H. GRUBB.

APPARATUS FOR SIGHTING OBJECTS FROM PROTECTED POSITIONS.

APPLICATION FILED MAR. 6, 1909.

978,368.

Patented Dec. 13, 1910.

6 SHEETS—SHEET 1.

Fig. 1

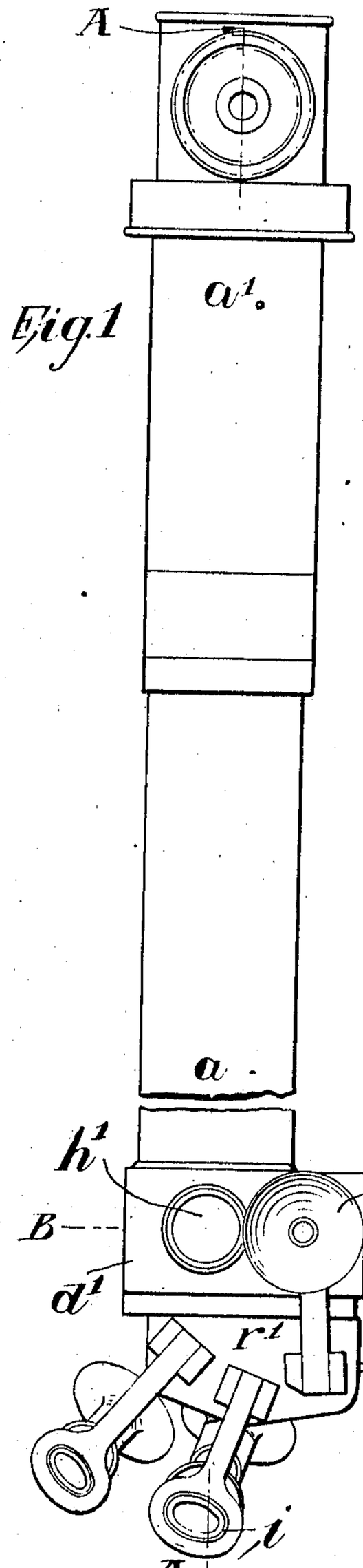

Fig. 4.

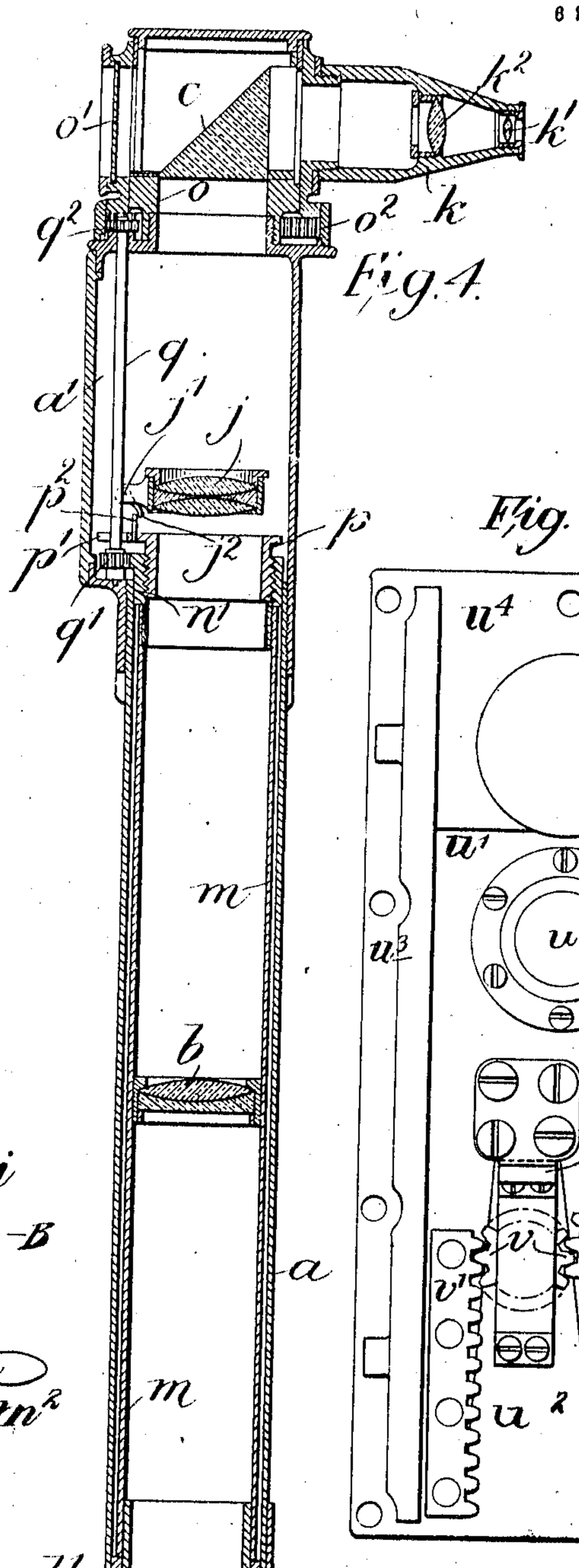

Fig. 9.

Witnesses
Joseph B. Stack.
Harry King.

Inventor
Howard Grubb
By Julian C. Dowell & Co.
his Attys

H. GRUBB.

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6 SHEETS—SHEET 2.

Fig. 2.

