

SILVER MEDALS,
FIRST PREMIUM OF LATE EXPOSITION FOR 1874



Our Surveyors' Compasses took the First Premium at the Ohio State Fair held at Cincinnati, September, 1874. We also took the Medal on *Practical, Tracing, Level, Dumpy, Level, and Surveyor's Compass*, at the Fair at *the Ohio State Exposition* held in this city, which ended 5th October 1876, after the most successful and comprehensive competition judged. We were awarded separate Medals for a *Treadle* and *Surveyor's Compass* at the Fair held at Cincinnati, September, 1876.

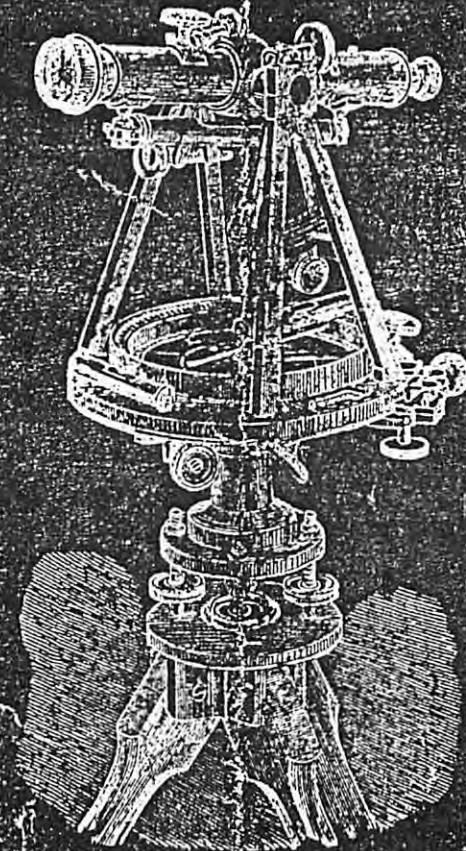
Our Surveyors' Compasses and *Surveyors' Levels* were also awarded Medals at the *International Exposition* held at Philadelphia, 1876. We also took the Medal on *Practical, Tracing, Level, Dumpy, Level, and Surveyor's Compass*, at the Fair at *the Ohio State Exposition* held in this city, which ended 5th October 1876, after the most successful and comprehensive competition judged. We were awarded separate Medals for a *Treadle* and *Surveyor's Compass* at the Fair held at Cincinnati, September, 1876.

ESTABLISHED IN 1853.

MATHEMATICAL INSTRUMENTS,

Manufactured and Sold by

T. F. RANDOLPH,



No. 67 West Sixth St.,
BETWEEN VINE AND WALNUT STREETS,
CINCINNATI, OHIO.

SILVER MEDAL,
FIRST PREMIUM OF LATE EXPOSITION, FOR 1871.



ALSO,
1874.



Our Surveyors' Compasses took the First Premium at the *Ohio State Fair*, held at Cincinnati, September, 1857. We also took the Medal on *Theodolite, Transit, Y Level, Dumpy Level, and Surveyor's Compass*, at the *Fair of the Ohio Mechanics' Institute*, held in this city, which ended 8th October, 1858, after the most scrutinizing examination by competent judges. We were awarded separate Medals for a *Theodolite* and *Surveyor's Compass* at the *United States Agricultural Fair*, held at Cincinnati, September, 1860.

References to local Engineers and Surveyors who have bought instruments of us—and we can say we have sold *all* of the *instruments* that have been bought by our local official *Engineers* and *Surveyors*, with only two exceptions, since we have been in business. This alone speaks for our *instruments*.

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INSTRUCTIONS TO CUSTOMERS.

To parties wishing to purchase Instruments at a distance from this city, the means of transportation in all directions are equal to any other large city, all the different Expresses having offices here, and will transport goods to almost any town in the United States and Canadas, also to all important parts of the globe. In the thousands of shipments made by us in the last 22 years, we have had but few accidents happen to our instruments. The Express company is responsible to us for safe transportation to any point for which they give us a receipt, and when sent by Express we are responsible to the purchaser to extent of Express transportation.

EXAMINATION OF INSTRUMENTS.

I desire to be as liberal as possible, in reference to giving satisfaction to customers, and cannot hope that all parties needing Instruments are acquainted with my style and make; to such I will forward Instruments ordered, with instructions to Express agent to collect the amount of bill, and hold the money, and give the purchaser a reasonable time to test the Instrument (the purchaser to name the time desired in order).

If not found to be as represented, the purchaser to have returned to him inside the specified time his money, and Express agent be directed to return goods to us, otherwise the money to be returned to us. In making this concession to customers, I ask that when they order, that they send name or names of some prominent persons in their vicinity as reference.

The purchaser pays freight in all cases unless goods are returned.

The purchaser also pays charges for return of money by Express on all bills of repairs, and sums under twenty Dollars in Amount.

Instruments properly packed for Shipment, besides the finely finished case that belongs to all Field Instruments.

Great care should be taken to give plain directions, name, town or city, county and State.

REMITTANCES.

Post-office Orders, other than by Express, are probably the most convenient; or Drafts payable to our order at Cincinnati, New York, or Philadelphia, will be received same as cash. All currency taken at Cincinnati quotations. When payment as above suggested comes with orders, for all amounts over \$20.00 we will make a deduction of 2 per cent.

T. F. RANDOLPH,

NO. 67 WEST SIXTH STREET,

CINCINNATI, OHIO.

TO ENGINEERS, ARCHITECTS, AND SURVEYORS.

In offering this circular to the public we only shall give, besides a partial description of our own manufacture of Instruments, some of the adjustments which Surveyors or Engineers can, in most all cases, make themselves. We do not design giving any thing like a full treatise on instruments, but only such information as we think will be of use to our customers, with the engravings made from our own instruments. We desire to make them understood by a short description.

Price List of Instruments, page 7.

Repairing of all kinds of Instruments has become of great importance, as there are few workmen really competent. Another important item, where parties are using Instruments constantly, is promptness. This branch of my business I take especial care to have the work promptly, and well done. Having the patterns for different parts of most makers' instruments, I can afford to do such work on reasonable terms. My charges are for actual time taken and material used, so that to undertake to give expenses for repairs is almost impossible, as often about instruments there are many little things that want some repairs, to make the Instrument useful, and take time to fix. On the receipt of Instruments for repairs, we like to have the order: *Make them right in every respect.* We then soon know what to do.

