, 2 Needle Points, Lengthening Bar and Knife Key . . . . . "	14 50
653.	Tubular Compasses, with improved Slide Bar, Pen, Pencil and 2 Needle Points, (lengthens to 9½ in.) "	16 10

KEUFFEL & ESSER CO. NEW YORK.

Illustrations ⅔ size.



No. 660. 661. 662. 665. 666. 667. 670. 671. 672.

660. Drawing Pen, Ivory Handle, 4½ in . . . . . each $ 1 35
661. do. " " 5½ " . . . . . " 1 45
662. do. " " 6 " . . . . . " 1 60

665. Drawing Pen, with Joint, Ivory Handle, 4½ in. . . . . " 1 60
666. do. " " " " 5½ " . . . . . " 1 90
667. do. " " " " 6½ " . . . . . " 2 15

670. Drawing Pen, with Joint, square Ivory Handle, 4½ in. . . " 1 90
671. do. " " " " 5½ " . . . " 2 15
672. do. " " " " 6½ " . . . " 2 45

Steelspring Dividers and Bows Nos. 460 to 467 match the above.

CASES OF ENGLISH INSTRUMENTS

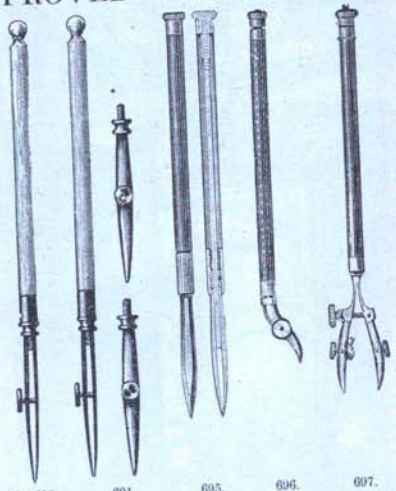
containing any of the above Instruments, also Scales, Colors, Brushes, etc., made to order.

For EMPTY CASES see page 144

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped KEUFFEL & ESSER CO. or K. & E. Co. N. Y.

IMPROVED DRAWING PENS.



Illustrations ⅔ size.

No. 690. 691 695. 696. 697.

690. Hatching Pen, extra fine, with Pushing Screw, 5 in. . . . each $ 1 10
691. do. " " " " 3 Pens to one Handle " 2 60

695. Improved Drawing Pen, 5½ in., without Thumb-screw . . " 1 45

This pen opens and closes by turning the set-screw at the upper end of the handle, making the screw through the blades unnecessary, and a displacement of the nibs sideways impossible. As there is no obstruction to the sight in working, this pen is preferable for fine work.

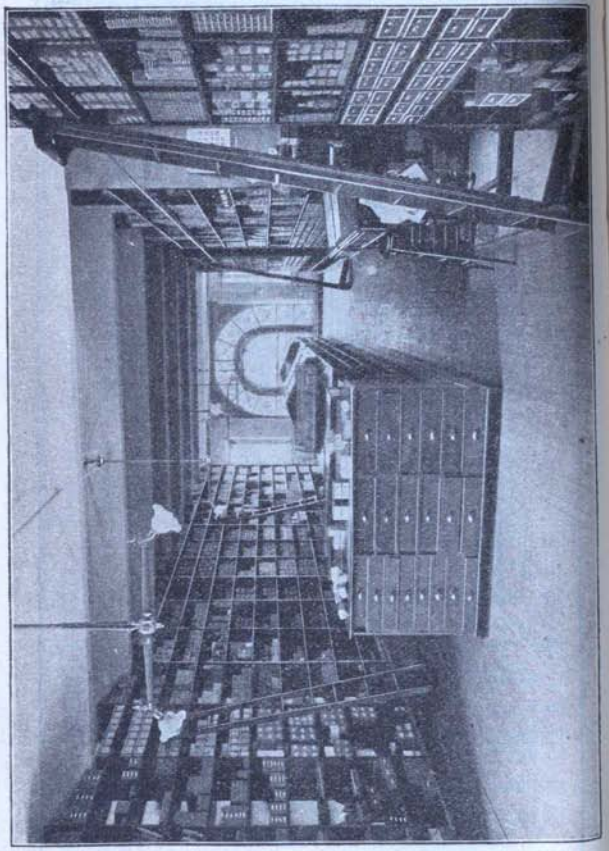
. . . . . each $ 1 50

696. Improved Curve Pen, 4½ in. . . . . The blades being fastened to the end of the rod and being eccentric to it, turn easily and follow the smallest curve with precision. By means of a nut at the upper end of the rod, the pen can be clamped and may then be used as an ordinary drawing pen.

. . . . . each $ 4 25

697. Improved Railroad Pen, 5½ in. . . . . The construction of this pen is like that of No. 696 with the exception of its having two pair of blades. The heads of the screws in the blades are graduated to secure uniform adjustment for thickness of lines.

As these improved pens, which we have introduced, have been extensively imitated in other grades, we stamp each of them with our name, for the protection of those buyers who want the best quality.



INSTRUMENTS AND SUNDRIES LOFT, FULTON ST.

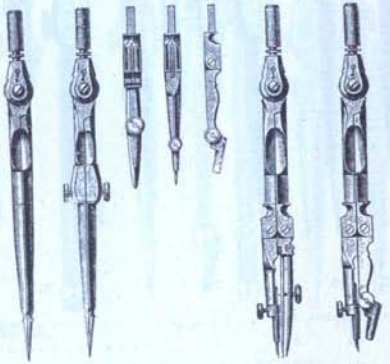
EXTRA FINE
GERMAN INSTRUMENTS

OF BEST GERMAN SILVER, FINE STEEL POINTS, HIGHLY FINISHED.

"TRADE MARK".

The above trade-mark is our full guaranty that these instruments are the very best of their kind. For description of quality see page 4 5

Illustrations ⅔ size.



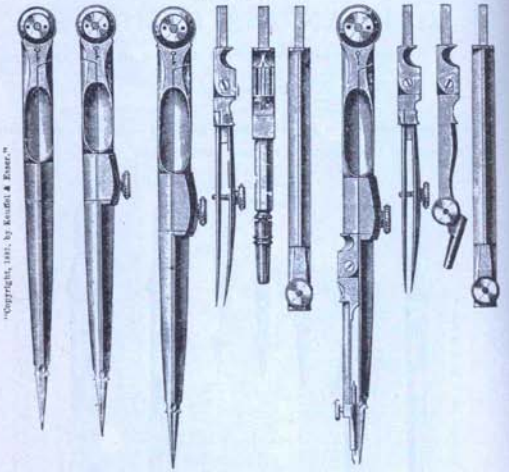
No. 700. 702. 704. 705.

700.	Plain Dividers, 3½ in., with Handle	each	$ 1 00
702.	Compasses, 3½ in., with Pen, Pencil and Needle Point	"	2 80
703.	do. 3½ " like No. 702, but with Lengthening Bar	"	3 05
704.	do. 3½ " with fixed Needle and Pen Point . . .	"	2 15
705.	do. 3½ " " " " " Pencil Point	"	2 15

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

Illustrations ½ size.



No. 707. 710. 714. 715.

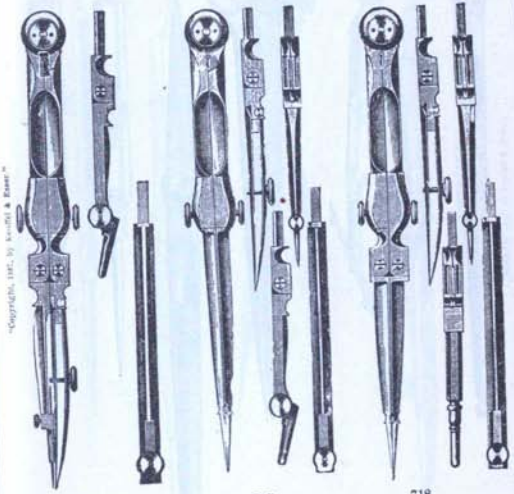
706.	Plain Dividers, 4 in.	each	$ 80
707.	do. 5 "	"	85
708.	do. 6 "	"	1 00
710.	Hairspring Dividers, 5 in.	"	1 50
711.	do. 6 "	"	2 00
714.	Compasses, 5½ in., with Pen, Pencil Point and Lengthening Bar	"	2 70
715.	do. 5½ " with fixed Needle Point, Steel, Pen, Pencil Point and Lengthening Bar	"	3 05

Compasses No. 714 and 715 can be furnished with straight pencil point as shown in cut No. 714, or with oblique point as in cut No. 715. Buyers who have any preference, will please specify the style wanted.

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

Illustrations ⅔ size.



No. 716. 717. 718.

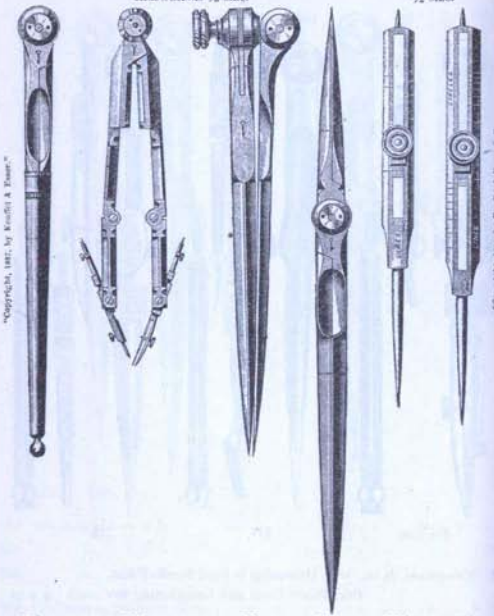
716.	Compasses, 5½ in., with Hairspring to fixed Needle Point, Pen, Pencil Point and Lengthening Bar	each	$ 4 55
717.	do. 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar	"	3 55
718	do. 5½ in., with Joint in each leg, Pen, Pencil, Needle Point and Lengthening Bar	"	4 40

Compasses No. 716 to 718 can be furnished with straight pencil point as shown in cut No. 718, or with oblique point, as in cut No. 717. Buyers, who have any preference, will please specify the style wanted.

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

Illustrations ⅔ size. ½ size.



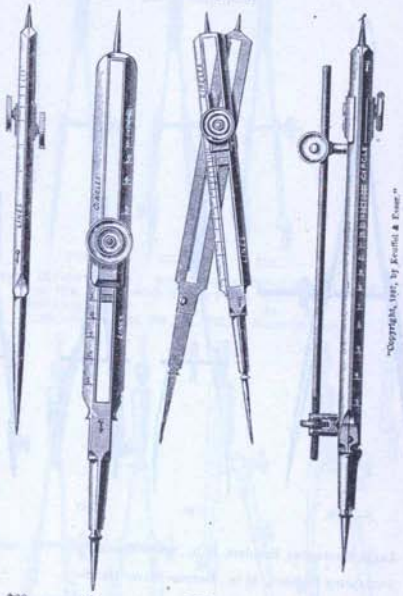
720. 721. 725. 727. 728. 728½

720.	Pocket Dividers, 5 in., with Sheath	each	$ 1 60
721.	Pocket Compasses, with folding Points	"	5 60
725.	Three-legged Dividers, 5 in.	"	2 95
727.	Whole and Half Dividers, 6½ in.	"	2 50
728.	Proportional Dividers, 6½ in., for lines	"	2 50
728½.	do. do. 7 " " " and circles	"	3 25

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

Illustrations ¼ size.



No. 729. 731. 732. 733.

729.	Proportional Dividers, 7 in., with Rack-Movement, for lines and circles	each	$ 5 20
730.	do. 7½ " for lines and circles, in Case	"	7 15
731.	do. 9½ " " " " " " "	"	10 40
732.	do. 7½ " with Rack-Movement, for lines, circles, solids and planes, in Case	"	10 30
733.	do. 9½ " with Micrometer adjustment, for lines and circles, in Case	"	13 80

Each instrument stamped with trade-mark

Illustrations ⅔ size.

No. 739. 740. 741. 742.

739.	Large Steelspring Dividers, 5½ in., white Handle	each	$ 2 35
740.	Steelspring Dividers, 3½ in., German Silver Handle . . .	"	1 85
741.	do. Bow Pen, 3½ in., with Needle Point, German Silver Handle	"	2 10
742.	do. Bow Pencil, 3½ in., with Needle Point, German Silver Handle	"	2 10
743.	do. Bows, set of 3, Nos. 740, 741, 742 in Morocco Case	set	6 90

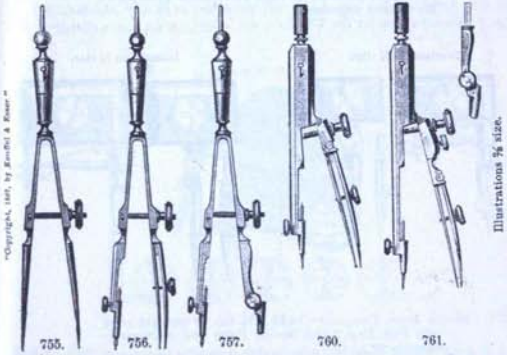
Steelspring Bows No. 740, 741, 742 have a right and left thread, operated by one thumbnut situated between the shanks of the instrument. They are opened and closed by the screw which holds the points rigidly in any position.

Each instrument stamped with trade-mark

Illustrations ⅔ size.

750. 751. 752.

750.	Steelspring Dividers, 3½ in., with German Silver Handle,	each	$ 1 10
751.	do. Bow Pen, 3½ " with Needle Point, do. do.	"	1 45
752.	do. Bow Pencil, 3½ " " " " do. do.	"	1 45
753.	do. Bows, set of 3, Nos. 750, 751, 752, in Morocco Case,	set	4 80



Illustrations ⅔ size.

755. 756. 757. 760. 761.

755.	Steelspring Dividers, 4 in., white Handle.	each	$ 1 00
756.	do. Bow Pen, 4 " with Needle Point, white Handle	"	1 35
757.	do. Bow Pencil, 4 in., " " " " "	"	1 35
758.	do. Bows, set of 3, Nos. 755, 756, 757, in Morocco Case,	set	4 50
760.	Spring Bow Pen, 3½ in., with Needle Point	each	1 50
761.	do. do. 3½ " " " and Pencil Point . . .	"	2 15

Each instrument stamped with trade-mark

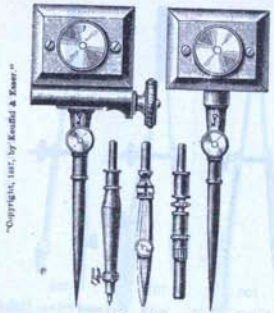
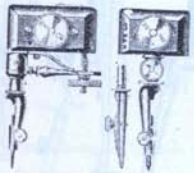


Illustration ⅝ size.

No. 770.

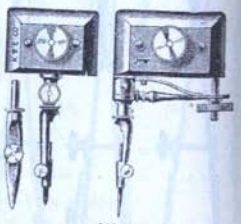
770. Beam Compasses, to fit on a bar or straight edge, with two Steel Points, Pen, Pencil and Needle Point, with Micrometer adjustment . . . . . each $ 7 00
Morocco Case for No. 770 . . . . . " 85

Illustration ⅜ size.



No. 771.

Illustration ½ size.



772.

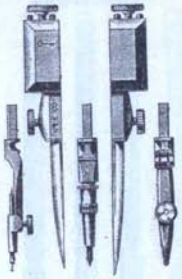
771. Minute Beam Compasses, to fit on a bar or straight edge with Pen, Pencil and Needle Point and Micrometer adjustment . . . . . each $ 5 85

772. Beam Compasses, to fit on a bar or straight edge with Pen, Pencil and Needle Point, with Micrometer adjustment . . . . . each $ 5 80
Morocco Case for No. 771 . . . . . " 85
" " " " 772 . . . . . " 85

For Bars for Beam Compasses see page 222.

Each instrument stamped with trade-mark

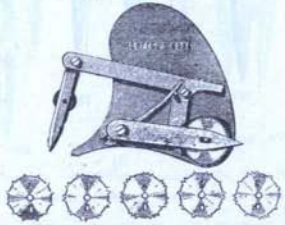
Illustration ½ size.



No. 773.

773. Beam Compasses, 2 Steel Points, Pen, Pencil and Needle Point, with 30 in. hardwood Bar . . . . . each $ 3 85
Morocco Case for No. 773 . . . . . " 85

Illustration ⅜ size.



No. 775.

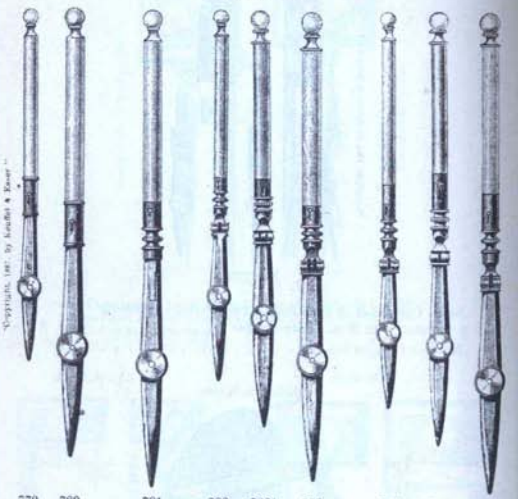
775. Dotting Instrument of German Silver, with 6 Wheels, in Case each $ 4 00

The outer wheel is rolled on the edge of a wooden T square or straight edge and turns the ratchet wheel, which causes the pen to move up and down. The flat point, close to the pen, must slide on the paper. To change the pattern of the dotted lines, throw back the spring which holds the wheel on the axle and insert the proper ratchet wheel.

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

Illustrations ⅝ size.



779. 780. 781. 782. 782½. 783. 784. 784½ 785.

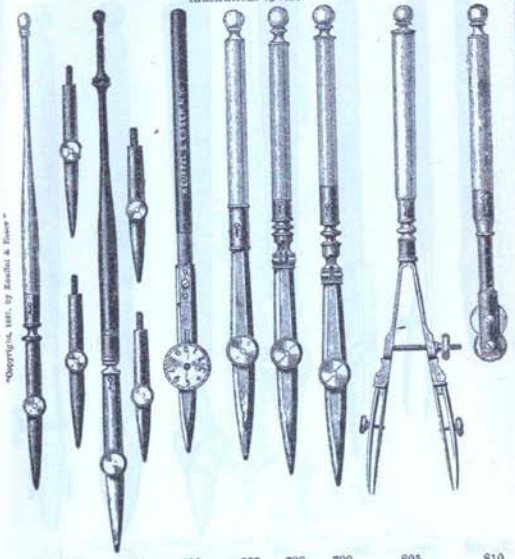
779.	Drawing Pen, Aluminum Handle,	4½ in.	each	$ 40
780.	do.	5½ "	"	45
781	do.	5½ "	plain Joint "	50
782.	do.	4½ "	fine Joint "	75
782½.	do.	5 "	" "	80
783.	do.	5½ "	" "	85
784.	do.	4½ "	" and Pin "	85
784½	do.	5½ "	" " "	90
785.	do.	6 "	" " "	95

Drawing Pens carefully set and sharpened . . each $ 15 to 20

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

Illustrations ⅝ size.



No. 786. 792. 795 797 798 799. 805 810

786.	Hatching Pen, 5 in.	with 3 Pens to one Handle, Bone Handle	each	$ 1 50
790.	do 6 "	with Pushing Screw, Ebony Handle,	"	85
791.	do 6 "	do 2 Pens to one Handle	"	1 30
792.	do. 6 "	do 3 " " " "	"	1 70
795.	Drawing Pen, 5½ "	graduated Thumb-screw, Ebony Handle	"	1 80
797.	do. 5 "	with German Silver Blades, for red ink		
		Aluminum Handle	"	70
798.	do. 5½ "	do do with Joint	"	90
799.	do. 5½ "	do do. " " and Pin	"	1 10
805.	Railroad Pen, 5½ "	Pens with Joint, Bone Handle	"	2 50
810.	Dotting Pen, with one Wheel, 5 in.,	Bone Handle	"	1 00

Drawing Pens carefully set and sharpened . . . each $ 15 to 20

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

Illustrations ⅔ size.

No. 806. 807. 808. 812. 813. 814. 815.

806.	Drawing Pen, Ebony Handle, upper blade with spring, 4½ in., each	$		75
807.	do.	"		80
808.	do.	"		85
812.	Detail Pen, 5½ in., flat Ebony Handle . . . . . each	$		75
813.	do. 6½ " " " " . . . . . "			85
814.	do. 6½ " round " " . . . . . "		1	00
815.	do. 6½ " for double lines, round Ebony Handle "		2	00

The Detail Pens are especially adapted for drawing long and heavy lines, such as occur in detail drawings, etc. They are made to hold much ink, to obviate the necessity of frequent filling.

Aluminum Handles for Nos. 812 and 813, extra . . . each $ 20

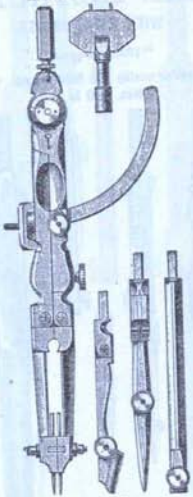
Drawing Pens carefully set and sharpened . . . . . " 15 to 20

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

LITHOGRAPHIC COMPASSES.

Illustration ½ size.



No. 820.

820. Compasses, German Silver, 8 in., very strong, with Arc, Set Screw and Micrometer adjustment, with Pen, Pencil Point, Lengthening Bar and Wrench-key, in Morocco Case . . . . . each $ 14 00

Illustrations full size.

No. 825.

830.

825. Adjusting-key and Screwdriver . . . . . each $ 35

830. Patent Leads for Instruments, nickel plated box, cont'g. 4 Leads . . . . . " 10

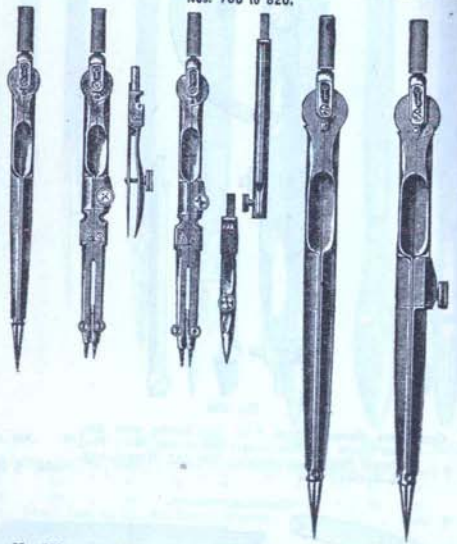
EXTRA FINE GERMAN INSTRUMENTS

WITH PIVOT-JOINTS.

"TRADE MARK."

Corresponding in workmanship, quality and finish to our "Key" Brand Instruments Nos. 700 to 820.

Illustrations ⅝ size.

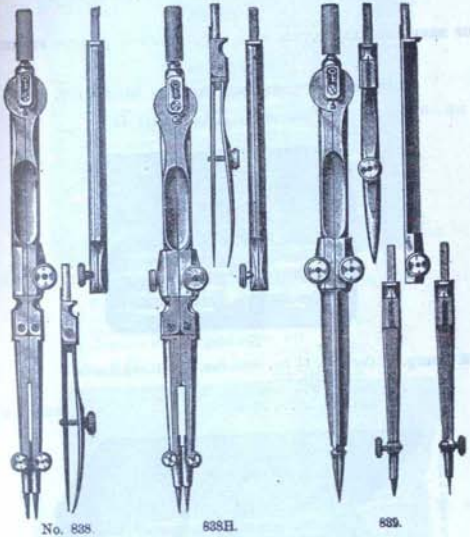


No. 831. 833. 834 836. 837.

831. Plain Dividers, 2½ in. . . . . each $ 1 35
833. Compasses, 2½ in., with fixed Needle Point, Pen and Pencil Point . . . . . " 3 60
834. Compasses, 3½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar . . . . . " 4 00
836. Plain Dividers, 5½ in. . . . . " 1 50
837. Hairspring Dividers, 5½ in. . . . . " 2 20

Each instrument stamped with trade-mark

Illustrations ⅝ size



No. 838. 838H. 839.

838. Compasses, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar . . . . . each $ 4 50

838H. Compasses, 5½ in., with Hairspring to fixed Needle Point, Pen, Pencil Point and Lengthening Bar . . . . . " 5 10

839. Compasses, 5½ in., with 2 Steel Points, Pen, Pencil and Needle Point, and Lengthening Bar . . . . . " 5 10

EXTRA FINE
GERMAN INSTRUMENTS
IN CASES.

OF BEST GERMAN SILVER, FINE STEEL POINTS, HIGHLY FINISHED.

"TRADE MARK"

FINE MOROCCO POCKET CASES, LINED WITH PURPLE VELVET.

For description of quality see page 46

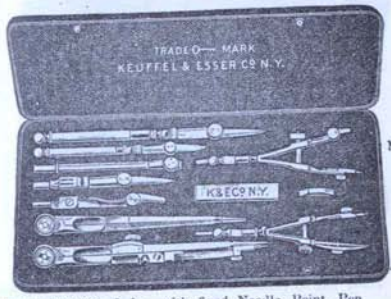
No. 850.

850. cont'g.: 1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 702,
1 Drawing Pen, with Joint, No. 782,
1 Box with Leads, No. 830 . . . . . each $ 4 60

No. 852.

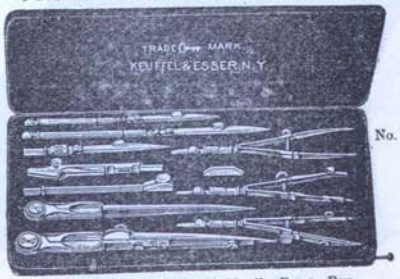
852. cont'g.: 1 Compass, 5 in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 715,
1 Divider, 5 in., No. 707,
1 Steelspring Bow Pen, with Needle Point, No. 756
1 Drawing Pen, with Joint, No. 782,
1 do. " " and Pin, No. 785,
1 Box with Leads, No. 830 . . . . . each $ 8 60

Each instrument stamped with trade-mark



No. 853

853 cont'g.: 1 Compass, 5 in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 715,
1 Divider, 5 in., No. 707,
1 Steelspring Bow Pen, with Needle Point, No. 756,
1 Steelspring Bow Pencil, with Needle Point, No. 757,
1 Drawing Pen, with Joint, No. 782,
1 do. " " and Pin, No. 785,
1 Box with Leads, No. 830, ... each $ 10 35



No. 854

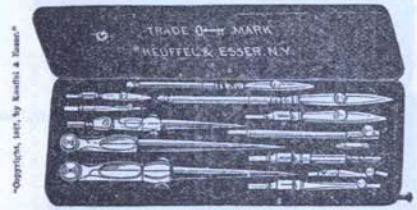
854. cont'g.: 1 Compass, 5 in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 715,
1 Divider, 5 in., No. 707,
1 Steelspring Divider, No. 755,
1 " Bow Pen, No. 756,
1 " Bow Pencil, No. 757,
1 Drawing Pen with Joint, No. 782,
1 do. " " and Pin, No. 785,
1 Box with Leads, No. 830 . . . . . each $ 11 40

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

No. 856.

856. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 717,
1 Divider, 5 in., No. 707,
1 Drawing Pen, with Joint and Pin, No. 783,
1 Box with Leads, No. 830 . . . . . each $ 6 90



No. 858.

858. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 717,
1 Divider, 5 in., No. 707,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 702,
1 Drawing Pen, with Joint, No. 782,
1 do. " " and Pin, No. 785.
1 Box with Leads, No. 830 . . . . . each $ 11 00

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

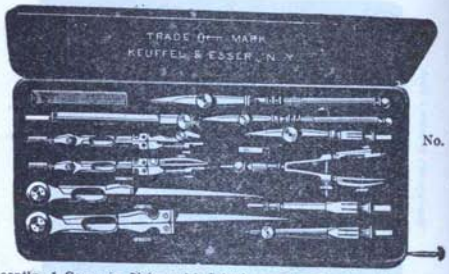
No. 862.

862. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 717,
1 Hairspring Divider, 5 in., No. 710,
1 Set Steelspring Divider and Bows, No. 755, 756, 757,
1 Drawing Pen, with Joint, No. 782,
1 do. " " and Pin, No. 785,
1 Box with Leads, No. 830 . . . . . each $ 12 90

No. 864.

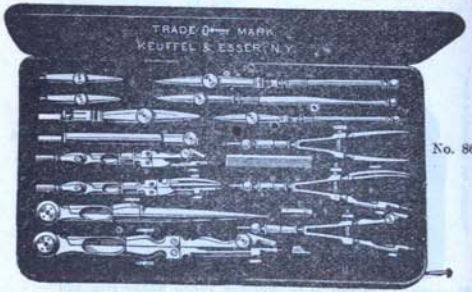
864. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point, and Lengthening Bar, No. 717,
1 Hairspring Divider, 5 in., No. 710,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 702,
1 Set Steelspring Divider and Bows, No. 755, 756, 757,
1 Drawing Pen with Joint, No. 782,
1 do. " " and Pin, No. 785,
1 Box with Leads, No. 830 . . . . . each $ 15 90

Each instrument stamped with trade-mark



No. 866.

866. cont'g.: 1 Compass, 5½ in., with Joint in each leg, Pen, Pencil, Needle Point and Lengthening Bar, No. 718,
1 Hairspring Divider, 5 in., No. 710,
1 Compass, 3½ in., fixed Needle and Pen Point, 704,
1 do. 3½ " " " " Pencil " 705,
1 Steelspring Bow Pen, No. 756,
1 each Drawing Pen, No. 782, 785,
1 Box with Leads, No. 830 . . . . . each $ 16 10



No. 868.

868. cont'g.: 1 Compass, 5½ in., Needle Point with Hairspring, Pen, Pencil Point, Lengthening Bar, No. 716,
1 Hairspring Divider, 5 in., No. 710,
1 Compass, 3½ in., fixed Needle and Pen Point, 704,
1 do. 3½ " " " " Pencil " 705,
1 Set Steelspring Divider and Bows, No. 755, 756, 757,
1 each Drawing Pen, No. 782, 785,
1 Hatching Pen, with 3 Pens to one Handle, No. 786,
1 Box with Leads, No. 830 . . . . . each $ 20 00

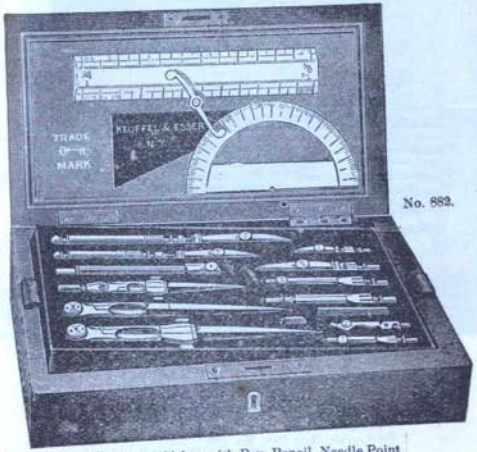
EXTRA FINE
GERMAN INSTRUMENTS.

OF BEST GERMAN SILVER, FINE STEEL POINTS, HIGHLY FINISHED.

"TRADE MARK"

IN FINE POLISHED MAHOGANY CASES, LINED WITH PURPLE VELVET AND WITH CUSHION BETWEEN INSTRUMENT AND LID, WITH LOCK AND TRAY.

For description of quality see page 46



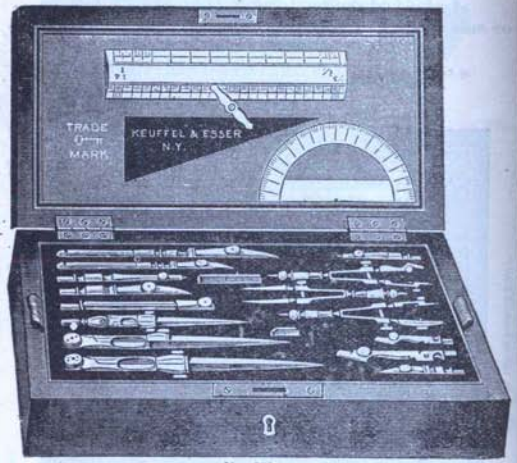
No. 882.

880. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 717,
1 Divider, 5 in., No. 707,
1 Steelspring Bow Pen, No. 756,
1 each Drawing Pen, No. 782, 785,
1 German Silver Protractor, 1 Rubber Triangle,
1 Boxwood Scale, No. 1390,
1 Box with Leads, No. 830 . . . . . each $ 12 90

882. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 717,
1 Divider, 5 in., No. 707,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 702,
1 each Drawing Pen, No. 782, 785,
1 German Silver Protractor, 1 Rubber Triangle,
1 Boxwood Scale, No. 1390,
1 Box with Leads, No. 830 . . . . . each $ 11 40

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark



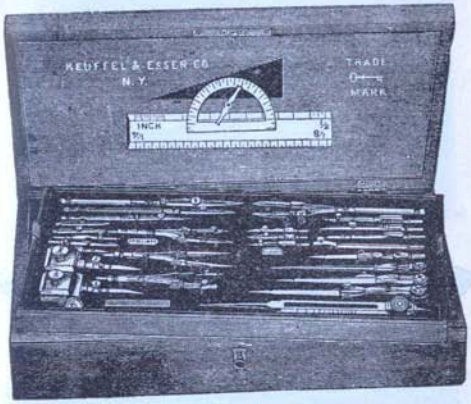
No. 888.

886. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 717,
1 Divider, 5 in., No. 707,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 702,
1 Steelspring Bow Pen, No. 756,
1 Drawing Pen, with Joint, No. 782,
1 do " " and Pin, No. 785,
1 German Silver Protractor, 1 Rubber Triangle,
1 Boxwood Scale, No. 1390,
1 Box with Leads, No. 830 . . . . . each $ 15 60

888. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 717,
1 Hairspring Divider, 5 in., No. 710,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 702,
1 Set Steelspring Divider and Bows, No. 755, 756, 757,
1 Drawing Pen with Joint, No. 782,
1 " " " and Pin, No. 785,
1 German Silver Protractor, 1 Rubber Triangle,
1 Boxwood Scale, No. 1390,
1 Box with Leads, No. 830 . . . . . each $ 19 65

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark



No. 892.

890. cont'g.. 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 717,
1 Hairspring Divider, 5 in., No. 710,
1 Plain Divider, 5 in., No. 707,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 702,
1 Set Steelspring Divider and Bows, No. 755 756, 757,
1 Proportional Divider, 7½ in., No. 730,
1 Railroad Pen, 5½ in., No. 805,
1 Drawing Pen, with Joint, No. 782,
1 do. " " and Pin, No. 785,
1 Hatching Pen, 6 in., with 3 Pens, No. 792,
1 German Silver Protractor,
1 Rubber Triangle,
1 Boxwood Scale, No. 1390,
1 Box with Leads, No. 830 . . . . . each $ 34 20

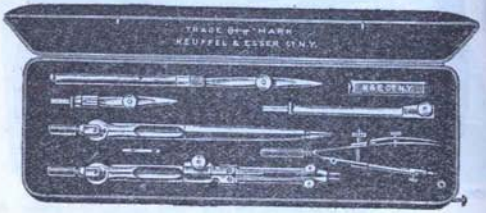
892. cont'g. the same instruments as No. 890, with addition of Beam Compass No. 770 . . . . . each $ 41 00

EXTRA FINE
GERMAN INSTRUMENTS
WITH PIVOT-JOINTS.

"TRADE MARK."

IN MOROCCO POCKET CASES, LINED WITH COTTON VELVET.

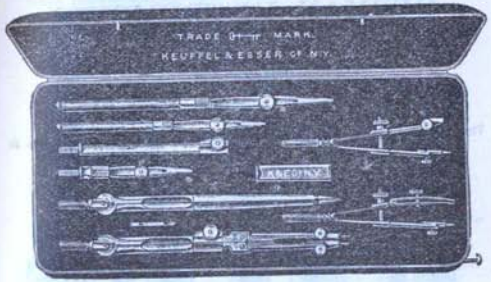
For description of quality see page 46.



No. 893.

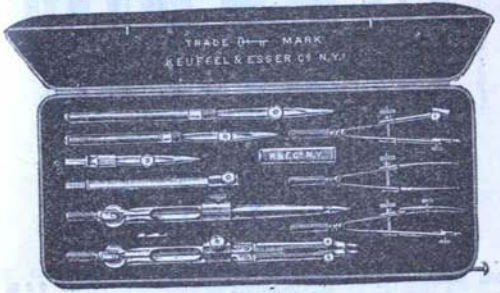
893. cont.: 1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 838,
1 Divider, 5½ in., No. 836,
1 Steelspring Bow Pen, No. 751,
1 Drawing Pen, 5½ in., Ebony Handle, upper blade with Spring, No. 808,
1 Box with Leads, No. 830 . . . . . each $10 00

Each instrument stamped with trade-mark



No. 896.

896. cont.: 1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 838,
1 Divider, 5½ in., No. 836,
1 Steelspring Bow Pen and Pencil, Nos. 751, 752,
1 each Drawing Pen, Ebony Handle, spring to upper blade, Nos. 806 and 808,
1 Box with Leads, No. 830 . . . . . each $12 50



No. 897.

897. cont.: 1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 838,
1 Hairspring Divider, No. 837,
1 Steelspring " and Bows, Nos. 750, 751, 752,
1 each Drawing Pen, Ebony Handle, upper blade with spring, Nos. 806 and 808,
1 Box with Leads, No. 830 . . . . . each $14 50

FINE GERMAN INSTRUMENTS.

GERMAN SILVER, STEEL POINTS.

"TRADE ➡ MARK."

For description of quality see page 46.

These Dividers and Compasses have ROUNDED Steel Points as shown in cuts on pages 107 to 109.

Illustrations ⅔ size.

No. 900. 902. 904. 906.

900.	Compasses, 3½ in., with Pen, Pencil and Needle Point . .	each	$ 2 25
901.	do. 3½ " like No. 900, but with Lengthening Bar	"	2 45
902.	Plain Dividers, 5 in.	"	70
904.	Hairspring Dividers, 5 in.	"	1 80
906.	Compasses, 5½ in., with Pen, Pencil Point and Lengthening Bar	"	1 95

Each instrument stamped with trade-mark ➡

Compasses No. 908 have ROUNDED Steel Points as shown in cuts on pages 107 to 109.

Illustrations ⅔ size.

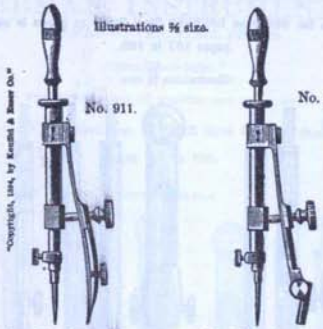
No. 907. 908.

907.	Compasses, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar	each	$ 2 15
908.	do. 5½ " with Pen, Pencil, Needle Point and Lengthening Bar	"	2 85

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

Illustrations ⅔ size.



No. 911. No. 912.

911	Drop Spring Bow Pen, 3½ in., for small circles, German Silver Handle, ...	each	$ 1 55
912	do. do. Pencil, 3½ in., for small circles, German Silver Handle, ...	"	1 55

In Spring Bows Nos. 911 and 912 a steel rod passes through the instrument, serving as needle point and carrying the handle. This centre-rod remains stationary while the pen or pencil revolve around it and draw by their own weight.

Illustrations, ⅔ size.

No. 913. 914. 915.

913	Steelspring Dividers, 3½ in., ... German Silver Handle,	each	$ 95
914	" Bow Pen, 3½ in., Needle Point, " " " "	"	1 15
915	" Bow Pencil, 3½ " " " " " "	"	1 15
915½.	" Bows, set of 3, Nos. 913, 914, 915, in Morocco Case .	set	3 85

KEUFFEL & ESSER CO. NEW YORK.

Each instrument stamped with trade-mark

Illustrations ⅔ size.

919. 920. 921. 922. 922½. 923. 924. 924½. 925.

919.	Drawing Pen, wh te handle 4½ in.	each	$	30
920.	do. " 5½ "	"		35
921.	do. " 5½ " plain Joint	"		40
922.	do. " 4½ " fine Joint	"		45
922½.	do. " 5 " " "	"		50
923.	do. " 5½ " " "	"		55
924.	do. " 4½ " " " and Pin . .	"		65
924½.	do. " 5½ " " " " " . .	"		70
925.	do. " 6 " " " " " . .	"		75

FINE
GERMAN INSTRUMENTS IN CASES.

GERMAN SILVER, STEEL POINTS.

"TRADE ⟶ MARK"

BLACK MOROCCO CASES, LINED WITH BROWN VELVET.

For description of quality see page 46

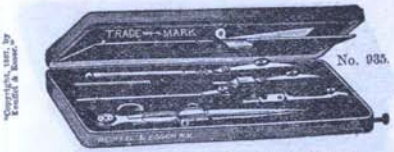
No 931.

931. cont'g.: 1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 900,
1 Drawing Pen, with Joint, No. 922,
1 Box with Leads, No. 830 . . . . . each $ 3 45

No. 933.

933. cont'g.: Compass, 3½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 901.
1 Divider, 3½ in., with Handle.
1 Drawing Pen, with Joint, No. 922.
1 Box with Leads, No. 830 . . . . . each $ 4 30

Each instrument stamped with trade-mark ⟶



No. 935.

935 cont'g. 1 Compass, 5½ in., with Pen, Pencil Point and Lengthening Bar, No. 906,
1 Drawing Pen with Joint, No. 923,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605 1 Triangle . . . each $ 3 55

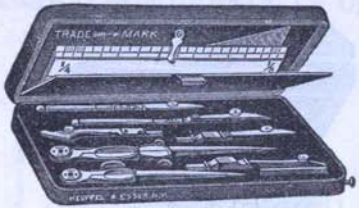
No. 937.

937. cont'g.: 1 Compass, 5½ in., with Pen and Pencil Point
1 Divider, 5 in., No. 902,
1 Drawing Pen with Joint, No. 923,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605, 1 Triangle . . . each $ 4 00

No. 939.

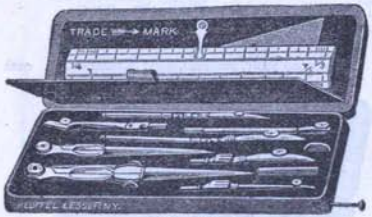
939. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 908,
1 Drawing Pen, No. 919,
1 Drawing Pen with Joint, No. 923,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605, 1 Triangle . . . each $ 5 00

Each instrument stamped with trade-mark



No. 941.

941. cont'g.: 1 Compass, 5½ in., with Pen, Pencil and Needle Point,
1 Divider, 5 in., No. 902,
1 Drawing Pen, No. 919,
1 Drawing Pen with Joint, No. 923,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605,
1 Triangle . . . . . each $ 5 45



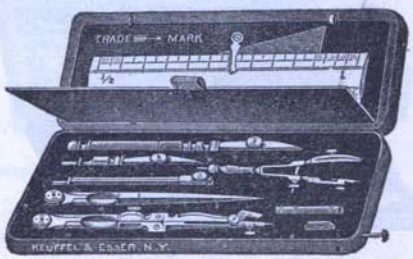
No. 943.

943. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 908,
1 Divider, 5 in., No. 902,
1 Drawing Pen, No. 919,
1 Drawing Pen with Joint, No. 923,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605,
1 Triangle . . . . . each $ 5 90

Each instrument stamped with trade-mark

No. 945.

945. cont'g.: 1 Compass, 5½ in., with fixed Needle Point, Pen and Pencil Point,
1 Divider 5 in., No. 902,
1 Drawing Pen with Joint, No. 923,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605,
1 Triangle . . . . . each $ 4 80



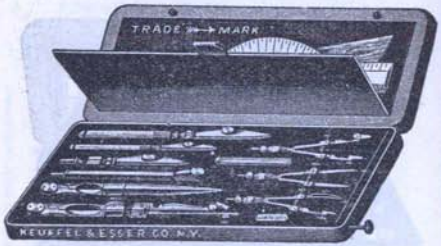
No. 947.

947. cont'g. 1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 907,
1 Divider, 5 in., No. 902,
1 Steelspring Bow Pen, No. 914,
1 Drawing Pen with Joint, No. 923,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605,
1 Triangle . . . . . each $ 6 00

Each instrument stamped with trade-mark TRADE MARK

No. 949.

949. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 908,
1 Divider, 5 in., No. 902,
1 Steelspring Bow Pen with Needle Point, No. 914,
1 Drawing Pen, No. 919,
1 Drawing Pen with Joint, No. 923,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605,
1 Semicircular Protractor,
1 Triangle . . . . . each $ 7 50



No. 950.

950. cont'g.: 1 Compass, 5½ in., with fixed Needle Point, Pen, Pencil Point and Lengthening Bar, No. 907,
1 Divider, 5 in., No. 902,
1 Steelspring Divider, No. 913,
1 do. Bow Pen, No. 914,
1 do. Bow Pencil, No. 915,
1 Drawing Pen, No. 919,
1 do. with Joint, No. 923,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605,
1 Semicircular Protractor,
1 Triangle . . . . . each $ 8 60

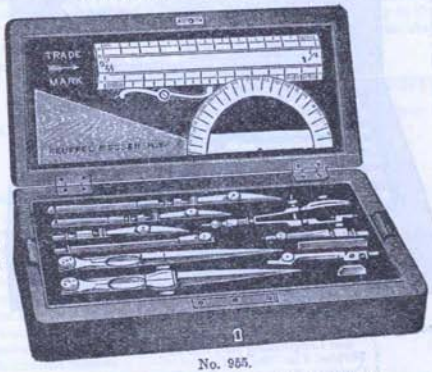
FINE
GERMAN INSTRUMENTS.

GERMAN SILVER, STEEL POINTS.

"TRADE MARK"

IN MAHOGANY CASES, LINED WITH BLACK VELVET AND WITH CUSHION BETWEEN INSTRUMENTS AND LID, WITH LOCK AND TRAY.

For description of quality see page 46

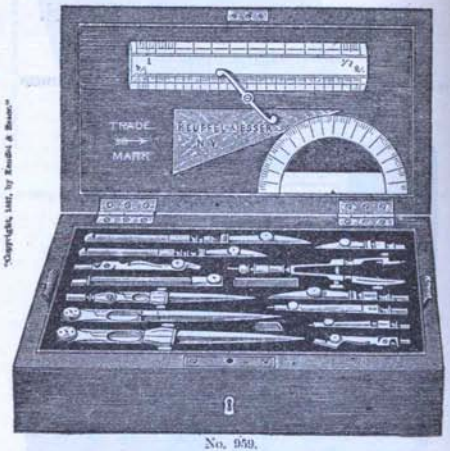


No. 955.

955. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 908,
1 Divider, 5 in., No. 902,
1 Drawing Pen, No. 919,
1 do. with Joint and Pin, No. 925,
1 Steelspring Bow Pen with Needle Point, No. 914,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605,
1 Semicircular Protractor,
1 Triangle . . . . . each $ 10 35

957. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 908,
1 Divider, 5 in., No. 902,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 900,
1 Drawing Pen, No. 919,
1 do. with Joint and Pin, No. 925,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1605,
1 Semicircular Protractor,
1 Triangle . . . . . each $ 12 20

Each instrument stamped with trade-mark



No. 959.

959. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 908,
1 Divider, 5 in., No. 902,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 900,
1 Steelspring Bow Pen with Needle Point, No. 914,
1 Drawing Pen, No. 919,
1 do. with Joint and Pin, No. 925,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1005,
1 Semicircular Protractor,
1 Triangle . . . . . each $ 13 25

961. cont'g.: 1 Compass, 5½ in., with Pen, Pencil, Needle Point and Lengthening Bar, No. 908,
1 Hairspring Divider, 5 in., No. 904,
1 Compass, 3½ in., with Pen, Pencil and Needle Point, No. 900,
1 Set Steelspring Divider and Bows, No. 913, 914, 915,
1 Drawing Pen, No. 919,
1 do. with Joint and Pin, No. 925,
1 Box with Leads, No. 830,
1 Boxwood Scale, No. 1005,
1 Semicircular Protractor,
1 Triangle . . . . . each $ 17 30

SEPARATE PARTS
FOR
PARAGON & GERMAN INSTRUMENTS.

To accommodate our customers we keep in stock separate parts for our Mathematical Instruments, as listed below. While we can replace parts for compasses, **we can replace neither the compasses (to be fitted to parts), nor the three-cornered steel legs of compasses.** To repair points which are not detachable from the compasses (fixed points) is generally not advisable.

As our instruments are hand-made and the parts belonging to them are not interchangeable, they must be fitted to the instrument. The charge for such fitting is included in the following prices:

PARTS FOR PARAGON INSTRUMENTS.

Pen Points, Pencil Points, Needle Points, for 3½ in. Compasses			each	$ 1 25
do.	do.	do. " 4½, 5½, 6 in. "	"	1 60
do.	do.	do. " 6½, 7 in. "	"	1 75
do.	do.	do. " Beam "	"	1 00
do.	do.	do.	"	1 35
Lengthening Bars for 3½, 4½, 5½, 6 in. Compasses			"	1 50
do.	" 6½, 7	" "	each	$ 15
Ebony Handles for Drawing Pens			"	20
Ivory do.	" do.		"	25
Aluminum do.	" do.		"	20
Ivory do.	" Bow Instruments		"	25
Ger. Silver do.	" do.		"	30
Nut and Thread	" do.	480 to 482	"	35
Thumbscrew with right and left Thread for Nos. 485 to 487			each $	12 to 15
Screws and Nuts			"	12 " 15
Shouldered Needles				

PARTS FOR GERMAN INSTRUMENTS.

Pen Points, Pencil Points, Needle Points, for 3½ in. Compasses			each	$ 1 00
do.	do.	do. " 5½ " "	"	1 25
do.	do.	do. " Beam "	"	80
do.	do.	do.	"	15
White Handles for Drawing Pens			"	25
Aluminum do.	" do.		"	15
White do.	" Bow Instruments		"	20
Ger. Silver do.	" do.		"	25
Nut and Thread	" do.	750 to 761	"	30
Thumbscrew with right and left Thread for Nos. 740 to 742			each $	10 to 12
Screws and Nuts			each $	08
Shouldered Needles				50

Drilled Needle Points, for Drawing Ellipses by means of a thread, per pair

We have the best facilities for Repairing and Cleaning Drawing Instruments and Sharpening Ruling Pens.

EMPTY WOODEN CASES

WITH LOCK AND TRAY

FITTED FOR

MATHEMATICAL INSTRUMENTS.

These Cases are made of thoroughly seasoned wood, have a tray to hold the instruments and under the tray room for colors, brushes etc.
Partitions under the tray for tools, colors etc., can be added at slight additional cost.

The dimensions refer to the size of the tray in the box.

Size of Tray.	Mahogany, Brass Hinges and Shield. Tray lined with Cotton Velvet.	Mahogany polished, Hinges and Shield plated, Tray lined with Silk Velvet.
4 × 9 in.	each $ 3 25	each $ 5 00
5 × 9 "	" 4 00	" 6 00
5 × 12½ "	" 5 75	" 8 50
6 × 10 "	" 5 00	" 7 25
7 × 11 "	" 5 75	" 8 50
7 × 13 "	" 7 25	" 10 75
10 × 14 "	" 12 50	" 18 00

Cases of Mahogany, Oak or other wood, with drawers, German silver or plated corners, bands, name-plate, escutcheon, etc., made to order. Such cases are illustrated under Nos. 583 and 584, pages 84 and 86.

EMPTY POCKET CASES

FITTED FOR

MATHEMATICAL INSTRUMENTS.

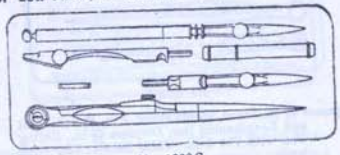
These Cases are covered with Morocco, lined with Velvet and have a Bar Lock as illustrated under Nos. 560, 850, etc.

Size of Case.	Lined with Cotton Velvet.	Lined with Silk Velvet.
2 × 6 in.	each $ 1 30	each $ 1 50
3 × 7½ "	" 1 75	" 2 00
3½ × 9 "	" 2 00	" 2 50
5 × 9 "	" 2 40	" 3 00
5 × 12½ "	" 3 70	" 4 50
6 × 10 "	" 3 20	" 4 00
7 × 11 "	" 3 70	" 4 50
7 × 13 "	" 4 20	" 5 00

For Pocket cases with folding flaps, (see No. 634 P, page 100) add 30% to above prices, for those with recessed and partitioned lid (see No. 566 D, page 76) add 50%.

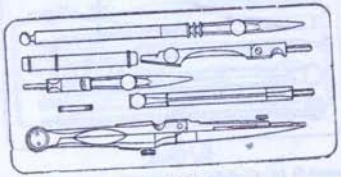
NICKEL-PLATED INSTRUMENTS

OF LOW PRICE, IN POCKET CASES, FOR BEGINNERS.



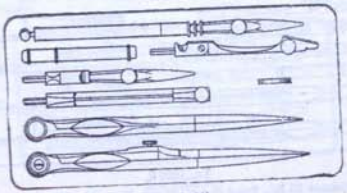
No. 1000 S.

1000 S. Compasses 4½ in., Pen and Pencil Point, Ruling Pen 4½ in. ebony handle, box with leads . . . . each $ 1 00



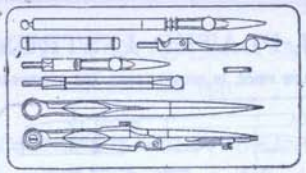
No. 1001 S.

1001 S. Compasses 4½ in., fixed Needle Point, Pen, Pencil Point and Lengthening Bar, Ruling Pen with Pin 4½ in. white handle, box with leads . . . each $ 1 80



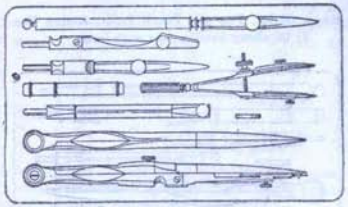
No. 1002 S.

1002 S. Compasses 4½ in. Pen, Pencil Point and Lengthening Bar, Dividers 4½ in., Ruling Pen 5 in. ebony handle, box with leads . . . . . each $ 1 40



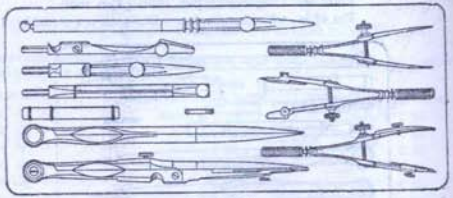
No. 1003 S.

1003 S. Compasses 4½ in., fixed Needle Point, Pen, Pencil Point and Lengthening Bar, Dividers 4½ in., Ruling Pen with Pin 5 in. white handle, box with leads . . . . . each $ 1 60



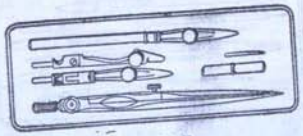
No. 1004 S.

1004 S. Compasses 5½ in., fixed Needle Point, Pen, Pencil Point and Lengthening Bar, Dividers 5½ in., Spring Bow Pen 3½ in., Ruling Pen with Pin 5½ in. white handle, box with leads . . . . . each $ 2 60



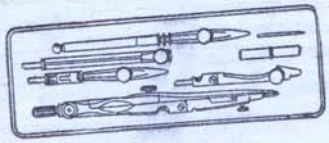
No. 1005 S.

1005 S. Compasses 5½ in., fixed Needle Point, Pen, Pencil Point and Lengthening Bar, Dividers 5½ in., Steel Spring Dividers 3½ in., Spring Bow Pen 3½ in., Spring Bow Pencil 3½in., Ruling Pen with Pin 5½ in. white handle, box with leads . . each $ 4 00



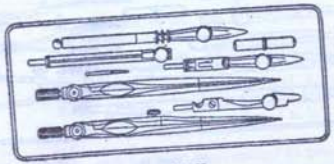
No. 1000 H.

1000 H. Compasses 4½ in., with Handle, Pen and Pencil Point, Ruling Pen 4½ in. with ebony handle, box with leads . . . . . each $ 1 10



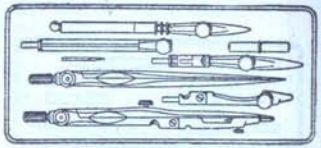
No 1001 H.

1001 H. Compasses 4½ in., with Handle, fixed Needle Point, Pen, Pencil Point and Lengthening Bar, Ruling Pen 4½ in., with Pin and white handle, box with leads . . . . . each $ 1 40



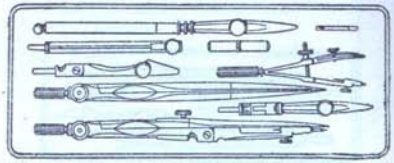
No. 1002 H.

1002 H. Compasses 4½ in., with Handle, Pen, Pencil Point and Lengthening Bar, Dividers 4½ in., with Handle, Ruling Pen 5 in., with ebony handle, box with leads . . . . . each $ 1 60



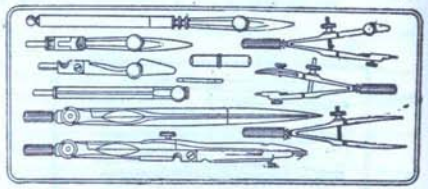
No. 1003 H.

1003 H. Compasses 4½ in. with Handle, fixed Needle Point, Pen, Pencil Point and Lengthening Bar, Dividers 4½ in. with Handle, Ruling Pen 5 in., with Pin and white handle, box with leads . . . . . each $ 1 85



No. 1004 H.

1004 H. Compasses 5½ in. with Handle, fixed Needle Point, Pen, Pencil Point and Lengthening Bar, Dividers 5½ in. with Handle, Spring Bow Pen 3½ in. with Needle Point, Ruling Pen 5 in., with Pin and white handle, box with leads . . . . . each $ 2 00

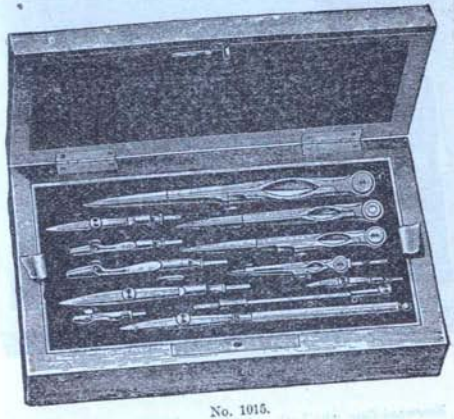


No. 1005 H.

1005 H. Compasses 5½ in. with Handle, fixed Needle Point, Pen, Pencil Point and Lengthening Bar, Dividers 5½ in. with Handle, Steel Spring Dividers 3½ in., Spring Bow Pen and Pencil 3½ in., with Needle Points, 2 Ruling Pens, 1-4½ and 1-5½ in., with Pin and white handle, box with leads each $ 4 75

FRENCH INSTRUMENTS IN CASES.

BRASS AND GERMAN SILVER.

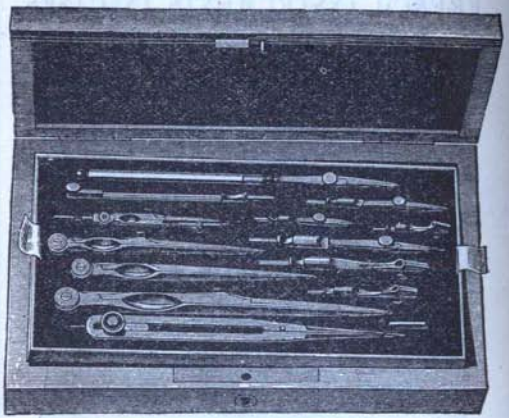


No. 1015.

1015. Rosewood Case, with Lock and Tray, cont'g.: 16 pieces, Brass,
1 Pair Compasses, 6½ in., with Pen, Pencil Point and Lengthening Bar,
1 Pair Compasses, 4½ in., with Pen and Pencil Point.
1 Pair Dividers, 4½ in., 1 Bow Pen with Pencil Point.
1 Drawing Pen, 1 Protractor, 1 Key, 1 Rule . . each $ 3 00

1016. Rosewood Case, with Lock and Tray, cont'g.: 16 pieces, Brass, like No. 1015, but the Compasses with Needle Points . . . . . " 3 70

1017. Rosewood Case, with Lock and Tray, cont'g.: 16 pieces, like No. 1015, but German Silver . . . . . " 6 00



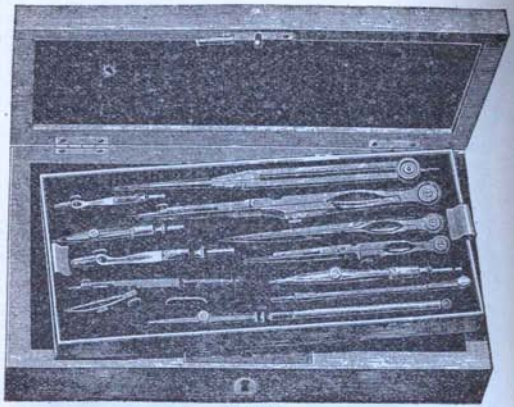
No. 1019.

1019. Rosewood Case, with Lock and Tray, cont'g.: 17 pieces, Brass,
1 Pair Compasses, 6¼ in., with Pen, Pencil Point and Lengthening Bar,
1 Pair Compasses, 4¼ in., with Pen and Pencil Point,
1 Pair Dividers, 4¼ in.,
1 Bow Pen with Pencil Point,
1 Proportional Dividers,
1 Drawing Pen, 1 Protractor, 1 Key,
1 Rule . . . . . each $ 5 50

1020. Rosewood Case, with Lock and Tray, cont'g.: 17 pieces, like No. 1019, but German Silver . . . . . " 8 80

No. 1025.

1025. Rosewood Case, with Lock and Tray, cont'g.: 14 pieces, Brass,
1 Pair Compasses with Needle Point, 6¼ in., with Pen, Pencil Point and Lengthening Bar,
1 Pair Compasses with Needle Point, 4¼ in., Pen and Pencil Point,
1 Pair Dividers, 4¼ in., 1 Spring Bow Pen,
1 Drawing Pen, 2 Protractors, 1 Key, 1 Rule . . each $ 3 75



No. 1028.

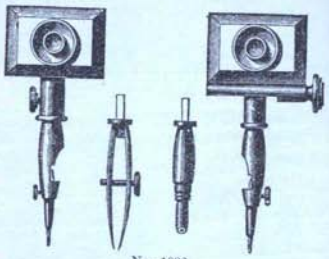
1028. Rosewood Case, with Lock and Tray, cont'g.: 15 pieces, Brass,
1 Pair Compasses with Needle Point, 6½ in. with Pen, Pencil Point and Lengthening Bar,
1 Pair Compasses with Needle Point, 4½ in., with Pen and Pencil Point,
1 Pair Dividers. 4½ in., 1 Spring Bow Pen,
1 Proportional Dividers,
1 Drawing Pen, 1 Protractor, 1 Key . . . . . each $ 6 35

1030. Rosewood Case, with Lock and Tray, cont'g.: 15 pieces, like No. 1028, but German Silver 9 00

1033. Rosewood Case, inlaid, with Lock and Tray, cont'g.: 18 pieces, German Silver,
1 Pair Compasses with Needle Point, 6½ in., with Pen, Patent Pencil Point and Lengthening Bar,
1 Pair Compasses, 4½ in., with Handle, with Needle Point, Pen and Patent Pencil Point,
1 Pair Dividers, 4½ in.,
1 Spring Bow Pen,
1 Proportional Dividers,
3 Drawing Pens,
1 Protractor,
1 8 in. Ivory Rule,
1 Key . . . . . each $ 20 25

1034. Rosewood Case, inlaid, with Lock and Tray, cont'g.: 22 pieces, German Silver,
1 Pair Compasses with Needle Point, 6½ in., with Pen, Patent Pencil Point and Lengthening Bar,
1 Pair Compasses, 4½ in., with Handle, with Needle Point, Pen and Patent Pencil Point,
1 Pair Dividers, 4½ in.,
1 Proportional Dividers,
1 Steelspring Dividers,
1 Steelspring Bow Pen,
1 Steelspring Bow Pencil,
3 Drawing Pens,
1 8 in. Ivory Rule,
1 Protractor,
1 Key,
2 Triangles,
1 Curve . . . . . " 24 40

FRENCH BEAM COMPASSES.



No. 1082.

