No. 710,374. Patented Sept. 30, 1902.

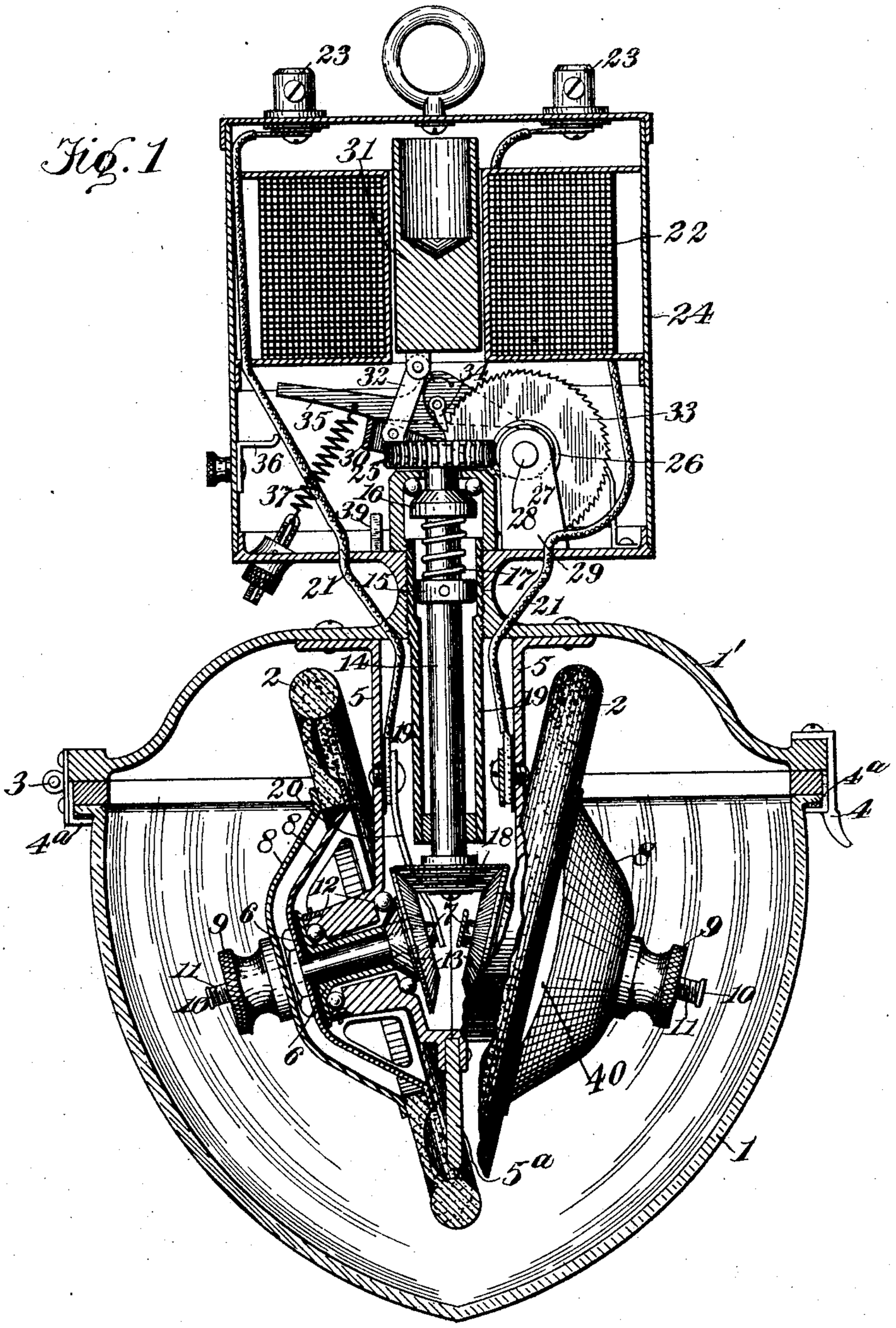
A. F. SHORE.

ELECTRIC ARC LAMP.

