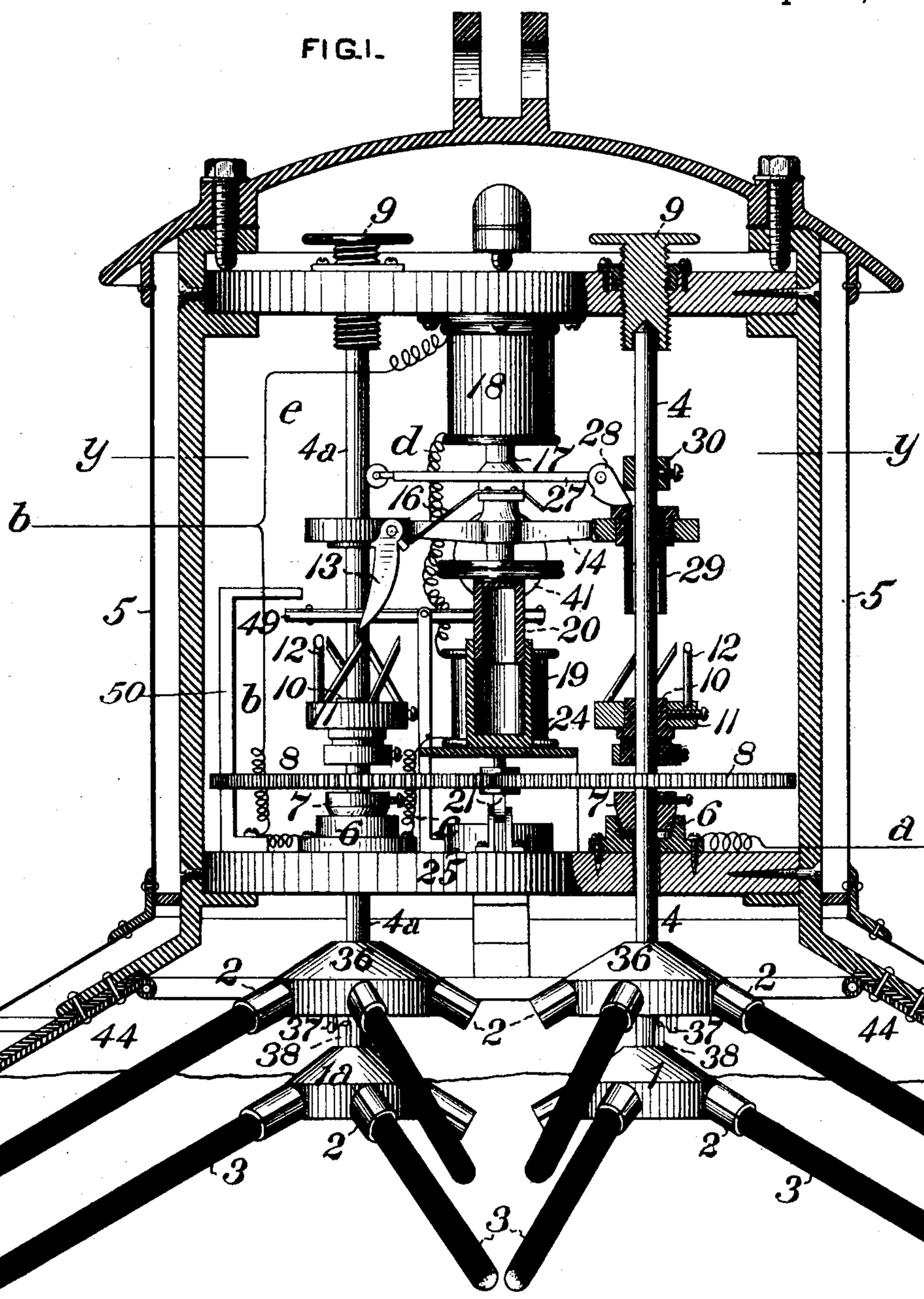
(No Model.) 4 Sheets—Sheet 1.