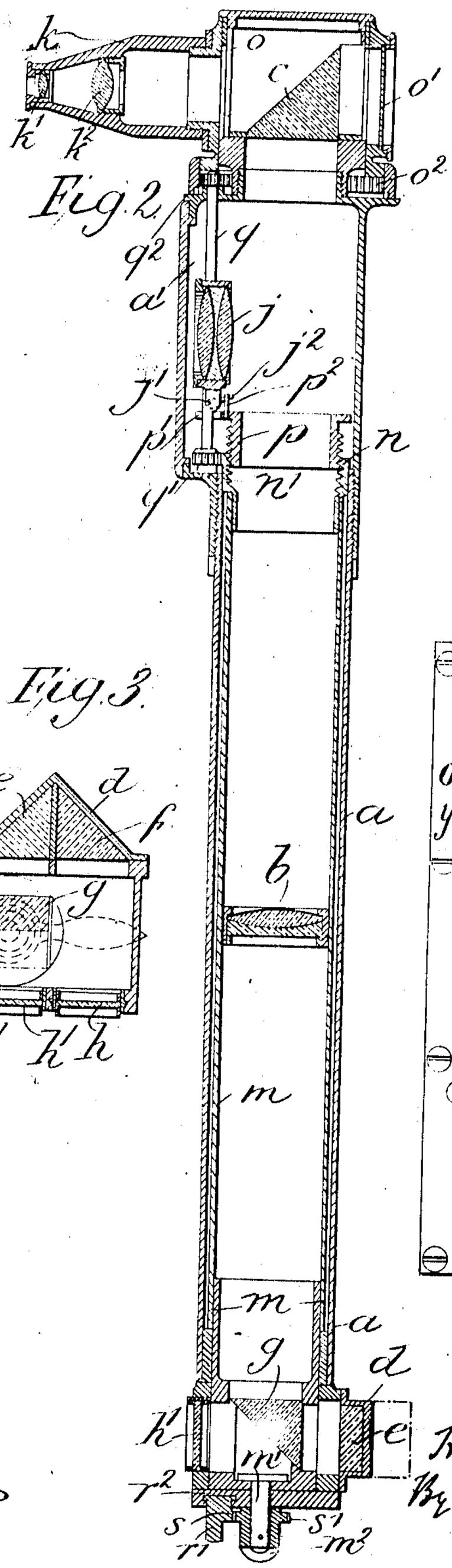
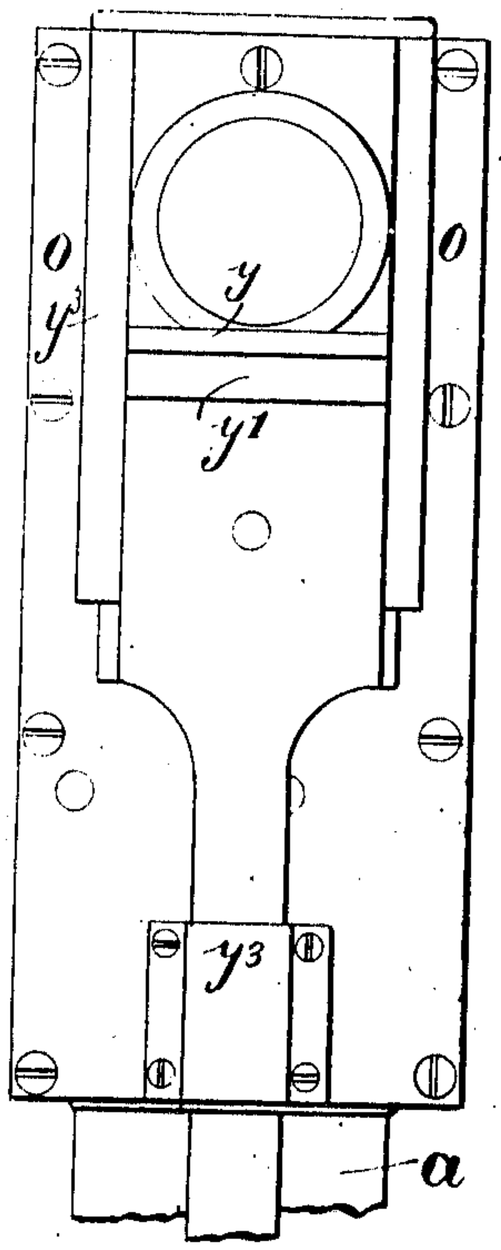


Fig. 3.

Fig. 8.



Witnesses
Joseph C. Stack.
Harry King.

Inventor
Howard Grubb
By Julius C. Burrell & Co.
his attys.

H. GRUBB.

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6 SHEETS—SHEET 3.

Fig. 10.

