

Oct. 5, 1937.

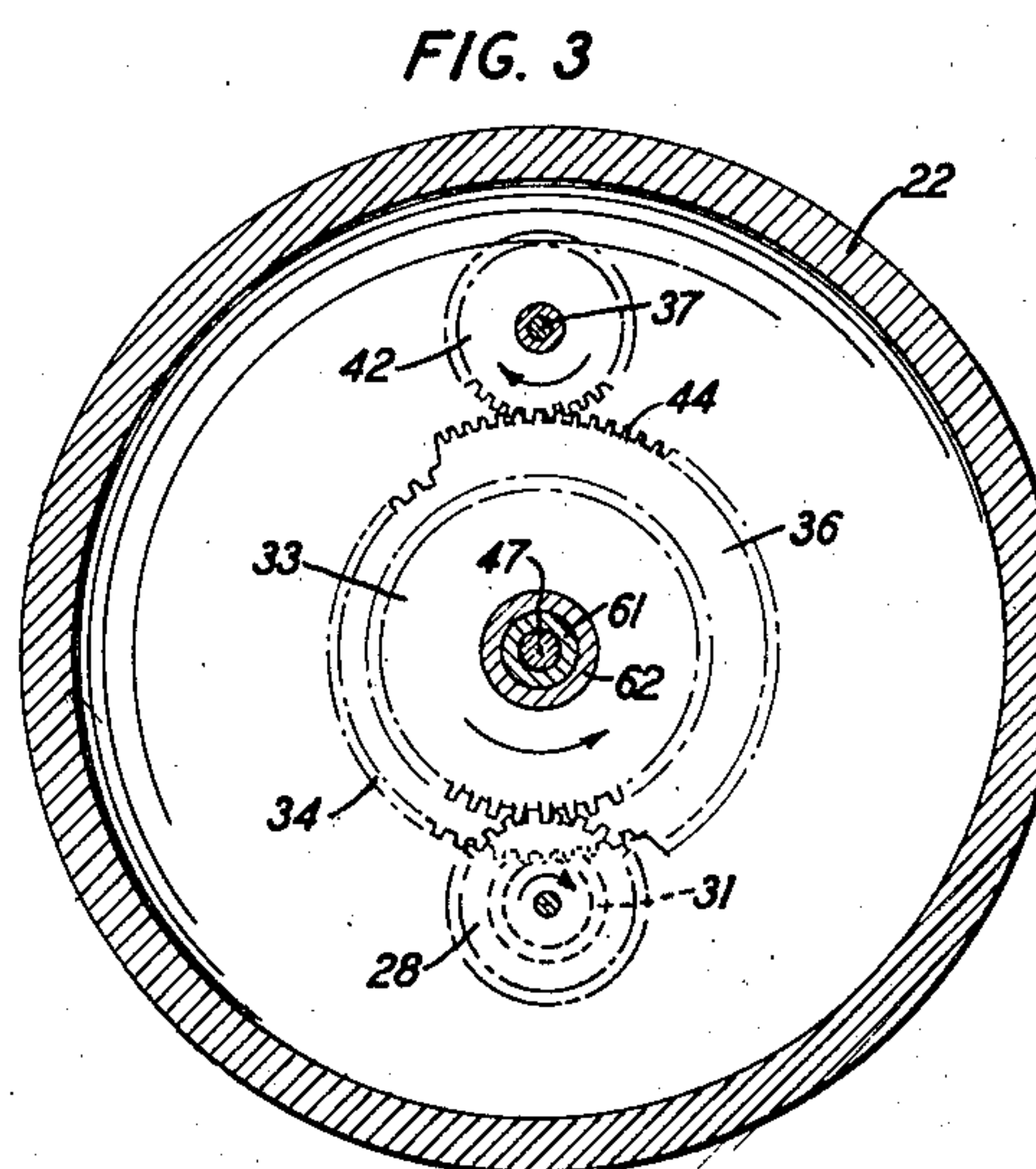
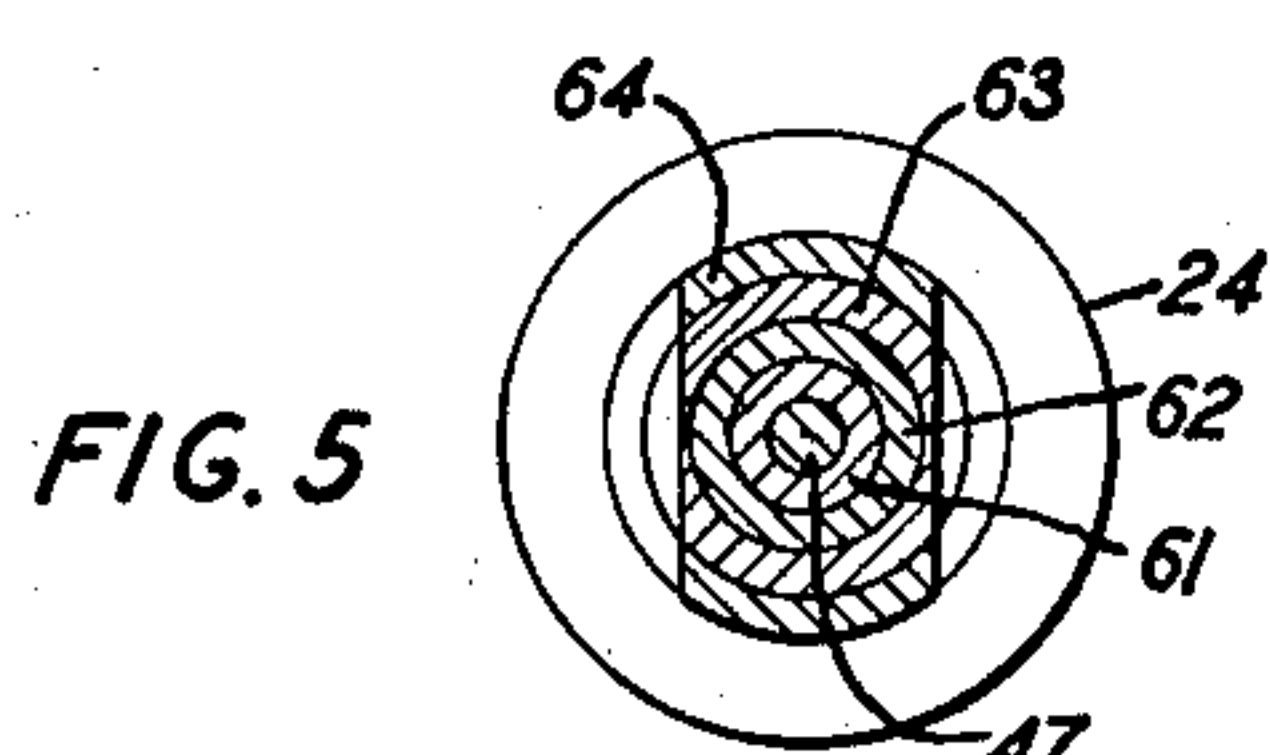
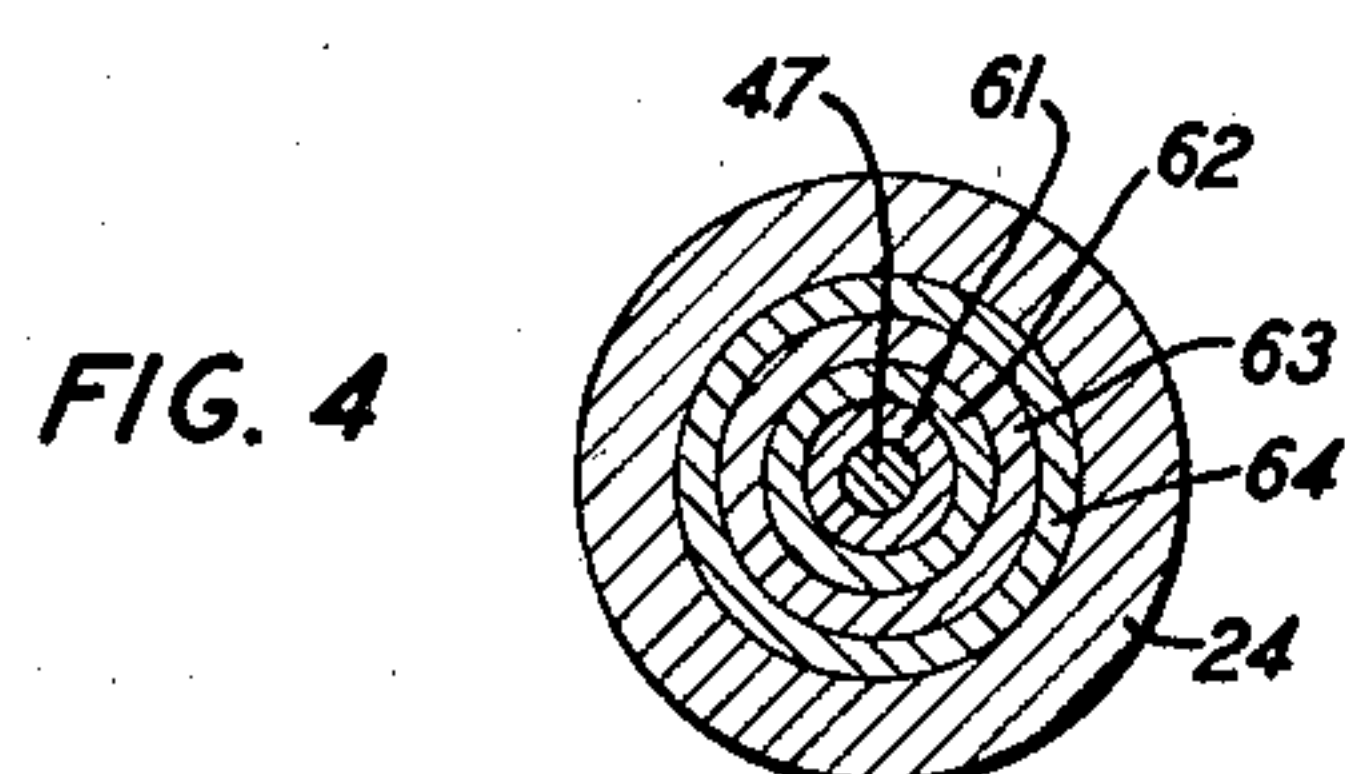
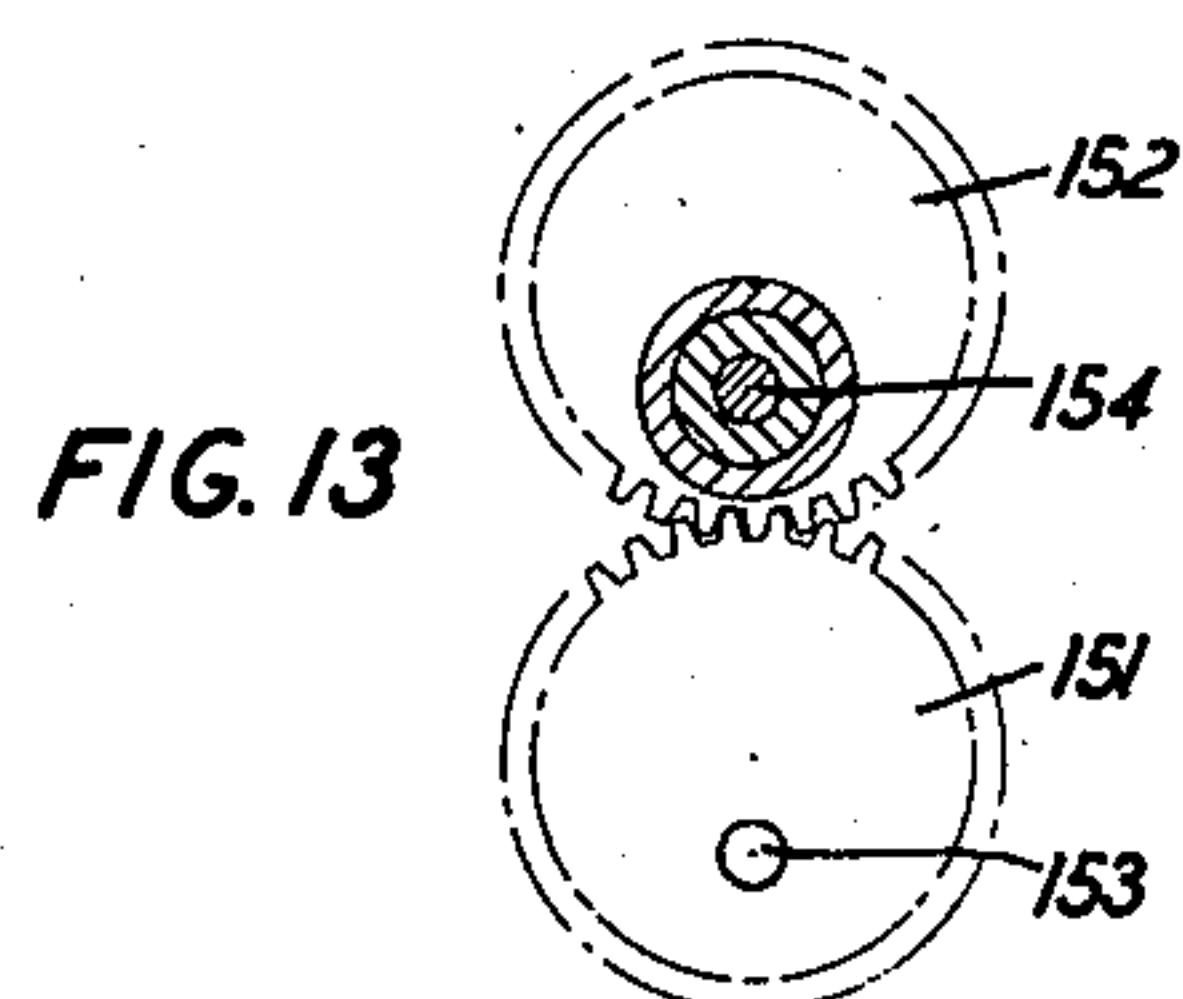
