No. 662,048.

Patented Nov. 20, 1900.

J. J. WOOD.

ELECTRIC ARC LAMP.

(Application filed July 28, 1898.)

(No Model.)

4 Sheets—Sheet 1.

FIG. 1.

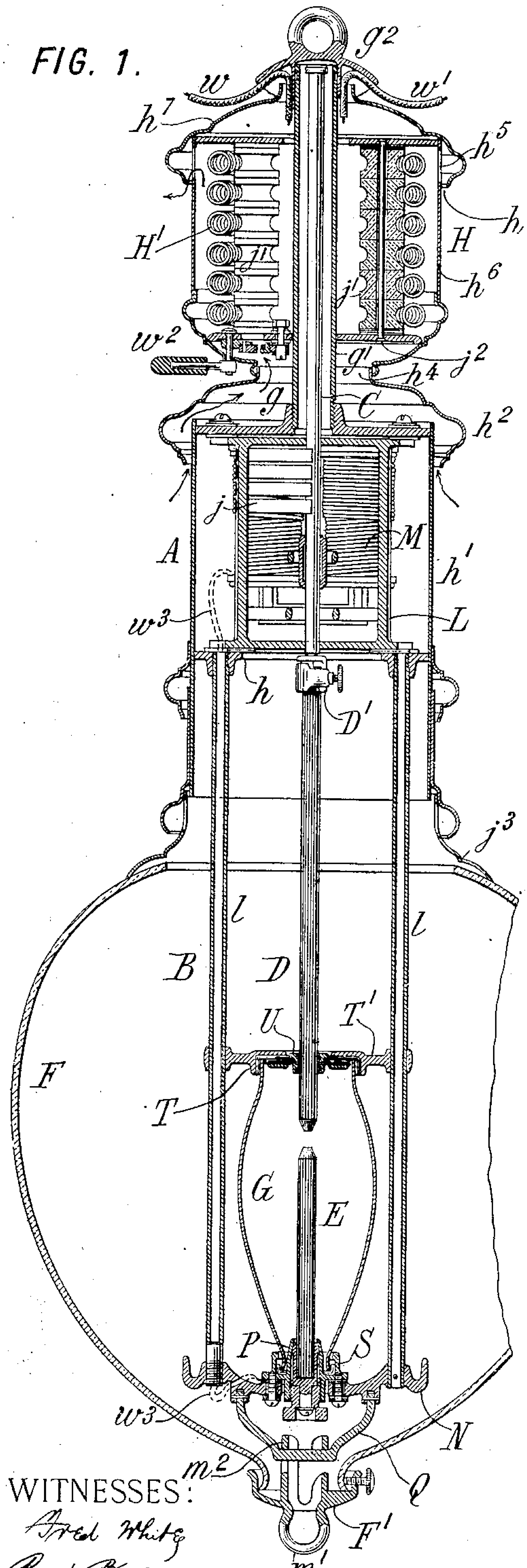
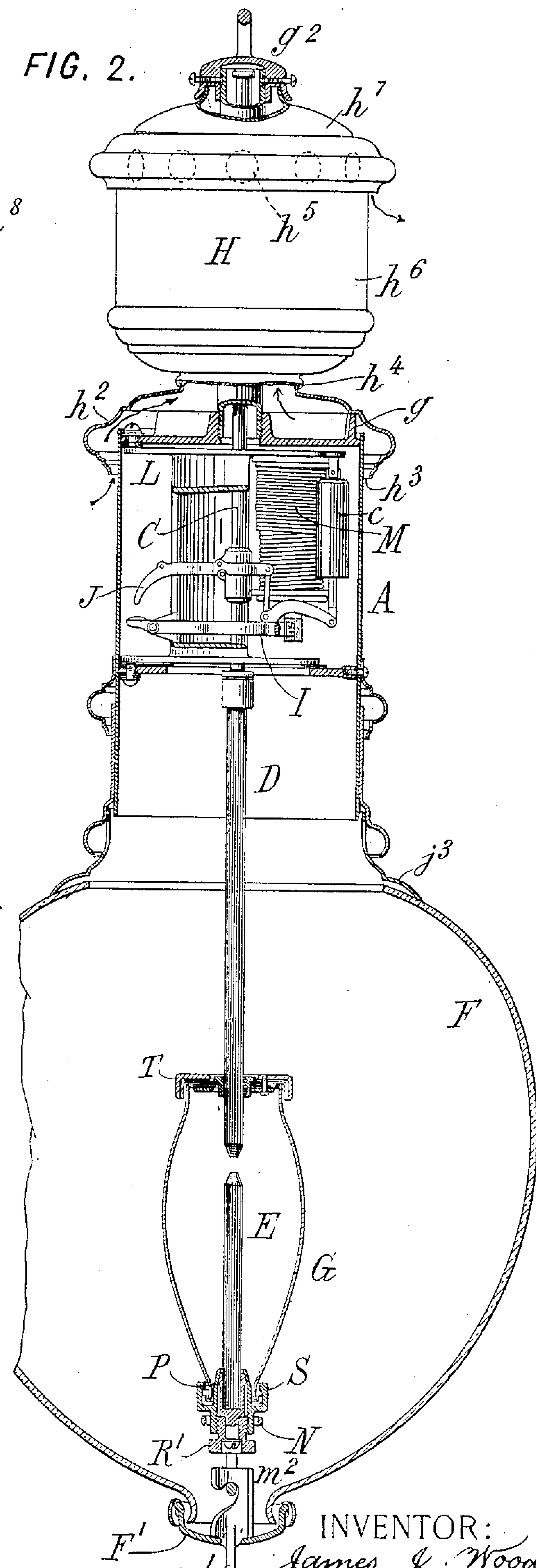


FIG. 2.



WITNESSES:

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René Bruine

INVENTOR:

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Arthur C. Fraser & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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4 Sheets—Sheet 2

FIG. 3.

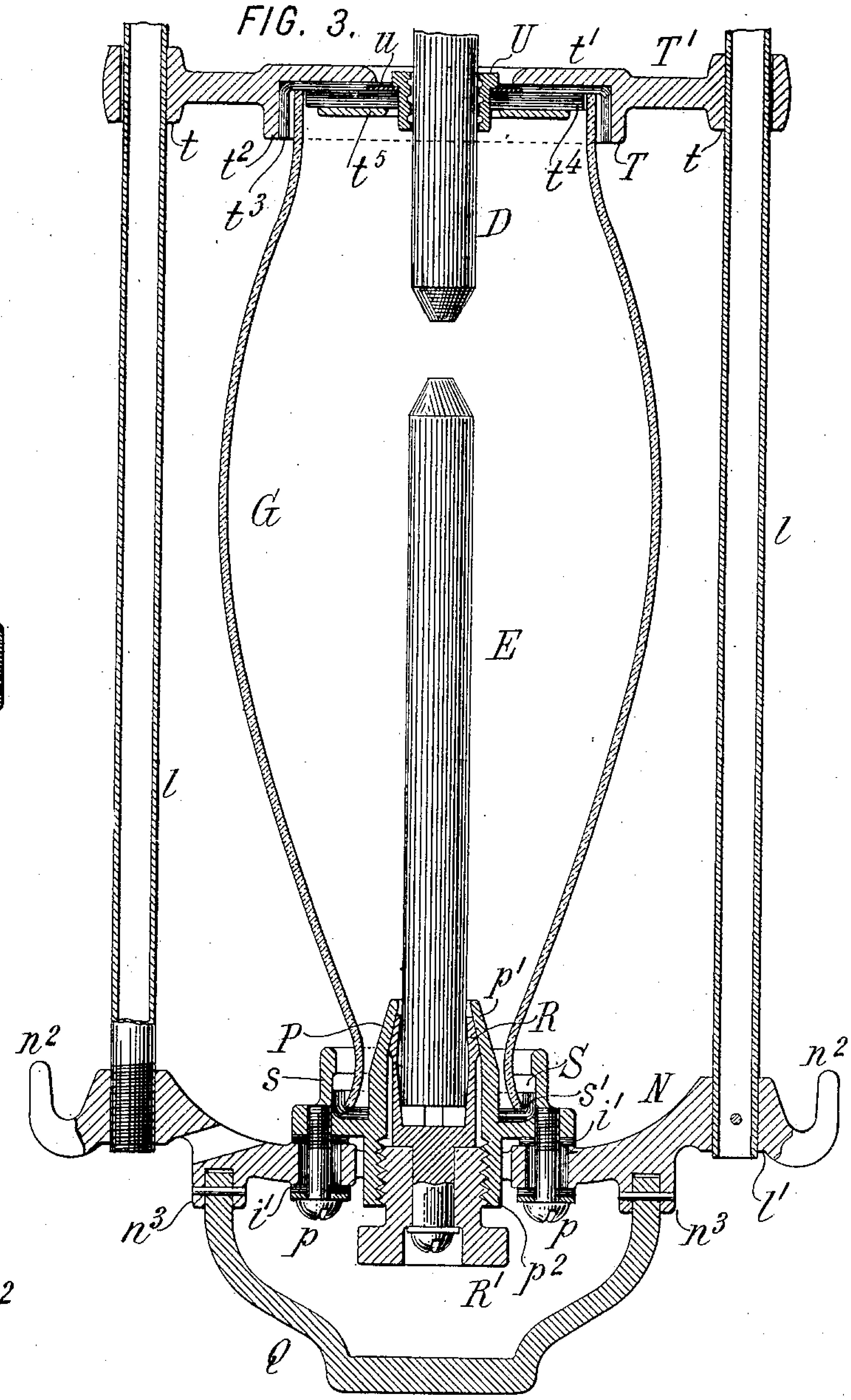


FIG. 5.