J. T. BIRCH.

ELECTRIC ARC LAMP.

No. 482,157. Patented Sept. 6, 1892.

FIG. 1.



WITNESSES:

E. Ammell.
H. E. Gaither.

INVENTOR,

John T. Birch
by George H. Christy
Att'y.

(No Model.) 4 Sheets—Sheet 2.

J. T. BIRCH.

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FIG. 2.

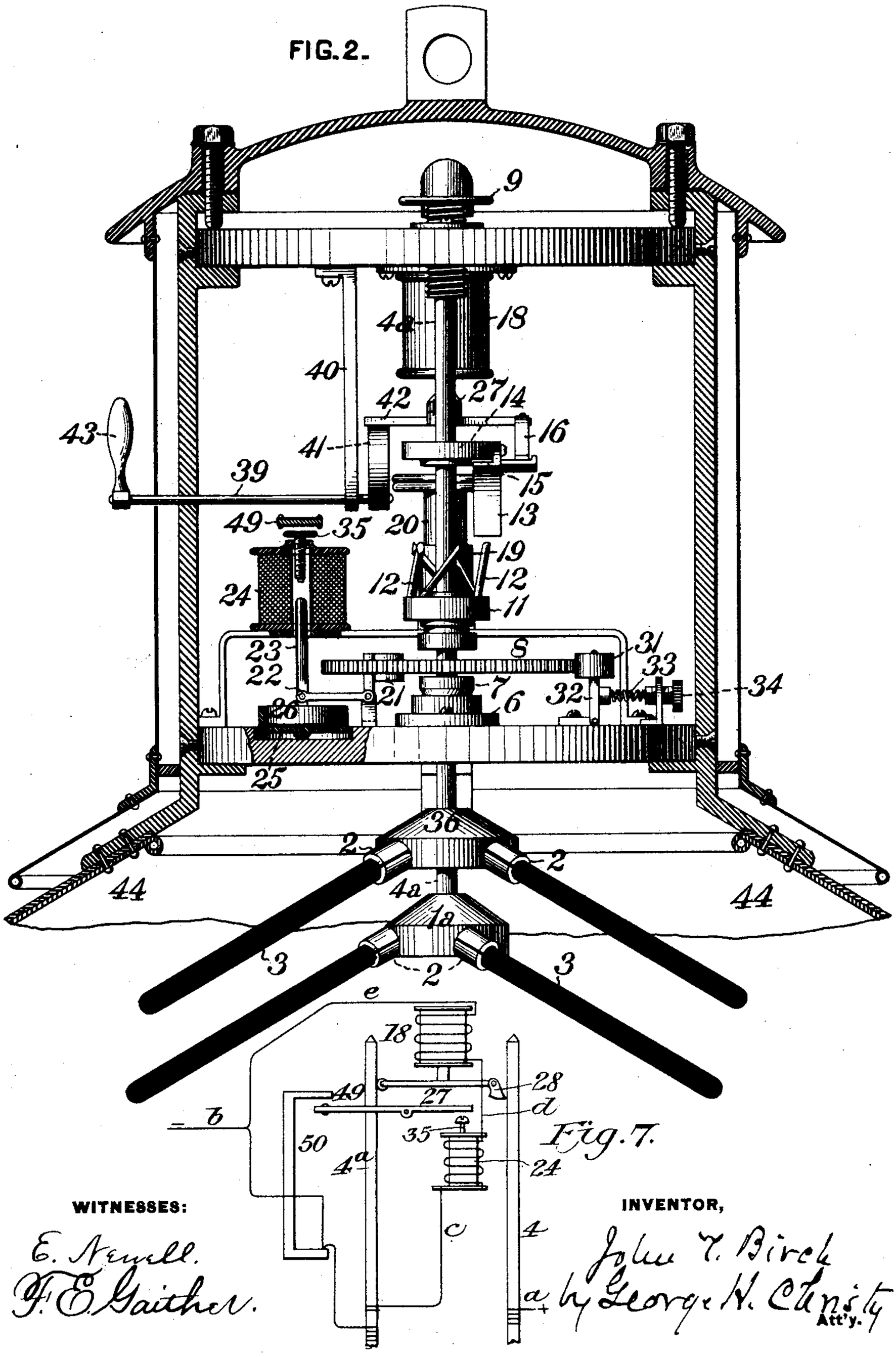

Fig. 7.

