

W. H. M. CHRISTIE.

RANGE FINDER.

APPLICATION FILED FEB. 20, 1909.

928,902.

Patented July 20, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

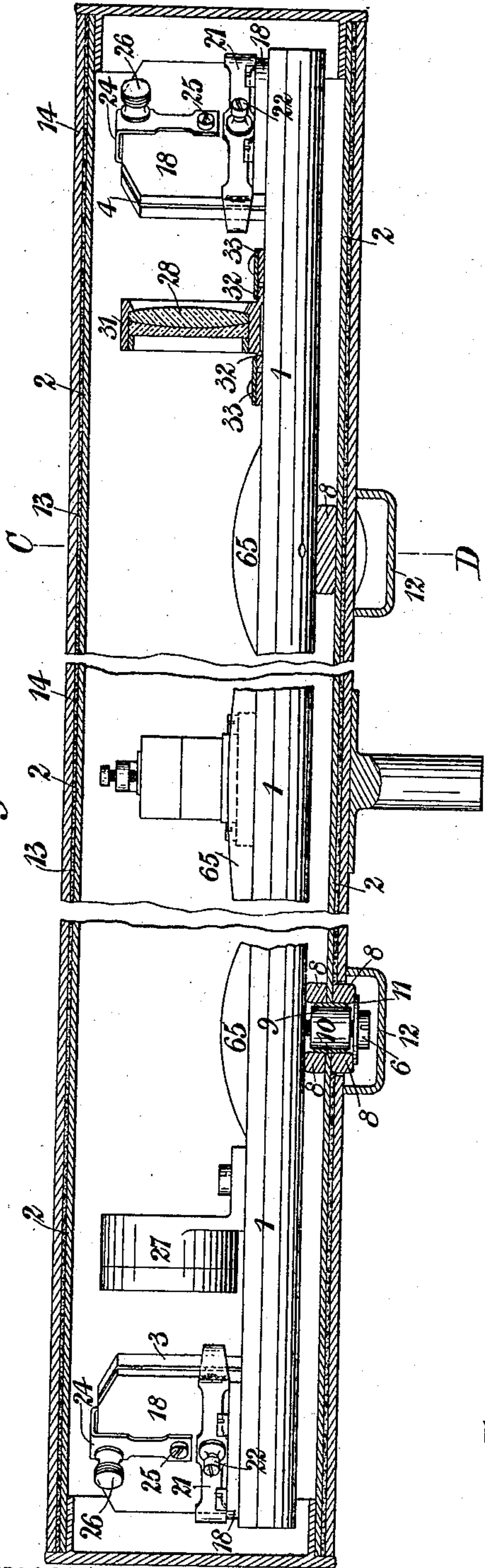
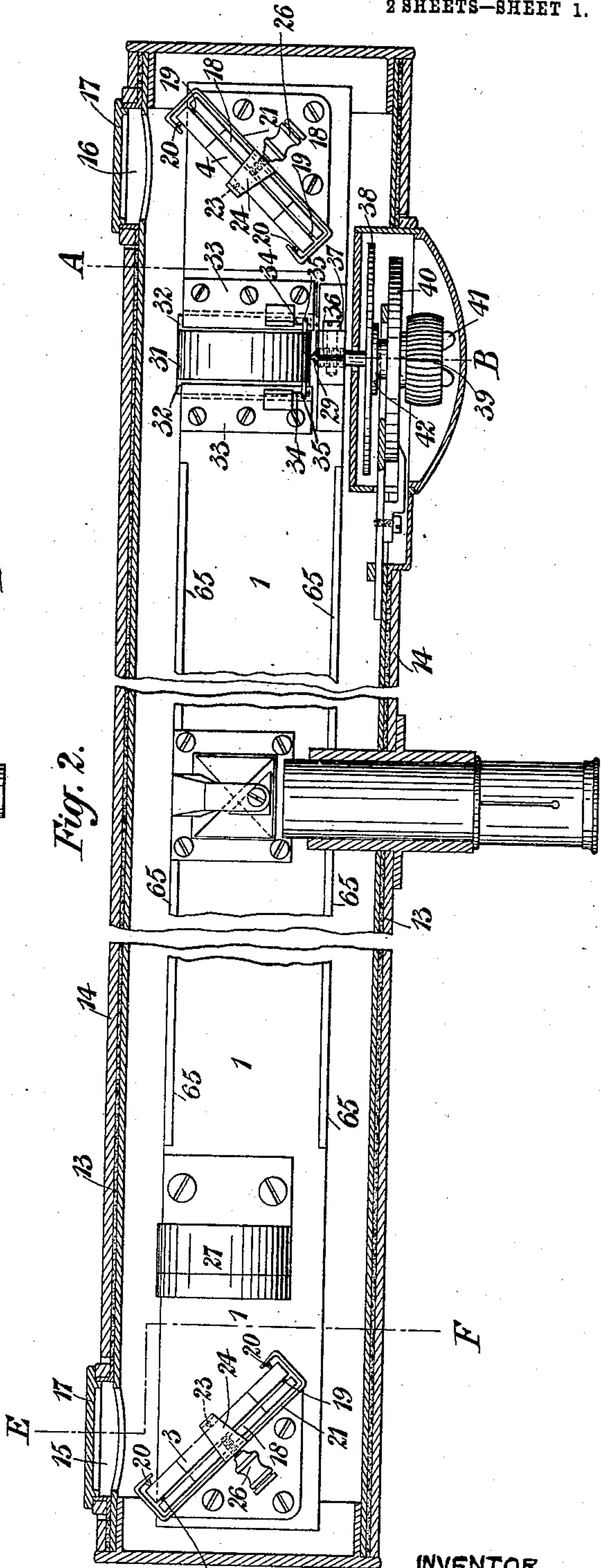