1082. German Silver Beam Compasses with Pen Pencil and 2 Needle Points, in Case . . . . . each $ 6 25

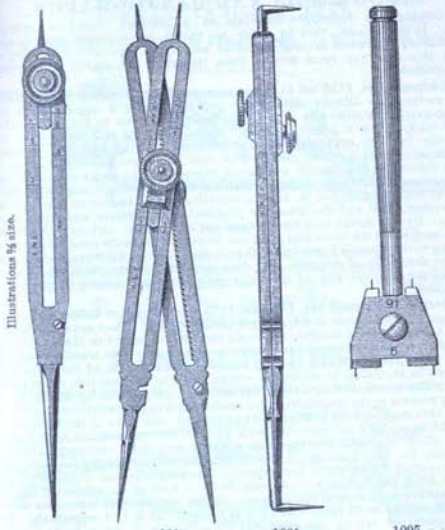
1083. Brass Beam Compasses with Pen, Pencil and 2 Needle Points, in Case . . . . . " 5 35

Wooden Bars for Beam Compasses see page 222

FRENCH POCKET DIVIDERS.

No. 1084.

1084. German Silver Pocket Dividers, Folding, with Pen, Pencil and 2 Needle Points, in Case . . . . . each $ 5 45



1085. 1089. 1091. 1095

1085. Brass Proportional Dividers, 6¼ in., in Case . . . . . each $ 1 90

1086. " do. do. 8 " " " . . . . . " 4 60

1087. German Silver Proportional Dividers, 6½ in., in Case . . " 2 35

1088. " " do. do. 6½ " divided for Lines, Circles, Solids and Planes, in Case . . . . . " 4 65

1089. " " do. do. 7 in., with Rack-Movement, in Case . . . . . " 5 90

1090. " " do. do. 7 in., with Rack-Movement, divided for Lines, Circles, Solids and Planes, in Case . . . . . " 7 35

1091. " " do. do. 7 in., with Rack-Movement, Points bent rectangular, in Case . . . " 7 00

1095. Fischer's Circle Divider, 3⅛ in., in velvet-lined slide box, with Directions . . . . . " 1 50

This novel little instrument serves to divide circles into any number of parts (also any odd number), and as angle protractor. It will be indispensable for gears, cams chainwheels, conveyors, waterwheels, etc., whenever the completeness of the drawing is essential. Every instrument is tested and warranted to be correct within $\frac{1}{1000}$ inch.

EIDOGRAPHS AND PANTOGRAPHS

are designed to reproduce drawings on a reduced, equal or enlarged scale. It is obvious, that in order to obtain an accurate reproduction, instruments of extreme accuracy must be employed, especially in enlarging, as in this case any error arising from imperfect mechanical construction is magnified.

Eidographs Nos. 1120 and 1121 are very carefully constructed instruments; their motions are delicate and regular and they cover a larger surface than a pantograph of similar size. The main beam, as shown in the cut, revolves horizontally upon a heavy socket. At each end of this beam is a disc and the two are connected by a steel band, so that one disc transmits simultaneous motion to the other. The steel bands are adjustable to secure equal motion of the tracing and pencil points. To the under surface of each disc a sleeve is attached, through which passes an adjustable arm. One end of each of these is adjusted to receive interchangeable tracing or pencil points. The center beam and the arms are provided with verniers and micrometer screws. By this means very fine settings can be obtained, and ratios other than those marked on the beam and arms can be established with great accuracy according to the formula furnished with each instrument. Allowance can be made for the shrinkage of originals, and drawings can be reproduced, so that the area of the original and of the copy may bear any desired proportion to each other.

Precision Pantographs Nos. 1122 and 1123, consist of four hollow metal bars, connected by fine joints and forming a parallelogram. They are suspended by metal rods from solid standards to avoid the friction caused in the ordinary instruments by the rolling of the casters on the paper. The standards are provided with spirit levels and leveling screws, and the length of the supporting rods can be regulated by adjusting screws to bring the bars into a horizontal plane. The instruments are set to the ordinary proportions by adjusting the sliding sockets to the respective index marks engraved upon three of their bars. These bars are also fully graduated like the beam and arms of the Eidographs. The sliding sockets are provided with verniers and micrometer adjustments, which allow the finest settings to be effected with great accuracy. The instrument, No. 1123 (see cut) is shown with the pole within the parallelogram, and supported by an extra bar crossing the parallelogram diagonally, suspended from the standard at one end, while a fork at the other end engages with and revolves around the fulcrum. **In this position these instruments will reduce and enlarge in all ratios from 20 : 1 to 1 : 1 or 1 : 20 to 1 : 1 respectively.** The instruments are set up the same way for enlarging as for reducing, except that the tracing and pencil points are interchanged. The pencil point can be raised or lowered by a lever at the tracing point. By interchanging the fulcrum with the pencil point, the instrument can also be set up as shown in cut of No. 1125; this position dispenses with the extra supporting bar, but does not allow reduction or enlargement between the ratios 5 : 4 to 1 : 1 or 4 : 5 to 1 : 1 respectively.

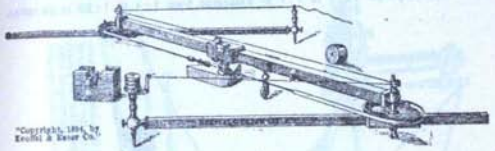
Precision Pantographs Nos. 1125 and 1125½, are practically the same instruments as Nos. 1122 and 1123, as far as workmanship and quality is concerned. They have, however, not the contrivance for erecting the instrument with the pole within the parallelogram. These instruments can not be used for reduction or enlargment between the ratios 5 : 4 to 1 : 1 or 4 : 5 to 1 : 1 respectively.

Precision Pantographs Nos. 1122 to 1125½, are, on account of their fine mechanical construction, especially adapted for very accurate reproductions, and are highly recommended to Civil and Mechanical Engineers, Topographers, Hydrographers, Engravers and Lithographers.

Suspended Pantographs Nos. 1129 to 1131, resemble Nos. 1125 and 1125½ in style, but are of simpler construction, although of the same class of workmanship and material. These instruments reduce and enlarge in all ratios from 20 : 1 to 5 : 4 or 1 : 20 to 4 : 5 respectively and yield good results. They are recommended to Designers, Pattern Makers, etc., for drawings where the highest degree of accuracy is not required.

EIDOGRAPHS.

For Reducing from 8 : 1 to 1 : 1 or Enlarging from 1 : 1 to 1 : 8 in all ratios.



No. 1120.

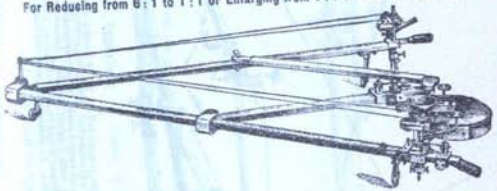
1120. Eidograph, brass, of improved construction, with 2 Balance-weights and movable Support, Arms 30 in., complete in Hardwood Case, with Table of Settings . . . . . each $110 00

1121. do. do. do. do. but Arms 36 in. . . . . " 125 00

For description see page 156.

PANTOGRAPHS.

For Reducing from 6 : 1 to 1 : 1 or Enlarging from 1 : 1 to 1 : 6 in all ratios.



No. 1127.

1126. Pantograph of hollow, square metal bars, connected by pivot joints. The left-hand bar is graduated and has a vernier and micrometer adjustment. Convenient contrivance for operating the pencil from the tracing point. Solid iron fulcrum with two adjustable needle points to fix its position on the drawing board. With pencil point, two steel points, one box of Paragon leads, in Hard-wood Case with Lock and Key . . . . . each $ 71 50

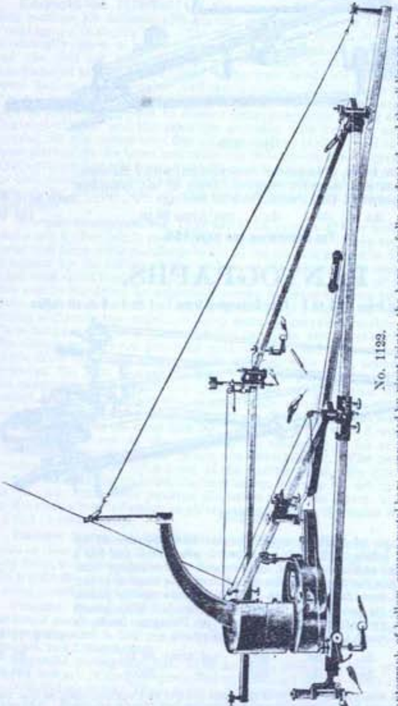
1127. do. do. do. do. but arms 28 in. . . . " 87 50

1128. do. do. do. do. " 33 " . . . " 100 00

Pantographs Nos. 1125 to 1128 are of the same quality and workmanship as Nos. 1125 to 1125½. They move on casters and are not suspended from a standard. Although this causes a little more friction, it makes the instrument better adapted for use in a limited space. It can also be replaced in its case more readily than the suspended pantographs, as it does not require setting up like the latter.

PRECISION PANTOGRAPHS.

For Reducing from 20:1 to 1:1 or Enlarging from 1:1 to 1:20 in all ratios.



No. 1122.

Pantograph of hollow, square metal bars, connected by pivot-joints; the bars are fully graduated and the sliding sockets are provided with verniers and micrometer adjustments. Extra Supporting Bar and appliances for setting up the instrument with the pole within the parallelogram. Pole and pencil point interchangeable. Convenient contrivance for operating the pencil from the tracing point. Solid Iron Standard, with 2 Spirit Levels, 2 Leveling Screws, and 2 extra Weights. Instrument with adjustable Tracing Point, Pencil Point with 3 Brass Weights, 2 Steel Points, 1 Spirit Level, 1 Box of Paragon Leads, Directions and Formula for computing the setting for any ratio. In polished Hardwood Case with Lock and Key.

1122. Length of Bars, 33 inches . . . . each $160 00
1123. " " 38 " . . . . " 170 00

*For description see page 156.

PRECISION PANTOGRAPHS.

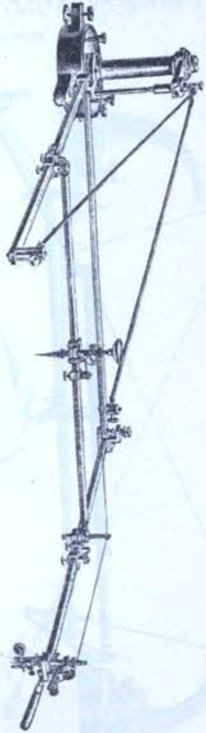
For Reducing from 20:1 to 5:4 or Enlarging from 1:20 to 4:5 in all ratios.

No. 1125.

This instrument is practically the same as No. 1122, but is without the appliance for erecting the instrument with the pole within the parallelogram and can be used only within the ratios given above.

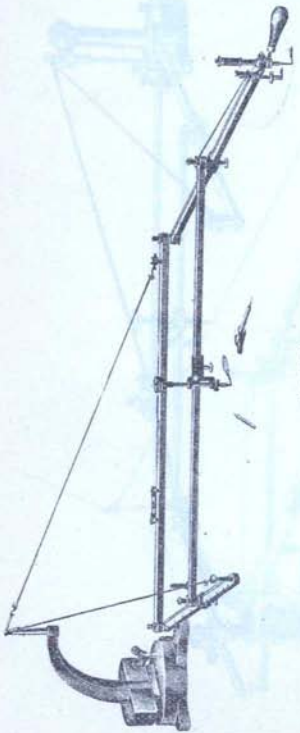
1125. Length of Bars, 24 inches . . . . each $ 155 00
1125½. " " 33 " . . . . " 165 00

For description see page 156.



SUSPENDED PANTOGRAPHS.

For Reducing from 20 : 1 to 5 : 4 or Enlarging from 1 : 20 to 4 : 5 in all ratios.



No. 1129.

Pantograph of hollow, square metal bars, connected by cone joints; the bars are fully graduated and the edges of the sliding sockets are beveled to facilitate the adjustment of ratios; Tracing and Pencil Points are interchangeable. Plain solid iron standard. Instrument with adjustable Tracing Point, Pencil Point with 3 Brass Weights, 2 Steel Points, 1 Spirit Level, 1 Box of Paragon Leads, Directions and Formula for computing the setting for any ratio. In Hardwood Case with Lock and Key.

1129.	Length of Bars, 28 inches	each	$ 75 00
1130.	" " " 33 "	"	85 00
1131.	" " " 38 "	"	92 50

For description see page 156.

SUSPENDED PANTOGRAPHS.

For Reducing and Enlarging in the following ratios:

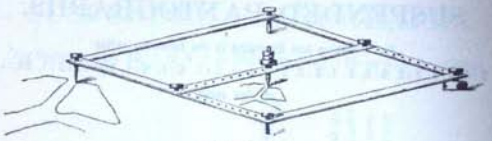
5 : 4, 4 : 3, 3 : 2, 5 : 3, 2 : 1, 5 : 2, 3 : 1, 4 : 1, 5 : 1, 6 : 1, 8 : 1, 10 : 1, 12 : 1, 20 : 1, or vice versa

No. 1132.

Pantograph of strong well-seasoned Pearwood Bars, connected by cone joints and provided with holes accurately bored for the above ratios. Tracing and Pencil Points are interchangeable. Plain solid iron standard. Instrument with adjustable Tracing Point, Pencil Point with 3 Brass Weights, 1 Steel Point, 1 Spirit Level, 1 Box of Paragon Leads and Directions. In Hardwood Case with Lock and Key.

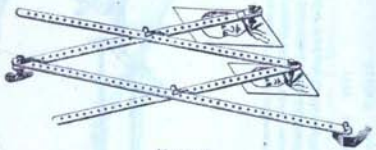
1132.	Length of Bars, 28 inches	each	$ 55 00
1133.	" " " 33 "	"	66 00
1134	" " " 38 "	"	87 50

For description see page 156.



No. 1143.

1143. Pantograph of Hardwood, with Brass Mountings, for reducing drawings, 22½ in. . . . . each $ 3 50



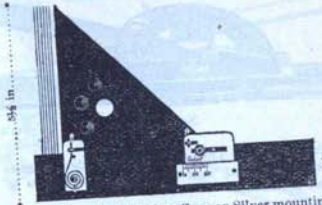
No. 1144.

1144. Pantograph of Hardwood, with Brass Mountings, for reducing and enlarging, 21 in. arms . . . . . each $ 1 75
1145. do. do. do. 41 " " . . . . . " 5 00

No. 1153. 1155.

1150. Eccentrolinead, German Silver, 9 in. . . . . each $ 3 25
1151. do. " " 9 " sliding arm . . . . " 4 00
1152. do. Ebony, German Silver mounted, 9 in. " 2 75
1153. do. " " " 9 " with sliding arm . . . . . " 3 25
1155. Templet Odontograph, for describing Teeth of Gear Wheels, a valuable instrument for Millwrights, Machinists, Pattern makers etc., with full description, in Case . . . . . " 3 50

SECTION LINERS.

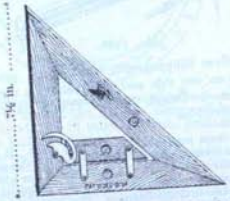


No. 1157.

1157. Casey's Section Liner, hard rubber, German Silver mountings, a very reliable and simple instrument. There is hardly any practice required to operate it to perfection. By the 2 scales and verniers on the metal plates, the distances are regulated to $\frac{1}{128}$th of an inch or $\frac{1}{5}$th of a millimeter, each $ 3 50

No. 1158.

1158. William's Section Liner, hard rubber, a simple and practical instrument which after a little practice will be found to work admirably well . . . . . each $ 2 00



No. 1158½.

1158½. Hill's Section Liner, pearwood. The width of the spacing can be instantly adjusted by rotating the cam-shaped piece shown in the cut. A simple and reliable instrument, each $ 1 00

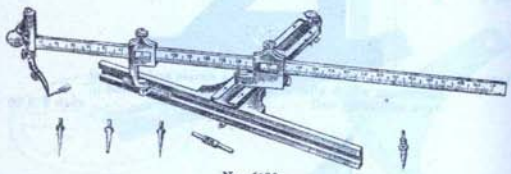
No. 1159. Pat'd Nov. 20, 1888.

1159. Both's Patent Section Liner and Scale Divider, German Silver, base 14½ in., rack 9 in., arm projecting 10 in. beyond protractor.
Instrument in polished wooden Box, with full Directions for setting and using . . . . . each $ 12 00

1160. Both's Patent Section Liner, as above, but with Vernier to the protractor . . . . . " 13 00

This Section Liner will enable from 4 to 200 parallel lines per inch to be drawn, and when set to the proper angle, decimal scales up to 1000 per foot, duodecimal scales up to 100 per inch or inch scales from ⅛ to 3 inches to the foot, in fact any desired scale can be accurately and rapidly produced by it. It is the easiest to manipulate, the most rapid and exact in execution, the simplest in construction, the finest in workmanship and the most durable hitherto known.

ELLIPSOGRAPH AND BEAM COMPASS.

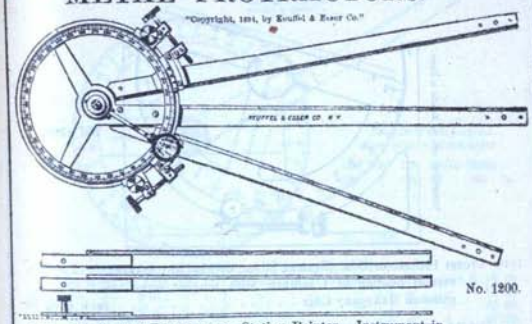


No. 1180.

1180. Fine German Silver Ellipsograph, 12-inch bar, graduated 32nds inches on one side and millimeters on the other, with 2 Pens, 1 Pencil, 3 Steel Points, in morocco Case with Directions . . . . . each $ 25 00

This is the best and most improved Ellipsograph made. It draws ellipses of any shape of a major diameter from ½ inch up to 22 inches with the greatest accuracy. Its construction is shown by the illustration. The graduated bar with the runners can be removed from the frame and a needlepoint inserted into a socket in one of the runners, when it forms a light, but strong Beam Compass. The Ellipsograph, even the T shaped frame, can be taken apart and stored compactly in the morocco Case.

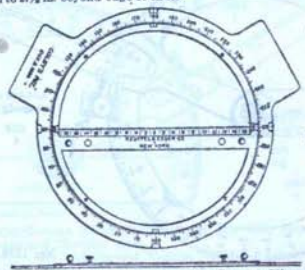
METAL PROTRACTORS.



No. 1200.

1200. Three Arm Protractor or Station Pointer. Instrument in substantial wooden Case, with Screwdriver . . . . . each $ 80 00

Protractor as made by us for the U. S. Navy. Circle 6¼ in., divided on silver to ½ degrees, numbered in opposite directions from 0 to 360 and from 360 to 0, with 2 verniers reading to 1 minute. Both verniers with tangent screw. Magnifying lens on central arm. Tubular centre 9/16 in. diameter, with glass bottom, removable cylinder for centre, with spring-point for marking centre exactly. Three arms, 17 in. long, each with extension piece, to lengthen to 27⅛ in. beyond edge of circle.



No. 1209.

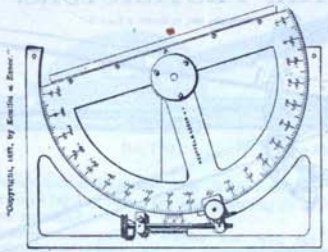
1209. Colby's Protractor, (Patented Oct. 3, 1893), German Silver, Limb 12 in., divided to 15 minutes, Scale graduated as required, in Mahogany Case . . . . . each $ 60 00

This instrument can be used for all kinds of protracting, but it is especially designed for plotting notes of surveys made with the stadia. For speed and accuracy in this work it is without a rival.

The limb is graduated from 0° to 360°, 15 minutes divisions. Scale on cross-arm has zero mark in centre, and is graduated in both directions in any unit desired. The revolving inner circle with the cross-arm, is raised to prevent rubbing on the paper.

To use this instrument, draw right-lines through the station, place zero of scale over station, indexes of limb over the right lines, turn off required angle and plot point at required distance by scale on cross-arm.

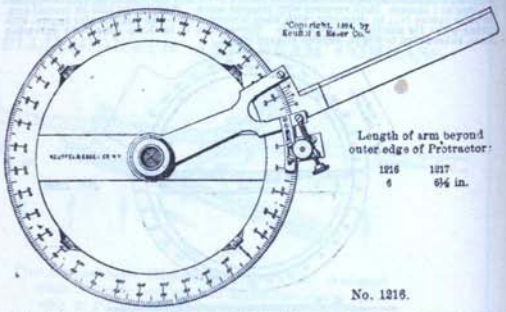
To hold instrument in position, leaden paper-weights are used on the two ear-pieces.



No. 1210.

1210. Crozet Protractor, 8 in., German Silver, divided to ½ degrees, vernier reading to 1 minute, with tangent screw, in polished Mahogany Case . . . . . each $ 40 00

This is a very practical protractor. It is used along a straight edge or T square, and angles are set off without bringing the centre over the starting point.



Length of arm beyond outer edge of Protractor:

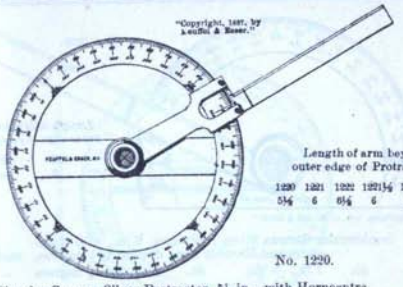
1216	1217
6	6¼ in.

No. 1216.

1216. Circular German Silver Protractor, 8 in., with Tangent Screw, Horncentre and Movable Arm, div. to ½ degrees, Vernier reading to 1 minute, each $ 20 00

1217. do do. 10 in. " " ½ " " " " 1 " " 24 00

Polished Mahogany Cases, for	5½	8	10 in. protractors.
For circular, each	$2 25	2 50	2 75
For semicircular "	1 75	2 00	2 25



Length of arm beyond outer edge of Protractor:

1220	1221	1222	1221½	1222½
5½	6	6½	6	6¼ in.

No. 1220.

1220. Circular German Silver Protractor, 5½ in., with Horncentre and Movable Arm, div. to ½ degrees, Vernier read'g to 3 min., each $ 14 00

1221. do. do. 8 in., " " ½ " " " " 1 " " 16 00

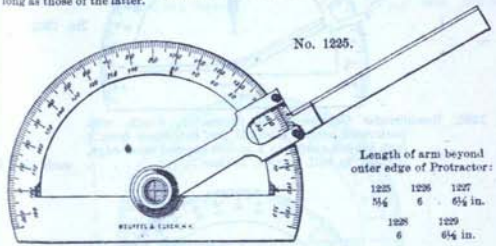
1222. do. do. 10 " " " ½ " " " " 1 " " 20 00

1221½. like No 1221, but div. " ½ " " " " 1 " " 17 25

1222½. " " 1222, " " " ½ " " " " 1 " " 21 25

The divisions of protractors 1221½, 1222½, 1220½ and 1227½ are again as open as of those divided to ¼ degrees, reading to 1 minute. Their verniers are therefore twice as long as those of the latter.

No. 1225.



Length of arm beyond outer edge of Protractor:

1225	1226	1227
5½	6	6½ in.

1228	1229
6	6¼ in.

"Copyright, 1897, by Keuffel & Esser."

1225. Semicircular German Silver Protractor, 5½ in., with Horncentre and Movable Arm, div. to ½ degrees, Vernier read'g to 3 minutes, each $ 10 00

1226. do. do. 8 in. " ½ " " " " 1 minute, " 14 00

1227. do. do. 10 " " ½ " " " " 1 " " 17 00

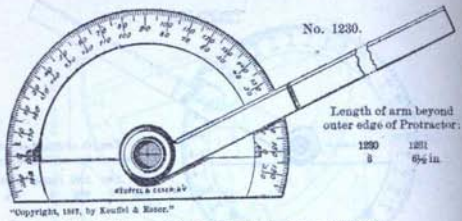
1226½. like No. 1226, but " ½ " " " " 1 " " 15 25

1227½. " " 1227 " " ½ " " " " 1 " " 18 25

1228. do. do. with Tangent Screw (see cut No. 1216). 8 in. div. to ½ degrees. Vernier read'g to 1 minute, " 18 00

1229. do. do. 10 " " ½ " " " " 1 " " 21 00

For Cases for above see preceding page.



No. 1230.

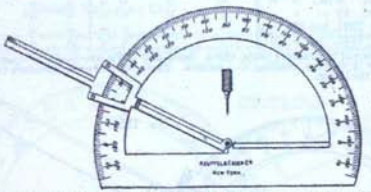
Length of arm beyond outer edge of Protractor:

1230	1231
6	6½ in.

1230. Semicircular German Silver Protractor, 6 in., with Horn-centre and Movable Arm, divided to ½ degrees, each $ 7 50

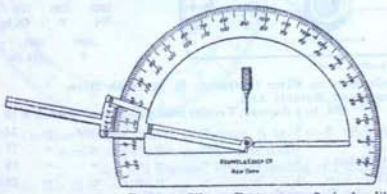
1231. do. 7 in., do. do. divided to ½ degrees " 9 00

For Cases for above see page 166.



No. 1233.

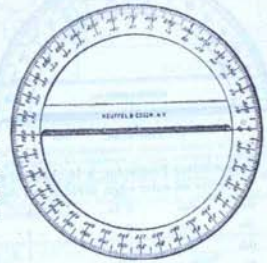
1233. Semicircular German Silver Protractor, 5-inch, with perforated centre, movable arm extending from ¼ inch beyond centre to 3 inches beyond outer edge, divided to half degrees, in Case . . . . . each $ 7 25



No. 1234.

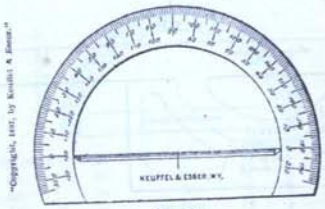
1234. Semicircular German Silver Protractor, 5 inch, like No. 1233, but with vernier reading to 3 minutes, in Case . . . . . each $ 8 00

Nos. 1233 and 1234 are the most practical form of protractor, as they allow lines to be drawn very nearly to the centre. The centre is perforated and the pricker furnished with the instrument enables setting the centre on a given point or exactly marking it.



No. 1235.

1235. Circular German Silver Protractor, 5 in., beveled edge, divided to ½ degrees . . . . . each $ 5 50



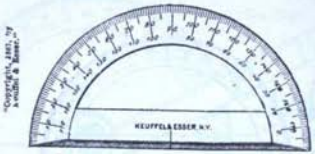
No. 1241.

1240. Semicircular German Silver Protractor, 4 in., beveled edge, centre on inner edge, divided to 1 degree, each $ 2 35

1241. do. 5 in., divided to ½ degrees " 3 00

1242. do. 6 " " " ½ " " 3 50

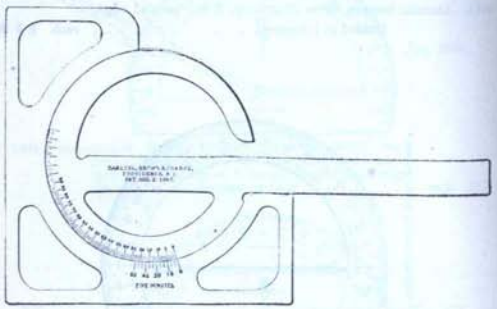
1243. do. 6 " " " ¼ " " 4 25



No. 1246.

1245. Semicircular German Silver Protractor, 4 in.. beveled edge, centre on outer edge, divided to 1 degree, each $ 1 60

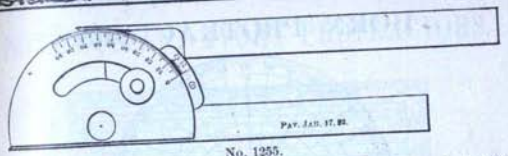
1246.	do.	do.	do.	5 in.,	"	"	½	"	"	2 25
1247.	do.	do.	do.	6 "	"	"	½	"	"	2 75
1248.	do.	do.	do.	6 "	"	"	¼	"	"	3 50
1249.	do.	do.	do.	7 "	"	"	½	"	"	4 50
1250.	do.	do.	do.	8 "	"	"	½	"	"	5 25



No. 1253.

1253. Draftsman's Steel Protractor, with Directions . . . . . each $ 6 50
do. do. do. in Morocco Case . . . " 7 75

This Protractor is made of sheet steel. The blade is 8¼ inches long. The circle is graduated to degrees, and the vernier reads to 5 minutes. This instrument is used chiefly in connection with a T square or Straight Edge; being perfectly flush on each side, it can be used either side up and on either edge of the blade. This makes it particularly convenient in dividing circles, transferring angles, drawing oblique lines at right angles to each other, or laying off given angles on each side of a line without changing the setting.



No. 1255.

1255. Draftsman's Steel Protractor nickel plated . . . . . each $ 4 00
do. do. in Mahogany case . . . . . " 5 00

This Protractor has spring-tempered blades about 9 inches long. The arc is four inches in diameter, graduated to degrees, with a vernier reading to five minutes. It has a clamping screw which securely holds the blades at any angle and serves as handle.

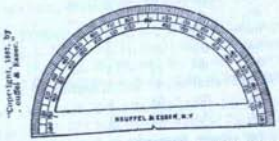
Either blade can be used in contact with a T square, giving any angle and its complement from 0° to 90°.

It forms a perfect adjustable triangle, and is nicely nickelplated and finished. It is a convenient and reliable tool.

No. 1257

1257. Rogers' Tangent Protractor, 10 in. radius, boxwood with bevels coated with a material resembling ivory, divided on both edges to 10 minutes and numbered 0—45—90° . . . . . each $ 4 00

A very convenient and accurate instrument for plotting angles and an efficient substitute for a vernier protractor.

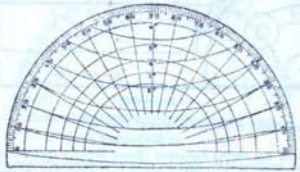


No. 1262.

1260.	Semicircular German Silver Protractor,			4½	in.,	1	degree, each	$ 70
1261.	do.	do.	do.	5½	"	½	"	"	1 00
1262.	do.	do.	do.	6½	"	½	"	"	1 15
1263.	do.	do.	do.	7½	"	½	"	"	1 40
1264.	do.	do.	do.	8½	"	½	"	"	2 00
1265.	do.	Brass	do.	3¾	"	1	"	"	09
1266.	do.	do.	do.	4½	"	1	"	"	25
1267.	do.	do.	do.	5½	"	½	"	"	55
1268.	do.	do.	do.	6½	"	½	"	"	70

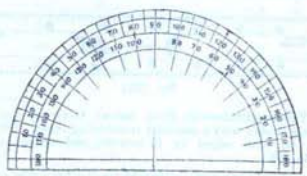
For Rubber Protractors see page 206.
" Xylonite " " " 211.
" Paper, etc. " " " 172.

HORN PROTRACTORS.



No. 1275.

1275. Railroad Curve Protractor, Horn, 8 in., ½ degrees, with circular curves from ½° to 8°, Scale 400 feet to the inch, each $ 1 60



No. 1277.

1276.	Semicircular Horn Protractor,			4½	in.,	1	degree	each	$ 14
1277.	do.	do.	do.	5½	"	½	"	"	25
1279.	do.	do.	do.	6½	"	½	"	"	30
1281.	do.	do.	do.	7	"	½	"	"	40
1283.	do.	do.	do.	8	"	½	"	"	60
1285.	do.	do.	do.	8½	"	½	"	"	70
1286.	Circular	Horn Protractor,		4	in.,	1	degree	"	1 00
1287.	do.	do.	do.	5½	"	½	"	"	1 35
1288.	do.	do.	do.	6½	"	½	"	"	1 60

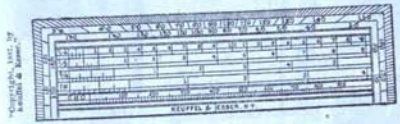
For xylonite protractors see page 211.

1290.	Square	do.	do.	4½	"	½	"	"	35
1291.	do.	do.	do.	6	"	½	"	"	50

PAPER PROTRACTORS.

1293.	Circular, on Vegetable Tracing Paper,			14	in.	diam.	½°	each	$ 30
1294.	do.	"	Drawing Paper,	14	"	"	½°	"	30
1295.	do.	"	Bristol Board,	14	"	"	½°	"	40
1296.	do.	"	"	8	"	"	½°	"	20
1297.	Semicircular, on Bristol Board,			5	"	"	½°	"	10
1298.	do.	"	"	5	"	"	½°		
	with Diagonal Scales of inches to $\frac{1}{100}$th, and millimeter							"	15

BOXWOOD AND IVORY PROTRACTORS.



No. 1320.

1319. Square Boxwood Protractor, 6 × 1½ in., divided: whole degrees, 4 Scales, ¼, ½, ¾, 1 inch, Diagonal Scales, Scale of Chords . . . . . each $ 35

1320. Square Ivory Protractor, 6 × 1½ in., divided: whole degrees, ¼, ½, ¾, 1 inch Scales, Scale of Chords, Diagonal Scale, Scales of 25, 30, 35, 40, 45 parts per inch . . . . . " 1 60

1321. Square Ivory Protractor, 6 × 1½ in., divided: whole degrees, ¼, ½, ¾, ⅛, ⅜, ⅝, ⅞, 1 inch Scales, Scale of Chords, Diagonal Scale, Scales of 30, 35, 40, 45, 50, 60 parts per inch, Scale of 40 on lower edge . . . . . " 2 00

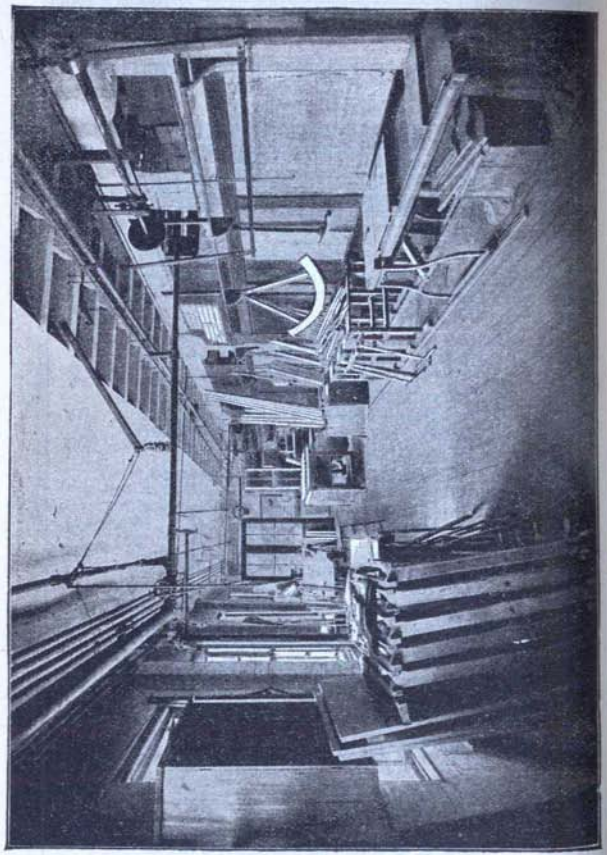
1322. Square Ivory Protractor, 6 × 2 in., divided: whole degrees, ¼, ½, ¾, ⅛, ⅜, ⅝, ⅞, 1, 1⅛, 1¼, 1⅜ inch Scales, Scale of Chords, Diagonal Scale, Scale of 30, 35, 40, 45, 50, 60 parts per inch, Scale of 40 on lower edge . . . . . " 4 35

1323. Square Ivory Protractor, 6 × 2½ in., divided: half degrees, ¼, ½, ¾, ⅛, ⅜, ⅝, ⅞, 1, 1⅛, 1¼, 1⅜, 1½ inch Scales, Scale of Chords, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60 parts per inch and Diagonal Scale, Scale of 40 on lower edge " 5 00

1324. Square Ivory Protractor, 8 × 2 in., divided: whole degrees, ¼, ½, ¾, ⅛, ⅜, ⅝, ⅞, 1 inch Scales, Scale of Chords, Diagonal Scale, Scales of 20, 25, 30, 35, 40, 45, 50, 60 parts per inch, Scale of 40 on lower edge . . . . . " 5 50

1325. Square Ivory Protractor, 8 × 2½ in., divided: half degrees, ¼, ½, ¾, ⅛, ⅜, ⅝, ⅞, 1, 1⅛, 1¼, 1⅜, 1½ inch Scales, Scale of Chords, Diagonal Scale, Scales of 10, 15, 20, 25, 30, 35, 40, 45, 50, 60 parts per inch, Scale of 40 on lower edge . . . . . " 7 00

1326. Square Ivory Protractor, 12 × 2½ in., divided: half degrees, ¼, ½, ¾, ⅛, ⅜, ⅝, ⅞, 1, 1⅛, 1¼, 1⅜, 1½ inch Scales, Scale of Chords, Diagonal Scale, Scales of 10, 15, 20, 25, 30, 35, 40, 45, 50, 60 parts per inch, Scale of 40 on lower edge . . . . . " 11 50



WOOD FINISHING ROOM, FACTORY.

IVORY, PARAGON AND BOXWOOD SCALES.

Machine-divided. U. S. St'd.

Our U. S. St'd. machine-divided Ivory, Paragon and Boxwood Scales are of the best selected material and are wider and thicker than the hand-divided, and of better finish. They are superior in quality and accuracy to any others in the market.

FLAT SCALES.

Flat Scales have manifest advantages over those of triangular or any other shape and are fast superseding them, since reliable and accurate Scales are made in this country, and consumers are no longer dependent for Flat Scales on the imported hand-divided article.

Flat Scales lessen the liability to error arising from employing the wrong division.

Flat Scales do not require careful searching for the division wanted, each time the scale is applied.

Flat Scales last much longer than triangular scales, because there is no divided surface in contact with the drawing. (This does not apply to our Patent Triangular Scales, in which the divided surfaces are beveled inwardly, to raise them from the paper. See cut page 187

Flat Scales can be replaced at less cost than triangular.

Flat Scales can be selected to have only those divisions which are required, instead of a number of other additional divisions, which may never be wanted.

Flat Scales are more convenient to hold in position on the drawing.

Flat Scales present the graduations nearly on a plane with the drawing and not at an inconvenient angle.

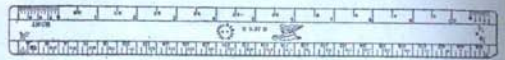
We also call attention to the lengths of scales. For divisions ½ inch to the foot or smaller a 12 inch scale will answer the purpose well, but for drawings made to a larger scale, an 18 or even 24 inch scale will be necessary in order to avoid errors from repeating the scale in setting off one measurement. We would therefore recommend 12 inch as the best length for ½ inch to the foot or smaller, 18 inch as the best length for ¾ to 2 inch to the foot, and 24 inch for still larger scales.

There is a general, although now decreasing belief, that ivory scales, being more expensive than others, are also proportionately better. Of the several materials employed for making scales, ivory, however, is about the worst in regard to stability. It is more liable to warp and shrink than our thoroughly seasoned boxwood. In their other advantages, nice appearance and distinctness of graduations, the ivory scales are excelled by our Paragon scales, which will not warp nor shrink.

KEUFFEL & ESSER CO. NEW YORK.

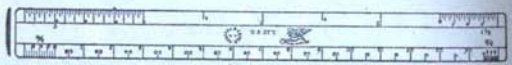
OPEN DIVIDED IVORY SCALES.

DIVIDED: INCH TO THE FOOT.



No. 1351. "Copyright, 1887, by Keuffel & Esser."

1350. Flat Ivory Scale, 6 in., divided $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, 1 inch to the foot, each $ 2 00
1351. do. 12 " " $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, 1 " " " " " " 3 00



No. 1352. "Copyright, 1887, by Keuffel & Esser."

1352. Flat Ivory Scale, 12 in., divided $\frac{1}{2}$, $\frac{1}{4}$, $1\frac{1}{8}$, 3 inch to the foot, each $ 3 00

IVORY CHAIN SCALES.

DIVIDED: INCHES AND TENTHS.

No. 1360. "Copyright, 1887, by Keuffel & Esser."

1355. Flat Ivory Chain Scale, 6 in., div. 10 × 50 parts to the inch, each $ 2 00
1356. do. 6 " " 20 × 40 " " " " " " 2 00
1357. do. 6 " " 30 × 60 " " " " " " 2 00
1358. do. 6 " " 80 × 100 " " " " " " 2 50

1360. do. 12 " " 10 × 50 " " " " " " 3 00
1361. do. 12 " " 20 × 40 " " " " " " 3 00
1362. do. 12 " " 30 × 60 " " " " " " 3 00
1363. do. 12 " " 80 × 100 " " " " " " 3 75

No. 1365. "Copyright, 1887, by Keuffel & Esser."

1365. Flat Ivory Offset Scale, 2 in., div. 10 × 50 parts to the inch each $ 80
1366. do. 2 " " 20 × 40 " " " " " " 80
1367. do. 2 " " 30 × 60 " " " " " " 80
1368. do. 2 " " 80 × 100 " " " " " " 1 00

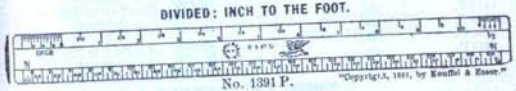
KEUFFEL & ESSER CO. NEW YORK.

FLAT PARAGON SCALES.

Paragon Scales are made of the best seasoned Boxwood. The bevels are coated with a material resembling Ivory, which will permanently remain white and will not shrink. The Paragon Drafting Scales are a great and decided improvement over all other Scales now in use. They combine durability and distinctness, and will not tire nor injure the eyes because they are even more distinct and legible than Ivory Scales, without being liable to shrink or warp like them.

Each Scale Stamped PARAGON.

DIVIDED: INCH TO THE FOOT.



No. 1391 P. "Copyright, 1887, by Keuffel & Esser."

Divided: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, 1 inch to the foot:

1390 P. Flat Paragon Scale, 6 in. . . . . each $ 75
1391 P. do. 12 " . . . . . " 1 25
1392 P. do. $12\frac{1}{2}$ " . . . . . " 1 35

Scale No. 1392P has the advantage of covering 100 feet on ¼ inch, 50 feet on ½ inch, and 25 feet on ¼ inch scale.

1393 P. Flat Paragon Scale, 18 in. . . . . each $ 2 25
1394 P. do. 24 " . . . . . " 3 00
1395 P. do. 24 " div. $\frac{1}{2}$, $\frac{1}{4}$ inch to the foot and $\frac{1}{16}$th inch full size " 3 00

No. 1396 P. "Copyright, 1887, by Keuffel & Esser."

Divided: $\frac{1}{2}$, $\frac{1}{4}$, $1\frac{1}{8}$, 3 inches to the foot:

1396 P. Flat Paragon Scale, 12 in. . . . . each $ 1 25
1397 P. do. 18 " . . . . . " 2 25
1398 P. do. 24 " . . . . . " 3 00

No. 1399 P.

Divided $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, 1 × $\frac{1}{2}$, $\frac{1}{4}$, $1\frac{1}{8}$, 3 inches to the foot:

1399 P. Flat Paragon Scale, 6 in., both sides beveled and divided, in leather sheath . . . each $ 1 35

This scale is less than one inch wide and very convenient also for the pocket. It has all the usual scales employed by the building professions.

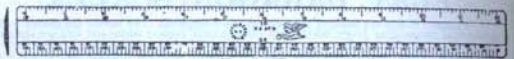
Divided: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, 1 × $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $1\frac{1}{8}$, 3 inches to the foot:

1400 P. Flat Paragon Scale, 12 in., both sides beveled and divided, each $ 2 00
1401 P. do. 18 " " " " " " " " 3 50
1402 P. do. 24 " " " " " " " " 4 75

Flat Paragon Scales with other divisions, also **divided on both sides**, made to order

KEUFFEL & ESSER CO. NEW YORK.

DIVIDED: INCHES AND TENTHS.

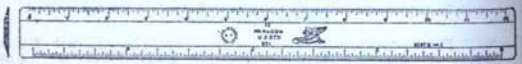


No. 1415 P. "Copyright, 1887, by Keuffel & Esser"

1410 P.	Flat Paragon Chain Scale,	6 in.,	div. 10×50	parts to the inch,	each $ 75
1411 P.	do.	6 "	" 20×40	" " " "	" 75
1412 P.	do.	6 "	" 30×60	" " " "	" 75
1413 P.	do.	6 "	" 80×100	" " " "	" 1 00
1415 P.	do.	12 "	" 10×50	" " " "	" 1 25
1416 P.	do.	12 "	" 20×40	" " " "	" 1 25
1417 P.	do.	12 "	" 30×60	" " " "	" 1 25
1418 P.	do.	12 "	" 80×100	" " " "	" 1 75

DIVIDED: FEET, DECIMALLY.

					each
1425 P.	Flat Paragon Chain Scale,	12 in.,	div. 100×500	parts to the foot,	$ 1 25
1426 P.	do.	12 "	" 200×400	" " " "	1 25
1427 P.	do.	12 "	" 300×600	" " " "	1 25
1428 P.	do.	12 "	" 800×1000	" " " "	1 75

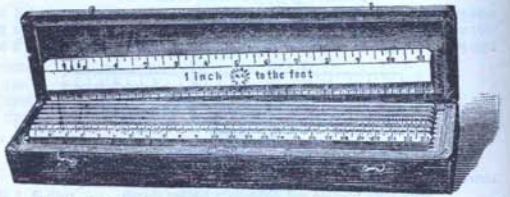


No. 1480 P.

1480 P. Flat Paragon Scale, 12 in.,
divided for diameters and circumferences . . . . . each $ 1 75

One edge of this scale is divided in inches to thirtyseconds, the other in 3.1416 in. to 1 inch, the ratio between diameter and circumference of a circle.

PARAGON SCALES IN SETS.



Flat Scales in Sets represent the most perfected form of Draughtsman's Scales. They are put up and arranged in a manner to make their use the most practical, time saving and economical. The Scales are arranged, as the above illustration shows, in a neat and strong mahogany box with a separate space for each scale, plainly numbered, so that the scale of the desired division can be selected at a glance. In this manner the scales, which are as valuable and more delicate than compasses and dividers, are protected as well as the latter. It is unreasonable that scales should be allowed to take care of themselves, while compasses are preserved in velvet lined cases.

KEUFFEL & ESSER CO. NEW YORK.

Each Scale Stamped PARAGON.

Each Scale has the same division on both edges, on edge reading from left to right, the other edge from right to left. See figure C, page

1575 P. Set of 4 Paragon Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch to the foot . . . . . set $ 6 25

1576 P. Set of 8 Paragon Scales, 12 in.
divided: $\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, 1, $1\frac{1}{2}$, 3 inches to the foot . . . " 11 50

1577 P. Set of 12 Paragon Scales, 12 in.
divided: $\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, 1, $1\frac{1}{2}$, 2, 3, 4, 6 inches to the foot and $\frac{1}{64}$ inch full size " 17 00

1578 P. Set of 4 Paragon Scales, 18 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch to the foot . . . . . " 10 75

1579 P. Set of 8 Paragon Scales, 18 in.
divided: $\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, 1, $1\frac{1}{2}$, 3 inches to the foot . . . " 20 25

1580 P. Set of 12 Paragon Scales, 18 in.
divided: $\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, 1, $1\frac{1}{2}$, 2, 3, 4, 6 inches to the foot and $\frac{1}{64}$ inch full size " 30 00

Each Scale has two different divisions, one on each edge, each of which is numbered to read both ways. See figure D, page

1584 P. Set of 4 Paragon Scales, 12 in.
divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch set $ 6 75

Each Scale has only one division, the same on both edges, and is numbered to read both ways on each edge.

1592 P. Set of 6 Paragon Scales, 12 in.
divided: 10, 20, 30, 40, 50, 60 parts to the inch . . . . set $ 9 00

1593 P. Set of 8 Paragon Scales, 12 in.
divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch " 13 00

OPEN DIVIDED BOXWOOD SCALES.

DIVIDED: INCH TO THE FOOT.

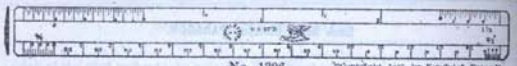
No. 1391. "Copyright, 1887, by Keuffel & Esser."

Divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch to the foot:

1390.	Flat Boxwood Scale,	6 in.	each	$ 50
1391.	do.	12 "	"	75
1392.	do.	$12\frac{1}{2}$ "	"	85

Scale No. 1392 has the advantage of covering 100 feet on $\frac{1}{8}$ inch, 50 feet on $\frac{1}{4}$ inch and 25 feet on $\frac{1}{2}$ inch scale.

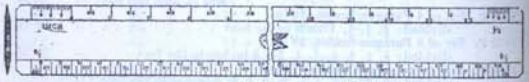
1393.	Flat Boxwood Scale,	18 in.	each	$ 1 50
1394.	do.	24 "	"	2 00
1395.	do.	24 " div. $\frac{1}{8}$, $\frac{1}{4}$, inch to the foot and $\frac{1}{64}$ inch full size	"	2 00



No. 1396. "Copyright, 1897, by Keuffel & Esser."

Divided: $\frac{1}{2}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3 inches to the foot:

1396.	Flat Boxwood Scale,	12 in.	each $	75
1397.	do.	18 "	"	1 50
1398.	do.	24 "	"	2 00



No. 1402. "Copyright, 1897, by Keuffel & Esser."

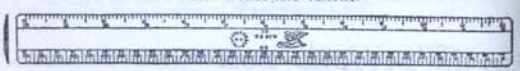
Divided: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $1 \times \frac{3}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3 inches to the foot:

1400.	Flat Boxwood Scale,	12 in., both sides beveled and divided, each	$	1 20
1401.	do.	18 " " " " " " "		2 25
1402.	do.	24 " " " " " " "		3 00

FINE QUALITY

BOXWOOD CHAIN SCALES.

DIVIDED: INCHES AND TENTHS.



No. 1415. "Copyright, 1897, by Keuffel & Esser."

1410.	Flat Boxwood Chain Scale,	6 in.,	div.	10×50	parts to the inch, each	$	50
1411.	do.	do.	6 "	"	20×40	" " " " "	50
1412.	do.	do.	6 "	"	30×60	" " " " "	50
1413.	do.	do.	6 "	"	80×100	" " " " "	75
1415.	do.	do.	12 "	"	10×50	" " " " "	75
1416.	do.	do.	12 "	"	20×40	" " " " "	75
1417.	do.	do.	12 "	"	30×60	" " " " "	75
1418.	do.	do.	12 "	"	80×100	" " " " "	1 20

"Copyright, 1897, by Keuffel & Esser."

No. 1420.

1420.	Flat Boxwood Offset Scale,	2 in.,	div.	10×50	parts to the inch, each	$	50
1421.	do.	do.	2 "	"	20×40	" " " " "	50
1422.	do.	do.	2 "	"	30×60	" " " " "	50
1423.	do.	do.	2 "	"	80×100	" " " " "	75

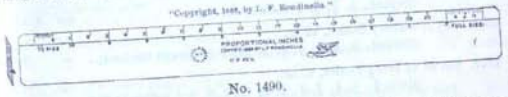
DIVIDED: FEET, DECIMALLY.

1425.	Flat Boxwood Chain Scale,	12 in.,	div.	100×500	parts to the foot, each	$	80
1426.	do.	do.	12 "	"	200×400	" " " " "	80
1427.	do.	do.	12 "	"	300×600	" " " " "	80
1428.	do.	do.	12 "	"	800×1000	" " " " "	1 25

MISCELLANEOUS GRADUATIONS.

1450.	Flat Boxwood Chain Scale,	12 in.,	div.	10×12	parts to the inch, each	$	75
1451.	do.	do.	12 "	"	10×16	" " " " "	75
1452.	do.	do.	12 "	"	12×16	" " " " "	75
1453.	do.	do.	12 "	"	16×32	" " " " "	1 00
1454.	do.	do.	12 "	"	32×64	" " " " "	50
1480.	do.	do.	6 "	"	16ths in. × mm.	"	75
1481.	do.	do.	12 "	"	" " " "	"	

SCALE OF PROPORTIONAL INCHES.



No. 1490.

This Scale is designed especially for the use of Mechanical and Machine Draftsmen. It contains the Scales most used in practice: full, $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ size in inches, two Scales on each edge, with the unit beyond the zero point subdivided.

1490. Flat Boxwood Scale, 12 in., bevels on opposite sides . . . . each $ 80

FLAT METRIC SCALES.

1530.	Flat Boxwood Scale,	10 cm.,	div.	mm. and half mm.	. . . . each	$	50
1540.	do.	20 "	"	"	" " " " "	"	60
1550.	do.	30 "	"	"	" " " " "	"	75
1560.	do.	50 "	"	"	" " " " "	"	1 50

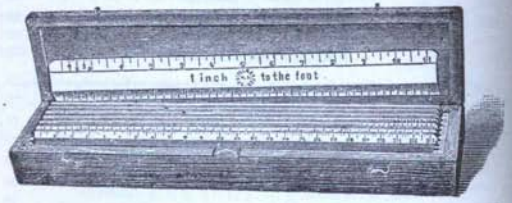
Purchaser's name put on Scale without charge.

For Flat Paragon Scales see page 177.

For Scales in Sets see pages 178 and 182.

IVORY AND BOXWOOD SCALES

IN SETS.



OPEN DIVIDED SCALES IN SETS.

Each Scale has the same division on both edges, one edge reading from left to right, other edge from right to left. See figure C, page 184.

1570. Set of 4 Ivory Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch to the foot . . . . . set $ 18 50

1571. Set of 8 Ivory Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 inches to the foot . " 25 50

1572. Set of 12 Ivory Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 4, 6 inches to the foot, and $\frac{1}{16}$ inch full size 37 50

1575. Set of 4 Boxwood Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch to the foot 4 25

1576. Set of 8 Boxwood Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 inches to the foot 7 50

1577. Set of 12 Boxwood Scales, 12 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 4, 6 inches to the foot, and $\frac{1}{16}$ inch full size 11 00

1578. Set of 4 Boxwood Scales, 18 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch to the foot . . . . . " 7 75

1579. Set of 8 Boxwood Scales, 18 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 inches to the foot . " 14 25

1580. Set of 12 Boxwood Scales, 18 in.
divided: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 4, 6 inches to the foot, and $\frac{1}{16}$ inch full size . . . . . " 21 00

CHAIN SCALES IN SETS.

Each Scale has two different divisions, one on each edge, each of which is numbered to read both ways. See figure D, page 185.

		Set
1582.	Set of 4 Ivory Scales, 12 in. divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch	$ 14 25
1583.	Set of 8 Ivory Scales, four 12 in. and four 2 in. Offset to match, divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch	17 75
1584.	Set of 4 Boxwood Scales, 12 in. divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch	4 70
1585.	Set of 8 Boxwood Scales, four 12 in. and four 2 in. Offset to match, divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch	7 25

Each Scale has only one division, the same on both edges, and is numbered to read both ways on each edge.

		Set
1588.	Set of 6 Ivory Scales, 12 in. divided: 10, 20, 30, 40, 50, 60 parts to the inch	$ 19 50
1589.	Set of 8 Ivory Scales, 12 in. divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch	28 25
1590.	Set of 12 Ivory Scales, six 12 in. and six 2 in. Offset to match, divided: 10, 20, 30, 40, 50, 60 parts to the inch	24 50
1591.	Set of 16 Ivory Scales, eight 12 in. and eight 2 in. Offset to match, divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch	35 75
1592.	Set of 6 Boxwood Scales, 12 in. divided: 10, 20, 30, 40, 50, 60 parts to the inch	6 00
1593.	Set of 8 Boxwood Scales, 12 in. divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch	9 00
1594.	Set of 12 Boxwood Scales, six 12 in. and six 2 in. Offset to match, divided: 10, 20, 30, 40, 50, 60 parts to the inch	9 25
1595.	Set of 16 Boxwood Scales, eight 12 in. and eight 2 in. Offset to match, divided: 10, 20, 30, 40, 50, 60, 80, 100 parts to the inch	15 50

For Flat Paragon Scales in Sets see page 178

SPECIAL SCALES TO ORDER.

We are called upon frequently to make Special Scales to order. To avoid error and tedious and delaying correspondence we give directions how to order such Scales.

There are two distinctly different ways of dividing a Scale:

the "**open divided**" and the "**full divided or Chain Scale.**"

OPEN DIVIDED SCALES

are illustrated under *A*, *B*, *C*. They are generally used in Architectural or Mechanical Drawing, and are divided in inches or parts of inches, which represent feet or full inches. The units are marked along the whole length of the edge and only the first unit is subdivided to inches and fractions.

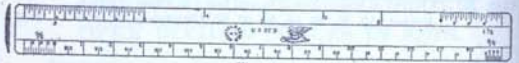


Fig. *A*. "Copyright, 1887, by Keuffel & Esser."

Fig. *A* represents an open divided Scale, with **four different divisions,** two on each edge. Two of these divisions are numbered to read from the right, the other two from the left.

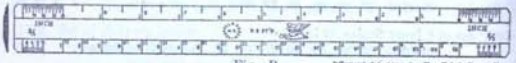


Fig. *B*. "Copyright, 1887, by Keuffel & Esser."

Fig. *B* represents an open divided Scale, with **two different divisions,** one on each edge; each edge reading from right to left and from left to right. When two divisions are to be placed on one edge, one must be the double of the other like $\frac{1}{8} \times \frac{1}{4}$, $\frac{3}{8} \times \frac{3}{4}$, 2×4, etc.

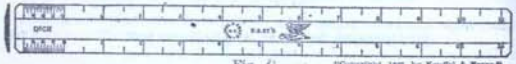


Fig. *C*. "Copyright, 1887, by Keuffel & Esser."

Fig. *C* represents an open divided Scale, with only **one division,** the same on both edges; one edge reads from right to left, the other from left to right.

In ordering open divided Scales it is therefore necessary to state that they are to be open divided, also length, shape and material, how many different divisions are wanted and which on each edge, and whether the figures should read from right to left, or from left to right or both ways. Of course they can read both ways only when there is but one division on each edge. If other than the usual numbering is wanted, this must also be explained in the order.

FULL DIVIDED OR CHAIN SCALES

are those on which equal divisions and sub-divisions are carried along the whole length of the edge. Therefore only one kind of division can be made on one edge. They are generally divided to decimals of inches, numbered continuous per 10 divisions, and are used by Surveyors and Civil Engineers, but they can be divided inches to the foot, as shown in figure *E*.

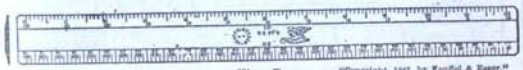


Fig. *D*. "Copyright, 1887, by Keuffel & Esser."

Fig. *D* represents a Chain Scale, with **two different divisions,** one on each edge, each of which **reads from right to left and from left to right.**

Fig. *E*. "Copyright, 1887, by Keuffel & Esser."

Fig. *E* represents a Chain Scale, with **two different divisions,** one on each edge, each of which reads from **left to right.**

In ordering Chain Scales it is therefore necessary to state that they are to be Chain Scales, also length, shape and material, which divisions are wanted and whether they should read from right to left, or from left to right, or both ways, and how they are to be numbered.

The safest way to order a Special Scale is to send us a sketch showing divisions and numbering, and to specify material and length. It is not necessary that such a sketch should show correct or actual divisions, if the value of the divisions (in inches etc.) is stated.

The price of special scales to order depends on so many factors, that it is not feasible to give any directions for estimating their cost. We shall be pleased to quote a price on receipt of an accurate description of the scale wanted.

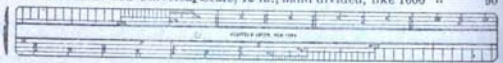
Scales with any divisions, also in foreign measures, made to order.

IVORY AND BOXWOOD SCALES.

No. 1600.

1600. Flat Ivory Universal Scale, 12 in., hand divided,
one side $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, $\frac{1}{16}$, $\frac{3}{8}$, $1\frac{1}{4}$, $2\frac{1}{2}$ }
other " $\frac{1}{16}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3, $\frac{1}{32}$, $1\frac{3}{4}$, 2, 4 } inches to the foot, . . each $ 4 00

1601. Flat Boxwood Universal Scale, 12 in., hand divided, like 1600 " 90



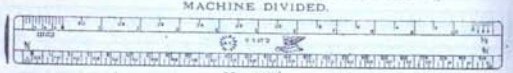
No. 1602.

1602. Flat Ivory Universal Scale, 12 in., hand divided, all Scales brought to the edge: one side $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, $\frac{1}{16}$, $\frac{3}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$ }
other " $\frac{1}{16}$, $\frac{3}{4}$, $1\frac{1}{2}$, $2\frac{1}{2}$, $\frac{1}{32}$, $\frac{3}{8}$, $1\frac{1}{4}$, 3 } inches to the foot, each $ 4 00

1603. Flat Boxwood Universal Scale, 12 in., hand divided, like 1602 " 90

PLAIN FLAT BOXWOOD SCALES,

MACHINE DIVIDED.



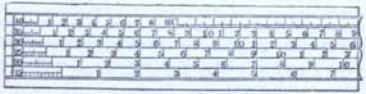
No. 1606.

Divided $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 inch to the foot:

1605. Flat Boxwood Scale, 6 in. . . . . each $ 30
1606. do. 12 " " 50
1606½. do. 18 " " 90
1607. do. 24 " " 1 20
1608. do. 12 " divided $\frac{1}{16}$ inches on both edges " 50

No. 1610.

1609. Flat Boxwood Scale, 12 in., both sides beveled and divided.
$\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 × $\frac{3}{8}$, $\frac{3}{4}$, $1\frac{1}{2}$, 3 inches to the foot . . . . . each $ 90
1609½. do. 18 in. " 1 50
1610. do. 24 " " 2 00



No. 1615.

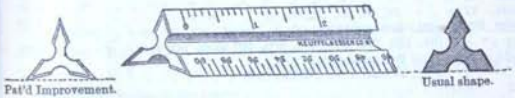
1615. Ivory Plotting Scale, 6 in. . . . . each $ 85
1616. Hardwood Plotting Scale, 6 in. " 15

TRIANGULAR SCALES.

MACHINE DIVIDED. U. S. ST'D.

PATENT TRIANGULAR PARAGON SCALES.

PATENTED JULY 8, 1890.



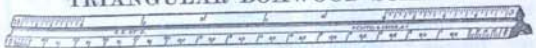
Pat'd Improvement. Usual shape.

These Paragon Scales have the improved shape, shown in above cut, which prevents the divisions wearing off by friction and insures better contact with the drawing and a better angle of vision. The bevels bearing the divisions are lined with a material resembling ivory, like the Flat Paragon Scales. The advantages of these combined improvements are obvious. This improvement which is protected by Patent and is applied only to our scales represents the only efficient means of protecting the divided surface of the scale without raising the edge from the drawing (like by end-plates) and causing errors from parallax, and unsteadiness from lack of contact.

Each Scale stamped PARAGON.

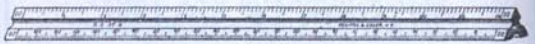
		each
	Triangular Paragon Scales, Architect's,	
1620 P.	6 in., div. $\frac{3}{32}$, $\frac{3}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 inch to the foot, $\frac{1}{16}$ in.,	$ 1 50
1621 P.	12 " " " " " " " " " " " " " " " " " "	2 50
1622 P.	12 " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 4 " " " " " "	2 50
1623 P.	18 " " " " " " " " " " " " " " " " " "	4 50
1624 P.	24 " " " " " " " " " " " " " " " " " "	6 50
	Triangular Paragon Chain Scales, Engineer's,	each
1630 P.	6 in., div. 10, 20, 30, 40, 50, 60 parts to the inch	$ 1 50
1631 P.	12 " " " " " " " " " " " " " " " " " "	2 50
1632 P.	18 " " " " " " " " " " " " " " " " " "	4 50
1633 P.	24 " " " " " " " " " " " " " " " " " "	6 50
1634 P.	12 " " 20, 30, 40, 50, 60, 80 " " " " " "	2 50
1635 P.	**Triangular Paragon** Chain Scale, 12 in. div. 100, 200, 300, 400, 500, 600 parts per foot	3 00

TRIANGULAR BOXWOOD SCALES.



No. 1621.

		each
	Triangular Boxwood Scales, Architect's,	
1620.	6 in., div. $\frac{3}{32}$, $\frac{3}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 3 inches to the foot, $\frac{1}{16}$ in.,	$ 60
1621.	12 " " " " " " " " " " " " " " " " " "	1 00
1622.	12 " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 4 " " " " " "	1 00
1623.	18 " " " " " " " " " " " " " " " " " "	2 50
1624.	24 " " " " " " " " " " " " " " " " " "	4 25



No. 1631.

