(No Model.) 3 Sheets—Sheet 1.

J. L. KELLUM, Jr.

MEASURING MACHINE.

No. 542,195. Patented July 2, 1895.

Fig. 1.

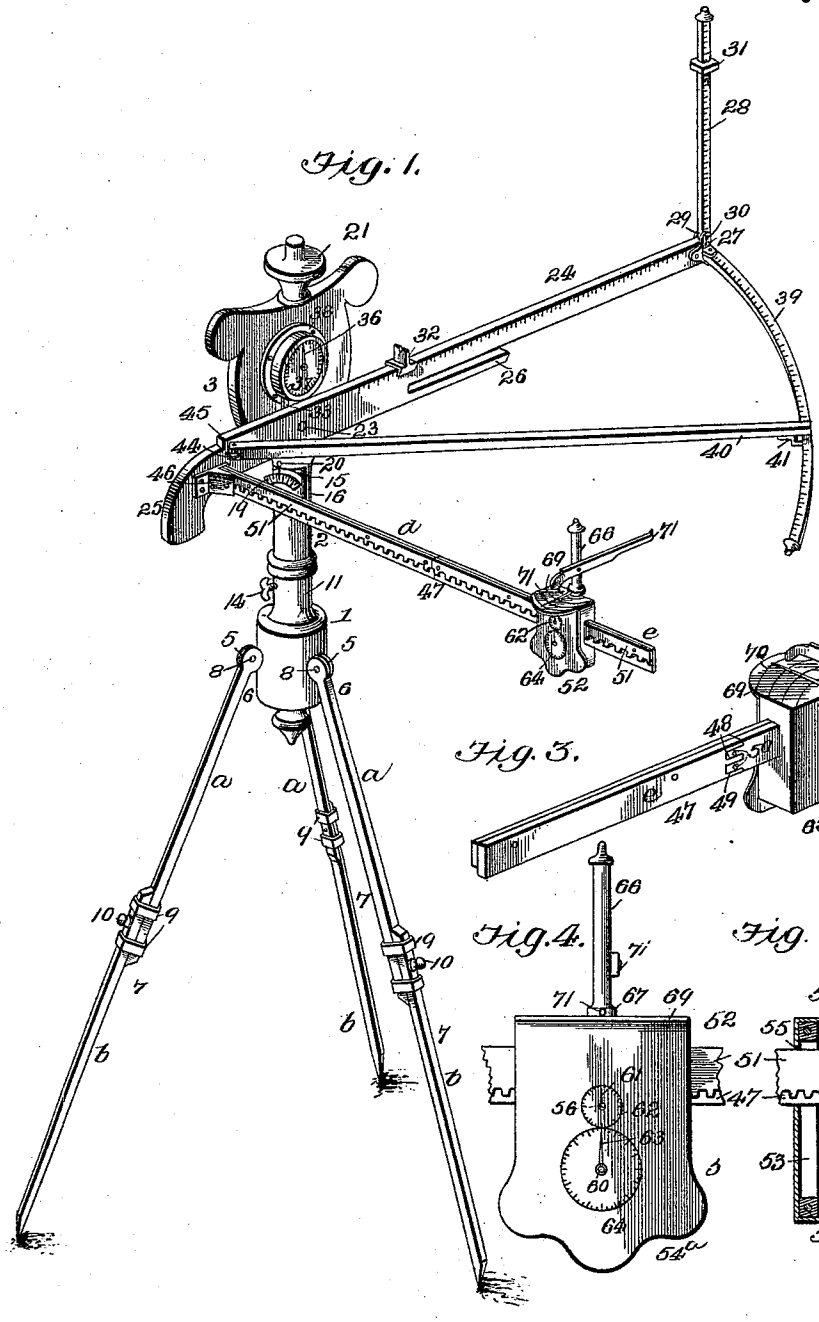
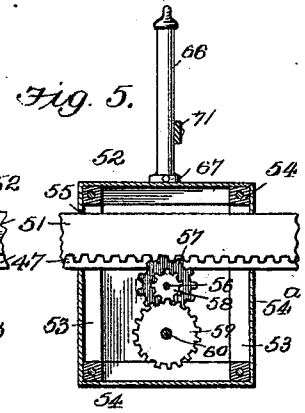


Fig. 3.

Fig. 4.

Fig. 5.



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(No Model.) 3 Sheets—Sheet 2.

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MEASURING MACHINE.

No. 542,195. Patented July 2, 1895.

Fig. 2.