It is the best plan to send the Tripod; this generally needs some repair, but we can always do without this, if the distance is great. But when a Compass is sent to me to be repaired, always send the socket that fits the *Jacob Staff*, as the pintle that fits the socket of the Compass generally requires refitting to make the Instrument work correctly; besides, if the Compass needs *adjustment*, this is required, or otherwise we have to fit something to the Compass to adjust it on. Surveyors in sending their Compass for repairs in its box, often forget this, because it is on the *Jacob Staff*.

REFERENCES.

- A. HICKENLOOPER**, present City Engineer. Four *Transits*, one *Theodolite*, one *Level*.
- JACOB WIRTH**, Ex-City Engineer. Three *Transits* and two *Levels*.
- R. C. PHILLIPS**, Ex-City Engineer and Superintendent of City Water Works. Two *Theodolites*, *Level*, *Compass*, and *Transit*.
- A. W. GILBERT**, Ex-City Engineer, now Sewerage Engineer. Three *Transits*, three *Levels*.
- JAMES B. BELL**, Ex-County Surveyor and Engineer of Hamilton County. *Theodolite* and *Level*.
- JOSEPH W. GILBERT**, Ex-County Surveyor and Engineer of Hamilton County. *Theodolite*, *Transit*, and *Level*.
- E. F. JEWETT**, Ex-County Surveyor. One *Theodolite*.
- S. W. IRWIN**, Ex-City Engineer and Superintendent City Water Works. *Transit*.
- C. S. KINSEY**, Ass't Surveyor of Hamilton County. *Transit*.
- THOMAS J. HIRST**, Engineer. *Transit*.
- J. EARNSHAW**, Engineer. *Transit* and *Theodolite*.
- SAMUEL H. WITMER**, Engineer. *Transit*, *Level*, and *Compass*.
- GEO. A. YATES**, Covington, Ky. *Theodolite*, *Transit*, and *Compass*.
- J. S. BINKERD**, Dayton, Ohio. Two *Theodolites* and *Level*.
- FRANCIS SNYDER**, Dayton, Ohio. *Transit*, two *Levels*, and *Theodolite*.
- SAMUEL B. SHOUP**, Dayton, Ohio. *Theodolite*.
City of Hamilton, Ohio. Two *Transits*.
Clermont County, Ohio. Eight *Surveyors' Compasses*.
- P. N. Jonte**, Ex-Assist. City Eng. *Theodolite* and *Level*.
- Wallace & Welsch**, Ex-Assists. City Eng. *Transit*.
- Cincinnati Southern Railroad**. 2 *Theodolites*, 5 *Transits*, 6 *Levels*.
- S. A. Hageman**, Ex-Assistant City Eng. *Theodolite*.

THE PLAIN OR SINGLE PLATE COMPASS.

ALL of our instruments, when sold, are in adjustment and ready for use. The Compasses as we make them scarcely ever need any re-adjustment, except the levels. To adjust the levels on a Compass—these same adjustments will also answer for the small levels on the Transit and Theodolite—we generally adjust one level first. Set the Compass on the Jacob Staff and bring the bubble of one level to the center of the slot in the brass tube; turn the Compass one-half around on its socket; if the bubble again settles in the center, the level is adjusted; if the bubble runs to one end of the slot, raise the opposite end by unscrewing the capstan head-screw, so as to bring the bubble one-half way back to the center; move the Compass on the ball-joint until the bubble remains in the center. Repeat this operation until the level remains in the center during a complete revolution of the Compass on its socket. One level being in adjustment, and the Compass level, raise or lower one end of the other level until the bubble stands in the center, and the levels are adjusted.

All other adjustments of a Compass better be made by competent Instrument Makers. We will give the other important adjustments, to enable all to test their Instruments. The needle should cut opposite graduation in every position very accurately. The sights should reverse on a plumb line. This adjustment, with those of the levels and needle, comprise all but those made permanent by the makers.

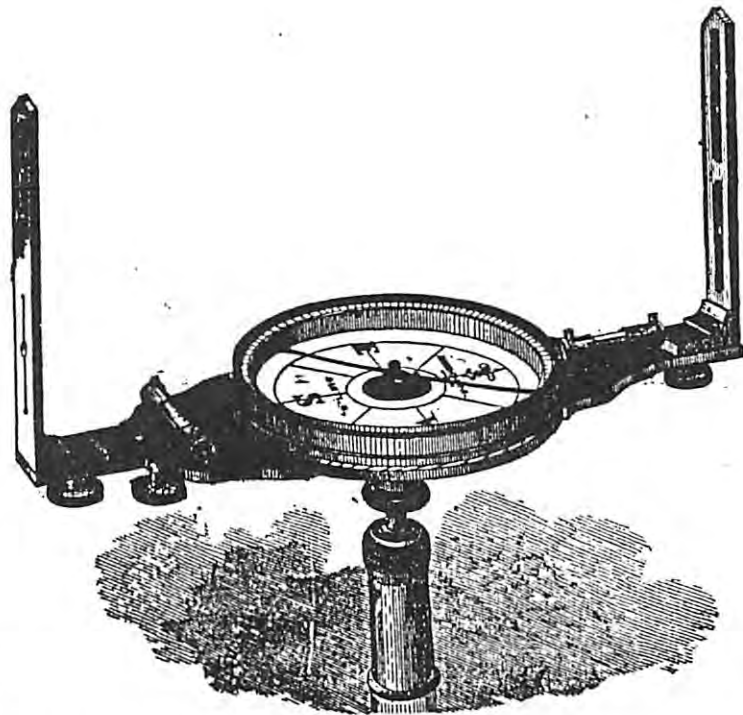
Surveyors sometimes complain of their Compass needles losing their magnetic qualities; this, in most all cases, is owing to the bluntness of the center pin or needle pivot. This is one of the most difficult parts of an instrument to repair, and can only be done right by an experienced Instrument Maker. The center pin can be unscrewed and sent by mail, with the needle, all enclosed in a piece of light wood so as not to be injured. To save time and trouble of writing two or three letters, in a case like the above, our charges for sharpening the center pin, re-charging the needle, and giving instructions for re-adjusting the same, is ONE DOLLAR and return postage. If this amount is remitted to us with the needle, we can return it soon as done.

When needle instruments are not in use, we recommend Surveyors and Engineers to let the needle rest on the pivot, in this way it will retain its magnetism longer; but always in transportation, screw the needle firm against the glass.