(Application filed Nov. 9, 1899. Renewed Feb. 15, 1902.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1



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3 Sheets—Sheet 2.

Fig. 2

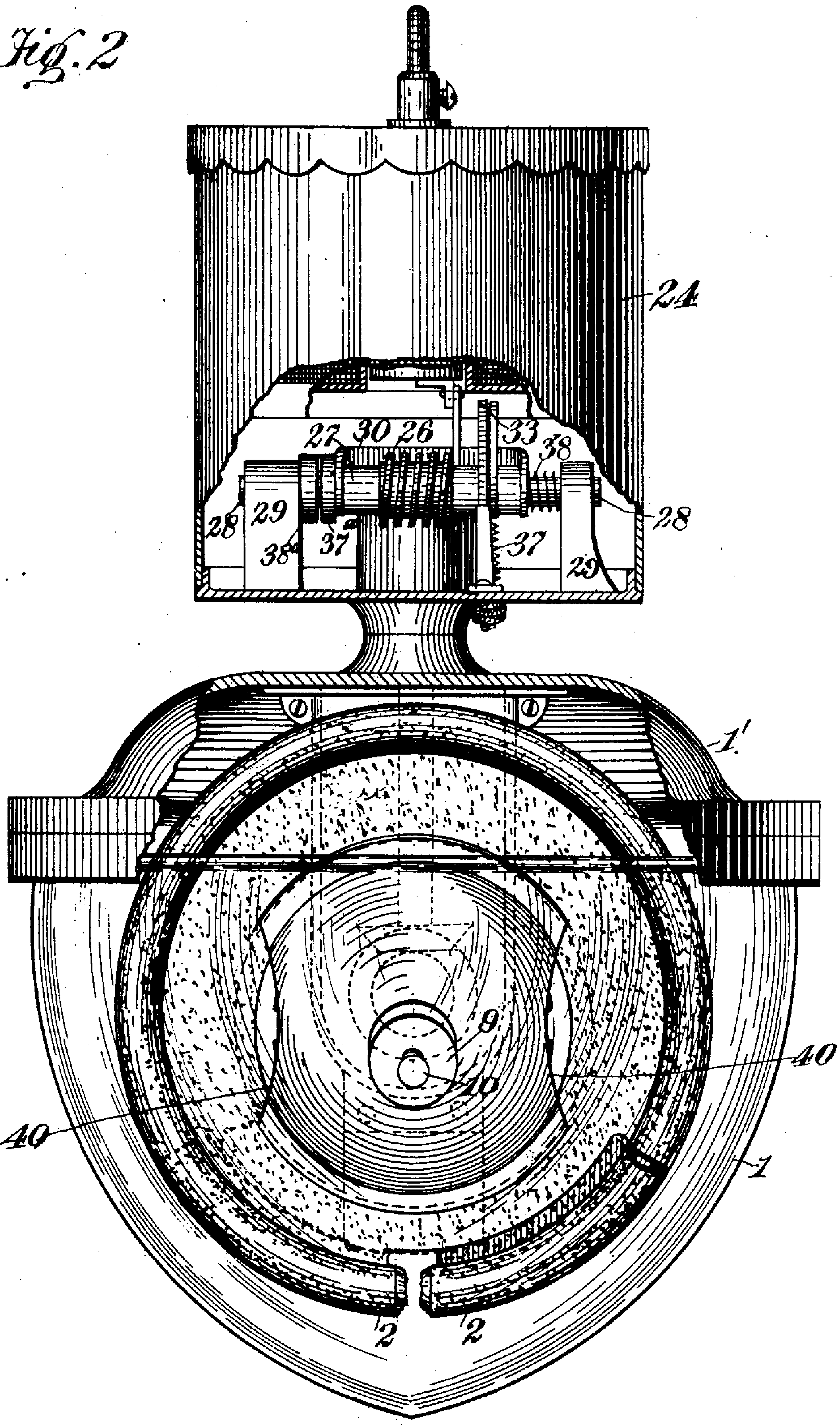