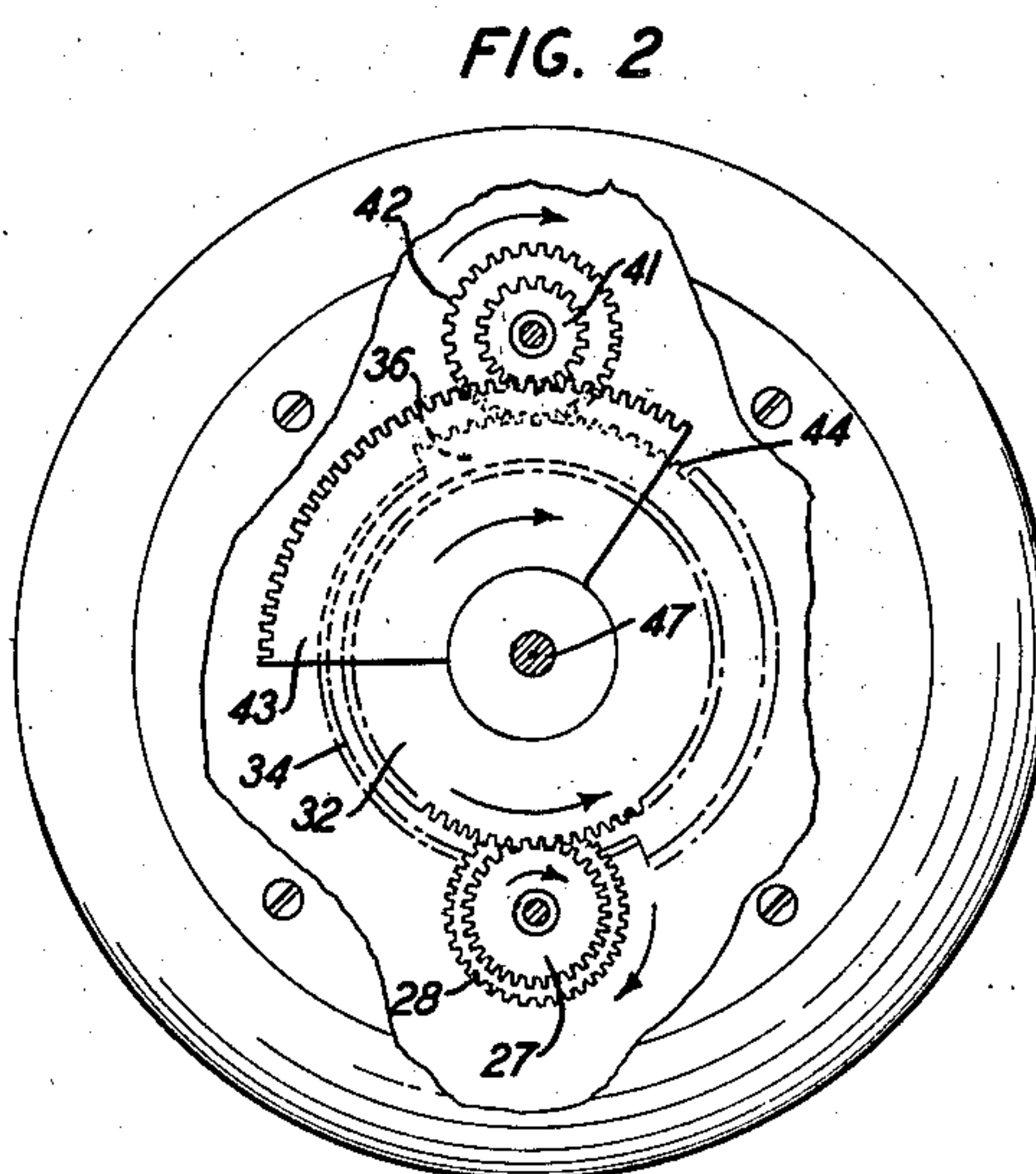
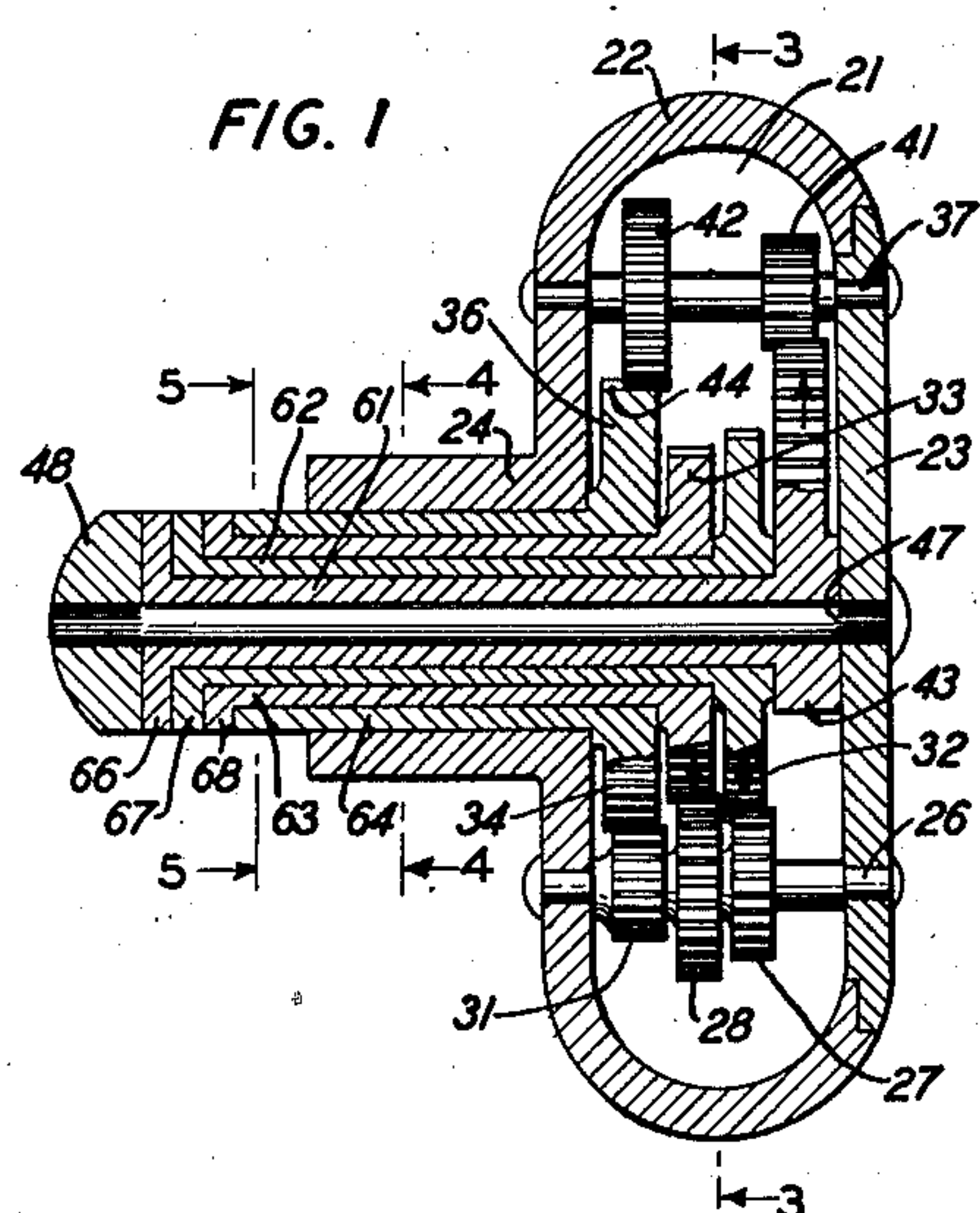
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2,094,574