In wiping the glass which covers the needle-box, always breathe on it; this removes any electricity which may be caused by rubbing. For the purpose of cleaning the glass, wet the tip of the finger, and touch the glass also.

T. F. RANDOLPH,
MATHEMATICAL INSTRUMENTS.

ESTABLISHED 1853.



PLAIN COMPASS.

THE VERNIER COMPASS.

This instrument has the same adjustments as the Plain Compass, and is made the same with the addition of the vernier plate, with clamp and pinion movement to turn the vernier plate. This vernier reads to minutes, and is for reading the variation of the magnetic meridian from the true meridian. The Vernier Compass is almost exclusively used by surveyors at the present time.

Rule for Reading the Vernier.—This Rule will apply to all our Verniers. Read the degrees from the zero on the circle in the direction of the graduations up to the line next preceding the zero line on the vernier, this is the reading of degrees; look along the vernier, in the same direction from the zero of the circle, until a dividing line is found to coincide with a line of the circle, the numbers on the vernier will give the minutes, the minutes added to the degrees will be the reading of the instrument.

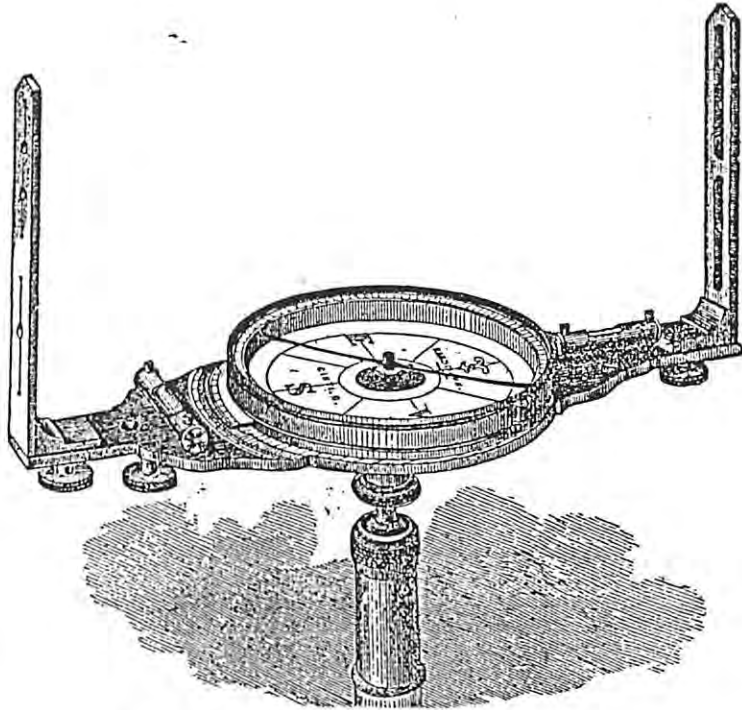
PRICES OF PRINCIPAL INSTRUMENTS.

Plain Compass, 6-inch Needle, 15 $\frac{1}{2}$ -inch Plate, Brass Cover, 2 Ground Spirit Levels Adjustable, Out-keeper, strong, well- made box of Walnut	\$40 00
Plain Compass, 5-inch Needle, same otherwise as the above ..	35 00
Vernier Compass, 6-inch Needle, the balance same as the 6-inch Plain Compass	50 00
Vernier Compass, 5-inch needle	45 00
Jacob Staff, with Steel-Pointed Socket	2 50
Set of Extra Sliding Sights for Levelling with Compass	8 00
Telescope Compass, 6-inch Needle, with Jacob Staff	95 00
“ “ 6-inch Needle with Tripod, with Ball for Levelling	100 00
With Levelling Screw and Clamp as represented by cut.....	110 00
Y Levels 18-inch Telescope	130 00
Transit, as described, Graduated on Sheet Silver, and on the best Engine in the country, strong box	190 00
Theodolite, same as above	230 00
Graduated Brass \$20 less.	
Either above with Variation vernier, cost each	20 00
(Theodolites, Transits, and Levels, we generally Bronze or Black, as the rays of the sun on the instruments do not af- fect the eyes as much as bright instruments. Engineers gen- erally prefer them on the above account. Also face of Com- pass dial.)	
12-foot Sliding Levelling Rod, to read to 1-1000th of a foot, com- plete with Sliding Target.....	15 00
Flag Poles, 8 or 10 ft. long,—steel-pointed socket, well painted Red and White, each	Ash \$3 50, Pine, 3 00

For further Price List, see pages 19 to 24.

T. F. RANDOLPH,
MATHEMATICAL **I**NSTRUMENTS.

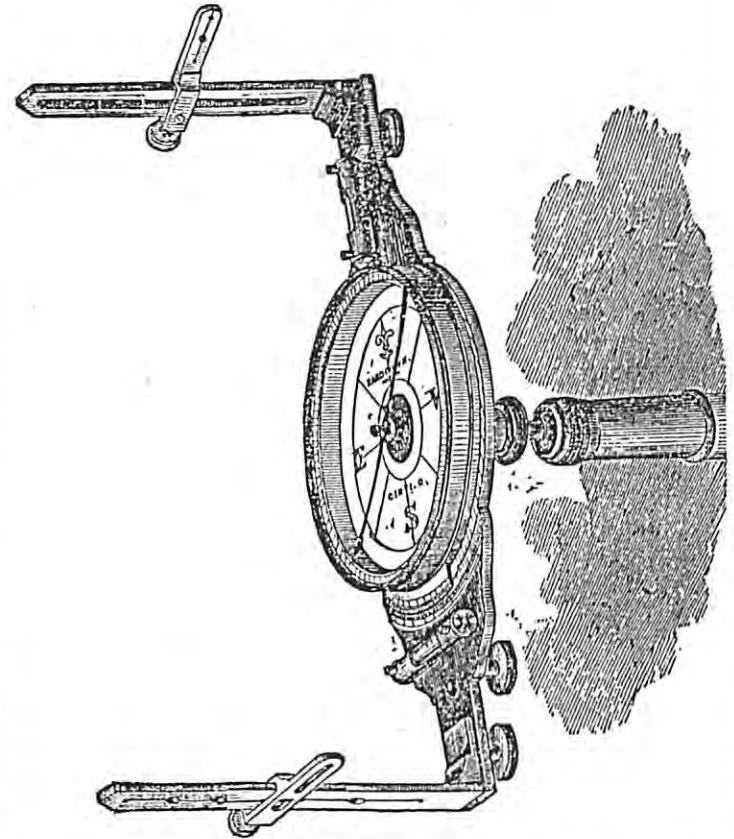
ESTABLISHED 1853.