Fig. 2.



WITNESSES

L. H. Grote

M. E. Keir

INVENTOR

William Henry Mahoney Christie

BY

Howard and Howard

ATTORNEYS

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2 SHEETS—SHEET 2.

Fig. 3.

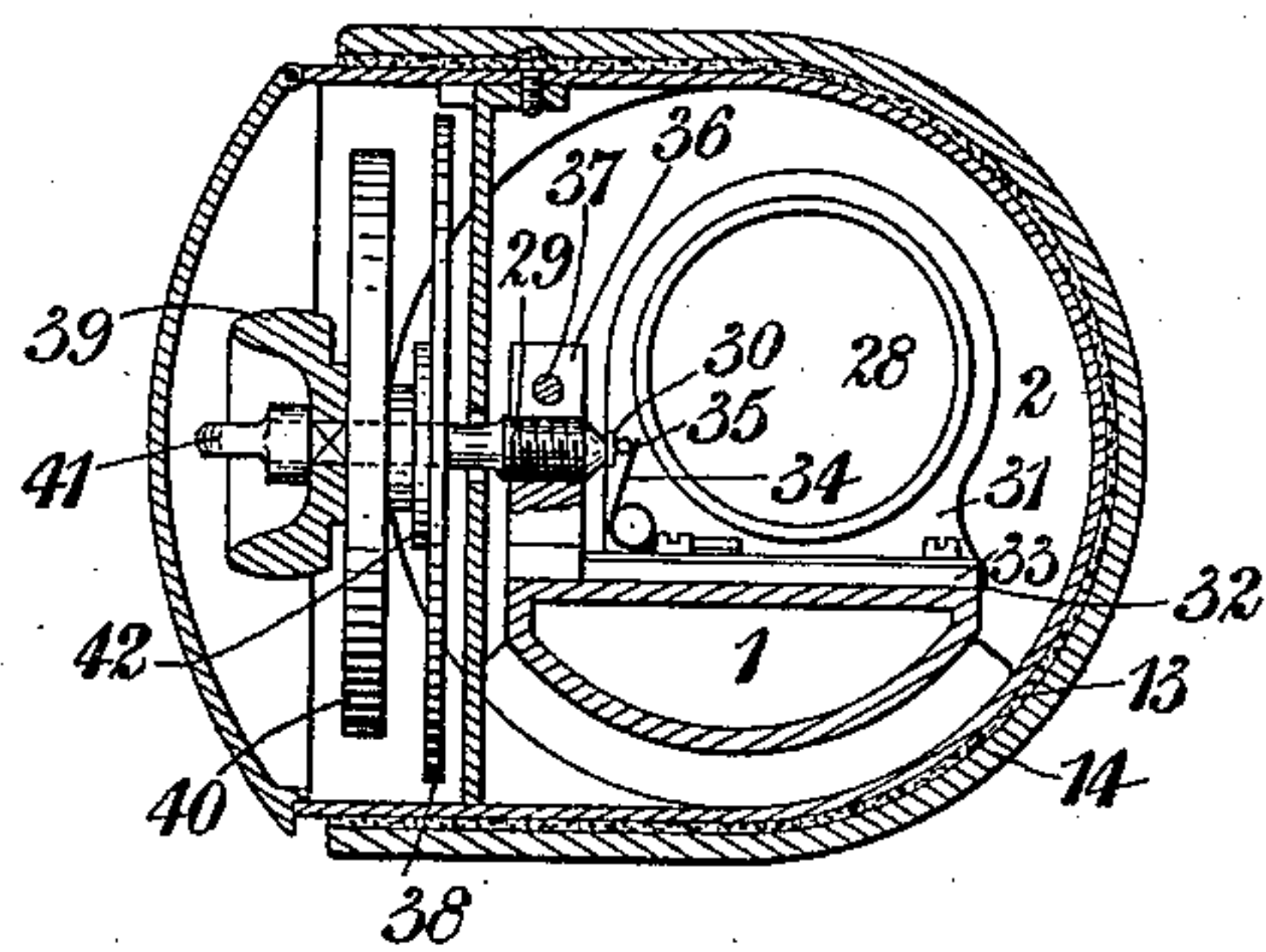


Fig. 4.

