

ILLUSTRATED CATALOGUE

—AND—

PRICE LIST

—OF—

CIVIL ENGINEERS' AND SURVEYORS'

INSTRUMENTS

MANUFACTURED BY

L. BECKMANN,

57 Adams Street,

TOLEDO, OHIO.

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The B. F. Wade Co., Printers and Binders,
1887.

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DESCRIPTION

— OF THE —

Principal Features of My Instruments.

GRADUATIONS.

The principal part of a good instrument is the graduation. As the plates of my instruments are divided on one of the very best dividing engines of this country, I can guarantee their graduation to be exact and accurately centered, both verniers reading the same.

There are on all my transits two double verniers reading right and left, which allow reading angles rapidly and to make four readings every time, thus securing the greatest accuracy. The graduation of an instrument with only one vernier can be only tested with the telescope, taking very much time. The graduation on my transit is made to read either to 1 minute, or $\frac{1}{2}$ minute, or 20 seconds if required. The numbering is usually from 0° to 180° each way. If ordered, will engrave two rows of figures, either from 0° to 90° each way, or 0° to 180° each way, with one continuous row from 0° to 360° . The verniers are marked A and B. Both verniers are protected by glass covers. For ease in reading I have provided my instruments with celluloid shades over the verniers, which cast a mild, subdued light on the vernier and limb in any position. I have made this improvement without increasing the cost of the instrument.

The graduations on my transits are either on brass and silvered or on solid silver. To graduate on solid silver adds \$10 to the cost, but its many advantages makes it the most satisfactory surface for fine graduations, reading less than one minute.

TELESCOPES.

The telescopes of my instruments are so constructed as to give as great a power as is consistent with light and good definition. It is without doubt a mistake to select a telescope of excessive magnifying power for field work, as it deprives the same of light and size of field. What is gained in magnifying power is lost in clearness and brilliancy of ob-

ject. Some of the extreme powerful telescopes cannot be used at all in dim light or on foggy days. The telescope of my transit is 11 inches long and magnifies 25 times; those of the leveling instrument are 18 long and magnify 40 times.

The lenses for my telescope are ground especially for me by the best opticians. The telescope is perfectly achromatic, and designed to furnish a large, flat field, with high power but without loss of light. The object glass has a very large aperture, and is focused by rack and pinion, the eye piece is focused by an improved screw motion. By a peculiar construction I can guarantee the line of collimation correct for all distances, without the use of the very objectionable adjustment for the object slide by means of narrow inner rings which wear loose so readily and make this adjustment worse than none at all. The only way to produce a true and perfect slide for the object glass is by good workmanship, without any adjustment whatever. The telescope of the transit reverses at both ends, and is well balanced when focused for a mean distance. If required, it will be fitted up with adjustable stadia reading attachment. As the object slides of telescopes are always exposed to flying dust and rain, which is carried into the main tube, thus rapidly destroying the object slide, I now supply all my telescopes with a dust and rain guard, which keeps the slide perfectly covered all the time, protects it carefully against rain and dust, and at the same time not interfering in the least with the perfect motion of the slide. I do not charge extra for this improvement as other makers do.

Spider web is preferable to any metallic wire, as the latter is never perfectly opaque, and if they are fastened properly to the diaphragm there will be no breaking or sagging of them. I put platina wire in mining transits or other instruments if desired.

CLAMP AND TANGENT SCREWS.

The lower clamp screw of my transits is of the best devised plan, it is strong and rigid and answers the slightest touch. In connection with this lower clamp I use two opposing screws for tangent movement, which gives the greatest stability to the circle and lower part of instrument. Or one screw with opposing spring.

The upper clamp is so constructed that it leaves the limb circle untouched, just grasping the sleeve of outside center against this clamp works a fine micrometer screw with opposing spring. This clamp

answers the slightest touch and is very rigid and the micrometer screw can never have any lost motion, as the opposing screw takes up all possible wear.

SHIFTING PLATES.

All my transits are provided with shifting plates for the accurate setting over a point after the approximate setting with the legs. The great convenience of this improvement to the engineer is such that whoever used it once will never dispense with it afterwards. In order to center the instrument the leveling screw only need be loosened, then shift the instrument until the plumb bob is over the point. The leveling up of the instrument will clamp the shifting plates.

LEVELING SCREWS.

As the leveling screws of the instruments are used more than any other part, they should be very durable. The screws of my instruments are made of hard composition metal and are cut very deep, on an automatic screw-cutting lathe—not with stock and dye, formerly used. The shape of the thread is V shaped with edges rounded off, which insures a fine, smooth, uniform motion. The lower end of the screw is provided with a cap which is held by a ball and socket joint, which not only provides a smooth motion but prevents their getting lost, as the socket in the cap is pressed over the ball.

THE TRIPOD.

The tripod I use in my instrument is an improvement over the so-called split leg used exclusively in Europe. The tripod head is cast hollow in a single piece to attain the greatest strength. When folded it is better adapted than the ordinary form for carrying on the shoulder.

The great advantage of this over the ordinary round leg tripod is, that it can easily be tightened before using. In the old form of tripod legs, in which the wood is inclosed by the unyielding brass checks of the tripod head, the legs would wear loose and had to be tightened with pieces of leather; or, again, in damp weather the wood would swell and the legs would not move. All this is avoided in the new form. If, however, round legs are desired I will furnish such, either split on top and fastened with jam nuts, or held by brass checks in the old way.

THE GRADIENTER SCREW.

This attachment to my transits is of very simple construction. It consists of a screw in the clamping arm of the telescope axis and an op-

posing strong spiral spring, both pressing against a cross piece projecting from the standard. The spiral spring takes up all possible wear of the screw and secures a smooth motion. The screw is cut with great care in an automatic screw-cutting lathe, of such a value as to move the horizontal line of telescope 50-100 of a foot, at a distance of 100 feet, in one revolution, or one foot in 100 feet in one revolution. The screw has a large silvered head, graduated into 50 or 100 equal parts, each of which represents 1-100 foot in 100 feet distance. As the screw is turned it passes under a silvered scale, so graduated that one revolution of the screw corresponds to one space of the scale, so that any number of revolutions of the screw can be read from the scale.

With this screw grades can be established very quick. It is only necessary to set the screw at zero, level and clamp the telescope and turn the screw up or down as many spaces of the screw as there are hundredths of a foot to hundred feet in the grade to be established. For instance, to establish a grade of 2.25, the screw is turned through 4 whole revolutions, or $4 \times 50 = 200$, and through 25 spaces more. This screw will also take the place of the stadia wires for measuring distances; as for any nearly horizontal distance, the number of hundredths of a foot contained in 2 revolutions of the screw will be the distance between instrument and leveling rod. For instance, to find the distance between the instrument and the leveling rod, the first reading to be 3.05, and, after turning the screw 2 revolutions, it be 5.48; difference between both readings 2.43. The distance between rod and center of instrument is 243 feet.

If the small scale over the screw is thrown back, the gradienter screw can be used as an ordinary tangent screw.

GENERAL CONSTRUCTION.