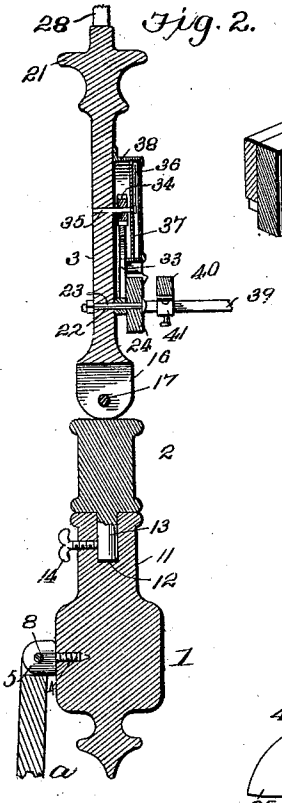


Fig. 6.

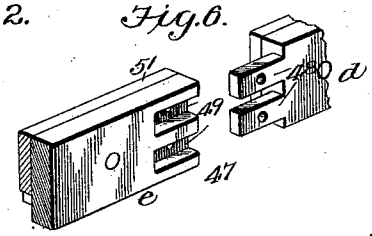


Fig. 7.

Fig. 12.

Fig. 8.

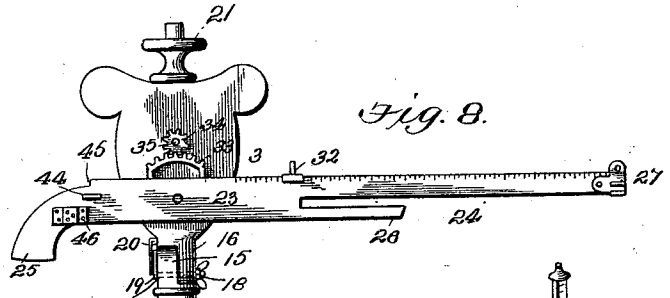


Fig. 9.

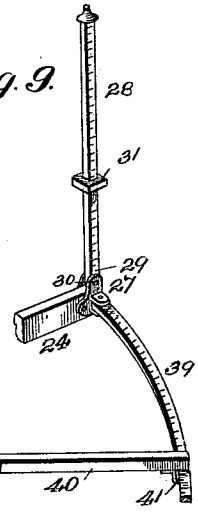
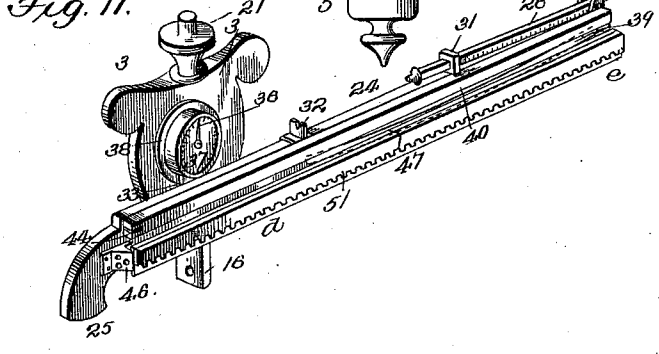


Fig. 11.



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(No Model.) 3 Sheets—Sheet 3.

J. L. KELLUM, Jr.

MEASURING MACHINE.

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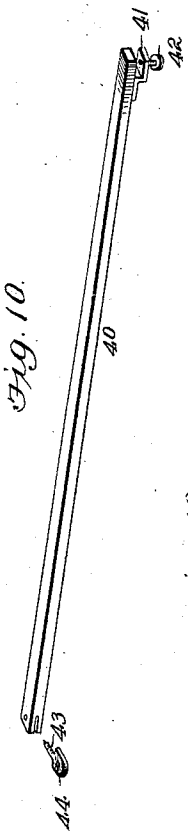

Fig. 10.

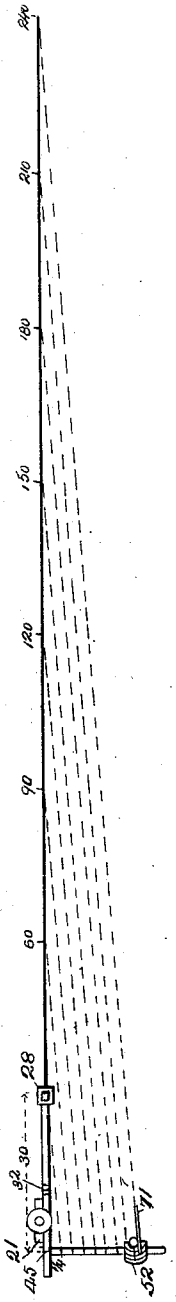

Fig. 13.

