

Sept. 29, 1953

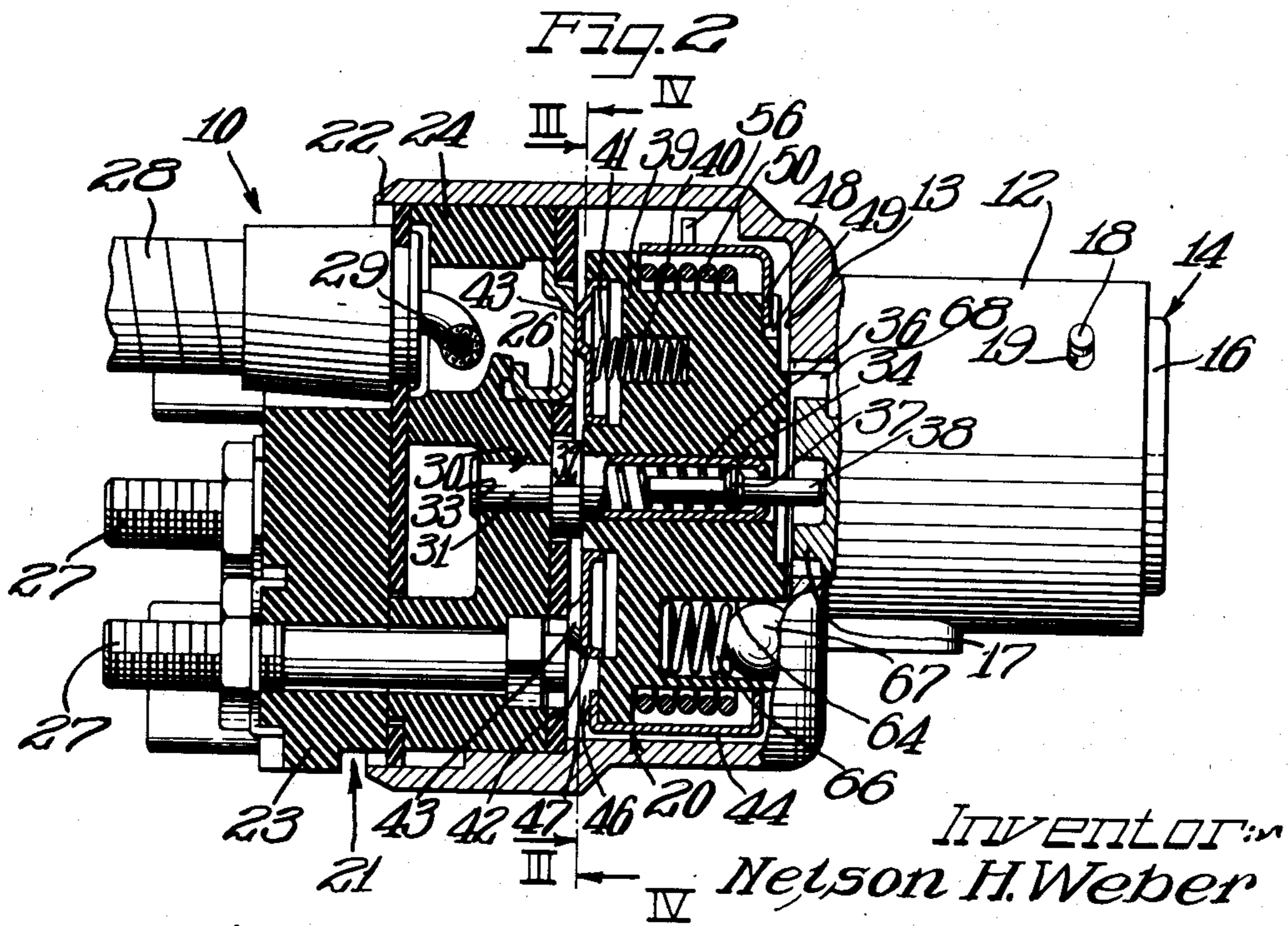