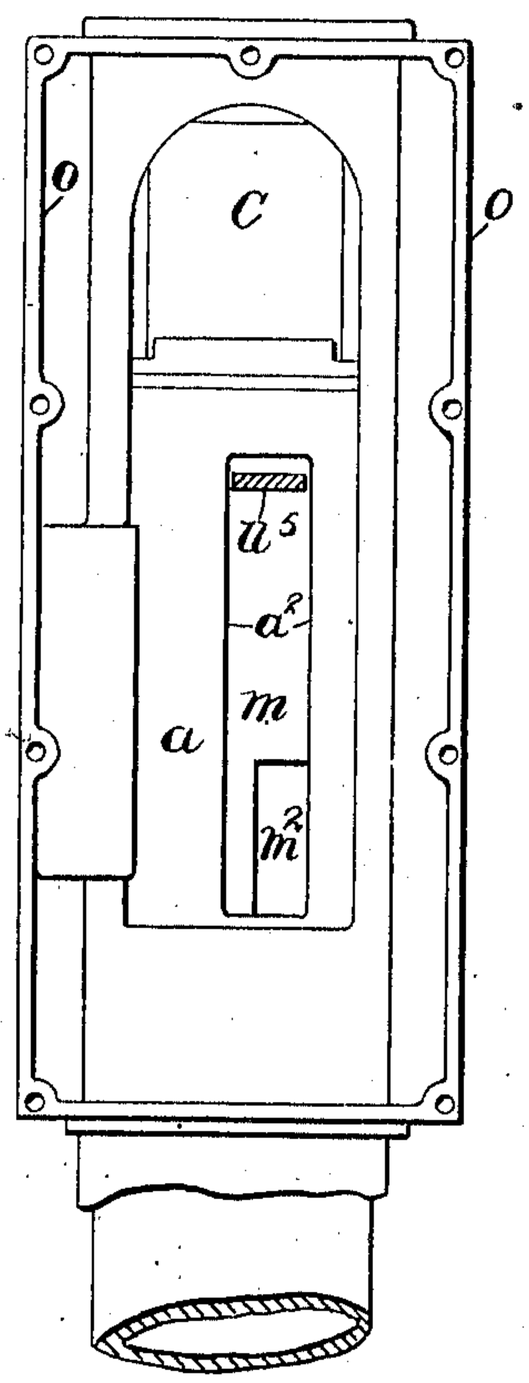
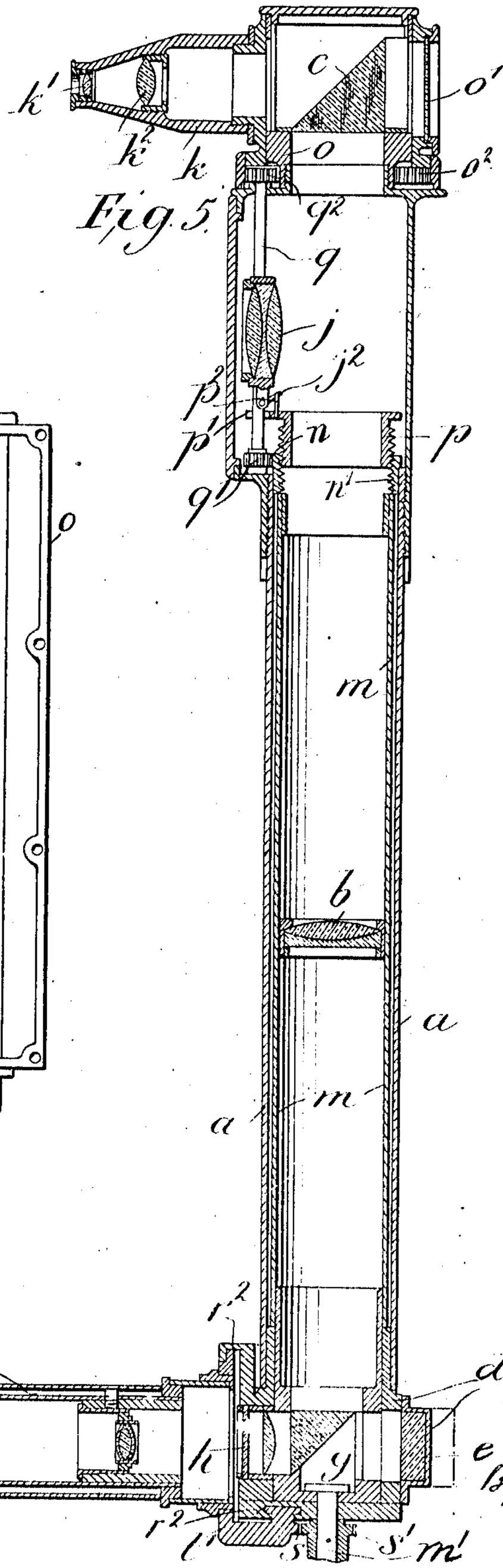


Fig. 5.



Witnesses
Joseph C. Stacy
Harry Jung.

Inventor
Howard Grubb
By Dickinson Albert & Co
his attys.

H. GRUBB.

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6 SHEETS—SHEET 4.

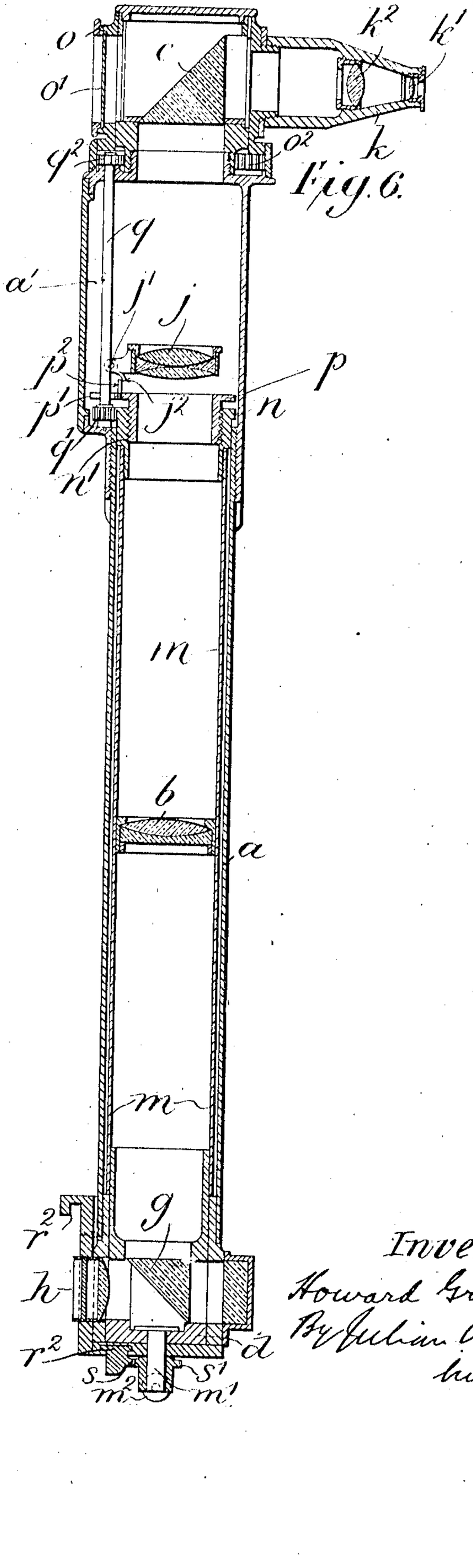

Fig. 6.

Witnesses
Joseph C. Stack.
Harry King

Inventor
Howard Grubb
By Julian C. Burdett & Son
his attys.

H. GRUBB.

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6 SHEETS—SHEET 5.

Fig. 11.