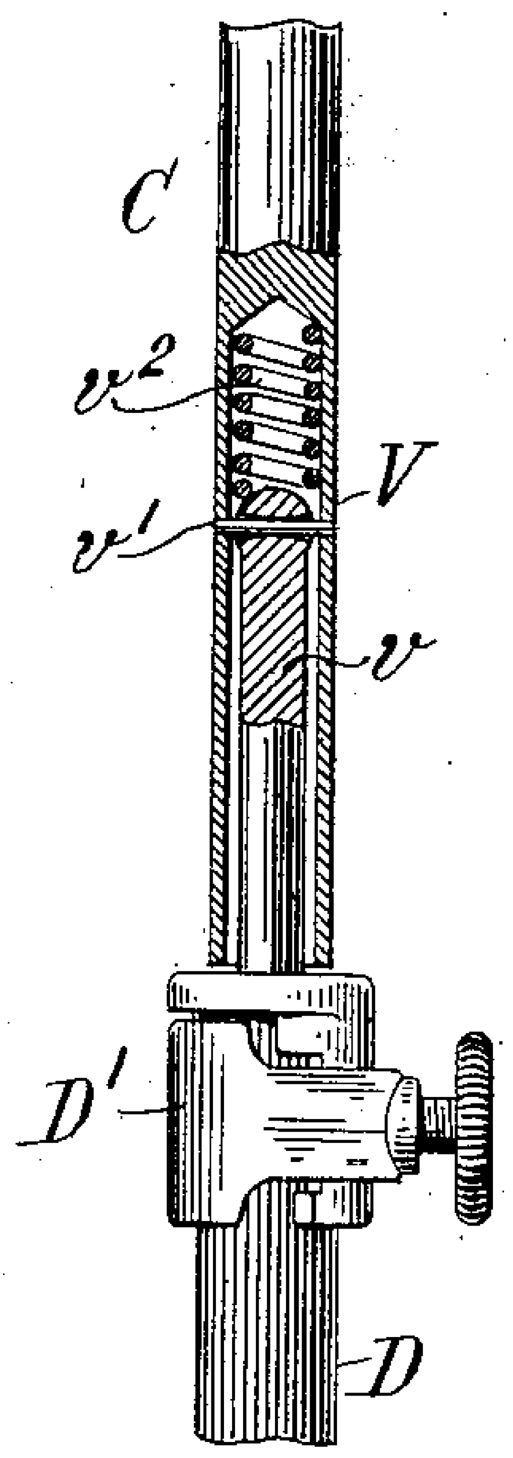


FIG. 6.

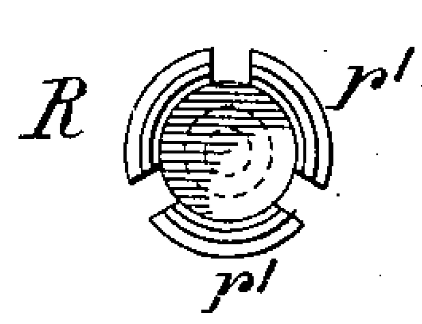


FIG. 7.

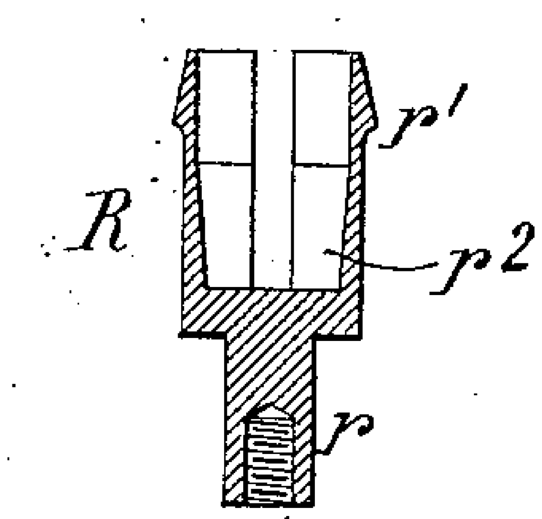
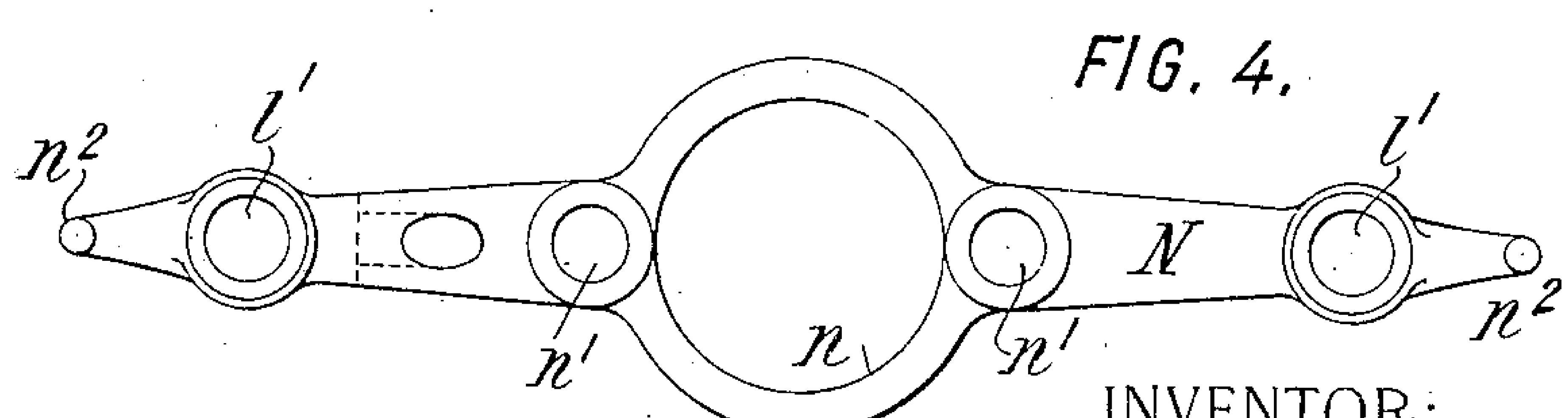


FIG. 4.



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(No Model.) 4 Sheets—Sheet 3.

FIG. 8.

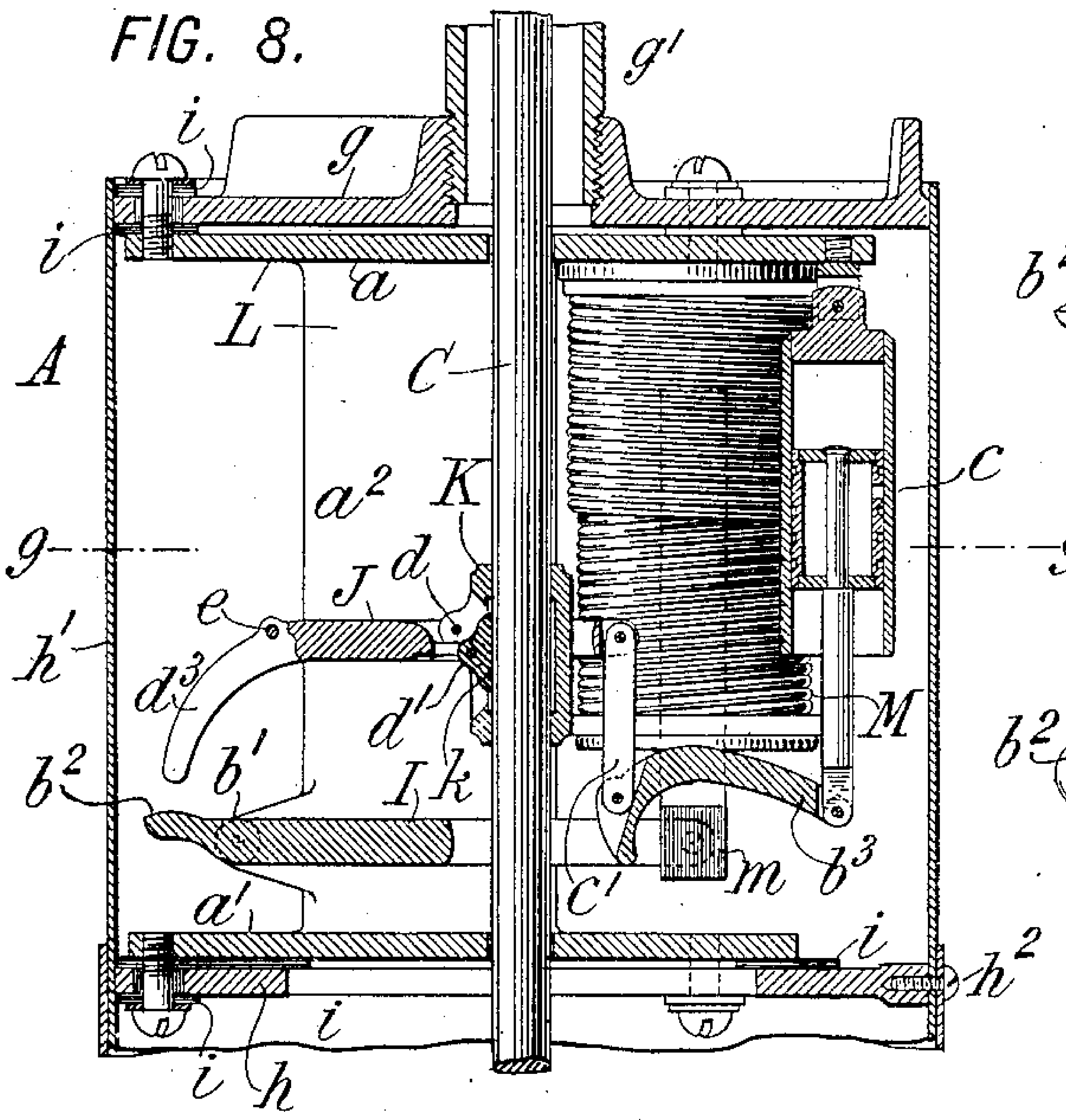


FIG. 10.