WITNESSES:

E. Newell.

F. E. Gaither.

INVENTOR,

John T. Birch

by George H. Christy

Att'y.

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J. T. BIRCH.

ELECTRIC ARC LAMP.

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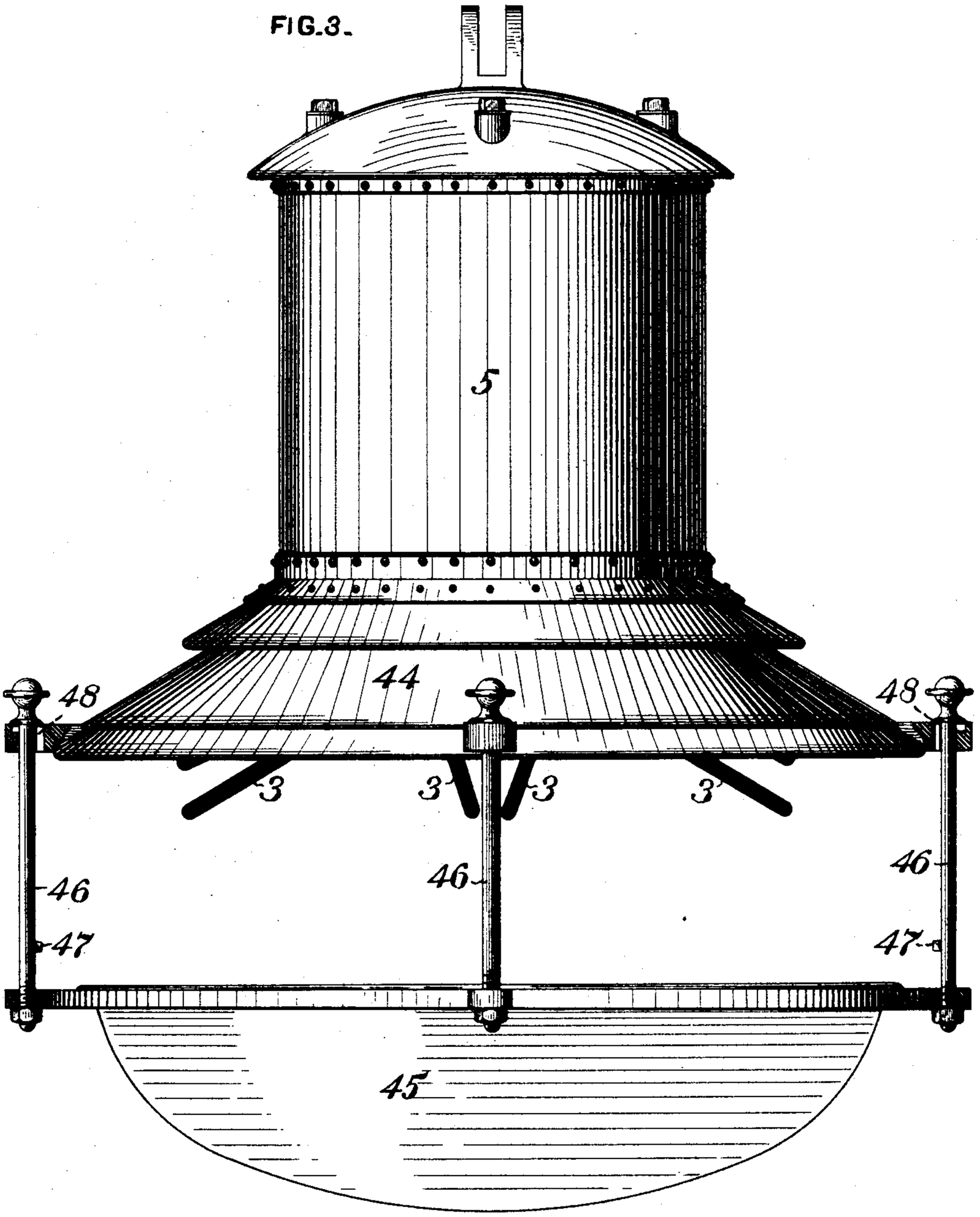
FIG. 3.