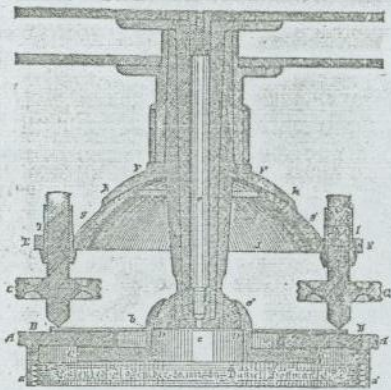
The demand of every engineer these days is to have as light an instrument as possible, combined with strength and stiffness. I have, therefore, removed the dead weight in my instruments wherever it is not necessary to the strength of same. This is accomplished by bracing or ribbing all parts as plates and standards. All braced parts are made of red composition metal (an alloy of copper and tin, very cohesive and hard). All centers and journals in my instruments are made of phosphor bronze, a new metal of excellent wearing quality and as hard as the hardest bell metal. Every piece of metal used in transits and compasses is tested for magnetic attraction. The center of gravity is

brought as close to the tripod as possible; with a large base, by this construction, I succeeded in making my instruments stiff, rigid and compact. All instruments have long centers (from $3\frac{1}{2}$ to 4 inches) and worked with the greatest possible care to insure perfect fitting.

The level vials are made with great care; the interior of the tube is ground to a regular curve, to give the required accuracy and sensitiveness to the bubble. Every leveling instrument has an *adjustable* attachment to keep crosswires perfectly horizontal, which answers its purpose better than any contrivance applied by other makers, as it is adjustable and does not interfere with the turning of the telescope in the wyes.

QUICK LEVELING HEAD.

FOR INSTANTLY CENTERING AND LEVELING UP ENGINEER'S INSTRUMENTS.



This new and improved tripod head has been thoroughly tested during the last 8 years by many engineers in the United States and in England, and found to give entire satisfaction in every particular, and is therefore highly commended by eminent engineers of both countries. It can be attached to any old or new instruments, of any make, such as transits, theodolites and levels, at a moderate cost. With this improvement the surveyor can *center and level his transit or any other instrument in a few seconds*, no matter what the shape of the ground or rocks may be—and when leveled it *will hold the most sensitive level bubble perfectly steady*.

Price of quick leveling head, if ordered with new instrument.....\$ 7 50
 “ “ “ “ if to be put on old instruments..... 15 00

REPAIRS OF INSTRUMENTS.

Repairing of instruments is of great importance, as a competent workman cannot be found in every city. Injuries to instruments are sometimes more serious than anticipated, and take longer time to repair them than the engineer would presume. Especially is this the case with injuries to centers of transits, which involve the tedious work of recentering the graduation, etc. The cost of repairs to centers and plates of transits may vary from \$15 to \$35, re-graduating and figuring \$15, small level vials \$1, large telescope vials \$3. Repairs of levels vary from \$5 to \$15. New level vials, accurately ground, \$5. This may give the engineer an idea of the approximate cost of repairs. The instruments should be well packed in their box when sent for repairs.

CARE OF INSTRUMENTS.

It is quite important that the engineer should know how to keep his instrument in good order. The following may help him in this respect: Do not allow the legs of your tripod to play loose upon the tripod-head; keep nuts and bolts always well tightened against the wood. Examine the shoes from time to time and screw them tight if wear and tear should loosen them. Be sure the instrument is well secured to the tripod and bring all leveling screws to a seat before shouldering the instrument. Let the needle gently down on the pivot and let it play only when in use. If too far from the point check its movement with the lifter; do not permit any playing with the needle; always arrest the needle after use and screw it up against the glass plate. Clean the lenses of the telescope with a camel hair brush; if the dust cannot be removed that way, use a clean piece of linen or chamois skin. Do not unscrew the object glass unnecessarily, as this is apt to disturb the adjustment of the telescope. The two outer lenses need frequent cleaning.

If dust settles on the cross-hairs, unscrew the eye-piece and objective and blow gently through the telescope. To take out the eye-glass unscrew the screws at the end of the telescope and pull out the eye-piece.

To clean the leveling or tangent screws use a stiff tooth brush, then apply a little oil, work the screws in and out and brush dry again. The adjustment screws should not be strained any more than neces-

sary to insure a firm seat; all straining spoils the screws and the adjustment.

As soon as any fretting in the vertical axis is discovered it should be taken apart and cleaned, by unscrewing the cap from which the plumb-bob is suspended, then unscrew the nut, and unscrew little cap which encloses the spring opposing tangent screw and the plates can be taken apart. Clean centers and sockets well, and if any roughness should appear on the centre or in the sockets, scrape well with a knife and wipe clean. Then replace first without oil and be convinced that it turns freely; if so, put a little fine watch oil on the centers and replace them, taking care that the oil is equally distributed, by lifting up the upper plate a few times and reversing and revolving it. Then replace the nut and secure the lower cap, taking care that the little spring which takes the deadweight of the centers being turned up. Any fretting in the telescope slide should be treated in a similar way but the slide replaced without oil. Protect your instrument with some water-proof cover in a rain or dust storm, and dust it off after usage.

ADJUSTMENT OF TRANSIT.

To enable those unacquainted with the adjustment of instruments I will give a short description of same.

To adjust the Levels.—Bring the bubbles of the small levels in the center by means of leveling screws and turn the instrument 180° ; if the bubble now runs to either side, adjust $\frac{1}{2}$ the error on the small capstan-head screws at the end of levels, the other $\frac{1}{2}$ by the leveling screws and repeat until the bubble stays in center.

To adjust the Standards—Level up instrument carefully; sight at some high object; clamp instrument, now bring telescope down to bisect some object at the base; reverse instrument 180° ; bring telescope to again bisect mark at base and elevate telescope to the top mark. If the wire cut this mark, the telescope moves in a true vertical line; if not, adjust $\frac{1}{2}$ the error by the screw under the telescope bearing in one of the standards, taking care to loosen and tighten the 2 upper screws of this adjustable journal.

To adjust line of Collimation.—Level up instrument and see if wires are vertical, so that top and bottom of wire will cover same object by raising and lowering telescope; if not, loosen the capstan head screws that hold the cross wires (those nearest to objective) and turn them un-

til wire is vertical. Then clamp instrument to sight on a sharp object about 500 feet away, revolve telescope and find a back sight nearly as far off. Now reverse instrument 180° and place wires on back sight; revolve telescope again and see if the wires strike the first object. If not, adjust $\frac{1}{4}$ of error on the horizontal capstan head screw, remembering that on account of inverting property of eye-glass the diaphragm must be moved in that direction which apparently increases the error. After adjusting $\frac{1}{4}$ of error place instrument again on foresight, find new back sight and repeat operations until the wires will cover both objects upon reversing the instrument. The above has reference only to the vertical wire, the most important in transit instruments. In a plain transit no other adjustment is needed, but if a level is attached to the telescope the horizontal wire has to be adjusted in the following manner: Level up the instrument carefully; clamp telescope in a nearly horizontal position and sight a point of 400 or 500 feet distance. Now turn the instrument on its center, and, without disturbing telescope, mark a point about 12 feet distance. Now turn transit 180° , reverse telescope and set the horizontal wire again on the nearest point. Turn the instrument on its center and see if the wire cuts the first point; if not, adjust by moving the wire $\frac{1}{2}$ the error. If cross wires should not be in center of field now, bring them in the center by the 4 capstan head screws nearest the eye-piece.