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Fig. 3

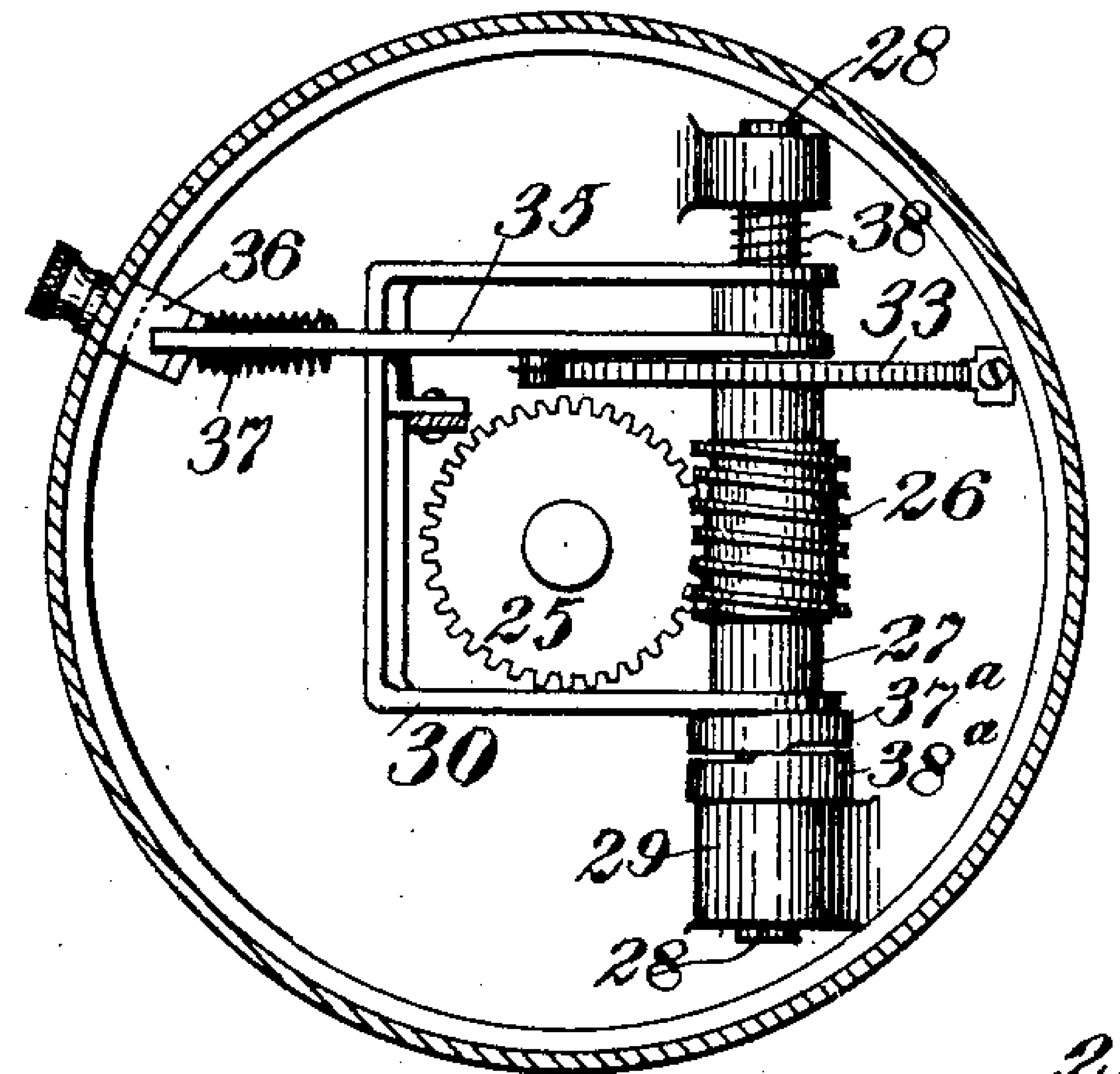