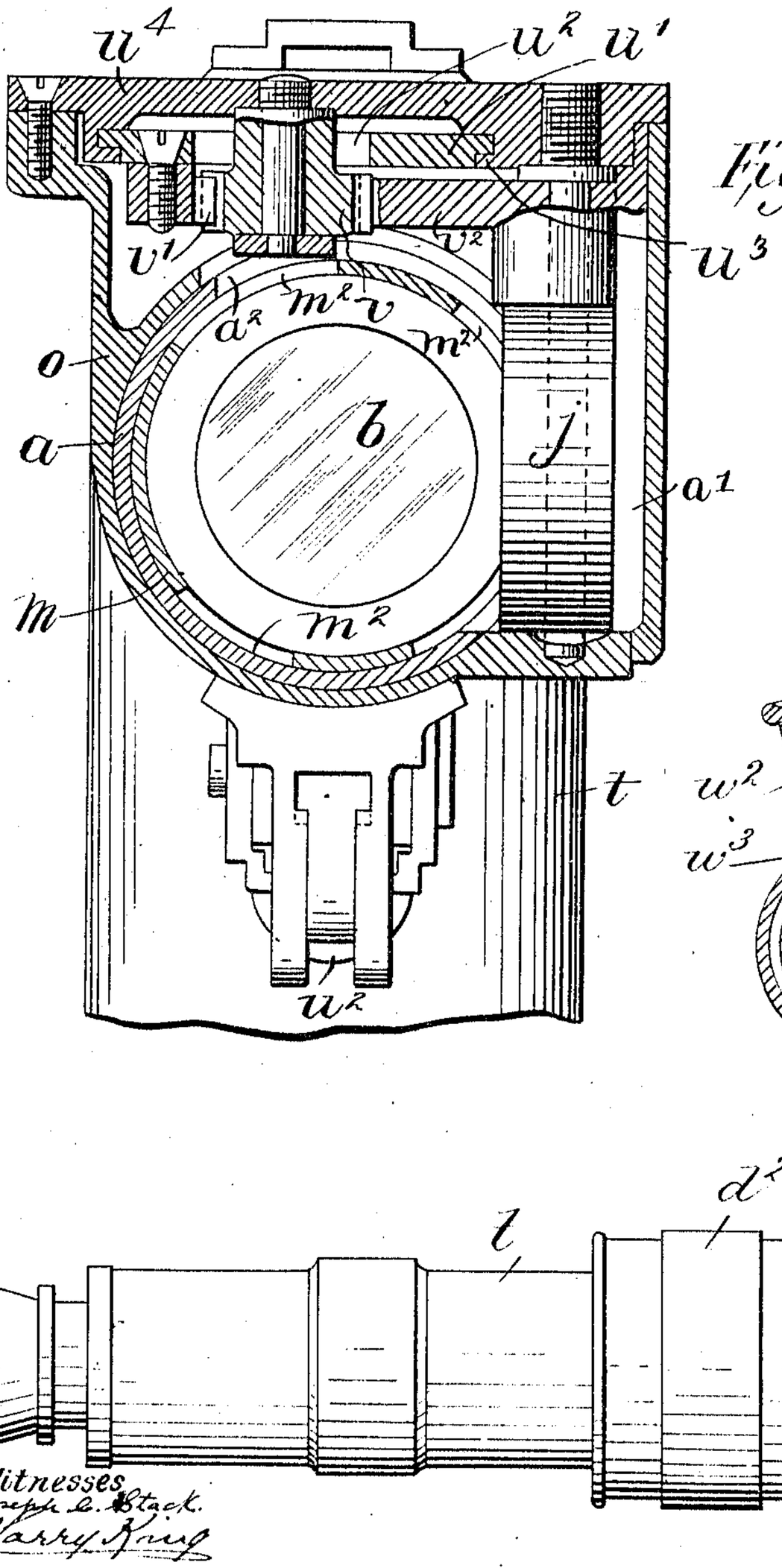
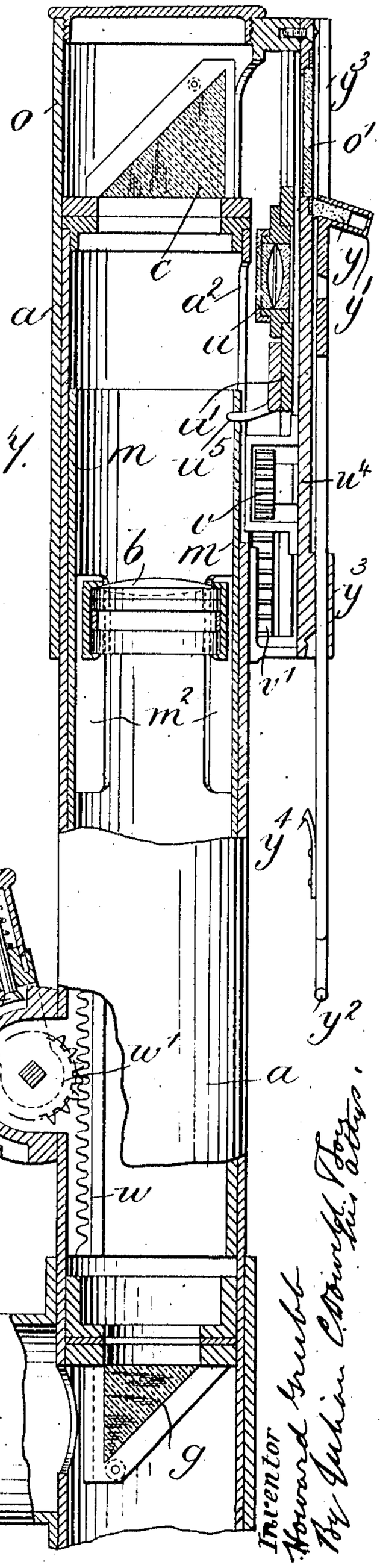


Fig. 4.



Witnesses
Joseph E. Stack.
Harry Krug

Inventor
Howard Grubb
By Julius C. Dowell, Atty.

H. GRUBB.

APPARATUS FOR SIGHTING OBJECTS FROM PROTECTED POSITIONS.

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6 SHEETS—SHEET 6

Fig. 13.