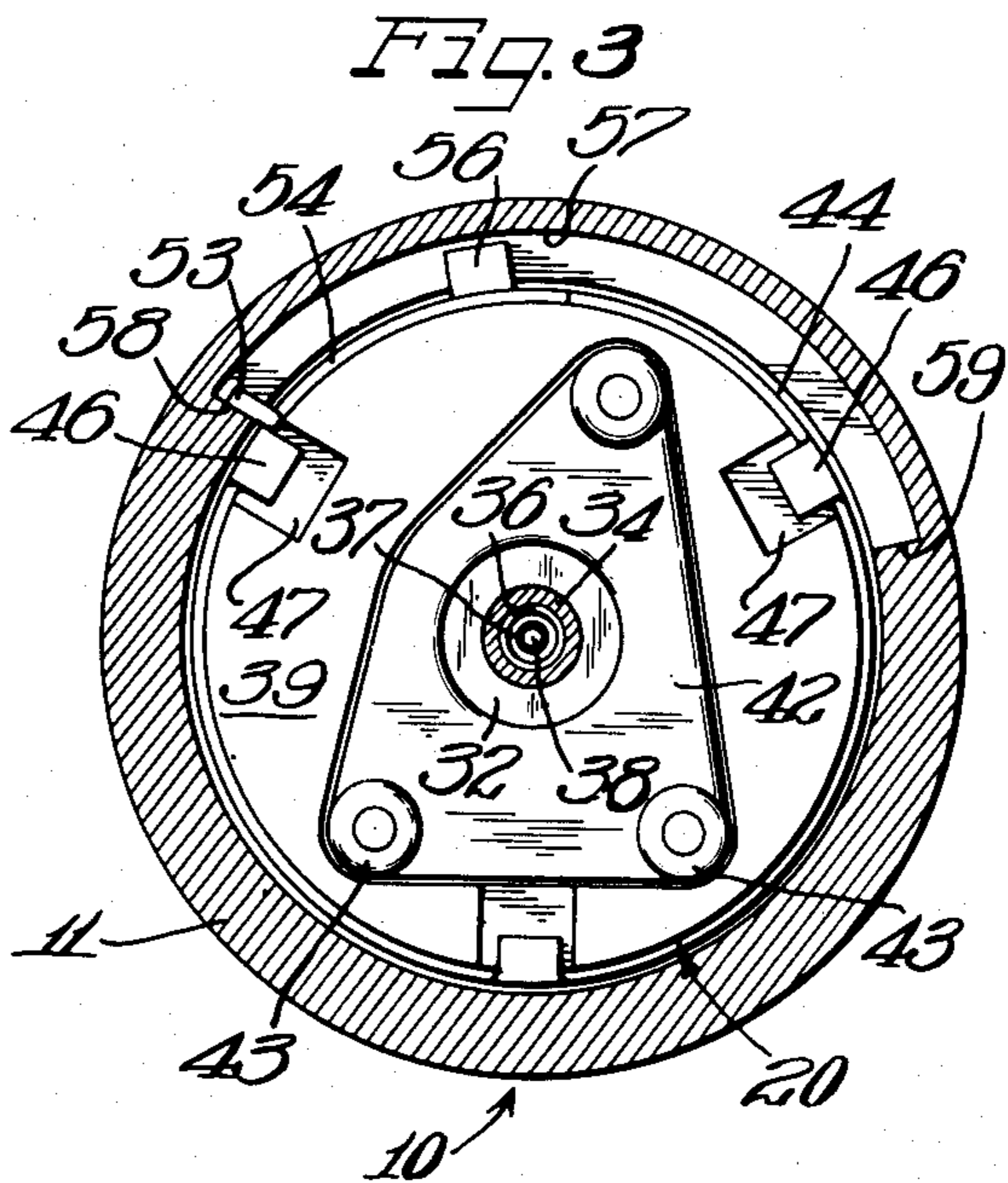
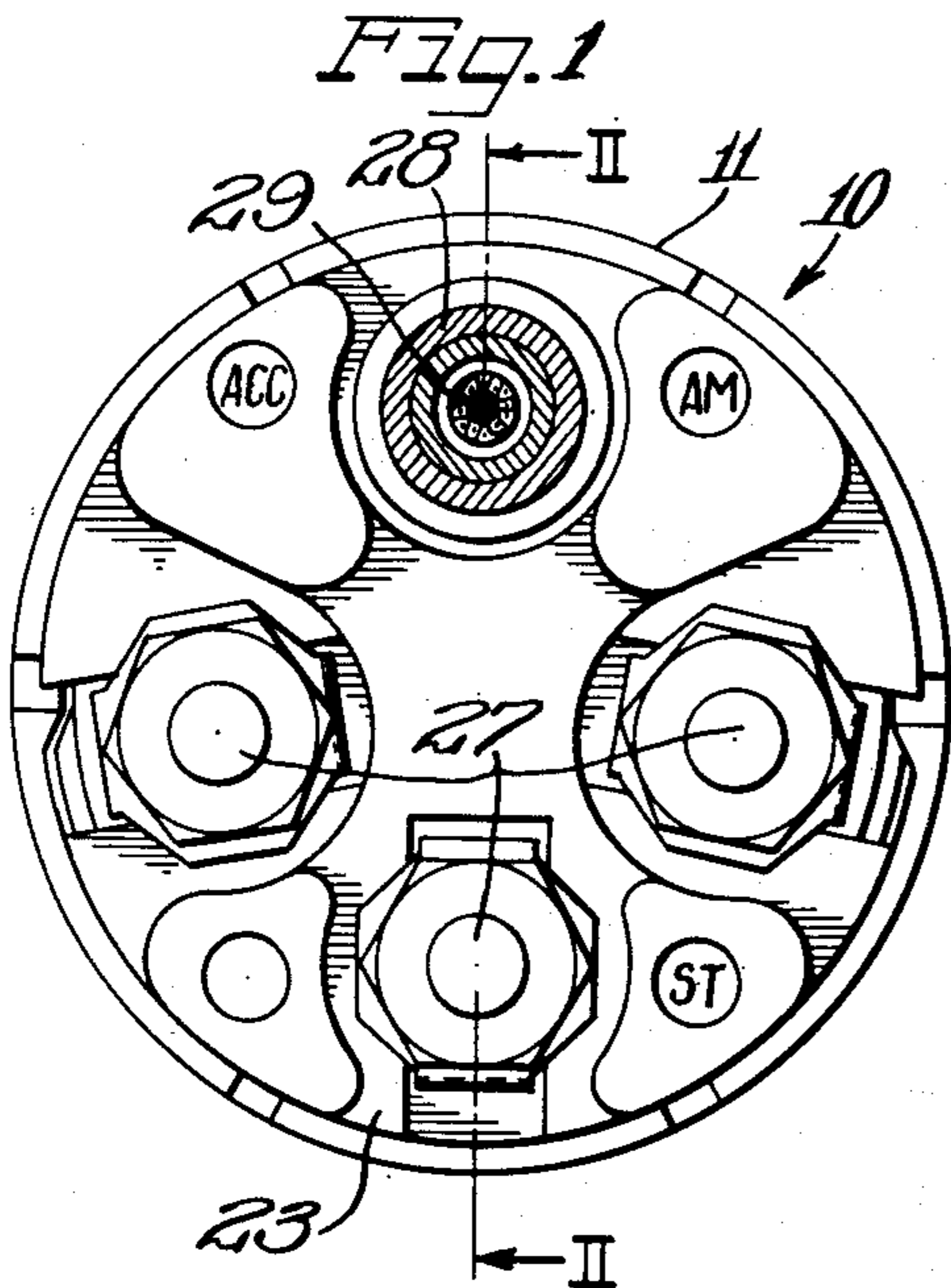
N. H. WEBER

