

Aug. 20, 1946.

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2,406,028

CIRCUIT MAKER AND BREAKER

Filed Nov. 1, 1944

FIG. 1.

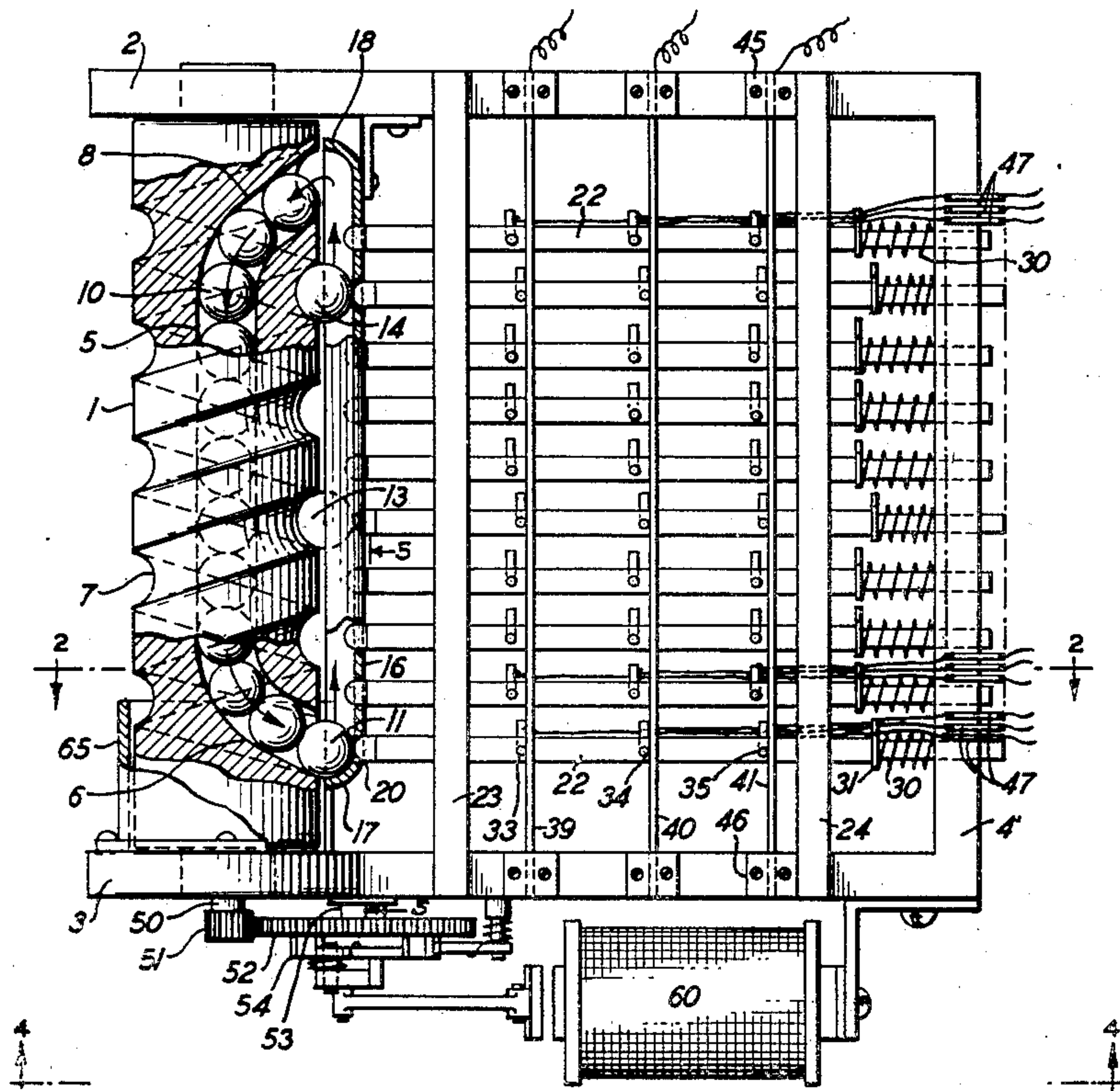


FIG. 2.