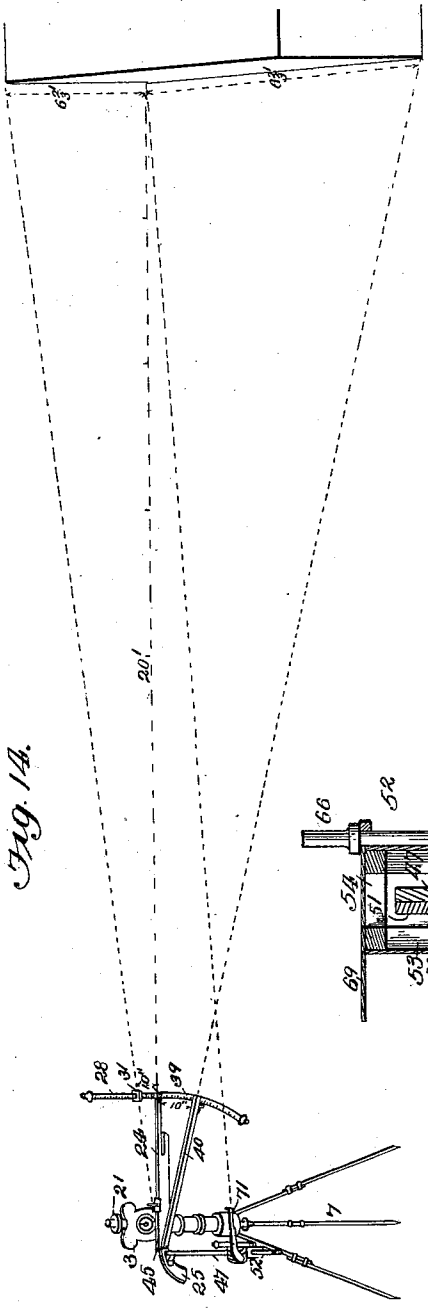

Fig. 14.

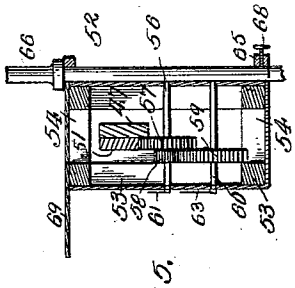

Fig. 15.

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UNITED STATES PATENT OFFICE.

JOHN LUCIUS KELLUM, JR., OF NEAR BRYSON, TENNESSEE.

MEASURING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 542,195, dated July 2, 1895.

Application filed August 7, 1893. Serial No. 482,621. (No model.)

To all whom it may concern:

Be it known that I, JOHN LUCIUS KELLUM, Jr., a citizen of the United States, residing near Bryson, in the county of Giles and State of Tennessee, have invented a new and useful Measuring-Machine, of which the following is a specification.

This invention relates to a machine for determining the distance, size, and proportion, or either of these three things, of objects; and it consists in certain improved mechanism whereby the theory of the right-angled triangle is utilized and applied to this purpose. These means will be fully described hereinafter, and finally embodied in the claims.

In the drawings, Figure 1 represents a perspective view of my complete machine, showing it operatively arranged and its parts in the proper adjustment; Fig. 2, a vertical section taken through the post or standard portion of my improvements; Fig. 3, an enlarged perpective view of the hypotenuse-indicating carriage, together with the track or guide for carrying the same; Fig. 4, a rear elevation of the said carriage; Fig. 5, a sectional view thereof, showing the gearing and its relation to the track or guide; Fig. 6, a detail view illustrating the construction of the said track or guide; Fig. 7, a detail perspective of the main beam for sighting toward the object under view; Fig. 8, a view of the upper portion of the post or standard of the instrument and showing the beam of Fig. 7 fixed thereto, while the dial-plate of said post or standard is shown to be removed; Fig. 9, an enlarged perspective of the free end of the main sighting-beam of Fig. 7 and showing attached thereto the several graduated bars, as will be better described hereinafter; Fig. 10, a detail perspective view of the needle-bar for ascertaining widths, together with the means for mounting the same on the standard or post of the machine; Fig. 11, a perspective view showing the post or standard of the machine with its several attachments folded and dismantled, illustrating the positions which they assume when being transported; Fig. 12, a view of a modified form of support for the machine; Fig. 13, a diagrammatic view illustrating the operation of measuring the distance of a perpendicular length or air-line; Fig. 14, a view illustrating the manner of determining the height and width of distant objects; Fig. 15, a second detail section of the hypotenuse-indicating carriage and taken on a line at right angles to that of Fig. 5.