To adjust level on Transit, Telescope, or to bring the level parallel to line of Collimation.—Select a level ground and level the instrument up carefully and clamp the telescope in a nearly horizontal position. Now drive 2 stakes equal distance from the transit (say 200 or 300 feet) to such a height that the readings on both will be the same, with the telescope well clamped. These 2 points must be on a level with each other. Now move the instrument to about 10 feet to one stake, level it up—clamp the telescope nearly horizontal—and take a reading on nearest stake and then on the further one. If both readings are not the same move the telescope, by means of tangent screw, over nearly the whole error and repeat this until both readings are the same when the telescope will be truly horizontal, then set the level on telescope by the small nuts on each end, that the bubble will be in the center.

ADJUSTMENT OF WYE LEVEL.

First, to make the level parallel to line of collimation, clamp the level bar over 2 leveling screws, bring bubble in center by means of

leveling screws, turn the telescope in the wyes about 15° to 20° and see if the bubble stays in place; if not, correct $\frac{1}{2}$ by the 2 side-screws on the one end of the level and try again until bubble is stationary. Now bring the bubble in center and reverse telescope in the wyes end for end, carefully, and adjust $\frac{1}{2}$ of error with the nuts under the level, the other $\frac{1}{2}$ by the leveling screws; repeat operation until bubble will stay in center.

To adjust the Wyes.—Clamp telescope in the wyes and level up over 2 opposing leveling screws. Now turn the instrument $\frac{1}{2}$ on its center and adjust $\frac{1}{2}$ the error on the nuts of the one adjustable wye—the other $\frac{1}{2}$ with the leveling screws. Repeat operation until the bubble is stationary over both pair of leveling screws.

To adjust the crosswires or line of Collimation.—Place the wire on some well defined object about 300 feet off—say the top of a chimney—and revolve the telescope in its bearings, and see if the wire strikes the same object; if not, correct $\frac{1}{2}$ the error by the 4 capstan head screws nearest the objective. However, as the eye-piece reverses the image, it should be done same way as described above in “transit adjustment.” The crosswires are brought in the center of field by the other set of screws which hold the eye-piece.

NOTICE.

I guarantee every instrument to be first-class in every respect, and to persons desiring to purchase and not acquainted with the style and finish of my instruments I will make the following offer: I will forward such instrument and will instruct the express agent to collect the money and keep it for three or four days to give the purchaser ample time to test the instrument; if not found as represented, that is, first-class in every respect, the party may return the instrument and receive the money.

TESTIMONIALS.

I hold a great many testimonials about my instruments, of which I will give a few in print.

UNIVERSITY OF MICHIGAN, ENGINEERS' DEP'T,
ANN ARBOR, JANUARY 16, 1884. }

L. Beckmann, Toledo, O.:

DEAR SIR:—It gives me pleasure to say that I think you have made a genuine improvement in the Y level in the disposition of the spindle clamp and slow motion screw. By your construction, the telescope is brought much nearer the tripod, and as the level has the same or a greater length of spindle, it should be steadier. You can make any use you please of this note.

Respectfully yours,
J. B. DAVIS,
ANN ARBOR, MICH.

OFFICE CITY CIVIL ENGINEER,
JOHN R. MILLER, ENG'R,
TOLEDO, O., February 20, 1885. }

Mr. L. Beckmann:

DEAR SIR:—We have used one of your transits, for city work, during the past four years, and it has given entire satisfaction in every way.

Very respectfully,
JOHN R. MILLER,
City Civil Engineer.

TOLEDO, O., December 14, 1886.

L. Beckmann, Esq.:

DEAR SIR:—I have used for the two years last past one of your 18-inch Y levels, and for all purposes have found it to be as a whole the best level I have used. I have used levels for twenty years and of the first-class. Yours stands in adjustment in rough work the best of any I have used. Levels can be taken at eight hundred feet with close accuracy. I can confidently recommend the levels of your make.

B. H. HITCHCOCK,
Civil Engineer.

OFFICE OF CO. SURVEYOR, OF KEOKUK CO.,
SIGOURNEY, IOWA, Oct. 31, 1887. }

L. Beckmann, Esq., Toledo, O.:

DEAR SIR:—I have used your transit (combined transit and leveling instrument, for one year. I have had it out in sunshine and rain, in the heat of summer and the cold of winter. It is the only instrument I have seen completely meeting the wants of a County Surveyor, viz.: All the necessary parts, *no more and no less*; durable, accurate, cheap. I recommend it especially for its steadiness of adjustment.

Respectfully,
J. H. KELLMAR,
Co. Surveyor.

WESTVILLE, IND., June 20, 1886.

L. Beckmann, Esq., Toledo, O.:

DEAR SIR:—The Y level you sent me in '83, does good service and is very sensitive. I have done very nice work with it; have leveled a distance of $1\frac{1}{4}$ miles, and closed within 1-100 of a foot, and part of the distance was in the marsh.

Respectfully,
HIRAM TURNER.

CLEVELAND, O., April 23, 1886.

L. Beckmann, Esq., Toledo, O.:

Many thanks for promptness. My level gives me best satisfaction.

Yours truly,
JOHN B. FULKERSON.

OFFICE OF FRANK KNIGHT,
SUPT & CHIEF ENG. KNIGHT ENG'ING & CON'T CO.,
WARASH, IND., December 27 1886. }

Mr. L. Beckmann, Toledo, O.:

DEAR SIR:—Pardon this delayed answer to your inquiry as to how I like the transit purchased of you. I can say this for your instrument:

I have had the combined transit of your make in use one year now, and while I have no wonderful tale of fine and skillful work to relate, still I have had sufficient opportunity to test its exactness, and I find it first-class in every particular. My instrument has been brought in direct competition with several other popular makes of instruments, and in each case its superiority has been conceded. I do not think I could be better pleased. My confidence in your instruments and your skillful workmanship is such that I will take pleasure in recommending your goods either publicly or privately.

Most truly yours,
FRANK KNIGHT,
Chief Engineer

OFFICE OF COUNTY SURVEYOR,
TOLEDO, O., October 19, 1887. }

Mr. L. Beckmann, Toledo, O.:

DEAR SIR:—I have given the transit (small mountain transit with level and gradienter attached) which you recently furnished me, a very thorough trial, not only in line and angle work, but also in setting grades, and in measuring distances by means of the gradienter screw, and I take pleasure in stating that I am more than satisfied with the results, both as to accuracy and rapidity. I have found it fully as accurate as an engineer's transit of the usual size and much more convenient for all class of engineering work.

Respectfully yours,
C. H. JUDSON,
Deputy Co. Surveyor.

OFFICE OF CITY ENGINEER,
SPRINGFIELD, O., June 10, 1886. }

L. Beckmann, Esq.:

DEAR SIR:—I have thoroughly tested the level sent me and find it does its work well and accurately. I am much pleased with the improvements on same and consider it a first-class level.

Very respectfully,
J. DOUGLASS MOLER,
City Engineer.

OFFICE OF COUNTY SURVEYOR,
ANGOLA, IND., October 24, 1887. }

L. Beckmann, Esq., Toledo, O.:

DEAR SIR:—The transit which I purchased of you last month I find the most accurate and reliable ever used in this office. The various improvements which it has, are improvements in fact as well as in name, and I take pleasure in saying that in my opinion your instruments are unexcelled by any made in this country.