LOCK

Original Filed March 17, 1936

2 Sheets-Sheet 1



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FIG. 6

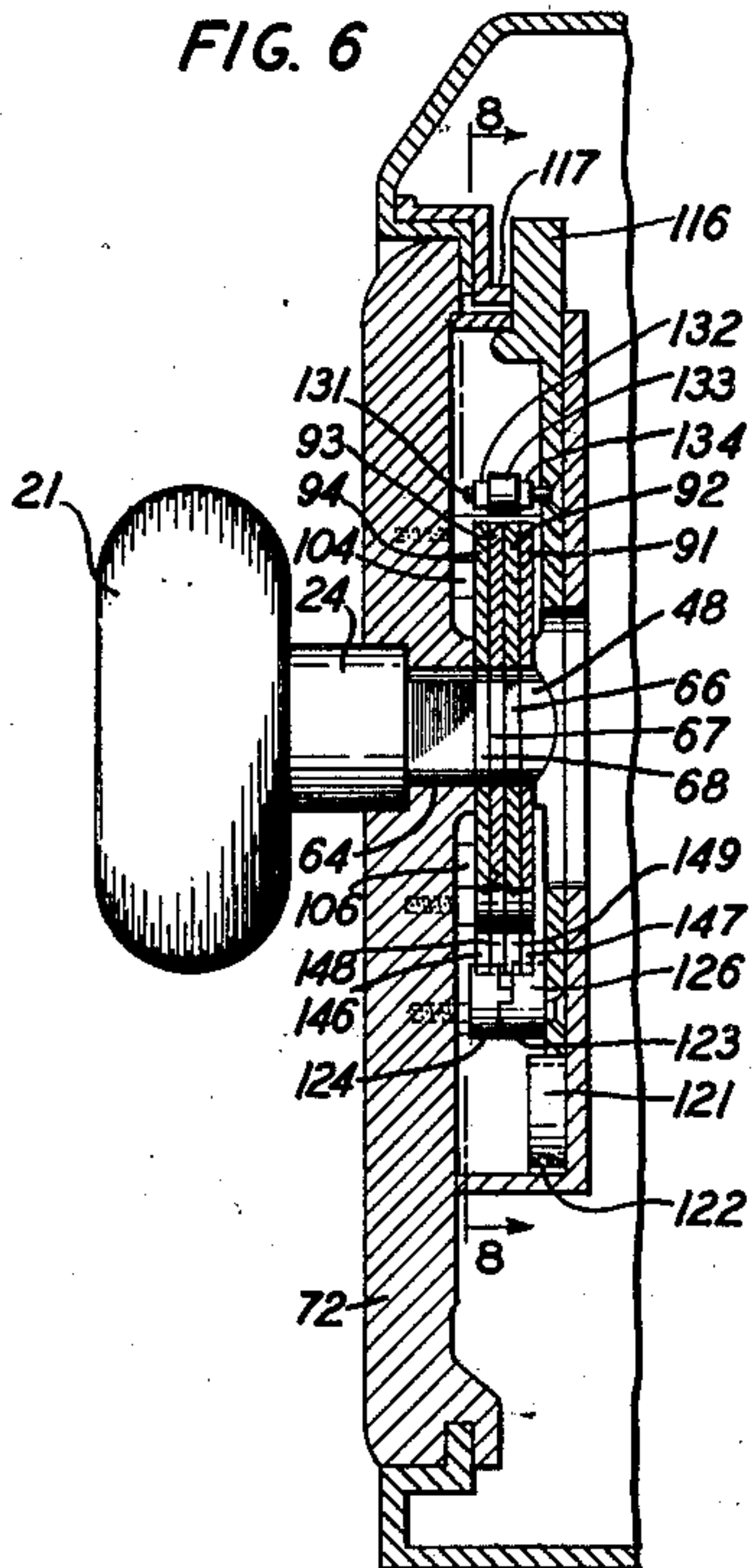