Fig. 4

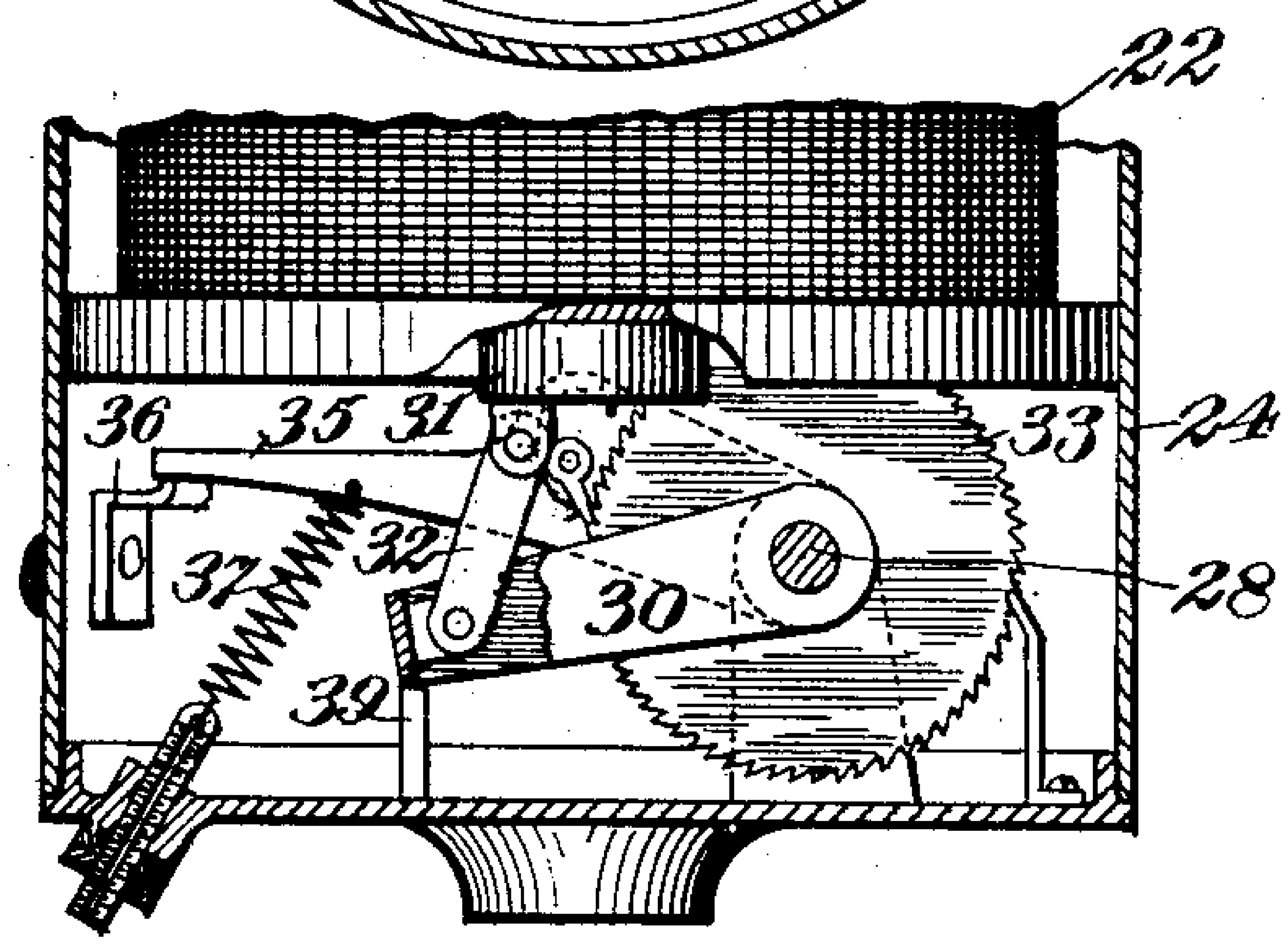
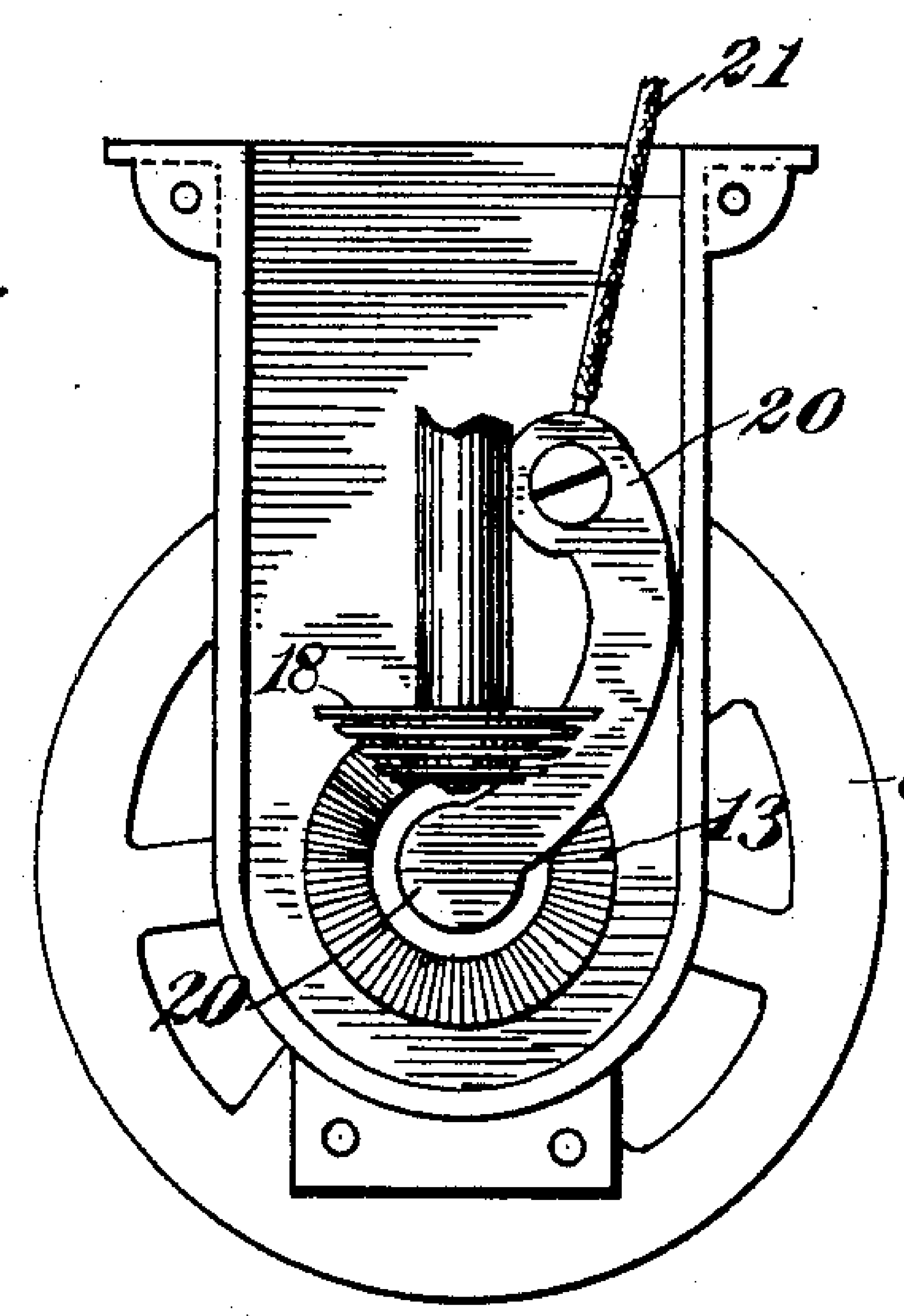