WITNESSES:

E. Stanfield.
F. E. Gaither.

INVENTOR,

John T. Birch
by George H. Christy
Att'y.

(No Model.) 4 Sheets—Sheet 4.

J. T. BIRCH.

ELECTRIC ARC LAMP.

No. 482,157. Patented Sept. 6, 1892.

FIG. 4.

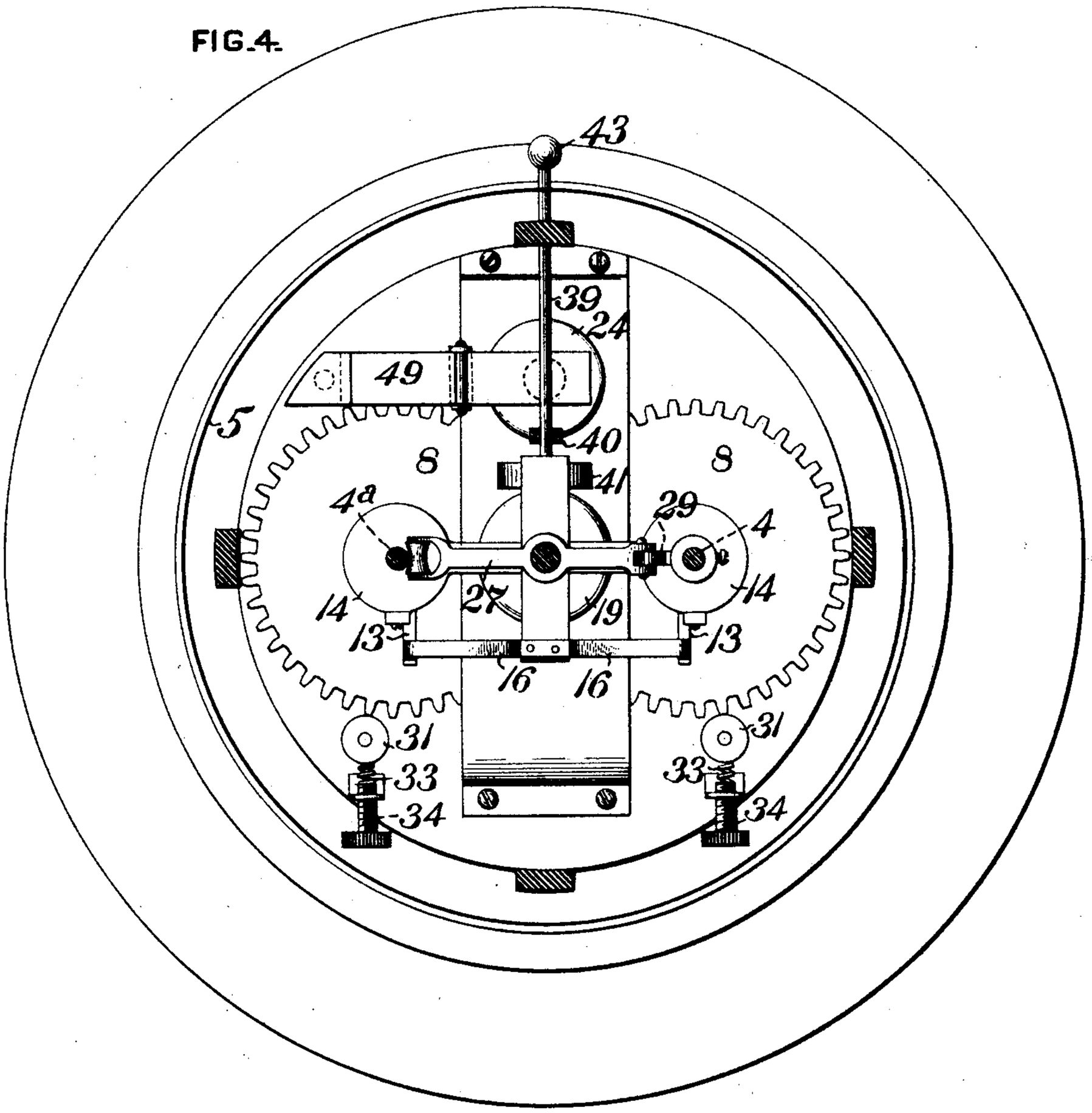


FIG. 5.

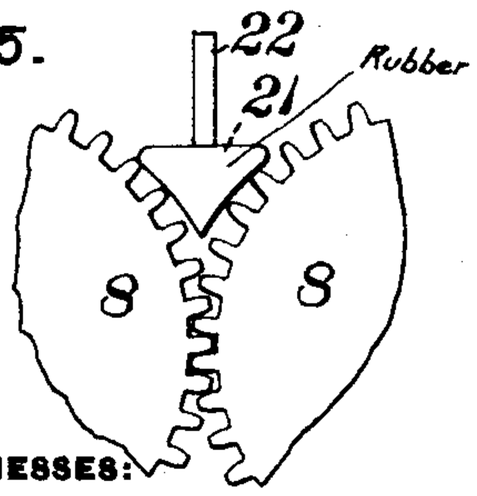
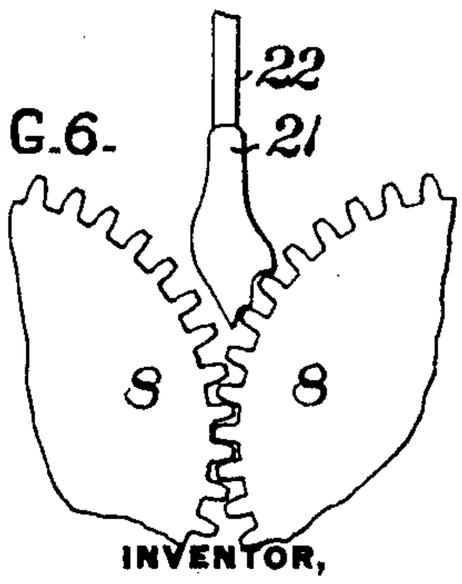


FIG. 6.



WITNESSES:

E. Arnell.

F. E. Gaither.

INVENTOR,

John T. Birch

by George N. Christy

Att'y.

UNITED STATES PATENT OFFICE.

JOHN T. BIRCH, OF PITTSBURG, ASSIGNOR OF ONE-HALF TO WILLIAM B. HENDERSON, OF INGRAM, PENNSYLVANIA.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 482,157, dated September 6, 1892.

Application filed April 4, 1892. Serial No. 427,658. (No model.)

To all whom it may concern:

Be it known that I, JOHN T. BIRCH, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Electric-Arc Lamps, of which improvements the following is a specification.

The invention described herein relates to certain improvements in arc lamps, and has for its object the employment of a number of carbon rods which are brought successively in pairs into operative relation with each other, thereby insuring an illuminating endurance or necessitating a less frequent trimming of the lamps.