NEWTON W. GILBERT,
County Surveyor.

OFFICE OF TOL., SAG. & MUSKEGON R'Y,
MUSKEGON, MICH., October 24, 1887. }

L. Beckmann, Esq., Toledo, O.:

We have in use on our road two of your levels with which we are very much pleased. For some years I have known your levels to be excellent and accurate instruments. Two of your make of transits are also giving great satisfaction. I have during my experience used transits of nearly all the makers in the United States, and while many of them are first-class in all respects, none for railroad use have suited me better than the ones we have of your make.

My assistants are very enthusiastic in praise of them. They certainly are daisies.

Yours truly,
H. C. SMITH,
Chief Eng. T., S. & M. R'y.

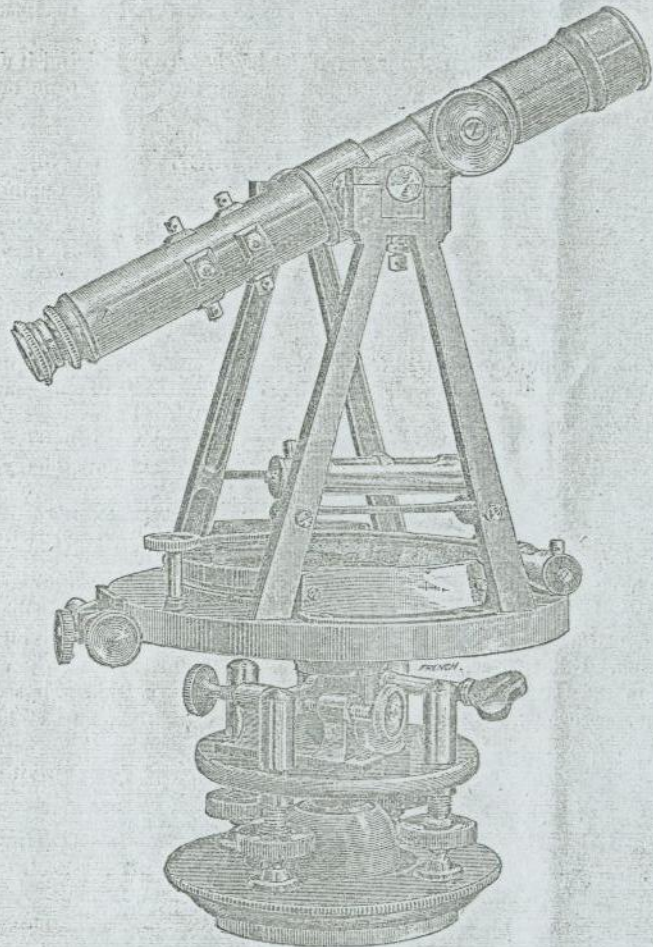
ENGINEER'S OFFICE,
DULUTH, SOUTH SHORE & ATLANTIC RY.,
SAULT ST. MARIE DIVISION, Oct. 23, 1887. }

L. Beckmann, Esq., Toledo, O.:

DEAR SIR:—Your letter just received. It followed me to here. Regarding your instruments, I like to say: Engineers contemplating the purchase of Surveying Instruments, will find it to their interest to buy the Beckmann transit and level. I have used both transit and level for the past three years on construction work. They have given me entire satisfaction.

W. L. WEBB,
Div. Eng. D., S. S. & A. R'y.

PLAIN TRANSIT.



No. 1. Horizontal circle, with 2 double verniers, verniers either at 90 degrees from line of telescope or at 30 degrees as in Fig. No. 8, read to minutes or 30'' or 20'' if desired, graduations silvered, improved spring tangent screws, shifting center to set instrument exactly over a given point, improved telescope, 11 inches long, magnifying 25 times, exactly balanced and reversing on both ends, eye-piece provided with improved screw arrangements to focus cross-wires, the line of collimation correct on all distances, long compound centers of phosphor bronze, improved tripod; weight, 13 1/2 lbs.; packed in box containing plumb-bob, screwdriver, magnifier and adjusting pins and shade. Price\$165 00

Combined Transit and Leveling Instrument.



No. 3.

No. 2. Same as No. 1, but with level and clamp to telescope. Price... \$180 00
 No. 3. Same as above, and cut No. 3 with gradienter to tangent screw, either 1 revolution to 1 foot or 2 revolutions to 1 foot in 100 feet, Price..... \$185 00
 No. 4. Same as No. 2, but with vertical arc of 3 1/2 inch radius to telescope axes. Price..... \$200 00

TRANSIT.

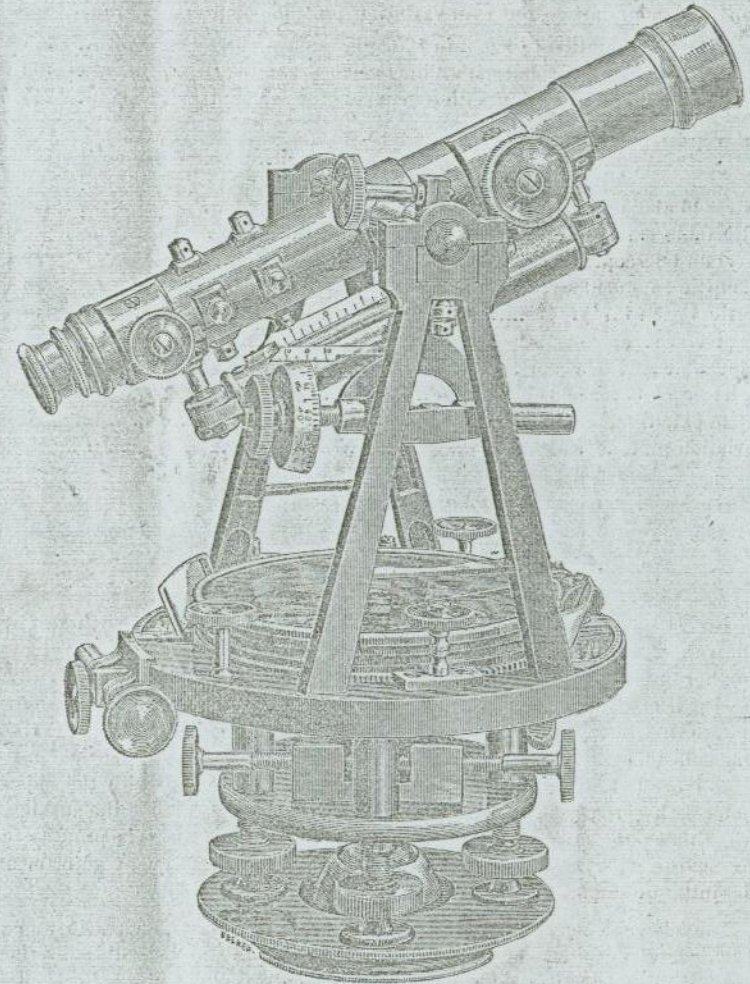
WITH SOLAR ATTACHMENT.



No. 5.

Instrument same as above described under plain transit and combined transit only with patent solar attachment.