Fig. 5



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UNITED STATES PATENT OFFICE.

ALBERT FERDINAND SHORE, OF NEW YORK, N. Y., ASSIGNOR OF TWO-THIRDS TO DANIEL N. HURLBURT, OF NEW YORK, N. Y.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 710,374, dated September 30, 1902.

Application filed November 9, 1899. Renewed February 15, 1902. Serial No. 94,217. (No model.)

To all whom it may concern:

Be it known that I, ALBERT FERDINAND SHORE, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Arc-Lamps, of which the following is a specification.

My invention relates to arc-lamps, more particularly to the kind in which the light-giving carbons are in the form of flattened disks.

The object of my invention is to produce an arc-lamp which shall be certain in its action, economical to construct, and which by its small size shall be adapted for use in places from which the arc-lamp is at present excluded.

Another object of my invention is to produce a lamp which will require much less attention than those at present in use and whose carbons will burn for a longer period.

A further object is to provide an arc-lamp whose feeding mechanism is positive and uniform in its operation and which being in no manner dependent upon gravity for its working can be placed at any desired angle to the horizon.

In my improved lamp the carbons are arranged in the form of a flattened disk, having a circular carbon ring as its outer circumference and a thin web of preferably the same material, or instead of the web I may form the inner portion of strips similar to the spokes on a wheel. In this way a relatively great length of carbon can be disposed within small limits, while by connecting the outer circle with a web or spokes a rigid and cheaply-formed carbon is obtained. I employ two of the ring disk carbons mounted rotatably within the framework of the lamp at an angle to each other, so that the carbons will be maintained normally in contact and preserve the arc in its proper length and position as the carbons are consumed. For rotating the carbons I employ simple and effective mechanism whose motion is controlled entirely by the current flowing in the lamp, thereby securing a movement of the rotating parts which perfectly compensates the consumption of the carbon and insures the proper length of arc.

My lamp is adapted for use on both alternating and direct current circuits.

Referring to the drawings, Figure 1 is a vertical section through the lamp, some of the parts being shown in perspective. Fig. 2 is a side view, portions being cut away to show the carbons and the feeding mechanism and also the method of inserting and removing the carbons. Fig. 3 shows a top view of arc striking and feeding mechanism; Fig. 4, a side view of a portion of the feeding mechanism; Fig. 5, a section of the carbon-holding frame and the method of making contact with the same.

In all the views similar reference-numbers designate similar parts.

1 1′ is the lamp-body proper, containing the carbons 2 2, the lower transparent portion 1 swinging by a hinge 3 on the upper metallic portion 1′ and retained in position by the spring-catch 4. The lamp being designed to work on the inclosed-arc principle, the joint between these two portions is made as nearly air-tight as possible by means of the asbestos or similar washer 4ª.

Attached to the metallic top 1′ is the frame 5 5, designed to serve as support for various portions of the rotating mechanism of the lamp.

5ª is a piece of porcelain or other difficultly-fusible insulator designed to protect the frame 5 5 from burning out through a short circuit or excessive heat.

Mounted rotatably on ball-bearings within the frame 5 is the shaft 6, carrying the carbon-supporting mechanism. Through this shaft, which acts as a bushing, passes insulated the pin 7, electrically connected with the spring-frames 8, holding the carbon disks. These frames are held in position by the screw-nuts 9 9, whose outward movement is limited by the upset heads 10 of the screw 11. The carbons and their holding-frames turn in the frame 5 5 on bearings 12. Motion is imparted to the carbon-holders by means of roughened bevel-wheels 13 13, pressing against the bevel-wheel 18 on the main rotating shaft 14. This shaft 14 is provided with a fixed collar 15, a

vertically-movable collar 16, a spiral spring 17, and ball-bearings at the top. The collar 16 is prevented from turning on the shaft 14 by a pin working in a vertical groove in said shaft. These coöperate to keep the pressure constant and sufficient between the bevel-wheels 13 13 and 18. The maintaining of a constant and firm pressure between the gear-wheel on the main feeding-shaft 14 and those on the carbon-rotating frames is a necessity for even working of the lamp. By my arrangement there is no lost motion when the carbons turn forward or backward, and, moreover, all transmission of vibration from electrical portions to the carbon-frames is prevented. This is especially necessary in the use of the alternating current.