VERNIER COMPASS.

T. F. RANDOLPH,
Mathematical **I**nstruments,

ESTABLISHED 1853.



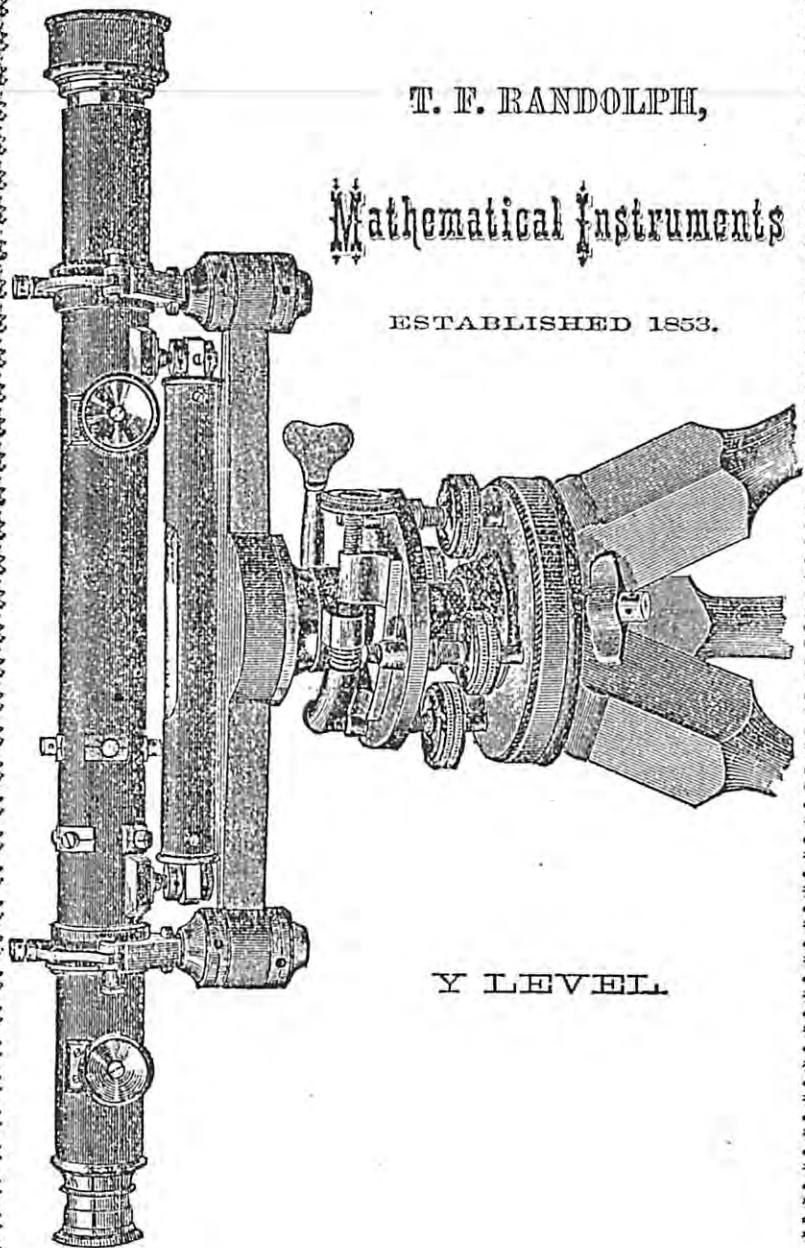
COMPASS WITH LEVELING SIGHTS,

Which are moveable up and down on the opposite sight of the Instrument, one of which is graduated on its outer face 10 deg. each way from center or zero. With the adjustable and nicely ground levels, quite good leveling can be done for many purposes.

T. F. RANDOLPH,

Mathematical Instruments

ESTABLISHED 1853.



Y LEVEL

THE Y LEVEL.

In this instrument, the telescope is made to revolve readily and truly in its Ys. on bearings of hard metal which are turned of exactly the same diameter, and when desired, may be firmly clamped by the small capstan head-screw in the clips. A rack and pinion movement adjusts the object glass. The Ys each have two nuts, both being adjustable with an ordinary steel pin. The level bar is made of hammered brass, and shaped so as to possess the greatest amount of strength in the parts most subject to sudden strains. The telescopes are of different lengths, and we make two styles of levels; one style (represented by the cut,) with a heavy tripod, the horizontal adjusting screws of which are boxed with the instrument; the other tripod is lighter and is not boxed with the instrument.

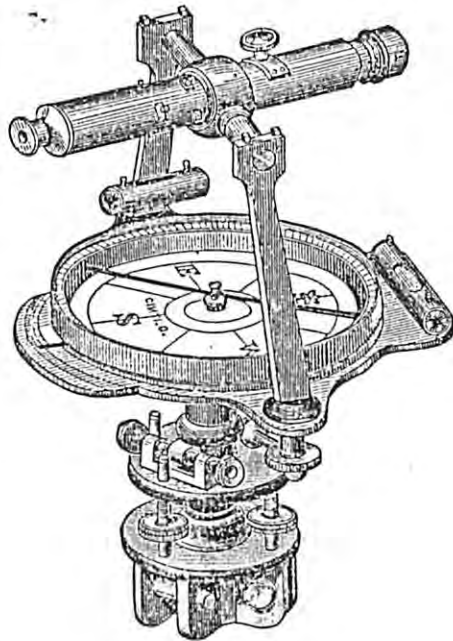
Adjustment of the Y Level.—First is that of the line of collimation, or the intersection of the cross-wires (we shall use the term *cross-wires* hereafter), to revolve on a given point by the entire revolution of the telescope in its Ys. The instrument is set on its tripod, and the eye piece drawn out far enough to bring the cross-wires in focus; the object-glass is then moved out, by turning the pinion, until the object appears distinct; the horizontal wire is brought to bear on some line or point, the telescope is turned one-half around in its Ys, and if the wire cuts the same point, that wire is adjusted; but if it comes either side of the first point observed, one-half of the variation is corrected by one of the four small capstan head-screws on the telescope, (the eye-piece of a direct telescope is always inverting, therefore, by moving the screw to bring the wire right, it will appear as increasing the error; the screw on the opposite side should always be unscrewed before tightening the one to move the wire. The four screwdriver head-screws between the eye-piece and the capstan screws, are for adjusting the cross-wires to the center of the field. It will be noticed that in the adjustment for the cross-wires it apparently moves them out of the center of the telescope; this adjustment of the eye-piece is made after that of the cross-wires,) the other half by raising or lowering the end of the instrument with the horizontal adjusting screws. The telescope is then turned one-quarter of the way around, and the other wire is adjusted to the same point.