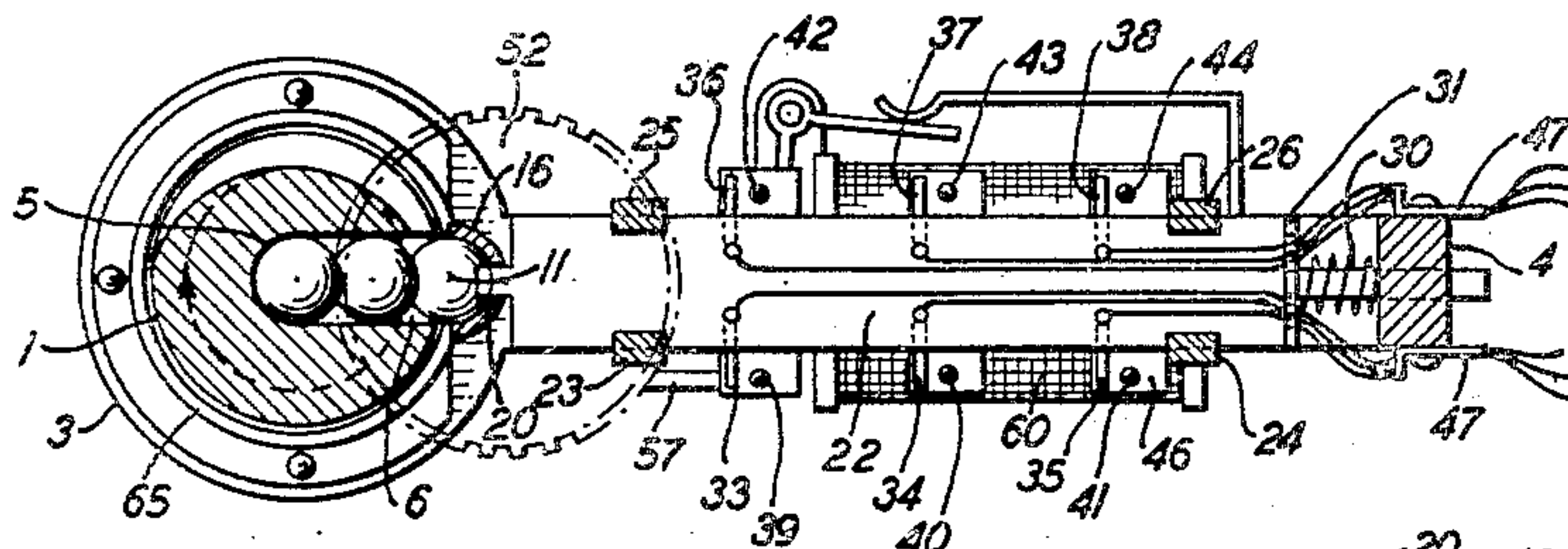


FIG. 3.