FIG. 7

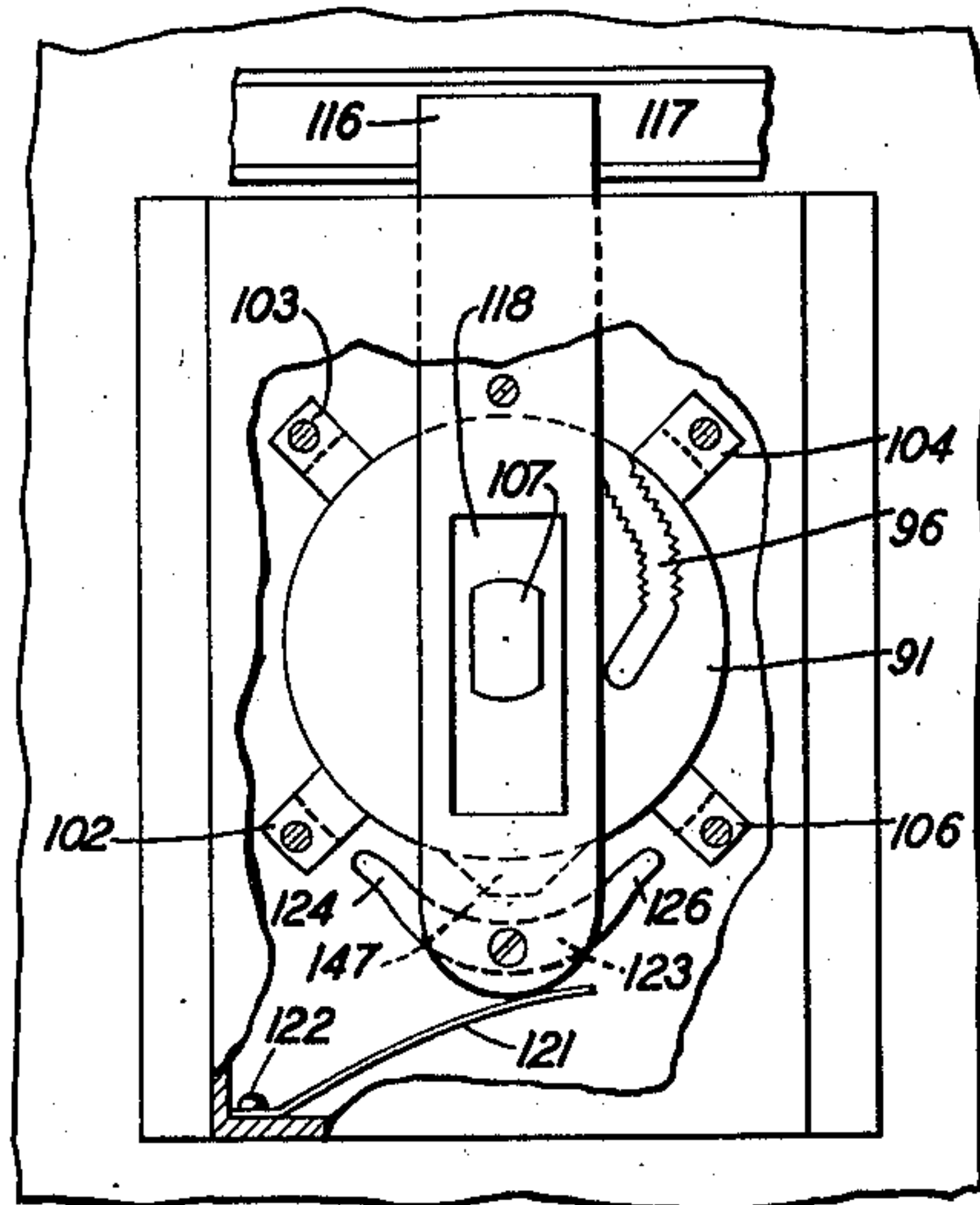


FIG. 12

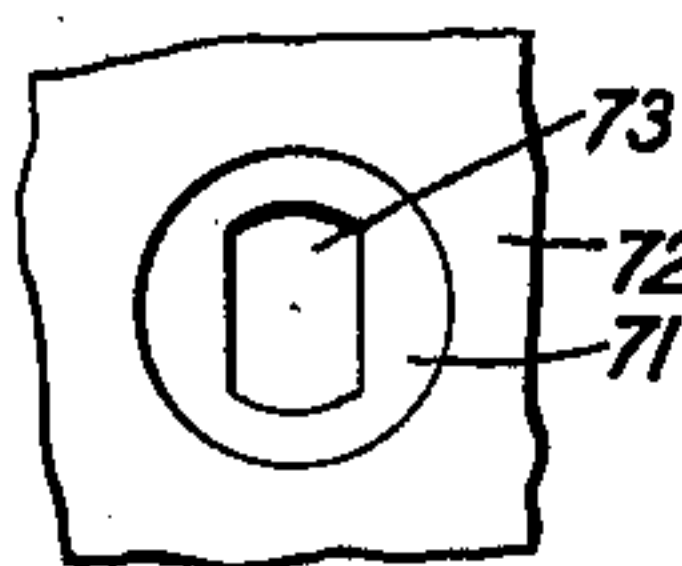


FIG. 11

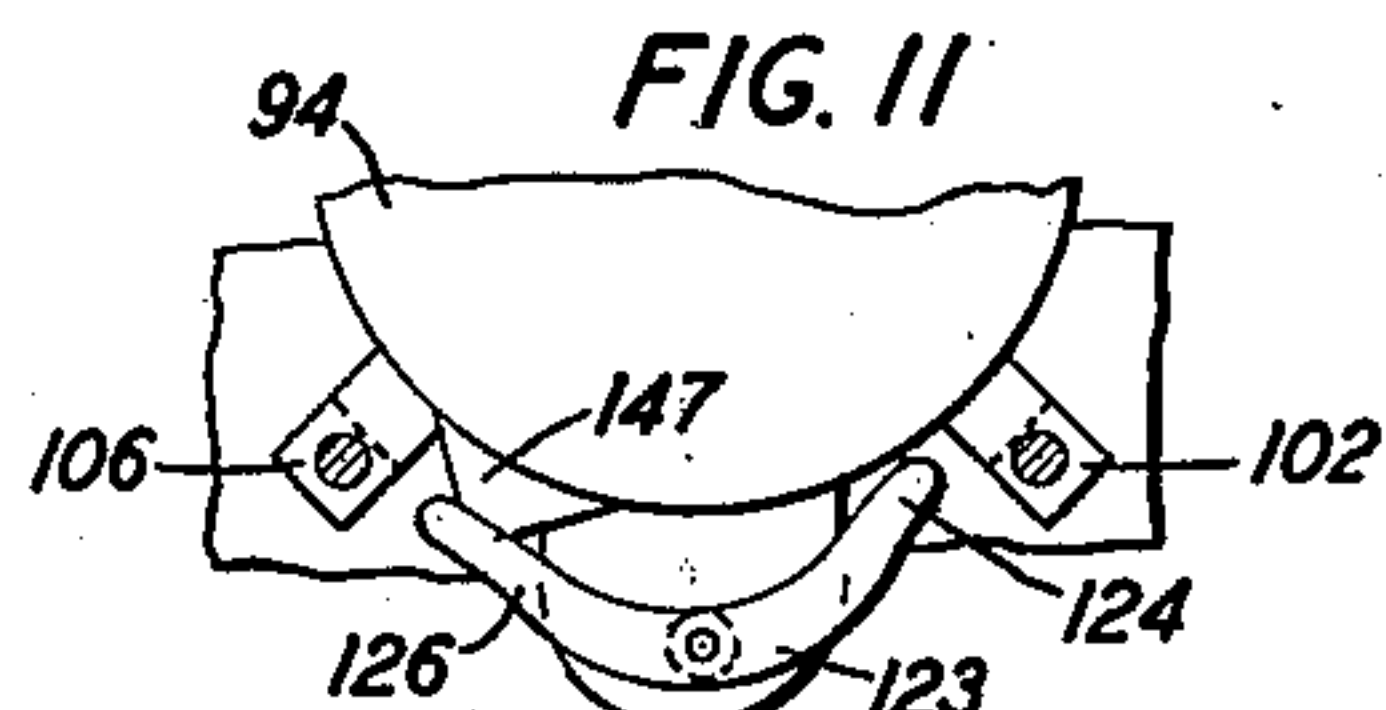