Triangular Boxwood Chain Scales, Engineer's,

1630.	6 in., div. 10, 20, 30, 40, 50, 60 parts to the inch . . . each	$ 60
1631.	12 " " " " " " " " " " " " " " " "	1 00
1632.	18 " " " " " " " " " " " " " " " "	2 50
1633.	24 " " " " " " " " " " " " " " " "	4 25
1634.	12 " " 20, 30, 40, 50, 60, 80 " " " " " "	1 50
1635.	Triangular Boxwood Chain Scale, 12 in. div. 100, 200, 300, 400, 500, 600 parts per foot . . "	1 75
1636.	Triangular Boxwood Offset Scale, 2 in., to match No. 1630 to 1633 . . . . . "	60

IMPROVED

TRIANGULAR BOXWOOD SCALES.

The shape of these Triangular Scales prevents the wearing of the surface from contact with the drawing while using the scale, and it affords a better angle of vision than the common shape. (See note on opposite page.)

Improved Triangular Boxwood Scales, Architect's, Each

1620 B.	6 in., div. $\frac{1}{32}$, $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, 1½, 3 inches to the foot, $\frac{1}{16}$ inch	$ 90
1621 B.	12 " " " " " " " " " " " " " " " "	1 50
1622 B.	12 " " $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, 1½, 2, 3, 4 " " " " " "	1 50

Improved Triangular Boxwood Chain Scales, Engineer's,

1630 B.	6 in., div. 10, 20, 30, 40, 50, 60 parts to the inch . . . each	$ 90
1631 B.	12 " " " " " " " " " " " " " " " "	1 50
1634 B.	12 " " 20, 30, 40, 50, 60, 80 " " " " " "	1 50
1635 B.	Improved Triangular Boxwood Chain Scale, 12 in. div. 100, 200, 300, 400, 500, 600 parts per foot . . . "	1 75

TRIANGULAR SCALES OF METAL.

1640.	Triangular Metal Scale, Architect's, divided like No. 1621, 12 in. . . . . each	$ 2 50
1641.	Triangular Metal Chain Scale, Engineer's, divided like No. 1631, 12 in. . . . . "	2 50
1642.	Triangular Metal Chain Scale, Engineer's, divided like No. 1634, 12 in. . . . . "	2 50

TRIANGULAR METRIC SCALES.

			Each
1645.	Triangular Boxwood Scale,	20 cm., div. .01 .02 .03 .05 .025 .0125	$ 1 25
1655.	do.	30 " " " " " " " "	1 50
1665.	do.	50 " " " " " " " "	2 75

PAPER SCALES.

ENGINE DIVIDED. PRINTED ON BRISTOL BOARD.

19 × 13¼ inches.

1675.	Series A, 6 in Set, div. $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, 1½, 3 inches to the foot, set	$ 1 00
1676.	do. B, 6 " " " $\frac{3}{32}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$ " " " " " "	1 00
1677.	do. C, 6 " " " 10, 20, 30, 40, 50, 60 parts per inch "	1 00
	Separate Scales of the above . . . . . each	20
	Separate Scales, div. 2, 4 inches to the foot, 66 parts per inch, or inches in sixteenths . . . . . "	20

No. 1678.

1678.	Meter and Inch Comparing Scale, $\frac{1}{2}$ meter long . . . . . each	$ 30
1679.	Meter Scale, $\frac{1}{2}$ meter long, div. in millimetres . . . . . "	20
1689.	Scale of Proportional Inches, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, 12 in. long . . . "	10

PATENT

TRIANGULAR SCALE GUARDS.

No. 1690.

1690.	Patent	Triangular Scale Guard, German Silver . . . . . each	$ 20
1691.	do.	do. Nickel plated . . . . . "	15

MAP MEASURES.

(CHARTOMETERS.)

Illustration ½ size.

No. 1692.

1692. Map Measure, 5 in., swiveling metal handle with lock-nut, dial with 2 graduations: Inches to Miles and Centimeters to Kilometers . . . . . each $ 3 25

Illustration full size.

No. 1694.

1694. Map Measure, watch pattern, dial with 2 graduations: 12 inches in eighths and 25 feet . . . . . each $ 2 15

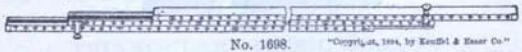
To measure a line, the instrument is set to 0, held vertical, and the small projecting wheel is carefully run along the line in one direction, when the index-hand will register on the dial, as described above.

EXTENSION MEASURES.

These Measures (see cuts below) are of hardwood with brass trimmings and the sections are tongued and grooved like in a Surveyors Leveling rod. Those in two sections (No. 1696) read opposite the end of the first section for all measurements beyond the first section; in those in three sections the reading is carried from the first to the third section and measurements beyond the first and third sections are read on the second (middle) section. They are all graduated in feet, inches and eighths of inches. They are useful in measuring between fixed points (floor and ceiling, door or window-frame posts, aisles etc.) and also where the object is not accessible for measuring with a tape.

No. 1696.

1696 A.	Extension Measure,	2 fold,	4 feet,	extending to	8 feet,	each	$	3	50
1696 B.	do.	2 "	5 "	"	" 10 "	"		4	00
1696 C.	do.	2 "	6 "	"	" 12 "	"		5	00



No. 1698.

1698 D.	Extension Measure,	3 fold,	3 feet,	extending to	9 feet,	each	$	5	00
1698 E.	do.	3 "	4 "	"	" 12 "	"		6	00
1698 F.	do.	3 "	5 "	"	" 15 "	"		7	50

SHRINKAGE RULES

FOR

SINGLE AND DOUBLE SHRINKAGE.

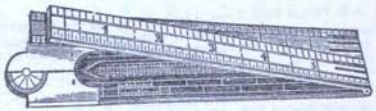
No. 1701.

These Shrinkage Rules are of hardwood, brass tipped, about 1½ inches wide by ¼ in. thick, and divided to one-eighth, one-tenth, one-twelfth and one-sixteenth inches. They are superior to all others in quality, accuracy and finish.

1700.	Shrinkage Rule,	$24\frac{7}{8}$ = 24 in.	. . . . .	each	$	1 20
1701.	do.	$24\frac{1}{4}$ = 24 "	. . . . .	"		1 20
1701½.	do.	$24\frac{3}{8}$ = 24 "	. . . . .	"		1 20
1702.	do.	$24\frac{1}{2}$ = 24 "	. . . . .	"		1 20
1703.	do.	25 = 24 "	. . . . .	"		1 20
1704.	do.	$25\frac{1}{2}$ = 24 "	. . . . .	"		1 20
1705.	do.	26 = 24 "	. . . . .	"		1 20
1706.	do.	$26\frac{1}{2}$ = 24 "	. . . . .	"		1 20

Rules to any other shrinkage made to order; prices on application.

SCALE RULES.



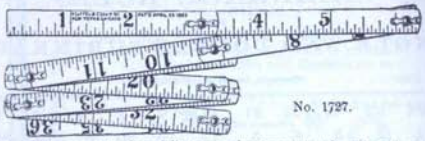
No. 1720.

1720. Ivory Joint Rule, 2 feet, 4 fold, German Silver mounted, divided: $\frac{1}{8}$, $\frac{1}{10}$, $\frac{1}{12}$, $\frac{1}{16}$ of an inch, outside edge foot in 100ths. The inside edges are beveled and have Scales of $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, $\frac{1}{3}$, $\frac{3}{8}$, $\frac{1}{4}$, $\frac{3}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$ inches to the foot. The main joint is graduated to 5 degrees for setting off angles . . . . . each $ 8 00

1721. Boxwood Joint Rule, 2 feet, 4 fold, German Silver mounted, divided like No. 1720 . . . . . " 2 45

1722. Boxwood Joint Rule, 2 feet, 4 fold, Brass mounted with Scales on beveled edges of $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, $\frac{1}{3}$, $\frac{3}{8}$, $\frac{1}{4}$, $\frac{3}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, 1 inch to the foot. The main joint is graduated at 45, 60 and 90 degrees . . . . . " 1 35

SPRING JOINT STEEL RULES.



No. 1727.

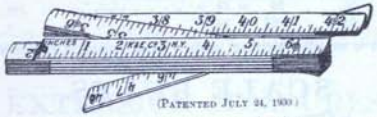
These Rules are made of carefully tempered spring steel, ⅜ in. wide and graduated on both sides. They fold up smaller than any other rule, so that the 12 fold three-foot rule is only ⅝ in. thick × 3⅛ in. long when folded.

The divisions are sharp and accurate and the numbering is very distinct on dark ground. It runs in opposite directions on the two sides. The aligning springs at the joints hold the rule in a rigid straight line when it is opened without in any way interfering with folding it.

1725.	K. & E. Steel Pocket Rule,	1	foot,	4	fold	div.	$\frac{1}{16}\times\frac{1}{16}$	in.	each $ 25
1726.	do.	do.		2	"	8	"	"	" " 50
1727.	do.	do.		3	"	12	"	"	" " 75
1728.	do.	do.		3	"	12	"	$\frac{1}{16}$ in.×mm.	" 1 20
	Leather Sheaths for above rules								" 05

K. & E. FOLDING POCKET RULES,

YELLOW FINISH.



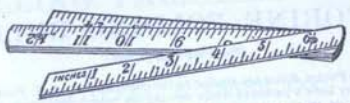
No. 1730-4

(Patented July 24, 1900.)

									each.
1730-2.	K. & E. Pocket Rule,	2	feet,	4	fold,	div.	$\frac{1}{16}\times\frac{1}{16}$	in., with springs,	$ 25
1730-3.	do.	do.		3	"	6	"	" do. " " "	35
1730-4.	do.	do.		4	"	8	"	" do. " " "	50
1730-5.	do.	do.		5	"	10	"	" do. " " "	60
1730-6.	do.	do.		6	"	12	"	" do. " " "	75
1730-8.	do.	do.		8	"	16	"	" do. " " "	1 00
1730-4 F.	K. & E. Pocket Rule,	4	feet,	8	fold,	div.	$\frac{1}{16}\times\frac{1}{16}$	in. numbered feet and inches, with springs,	50
1730-5 F.	do.	do.		5	feet,	10	fold,	do. " "	60
1730-6 F.	do.	do.		6	"	12	"	do. " "	75
1731-4.	K. & E. Pocket Rule,	4	feet,	8	fold,	div.	$\frac{1}{16}\times\frac{1}{20}$	in., " "	50
1732-4.	do.	do.		4	"	8	"	" $\frac{1}{16}$×mm. " "	50
1730 S.P.	do.	do.		4	"	8	"	" $\frac{1}{16}\times\frac{1}{16}$ in., with scales and tables	75

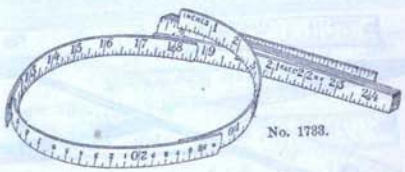
Nos. 1730 to 1730 S.P. are provided with ingenious spring joints, which hold the rule in a straight line when open, so that vertical or horizontal distances may be easily measured. The ends are provided with metal tips (see note, page 194).

Rule 1730 S.P. is divided on both sides like No. 1730-4. In addition it has scales of ⅛, ¼, ⅜, ½ inch to the foot and a reliable table of 22 of the most frequently used ratios and specific gravities.



No. 1734-3.

1734-3.	K. & E. Pocket Rule,	3	feet,	6	fold,	div.	$\frac{1}{16}\times\frac{1}{16}$	in.,	no springs	each $ 18
1734-4.	do.	do.		4	"	8	"	"	"	do. " 25
1735-2.	do.	do.		2	"	6	"	"	"	do. " 15
1735-3.	do.	do.		3	"	9	"	"	"	do. " 25



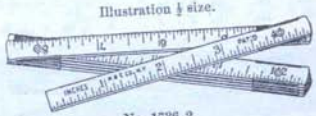
No. 1733.

each

1733-2.	K. & E. Pocket Rule,	2	feet,	4	fold,	div.	$\frac{1}{16}\times\frac{1}{16}$	in.,	extra flexible,	$ 20
1733-3.	do.	do.		3	"	6	"	"	do. " "	30
1733-4.	do.	do.		4	"	8	"	"	do. " "	40

No. 1733 are very thin and flexible, so that curves, as well as the circumferences of round objects, as small as 5 in. diameter, may be easily measured with them.

Illustration ½ size.



No. 1736 2.

each

1736-2.	K. & E. Pocket Rule,	2	feet,	6	fold,	$\frac{1}{16}\times\frac{1}{16}$	in.,	with springs,	$ 30
1736-3.	do.	do.		3	"	9	"	do.	" "	45
1737-2.	do.	do.		2	"	6	"	$\frac{1}{10}$ and $\frac{1}{100}$	feet on both sides,	30

No. 1736-2 to 1737-2 are made like numbers 1730-2 etc., but are in 4-inch joints and only ¾ in. wide. The 3-foot rule, when closed, measures only ⅜ x $\frac{3}{16}$ x 5 inches. These miniature rules are therefore very convenient for the pocket. They are just as accurate as the larger rules.

K. & E.

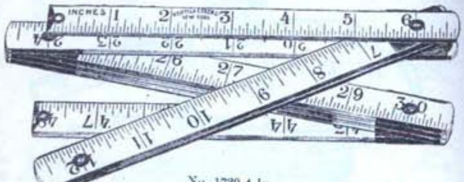
IVORINE FOLDING RULES.

(Patented July 24, 1900.)

Ivorine Pocket Rules are similar to the celebrated K. & E. Folding Pocket Rules. They have a patented white coating on which the black graduations and figures are much more distinct and legible than on yellow rules. This coating is very durable and permanent, resists heat and moisture and can be cleaned with water, alcohol or oil, so that the nice appearance and distinctness of the rule can be preserved. The Ivorine Rules are well adapted also for use in hot climates.

The ends of the rule are protected against wear by metal tips of a very practical patented device. They do not obscure the graduations and are securely fastened in place without rivets.

They prevent wear of the ends and preserve the correctness of the rule.



No. 1730-4-Iv.

					each.
1730-2-Iv.	Ivorine Pocket Rule,	2 ft.,	4 fold,	div. $\frac{1}{16} \times \frac{1}{16}$ in., with springs,	$ 40
1730-3-Iv.	do. do.	do. 3 "	6 "	" do. " " "	50
1730-4-Iv.	do. do.	do. 4 "	8 "	" do. " " "	60
1730-5-Iv.	do. do.	do. 5 "	10 "	" do. " " "	75
1730-6-Iv.	do. do.	do. 6 "	12 "	" do. " " "	90
1730-8-Iv.	do. do.	do. 8 "	16 "	" do. " " "	1 20
1730-100-Iv.	do. do.	do. 4 "	8 "	" $\frac{1}{16}$ in. × $\frac{1}{100}$ ft. "	75

No. 1736-3-Iv.

					each.
1736-2-Iv.	Ivorine Pocket Rule,	2 ft.,	6 fold,	div. $\frac{1}{16} \times \frac{1}{16}$ in., with springs,	$ 50
1736-3-Iv.	do. do.	do. 3 "	9 "	" do. " " "	60
1737-2-Iv.	do. do.	do. 2 "	6 "	" on both sides, $\frac{1}{16}$ and $\frac{1}{100}$ ft.	50
1737-M.Iv.	do. do.	do. 1 meter,	10 fold,	div. $\frac{1}{16}$ in. × mm.	75

ROLLING PARALLEL RULES.

STANDARD QUALITY.

MANUFACTURED BY

KEUFFEL & ESSER CO.

Our Metal Rolling Parallel Rules are constructed to insure the greatest possible accuracy of motion and are also much heavier than those generally offered. The metal guard over the axle is so shaped that it forms a convenient handle.

No. 1751.

GERMAN SILVER.

1750.	Parallel Rule,	9 in.,	weight about 19 oz.	each	$ 8 50
1751.	do.	12 "	" " 24 "	"	10 00
1752.	do.	15 "	" " 32 "	"	12 00
1753.	do.	18 "	" " 42 "	"	15 00
1754.	do.	24 "	" " 60 "	"	20 00

BRASS.

1755.	Parallel Rule,	9 in.,	weight about 18 oz.	each	$ 7 25
1756.	do.	12 "	" " 23 "	"	8 50
1757.	do.	15 "	" " 31 "	"	10 00
1758.	do.	18 "	" " 40 "	"	12 00
1759.	do.	24 "	" " 58 "	"	18 00

Polished Boxes for above	9	12	15	18	24 in.
each $	75	85	1 00	1 10	1 25

No. 1760.

1760.	Ebony Rolling Parallel Rule, Brass mountings, white edges, divided $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 in. to the foot		12 in.,	each	$ 5 00
1761.	do.	do. do.	15 "	"	6 50
1762.	do.	do. do.	18 "	"	7 50

For Rubber Rolling Parallel Rules see page 206.

KEUFFEL & ESSER CO. NEW YORK.

No. 1766.

1765.	Ebony Rolling Parallel Rule,	Brass mountings,	9 in.	. .	each	$ 2 75
1766.	do.	do.	"	"	12 "	. .	"	3 25
1767.	do.	do.	"	"	15 "	. .	"	4 00
1768.	do.	do.	"	"	18 "	. .	"	5 00

FOLDING PARALLEL RULES.

1771. Parallel Rule, all German Silver, 6 in. . . . . each $ 1 50

No. 1781.

As the imported wooden Rules warp and shrink when brought into this climate, we make Folding Ebony Parallel Rules here which we can recommend and warrant.

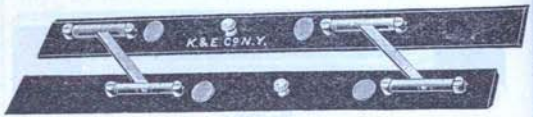
KEUFFEL & ESSER CO.'s Ebony Parallel Rules, Brass Bars,

1780	1781	1782	1783	1784	1785	
6	9	12	15	18	24	in.
each $ 30	55	75	90	1 10	2 20	

For Rubber Folding Parallel Rules see page 203

SIGSBEE'S

PATENT PARALLEL RULES.



No. 1797.

1796.	Sigsbee's Patent Parallel Rules,	15 in.,	Ebony,	. .	each	$ 3 00
1797.	"	"	"	"	18 "	"	"	. .	"	4 00
1798.	"	"	"	"	24 "	"	"	. .	"	5 00

These Parallel Rules have brass mountings and the bars are pivoted so that the rule can be laid over, (stepping) to cover any distance

CABINET MAKERS LOFT, FACTORY.

HARD RUBBER DRAWING TOOLS.

MANUFACTURED BY

KEUFFEL & ESSER CO.



All our Tools of Hard Rubber are highly recommended. Their superiority over others is recognized and indorsed by the best authorities. They are made of new rubber of the best and most uniform quality and all the working edges are hand-finished (not polished), so that they are true and of the proper smoothness.

The triangles are carefully graded in thickness, each being of the thickness proportionate to its size. This forbids cutting the smaller triangles out of the centres of the larger ones, but the advantage of having triangles of proper thickness, far outweighs the saving which would result from utilizing pieces from larger triangles for the smaller ones.

On account of the superior quality of the material employed, our hard rubber tools retain their true edges longer than others and they are less liable to break from a fall or to smudge the drawing, than those of inferior rubber, not to mention those made of worked-over scrap.

As we warrant all our hard rubber goods, and to enable buyers to know that they are obtaining our goods, we stamp each one with our firm name and trade-mark:

HARD RUBBER TRIANGLES.

No. 1800.

1801.

1800. Hard Rubber Triangles, solid, 30×60 degrees,

	4	6	8 in.
each $	15	20	30

1801. Hard Rubber Triangles, solid, 45 degrees,

	3½	5	6 in.
each $	15	20	30

No. 1802. 1803. 1804.

1802. Improved Hard Rubber Triangles, 30×60 degrees, (see note page 208.)

	4	5	6	7	8	9	10	11	12	13	14	15	16 in.
each $	20	25	30	35	45	55	65	75	90	1 00	1 25	1 40	1 50

1803. Improved Hard Rubber Triangles, 22½×67½ degrees, (see note page 208.)

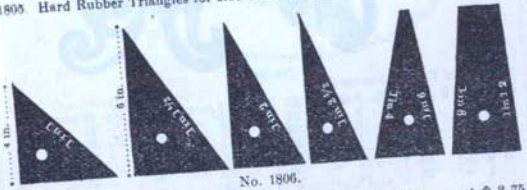
	4	5	6	7	8	9	10	11	12	13	14	15	16 in.
each $	20	25	30	35	45	55	65	75	90	1 00	1 25	1 40	1 50

1804. Improved Hard Rubber Triangles, 45 degrees, (see note page 208.)

	4	5	6	7	8	9	10	11	12	13	14	15	16 in.
each $	25	35	45	50	65	75	95	1 10	1 30	1 60	1 85	2 15	2 50

No. 1805.

1805. Hard Rubber Triangles for Roof Pitches, 6 in set . . . . . set $ 2 50



No. 1806.

1806. Hard Rubber Triangles for Embankments, 8 slopes in set . set $ 3 75

No. 1810.

1810. Hard Rubber Lettering Triangles, 3 in set . . . . . set $ 1 20

HARD RUBBER CURVES.

Illustration about ½ size.

No. 1820.

1820. Hard Rubber Curves:

No. 1	each $ 35	No. 8	each $ 25	No. 15	each $ 45	No. 22	each $ 35
" 2	" 35	" 9	" 25	" 16	" 35	" 23	" 40
" 3	" 50	" 10	" 20	" 17	" 35	" 24	" 60
" 4	" 50	" 11	" 20	" 18	" 40	" 25	" 40
" 5	" 40	" 12	" 30	" 19	" 50	" 26	" 35
" 6	" 35	" 13	" 50	" 20	" 50	" 27	" 75
" 7	" 30	" 14	" 35	" 21	" 45	" 28	" 2 25

Illustration ¼ size.

No. 1822.

1822. Logarithmic Spiral Curve, with Directions . . . . . each $ 1 50

This curve is mathematically constructed and contains every curve within the limit of its size. If properly used according to the directions accompanying each, the most difficult calculations can be made with it.

Directions for Logarithmic Spiral Curve . . . . . each $ 20

No. 1827. 1825. 1828.

1825.	Hard Rubber Ellipses,	10	in set	from	1½	to	6	in.	set $ 2 50
1826.	do. do.	6	" "	"	2	"	4½	"	" 1 50
1827.	Hard Rubber Hyperbolas,	8	" "	"	2	"	5½	"	" 2 35
1828.	Hard Rubber Parabolas,	8	" "	"	1½	"	5½	"	" 2 25
1829.	do. do.	8	" "	"	3¼	"	14¼	"	" 5 00

Section.

No. 1835.

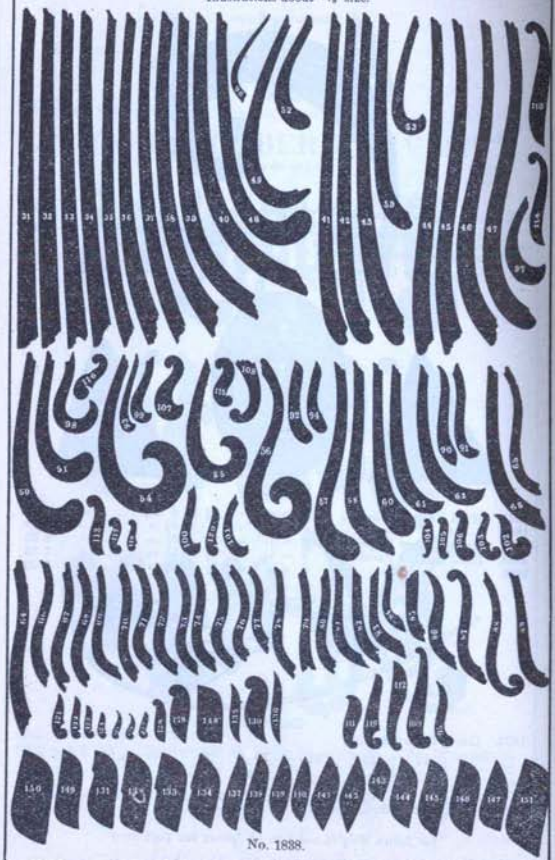
1835. Hard Rubber Splines,

12	18	24	30	36	42	in.
each $ 25	30	35	40	45	50	

These Splines have a small groove, as shown in the section, to admit the finger of the weights which hold them in position.

For Spline Weights and Sets of Splines see page 219

Illustrations about $^1/_3$ size.



No. 1838.

HARD RUBBER SHIP CURVES.

1836. Set of 121 Hard Rubber Copenhagen Ship Curves, No. 1838, (31 to 151), in Black Walnut Case (see cut on preceding page) . . . . . $ 65 00

Illustration about $^1/_3$ size.

No. 1837.

1837. Set of 10 Hard Rubber Curves for Mechanical Engineers, cont'g.: No. 55, 60, 94, 102, 104, 109, 114, 119, 121, 128 . . . . . Set in Case $ 3 75

1838. Hard Rubber Copenhagen Ship Curves. (See cut opposite.)

No. 31 each	$ 1 25	62 each	$ 75	92 each	$ 50	122 each	$ 30
32 "	1 25	63 "	75	93 "	40	123 "	25
33 "	1 25	64 "	75	94 "	50	124 "	25
34 "	1 25	65 "	75	95 "	40	125 "	25
35 "	1 25	66 "	50	96 "	40	126 "	25
36 "	1 25	67 "	50	97 "	50	127 "	25
37 "	1 25	68 "	50	98 "	50	128 "	35
38 "	1 25	69 "	50	99 "	40	129 "	40
39 "	1 25	70 "	50	100 "	40	130 "	50
40 "	1 25	71 "	50	101 "	40	131 "	40
41 "	1 25	72 "	50	102 "	40	132 "	40
42 "	1 25	73 "	50	103 "	40	133 "	40
43 "	1 25	74 "	50	104 "	35	134 "	40
44 "	1 25	75 "	50	105 "	25	135 "	40
45 "	1 25	76 "	50	106 "	40	136 "	35
46 "	1 25	77 "	50	107 "	50	137 "	30
47 "	1 25	78 "	50	108 "	50	138 "	40
48 "	1 00	79 "	50	109 "	75	139 "	40
49 "	80	80 "	50	110 "	75	140 "	40
50 "	80	81 "	50	111 "	40	141 "	40
51 "	80	82 "	50	112 "	60	142 "	40
52 "	60	83 "	50	113 "	40	143 "	35
53 "	60	84 "	40	114 "	50	144 "	40
54 "	1 00	85 "	50	115 "	40	145 "	40
55 "	80	86 "	50	116 "	40	146 "	40
56 "	1 25	87 "	60	117 "	35	147 "	40
57 "	80	88 "	75	118 "	25	148 "	40
58 "	80	89 "	75	119 "	50	149 "	40
59 "	80	90 "	60	120 "	35	150 "	50
60 "	80	91 "	60	121 "	35	151 "	50
61 "	75						

For Pearwood Copenhagen Ship Curves see page 220

KEUFFEL & ESSER CO. NEW YORK.

HARD RUBBER RAILROAD CURVES

AWARDED

THE ONLY MEDAL

AT THE NATIONAL EXPOSITION

OF

RAILWAY APPLIANCES,

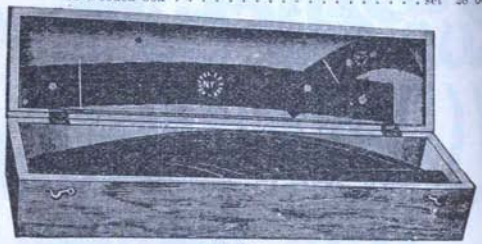
CHICAGO, 1883.

All these curves are cut by special machinery and are perfectly correct circular curves. They are the same on both edges, so that either edge can be used. Our curves will be found far more correct and accurate than any others. Their edges have the same hand finish (not polish) as our other hard rubber tools.

1840. Hard Rubber Railroad Curves, 10 in set, viz: 12, 24, 36, 48, 60, 72, 84, 96, 108, 120 in. radius, in wooden box . . set $ 7 75

1841. Hard Rubber Railroad Curves, 17 in set, viz: 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60 in. radius, in wooden box . . . . . set 13 25

1842. Hard Rubber Railroad Curves, 40 in set, viz: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60, 66, 72, 78, 84, 90, 96, 102, 108, 114, 120 in. radius, 1 curve 1" to 100 foot scale, 57.30 in., 1 curve 2" to 100 foot scale, 28.65 in., in wooden box . . . . . set 28 00



No. 1845.

1845. Hard Rubber Railroad Curves **with Tangent**, 55 in set, viz.: 3, 3½, 4, 4½, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 32, 34, 35, 36, 38, 40, 45, 50, 55, 60, 65, 70, 75, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200 in. radius, in wooden box . . . . . set $ 40 00

KEUFFEL & ESSER CO. NEW YORK.

1846. Hard Rubber Railroad Curves, **with Tangent**, marked in degrees and inches, to scale 100 feet = 1 inch, 41 in set, viz.:

0°.30' = 114.59 in.	3°.30' = 16.37 in.	6° = 9.55 in.	8°.30' = 6.75 in.
1° = 57.30 "	3°.45' = 15.28 "	6°.15' = 9.17 "	8°.45' = 6.55 "
1°.15' = 45.84 "	4° = 14.33 "	6°.30' = 8.82 "	9° = 6.37 "
1°.30' = 38.20 "	4°.15' = 13.48 "	6°.45' = 8.49 "	9°.15' = 6.20 "
1°.45' = 32.74 "	4°.30' = 12.73 "	7° = 8.19 "	9°.30' = 6.04 "
2° = 28.65 "	4°.45' = 12.07 "	7°.15' = 7.91 "	9°.45' = 5.88 "
2°.15' = 25.47 "	5° = 11.46 "	7°.30' = 7.64 "	10° = 5.74 "
2°.30' = 22.92 "	5°.15' = 10.92 "	7°.45' = 7.40 "	10°.30' = 5.48 "
2°.45' = 20.84 "	5°.30' = 10.42 "	8° = 7.17 "	11° = 5.22 "
3° = 19.10 "	5°.45' = 9.97 "	8°.15 = 6.95 "	11°.30' = 4.99 "
3°.15' = 17.63 "			

In wooden box . . . . . set $ 30 00

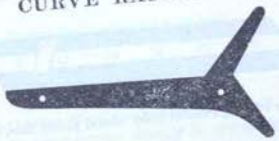
These Hard Rubber Railroad Curves are made to correct radii from the formula radius = ½ chord ÷ sin ½ angle = 50 ÷ sin ½ angle, and to a scale of 1 inch = 100 feet, both edges having the same radius. The short tangents are very useful, as they enable the beginning of the curve to be correctly located on the drawing by means of the radial line separating the tangent from the curve.

SEPARATE RAILROAD CURVES.

Single Railroad Curves, as described above, of any desired scale, cut to order. . . . . each $ 75

Single Hard Rubber Railroad Curves do. do. with Tangent . . . . " 90

CURVE RADIATOR.



No. 1848.

1848. Curve Radiator, hard rubber, 9 in . . . . . each $ 1 50

A convenient tool for erecting perpendiculars (radii) on curves. It can be used from either the convex or the concave side of the curve. The angle of the drawing edge gives the tangent.

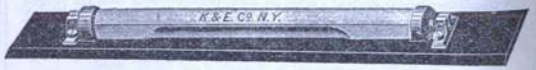
HARD RUBBER PROTRACTORS.

No. 1850.

1852.

1850.	Semicircular Rubber Protractor,	beveled	edge,	6	in.,	½"	each $ 3 00
1851.	do.	do.	"	"	8	"	½"	" 3 75
1852.	Circular Rubber Protractor		"	"	6	"	½"	" 3 75
1853.	do.	do.	"	"	8	"	½"	" 5 00
1854.	do.	do.	"	"	10	"	½"	" 6 00

HARD RUBBER PARALLEL RULES.



No. 1911.

								Each
1910.	Hard Rubber Rolling Parallel Rule,	nickel	plated	mountings,	9	in.	$ 3 50
1911.	"	"	"	do.	"	"	"	12	"	4 25
1912.	"	"	"	do.	"	"	"	15	"	5 00
1913.	"	"	"	do.	"	"	"	18	"	6 00
1914.	"	"	"	do.	"	"	"	24	"	8 00

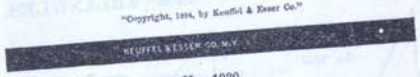
No. 1921.

1920.	Hard Rubber Folding Parallel Rule,	nickel	plated	bars,	6	in.,	each $ 75
1921.	"	"	"	do.	"	"	"	9	"	" 1 00
1922.	"	"	"	do.	"	"	"	12	"	" 1 25
1923.	"	"	"	do.	"	"	"	15	"	" 1 50
1924.	"	"	"	do.	"	"	"	18	"	" 1 75
1925.	"	"	"	do.	"	"	"	24	"	" 2 50

For Sigbee's Parallel Rules see page 196

HARD RUBBER

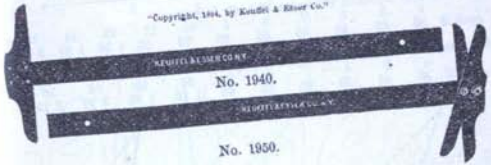
STRAIGHT EDGES AND T SQUARES.



No. 1930.

1930. Hard Rubber Straight Edges, with square edges,

	12	15	18	24	30	36	42	in.
each $	35	40	50	75	1 00	1 35	1 75	



No. 1940.

No. 1950.

1940. T Squares, Rubber Blade, ebonized fixed head,

	6	9	12	15	18	24	30	36	in.
each $	40	50	60	75	90	1 25	1 60	2 00	

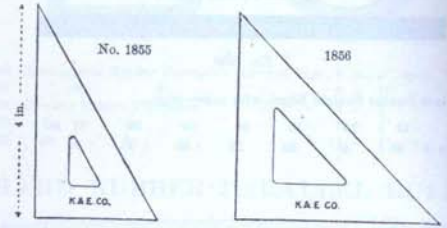
1950. T Squares, Rubber Blade, ebonized shifting head, K. & E. Co. pattern, with two fine brass swivels. Sizes 18 in. and smaller have one swivel.

	12	15	18	24	30	36	in.
each $	1 10	1 25	1 60	2 00	2 50	3 00	

XYLONITE DRAWING TOOLS.

Xylonite has been extensively adopted for drawing tools, on account of its transparency, but it is impossible, so far, to produce xylonite which is not liable to become incorrect in time, seemingly from chemical changes. Xylonite tools for accurate work should be used only with constant attention to their correctness. The xylonite which we use is made specially for such tools as we make, and it will stand better than the material generally used.

IMPROVED XYLONITE TRIANGLES.

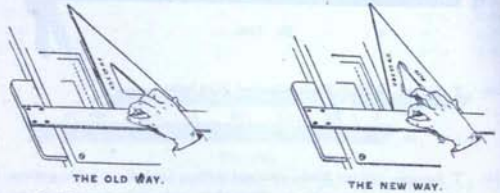


1855. **Improved** Xylonite Triangles, 30 × 60 degrees,

	4	5	6	7	8	9	10	11	12	14	16 in.
each $	25	35	40	45	55	65	75	85	1 00	1 65	2 50

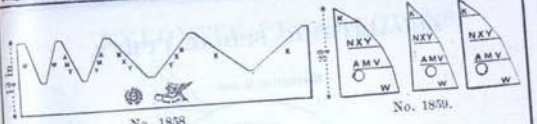
1856. **Improved** Xylonite Triangles, 45 degrees,

	4	5	6	7	8	9	10	12	14	16 in.
each $	35	45	55	65	75	95	1 10	1 65	2 20	3 15



The K. & E. Co. Improved Xylonite and the Hard Rubber Triangles (page 199) have bevels on their *inner* edges from opposite faces (or surfaces) so that they can be readily picked up by catching the finger-nail under the bevel when taking hold of them.

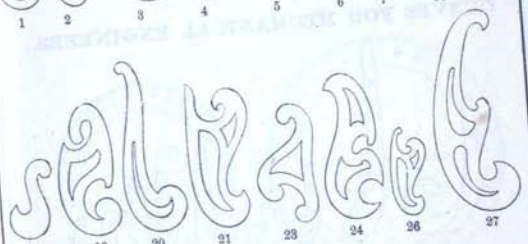
Draftsmen who have experienced the great annoyance of blurring a fresh ink-line in trying to shift or remove a triangle, will readily appreciate this important although simple improvement.



1858. Xylonite Lettering Templets, 3 in set . . . . . per set $ 2 00
1859. " " Triangles, 3 " . . . . . " 1 50

XYLONITE CURVES.

Illustrations about 1/7 size.



1860. Xylonite Curves

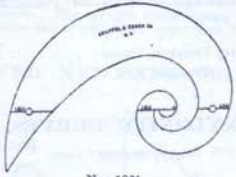
Nos.	1	2	3	4	5	6	7	13	14
each $	45	45	60	60	45	45	40	60	45

Nos.	16	19	20	21	23	24	26	27
each $	45	60	60	50	45	75	45	90

For Hard Rubber Curves see page 200.

LOGARITHMIC SPIRAL CURVE.

Illustration ¼ size.



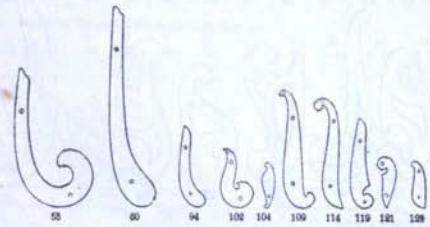
No. 1861.

1861. Logarithmic Spiral Curve of Xylonite, with Directions . . each $ 1 75

This curve is mathematically constructed and contains every curve within the limit of its size. If properly used according to the directions accompanying each, the most difficult calculations can be made with it.

Directions for Logarithmic Spiral Curve . . . . . each $ 20

CURVES FOR MECHANICAL ENGINEERS.

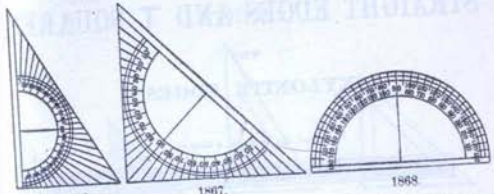


No. 1863.

1868. Xylonite Curves for Mechanical Engineers, set of 10, in polished wooden box . . . . . $ 4 80

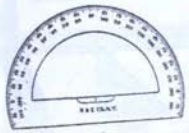
For Hard Rubber Curves see pages 200—203.

XYLONITE PROTRACTORS.



No. 1866. 1867. 1868.

1866.	Xylonite Protractor Triangle, 30 × 60°,	5	in.,	div. to	1°	each $ 45
	" " " "	6	"	"	1	" 50
	" " " "	7	"	"	1	" 70
1867.	Xylonite Protractor Triangle, 45°,	5	"	"	1	" 50
	" " " "	6	"	"	1	" 70
	" " " "	7	"	"	1	" 90
1868.	Xylonite Semicircular Protractor, flat,	5	"	"	½	" 45
	" " " "	6	"	"	½	" 60
	" " " "	7	"	"	½	" 75
	" " " "	8	"	"	½	" 1 20
	" " " "	10	"	"	½	" 2 00



No. 1869.

No. 1872.

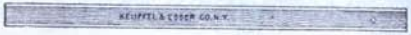
1869.	Semicircular	Xylonite	Protractor,	beveled edge,	6	in.,	½°	each $ 3 00
1870.	do.	do.	do.	" "	8	"	½°	" 3 75
1871.	Circular	do.	do.	" "	6	"	½°	" 3 75
1872.	do.	do.	do.	" "	8	"	½°	" 5 00
1873.	do.	do.	do.	" "	10	"	½°	" 6 00

For Hard Rubber Protractors see page 206.

STRAIGHT EDGES AND T SQUARES

WITH

XYLONITE EDGES.



No. 1886.

1886. Xylonite Lined Straight Edges, Maple, square edges,

	18	24	30	36	42	48 in.
each $	75	1 00	1 25	1 50	1 80	2 20

No. 1887.

No. 1888.

1887. Xylonite Lined T Squares, Maple blade, ebonized fixed head,

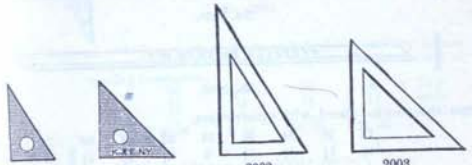
	18	24	30	36	42	48 in.
each $	1 10	1 50	1 85	2 15	2 50	3 00

1888. Xylonite Lined T Squares, Maple blade, ebonized shifting head, K. & E. Co. pattern, with 2 fine brass swivels. The 18 in. squares have one swivel.

	18	24	30	36	42	48 in.
each $	1 90	2 45	2 80	3 20	3 60	4 20

METAL TRIANGLES.

STEEL.



No. 2000. 2001. 2002. 2003.

2000. Steel Triangles, nickel plated, solid, 30 × 60 degrees,

	2½	3	4 in.
each $	65	75	80

2001. Steel Triangles, nickel plated, solid, 45 degrees.

	2	2½ in.
each $	65	75

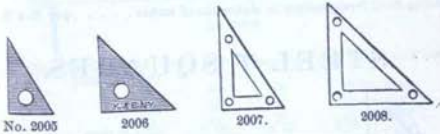
2002. Steel Triangles, nickel plated, open centre, 30 × 60 degrees,

	6	7	8	10½	15 in.
each $	3 20	3 50	3 85	4 25	6 50

2003. Steel Triangles, nickel plated, open centre, 45 degrees.

	5	6½	8	10	12 in.
each $	3 20	3 50	4 25	5 50	6 50

GERMAN SILVER.



No. 2005 2006 2007. 2008.

2005. German Silver Triangles, solid, 30 × 60 degrees,

	2	3	3½ in.
each $	60	70	80

2006. German Silver Triangles, solid, 45 degrees,

	2	2½ in.
each $	60	70

2007. German Silver Triangles, open centre, 30 × 60 degrees,

	5½	7	8	10	12	14 in.
each $	2 50	2 75	3 00	4 00	5 00	6 50

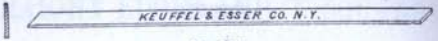
2008. German Silver Triangles, open centre, 45 degrees,

	5	6	8	10	12 in.
each $	2 50	2 75	4 00	5 00	6 50

No. 2007 and 2008 have thin ivory buttons near the corners, to prevent soiling of the drawing. These buttons are flat so that they leave no impression on the paper

KEUFFEL & ESSER CO. NEW YORK.

STEEL STRAIGHT EDGES.



No. 2020.

No. 2030.

2020. Steel, nickel plated, with square edges,

	15	18	24	30	36	42	48	60	72 in. long
	1½	1¼	1½	1¾	2	2¼	2½	2¾	3 " wide
	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16 " thick
each	$ 1 25	1 50	2 00	3 00	4 00	5 00	6 00	8 50	12 00

2022. Steel, Extra heavy, nickel plated, with square edges,

	36	42	48	60	72	84	96 in. long
	2	2¼	2½	2¾	3	3¼	3½ " wide
	1/8	1/8	1/8	1/8	1/8	1/8	1/8 " thick
each	$ 5 25	6 60	8 25	11 25	14 75	19 00	24 00

2030. Steel, nickel plated, one edge beveled,

	15	18	24	30	36	42	48	60	72 in. long
	1½	1¼	1½	1¾	2	2¼	2½	2¾	3 " wide
	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/8	1/8 " thick
each	$ 1 75	2 00	3 00	4 00	5 00	6 50	8 00	11 00	15 00

Dividing Steel Straightedges to sixteenths of inches . . . . . per foot $ 1 00

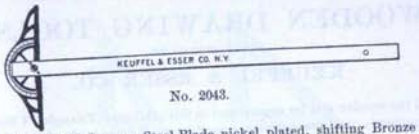
STEEL T SQUARES.

No. 2040.

2040. Protractor T Squares, Steel Blade nickel plated, with German Silver double Protractor Head, the outside one reading to 1 minute, the inside one to 5 minutes, both with vernier,

	24	30	36 in. long
	1¼	1½	1½ " wide
	1/16	1/16	1/16 " thick
each	$ 28 00	30 00	32 00

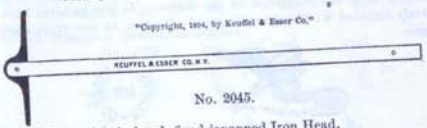
KEUFFEL & ESSER CO. NEW YORK.



No. 2043.

2043. Protractor T Square, Steel Blade nickel plated, shifting Bronze Head with Protractor divided to half degrees, Vernier on end of blade reading to minutes,

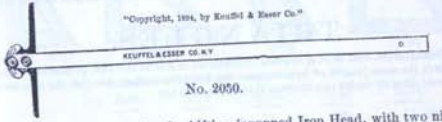
24	30	36	42	in. long
1¼	1½	1½	1½	" wide
1/16	1/16	1/16	1/16	" thick
each $ 8 50	9 50	10 50	11 50	



No. 2045.

2045. Steel Blade, nickel plated, fixed japanned Iron Head,

18	24	30	36	in. long
1¼	1¼	1½	1½	" wide
1/16	1/16	1/16	1/16	" thick
each $ 3 00	3 50	4 50	5 50	



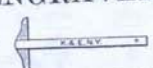
No. 2050.

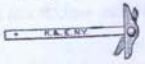
2050. Steel Blade, nickel plated, shifting japanned Iron Head, with two nickel plated swivels,

18	24	30	36 in. long
1¼	1¼	1½	1½ " wide
1/16	1/16	1/16	1/16 " thick
each $ 4 25	5 00	5 75	6 75

ENGRAVERS T SQUARES.

No. 2060.





No. 2065.

2060. Engravers T Square, Steel Blade, fixed brass head,

4	6	8	10	12	in.
each $ 1 00	1 25	1 50	2 00	2 50	

2065. Engravers T Square, Steel Blade, shifting brass head, with swivel,

4	6	8	10	12	in.
each $ 1 25	1 50	1 75	2 25	2 75	

WOODEN DRAWING TOOLS.

MANUFACTURED BY

KEUFFEL & ESSER CO.

All the wooden articles enumerated in this catalogue (Triangles, T Squares, Drawingboards etc.) are our own manufacture and are made of material seasoned in our own yards. We have specially designed machinery which insures correctness, and as the workmanship of our goods is perfect, we warrant them to remain correct.

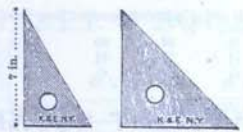
Any carpenter can make a board that looks like a Drawingboard, or put together pieces of wood to look like a square, but the only guaranty of quality and stability is in the reputation of the maker. As our patterns have been extensively imitated we beg to call special attention to our trade-mark and firm name

with which each article of our manufacture is stamped (except Drawingboards, which are branded with our firm name). The quality of goods so marked is warranted by us.

The "Pearwood" tools are of genuine pear-tree wood, and are so warranted by us.

TRIANGLES.

Triangles No. 2100. 30 × 60 degrees, correspond in size to No. 2105, 45 degrees, because they have the same length of hypotenuse. Such corresponding sizes of the two shapes are placed directly under one another throughout the list.



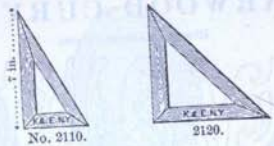
No. 2100. No. 2105.

Pearwood Triangles, solid, 30 × 60 degrees,

No.	2100	2101
	7	9 in.
each $	10	12

Pearwood Triangles, solid, 45 degrees,

No.	2105	2106
	5⅞	7⅞ in.
each $	10	12



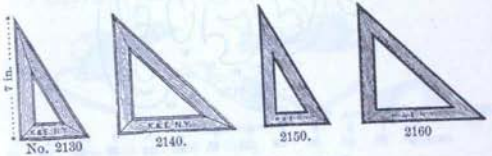
No. 2110. 2120.

Pearwood Triangles, framed, 30 × 60 degrees,

No.	2110	2111	2112	2113
	7	9	11	14 in.
each $	18	24	30	35

Pearwood Triangles, framed, 45 degrees,

No.	2120	2121	2122	2123
	5⅞	7⅞	9	11½ in.
each $	18	24	30	35



No. 2130 2140. 2150. 2160

Pearwood lined Triangles, 30 × 60 degrees,

No.	2130	2131	2132	2133	2134
	7	9	11	14	17 in.
each $	25	30	40	50	75

Pearwood lined Triangles, 45 degrees,

No.	2140	2141	2142	2143	2144
	5⅞	7⅞	9	11½	14 in.
each $	25	30	40	50	75

Mahogany Triangles, Ebony lined, 30 × 60 degrees,

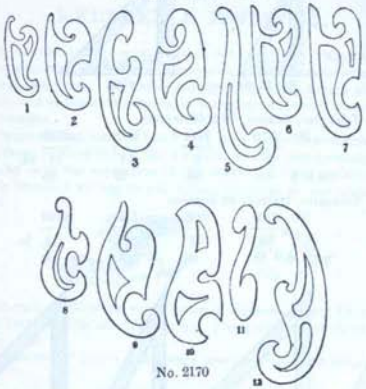
No.	2150	2151	2152	2153	2154	2155
	7	9	11	14	17	20 in.
each $	30	40	55	75	1 20	1 50

Mahogany Triangles, Ebony lined, 45 degrees,

No.	2160	2161	2162	2163	2164	2165
	5⅞	7⅞	9	11½	14	16½ in.
each $	30	40	55	75	1 20	1 50

PEARWOOD CURVES.

Illustrations about ¹/₄ size.



No. 2170

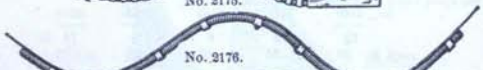
2170. Pearwood Curves, fine finish,

No.	1	2	3	4	5	6	7	8	9	10	11	12
each $	20	25	30	30	30	25	30	25	30	35	20	35

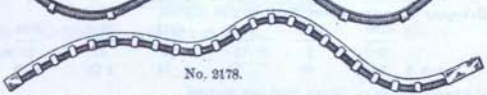
For Rubber Curves see page 200

PATENT ADJUSTABLE CURVE RULERS.

No. 2175.



No. 2176.



No. 2178.

These rulers consist of a ruling edge of rubber (Nos. 2175, 2177, 2178) or steel (No. 2176) in combination with a bar of soft lead. They will hold any curve into which they are bent.

2175. Adjustable Curve Ruler, 14½ in. long . . . . . each $ 1 87
2176. do. do. 30 " " . . . . . " 2 87
2177. do. do. cheaper construction, 12 in. long " 87
2178. do. do. " " 24 " " " 1 50

No. 2182. 2180. 2183.

2180. Pearwood Ellipses, 10 in set, from 1½ to 6 in. . . . . set $ 2 00
2181. do. 6 " " " 2 " 4½ " . . . . . " 1 25
2182. Pearwood Hyperbolas, 8 " " " 2 " 5½ " . . . . . " 1 50
2183. Pearwood Parabolas, 8 " " " 1½ " 5½ " . . . . . " 1 50
2184. do. 8 " " " 3¼ " 14½ " . . . . . " 3 00

SPLINES AND SPLINE WEIGHTS.

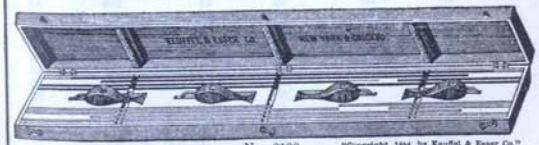
Section of 2185.

No. 2185 and 2186 or 2186½. 2187.

2185. Pearwood Splines, grooved,

	12	18	24	30	36	48	60 in.
each $	10	15	20	25	30	40	50

2186. Lead Weights for Splines, with finger, about 3¾ pounds . . each $ 85
2186-½. Lead " " " " " 8 " . . . " 1 25
2187. Iron " " " no " " 3¼ " . . . " 50



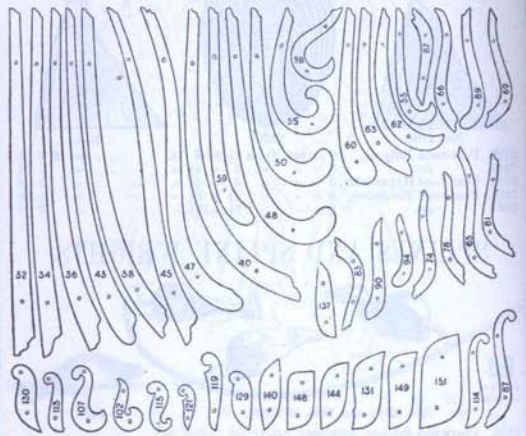
No. 2190.

2190. Set of Splines and Spline Weights, cont'g.:
4 Spline Weights, No. 2186,
1 each Hard Rubber Splines, No. 1835, 12, 18, 24, 30, 36, 42 in.
1 " Pearwood " " 2185, 12, 18, 24, 30, 36, 48 "
in strong wooden box . . . . . set $ 10 00

For Hard Rubber Splines see page 201

PEARWOOD SHIP CURVES.

Illustrations about ½ size.



No. 2195.

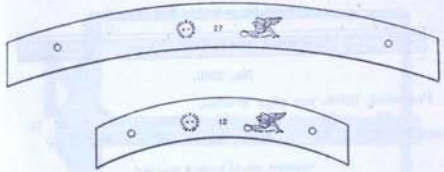
2195. Pearwood Copenhagen Ship Curves,

No. 32 each	$ 1 00	No. 63 each	$ 65	No. 107 each	$ 45
34	1 00	65	65	113	35
36	1 00	66	45	114	45
38	1 00	69	45	115	35
40	1 00	74	45	119	45
43	1 00	78	45	121	30
45	1 00	81	45	129	35
47	1 00	82	45	130	45
48	85	83	45	131	35
50	70	87	50	137	25
53	50	89	60	140	35
55	70	90	50	144	35
59	70	94	45	148	35
60	70	98	45	149	35
62	65	102	35	151	45

2196. Set of 45 Pearwood Copenhagen Ship Curves, cont'g one each curve as listed under No. 2195, in hardwood case . . . . . per set $ 25 70

For Hard Rubber Ship Curves, see page 203

PEARWOOD RAILROAD CURVES.



2200. Pearwood Railroad Curves, 10 in set, viz.: 12, 24, 36, 48, 60, 72, 84, 96, 108, 120 in. radius, in wooden box . . . . . set $ 3 50

2202. Pearwood Railroad Curves, 17 in set, viz.: 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60 in. radius, in wooden box . . . . . " 6 00

2204. Pearwood Railroad Curves, 44 in set, viz.: 3, 3½, 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 12, 14, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 42, 48, 54, 60, 66, 72, 78, 84, 90, 100, 110, 120, 130, 140, 160, 180, 200 in. radius, in wooden box . . " 12 00

Pearwood Railroad Curves of any desired radius cut to order . . . . . each $ 45

These curves are made of genuine pearwood, by special machinery, and are warranted to be correct. They are the same on both edges, so that either edge can be used.

CARD BOARD RAILROAD CURVES.

2210. Card Board Railroad Curves, 30 in set, viz.. 1½, 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 35, 40, 45, 50, 60 in. radius, in wooden box . set $ 5 25

2211. Card Board Railroad Curves, 50 in set, viz.: 1½, 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 10½, 11, 11½, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120 in. radius, in wooden box . . . . . " 8 50

2212. Card Board Railroad Curves, 100 in set, viz.: 1½, 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 6½, 7, 7½, 8, 8½, 9, 9½, 10, 10½, 11, 11½, 12, 12½, 13, 13½, 14, 14½, 15, 15½, 16, 16½, 17, 17½, 18, 18½, 19, 19½, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120, 130, 140, 150, 160, 180, 200, 220, 240 in. radius, in wooden box . . " 14 50

For Rubber Railroad Curves see page 204

KEUFFEL & ESSER CO. NEW YORK.

STRAIGHT EDGES.

"Copyright, 1894, by Keuffel & Esser Co."

No. 2250.

2250. Pearwood, thick, one edge beveled.

	12	15	18	24	30	36	42 in.
each $	12	15	20	25	30	40	50

"Copyright, 1894, by Keuffel & Esser Co."

No. 2260.

2260. Hardwood lined, thin, square edges,

	24	30	36	42	48	54	60	72	84	96	120 in.
each $	35	45	60	75	1 00	1 20	1 50	2 00	2 75	3 75	5 00

"Copyright 1894, by Keuffel & Esser Co."

No. 2270.

2270. Mahogany, Ebony lined, thin, square edges,

	24	30	36	42	48	54	60	72 in.
each $	50	60	80	1 00	1 35	1 60	2 00	2 75

For Steel Straight Edges see page 214

For Hard Rubber Straight Edges see page 207

BARS FOR BEAM COMPASSES.

No. 2280.

2280. Hardwood Bars for Beam Compasses Nos. 509, 510, 770, 771, 772, 1083 and 1083.

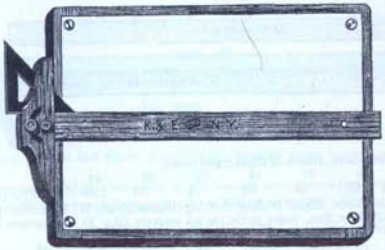
	24	30	36	42	48	60 in.
each $	25	30	35	40	50	65

2281. Hardwood Bars for Beam Compasses Nos. 512 and 515.

	24	30	36	42	48	60 in.
each $	20	25	30	35	40	50

KEUFFEL & ESSER CO. NEW YORK.

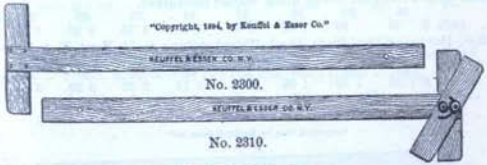
WOODEN T SQUARES.



K. & E. CO.'S PATTERN.

We beg to call attention to the K. & E. Co.'s pattern of double-head (shifting) T Squares. These T Squares have two swivels, of which the smaller serves as pivot on which the head shifts, while the larger, placed near the end of the blade for better leverage, and passing through an arched recess in the upper head, clamps the shifting head rigidly. The two heads of these T Squares are separated to the extent of the thickness of the blade, and the fixed head is made to lie flush with the drawing board so that a triangle can be applied up to the edge of the board by letting it project between the two heads of the T Square. A glance at the illustration will show the great superiority of these T Squares over all others.

"Copyright, 1894, by Keuffel & Esser Co."



No. 2300.

No. 2310.

2300. Pearwood Blade and Head, fixed Head,

	15	18	21	24	30	36	42	48 in.
each $	25	28	30	35	45	55	65	90

2310. Pearwood Blade and Head, shifting double Head, K. & E. Co. pattern, with two brass milled-head swivels (the 15 and 18 in. squares have one swivel).

	15	18	21	24	30	36	42	48 in.
each $	70	75	80	90	1 00	1 15	1 25	1 50

KEUFFEL & ESSER CO. NEW YORK.

No. 2330

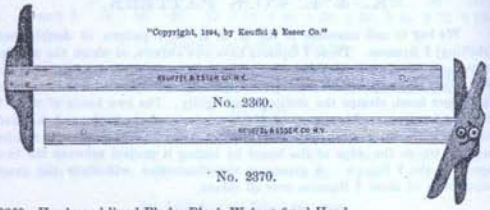
No. 2340.

2330. Maple Blade, Black Walnut fixed Head,

	18	21	24	30	36	42	48	54 in.
each $	45	50	60	75	90	1 05	1 20	1 40

2340. Maple Blade, Black Walnut shifting double Head, K. & E. Co. pattern, with two fine, brass milled-head swivels (the 18 in. square has one swivel),

	18	21	24	30	36	42	48	54 in.
each $	1 00	1 10	1 20	1 35	1 50	1 65	1 85	2 10



No. 2360.

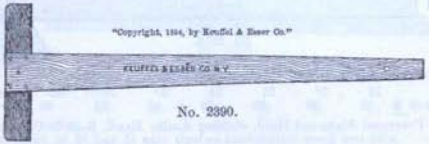
No. 2370.

2360. Hardwood lined Blade, Black Walnut fixed Head,

	24	30	36	42	48	54	60	72 in.
each $	75	90	1 05	1 25	1 50	1 75	2 25	3 00

2370. Hardwood lined Blade, Black Walnut shifting double Head, K. & E. Co. pattern, with two fine, brass milled-head swivels,

	24	30	36	42	48	54	60	72 in.
each $	1 35	1 50	1 65	1 85	2 15	2 50	3 00	4 00

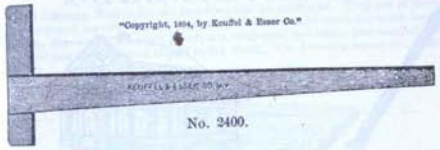


No. 2390.

2390. Hardwood Blade, tapered, Black Walnut fixed Head,

	24	30	36	42	48 in.
each $	65	80	1 00	1 20	1 50

KEUFFEL & ESSER CO. NEW YORK.

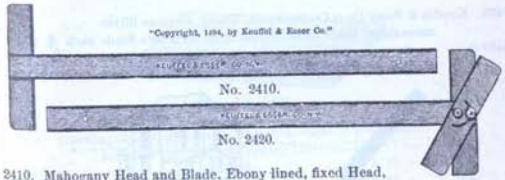


No. 2400.

2400. Mahogany Head and Blade, Ebony lined, beveled edge, fixed Head.

The blade is tapered and very wide at the base, to prevent spring at the further (free) end. The drawing edge is in line with the middle of the head.

	30	36	42	48	54 in.
each $	1 20	1 40	1 60	1 85	2 25



No. 2410.

No. 2420.

2410. Mahogany Head and Blade, Ebony lined, fixed Head,

	24	30	36	42	48	54 in.
each $	1 00	1 20	1 40	1 60	1 85	2 25

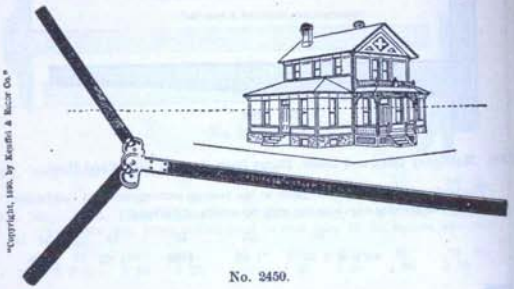
2420. Mahogany Head and Blade, Ebony lined, shifting double Head K. & E. Co. pattern, with two fine brass milled-head swivels,

	24	30	36	42	48	54 in.
each $	1 75	2 00	2 25	2 50	2 80	3 25

Hand-polished T Squares, or such of fancy combinations of different kinds of wood, made to order at reasonable prices.

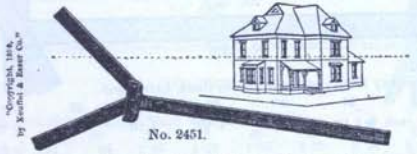
For Steel T Squares see page 214, 215
" Rubber do. " " 207.
" Xylonite do. " " 212.

CENTROLINEADS.



No. 2450.

2450. Keuffel & Esser Co.'s Centrolinead, Ebony, German Silver mountings, Blade 42 in., Arms 15 in. with two Studs each $ 11 00
2450-2. do. do. hardwood ebonized, brass mountings, Blade 42 in., Arms 15 in. with two Studs " 7 00



No. 2451.

2451. English Centrolinead, pearwood, brass swivels, with two Studs, Blade 24 in., Arms 10 in each $ 3 00
2452. do. do. do. do. " 30 " " 11 " " 3 50
2453. do. do. do. do. " 36 " " 12 " " 4 00

Centrolineads are used when the vanishing point of a perspective drawing is beyond the drawing board, and are employed as follows: Draw a horizontal line (line of sight) and a vertical line crossing it near its end toward the vanishing point. Place the two studs in this vertical line, equidistant from the horizontal, and about 8 to 16 inches from it, according to the size of the angle. The angle at which the two arms are to be set, is determined as follows: Multiply the distance of either of the studs (from the horizontal line) by itself, divide the product by the distance of the vanishing point from the vertical line, and the quotient will be the distance from the vertical line toward the drawing, at which the centre of the head (the point at which the lines of the inner edges of the arms intersect the horizontal line), should be placed. For instance, if either stud be 8 inches from the horizontal line and the vanishing point 24 inches beyond it, then $8 \times 8 = 64 \div 24 = 2\frac{8}{3}$ i. e. the point of intersection should be placed $2\frac{8}{3}$ inches from the vertical line towards the drawing. To draw from the other side, transfer the outer arm to the socket at the other end of the blade-head and find the angle as before.

Directions furnished with above.

DRAWING BOARDS.

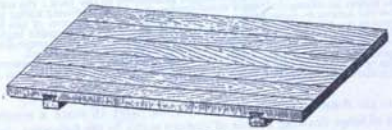
These Drawing Boards are the best that can be produced. They are of thoroughly seasoned, selected, narrow strips of pinewood. Boards can be made for much less money, if other than thoroughly seasoned woods are employed, the strips less carefully selected and matched and less attention is paid to the finish. The following boards are of the very best quality.