Adjustment of the Ys.—Raise the clips, bring the horizontal wire on a point, turn the telescope end for end in the Ys; turn the instrument one-half around on the socket. If the cross-wire cuts the first point observed, the Ys are adjusted; if not, one half the error is corrected by the nuts securing the Ys to the level bar, and the other half by the horizontal adjusting screws.

Adjustment of the Spirit Level.—Bring the level over a set of horizontal adjusting screws, and bring the bubble to the center, (the glass tube has lines marked on it to correspond with the length of the bubble, in the place of a brass scale over the level tube,) turn the instrument one-half around; if the bubble again runs to the center, the level is in adjustment, if not, one half of the adjustment is made by the capstan nuts, which secure the level to the telescope tube, the other half by the horizontal adjusting screws; all of these adjustments should be repeated. There is a rack and pinion movement to eye piece of all my telescope instruments.

T. F. RANDOLPH,
MATHEMATICAL INSTRUMENTS.

ESTABLISHED 1853.



TELESCOPE OR TRANSIT COMPASS.

DUMPY LEVEL.

This instrument is furnished with an object-glass of large aperture and short focal length, sufficient light being thus obtained to admit of a higher magnifying power in the eye piece. This telescope inverts the object; some of the advantages of a much larger instrument are obtained without the inconvenience of its length. The level and cross-wires are the only adjustments to this instrument; the cross-wires are brought to the center of the field by the capstan screws close to the end of the telescope tube. The simplest way to adjust the level to the cross-wires, is to the water level; this is done by erecting two stakes, say, one or two hundred yards distant from each other, in a still body of water, being careful to leave each stake extending the same distance from the water's surface. Plant the instrument, say one hundred yards distant from one of the stakes, and in a line with both stakes; now lower or raise the instrument until the cross-wire cuts the top of both stakes at the same time. This being done, adjust the level tube until the bubble stands in the center, and the instrument is in adjustment.

THE TELESCOPE OR TRANSIT COMPASS.

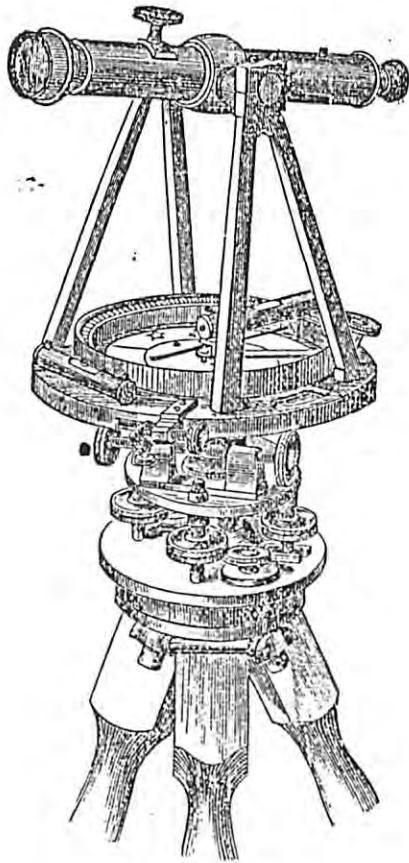
The telescope of this instrument has the same means of adjustment as that of the Y Level. The telescope answers the place of sights, and is better for long ranges, and all kinds of ground, level or hilly, is much easier on the eyes, and more accurate in work, as well as more expeditious; the levels have the same adjustments as those on the plain compass.

ADJUSTMENT OF THE VERTICAL CROSS-WIRE.

Set the instrument on the Jacob staff; the instrument being level, make the vertical adjustment of the wire same as that of the Transit. Now bisect some point with the vertical wire, revolve the telescope one-half around on its axis, and the opposite direction from the first object to another distinct point; turn the instrument one-half around on its axis until the vertical wire bisects the first object observed, turn the telescope as before and see if it again bisects the second point observed; if it does, the adjustment is right; if not, one-quarter of the error is corrected by moving the cross-wire, one-quarter by moving the instrument on its socket, and one-half by moving one of the points observed.

T. F. RANDOLPH,
MATHEMATICAL INSTRUMENTS.

ESTABLISHED 1853.



TRANSIT.

THE TRANSIT INSTRUMENT.

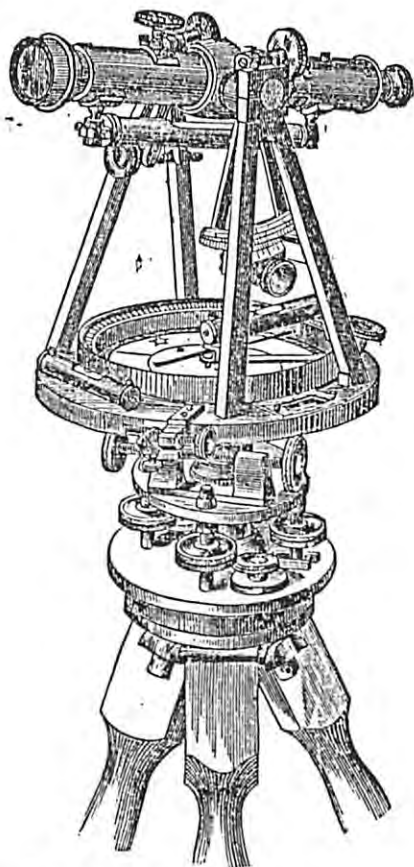
This instrument is used for taking horizontal angles exclusively, and has a graduated circle in addition to the needle circle. This instrument is made in the most approved style. The principal plates are made of hard metal and turned so that there are no sharp corners on the plates. The socket bearings are four inches long, which allows the plates to move with the least possible friction. There are no grooves to hold the clamp of the tangent screw to its place, turned in the plates. The whole attachment being made to the upper plate, as soon as unclamped the plates are perfectly free from each other, and move around without any catching as in instruments where there are grooves. This is one of the most important movements of the Transit. The needle is four and three-fourths inches long; the vernier circle six and one-half inches in diameter, divided to half degrees, with two double verniers to read to minutes. We make an instrument with the needle five inches long, and vernier circle six and seven-eighths inches in diameter. The verniers are covered with glass, which protect the graduation. Two ground spirit levels adjustable. The telescope has the same means of adjustment as that of the Level Telescope.