FIG. 8

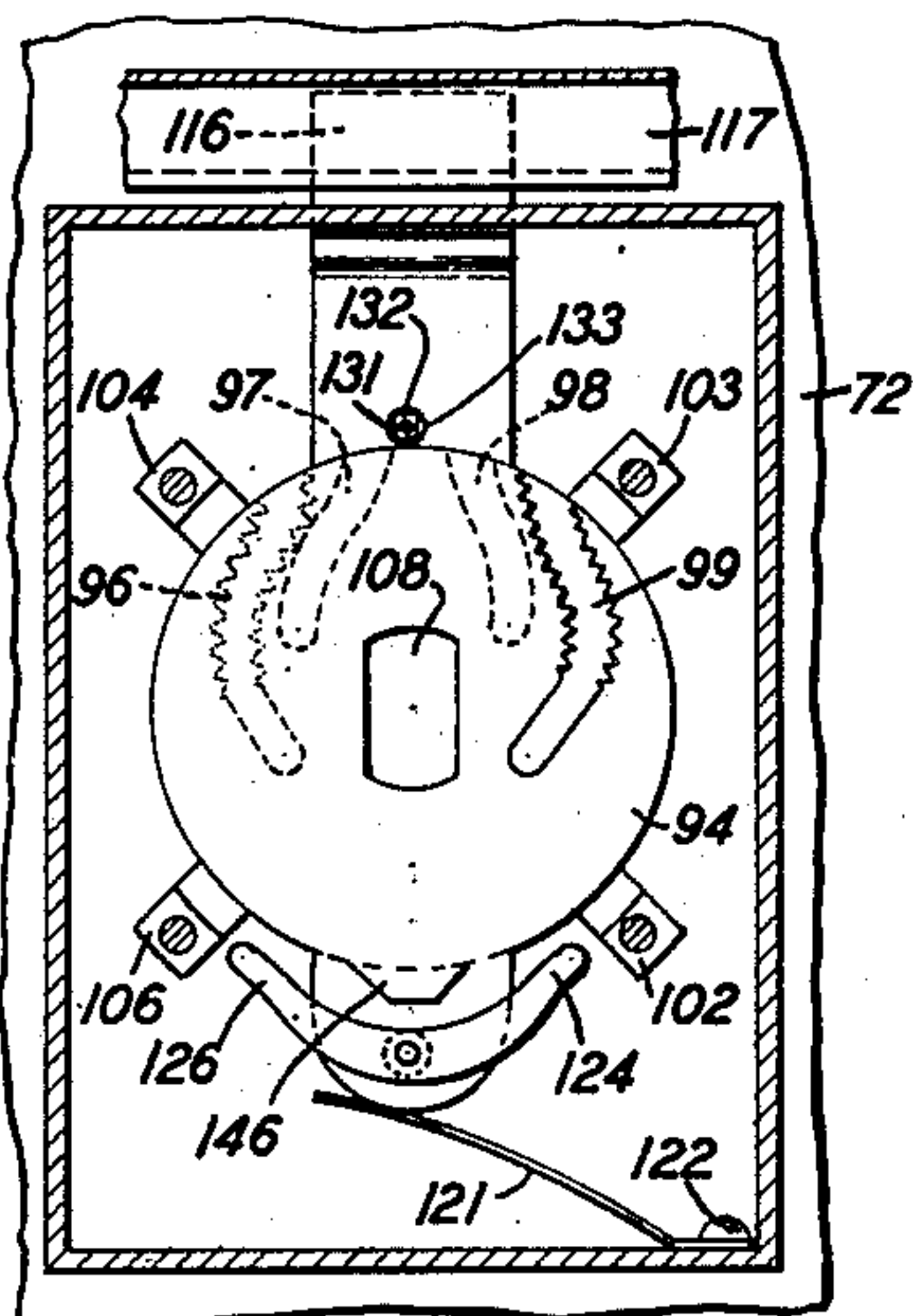


FIG. 9

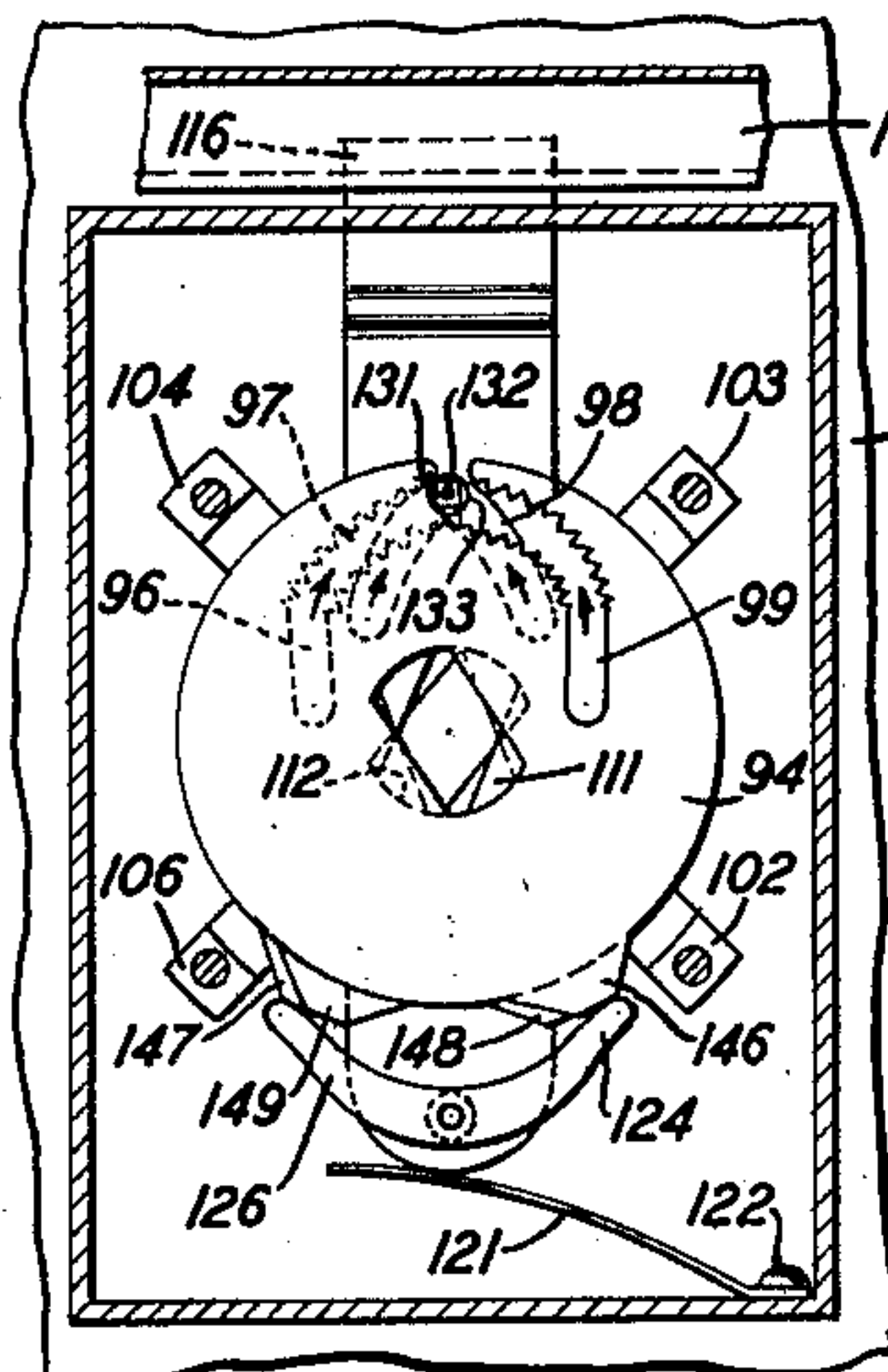
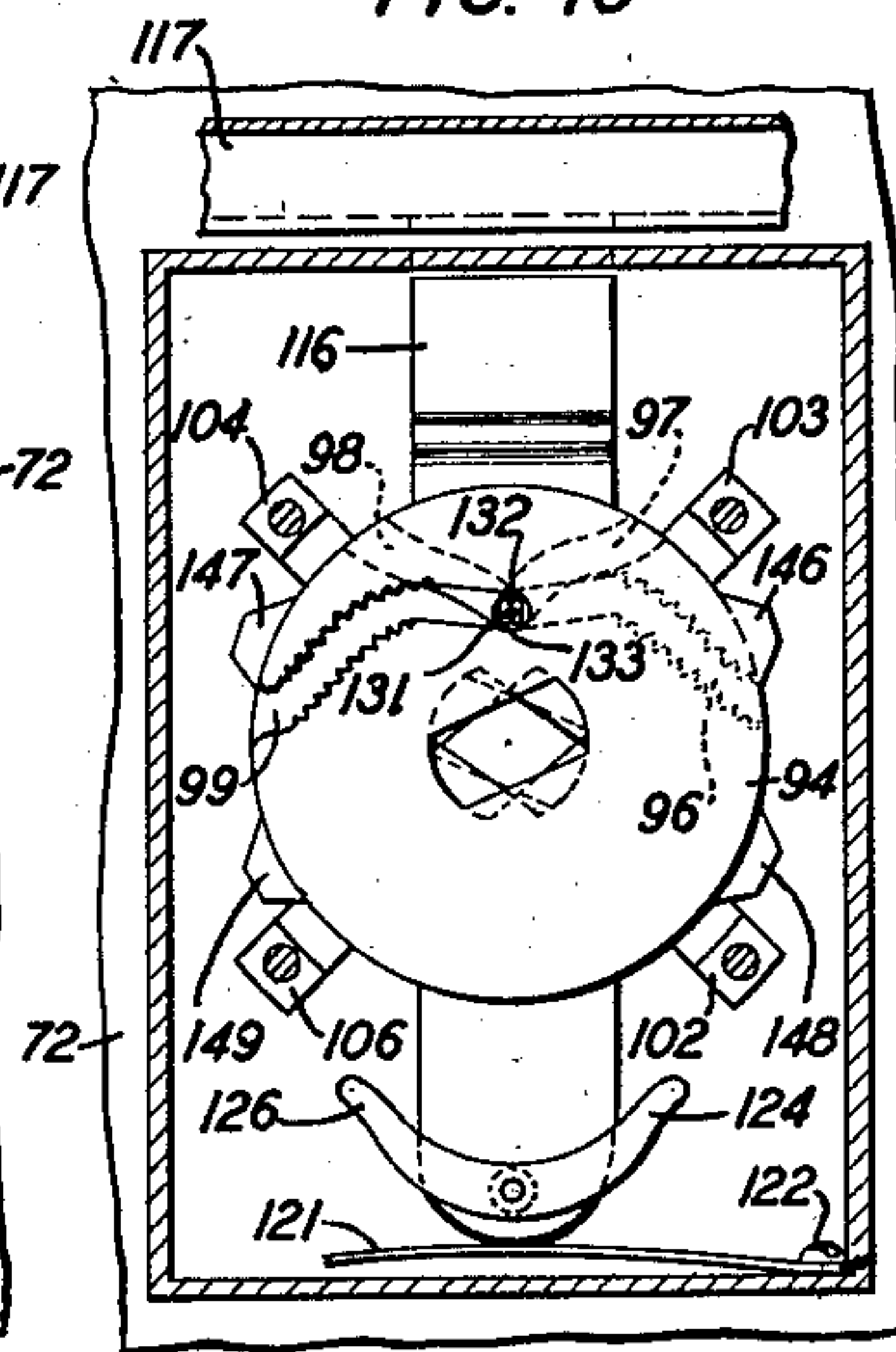