No. 2500.

2500. Drawing Board, pinewood, with side ledges of pinewood, clamped, 12 × 17 in. . . . each $ 65
2501. do. do. 16 × 21 " . . . " 90
2502. do. do. 20 × 26 " . . . " 1 20

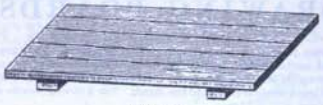
No. 2505.

2505. Drawing Board, pinewood, with thin ledges of pinewood, both sides presenting drawing surfaces, 12 × 17 in. each $ 65
2506. do do. 16 × 21 " " 90
2507. do do. 20 × 26 " " 1 20



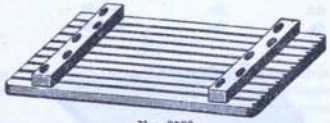
No. 2512.

2512. Drawing Board, pinewood, dovetailed hardwood ledges to allow contraction or expansion, 23 × 31 in. each $ 3 00
2513 do. do 27 × 34 " " 3 75
2514. do. do. 31 × 42 " " 4 50
2515. do. do. 33 × 55 " " 8 00



No. 2520.

2520.	Drawing Board, pinewood, hardwood ledges attached by screws sunk in slots bushed with metal, to allow contraction or expansion, as described under No. 2530		16 × 21 in.	each	$ 1 50
2521.	do.	do.	20 × 26 "	"	2 20
2522.	do.	do.	23 × 31 "	"	3 25
2523.	do.	do.	31 × 42 "	"	5 50
2524.	do.	do.	33 × 55 "	"	8 50



No. 2530.

2530.	Drawing Board, pinewood, hardwood ledges,		16 × 21 in.	each	$ 2 50
2531.	do.	"	20 × 26 "	"	3 20
2532.	do.	"	23 × 31 "	"	4 00
2533.	do.	"	31 × 42 "	"	6 50
2534.	do.	"	33 × 55 "	"	10 00

The Drawing Board illustrated above is the best and deserves recommendation, as it is the only one which possesses all the qualities a good and true board should have. It is made of pinewood, glued up to the required width, with the heart-side of each piece of wood to the surface. A pair of hardwood ledges is screwed to the back; the screws pass through the ledges in oblong slots with metal bushings, which fit closely under the heads and yet allow the screws to move freely when drawn by the contraction of the board. A series of grooves is sunk in half the thickness of the board over the entire back. These grooves take the transverse strength out of the wood to allow it to be controlled by the ledges, leaving at the same time its longitudinal strength nearly unimpaired.

To make the working edge perfectly smooth, allowing an easy movement of the square, a slip of ebony is let into the end of the board. The slip is sawed apart at about every inch to allow for contraction of the board.

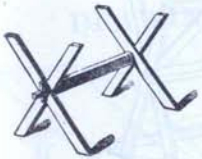
Besides the drawing boards listed here, we carry in stock a considerable assortment of large drawing boards of various styles in the following sizes:

30 × 60 in.	48 × 72 in.	54 × 96 in.
42 × 60 "	48 × 84 "	54 × 120 "
42 × 72 "	48 × 96 "	60 × 96 "
42 × 84 "	48 × 108 "	60 × 120 "
42 × 96 "	48 × 120 "	

We shall be pleased to answer enquiries relating to large drawing boards.

For Trestles and Horses for Boards see next page.

TRESTLES FOR DRAWING BOARDS.



No. 2550.

2551.

2550.	Pinewood Trestles, 37 in. high, 38 in. long, 30½ in. spread, each			$ 5 50
2551.	Pinewood Horses, 37 " " 35 " " with removable sloping Ledges		per pair	5 50
2551-1.	do.	do.	plain, 37 in. high, 35 in. long " "	3 00
2551-2.	do.	do.	like No. 2551-1 fine quality " "	5 00

No. 2551-3.

2551-3. Adjustable Pinewood Horses, best workmanship, adjustable for height from 37 to 47 in. on level or slope . . . . . per pair $ 7 00

FOLDING TRESTLES.

No. 2552.

2552. Folding Hardwood Trestle, 37 in. high, 33 in. long, 26½ in. wide . . . . . each $ 7 00

No. 2553.

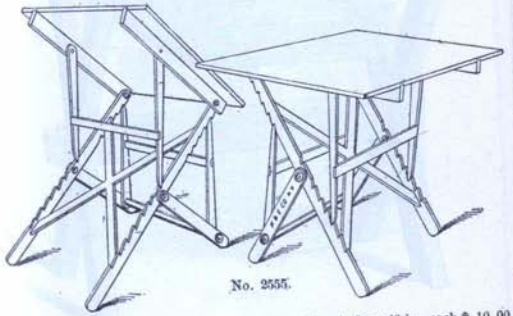
2553. Folding Hardwood Trestle with Drawing Board, 37 in. high. The Drawing Board is made of selected pinewood and hinged to the Trestle, on which it can be slanted by means of supports catching in toothplates. Board and Trestle fold up compactly Board 31 × 42 in. . . . . each $ 11 00

2554. Folding Hardwood Trestle, do. do. Board 33 × 55 in. " 14 00

UNIQUE FOLDING TRESTLE

AND

DRAWING BOARD.



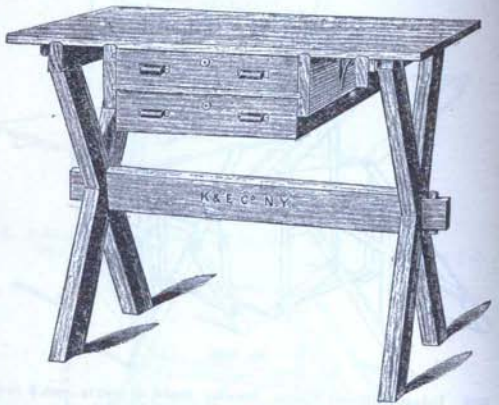
No. 2555.

2555.	Unique Hardwood Trestle, Drawing Board,	31 × 42 in., each	$ 10 00
2556.	" " " " "	33 × 55 " "	13 00
2557.	" Pinewood Trestle, Plain Drawing Board	23 × 31 " "	7 00
2558.	" " " " " "	31 × 42 " "	8 00
2559.	" " " " " "	33 × 55 " "	10 50

The Unique Folding Trestles combine simplicity of construction with great range of adjustability and firmness in any position. The range of adjustment is from 31 to 41 inches for height and from horizontal to 45 degrees for slant of board. When folded, these trestles occupy but a few inches in thickness. The drawing boards on these trestles are regular made and of good quality.

We recommend the Unique Folding Trestles also for use in Colleges and Schools &c.

STEVENS DRAWING STAND.



No. 2559-1.

2559-1.	Stevens Drawing Stand, board 28 x 48 in.		each	$ 12 50
2559-2.	do.	do.	with 1 drawer, with lock .	" 15 50
2559-3.	do.	do.	" 2 drawers. " "	" 18 00

The Stevens Drawing Stand is substantially constructed of selected pinewood and the top is a first-class drawing board 28x48 inches, made like No. 2553. The trestle is 37 inches high. This is a very rigid and durable table, intended also for use in technological institutions.

MAGAZINE DRAWING TABLE.

No 2559-5.

2559-5. **Magazine Drawing Table,** polished hardwood, 35 x 48 in., 34 in. high, sides paneled, 7 drawers 31 x 42 in., 2½ in. deep, japanned metal handles. The top is a fine drawing board of selected pinewood and is hinged to a sliding frame, on which it can be slanted by means of supports catching in tooth plates. This supporting frame slides out beyond the front edge of the table (as shown in cut) where it is held by a catch engaging automatically in a rack. The spaces on the top of the table under the drawing board can be used for tools.

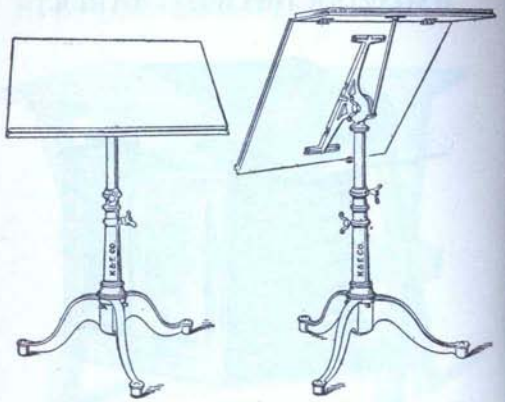
each $45 00

CHESTS OF DRAWERS

for storing drawings, tracings and papers, made to order. When asking for estimates please give all particulars, such as dimensions of chest, number and depth of drawers, kind and finish of wood, whether drawers are to be on rollers, with lock, &c., &c.

KEUFFEL & ESSER CO. NEW YORK.

COLLEGE DRAWING TABLES.



No. 2560. No. 2561, but with Top-Shelf.

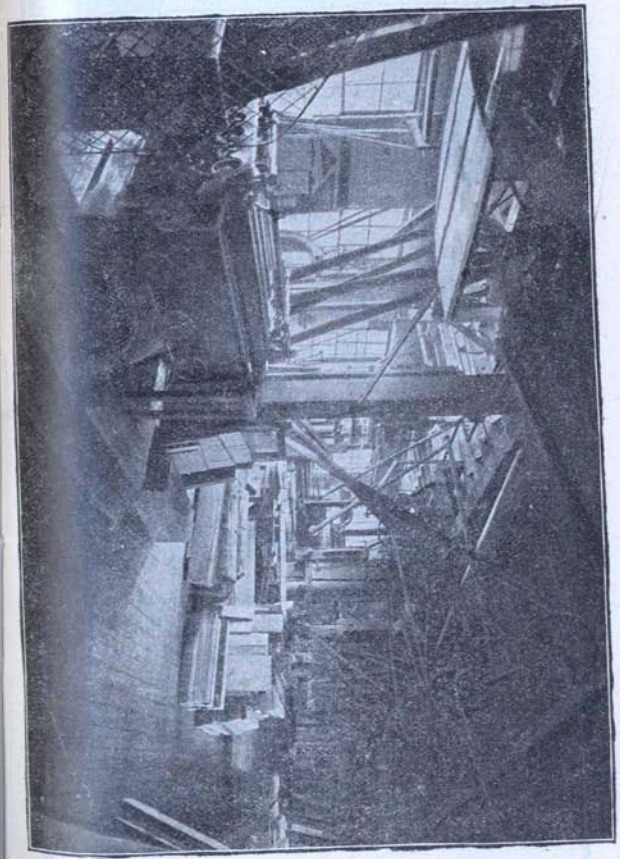
Our College Drawing Tables possess all the features of an efficient and satisfactory.

DRAWING STAND FOR THE CLASS ROOM.

The top is of ashwood, highly finished, and can be clamped horizontal or at any angle by a conveniently placed clamp, which locks it absolutely and rigidly. We can supply the tables also with a plain pinewood drawing board instead of the ashwood top.

The top-shelf or ledge (see No. 2561) for drawing instruments, inks, etc., remains horizontal at any inclination of the table top. The top is attached to a strong spindle, on which it can be rotated in the hollow standard after releasing its clamping screw. There is a sliding collar with a clamp screw on the spindle, by clamping which the height of the table is regulated. The table stands 30 inches high and can be raised to 42 inches, and the top can be placed at any inclination or at any height within this range.

2560.	College Drawing Table, ash top, 22 x 24 inches	each	$ 8 00
2561.	" " " " " 22 x 26 "	"	9 00
	Top-shelf for No. 2561, 6½ in. wide, remains horizontal at any inclination of the table top . . . . . extra, each	$	1 00
	Top-shelf as above, but with two drawers " "		2 00



HEAVY WOOD WORKING MACHINERY, FACTORY.

FAVORITE DRAWING TABLES.

PATENTED MARCH 27, 1883.

AWARDED

THE ONLY MEDAL

AT THE NATIONAL EXPOSITION OF RAILWAY APPLIANCES, CHICAGO 1883.

Our Favorite Drawing Tables are in use in a great many offices and draughting rooms and in colleges and schools of the very highest standing, and they give such perfect satisfaction that we confidently recommend them as the best of all, in material, workmanship and practical construction. They are **more rigid** and durable than any other and have patented improvements which are not found on any other tables. By their elegant appearance they are also an ornament to any office, studio or library.

The adjusting and clamping of the top to any desired slant is done by shifting a lever conveniently placed under the front of the table top, which locks the clamp absolutely.

The Bracket-Arm, holding the Shelf and Drawer, can be readily moved to any desired point on either side of the table, and raises or lowers with the table top.

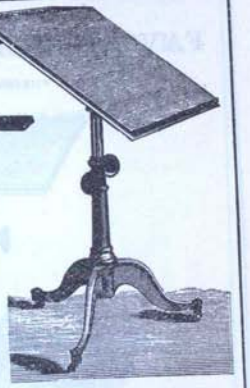
The Iron Foot-Rest, which is detachable, is an improvement of great value, and very ornamental. It admits of a comfortable position while working.

The tables are provided with casters on two of the legs: the third leg has an iron foot to prevent the table from rolling, except when the iron foot is lifted off the floor

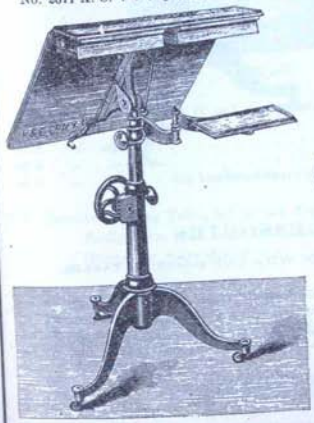
No extra charge for packing these tables for shipment.

KEUFFEL & ESSER CO. NEW YORK.

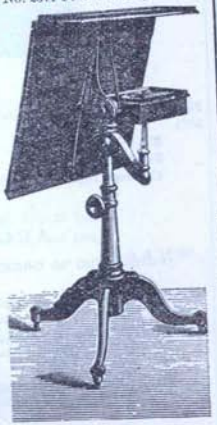
No. 2571 A. C. . . . $ 12 50.



No. 2571 F. . . . $ 12 50.



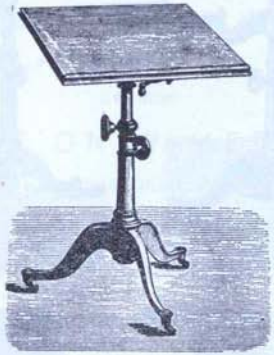
No. 2576 A. F. . . . $ 17 00.



No. 2571 B. C. E. . $ 15 50

FAVORITE DRAWING TABLES.

PATENTED MARCH 27th, 1883.



No. 2570.

2570.	Favorite Drawing Table, ash or oak Top, 21 × 24 in. . . .	each	$ 9 00
2571.	do. do. " " " " 22 × 26 " . . .	"	9 50
	Black Walnut Top	extra "	1 00
	Polished Mahogany Top	" "	2 00
	Ebonized Top, Stand finely ornamented and gilt . .	" "	5 00

ACCESSORIES

FURNISHED TO ORDER WITH OUR DRAWING TABLES.

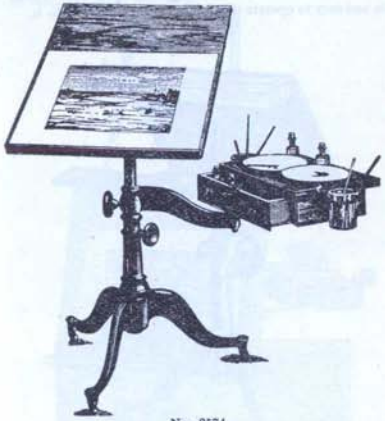
A.	Folding-Arm, with plain Shelf	each	$ 1 50
B.	do. " Shelf and Drawer	"	2 50
C.	Detachable Iron Foot-Rest, japanned	"	1 50
E.	Top-Shelf, (without Drawers), for Tables No. 2571 & 2576	"	2 00
F.	do. with two " " " " 2571 & 2576	"	3 00
G.	Folding-Arm, with large Shelf, Drawer etc. as described with table No. 2574, on opposite page	"	4 00

These Tables are packed for shipment without extra charge.

FAVORITE DRAWING TABLE.

PATENTED MARCH 27th, 1883.

SPECIALLY ADAPTED FOR WATER-COLOR PAINTING.



No. 2574.

2574.	Favorite Drawing Table, ash or oak Top, 21 × 26 in., Folding-Arm with large Shelf, Drawer, and two Holders for water-glasses	each	$ 13 50
	Black Walnut Top	extra "	1 00
	Polished Mahogany Top	" "	2 00
	Ebonized Top, Stand finely ornamented and gilt . .	" "	5 00

For Accessories see page 238

These Tables are packed for shipment without extra charge.

FAVORITE DRAWING TABLES.

PATENTED MARCH 27th. 1883.

These Tables have a Wheel-lift for raising and lowering the table top. It consists of a rack and pinion movement which is operated by a large wheel and is so simple and easy to operate that a lady or child can handle it.

No. 2576. A. F. $ 17 00

2575.	Favorite Drawing Table, ash or oak Top, 21 × 24 in. . .	each	$ 12 00
2576.	do. do. " " " " 22 × 26 " . .	"	12 50
	Polished Mahogany Top	extra "	2 00
	Ebonized Top, Stand finely ornamented and gilt . .	" "	5 00

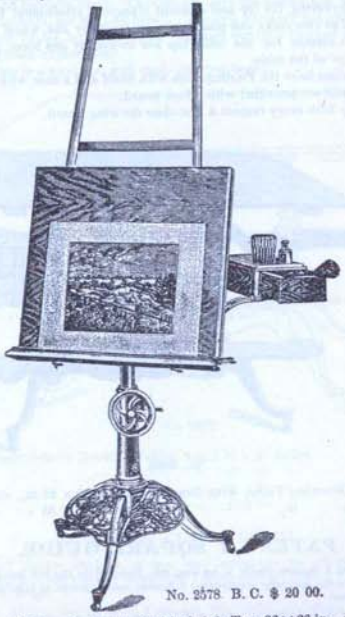
For Accessories see page 238.

These Tables are packed for shipment without extra charge.

FAVORITE DRAWING TABLES.

PATENTED MARCH 27th, 1883.

This Table has the Wheel-Lift for raising and lowering the table top, as described on opposite page. The Table can be converted into an Easel by setting the hinged lower edge of the table top at right angle, where it is held by catches. The rack for studies, shown in the cut, can be folded behind the table top, when not in use.



No. 2578. B. C. $ 20 00.

2578.	Favorite Drawing Table, Polished Ash Top, 26 × 26 in.	each	$ 16 00
	Ebonized Top, Stand finely ornamented and gilt,	extra "	5 00

These Tables are packed for shipment without extra charge.

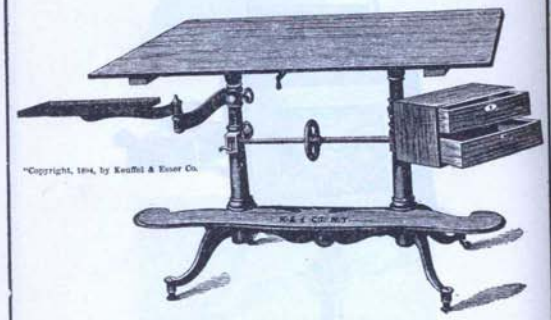
OFFICE
FAVORITE DRAWING TABLES.

PATENTED MARCH 27th, 1883.

These Tables are intended for office use, for which they will be found excellently well adapted. On each of the two columns is a rack and pinion for raising and lowering the top and a patent clamping attachment for adjusting the slant. The two racks and pinions are operated by one wheel (Wheel-Lift) and the two clamps for the table top are locked by one lever, placed under the front edge of the table.

The Tables have the Folding-Arm with Shelf and a case with two drawers with locks, and are provided with a foot board.

The top is in every respect a first-class drawing board.



No. 2583.

2582.	Office Drawing Table, with Drawing Board,				30 × 42 in.,	each	$ 35 00
2583.	do.	do.	"	"	" 33 × 55 "	"	38 00

PATENT T SQUARE GUIDE.

The Patent T Square Guide is an iron bar, fastened to the left hand side of the board, on which the specially constructed T Square moves freely, or is held at any point by a spring clamp.

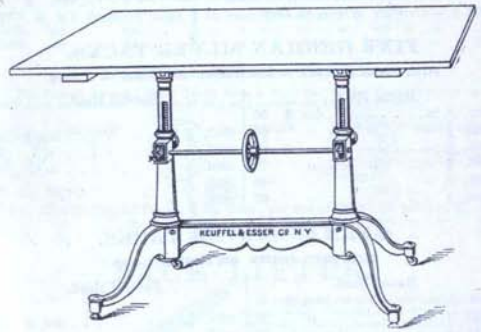
2585.	Patent T Square Guide, with T Square No. 2370, for Table No. 2582, ...	each	$ 9 00
2586	do.	do.	with T Square No. 2370, for Table No. 2583, ...	"	10 00

CONSTRUCTOR'S
FAVORITE DRAWING TABLES.

PATENTED MARCH 27, 1883.

The Constructor's Drawing Tables are very similar to the Office Tables described, on opposite page. They do not have the folding arm with shelf, the case with drawers, nor the foot-board. The iron parts are not ornamented, like on the Office Tables, but they are fine castings carefully finished and painted in one color (black or marroon).

The top is a good and well made drawing board.



No. 2587.

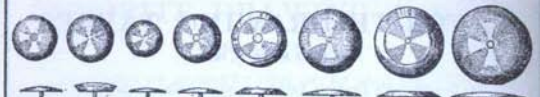
2587.	Constructor's Drawing Tables, board				31 × 42 inches	each	$ 22 50
2588.	"	"	"	"	33 × 55 "	"	27 50
2588-1.	"	"	"	"	36 × 60 "	"	30 00
2588-2.	"	"	"	"	42 × 72 "	"	35 00

T SQUARE GUIDE.

The T Square Guide is an iron bar, fastened at the left hand side of the board, on which the specially constructed T Square moves freely, or is held at any point by a spring clamp.

2589.	T Square Guide, with T Square, No. 2370, for Table No. 2587	each	$ 9 00
2589-1.	do.	do.	with T Square, No. 2370, for Table No. 2588	"	10 00

DRAWING PINS OR THUMB TACKS.



2600. 2601. 2621. 2642. 2653. 2624. 2635. 2626.

STEEL TACKS.

2600. Solid Steel Tacks, fine, $\frac{5}{16}$ in. diam. . . . . doz. $ 80
2601. do. $\frac{1}{4}$ in. diam. . . . . " 20

FINE GERMAN SILVER TACKS.

STEEL POINTS. SCREWED IN AND RIVETED. ONE DOZEN ON A CARD.

	Round Head.			Beveled Head.		
2621.	$\frac{5}{16}$ in.,	doz. $	50			
2622.	$\frac{3}{8}$ "	"	60	2632. $\frac{3}{8}$ in.,	doz. $	60
2623.	$\frac{7}{16}$ "	"	65	2633. $\frac{7}{16}$ "	"	65
2624.	$\frac{1}{2}$ "	"	70	2634. $\frac{1}{2}$ "	"	70
2625.	$\frac{9}{16}$ "	"	80	2635. $\frac{9}{16}$ "	"	80
2626.	$\frac{5}{8}$ "	"	90	2636. $\frac{5}{8}$ "	"	90

GERMAN SILVER TACKS.

STEEL POINTS, RIVETED. ONE DOZEN ON A CARD.

	Round Head.			Beveled Head.		
2641.	$\frac{5}{16}$ in.,	doz. $	25			
2642.	$\frac{3}{8}$ "	"	28	2652. $\frac{3}{8}$ in.,	doz. $	28
2643.	$\frac{7}{16}$ "	"	30	2653. $\frac{7}{16}$ "	"	30
2644.	$\frac{1}{2}$ "	"	35	2654. $\frac{1}{2}$ "	"	35
2645.	$\frac{9}{16}$ "	"	45	2655. $\frac{9}{16}$ "	"	45
2646.	$\frac{5}{8}$ "	"	55	2656. $\frac{5}{8}$ "	"	55

BRASS TACKS.

STEEL POINTS. RIVETED. NOT MOUNTED.

	Round Head.				Beveled Head.			
2660.	$\frac{1}{4}$ in.,	gross $	80	doz. $ 10				
2661.	$\frac{5}{16}$ "	"	95	" 12				
2662.	$\frac{3}{8}$ "	"	1 60	" 20	2672. $\frac{3}{8}$ in.,	gross $	1 60	doz. $ 20
2663.	$\frac{7}{16}$ "	"	2 20	" 25	2673. $\frac{7}{16}$ "	"	2 20	" 25
2664.	$\frac{1}{2}$ "	"	2 40	" 30	2674. $\frac{1}{2}$ "	"	2 40	" 30
2665.	$\frac{9}{16}$ "	"	3 00	" 35	2675. $\frac{9}{16}$ "	"	3 00	" 35
2666.	$\frac{5}{8}$ "	"	3 80	" 40	2676. $\frac{5}{8}$ "	"	3 80	" 40

K. & E. BRAND STAMPED STEEL TACKS.

The K. & E. Stamped Steel Tacks are made of one piece of tough, hard steel (specially made for this purpose) and are of the very best quality. They have **needle finished points**, so that they make an excellent substitute for the regular thumb tacks, when it is desired to have a lower priced article.

No. 2677. 2678. 2679.

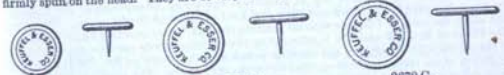
2677. K. & E. Stamped Tacks, $\frac{3}{8}$ in. diam., per box of 100 $ 55 per doz. $ 08
2678. do. do. $\frac{7}{16}$ " " " " " " 65 " " 10
2679. do. do. $\frac{1}{2}$ " " " " " " 80 " " 12

NICKELPLATED STEEL TACKS.

2677N. K. & E. Stamped Tacks, $\frac{3}{8}$ in. diam. per box of 100 $ 65 per doz. $ 10
2678N. do. do. $\frac{7}{16}$ " " " " " " 80 " " 12
2679N. do. do. $\frac{1}{2}$ " " " " " " 1 00 " " 15

CAPPED STEEL TACKS.

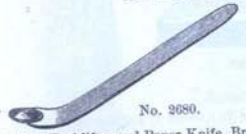
The Capped Stamped Steel Tacks have a thin but strong German Silver cap, firmly spun on the head. They are of very neat appearance and very durable.



No. 2677 C. 2678 C. 2679 C.

2677 C. K. & E. Capped Tacks, $\frac{3}{8}$ in. diam., per box of 100 $1 00 per doz. $ 15
2678 C. do. do. $\frac{7}{16}$ " " " " " " 1 20 " " 18
2679 C. do. do. $\frac{1}{2}$ " " " " " " 1 45 " " 22

TACK LIFTER.



No. 2680.

A handy and simple instrument to extract thumb tacks. The end of the lifter is placed under the head of the tack and takes it out without bending the point or wrenching off the head, as is done by using a knife.

The handle of this instrument is a Paper-Knife, useful for removing drawings which have been glued to the board, etc. (See also No. 388, page 281.)

2680. Tacklifter and Paper Knife. Brass, Nickel plated, $5\frac{1}{2}$ in. each $ 20

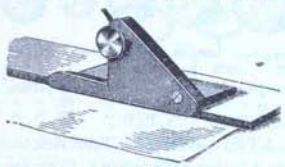
HORNCENTRES.

No. 2690. No. 2691.

2690. Horncentre, plain, $\frac{1}{2}$ in. diam. . . . . each $ 10
2691. do. with German Silver rim., $\frac{3}{4}$ in. diam. . . . . " 50

PAPER CUTTERS.

Illustrations ⅜ size.



No. 2700.

2703.

2700. Handy Paper Cutter, Brass . . . . . each $ 35
2701. do. do. Nickelplated . . . . . " 50
2703. Safety Paper Cutter, Brass . . . . . " 60

These little instruments are of important service to Draughtsmen, for cutting drawings from the board, also for cutting any kind of paper or bristol board. They are slid along the ruler or T Square without injuring its edge, as an ordinary knife would do. The cutter of Nos. 2700 and 2701 is adjusted by the thumb screw to cut only the thickness of the paper, without striking the drawing board, and the cutter of No. 2703 is adjusted by means of the thumbscrew projecting above the instrument. The knife can be removed from either kind, for sharpening.

PAPER WEIGHTS.

No. 2710.

2710. Lead Paper Weight, covered with leather,
4 × 2¼ × 1⅛ in., about 2½ pounds, each $ 80
2711. do. do. 4¼ × 2½ × 1 " " 3¾ " " 1 00

No. 2715.

2716.

2715. Iron Paper Weight, round, with knob, small . . . . . each $ 50
2716. do. do. square, " " large . . . . . " 75

ARKANSAS OIL STONES.

No. 2720.

2720. Arkansas Oil Stone, in case with cover, 3 in. . . . . each $ 75
2721. " do. " " " " 5 " . . . . . " 2 00
2725. " do. mounted on wood with handle, 3 in. . " . 60
2726. " do. " " " " 4 " . . " 1 00
2727. " do. " " " " 5 " . . " 1 50
2730. " do. Slips . . . . . each from $ 25 to $ 1 50

TECHNICAL (CONVENTIONAL)

LIQUID WATER COLORS.

These colors are intended for every description of coloring on professional (technical) drawings. The tints employed to indicate each material are those universally adopted, and the same as our Moist Technical Colors No. 2900. They have been selected more with a view to sharp differentiation than to the representation of the actual colors of the materials. They are always ready for use, without grinding or mixing or dissolving and therefore insure uniform results and correct duplicating of tints. Washes can be laid on with them with less trouble and greater certainty of a perfect result than with dry or moist colors. As they are used directly from the bottle and there is no mixing and no waste, they are also the most economical colors to use.

No. 2880.

1. Cast Iron,
2. Wrought Iron,
3. Steel,
4. Copper,
5. Brass,
6. Machinery,
7. Leather,
8. Light Wood,
9. Dark Wood,
10. Brick,
11. Stone,
12. Brown Stone,
13. Prussian Blue,
14. Gamboge,
15. Yellow Ochre,
16. Vermillion,
17. Burnt Sienna,
18. Carmine.

2880. Liquid Technical Colors . . . . . per Bottle $ 25
2881. Set of 6 Technical Colors, Nos. 13 to 18, in box, . . . per set $ 1 50
2882. " " 12 " " " 1 " 12, " " . . . " " 3 00
2883. " " 18 " " " 1 " 18, " " . . . " " 4 50

TECHNICAL (CONVENTIONAL)

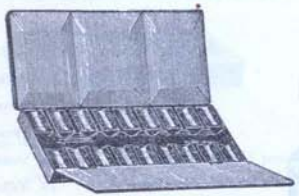
WATER COLORS.

The Technical Colors introduced by us many years ago, offer to the profession an always ready material for tinting drawings. The tints being ready mixed, these moist colors save the work and time of mixing and warrant uniformity at all times.

Half Pan.

No. 2900. Full Pan.

2900.	1. Cast Iron	7. Leather	13. Prussian Blue					
	2. Wrought Iron	8. Light Wood	14. Gamboge					
	3. Steel	9. Dark Wood	15. Yellow Ochre					
	4. Copper	10. Brick	16. Vermilion					
	5. Brass	11. Stone	17. Chinese White			Full Pans.		Half Pans.
	6. Machinery	12. Brown Stone	. . . . .	each	$	18	$	10
2901.	18. Carmine	. . . . .		"		50		25



No. 2913.

2910.	Japanned Tin Box, cont'g.:	12 half Pans Nos. 1 to 12 of above,	each	$	2	00
2911.	do.	do.	"	18	"	"	"	1 " 18	"	"	"	3	00
2912.	do.	do.	"	12 full	"	"	1 " 12	"	"	"	3	35
2913.	do.	do.	"	18	"	"	1 " 18	"	"	"	5	00

Each box contains also 1 each brushes No. 3132—2—6.

For empty Tin Boxes, see page 261

WINSOR & NEWTON'S

WATER COLORS.

Full Cake.

Full Pan

Half Cake.

Half Pan.

									Cake or Pan. Full		Half
2920.	1. Antwerp Blue	16. Emerald Green	30. New Blue								
	2. Bistre	17. Flake White	31. Olive Green								
	3. Blue Black	18. Gamboge	32. Orange Chrome								
	*4. British Ink	19. Hooker's Green, No. 1	33. Payne's Grey								
	5. Brown Ochre	20. Hooker's Green, No. 2	101. Permanent Blue								
	6. Brown Pink		34. Prussian Blue								
	*7. Bronze		35. Prussian Green								
	8. Burnt Sienna	21. Indigo	36. Raw Sienna								
	9. Burnt Umber	22. Indian Red	37. Raw Umber								
	*94. Charcoal Grey	23. Italian Pink	40. Roman Ochre								
	10. Chinese White	24. Ivory Black	41. Sap Green								
	95. Chrome Lemon	25. King's Yellow	42. Terre Verte								
	11. Chrome Yellow	26. Lamp Black	43. Vandyke Brown								
	12. Cologne Earth	27. Light Red	44. Venetian Red								
	*13. Constant White	†100. Mauve	45. Vermilion						$	25	$ 15
	14. Deep Chrome	28. Naples Yellow	47. Yellow Lake								
	15. Dragon's Blood	29. Neutral Tint	48. Yellow Ochre								
2921.	96. Alizarin Crimson	89. Cerulean Blue	56. Purple Lake								
	102. Alizarin Green	52. Crimson Lake	57. Roman Sepia								
	103. Alizarin Orange	53. Indian Yellow	58. Ruben's Madder								
	104. Alizarin Scarlet	106. Leitch's Blue	59. Scarlet Lake								
	105. Alizarin Yellow	54. Mars Yellow	60. Scarlet Vermilion								
	*49. Black Lead	55. Neutral Orange	61. Sepia								
	50. Brown Madder	64. Orange Vermilion	62. Warm Sepia							45	25
	51. Carmine Lake										
2922.	69. Cadmium Orange	87. Mars Orange	99. Permanent Violet								
	68. Cadmium Yellow	†107. Emerald Oxide of Chrome	77. Pale Cadmium Yellow								
	63. Cobalt Blue										
	97. Cobalt Green	73. Oxide of Chromium	79. Pure Scarlet								
	71. French Blue		†109. Ultramarine Ash-Gray								
	74. Indian Purple	†108 do Transparent									
	75. Intense Blue	98. Permanent Mauve	65. Violet Carmine								
	76. Lemon Yellow		81. Viridian							65	35
2923.	66. Aureolin	110. Gallstone	112. Rose Doree								
	91. Aurora Yellow	86. Madder Carmine	90. Scarlet Madder								
	67. Burnt Carmine	111. Madder Lake, Deep	80. Rose Madder								
	70. Carmine	78. Pink Madder	113. Rose Madder Pink Shade								
	85. Field's Orange Vermilion	92. Primrose Aureolin	100. Yellow Carmine							90	45
		82. Purple Madder									
2924.	88. Smalt	84. Ultramarine Ash Blue.							1	40	70
2925.	83. Genuine Ultramarine	. . . . .							½ Cake each		$ 2 25

Colors marked * are made ONLY in CAKES, and those marked † ONLY in PANS.

WINSOR & NEWTON'S

WATER COLOR BOXES.

No. 2930.

No. 2934.

2949.

FULL CAKE BOXES FITTED.

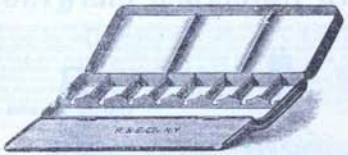
2930.	12 Cakes, Polished Mahogany Slide Lid Box	each	$ 5 00
2931.	18 " " " " " " "	"	7 50
2932.	12 " " " Lock Box	"	6 00
2933.	18 " " " " " "	"	9 00
2934.	12 " " " Lock and Drawer Box	"	7 25
2935.	18 " " " " " "	"	10 00
2936.	12 " " " Complete Box fitted	"	9 00
2937.	18 " " " " " "	"	13 50
2938.	24 " " " " " "	"	18 00

HALF CAKE BOXES FITTED.

2940.	12 Half Cakes, Polished Mahogany Slide Lid Box	each	$ 2 75
2941.	18 " " " " " "	"	4 00
2942.	12 " " " " Lock Box	"	4 00
2943.	18 " " " " " "	"	5 25
2944.	12 " " " " Lock and Drawer Box	"	5 25
2945.	18 " " " " " "	"	6 50
2946.	12 " " " " Complete Box fitted	"	6 00
2947.	18 " " " " " "	"	7 75
2948.	12 " " " " Caddy Lid Box complete fitted	"	8 50
2949.	18 " " " " " "	"	10 75

EMPTY JAPANNED TIN BOXES

for Moist Colors in Pans.



No. 2951.

2950.	For 6 full or 12 half Pans	each	$ 80
2951.	" 8 " " 16 " "	"	90
2952.	" 9 " " 18 " "	"	1 00
2953.	" 10 " " 20 " "	"	1 05
2954.	" 12 " " 24 " "	"	1 15
2955.	" 16 " " 32 " "	"	1 30
2956.	" 18 " " 36 " "	"	1 40
2957.	" 20 " " 40 " "	"	1 45
2958.	" 24 " " 48 " "	"	1 60

These boxes can be fitted with the colors listed on page 248 and 249. Brushes are listed on pages 264 and following.

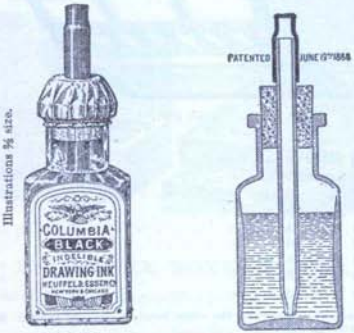
WATER COLOR LIQUIDS.

2960.	Winsor and Newton's Chinese White	each	$ 30
2961.	" " " Indian Ink	"	30
2962.	" " " Oxgall	"	30
2963.	" " " Gold Ink	"	30
2964.	" " " Carmine	"	30
2965.	" " " Indelible Brown Ink	"	30
2966.	" " " Prout's Brown	"	30
2967.	" " " Sepia	"	30
2968.	" " " Blue	"	60

KEUFFEL & ESSER CO. NEW YORK.

COLUMBIA

LIQUID INDELIBLE DRAWING INK.



No. 3000.

The Columbia Drawing Inks are of most superior quality and warranted to give perfect satisfaction. They are all homogeneous liquids, flow freely and cover well and can be used with pen or brush with uniform, perfect results. The lines drawn with these inks are indelible (water proof, washable), in that they will not blur nor be defaced by frequently applied brush tints, nor by exposure to moisture in outdoor use. We recommend the black Columbia Ink for all work of the draughtsman or designer.

3000.	Columbia Indelible Drawing Ink, Black	each $	25
3001.	" " " " Brown	"	25
3002.	" " " " Blue	"	25
3003.	" " " " Green	"	25
3004.	" " " " Scarlet	"	25
3005.	" " " " Carmine	"	25
3006.	" " " " Yellow	"	25
3007.	" " " " Vermilion	"	25

KEUFFEL & ESSER CO. NEW YORK.

THE PATENT INK FILLER,

Patented June 19th, 1888.

consists of a glass tube with flattened capillary opening, which can be inserted between the blades of a drawing pen, and is provided with a rubber bulb to fill it by suction and to feed by pneumatic pressure. This device is so clearly that it does not require wiping the pen before drawing, and hence requires no pen-wiper, there is no soiling of the pen and fingers (and sometimes of the drawing), the glass filler cannot become soft and flabby, like other material does, and there is no waste of ink. With other devices for filling pens, there is more ink wasted than there is used; with our filler there is no waste, making it the most economical as well as the most practical and cleanly. It is furnished with the regular size only, viz.: Nos. 3000 to 3007.

No. 3010.

3010.	Set of above Columbia Inks (Nos. 3001 to 3006) 6 bottles in polished Mahogany Box, per set	$	2 25
3011.	do. do. do. but in plain Box	" "	1 50

COLUMBIA INDELIBLE DRAWING INK.

HALF SIZE.

No. 3000½.

3000½.	Half Size, Black	each $	15
3001½.	" " Brown	"	15
3002½.	" " Blue	"	15
3003½.	" " Green	"	15
3004½.	" " Scarlet	"	15
3005½.	" " Carmine	"	15
3006½.	" " Yellow	"	15
3007½.	" " Vermilion	"	15

The Half Size Columbia Indelible Ink is NOT provided with our Patent Ink Filler.

COLUMBIA

LIQUID INDELIBLE DRAWING INKS

IN LARGE BOTTLES.

QUARTER-PINTS.

Black,	3000 C, .	90
Brown,	3001 C, .	90
Blue,	3002 C, .	90
Green,	3003 C, .	90
Scarlet,	3004 C, .	90
Carmine,	3005 C, .	90
Yellow,	3006 C, .	90
Vermillion,	3007 C, .	90

PINTS.

Black,	3000 E, .	$3 00
Brown,	3001 E, .	3 00
Blue,	3002 E, .	3 00
Green,	3003 E, .	3 00
Scarlet,	3004 E, .	3 00
Carmine,	3005 E, .	3 00
Yellow,	3006 E, .	3 00
Vermilion,	3007 E, .	3 00

HALF-PINTS.

Black,	3000 D, .	$1 60
Brown,	3001 D, .	1 60
Blue,	3002 D, .	1 60
Green,	3003 D, .	1 60
Scarlet,	3004 D, .	1 60
Carmine,	3005 D, .	1 60
Yellow,	3006 D, .	1 60
Vermilion,	3007 D, .	1 60

QUARTS.

Black,	3000 F, .	$5 75
Brown,	3001 F, .	5 75
Blue,	3002 F, .	5 75
Green,	3003 F, .	5 75
Scarlet,	3004 F, .	5 75
Carmine,	3005 F, .	5 75
Yellow,	3006 F, .	5 75
Vermilion,	3007 F, .	5 75

No. 3020.

3021.

3020.	Waterproof Drawing Ink, Black,	Keuffel & Esser Co.'s	. . each	$ 20
3021.	Liquid Photo-drawing Ink,	do.	do. . . "	20

KALLOS LIQUID DRAWING INKS.

(Container Patented December 14th, 1897.

The Kallos Drawing Inks represent an entirely new departure, both in the mode of manufacture, which is based on recent chemical discoveries, and in the manner in which they are put up.

The Kallos Inks are made in black and seven colors, all of which are waterproof (washable) and work equally well on paper and on tracing cloth. Kallos Inks are put up in improved patented bottles (see cut) which permit of using the ink to the last drop. The improved shape of the bottle obviates the danger of upsetting it in with-

drawing or inserting the filler, as the neck is oblique and in the line of the motion of the hand. The new, very practical filler, which is set into the stopper, is shaped like a barrel pen, will hold sufficient ink and transfer it to the pen without waste or soiling and, being of metal, will not become soft and flabby like a quill filler.

The Black Kallos Ink is guaranteed to be a pure carbon ink, equal to the best India ink in tone, depth of color and photographic properties. Even the finest lines absolutely intercept all light, and produce perfect copies by photo-processes.

3012.	Kallos Indelible Drawing Ink, Black		each	$ 25
3013.	" " " " Blue		"	25
3014.	" " " " Brown		"	25
3015.	" " " " Carmine		"	25
3016.	" " " " Green		"	25
3017.	" " " " Scarlet		"	25
3018.	" " " " Vermillion		"	25
3019.	" " " " Yellow		"	25

Kallos Liquid Indelible Drawing Inks

IN BOTTLES WITH GLASS STOPPER.

QUARTER-PINTS.

Black,	3012 C,	$ 90
Brown,	3013 C,	90
Blue,	3014 C,	90
Green,	3015 C,	90
Scarlet,	3016 C,	90
Carmine,	3017 C,	90
Yellow,	3018 C,	90
Vermilion,	3019 C,	90

HALF-PINTS.

Black,	3012 D,	$1 60
Brown,	3013 D,	1 60
Blue,	3014 D,	1 60
Green,	3015 D,	1 60
Scarlet,	3016 D,	1 60
Carmine,	3017 D,	1 60
Yellow,	3018 D,	1 60
Vermilion,	3019 D,	1 60

PINTS.

Black,	3012 E,	$3 00
Brown,	3013 E,	3 00
Blue,	3014 E,	3 00
Green,	3015 E,	3 00
Scarlet,	3016 E,	3 00
Carmine,	3017 E,	3 00
Yellow,	3018 E,	3 00
Vermilion,	3019 E,	3 00

QUARTS.

Black,	3012 F,	$5 75
Brown,	3013 F,	5 75
Blue,	3014 F,	5 75
Green,	3015 F,	5 75
Scarlet,	3016 F,	5 75
Carmine,	3017 F,	5 75
Yellow,	3018 F,	5 75
Vermilion,	3019 F,	5 75

KALLOS INKS IN SETS.

No. 3028.

3028. Set of any six colors of Kallos Inks, in circular tray of polished hardwood . . . . . each $ 2 00

CHINESE OR INDIAN INK.

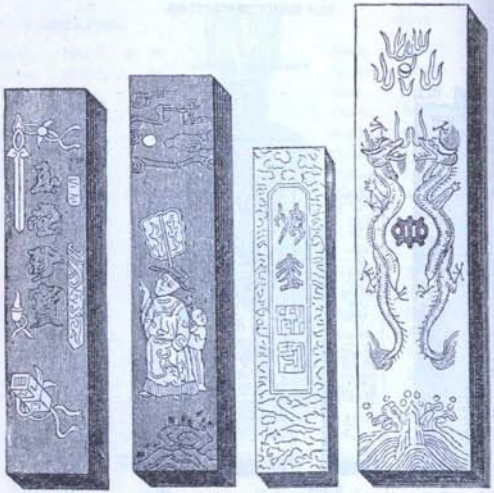
OUR DIRECT IMPORTATION.

Illustrations full size.

B. D. E. G. H.

3030.	A.	Oval, black . . . . . cake	$ 25
	B.	" " with Lion Head . . . . . "	50
	D.	Oblong, gilt . . . . . "	40
	E.	" " . . . . . "	60
	F.	Square, black, gilt figures . . . . . "	30
	G.	" " " " . . . . . "	40
	H.	" " " " . . . . . "	75

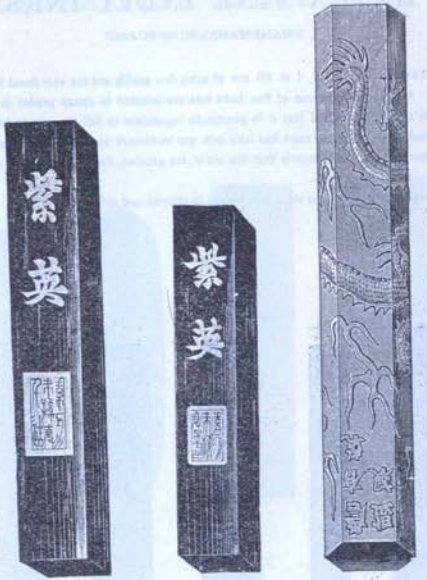
Illustrations full size.



J. K. L. M.

3030. J.	Oblong, black, blue and gilt figures	each	$ 1 50
K.	" " " " "	"	1 25
L.	" gilt, fine	"	1 50
M.	" " "	"	2 00

Illustrations full size.



N. N 2. S.

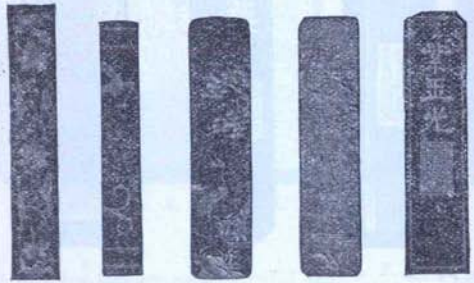
3030. N.	Square, black, gilt figures, Super Super	each	$ 1 00
N-2.	" " " " " " small	"	50
S.	Hexagon, gilt	"	3 00

EXTRA FINE INDIA INKS.

TRADEMARK: K. & E. CO.

The inks No. 3031, I to XII are of extra fine quality and the very finest that are made. As ALL the patterns of fine India inks are imitated in cheap grades in China, and are so minutely copied that it is practically impossible to tell the counterfeit from the genuine, we mark our extra fine inks with our trademark and initials. This enables the buyer to have our guaranty that the ink is the genuine, fine article and not an imitation.

We highly recommend these fine inks to Draftsmen and Artists.



3031 I. II. III. IV. V.

3031- I.	Oblong, black, 3 in. long	each	$	1 50
II.	" " 2¾ " "	"		1 50
III.	" " 2½ " "	"		3 00
IV.	Oblong, gilt, 2¾ " "	"		2 50
V.	" black, with pearl, 2½ in. long	"		2 50

EXTRA FINE INDIA INKS.

TRADEMARK: K. & E. CO.

No. 3031-VI. VII. VIII. IX.

3031-VI.	Oblong, black, 3½ in. long	each	$	3 00
VII.	Oval, " 3½ " "	"		4 00
VIII.	Oblong, " 3½ " "	"		3 00
IX.	" " " 3¾ " "	"		4 50

EXTRA FINE INDIA INKS.

TRADEMARK: K. & E. CO.

No. 3031-X.

XI.

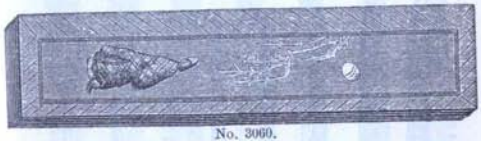
XII

3031-X.	Oblong, gilt,	3½ in. long	each	$ 4 00
XI.	" black,	4 " "	"	8 00
XII.	" "	4½ " "	"	6 00

JAPANESE INK.

The lines drawn with this ink will remain clear and distinct and will not be blurred nor defaced by applying brush tints.

Illustration full size.



No. 3060.

3060.	Oblong, black with figures, best, small cake	per cake	$ 1 00
3061.	" " " " " medium cake	" "	2 00

KEUFFEL & ESSER CO.'S

PHOTO-DRAWING INK.

Illustration full size.

No. 3070.

3070.	Photo-Drawing Ink, (about 3¾ in.)	per cake	$ 1 00

This is a dead black ink specially prepared for drawings to be photographed or reproduced by the blue or black process and is of great value to Patent Solicitors, Photo-Engravers and Photo-Lithographers.

BRUSHES.

As the quality of brushes can not be exactly described and as illustrations can not be made to show quality, we mention that all the brushes we list are the very best of their respective kind. They are always of the kind of hair mentioned, without adulteration or substitution, and each size contains the proper quantity of hair. The numbering of our brushes is the same now for the same sizes which we so numbered over 25 years ago.

Illustrations full size.

3100. Black Sable in Quills,

No.	1	2	3	4	5	6	7	8
each $	85	70	60	50	40	30	25	20

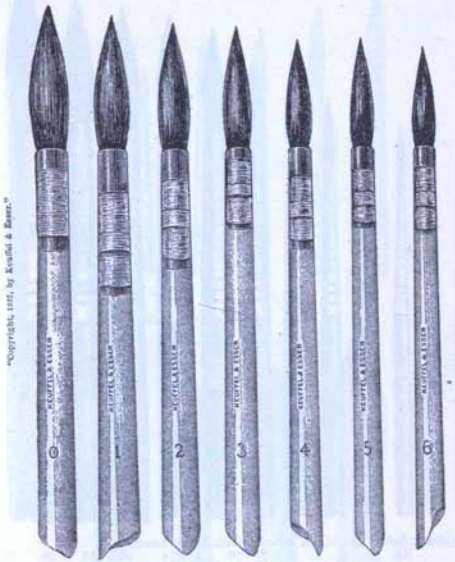
3101. Red Sable in Quills,

No.	1	2	3	4	5	6	7	8
each $	80	65	55	45	35	28	22	18

3102. Camel Hair in Quills,

No.	1	2	3	4	5	6	7	8
each $	10	10	08	08	06	06	05	05

Illustrations full size.



3110. Black Sable in Swan Quills,

No.	0	1	2	3	4	5	6
each $	3 50	2 80	2 25	1 80	1 40	1 15	85

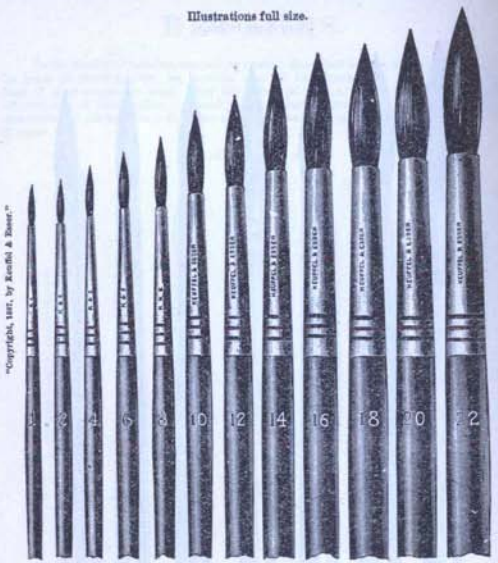
3111. Red Sable in Swan Quills,

No.	0	1	2	3	4	5	6
each $	3 20	2 65	2 15	1 70	1 35	1 10	80

3112. Camel Hair in Swan Quills,

No.	0	1	2	3	4	5	6
each $	70	60	45	30	20	15	10

Illustrations full size.



3120. Black Sable, round, in Albata, with black handle,

No.	1	2	4	6	8	10	12	14	16	18	20	22
each $	20	25	30	35	45	55	70	90	1 25	1 75	2 35	3 15

3121. Red Sable, round, in Albata, with black handle,

No.	1	2	4	6	8	10	12	14	16	18	20	22
each $	18	20	25	30	40	50	65	90	1 20	1 50	2 00	2 75

Illustration ½ size.

No. 3123.

3123. Red Sable, round, in Albata, with two points,

No.	1	2
each $	1 10	1 50

Please note that ours are **real sable** brushes. We emphasize this because sable hair, on account of the advances in its price has been extensively adulterated. Real sable brushes form a finer point and retain this point longer than others and remain elastic.

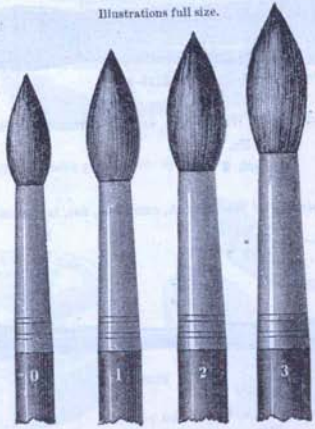
Illustrations full size.

No. 3132.

3132. Camel Hair in Tin, with red handle,

No.	1	2	3	4	5	6
each $	10	10	10	12	12	15

Illustrations full size.



No. 3133.

3133. Camel Hair Sky or Wash Brush, in Tin, with polished handle,

No.	0	1	2	3
each $	25	30	35	40

No. 3134, 3135.

3134. Camel Hair in Tin, with 2 points,

No.	0000	000	00
each $	30	35	40

3135. Camel Hair in Tin, with 2 points,

No.	0	1	2	3
each $	45	50	55	60

Illustration full size.

"Copyright, 1887, by Keuffel & Esser."

No. 3136-3.

3136. Camel Hair Sky or Wash Brush, extra fine, round, in Albata,

No.	1	2	3
each $	50	60	70

3137. Camel Hair Sky or Wash Brush, extra fine, flat, in Albata,

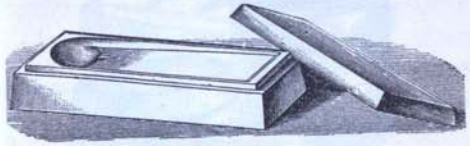
No.	1	2	3
each $	50	60	70

No. 3138.

3138. Camel Hair in Albata, with 2 flat points,

No.	1	2
each $	1 10	1 30

CHINA AND GLASS WARE.



No. 3150.

				Each
3150.	Keuffel & Esser Co.'s Pat. Ink Slab, China, with cover,		$1\frac{3}{4}\times4\frac{1}{2}$ in.	$ 35
3151.	do.	do.	$2\frac{1}{2}\times5\frac{1}{2}$ "	40
3153.	do.	do.	Slate Slab, glass cover, $2\frac{1}{2}\times5\frac{1}{2}$ in.	80

No. 3154.

3154. Slate Ink Cup, with glass cover, $3\frac{1}{2}\times3\frac{1}{2}$ in. . . . . each $ 35

No. 3156.

3158.

3156. Chinese Ink Cup, of opal glass, $3\frac{1}{4}$ in. diam., with cover . . each $ 50

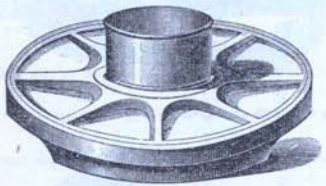
3158. Poole's Patent Ink Slab, with cover 50

No. 3160.

3160.	Nest of Cabinet Saucers,	6	in set,	2½ in.	set $ 45
3161.	do.	6	" "	2½ "	" 55
3162.	do.	6	" "	3½ "	" 65
3163.	do.	6	" "	3½ "	" 75
3164.	do.	deep 4	" "	2½ "	" 70
3165.	do.	" 4	" "	3½ "	" 80
3166.	do.	" 4	" "	3½ "	" 90

A "Nest of 6" consists of 5 saucers and cover; a "Nest of 4" of 3 saucers and cover.

No. 3169.



3169. Architect's Slant and Basin, 8 divisions and cup, 7 in. diam., each $ 1 35

No. 3170. 3174.

3170.	Ink or Color Slab,	3	Wells and Slope,	1½ × 2½ in.	each $ 10
3171.	do.	3	" " "	2½ × 3½ "	" 18
3172.	do.	3	" " "	2½ × 4½ "	" 25
3173.	do.	3	" " "	3 × 4½ "	" 30
3174.	do.	3	" " 3 Slopes,	2½ × 4 "	" 18
3175.	do.	5	" " 5 "	4 × 7½ "	" 55

No. 3178.

3176.	Sloping Tile,	3	divisions,	2½ × 4 in.	each $ 15
3177.	do.	4	"	3½ × 7½ "	" 30
3178.	do.	5	"	3½ × 7½ "	" 35
3179.	do.	6	"	3½ × 7½ "	" 40
3180.	do.	8	"	6 × 7½ "	" 50
3181.	do.	10	"	6 × 7½ "	" 55
3182.	do.	12	"	6 × 7½ "	" 65

No. 3183.

3183. Centre Slab, 5 divisions, 2½ × 6 in. . . . . each $ 20

No. 3184. 3185.

3184.	China Color Cups,	2½	3	3½ in. diam.
	each $	07	10	20

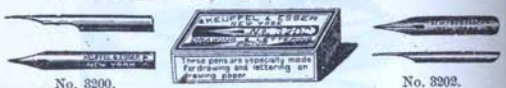
3185. China Brush Rest, 5½ in. long . . . . . each $ 15

No. 3186.

3186.	Artist's Water Glass,	2½	in. diam.	each $ 12
3187.	do.	3½	" "	" 25
3188.	do.	4½	" "	" 30
3189.	do.	4½	" "	" 35

KEUFFEL & ESSER CO. NEW YORK.

K. & E. CO. STEEL PENS.



No. 3200. No. 3202.

3200. Keuffel & Esser Co.'s Crow Quill Pens, 1 doz. in a box . doz. $ 60

3202. Keuffel & Esser Co.'s Drawing and Lettering Pens, 1 doz. in a box doz. 60

The above pens No. 3200 and 3202 are specially made for Draughtsmen for drawing and lettering on drawing paper, which has a more or less coarse surface. They have longer nibs and less sharp points than most others, possess great elasticity and permit of more rapid lettering or drawing, without scratching or catching in the grain of the paper. Draughtsmen will prefer these pens to any other kind, as all others are intended principally for drawing on stone.

3204. Keuffel & Esser Co.'s Lithographic Pens, 1 doz. in a box, doz. $ 60

The pens No. 3204 differ from all other Lithographic Pens in having shorter (and therefore firmer) nibs, and points of the utmost fineness.

No. 3201.

3201. Keuffel & Esser Co's Crow Quill Pens, 1 doz. pens 3200 and holder, on a card . . . . . card $ 60

No. 3203.

3203. Keuffel & Esser Co's Drawing and Lettering Pens, 1 doz. pens 3202 and holder, on a card . . . . . card $ 60

KEUFFEL & ESSER CO. NEW YORK.

No. 3205.

3205. Keuffel & Esser Co's Lithographic Pens, 1 doz. pens 3204 and holder, on a card . . . . . card $ 60

No. 3206.

3206. Keuffel & Esser Co's Crow Quill Pens, No. 3200, with improved holder with cork finger piece, card of ten pens, each with holder . . . . . card $ 1 00

do. do. do. . . . . each 10

STEEL PENS.

3210.	Lithographic Crow Quill Pens	Joseph Gillott's	doz.	$	60
3211.	Superfine long shoulder Crow Quill Pens,	do.	"		75
3212.	Lithographic Pens	do.	"		60
3213.	Mapping Pens	do.	"		60
3214.	Mapping or Ladies Pens, (No. 170)	Joseph Gillott's . .	doz.	$	10
3215.	Lettering Pens, (No. 303)	do. . .	"		15
3216.	do. (No. 404)	do. . .	"		10
3217.	Crow Quill Pens, with holder, French, (B. P. Co.) . . .		"		30

K. & E. CO. PENHOLDERS.

No. 3220.

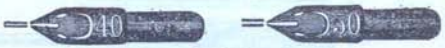
3220. Improved Crow Quill Pen Holder . . . . . each $ 10

No. 3221

3221. Improved Lettering Pen Holder . . . . . each $ 10

These holders for crow quill and lettering pens are of the thickness of an ordinary penholder, a great improvement over the thin sticks generally used.

ROAD PENS.



No. 3222.

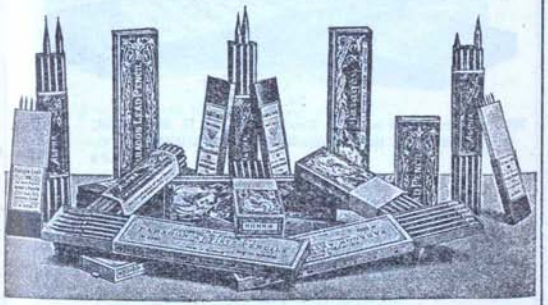
3222. Road Pens, Nos. 40 and 50 . . . . . per dozen $ 35

These pens have two fine points and are used as road pens in map drawing.

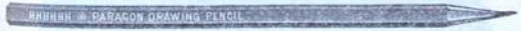
For Round Writing Pens etc. see page 284

LEAD PENCILS.

KEUFFEL & ESSER CO.'S.



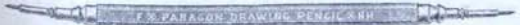
Our Paragon Pencils and Leads as well as the colored pencils, are of the very best quality and possess all the merits of other best makes already established in this market. They excel in **correctness and uniformity of grading.** As there is no well introduced manufacturer's name to pay for, they cost less than other similar pencils. We fully warrant these pencils and leads and solicit a trial of them.



3300. Paragon Pencils, extra fine quality, hexagon, silver-grey polish and gilt: HB, F, H, HH, HHH, HHHH (4), HHHHH (5), HHHHHH (6), HHHHHHH (7) . . . . . per doz. $ 1 00

3310. Alpha Pencils, fine quality, hexagon, red and gilt, Nos. 1, 2, 3, 4, 5 . . . . . per doz. $ 70

3320. Paragon Artist Pencils, with movable lead: silver-grey polish, HB, F, H, HH, HHH, HHHH (4), HHHHH (5), HHHHHH (6), HHHHHHH (7) each $ 25



3321. Paragon Artist Pencils, with movable lead, silver-grey polish, double pointed . . . . . each $ 35

No. 3325.

3325. Paragon Leads for Artist Pencils. HB, F, H, HH, HHH, HHHH (4), HHHHH (5), HHHHHH (6), HHHHHHH (7), per box of 6 $ 50

No. 3331.

3330. K. & E. Red Hexagon Pencils, finest quality . . . . per doz. $ 1 00
3331. do. Blue " " " " . . . . " " 1 00

No. 3335.

3335. K. & E. Red Round Pencils, finest quality . . . . . per doz. $ 75
3336. do. Blue " " " " . . . . . " " 75

No. 3340.

3340. K. & E. Red and Blue Hexagon Pencils, finest quality, per doz. $ 1 25
3345. Round White Pencils (for blueprints etc.) . . . . . " " 75

K. & E. CO. DETAIL PENCILS.

No. 3348.

3348. K. & E. Co. Detail Pencils, hexagon, gilt,
Nos. 2. 3. 4. 5 . . . . . gross $ 3 50 doz. $ 35

We recommend these Detail Pencils as being of excellent quality and carefully graded.