Adjustment of the Transit.—The instrument is set up firm on its tripod, and the levels are adjusted by revolving the instrument on its axis, in a similar manner to that of the Surveyor's Compass.

Adjustment of the Cross-wires.—The zero of the vernier is brought to coincide with the zero of the vernier circle. The telescope is then adjusted to the focus of the object, and the vertical wire brought to bear on a distant object near the intersection of the wires; the telescope is then moved in a vertical direction to see if the vertical wire keeps on the same point to the edge of the field; if it does not, the capstan head-screws must be turned on the telescope tube, by bearing gently and turning at the same time, to bring the wire in a vertical position. This adjustment being correct, and the wire being still on the same point, see that the instrument is all firm; now unclamp the plates and turn the vernier plate one-half around, so the same zero point on the vernier will coincide with the opposite zero on the circle, turn the telescope one-half around on its axis, and if the vertical wire cuts the same point, this adjustment is correct; if it does not, one-half the error is corrected by the cross-wire, and the other half by the lower tangent screw. The horizontal wire in a Transit Telescope is brought as near as can be judged to the center of the telescope, there being no particular use for it. The Tripod heads for Transits and Theodolites have shifting centres for setting the instrument over a given point, without changing the level of instrument or position of legs. They also have improved spring tangent screws, the spring being on the inside and out of sight.

T. F. RANDOLPH,
MATHEMATICAL INSTRUMENTS.

ESTABLISHED 1853.



THEODOLITE.

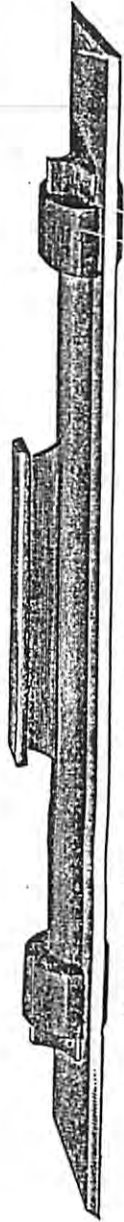
THE THEODOLITE.

We make two sizes of this instrument, also two sizes of Transits, the largest size having 5-inch needle, vernier circle 7 inches. In all our Transits and Theodolites the verniers read flush.

This instrument is the same as the Transit Instrument, with the addition of the vertical arc (which is one-fourth circle) and revolving level on the telescope. This instrument, therefore, can be used for leveling horizontal and vertical angles, and is mostly used by City Engineers, it being adapted to all kinds of work, and but little heavier than the Transit. The vertical cross-wire is adjusted the same as that in a Transit instrument. The revolving level is adjusted on its own axis by the maker, and made permanent in its tube.

To Adjust the Revolving Level.—Level the instrument by the two small levels; bring the telescope as near to a level as possible, by turning it on its axis; now clamp the axis and move the telescope and level together on their axis, by the slow-motion tangent screw, until the bubble stands in the center, designated by the lines made on the level glass; turn the instrument one-half around; if the bubble again comes to the center, the level is adjusted; if not, one-half of the adjustment is made by raising or lowering one end of the level, as the case may be, by the adjusting nuts at its ends, the other half by the tangent screw.

D Adjustment of the Horizontal Cross-wire to the Level.—Observe a point, say one hundred yards distant, bringing the horizontal wire to bear on it, the level still remaining in the center, unclamp the telescope axis and turn it half over on its axis; this will bring the level to the top of the telescope; turn the level on its own axis until the bubble comes to the top; turn the instrument one-half around on its socket; clamp the telescope axis and bring the bubble to the center by the tangent screw; now see if the same wire cuts the same point; if it does, the cross-wire is in adjustment with the level; if not, one half of the error is corrected by moving the cross-wire, the other half by raising or lowering the point observed. The vertical arc being loose on the telescope axis, which can be clamped at any point, needs no adjustment. To start from zero on the vertical arc, the telescope must be level; the zero on the arc is then made to coincide with that on the vernier, and clamped to the vernier, the arc is then clamped to the telescope axis, the clamp of the vernier is then unloosed, with that of the tangent screw, and the arc will move with the telescope. All my tripod legs are attached, as shown best in the cut of Y Level, and can be tightened to suit the operator by the capstan screws. The wood has a bearing of near half a circle, and allows the leg to open to right angles with the axis of the instrument.



BRASS PARALLEL RULERS,

Of My Own Make, of Superior Workmanship, Shaft Pivoted at Both Ends.