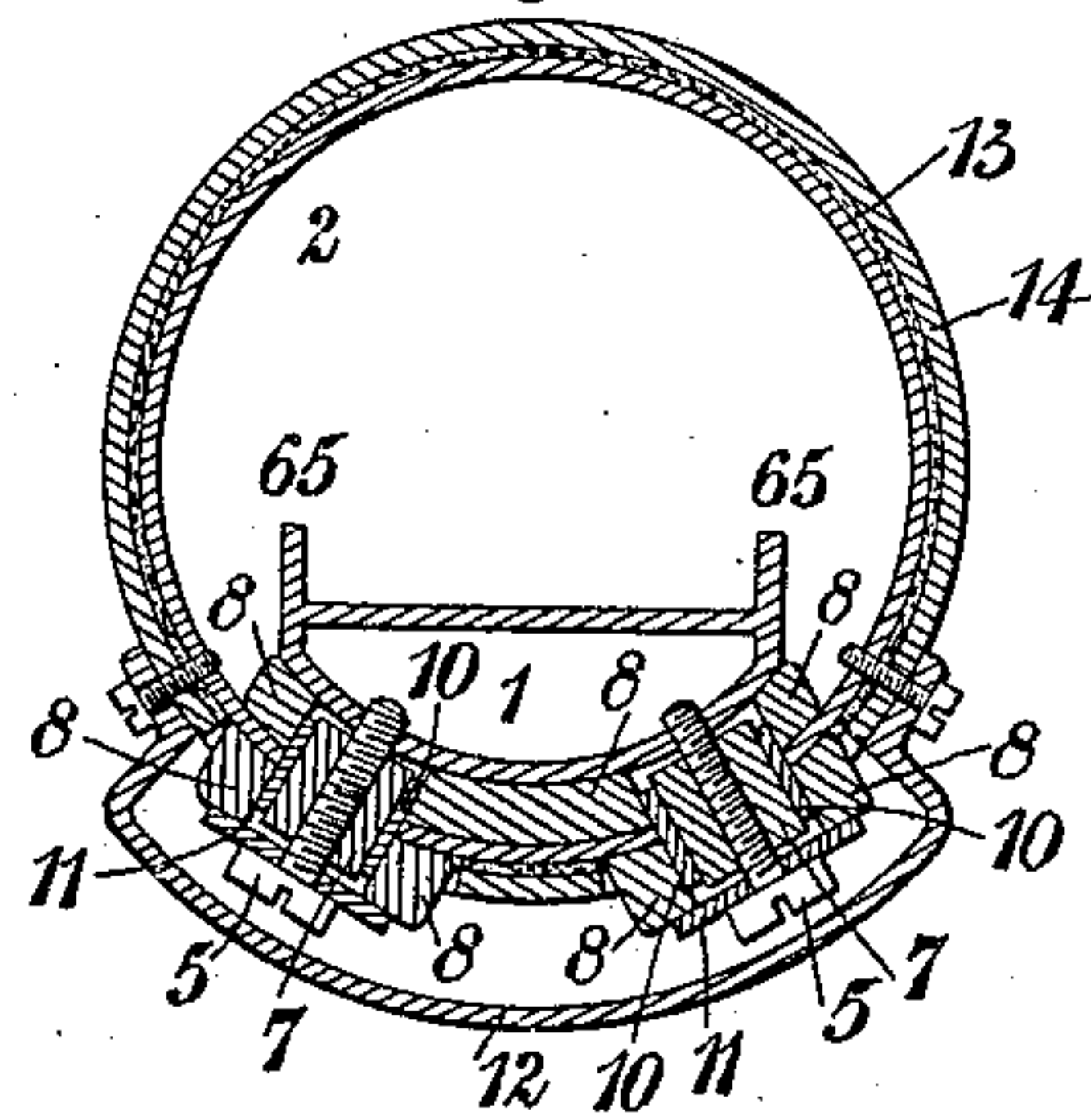