2,654,005

COMBINED STARTER AND IGNITION SWITCH

Filed July 26, 1951

2 Sheets-Sheet 1



INVENTOR

Nelson H. Weber

BY *Neil Sherman, Morris Gross & Company* ATTYS

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2 Sheets-Sheet 2

Fig. 4

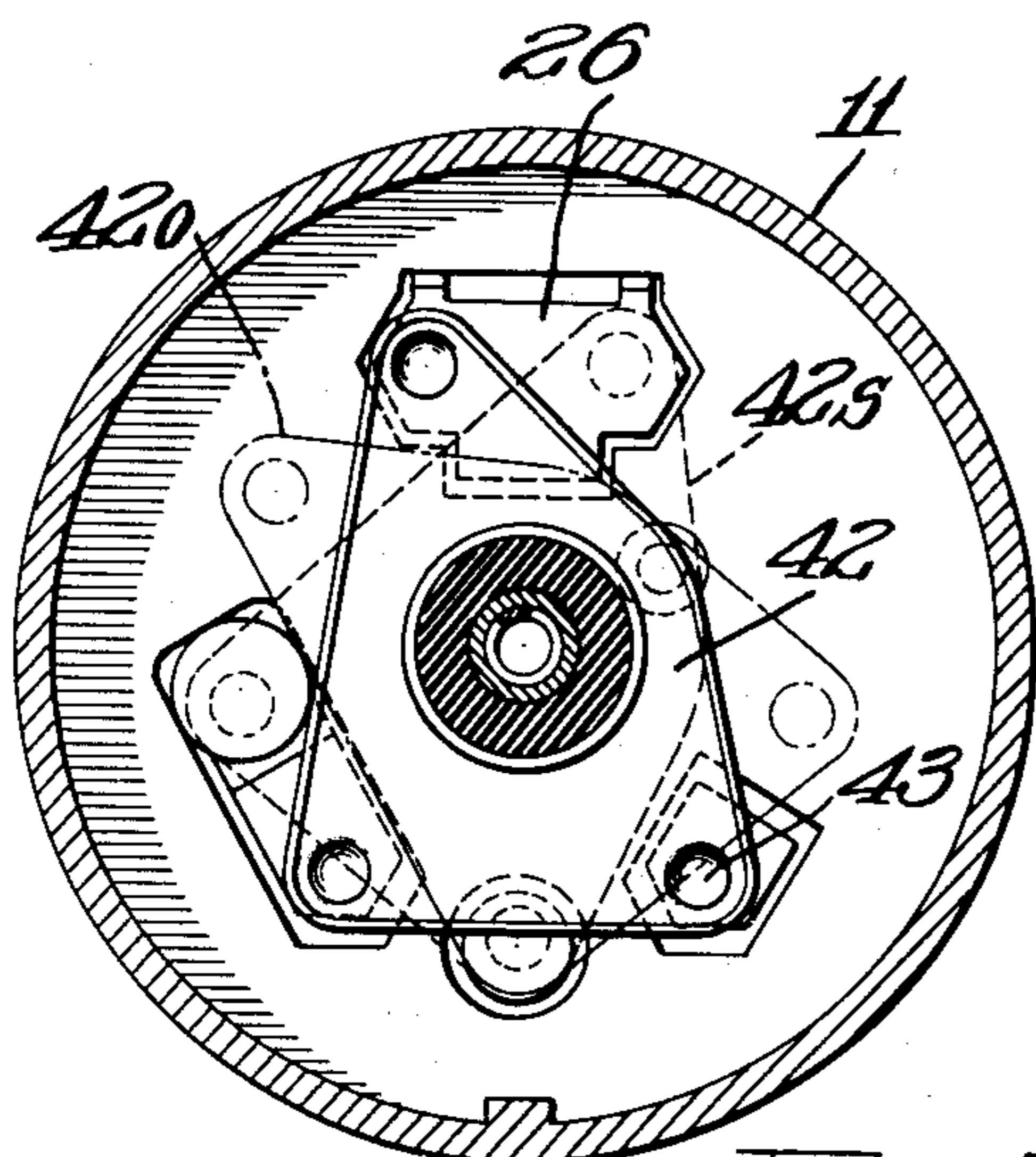