The preferred form of my invention is provided with a post or standard, or, rather, a body portion, composed of three principal parts 1, 2, and 3. The portion 1 consists of a cylindrical main part having the three pins 4 secured therein at equidistant points around its circumference. These pins have formed integral with their outer ends the circular plates or disks 5, which are, of course, one for each pin and which are centrally perforated. The purpose of this perforation of the disks 5 is to permit pivotally securing the bifurcated upper ends 6 of the tripod-legs 7 to the portion 1 of the post, and this is effected by causing said bifurcated ends to embrace the disks and securing them in place through the medium of pins 8.

The legs 7 are, as previously explained, three in number, and are formed of two sections *a* and *b*, joined to each other by the yokes 9 and set-screws 10, the yokes being two for each leg, while the set-screws are one therefor. The upper end of the portion 1 is reduced at 11 and formed with an axial socket 12, in which the pin 13 of the portion 2 is revolubly seated, a set-screw 14 being provided and passed through the portion 1, so that it will be capable of engaging the spindle 13, whereby the two parts may be locked in place. The part 2 of the post or standard of the machine is of approximately the same size as the reduced upper end 11 of the part 1, and the upper end of the portion 2 is formed with a projection 15, shaped as one longitudinal half of the portion and adapted to co-operate with the corresponding portion 16 of the part 3 of the post. These two parts 15 and 16 are held in place by means of the bolt 17, which passes horizontally through them and is provided with a thumb-nut 18, whereby the parts may be clamped in place and at any desired relation. Fixed to the projection 15 of the part 2 is the segmental dial-plate 19, which is so placed that the bolt 17 will be axially related thereto, and which is adapted to co-operate with the indicator-point 20 of the part 3. These two parts—the dial-plate 19 and indicator 20—are so related on their respective

portions of the machine that as the portion 3 swings on its pivotal mounting—namely, the bolt 17—the indicator will travel over the face of the dial, thus permitting the slant of the part 3 to be ascertained by an examination of the graduations on the plate 19. The parts are so related that when the portion 3 assumes a truly vertical position in relation to the remainder of the post its indicator 20 will point midway the dial-plate 19. The upper extremity of the part 3 is provided with a compass-set 21, which is provided to permit securing a mariner's compass to the machine, as will be understood. The main portion of the part 3 may be variously ornamented, as shown in the drawings. This, however, is not materially related to my invention. Formed in the portion 3, near the lower end thereof, is a transverse opening 22, through which the pin 23 passes, and in which said pin is rigidly secured. This pin of necessity is extended at right angles to the bolt 17 and is projected beyond the portion 3 to facilitate affording means for mounting the main beam 24. The main beam 24 is mounted upon the pin 23, so as to be capable of swinging thereon, and it is provided at its rear or short arm with a hand-grip 25, shaped similar to the handle portion of a pistol and adapted to afford means for manipulating the beam.

The beam 24 has its front and long arm reduced and graduated, as may be seen by reference to the drawings, while it has formed integral with its under side a parallel and forwardly-extending projection 26, having a hereinafter-specified purpose. Fixed to the free end of the long arm are the plates 27, which are two in number and which are arranged one on each side of the beam and with a portion projecting above the same. Within these portions the lower end of the bar 28 is pivotally mounted by means of the pin 30, extending transversely through the projections or feet 29, formed at the lower end of said bar 28. By these means the bar 28 is mounted upon the beam 24 so as to be capable of swinging to a vertical position and of folding horizontally with the beam 24.

The bar 28 is formed with graduations thereon, as may be seen by reference to the drawings, and provided with a sliding indicator 31, which is movable throughout the vertical extent of the bar and which is adapted to indicate points thereon the knowledge of which is necessary to the finding of heights, all of which will appear hereinafter.

The upper edge of the beam 24 is formed dovetailed and adapted for the reception of the sliding sight 32, which is formed with a corresponding base portion and which has an upper portion consisting of a transverse plate notched at its middle, so as to be in alignment with the bar 28. Fixed to the inner side of the beam 24 and lying directly against the portion 3 of the post or standard is the segmental gear-plate 33, which has its outer edge formed with cog-teeth thereon, adapted to mesh with the similar teeth on the pinion 34. The pinion 34 is fixed to a revoluble spindle 35, mounted in turn in the portion 3. The outer end of the spindle 35 is provided with an indicator-arm 36, which is fixed thereto and which is adapted to move around in a circle in unison with the movements of the spindle.

Secured over the upper end of the sector-plate 33 and over the gear 34 is the dial-plate 37, which has an annular flange 38 formed thereon and by which it is secured in place. The plate 37 is circular in shape and has its face provided with the graduations, as shown, it being so arranged that the arm 36 will lie on its outer side, all of which may be seen by reference to the drawings. By this construction the beam 24 may be swung on its pin 23 and its inclination ascertained, since the sector or gear plate 33 will move therewith and impart to the gear 34 and arm 36 a corresponding movement.