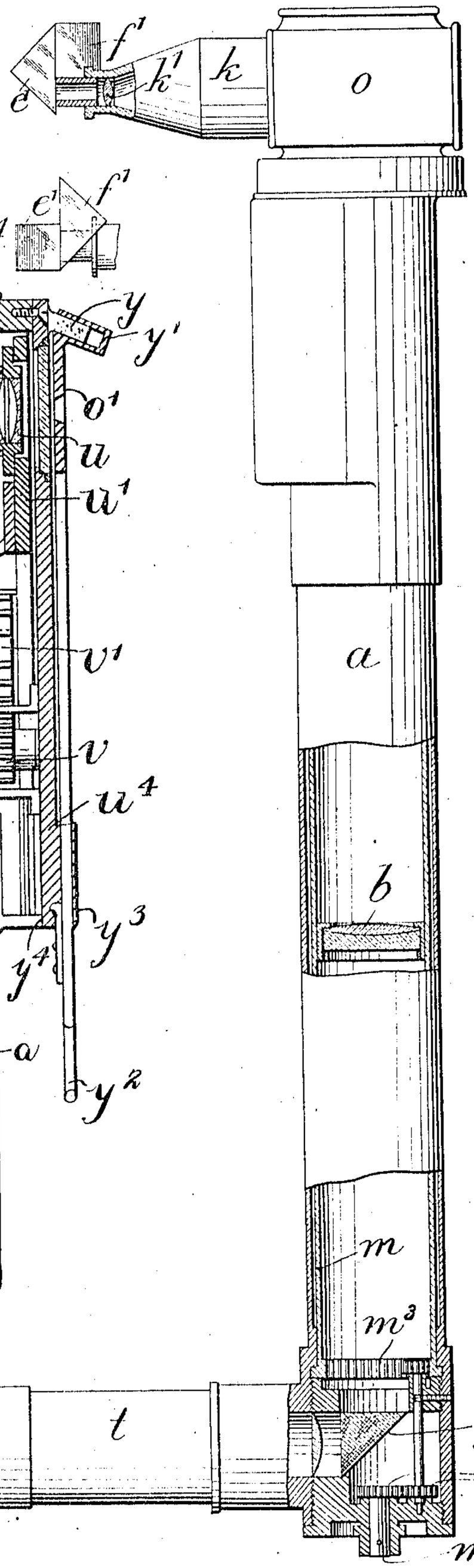
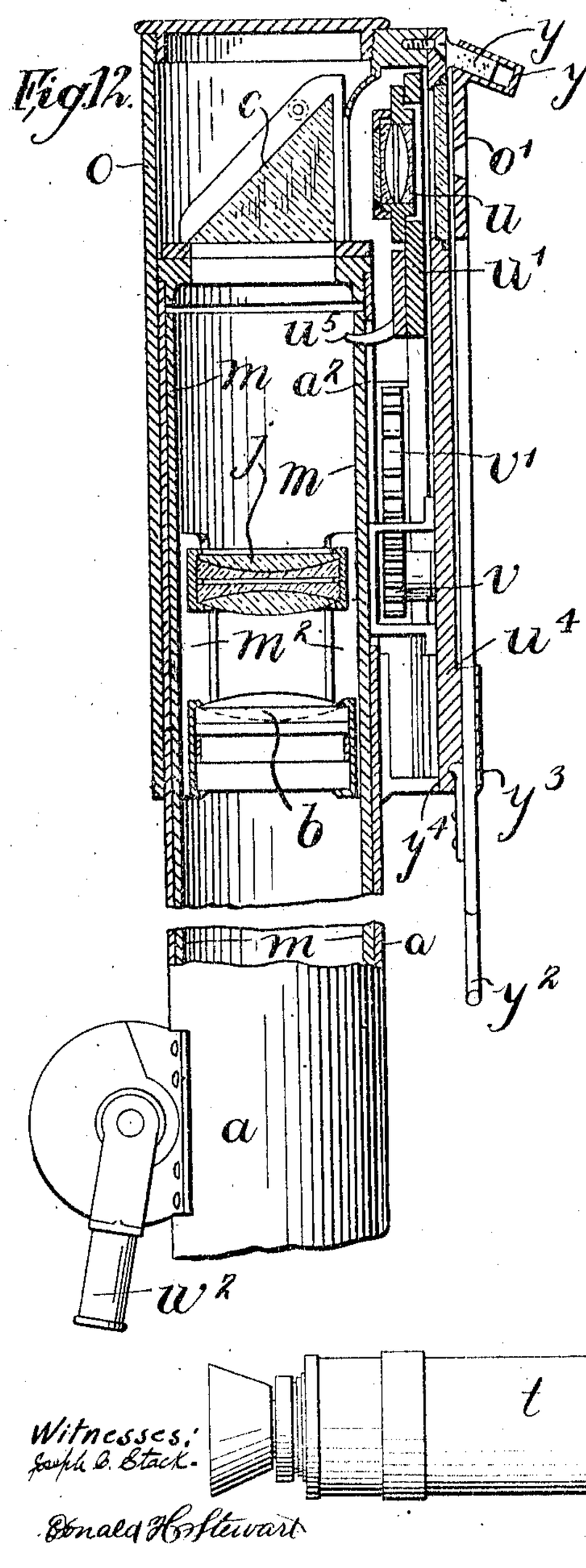


Fig 14.

Fig 12.



Witnesses:
Joseph B. Stack.
Donald Hoffstewart

Inventor.
Howard Grubb
By Julian C. Sewell
Son
his attys.

UNITED STATES PATENT OFFICE.

HOWARD GRUBB, OF RATHMINES, DUBLIN, IRELAND.

APPARATUS FOR SIGHTING OBJECTS FROM PROTECTED POSITIONS.

978,368. Specification of Letters Patent. **Patented Dec. 13, 1910.**

Application filed March 6, 1909. Serial No. 481,715.

To all whom it may concern:

Be it known that I, HOWARD GRUBB, knight, a subject of the King of Great Britain and Ireland, residing at Rathmines, Dublin, Ireland, have invented Improvements in Apparatus for Sighting Objects from Protected Positions, of which the following is a specification.