PENCIL HOLDER.

No. 3349.

3349. Holder for pencil stumps, hexagonal, metal ferrule . . . . each $ 10

A. W. FABER'S PENCILS.

No. 3350.

3350. Hexagon, very best Siberian, No. 2 B to 6 H . . . . doz. $ 1 25
3351. do. " " Drawing, No. 1 — 5 . . . . . " 75
3352. Black round, best, No. 1 — 4 . . . . . " 50
3353. Yellow polished, round, No. 4 B to 4 H . . . . " 60

3360. Artist Pencil with Siberian lead, double pointed . . . . . each 35
3361. do. " " " . . . . . " 25
3362. do. " best " . . . . . " 20

3370. Leads for Artist Pencils, Siberian, 2 B to 6 H, 6 in box . box 65
3371. do. " " " best 6 " " . " 35

3375. A. W. Faber's Wax Crayons . . . . . doz. $ 1 25 each 12

No. 1.	White,	No. 62.	Orange,
" 2.	Yellow,	" 63.	Light green,
" 13.	Dark blue,	" 69.	Dark green,
" 30.	Sienna,	" 75.	Carmine,
" 38.	Vermillion,	" 88.	Light blue,
" 54.	Purple,		Finest black.

3376. A. W. Faber's Wax Crayons in boxes,

6	12	18	24	36	48 ass'td colors
each $ 80	1 50	2 00	2 50	3 50	4 50

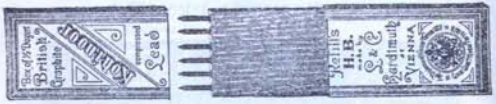
KOH-I-NOOR PENCILS.

No. 3380.

3380.	Koh-i-noor Pencils, hexagon, yellow polish. BBBBBB (6), BBBBB (5), ...	doz.	$ 1 80
	do. do. do. BBBB (4) . . .	"	1 50
	do. do. do. BBB, BB, B, F, HB, H, HH, HHH, HHHH (4), HHHHH (5), HHHHHH (6), HHHHHHH (7)	"	1 25

No. 3383.

3383.	Koh-i-noor Artist Pencils, yellow polish, BBBBBB (6), BBBBB (5), BBBB (4), BBB, BB, B, F, HB, H, HH, HHH, HHHH (4), HHHHH (5), HHHHHH (6), HHHHHHH (7)	each	25



No. 3385.

3385	Koh-i-noor leads for Artist Pencils, BBBBBB (6), BBBBB (5), BBBB (4), BBB, BB, B, F, HB, H, HH, HHH, HHHH (4), HHHHH (5), HHHHHH (6), HHHHHHH (7)	per box of 6	60

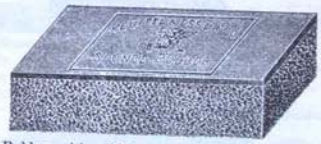
RED CHALK.

No. 3400.

3400.	Red Chalk (Keel) in Cedar for marking stakes	doz.	$ 75
3401.	do. " " " " " " very thick . .	"	1 25
3402.	Red Chalk (Keel) in Sticks, covered with paper, thin . . .	"	25
3403.	do. " " " " " " medium . .	"	50
3404.	do. " " " " " " thick . . .	"	75

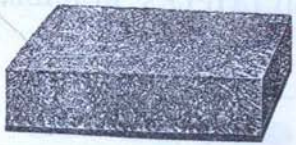
SPONGE RUBBER

for cleaning drawings.



No. 3408.

3407.	Sponge Rubber, with solid back, $2\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{4}$ in.	each	$ 30
3408.	do. " " " $4 \times 2 \times 1$ "	"	70
3409.	do. " " " $6 \times 4 \times 1$ "	"	2 15



No. 3412.

3410.	Sponge Rubber, with plain, solid back, $1 \times 1 \times 1$ in., . .	each	$ 12
3412.	do. " " " " $4 \times 2 \times 1$ " . . .	"	60
3413.	do. " " " " $6 \times 4 \times 1$ " . . .	"	1 80

ALBA RUBBER.

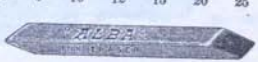
No. 3415.

3416.

The ALBA is a high grade pencil eraser, smooth finished and of excellent purity. It takes hold readily, will not smudge nor stain the paper and retains its excellent qualities longer than any other rubber.

3415.	Alba Pencil Rubber, flat, per cake $	6	8	10	12	15	20	25	50
3416.	Alba Pencil Rubber, oblong, per cake $	5	8	10	12	15	20	25	

No. 3417.



3418.

3417.	Alba Ink Eraser, flat, $1\frac{1}{2} \times 1 \times \frac{1}{4}$ in.	per cake	$ 05
3418.	do. oblong, $2\frac{1}{2} \times \frac{1}{2} \times \frac{1}{4}$ "	" "	06
3419.	do. " $3\frac{1}{4} \times \frac{5}{8} \times \frac{3}{8}$ "	" "	10

RED RUBBER.

No. 3420.

3420. Red, Molded Pencil Rubber, 1⅛ × 1½ in. . . . . each $ 12
3422. do. do. 2⅛ × 1⅛ " . . . . . " 24

This is a fine quality erasing rubber and can be used for cleaning drawings (like sponge rubber) or for erasing pencil marks. It attacks the surface of the paper less than any other erasing rubber.

MULTIPLEX RUBBER.

No. 3424.

3424. Multiplex Rubber, oblong,
per cake $ 6 8 10 15 20 25

A. W. FABER'S RUBBERS.

3425. Artist Rubber, flat, per cake $ 6 8 10 12 15 20 25 50
3440. Ink Eraser . . . . . per cake $ 05
3441. do. large . . . . . " " 10
3442. do. extra large . . . . . " " 20
3445. Ink and Pencil Eraser in Wood . . . . . " " 15
3446. do. do. Mammoth . . . . . " " 25

HARDTMUTH'S PLIABLE RUBBER.

3450. Pliable Rubber, grey, flat . . . . . per cake $ 10 25 50

DAVIDSON'S VELVET RUBBER.

3460. Davidson's Velvet Rubber, flat, per cake $ 10 12 15 20 25 50
3461. do. do. oblong " " 12 20

STEEL ERASERS.

No. 3480 and 3480½.

3480. Steel Eraser with long blade, Ivory Handle, Domestic . . each $ 1 00
3480½. do. " " " " " Rodger's . . " 2 10
3481. do. " " " Coco " Domestic . . " .45
3481½. do. " " " " " Rodger's . . " 80

No. 3486 and 3486½.

3485. Steel Eraser with short blade, Ivory Handle, Domestic . . each $ 85
3485½. do. " " " " " Rodger's . . " 1 20
3486. do. " " " Coco " Domestic . . " 35
3486½. do. " " " " " Rodger's . . " 60

LEAD PENCIL FILE.

No. 3488.

3488. Lead Pencil File, 6 in. . . . . each $ 25

A convenient little tool, consisting of a steel file with black wooden handle and with a steel tack lifter at the end.

PENCIL POINTERS.

These Pencil Pointers consist of sheets of flint paper made into a block.

No. 3500.

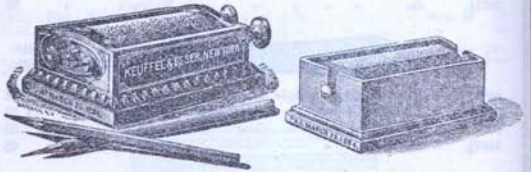
3500. Pencil Pointer, 2 × 2½ in. . . . . each $ 10
3501. do. 2½ × 4 " . . . . . " 15
3502. do. 1¼ × 4 " . . . . . " 10

No. 3507

3505. Pencil Pointer with wooden handle, 2 × 2½ in. . . . . each $ 15
3506. do " " " 2½ × 4 " . . . . . " 20
3507. do. " " " 1¼ × 4 " . . . . . " 15

PENCIL POINTERS & PAPER WEIGHTS

Patented Oct. 15th, 1865



No. 3510. 3511 and 3513.

All Pencil Pointers brought before the public so far, had the great disadvantages of soiling the hand and all articles with which they came in contact and of requiring the use of both hands in pointing a pencil. These Pencil Pointers and Paper Weights entirely obviate these drawbacks. The filings of the pencil-lead fall into the box which forms the body of the apparatus. Its weight holds it steady, so that a pencil can be sharpened with one hand while the other holds the scale, triangle, protractor or other drawing implement. In the "Convenient" Pencil Pointer the sandpaper is mounted on rollers, so that all parts of it can be used successively, and it is easily replaced when worn

The "Useful" Pencil Pointer is a modification of the "Convenient." The roller has 6 faces, so that it will last a long time. Besides there are 2 extra sandpaper coverings for the roller with each Pencil Pointer. The box catches the debris from the pencil and is heavy enough to require no holding during use, and to make a good paper weight.

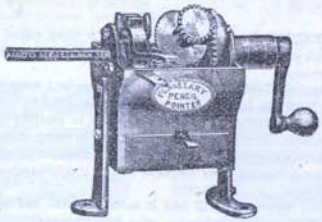
3510. "Convenient" Pencil Pointer and Paper Weight, about 2¼ lbs. . . . . each $ 80

3511. "Useful" Pencil Pointer and Paper Weight, about 1½ lbs. " 40

3512. "Useful" Pencil Pointer and Paper Weight, like No. 3511, but with two rollers, the second covered with velvet, for wiping pencil after sharpening . . . . . " 60

3513. "Useful" Pencil Pointer and Paper Weight, like No. 3511, but of bright bronze, finely finished . . . . . " 1 00

PENCIL SHARPENERS.

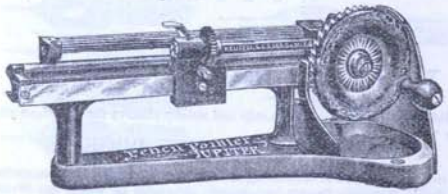


No. 3515.

3515. Planetary Pencil Sharpener . . . . . each $ 4 50

3516. Extra Knives for Planetary Pencil Sharpener . . . . . " 65

The Planetary Pencil Sharpener makes a perfect point on all kinds, grades and sizes of lead or slate pencils, wax crayons etc. It can be attached to the wall or table.



No. 3518.

3518. Jupiter Pencil Sharpener . . . . . each $ 10 00

The Jupiter Pencil Sharpener excels all others in workmanship and the ease with which it can be operated.

The cutting wheel is made reversible, so that, when one side is dull, the other can be used, after which a new cutting-wheel can be supplied or the old one sharpened.

Round Writing

F. SOENNECKEN'S system of ornamental writing, called Round Writing, has met with such flattering success that hardly any recommendation on our part is necessary.

The Methodical Text-Book for self-instruction is a complete guide for acquiring this beautiful hand in a very short time (ten to fourteen lessons suffice for a complete course in schools), and there is scarcely any profession but could advantageously make use of this writing in many ways.

Engineers, Architects and Draughtsmen are enabled to letter drawings, maps etc. in Round Writing more elegantly and in considerably less time than by any other method.

Bankers and Merchants will find it most valuable and appropriate in heading books, filling out check blanks, price lists, etc., etc.

Insurance Companies and Lawyers cannot use more distinct letters for filling out or writing policies and legal documents.

Store keepers can write neat show cards or price tags in this hand.

—o—

NOTICE

IN ORDER

TO LEARN ROUND WRITING

it is **indispensable** to thoroughly study and strictly observe the directions given in the

METHODICAL TEXT BOOK

especially with respect to the holding of the pen and to the exercises in writing.

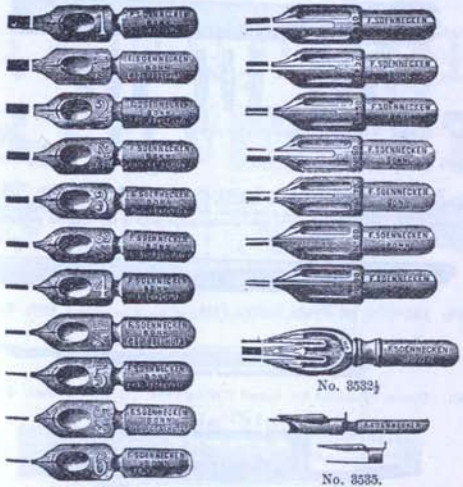
The book plainly shows the scientific principles on which this Writing System is based; all efforts to master it by using the pens without the Text Book will be unsuccessful, vainly wasting time and labor. The correct and artistic execution of the characters does not depend, as may erroneously be supposed, on the

ADROITNESS OF THE HAND,

but merely on the thorough knowledge of the manner of holding the pen and of the system of the characters as exhibited in the

METHODICAL TEXT BOOK.

3520. Methodical Text-Book to Round Writing by F. SOENNECKEN, (published by KEUFFEL & ESSER Co., New York) including an assortment of 25 single and double pointed pens, each $ 1 00 post paid $ 1 10
3521. do. do. do. without pens . . . . " 65 " " 70
3522. do. do. do. bound in cloth, with an assortment of 25 pens . . . . . " 1 60 " " 1 78
3523. Copy Book without instructions (School Ed.) including an assortment of 25 single and double pointed pens . . " 70 " " 80
3524. do. do. do. without pens . . . . " 35 " " 39



No. 3532½

No. 3535.

3530. Single Pointed Pens, No. 1, 1½, 2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, any one number, per gross $ 85 post paid $ 1 00
3531. do. do. do. do. " ¼ " 25 " " 31
3532. Double Pointed Pens, No. 10, 20, 30, 60, 70, 80, 90, any one number . . . " ¼ " 65 " " 71
" doz. 35 " " 41

Every gross or ¼ gross box contains Pens of one number only.

3532½. Three-Pointed Pen, for ornamental work, doz. $ 50 post paid 56
3533. Sample Assortment of Single and Double Pointed Pens, 25 in a box $ 35 " " 41
3535. Inkholder to be applied to Round Writing Pens, specially for writing with India and Autograph Ink, per box of 6 $ 30 each $ 10

KEUFFEL & ESSER CO. NEW YORK.

Musica

The above specimen is a reduction to one-half size of the original, as executed with the Round Writing Instrument.

3536. Round Writing Instrument, complete with 9 minute pens . . . . . each $ 1 00 post paid $ 1 10

3537. Minute Pens for above . . . . . doz. 75 each 10

With this instrument 2 or 3 parallel lines can be made with one motion. It is used exactly in the same manner as the above single and double round writing pens.
The accompanying 9 minute pens admit of producing 144 different double and 504 different triple lines, by changing or interchanging the pens in the different places in the holder.

3560. Penholder for Round Writing Pens . . . . . each $ 10

3561. Double Penholder for Round Writing Pens . . . . . each $ 10

3564. Parcel Pens, in 4 widths, for bold and large lettering.

No.	F	M	B	BB	
	1/32	1/16	1/8	1/4	in. wide . . each $ 25

CEDAR BOXES WITH ROUND WRITING PENS.

3565. Box containing an assortment of 11 penholders with pens, each $ 2 00

RULED PAPER IN SHEETS.

6 patterns for the different sizes of letters of Round Writing per sheet $ 06
These sheets are placed under blank paper to serve as rulings for writing.

KEUFFEL & ESSER CO. NEW YORK.

DRAUGHTSMAN'S ALPHABET

BY

KEUFFEL & ESSER CO.,

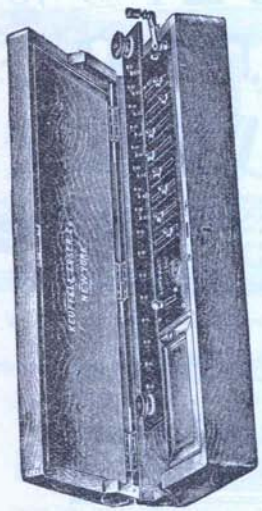
3570. Cloth bound, with gilt imprint on cover, size 7 × 10½ in. . each $ 1 50
post paid . . . " 1 60

3571. Student's Alphabets, a selection of the most useful Alphabets from above book, in paper cover . . . . . " 25
post paid . . . " 27

The above cut shows reduced specimens of our New Edition of the "Draughtsman's Alphabet", which has been entirely revised and much enlarged.
This book gives on 32 pages a larger variety of Alphabets, Numbers, Topographical Signs, etc., than any other book of the same size, and will be found the most useful to any draughtsman. The selection of the contents of the book is made with great care, and it is engraved with reference to practical use, so that each letter, number or sign may be copied without difficulty, which is almost an impossibility with the fine copper and steel engraved books, made only for the purpose of showing fine and elaborate engraving.
We trust that this work will be approved generally, as it has been by many draughtsmen of our city, who have contributed to it by suggestions for making it perfect and indispensable to every one needing such a work.

For other Alphabet Books see list of books at end of catalogue.

RECKONING MACHINES.



4006

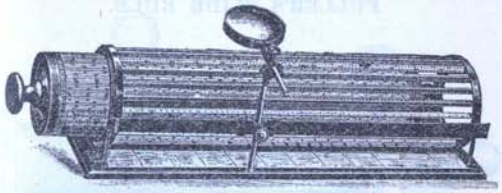
Calculations, such as Addition, Subtraction, Multiplication, Division, Squaring, Cubing, Extracting of Square Roots, &c., etc., can be performed with rapidity and unfailing accuracy and without mental effort by means of this machine. The tedious work of reckoning is reduced to setting the figure discs or shifters and turning the crank handle, a simple mechanical operation. The machine will multiply two factors, each of which may have as many figures as there are grooves.

The machine is mechanically perfect and built in the most substantial manner so that it will retain its efficiency and accuracy for a very long time. There are a great many of these machines in use in public and private offices and scientific laboratories here and in Europe, and they are in all cases giving the greatest satisfaction.

Old No.						
1739 A.	4005.	Reckoning Machine,	6	grooves,	12 holes in upper row, ... each	$ 193 25
1739 B.	4006.	do.	8	"	16 " " " " " "	241 50
1739 C.	4007.	do.	10	"	20 " " " " " "	398 25

SLIDE RULES.

THACHER'S CALCULATING INSTRUMENT.



No. 4013.

Old No

1740 4012. Thacher's Calculating Instrument, for performing a great variety of useful calculations with unexampled rapidity and great accuracy, cylinder 18 in., in polished Mahogany Box . . . . . each $ 35 00

1741 4013. do. do. do. with 3 in. reading glass sliding on brass bar, adjustable to any part of the instrument and for focus . . . . . " 45 00

Thacher's Calculating Instrument consists of a cylinder 4 inches in diameter and 18 inches long, upon which the logarithmic scales are arranged in 20 parallel lines. This cylinder revolves within an open framework composed of 20 angular bars, attached at their ends to metal rings, which fit into circular apertures in the standards and admit of rotating the framework. The logarithmic scale is duplicated on the exposed sides of the bars and the rotary and longitudinal motion of the cylinder allows any of its graduations to be brought instantly into coincidence with any graduation on any bar.

The scales, the longest ever made, contain upwards of 33,000 divisions and 17,000 engraved figures, executed upon a dividing machine, made expressly for this instrument. The logarithmic scale, corresponding with the scale on the cylinder, is 20 feet, and the scale of square roots on the upper edge of the bars 40 feet long, and therefore results can be obtained to the fourth and usually to the fifth space of figures, sufficient to satisfy nearly every requirement of the professional or business man.

By the use of this instrument the drudgery of calculation is overcome, the mind is greatly relieved, and the results obtained are more reliable than when worked out in the usual way. Examples in multiplication, division, proportion, powers or roots, involving not more than three quantities, are solved by one operation, and any number of values of an algebraic function composed of two constants and a single variable may generally be found by one setting. For example, any of the formulas

$$\frac{ax}{b} \cdot \frac{ax^2}{b} \cdot \frac{ax}{b^2} \cdot \frac{ax^2}{b^2} \cdot \sqrt{\frac{ax}{b}} \cdot \sqrt{\frac{a^2x}{b}}$$

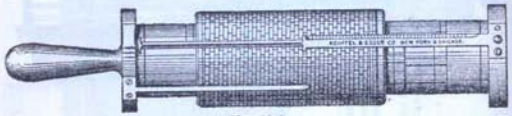
in which a and b may have any values and x any number of values are readily solved by one setting. Squares, square roots, cube roots and reciprocals are also readily worked.

The useful applications of the instrument are almost unlimited; among these may be mentioned, finding the stresses and sections in trusses and girders, mensuration, estimates of work and material, solving trigonometrical formulas, making and applying tables, problems in the mechanical powers, machinery and hydraulics, problems of simple and compound interest, discount and fellowship, pro-rating, gauging, exchange and the conversion of weights and measures.

It will be found useful to the Engineer, Architect, Actuary, Scientist, Manufacturer, Mechanic, Navigator and Accountant.

A book containing a full description of the instrument, all the necessary rules for operating it and numerous examples, both general and special, accompany each instrument.

FULLER'S SLIDE RULE.



No. 4015.

Old No.

1742 4015. Fuller's Spiral Slide Rule, in Mahogany Box, with Directions . . . . . each $ 30 00

Fuller's Spiral Slide Rule consists of a wooden cylinder which can be moved up or down or around a wooden axle provided with a handle. A single logarithmic scale nearly 42 feet long, is wound spirally around this cylinder. There are two indexes: a fixed one attached to the handle, and a movable one attached to a brass tube sliding in the axle. This latter bears two indexes (whose distance apart is the axial length of the complete spiral) and a scale of equal parts for the rapid finding of logarithms.

Ratios are established by setting a given number to the fixed index, setting the movable index to another given number, bringing any other number to the fixed index and reading the fourth term at the movable index. Hence the Fuller Rule requires setting each time the third term of a proportion changes and it does not give a complete series of equal ratios at sight, like the Thacher and Mannheim Rules. Its use is also somewhat tiring as it must be held in the left hand and is rather heavy. On the axle a number of valuable tables and settings is given.

CHARPENTIER AND BOUCHER CALCULATORS.

No. 4020.

4024.

Old No.

1743 4020. Charpentier's Calculator . . . . . each $ 5 00

The Charpentier Calculator is a circular slide rule, 2¾ in. diameter, with a circular slide which is revolved and set by the handle. This instrument being made of metal is but slightly affected by atmospheric variations. On the face of the calculator (shown in cut) there is a logarithmic scale on the slide corresponding to another such, external to it on the body of the rule. On the surface within the slide are the square roots in two circles, one from 0 to 3.162, the other from 3.162 to 10. They are made to coincide with the outermost scale by means of an index. On the other side of the rule there are three scales, an outer one of equal parts and two inner ones of angles from 0 to 90 and from 0 to 25 respectively; the latter two give the sines of the first and the tangents of the second on the scale of equal parts, by means of an index. The indexes on the two faces correspond, so that the logarithms of the numbers on the logarithmic scale can be read on the scale of equal parts.

4022. Boucher Calculator, silvered metal dials . . . . . each $ 14 00

The Boucher Calculator resembles an ordinary stem-winding watch with glass covered dials back and front.

It is about 2¾ in. diameter by ¼ in thick; hence of convenient size for the pocket. One of its dials can be revolved by means of the milled-head key at the stem; the other is fixed. Each dial is provided with a hand or pointer. These two pointers are fixed on a common axle and moved together and alike by a milled-head key on the edge of the case. A third pointer is attached to the rim over the movable dial.

The fixed dial has an outer scale of equal parts and the three inner circles are the cube roots of the numbers on the logarithmic scale from 1 to 2.154, from 2.154 to 4.637 and from 4.637 to 10, respectively.

The movable dial has an outer circle of angles from 5° 44′ 39″ to 90°, the sines of which are found on the next inner circle, which is the logarithmic scale. Ratios are set off in a similar manner as on the Fuller Slide Rule.

1743½ 4024. Boucher Calculator, enameled cardboard dials . . . . . " 8 50

No. 4024 is similar to No. 4022, but about ⅝ in. thick. There is no second milled head key for the pointers, which are operated by the key at the stem when pressing a button on the edge.

K. & E. SLIDE RULES.

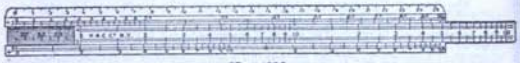
As the Slide Rule is becoming more generally known, its popularity is rapidly increasing, and in its present perfected form it is becoming an indispensable aid not only to the engineer and scientist, but also to the manufacturer, the merchant, accountant, and all others whose occupation or business involves calculations.

We manufacture slide rules here and devote to them a separate department of our factory, which is thoroughly equipped with the most improved special machinery.

Our Slide Rules are **engine divided** and of the very best materials. They are not liable to shrink or warp with climatic variations like the imported rules, and our patent adjusting device permits of compensation for wear so that our slide rules remain perfect for a long time. Great care has been bestowed also on the figures of our Rules to make them as clear and distinct and as permanent as possible. We prefer not to number the subdivisions throughout as is done on some of the **printed** rules. The sub-numbers are not required by the adept, they even are confusing, and interfere with rapid and accurate reading. Should they be required for any special purpose, we will put them on without extra charge. Several of our improvements are protected by patents, and are therefore not embodied in other Rules.

The principle involved in the Slide Rule is the graphic representation of logarithmic values, but a knowledge of logarithms is not required for the successful manipulation of the rule. The principles which must be familiar are few and very simple, and easily mastered by anyone with a little attention and practice. Arithmetical, algebraic and trigonometrical problems can be solved with the Slide Rule more easily and rapidly and with much less chance of error than by ordinary calculation. Complete directions are furnished with each rule.

GUNTER SLIDE RULE.



No. 4028.

Old No.

1745 4028. Gunter Slide Rule, 10 in., engine div. boxwood, polished, each $ 2 00

The Gunter Slide Rule is the original form of the slide rule. It is entirely of boxwood and has no indicator. The upper scale of the Rule and both scales of the slide are double scales, each 5 in. long, while the lower scale of the Rule is a single logarithmic scale 10 in. long, giving the square root of corresponding readings of the double scales. On the under face of the slide are scales of sines, tangents and one of equal parts, which latter gives the logarithms of the numbers on the logarithmic scale.

MANNHEIM SLIDE RULES.

This form of rule was devised by Lieut. Mannheim and represents a considerable improvement over the Gunter's slide rule. Both lower scales (C and D) are single 10 in. scales, which admit of close reading, and there is an indicator for finding the coinciding points on any of the scales. The indicator admits of working out extensive calculations without taking intermediate readings, thus increasing the accuracy of the final reading, and of finding square roots. The four scales are generally designated as A, B, C, D, in the order in which they occur on the rule, beginning at the top.

On the under face of the slide are scales of sines, tangents and equal parts, like in the Gunter rule. An opening with index marks in the under side of the body of the rule permits of reading the scales on the under face of the slide without reversing it. The under surface of the rule shows a table of a number of settings and ratios.

The new **K. & E. Patent Adjustable Slide Rule** (Patented June 5th, 1900) embodies an important improvement which will be universally appreciated.

Cross-section of No. 4040.

It is well known that the materials of which slide rules are made are affected by atmospheric changes, notwithstanding previous treatment of seasoning. Even in the best rules, except those of metal, the slide is liable to work too tight or too loose from changes in the materials.

In the ordinary slide rules the stock and guide pieces are made integral, but in our patented slide rules one of the guide pieces is adjustable. It is firmly held in place by set-screws, which pass through oblong holes, and is adjusted by loosening the screws and bringing the guide piece up against the slide according to the friction desired, when the screws are again tightened. The adjustable slide rule can thus be kept to work evenly in spite of atmospheric changes or seasoning.

MANNHEIM SLIDE RULES.

K. & E. PATENT ADJUSTABLE.

PATENTED JUNE 5, 1900.

(See cut on page 293.)

No. 4041.

Old No.		
1747	4030. K. & E. Patent Adjustable (Mannheim) SlideRule, 5 in., engine divided, divisions on white facings, with brass indicator, in sewed-Leather Sheath, with Directions . . each	$ 4 50
	This rule is subdivided as closely as the 10 in. rule, notwithstanding its small size.	
	4031. Do., like 4030, but with glass indicator . . . . . "	4 50
	4032. Do., " 4030, " " reading lens . . . . . "	6 00
1746	4040. K. & E. Patent Adjustable Mannheim Slide Rule, 10 in., engine divided, divisions on white facings, brass indicator, in Case with Directions . . . . . each	$ 4 50
1746½	4041. Do., like 4040, but with glass indicator . . . . . "	4 50
1748	4050. K. & E. Patent Adjustable Mannheim Slide Rule, 20 in., engine divided, divisions on white facings, brass indicator, in Case with Directions . . . . . each	$12 50
1748½	4051. Do., like 4050, but with glass indicator . . . . . "	12 50

The 20 in. rules are divided more closely than the 5 and 10 in. They have from 200 to 20 subdivisions between numbers, while the 10 in. have from 100 to 10, so that reading is much easier, and closer by at least one figure and another one can be accurately estimated. The former objection to 20 in. rules, *i. e.* their greater liability to warp or shrink, is now overcome by our patent adjusting contrivance.

K. & E. FAVORITE SLIDE RULES.

MANNHEIM STYLE.

No. 4054.

Old No.		
1748.3	4054. Favorite (Mannheim) Slide Rule, 10 in., divided on white facings, with glass indicator, in Case, with Directions each	$ 3 00
	4056. Favorite (Mannheim) Slide Rule, 10 in., polished boxwood, with brass indicator, in Case, with Directions . . . each	$ 2 75

The Favorite Slide Rules are of the same pattern as Nos. 4030 etc., but they are not adjustable. They are an improvement over the imported rules, being made of materials seasoned here and therefore less liable to warp or shrink. The divisions are sharply cut and therefore plainer and much more durable than those of the printed rules.

K. & E. STUDENT'S SLIDE RULE.

No. 4058.

1749-1	4058. Student's Slide Rule. (Mannheim), 10 in., with indicator and Directions . . . . . each	$ 1 00

The Student's Slide Rule is intended only for the use of students, to enable them to become familiar with the slide rule without incurring the relatively great expense of the regular rule.

It is similar to our Mannheim Slide Rule, and the graduations are on white paper facing which has a protective coating. With each rule we furnish plain directions.

BOOKS ON THE SLIDE RULE.

A.	Directions for Mannheim Rule (same as furnished with the rule), each	$ 25
B.	" The Slide Rule," complete Manual, by Wm. Cox . . . . . "	50
C.	Directions for Duplex Slide Rule, by Wm. Cox . . . . . "	25
D.	Manual of the Duplex and Mannheim Slide Rules, bound together "	75

DUPLEX SLIDE RULES.

PATENTED OCTOBER 6th, 1891.

No. 4070.

In the "DUPLEX" SLIDE RULE the slide is of the same thickness as the rule and has its two faces flush with those of the rule. The rule and slide are fully graduated on both sides, scales A and D being alike on both sides of the rule, whereas scales B and C on the arithmetical slide are graduated on their upper face in the usual way like A and D, but on their under face in reversed order, the initial indexes being on the right hand, and the scales progressing towards the left. The indexes of the scales of one face are in alignment with those of the other face, and a runner, encircling the whole rule, enables coinciding points on any scales of either face to be at once found.

This improvement simplifies considerably the working out of many complex calculations, for example such operations as

$$a \times b \times c = x; \quad a^x = x; \quad \frac{a}{b \times c \times d} = x; \quad \sqrt[2]{\frac{a}{5}} = x$$

may be performed with one setting. Besides, there is on the Duplex Rule an inverted slide always in position, with the numbers right-side up and the corresponding scales contiguous, instead of the numbers inverted and scale C next to A and B next to D.

To still further increase the value of the Duplex Rule, an interchangeable Trigonometrical Slide, having the regular B and C scales on one, and the scales of sines, tangents and equal parts on the other side, can also be furnished when ordered with the rule, and by its use all trigonometrical problems can be quickly solved and the logarithms of numbers readily found.

Old No.			
1744½	4060.	Duplex Slide Rule, 5 in., engine divided, divisions on white facings, with brass indicator and with Arithmetical Slide, in sewed leather Case and with Directions . . each	$ 6 50
	4061.	do. do. like No. 4060, but with glass indicator . . . "	8 00
	4065.	do. do. " " 4060, but with Arithmetical and Trigonometrical Slides (interchangeable.) . . . . . "	8 00
	4066.	do. do. like No. 4065, but with glass indicator . . . "	9 50
1744	4070.	Duplex Slide Rule, 10 in., engine divided, divisions on white facings, with brass indicator, with Arithmetical Slide, in Case and with Directions . . . . . "	6 50
	4071.	do. do. like No. 4070, but with glass indicator . . . "	8 00
1744B	4075.	do. do " " 4070, " Arithmetical and Trigonometrical Slides (interchangeable) . . . . . "	8 00
	4076.	do. do. like No. 4075, but with glass indicator . . . "	9 50
	4078.	Duplex Slide Rule, 20 in., engine divided, divisions on white facings, with brass indicator, with Arithmetical Slide, in Case and with Directions . . . . . "	16 50
	4079.	do. do. like No. 4078, but with glass indicator . . . "	18 00

UNIVERSAL SLIDE RULE.

PATENTED MARCH 21, 1899.

No. 4090.

4090. Universal Slide Rule, 10 in., engine divided, divisions on white facings, with brass indicator, in Case and with Directions . . . . . each $20 00

The Universal Slide Rule is graduated on both sides, like the Duplex, from which it differs in having two slides, with an intervening graduated guidepiece. The two slides are joined, forming one piece. It is practically the Duplex Rule with both the arithmetical and trigonometrical slides in position. The indexes at the ends and centre are all in perfect alignment. A brass indicator embraces the whole rule. The four top scales on the front face of the rule are the regular Mannheim A, B, C, D scales, the next two scales on contiguous edges are folded logarithmic, i. e., beginning at the centre and progressing to the right to 3.16 and continued from the left index to the centre. The seventh scale is one of angles from 30 to 90 degrees, whose corresponding natural sines can be read off on the adjacent eighth scale, a regular double logarithmic scale.

On the reverse side of the rule are nine scales. Scales A, B, C, D are inverted, like those on the reverse side of the Duplex Rule. The other scales in their order are

a folded logarithmic scale,
a folded single logarithmic scale inverted,
a scale of equal parts,
a scale of tangents (angles from 5° 43′ to 45°),
a single logarithmic scale.

The superiority of this rule is obvious. As all the scales on the slide move simultaneously, they are always in the same position relative to one another, and by means of the indicator, which embraces the whole rule, any two scales may be operated together. Complex arithmetical and trigonometrical calculations can be solved with fewer settings and consequently with greater rapidity and less liability to error than on any other slide rule.

As the folded logarithmic scale begins and ends at the centre of the rule, the result of a calculation which lies beyond the rule can at once be read off on the folded scale without resetting the slide.

TRIANGULAR METAL SLIDE RULE.

PATENTED MAY 10, 1898.

No. 4095.

4095. Triangular Metal Slide Rule, 10 in., brass indicator, in Case and with Directions . . . . . each $25 00

The Triangular Metal Slide Rule has several important advantages. Being made of metal, it will never warp nor shrink, so that it can always be relied upon in any temperature or climate. In shape and size it resembles a triangular scale.

On the three faces are the following scales:

1. Scales A, B, C, D, of the regular Mannheim rule.
2. Scale A, B inverted, C inverted, Scale D.
3. Scale A, Scale of Sines, Scale of Equal Parts, Scale of Tangents, Scale D.

It thus forms the most compact Slide Rule considering the number of scales. A brass indicator, encircling the whole rule, allows any of these scales to be worked in connection with any others.

KEUFFEL & ESSER CO. NEW YORK.

K. & E. STADIA SLIDE RULES.

No. 4100.

Old No.

4100. Stadia Slide Rule, engine divided, 10 in., divisions on white facings, in Case with Directions . . . . . each $ 4 50

1749 4101. do. do. but 20 in. . . . . " 12 50

The Stadia Slide Rule is especially designed to solve the two equations generally used in stadia measurements, viz.:

$$\text{Height} = \frac{\text{Stadia Distance}}{2} \times \text{Sin } 2\,a$$

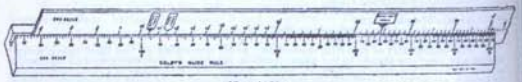
and

$$\text{Distance} = \text{Stadia Distance} \times \text{Cos.}^2\, a.$$

These two equations can be read off on the face of the rule with one setting. It is finely graduated and will be found of great use to the Topographer, as it enables him to compute quickly the results of his labors in the field.

COLBY'S STADIA SLIDE RULE.

PATENTED JULY 30, 1899.



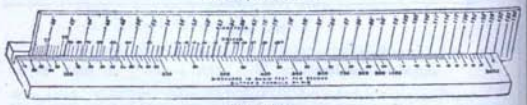
No. 4125.

1749-3 4125. **Colby's Stadia Slide Rule,** 50 in., hardwood, in Case, with Directions . . . . . each $ 20 00

Colby's Stadia Slide rule gives differences of elevation between two points when stadia-reading and vertical angle are known. By a combination of three indices it will also give differences of elevation in feet, when stadia distances are read in either meters, yards or feet, and will also give differences of elevation in these units.

COLBY'S SEWER COMPUTER.

PATENT APPLIED FOR.



No. 4130.

1749-2 4130. **Colby's Sewer Computer,** hardwood, in Case, with Directions, each $ 10 00

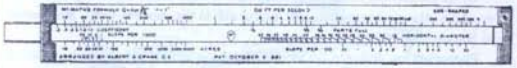
This is a slide rule graduated after Kutter's formula, and the values obtained by it are the same as given by that formula, the value of the co-efficient "N" being taken at .013. It gives the relations between discharge, diameter and grade for round sewers from 6 inches to 20 feet in diameter and for egg-shaped sewers from 12 X 18 inches to 12 x 18 feet, and the grades for either from .05 to 20 per cent. The rule is 20 inches long.

The few directions required are furnished with the rule.

KEUFFEL & ESSER CO. NEW YORK.

CRANE'S SEWER SLIDE RULE.

PATENTED OCTOBER 6, 1891

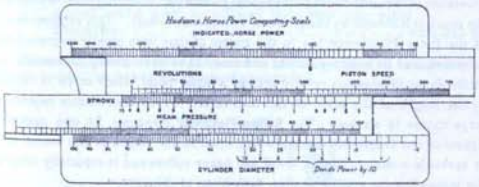


Old No.

1749-4 4132. Crane's Sewer Slide Rule, 10 in., paper facings with Directions . . . . . each $ 2 00

Crane's Sewer Slide Rule, is based on McMath's formula for amount of storm water and Kutter's formula for capacities, for circular sewers from 6 to 180 in. diam and egg-shaped sewers from 18 to 80 in. horizontal diameters, ratio of radii 1:2:6.

HUDSON'S HORSE POWER COMPUTING SCALE.



No. 4140.

4140. Hudson's Horsepower Computing Scale, 4½ in., printed on cardboard, in sewed leather Case with Directions . . . each $ 3 00

4141. do. do. do. do. but boxwood . " 6 50

This is a slide rule consisting of a body and two contiguous slides upon the edges of which the scales are arranged.

With this slide rule can be found at once:

1. The indicated horse-power of an engine.
2. The size of cylinder required for any desired power.
3. The piston speed due to any stroke or revolutions per minute.
4. The ratio of compound cylinders.
5. The proportion of initial pressure realized as mean pressure with the steam cut off at different percentages of stroke.

IVORY AND BOXWOOD SECTORS.

No. 4176

1749-7 4175. Boxwood Sector, 12 in., brass joint, hand divided . . . each $ 1 00

1749-8 4176. Ivory Sector, 12 in., German silver joint, hand divided . " 2 25

PLANIMETERS AND INTEGRATORS.

Of all mechanical devices for computation **Planimeters** and **Integrators** rank foremost as the most ingenious and useful aid to the modern Civil, Mechanical and Marine Engineer.

Planimeters are designed for ascertaining by a simple mechanical operation the area of any plane surface represented by a figure drawn to any scale, such as indicator diagrams, profiles, plans, sections, etc. They are classed in **Polar Planimeters** and **Rolling Planimeters.**

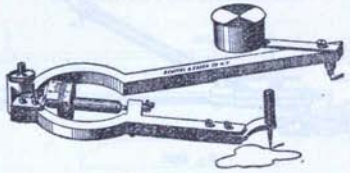
The **Polar Planimeter,** invented by Prof. Amsler in 1856, consists of two principal parts, the **tracer arm,** carrying the tracing point and the carriage with the measuring wheel, and the **pole arm,** to the end of which is affixed the pole, around which the instrument revolves. The area of any figure is readily and accurately obtained by tracing the boundary line with the tracing point, whereupon the result is indicated by the graduated measuring wheel. This original design of the Polar Planimeter has in the course of time been greatly improved and perfected, and its accuracy, utility and range have been greatly increased. As all the Polar Planimeters revolve around a fixed point, their scope is limited by the length of the arms of the instrument, which necessitates measuring large figures in sections. The **Rolling Planimeter** measures by one operation figures of any length and up to a width equal to the length of the tracer arm. It moves in a straight line on broad and heavy rollers and is especially adapted for measuring the area of profiles, deck-plans of ships etc.

INTEGRATORS AND THE INTEGRAPH

ascertain the Area and Moments relative to any axis of any figure, by simply tracing its outline. They are an invaluable aid to Civil and Mechanical Engineers, Bridge Builders, Naval Architects, etc. They greatly facilitate the finding of the displacement, moments of stability and inertia, centre of gravity, etc., of ships, the tensile strength, resistance, safe load, etc., of cables, tracks, beams and girders, contents of embankments, cuttings, etc. On the Integrators the readings are taken from graduated discs, and on the Integraph from a graduated bar. The Integraph in addition draws automatically the integral curves giving a graphic representation of the integration, a feature very valuable to ship builders, etc., who have to compute these curves.

Planimeters and Integrators are so simple, that they can be used by anybody after a little practice. They will soon pay for themselves through saving time and labor and give more accurate results than any other method.

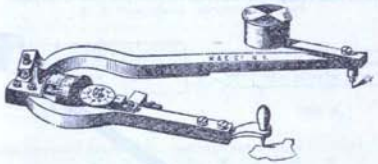
POLAR PLANIMETERS.



No 4210.

Old No. 1110 — 4210. Polar Planimeter, German Silver, fixed tracer arm, improved needle pole*; in polished Mahogany case, with Directions . . . . . each $15 00

No. 4210 represents the Polar Planimeter in its simplest form. It measures up to 10 square inches in tenths and hundredths of a square inch.

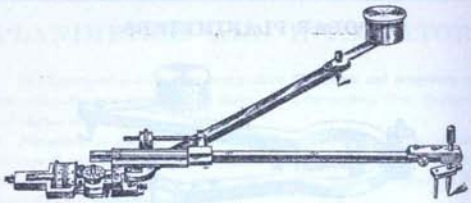


No. 4212.

1111 — 4212. Polar Planimeter, German Silver, fixed tracer-arm, improved needle pole*; with horizontal recording wheel engaging with the measuring wheel and registering its revolutions; in polished Mahogany Case, with Directions . . . . . each $16 50

The horizontal recording wheel registers 10 revolutions of the measuring wheel, so that areas of figures up to 100 square inches can be measured. The areas of small drawings made to scale may be obtained by reduction.

* The improvement of the needle-pole consists in having a weight attached to a bar revolving around the pole, which can be directed to counterbalance the weight of the instrument proper in any position.

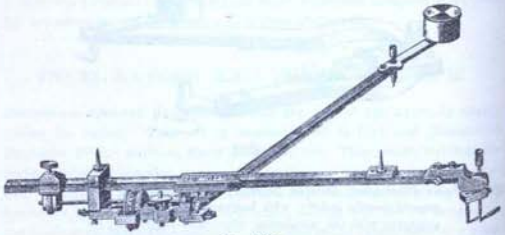


No. 4220.

Old No. 1102

4220. Polar Planimeter (Amsler's pattern), German Silver; adjustable tracer-arm with index marks for 4 ratios, and with clamp and slow-motion screw. Improved Needle-pole; in polished Mahogany Case, with Directions . . . each $28 00

This instrument embodies several improvements over the regular Amsler Planimeter. The flange of the roller wheel is at the center of the wheel axis, thus distributing the wear. The horizontal disc is so placed that it is always visible and not concealed beneath the tracer-arm as on the older style of instruments. The tracer arm is adjustable, and marks for setting to several scales are indicated on it. The tracing point is adjustable, so that it can be brought into alignment with the axis of the roller-wheel. It is also provided with a support, which keeps the point just clear of the paper.



No. 4225.

1112 4225. Polar Planimeter (Amsler's pattern), German Silver like 4220, but with special device for rapidly finding the **Mean Height of Indicator Diagrams** (see following page), in Mahogany Case, with Directions . . . . . each $30 00

Directions (The Polar Planimeter, by Wm. Cox.) . . . . . " 25

DEVICE FOR FINDING THE MEAN HEIGHT OF INDICATOR DIAGRAMS.

(See Nos 4225 and 4235.)

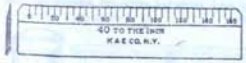
This device consists of two fine steel points, one attached to the upper side of the tracer arm, and the other to the surface of the carriage in which this arm slides. To obtain the mean height of the diagram, hold the planimeter upside down and adjust these points so that the distance between them shall coincide exactly with the length of the diagram, then clamp the arm and proceed in the usual way exactly as if the area of the diagram were sought. Instead of giving, however, the area, the setting of the tracer-arm is by this means such that the difference of the readings at the beginning and end of the operation, divided by 0.4 is the mean height of the diagram in inches.

Example: Second reading 4.786
First reading 4.322

Then 4.786 — 4.322 ÷ 0.4 = 1.16 inches = the mean height.

SCALES FOR INDICATOR DIAGRAMS.

U. S. Standard. Engine divided



Old No. 1116

No 4226 C. 1228 M.

4226. Flat Boxwood Scales, 4 in., one edge beveled and divided

	A.	B.	C.	D.	E.	F.	G.	H.	J.	K	L.
parts to inch:	10	20	40	50	60	80	100	12	24	32	64
each $	30	30	30	30	30	40	40	30	30	30	30

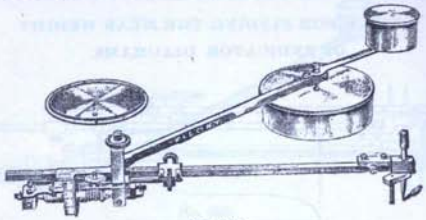
1116½ 4227. Set of above Scales, in Mahogany Case, with marked receptacles, set $ 3 75

1117 4228. Triangular Boxwood Scale, 3 in., six edges divided.

M. Indicator Scales, graduated 10, 20, 30, 40, 50, 60 parts to in., each $ 75
N. " " " 20, 40, 50, 60, 80, 100 " " " " 75
O. " " " 10, 15, 25, 30, 40, 70 " " " " 75
P. " " " 10, 20, 25, 60, 80, 100 " " " " 75
R. " " " 12, 24, 32, 64, 40, 60 " " " " 75

Indicator Scales with different graduations made to order

1118 4229. **Metallic Paper** for Indicator Cards, sheets 20 × 25 in., . . . quire $ 3 00
Cut blanks, 3¼ × 7¼ in. . . . . " 40

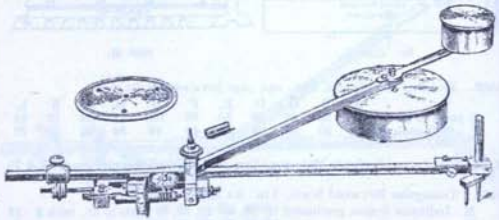


No. 4230.

Old No. 1104

4230. Improved Polar Planimeter, German Silver, adjustable tracer-arm, fully graduated, with vernier and clamp and slow-motion screws, with ball-pole, pole-weight and balancing weight; with testing disc and table of settings for U. S. Standard and Metric Measures; in polished Mahogany Case, accomodating the instrument when set to any scale, with Directions . . . . . each $33 35

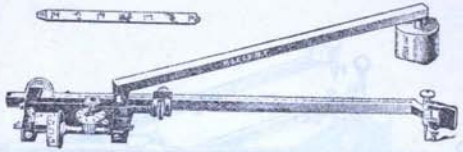
As the tracer-arm is fully graduated, very fine settings can be effected with great accuracy for any scale in U. S. Standard or any foreign measurement, and allowance can be made for the shrinkage of drawings. The tracer-arm is also provided with index marks for a number of scales for U. S. Standard and Metric measurements. The Testing Disk greatly facilitates the rapid finding of these settings, and also serves to prove the accuracy of the instrument and as an aid in adjusting it. By shifting the pole weight, which is smooth underneath, the measuring wheel can be easily set to zero. The different parts of the instrument are adjustable and provided with set screws, so that corrections can be made for instrumental errors.



No. 4235.

4235. Improved Polar Planimeter, German Silver, like 4230, but with special device for finding the MEAN HEIGHT OF INDICATOR DIAGRAMS (as explained on preceding page) each $35 50

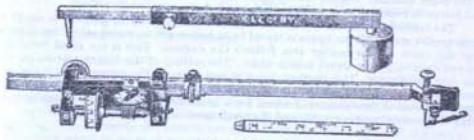
The Steel Points of this instrument when not in use, are protected by German Silver Caps so that the sharp points will not interfere when measuring areas.



No. 4240.

4240. Compensating Planimeter, German Silver and bronzed Brass: adjustable tracer-arm fully graduated (see note on preceding page); improved pole-weight; testing rule and table of settings for U. S. Standard measure, in morocco Case accomodating the instrument when set to any scale, with Directions . . . . . each $36 00

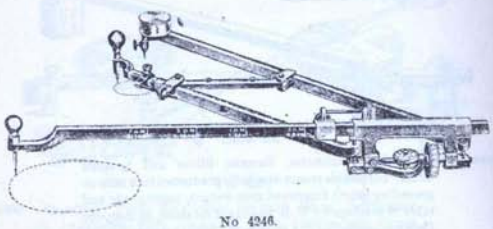
The mechanical construction of this planimeter is novel. The instrument consists of two separate parts: one part is composed of the tracer-arm and the carriage with the measuring and recording wheels, the other part is the pole-arm having at one end the poleweight and at the other end a steel ball, which forms a ball joint with the wheel carriage. This ball joint can not become loose or shaky, nor is it liable to be injured, when adjusting the tracer-arm or during shipment, as each part can be handled and is stored in the case separately (see cut below). This construction gives the tracer-arm a motion of 180 degrees right and left, and the range of this instrument is therefore much greater than of the usual planimeters, the tracer-arms of which have a motion of only about 90 degrees. By measuring a diagram with the pole on the left and then again with the pole on the right side of the tracer-arm and taking the mean reading, all instrumental errors are compensated. The pole is of improved pattern, combining the advantages of the pole-weight and needle-pole. The tracing point has also been improved upon: its construction can be clearly seen in the cut.



No. 4242.

4242. Compensating Planimeter like 4240, but with adjustable pole-arm . . . . . each. $47.50

The adjustable Pole Arm bears index marks for the different settings furnished with the instrument, and can be adjusted so that when the instrument is used with the pole inside of a figure, the constant is a round number, 20.000, for any setting. The instrument is used in the same way with the pole inside as with the pole outside, and by tracing the figure with the pole on the right and on the left of the tracer-arm and taking the mean reading, very large areas can be measured with great accuracy. The extensibility of the pole-arm and the great range of the tracer-arm permit of measuring very large figures with the pole outside. By reducing the length of the pole and tracer-arms, the instrument can be used on a very small space.



No 4246.

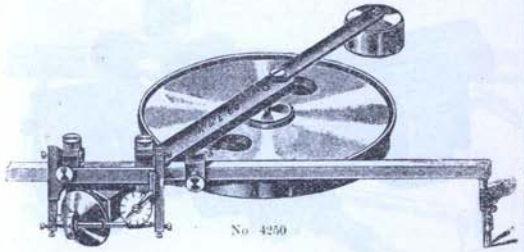
4246. Pantograph Polar Planimeter, German Silver, two adjustable tracer-arms with index marks for different ratios, clamp and slow motion screw to each tracer-arm, with needle-pole; in velvet linedm orocco Case, with Directions . . . . . each, $65 00

This Planimeter is especially adapted for measuring very large and very small figures. The long tracer-arm has a range covering a circle 88 in. diameter and is used for measuring large figures. It is adjusted to the required scale, and the figure is traced in the usual manner. During the operation the tracing point of the shorter tracer-arm had better be removed

The smaller tracer-arm is used for measuring very small figures. It is set to the proper index mark and the figure is traced by so guiding with the tracing point of the longer arm that the point of the smaller arm follows the outline. This is not at all difficult as the two tracing points travel nearly alike. The setting of the longer tracer-arm is in this case indifferent. The starting point is best taken at the tracer of the longer arm. The construction of the instrument is such, that, when the smaller tracing point is used, a greater travel of the measuring wheel for a given area is effected; consequently the value of the wheel unit is smaller and the result more accurate.

4248. **Testing Disc**, brass, with one engraved circle enclosing an area of exactly 4 square inches, with three pins to prevent slipping (see cut No 4230). . . . . each, $ 2 25

4249. **Testing Rule**, German Silver, with recesses giving radii of 1, 2, 3 and 4 inches from center-pin (similar to cut No. 4240) each, $ 1 50



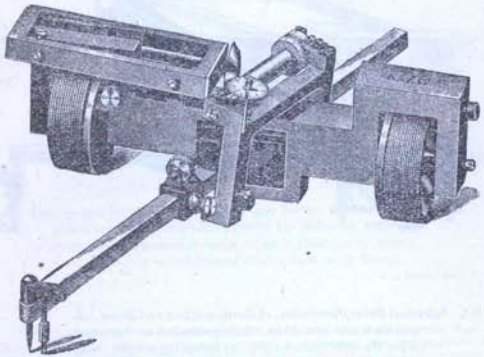
No 4250

Old No.

1105 4250. Spherical Polar Planimeter, of German Silver and Brass, adjustable tracer-arm 12 in., fully graduated as described under No. 4230, pole weight and balancing weight, with testing rule and table of settings for U. S. Standard and Metric measures, in polished Mahogany Case accomodating the instrument when set to any scale, and with Lock and Key, with Directions . . . . . each $85 00

This instrument revolves around the centre of the pole weight and is balanced by a counter-weight, so that only the pole weight and the tracer are in contact with the drawing. Consequently the results are not affected by irregularity of the paper. The measuring wheel is made to revolve by contact with a polished sphere segment, which derives its motion from the rotation of its axis rod against the finely toothed raised rim of the round base. The recording wheel registers up to 30 revolutions of the measuring wheel The construction of this instrument considerably increases the number of revolutions of the measuring wheel over a given space, thus making the value of the vernier units very much smaller than in the preceding instruments, which adds to the accuracy of the results.

ROLLING PLANIMETERS.



No. 4262.

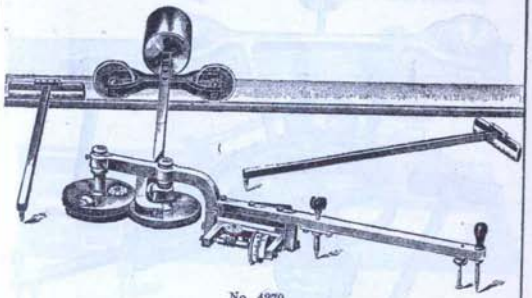
4260. Precision Rolling Planimeter of German Silver and Brass; adjustable tracer-arm, fully graduated, 8 inches long, with 8-inch telescoping extension piece, with Testing Rule and Table of Settings for U. S. Standard and Metric measures; morocco Case accomodating the instrument set to any ratio, and with Lock and Key; with Directions . . each $82 50

Old No. 1106

4262. Precision Rolling Planimeter like 4260, but larger, tracer-arm 12 inches long, telescoping extension piece 10 inches . 95 00

The Rolling Planimeter moves on two broad rollers; from one of which motion is imparted to the recording mechanism, which latter is essentially the same as in Planimeter No. 4260. The area of a figure of any length and the width of which does not exceed the length of the extended tracer-arm can be measured in one operation.

AMSLER'S MECHANICAL INTEGRATORS.



No. 4270.

4270. Amsler's Integrator, German Silver, with **two Recording Mechanisms** giving the **Area** and **Moment** of any figure; two tracing points, two gauges for adjusting instrument to axis of moments; grooved steel rail 29 inches; in Walnut Case, with Directions . . . . . each $115 00

4272.* Amsler's Integrator, like No. 4270, but Brass . . . . . " 90 00

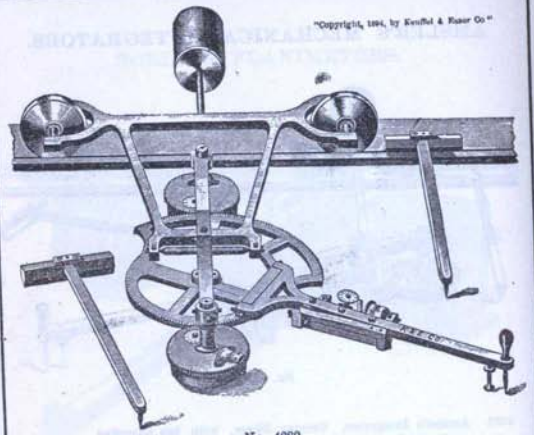
Integrators Nos. 4270 and 4272 give the area and moment of any figure by a simple mechanical operation. They are provided with two tracing points, for large and small figures. The one nearest to the centre of rotation of the instrument effects a greater travel of the measuring wheel; consequently the area value of the wheel unit is smaller and the result more accurate. Large figures can be measured in sections. Area and moment of figures drawn to scale can be easily obtained by means of a formula furnished with each instrument.

The range of the instrument is

Longitudinal	26 in.
Transverse	15 in.

Rails of other length furnished to order on short notice.

*** Integrators marked * are not carried in stock and are imported to order only.**



No. 4280.

Old No. 1108

4280. Amsler's Integrator, with **three Recording Mechanisms,** giving the **Area, Moment,** and **Moment of Inertia** of any figure: German Silver, two Tracing Points: two Gauges for adjusting instrument to axis of moments; instrument in Walnut Case: Grooved Steel Rail, 59 in., in separate Hardwood Case; with Directions . . . . . each $175 00

4282.* Amsler's Integrator, like No. 4280, but Brass . . . . . " 150 00

Integrators No. 4280 and 4282 are provided with a third train of recording wheels which renders the moment of inertia of the figure measured.

Their range is:

Longitudinal . . . . . 50 inches
Transverse . . . . . 13 "

4286.* Amsler's Integrator, like No. 4280, but **Extra Large,** German Silver, three Tracing Points, Grooved Steel Rail 78 in. each $280 00

4288.* Amsler's Integrator, like No. 4286, but Brass . . . . . " 230 00

Integrators No. 4286 and 4288 are practically the same instruments as No. 4280 and 4282, but built on a larger scale, so that they measure proportionately larger figures by one operation.

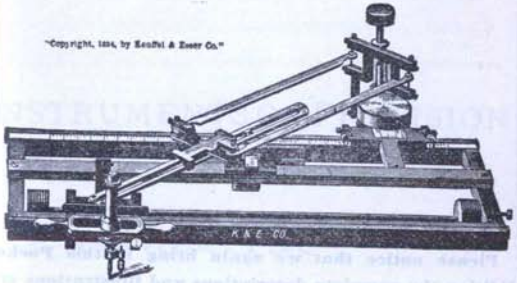
Their range is:

Longitudinal . . . . . 67 inches
Transverse . . . . . 26 "

Rails of other length furnished to order on short notice.

*** Integrators marked * are not carried in stock and are imported to order only.**

CORADI'S MECHANICAL INTEGRAPH.



No. 4295.

Old No. 1109

4295 Coradi's Mechanical Integraph, German Silver and Brass, with Swiveling Pen and Pencil Points, with Testing Rule, in Walnut Case with Lock and Key . . . . each $157 50

Like the Mechanical Integrators, the Integraph has proved in a comparatively very short time to be an aid of no small consideration to Civil and Mechanical Engineers and especially Naval Architects. The instrument enables them to compute the different moments, curves of stability, etc., etc., like with the Integrator, but in one way it is superior to the latter. **While it is necessary with the Integrator to compute the several curves point by point and to construct them by means of the computed points, the Integraph directly draws the curves on the paper,** thus giving a graphical representation of the integration. The operator traces the outline of the figure, i. e., the differential curve, and the pen or pencil point automatically draws the integral curve. The value of the ordinate of this integral curve can be measured off on the paper or read on a finely graduated bar. This value multiplied by the constant furnished with the instrument, gives the area of the figure. By regarding the new curve as the differential curve and tracing it in the same manner in which the first one was traced, the integral curve of the next higher order is drawn, the ordinate of which multiplied by the constant gives the moment of the original diagram. By repeating this operation, the moment of inertia, moments of the 4th, 5th, etc., order can be readily found. By this means practically all problems of stability, etc., may be solved almost entirely by mechanical operations, and much labor and brain work saved.

Please notice that we again bring in this Pocket Edition the complete descriptions and illustrations of

SURVEYING INSTRUMENTS

which were omitted from recent editions

KEUFFEL & ESSER CO. NEW YORK.

INSTRUMENTS OF PRECISION

FOR

Engineering

AND

Surveying.

DESIGNED AND MADE BY

KEUFFEL & ESSER CO.,

NEW YORK.

IMPROVED

SURVEYING INSTRUMENTS

MADE BY

KEUFFEL & ESSER CO.

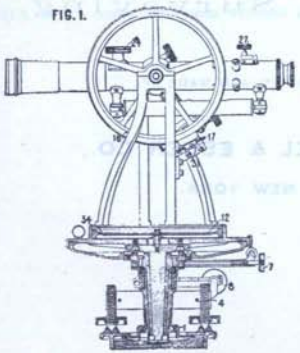
The Transits and Levels here described, exhibit in many important respects a thorough departure from all the styles of similar instruments of other makes. We have in many instances been able to still further elaborate and perfect the important improvements which we have originated, so that our instruments are now more accurate, more reliable and much stronger than any previously constructed. They embody the most perfected means for obtaining permanent delicacy and precision in their adjustments as well as accuracy in their graduated parts, while the quality of the materials employed and the workmanship are of the highest order.

The instruments described and illustrated in this Catalogue are our regular patterns, which we have in stock, but we are prepared to carry out, as far as feasible, any suggestions as to details of construction which the practical experience of our professional friends may lead them to desire.

GENERAL FEATURES.

The **outer** and **inner centres** are longer than those in the older style, to give stability and to allow the centre of gravity to be brought down as close as possible to the tripod head. They are made of anti-friction metals, to allow of their moving upon each other with the least possible wear, and thus enable the instrument to revolve on its axis both freely and smoothly. These centres are also better protected than those of any other style, on account of our original, patented construction of the lower or leveling part.

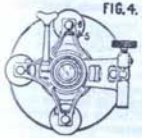
FIG. 1.



The **Half-ball Joint** on our Transits, Fig. 1, 1, instead of being attached, as is usual, to the outer centre, forms part of a false sleeve or collar, the upper part of which is screwed to the outer centre shouldering on the leveling arms. Between the lower part of the two, there is a small annular space, so that a shock which the instrument may receive from a fall, or otherwise, would be broken by the sleeve of the ball joint, thus protecting the centres.

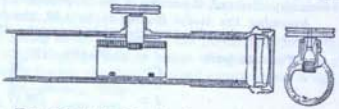
The **4 Leveling Arms**, Fig. 1, 4 and Fig. 4 are so constructed, that if any of them should be bent by a shock or strained by the leveling screws, the delicately fitted centres would not be in any way affected or injured. The leveling arms have the advantage over the solid plate, that they afford more room for manipulating the screws. The arms, Fig. 4, which receive the leveling screws, are slotted and can be adjusted by means of set screws, Fig. 4, 5, so that the friction may be made uniform under all conditions of wear and temperature. This arrangement dispenses with the dust-caps.

FIG. 4.



The **Clamps** for the limb and centre, Fig. 1, clamp absolutely and without injuring the parts. Each one is provided with an improved micrometer tangent screw, Fig 1, 8 and Fig. 4, permitting of very fine adjustment of the plates. These screws are made of German silver, almost as hard as steel. The threads are cut on a special lathe with precision screw, thus securing a very accurate and durable thread. The heads of the clamp screws and their tangent screws are so placed that they are easily accessible, but still well protected and out of the way. On our Engineer's Levels they are attached to the bar, so that they revolve with it, and are always in the same relative position.

The **Telescope** lenses are of the best optical glass, made specially for this purpose. The objective is focused by a patented contrivance, consisting of a rack movement with a compensating spring, which takes up all lost motion, and a pinion with anti-friction mounting, thus insuring easy and *accurate* motion, without binding. The slide of the objective is extra long and can be extended very far to permit of focusing on very near points.