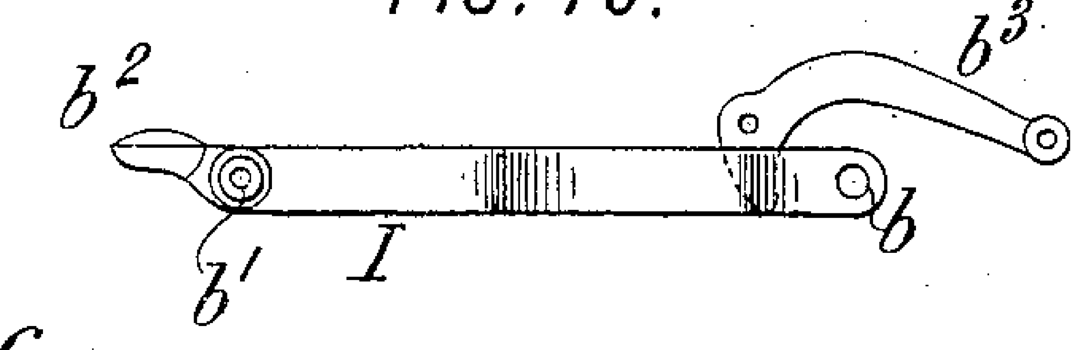


FIG. 11.

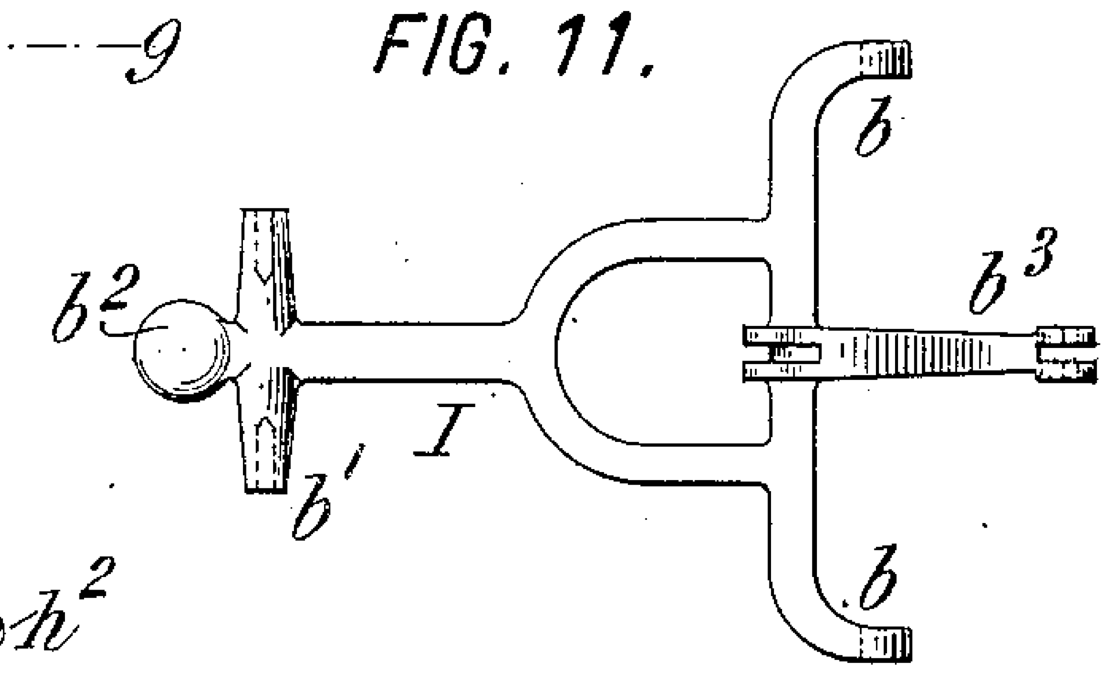


FIG. 9.

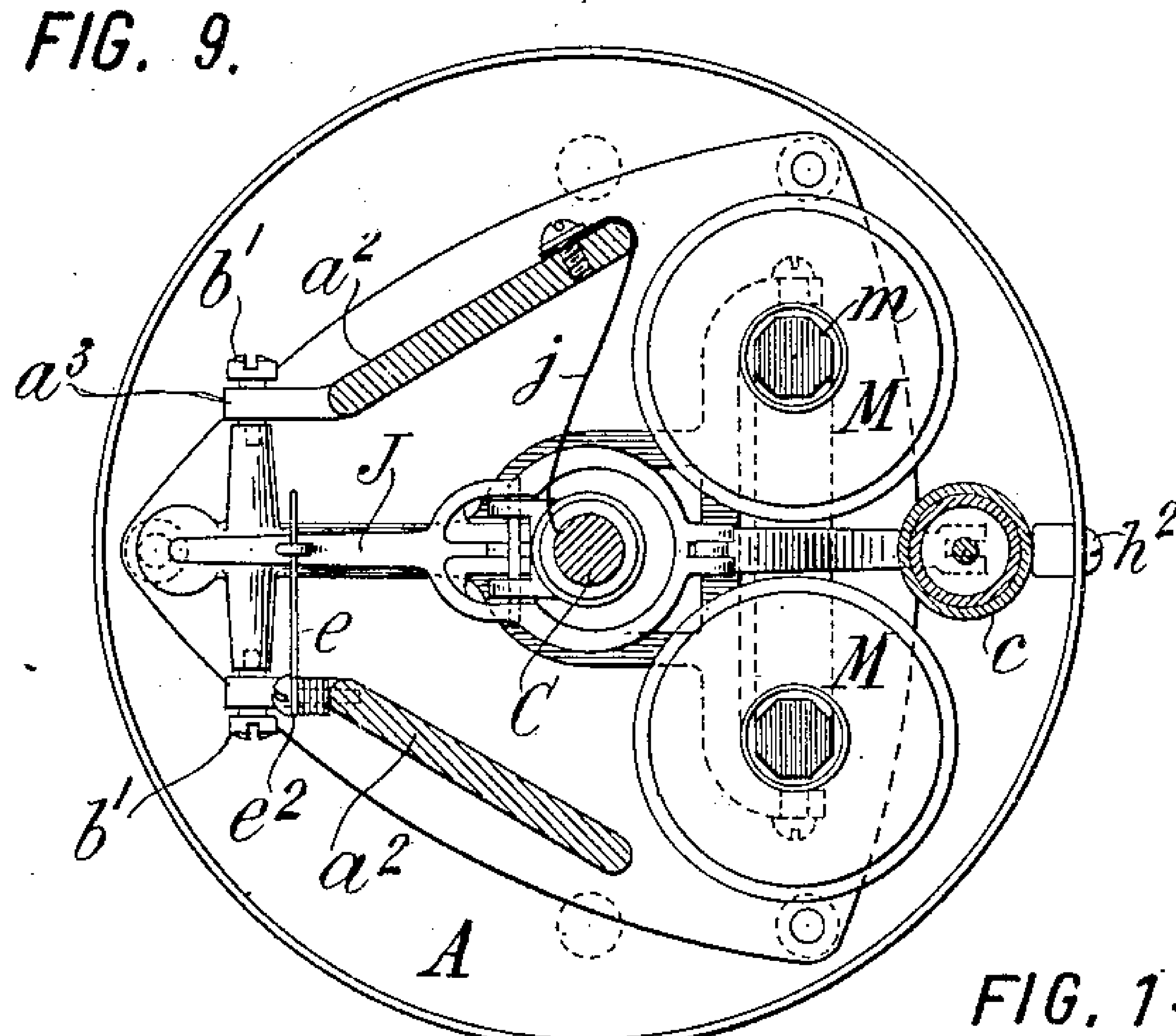


FIG. 12.

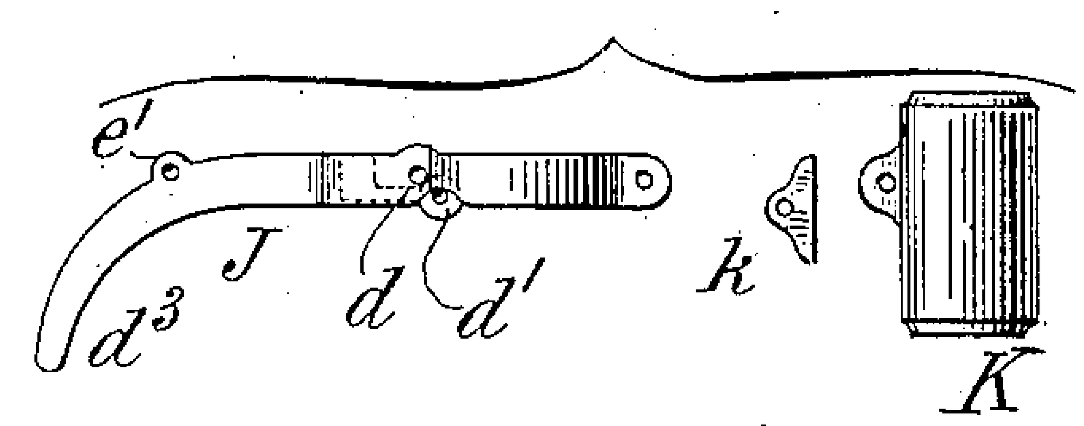


FIG. 13.