This invention relates to apparatus for sighting objects from protected positions and has for its object to provide a device or instrument by which it is possible to alternately obtain what, in the case of submarine work, may be termed a hyphydroscopic view and in other cases a periscopic view corresponding to the naked eye view of an observer if exposed beyond the protection afforded, and a more accurate sighting view such as would be obtained by the use of a telescope at the exposed position. For this purpose the device or instrument embodies a series of prisms or reflectors and lenses, or prisms and reflectors and lenses, and is so constructed that by manipulation of an appropriate part, the said prisms or reflectors or both and the lenses can be arranged in a system or combination which will permit the instrument at one time to be used as a telescope and changed in a practically instantaneous manner into a system or combination for use at another time as, what will for brevity be hereafter called, a periscope or vice versa.

The effect of manipulating the device or instrument so that it is changed from one use to another, may in some cases alter the point of vision of the observer but in such an instance the eye piece or multiple eye pieces used is or are mounted in a carrier which automatically alters in position with the change aforesaid.

The invention consists in various novel features of construction and in various combinations and arrangements of parts all as hereinafter more particularly described and pointed out in the claims.

In the accompanying illustrative drawings, Figure 1 is a front elevation and Fig. 2 a vertical section on the line A A of Fig. 1, with parts removed showing one construction of instrument embodying the invention, the instrument being in the condition for use as a telescope. Fig. 3 is a cross section taken on the line B—B of Fig. 1. Fig. 4 is a view similar to Fig. 2 but with the parts altered in position to enable the instrument to be used as a periscope. Figs. 5 and 6 are views corresponding to Figs. 2 and 4 respectively showing another construction of instrument according to the invention. Fig. 7 is a part elevation and part central vertical section of a further modified form of instrument arranged for use as a telescope, Fig. 8 is a rear elevation of the upper portion of the instrument, Fig. 9 is an inside elevation of part of Fig. 8 removed, Fig. 10 is a view corresponding to Fig. 8 after removal of the part illustrated in Fig. 9, Fig. 11 is a horizontal section taken adjacent to the pivotal axis of the supplementary object glass, and Fig. 12 is a partial view corresponding to Fig. 7, showing the movable parts of the instrument in altered positions. Fig. 13 is a part sectional elevation of a further modification and Fig. 14 is a plan of part of Fig. 13.

The device or instrument shown in Figs. 1 to 4 inclusive comprises a tube *a* (intended to embrace any appropriate composite tubular structure) which, in the case of say a barbette protected gun, is or may be connected to the ordinary sight mounting of the latter, and extends vertically to a suitable height above the barbette. At the upper end of this tube *a*, which is of a diameter sufficient to allow of the use therein of an appropriate telescopic objective *b*, is mounted a right angled prism *c*, with, in this case, a reflection in a vertical plane, which can, if desired, be variously directed by turning the said tube about its longitudinal or other axis in any usual way. At the lower end of the tube *a* and arranged within a carrying box *d* to one side thereof, may be either a single prism with two internal reflections, or, as shown, two prisms *e*, *f* with one reflection each, in a horizontal plane, which, together with the prism *c* at the upper end of the tube and a similar prism *g*, with a single reflection in a vertical plane, adjacent to the prism or prisms *e*, *f*, fulfil, when in the position shown in Figs. 1, 2 and 3, the conditions of an ordinary prismatic eye piece adapted, in conjunction with the intermediately disposed object glass *b*, to produce an image upon one *h* of a pair of what are herein termed wire plates *h*, h^1, mounted on the face d^1 of the prism box *d* at the lower end of the tube *a*, where it is viewed by an ordinary positive eye piece *i*, the whole constituting a sighting telescope giving erect images. The ex-

pression "wire plate" is intended to embrace any suitable support for intersecting filaments such as are variously employed in sighting instruments. The lower prism *g* is capable of being moved about the axis of the tube *a* relatively to the prism or prisms *e*, *f*, say through an angle of 180°, so that the image can be directly formed upon the other h^1 of the pair of wire plates, as will be apparent from Fig. 4, the act of changing the position of the movable prism *g* serving also to interpose a supplementary object glass *j* between the lower or main object glass *b* and the upper prism *c* and to bring a periscopic nozzle *k* into position for use in front of the upper prism so as to adapt the instrument for use as a periscope (Fig. 4).

In the example, the lower movable prism *g* is mounted within a tube *m* rotatable within the main tube *a* and extending sufficiently far to carry the telescope object glass *b*, a circular or segmental externally toothed rack *n* and an internally screw threaded collar n^1. The supplementary object glass *j* pertaining to the periscopic combination, and which serves, as heretofore, to render the rays issuing from it parallel or nearly parallel to each other, is hinged to the outer or main tube *a* of the device or instrument, as at j^1, so that it can be moved into operative position within and across the tube *a*, or be folded back into an inoperative position within a pocket a^1 designed for its reception, while the periscopic nozzle *k*, which is or may be provided, as usual, with a short focus or view forming lens k^1 and a condenser k^2 on which an image of the view is formed, is mounted upon a hood or cylinder *o* capable of being rotated on the outer or main tube *a* and provided with a glass window o^1 which occupies a position opposite to the upper prism *c* when the periscopic nozzle is not in use; see Fig. 2. This hood or cylinder *o* serves as a cover to keep dust or water out of the instrument. The inner tube *m* of the instrument is provided with means, such as a spindle m^1, which passes through the bottom of the prism box *d* at the lower end of the outer or main tube *a* and carries a handle m^2 by which it can be turned, the motion of rotation serving to impart axial movement to a nut *p* which is externally screw threaded to engage the internal screw thread of the collar n^1 before referred to. This nut *p* is prevented from rotating by the engagement of a fork p^1 thereon with a spindle *q* having two pinions q^1, q^2, one of which, viz. q^1, engages the exteriorly toothed rack *n* and the other, viz. q^2, an internally toothed rack o^2 formed upon the rotatable hood or cylinder *o* of the instrument. The arrangement is such that as the inner tube *m* is rotated, the nut *p* controlled thereby causes means, such as an angle piece p^2 with which it is provided, to effect movement, through a suitable finger, j^2, of the supplementary object glass *j* for the periscope, to place the same in operative or inoperative position at the same time that the rack and pinion arrangement effects corresponding positioning of the periscopic nozzle *k*. With such an instrument three eye pieces *i* of various powers might be employed hinged to a carrier r^1 so that they can be individually brought into use either when the instrument is being used as a telescope (Figs. 1 and 2), or as a periscope (Fig. 4), the carrier r^1 being mounted to slide in guides r^2 below the wire plates *h*, h^1 of the prism box *d* and provided with a rack *s* engaged by a pinion s^1 upon the spindle m^1 of the inner tube *m* so that when changing the optical combination, the center at which any eye piece *i* can be placed, is altered from one wire plate *h* or h^1 to the other.