19 is a sleeve for the shaft 14.

20 is a spring insulated from the frame 5 for establishing electrical communication with the carbon rings through the pin 7, frame 8, conductor 21, solenoid 22, and binding-posts 23 23.

The feeding mechanism contained in the casing 24 consists of a gear-wheel 25, attached to the top of shaft 14, which meshes with a worm 26 on the shaft 27, supported by bearings 28 in the standard 29. Attached to the shaft 27 is a U-shaped piece 30, and this U-shaped piece is caused to move with the core 31 of the solenoid 22, being connected therewith by the hinged strip 32. On the shaft 27 is fastened a notched wheel 33, worked by the pawl 34, attached to the lever 35, whose movements are limited by the retractile spring 37 and the back-stop 36. 38 is a spiral spring allowing the shaft 27 to shift laterally in its bearings.

38ª is a boss fixed to the standard 29; 37ª, a corresponding boss attached to the U-shaped piece 30, having a cam-like projection adapted to engage with a corresponding shape on 38ª.

39 is a stop for limiting the descent of the U-shaped piece 30.

The method of operation is as follows: The carbon rings being normally in contact and the feeding mechanism being as shown in Fig. 4, a current is sent through the lamp from the binding-posts 23 23. The course of the current is: binding-post 23, conductor 21, spring 20, pin 7, frame 8, carbon ring disk 2, to other carbon disk, frame 8, pin 7, spring 20, conductor 21, solenoid 22, to binding-post 23. This current in its passage energizes the solenoid 22, which acts as a magnet on the plunger-core 31, which begins to be drawn into the solenoid. The first effect is to raise the U-shaped piece 30, attached to the shaft 27. This causes the shaft 27 to be urged laterally on the bearings 28 against the spiral spring 38, Fig. 3. In this movement the worm 26 acts like a rack, with the gear-wheel 25 attached to the top of the shaft 14, the result being to transmit the motion, per bevel-wheels 18 13 13, to the carbon disks and separate their carbon points, thus striking the arc. The increasing current causes the plunger-core to be drawn farther into the solenoid until the predetermined length of arc has been attained. As the core 31 penetrates into the solenoid it draws with it the U-shaped piece 30 until it contacts with the lever 35, which carries the dog 34, working in the toothed feeding-wheel 33. Should now by the consumption of the carbons the arc become longer, the resistance in the lamp will be increased. Consequently the magnetic strength of the solenoid will be decreased and the plunger will descend. The retractile spring 37 will then draw the lever 35 downward. The pawl 34 will act on the toothed wheel 33, causing it to rotate. This rotation communicated to the worm 26, then to the gear-wheel 25, will impart rotation to the shaft 14, which motion being transmitted by the bevel-wheels 18 13 13 to the carbon disks will cause their rings to approach each other until the normal length of arc is again reached, when the same cycle of operations as at first starting will be repeated. It will thus be seen that each variation of current affects directly and immediately the feeding mechanism and that great steadiness in the arc must result.

The manner in which the carbons may be replaced is as follows: Fig. 2 shows that the carbon rings have a circular central orifice slightly smaller than the diameter of the retaining-frames 8 8, a portion of whose circumference is cut away at each side 40 40. By loosening the nut 9 the carbons can be lifted over the edge of the frames 8 8 and either inserted or removed, as desired.

To render the arc-striking mechanism more clear, I will explain its construction in detail. Fastened to the standard 29 is a boss 38ª, having a cam-like projection, and attached to the U-shaped lever-piece 30 is a similar boss with a similar cam-like projection. When the mechanism is at rest and the lamp not working, these two projections fit into each other. As soon as the solenoid 22 begins to pull on the U-shaped piece 30 and turn it on its axis the cam projections react on each other and the shaft 27 is shifted laterally against the spiral spring 28. The result of this is, as hereinbefore explained, to effect the motion necessary for striking the arc.