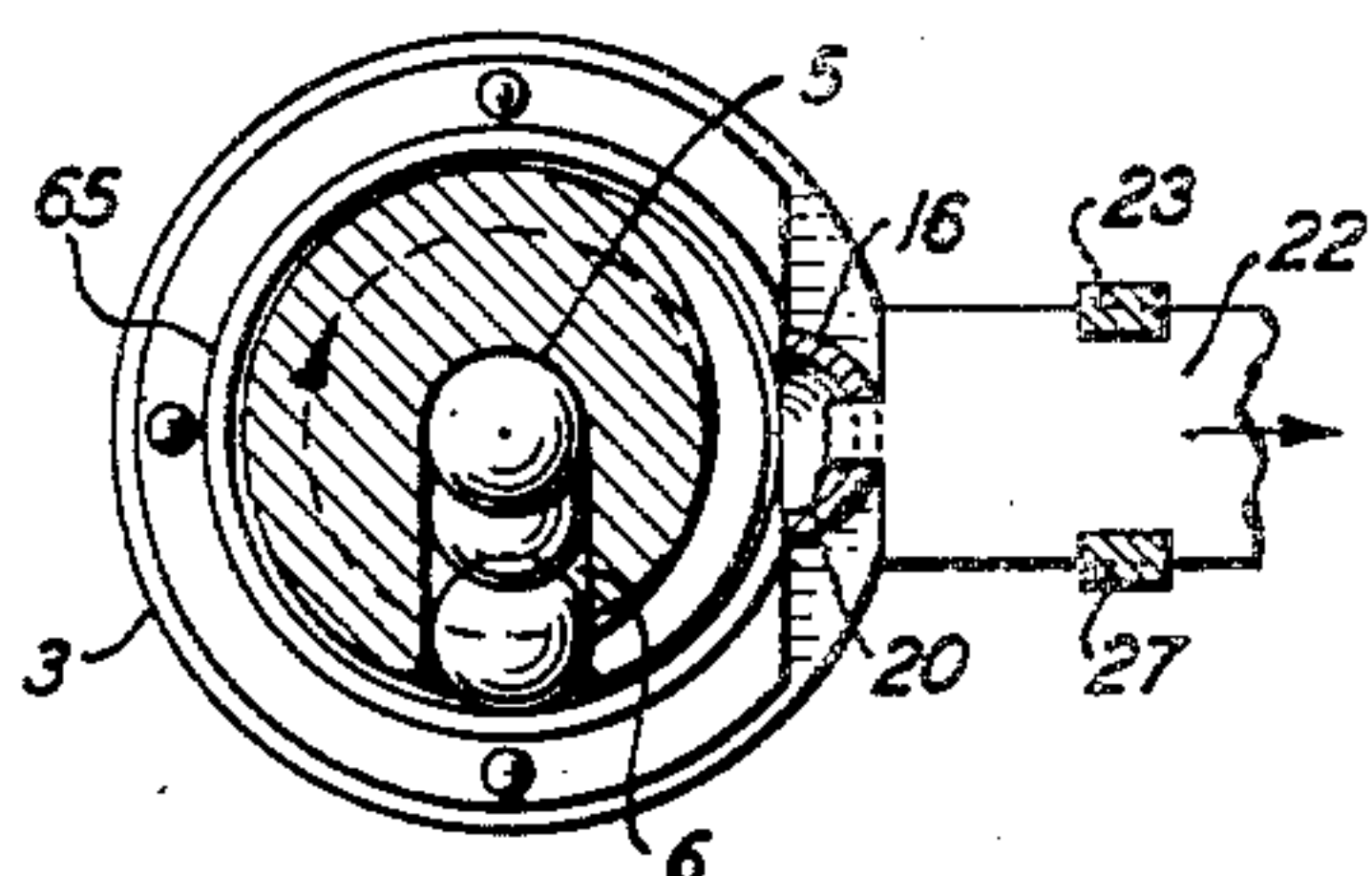


FIG. 5.