Fig. 5

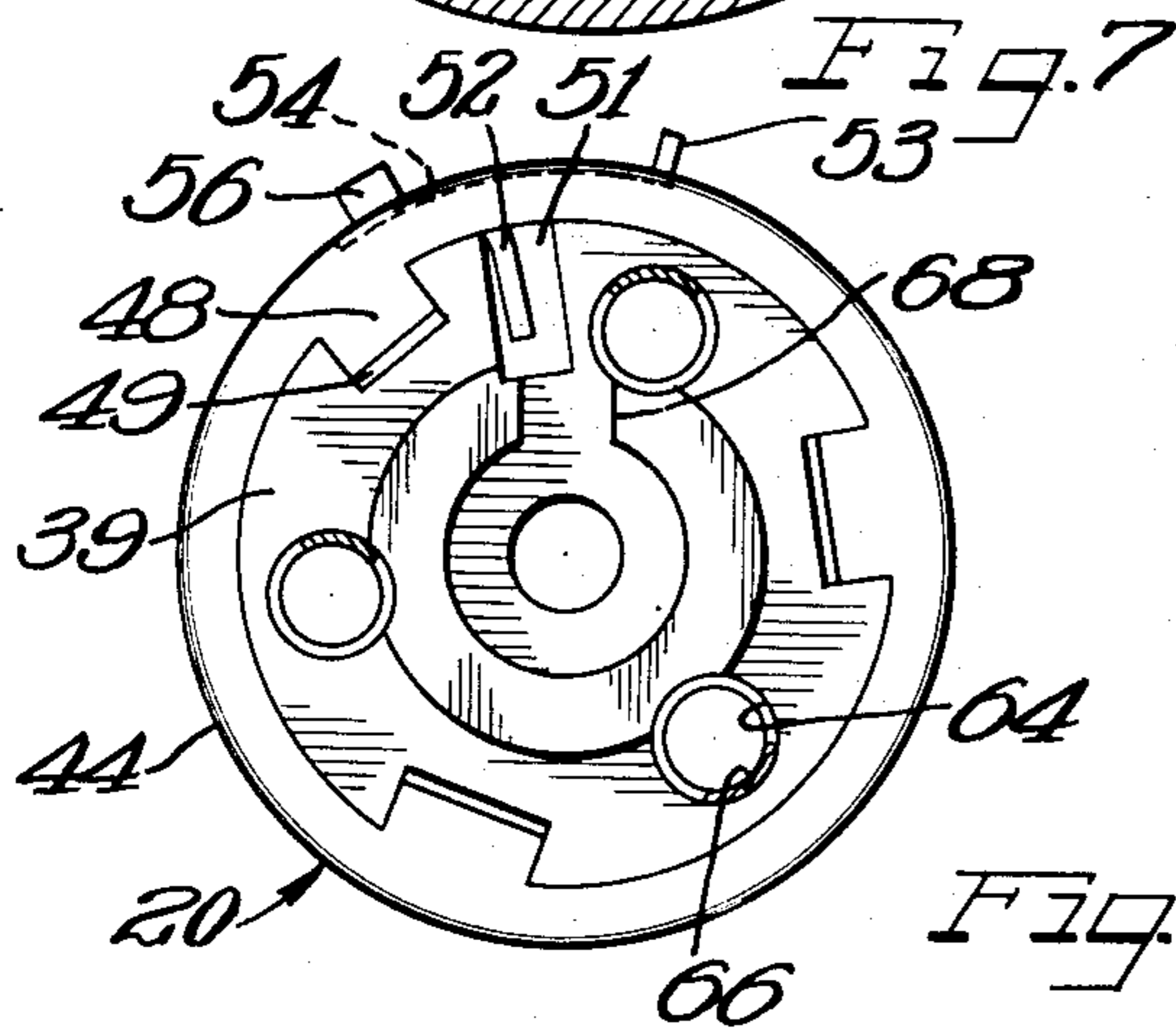
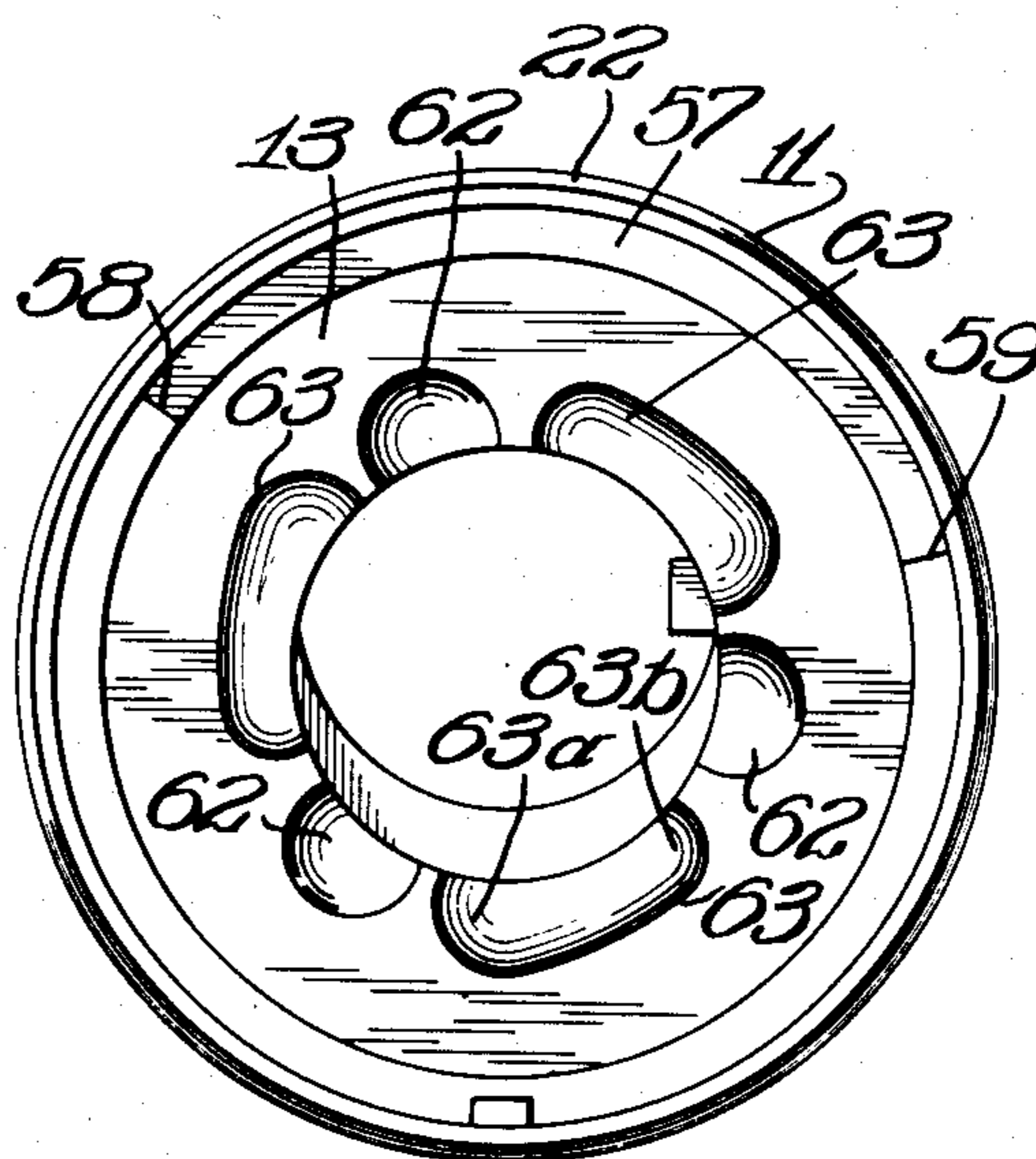
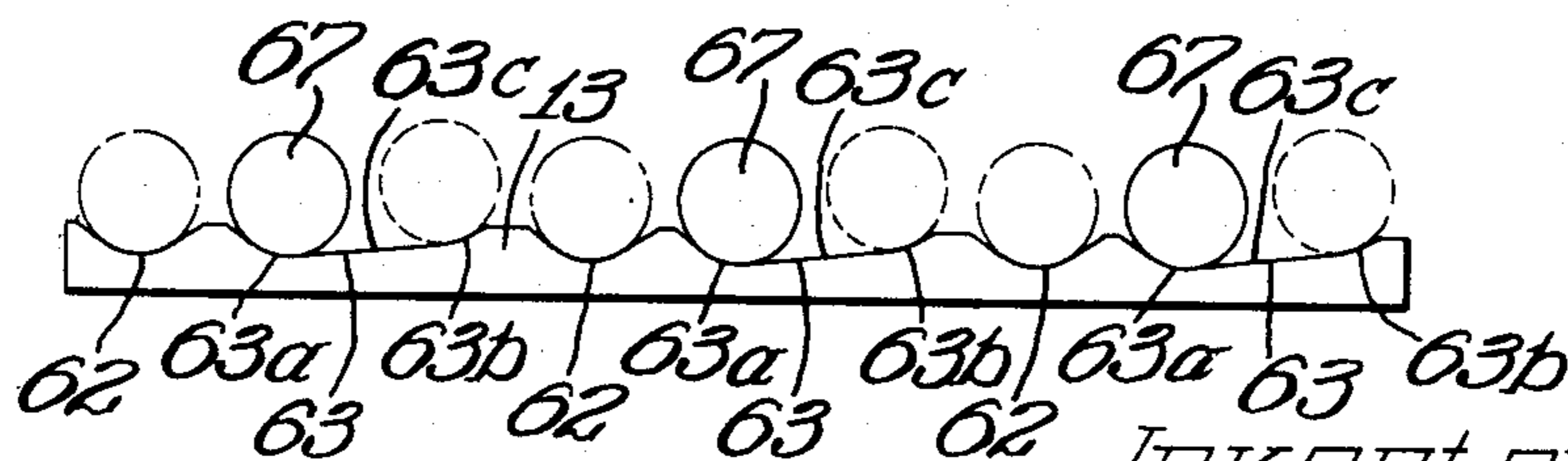