In general terms the invention consists in the novel arrangement of the carbon rods and in the mechanism for moving the carbon rods into operative relation to each other and for regulating such movements, as more fully hereinafter described, and particularly claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a view in elevation of my improved lamp, the case being partially removed to show the operating mechanism. Fig. 2 is a similar view at right angles to Fig. 1. Fig. 3 is an elevation of the lamp, the globe being lowered for trimming the lamp. Fig. 4 is a sectional plan view, the plane of section being indicated by the line *y y*, Fig. 1. Figs. 5 and 6 are detail views of parts of the feed mechanism, and Fig. 7 is a diagrammatic view illustrating the several circuits through the lamp.

In the practice of my invention hubs 1 1^a, provided with radial sockets 2 for the reception of the carbon rods 3, are secured on the lower ends of vertical shafts 4 4^a. These shafts pass up through openings in the bottom of the inclosing frame 5 and the shoes 6, upon which the conical hubs 7 of the intermeshing pinions 8 rest, said hubs being fastened to the shafts 4 by set-screws or other suitable means, and thereby support the shafts as against vertical movement. The shoes 6 form the lower bearings for the shafts, the upper bearings being formed by the threaded plugs 9, screwing down through the top of the frame 5, as shown in Fig. 1.

On the shafts 4 are secured sleeves 10, of insulating material, to which are attached metal rings 11, provided on their upper faces with a series of cam-like projections, preferably formed by a series of inclined pins 12. The shafts are rotated by means of dogs 13, pivoted to the cross-head 14, movable up and down the shafts, the dogs engaging the cam projections as the cross-head descends and forcing the shafts around. As shown in Fig. 2, a shoulder 15 is formed on each of the dogs projecting under the cross-head and serves as a stop to prevent an upward movement of the dogs when bearing upon the cam projections 12. As the upper portion of each cam projection overhangs the lower portion of the next succeeding one, the dogs are so mounted as to be free to move back when raised by the cross-head and are pushed forward into operative position by springs 16, attached to the cross-head and bearing upon the dogs or projections on the rear side of the same. The cross-head is concected to the core 17 of the solenoid 18, which when excited will raise the cross-head sufficiently high to permit the dogs clearing the upper ends of the cam projections 12. The downward movement of the cross-head is controlled by the dash-pot consisting of the cylinder 19 and the plunger 20, the latter being attached to the under side of the cross-head.

In order to separate the carbon rods when they have been shifted into contact with each other by the feed mechanism hereinbefore described, a block 21, adapted to engage the peripheries of the pinions 8, is attached to one arm of the bell-crank lever 22, which is pivoted in such relation to the pinions that when shifted, as presently to be described, the block will engage and turn the pinions in the reverse direction to that effected by the feed mechanism, thereby so separating the carbon rods that an arc will be formed between them, as shown in Figs. 2, 5, and 6. The other arm of the lever 22 is connected to the core 23 of the solenoid 24, which when excited will shift the block 21 into engagement with the pinions, as described. The movements of the core and lever are controlled by a dash-pot consisting of the cylinder 25 and plunger 26.

As shown in Fig. 5, the block 21 may be formed of some suitable material—such as

rubber—which will have a good frictional engagement with the peripheries of the pinions 8; or the block may be formed of metal and provided with shoulders on its faces, adapted to engage the teeth of the pinions, as shown in Figs. 6.

As shown in Fig. 1, the conductors *a* and *b* are connected to the shoes 6, through which the shafts 4 4ª pass, and as long as the carbon rods are in proper relation to each other for the formation of an arc between them the current will pass through the shaft 4, hub 1, carbon rod attached thereto, thence to a carbon rod in hub 1ª, the hub, the shaft 4ª, and its shoe to conductor *b*. In case the carbons come together, thereby removing resistance from the circuit, a portion of the current will pass through the shunt-circuit formed by the wire *c*, connected to the shoe of shaft 4ª, the solenoid 24, wire *d*, solenoid 18, and wire *e*, connected to wire *b*, thereby exciting the solenoids 24 and 18. The excitation of the solenoid 24 will shift the block 21 so as to turn the pinions 8 back, thereby separating the carbons which are in contact, and the excitation of the solenoid 18 will raise the cross-head, thereby relieving the cam projections 12 from the weight of the cross-head and connections, thereby permitting of the reverse rotation of the shafts 4 4ª by the block 21, as described. The number of cam projections or pins 12 is equal to the number of carbon rods attached to the hubs, so that it is necessary as soon as a pair of carbon rods have been burned so short that no current will pass between even when both are in a line connecting the centers of the hubs that the current should be directed through the solenoid 18, so as to raise the cross-head until the dogs 13 are above the cam projections 12.