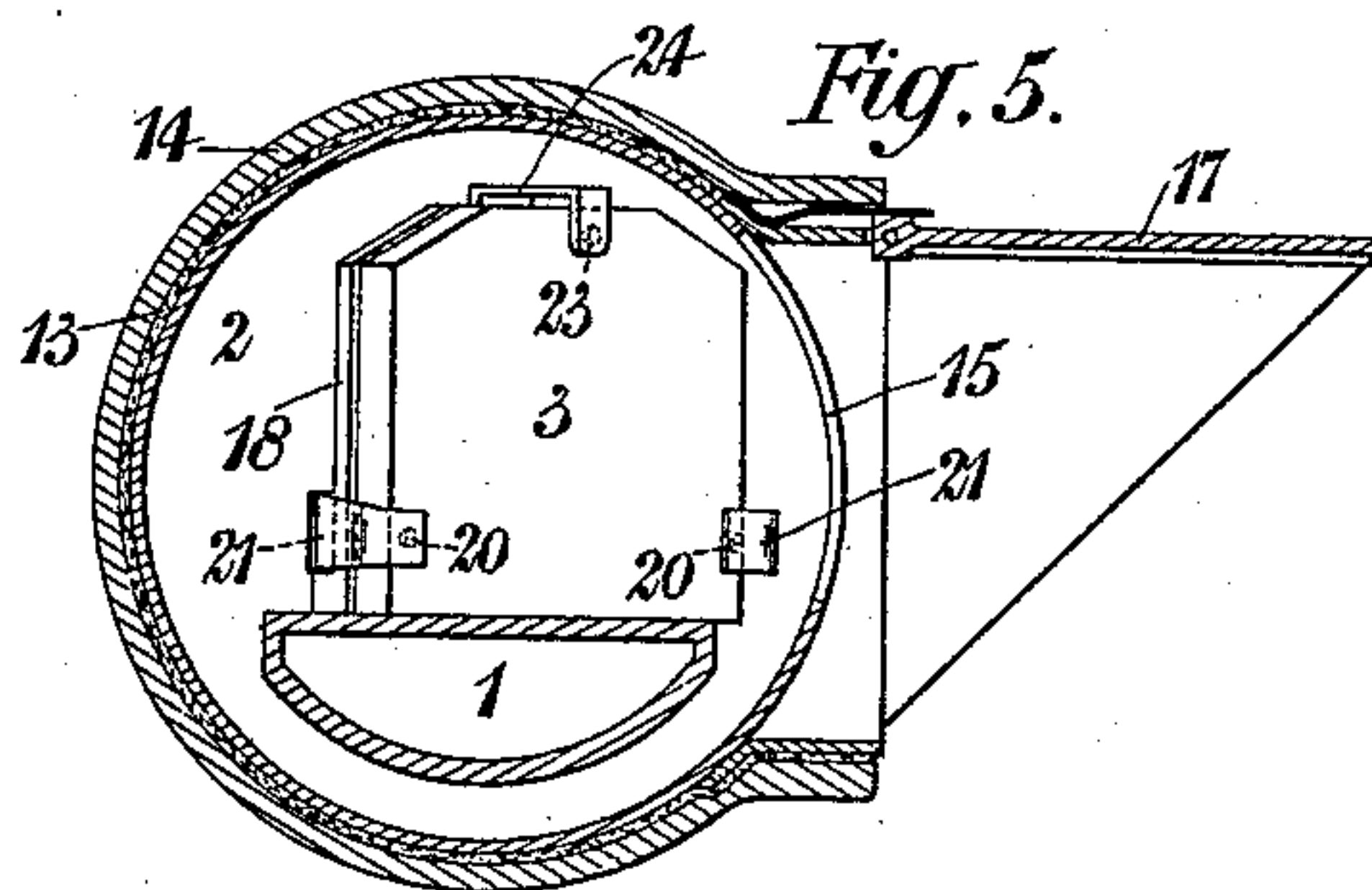