Fig. 6



INVENTOR:

Nelson H. Weber

BY *Nell Herman Merritt & Associates* ATTYS

## UNITED STATES PATENT OFFICE

2,654,005

## COMBINED STARTER AND IGNITION SWITCH

Nelson H. Weber, Bronson, Mich., assignor to  
Kingston Products Corporation, Kokomo, Ind.,  
a corporation of Indiana

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13 Claims. (Cl. 200—44)

1

This invention relates generally to multiple position switch structures, particularly suited for use with an automotive vehicle as a combined starter and ignition switch and more particularly relates to improvements in such a structure wherein improved positioning means are provided to control the relative angular alignment between adjacent rotatable parts of the switch structure and wherein continuous biasing means are incorporated within the switch structure to insure a tight assembly of the assembled components.

According to the general principles of the present invention, an open ended housing having a key-lock in one end thereof encloses a rotatable carrier assembly having a driven connection with the keylock. The housing is provided with a wall portion adjacent the carrier assembly formed with a plurality of depressions and a plurality of spring biased balls are received in the depressions to angularly position the carrier assembly relative to the housing. The bottoms of the depressions are tapered to provide inclined raceways for the spring biased balls, thereby tending to rotatably drive the carrier assembly toward a predetermined angularly aligned position. A base assembly is provided in the other end of the housing and includes a pivot pin structure extending into the housing and journaling the carrier assembly for rotation in the housing. The pivot pin structure includes continuous biasing means engaging the keylock to minimize rattling of the keylock in the housing.

It is an object of the present invention to provide a multiple position switch structure having improved means for angularly aligning relatively rotatable adjacent parts.

Another object of the present invention is to provide a switch structure having a rotatable carrier assembly journaled on a pivot pin structure which is provided to align the rotatable components of the switch structure and to continuously bias a key actuating mechanism axially spaced from the rotatable carrier assembly, thereby to minimize rattling of the switch structure components.

Another object of the present invention is to improve the positioning feel of a manually operated key actuated combination ignition starter switch.

2

A further object of the present invention is to minimize rattling in a key actuated combination ignition starter switch.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

On the drawings:

Figure 1 is an end elevational view with parts shown in cross-section of a combined-starter ignition switch incorporating the principles of the present invention;

Figure 2 is a cross-sectional view with parts shown in elevation and with parts broken away taken substantially on line II—II of Figure 1;

Figure 3 is a cross-sectional view with parts shown in elevation taken substantially on line III—III of Figure 2.

Figure 4 is a cross-sectional view with parts shown in elevation taken substantially on line IV—IV of Figure 2, the movable components being variously positioned as indicated in phantom;

Figure 5 is an end elevational view of the housing member provided in accordance with the principles of the present invention showing additional details of construction of the improved recess positioning means; and

Figure 6 is a 360° diagrammatic development showing in cross-section additional details of construction of the recesses provided in the housing structure of Figure 5 and Figure 7 is an end elevational view of the rotatable carrier assembly provided in accordance with the principles of the present invention.

As shown on the drawings:

A combination-ignition starter switch structure as indicated generally by the reference numeral 10 and comprises a substantially cylindrical housing 11 having a reduced diameter portion 12 at one end bounded by a medial radially extending wall 13.

A keylock indicated generally at 14 is situated in the reduced diameter portion 12 and comprises a lock cylinder 15 having the usual lock tumblers therein which cooperate with a key rotated

3

shaft 17 extending through the lock cylinder 16 and projecting into the housing 11.