It will be observed that the pin 23 and bolt 17 are disposed at right angles to each other, and this so as to permit adjusting the beam 24 in addition to the adjustment afforded by the bolt 17. Thus, owing to the arrangement attending the bolt 17, the beam 24 may be moved laterally, while by manipulating the beam on pin 23 the former may be moved in a vertical line and at right angles to the first line of movement.

Pivotally connected to the right-hand plate 27 of the beam 24 is the arc-shaped plate 39, which extends horizontally and which curves inwardly, the pitch of the curve being such as to have for its center the rear or inner extremity of the beam 24. Operating with the plate 39 is the needle-beam 40, which is shown in detail by Fig. 10 and which consists of a slender bar or beam of a length equal to the radius of the curve described by plate 39 and provided at its outer end and on the under side thereof with a downwardly-extending finger 41, in which a set-screw 42 operates, by which the beam may be secured at any point throughout the extent of the plate 39. The remaining and inner end of the beam 40 is pivotally connected to the rear end of the beam 24 by means of the pin 43, which is rigidly secured therein and which is provided with the perforated plate or disk 44, disposed horizontally and adapted to have the bifurcated inner end of the beam 40 to embrace it, a pin being passed vertically through said bifurcated inner end and through the perforation in the plate 40. By these means the beam is mounted so as to be capable of swinging horizontally.

It will be observed that the plate 39 is capable of swinging on its mounting, and it is so arranged that it will be capable of swinging approximately parallel with the beam 24 and into the space between the under side of said beam and the offset 26, of prior description. This construction is provided so as to permit folding the plate 39 parallel with the beam 24, as shown in Fig. 11. When the plate

39 is so disposed, the beam 40 will be disengaged therefrom and will be moved parallel with the beam 24, all of which is illustrated in the figure above referred to.

The beam 24 has at its rear end a shoulder 45, which has been hereinbefore referred to as the rear extremity of the beam, and which is practically such, though the enlargement or manipulating-extension 25 projects still farther rearward. Rigidly fixed to the forward portion of the handle 25 is the V-shaped block 46, which is formed with a side extending at right angles to the longitudinal disposition of the beam 24, and it is to this side that the way or track 47 is rigidly yet removably secured by means of screws or equivalent devices.

The track or guide 47 is formed of two sections *d* and *e*. The section *d* is formed with tongues 48 thereon, which are two in number and which are adapted to be received in the corresponding notches 49 formed in the section *e*. These parts are held rigidly connected by means of the screws 50, which are one for each lug and which pass through the same. This way or guide extends horizontally and at right angles to the beam 24. Riveted to the rear side of the guide 47 is the rack-bar 51, which is disposed with its teeth downwardly and which is formed in two sections to accommodate the sections of which the guide is composed. The rack-bar 51 is so arranged on the sections of the guide that when the two are assembled the contiguous edges of the rack-bar will snugly engage each other and form a continuous device.

By means of the joint in the guide its sections may be folded and placed alongside each other, while the fastening devices of block 46 may be released and the whole beam laid alongside of the beam 24, so as to make the machine compact and capable of easy transportation, as shown in Fig. 11. Sliding on the guide 47 is the carriage 52, which consists of two approximately square frames 53, rigidly joined to each other by blocks 54, interposed between their corners and provided with screws or other fastening devices passing through them. Arranged over the frames 53 is a casing 54^a, which extends around the sides and ends thereof and which is formed with openings 55, through which the guide-bar 47 passes and in which the said bar is movable.

Revolubly journaled within the casing 54^a and at the upper portion thereof is the spindle 56, upon which the spur-gear 57 is mounted and to which the said gear is fixed. This gear is so related to the guide-bar 47 that it will mesh with the teeth thereof, and by these means as the carriage is moved along the guide-bar the shaft 56 will be given a rotary movement commensurate with the movements of the carriage. Fixed to the shaft 56 and lying alongside of the gear 57 is the pinion-gear 58, which meshes with the spur-gear 59, fixed in turn to the shaft 60, also journaled in the casing 54^a.