In order to switch the current through the solenoid, a bar 27 is connected to the core 17 of the solenoid 18 and has one end bearing against the shaft 4ª, preferably through the medium of an antifriction-roller, while the opposite end of the bar is provided with a dog 28, pivoted thereto. A sleeve 29, formed of insulating material, passes through one end of the cross-head and surrounds the shaft 4. This sleeve projects below the cross-head such a distance that it will strike against the sleeve 10 before the dogs 13 reach the lower limit of their movements.

As shown in Fig. 1, the dog 28 rests upon the head of the sleeve 29, so that as the cross-head and core continue their downward movement after the sleeve 29 is stopped the dog 28 will be forced outward against the shaft 4, thereby forming an electrical connection between the shafts 4 and 4ª. Hence as soon as the carbons are consumed to such an extent that the current will not pass between them it will pass through the bar 27, and a portion thereof will flow through the solenoid 18, which will immediately raise the cross-head.

In order to keep the dog 28 in contact with the shaft 4 until the dogs 13 have been raised above the cam projections 12, the sleeve 29 is made to fit sufficiently tight in the cross-head as to maintain its raised position with relation to the cross-head until it is forced down by the dog 28 coming in contact with the stop 30 on the shaft 4. This stop is so located that the dog 28 strikes against it as soon as the cross-head is raised sufficiently high to permit the dogs 13 to clear the upper ends of the projections 12. By contact with the stop 30 the dog 28 is pushed away from the shaft 4, breaking the circuit, and the sleeve 29 is pressed down to normal position. As soon as the circuit is broken, the cross-head and its connections will drop, the dogs 13 coming in contact with a new set of cam-projections 12, thereby so rotating the shafts 4 and 4ª as to bring a new set of carbon rods into proper relation to each other. The dash-pot connected with the core 17 will prevent a too sudden or too rapid movement of the cross-head; but in order to prevent any movement of the shafts, except as pressed around by the cross-head and dogs, a brake is applied to the peripheries of the pinions 8, as shown in Figs. 2 and 3. This brake consists of a roller 31, mounted on the upper end of a movable arm 32, and the roller is held against the pinion by a spring 33, whose tension is adjusted by a screw 34.

The movement of the block 21 is regulated by a screw 35, passing down into the solenoid 24, so as to check the upward movement of the core 23. The screw 35 is formed of iron, so that it becomes magnetized on the passage of a current through the solenoid and will attract one end of the lever 49, whose opposite end will come in contact with the projection from the post 50 when the end attracted by the screw comes in contact therewith. This post 50 is connected to the wire *b*, and the bobbin of the solenoid or magnet is formed of brass or other conducting material and is connected in the circuit of the solenoid, so that when the lever is attracted by the screw 35 a second shunt-circuit will be formed. The screw and lever are adjusted in such relation to each other that the lever will be shifted only in case of an abnormal increase of current.

If it is desired to increase the capacity of the lamp, auxiliary hubs 36, provided with sockets for the carbons, may be mounted loosely upon the shafts 4 4ª above the hubs 1 1ª, so as not to rotate except when actuated by the hubs 1 1ª. To actuate the auxiliary hubs, projections 37 are formed on the lower side thereof, and corresponding projections 38 are formed on the upper side of the hubs 1 1ª. When the lamp is trimmed, the auxiliary hubs are so adjusted on the shafts that the projection on the hubs 1 will not engage the projections on the auxiliary hubs until the hubs 1 have made a complete revolution. During this complete revolution of the hubs 1 the carbons thereof will be consumed, so that no shadows will be thrown during the burning of the carbons of the auxiliary hubs.