A spring biased pin 18 is carried by the lock cylinder and is received by a slot 19 formed in the reduced diameter portion to prevent axial withdrawal of the keylock 14 from the housing 11.

A contact carrier assembly indicated generally at 20 is situated within the housing 11 adjacent the wall 13.

A base assembly indicated at 21 closes the large end of the housing 11 and may be secured in firm assembly therewith by peening over an edge portion 22 so as to securely stake the housing 11 to the base assembly 21. It will be noted that the base assembly 21 includes an outer base 23 and an inner base 24, there being provided aligned contact means 26 in the inner base 24 which are electrically connected to appropriate binding posts 27 which extend outwardly through the outer base 23. A cable 28 is also provided and includes suitable conductor means 29 to establish electrical communication with the appropriate conductors of an electrical circuit to be controlled by the switching mechanism, for example, the ignition, starter and accessory circuits of an automotive vehicle which are to be controlled by the combination ignition-starter switch 10.

A pivot pin assembly indicated at 30 is secured in firm assembly to the inner base 24 and projects axially from one face of the inner base 24 into the housing 11, thereby to journal the rotatable carrier assembly 30 and to radially align the carrier assembly 20 relative to the housing 11.

The pivot pin assembly 30 includes a pivot pin 31 having an annular shoulder 32 abutting one face of the inner base 24 and being peened over as at 33 to place the pivot pin 31 in firm assembly with the inner base 24.

The pivot pin 31 further includes a hollow tubular portion 34 housing a compression spring 36 which bottoms against a medial shoulder 37 formed on a lockpin 38 which is axially reciprocable within the tubular portion 34 and which projects outwardly from one end of the pivot pin 31 to resiliently engage the shaft 17 of the keylock 14.

It will be appreciated that the lockpin 38 not only serves to properly align the components of the switch structure 10 by seating in the end of the shaft 17, but also transmits the continuous biasing force exerted by the compression spring 36 to the keylock 14, thereby tending to minimize rattling of the keylock cylinder 16 in the housing 11.

Referring now more particularly to Figures 3 and 7 in connection with Figure 2, it will be noted that the contact carrier assembly 20 comprises a carrier 39 having a plurality of recesses 40 in one face thereof which receive a corresponding plurality of compression springs 41 arranged to resiliently bias a contact plate 42 toward the base assembly 21. The contact plate 41 is provided with a plurality of suitably spaced apart embossments 43 which establish point contact with the contact means 26 carried by the inner base 24 and thereby serving to selectively bridge suitable circuits associated with the contact means 26.

A cup-shaped spring housing 44 surrounds the carrier 39 and is securely assembled therewith by means of a plurality of bent-over lugs 46 matingly seated within a corresponding plurality of recesses 47 formed in one face of the carrier 39 and a plurality of bent-over lugs 48 which are

4

matingly seated in a corresponding plurality of recesses 49 formed in the other face of the carrier 39.

A torque spring 50 is enclosed by the spring housing 44 and has one end retained by the carrier 39, a recess 51 being provided to receive a tongue 52 on one end of the torque spring 50. The other end of the torque spring 50 extends radially outwardly as at 53 and is received in slot 54 formed in the peripheral portion of the spring housing 44. It will be noted that the spring housing 44 is further provided with a radially outwardly extending lug 56 which lies in spaced alignment relative to the outwardly projecting end portion 52 of the torque spring 50. The torque spring 50 is initially loaded so as to have the end portion 53 seated in one end of the slot 54 and the lug 56 is preferably located adjacent the other end of the slot 54 for a purpose which will become manifest presently.

The bore of the generally cylindrical housing 11 is provided with a relieved arcuate recess 57 extending between a pair of radially spaced shoulders 58 and 59. The carrier 39 is provided with a centrally disposed aperture 60 which receives the tubular portion 34 of the pivot pin 31. Thus, the pivot pin assembly 30 serves to journal and support the contact carrier assembly 20 for rotation in the housing 11 and also radially aligns the carrier contact assembly or switch assembly 20 so that the end portion 53 of the torque spring 50 and the lug 56 of the spring housing 44 extend into the arcuate recess 57. It will be readily evident that the lug 56 serves to limit the angular displacement of the contact carrier assembly 20 relative to the housing 11 by engaging the shoulders 58 and 59.

Referring now more particularly to Figures 5 and 6, it will be noted that the wall 13 is provided with a plurality of circumferentially aligned depressions forming alternately spaced ball seating recesses 62 and elongated guiding recesses 63.

The profile configuration of the recesses 62 and 63 is clearly shown in the developed diagrammatic view of Figure 6.

It will be noted that each of the ball seating recesses 62 is provided with a substantially symmetrical indented portion bounded on either side by a shoulder portion tending to restrain a shiftable element such as a ball against relative displacement.

The elongated recesses 63, on the other hand, are provided with tapered bottoms, thereby to provide a relatively deep end portion 63a and a shallow end portion 63b and further providing an inclined raceway 63c between the end portions upon which the shiftable element such as a ball may be moved.