The shafts 56 and 60 are each extended beyond the casing 54^a and on the rear side thereof. The shaft 56 is provided with an indicating-arm 61, which travels around a dial-face 62 and which is adapted to indicate the several graduations thereof, as will appear more fully hereinafter. The shaft 60 is also provided with an indicating-arm 63, which operates with a dial-face 64, both of which are similar to the arm 61 and face 62, with the exception of the size, which is twice as great in the dial-face 64 as in the face 62. Fixed to or formed integral with the front side of the casing 54^a are the vertically-aligned eyes 65, which are two in number and which are provided for the reception of the spindle 66. The spindle 66 is formed with a shoulder 67, which bears against the upper eye 65 and prevents downward movement of the spindle, a set-screw 68 being provided, whereby the spindle may be held incapable of revolution and at any axial position. The upper side of the casing 54^a is provided with a semicircular plate 69, which is graduated with radial and concentric lines and which is adapted to cooperate with the indicating-arm 70, fixed to the spindle 66, and in such a position that it will be capable of playing over the face of the plate 69. By this means the angle and relative position of the spindle 66 may be determined.

Fixed to the spindle 66 at a point above the arm 70 is a rod 71, which projects forwardly from the carriage 52, though it is capable of swinging rearwardly owing to the revoluble character of the mountings of spindle 66. It will be observed that as the carriage 52 is moved along the guide-bar 47 the shafts 60 and 56 will be given a rotary movement and that this will be imparted to their arms 63 and 61, respectively, causing them to indicate the degree and extent of their revolutions on the dial-faces with which they co-operate. All of this will be more fully described hereinafter.

The modification of Fig. 12 consists in an appliance for substituting the legs 7, and this consists of a single staff 72, provided at its lower end with a pointed ferrule 73, whereby it may be driven into the ground, and at its upper end with a vertically-extending socket 74 and set-screw 75. This socket is adapted to receive the spindle 13 of the portion 2 of the post or standard of the machine, while the set-screw 75 is provided to lock the parts in position. When this device is used, the legs 7 will of course, together with the section 1 of the post or standard, be dispensed with.

Fig. 11 shows how the various parts of the machine may be folded so as to make the machine compact and so as to facilitate its transportation. When so arranged, the bar 28 is swung horizontally upon the upper side of the beam 24, the plate 39 moved so as to lie be-

tween the projection 26 and the beam 24, the beam 40 moved parallel with the latter beam, and the guide-bar 47 disconnected from its plate 46 and arranged parallel with the other portions of the machine. The guide-bar 47 is formed in sections to the end that when the machine is folded it will not project beyond the beam 24, and when the length of the bar 47 is not greater than that of the beam 24 it will not be necessary to disconnect its sections.

The use of my invention is illustrated in Figs. 13 and 14 of the drawings, and these will now be described.

Fig. 13 illustrates the principal operation which my machine is capable of performing, and that which is essential to every other operation thereof. This consists in the finding of perpendicular lengths, or the distance to an object. To attain these ends I employ an imaginary right-angled triangle, the altitude of which is longitudinally aligned with the air-line to the object-point. Thus, in the operation, the beam 24 is adjusted so that it will represent the altitude of the triangle and the guide-bar 47 arranged to extend at right angles to the beam 24 and to comprise the base of the triangle. I now move the carriage 52 inwardly toward the beam 24 and adjust the rod 71 so that it will intersect at its line of vision with the end of the beam 24. Now we have described a right-angled triangle whose base is the distance from the carriage inwardly to the beam 24, whose altitude is the length of the beam 24, and whose hypotenuse is the distance from the front end of the beam 24 to the spindle 66. Suppose now that the beam 24 is of a length equal to thirty inches and that the distance representing the base of the triangle is one-fourth of an inch. Now, the operation of determining the distance to the object-point consists in extending the base of the triangle so that it will have an extent equal to some multiple of its former extent and in correspondingly extending the hypotenuse. Thus for every multiple of the base we have a corresponding multiple of the altitude; and the altitude is determined, as the base is increased, by sighting along the rod 71 and by determining the point at which the line of vision, running along said rod, intersects with the air-line to the object-point. So the length of the base is increased until the rod 71 is in a position which will permit its line of vision to intersect with the object-point, whereupon the operation will be complete, and the actual distance of the air-line may be ascertained by multiplying the number of increases in the base by the length of the beam 24. Taking, for example, thirty inches as the length of the beam 24 and one-fourth of an inch as the primary length of the base of the triangle, and supposing that the base has been increased eight times in attaining the intersection of the rod 71 with the object-point, thus we have the formula of eight multiplied by thirty inches equals two hundred and forty inches, which, reduced to feet, makes twenty feet. Therefore the distance to the object-point will be twenty feet.