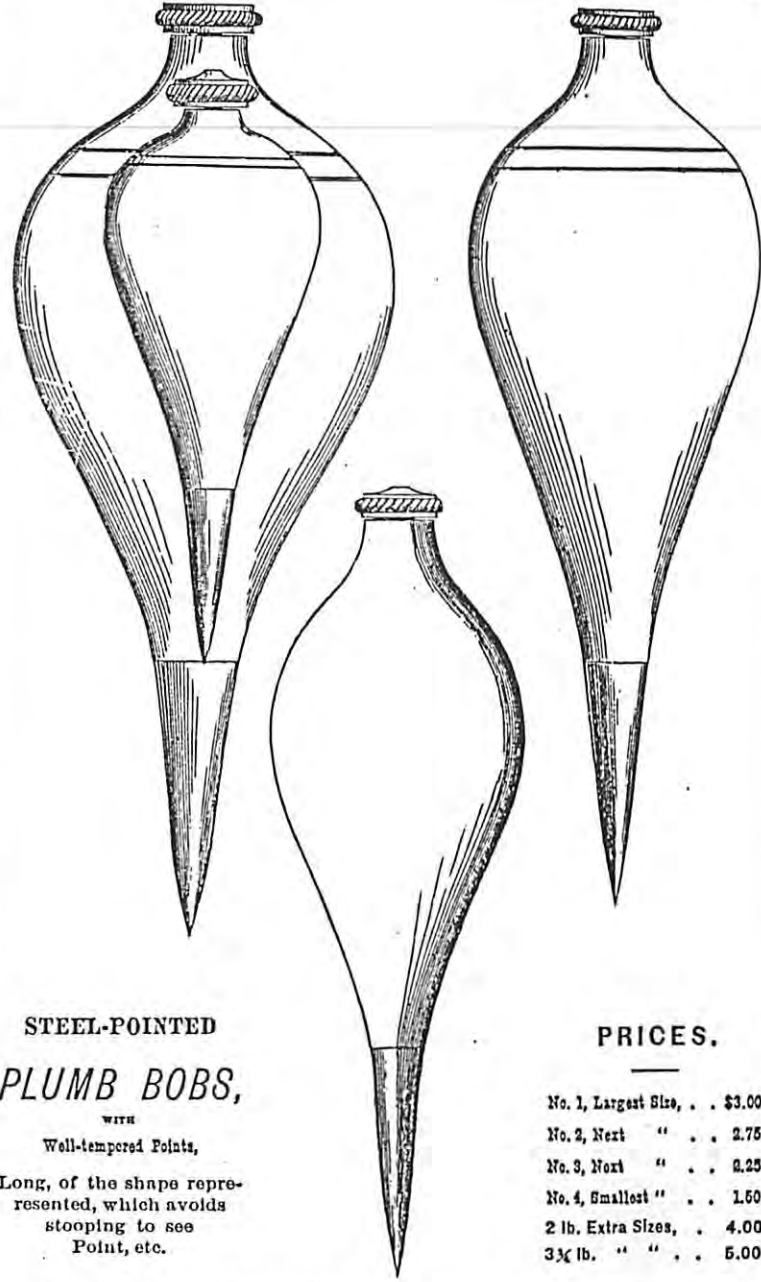
Blade 18 inches long, 2 $\frac{1}{4}$ inches wide,	-	-	\$15 00
" 15 " " 2 $\frac{1}{2}$ " " " " " "	-	-	13 00
" 14 " " 2 " " " " " "	-	-	12 00
" 18 " " 2 " " " " " "	-	-	15 00



This cut represents the shape and style of my Magnetic Needles, which on several occasions has been hotly discussed, the needle is light, and gives large surface at the points, up and down being only a fine line when looking down upon it. This large surface enables the needle to retain a large amount of electricity. They are finely polished and blued.

MIDDLEBURG, Ky., April 24, 1875.—I have used the Compass which Mr. Fair bought of you, and find it to be the best I ever used. It is the best needle that I ever saw. It is all right in every particular.

D. W. COLEMAN.



STEEL-POINTED PLUMB BOBS,

WITH

Well-tempered Points,

Long, of the shape represented, which avoids stooping to see Point, etc.

PRICES.

No. 1, Largest Size, . . .	\$3.00
No. 2, Next " . . .	2.75
No. 3, Next " . . .	2.25
No. 4, Smallest " . . .	1.50
2 lb. Extra Sizes, . . .	4.00
3 $\frac{1}{2}$ lb. " " . . .	5.00

THE SPIDER LINES OR CROSS WIRES,

In an instrument with a telescope, seems to be the subject of many instrument maker's instructions to their customers, as well as learning them surveying and engineering, how to catch a living spider and make him weave a suitable web for immediate use, and to order—the spider is, of course, a very desirable insect to handle—and is easily managed. If there should be any difficulty in the management, after you have caught one (the yellowish brown fellows) call on some lady to help hold him, whose nerves are very steady—which, as a matter of course, will be the case if a spider is to be handled—it will help stretch the web. Keep your nerves very steady while you wax the web to its place; I would suggest (only it would make the spider mad) that you wax his feet fast to some substance, and pull the web gently to its place.

I will give my experience and instructions as an instrument maker. I have at times raised my own spiders, but in late years I have found it unnecessary, the right web being so easily obtained. About the time of the first frost in the fall, when the leaves begin to fall, is the proper time to obtain the web, which is found on fruit trees and small shrubbery or grape vines, in cocoons, balloon-shaped, from one half to one inch in diameter, in color, from light to dark brown; they are generally protected by a few leaves that are caught by the surrounding web, and to find them when this is the case, is quite difficult, but when found, open the cocoon at once and empty the eggs out, for they hatch soon after frosts set in and seem to destroy the web—the red portion of the web is the strongest and finest part; after the eggs are out of the way, keep the web clean for use by folding them in paper. To put them on the brass ring is the work of an instrument maker, but having got clear of the spider, I will give my mode of doing the work. The brass ring or diaphragm has marked on its face delicate lines into which the web is to be cemented by beeswax, or quick drying varnish (we use shellac varnish, and heat the ring with a soldering iron to dry the varnish), the ring or diaphragm is fixed permanent, with lines up, the first tools are U shaped wires with wax or shellac on their extreme ends, this wire is sprung by a hook across it midway so that it will stretch the web when attached to the ends of the U shaped wires about one half its former length, making it one third longer; the web is stretched and cemented while the ends of the U are compressed, then the web is held over steaming water, and the hook carefully removed, which leaves the web well stretched and ready to lay in the lines of the diaphragm and cement to their places, all of which needs delicate handling. To handle the web, hold the mass in one hand, and with thumb and finger of the other, draw a web out long enough for the two, if possible, so that both lines will be the same web. When you have drawn the web until only a single web remains, let the mass of the web hang by the single one, and cement it on the U, as above directed. To see the web, let the light shine on it, and hold it between the eye and a dark object. The diaphragm being permanently fixed, place the webs in the lines, leaving the weight of U shaped wires to keep them tight; now apply the drying cement or wax; when dry remove the U shaped wires, and re-insert diaphragm in the telescope. A stick, fitting the diaphragm, with a black end done with ink or paint, and long enough to insert in the end of the telescope, until the diaphragm reaches its place, is the most convenient mode of handling the whole thing, the black end showing the web best.

DRAWING INSTRUMENTS,

In Great Variety and of Different Manufacture,

In cases or single, of Brass or German Silver, French, German, and Swiss Manufacture. Also,

ALLENDER'S PATENT INSTRUMENTS,

Including Scales of Ivory, Paper, and Boxwood, Protractors, Horn, Brass Paper, and German Silver.

HORN, RUBBER, AND PEAR-WOOD TRIANGLES AND CURVES,

T SQUARES IN VARIETY,

Of my own make and imported, from 1 to 6 feet in length, with Swivel or Stationary Heads. Prices, from 50 cts. to \$5.50.