FIG. 10



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2,094,574

LOCK

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Continuation of application Serial No. 69,390,
March 17, 1936. This application October 6,
1936, Serial No. 104,266

17 Claims. (Cl. 70—355)

This invention relates to locks.

This application is a continuation of my ap-
plication Serial No. 69,390, filed March 17, 1936
entitled Locks and keys for operating the same.

An object of the invention is the prevention of
fraudulent operation of locks.

In accordance with a specific embodiment of
the invention the tumblers of the lock are in
the form of rotatable discs each of which is pro-
vided with a slot which follows an irregular
path. The lock is adapted to be operated by a
key of the type disclosed in my application Ser-
ial No. 88,857, filed July 3, 1936 entitled Keys.
In accordance with one specific arrangement of
the key as described in my copending applica-
tion just referred to it comprises a plurality of
concentric tubes or sleeves each of which ter-
minates in a flange. When the key is inserted
in the lock each flange is individually associated
with a tumbler. The tubes or sleeves are driven
through gears by the rotatable knob or hand
grip of the key; the flanges of the key individual-
ly rotating the tumblers of the lock at such rela-
tive speeds that corresponding portions of all
the slots are progressively aligned to cause and
to permit the linear movement down the slots
of a pin carried by the bolt, this movement re-
sulting in a retraction of the bolt.

A complete understanding of the operation of
the lock contemplated by the invention and of
the various advantageous features thereof may
be gained from a consideration of the following
detailed description and the annexed drawings
in which:

Figure 1 is a central sectional view of a key
of the type adapted to be used with the lock con-
templated by the present invention;

Fig. 2 is an end view of the key, a portion of the
end cover plate being broken away to show
parts of the operating mechanism;

Fig. 3 is a sectional view of the key taken on
line 3—3 of Fig. 1;

Fig. 4 is a sectional view of the key taken on
line 4—4 of Fig. 1;

Fig. 5 is a sectional view of the key taken on
line 5—5 of Fig. 1;

Fig. 6 is a view of the key positioned in a lock
of the type contemplated by the present inven-
tion, the lock being shown mounted on a cash
receptacle housing door, said lock and door
being shown in section;

Fig. 7 is a rear view of the structure shown in
Fig. 6, a portion of the door casing being broken
away to show parts of the lock;

Fig. 8 is a sectional view taken on line 8—8 of

Fig. 6, showing the positions of parts of the lock
when the bolt is in fully projected position;

Fig. 9 is a view similar to that of Fig. 8, the
bolt, however, being in partially retracted posi-
tion;

Fig. 10 is a view similar to that of Fig. 8,
the bolt, however, being in fully retracted posi-
tion;

Fig. 11 is a view of the lowermost portions of
the bolt and one of the tumblers showing the
result of a fraudulent attempt to operate the
lock without the proper key;

Fig. 12 is a view of a portion of the cash
receptacle housing door shown in Fig. 6, showing
the arrangement of the key receiving aperture
therein; and

Fig. 13 is a sectional view of a portion of the
key mechanism showing a modified form of
driving gears.

Referring now to the drawings, a key 21 is
shown in Fig. 1 which comprises a hand grip
portion 22 the shape of which is similar, in gen-
eral, to that of an ordinary door knob. The
hand grip portion is provided with an opening
on one side, this opening being normally closed
by plate 23, and terminates at its opposite side
in hub portion 24. Several gear wheels, the ar-
rangement and operation of which will be de-
scribed in detail in the following paragraphs,
are positioned within hand grip portion 22 while
sleevelike extensions of certain of these gears
project through hub portion 24 and form, so to
speak, the core of the key structure.

A shaft 26 (Fig. 1) is positioned within hand
grip portion 22, upon which shaft are fixedly
mounted gear wheels 27, 28 and 31. These gear
wheels are in mesh, respectively, with gear wheels
32 and 33 and geared segment 34 of plate 36.
(Figs. 1, 2 and 3.) A second shaft 37 (Fig. 1)
is also positioned within the hand grip portion,
gear wheels 41 and 42 being fixedly mounted on
this shaft. Gear wheels 41 and 42 are in mesh
respectively with geared sector 43 and with
geared segment 44 of plate 36.

A pin 47 passes through the center of the key
being anchored at one of its ends in cover plate 23
and at its other end in tip portion 48 of the key.
This pin, therefore, operatively connects tip 48 of
the key to the hand grip portion so that, when the
latter is rotated, tip 48 rotates in a corresponding
manner.

As shown in Figs. 1 and 4, the core of the key
structure is formed by a plurality of sleeve-like ex-
tensions of certain of the gear wheels and plates
housed within the hand grip, namely, sleeve 61

the extension of geared sector 43, sleeve 62 the extension of gear wheel 32, sleeve 63 the extension of gear wheel 33 and sleeve 64 the extension of plate 36.

5 As shown in Fig. 4 the core portion of the key, when viewed as a section through hub 24, is composed of a series of concentric circular elements, namely pin 47, the several sleeves referred to above and hub 24. However, as shown in Fig. 5, 10 the sleeves are, upon emergence from hub 24, flattened on two sides so that the portion of the core which projects from hub 24 presents a surface bounded on two sides by parallel straight faces and on the other two sides by arcs. The 15 reason for the provision of these flat faces will be apparent from the subsequent description of the operation of the key and lock.

Sleeve 61 terminates in flange 66 (Figs. 1 and 6), sleeve 62 in flange 67 and sleeve 63 in flange 68. 20 Each of these flanges, due to the flattening of the sides of the core of the key described above, presents a surface bounded on two sides by parallel straight faces and on the other two sides by arcs.

25 Subsequent to the description of the lock mechanism which is to follow, the operation of the key, the arrangement of which has been described above, will be described in detail. However, while still on the subject of the key it may be of 30 interest to consider very briefly its general method of operation. It is contemplated that, when the key is inserted in the lock (Fig. 6), the circular hub portion 24 will be positioned in circular aperture 71 (Fig. 12) of cash receptacle 35 door 72 while the flattened projecting portion of sleeve 64 will be positioned in aperture 73 of the door, aperture 73 being of such a shape and size that the end of sleeve 64 fits snugly therein.

Tip 48 and flanges 66, 67 and 68 of the key will, 40 when the key is inserted in the lock be positioned in intimate contact with apertures in the rotatable tumblers of the lock in such a manner that rotation of the tip and flanges causes a corresponding rotation of the respective associated 45 tumblers. As tip 48 is connected to cover plate 23 by pin 47 (Fig. 1) the tip will, of course, be rotated in the same direction and at the same speed as hand grip 22. The gearing arrangement is such (exact arrangement will be described subsequently) that flange 66 is also rotated in this 50 same direction but at only one-half the speed while flanges 67 and 68 are rotated in the opposite direction, the speed of rotation of flange 67 being the same as that of flange 66 and the 55 speed of rotation of flange 68 being the same as that of tip 48. When the key is inserted in the lock and rotated therefore, the tumblers associated with tip 48 and flange 68 are rotated at the same speed but in opposite directions while 60 the tumblers associated with flanges 66 and 67 are also rotated at the same speed but in opposite directions. This rotation causes operation of the lock in a manner which will be described in detail subsequently.