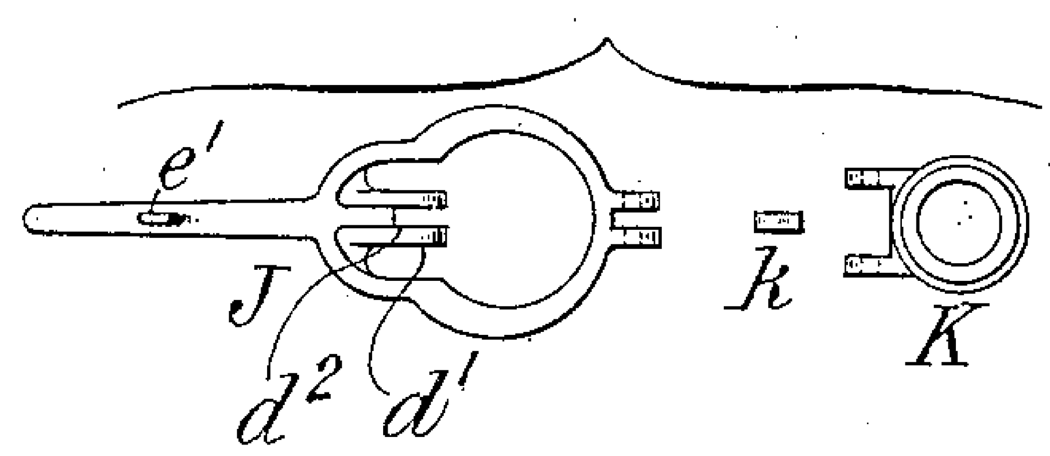


FIG. 14.

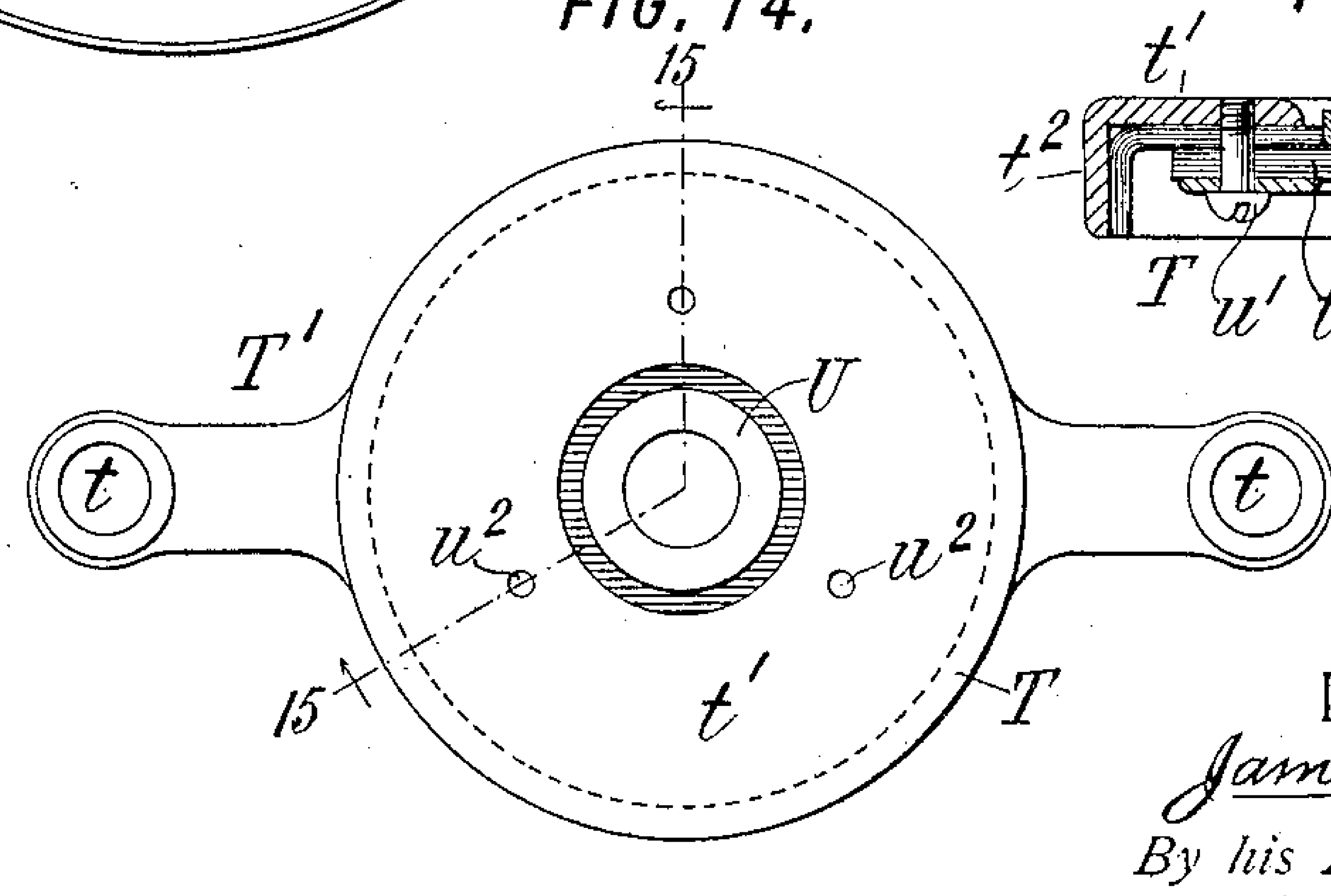


FIG. 15.

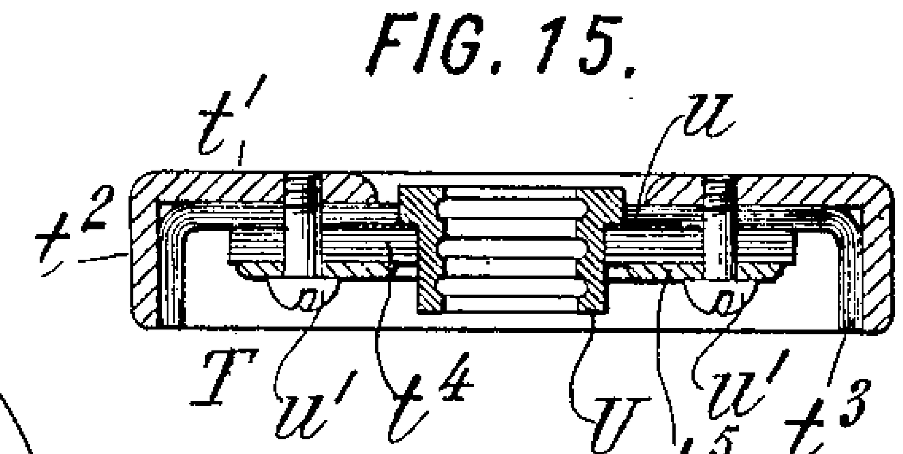
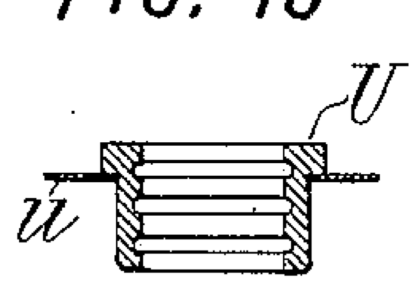


FIG. 16



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4 Sheets—Sheet 4.

FIG. 18.