Fig. 5.



WITNESSES
L. H. Grote
M. E. Kier

INVENTOR
William Henry Mahoney Christie
BY

H. H. H. H. H.
ATTORNEYS

UNITED STATES PATENT OFFICE.

WILLIAM HENRY MAHONEY CHRISTIE, OF GREENWICH, ENGLAND.

RANGE-FINDER.

No. 928,902.

Specification of Letters Patent.

Patented July 20, 1909.

Application filed February 20, 1909. Serial No. 479,250.

To all whom it may concern:

Be it known that I, WILLIAM HENRY MAHONEY CHRISTIE, a subject of the King of Great Britain and Ireland, of the Royal Observatory, Greenwich, in the county of Kent, England, have invented new and useful Improvements in Range-Finders, of which the following is a specification.

My invention relates to range finders of the kind in which reflectors at each end of a base are employed, and more especially to range finders such as that described in the specification of British Letters Patent No. 12,404 A. D. 1886, granted to me, my present invention having for its object to improve such range finders and render them very readily adjustable and less liable to become distorted by changes of temperature, or other causes, so that the indications of the range finders are more exact.

I will describe my invention with reference to the accompanying drawings.

Figure 1 is a vertical longitudinal section, and Fig. 2 is a horizontal longitudinal section, of an improved range finder made in accordance with my present invention. Figs. 3, 4 and 5 are transverse sections respectively taken on the lines A, B, Fig. 2; C, D, Fig. 1; and E, F, Fig. 2.

In range finders of the aforesaid kind, as hitherto made, the base which carries the optical parts is liable to become distorted under the heat of the sun. To prevent this I use a hollow metallic base 1, to carry the optical parts upon its upper outer side, and I surround this base, and the parts carried by it, with any usual, or suitable, protective tube 2. The said hollow base 1 is made of aluminium, or other metal which is a good conductor of heat, and is preferably made with a flat upper side, or top, for the reception of the optical parts, and with a rounded, or angled, under part. Convenient forms, in cross section, for the said hollow base 1 are, for instance, a segment of a circle, as shown in the drawings, or a triangle, or other equivalent form, which will give the requisite lateral stiffness and facilitate the passage of heat from one side to the other by conduction and radiation. I prefer to make the said base 1 thicker, or stronger, at the parts which are most liable to distortion by strain, or the action of gravity. This I may do by casting fins on it, as shown at 65. The base 1 is attached to the protective tube

2, preferably at three points, so chosen that the parts at, or toward, each end of the base 1, to which the mirrors 3 and 4 are attached, will remain in the same horizontal plane with each other should the base 1 become somewhat distorted under strain, or the action of gravity. The said points of attachment may consist of two screws 5 (see Fig. 4) toward one end with the intervention of resilient devices, or buffers, and one screw 6, toward the other end, (see Fig. 1), these screws passing through enlarged holes in the outer tube 2, and also with a resilient device, or buffer, so as to absorb jars, or vibrations, and allow of relative movement under expansion and contraction. The resilient devices, or buffers, at these points of attachment may conveniently be pads of rubber (7, 7 and 9) surrounding each screw and contained in a metal tube 10, and pads 8 situated between the base 1 and the inside of the protective tube 2, and between the outside of the protective tube 2 and the head of each screw 5, 5 and 6, or a washer 11 thereon, as shown, and caps 12 may be placed, and secured, over the screw-heads as illustrated.