65 Turning now for the present from consideration of the key to that of the lock, there is shown in Fig. 6 a lock structure mounted on the door of the cash receptacle housing of a coin collector of the general nature described in Patent No. 1,043,219 70 issued November 5, 1912 to O. F. Forsberg. The lock structure includes four rotatable disc-like tumblers 91, 92, 93 and 94, each of which tumblers is provided with a slot which follows an irregular path, the paths of slot 96 in tumbler 91 and of 75 slot 99 in tumbler 94 being of similar contour but

extending in opposite relative directions and the paths of slot 97 in tumbler 92 and of slot 98 in tumbler 93 being of similar contour but extending in opposite directions. The four tumblers are supported in proper axial alignment by four sup- 5 porting tabs 102, 103, 104 and 105 (Fig. 7). The tumblers are so supported that each is free to rotate with respect to the others. Each of the tumblers is provided with an aperture, aperture 107 of tumbler 91 (Fig. 7) being of proper size and 10 shape to receive tip 48 of key 21, aperture 108 of tumbler 94 being of proper size and shape to receive flange 66 of the key, aperture 111 of tumbler 92 (Fig. 9) being of proper size and shape to receive flange 66 of the key and aperture 112 of 15 tumbler 93 (Fig. 9) being of proper size and shape to receive flange 67 of the key.

A bolt 116 is slidably supported in the lock casing, being adapted when projected to be positioned back of flange 117 of the cash receptacle 20 housing (Fig. 6) in order to prevent removal of the door from the housing. A rectangular opening 118 (Fig. 7) is provided in bolt 116. A leaf spring 121 is mounted in the lower part of the lock casing by means of screw 122 (Fig. 7) its free end 25 being in contact with the lower end of bolt 116 and normally holding said bolt in fully projected position.

A grapple shaped member 123 is pivotally mounted on the lower end of bolt 116 and com- 30 prises two arms 124 and 125 which arms are, as shown in Fig. 6, offset with respect to each other. Member 123 forms an important link in the mechanism included for preventing fraudulent operation of the lock as do also the serrated edges of 35 slots 96 and 99. This fact will be evident from the subsequent description of the operation of the lock.

A pin 131 (Fig. 6) is carried by bolt 116, a round rotatable bearing member 133 being mounted on 40 the pin between the two square shank portions 132 and 134.

Now that the general arrangement of the key and that of the lock have been considered let us assume that the key be inserted in the lock (Fig. 45 6) and that hand grip 22 be rotated in a clockwise direction in order to unlock the lock. As briefly described above this clockwise rotation of hand grip 22 will result in rotation of tip 48 in a clockwise direction and at the same speed as hand 50 grip 22, rotation of flange 66 in a clockwise direction at one-half the speed of hand grip 22, rotation of flange 67 in a counterclockwise direction at one-half the speed of hand grip 22 and rotation of flange 68 in a counterclockwise direction at the 55 same speed as hand grip 22. We will now see just how these relative speeds and directions of rotation are brought about.

As pointed out above, when hand grip 22 is rotated, rotation of sleeve 64 (and plate 36) is 60 prevented due to contact of the flattened end portion of the sleeve with aperture 73 of door 72 (Fig. 12). As hand grip 22 is rotated in a clockwise direction we have, therefore, (plate 36 remaining stationary), rotation of gear wheel 31 65 in a clockwise direction, as it is meshed with geared segment 34, and rotation of gear wheel 42 in a clockwise direction as it is in mesh with geared segment 44.

Now as gear wheels 31, 28 and 27 are all keyed 70 to shaft 26, rotation of gear wheel 31 in a clockwise direction causes rotation of gear wheels 28 and 27 in a clockwise direction and at the same speed as gear wheel 31 and, as gear wheels 42 and 41 are both keyed to shaft 37, rotation of gear 75

wheel 42 in a clockwise direction causes rotation of gear wheel 41 in a clockwise direction and at the same speed as gear wheel 42.

Rotation of gear wheel 28 in a clockwise direction causes rotation of gear wheel 33, as well as sleeve 63 and flange 68, in a counterclockwise direction, the ratio of the gears being such that the speed of rotation of gear wheel 33 is the same as that at which hand grip 22 is rotated. Flange 68 and tip 48 therefore rotate at the same speed but in opposite directions.

Rotation of gear wheel 27 in a clockwise direction causes rotation of gear wheel 32, as well as sleeve 62 and flange 67, in a counterclockwise direction, the ratio of the gears being such that the speed of rotation of gear wheel 32 is one-half that at which hand grip 22 is rotated. Flange 67, therefore, rotates at one-half the speed of tip 48 and in the opposite direction.

Rotation of gear wheel 41 in a clockwise direction results in rotation of geared sector 43, as well as sleeve 61 and flange 66, in a clockwise direction, the ratio of the gear wheels being such that the speed of rotation of geared sector 43 is one-half that of hand grip 22. Flange 66, therefore, rotates in the same direction as tip 48 but at only one-half the speed.

As pointed out above, tip 48 is, when the key is inserted in the lock, positioned in aperture 107 of tumbler 91, flange 69 is positioned in aperture 108 of tumbler 94, flange 67 is positioned in aperture 112 of tumbler 93 and flange 66 is positioned in aperture 111 of tumbler 92, so that, when hand grip 22 is rotated, each of the tumblers is rotated in the same direction and at the same speed as that of the particular flange which is associated with it.

The relative positions of the tumblers at the time the key is inserted and before rotation thereof is shown in Fig. 8. It will be seen that retraction of the bolt is prevented due to contact of pin 131 and the upper edge of tumblers 91, 92, 93 and 94. It will also be apparent from casual inspection of this figure that slot 99 of tumbler 94 and slot 96 of tumbler 91 are of equal length and slope but extend in generally opposite directions with respect to the vertical center line of the bolt, that slot 98 of tumbler 93 and slot 97 of tumbler 92 are also of equal length and slope and extend in opposite directions and, further, that the lengths and slopes of the two last mentioned slots are one-half those of the two first mentioned. It will be apparent from this that, in order to secure the progressive coincidence of the slots necessary to permit retraction of the bolt, tumblers 91 and 94 should be rotated at the same speed but in opposite directions, that tumblers 92 and 93 should be rotated at the same speed but in opposite directions and that the speed of rotation of the last mentioned pair of tumblers should be one-half that of the first mentioned pair. As described above, key 21 is adapted, when rotated, to produce this exact movement of the lock tumblers.

Now as the key is rotated in a clockwise direction as mentioned above, lug 146 carried by tumbler 94 and lug 147 carried by tumbler 91 are brought into contact with the tips of arms 124 and 126, respectively, contact being made at exactly the same moment with each arm so that, as shown in Fig. 9, bolt 116 is drawn down a certain distance against the action of spring 121. Due to the synchronized movement of the tumblers which is caused by the key mechanism as described above, the open ends of slots 96, 97, 98

and 99 are brought into full coincidence just as pin 131 is brought into position to enter said slots by partial retraction of the bolt. (Fig. 9.) Thereupon, bearing surface 133 of pin 131 is engaged by the sides of slots 97 and 98 and, as movement of the tumblers continues, this engagement is effective to pull the pin down, and to cause retraction of bolt 116.

Keeping in mind the relative lengths and slopes of slots 96, 97, 98 and 99 and the relative rates and directions of rotation of tumblers 91, 92, 93 and 94, the progressive movement of the slots from the position of Fig. 8 (bolt fully projected) to that of Fig. 9 (bolt partially retracted) and finally to that of Fig. 10 (bolt fully retracted) may be easily visualized.

It is believed that it will be clear from the above that retraction of the bolt can only be brought about by rotation of the tumblers at exact predetermined speeds and directions which rotation can, as a matter of fact, be achieved only by the use of a properly designed key. That is to say, it would be next to impossible for an unlawful person to individually manipulate the tumblers by any other means in such a manner that the bolt would be retracted. In the first place tumblers 94 and 91 must be so rotated that lugs 146 and 147 will contact the respective arms 124 and 126 of member 123 at exactly the same instant in order that bolt 116 will be retracted sufficiently to bring pin 131 into the path of slots 97 and 98. (It will be evident, of course, that rotation of the tumblers when the bolt is in the position shown in Fig. 8 will have no tendency to cause retraction of the bolt inasmuch as pin 131 is out of the path of the slots.) As shown in Fig. 11 should the tumblers be so rotated that lug 147 contacts arm 126 at a time when lug 146 is not in contact with arm 124, member 123 will merely rotate about its pivot and allow lug 147 to pass, no retraction of the bolt being caused. The same action results, of course, if lug 146 contacts arm 124 at a time when lug 147 is not in contact with arm 126.

Lugs 146 and 147, in addition to their "safety" feature just referred to, serve also in the capacity of counterweights to normally hold the associated tumblers in the position of Fig. 8. A like service is rendered by lugs 148 and 149 provided on tumblers 93 and 92 respectively. It is desirable that the tumblers normally be in the position shown in Fig. 8 in order that the apertures 107, 108, 111 and 112 will be aligned whereby the key may be readily inserted.