It will be observed that the size of the primary triangle may be variously changed without affecting the principle of the invention, and I have provided means for so changing the triangle in making the spindle 66 adjustable on the carriage 52. Thus the carriage may be arranged, in the first instance, one or two inches from the beam 24 and the rod 71 made to intersect with the end of the beam 24, thus describing a triangle having a base of two inches and an altitude of thirty. With this or any other adjustment the operation of finding the distance to the object will be the same as that just described. It will also be observed that should beam 71 intersect with the object at a point midway of one of the original bases, so as to cause the base of the enlarged triangle to be equal to a number of the original bases and a fraction thereof, this will not interfere with the accurate determination of the distance, since the formula may be eight and one-half multiplied by thirty inches just as well as in the first formula.

I provide the dials 62 and 64 and their respective indicators for dispensing with mathematical calculation in the attainment of the above-operation, and this is done by determining a specific base and by arranging the dials so that each increase or fractional increase of the base will be recorded and concurrently multiplied with the altitude. Thus we have the distance to the point with which the rod 71 intersects always indicated, no matter what be the position of the carriage 52; and when the beam 71 intersects with the object-point all that will be necessary is to read the distance from the dials, one of which is made to indicate feet and the other inches. I will not go into a detailed description of the graduations and operation of these dials, since this is a matter of common knowledge and does not require anything more than mechanical skill to provide such an arrangement. It will be understood, however, that with each change of the base of the primary triangle this indicating device will have to be correspondingly changed, if it is desired that its showings be correct.

Fig. 14 illustrates the method of determining the width and height of distant objects by my machine, and this consists in the use of the bar 28 and plate 39. Thus, to determine the height of an imaginary cube at the distance of twenty feet, such distance having been previously determined, all that will be necessary is to sight the beam 24 so that it will point to the base of the cube, then raise the indicating-slide 31 up the bar 28 until the object-point 45 of the beam 24, the slide 31, and the top of the cube are each aligned with the other. The actual height of the cube may now be determined by multiplying the number of times which the length of the beam 24 enters into the distance to the cube by the distance between the slide 31 and the base of

the bar 28. Thus, for example, supposing the cube to be twenty feet distant, the thirty inches represented by the beam 24 will be contained in this distance eight times. And suppose that the slide 31 was ten inches from the base of the bar 28. Now we would have the formula of eight multiplied by ten inches equals eighty inches, reduced to feet making six and two-thirds feet, which is the height of the cube. The width is attained by the use of a similar principle and by causing the beam 24 to point toward one end of the cube, after which the beam 40 should be swung out along the plate 39 until it intersects with the opposite side of the cube. The width is now determined by multiplying the number of times which the beam 24 is contained in the distance to the cube by the distance from the front end of the beam 24 to the corresponding end of the beam 40. Thus, supposing this latter distance is ten inches and using the measurements of the preceding formulas, we have eight multiplied by ten inches equals eighty inches, which, reduced to feet, equals six and two-thirds feet, which will be the width of the cube.

If so desired, in the measurements of heights the bar 28 may be dispensed with and the height attained by first sighting the beam 24 to the base of the object measured and noting the indications of the dial 37, after which the beam 24 should be raised until it points to the upper end of the object measured and the then changed indications of the dial 27 noted. The difference between these two indications of the dial 37 will be equal to the distance of the arc described by the outer end of the beam 24. The remainder of the problem is now worked out in the manner heretofore described.

It will be observed that my machine is capable of performing various other operations dependent upon these fundamental principles, such as the measurement of the bases of mountains and various other calculations. It is not necessary to explain these here, since they are all dependent upon and are mere variations from the three fundamental operations hereinbefore described.

Various changes in the form, proportion, and arrangement of the parts of my invention may be resorted to without departing from the substance thereof. Therefore I desire it understood that I am not restricted to the precise construction herein shown, but am entitled to such variations as come within the above definition.

Having described the invention, I claim—

1. In a machine for measuring distances, the combination with a rigid portion or standard, of a main beam mounted thereon so as to be capable of swinging on a horizontal axis, said beam having a triangular block fixed thereto, a guide-beam comprising two sections removably and rigidly joined to each other, the guide-beam having one end removably secured to the triangular block so as to extend at right angles to the main beam, and an indicator movable on the guide-beam, substantially as described.

2. In a distance measuring machine, a rigid portion or standard, a main beam mounted thereon so as to be capable of swinging on a horizontal axis, an arc-shaped and graduated rod secured to the outer end of the main beam and extending horizontally, a needle beam hinged to the opposite end of the main beam and arranged so that its free end will swing in the arc of the said graduated rod, a guide-beam removably secured to the main beam and extending horizontally and at right angles thereto, and an indicator mounted and operating on the guide-beam, substantially as described.