If the use of multiple eye pieces *i* be considered undesirable on account of the time occupied in changing from one to another, a single eye piece in the form of a panoratic day eye piece *t*, such as shown in Figs. 5 and 6, may be employed, with automatic adjustment for focus with varying powers, as commonly used in gun directing telescopes. In this case, as the eye piece *t* re-inverts the images, it is necessary that the position of the lower movable prism *g* and the position of the eye piece carrier t^1 shall be reversed as compared with the prism and eye-piece position shown in the previous example, so that the light rays from an object being sighted will be transmitted directly into the eye piece *t* when the instrument is used as a telescope (Fig. 5), and transmitted indirectly by the inverting prism or prisms *e f* when used as a periscope (Fig. 6), all as will be apparent from an inspection of Figs. 5 and 6.

According to a further modification, wherein a pancratic eye piece is employed, the erecting prismatic arrangement *e f* shown at the lower end of the instrument in Figs. 5 and 6 may be dispensed with and a set of small erecting prisms e^1, f^1 be substituted in front of the view forming lens k^1 of the periscope nozzle *k*, as shown in Figs. 13 and 14, thereby avoiding the necessity of employing a movable lower prism *g* and traversing the eye piece *i* when changing the condition of the instrument, it being only requisite to manipulate the hood or upper cylinder *o* thereof by any suitable means, the inner tube *m*, in the example, being shown provided for this purpose with a rack m^3 operated from the spindle m^1 through the gear wheels m^4. Instead of mounting the hood carrying the periscope nozzle to rotate upon the upper end of the tube, it may be arranged to slide endwise thereon so that the periscopic nozzle can be brought opposite to the upper prism or

moved away from this position, as may be required. This movement of the hood might be effected either directly by hand or indirectly through intermediate mechanism from a hand operated device at the lower end of the tube, such endwise movement of the hood being adapted through any suitable mechanism to move the supplementary object glass into and out of the operative position as required. In a construction of this kind, the lower prism or prisms is or are or may be fixed, the only movable parts being the hood with nozzle and the supplementary object glass and connections.

In the constructional example of a modification of the arrangement last referred to, shown in Figs. 7 to 12 inclusive of the drawings, a as before, is the main tube, b the telescope object glass, c the upper prism, g the lower prism, which latter is stationary, and t the pancratic eye piece. In this respect the telescope combination (Fig. 7) is the same as that described with reference to Fig. 5 except that the wire plate is not incorporated in the eyepiece but is fixed in the nozzle d^2 into which the eyepiece is screwed. The wire plate may thus be said to be fixed in position with regard to the eyepiece. When a periscopic view is desired, a negative lens combination u is arranged in front of the upper prism c, the cell of the lens combination being secured to a sliding plate u^1 which is slotted at u^2 and arranged to move in guides u^3 formed in a front plate u^4 detachably fixed to the hood o which, in this instance, is stationary. o^1 is the glass window of the hood o. v is a pinion the pivot of which is carried by the front plate u^4, and v^1 is a rack mounted upon the sliding plate u^1 for operating the pinion v. v^2 is a segmental rack engaging the pinion v and secured to the pivot of the supplementary object glass j. The inner tube m of the instrument in lieu of being rotatable is mounted to slide longitudinally within the tube a being, for this purpose, provided with a rack w engaged by a segmental rack w^1 adapted to be moved to a definite angular extent by a handle w^2 having a spring controlled locking catch w^3. The sliding plate u^1 is provided with a driver u^5 engaging a slot in the tube m, so that movement of the said tube m is transmitted to the sliding plate u^1. a^2 is a slot in the tube a to permit the driver u^5 to operate, and m^2 are cut away portions in the tube m to permit it to clear the supports of the object glass b and the supplementary object glass j as the latter moves into and out of its pocket a^1.

The use of a negative lens combination such as u results in the formation of a virtual image instead of the actual image of a positive combination and obviates the necessity of employing inverting prisms, the arrangement being such that when the handle w^2 is lowered from the position shown in Fig. 7 to the position shown in Fig. 12, the sliding plate u^1 is correspondingly elevated to bring the lens combination u in front of the prism c. At the same time, the rack v^1 has rotated the pinion v and caused the segmental rack v^2 to move the supplementary object glass j from its pocket a^1 into its position across the tube a. If desired, a wiper comprising say a strip y of india-rubber or other suitable material, mounted in a holder y^1 that has a handle y^2 and is mounted to slide in guides y^3 may be arranged in front of the front plate u^4 so that by moving it up and down between the limits indicated by Figs. 7 and 12, the window o^1 in the hood o can be cleaned if it becomes wet or soiled. y^4 is a spring catch by means of which the wiper can be held in its uppermost position if required. In this example it will be seen that every portion of the optical combination which constitutes the telescope is rigidly and firmly attached to the instrument and incapable of movement one with respect to another and all the movable parts in which there might be a possibility of mechanical loss or error in position are used only in connection with the naked eye viewing condition of the instrument, which is therefore particularly applicable for sighting purposes.