As the tube 2 is to protect the base 1 from unequal heating, for instance by the sun's rays striking on one side, the said tube 2 should be made, as far as possible, or convenient, non-conductive of heat to the inside, while conductive of heat all around the tube, the air-space between the base 1 and the inside of the tube 2 insuring the base 1 being equally subjected all around to any heat. The tube 2, for this purpose, is preferably made of aluminium, or other suitable metal, and, outside this, a layer 13, of material non-conductive of heat, such as asbestos, cork, or wool, for example, and a leather covering 14 outside this.

The openings 15 and 16 in the tube 2, through which the rays from the object enter each end of the instrument, may be provided with means for preventing access of rain and of the sun's rays, so that they do not impinge on parts of the base 1 and thus cause distortion. This can be effected by shields, projecting from the sides of the instrument, and these may be made for example as foldable flaps 17, with springs to act on a squared part to hold them open and closed, as shown.

In order to support the mirrors 3 and 4, firmly and without risk of their being

strained, and yet provide for fine adjustment thereof, I mount them each on a support 18 (secured to the base 1) between three pairs of points, two pairs at bottom 5 and one pair at top, the members of each pair being in line front and back. The points which bear on the back at the sides are marked 19. The points 20 which bear on the front, opposite the points 19, are carried by a spring 21 extending across the back 10 of the support 18, with its ends turned over the front side edges of the mirror, the said spring 21 being secured by a screw 22, pressing on the back of the support 18. The upper front bearing point 23 is carried by the spring 24, secured by the screw 25, to the support 18, and having its end brought over the front top edge of the mirror, and the upper back bearing point is constituted by 20 the end of a screw 26, passing through the spring 24, and screwed through the support 18. If desired, one of the lower back bearing points 19 may be made similarly adjustable. By means of the screw adjustments described, 25 images can be easily separated, for observation of small objects, without a suitable vertical line, such, for example, as a star, or light, at night, or a stone by day.

The object glasses are marked 27 and 28. 30 The sliding arrangement for the object glass 28 is preferably made so that it is pressed against the end of the micrometer screw 29, by spring pressure, and this may be done as follows:—The point of the micrometer screw 35 29 bears on a piece 30 of agate, or other hard substance, (see Fig. 3) on the side of the cell 31 of the object glass, which cell is formed with slides 32, to slide in guides 33, secured to the base 1, the said agate, or like, piece, 40 30 being kept to its bearing on the end of the micrometer screw 29 by springs 34, acting on pins 35, projecting from each side of the cell 31, the lines of action of the springs 34 on the pins 35 being preferably parallel 45 with the axis of the micrometer screw 29, and as near to its bearing on the agate, or like, piece 30 as possible. The slide 32 preferably extends the whole, or a considerable portion, of the width of the base 1, and it 50 is narrow compared with its length and the screw nut through which the micrometer screw 29 works may be slit, as at 36, and can be connected by a screw 37, to allow of taking up wear of the said nut and micrometer 55 screw 29. To allow of more conveniently setting the head of the micrometer screw 29 to zero, I provide an additional disk 38, with a scale to indicate parts of a rotation of the micrometer screw 29, keyed onto the body 60 of the micrometer screw 29, and provided with a head 39 for turning it. By the side of this disk 38 is carried the scale disk 40, which is held to the micrometer screw 29 by being pressed onto the disk 38 by a pinching 65 nut 41 (preferably a fly-nut) through the

intervention of the collar piece 42. The divisions on the scale disk 40 may be in a spiral and may be graduated to read ranges direct. I can adjust the scale by observing an object at a known distance and turning the micrometer screw 29 to obtain coincidence of the images in the usual way, and then reading the scale on the additional disk 38. This may be repeated and the mean taken. The pinching nut 41 is loosened and the scale 70 disk 40 is set until the known range, or the infinity mark, corresponds to the reading (or the mean of the readings) of the scale on the additional disk 38. After this adjustment, the disks 38 and 40 are clamped 75 together by the pinching nut 41 and the instrument is ready for use. The eye-piece and prisms at the center of the length of the instrument may be of the ordinary, or any suitable kind, and require no description. 80 I have, in the foregoing description, presumed that the instrument is used with the base horizontal, and in the position illustrated in the drawings, but it may of course be used in any other convenient position. 85 In referring to the upper and lower parts in the claims I mean the position shown in the drawings regardless of the position in which the instrument may be used.