The eyepiece is focused by a patent lever, Fig. 1, 27, and Fig. 9 which is a simple and ingenious improvement, delicate and positive in action, and allows of very nice adjusting, thus overcoming the objectionable features of the ordinary rack and pinion or of the spiral motion. The milled heads for focusing the objective and ocular are placed on top of the telescope, Fig 1, 24 and 27, to make them conveniently accessible for either hand.

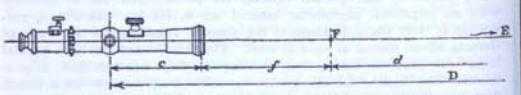
FIG. 9.

The **Magnifying Power** of the telescopes of our surveying instruments is carefully adapted to their purpose and is as great as is compatible with proper field and definition. With increase of the magnifying power of the telescope the size of the field of vision and the illumination must necessarily proportionately decrease. Consequently to obtain the best performance of a telescope, it must be only of such power as its purposes demand, and this limit should not be exceeded unnecessarily at the expense of field and light *and resultant definition.*

The **Level Vials** are of Jena glass made especially for this purpose. They are ground to a true curve and contain a very light fluid which will not form a sediment. Each bubble is carefully tested before it is placed into the instrument. The telescope bubbles are longer than those usually employed and all bubbles are graduated on the glass and are very sensitive, in keeping with the high grade of the instruments. The sensitiveness of each level vial is marked on it in seconds of arc per graduation.

It should be borne in mind that the accuracy of the results obtainable, if the instrument be otherwise well made, depends on the sensitiveness of the bubbles, and that the results can not be accurate if the bubbles do not readily respond to the slightest change in adjustment. Coarse and sluggish bubbles are readily brought into **apparent** adjustment, but the actual results obtained with them are very uncertain. Even when fine and sensitive bubbles seem to be a "little out" the actual results obtained are far better than those with sluggish bubbles which **seem** to indicate perfect adjustment.

STADIA MEASURING.



The **Stadia Hairs** in our Transits are adjusted to intercept one foot on a rod at a distance of 100 feet. As the image of the crosshairs is optically projected beyond the objective to the extent of the focal length of the latter, the rays converge at that point and measurements must be taken from there. Therefore in order to obtain accurate results, a constant must be added to each stadia reading. This constant is the focal length of the objective f, plus the distance between objective and the centre of the instrument c (see cut). Example:

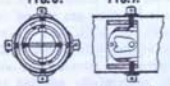
Assuming the stadia reading to be 1.37, the focal length f .62, and the distance from objective to centre of instrument c .45

Then we have	$d =$ (1.37x100)	137.
	$f =$	.62
	$c =$	.45
	$d =$	138.07

The distance f remains constant for each instrument. The distance c is practically constant for all distances over about 50 feet. For inclined sights, correction must be made to obtain the horizontal distance.

For some kinds of work **Adjustable Stadia Hairs** are considered preferable. We can furnish such of most superior construction, as shown in the cuts No. 6 and 7.

FIG. 6. FIG. 7.



By this method of construction the stadia hairs and cross-hairs can each be adjusted independently of and without disturbing the other, and with the greatest nicety, while the jaws, when set, will maintain their adjustment.

The **Gradienter Screw** is used for determining grades, measuring horizontal distances and differences of level and for computing vertical angles on sloping as well as level ground. It is an adaptation of the ordinary clamp and tangent screw. The silvered edge of the head is generally divided into 100 parts and the pitch of the screw and the length of the clamp arm are so determined, that one complete revolution of the micrometer head raises or lowers the line of sight of the telescope 1 foot vertically in a horizontal distance of 100 feet. A small graduated bar indicates the number of complete revolutions of the Gradienter screw.

TRANSITS.

Our Transits are much stronger in all their parts and more rigid than the older style, although they weigh from 20 to 25 per cent. less, owing to the substitution of ribs and braces for heavy castings, and also to their improved construction.

The **Lower Plate** is a substantial ribbed casting, which has on its upper surface the **horizontal limb.** The graduations on the horizontal limb, the vertical arcs and limbs and on the compass ring of all our Transits are on solid silver.

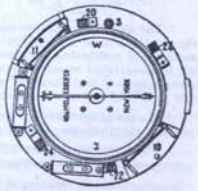
The **Verniers** are placed at 45 degrees with the telescope, without decreasing the firmness of the standards, owing to our improved and patented construction. The two opposite verniers each read both right and left and are protected by glasses and provided with hinged metal shades, Fig. 3, 19 and 21, which protect the vernier glasses and serve as reflectors to facilitate the reading of the divisions, as they are lined with a white material.

FIG. 5.

The **Compass Circle** is beveled towards the centre, graduated to half degrees and numbered in quadrants from 0 to 90, the graduations being on solid silver on the beveled rim. The needle is bent upwards at the ends, Fig. 1, 34, as this permits of closer reading. It has an agate centre, is made heavier near the points than at the middle, and is more sensitive than any edge-bar or flat needle can be, as this shape holds the magnetism better. The milled head, Fig. 3, 3, for raising and lowering it, is small and so placed as to be as much as possible out of the way. The socket which holds the pivot upon which the needle swings, can be unscrewed in case of accident to the pivot, and the latter can be replaced by any good sewing needle which fits the hole, Fig. 5.

The mechanism for **setting off the variation** of the needle has been much improved, the compass ring being operated by means of a pinion. The shaft of this pinion extends above the top plate and its small capstan-head is operated by an adjusting pin (lever). This means of adjustment is much more delicate than the old style milled thumbnut, is less liable to be disturbed and permits of protecting it from rain and dust. The accurate setting-off of the variation is determined by a graduated arc on the face of the compass plate in conjunction with a vernier on the vertical part of the compass ring.

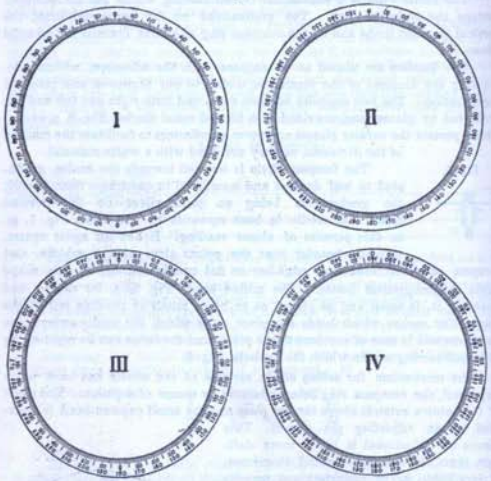
FIG. 8.



The **Standards** are well spread and their feet are placed close to the compass box where the top plate is strongest and offers the most substantial support, thus insuring the telescope being perfectly steady and free from vibration. They are twisted, which considerably increases their rigidity and resistance.

The **Vertical Limb**, which is reinforced at the back, is divided on its surface, but not up to its edge as usual, Fig. 1, 16, as the least shock would impair the graduations and render accurate readings impossible. The beveled vernier is hinged on adjustable pivots, Fig. 1, 17, so that it can be lifted off the graduations to prevent wear, Fig. 1, 31, while pointing the telescope.

Numbering of Limbs.



The above illustrations show some of the various methods of numbering the graduations of the horizontal and vertical limbs of transits. Unless other methods of numbering are specified in the order, *we furnish our transits with the horizontal limb numbered double: from 0 to 360° and in quadrants, like cut III, and the vertical limb numbered in quadrants like cut I*, which is the most generally preferred and most practical mode of numbering.

We are prepared to furnish to order also transits with graduations of 100 parts to the quadrant (the so-called decimal division of the circle).

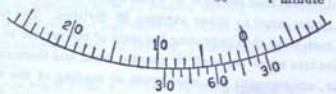
The following are the different methods of graduating the circle with the corresponding vernier readings:

Divisions of Circle.	Reading of Vernier.	Divisions of Circle.		Divisions of Vernier
Degrees,	5 minutes,	11	=	12
Half degrees,	Single minutes,	29	=	30
20 minutes,	30 seconds,	39	=	40
20 "	20 "	59	=	60
10 "	10 "	59	=	60

GRADUATIONS.

Correct and distinct graduations of the limbs and well-combined verniers are of great importance in all surveying instruments. The following illustrations represent the different styles adopted by us for our Transits and Builder's Levels; they will be found convenient in arrangement and easy to read. They are in detail as follows:

Style.	Reading of the Limb.	Divisions of the Limb.	=	Divisions of the Vernier	Reading of the Vernier.	Kind of Vernier.
A.	Degrees	11	=	12	5 minutes	Folded.
B.	30 minutes	29	=	30	1 "	Direct.
C.	20 "	39	=	40	30 seconds	"
D.	20 "	59	=	60	20 "	Folded.
E.	30 "	29	=	30	1 minute	"



Style *A*

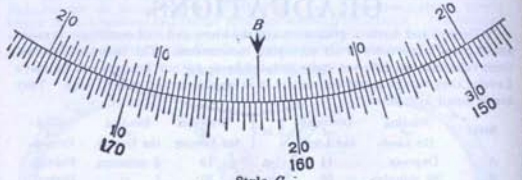
The above figure represents the method of graduating the horizontal circle of our Architect's or Builder's Levels, with the corresponding vernier. This vernier, which is a **folded vernier**, reads from the centre 60 (sometimes also marked 0 or ⅄) either way, according to the direction in which the circle is figured and read, to the 30 division, and if no coinciding lines be found, the reading is continued from the other 30 division to the centre. The circle is divided into single degrees, and as the vernier comprises 12 divisions, the least count or readit.g of the vernier is 60 minutes ÷ 12 = 5 minutes.

The figure reads 3° 00′ + 40′ = 3° 40′ from right to left.

Style *B*

Style *B* represents the usual graduation of the horizontal limb of an Engineer's Transit with its vernier. This is an ordinary **double direct vernier**, reading from the centre only, to each extreme 30 division. it is in fact two single verniers, that scale being used in which the direction of the numbering corresponds to the direction in which the limb is numbered and read. The limb is divided into half-degrees, and the vernier (from zero to 30) comprises 30 divisions, therefore the least count or reading of the vernier is 30 minutes ÷ 30 = single minutes.

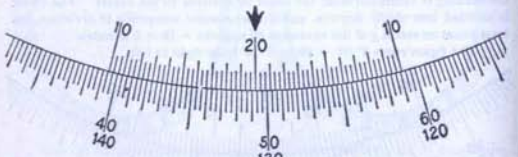
The figure reads 27° 00′ + 25′ = 27° 25′ from left to right, and 152° 30′ + 05′ = 152° 35′ from right to left.



Style *C*.

This style represents the graduation and vernier of an Engineer's Transit, having finer divisions than the style *B*. This also is a **double direct vernier**, reading from the centre arrow to either extreme 20 division. The horizontal limb is numbered both ways thus indicating the scale of the vernier to be used. The limb is divided into equal parts of 20 minutes each, and there are 40 divisions in the vernier, consequently the least count or reading of the vernier is 1200 seconds ÷ 40 = 30 seconds.

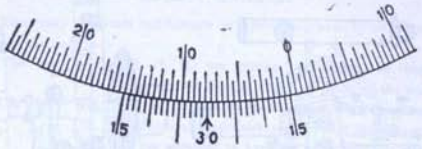
The illustration reads 17° 40′ + 12′ 30″ = 17° 52′ 30″ from left to right, and 162° 00′ + 7′ 30″ = 162° 7′ 30″ from right to left.



Style *D*.

This is part of the horizontal limb with the vernier of an Engineer's Transit, having still finer divisions than those of style *C*. This vernier is a **folded** one like style *A*, reading from the centre indicated by the arrow, to either of the extreme 10 division, and then forward in the same direction from the other 10 division to the centre division 20, the direction being determined by the figuring and reading of the limb. The limb is divided to 20 minutes, whilst the vernier is composed of 60 equal parts, consequently the least count or reading of the vernier is 1200 seconds ÷ 60 = 20 seconds.

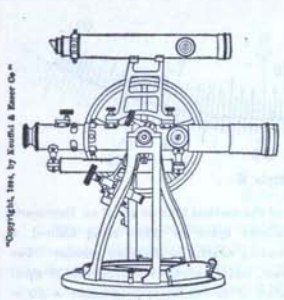
The figure reads 49° 00′ + 14′ 20″ = 49° 14′ 20″ from left to right, and 130° 40′ + 5′ 40″ = 130° 45′ 40″ from right to left.



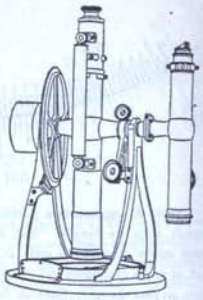
Style *E*

Style *E*. represents a portion of the vertical limb or arc of an Engineer's Transit with its vernier. The available space in these being limited, a **folded vernier** is used like style *D*, reading exactly in the same manner. The limb or arc is graduated to half degrees, and the vernier is divided into 30 equal parts, so that the least count or reading of the vernier is 30 minutes ÷ 30 = single minutes.

The figure reads 7° 30′ + 21′ = 7° 51′ from right to left.



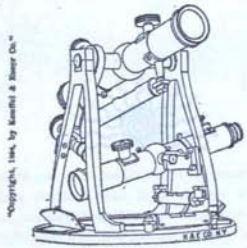
Style *A*.



Style *B*.

We here illustrate two devices, which we make to order, for applying a second (vertical sighting) telescope to a transit. These telescopes and that part of their supports which admits of it, are of aluminum, to reduce their weight and keep the instrument well balanced. In both styles the second telescope has an inverting eyepiece with prism.

The Solar Attachment, described on page 338, is also a very efficient and practical contrivance for vertical sighting.



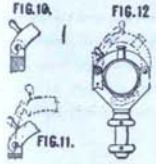
Style *C*.

This cut represents one of our transits with a second telescope at right angle to the other. It can be applied only to our transits with symmetrical standards and can be easily removed when not wanted. (For prices for these second telescopes see page 361).

LEVELS.

These very important instruments have been improved by us to a similar extent as the transits

The Y's, (see fig. 10, 11, 12) are strong and have an improved patented locking device in place of the unsightly and unreliable pin bolts. They are provided with an improved stop so that the telescope can be adjusted to have the cross-hairs truly vertical and horizontal



The bar is a ribbed casting of the most rigid construction, being wide and deep at the middle and diminishing towards the Y's.

There are, besides these important features, many minor improvements, which require no special description.

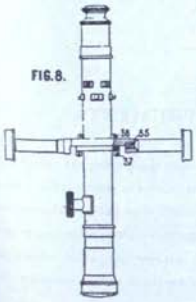
Most of the above improvements are covered by the following Patents:

December 3, 1889, August 12, 1890, October 13, 1891, October 13, 1891, July 19, 1892.

CONVERTIBLE ARCHITECTS' LEVELS.

(See page 331.)

Our **Convertible Architect's Levels**, through our patented arrangement, can be used also for sighting objects above or below the horizontal plane. At the middle of the telescope is a (third) collar with a threaded socket at each side, into which strong trunions can be screwed, to form a rigid axle, at right angles to the telescope The further ends of the trunions have bearing surfaces which fit into the Y's and can be clamped there, like the collars of the telescope. When they rest in the Y's, the telescope can be moved in altitude, so that vertical lines may be determined, as also horizontal angles between two points not in the same plane. Architects and Builders will find this addition a very useful one and well worth the extra cost. When the instrument is being used as a Level, the trunions are removed and placed in special receptacles in the box, so that the operator is not encumbered with them.



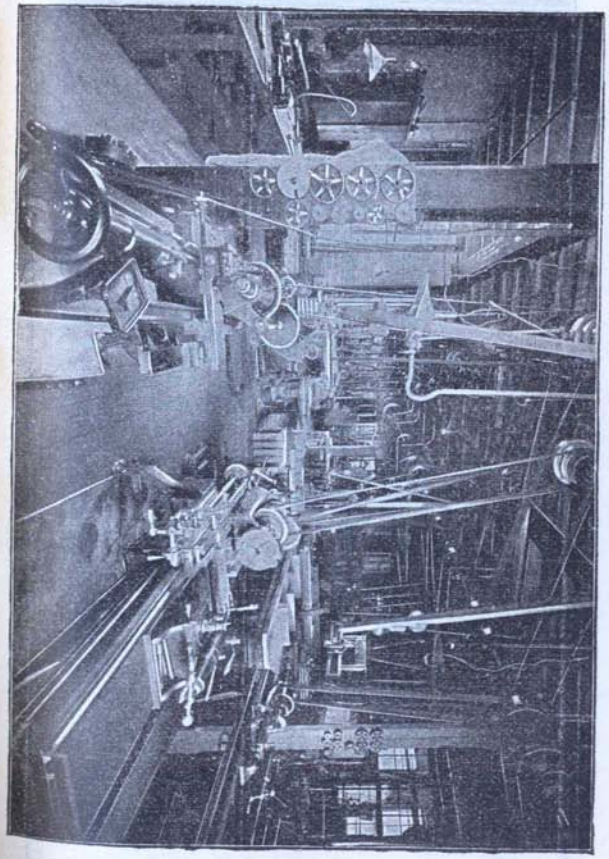
THREE LEVELING SCREWS.

We have again improved the arrangement for leveling with three screws and have found means of dispensing with the usual cumbersome construction, by substituting an extremely simple and efficient device without loose parts. By this, the three-screw transits have shifting centres and they, as well as levels, can be mounted on the tripod as readily as the instruments with four screws. (See cut on page 328.)

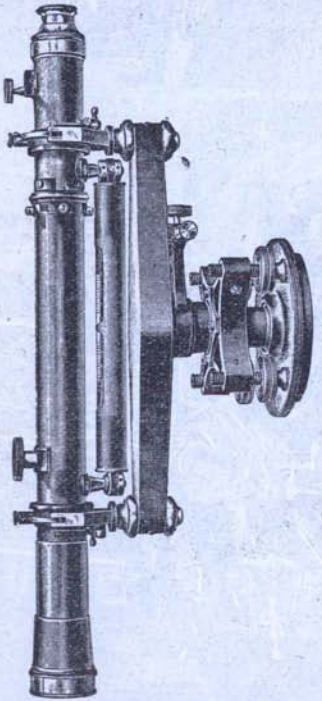
The above instruments are of the highest grade in every respect and of the utmost precision. They have all our patented improvements, and we consider them the best made. Besides these instruments we make another series, described on pages 354 etc. These instruments are also of fine quality and workmanship, and, while they do not have all our latest improvements, they will compare favorably in precision and durability with most other makes of instruments.

SHIPPING OF INSTRUMENTS.

We ship our instruments by express without designating the contents on the cases and our uniform experience is that they arrive in good condition when so shipped, but we do not assume any responsibility after having delivered the instrument to the express company. If the instruments are designated as such on the boxes and their value is declared, the express companies assume the responsibility for the declared value and for breakage in consideration of a higher rate



HEAVY MACHINERY LOFT, FACTORY.



No. 5010.

(For Description see page 826.)

(No. 5013 is the same instrument, but with three leveling screws.)

ENGINEER'S
SMALL Y LEVEL.

(See also general description, page 823 &c.)

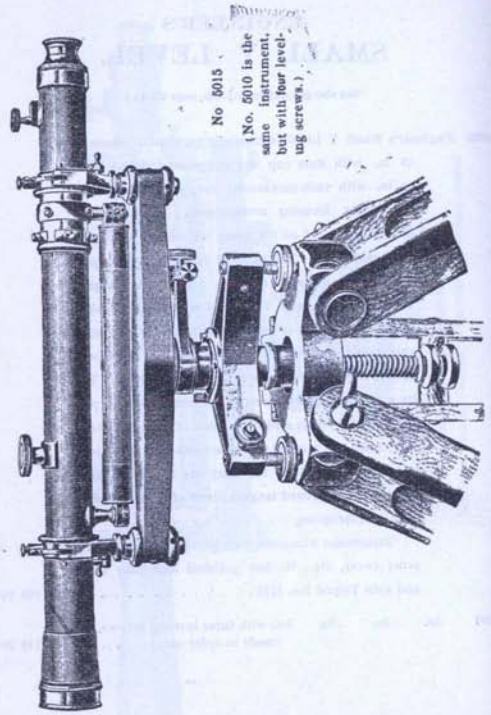
5005. Engineer's Small Y Level, achromatic terrestrial telescope 15 in. with dust cap and sun shade, object-glass 1¼ in. with rack-movement, eyepiece with patent micrometer focusing arrangement. Fine sensitive bubble graduated on the glass, adjustable vertically and horizontally. The bar is of gunmetal and shaped to combine greatest strength with least weight. The telescope rests in Y's, one of which is adjustable for altitude; they are provided with improved adjustable stops for so placing the telescope, that the cross-hairs are vertical and horizontal. It is locked in the Y's by a patented arrangement dispensing with the pin bolts. The leveling screws are made of German silver The clamp and tangent screws are attached to the bar and revolve with it, so that they are always equally accessible. Improved tangent screw of German silver with counter-spring.

Instrument complete, with adjusting pins, water proof cover, etc., in fine polished Mahogany Box and with Tripod No. 5175. . . . . each $ 100 00

5007 do. do. do. but with three leveling screws, (made to order only). . . 110 00

For Architect's Levels see pages 349, etc.

We have the best facilities for repairing Surveying Instruments of any make.



No 5015 (No. 5010 is the same instrument, but with four leveling screws.)

ENGINEER'S Y LEVEL.

(See also general description, page 323 &c.)

5010 Engineer's Y Level (see cut page 326), achromatic terrestrial telescope, 18 in. with dust cap and sun shade, object-glass 1¾ in. with improved rack-movement, eyepiece with patent micrometer focusing arrangement. Fine, sensitive bubble graduated on the glass, adjustable vertically and horizontally. The bar is of gunmetal and shaped to combine greatest strength with least weight. The telescope rests in Y's, one of which is adjustable for altitude. They are also provided with improved adjustable stops for so placing the telescope that the cross-hairs are vertical and horizontal. It is locked in the Y's by a patented arrangement dispensing with the pin bolts. The leveling screws are made of German silver. The clamp and tangent screws are attached to the bar and revolve with it, so that they are always equally accessible. Improved tangent screw of German silver, with counter-spring.

Instrument complete, with adjusting pins, waterproof cover, etc., in fine polished Mahogany Box and with Tripod No. 5175 . . . . . $ 130 00

5012. Y Level, like No. 5010, but telescope 20 in. 135 00

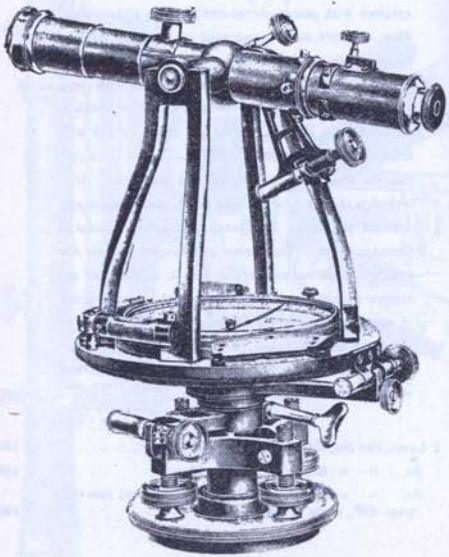
5013. do. " " 5010, " " 22 " 140 00

5015. do. " " 5010, " with 3 leveling screws (see cut, page 328), made to order only 140 00

For Railroad Level see page 354.

For Attachments and Parts see pages 360, 361.

ENGINEER'S TRANSITS.



No. 5030 X.

KEUFFEL & ESSER CO. NEW YORK.

ENGINEER'S TRANSITS.

PLAIN.

The transits here described, to which the general description page 314 etc. also refers, are the styles which we keep in stock. When other styles are wanted they must be made to order

5030 X. Engineer's Transit (for repeating angles) with achromatic terrestrial telescope 10¾ in., object glass 1 7/16 in., with dust cap and sun shade, improved rack-movement, eyepiece with patent micrometer focusing arrangement and stadia hairs. Compass ring graduated on inlaid silver, and face of plate coated with a permanent white material. Improved needle about 4½ in., horizontal limb 6 in., graduated to half degrees and numbered like fig. III, page 318; two verniers at 45° with telescope, reading to one minute with hinged reflectors lined white. Two fine graduated bubbles to horizontal limb. All leveling and tangent screws are of German silver, tangent screws of improved pattern with counter spring. The centres are extra long and of different kinds of metal, to reduce friction. Shifting centre.

Instrument complete, with plumb bob, adjusting pins, waterproof cover etc., packed in fine polished Mahogany Box and with Tripod No. 5175 . . . . . $ 185 00

5032 X. Engineer's Transit, like No. 5030 X, but telescope 11½ in., needle about 5 in., horizontal limb 6½ in. Instrument complete, with Tripod, etc. 190 00

The above instruments with three leveling screws, (made to order only) . . . . . extra 10 00

do do. do. telescope with inverting eyepiece (astronomical telescope), made to order withqut extra charge

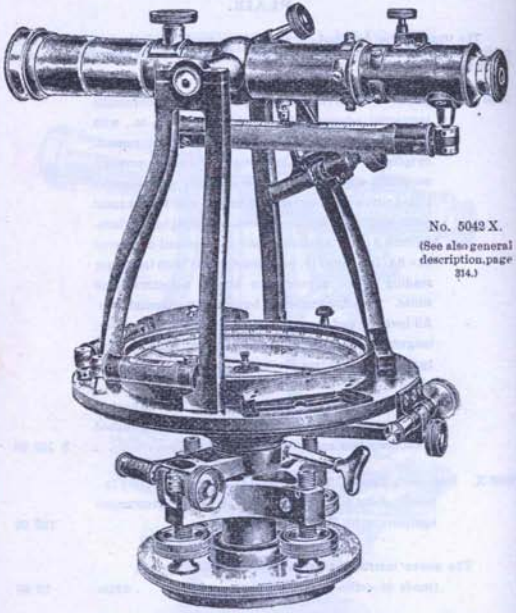
For Railroad Transit see page 357.

We have the best facilities for repairing Surveying Instruments of any make.

KEUFFEL & ESSER CO. NEW YORK.

ENGINEER'S TRANSITS

WITH BUBBLE TO TELESCOPE.



No. 5042 X.

(See also general description, page 314.)

5040 X. Engineer's Transit, as described under No. 5030 X, (page 331), but with fine bubble to telescope, graduated on the glass, clamp and tangent screws of improved pattern with counter-spring, needle about 4½ in., horizontal limb 6 in. Instrument complete, with Tripod No. 5175, etc. . . . . $ 205 00

5042 X. Engineer's Transit, like No. 5040 X, but telescope 11½ in., needle about 5 in., horizontal limb 6½ in. Instrument complete, with Tripod, etc. . . . . $ 210 00

The above instruments with three leveling screws, (made to order only) extra . . . . . $ 10 00

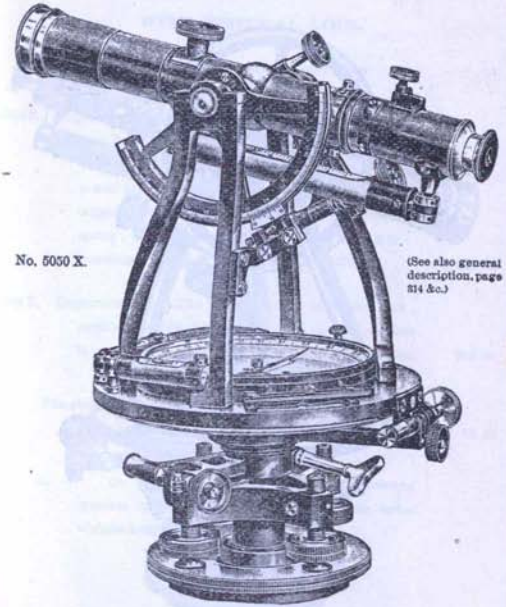
do. do. do. but telescope with inverting eyepiece (astronomical telescope) made to order without additional charge.

For Attachments and Parts see pages 360, 361.

KEUFFEL & ESSER CO. NEW YORK.

ENGINEER'S TRANSITS

WITH VERTICAL ARC.



No. 5050 X.

(See also general description, page 314 &c.)

5050 X. Engineer's Transit, as described under No. 5030 X, (page 331), but with fine bubble to telescope graduated on the glass, arc 5 in. diameter, graduated on silver to half degrees, reading to one minute, with clamp and tangent screws of improved pattern, with counter-spring; needle about 4½ in., horizontal limb 6 in. Instrument complete, with Tripod No. 5175, etc. . . . . $ 220 00

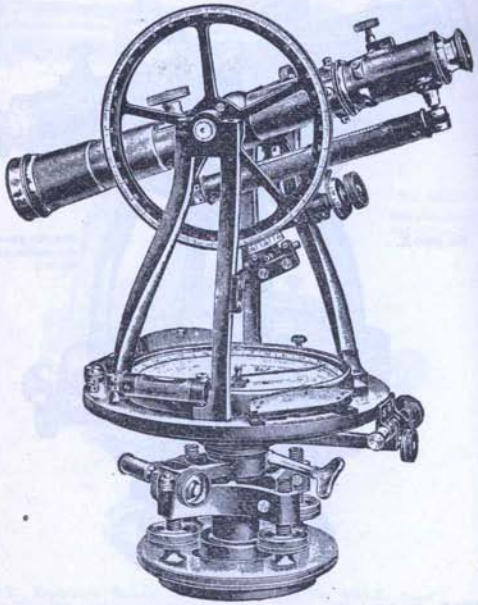
5052 X. Engineer's Transit, like No. 5050 X, but telescope 11½ in. needle about 5 in., horizontal limb 6½ in., arc 5½ in. diameter. Instrument complete, with Tripod etc. 225 00

The above instruments with three leveling screws, (made to order), extra 10 00

do. do. telescope with inverting eyepiece (astronomical telescope), made to order without additional charge.

For Attachments and Parts see pages 360, 361.

ENGINEER'S TRANSITS.



No. 5062 X, but with Gradienter

ENGINEER'S TRANSITS

WITH VERTICAL LIMB.

(See also general description, page 314 &c.)

5060 X. Engineer's Transit, as described under No. 5030 X, but with fine bubble to telescope graduated on the glass, vertical limb 5 in. diameter, graduated on Silver to half degrees, reading to one minute, with clamp and tangent screws of improved pattern with counter-spring, needle about 4½ in., horizontal limb 6 in. Instrument complete, with Tripod No. 5175, etc. $ 235 00

5062 X. Engineer's Transit, like No 5060 X, but telescope 11½ in., needle about 5 in., horizontal limb 6½ in., vertical limb 5½ in. diameter. Instrument complete, with Tripod etc 240 00

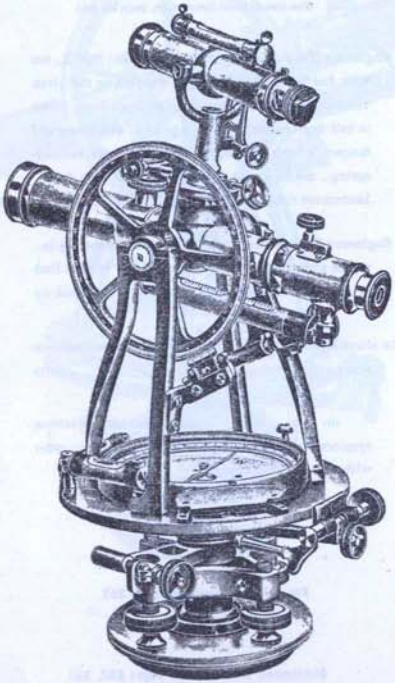
The above instruments with three leveling screws, (made to order only) . . . . . extra 10 00

do do do telescope with inverting eyepiece (astronomical telescope), made to order without additional charge.

For Railroad Transit see page 357.

Attachments and Parts see pages 360, 361

LIGHT, MOUNTAIN AND MINING TRANSITS.



No. 5076 X. but with Solar Attachment No 5090

LIGHT MOUNTAIN AND MINING TRANSITS.

(See also general description, page 314, &c.)

5072 X Light Mountain and Mining Transit (for repeating angles) with achromatic terrestrial telescope 9 in., object glass 1¼ in., dust cap and sun shade, with improved rack-movement, eyepiece with patent micrometer focusing arrangement and stadia hairs. Fine **bubble to telescope** graduated on the glass, clamp and tangent screws of improved pattern with counter-springs. Compass ring graduated on inlaid silver and face of plate coated with a permanent white material. Improved needle about 4 in., horizontal limb 5½ in. graduated to half degrees, numbered like fig III, page 318, two verniers at 45° with telescope reading to one minute with hinged reflectors lined white Two fine graduated bubbles to horizontal limb All leveling and tangent screws of German silver, tangent screws of improved pattern with counter-springs. The centres are extra long and of different kinds of metal to reduce friction. Shifting centre

Instrument complete, with plumb bob, adjusting pins, waterproof cover, etc., packed in fine polished Mahogany Box, and with Tripod No. 5175 . . . . . $ 190 00

5074 X. Light Mountain and Mining Transit, like No. 5072 X, but with **vertical arc** 4½ in. diameter, divided on silver to half degrees, reading to 1 minute. Instrument complete, with Tripod, etc. 205 00

5076 X Light Mountain and Mining Transit, like No. 5072 X, but with **vertical limb** 4½ in. diameter divided on silver to half degrees, reading to 1 minute. Instrument complete, with Tripod, etc. 220 00

The above instruments with three leveling screws, (made to order only) . . . . . extra 10 00

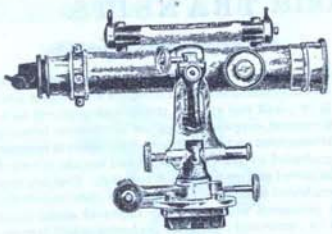
do do do telescope with inverting eyepiece (astronomical telescope) made to order without additional charge.

For Expedition Transit see page 341.

For Locating Transit see page 359.

For Attachments and Parts see page 360, &c.

SOLAR ATTACHMENT.



No. 5090.

(See also cut No. 5076 X, page 836.)

5090. Solar Attachment, Bronze and Aluminum, cloth finished standard, prism to eyepiece, (price includes mounting, if ordered with new instrument) . . . . . each $ 50 00

The above is a very simple and accurate Solar Attachment. The astronomical meridian, the latitude and time may be obtained with this Solar attachment with great accuracy by a simple operation as explained in the following. When attached to a transit it **serves also as a vertical sighting telescope,** making a valuable addition for mine work, etc.

It consists of a small telescope with prism to eyepiece, mounted in a Y shaped standard which revolves upon a vertical axis attachable to the telescope of the transit. This small telescope, called the solar telescope, is capable of rotation in altitude and azimuth, slow motion being imparted to it in either sense by means of tangent screws. The vertical axis, called the polar axis, can be inclined to correspond with the axis of the earth's rotation by inclining the transit telescope, to which it is attached, the vertical circle giving the inclination. A level which surmounts the solar telescope is provided with two pointers, so placed that when the shadow of one of them falls upon the other, the sun will be in the field of view.

DIRECTIONS FOR DETERMINING THE MERIDIAN.

1. Incline the transit telescope until the angle of declination, corrected for refraction, is indicated by the vertical limb or arc, depressing the telescope if the sun's declination is north, and elevating it if it is south. See Fig. 1.

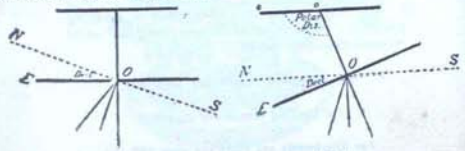


Fig 1 Fig 2

2. Bring the solar telescope into the vertical plane of the transit telescope, (without disturbing the position of the latter) and also to a horizontal position by means of its level. The two telescopes will now enclose an angle equal to the amount of the declination. See Fig. 2.

3. Without disturbing the relative positions of the two telescopes, elevate the transit telescope (and with it the solar) until the amount of the co-latitude is indicated by the vernier of the vertical limb. See Fig. 3.

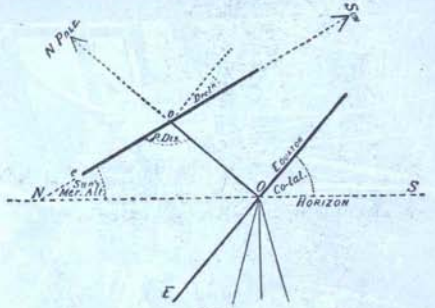


Fig. 3.

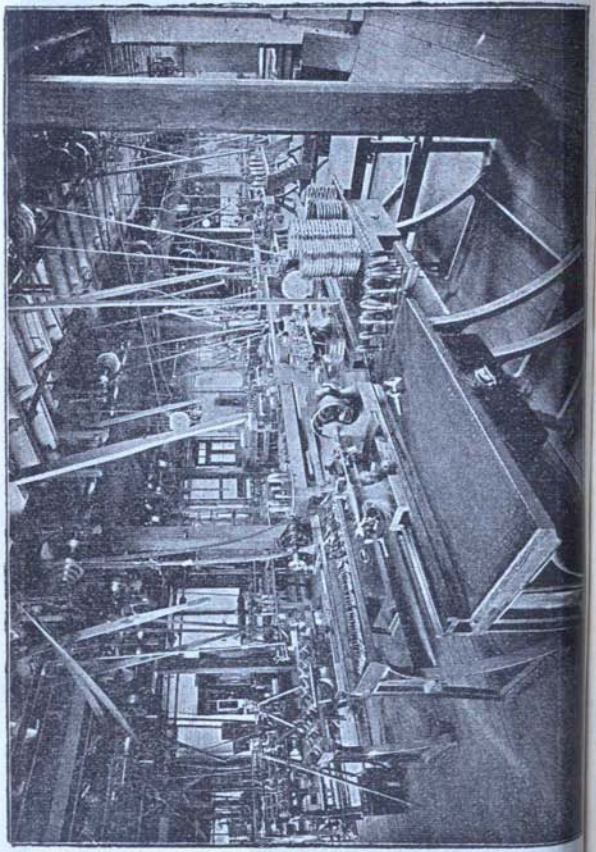
4. Revolve the two telescopes together upon their respective vertical axes until the image of the sun is brought into the field of the solar telescope; when the sun is accurately bisected the transit telescope will be in the meridian and the compass needle will indicate the amount of its declination at the place of observation. It will of course considerably facilitate this last operation if, before commencing to revolve the two telescopes, the transit one is approximately pointed toward the south by means of the transit compass needle.

DIRECTIONS FOR ASCERTAINING THE LATITUDE.

Direct the transit telescope towards the south, incline it to an amount equal to the sun's meridian declination uncorrected for refraction, depressing the telescope if the declination is north and elevating it if it is south. Now bring the solar telescope into the vertical plane of the transit telescope and to a perfectly horizontal position by means of its level, then clamp it. A few minutes before noon (the moment of the sun's culmination) bring the sun's image between the two horizontal wires of the solar telescope by moving *only the transit telescope* in altitude and azimuth. By means of the tangent screws of the transit, keep the sun, as it continues to rise and travel southwards, in this position relatively to the cross hairs of the solar telescope. When it has ceased to rise, take the reading of the vertical arc of the transit, deduct from it the refraction due to this altitude, and the remainder is the co-latitude, which deducted from 90° gives the latitude The position of the two telescopes is identical with that shown in Fig. 3.

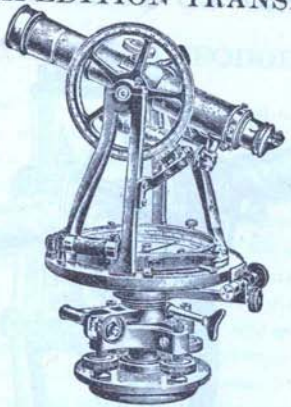
OBSERVATION FOR TIME.

Having brought the two telescopes into their final positions for determining the meridian, that is the transit one in the meridian and the solar telescope bisecting the sun revolve them both upon their *horizontal* axis, without disturbing the vertical axis, until they are both perfectly level. The angle formed by their respective lines of sight, which can be determined by sighting with the two telescopes upon any clearly defined distant object, and taking the difference of the respective readings of the transit horizontal limb, is the hour angle. This is then reduced to time before or after apparent noon: 1 degree of arc = 4 minutes of time and 1 minute of arc = 4 seconds of time The time obtained by such an observation is reliable to a few seconds.



PRECISION LATHES, EAST WING, FACTORY.

EXPEDITION TRANSIT.



No. 5079 X.

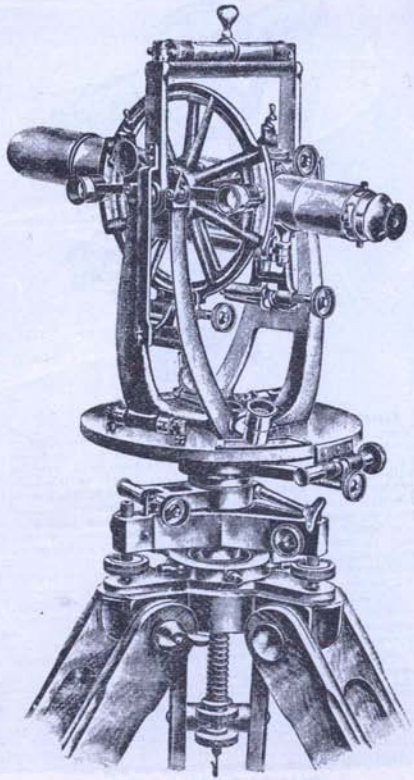
5079 X. **Expedition Transit** (for repeating angles), similar to our Light Mountain Transit No. 5076 X (page 337). The astronomical (inverting) telescope is 6¼ in. with dust cap and sun shade, object-glass ¾ in. with improved rack-movement, eyepiece with spiral focusing arrangement. Fine bubble to telescope, graduated on the glass. Compass ring graduated on inlaid silver face of plate coated with a permanent white material; variation plate to compass. Improved needle 2¾ in., horizontal limb 4 in., graduated to half degrees, two verniers at 45° with telescope, reading to 1 minute, with hinged reflectors lined white. Two fine graduated bubbles to horizontal limb, shifting centre. Vertical limb 3 in. diameter, divided on silver to half degrees, hinged vernier reading to 1 minute.

Instrument complete, with plumb bob, adjusting pins, waterproof cover, etc., in fine polished mahogany Box, and with patent extension tripod, like No. 5180, page 363 . . . . . $220 00
Sole-leather sling case with shoulder straps, for transit . . 5 00
do. skeleton sling case with shoulder straps, for tripod, 3 00

The Expedition Transit is of the same grade and quality as our finest Engineer's transits and of corresponding accuracy. It is about 8 inches high, the outer diameter of the horizontal limb is 4½ inches and its mahogany box measures about 9¾ x 7 x 5¼ in. outside. The complete transit weighs about 4 pounds. The tripod, the legs of which can be extended to 59 inches, is of the pattern of our patent extension tripods No. 5180, and weighs about 3½ pounds. With the sole-leather sling cases for transit and tripod, this makes the most portable *accurate* instrument for the many occasions where the combination of these features is of value.

For Mountain and Mining Transits see page 337.
For Locating Transit see page 359.

IMPROVED THEODOLITE.



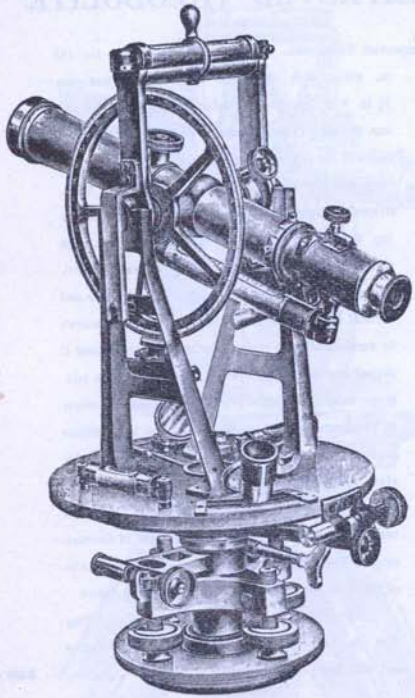
No. 5080.

IMPROVED THEODOLITE.

5080. Improved Theodolite, achromatic telescope 11½ in. (14 in. when with terrestrial eyepiece), object-glass 1¾ in. with improved focusing arrangement and two sun shades. Two eyepieces, one terrestrial (erecting) and one astronomical (inverting). Fine graduated reversible bubble to telescope, vertical limb 5½ in. divided on silver to 20 minutes, with two verniers reading to 20 seconds, mounted microscope to each vernier, vertical limb protected by a metal guard. Improved clamp and tangent screws to telescope and vertical limb and separate clamp and tangent screws to vernier, all with counter-spring. Cloth finished U shaped standards. Graduated striding level to telescope axis. Horizontal limb 7 in. divided on silver to 10 minutes reading to 10 seconds by two verniers provided with mounted microscopes. Two fine graduated bubbles to horizontal limb. Clamp and tangent screws with counter-spring to horizontal limb and vernier plate, leveling and tangent screws of German silver. The three leveling arms are slotted and can be adjusted by set screws. Improved shifting centre

Instrument complete, with plumb bob, adjusting pins, etc., packed in two polished mahogany-Boxes, and with fine polished tripod $350 00

K. & E. IMPROVED TACHYMETER.



No. 5085.
but with Striding Level.

K. & E. IMPROVED TACHYMETER.

For Precision Work, Triangulation, etc.

This instrument is of recent design and has all our latest improvements. It should be used where greater accuracy is required than the usual types of transits afford.

It has no compass, thus permitting placing the standards almost directly over the centre, so that the greatest rigidity in the instrument is obtained.

5082. Improved Tachymeter (for repeating angles) with achromatic terrestrial telescope 1¼ in. object glass 1¼ in. with dust cap and sun shade, improved rack-movement, eye-piece with patent micrometer focusing arrangement and stadia hairs, fine bubble to telescope graduated on the glass, horizontal limb 6½ in. graduated on silver to 20 minutes, and numbered like Fig. III, page 318; two opposite verniers at 30 degrees with telescope reading to 20 seconds, two attached microscopes with reflectors for reading horizontal limb, cloth finished standards. Two fine graduated bubbles to horizontal limb. All tangent and leveling screws of German silver, tangent screws of improved pattern with counter-spring. The centres are extra long and of different metals to reduce friction. Shifting centre. Four leveling screws, leveling arms slotted and provided with set screws to take up wear.

Instrument complete with plumbbob, waterproof cover, adjusting pins, etc., packed in fine polished mahogany Box and with tripod No. 5175 . . . . . $335 00

5084. Improved Tachymeter, like No. 5082, but with vertical arc 5½ in. diameter divided on silver to ½ degrees, vernier reading to 1 minute. Instrument complete with tripod No. 5175, etc. 250 00

5085. Improved Tachymeter like No. 5082, but with full vertical limb 5½ in. diameter, divided on silver to ½ degrees, vernier reading to 1 minute. Instrument complete with tripod No. 5175, etc. 365 00

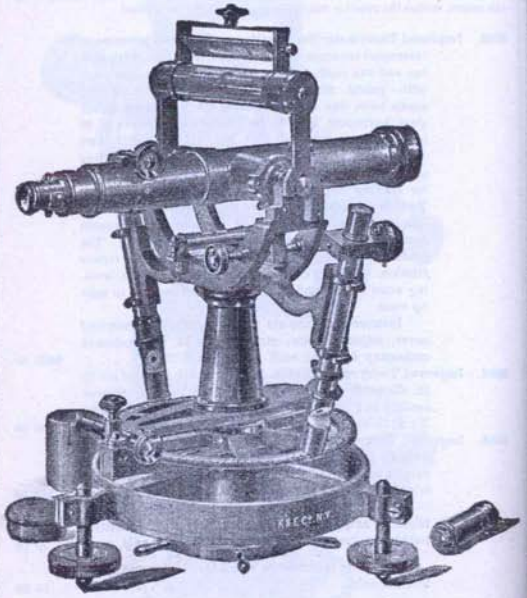
The above instruments with fine Striding Level to telescope axis (see cut), with accurately ground sensitive bubble graduated on the glass, *made to order only*, extra 20 00

The above instruments with 3 leveling screws (made to order only), ... extra, 10 00

The above instruments with telescope with inverting eye-piece (astronomical telescope) made *to order only*, without additional charge.

For attachments and parts see pages 360, 361.

PRECISION THEODOLITE.



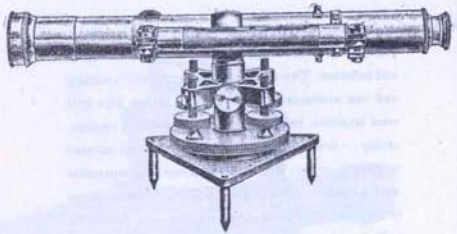
No. 5086.

PRECISION THEODOLITE.

5086. Precision Theodolite, for triangulation, telescope 13 in., object-glass 1⅞ in. with rack-movement, improved sun shade and reflector. Two eyepieces, one terrestrial (erecting) and one astronomical (inverting). Strong axis with steel trunions, improved tangent screw with counter-spring. Graduated sensitive striding level encased in glass to protect it against variations of temperature with adjustable silvered glass reflector. The telescope is mounted on a strong column, the axis resting in a Y-shaped support, with fine bubble, graduated on the glass. Horizontal limb 7½ in., divided on silver to 5 minutes, reading to 5 seconds by two opposite filar micrometers with microscopes mounted on stout arms and so adjusted that one full turn of the screw covers one division of the horizontal limb. These screws are divided to 30 double-seconds. The vertical centre on which the upper part of the instrument revolves is of steel. Improved tangent screw for horizontal limb. The centre is clamped by a horizontal wheel with projecting spokes. Three leveling screws in slotted arms. A stout metal ring connects the leveling arms and serves for carrying the instrument without straining any of its delicate parts.

Instrument complete, packed in two polished mahogany Boxes (no tripod) . . . . . $ 450 00

AMERICAN DUMPY LEVEL.



No. 5107.

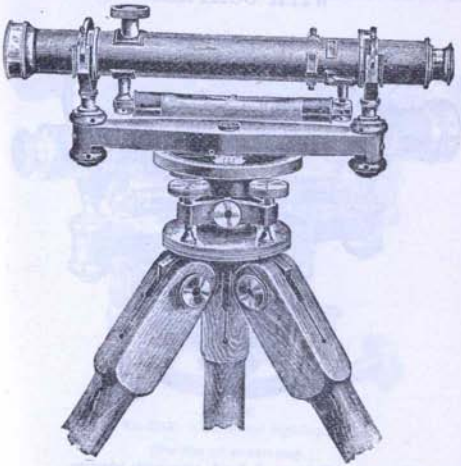
5107. American Dumpy Level, an excellent instrument for work which does not require great accuracy, such as ditching, draining, road-leveling, etc. The achromatic telescope is 11 in. long, object-glass 1½ in. with rack-movement, graduated bubble. The eyepiece is also adjustable, to focus the cross-hairs.

Instrument complete, with metal trivet, plumb bob, etc., in strong box and with hardwood tripod No. 5176 . . . . . $ 35 00

For Architect's Leveling Rods see page 411.

We have the best facilities for repairing Surveying Instruments of any make promptly and satisfactorily.

ARCHITECT'S LEVEL.



No. 5110.

5110. Architect's or Builder's Y Level, achromatic telescope 11 in. with dust shade and cross-hairs, graduated bubble, object-glass 1½ in. with rack-movement, eyepiece adjustable to focus the cross-hairs. Horizontal circle 3 in. divided to degrees with vernier reading to 5 minutes. A most serviceable and compact instrument.

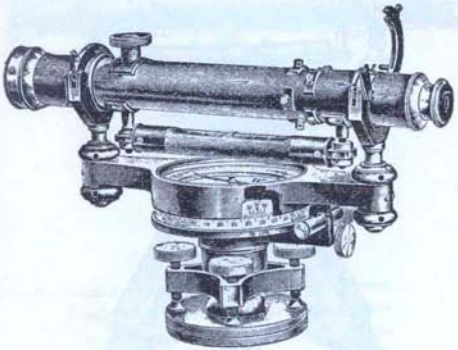
Level complete, with metal trivet, plumb-bob and adjusting pins, in polished mahogany Box and with hardwood tripod No. 5176 . . . . . $45 00

5111. Architect's or Builder's Y Level, like No. 5110, but with Tangent Screw 50 00

For Architect's Leveling Rods see page 411.

ARCHITECT'S LEVEL

WITH COMPASS.



No. 5112.

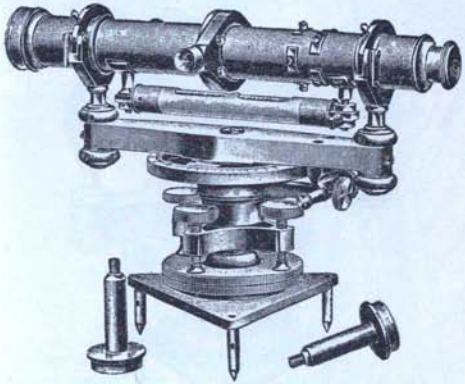
5112. Architect's or Builders's Y Level, achromatic telescope 11 in. with dust shade and cross-hairs, graduated bubble, object-glass 1½ in. with rack-movement, eyepiece adjustable, compass divided on raised ring to degrees, improved needle about 3 in., horizontal circle 3¾ in. divided to degrees with vernier reading to 5 minutes. A most serviceable and compact instrument.

Level complete, with metal trivet, plumbbob and adjusting pins, in polished mahogany Box and with hardwood tripod No. 5176 . . . . . $ 60 00

5118. Architect's or Builder's Y Level with Compass, like No. 5112, but with Tangent Screw 65 00

For Architect's Leveling Rods see page 411.

CONVERTIBLE ARCHITECTS' LEVEL.



No. 5115. (Horizontal Sighting.)

(See also cut on next page.)

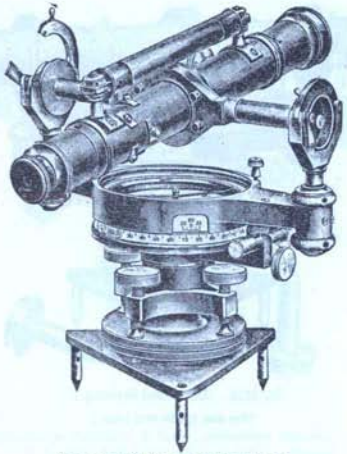
5114. Convertible Architect's Level, like No. 5110, but with extra removable axis to adapt telescope to sighting vertical lines, as described on page 323. Instrument complete, with metal trivet, plumbbob, etc., in polished mahogany Box, and with hardwood tripod No. 5176 . . . . . $ 60 00

5115. Convertible Architect's Level, like No. 5114, but with Tangent Screw 65 00

For Architect's Leveling Rods see page 411.

CONVERTIBLE ARCHITECTS' LEVEL

WITH COMPASS.



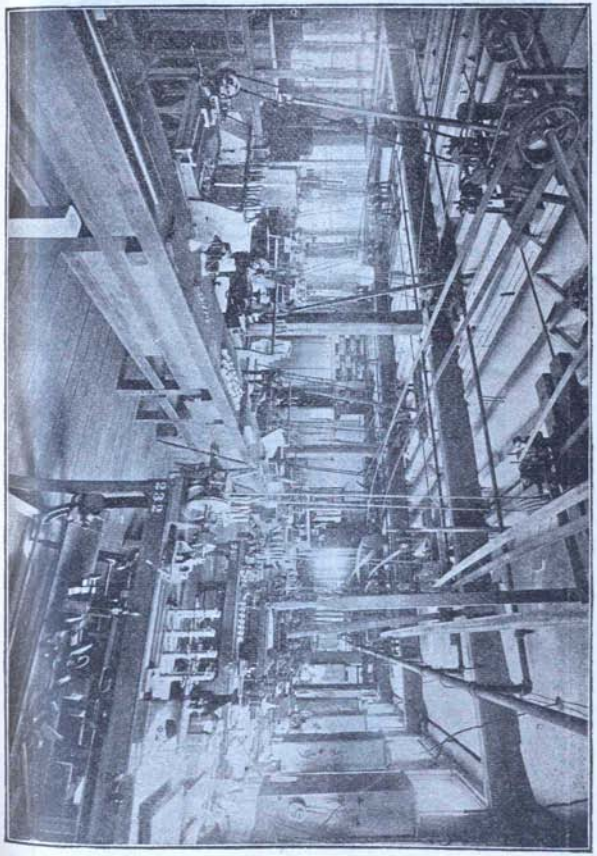
No. 5117. (Sighting a Vertical Line.)

(See also cut on preceding page.)

5116. Convertible Architect's Level, extra removable axis, like No. 5114, but with Compass, like No. 5112, (on page 350). Instrument complete, with metal trivet, plumbbob, etc., in polished mahogany Box and with hardwood tripod No. 5176 . 75 00

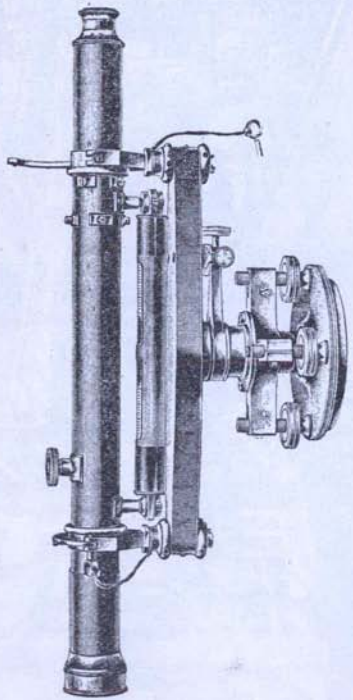
5117. Convertible Architect's Level with Compass, like No. 5116, but with Tangent Screw 80 00

For Architect's Leveling Rods see page 411.



SURVEYING INSTRUMENT ROOM, FACTORY.

RAILROAD Y LEVEL.



No. 5120

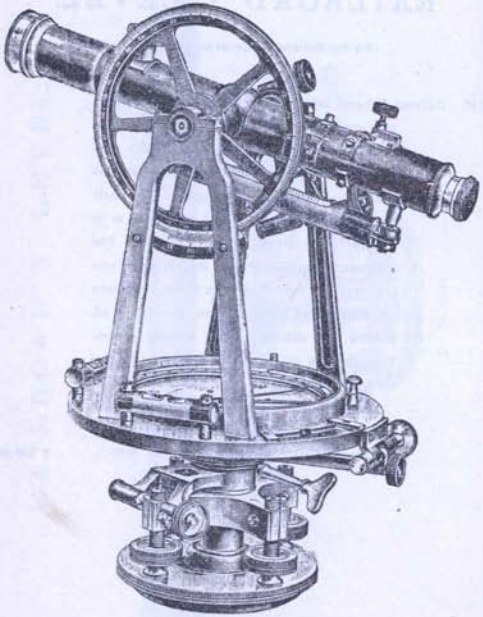
RAILROAD Y LEVEL.

(For fine Engineer's Y Levels see pages 326, etc.)

5120. Railroad Y Level, achromatic terrestrial telescope 18 in. with sun shade, object-glass 1¾ in. diameter, rack-movement to object-glass, adjustable eye-piece. Graduated bubble to telescope with vertical and horizontal adjustment. The main bar is made of gunmetal and so shaped as to combine great strength with lightness. The telescope is provided with a stop, to insure true horizontal and vertical position of the cross-hairs and rests in two strong Y's, one of which is adjustable for altitude. Four leveling screws. Tangent screw with compensating spring for fine horizontal movement.

Instrument complete, with adjusting pins, waterproof cover, etc., packed in polished mahogany Box and with hardwood tripod No. 5175 . . $ 100 00

RAILROAD TRANSIT.



No 5160.

RAILROAD TRANSIT.

5130. **Railroad Transit** (for repeating angles) with achromatic terrestrial telescope 11 in., with dust cap and sun shade, object-glass 1½ in. with rack-movement, eyepiece with patent slow-motion focusing arrangement. Tangent screw with counter-spring to telescope. Compass with raised ring, silvered, divided to half degrees, with variation plate. Needle about 5 in. Horizontal limb 6½ in. graduated to half degrees reading to minutes by two opposite verniers placed at 30 degrees from telescope. Two bubbles to horizontal limb. All tangent screws with counter-spring. Long centres. Four leveling screws. Shifting centre.

Instrument complete, with plumbbob, reading glass, adjusting pins, water-proof cover, etc., packed in polished mahogany Box and with tripod No. 5175. . . . . $ 150 00

5140. **Railroad Transit**, as described under No. 5130, but with graduated **bubble to telescope**, with tangent screw with counter-spring.

Instrument complete, with tripod, etc 160 00

5150. **Railroad Transit**, as described under No. 5140, but with **vertical arc** 5 in. diameter, graduated on silver to half degrees, vernier reading to minutes, with tangent screw with counter-spring.

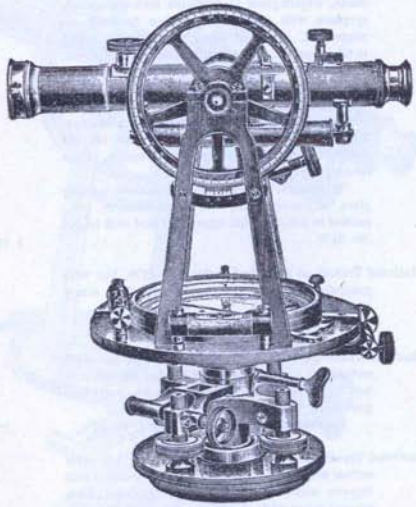
Instrument complete, with tripod, etc 170 00

5160. **Railroad Transit**, as described under No. 5140, but with **vertical limb** 5 in. diameter, divided on silver to half degrees with vernier reading to minutes, with tangent screw with counter-spring.

Instrument complete, with tripod, etc. . . . 175 00

For fine Engineer's Transits see page 330 &c.

LOCATING TRANSIT.



No. 5165.

KEUFFEL & ESSER CO. NEW YORK.

LOCATING TRANSIT.

5165. Locating (Mountain or Mining) Transit, for repeating angles, with achromatic, terrestrial telescope 9 in. with dust and sun shade, object-glass 1 in. with rack-movement, eyepiece with patent slow-motion focusing arrangement. Graduated bubble to telescope, vertical limb 4 in. divided on silver to half degrees, vernier reading to minutes; clamp and tangent screw to telescope. Silvered compass ring divided to half degrees with variation plate set by capstan-head pinion. Needle about $3\frac{3}{4}$ in. Horizontal limb $5\frac{1}{2}$ in. graduated to half degrees reading to minutes by two opposite verniers placed at 90 degrees from line of telescope. Two bubbles for leveling the plates. All tangent screws with counter-spring. Long centres. Four leveling arms adjustable for wear. Shifting centre.

Instrument complete, with plumbbob, reading glass, adjusting pins, etc., packed in polished mahogany Box, and with tripod No. 5175 . . . . . $ 170 00

For fine Mining Transits see page 337.

For Expedition Transit see page 341.

ATTACHMENTS AND PARTS

FOR

TRANSITS, LEVELS AND COMPASSES.

No. 5169.

5169. Improved Sunshade and Reflector for illuminating cross and stadia hairs, if ordered with new instrument . . each $ 4 00

The reflecting mirror is rigidly mounted on a short tube, which is inserted in the tube forming the sunshade, and held in position by a stop. To use the sunshade as such, the mirror with its inner tube is taken out and the sunshade turned, to bring the opening in its side away from the sun.

Screwdriver and centre key.

Folding screwdriver and centre key.

5170. Combination screwdriver and centre key . . . . . $ 75
5171. " " " " folding, ... 1 00

Sunshade	75
Object-glass	$ 6 00 to 10 00
Eyepiece	6 00 " 8 00
Cap for object-glass	50
do. " eyepiece	75
Clamp screw for horizontal limb or centre	75
Tangent screw for " " " "	1 50
Leveling screws	each 1 50
Compass needle and centre pin	2 50
Cover glass for compass	25
" " " with ground edge	50
Steel adjusting pins	each 05
Screwdriver	20
Tripod head with bolts	5 00
Waterproof cover for transit or level	1 00
Leather case with shoulder strap for transit or level	$10 00 to 12 00
" " " " " Architect's Level or Surveyor's Compass	8 00 " 10 00
Fine Oil for Surveying Instruments	per bottle 25

For Tripods see pages 362, 363.

We have the best facilities for repairing Surveying Instruments of any make promptly and satisfactorily.

The following approximate prices apply only when the attachments are ordered with a new instrument, or when they are for one of our improved instruments. If ordered for another or an older instrument they may involve more work and consequent additional expense.