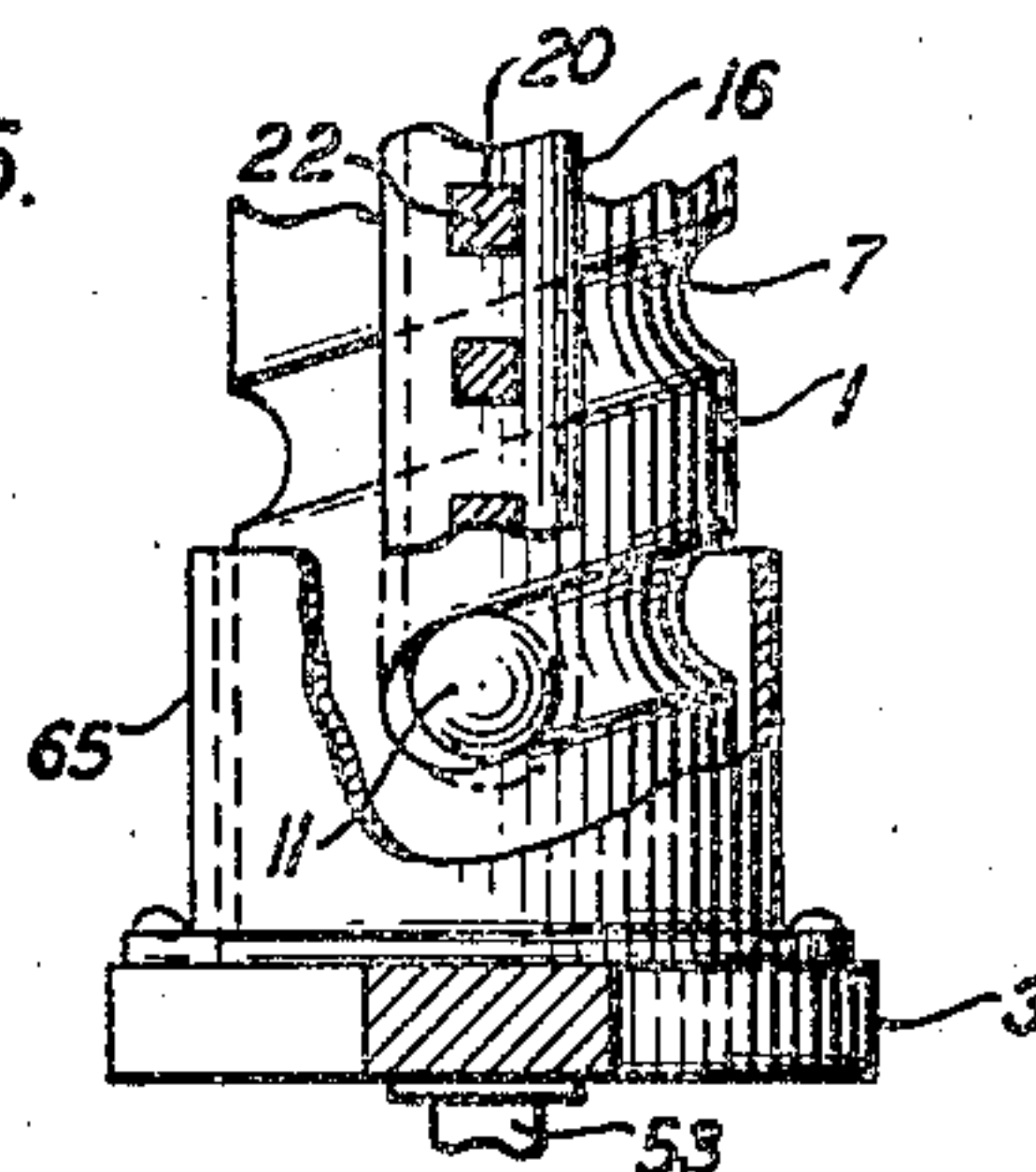
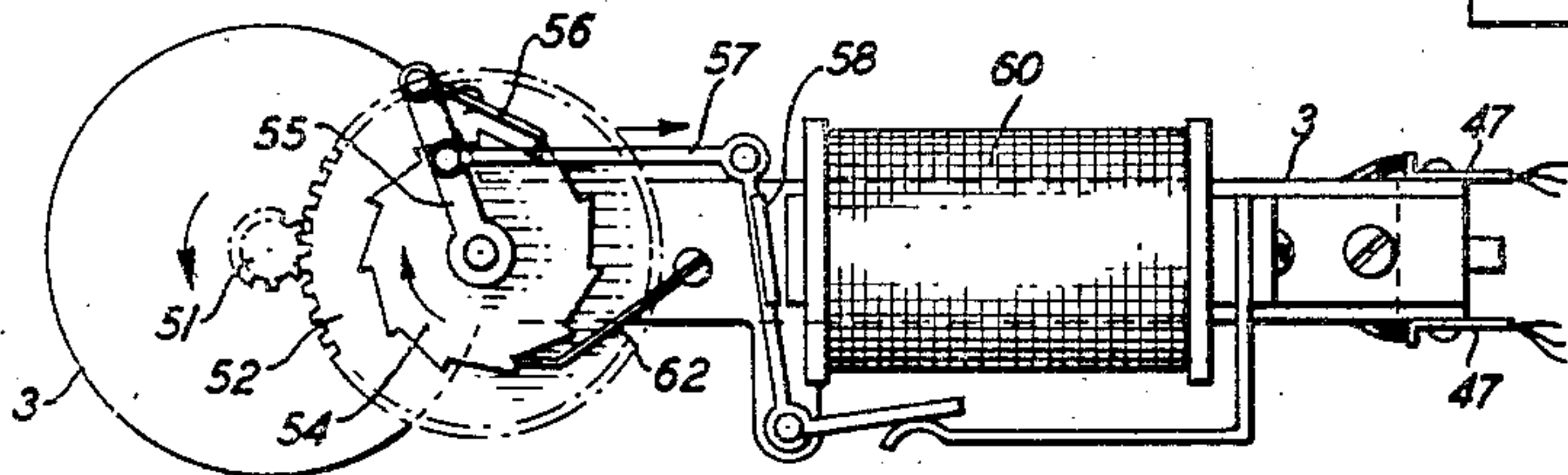


FIG. 4.



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2,406,028

CIRCUIT MAKER AND BREAKER

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Application November 1, 1944, Serial No. 561,400

7 Claims. (Cl. 200—1)

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This invention relates to contact operating mechanisms and particularly to such mechanisms in which succeeding circuit connections are made or broken during the operation thereof.

An object is to simplify and improve such mechanisms to reduce the cost thereof.

Heretofore various types of such mechanisms have been used in which by the operation of a stepping magnet, succeeding connections are momentarily established for each step of the magnet or where a series of succeeding connections are made or opened. In some instances a drum having cams or projections spirally arranged are used for the control of the connections.