Price, complete\$ 250 00

Small Mountain Transit.

No. 8.

No. 6. Small Mountain Transit, with 2 verniers at an angle of 30 degrees from line of telescope, reading to 1 minute with shifting center improved telescope 9 inches, diameter of plates 6 inches, weight, 8½ lbs. In all respects equal to large size. Price \$160 00

- No. 7. Same, with level and clamp and tangent screw to telescope.
Price.....\$ 175 00
- No. 8. Same as above, but with variation plate to compass and gradienter, 1 revolution to 1 foot in 100 foot, same as cut. Price..... 185 00
- No. 9. Same as No. 7, but with 3 inch vertical arc. Price..... 190 00
- No. 10. Same as No. 8, but with patent solar attachment. Price..... 245 00

Extras to above Transits.

- Extras to above transits, graduation on solid silver\$ 10 00
- Adjustable stadia wire..... 5 00
- Level on telescope, with scale..... 12 00
- Clamp and tangent screw to telescope..... 6 00
- Vertical arc to telescope 15 00
- Gradienter screw to telescope tangent screw..... 5 00
- Detachable side telescope for mining purpose..... 30 00
- Water-proof cover of rubber cloth..... 1 00
- Patent extension tripods in place of ordinary..... 10 00
- Variation plate to compass..... 5 00

The Engineer's Level.

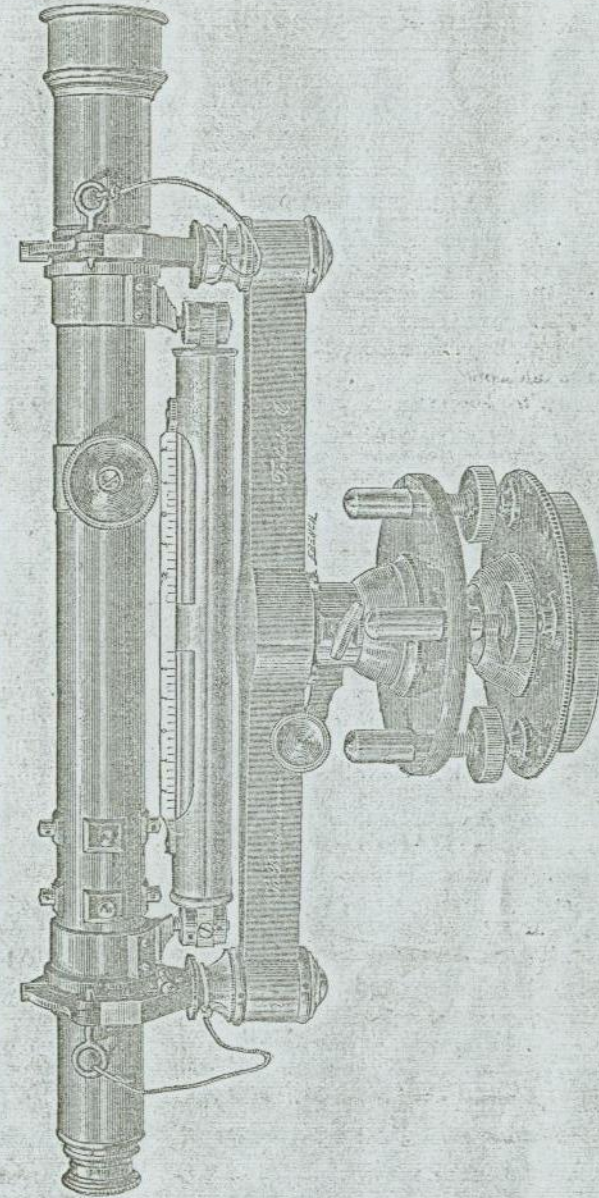
No. 11. The principal feature of this level, which finds such general approval, is its compactness and lightness. It has a long, stout center of phosphor bronze, and the rings of telescope are of the hardest bell metal. The cross-bar is cast hollow, carrying with it partly inside the clamp and tangent screw, so they always keep the same relative position to telescope, on the right hand side of observer. The telescope is held in the Y by a spiral spring, pressing an ivory button on the hard metal ring, thus doing away with the objectionable cork piece, that wears out so soon. If desired, I provide the inside of wyes with agate bearings at an additional cost of \$10; as this protects the wyes against wear from turning of telescope, the cause of frequent adjustment, it is quite an important improvement.

The telescope has an adjustable arrangement to keep cross-wires in an exact horizontal position, consisting of a projecting pin on the collars. When this pin is brought in contact with this adjustable screw, the wire is horizontal. This permits the collars to lay in the wyes without the least strain, and the telescope can be revolved without opening the clasps.

Weight of instrument, with 18-inch telescope, 9½ lbs.

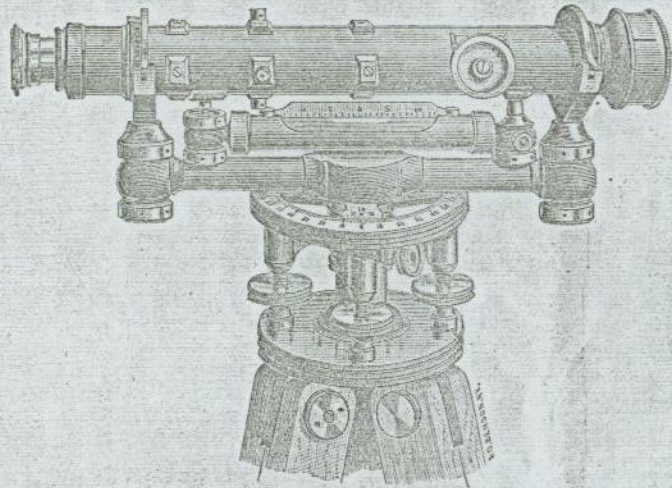
- Price, with 18 or 20 inch telescope.....\$110 00
- " of 15 inch telescope..... 90 00

NEW IMPROVED LEVELING INSTRUMENT.



No. 11.

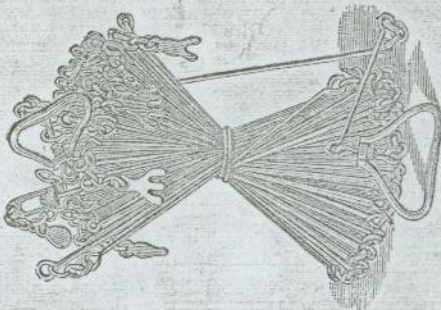
The Architect's Level.



No. 13.

The telescope of this level is 12 inches long; is constructed the same as the larger level; has a clamp to the center, but no tangent screw, also has a horizontal circle of 3 inches diameter, which turns on the center and can be fastened anywhere to the outside socket, divided to degrees and is read to 5 minutes by the vernier, turning with the center. This level is used very much by architects and builders. Price \$50 00

ENGINEERS' CHAINS.



IRON CHAINS.

100 foot.....	\$ 5 50
50 foot.....	3 50
66 foot.....	4 20
33 foot.....	2 70

Tempered Steel Wire, Brazed Links and Rings.