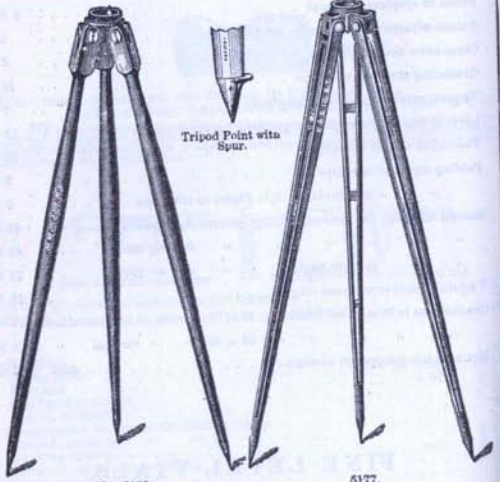
Prism to eyepiece of transit	$ 5 00
Patent adjustable stadia-hairs, see page 316	4 00
Cross-hairs and diaphragm	3 00
Gradienter screw to telescope	10 00
Tangent screw to telescope, improved	8 00
Level to transit telescope, fine graduated ground bubble	12 00
Theodolite axis to telescope	10 00
Folding sights to telescope	8 00
" " standards, at right angles to telescope	8 00
Second telescope for vertical sighting, pattern *A*, page 322	40 00
" " " " " " *B*, " 322	40 00
" " at right angles, " *C*, " 322	55 00
Variation plate to compass ring	10 00
Graduations to 20 minutes, reading to 20 or 30 seconds, on horizontal limb	10 00
" " " " 20 " 30 " " vertical "	6 00
Mounted microscopes to verniers	each 5 00

FINE LEVEL VIALS.

Fine Level Vials for telescope for				15 in. Levels	each $ 4 00
"	do.	"	"	" 18, 20 or 22 in.	" 5 00
"	do.	"	"	" transits	" 3 00
"	do.	"	"	" mining transits	" 2 50
"	do.	"	plates of transits		" 1·00

The fine level vials (bubbles) which we here list, are the same as those on our fine transits and levels No. 5005 to 5036 and our plane tables. They are made of annealed glass specially manufactured for this purpose, and are accurately ground, exceedingly sensitive, and graduated on the glass. (See page 316).

TRIPODS
FOR
LEVELS AND TRANSITS.



Tripod Point with Spur.

No. 5175. 5177.

5175. Hardwood Tripod for levels and transits . . . . . each $ 10 00
This is the style of tripod which we furnish with our surveying instruments No. 5005 and following.

5176. Hardwood Tripod, like No. 5175, but lighter, for Architect's Levels, etc. . . . . " 6 00

5177. Split Tripod of hardwood, for levels and transits, latest construction, very strong, extremely light and rigid, (weight about 6 lbs.) . . . . . " 12 50

do do. do. if furnished with instrument in place of No. 5175 . . . . . extra " 2 50

Any of the above tripods can be furnished also with spurs on the points (see cut) for pressing the points into the ground, at an extra charge of . . . . . per tripod 1 00

PATENT EXTENSION TRIPODS.

PATENTED AUG. 24, 1886.

Cross-section of No. 5180.

No. 5184. 5180.

5180. Patent Extension Tripod . . . . . each $ 15 00
do. do. if with instrument in place of No. 5175, extra " 5 00

This Patent Extension Tripod combines rigidity with lightness; its manipulation is easy as it is construction such, that the sliding leg can neither wear loose nor bind, but will always move smoothly. The special clamps used render it as steady, even when the legs are fully extended, as any solid-leg tripod. The head is very firm, wing nuts being used instead of tenon joints. It is adjustable to any height between 30 and 57 inches and weighs about 10 pounds. Whilst being stronger than any other Extension Tripod, it is less bulky and more portable.

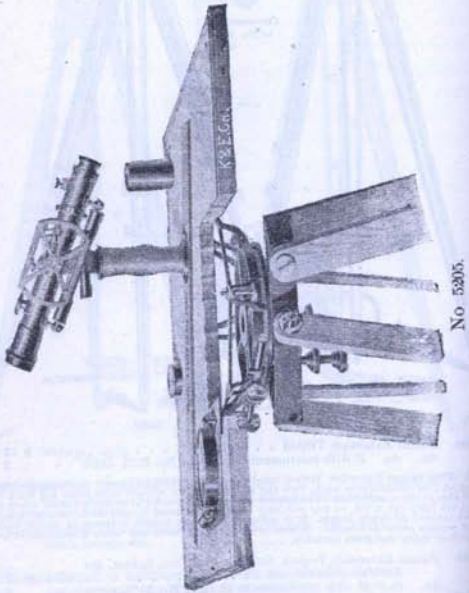
5182. Patent Extension Tripod, like No. 5180, but lighter, for Architect's Levels, etc., ... each $ 12 00
do. do. if with instrument in place of No. 5176, extra " 6 00

5184. Split Tripod with one extension leg and two split legs " 13 50
do do if with instrument in place of No. 5175, extra " 3 50

Tripods No. 5184 have two split legs like No. 5177, and one patent extension leg like No. 5180. They offer nearly all the advantages of an extension tripod in using them on uneven ground, but they can not be put up as compactly for carrying.

Any of the above tripods with spurs at the points (see cut on preceding page) extra . . . . . per tripod $ 1 00

PLANE TABLE.



No 5205.

PLANE TABLES.

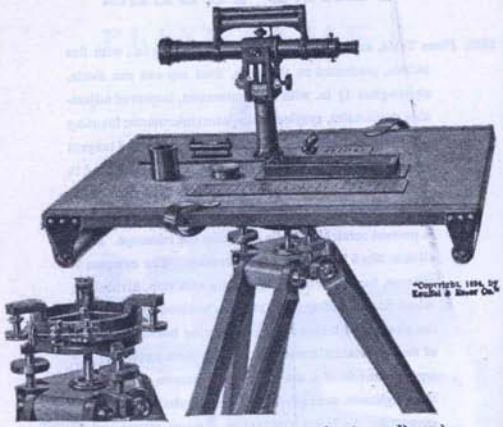
5205. Plane Table, achromatic terrestrial telescope 11½ in., with fine bubble, graduated on the glass, dust cap and sun shade, object-glass 1¼ in. with rack-movement, improved adjustable stadia-hairs, eyepiece with patent micrometer focusing arrangement. Telescope with improved clamp and tangent screws, double vertical arc (of 30° each way) graduated to degrees, vernier reading to 1 minute. The vernier is hinged on pivots, so that it can be swung clear of the arc to prevent scratching while adjusting the telescope. Brass alidade 20×3 in., drawing edge beveled. The compass is of brass, base 5×5 in., 2¾ in. needle with stop, divided on raised ring to half degrees, two fine bubbles, graduated on the glass. The table proper is a drawing board 18×24 in., of most substantial construction. The three-screw leveling arrangement is of a much improved pattern, which combines lightness, strength and easy manipulation. The part supporting the board revolves in a metal groove and is provided with clamp and tangent screws of improved pattern, with counter-spring. The split hardwood tripod is very substantial and rigid.

Instrument complete, in two strong Boxes, plumb bob, arm for plumbbob and including split tripod, . . . $ 165 00

5206. Plane Table, like No. 5205, but without the tangent screw to the leveling support on which the board revolves.

Instrument complete, in two strong Boxes, plumbbob, arm for plumbbob, and including split tripod . . . 150 00

PLANE TABLE.



No. 5208, (with No 5209 Rollers for Continuous Paper.)

5208 Plane Table, as made for the U S Coast and Geodetic Survey, achromatic astronomical telescope 10½ in. with fine bubble graduated on the glass, and sun shade, object-glass 1 in., cross and stadia-hairs, rack adjustment The telescope is mounted in a sleeve, and is adjustable to bring the cross-hairs vertical and horizontal. Telescope with improved tangent screw with counterspring and vertical arc (of 30° each way) divided to half degrees, with vernier reading to 1 minute. Bronze alidade 12×2½ in Box compass (covering 20°) divided to 30 minutes, 5½ in needle with agate centre and stop. German silver diagonal scale, 10½ × 2 in. one side graduated $\frac{1}{16}\frac{1}{32}$ other side $\frac{1}{32}\frac{1}{64}$. The table proper is a drawing board 16×20 in. of most substantial construction The three-screw-leveling arrangement is of excellent design and has a tangent screw. Split tripod of hardwood, 54 in. high

Instrument complete, in 2 neat and strong Boxes, (board in separate box), with plumbbob, etc., including split tripod and clamps for paper . . . . . $ 160 00

5209. Rollers, for fastening continuous paper on plane table (see cut No. 5208) . . . . . extra 10 00

TRAVERSE TABLES.

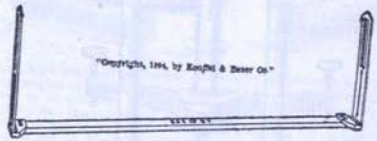
5210. Drawing Board for Traverse Table 18×18 in. . . . . each $ 7 00
5211. do. " do. 20×25 " . . . . " 9 00
5212. do. " do. 24×31 " . . . . . " 10 00

These boards are thoroughly well made of selected pinewood. A magnetic needle 3¼ in. in glazed oblong box is set flush in the board. All these boards have a screw-socket for tripod and Nos. 5211 and 5212 have screw studs at the corners for fastening the drawing paper.

5215. Plain Hardwood Tripod, like No. 5176, for above boards, each $ 6 00

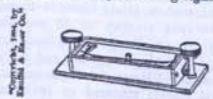
Leveling Head of No. 5216.

5216. Hardwood Tripod with four-arm leveling head, including fitting to any of above boards . . . . . each $ 16 00
5217. Hinged Plumbbob Bar of hardwood and Plumbbob . . . " 4 00



No. 5218.

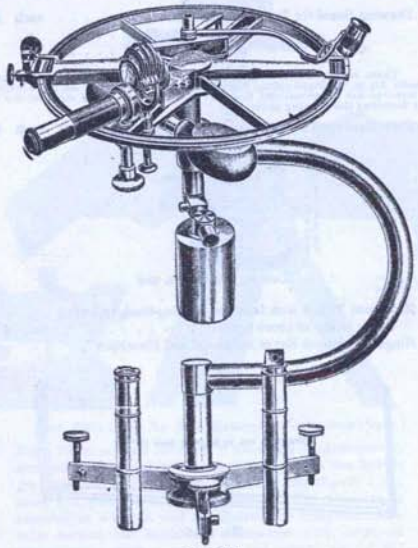
5218. Traverse Table Alidade, brass, 12 × 1½ in., graduated beveled edge in line of sight, folding sights 3 in. high, each $ 15 00



No. 5219.

5219. Plane Table Compass, (trough compass), with milled head screws to fasten to board, improved needle about 3½ in., divisions on raised limb covering 10 degrees each way . . . . . each $ 7 00

REFLECTING PRISMATIC CIRCLE.

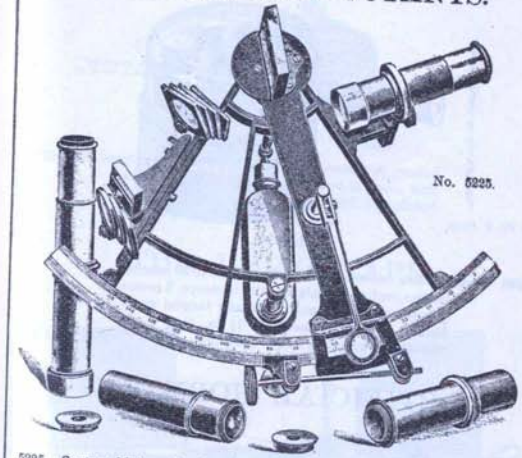


No. 5222

5222 Reflecting Prismatic Circle of Brass, light but very strong, 5 in. radius, graduated on inlaid silver to 10 minutes, two opposite verniers reading to 10 seconds, one mounted microscope, one clamp and tangent screw to verniers, 1 mirror, 1 rectangular prism and six neutral glasses to instrument. 1 terrestrial, 2 astronomical telescopes, 3 neutral glasses mounted on revolving diaphragm, and rectangular prism attachable to any telescope, bronzed brass standard with counterweight to balance instrument, three leveling screws, leveling arms can be folded.

Instrument complete with accessories in two polished hardwood Cases . . . . . each $ 200 00

SEXTANTS AND OCTANTS.



No. 5225.

5225. Sextant, high grade, of gun metal, as made by us for the U. S. Navy; measuring angles up to 130 degrees. Radius 7½ in. Graduations on inlaid silver to 10 minutes, vernier reading to 10 seconds; magnifying glass, clamp and tangent screw to vernier. 1 sighting tube, 1 star telescope 1 inverting tele-cope with two eyepieces of magnifying powers of 6 and 12 diameters; 7 neutral glasses to sextant, 2 neutral glasses for telescopes, 1 each spare index and horizon mirror.

Instrument complete with two screw drivers, in fine polished mahogany Case with Lock and Key . . . . . each $ 120 00

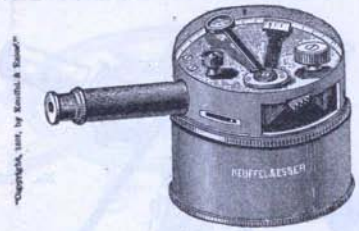
5227. Surveying Sextant, of gun metal, as made by us for the U. S. Navy, measuring angles up to 130 degrees. Radius 6 in. Graduations on inlaid silver to 20 minutes, vernier reading to 30 seconds. 1 sighting tube, 1 star telescope, one inverting telescope, magnifying power of 6 diameters. 7 neutral glasses to sextant, 2 neutral glasses for telescope and one each spare index and horizon mirror.

Instrument complete with two screw drivers in polished mahogany Case with Lock and Key . . . . . each $ 90 00

5229. Octant, of gun metal, as made by us for the U. S. Navy, measuring angles up to 100 degrees. Graduations on inlaid silver to 20 minutes, vernier reading to 30 seconds; magnifying glass clamp and tangent screw to vernier. 1 sighting tube, 1 star telescope, 2 neutral glasses for telescope, 1 each spare index and horizon mirror.

Instrument complete with two screw drivers, in fine polished mahogany Case with Lock and Key . . . . . each $ 80 00

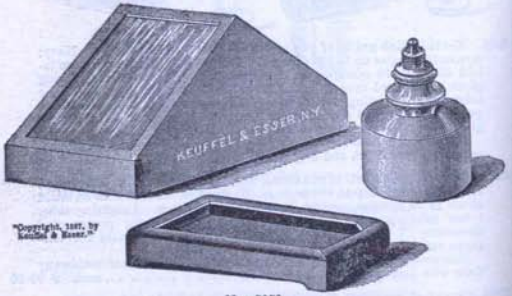
We have the best facilities for repairing Sextants and Octants of any make.



No. 5240.

5240. Pocket or Box Sextant, graduated on silver to 30 minutes, vernier reading to 1 minute, with telescope, 2 neutral glasses, reading lens and micrometer tangent screw. Metal box 3 in. diameter × 1½ in. high, a very reliable instrument, in leather sling case . . . . . each $ 42 50

ARTIFICIAL HORIZONS.



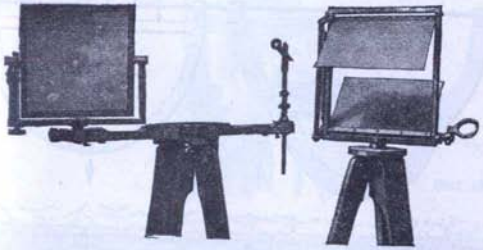
No. 5250.

5250. Mercurial Horizon, consisting of iron trough, iron bottle with screw stopper and funnel cap, metal roof with finest parallel-plane ground and polished glass, 8½ × 7 in., in polished mahogany box . . . . . set $ 30 00

No. 5251.

5251. Reflecting Horizon, black glass plane, accurately ground and polished, diam. 3⅜ in., mounted in brass, with three leveling screws and spirit level, in polished mahogany case . . . . . each $ 16 00

THE HELIOGRAPH.



No. 5255.

5255. Heliograph, as adopted by the U. S. Signal Service; outfit complete for one station, with Directions . . . . . each $ 60 00

Military Signaling; a Handbook, by Captain Albert Gallup, bound in cloth . . . . . " 50

The Heliograph consists of 2 mirrors, 5 × 5 in. (only one of which is shown in the engraving), a mirror bar 13 in. long, a sighting rod with movable disc, a screen 6½ × 7½ in. and 2 tripods standing about 40 in. high, all of the best material and construction in leather case with carrying straps.

Descriptive Circular of Heliographs sent on Application.

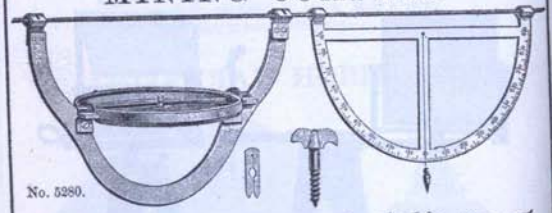
SUN-DIALS.

No. 5270.

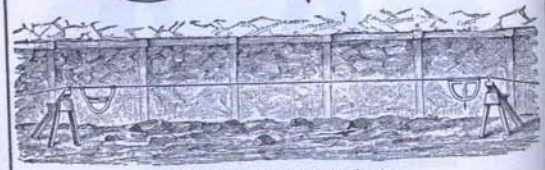
No. 5275

5270. Universal Sun-dial and Compass for both North and South Latitudes, best make, 2½ in., in morocco case . . . each $ 14 80
5275. Sun-dial and Compass, German silver, 2 in. . . . . " 3 65

MINING COMPASS.



No. 5280.

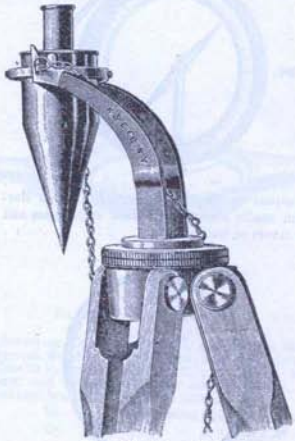


Mining Compass and Clinometer in use.

5280. Mining Compass and Clinometer, Compass graduated to half degrees, suspended in a frame with hooks, by a universal joint (gimbal), needle about 3 in., with stop. Clinometer 7 in. diameter, graduated to half degrees, with hooks and plumbbob, screws for cord, and brass stop, in chamois lined leather sling case . . . . . each $ 50 00
Station bucks . . . . . per pair 4 00
Water-proof cord, 80 feet, on reel 3 00

MINING LAMP AND PLUMMET.

Illustration ½ size.



No. 5285 with 5289.

5285. One Plummet in mahogany box with strap . . . . . each $ 10 00
5286. Two do. in one mahogany box with strap . . . . . pair 20 00

This is a large brass Plummet with steel point, 2 in. diameter, 6¼ in. long, weight about 20 oz., mounted in universal joint (gimbal) with chains for suspending. The upper part is hollow, for oil, and provided with a burner, forming a lamp. The sight is taken to centre of flame.

5288. Standard for suspending Plummet, with plain tripod, like No. 5176 . . . . . each $ 15 00
5289. do. do. do. with extension tripod, like No. 5182 " 21 00

MINER'S COMPASSES.

No. 5290.

5290. Miner's Compass, or Dipping Needle, 3¾ in., with Norwegian needle about 3 in., with stop, glass and brass covers on both sides, ... each $ 14 00

No. 5293.

5293. Miner's Compass or Dipping Needle, 3¾ in., needle about 3 in., with stop, glass and brass covers on both sides, each $ 12 00

SURVEYING COMPASSES.

In Surveying Compasses the East and West lettering is reversed from its usual position on a map. This is because the needle is the fixed point while the compass-box is revolved in directing the sights to the object observed. For instance, in sighting a point situated N. W. the needle will point N. E., but it will correctly read N. W. in accordance with the line actually sighted, because the East quadrant is marked West.

No. 5306, with Out-Keeper.

5300. Large Surveying Compass, bronzed, graduated to half-degrees, numbered in quadrants, needle about 4 in., plate 12 in., graduated sights, 2 level bubbles, ball joint and socket for Jacob staff mounting, in polished mahogany Case with carrying strap . . . . each $ 25 00

5302. do. do. needle about 5 in., plate 14 in., " " 30 00

5304. do. do. " " 6 " " 16 " " " 35 00

5306. Large Surveying Compass, like No. 5300, but with **variation plate**, reading to minutes . . . . . each $ 30 00

5308. do. do. like No. 5302, but with variation plate, " 35 00

5310. do. do. " " 5304, " " " " " 40 00

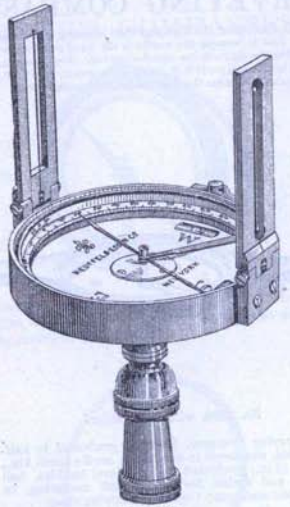
The Surveying Compasses No. 5300 to 5310 represent our latest construction of such instruments, which have been improved in very many features.

The compass box is sunk flush with the plate instead of projecting beyond it. The graduations, to half-degrees, are on a raised ring and the needle is of our improved pattern, as described on page 317. One of the detachable sights is graduated and provided with a sliding cross-piece for measuring vertical angles.

The variation of the needle is set off by a capstan-head pinion and provided with a vernier reading to minutes.

The above Compasses are furnished with Out-Keeper (tally register), as shown in cut at an additional charge of . . . . . each $ 1 50

For Tripods for above see page 378.



No. 5321.

5320. Surveying Compass, with folding sights, graduated to degrees, variation plate, two level bubbles, ball joint and socket for Jacob staff mountings, needle about 3½ in., in polished mahogany case . . . . . each $ 16 00

5321. do. do. needle about 4 in., in polished mahogany case . . . . . " 18 00

5322. do. do. needle about 4½ in., in polished mahogany case . . . . . " 20 00

Compasses Nos. 5320 to 5322 are of the most practical construction and very carefully and substantially made. The variation of the needle is set off by means of a pinion with capstan head, which admits of the most delicate adjustment and is protected from dust and rain.

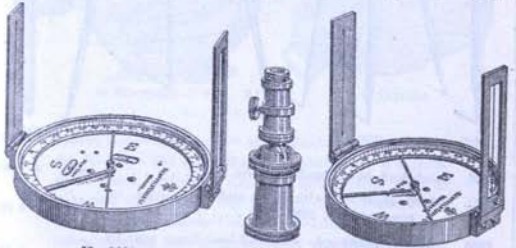
For Jacob Staffs and Tripods see page 378

as Compass. as Clinometer.

No. 5330.

5330. Surveying Compass and Clinometer, bronzed, with folding sights ending in hooks, graduated to degrees, with ball joint and socket for Jacob staff mounting, needle about 2 in., in mahogany case, each $13 50

5331. do. do. " " 2½ " " " " " 14 00



No. 5332. No. 5335.

5332. Surveying Compass, with folding sights, graduated to degrees, with 2 level bubbles, ball joint and socket for Jacob staff mounting, needle about 3 in., in mahogany case, each $ 10 50

5333. do. do. " " 3½ " " " " " 11 50

5334. do. do. " " 4 " " " " " 13 00

5335. Surveying Compass, like No. 5332, but without level bubbles, needle about 2½ in., in mahogany case . each $ 8 00

5336. do. do. " " 3 " " " " " 9 00

5337. do. do. " " 3½ " " " " " 11 00

5338. do. do. " " 4 " " " " " 11 50

For Jacob Staffs and Tripods see next page.

JACOB STAFFS AND TRIPODS.

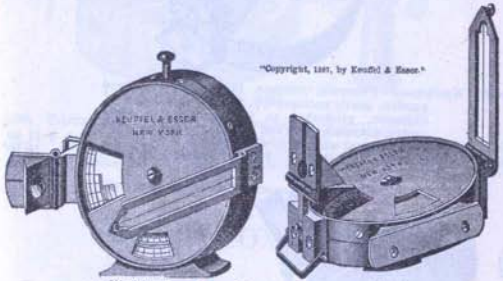
5350. 5351. 5356. 5358.

5350.	Jacob Staff, 5/4 in., hardwood, iron shoe	each	$ 1 00
5351.	Tripod, hardwood, with Jacob staff head, light, for compasses No. 5320—5338	"	3 00
5356.	do. hardwood, with staff-head brass top, for Compasses No .5300 to 5338	"	5 00
5358.	do. polished mahogany, round, cane pattern, ball joint with socket, metal screw cap for top, for No. 5330, 5331, and prismatic compasses No. 5400 and 5420 to 5429	"	12 50

For Patent Extension Tripod see No. 5182 page 363.

PRISMATIC COMPASSES.

Prismatic Compasses permit of observing the magnetic azimuth of objects not in the plane of the observer and are more accurate than others (except the regular Surveyor's Compasses) because by means of the prism the vertical hair of the sight-vane appears directly continuous with one of the divisions. The object, by means of the vertical hair, is vertically projected to the plane of observation, so that angles are observed in one plane, like they are laid down on a map. Their accuracy can be increased by repeating the observations and taking their mean, or by back-sighting.



as Clinometer. as Compass.

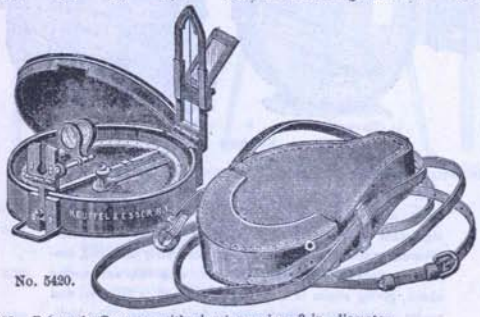
No. 5400.

5400. Prismatic Compass, Clinometer and Altimeter, bronzed, pocket size. Compass dial 2½ in. diameter, graduated to ½ degrees, agate centre, automatic stop and spring check. Hinged sight-vane with vertical wire, fiduciary edge for clinometer. Clinometer and Altimeter formed by accurately balanced, sensitive, weighted disc, 2½ in. diameter, with stop and spring check, giving slopes in inches per yard and in degrees, and angles of elevation or depression in half-degrees. The inclination is read off under the hair line on the glass in the cover. The compass is read by the prism, which is adjustable for focus. Mounted for Jacob staff, in leather sling case, complete . . . . . each $ 27 00

No. 5410.

5410. Hutchinson's Prismatic Compass, bronzed, of improved pattern, nearly enclosed top, floating card dial, 2 in. diameter, graduated to ½ degrees, with agate centre, automatic stop and spring check, sight-vane with vertical wire, in morocco case . . . . . , each $ 11 00

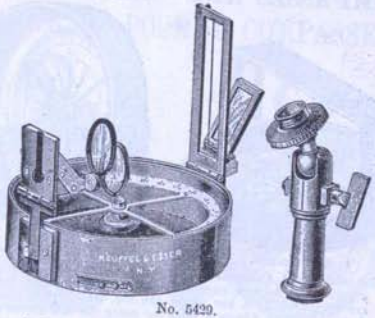
5411. do. do. do. 3 in., in leather sling case . " 16 00



No. 5420.

5420. Prismatic Compass with aluminum ring, 3 in. diameter, graduated to ½ degrees, agate centre, automatic stop and spring check, hinged sight-vane, with vertical wire and sliding mirror, which can be reversed to face upwards or downwards, to show objects much above or below the horizontal plane, dark glasses for observing the sun's magnetic azimuth. Best quality instrument in leather sling case. . . . . , each $ 30 00

5422. do. do. with polished mahogany tripod with ball joint and socket, cane pattern, No. 5358, page 349, " 42 50



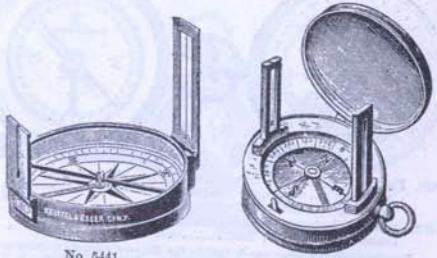
No. 5429.

5428. Prismatic Compass, 3 in., with floating metal dial, socket for Jacob staff, in mahogany case . . . . . , each $ 12 85

5429. do. do. 3½ in., with azimuth glasses, ball joint and socket for Jacob staff, in morocco case . . . . . " 21 50

For Tripod for Prismatic Compasses, see page 379

SIGHT COMPASSES.



No. 5441. 5450.

5440. Bronzed Pocket Compass, 2½ in., with cover, folding sights, edge bar needle with stop, each $ 5 25

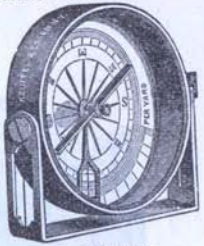
5441. do. do. do. do. 3 in. " 6 25

5450. Pocket Compass, watch pattern, with folding sights, stop to needle, 1¾ 2 2¾ in.
each $ 4 00 4 60 5 10

COMPASSES AND CLINOMETERS.

No. 5460.

as Sight Compass.

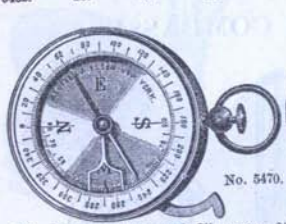


as Clinometer.

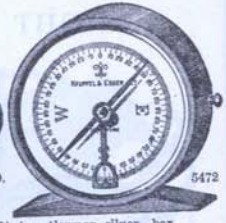
5460. Bronzed Sight Compass and Clinometer, 2½ in. diameter, graduated to degrees, edge bar needle and stop. The sights are connected by a bar across the top, which when turned down serves as fiduciary edge for using the instrument as a clinometer. The clinometer is graduated to give slopes in inches per yard and in degrees. This is a very practical instrument for taking angles, bearings of walls or strata, altitudes, etc. Its lightness and small size add to its usefulness. The instrument in mahogany Box . . . . . each $ 7 25

5461. do. do. do. do. diameter 3 in. " 8 75

5462. do. do. do. do. " 4 " " 10 50



No. 5470.



5472

5470. Pocket Compass and Clinometer, 2½ in., German silver, bar needle 1¾ in., with agate cap and stop, divided on raised ring to 2 degrees, shifting clinometer foot . . . . . each $ 4 30

5472. Harvard Geological Compass and Clinometer . . . . . " 4 00

Leather Case for No. 5472 . . . . . " 55

This Geological Compass was devised by the Harvard Geological Department. It is used there to a great extent, and has given excellent satisfaction. It is made of brass, bronzed; measures 2 inches in diameter × ½ inch thick, and has a solid base. The dial is silvered and is divided to degrees, numbered in quadrants. The needle is of the most approved pattern, with agate centre and stop. The pendulum clinometer is very sensitive and can be read closely. The instrument weighs about 8½ ounces.

This Compass is devised by a Geologist for Geologists, and is better adapted for this particular purpose than any other compass. It will be appreciated also by students, on account of its practical design.

MAGNETIC POCKET COMPASSES.

No. 5490.

5493.

5490. Fine Watch pattern Compass, nickel plated hunting case, edge bar needle, with stop, metal dial, 1½ in., each $ 2 95

5491. do. do. do. do. 1¾ " " 3 20

5492. do. do. do. Singer's card dial, 1½ " " 2 35

5493. do. do. do. " " " 1¾ " " 2 65

5494. do. do. do. " pearl " 1¾ " " 3 85

No. 5510.

5510. Fine Brass Mariner's Compass, bronzed brass hunting case, floating pearl dial ¾ in. diameter, with luminous north and south points, suspended in nickelplated collapsing gimbals with stop . . . . . each $ 8 50

No. 5550.

5556.

5575.

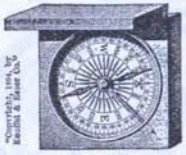
5550. Pocket Compass, brass, watch pattern, paper dial 1¼ 1⅜ 1½ in.
each $ 20 25 30

5556. do. brass, watch pattern, metal dial, stop to needle,
1⅜ 1½ in.
each $ 55 65

5575. do. brass, pull off cover, paper dial 1¼ 1⅜ 1½ in.
each $ 25 30 35

No. 5585.

5592.



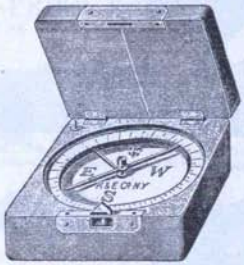
5600.

5585. Pocket Compass, brass, pull off cover, metal dial, stop to needle,
1⅜ 1½ in.
each $ 85 95

5592. do. brass, pull off cover, enameled card dial, divided to 2 degrees, edge bar needle with agate centre and stop
1⅜ 2⅜ in.
each $ 1 90 2 35

5600. do. square mahogany case with cover, stop to needle, card dial divided to degrees,
2 3 in.
each $ 2 25 2 65

MILITARY COMPASS.



No. 5602.

5602. Military Compass, 3×3 in., needle 2 in. with agate centre and automatic stop, divisions on raised ring, to degrees. Polished mahogany box, the sides of which serve as fiduciary edges . . . . . each $ 2 50

HAND LEVELS.

No. 5700.

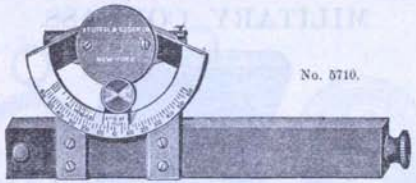
5700. Locke's Hand Level, German Silver, in Case, 5 in. . . . . each $ 8 00
5701. do. Bronze, " " 5 " . . . . . " 7 00

Patented April 24th, 1894. No. 5703.

Diagram, showing appearance of field

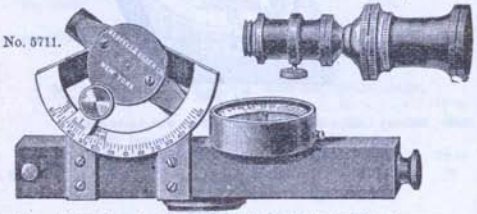
5703. K. & E. Co. Patent Hand Level, square tube, bronzed, 5 in., each $ 4 50

In No. 5703 the reflector is a narrow prismoid, crossing the middle of the field of view, so that the field appears on both sides of the reflected bubble, as shown in above diagram. As the lower surface of the tube is flat and parallel with the bubble, this hand level can be used also as a bench-level.



No. 5710.

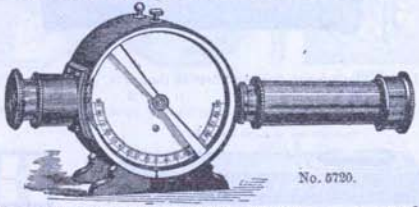
5710. Abney's Reflecting Level or Pocket Altimeter, 5 in., improved, with divided arc to show gradients, in Mahogany Case, each $ 13 50



No. 5711.

5711. Abney's Reflecting Level or Pocket Altimeter, 5 in., improved, with bar needle compass and socket for Jacob staff, in Mahogany Case . . . . . each $ 18 00

POCKET ALT-AZIMUTH.

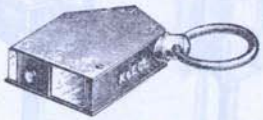


No. 5720.

5720. Pocket Alt-Azimuth Compass, in Morocco Case . . . . each $ 51 00

The compass has agate centre, with stop and spring check and the weighted disc for inclinations is accurately balanced and very sensitive, divided to degrees, with stop and spring check. Compass and clinometer are both graduated to degrees and numbered also on their edges, and are there read through the eye-piece of the telescope, which is adjustable and provided with cross-hairs. The telescope is focused by extending its tube and has a cap with colored glass to modify excessive light. The instrument has a fiduciary edge for using it as clinometer. It measures 6¼ × 3¼ × 1¾ inches, and weighs 13 ounces. It is so well made and practical that it is reliable for all observations within the scope of its size.

PENTA-PRISM RANGE FINDER.



No. 5745.

5745. Penta-Prism Range Finder, mounted in metal, in Leather Case, with Directions . . . . . each $ 16 00

This is a pentagonal prism, (see page 389,) with which distances up to over two miles can be determined with sufficient accuracy for many of the requirements of the surveyor or military man. The mode of using it is extremely simple and very easily acquired with but little practice. Complete directions are furnished with each instrument. To obtain the distance sought, the base line, as determined by the prism, is multiplied by 30 (4°), the angles of the prism being ground so accurately that no tables are required. Right angles are determined with this prism with great accuracy in the usual way.

ADJUSTABLE FOLDING ANGLE MIRROR.

No. 5748.

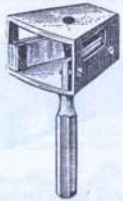
5748. Adjustable Folding Angle Mirror, with Rack and Pinion with Clamp, Ebony Handle, in velvet lined morocco Case . . . . . each $ 10 00

The chief advantage of this Angle Mirror is that instead of the mirrors being fixed, as in Nos. 5750 to 5761, one of them is movable. The inclination is determined by an Arc graduated from zero to 120 degrees, figured in accordance with the angular distance of the objects sighted, being consequently double the inclination of the mirrors. With this instrument offsets may be laid down at any angle up to 120 degrees from a given base and distances to inaccessible objects may be determined by means of a measured base and an angle, then distance = base × tangent of angle. The computations for distances can also be worked out in a very simple manner by means of the slide rule.

This Angle Mirror folds up into a space of 3 × 1 × ¾ inches. It will be found very useful, not only for the Surveyor and Civil Engineer, but also for the Tourist, Traveler or Amateur.

ANGLE MIRRORS.

No. 5750.



5751.

5750. Angle Mirror, for angles of 90 degrees, with small plumbbob. The handle can be unscrewed and stowed in frame of instrument. Size of instrument $2\frac{1}{2}\times2\times1\frac{1}{2}$ in., in morocco Case . . . . . each $ 7 50

5751. Angle Mirror, plain, for angles of 90 degrees, in morocco Case " 5 00

No. 5752.

5760.

5752. Angle Mirror, for angles of 90 degrees, in Brass Case, $2\frac{1}{2}\times2\frac{1}{2}\times\frac{3}{4}$ in., cover folding back to serve as handle each $ 6 00

5760. Double Angle Mirror, one side for angles of 90 degrees, the other for angles of 45 degrees, in Mahogany Case " 10 00

5761. do. do. for angles of 90 and 60 degrees . . . . " 10 00

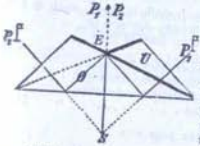
ANGLE PRISMS.

No. 5762.

5763.

5762. Rectangular Prism, for angles of 90 degrees, $2\frac{1}{2}\times1\frac{1}{2}\times1\frac{1}{2}$ in. in morocco Case . . . . . each $ 5 00

5763. Double Prism, for angles of 90 and 45°, in morocco Case " 10 00



This neat and simple instrument consists of two prisms of $22\frac{1}{2}\times45$ and $112\frac{1}{2}°$, placed one above the other in brass mounting, to the handle of which a plumb line can be attached. The longer sides of the prisms are placed in one plane, facing the observer, and the reflecting surfaces cross each other at E.

When one prism is used alone, an angle of 45° can be set off. By using both prisms, the observer will see the object P_2 in the upper prism to the right and object P_1 in the lower prism to the left. When the position is shifted, so that the two objects are seen as being one vertically above the other, the observer is in the apex of the right angle, between the two objects.

This instrument is very useful in cross sectioning and dividing up land, also for laying out building-ground.

No. 5765.

5765. Pentagonal Prism, for angles of 90 degrees, with detachable Handle . . . . . each $ 10 00

The Pentagonal Prism has five sides as indicated by its name. Two of the faces are polished, the two longer faces are polished and silvered, and the background dull. By this novel optical construction the reflected immovable image is much more distinct and better illuminated than in triangular prisms, while its size is about twice that produced by the latter. These pentagonal prisms are therefore far superior to triangular prisms of similar size and give more accurate results with easier manipulation.

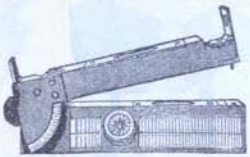
STAFF HEADS.

No. 5770.

5770. Cross Staff Head, octagonal, 2¼ in. for Jacob staff, in Case, each $ 2 75
5772. do. 3 in., with magnetic compass, divided to 2 degrees, on raised ring, needle 1⅞ in. in Case . . . . . " 4 75
5775. do. revolving, with rack-movement, German silver rim, graduated to degrees, with vernier reading to 3 minutes, compass graduated to 2 degrees, needle 2½ in. with agate cap and stop, in Case . . . . . " 11 50

For Jacob Staff and Tripods see page 378

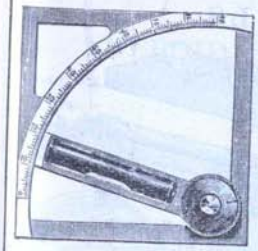
CLINOMETERS.



No. 5801.

5800. Boxwood Clinometer, 12 in., folding to 6 in., brass mountings, with 2 levels, compass and inclination scale, in leather Pocket Case . . . . . each $ 9 20
5801. do. do. do. with sights, in Leather Pocket Case " 12 40

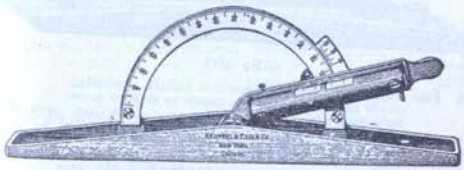
The inclination scale marked upon these clinometers, gives the value of any angle, as follows: The angle ascertained from the divided arc upon the instrument, refers to that degree in the column marked angle and opposite in another column, will be found the rise or fall in any given measured distance. For instance, any the degree shown on the divided arc is 18, opposite to this number on the scale, is 3, thus indicating one part fall or rise in three, or 1 mile in 3 miles, 1 foot in 3 feet, etc.



No. 5805.

No. 5806.

5805. Clinometer or Slope Level, brass, square frame, 4 in., with arc divided to degrees, vernier reading to 5 minutes, in Case . . . . . each $ 10 00
5806. Clinometer or Slope Level, brass, triangular frame, 4½ in., divided to ½ degrees, vernier reading to 5 minutes, in substantial Leather Case . . . . . each $ 10 00

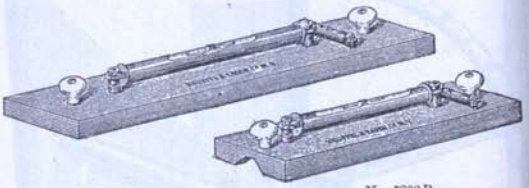


No. 5808.

5808. Combined Level and Clinometer, bronze, base 9 in., silvered arc 4½ in. diameter, graduated to degrees, vernier reading to 5 minutes, fine adjustable bubble, graduated on the glass, with clamp-screw, in Mahogany Case . . . . . each $ 12 00

This is a very practical level for Civil Engineers, Architects, Machinists, Builders and others. It can be applied direct in mounting machinery, construction material, etc., or it can be used on a straight-edge to determine the slope of ground, embankments or excavations, in laying rails and for other similar purposes.

LEVELS.



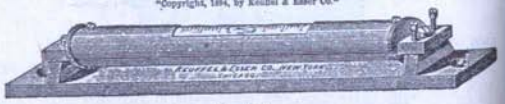
No. 5809 A. No. 5809 B.

5809 A.	Fine Adjustable Level Iron Base 18×4×1 in., bubble tube 9 in., weight about 13 lb	each	$ 20 00
5809 B.	do. do. 12×3×1 in., bubble tube 7 in., weight about 6 lb	"	16 00
5809 C.	do. do. 12×3× 1in., bubble tube 7 in., weight about 6 lb	"	12 00

The levels No. 5809 are of the finest workmanship and of the greatest possible precision and very sensitive. The bubbles are ground and divided on the glass and are adjustable. Each level is provided with a cross-bubble for accurate adjustment. No. 5809 B has a grooved (V shaped) base for use on round surfaces, such as shafting. We recommend these levels for the most particular and delicate work.

No 5810.

5810.	Fine Adjustable Level, fine sensitive bubble, graduated on the glass, base with side braces to make it more rigid, base 8 in., level vial 3½ in., ... in Case,	each	$ 6 00
5811.	do. do. do. but base 12 in., level vial 6 in.,	"	" 8 00
5812.	do. do. do. " " 16 " " " 7 "	"	" 10 00

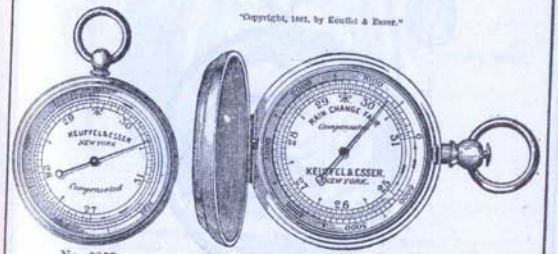


No. 5816.

5815.	Adjustable Level, brass, graduated bubble, base 6 in., bubble tube 4 in., in Case,									each	$ 3 50
5816.	do.	do.	do.	"	8	"	"	"	6	"	"	"	3 00
5817.	do.	do.	do.	"	10	"	"	"	8	"	"	"	3 50
5818.	do.	do.	do.	"	12	"	"	"	10	"	"	"	4 00
5819.	do.	do.	do.	"	14	"	"	"	12	"	"	"	4 50

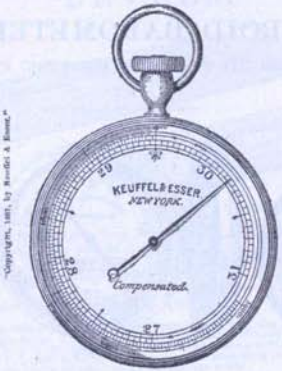
ANEROID BAROMETERS.

FOR MEASURING HEIGHTS AND ATMOSPHERIC PRESSURE.



No. 5855. 5871.

5850.	Watch pattern, gilt case, 1¾ in. diameter, silvered dial, revolving altitude scale 8000 feet, in morocco case,	each	$ 12 90
5855.	Watch pattern, gilt case, 1¾ in. diameter, silvered dial, revolving scale 3000 feet, compensated for temperature, in morocco case	"	20 00
5856.	Like No. 5855, but altitude scale 6000 feet	"	18 80
5857.	" " 5855, " " " 12000 "	"	20 00
5858.	" " 5855, " " " 18000 "	"	21 50
5860.	Pocket pattern, gilt case, 1¾ in. diameter, silvered dial, revolving altitude scale 8000 feet, compensated for temperature, detachable bar-needle compass on reverse side, in morocco case	"	29 50
5861.	Like No. 5860, but altitude scale 18000 feet	"	30 60
5870.	Watch pattern, nickel hunting case, 2 in. diameter, silvered dial, revolving altitude scale 3000 feet, compensated for temperature	"	23 20
5871.	Like No. 5870, but altitude scale 6000 feet	"	22 00
5872.	" " 5870, " " " 12000 "	"	23 20
5873.	" " 5870, " " " 18000 "	"	25 25

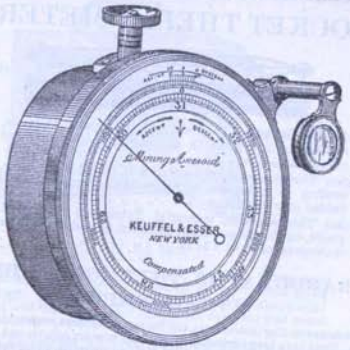


No. 5890.

5880.	Pocket pattern, brass case, 2½ in. diameter, silvered dial, revolving altitude scale 3000 feet, compensated for temperature, in morocco case	each	$ 21 00
5881.	Like No. 5880, but altitude scale 6000 feet	"	20 00
5882.	" " 5880, " " " 12000 "	"	21 00
5883.	" " 5880, " " " 18000 "	"	22 00
5890.	Pocket pattern, bronzed case, 2¾ in. diameter, silvered dial, revolving altitude scale 3000 feet, operated by rack and pinion, revolving pointer (index) operated by separate action by milled ring, compensated for temperature, in morocco case	"	33 30
5891.	Like No. 5890, but altitude scale 6000 feet	"	32 20
5892.	" " 5890, " " " 12000 "	"	33 30
5893.	" " 5890, " " " 18000 "	"	34 65

As the altitude scale and the pointer of Nos. 5890 to 5893 have separate actions, the instrument can also be used as one with fixed altitude scale.

5895.	Mining Barometer, like No. 5890, but reading 2000 feet below and 6000 feet above sea level	each	$ 34 65



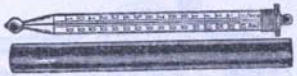
No. 5920.

5900.	English Government pattern, brass case, 5 in. diameter, silvered dial, divisions on raised ring, fixed altitude scale 6000 feet, revolving pointer, compensated for temperature, curved thermometer, in morocco case,	each	$ 32 20
5902.	Like No. 5900, but altitude scale 12000 feet	"	35 45
5904.	" " 5900, " " " 18000 "	"	38 10
5910.	Surveying Barometer, brass case, 3 in. diameter, silvered dial, divisions on raised ring, fixed altitude scale 14800 feet, vernier scale operated by rack and pinion, reading to 5 feet, compensated for temperature, adjustable reading lens, in leather sling case . . .	"	50 50
5915.	Surveying Barometer, brass case, 5 in. diameter, silvered dial, division on raised ring, fixed altitude scale 5000 feet, vernier scale operated by rack and pinion, reading to 1 foot, compensated for temperature, adjustable reading lens, in leather sling case . . .	"	53 70
5916.	Like No. 5915, but altitude scale 14900 feet	"	75 00
5920.	Mining Barometer, brass case 5 in. diameter, silvered dial, divisions on raised ring, fixed altitude scale 2000 feet below and 4000 feet above sea level, vernier scale operated by rack and pinion, reading to 1 foot, compensated for temperature, adjustable reading lens, in leather sling case	"	53 70

The instruments Nos. 5910 to 5920 are constructed specially for ascertaining slight variations in gradients, levels etc. Their extreme sensitiveness is of great value in mining and surveying work generally. A valuable improvement in these instruments is an arrangement of the scale of altitude permitting the reading by a vernier, formerly impracticable, owing to the usual altitude scale being a gradually diminishing one to which a vernier could not be applied. In the above instruments the action has been so adjusted as to give accurate readings upon a uniform scale of altitudes, the barometrical scale of inches having been made progressive so as to afford the correct relative readings with the scale of altitudes.

These instruments are also constructed for measuring greater altitudes, i. e., 10,000, 15,000 or 20,000 feet, but with these higher scales the measurements cannot be made quite so minute as in the more open scales.

POCKET THERMOMETERS.



No. 5930.

5930. Pocket Thermometers, mercurial, 5 in., opal glass scale, reading to 2 degrees, in nickel-plated brass or hard rubber case . . . . . each $ 85

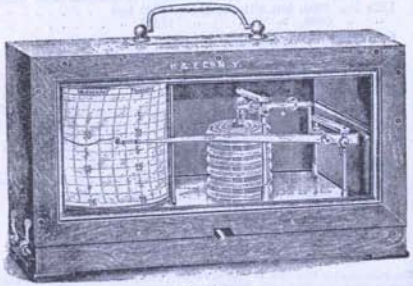
5931. Pocket Thermometers, mercurial, 4 in., opal glass scale, reading to 2 degrees, in nickel-plated brass or hard rubber case with ring 50

5932. Pocket Thermometers, mercurial, Fahrenheit and Centigrade, oxidized brass scale, mounted in polished, hinged mahogany case, 4½ x 1½ in. 1 75

BAROGRAPHS, THERMOGRAPHS & HYGROGRAPHS.

These self-recording instruments are for many purposes preferable to reading instruments. They have been perfected, so that they now are reliable and correct.

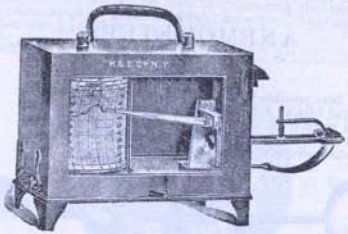
The vital part of these instruments expands or contracts under varying conditions of the atmosphere and imparts its motion to a multiplying lever. To one end of this a pen is attached which automatically draws a curve on a graduated chart wound around a cylinder. The latter revolves once a week by clockwork running one week.



No. 5941.

5940. Barograph, small size; registering one week; from 28 in. to 30.5 in. atmospheric pressure, by twentieths inches. Series of 5 vacuum boxes; cylinder 2½ in. diameter by 2¾ in. high. In polished mahogany Case, hinged cover with glass paneled front and handle. With charts for one year and usual accessories. . . . . each $45 00

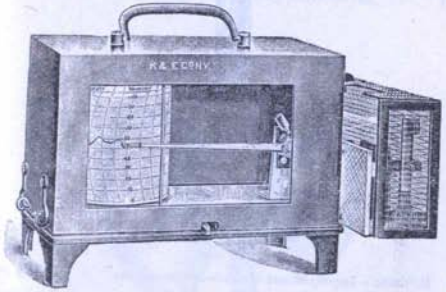
5941. do. do. but large size; series of 8 vacuum boxes, cylinder 3½ in. diameter by 3¾ in. high 55 00



No. 5942.

5942 Thermograph, registering one week; from 0 to 100 degrees Fahrenheit by 2 degrees; cylinder 2½ in. diameter by 2¾ in. high. In weather-proof metal case, with glass paneled front and handle. With charts for one year and usual accessories . . . . . each $ 45 00

The curved tube outside of the case is filled with alcohol and hermetically sealed; the alcohol expands and contracts under changes of temperature, thereby changing the curve of the tube and this motion is imparted to the recording lever.



No. 5943.

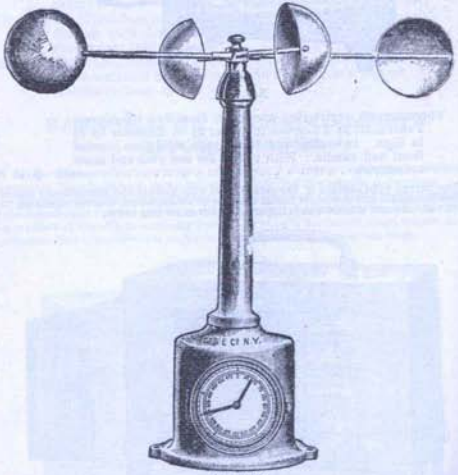
5943. Hygrograph, registering one week; from 0 to 100 per cent. of moisture by single per cent. Cylinder 3½ in. diameter by 3¾ in. high. The sensitive hairs are protected by a wire cage. Instrument in weather proof metal case with glass paneled front and handle. With charts for one year and usual accessories . . . . . each $ 60 00

The vital part of this instrument consists of a bundle of fine sensitive hairs, which expand and contract under variations of the humidity and this motion is imparted to the recording mechanism.

ANEMOMETERS.

TESTING.

We have the best possible appliances for testing anemometers and furnish with each anemometer a table giving a number of variations. A much more complete table of this kind, practically covering the range of the instrument will be furnished for . . . . . $ 5 00



No. 5948

5948 Robinson's Improved and Simplified Anemometer . . each $ 30 00

The four hemispherical cups are set in rotation by the motion of the air and the number of revolutions is recorded by the mechanism in the base of the instrument The vertical axis communicating the motion of the cups to the recording mechanism runs in ball bearings, thus assuring a very sensitive and delicate movement The results of observations can be read off on an enameled dial on the face of the base The outer circle of this dial registers 5 miles by $\frac{1}{10}$ mile and the inner one up to 500 miles The two hands can be set to zero

As we manufacture anemometers, we have the best facilities for repairing them, whether of our make or other.

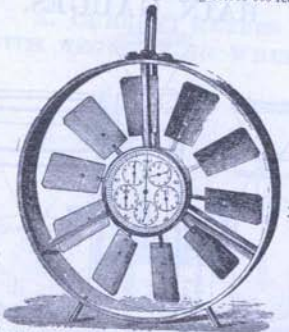
For Stop Watches, see page 405.

Anemometers (Air Meters) are used for measuring the velocity of air currents in mines, hospitals, public buildings, sewers etc. They serve manifold and important sanitary and scientific purposes.

The fans (or vanes) must always face the current. The long hand registers feet on the large circle, while on the small circle hundreds, thousands, ten-thousands, etc. are registered.

No. 5950.

5950. Improved Portable Air Meter, with disconnecter, vane 2½ in. diam., registering 1000 feet, in Wooden Case, each $ 19 50
5952. do. do. do. registering 10,000 000 feet, " 21 75



No. 5955

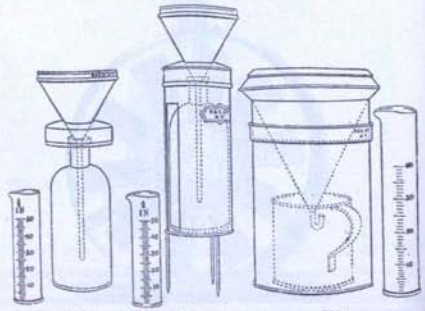
5953. Biram Anemometer, 3 in. diam., reading to 1000 feet,
5957. do. 4 in. diam., reading to 1000 feet, with disconnecter each $ 20 25
5958. do. 4 " " " " 100,000 " do. " 19 00
5963. do. 6 " " " " 1000 " do. " 21 00
5965. do. 6 " " " " 10,000,000 " do. " 21 00
Leather Sling Cases for Anemometers, each $ 2 50 3 2 75 4 3 00 6 in.

For Stop Watches see page 405.

No. 5968

5968. Watch pattern Anemometer, 2 in., registering to 1000 feet; nickel plated hunting case, with stop. The two covers when open form a base for the instrument. In silk velvet lined morroco Case . . . . . each $ 30 00

RAIN GAUGES.



No. 5980. 5982. 5984

5980. Rain Gauge, Howard's model, simple construction, with graduate, reading to $\frac{1}{10}$ in. . . . . each $ 4 00

5982. do. do. Symon's model, with prongs to prevent tipping, with graduate reading to $\frac{1}{100}$ in., " 6 00

5984. do. do. Glaisher's model, a very reliable instrument, with graduate reading to $\frac{1}{100}$ in., . . . " 8 50

K. & E. CURRENT METERS.

The use of the Current Meter is becoming of increasing importance for technical and scientific purposes. The construction of these instruments, as offered by us presents a considerable progress and many improvements.

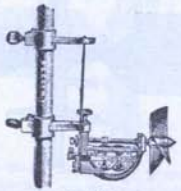
Current Meters are constructed either with graduated registering wheels or with electrical recording mechanism or with both these means of observation. They are mounted on a rod or are anchored (floating meters).

While meters with electrical recording device (Hasslacher's construction) can be used under all conditions, those with graduated recording wheels (Woltmann's construction) are adapted chiefly to shallow waters and medium and low velocities.

Of the various improvements we would mention the ball-bearings of the propeller axis. The balls are of a very hard nickel alloy and rust-proof. The ball-bearing in conjunction with the agate bearing of the pivot insures a hitherto unattained ease of motion. The wings of the propellers are on the plane of a true screwthread at a definite angle to the axis. The constant is therefore in a definite relation to the pitch, except at the very lowest velocities.

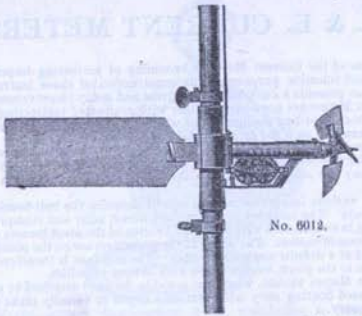
Current Meters should, whenever possible, be used attached to a rod, and should be used floating only when extreme depth or velocity make this mode of use necessary.

A. CURRENT METERS WITH REGISTERING WHEELS.



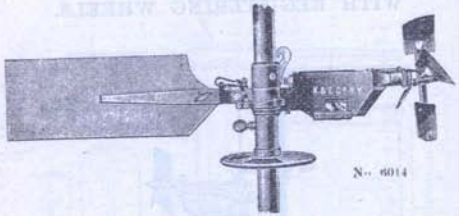
No. 6010.

6010. Current Meter, pocket size; two graduated wheels registering to 1000 revolutions. The registering wheels can be thrown into and held in gear by a string attached to a lever carrying them, or they can be released and stopped by means of a cam operated by two strings and attached to the frame. The instrument fits on a pole of $\frac{3}{4}$ inch diameter. It can be taken apart and stored compactly in a morocco Case 9 x 4 x $1\frac{1}{2}$ in. . . . . each $ 45 00



No. 6012.

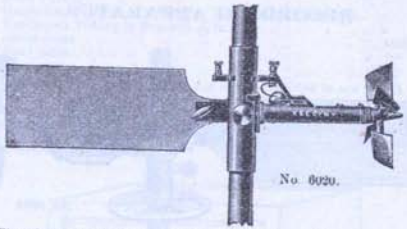
6012 Current Meter, medium size; propeller axis in ball and agate bearings encased in torpedo-shaped mantle; two graduated wheels registering to 1000 revolutions; improved arrangement for engaging and disengaging registering wheels; detachable metal rudder $3\frac{1}{2}$ x 9 in.; fits on a pole 1 in. diameter. Two adjusting rings with clamp screw. Instrument in polished Hardwood Case. each $ 90 00



No. 6014

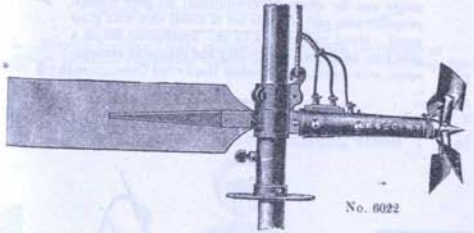
6014. Current Meter, large size; propeller axis in ball and agate bearings; two graduated wheels registering to 1000 revolutions; recording mechanism and axis enclosed in a metal case with glass panel; continuous engaging and disengaging mechanism to recording wheels (one pull on the lever engages, the next pull disengages the gearing and so on alternately.) Metal rudder $4\frac{1}{2}$ x 12 in.; instrument fits on a pole of 1 in. diameter. Pulley for top of pole with clamping device for raising and lowering instrument, sights for determining the direction of the instrument. Instrument in polished Hardwood Case . . . . . each $ 120 00

B. CURRENT METERS WITH ELECTRICAL RECORDING MECHANISM.



No. 6020.

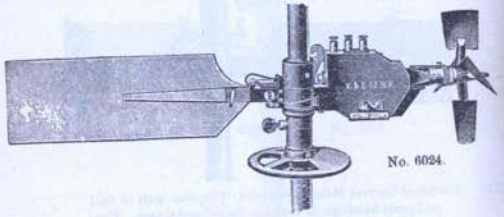
6020 Electrical Current Meter, small size; propeller axis in ball and agate bearings, in torpedo-shaped metal case. Contact for every 25 revolutions. Metal rudder $3\frac{3}{4}$ x 9 in. Instrument fits on a pole of 1 in. diameter; two adjusting rings with clamp screws. In polished hardwood Case . . . . . each $ 70 00



No. 6022

6022. Electrical Current Meter, medium size; propeller axis in ball and agate bearings, contact for single and for every 20 revolutions; propeller axis and contacts in torpedo-shaped metal case. Metal rudder $4\frac{3}{4}$ x 12 in. Instrument fits on a pole of 1 in. diameter. Pulley for top of pole for raising and lowering the instrument; clamping sleeve with set screw, with sights. The torpedo-shaped body of this instrument carrying the propeller axis and contacts, can be unscrewed and attached to a large metal rudder, thus forming a Floating Current Meter (see cut No 6030.) Instrument in polished Hardwood Case each $ 110 00

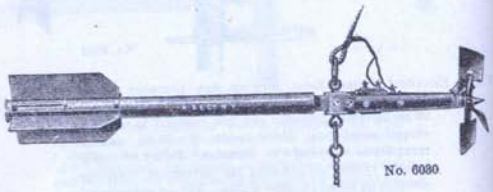
C. CURRENT METERS WITH GRADUATED RECORDING WHEELS AND ELECTRICAL RECORDING APPARATUS.



No. 6024.

6024. New Universal Current Meter; propeller axis in ball and agate bearings; two graduated gear wheels registering to 1000 revolutions, with a continuous engaging and disengaging mechanism (see No. 6014). Contacts for single and for every 25 revolutions; all gear wheels, propeller axis and contacts are in metal case with glass panel. Metal rudder 4½ x 12 in. Instrument fits on a pole 1 in. diameter, with pulley and clamping arrangement, with sights. In polished Hardwood Case . . each $ 200·00

D. FLOATING CURRENT METER.



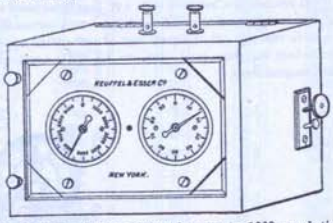
No. 6030.

6030. Brass Rudder with Hooks for suspending and anchoring. For converting Current Meter No. 6022 into a floating Meter as described under No. 6022, in Hardwood Case, each $ 25 00

ACCESSORIES FOR CURRENT METERS.