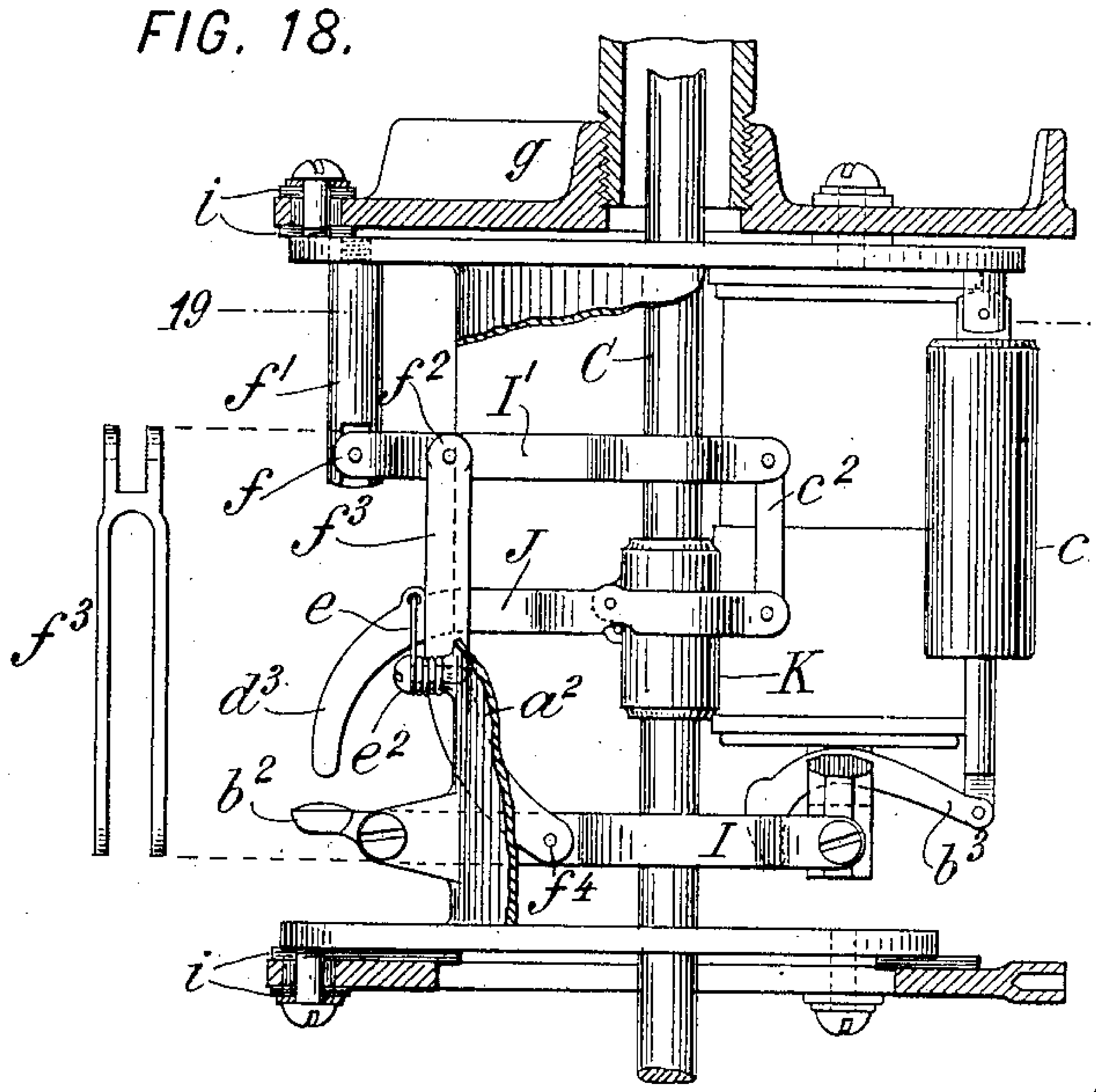


FIG 17.

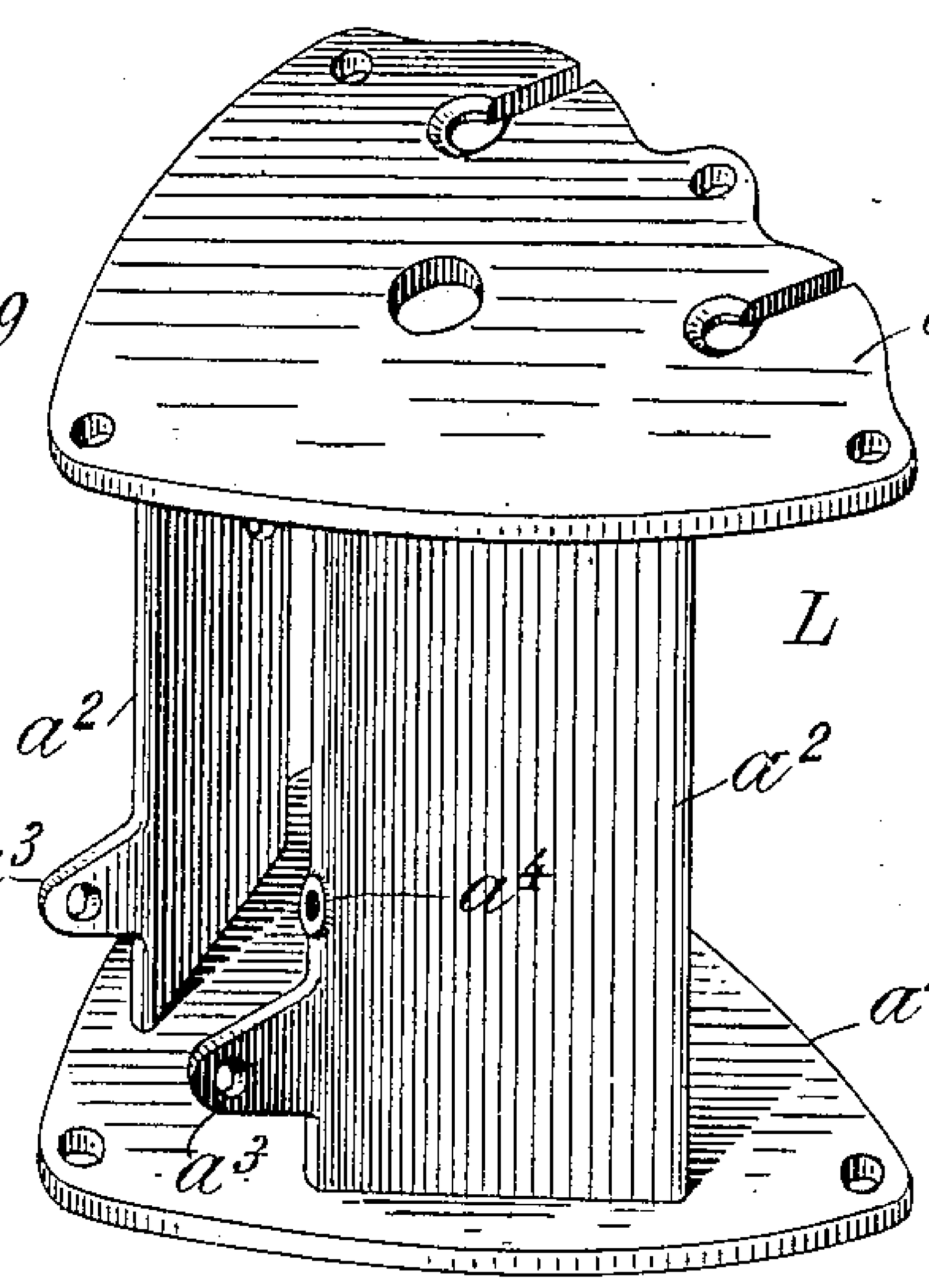


FIG. 19.

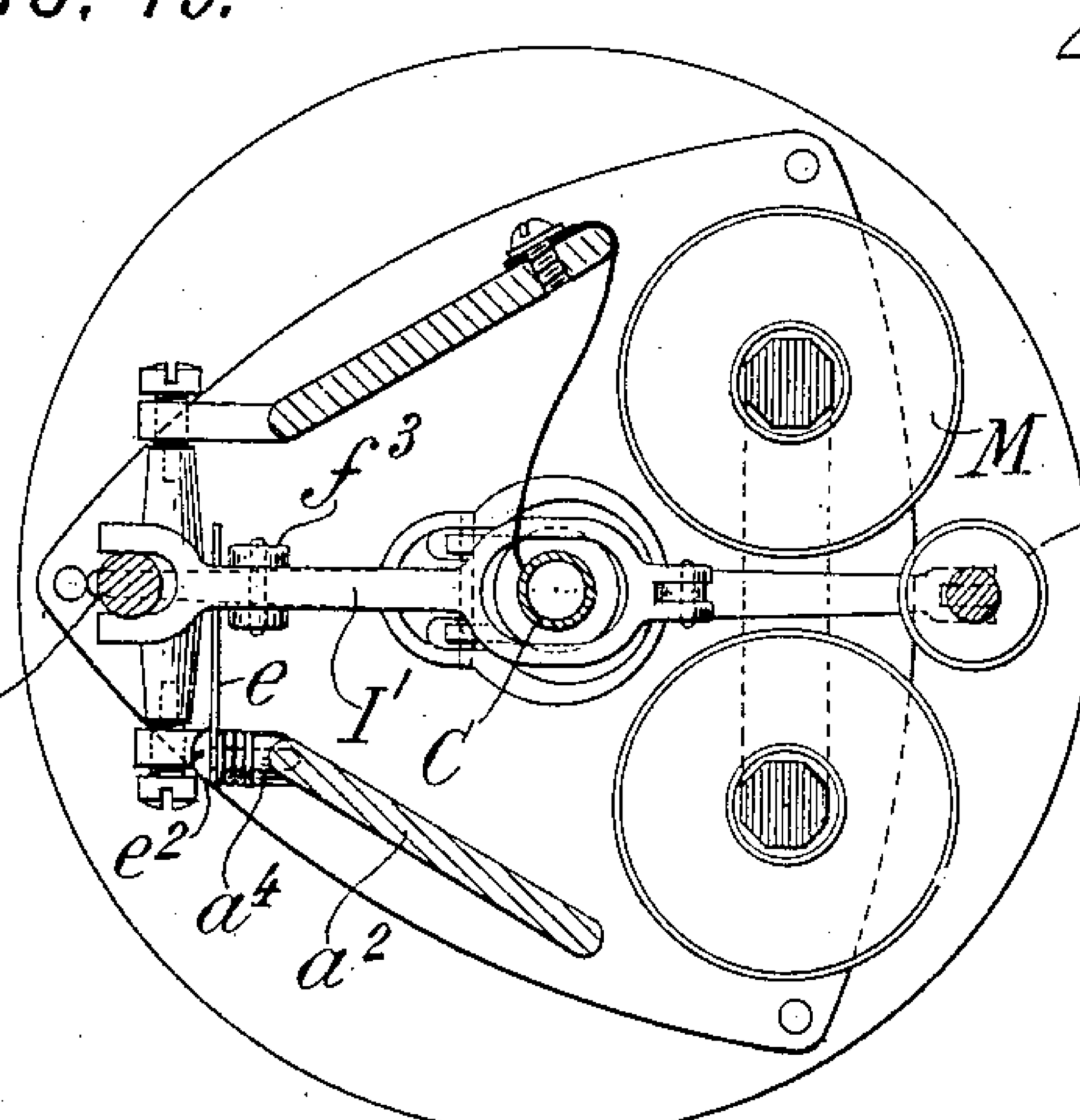


FIG. 20.