100 feet, No. 12 Tempered Steel, Brazed Links and Rings.....	\$11 50
66 feet, No. 12 " " "	10 00
50 feet, No. 12 " " "	6 00
33 feet, No. 12 " " "	5 50
Marking Pins, 11 in a set, of Steel Wire, thin	1 00
" " " medium	1 50
" " " heavy	2 00

Telescope Compass.

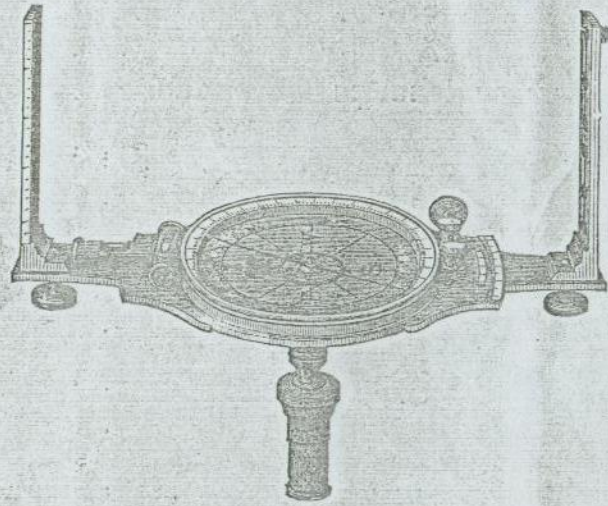


No. 14.

The above instrument will be found very convenient for county surveyors who want to do good land surveying and not invest so much money for a transit. It is provided with a very substantial leveling arrangement, has 2 straight levels, and in place of the sights, it has a strong telescope, 8 inches long, with cross-hairs complete, like the telescope of a transit. The needle is 5½ inches long, with variation plate inside the circle. The instrument is not heavier than an ordinary compass; weight without Jacob staff, 5 lbs., and can easily be carried by passing the arm through between telescope axis and plate. It also has a clamp and tangent screw to center, not shown in cut. It is provided with box to carry over shoulder.

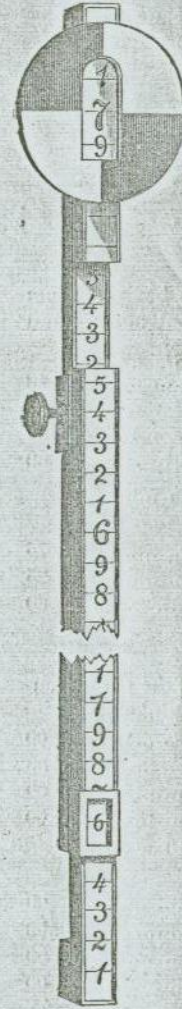
Price, with Jacob staff.....	\$70 00
The same with light tripod.....	75 00

Surveyor's Compasses.



Plain Compass, 4-inch needle, 2 straight levels, Jacob Staff mountings, out keeper, etc.....	\$ 25 00
Plain Compass, same as above, but with 5-inch needle.....	30 00
Plain Compass, same as above, but with 6-inch needle.....	35 00
Vernier Compass, same as above, but with vernier under the glass, for adding or subtracting magnetic variation, with 4-inch needle.....	30 00
Vernier Compass, same as above, but with 5-inch needle.....	35 00
Vernier Compass, same as above, but with 6-inch needle.....	40 00
Extras for Compasses—	
Tripod for Compass.....	\$ 5 00
Clamp and tangent screw for center.....	5 00

Leveling Rods.



No. 16.



No. 17.

Philadelphia Self-Reading Rod, like cut No. 16.....	Price, \$16 00 to \$18 00
New York Leveling Rod, like cut No. 17.....	16 00
Pocket Leveling Rod, 10 feet long, divided like self-reading rod, to read to 1-100, made of pliable, strong rubber canvas, can be coiled up and carried in pocket; for use it is fastened to a board or stick with thumb tacks.....	4 50
Single Non-Sliding Rod, 8 feet long, to read to 1-100.....	5 00
“ “ 10 “ “ “.....	6 00
Flag Poles, 6, 8 or 10 feet long.....	\$2 00 to 3 00
Plumb Bobs, of brass, with tempered steel points, improved to settle very quick, according to weight.....	1 50 to 3 00

Chesterman's Metallic Tape Measures.



These Tapes are made of linen thread, interwoven with fine brass wire, not so liable to stretch as the usual linen tape, and better calculated to withstand the effect of moisture. They are in substantial leather boxes.

33 feet, divided in 1-10 or 1-12 and links	\$2 10
50 feet, " " "	2 50
66 feet, " " "	3 00
100 feet, " " "	4 50

Chesterman's Metallic Tapes furnished without boxes, at the following prices:

50 feet.....	\$1 75
66 feet.....	2 25
100 feet.....	3 60

Chesterman's Steel Tape Measures.

All steel, to wind up in a box same as the Metallic Tapes, the most accurate, durable and portable measure; divided in 1-10 or 1-12 and links.

25 feet.....	\$ 5 00
50 feet.....	7 00
66 feet.....	9 00
100 feet.....	14 00

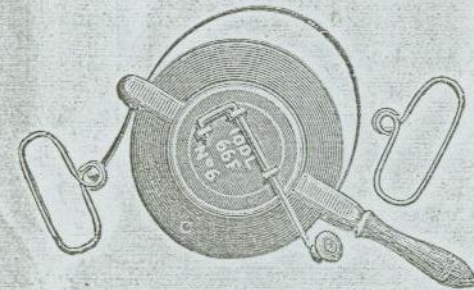
Excelsior Steel Tapes, in strong leather case, divided in 1-10 or 1-10 and links:

50 feet.....	\$ 7 00
66 feet.....	9 00
75 feet.....	11 00
100 feet.....	14 00

Excelsior Steel Tape in patent handles:

50 feet, divided in 1-10.....	\$ 8 00
100 " " "	15 00

Steel Wire or Ribbon Tapes of my own Manufacture.



The general favor with which these tapes are received show that in the future they will take the place of the heavy chains, with their hundreds of wearing places.

These tapes are intended for use wherever the chain can be used, and in many places where it cannot. They are not intended to take the place of the light, finely graded ones, but are especially designed for convenience and durability, and to take the place of the chain in all land surveying, railroad and canal work and town platting.

I use the best tempered "polished and blued" steel wire, 5-32 to 5-16 inch in width, and Nos. 30 to 36 in thickness. For tapes 100 feet or under, I generally use $\frac{1}{4}$ inch, No. 32. Wider ribbon is more apt to get "kinked" and broken, and is more affected by the wind. The graduations are made on a surface of fine Babbit Metal, of sufficient thickness to receive and retain the figures, which are of a size corresponding to the width of the tape.

The tape is not easily broken by fair usage, but should an accident of that kind occur it is easily mended by brightening the surface near the ends, then claspings them with a sleeve of thin brass or tin and letting a little solder flow in, being careful of course to keep the ends butted together and keep it straight while cooling.

The handles are made to unship, that by drawing the tape through the brush it is not liable to catch anywhere.