Having thus fully described and illustrated my invention, what I claim is—

1. In an arc-striking mechanism for arc-lamps, the combination of a shaft movable longitudinally in its bearings, a rack on said shaft meshing with gearing regulating the movement of the arc-carbons, a lever turning freely on said shaft, and controlled by the current flowing in the circuit, and means on said shaft and its bearings for producing a longitudinally-directed motion of the shaft, substantially as set forth.

2. In an arc-feeding mechanism, the combination of a solenoid, a plunger-core, a lever attached to said core, and provided with a cam, a shaft, longitudinally movable in its

bearings, a fixed cam adapted to engage with the lever-cam, and means for transforming the longitudinal movement of the lever-shaft into a rotary motion of the arc-carbons, substantially as described.

3. In an arc-feeding mechanism, the combination of a solenoid, a plunger-core, a lever attached to and moving with said plunger, a longitudinally-movable shaft attached to said lever, a toothed wheel attached to the shaft, a second lever adapted to be engaged by the lever attached to the plunger, and provided with a pawl engaging with the toothed wheel for controlling the feeding mechanism, a retractile spring and stop for limiting the movement of the second lever, and means for transmitting the motion of the feeding mechanism to the light-giving carbons, substantially as described.

4. In an arc-lamp, the combination of a pair of carbon rings set at an angle to each other, frames for holding said carbons rotatably mounted on shafts arranged to transmit the current to the carbons, bevel-wheels on said carbon-supporting shafts, a main rotating shaft having a bevel-wheel for engaging with and transmitting motion to the bevels on the carbon-supporting shafts, means for maintaining firm and constant contact between the bevel-wheel on the main shaft and the bevels on the carbon-supporting shafts, and means for causing the said main shaft to rotate in order to compensate varying lengths of the arc, substantially as set forth.

5. In an arc-lamp, the combination of a pair of carbon disks or rings, forming an angle with each other and rotatably mounted on axes supported by the body of the lamp, means for transmitting the current to the rotary carbons, bevel-wheels on the carbon-supporting axes engaging with a bevel-wheel attached to the main rotating shaft, means for maintaining the frictional contact between the bevels on the carbon-supporting axes and the bevel on the main shaft, a toothed wheel mounted on the top of the main shaft, a worm engaging with said toothed wheel and mounted on an axis capable of rotary and longitudinal motion, a notched wheel attached to said axis and actuated by a pawl attached to a lever whose movements are controlled by a retractile spring and by a lever attached to the worm-shaft, a plunger connected with this latter lever, and a solenoid, all coöperating to bring about the feeding action of the lamp, substantially as set forth.

6. In arc-feeding mechanism, the combination of a pair of circular carbon-holders, a main rotating shaft, coöperating bevel-wheels on the carbon-holders and on the main shaft, and a spring controlling the pressure between the bevel-wheels on the carbon-holders and on the main shaft, substantially as set forth.

7. In arc-feeding mechanism, the combination of a pair of circular carbon-holders, a main rotating shaft, coöperating bevel-wheels on the carbon-holders and on the main shaft, and means for maintaining constant and firm contact between the bevel-wheels on the carbon-holders and on the main shaft, substantially as described.

8. In arc-feeding mechanism, the combination of a pair of bevel-wheels for revolving the carbons, a bevel-wheel on the main shaft, a fixed collar attached to the main shaft, a collar movable along said shaft, bearings for said movable collar, and a spring for maintaining a firm pressure between the bevel-wheel on the main shaft and the carbon-revolving bevel-wheels, substantially as set forth.

9. In arc-feeding mechanism, the combination of a carbon-holding frame, a hollow shaft for said frame, a conducting-pin insulated from and revolving with said hollow shaft adapted for conducting the current to the carbon-holding frame, substantially as described.

Signed at New York, in the county of New York and State of New York, this 3d day of November, A. D. 1899.

ALBERT FERDINAND SHORE.

Witnesses:
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A. STETSON.