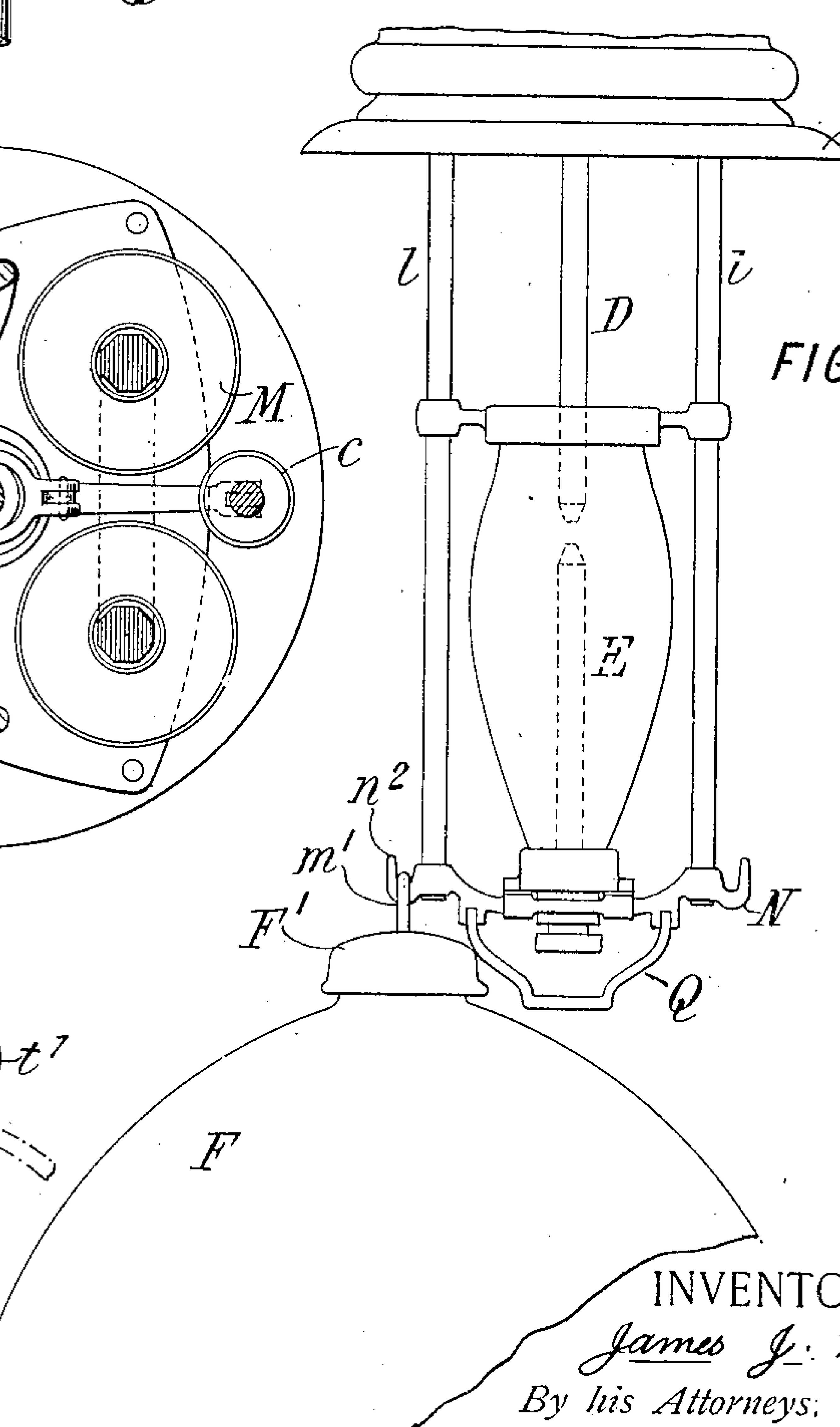
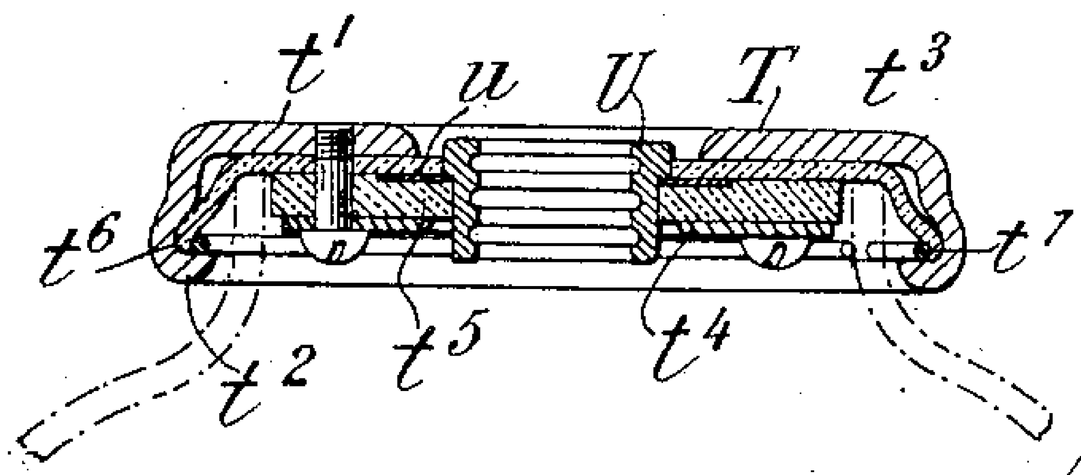


FIG. 21.



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UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF FORT WAYNE, INDIANA, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 662,048, dated November 20, 1900.

Application filed July 28, 1898. Serial No. 687,119. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing in Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Arc-Lamps, of which the following is a specification.

This invention relates largely to inclosed-arc lamps, but also partly to features of construction applicable to lamps with an exposed arc.

The novel features of the invention will be described with reference to the accompanying drawings, wherein—

Figure 1 is a vertical mid-section of an inclosed-arc lamp embodying my invention. Fig. 2 is a similar section at right angles to Fig. 1, the upper part being in elevation. Fig. 3 is an enlargement of Fig. 1, showing in detail the lower portion thereof, including the inner globe and the supports therefor and the lower-carbon holder. Fig. 4 is a plan of the bottom yoke of the frame. Fig. 5 is a fragmentary section showing the universal-joint connection between the feed-rod and upper-carbon clamp. Figs. 6 and 7 are respectively a plan and horizontal section of part of the lower-carbon holder or clamp. Fig. 8 is a view corresponding to part of Fig. 2, except that it is in vertical mid-section, showing the feed mechanism. Fig. 9 is a horizontal section of Fig. 8 on the line 9 9 therein. Figs. 10 and 11 show the armature-lever in side elevation and plan. Figs. 12 and 13 show the clutch-lever and the parts of the clutch in side elevation and plan, respectively. Fig. 14 is a plan of the top support for the inner globe. Fig. 15 is a cross-section thereof on the line 15 15 in Fig. 14. Fig. 16 is a vertical section of the guiding-sleeve for the upper carbon shown in Fig. 15. Fig. 17 is a perspective of the frame for supporting the feed mechanism. Fig. 18 is a sectional side elevation answering to Fig. 8, but showing the adaptation of the invention to a high-potential lamp. Fig. 19 is a cross-section thereof on the line 19 19 in Fig. 18. Fig. 20 is an elevation of the lower part of the lamp answering to Fig. 1 and showing the outer globe disconnected and hooked onto the lamp-frame. Fig. 21 is a cross-section answering to Fig. 15, showing a slightly-different construction.

The particular construction of lamp which is shown in the drawings is designed for constant-potential direct-current circuits. The lamp shown in Figs. 1 to 13 is specially designed for use on a one-hundred-and-ten volt circuit. That shown in Figs. 18 and 19 is designed for a two-hundred-and-twenty volt circuit. These two types are given as instances of the application of my invention, which, however, is not confined thereto.

Let A designate the mechanism case or box, and B the lamp-frame as a whole. The vertically-sliding carbon-holding rod or feed-rod, is lettered C, while the upper and lower carbon pencils are lettered D and E, respectively.

F is the usual outer globe, and G is the inner globe, which incloses the arc.

H is a case inclosing the rheostat which is usually employed in connection with an arc-lamp used on a constant-potential circuit.

The several parts of the lamp thus referred to may be understood to be of the usual construction or of any ordinary construction, except in respect of the special features which are hereinafter described as being of novel construction.