3. In a machine for measuring distances, the combination of a rigid portion or standard, a main beam mounted thereon so as to be capable of swinging on a horizontal axis, a guide-beam rigidly secured to the main beam and extending at right angles thereto, the said guide-beam having a series of cog-teeth extending throughout its length, an indicating carriage slidably mounted on said guide-beam and having at one side a dial face, a spindle mounted vertically on the indicating carriage and capable of axial adjustment thereon, a horizontal indicating rod fixed to the spindle, a shaft revolubly mounted within the indicating carriage, an indicating arm fixed to said shaft and operating with the dial on the carriage, and a gear fixed to the shaft and meshing with the cog-teeth on the guide-bar, substantially as described.

4. In a machine for measuring distances, the combination of a rigid portion or standard, a main beam mounted on the same so as to be capable of swinging on a horizontal axis, distance indicating devices carried by said main beam, a toothed sector fixed to the main beam and concentric with the axis thereof, a spindle or shaft revolubly mounted in the rigid portion or standard and above the sector, a gear fixed to the shaft and meshing with the sector, a dial fixed adjacent to the shaft, and an indicating arm operated by the shaft and working on the dial, substantially as described.

5. In a machine for measuring distances, the combination of a rigid portion or standard, a main beam mounted thereon so as to be capable of swinging on a horizontal axis and having at its under side and near its middle a parallel and forwardly-projecting extension, a graduated and arc-shaped plate having one end hinged to the front end of the main beam and capable of swinging so as to lie with its free end in the space between the said beam and the parallel extension, and a needle-beam hinged to the opposite end of the main beam and having its free end capable of sliding connection with the plate, substantially as described.

6. In a machine for measuring distances, a body portion or standard comprising the parts

1, 2, and 3, the part 1 being provided with suitable supporting legs and having at its upper portion an axial socket, the part 2 being formed with a stud on its lower side which fits into the said socket and having at its upper end a horizontally-perforated projection, and the part 3 being provided at its lower side with a corresponding projection hingedly mounted on the projection of the part 2 by means of a pin passing through the two parts, and distance-indicating mechanism mounted on the part 3 and capable of swinging on a horizontal axis, substantially as described.

7. In an instrument for measuring distances, the combination of a vertical support, a graduated beam pivoted to the support between its ends and adapted to tilt in a vertical plane, indicating devices to determine the declination of the said graduated beam and actuated on moving the latter, a graduated bar pivotally attached to the front end of the said beam and having a slide mounted thereon, and a sight slide adapted to travel upon the graduated beam and co-operate with the graduations of the latter and the graduations of the said pivoted bar when determining the required measurements, substantially as set forth.

8. In an instrument for determining distances, the combination of a support having an upper part pivoted thereto so as to move laterally, an indicating mechanism for determining the variation of the said upper part from a normal position, a graduated beam pivotally connected between its ends to the said upper part of the support so as to operate in a vertical plane, the two pivotal connections between the parts of the support and the said beam and the support, respectively, being right-angularly disposed, indicating mechanism to determine the variation of the graduated beam from a pre-determined position, a graduated bar at the outer end of the beam and occupying a vertical position, and a sight slide adapted to move upon the graduated beam, substantially as set forth for the purpose described.

9. In a machine for measuring distances, the combination of a rigid body portion or standard, a main beam mounted on the body portion or standard and so as to be capable of swinging on a horizontal axis, a guide-bar rigidly secured to the main beam and extending at right angles thereto, an indicating carriage movable on the guide-bar and having a segmental dial face on its upper side, a spindle mounted on one vertical side of the indicating carriage and extending vertically thereon, an indicator-arm fixed to the spindle and projecting over the said dial face, and a second indicating arm or rod fixed to the spindle and capable of projecting toward the free end of the main beam, substantially as described.

10. The herein specified measuring and surveying instrument, comprising a support formed of pivoted parts, an indicating mechanism to determine the relative variation of the said parts when moved upon the connecting pivot, a graduated beam having pivotal connection with the support, the said pivots being right-angularly disposed, a registering mechanism to determine the declination of the graduated beam and actuated thereby, a graduated bar, and a graduated arc-shaped plate having pivotal connection with the front end of the beam, the said bar extending vertically and the plate horizontally, a needle bar having pivotal connection with the rear end of the beam and adapted to move on the arc-shaped plate, a guide beam extending at right angles to the graduated beam, an indicator movable upon the guide beam and having its registering mechanism actuated by direct contact therewith, and having a segmental dial face on its upper side, a spindle journaled on one side of the said indicator, and an indicating arm pivoted to the said spindle and adapted to operate over the said segmental dial face, substantially as described for the purpose set forth.

JOHN LUCIUS KELLUM, JR.

Witnesses:
JOSEPH W. KENNEDY,
W. O. HARRIS.