A.	Iron Tubing, galvanized	per foot	$0 20
B	Brass Tubing, seamless	"	50
C.	Steel Tubing,	"	35
D.	Guide-bar, attached to tubing for Nos. 6014, 6022 and 6024	"	1 50
E.	Graduated Tubing in feet and ⅛ ft.	"	50
F.	Screw-joint	each	2 50
G.	Steel point	"	1 00
H.	Base plate	"	75

These tubings are made to order only and can be furnished in any length up to 12 feet, plain or graduated. For convenience of carrying we also make them in sections with screw joints. The tubing for Current Meters No 6014, 6022 and 6023 can be provided with a guide-bar to prevent the instrument revolving on the tube when raising and lowering it by means of the cable. The prices for tubings and their attachments are given separately to facilitate selection.

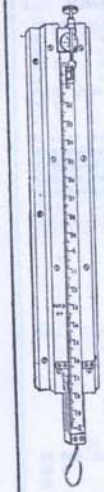


L

L.	Electric Register, 2 dials registering up to 1000 revolutions of propeller, in polished mahogany Case 4½ x 6½ x 3½ in. with switch,	each	$50 00
N.	Electric Bell	"	1 00
O.	Dry Cells	"	40
P.	Electric Register, Bell and 4 Dry Cells	"	57 00
R.	Electric Bell and 2 Dry Cells, in hardwood Case	"	3 50
S.	Insulated Copper Wire, per foot	"	03
T	Lead weight, about 75 lbs., with chain for anchoring, No. 6030	"	10 00

No. 6040.

6040. Stop Watch, stem-winder, nickel plated case, porcelain dial, registering to 30 minutes by ¼ seconds, fly-back engaging and disengaging mechanism . . . . . each $6 00



BOYDEN'S HOOK GAUGE.

6050. Boyden's Hook Gauge, boxwood, brass trimmings . . . . . each $ 25 00

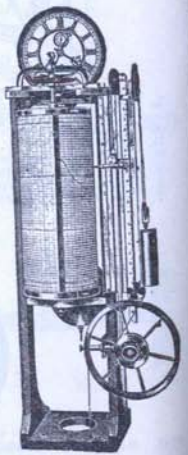
Boyden's Hook Gauge is used for ascertaining the depth of water running over a dam, weir, etc.

It consists of a boxwood scale 2 ft. long, graduated to 100th ft. and sliding in the groove of a boxwood frame, which carries also the vernier, reading 1000th ft. To the lower end of this sliding scale is attached a brass hook with a fine point, while the top end is provided with a clamp and tangent screw.

SELF-REGISTERING TIDE GAUGE.

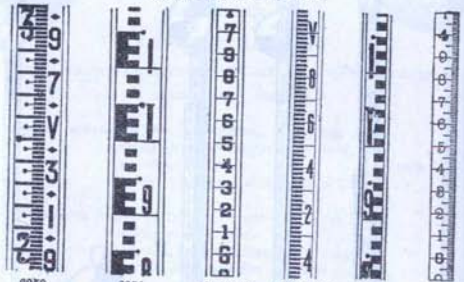
6060. Self-registering Tide Gauge, with fine Regulator Clock running eight days. In case with glass-paneled door with usual accessories . . . . . each $170 00

As the tide rises or falls, it carries with it a balanced float, the motion of which is transmitted by a train of gear wheels to the pencil. This automatically draws the recording curve on a graduated chart wound around a cylinder, which makes one revolution in seven days.

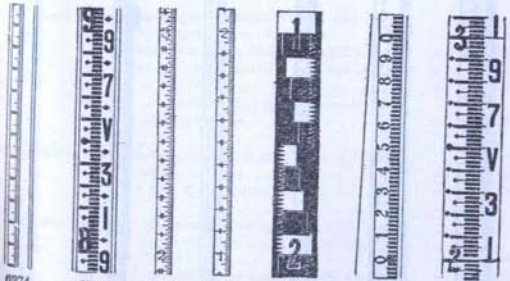


No. 6060.

DIVISIONS AND NUMBERING OF KEUFFEL & ESSER CO.'S LEVELING RODS.



6250. 6251. 6254 & 5. 6260 & 1. 6267 & 8. 6256 & 7. 6262 & 3. 6258. 6264. 6270 6271.



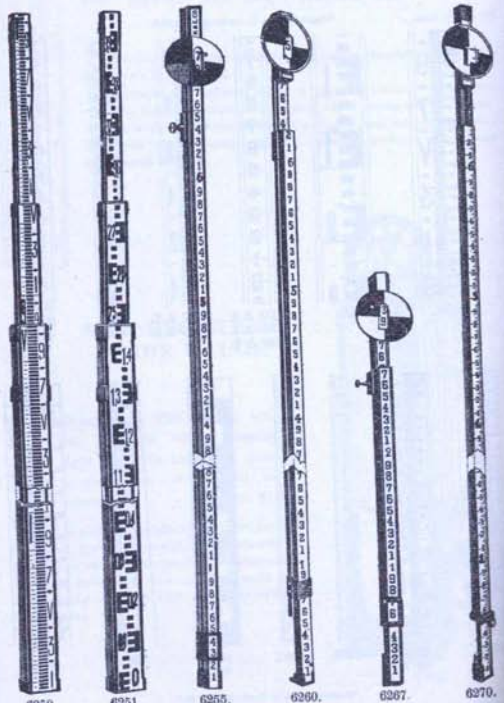
6274. 6276. 6277. 6280. 6281. 6284. 6285. 6288. 6330. 6332.

The numbers refer to illustrations and descriptions pages 408-411

KEUFFEL & ESSER CO.'S

LEVELING RODS AND POLES.

SUPERIOR QUALITY.



6250. 6251. 6255. 6260. 6267. 6270.

For illustrations of graduations see preceding page.

KEUFFEL & ESSER CO. NEW YORK.

THE ONLY MEDAL

FOR

LEVELING RODS

WAS AWARDED TO

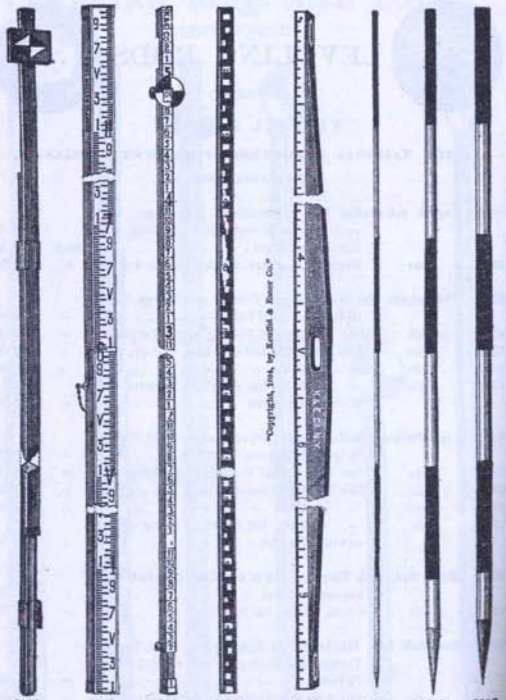
KEUFFEL & ESSER

AT THE NATIONAL EXPOSITION OF RAILWAY APPLIANCES, CHICAGO, 1888.

6250.	**English self-reading Rod,** telescoping, Mahogany, with strong Brass Mountings, 5 feet long, sliding out to 14 feet	each	$	22 50
6251	do	Metric, 1.5 meter, sliding out to 4 meter	"	22 50
6254.	**Philadelphia Rod,** with Target, Vernier and Clamp, 7 feet sliding out to 12 feet	"		15 00
6255.	do.	but with Patent Rolling Angle Target	"	16 00
6256.	do.	like No. 6254, but div. in $\frac{1}{10}$ and $\frac{1}{100}$ feet,	"	15 00
6257.	do.	" " 6255, " " " $\frac{1}{10}$ " $\frac{1}{100}$ "	"	16 00
6258.	do	" " 6254, but metric, 2.2 meter sliding out to 4 meter	"	15 00
6260.	**Light Philadelphia Rod,** with Target, Vernier and Clamp, 6½ feet, sliding out to 12 feet	"		13 00
6261.	do.	but with Patent Rolling Angle Target	"	14 00
6262.	do.	like No. 6260, but div. in $\frac{1}{10}$ and $\frac{1}{100}$ feet,	"	13 00
6263.	do.	" " 6261, " " " $\frac{1}{10}$ " $\frac{1}{100}$ "	"	14 00
6264.	do.	" " 6260, but metric, 2 meter sliding out to 3.7 meter	"	13 00
6267.	**Mining Rod,** with Target, Vernier and Clamp, 3 feet, sliding out to 5 feet	"		12 00
6268.	do	5 feet, sliding out to 9 feet	"	12 75
6270.	**New York Rod,** Hardwood of light color, with Target, Vernier and Clamp, 6½ feet sliding out to 12 feet	"		14 00
6271.	do.	but with Patent Rolling Angle Target	"	15 00
6272	do.	like No. 6270, but metric, 2 meter sliding out to 3.7 meter	"	14 00

For illustrations of graduations see page 407

For description of Patent Rolling Angle Target, and Rod Level see page 412



6274. 6276. 6280. 6285. 6288. 6290. 6292. 6293.

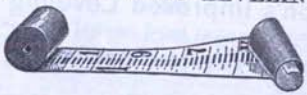
For illustrations of graduations see page 407

For other Leveling Rods see preceding page.

6274.	**Boston Rod,** Mahogany, machine divided on Satinwood, with Target, Vernier at each end, 6½ feet sliding out to 11 feet	each	$ 14 00
6276.	**Telemeter Rod,** self-reading, folding, with strong bronze hinge, 12 feet, folding to 6 feet	"	12 00
6277.	do. 14 " " " 7 "	"	13 50
6280.	**Architects Rod,** light colored Hardwood, brass mounted, with Target, Vernier and Clamp, divided to inches and ½, 5½ feet, sliding out to 10 feet	"	6 00
6281.	do. divided in $\frac{1}{10}$ and $\frac{1}{100}$ feet	"	6 00
6284.	**Florida Rod,** (in one piece), 10 feet, Hardwood . . .	"	8 00
6285.	do. " " " 12 " " . . .	"	10 00
6288.	**Cross Section Rod,** 10 feet, divided on both sides, in $\frac{1}{10}$ and $\frac{1}{100}$ feet, Pinewood, two level bubbles, opening for the hand	"	10 00

FLEXIBLE OR POCKET LEVELING RODS.

No. 6330.



			Each
6330.	Flexible or Pocket Leveling Rod, 8 feet, div. in $\frac{1}{10}$ and $\frac{1}{100}$ feet,		$ 3 00
6331.	do.	do. 10 " " " " "	3 25
6332.	do.	do. 12 " " " " "	4 00
6335.	do.	do. 12 " div. inches and ½ inch,	4 00
6340.	do.	do. metric, 3.5 meter, div. to centimeter	4 00

These Rods are strips of prepared canvas, 3 in. wide, divided like self-reading rods. For use they are fastened to a straight board with thumb tacks. When rolled up they are easily carried in the pocket. (For illustrations of graduations see page 407)

RANGING POLES.

6290. Iron Tubular Ranging Poles, ½ in. diameter, painted red and white alternately every foot,

6	8	10 feet
each $ 2 75	3 00	3 50

6292. Ranging Poles of best seasoned wood, round, tapered, painted red and white alternately every foot,

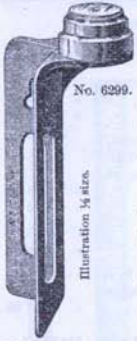
6	8	10 feet
each $ 2 00	2 25	2 50

6293. Ranging Poles of best seasoned wood, octagonal, tapered, painted red and white alternately every foot,

6	8	10 feet
each $ 2 00	2 25	2 50

6295. Ranging Poles, metric, of best seasoned wood, octagonal, tapered, painted red and white alternately every half meter,

2	2½	3 meter
each $ 2 50	3 00	3 75



No. 6299.

Illustration ¼ size.

ROD LEVEL.

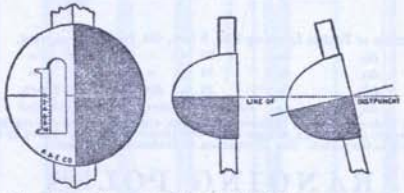
6299. Rod Level, brass, round level vial
1 inch . . . . . each $ 3 00

This Rod Level is used for determining that the rod is held perpendicular. The long rectangular plate insures proper contact when holding it to the rod, but it may beattached to the rod by means of a flat-head screw for which there is a key-hole slot in the plate.

Thompson's Improved Leveling Target.

(PATENTED JUNE 11, 1889.) WITH

KEUFFEL & ESSER CO.'S PATENT ROLLERS, (PATENTED, MARCH 16, 1886.



Patent Rolling Angle Target for Philadelphia Rods . . . . . each $ 7 50
do. do. do. " New York " . . . . . " 7 00

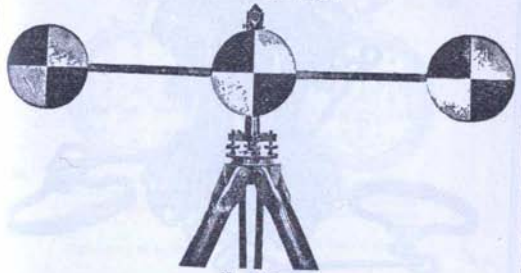
This Leveling Target is devised to insure the rod being held perpendicular to the observer's line of sight, by giving him full control of its position and an efficient check upon a careless rodman.

The horizontal dividing line of the target is carried over two surfaces placed at right angles to each other, thus showing a continuous and unbroken line only when the rod is held vertical.

Besides presenting a greater bearing surface to the rod, this target is steadier than the ordinary form, and when combined with K. & E. Co.'s Patent Rollers, is the easiest to set, the most convenient to move and the most positive in its action, as the rollers, with which the binding springs are provided, bear against the rod and enable the target to be moved up or down easily and without jerking, while they do not wear the rod but prevent the scraping inevitably resulting from the contact of springs. **Rods 6255, 6257, 6261 6263 and 6271 in preceding list, have these Patent Rolling Angle Targets.**

URRUTIA'S TELEMETER TARGET.

Patented November 15, 1892.



No. 6345.

6345. Urrutia's Patent Telemeter Target, bronze, in polished mahogany box and with fine Extension Tripod No. 5180, with Directions . . . . . each $ 80 00

Urrutia's Telemeter Target serves as a fixed base-line for distance measuring by means of a transit. The length of this base-line is determined by targets similar to those used on leveling rods, so that it can be sighted at a considerable distance and with a degree of correctness limited only by the correctness of the transit and the care of the observer.

The instrument is provided with a leveling head like a transit, to set the target horizontal, and has a sighting arrangement to determine that the targets stand vertical to the line of sight.

STANDARD MEASURES.

These measures are made corresponding to the U. S. Standard Measures in the Coast Survey at Washington.

6360. U. S. St'd Measure, of seasoned pine, faced with hardwood, brass bound ends; 5 feet 3 inches long, divided in feet, the first foot in $\frac{1}{10}$ and $\frac{1}{100}$, the last foot in inches in eighths, the last inch in $\frac{1}{64}$ . . . . . each $ 7 00

6361. do. do. of seasoned Pine, faced with hardwood, brass bound ends, 10 feet 3 inches long, divided in feet, the first foot in $\frac{1}{10}$ and $\frac{1}{100}$, the last foot in inches and eighths, the last inch in $\frac{1}{64}$ . . . . . " 10 00

6362. do. do. of iron $\frac{3}{4} \times \frac{1}{4}$ inch, 5 feet 3 inches long, divided like No. 6361, but the last $\frac{1}{10}$ in $\frac{1}{1000}$ of a foot, in Case . . . . . " 15 00

6363. do. do. of iron, 10 feet 3 inches long, divided like No. 6362, in Case . . . . . " 30 00

6364. do. do. of brass, 1 meter, divided to millimeter, in Case . . . . . " 15 00

6365. do. do. of brass, 1 yard, divided in feet, one end-inch in $\frac{1}{8}$, the other end-inch in $\frac{1}{100}$ in., in Case . . . . . " 15 00

MEASURING CHAINS.

No 6451

STEEL, U. S. STANDARD.

6400 Steel, W G. 12, Brass Handles, oval rings, 50 feet . . . each $ 4 50
6401. do. " " 12, " " " " 100 " . . . . " 8 00
6402. do. " " 12, " " " " 33 " . . . . " 3 50
6403. do. " " 12, " " " " 66 " . . . . " 6 50
6410. do. " " 12, " " brazed links and rings, 50 feet " 6 00
6411. do. " " 12, " " " " " " 100 " " 11 00
6412. do. " " 12, " " " " " " 33 " " 5 50
6413. do. " " 12, " " " " " " 66 " " 10 00

Chain 6411 has a spring-hook (snap) at 50 feet, so that it can be separated there and the handle attached for using it as a 50 foot chain.

STEEL, METER AND VARA.

6420. Steel, W. G. 12, Brass Handles, oval rings, 10 meter . . . each $ 8 50
6421. do. " " 12, " " " " 15 " . . . " 5 00
6422. do. " " 12, " " " " 20 " . . . " 6 20
6424. do. " " 12, " " brazed links and rings, 10 meter " 5 50
6425. do. " " 12, " " " " " " 15 " " 7 50
6426. do. " " 12, " " " " " " 20 " " 10 00
6427. do. " " 12, " " " " " " 25 " " 12 50
6430. do. " " 12, " " oval rings, 10 Varas . . . " 3 50
6431. do " " 12, " " " " 20 " . . . " 6 50
6434. do. " " 12, " " brazed links and rings, 10 Varas " 5 50
6435. do. " " 12, " " " " " " 20 " " 10 00

IRON, U. S. STANDARD.

6440. Iron, W. G. 8, Brass Handles, 2 round rings, 50 feet . . . each $ 2 50
6441. do. " " 8, " " 2 " " 100 " . . . . " 3 50
6442. do. " " 8, " " 2 " " 33 " . . . . " 2 00
6443. do " " 8, " " 2 " " 66 " . . . . " 3 20
6450. do " " 8, " " 3 sawed oval " 50 " . . . . " 3 50
6451. do. " " 8, " " 3 " " 100 " . . . . " 5 50
6452. do. " " 8, " " 3 " " 33 " . . . . " 2 70
6453. do. " " 8, " " 3 " " 66 " . . . . " 4 25

TALLYING MACHINES.

No 6456.

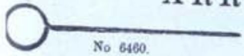
No 6457

6456 Tallying Machine, for keeping count by pressing on a knob, nickel-plated watch case, porcelain dial, 3 graduated circles registering to 1000, with lever for setting hands to zero . . . . each $ 4 00
6457 do. do. do. but with 4 graduated circles, registering to 10,000 . . . . " 5 50

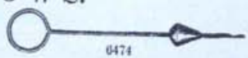
No. 6459

6459 Tallying Machine, for keeping count by pressing on a knob, nickel-plated, registers to 999 . . . . each $ 2 50

ARROWS.



No 6460.

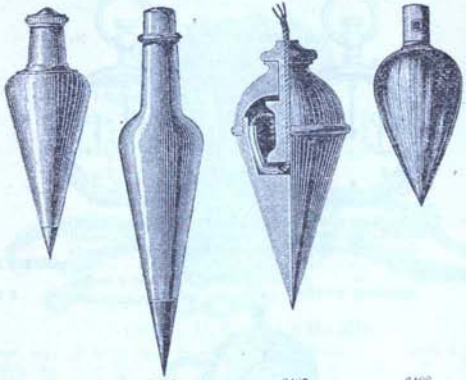


6474

6476.

6460 Steel Arrows, W. G. 6, bright, 14 in., set of 11 . . . . $ 1 50
6461. do do. " " 9, " 14 " " " 11 . . . . 1 00
6462. do. do. " " 9, japd. 12 " " " 11 . . . . 1 20
6463. do. do. " " 11, bright, 12 " " " 11 90
6464. Brass do. " " 6, " 12 " " " 11 . . . . 2 00
6470. Iron do. " " 9, " 14 " " " 11 60
6474. Steel do. Weighted, W. G. 10, 14 " " " 11 . . . . 3 00
6475. do. do. " " " 8, 14 " " " 11 . . . . 3 00
6476 do do. W. G. 6, bright, 14 in., with white enameled disc, 2½" diam., with red figures 1 to 11, set of 11 . . 5 00
6478. Canvas Carrying Case for No. 6476, with shoulder strap . . . each 2 50

PLUMB BOBS.



No. 6480. 6483. 6487. 6488.

6480.	Brass Plumb Bob, about 6 ounces, steel point, screw cap, each	$	1 50
6481.	do. " 8 " " " " " " "		1 75
6482.	do. " 12 " " " " " " "		2 00
6483.	do. " 14 " " " " " " " with long neck "		2 25
6484.	do. " 24 " " " " " " "		3 25
6485.	do. " 32 " " " " " " "		3 75
6486.	do. " 48 " " " " " " "		5 00
6487.	do. with concealed reel, on which the line is wound and held by friction at any point of its length "		2 50
6488.	Iron Plumb Bob, about 7 ounces . . . . . "		75
6489.	Common Brass Plumb Bob, steel point, about 8½ ounces "		1 00
6490.	do. " " " 11½ " "		1 20

STAKE TACKS.

6494.	Stake Tacks, galvanized, tin box of 50		10
6495.	" " " " " 100		20

These tacks have an indentation in the surface of the head to guide the point of the plumb bob in exactly indicating position.

PLUMB BOB CORD.

6496.	Plumb Bob Cord, best linen, thin, medium or thick . . per yard	$	02
6497.	do. best braided silk . . . . . " "		06

TAPE GRADUATING LOFT.

EXCELSIOR MEASURING TAPES.

(Patented: Oct. 19, 1880. March 23, 1886. April 21, 1887. May 17, 1887. April 22, 1894. June 26, 1894)

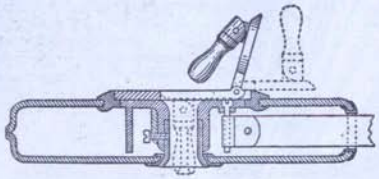
MANUFACTURED BY

KEUFFEL & ESSER CO.

NEW YORK.

These **American-made** tapes are recommended as superior to all others in *accuracy, construction, material* and *workmanship*. They are divided according to the U. S. Standard, as fixed by the U. S. Coast and Geodetic Survey. The Steel Tapes are standard at 62°F.

PATENTED IMPROVED CENTRE.



The New Patent Centre with flush folding handle, as shown in cut, has a large drum which winds the tape quickly and avoids the close coiling which injures the steel lines. A long swiveling handle, when closed, protrudes beyond the surface of the tape case, so that the crank can be thrown open by pressing the projecting end of the handle. The larger centre permits using a longer crank giving more leverage.

SUBDIVISIONS.

Steel Tapes in 10ths have the foot divided into 10 parts and each $\frac{1}{10}$ again into 10 parts, making the ultimate division $\frac{1}{100}$ foot.

Steel Tapes in 12ths have the foot divided into inches ($\frac{1}{12}$ foot) and each inch into eighths, making the ultimate division $\frac{1}{8}$ inch.

Woven Tapes in 10ths have the foot divided into 10 parts and each $\frac{1}{10}$ into halves, making the ultimate division half-tenths of a foot.

Woven Tapes in 12ths have the foot divided into inches ($\frac{1}{12}$ foot) and the inches into halves, making the ultimate division half-inches.

Spring Pocket Tapes are divided in inches and $\frac{1}{8}$ inches.

As an additional means of obtaining accuracy and uniformity in measuring, we recommend

EXCELSIOR STEEL TAPES

WITH

TEMPERATURE COMPENSATING SCALE.

PATENTED JUNE 26, 1894.

In the tapes No. 6502½, 6532½ and 6542½ there is a special scale opposite the 50 or 100 foot mark, so that the 50 and 100 feet are not read from the usual mark, but from the special scale. The latter is numbered to correspond with the thermometer readings, and the 50 or 100 feet point is at that mark of the special scale, whose number agrees with the thermometer reading at the time of measurement. At 62° F. at which the tapes are standard, the 50 or 100 foot mark would coincide with the thermometer reading, for all other temperatures it would be before or beyond it. For instance, at 80° the 100 feet terminate at the mark numbered 80; at 40° at the mark numbered 40, etc. The above cut, which is actual size, will show how important it is for exact measuring, to make this correction for temperature. The fig. "9" in the cut is the ninth $\frac{1}{10}$ of the last foot of a 100 foot tape.

EXCELSIOR STEEL TAPES

WITH STATED TENSION.

To secure uniformity in measurements we etch on any of the tapes Nos. 6502 to 6580 the tension at which the tape agrees with the Coast Survey Standard, when supported for its entire length, and when supported by its ends only and also the temperature at which these tensions were determined.

The charge for determining the tension and etching it on the line is . . $ 2 00

Excelsior Tapes in Metric, Vara and other measures furnished to order at very short notice.

REPAIRING TAPES.

We promptly attend to any repairs on steel or woven tapes and execute them in the most approved manner at moderate charge.

NICKEL PLATED TAPES.

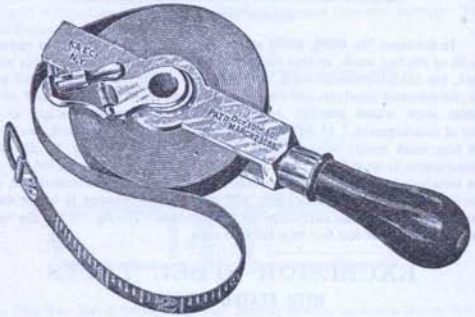
We are prepared to nickelplate our steel tape lines in the best and most durable manner (for protection against rust) at the following prices:

	25	33	50	66	75	100 feet
each $	90	90	1 35	1 55	1 55	1 75

EXCELSIOR

STEEL MEASURING TAPES.

Excelsior Steel Lines are of superior quality, made by an improved method which insures correct and legible dividing.



Stevens EXCELSIOR STEEL TAPES, **1/2 in. wide,** on patent brass frame, patent improved centre with folding handle. **Graduations begin on the line.**

			Length in feet	**50**	**100**
6503.	10ths	of feet	each $	6 20	11 15
6503.	12ths	"	"	6 20	11 15
6508.	10ths	" and Links	"	6 40	11 50
6509.	12ths	" "	"	6 40	11 50
6510.	12ths	" and Meter	"	7 65	14 00
6502½.	10ths	" with Patent Temperature Scale, see page 419	"	7 20	12 15

Columbia EXCELSIOR STEEL TAPES, **1/2 in. wide,** stout bent leather case, all mountings nickel plated, patent improved centre with flush folding handle. Graduations begin **at end of line**

			Length in feet,	**33**	**50**	**66**	**75**	**100**
6512.	10ths	of feet	each $	4 65	6 50	8 30	9 30	11 60
6513.	12ths	"	"	4 65	6 50	8 30	9 30	11 60
6518.	10ths	" and Links,	"	4 85	6 70	8 55	9 65	11 90
6519.	12ths	" "	"	4 85	6 70	8 55	9 65	11 90
6520.	12ths	" and Meter.	"	5 65	7 90	10 15	11 60	14 35
6512½.	10ths	" with Patent Temperature Scale, see page 419,	each $	—	7 50	—	—	12 60

Cornell EXCELSIOR STEEL TAPES, **3/8 in. wide,** stout bent leather case, all mountings nickel plated, patent improved centre with flush folding handle. Graduations begin **at end of ring.**

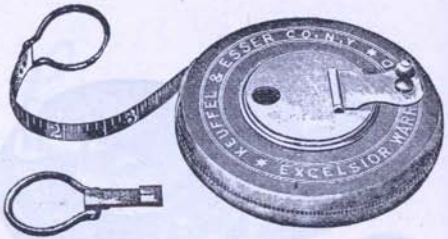
			Length in feet,	**25**	**33**	**50**	**66**	**75**	**100**
6532.	10ths	of feet	each $	3 60	4 15	5 75	7 35	8 35	10 30
6533.	12ths	"	"	3 60	4 15	5 75	7 35	8 35	10 30
6536.	10ths	" and Links	"	3 75	4 30	6 00	7 60	8 60	10 60
6537.	12ths	" "	"	3 75	4 30	6 00	7 60	8 60	10 60
6532½.	10ths	" with Patent Temperature Scale, see page 419,	each $	—	—	6 75	—	—	11 30

Vanderbilt EXCELSIOR STEEL TAPES, 3/8 in. wide, stout bent leather case, all mountings nickel plated, flush folding handle. Graduations begin at end of ring.

		Length in feet.	25	33	50	66	75	100
6538.	10ths of feet	each	$ 3 50	4 10	5 70	7 25	8 25	10 15
6539.	12ths "	"	3 50	4 10	5 70	7 25	8 25	10 15
6540.	10ths " and Links	"	3 65	4 20	5 90	7 50	8 50	10 40
6541	12ths " . . .	"	3 65	4 20	5 90	7 50	8 50	10 40

Nonsolace EXCELSIOR STEEL TAPES (Paine's Pattern), 5/16 in. wide, stout bent leather case, all mountings nickel plated, patent improved centre with flush folding handle; two handles for tape line. Graduations begin at end of line.

		Length in feet,	50	66	75	100
6542.	10ths of feet	each $ 6 15	7 75	9 20	11 40
6543.	12ths "	" 6 15	7 75	9 20	11 40
6543½.	10ths " with Patent Temperature Scale, see page 419,	each $ 7 15	—	—	12 40



Princeton EXCELSIOR STEEL TAPES (Paines Pattern), 5/16 in. wide, bent leather case, all mountings nickel plated, plain folding handle; two handles for tape line. Graduations begin at end of line.

	Length in feet,	25	33	50	66	75	100
6562.	10ths of feet . . each	$ 2 45	3 10	4 15	5 55	6 90	8 30
6563.	12ths " . . . "	2 45	3 10	4 15	5 55	6 90	8 30

EXTRA-NARROW STEEL TAPES.

New York EXCELSIOR STEEL TAPES (Paine's Pattern), 3/16 in. wide, bent leather Case, all mountings nickel plated, plain folding handle, two handles for tape-line.

	Length in feet,	50	100
6570.	10ths of feet . . . . . each	$ 5 85	10 50

(This Tape is not made in 12ths of feet.)

The New York Tape is an extra-narrow full divided tape, and is of heavy tough steel ribbon, so that it has good wearing qualities. It is intended specially for the use of Surveyors.

6580. *Berkeley* EXCELSIOR STEEL TAPE, 1/4 in. wide, nickelplated brass reel with strap handle, all mountings nickel plated, two handles for tape-line, divided 10ths of feet (not made in 12ths of feet).

Length in feet,	50	100
each	$ 6 50	$ 10 50

The Berkeley Excelsior Steel Tape is of the finest quality and divided in accordance with the standard of the U. S. Coast and Geodetic Survey at Washington.

The line is provided with a loop at each end, to receive the snaphook holding the ring.

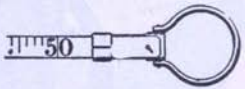
The reel is of heavy rolled brass and nickelplated. The crank for winding folds across the central opening in the reel, to accommodate the knob attached to it. A stout leather strap serves for holding the reel during use. It is very convenient and adds but little to the bulk of the tape.

This is a very practical form of tape for use in mines, by surveyors, etc. The long crank affords ample power for winding. The open reel prevents the accumulation of earth or sand, and allows the line to dry quicker than in a case.

Tapes of other lengths or styles, or with other divisions made to order.

HANDLES FOR TAPES.

No. 6596.



No. 6595.

6595. Plain Brass Handles, for tapes. No. 6542 to 6570 . . . each $ 25
6596. Compensatory Handles for 50 foot tapes do. do. pair 2 00
6597. do. do. " 100 " " do. do. " 2 00

A pair of Compensatory Handles consists of one handle as illustrated under No. 6596 and another of the same size and shape but without the adjustable sleeve.

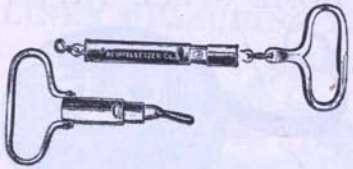
SPRING BALANCES.

For Engineer's Steel Tapes.

These spring balances form a very valuable addition to a tape, as they enable the user to apply exactly the tension, at which the tape is standard.

No. 6598-1.

6598-1. Spring Balance, brass, nickel-plated, indicating tension up to 10 lbs., reading to half pounds, with nickel-plated Handle . . . . . each $2 50
6598-2. Spring Balance, like 6598-1, but indicating tension up to 20 lbs. . . . . " $2 50



No. 6598-2.

No. 6598-4.

6598-3. Spring Balance, brass, with nickel-plated handle . . . . each $3 00
6598-4. Spring Balance, like 6598-3, but with spirit level . . . " 4 00

Spring Balances No. 6598-3 and 6598-4 can be used only with those tapes, which have been standardized with them.

For Plain and Compensatory Handles see preceding page.

For Pocket Thermometers see page 396.

ARCHITECT'S STEEL TAPE.

Yale Excelsior Steel Tapes, in solid German silver case, folding flush Handle, a very handy tape, 25 feet long, $\frac{7}{8}$ in. wide, case $2\frac{1}{2}$ in. diameter. Preferable to Metallic and Steel Tapes in leather cases on account of their small size and light weight; an excellent pocket tape for professional men

6605. 10ths of feet . . . . . each $ 4 00
6606. 12ths " . . . . . " 4 00
6607. 10ths " and Meter . . . . . " 4 50
6608. 12ths " " " . . . . . " 4 50

HOME STEEL TAPES.

HOME STEEL TAPES. 3/8 in. wide, stout bent leather case, all mountings nickel plated, flat folding handle. Graduations begin at end of ring.

	Length in feet,	25	50	75	100
6619.	12ths of feet . . . . . each	$ 2 90	3 50	4 70	6 00
6620.	10ths " . . . . . "	2 90	3 50	4 70	6 00

The Home Steel Tapes are intended to supersede the woven tapes which on account of their low price are often used where a more reliable tape ought to be employed. They will therefore frequently meet a want with the building trades and mechanics. The Home tapes are of best quality steel and accurately divided. The graduations and figures are bright, while the ground-surface is nearly black, so that the measurements are easily read, like on our Excelsior tapes.

WARD'S
PATENT ENGINEER'S TAPE.

6648. Excelsior Engineer's Tape, Ward's Patent, 50 feet long, of same quality as No. 6660, in bent leather case, with folding handle, all mountings nickel plated, divided for single track road-bed, with Directions . . . . . each $ 2 75

6649. Like No. 6648, but divided for double track road-bed . . " 2 75

This Tape is All Linen, in best bent leather case. One side of the tape is marked in feet and tenths, as for ordinary measurements, while the other side is marked in a special manner for setting slope stakes or for finding the centre from the slope stakes, after the Centre Stake has been removed.

A small pamphlet, How to use Slope Stakes, giving full particulars of the method of using it, is supplied with each one of these Tapes.

EXCELSIOR
ALL LINEN MEASURING TAPES.

No. 6650.

Franklin EXCELSIOR ALL LINEN TAPES, ⅜ in. wide, black bent leather Case, patent improved centre with flush folding handle and with leather re-inforced end. Graduations begin at end of ring.

	Length in feet,	25	33	50	66	75	100
6650.	10ths of feet }						
6651.	12ths " }	each $ 1 90	2 00	2 60	2 85	3 10	3 75
6652.	10ths " and Links }						
6653.	12ths " " " } . "	2 00	2 25	2 70	3 00	3 25	4 00

No. 6660.

London EXCELSIOR ALL LINEN TAPES, ⅜ in. wide, black bent leather Case, folding Handle, with leather re-enforced end. Graduations begin at end of ring.

	Length in feet,	25	33	50	66	75	100
6660.	10ths of feet }						
6661.	12ths " }	each $ 1 45	1 80	2 15	2 40	2 65	3 00
6662.	10ths " and Links }						
6663.	12ths " " " } . "	1 55	1 90	2 20	2 55	2 80	3 55

Excelsior All Linen Tapes, ⅜ in. wide. Lines only (without case)

	Length in feet,	25	33	50	66	75	100
6666.	10ths of feet }						
6667.	12ths " }	each $ 70	85	1 20	1 35	1 55	2 20
6668.	10ths " and Links }						
6669.	12ths " " " } "	80	95	1 30	1 55	1 70	2 50

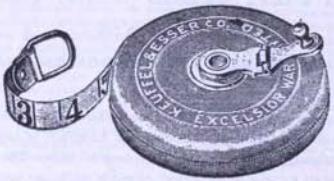
Tapes as above but in Metric Vara and other measures furnished to order at very short notice.

EXCELSIOR METALLIC MEASURING TAPES.

Harvard EXCELSIOR METALLIC TAPES. 5/8 in. wide, stout bent leather case, patent improved centre with flush folding handle, all mountings nickel plated; line interwoven with metal and with leather re-enforced end. Graduaditons begin at end of ring.

		Length in feet	25	33	50	66	75	100
6670.	10ths of feet	each $	1 70	2 00	2 40	2 65	2 90	3 55
6671.	12ths "	"	1 70	2 00	2 40	2 65	2 90	3 55
6672.	10ths " and Links	"	1 80	2 05	2 45	2 80	3 05	3 80
6673.	12ths " "	"	1 80	2 05	2 45	2 80	3 05	3 80

All and any woven tapes of any make, both the all-linen and metallic, are liable to stretch or shrink. Woven tapes should therefore not be used when exact measurements are required, without constant attention to their condition by comparison with a standard steel tape. Any of our Excelsior Steel Tapes will answer this purpose, as they are made according to the standard in the U. S. Coast Survey at Washington.



Dartmouth EXCELSIOR METALLIC TAPES, 5/8 in. wide, stout bent leather case, folding handle, all mountings nickel plated; line interwoven with metal, with leather re-enforced end. Graduations begin at end of ring.

		Length in feet,	25	33	50	66	75	100
6680.	10ths of feet	each $	1 45	1 70	2 15	2 40	2 65	3 30
6681.	12ths "	"	1 45	1 70	2 15	2 40	2 65	3 30
6682.	10ths " and Links	"	1 55	1 80	2 25	2 55	2 80	3 55
6683.	12ths " "	"	1 55	1 80	2 25	2 55	2 80	3 55

METALLIC LINES, (without case).

		Length in feet,	25	33	50	66	75	100
6686.	10ths of feet	each $	70	85	1 20	1 35	1 55	2 20
6687.	12ths "	"	70	85	1 20	1 35	1 55	2 20
6688.	10ths " and Links	"	80	95	1 30	1 55	1 70	2 50
6689.	12ths " "	"	80	95	1 30	1 55	1 70	2 50

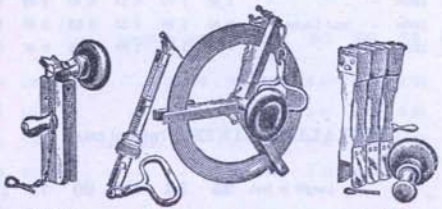
FINE FLAT STEEL WIRE TAPES

ESPECIALLY ADAPTED FOR

CITY, RAILROAD, MINE AND BRIDGE ENGINEERING.

These tapes are made of the best flexible steel-ribbon, carefully tempered to prevent breaking or kinking. They can be furnished in any length up to 1000 feet without joints, and either $\frac{1}{2}$ in. or $\frac{1}{4}$ in. wide. The wider tape is recommended on account of its greater strength, while the narrow has the advantage of being of lighter weight and less influenced by wind. The graduations and numbers are marked on small brass plates firmly attached to the tape. The $\frac{1}{4}$ in. tape can be furnished also with the graduations and numbers etched. Two strong nickel plated handles accompany each tape. All these tapes are graduated according to the standard of the U. S. Coast and Geodetic Survey, and are correct at 62° Fahrenheit. We furnish, if so ordered, a certificate giving the temperature and the tension at which the tape agrees with our standard (a facsimile of the standard of the U. S. C. and G. S.), when the tape is supported over its entire length and when it is suspended from its ends. The charge for a certificate of comparison will be according to the conditions of the test.

Fine flat wire tapes graduated in Meters, Vara, or other measures furnished to order at short notice.



Reel B folded. No. 6740. *Reel A folded.*

6740. City Engineer's Standard Tape, $\frac{1}{2}$ in. wide, 50 ft., with improved spring balance, adjustable for temperature, with level and thermometer, two nickel-plated handles on folding brass reel Style B. . . . . each $18 00

6740½. City Engineer's Standard Tape, like 6740, but 100 ft . . . " 21 00

The spring balance consists of two telescoping brass tubes connected by a strong spring; the inner tube carries at its end the spirit level and tension mark, and the outer one carries the thermometer, which is protected by a revolving semi-tubular cover. A knurled clamping ring encircles the outer tube, in it is cut a V shaped groove, representing the end mark of the measure. The spring balance up to the groove in the ring is included in the measure. On the outer tube is engraved the temperature scale, which compensates for expansion and contraction and is marked with the corresponding degrees Fahrenheit. Correction for temperature, i. e. allowance for contraction and expansion is made by adjusting the clamping ring on the temperature scale to the degree indicated by the thermometer. The starting point is marked by another V shaped groove in a brass plate at the other end of the tape. There are no intermediate graduations on this tape, and the tension and temperature corrections apply to its entire length only.

To use this tape, first adjust the clamping ring to the proper temperature, then bring the V shaped zero groove at the other end of the line exactly over the starting point by means of a suspended plumb-bob; pull the handle until the two tension marks coincide, and bring the tape into a horizontal plane by means of the spirit level, a second plumb-bob suspended from the V shaped groove in the spring balance will then indicate the terminal point on the ground.

6742. Narrow Steel Tape, $\frac{1}{4}$ in wide, 100 ft., with graduations to 10ths and 100ths ft. and numbers etched on tape, with two nickel-plated, detachable handles . . . . . each 7 50

Each additional 100 ft. same graduation . . . . . " 6 50

6745. Narrow Steel Tape, $\frac{1}{4}$ in. wide, 100 ft., black, graduated on brass sleeves every 10 ft., with two nickel-plated detachable handles . . . . . " 3 00

Each additional 100 ft., same graduation 2 00

First 10 ft. graduated on brass sleeves to single feet 1 00

First foot etched to 10ths and 100ths ft 50

6747. Narrow Steel Tape, 100 ft., like No. 6745, but plated with white metal (to resist rusting), with two nickel-plated, detachable handles . . . . . " 4 50

Each additional 100 ft., same graduation 3 50

First 10 ft. graduated on brass sleeves to single feet 1 00

First foot graduated on brass sleeves to 10ths ft. 1 00

The Prices given are for the Tape Lines only.

For Price and Description of Reels see pages 435 to 437.

6751.	Narrow Steel Tape, ¼ in. wide, 100 ft., **black, graduated on brass sleeves every ft.** with 2 nickel-plated detachable handles . . . . . each	$ 7 00
	Each additional 100 ft., same graduation	6 00
	Each additional 100 ft., graduated on brass sleeves every 10 ft	2 00
	First foot etched to 10ths and 100ths ft	50
6753.	Narrow Steel Tape, 100 ft., **like No. 6751, but plated with white metal** (to resist rusting), with two nickel-plated, detachable handles	8 50
	Each additional 100 ft., same graduation	7 50
	Each additional 100 ft., graduated on brass sleeves at every 10 ft	3 50
	First foot graduated on brass sleeves to 10ths ft . .	1 00
6757	Narrow Steel Tape, ¼ in. wide, 100 ft. **plated with white metal** (to resist rusting), **graduated every 10 ft.** on tubular brass sleeves carefully soldered to the tape, to prevent corrosion from moisture entering between sleeve and tape, with two nickel-plated detachable handles . . . . . "	6 00
	Each additional 100 ft., same graduation	5 00
	First 10 feet graduated on tubular soldered brass sleeves to single feet	1 50
	First foot graduated on tubular soldered brass sleeves to 10ths. ft	1 50
6758.	Narrow Steel Tape, **like No. 6757, 100 ft., but graduated every 25 ft.** . . . . . "	5 00
	Each additional 100 ft., same graduation	4 00
	First 25 ft. graduated on tubular soldered brass sleeves to 5 ft	1 00
	First 5 ft. graduated on tubular soldered brass sleeves to single ft	1 00
	First foot graduated on tubular soldered brass sleeves to 10ths ft.	1 50

These Prices are for Tape Lines only.

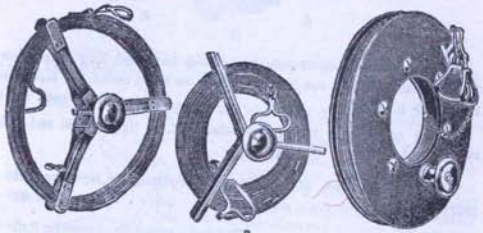
For Prices and Description of Reels see pages 435 to 437.

REELS.

The reels described in this price list embody all the latest improvements which are the result of years of experience and study. The tapes listed on pages 433 and 434 can be furnished on these reels, according to selection.

The Steel Tapes listed under Nos. 6742 to 6758 can be furnished on either Reel A. B. C. D. or E, **white Reel F will accomodate only Nos. 6742, 6757 and 6758.** Each Reel is made in different sizes for the different lengths of tapes. **The prices given for Nos. 6742 to 6758 are for the tape lines only, and the price of the reel selected must be added.**

The following illustrations and descriptions will enable the Engineer to select the reel best suited for his work.



B *C*

A. Plain folding wooden reel, brass trimmings, hardwood knob, for tapes 100 to 500 ft. long . . . . . each $1 25

B. Folding brass reel, hardwood knob, for tapes 100 to 200 ft. long . . . . . each $4 00

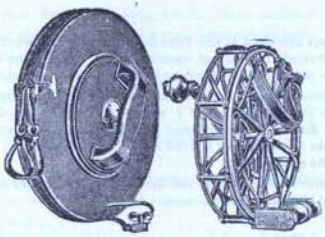
These reels can be folded and conveniently carried in the pocket while the tape is being used. See illustration on page 432.

C. Substantial reel of polished, built-up hardwood, nickel-plated brass bolts and two hardwood knobs revolving on metal centers, for tapes from 100 to 500 ft. . . . . each $7 00

The opening in the center of this reel enables the chainman to slip the reel over his arm, where it will not impede him in manipulating the tape.

The Prices are for the Reels only.

For Prices of Tape Lines see pages 433 and 434.

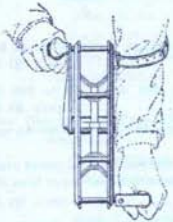


D. E.

D. Improved Reel of polished, built-up hardwood, long metal center, large wooden grip and one knob, revolving on brass center, for tapes from 100 to 500 ft. long . . . . . each $10 00

This reel is very strong and substantial, of light weight and easily manipulated.

E. Skeleton Reel, of gun metal, nickel-plated, for tapes from 800 to 1000 ft. . . . . each $13 50



This reel is especially adapted for Railroad and Bridge Engineering, being built exceedingly strong, to withstand extreme rough usage. It is provided with a strong wooden handle and a leather strap fitting around the forearm of the chainman, thus distributing the weight over the whole arm and greatly reducing the strain on the wrist. Should shorter measures than the full length of the tape be required, the unreeling of the tape can be arrested at any desired point by a brake applied by a half-turn of the milled head on the wooden knob of the crank.

The Prices are for the Reels only.

For Prices of Tape Lines see pages 433 and 434.

F.

F. Wooden Cross Reel, nickel-plated trimmings, with shoulder strap, for tapes from 100 to 1000 ft. . . . . each $10 50

This Reel will accommodate only Nos. 6742, 6757 and 6758.

This reel consists of a strong, hardwood cross, with a heavily nickel-plated brass center, crank and trimmings. A strong leather carrying strap is attached to one side, enabling the chainman to carry the reel over his shoulder, leaving both hands free to manipulate the tape. This reel is especially designed for use in TUNNELS and MINES. It is built exceedingly strong, and no part of it is liable to rust. The reeled up tape is exposed to the air and can be easily cleaned and dried. The large diameter of the center facilitates the rapid unreeling and reeling of the tape.

The prices given are for the reels only.

For prices of Tape Lines see pages 433 and 434.

For Plain and Compensatory Handles see page 426.

For Spring Balances see page 426 and 427.

For Pocket Thermometers see page 396.

EXCELSIOR BAND CHAINS.

The Excelsior Band Chains are a great improvement over the linked, round wire chains. While they cannot take the place of Engineer's Steel Tapes, they will be found far more correct than linked chains, and their advantages over them are obvious. They are made of tempered steel ribbon, ¼ in. wide; the divisions are marked by rivets and the numbers stamped on brass plates riveted to the tape every 5 feet or 5 links respectively. A folding wooden reel Style A and two detachable handles are furnished with each band chain.

No. 6762.

6761.	Excelsior Band Chain,	50	feet,	div.	every	foot,	end-foot	to	10ths,	each $ 4 00
6762.	"	"	"	100	"	"	"	"	"	" 5 00
6763.	"	"	"	200	"	"	"	"	"	" 7 50
6764.	"	"	"	200	"	"	5 feet,	"	"	" 6 00
6771.	"	"	"	50	"	"	foot,	"	12ths	" 4 00
6772.	"	"	"	100	"	"	"	"	"	" 5 00
6773.	"	"	"	200	"	"	"	"	"	" 7 50
6774.	"	"	"	200	"	"	5 feet,	"	"	" 6 00
6775.	"	"	"	66	"	"	link			" 5 00

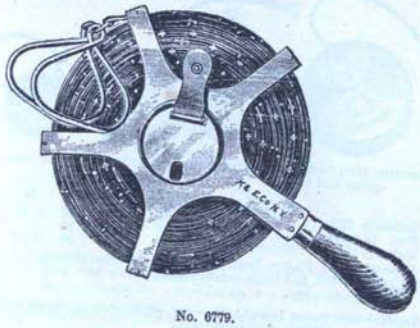
6777. Excelsior Band Chain, **EXTRA HEAVY**, for Railroad work, etc., ½ in. wide, 100 feet, divided every foot, end-foot to tenths, very thick steel band, divisions on brass plates, two swiveling chain handles attached by strong spring hooks and stout solid rings; best quality and workmanship throughout; reel similar to Style A; a very substantial Band Chain for rough work . . . . . each $ 10 00

Band Chains nickel-plated at the following prices:

	50	66	100	300 feet.
Nickel-plating . . . . . each $	1 00	1 00	1 25	2 00

CHAMPION EXCELSIOR BAND CHAINS.

Patented March 13, 1900



No. 6779.

6779. Champion Excelsior Band Chain, superior quality, 100 feet, **heavy blued steel ribbon**, ¼ in. wide; **divided and marked by rivets** at every foot, both end-feet at every tenth, numbered at every 5 feet and with additional number marks (by rivets) at every 10 feet. The reel is of brass, nickel plated, and has a polished wooden handle. The two nickel plated tape handles are provided with double hooks, to prevent their becoming detached accidentally. The tape and reel weigh about 2 pounds and measure 6½ in. across. This is a very substantial and reliable tape of light weight, strong enough for rough work and easy to unreel and reel up; when wound up the whole tape is exposed to the air and can be easily dried and cleaned. . . . . each $ 6 00

6779 A. Champion Excelsior Band Chain like **No. 6779, but plated with white metal**, to resist rusting . . . . . " 6 00

6779 B. Champion Excelsior Band Chain, like **No. 6779 A, graduated and numbered on Babbitt metal**, ... " 6 00

Band Chain 6779 B is intended for use in mines, as no water or moisture can enter between the Babbitt metal and band and corrode the tape. On rough ground like stone or gravel, the divisions are less liable to injury than rivets or plates.

EXCELSIOR POCKET TAPES.

STEEL AND LINEN.

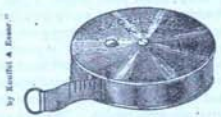
Excelsior Steel Pocket Tapes, ¼ in. wide, patent German silver case, with spring and stop.

	Length in feet,	3	5	6	9	12
6780.	Inches in 16ths . . . . . each	$ 1 00	1 25	1 40	1 90	2 50
6781.	Feet in 100ths . . . . . "			1 60		
6782.	Inches in 16ths and Meter . . "	1 10	1 40	1 60	2 20	2 80

6788. Excelsior Steel Pocket Tape, ¼ in. wide, 10 feet, divided 10ths of feet and links, patent German Silver case with spring and stop . . . . . $ 3 00

Excelsior Steel Pocket Tapes, $\frac{1}{8}$ in. wide, patent German silver case, 1 in. diam. with spring and stop, 36 in.

6790. Inches in 16ths . . . . . each $ 1 00
6791. " " and Meter . . . . . " 1 10



No 6795.

Excelsior Linen Pocket Tapes, patent German silver case, with spring and stop.

	Length in feet,	3	5	6	8
6795.	Div. in inches and Meter . . . . . each $	80	1 00	1 05	1 35

STEEL TAPES

FOR

MEASURING DIAMETERS AND CIRCUMFERENCES.

6796. Excelsior Steel Pocket Tape, ¼ in. wide, in patent German Silver Case, with Spring and Stop, 12 feet . . . . . each $ 3 25

This tape is graduated on one side in inches and sixteenths of inches; on the other side spaces equal to 3.1416 inches each are marked off and numbered 0, 1, 2, etc., the first one being subdivided into 64 equal parts. By passing this tape round any circular body, the circumference is at once read off on one side of the tape, and the diameter on the other side. There are many cases in which such a tape would be useful and certainly handier than a pair of large calipers.

PEDOMETERS AND ODOMETERS.

No. 6905.

6900. Pedometer, watch pattern, nickel case, 1¾ in., registering 12 miles by ¼ mile . . . . . each $ 4 50

6901. do. do. registering 50 miles by 80 yards " 5 25

Pedometers No. 6900 and 6901 indicate the distance walked. The hand advances in proportion to the length of stride, as the instrument is adjustable by an easily accessible screw.

6905. Passometer, watch pattern, nickel case, 1¾ in., registering to 100,000 steps . . . . . each $ 6 50

Passometer No. 6905 registers the number of steps walked and is not adjustable to length of stride. The distance walked can be computed from the number of steps registered.

No. 6910.

6910. Odometer of Brass, with silvered dials, in dust proof leather case with straps . . . . . each $ 15 00

The Odometer is attached to the spokes of a wheel near the hub. It registers the number of revolutions of the wheel up to 10,000, and the distance travelled is determined by multiplying the circumference of the wheel by the number of revolutions which the dial indicates.

FIELD AND MARINE GLASSES.

We keep in stock the finest and best quality of Field and Marine Glasses as only these are desirable and required for Engineering.

No. 6921.

6923.

6921. Field and Marine Glass, object glass 14 lines, power about 2½ times, in soft morocco case, with handle, shoulder strap and leather cord . . . . . each $ 7 80

6923. do. do. object glass 15 lines, power about 4 times, in sole leather sling case, with leather cord " 8 85

No. 6924.

6925.

6924. Field and Marine Glass, object glass 15 lines, like No. 6923 but with sun shades . . . . . each $ 9 25

6925. do. do. aluminum, covered with black morocco, object glass 15 lines, power about 4 times, in sole leather sling case, with leather cord . . . . " 22 50

Engineers and others who use glasses frequently, will welcome these little Field glasses which are of about the size of Opera glasses. They are specially adapted for the use of Engineers etc., have a large field, good light and good definition and as much power as the older style large and heavy glasses. The low prices at which we are offering them should not be taken as an indication of their quality.

EXTRA FINE

FIELD AND MARINE GLASSES.

The progress in the manufacture of optical glass, which led to the production of glass of much higher refractive index than could be made formerly, has been utilized also in the construction of field glasses. The glasses we here list are of greater range and better definition than the older kinds and are at the same time less bulky. Our assortment has been determined with special reference to the requirements of Civil and Military Engineers.

In explanation of the data we give, we would state that the efficiency of a field glass is not dependent on its magnifying power, but on its illumination and definition. An object, to be seen, need be magnified only sufficiently to subtend a visual angle which the eye can appreciate, but it becomes plainly visible only when it is well illuminated. As the illumination is inversely proportional to the magnification, the power of the glass should be in such limits that there is light enough to illuminate the image also on dark days and towards evening. The size of the field is also inversely proportional to the magnification.

The improved field glasses are preferable to the more costly binocular telescopes, because telescopes have collecting oculars which give less light, while field glasses (properly called Galilean telescopes) have dispersing oculars which give more light, and the better illumination of the latter will show an object more distinctly than the slightly greater magnification of a telescope would.

The angle we give in the description is measured vertically. The horizontal angle is indefinite, because it varies with the inter-pupillary distance of the observer, and we therefore do not give it. All the data we give are, of course, for normal (emmetropic) eyes.

In the glasses No. 6927 to 6934 inclusive, the focusing screw is independent of the telescoping arrangement, so that when the glass is telescoped after focusing, it will be in the same focus, without re-adjusting it, when the tubes are again drawn out. There is a disc on the upper bar, for telescoping or withdrawing the tubes without disturbing the focusing screw.

6926. Field and Marine Glass, japanned and covered with morocco, object glass 21 lines, 8 lenses, magnifying power 3 and 5 times, vertical angle 9° 5′ for the lower power and 5° 50′ for the higher, so that the glass would cover 180 and 115 inches respectively on a rod at 100 feet distance. Glass in soft leather case, with handle . . . . . each $ 14 00

The two powers of this glass are produced by a movable compensating lens in the ocular, which drops into the field or out of it according to the position in which the glass is held. The upper cross bar is marked "Far" and "Near" and that one of the words which reads right-side up, indicates whether the movable lens is in the field or not.

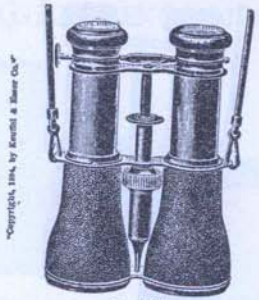
No. 6927.

6927. Field and Marine Glass, japanned and covered with morocco, object glass 24 lines, 8 lenses, magnifying power 3½ times, vertical angle 9°. The glass would cover 189 inches on a rod at 100 feet distance. The telescoping bar is independent of the focusing screw, as described on page 443. In soft leather case, with handle . . . . . each $ 16 00

It will be noticed in comparing the glasses on this list, that of all of them No. 6927 has the largest field for its magnifying power, and the highest power for the size of the field, as neither of these factors has been reduced at the expense of the other. This makes it particularly well adapted for a search glass and for general use.

6928. Field and Marine Glass, japanned and covered with morocco, with sun shades, object glass 17 lines, 6 lenses, magnifying power 4½ times, vertical angle 6°, (would cover 126 inches on a rod at 100 feet distance). The telescoping bar is independent of the focusing screw, as described on page 443. Glass with shoulder cord, in sole leather case, with hand and shoulder straps . . . . . each $ 16 00

6929. Field and Marine Glass, japanned and covered with morocco, like No. 6928, but object glass 19 lines, magnifying power 6 times, vertical angle 4° 20' (would cover 91 inches on a rod at 100 feet distance) " 18 25



No. 6930.

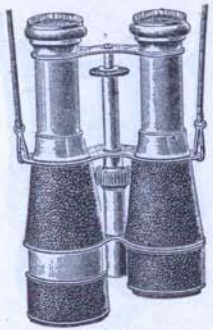
6930. Field and Marine Glass, japanned and covered with morocco, object glass 21 lines, 6 lenses, magnifying power 3½ and 6 times, vertical angle 8° for the lower power and 3° 40' for the higher, so that the glass would cover 168 and 101 inches respectively on a rod at 100 feet distance. The telescoping bar is independent of the focusing screw, as described on page 443. Glass with shoulder cord, in sole leather case with handle and shoulder strap . . . . . each $ 21 50

In this glass the power is changed by a revolving cross-bar provided with a milled head. The central part of the bar, between the oculars, has separate faces marked to show which power is in adjustment. The use of the independent telescoping arrangement is, of course, limited to that power for which the focus has been adjusted by the screw.

6931. Field and Marine Glass, japanned and covered with morocco, with sun shade, object glass 19 lines, 6 lenses, magnifying power 8 times, vertical angle 4° 15' (would cover 45 inches on a rod at 100 feet distance). The telescoping bar is independent of the focusing screw, as described on page 443. Glass with shoulder cord, in sole leather case with hand and shoulder straps . . . . . each $ 20 00

6932. Field and Marine Glass, like No. 6931, but magnifying power 10 times vertical angle 3° 15' (would cover 42½ inches on a rod at 100 feet distance) . . . . . " 24 00

6933. Field and Marine Glass, like No. 6931, but of aluminum, covered with morocco . . . . . " 22 50



No. 6934.

6934. Field and Marine Glass, like No. 6932, but of aluminum, covered with morocco . . . . . each $ 26 50

6935. Field and Marine Glass, japanned and covered with morocco, with sun shades, object glass 21 lines, 6 lenses, magnifying power 3 times, vertical angle 11° (would cover 187 inches on a rod at 100 feet distance). Glass in sole leather case with handle and shoulder strap . . . . . " 14 20

No. 6935½

6935½. Field and Marine Glass, like No. 6935, but object glass 24 lines, vertical angle 12° (would cover 196 inches on a rod at 100 feet distance) . . . . . each $ 16 00

MAGNIFYING GLASSES.

No. 6970.

6970. Reading Glasses, German Silver Rim, Black Handle, Best Quality,

	1½	2	2½	3	3½	4	4½	5 in.
each $	50	75	1 10	1 25	1 70	2 15	2 90	3 50

POCKET MAGNIFYING GLASSES.

MOUNTED IN METAL.

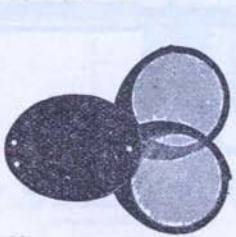
No. 6980. 6986.

6975.	Round,	nickel plated	frame,	1	lens,	1	in.	each $ 70
6980.	do.	bronzed	"	1	"	1	"	" 40
6981.	do.	"	"	2	"	1	"	" 55
6982.	do.	"	"	3	"	1	"	" 1 80
6985.	do.	German Silver	"	1	"	1	"	" 75
6986.	do.	" "	"	2	"	1	"	" 1 00
6987.	do.	" "	"	3	"	1	"	" 1 30

These glasses have a large, flat field and good magnifying power and are well adapted for reading graduations on Surveying Instruments. As they are mounted in metal they are more durable than those in horn or rubber

POCKET MAGNIFYING GLASSES

MOUNTED IN RUBBER.



No. 7002

7008.

7000.	Oval Pattern,	1 lens,	1 in. diameter	each	$ 35
7001.	do.	1 "	1½ " "	"	55
7002.	do.	2 lenses,	1 " "	"	60
7003.	do.	2 "	1½ " "	"	1 00
7006.	Round Pattern,	1 lens,	½ " "	"	35
7007.	do.	1 "	1 " "	"	40
7008.	do.	2 lenses,	¾ " "	"	50
7010.	do.	2 "	1 " "	"	65
7012.	do.	3 "	¾ " "	"	70
7013.	do.	3 "	1 " "	"	95

No. 7021.

7022

7021. Pocket Magnifier, achromatic, in bronzed brass frame, lens ¾ in., power 5 times, a very fine glass with good definition, for examining ore etc. . . . . each $ 7 50

7022. do. do. do. but in brass cylinder case " 8 85

No. 7023.

7024.

7023. Pocket Magnifier, achromatic, in bronzed brass frame, lens ¼ in., power 12 times, a glass of extra power, each $ 6 70

7024. do. do. do. lens ¾ in., power 5 times, " 5 10

No. 7026.

7025. Coddington Lens, brass frame and handle, nickelplated, ¾ in. each $ 1 60

7026. do. " " " " " 1 " " " 1 85

7027. do. " " wooden handle " 1½ " " 2 50

7035. Thread Counter, brass frame, ¼ in. field . . . . . " 35

7036. do. " " " " . . . . . " 50

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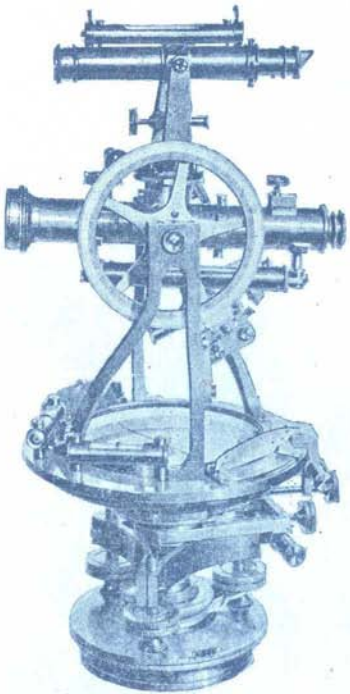

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