Drawing Boards, Lead Pencils of different and Best Qualities. Siberian Lead Pencils, B.B. to 6 B

MINERS' AND POCKET COMPASSES, Superior.

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ANEROID BAROMETERS,

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THERMOMETERS, different Makers,

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Orders accompanied with Cash, or its equivalent, to the amount of \$20.00 or over, for the above goods, or any thing in this class selected from other Catalogues than my own, I will fill at prices quoted therein. In this case give name of Catalogue and number of articles desired.

Books on Civil Engineering and Surveying furnished at Publishers' prices.

I will furnish any Philosophical Apparatus on the same conditions as above. I always have competent Philosophical Instrument Makers in my employ, who can make personal examinations of such Instruments.

CHESTERMAN'S TAPES.

METALLIC TAPE MEASURE.

33 feet long, in 10ths or 12ths, each.....	\$3 25
50 " " " " " "	4 00
66 " " " " " "	4 75
80 " " " " " "	5 50
100 " " " " " "	6 25
100 " " " " " "	7 00

STEEL TAPE MEASURES,

All Steel, to wind up in a Box, same as Linen Measure; the most accurate, durable, and portable Measure.

10 feet long, in 10ths or 12ths, in German Silver Case, each.....	\$4 50
33 " " " " " each	8 00
50 " " " " " "	10 00
66 " " " " " "	12 50
100 " " " " " "	19 00

POCKET TAPE MEASURE,

All Steel, in German Silver Cases, with Spring and Stop.

5 feet long, in 10ths or 12ths, each.....	\$3 50
8 " " " " " "	2 00

CHAINS.

GRUMMAN'S PATENT STEEL CHAINS, TEMPERED.

33 feet, No. 15 steel Wire, 50 links, weight $\frac{3}{4}$ lb., 5 ext. links.....	\$6 50
66 " " " " 100 " " $1\frac{1}{4}$ " 10 "	10 50
50 " " " " 100 " " 1 " 10 "	8 50
100 " " " " 200 " " 2 " 15 "	15 00
33 " No. 16 or 18 " 50 " not tempered.....	2 50
50 " " " " 100 " " "	3 00
66 " No. 18 " 100 " " "	3 50
33 " No. 8 Iron Wire, 50 " coppered.....	2 75
66 " " " " 100 " " "	4 50
50 " No. 6 " 50 " " "	5 00
100 " " " " 100 " " "	8 00
66 " Brazed Links and Rings, No. 12 best Steel Wire, tempered, 15 00	
50 " " " " " " " "	8 50
100 " " " " " " " "	15 50

Twenty-foot Measuring Rods, for city use, made to order, with a Level at either end.

MARKING PINS.

No. 4 Iron Wire, Set of 11 pieces.....	\$1 00
" 6 " " " " " short.....	50
" 10 Steel " " " " " "	1 00

DRAWING PAPER.

WHATMAN'S HOT AND COLD PRESSED, BEST.

	SIZE, INCHES.	PRICE PER SHEET.	PRICE PER QUINE.
Demy.....	20 x 15	\$0 10	\$1 00
Royal.....	24 x 19	15	2 00
Imperial.....	30 x 22	25	3 50
Double Elephant.....	40 x 27	40	6 00
Antiquarian.....	52 x 31	2 00	30 00

ROLL DRAWING PAPER.

GERMAN WHITE, VERY BEST, ANIMAL SIZED.

58 inches wide.....By Roll, Per Pound, 55c.

DRAWING PAPER (Mounted on Muslin).

BEST QUALITY, THIN, ROUGH OR SMOOTH SURFACE, IN ROLLS OF 10 YARDS.

36 inches wide.....	Per Yard, \$1 00	Per Roll, \$9 00
42 " "	" 1 40	" 12 00
54 " "	" 1 60	" 14 00

BEST QUALITY, THICK, ROUGH OR SMOOTH SURFACE, IN ROLLS OF 10 YARDS.

42 inches wide.....	Per Yard, \$1 60	Per Roll, \$14 00
54 " "	" 1 80	" 16 00

Large pieces, of any size, for City, County, or State Maps, made to order.

TRACING OR VELLUM CLOTH.

SAGAR'S PATENT, IN ROLLS OF 24 YARDS.

18 inches wide.....	Per Yard, \$0 50	Per Roll, \$6 50
30 " "	" 70	" 8 00
36 " "	" 80	" 10 00
42 " "	" 90	" 13 50

DETAIL PAPER.

IN ROLLS, BUFF COLOR.

40, 42, and 48 inches wide.....Per Pound, 13a20c.

CONTINUOUS OR ROLL PROFILE PAPER.

PLATE D—RED, GREEN, OR BLUE.

Ruling 22 inches wide.....Per Yard, 30c.
" 9 " " " " 20c.

MUSLIN BACKED.

Ruling 22 inches wide.....Per Yard, 75c.

CROSS SECTION PAPERS.

Ruling 16 x 22 inches, 8 feet to Inch.....Per Sheet, 25c.
" 16 x 22 " 10 " " " " 25c.

FIELD, LEVEL, AND TRANSIT BOOKS.

INK SLABS AND SAUCERS, CABINET NEST.

BRUSHES. INDIA INKS, FLUID & IN STICKS.

WATER COLORS OF WINSOR & NEWTON.

Whole Cakes or Pans, 30 Cents. Half Cakes or Half Pans, 18 Cents.

- Brown Ochre, Ivory Black, Raw Umber,
Burnt Sienna, Neutral Tint, Red Ochre,
Burnt Umber, Olive Green, Roman Ochre,
Chrome Yellow, Orange Chrome, Venetian Red,
Deep Chrome, Prussian Blue, Vermillion,
Emerald Green, Prussian Green, Yellow Lake,
Indigo, Raw Sienna, Yellow Ochre.

Whole Cakes or Pans, 60 Cents. Half Cakes or Half Pans, 30 Cents.

- Crimson Lake, Mars Yellow, Neutral Orange, Purple Lake,
Roman Sepia, Scarlet Lake, Sepia, Warm Sepia.

Whole Cakes or Pans, \$1.40. Half Cakes or Half Pans, 70 Cents.

- Carmine, Cadmium, French Blue, Intense Blue.

Whole Cakes or Pans, \$2.00. Half Cakes or Half Pans, \$1.00.

- Burnt Carmine, Cadmium Yellow, Pure Scarlet.