I claim:—

1. A range finder, having a protective tube, a hollow metallic base mounted in the lower part thereof by means which allow of movement of the said base under expansion and contraction, or distortion of the protective tube, together with optical devices for the range finder carried by the upper part of the said hollow metallic base. 95
2. A range finder having a protective tube, a hollow metallic base mounted in the lower part thereof by means which allow of movement of the said base under expansion and contraction, or distortion of the protective tube, together with optical devices for the range finder carried by the upper part 100 of the said hollow metallic base, said protective tube being made of metal covered with a material non-conductive of heat and further covered with a leather covering. 105
3. A range finder having a protective tube, a hollow metallic base mounted in the lower part thereof by means which allow of movement of the said base under expansion and contraction or distortion of the protective tube, together with optical devices for the range finder carried by the upper part 110 of the said hollow metallic base, said base being strengthened at the parts most liable to distortion by strain, or the action of gravity. 115
4. A range finder having a hollow metallic base with a flat upper part and a rounded under part, a protective tube in the lower part of which said base is mounted by means which allow of movement of the said base under expansion and contraction or distortion 120 125 130

tion of the protective tube and optical devices carried by the upper part of said hollow metallic base.

5. A range finder having a hollow metallic base with a flat upper part and an angled under part, a protective tube in the lower part of which said base is mounted by means which allow of movement of the said base under expansion and contraction or distortion of the protective tube, and optical devices carried by the upper part of the said hollow metallic base.

6. In range finders, a protective tube, a hollow metallic base mounted in the lower part thereof, optical devices carried by the upper part of the said hollow metallic base and screw attachments for securing the said base to the said tube, with intervening resilient devices, substantially as hereinbefore described.

7. In range finders, a protective tube, a hollow metallic base mounted in the lower part thereof, and optical devices carried on the upper part of said base, the latter being secured to the said tube at three points by devices which allow of movement of the base under expansion and contraction or distortion of the protective tube, substantially as hereinbefore described.

8. In range finders, a protective tube, a hollow metallic base carried within the same together with optical devices and means for mounting the same on said base, said optical devices including mirrors and said mounting means comprising, for each mirror, a support and springs both carrying three points bearing on the back and front of the mirror respectively, and means for adjusting the relative position of the said points, whereby the position of the mirror may be altered, substantially as hereinbefore described.

9. In range finders, a protective tube, a hollow metallic base carried within the same together with optical devices and means for mounting the same on said base, said optical devices including mirrors and said mounting means comprising, for each mirror a support secured to the base, and carrying three points to bear on the back of the mirror and also springs extending, at the front, over the edges of the mirror and carrying points to bear on the front of the mirror in line with the points on the support and means for

altering the relative position of the points carried by the support whereby the position of the mirror may be adjusted, substantially as hereinbefore described.

10. In range finders, a protective tube, a hollow metallic base carried within the same and object glasses supported on said base, together with means for mounting and adjusting one of the object glasses on the base, the said means consisting of the combination of guides secured to the base and a cell for the object glass adapted to slide in the guides, a micrometer screw and springs in the base acting on the cell to keep it against the point of said micrometer screw, substantially as hereinbefore described.

11. In range finders, a protective tube, a hollow metallic base carried within the same, object glasses supported on said base, together with means for mounting and adjusting one of the object glasses on the base, the said means consisting in a micrometer screw, a cell for the object glass having a bearing piece against which the point of said screw bears, the said cell being provided with sliders running in guides secured to the base and with pins and springs bearing thereon, the said pins being on either side of said bearing piece on the object glass cell so that the line of action of the springs is parallel with the axis of the micrometer screw, substantially as hereinbefore described.

12. In range finders, a protective tube, a hollow base within the same and optical parts carried by said base in combination with a micrometer screw for adjusting one of the optical parts and two disks mounted on said screw and marked with the requisite scales, one disk being fixed to the micrometer screw, and provided with a turning head, and the other disk being capable of independent adjustment, on said screw, together to the fixed disk whereby the said disks can be operated separately for setting the range finder and then be clamped together for use, substantially as hereinbefore described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM HENRY MAHONEY CHRISTIE.

Witnesses:

CHARLES W. CROCKER,
HERBERT D. JAMESON.