REDUCED PRICE LIST OF TAPES

LENGTH.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
50 feet.....	\$ 1 25	\$ 1 75	\$ 1 75	\$ 3 00	\$ 3 25	\$ 5 00
100 ".....	2 25	2 75	2 75	5 00	5 50	7 00
200 ".....	4 00	5 00	4 75	10 00	10 50	12 00
250 ".....	5 00	6 50	5 50	12 50	13 00	14 50
300 ".....	6 00	8 00	6 75	15 00	15 50	17 00
Each additional 100	1 50	2 00	1 50	5 00	.....	.....
50 links, 33 feet.....	1 25	1 75	1 75	3 00	.....	5 00
100 ".....	2 00	2 50	2 50	4 75	.....	6 75
200 ".....	4 00	5 00	4 25	9 00	.....	11 00
250 ".....	4 50	5 75	4 75	12 00	.....	14 00
500 ".....	9 00	11 50	9 25	22 00	.....	24 00

No. 1 graduated each 10 feet or links.

" 2 " " 5 " " "

" 3 " " 10 " " " first 10 each foot or link.

" 4 " " foot or link.

" 5 " " foot, first one in 10ths or 12ths.

" 6 is No. 4 complete with reel and handles.

Builders' Tape, 50 feet pocket case,\$5 00

Pair of handles 50c. a reel,..... 1 50

Small Steel Pocket Tapes, to accompany the large tapes, in German silver case, with spring and stop.

3 feet,\$1 50

6 " 2 00

9 " 2 75

12 " 3 50

25 " with flush handle, no spring,..... 5 50

TERMS.—Cash with order or C. O. D. as preferred. If C. O. D., at least \$1 cash should be sent with order to cover express charges in case of accident. If ordered to be sent by mail, send 50 cents to cover postage; any excess will be returned.

Opinion of Prof. J. B. Davis, of Ann Arbor, about these Tapes.

ANN ARBOR, Mich., April 22, 1884.

TO ALL WHOM IT MAY CONCERN:—

I take great pleasure in adding my testimony to that of others, regarding the tapes made by S. C. Hodgman, of Traverse City, Michigan, now made by L. Beckmann, Toledo, O. I have used four of them, 100 feet each, for a year past. I regard them as superior to any others that have come to my notice in the following particulars: They are the most practical. They have the most practical handles. I do not expect to see the handles much improved upon. They are by far the cheapest. In addition to these considerations, in which they stand first, as far as my observation goes, they have the following important merits: They are very carefully and exactly graduated. The four I am using are exactly alike in all their marks, and are exactly like other U. S. standard measures made a thousand miles away. A hundred feet tape with a mark at zero, at 33 feet, at 50 feet, at 66 feet, at 99 feet, and at 100 feet, with a 25 foot

steel pocket tape graduated to hundredths of a foot, make the most complete and reliable measuring tools I know of for any ordinary service in the cities, villages and rural districts of this State. Here will be obtained all the precision required in any court, in all but the most extraordinary cases, at half the cost of a good 100 foot chain.

There is also furnished for those tapes a practical reel—one that is neat, ingenious, serviceable, cheap, and that will go in a pocket when the tape is off of it. It is an open reel. No other should be used, as the tape is sure to become rusty on such. In a word, there is no longer left any possible excuse for depending upon a chain.

As to service, they are a great success anywhere where a chain can be used and in numerous places where a chain cannot possibly be employed. As to breakage, there is no more need of breaking one than of breaking a chain, and ordinarily no more possibility of it. The steel makers will take care of that. Whoever uses one is not at all likely to return to the use of any chain, however good it may be.

Respectfully,
J. B. DAVIS, C. E.,
Assistant Professor Civil Engineering, University of Michigan, and President of Michigan Engineering Society.

LINCOLN, Neb., August 15, 1885.

DEAR SIR:—I bought one of your 100 feet steel lines a year or more ago, and it has given me very good satisfaction. I find the Hodgman tape does the best service of any tape I have used.

J. P. WALTON, City Engineer.

LAKE SUPERIOR MINING CO., }
ISHPEMING, L. S., Mich., May 9, 1884. }

I find your tape very useful in mining work, and with ordinary use and strain it quite strong enough.

JAMES E. JOPLIN, Mining Engineer.

This was a very light tape 400 feet long.

INDEPENDENCE, Mo., July 14, 1884.

Received tape to-day, and think it the best tape I ever saw for the money.

H. H. PENDLETON, Surveyor.

MONTICELLO, Mo., July 23, 1884.

The tape received. Your reel is the best thing I have ever seen, and I like the tapé very much.

GEORGE H. ROBERTS.

MCBRIDES, Mich., July 7, 1884.

I have used your steel tape now one year and like it very much. Have no intention of purchasing any more chains.

F. A. PALMER, County Surveyor.

MILWAUKEE, Wis., June 10, 1884.

The 100 feet I bought of you a year ago does very good service, and I call it the best I have had.

CHAS. J. PEETSCH, Ass't City Engineer.

PORTLAND, Me., August 30, 1884.

The tape came to-day. I am very much pleased with its appearance. Please send me another just like it.

WM. A. ALLEN, Chief Engineer Maine Central R'y.

WAHOO, Neb., June 22, 1885.

The tape I bought four months ago has given entire satisfaction. The only injury it has received was from a Bohemian and a sharp spade, but was easily mended.

Respectfully yours,

W. WELCH.

VERNON, Texas, 21, 3, '86.

Tape arrived safely. It is the neatest and best measuring apparatus I ever saw.

Truly yours,

GEO. H. SHIPMAN.

Abney Level and Clinometer.

With Divided Arc, in case.....	\$ 15 00
“ “ “ with Compass, in case.....	18 00

Loke's Hand Level.

Loke's Hand Level, brass case.....	\$ 8 00
“ “ German silver case.....	10 00
“ “ Brass, common.....	6 00

Pocket Surveying Compass.

Pocket Surveying Compass, 3½ inch needle, with vernier on side of compass.....	\$16 00
Same, with tripod.....	21 00

MINERS' COMPASS OR DIPPING NEEDLE FOR TRACING ORE.

It consists of a magnet needle, suspended to move in a vertical plane. The angle of inclination or the dip is measured on the divided rim of the compass box.

When in use, the compass must be held in the plane of the magnetic meridian, when the needle will take a horizontal position, if not affected by the presence of iron ore. When brought over a mass of iron, it dips and thereby indicates the presence of iron.

Miners' compass glass on both sides, with stop,	\$12 00
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ODOMETERS.

Odometers for measuring distances by a carriage wheel. Can be attached to any wheel of any carriage and removed at pleasure. The circumference of the wheel being given, the distance is obtained by multiplying it with the number of revolutions recorded on the dial.

Price, with outside dial,	\$10 00
“ “ leather case	20 00

Anemometers.

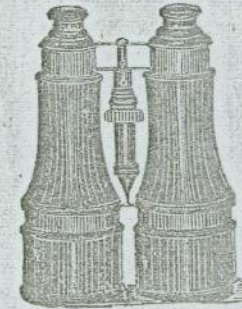
For measuring the pressure and velocity of currents of air in coal mines, ventilators, flues, etc.

Biram's Anemometer, 4 in. diameter, reading to 1000 feet, without disconnecter	\$20 00
Reading to 1000 feet, with disconnecter.....	23 50
Reading to 1000 feet, 6-in. diameter, with disconnecter.....	25 00
Reading to 100,000 feet, 6-in. diameter, with disconnecter	30 00
Reading to 10,000,000 feet, 6-in. diameter, with disconnecter.....	40 00

Pocket or Mountain Barometer.