The feed mechanism may be in general of any ordinary construction, its particular construction varying according to the character of circuit on which the lamp is to be used. For a one-hundred-and-ten-volt direct current I prefer the construction shown best in Figs. 8 to 13. In this the mechanism-case is formed with top and bottom plates a a', having central holes through which the rod C moves with a free sliding fit and whereby it it is guided. The lamp shown has a clutch feed actuated by the usual feeding magnet or solenoid M, the armature or movable member m of which, being preferably a U-shaped laminated core, is pivoted to an armature-lever I between the forked arms b b thereof, Fig. 11. This lever is pivoted at b' between upright frames a^2 and has a tail b^2 projecting to the opposite side of its fulcrum. It has also an arm b^3, which is pivotally connected to the movable member of the usual dash-pot c, as shown. The armature-lever I is connected by a link c' to the clutch-lever

J, Figs. 12 and 13, which has an annular portion encircling the feed-rod, in which is the clutch K, which is pivoted at d to the lever J, while a clutch-shoe k, Figs. 12 and 13, is pivoted at d' between ears on an arm d^2, formed on the lever J and projecting into its annular portion downwardly or beneath the pivot e. This clutch operates mainly in the usual manner—that is, the excitation of the magnet M pulls upward its armature m, thereby tilting the lever I, this motion being moderated by the dash-pot c and the upward movement being communicated through link c' to the lever J, which being pivoted at d the clutch K acts to press the shoe k against the rod C, so that the latter is gripped between the clutch and shoe, and hence the clutch and rod are lifted bodily with the upward movement of the lever J, thereby drawing the arc. As the arc elongates its resistance becomes sufficient to so cut down the current as to partly deënergize the magnet until equilibrium is attained at a point where the strength of the magnet becomes just sufficient to uphold the weight of the feed-rod and its connected parts, the arc being then of stationary length. When by the consumption of the carbons the arc becomes too long, the increased resistance reduces the current and weakens the magnet M, which gradually lowers the feed-rod to maintain the arc of standard length, until it is so far lowered that the downwardly-turned tail d^3 of the clutch-lever J encounters and rests upon the tail b^2, whereupon any farther lowering of the armature releases the clutch and permits the feed-rod C to slide downward until by the shortening of the arc the increased current causes the magnet to again pull up the armature, thereby reclutching the rod and again lifting it to restore the arc to standard length. The novel feature of this feed mechanism lies in the coöperation of the tail b^2 of the armature-lever I with the tail d^3 of the clutch-lever J, whereby a quicker movement is given to the clutch than with the ordinary construction. The first upward movement of the magnet by tilting the lever I lowers its tail b^2, on which the tail d^3 is resting, and thereby drops that end of the lever J while its opposite end is being pushed up by the link c', thereby imparting to the lever J an initial tilting movement around its pivot d, which causes its clutch to engage more quickly than if the tail d^3 rested on an immovable part. Also in the downward feed the descending tail d^3 strikes the ascending tail b^2 and is lifted thereby, thereby more quickly tilting the lever J and more promptly releasing the clutch than if the part b^2 were a stationary abutment. Another novel feature of this clutch is the interposition of a downwardly-pressing spring e, (shown best in Figs. 8, 9, 18, and 19,) which spring passes through an eye e' in the lever J and is fixed to a screw e^2, applied to the side frame a^2. The purpose of this spring, which exerts a very light pressure, is to overcome the inertia of the clutch-lever J while drawing the arc. Without this spring the sudden upward movement imparted to this lever through the link c' would give it so much momentum that at the end of its upward thrust the lever would continue moving upwardly around its pivotal connection with the link, and thereby would release the clutch and permit the rod C to commence a downward feed before the clutch could be reengaged. The spring e is exactly proportioned to overcome this momentum of the lever J, so that the latter on being suddenly thrust up does not release the clutch.

The feed mechanism already described is that designed for use with one hundred and ten volts, which corresponds to an arc one-half inch long. The same mechanism would, of course, be useful with lower voltages, but for a materially higher voltage—say, for example, two hundred and twenty volts, which corresponds to a one-inch arc—it is desirable to vary the feed mechanism in order to provide for drawing so long an arc without requiring that the regulating magnet or solenoid shall be given an undesirably long stroke. To this end I reconstruct the regulating mechanism by compounding the levers. The armature-lever I and the clutch-lever J are unchanged, but an intermediate compounding-lever I' is interposed, arranged most conveniently above the lever J, is fulcrumed at f to a post f', and is connected at f^2 by a link f^3 (shown in edge view detached at the left of Fig. 18) to the armature-lever I, with which it connects by a pivot f^4. The link f^3 is made double and straddles the lever J without touching it. The lever I' extends around the rod C, and its free end is connected by a link c^2 (identical with the link c', Fig. 8) with the end of clutch-lever J. The operation of this construction is exactly the same as the preceding, except that by reason of the interposition of the lever I' the movement imparted to the clutch-lever J is doubled.

The top and bottom plates $a\ a'$ of the mechanism-case and the intervening upright frames a^2 are constructed in one casting, which as a whole is lettered L, as best shown in Fig. 17. This affords a strong and rigid support for the mechanism and avoids the necessity of using screws for fastening the different parts of the case together and of finishing the meeting surfaces for such parts when cast separately, as heretofore. To give the maximum of strength, the upright frames $a^2\ a^2$ are arranged in vertical planes nearly perpendicular to each other, their precise angle being shown in Figs. 9 and 19. Their sides, which most nearly approach each other, are formed with lugs a^3, through which pass pivot-screws at b', by which the armature-lever I is pivoted. One of the parts a^2 also has a screw-threaded hole a^4 for receiving the screw e^2 for fastening the spring e.

In constructing the mechanism-case the casting L is fastened between top and bottom plates g and h, being insulated therefrom by interposed insulations i, preferably of mica. The casting L is made part of the circuit, and to insure the complete electric connection therewith of the rod C the latter is pressed upon by copper brushes j, Figs. 1 and 9, which are screwed to one of the uprights a^2. The top and bottom plates $a\ a'$ of the mechanism-frame L are preferably made approximately triangular, having three screw-holes at their outer portions or corners for attachment to the top and bottom plates $g\ h$. The latter plates are circular and fit closely within the outer shell h', inclosing the mechanism-case, the latter being fastened by a screw h^2, Fig. 8. Into the top plate g is screwed a pipe g, forming a housing, in which moves the upper end of the feed-rod C, and on the top of this pipe is fastened the usual cap g^2, having an eye by which to suspend the lamp, and having lateral wings through which the circuit-wires $w\ w'$ are led into the case, as shown in Fig. 1. One of these wires leads to the switch w^2, which may be of any usual construction.

In the case of a lamp working on a constant-potential circuit, where the lamp is required to be connected in series with a rheostat or dead resistance between the opposite circuit-leads, I place this rheostat (lettered H') in the case H, which surmounts the mechanism-case A. The rheostat usually consists of a resistant wire coiled into a close helix, which in turn is coiled around a series of upright supports consisting of grooved porcelain knobs j', strung on vertical rods j^2, of which one is shown in Fig. 1. As considerable heat is generated in the rheostat, it is important to provide adequate ventilation therefor, and to this end I have devised the novel construction of casing shown in Figs. 1 and 2. The outer tube h' of the mechanism-case has its top portion inclosed by a shell h^2, which does not touch it, thereby leaving an opening h^3 for ingress of air, while the upper part of the shell terminates in a large neck h^4, forming within it an ample air-flue communicating with the interior of the case H. The supports for the resistant-coils are formed with ample openings, through which the air may ascend and flow around all portions of the coiled wire, finally escaping through openings h^5 in the top of the shell h^6 of said case, these openings being shown in dotted lines in Fig. 2. The top of this case is closed by a shell h^7, the lower part of which covers the said openings and is out of contact with the shell h^6, thereby leaving an annular space h^8 between them for the egress of the heated air. This construction effectually protects the inclosed parts from the weather, since rain is effectually shed by the shells h^2 and h^7, which serve as roofs for the respective casings.

The lamp-frame is constructed of the cap g^2, pipe g', and top plate g, already described, with the bottom plate h and intervening casting L, while the lower part or pendent portion of the frame is attached to this bottom plate h and consists of two vertical parallel tubes $l\ l$, screwed thereto and united at their lower ends by a yoke N, which yoke serves as the support for the lower carbon, for the inner globe G, and for the outer globe F. The insulated wire which leads from the mechanism-case to the lower carbon is preferably led in the usual manner down through the left-hand tube l in Fig. 1 and from the bottom end thereof is connected to the negative-carbon holder P, as indicated in dotted lines at w^3 in Fig. 1. For this reason the lower end of the left-hand tube is preferably screwed into the yoke, as shown, while the right-hand tube is best united thereto by a pin.

The yoke N is of peculiar construction, as best shown in Figs. 3 and 4. It is shown isolated in Fig. 4. Its central portion is a ring n, at opposite sides of which are holes $n'\ n'$, while near the ends of the yoke are the holes $l'\ l'$, in which the rods are fastened, while outside of these are hooks $n^2\ n^2$. The under side of the yoke has pivotal lugs $n^3\ n^3$, to which is pivoted the bail Q for supporting the outer-globe holder. By reason of this pivotal construction this bail can be turned up at right angles to get access to the negative-carbon holder. The outer globe F is clamped by three screws or otherwise to a globe-holder F', which is formed underneath with an eye or ring m' and has within it two upwardly-projecting lugs m^2, each of the shape clearly shown in Fig. 2 and turned in opposite directions. These hooks hook over the bail Q, and thereby support the outer globe, the top of which is stayed by the usual shell j^3, which has an upward sliding motion on the shell h'. To get access to the lamp for trimming, the shell j^3 is first slid up to leave the top of the globe free, whereupon the operator lifts the holder F' and by a quarter-turn unhooks the hooks m^2 from the bail Q, whereupon he can freely lower the holder and globe until the globe is entirely beneath the lamp-frame, whereupon he turns it upside down and hooks the eye m' over either of the hooks n^2 of the yoke N, as shown in Fig. 20. Thus the outer globe is securely supported and is out of his way during the trimming of the lamp.