The instrument is constructed in an almost air tight manner and can be desiccated before assembly of the parts to avoid any possibility of internal dewing.

What I claim is:—

1. Sighting apparatus comprising optical elements and means for arranging such elements in different orders to enable the apparatus to be used at one time as a telescope and at another time as a periscope.

2. Sighting apparatus comprising stationary optical elements common to a telescopic optical system and to a periscopic optical system, movable elements for completing the periscopic system and means for alternately bringing the said movable elements into and out of operative relationship with the stationary optical elements.

3. An instrument for sighting objects from protected positions, comprising a tubular structure having a view orifice at its exposed end and a viewing orifice at its other end, a reflecting prism opposite each of said orifices, a telescopic objective between said prisms, a supplementary object glass adapted to be brought into an operative position between the telescopic object glass and the prism of the view orifice and to be moved into an inoperative position, a lens carrier adapted to be brought opposite the prism of the view orifice and to be removed therefrom, and means for simultaneously bringing the supplementary object glass into the

operative position and moving the lens carrier opposite the view orifice of the tubular structure and for simultaneously moving these parts into the inoperative positions.

4. An instrument for sighting objects from protected positions, comprising a tubular structure having a view orifice at its exposed end and a viewing orifice at its other end, a reflecting prism opposite each of said orifices, a telescopic objective between said prisms a supplementary object glass adapted to be brought into an operative position between the telescopic object glass and the prism of the view orifice and to be moved into an inoperative position, a lens carrier adapted to be brought opposite the prism of the view orifice and to be removed therefrom, a pancratic day eye piece disposed opposite the viewing orifice, and means for simultaneously bringing the supplementary object glass into the operative position and moving the lens carrier opposite the view orifice of the tubular structure and for simultaneously moving these parts into the inoperative positions.

5. An instrument for sighting objects from protected positions, comprising a tubular structure, a second tubular structure within the other tubular structure, a telescopic objective mounted within the inner structure so that it cannot move endwise, means at the exposed end of the outer structure for reflecting light rays to the viewing end thereof, an eye piece at the viewing end of such structure, means for reflecting light rays from the interior of the instrument into the eye piece, a carrier movable with respect to the ray reflecting means at the exposed end of the instrument, a lens combination on such carrier, a supplementary object glass between the telescopic objective and the ray reflecting means at the exposed end of the instrument, means for producing relative movement between the inner and outer tubular structures, and means whereby said movement simultaneously moves the lens combination and supplementary object glass into or out of operative relationship with both of the said ray reflecting means.

6. An instrument for sighting objects from protected positions, comprising an outer tube having a view orifice at its exposed end and a viewing orifice at its other end, a reflecting prism opposite each of said orifices, a telescopic objective between said prisms, a tube longitudinally movable within the outer tube; means for moving the inner tube, a guide carried by the outer tube, a carrier movable in said guide, a negative lens combination mounted on said carrier, a supplementary object glass between the telescopic objective and the prism of the view orifice, means connecting said carrier to the inner tube so that it moves in unison therewith, and means upon the carrier for moving the supplementary object glass into position within the inner tube simultaneously with advancement of the negative lens combination into position opposite the view orifice.

7. An instrument for sighting objects from protected positions, comprising an outer tube having a view orifice at its exposed end and a viewing orifice at its other end, a reflecting prism opposite each of said orifices, a telescopic objective between said prisms, a housing into which the supplementary objective glass is adapted to be moved to allow the instrument to be used as a telescope, a tube longitudinally movable within the outer tube; means for moving the inner tube, a guide carried by the outer tube, a carrier movable in said guide, a negative lens combination mounted on said carrier, and adapted to be positioned in front of the view orifice when the instrument is used as a telescope, a supplementary object glass between the telescopic objective and the prism of the view orifice, means connecting said carrier to the inner tube so that it moves in unison therewith, and means upon the carrier for moving the supplementary object glass into the said housing when the inner tube is operated to remove the negative lens combination from its position opposite the view orifice in the act of converting the instrument into a telescope.

8. In an instrument for sighting objects from protected positions, a tubular structure having a view orifice at the exposed end of the instrument, a glass window protecting such orifice and means for wiping said window from within the protected position.

9. An instrument for sighting objects from protected positions, comprising an outer tube having a view orifice at its exposed end and a viewing orifice at its other end, a reflecting prism opposite each of said orifices, a telescopic objective between said prisms, a tube longitudinally movable within such outer tube; a rack on the inner tube, a pinion mounted on the outer tube engaging said rack, a handle outside the outer tube for operating the pinion, a guide adjacent to the view orifice, a carrier movable in said guide, means connecting said carrier to the inner tube, a negative lens combination mounted upon the carrier, a supplementary object glass between the telescopic objective and prism at the view orifice, a housing to one side of the outer tube to receive the supplementary object glass, a toothed segment connected to such object glass, a rack movable with the carrier aforesaid and a pinion rotatable about a stationary axis for transmitting motion from the rack of the carrier to the toothed segment of the supplementary object glass.

10. An instrument for sighting objects

from protected positions, comprising an outer tube having a view orifice at its exposed end and a viewing orifice at its other end, a reflecting prism opposite each of said orifices, a telescopic objective between said prisms, a tube longitudinally movable within such outer tube, a rack on the inner tube, a pinion mounted on the outer tube engaging said rack, a handle outside the outer tube for operating the pinion, a guide adjacent to the view orifice, a carrier movable in said guide, means connecting said carrier to the inner tube, a negative lens combination mounted upon the carrier, a supplementary object glass between the telescopic objective and prism at the view orifice, a housing to one side of the outer tube to receive the supplementary object glass, a toothed segment connected to such object glass, a rack movable with the carrier aforesaid, a pinion rotatable about a stationary axis for transmitting motion from the rack of the carrier to the toothed segment of the supplementary object glass and a pancratic day eye piece disposed at the viewing orifice of the instrument.

Signed at Dublin this 13 February 1909.

HOWARD GRUBB.

Witnesses:
ROMUCY R. GRUBB,
FREDK. E. LADD.