Watch, size 1¼ inches diameter, gilt case, silvered metal dial, altitude, 10,000 feet.....	\$10 00
Same, but best quality, compensated for temperature, altitude, 100,000 feet.....	22 00
Same, but altitude 15,000 feet.....	25 00
Pocket Aneroid Barometer, but 2½ inch diameter, best quality, altitude 15,000 feet.....	25 00
Mining Barometer, 5 inch dial, silvered metal dial, raised ring for divisions, altitude 2,000 feet below and 4,000 feet above sea level, with vernier scale reading to 1 foot, with magnifying lenses in leather sling case.....	50 00

Field or Marine Glasses.



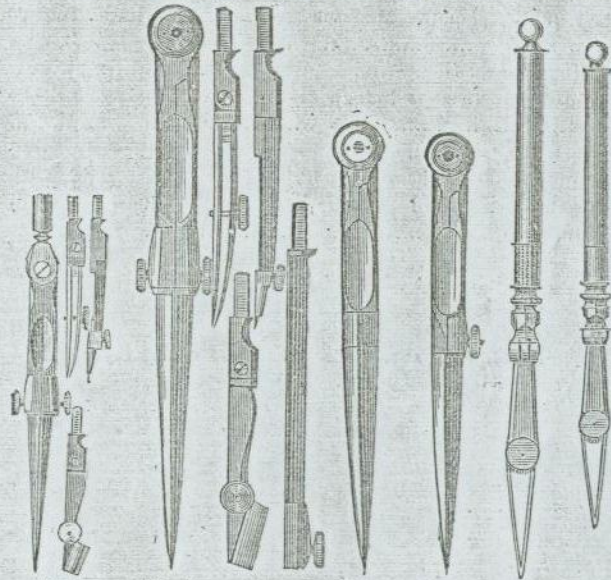
Achromatic field glass, morocco covered, with sun shade and leather case and strap, 21 lines.....	\$ 7 50
24 lines.....	8 50
26 lines.....	9 50
Best quality, 24 lines.....	12 00
Best quality, 26 lines.....	15 00
Bardon high power, 24 lines.....	20 50
Bardon high power, 26 lines.....	25 00

Also full assortment of Opera Glasses on hand, handy for road men to use, for \$4.00 to \$15.00.

Drawing Instruments.

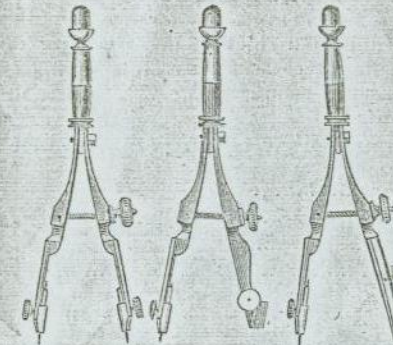
RIEFLER'S CELEBRATED SWISS TUBULAR DRAWING INSTRUMENTS,

Of German Silver, Best Steel Points Highly Finished, suitable for Office Work.



No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
Dividers with handle, 3½ inches.....					\$1 00
Compass, 3½ inches, with Pen, Pencil, Needle Point, like No. 1.....					3 00
Plain Dividers, 4 inches, like No. 3.....					90
“ “ 5 “ “ “ 3.....					1 00
“ “ 6 “ “ “ 3.....					1 00
Hairspring Divider, 4 inches, like No. 4.....					1 90
“ “ 6 “ “ “ 4.....					2 10
Compass, 5½ inches, with Pen, Pencil Point and Lengthening Bar.....					3 00
Compass, 5¼ “ “ “ Needle Point and Lengthening Bar, like No. 2.....					4 00
Drawing Pen 4 inches.....					50
“ “ 5 “.....					70
“ “ 4 “ Fine Joint, like No. 5.....					85
“ “ 5¼ “ “ “ “ 5.....					1 25
Best Swiss Drawing Pen, 4½ inches, Fine Joint, like No. 5.....					1 50
“ “ “ 5½ “ “ “ 5.....					1 75
“ “ “ 6½ “.....					2 00

Drawing Instruments.



No. 6. No. 7. No. 8.

Steel Spring Divider, with white handle.....	\$1 25
“ “ with Needle Points, like No. 6.....	1 50
“ “ with Bow Pencil, Needle Points, like No. 7.....	1 00
“ “ with Bow Pen, “ “ “ “ 8.....	1 50
“ “ Needle Points, extra fine, like No. 6.....	2 10
“ “ Bow Pencil, Needle Points, extra fine, like No. 7.....	2 10
“ “ Bow Pen, “ “ “ “ 8.....	2 15

Morocco Cases containing above instruments always on hand.



No. 9.

Proportional Divider, of Brass, in case, like No. 9.....	\$2 00
“ “ of German Silver, in case.....	3 00
“ “ “ “ “ with rack movement.....	6 00
Beam Compass, of German Silver with Pen, Pencil, and Needle Points, in Case.....	6 50
Steel Straight Edges, 2 foot, Nickel Plated.....	2 50
“ “ 3 “.....	4 20
Triangular Scales, 1 foot long.....	2 00

Best Swiss Instruments, same number of pieces, extra fine, cost about twice as much.

Common Brass Instruments cost about one-third of above prices.

Drawing Stationery.

Detail Paper, Thin, Medium and Thick, 36 to 50 inches wide, in rolls of 75 to 100 lbs., per lb., 15c; per yard, according to thickness and width, 10 to 20c.

White German Drawing Paper—Smooth Surface.

36 inch wide, medium.....	per lb., 40c.....	per yard, 25c
42 " "	" 40c.....	" 30c
56 " "	" 40c.....	" 35c
62 " "	" 40c.....	" 45c

Best Egg Shell Paper (Paragon) Pebbled Surface.

36 inch wide, medium.....	per lb., 45c.....	per yard, 35c
42 " "	" 45c.....	" 40c
58 " "	" 45c.....	" 50c
58 " thick	" 45c.....	" 70c
58 " extra "	" 45c.....	" 90c

Paragon Paper Mounted on Best Muslin.

36 inch wide, medium.....	per roll, 10 yards, \$8 50.....	per yard, \$1 00
42 " "	" " 9 50.....	" 1 10
58 " "	\$ " 12.50.....	" 1 40

Large Pieces for City or County Maps, Mounted to Order.

Tracing or Vellum Cloth.

In Rolls of 24 yards, both sides glazed, or face glazed and back dull, suitable for pencil marks.

Imperial, 36 inch wide,.....	per roll, \$ 7 50	per yard, \$0 40
" 42 "	" 10 50.....	" 0 60

Profile Paper.

Continuous Profile Paper Plates, A or B, 22 inches wide, per yard.....	\$0 30
Plate A, 42x15 inches, horizontal ruling, 4, vertical, 20 to inch, per sheet	40
Plate B, 42x13½ " " " 4, " 30 " "	40
Plate C, 42x15 " " " 5, " 25 " "	40
The three above, per quire.....	8 50

Cross section paper of all different styles.

Engineers' Field books, Level Books 7x4 in., per doz. \$5.00, each 50c.

Transit Books, 7x4, per doz. \$5.00, each 50c.