The lower-carbon holder consists of an outer shell P, an inner chuck or clamp R, (shown separately in Figs. 6 and 7,) and an operating-screw R'. The shell P is fastened to the yoke N by two screws $p\ p$ passing through the holes n' in the yoke and surrounded by insulation i', by which the shell is insulated from the yoke. The central portion of the shell is tubular and incloses the chuck R, its upper portion p' being conical, while its lower portion p^2 projects down through the annular portion n of the yoke and is internally threaded to receive the screw R'. The chuck R has a neck r, which passes through the screw R' and is swiveled therein. The chuck R is tubular in its upper portion to receive within it the base of the negative carbon pencil E, and this tubular portion is slitted or divided into three (more or less) jaws r' r', which are made thin enough to be flexible and the outer portions of which are preferably made conical to fit the internal cone p' of the shell P. Hence when the screw R' is screwed up it pushes up the chuck R, the jaws of which are forced together by the internal cone p', and hence are caused to close upon and grip the carbon. To insure the proper centering of the carbon, it is held at two points, the socket within the jaws r' of the chuck being formed at its lower portion r^2 as an internal cone, into which the pencil is pressed until its lower end makes a tight fit therewith, whereupon by screwing up the chuck-screw the upper ends of the jaws r' are caused to grip the carbon, whereby the latter is held at two points. In the operation of trimming, the bail Q being turned up out of the way, the screw R' is screwed down sufficiently to release the negative carbon stump, which is removed and a new carbon substituted, pressing it well down into the conical socket r^2, whereupon the screw R' is screwed up until the chuck-jaws firmly grip the carbon. This operation may be performed, if desired, without disturbing the inner globe G by entirely unscrewing the screw R', which, being removed downwardly, carries with it the chuck R and the carbon stump, and by inserting a new carbon and thrusting this up through the shell P until the chuck enters within the shell and then screwing up the screw R' until the carbon is tightly clamped.

I will now describe those features of my invention which are peculiar to an inclosed-arc lamp. In such lamps it is common to provide a guide for the lower portion of the upper carbon where it enters the inner globe, which guide is usually mounted on the top of the inner globe, and the inner globe is usually fastened in place by clamping it at its bottom to a globe-holder carried by the bottom yoke. The inner globe is held by means of supports or holders which engage it at both top and bottom. Preferably the upper one of said supports is movable to disengage the globe. The bottom support S, I have shown as formed in one piece with the carbon-holder P, which is a convenient arrangement, but not essential. As shown, a flange s projects upwardly around the exterior of the base of the globe, which latter is seated against a layer s' of insulating material, preferably asbestos, the outer portion of which is upturned to form a lining for the cup-shaped support. The top support T is an inverted cup formed as part of a cross-head T', which extends between the rods l l and has sockets t t, through which said rods pass. The support T is formed by means of a flat annular plate t' and an annular downwardly-projecting flange or rim t^2, forming an inverted cup, with a lining t^3 of insulating material, preferably asbestos, the central portion of which is flat against said plate t', while the outer portions are downturned against the flange t^2. The asbestos t^3 is exterior to the globe, while preferably another layer or disk of asbestos t^4 is provided which projects interiorly of the globe. Either alone would serve to guide and center the top of the globe.

To admit of removing and replacing the globe, the upper support T is made vertically movable, preferably by being mounted on a cross-head T', as stated. It is desirable that when this cross-head is pushed upward to free the globe it will remain in place and not drop back until it is again pulled down. To accomplish this, I form the cross-head with its end sockets or holes t t placed a different distance apart than the distance apart of the rods l l where this cross-head engages them. Thus the cross-head serves as a means of springing the rods l l in direction either toward or from each other, so that their elasticity is utilized to produce frictional engagement between them and the sockets t t.

The upper carbon D is guided where it enters the inner globe by means of a guiding-sleeve U, through which it freely passes, the sleeve being preferably internally grooved, as shown, to make a loose stuffing-box impeding circulation of air. This guiding-sleeve is supported upon the cross-head T', but is insulated therefrom in order that no current may pass from the positive carbon into the lamp-frame. To effect this insulation while strongly supporting the sleeve, I have devised the simple construction shown. The sleeve U has an external flange u, which is preferably very thin and which I prefer to make as a steel washer, which is tightly forced over the sleeve, as shown in Fig. 16. This flange or washer is clamped between the insulating layer t^3, Fig. 15, and the insulating layer t^4. These layers are clamped between plate t' and a washer t^5 by means of three screws u', which pass outside of the flange u and screw into three holes u^2, Fig. 14, in the plate t' of the cross-head. The asbestos layers t^3 t^4 have central holes admitting and centering the sleeve U, all as clearly shown in Fig. 15. It is thus apparent that the insulating layers t^3 and t^4 serve two functions: first, as part of the top support T for the inner globe, and, second, as a means for supporting the upper-carbon guide while insulating it from the cross-head. In some cases, especially with a large globe, it is desirable to confine the edge of the cupped asbestos lining t'. This I do as shown in Fig. 21, which is the same as Fig. 15, except that the rim t^2 is enlarged and formed with an internal groove t^6, into which the edge of the asbestos is pressed by an expanding divided ring t^7, which is sprung into the groove.

In an inclosed-arc lamp, or in any lamp in which the lower part of the upper carbon works through a guide, it is necessary to provide some means for allowing for unevenness in the carbon pencils, which are not always perfectly straight. For this purpose I introduce a universal joint between the feed-rod and the carbon, so that such joint will admit of a deflection of the carbon in any direction. The feed-rod C is guided by passing through holes in the top and bottom plates a a', as described, so that its motion is invariable. By connecting the carbon D to the rod by means of a universal joint the latter is guided at its upper end by such joint and at its lower end by the guiding-sleeve U. Accordingly I introduce a universal joint between the clamp D′, by which the carbon is fastened to the rod, and the rod itself, the preferred construction being that shown in Fig. 5. Here the lower part of the rod is made tubular, and the clamp D′ is mounted on a stem v, which projects up into this tubular socket for a suitable distance and at its top is connected therewith by a universal joint V. This joint is preferably constructed as a rounded head or knob on the top of the stem, which head is connected in any suitable way to the rod to prevent its escaping therefrom, preferably by means of a pin v' passing through the rod and passing loosely through a hole in said head. The head is preferably spherical, and the hole through it is tapered both ways, as shown, so that the head may rock in all directions upon the pin. To prevent rattling or too free movement and at the same time make a good electrical contact, I introduce a spring v^2 in the tubular cavity above the head, which spring is so compressed that it presses down upon the head.

My invention may be variously modified without departing from its essential features. Certain of such modifications are hereinbefore suggested; but I may further suggest that in a lamp wherein the inner globe G is fastened wholly by clamping it in a support at its lower ends the carbon-guide U may, if desired, be supported wholly on the top of the globe by simply omitting the cross-head T′, retaining otherwise those parts that are essential to the upper support T, or the upper support T may be omitted and the guide U be mounted on the cross-head, which latter will then be employed solely for the purpose of supporting this rod.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. In an arc-lamp, a clutch feed mechanism comprising an armature-lever I and a clutch-lever J, the armature-lever connected to the clutch-lever on one side of its fulcrum and having a tail projecting to the opposite side of its fulcrum, and adapted to serve as a movable abutment for the free end of the clutch-lever in the manner described.

2. In an arc-lamp, a clutch feed mechanism comprising a clutch and a clutch-lever J, the regulating magnet or solenoid having its movable member connected to said clutch-lever, and a spring e arranged to bear downwardly upon said clutch-lever to overcome the momentum thereof and prevent the consequent release of the clutch after striking the arc.

3. In an arc-lamp, a clutch feed mechanism comprising an armature-lever I, a clutch-lever J, having a projecting tail, an intermediate compounding-lever I′, a link connecting the armature-lever with the compounding-lever, a link connecting the latter to the clutch-lever for multiplying the motion imparted by the regulating-magnet to strike a long arc, and a stop against which said tail abuts at its extreme movement to open the clutch.

4. In an arc-lamp, a clutch feed mechanism comprising an armature-lever I, a clutch-lever J above it, the armature-lever having a tail b^2 adapted to engage the end d^3 of said clutch-lever, a compounding-lever I′ above the clutch-lever, a link f^3 connecting the armature-lever to said lever T, and a link c^2 connecting the latter to the clutch-lever.

5. In an arc-lamp, the combination with the lamp-frame of a guide for the upper carbon comprising a sleeve through which the carbon moves, having a horizontally-projecting flange, two annular insulating-disks between which said flange is confined, and a support to which said disks are fastened.

6. In an arc-lamp, the combination with the lamp-frame of a guide for the upper carbon comprising a sleeve through which the carbon moves, a washer forced onto said sleeve to form a horizontally-projecting flange therefor, two annular insulating-disks between which said flange is confined, and a support to which said disks are fastened.

7. In an inclosed-arc lamp, the combination with the lamp-frame of a guide for the upper carbon comprising a sleeve through which the carbon moves, having a horizontally-projecting flange, two annular insulating-disks between which said flange is confined, and a support to which said disks are fastened, said support engaging the top of the inner globe.

8. In an inclosed-arc lamp, the combination with the lamp-frame of a guide for the upper carbon comprising a sleeve through which the carbon moves, having a horizontally-projecting flange, two annular insulating-disks between which said flange is confined, and a support to which said disks are fastened, said support formed as an inverted cup embracing the top of the inner globe, one of said insulating-disks extended beyond the other and cupped as a lining to said support.

9. In an inclosed-arc lamp, the combination with a frame having means for supporting the inner globe and comprising a lower cross-head N, a lower-carbon holder comprising a chuck passing centrally through said cross-head and adapted to insert the carbon from beneath without removing said inner globe, said cross-head having hooked ends n^2, and a globe-holder F′ for the outer globe having an eye m' adapted to engage said hooked

ends for suspending the outer globe, while trimming the lamp, out of line with said carbon-holder.

10. In an arc-lamp, the combination with the lamp-frame comprising rods $l\ l$ and bottom yoke N, the latter formed with a central ring, a lower-carbon holder fastened to said yoke and projecting through said ring, and a pivoted bail Q for supporting the globe-holder, pivoted to said yoke so as to swing up to afford access to said carbon-holder.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:
A. L. HADLEY,
N. N. KING.