The present invention relates to devices of these types and a feature thereof is a mechanism comprising a hollow shaft containing a plurality of operating elements, preferably in the form of balls, and having a thread cut on the outside thereof with guide means whereby one or more balls may be advanced by the thread in a straight line as the shaft is rotated by a step-by-step mechanism. The advanced balls are deposited into the shaft at one end and forced out from the opposite end by this guide and the thread and as the balls are advanced by the thread succeeding sets of contacts are operated thereby.

The invention has been illustrated in the accompanying drawing in which

Fig. 1 shows a front view of a mechanism embodying the applicant's invention.

Fig. 2 is a cross-section taken on line 2—2 of Fig. 1.

Fig. 3 is a similar cross-section to that shown in Fig. 2 with the shaft rotated a quarter of a turn.

Fig. 4 is a bottom view of the mechanism shown in Fig. 1.

Fig. 5 is a partial cross-section taken on line 5—5 of Fig. 1.

Referring now to the drawing, the mechanism shows a shaft or drum 1 mounted in bearings between the two frame members 2 and 3, which are connected at the right looking at Fig. 1 by means of a third frame member 4. This shaft is provided with an inside channel or tubular opening 5 running through the center of the shaft, this opening 5 extends at the bottom at 6 in an easy curve to the outside of the shaft into an outside thread 7 which extends to the top of the shaft where a similar opening 8 extends downwardly in an easy curve into the shaft to meet the opening 5. These openings 5, 7 and 8 are filled with balls 10, the last ball 11 lying at the end of opening 6 at the beginning of the thread 7. Along

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thread 7 may be placed one or more other balls. As shown in Figs. 1 and 2, two balls 13 and 14 have been so placed. These outside balls are covered by a guide or runway 16 lying alongside the shaft 1. This guide is at the bottom at 17 and at the top at 18 curved inwardly to guide the balls out and in of the openings 6 and 8, respectively. The guide is also provided with openings such as 20 appearing at a distance apart equal to one half of the pitch of thread 7. Protruding into the guide 16 through the openings 20 are the forward narrow ends of plates 22. These plates are of insulation material and slidably mounted in slots between the bars 23 to 26 which in turn are secured at opposite ends to the frame members 2 and 3. The narrow rear ends of these plates protrude through openings in the frame member 4. Each of the rear ends of the plates 22 is surrounded by a spring 30 abutting at one end against the members 4 and at the other end against washer 31 on the plate to normally maintain the forward end protruding a short distance through the opening 20 into the guide 16. At the narrow point and near edges of each of these plates are secured terminals 33 to 38 which are respectively and normally closely located near connecting rods 39 and 44 running perpendicularly across the plates 22 and the corresponding terminals of all the plates for the establishing of connections thereto when the plates are moved towards the right. These rods may be insulatedly connected at opposite ends to the frame members 2 and 3 by means of blocks such as 45 and 46 and individually connected to outside circuits, while the individual terminals on the plates may be similarly connected to outside circuits through terminals 47 mounted on frame member 4.

The shaft or bearing 50 for shaft 1 extends to the outside of the frame member 3 and is connected to a pinion 51 meshing with the gear 52, rotatably mounted on a shaft 53 secured to the frame member 3. On the outside of gear 52 is attached a ratchet wheel 54 and on the shaft 53 outside of the ratchet wheel 54 is also mounted a lever 55 having a pawl 56 engaging normally a tooth in the ratchet wheel 52. This lever 55 is connected to a link 57 which in turn is connected to an armature 58 controlled by a magnet 60 secured to the frame member 3. A holding pawl 62 is mounted on the frame member 3 to engage a tooth in the ratchet wheel 54.

The operation of this mechanism is as follows: The proportions of the pinion 51 and gear 52 and the distance of the teeth in the ratchet wheel 54 are such that on the energization of the mag-