In addition to the synchronized movement of tumblers 91 and 94 just referred to it is further necessary for retraction of the bolt that tumblers 92 and 93 be so rotated that, at the instant of contact between lugs 146 and 147 and arms 124 and 126, the open ends of slots 97 and 98 will coincide with the open ends of slots 96 and 99 in order that pin 131 may enter therein. The four tumblers must then be so rotated that portions of the four slots are progressively aligned in order to provide a path for pin 131. The serrated edges of slots 96 and 99, which were referred to above, render fraudulent operation of the device even more difficult for if the slots are not aligned at the exact predetermined rate the square shank portions 132 and 134 carried by the pin 131 will engage in the teeth of the slots and prevent further movement of the pin and bolt. The slots are so designed, however, that when the tumblers are rotated by a properly designed key, the pin will "clear" the edges of slots 96 and 99.

While simple gear forms producing regular movements of the key parts have been described, it will be understood that other gear forms producing irregular movements of the key parts may be used. For example, it is well known that a variable speed mechanism will result if two gears of equal diameter be meshed, their shafts each being placed off center an equal distance from the center of the respective gear. Such a well known expedient may be made use of in the key described above in order to produce a variable movement of desired parts of the key. For example, as shown in Fig. 13, two of the gears of the key, gear 151 (corresponding to gear 28 of key 21), and gear 152 (corresponding to gear 33 of key 21), may be mounted on shafts 153 and 154 respectively which shafts are each off center an equal amount with respect to the centers of the respective gears. Operation of the key will then of course result in a variable speed movement of the part driven by gear 152. It is not believed necessary to show other parts of the key or to describe the operation of the modified form in detail inasmuch as the use of off-center gears is, as mentioned above, well known and it will be understood that the general arrangement and operation of the modified type of key will be similar to that of the key shown in Fig. 1 and described in detail previously.

While the above description relates primarily to the unlocking operation, it will be evident that the locking operation is just the reverse of the unlocking procedure. For example, it will be apparent that counter-clockwise rotation of the key, after the fully retracted position of Fig. 10 has been reached, will cause rotation of the tumblers in directions opposite to those described in connection with the unlocking method, the resulting action of slots 97 and 98 being to force pin 131 and bolt 116 back to the position at which the pin emerges from the path of the slots. When this point is reached and the pin is freed of restraint by the slots, spring 121 acts to urge bolt 116 into the fully projected position of Fig. 8.

While certain specific embodiments of the invention have been described above, the invention is by no means limited in its application to those embodiments described. For example, it will be evident that more than four tumblers (or less than four) may be utilized, that the shapes of the slots may differ from those illustrated and that various relative movements of the tumblers may be introduced. In short the embodiments described should be considered as illustrative of the invention rather than as restrictive thereof.

What is claimed is:

1. A lock comprising a bolt, a projection on said bolt and a plurality of key operated tumblers for controlling retraction of the bolt, said tumblers comprising rotatable discs, each of said discs having a curved slot therein, certain of said slots extending in one direction and others of said slots extending in another direction, said projection being positioned in said slots during retraction of said bolt.

2. A lock comprising a bolt, a projection on said bolt and a plurality of rotatable key operated tumblers for controlling retraction of the bolt, each of said tumblers having a curved slot therein, certain of said slots extending in one direction and others of said slots extending in another direction, said projection being positioned in said slots when the bolt is in unlocked position, and being positioned outside said slots when the bolt is in locked position.

3. A lock comprising a bolt and a plurality of rotatable discs for controlling retraction of the bolt, each of said discs having a slot therein, the slots being so shaped and the discs being so positioned with respect to each other that, as the discs are rotated at predetermined relative speeds, portions of each of the slots are progressively brought into registry, the portions of the slots in registry at any one time being relatively short as compared to the entire length of the slots.

4. A lock comprising a bolt, a projection on said bolt, and a plurality of key operated tumblers for controlling retraction of the bolt, said tumblers comprising rotatable discs, each of said discs having a slot therein, certain of said slots being provided with serrated edges, said projection being positioned in said slots during retraction of the bolt.

5. A lock comprising a bolt, a projection on said bolt, and a plurality of key operated tumblers for controlling retraction of the bolt, said tumblers comprising rotatable discs, each of said discs having a slot therein, certain of said slots being provided with serrated edges, and others of said slots being provided with smooth edges, said projection being positioned in said slots during retraction of the bolt, the portions of said projection which are adapted to be positioned in the serrated slots being provided with straight sides and the portions of said projection which are adapted to be positioned in the smooth slots being provided with round sides.

6. A lock comprising a bolt, a plurality of rotatable key operated tumblers, said tumblers being normally free to rotate without causing movement of said bolt, projections on certain of said tumblers, and means carried by said bolt for cooperating with said projections to bring said bolt and said tumblers into cooperative position whereby movement of said tumblers will result in movement of said bolt.

7. A lock comprising a bolt, a plurality of rotatable key operated tumblers, said tumblers being normally free to rotate without causing movement of said bolt, projections on certain of said tumblers, and a double-ended pivoted member carried by said bolt for cooperating with said projections to bring said bolt and said tumblers into cooperative position whereby movement of said tumblers will result in movement of said bolt.

8. A lock comprising a bolt, a projection on said bolt, a plurality of rotatable key operated tumblers for controlling retraction of the bolt, each of said tumblers having a slot therein, said projection being outside the path of said slots when the bolt is in projected position, projections carried by two of said tumblers, a double ended arm rotatably mounted on said bolt, simultaneous contact of one of said tumbler projections with one end of said arm and of the other of said tumbler projections with the other end of said arm being effective to bring said bolt projection into the path of said slots.

9. A lock comprising a bolt, a plurality of key operated rotatable tumblers for controlling the retraction of said bolt, a projection on said bolt movable towards the axis of said tumblers for bolt retraction, said tumblers being interposed in the path of said projection to normally prevent the retraction of said bolt, each of said tumblers having a slot following a non-linear path to receive said projection for bolt retraction, certain of said slots extending in one direction and

others of said slots extending in another direction.

10. A lock comprising a bolt, a plurality of key operated rotatable tumblers, a projection on said bolt movable towards the axis of said tumblers for bolt retraction, said tumblers being interposed in the path of said projection to normally prevent the retraction of said bolt, each of said tumblers having an elongated slot, the side walls of said slots camming said projection to retract said bolt when said tumblers are rotated in certain different predetermined relative directions.

11. A lock comprising a bolt, a plurality of key operated tumblers for controlling the retraction of said bolt, said tumblers being freely rotatable when said bolt is fully projected, a projection on said bolt movable towards the axis of said tumblers for bolt retraction, said tumblers being interposed in the path of said projection to normally prevent the retraction of said bolt, each of said tumblers having a curved slot for receiving said projection during bolt retraction, certain of said slots extending in one direction and others of said slots extending in another direction.

12. A lock comprising a bolt, a plurality of key operated discs for controlling the retraction of said bolt, said discs being freely rotatable when said bolt is in its fully projected position, a projection on said bolt movable towards the axis of said discs for bolt retraction, one of said discs having an elongated slot following a curved path, a second of said discs having an elongated slot following a path of different curvature whereby only short portions of said slots may be brought into registry at one time, said slots receiving said projection for bolt retraction.

13. A lock comprising a bolt, a projection on said bolt, a plurality of rotatable tumblers each having a slot following a non-linear path, certain of said slots extending in one direction and others extending in another direction, said slots receiving said projection when said tumblers are rotated to bring said slots into registry and the walls of said slots camming said projection as the rotation of the tumblers is continued to cause

the retraction of said bolt, said lock having a key opening and being operable by a key means insertable in said opening for rotating said tumblers.

14. A lock comprising a bolt, a projection on the bolt and a plurality of rotatable discs for controlling retraction of the bolt, each of said discs having a slot therein, the slots being so shaped and the discs so positioned with respect to each other that, as the discs are rotated at predetermined relative speeds, portions of each of the slots are progressively brought into registry, said projection on the bolt being positioned in the slots during retraction of the bolt, said lock being operable by means adapted to rotate said discs to bring portions of said slots into registry to retract the bolt at such a speed that the projection thereon moves linearly within the slots as portions thereof are brought into registry.

15. A lock comprising a bolt, a projection on said bolt and a plurality of rotatable discs for controlling retraction of the bolt, each of said discs having a curved slot therein, certain of said slots being of greater length than others of said slots, said projection being positioned in said slots during retraction of said bolt.

16. A lock comprising a bolt, a projection on said bolt and a plurality of rotatable discs for controlling retraction of the bolt, each of said discs having a curved slot therein, certain of said slots being of greater length than others of said slots, and certain of said slots extending in one direction and others of said slots extending in another direction, said projection being positioned in said slots during retraction of said bolt.

17. A lock comprising a bolt, a plurality of rotatable key operated tumblers, said tumblers being normally free to rotate without causing movement of said bolt, a projecting member carried by said bolt, and means carried by certain of said tumblers for cooperating with said member carried by the bolt to bring said bolt and said tumblers into cooperative position whereby movement of said tumblers will result in movement of said bolt.

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