In order to facilitate trimming of the lamp,

the hubs 1 1ª should be capable of being turned freely by hand. It is therefore necessary that the dogs 13 should be raised above the cam projections 12. To this end a shaft 39 is passed through the frame of the lamp and is supported near its inner end by a hanger 40. On the inner end of this shaft is secured an eccentric 41, adapted to bear against the under side of a projection 42 from the cross-head and to raise the latter when rotated, as shown in Fig. 2. It will be observed that both the eccentric and the handle 43 on the outer end of the shaft are above their center of rotation when turned to raise the cross-head, so that if the latter be slightly raised, as it will be by the solenoid when the current is again switched in the lamp, the eccentric will turn around to its lowest position and permit of the normal operation of the lamp.

The carbons are protected from above by an apron 44, extending laterally from the lower end of the frame, and from below by a bowl-shaped glass shade 45, which is supported by rods 46, passing through the rim of the apron and attached at their lower ends to the rim of the shade. These rods are made of sufficient length to permit the shade to drop down, as shown in Fig. 3, to allow of the insertion of new carbons. In order to support the shade with its rim in contact with the rim of the apron, lugs 47 are formed on the rods at such points that when the shade is raised they will pass through slots 48 in the rim of the apron and by turning the rods will rest upon the top of the rim of the apron.

If desired, a reflecting-surface may be formed on the under side of the apron 44, so that the rays of light reflected therefrom will destroy all shadows, especially such as may be caused by the hubs 1 1ª and the stumps of the carbons thereon, when the carbons of the auxiliary hubs are in use.

I claim herein as my invention—

1. In an arc lamp, the combination of two hubs, each provided with radially-arranged holders for carbon rods, a series of cam projections connected to the shafts carrying the hubs, and reciprocating dogs engaging said projections and thereby rotating the shafts and hubs, substantially as set forth.

2. In an arc lamp, the combination of two hubs, each provided with radially-arranged holders for carbon rods, a series of cam projections connected to the vertical shafts carrying the hubs, dogs operative by gravity and adapted to engage said projections, and a solenoid for raising the dogs, substantially as set forth.

3. In an arc lamp, the combination of two hubs, each provided with radially-arranged holders for the carbon rods, a series of cam projections connected to the vertical shafts carrying the hubs, dogs operative by gravity and adapted to engage said projections, a solenoid for raising the dogs, and means operative by an electric magnet for moving the hubs in a direction contrary to that imparted by the dogs, substantially as set forth.

4. In an arc lamp, the combination of two hubs, each provided with a series of radially-arranged holders for the carbon rods, a series of cam projections connected with the vertical shafts carrying the hubs, dogs operative by gravity and adapted to engage the cam projections, a solenoid for raising the dogs, and a switch movable with the dogs and operative to direct the current through the solenoid as the dogs approach the lower limit of the movement and to break the current through the solenoid as the dogs reach the upper limit of their movement, substantially as set forth.

5. In an arc lamp, the combination of two hubs, each provided with radially-arranged sockets for carbon rods, mechanism for rotating said hubs so as to bring the carbon rods into operative relation to each other successively, auxiliary hubs provided with radially-arranged sockets, and connections between the main and auxiliary hubs, whereby the auxiliary hubs may be rotated by the main hubs after the latter have made one revolution, substantially as set forth.

6. In an arc lamp, the combination of an electric magnet having a conducting-spool and included in the shunt-circuit of the lamp, an armature operative on an abnormal increase in the current through the magnet, and a contact-piece connected to the main circuit, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JOHN T. BIRCH.

Witnesses:

DARWIN S. WOLCOTT,

R. H. WHITTLESEY.