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net 60 to attract its armature 58, the pawl 56 rotates the ratchet wheel the distance of one tooth which in turn causes the shaft 1 to rotate one-half turn. The shaft 1 in rotating this half turn causes the thread 7 to advance the balls 13 and 14 in the guide 16 half the distance of the pitch of the thread and in so doing, they will travel from engagement with one of the front ends of a member 22 to engage the front end of the next succeeding member 22 and thereby release the preceding members and push the succeeding members longitudinally towards the right locking at Fig. 1. This longitudinal movement of members 22 by the balls causes the corresponding terminals 33 to 38 on the released members to disengage respectively from the cross-rods 39 to 44, and the corresponding terminals on the advanced members to engage respectively these cross-rods. Thus six different connections are released and six made. It is understood, of course, that only one ball may be located in the guide 16 or a larger number of balls as desired to establish succeeding connections as the balls advance on each step of the stepping magnet 60. As an upper ball arrives at the position where it is engaged by the curved portion 18 of the guide 16 it will be forced into the curved portion 8 of the opening 5, thus pushing the other balls inside the shaft downwardly a corresponding distance. This downward movement of the balls in the opening 5 will force a succeeding ball out from the curved portion 16 into the thread 7 so that this ball will then on the next rotatory movement of the shaft be forced upward to engage a succeeding member 22. Sleeve 65 serves to hold the balls in the opening 5 during the rotation of the shaft. Thus through the stepping of the magnet 60 succeeding connections, are opened and made between succeeding groups of terminals and the cross-rods.

What is claimed is:

1. In a contact operating mechanism, a hollow shaft having a thread cut on the outside thereof, means for rotating said shaft, operating elements inside said hollow shaft and in said thread, means for advancing said elements in a straight line by the thread as the shaft is rotated with the elements deposited into the shaft from the thread at one end and forced out from the other end into the thread, and contact springs so located in relation to the elements that succeeding sets are actuated by the elements advanced by the threads.

2. In a contact operating mechanism, a shaft having an outside thread, means for rotating said shaft, sets of contact springs and means including a series of operating balls stored inside said shaft and one ball in said thread and controlled by the rotation of the shaft for advancing said balls in succession by said thread along said thread and through the storage space in said shaft and for operating a succeeding set of contact springs for each one-half turn of said shaft by said operating balls as they are advanced by said thread.

3. In a contact operating mechanism, sets of contact springs, a shaft having an outside thread cut therein, means for rotating said shaft, balls in a magazine inside said shaft and in said thread, guide means operative on rotation of said shaft for advancing said balls, received from the magazine at one end of the shaft and deposited at the

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other end into the magazine, along said thread and in succession and for actuating said sets of contact springs with said balls in the thread as they are advanced therein.

4. In a contact operating mechanism, sets of contact springs, a shaft having an outside thread cut therein, means for rotating said shaft, balls in a magazine inside said shaft, balls in said thread at predetermined distances apart, guide means operative on rotation of said shaft for advancing said balls in the thread for depositing them in succession in the magazine at one end of the shaft and for receiving other corresponding balls at the other end of the shaft from the magazine, and for actuating said sets of springs in succession by each of said balls in the thread as it is advanced therein.

5. In a contact operating mechanism, a hollow shaft having an outside thread cut therein, means for rotating said shaft, contact springs associated with said shaft, balls inside said hollow shaft, another ball in said thread and means operative when the shaft is rotated for causing said one ball to be advanced in said thread from one end of the shaft to the other to operate succeeding contact springs and for causing said one ball when driven to one end of said thread to be inserted inside said shaft and causing another ball inside said shaft to be removed therefrom and placed in said thread for succeeding operations of said springs by succeeding balls.

6. In a contact operating mechanism, contact springs, a shaft having a passage therethrough and a thread cut on the outside thereof, balls in said passage, balls deposited in said thread at intervals, a guide member holding said balls in the thread to prevent rotary motion of said balls around said shaft but permitting longitudinal movement of said balls along the thread when the shaft is rotated, guide means at one end of said guide member for guiding balls arriving at one end during the rotation of the shaft from the thread into the passage to force other balls in the passage toward the opposite end of the shaft to extrude a corresponding ball from said passage at the other end and guide means for guiding said extruded ball into the thread, said contact springs being so located in relation to the balls in the thread that on the travel of said balls in said thread from one end of the shaft to the other, said contacts are actuated by said balls in succession.

7. In a selector switch, a hollow shaft having an exterior screw thread cut thereon, means for rotating said shaft, contact springs arranged in rows alongside said screw thread, balls inside said shaft, another ball in said screw thread, means for holding said last-mentioned ball from movement in a direction transverse to said shaft and to permit said ball to be advanced by said set in a direction parallel to the shaft when the shaft is rotated, means at one end of the shaft for depositing said one ball inside said shaft when it has been advanced to said end and to cause said ball to shift the balls in the shaft in the opposite direction inside said shaft so as to expel the last ball inside the shaft out into the thread of the shaft and means for causing said ball advanced by the shaft during the rotation thereof to operate said contact springs in succession.

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