To cooperate with the recesses 62 and 63 formed in the wall 13, there is provided a plurality of recesses 64 in the carrier 39, each recess 64 bottoming a coiled compression spring 66 which is axially aligned between the carrier 39 and the wall 13. A shiftable element such as a ball 67 engages each spring 66 and is arranged to cooperate with a corresponding pair of the recesses indicated at 62 and 63.

The recesses 62 are arranged to normally align the carrier assembly in a predetermined position within the housing 11 corresponding to a first position, or an "off" position. The "off" position is indicated in the drawings by the broken line showing of the balls 67 seated in the recesses 62, a corresponding broken line showing of the contact plate 42 being indicated on Figure 4 at 42o.

5

The carrier 39 is provided with a suitable driving connection indicated at 68 with the shaft 17 of the keylock 14 so that selective angular displacement of the rotatable contact carrier assembly may be effected upon rotation of the shaft 17 in the lock cylinder 16.

Upon rotative displacement of the carrier contact assembly 20, the balls 67 will be moved into the deep end portion 63a of the elongated recesses 63, which position corresponds to an "ignition on" position, or a second position. The "ignition on" position corresponds to the full line position of the balls 67 in Figure 6 and in Figure 4 the contact plate 42 is also shown in full line with the embossments 43 effecting an appropriate bridging action across the terminals of the contact means 26 in control of the so-called "ammeter circuit" conventionally provided in an automotive vehicle.

In the second position, the end portion 53 of the torque spring 50 will be aligned in engaging abutment with the shoulder 58. Upon effecting additional angular displacement of the contact carrier assembly 20 by rotating the carrier assembly beyond the "ignition on" or second position, the balls 67 will be moved upwardly on the inclined raceway 63c of the elongated recesses 63 to a "starter" position, or a third position shown by the dotted line balls of Figure 6 and the dotted line position of the contact plate 42 shown in Figure 4 at 42s.

It will be appreciated that the movement of the contact carrier assembly between the "ignition on" position to the "starter" position will be resiliently impeded by the torque spring 50 because of the engagement of the end 53 of the torque spring 50 with the shoulder 58. In this regard, it may be noted that the spacing dimension between the end portion 53 of the torque spring 50 and the lug 56 on the spring housing 44 is approximately coextensive with the length of the elongated recesses 63. Thus, as soon as the keylock 14 is released by the operator, the torque spring 50 will rotatively drive the carrier contact assembly back to the "ignition on" position.

To further improve the positioning feel of the manually operable combination ignition-starter switch 10 and to provide an improved actuating mechanism between the relatively rotatable parts of the switching mechanism, the present invention contemplates the development of an additional driving force which will return the contact carrier assembly 20 to the "ignition on" position after release of the manually operated ignition lock 14.

It will be noted that the movement of the balls 67 from the deep portion 63a of the elongated recesses 63 to the shallow portion 63b results in a compression of the springs 66. Upon release of the keylock 14, the balls 67, together with the recesses 63 will act to rotatably drive the contact carrier assembly 20 to the "ignition on" position.

Although various structural modifications might be suggested by those versed in the art in connection with the preferred structural embodiment disclosed and described by way of illustrative example, it should be clearly understood that I wish to embody within the scope of this invention all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. A key actuated switch comprising an open-ended housing, a keylock cylinder having tumblers therein in one end of said housing, a key

6

rotatable shaft extending through said cylinder and controlled by said tumblers, a base assembly in the other end of said housing having a pivot pin assembly extending toward one end of said housing, and a switch assembly journaled on said pivot pin assembly for rotation in said housing and having a driven connection with said shaft, said pivot pin assembly having an axially movable continuously biased pin extending from the end thereof and engaging said shaft, thereby to minimize rattling of said keylock cylinder.

2. A keylock actuated switch comprising a housing, a keylock in one end of said housing, and a pivot pin assembly fixed in said housing coaxially aligned with said keylock to journal a switching mechanism for rotation in said housing, said pivot pin assembly having a continuously biased axially movable pin projecting outwardly therefrom and engaging said keylock to minimize rattling thereof.

3. A keylock actuated switch comprising a housing adapted to enclose a switching mechanism, a keylock cylinder in one end of said housing and having key-operated elements to actuate the switching mechanism, pin and slot means between said cylinder and said housing retaining said cylinder in assembly with said housing, and a continuous bias exerting means carried by said housing and engaging said cylinder to minimize rattling of said cylinder in said housing.

4. A keylock actuated switch comprising an open-ended housing, a keylock cylinder in one end of said housing having rotary key-operated elements, retaining means between said housing and said cylinder preventing outward displacement of said cylinder from said one end of said housing, a rotary switch in said housing having a driven connection with said actuating elements, a closure in the other end of said housing having a pivot pin projecting into said housing journaling said rotary switch, and a continuous bias exerting means carried at the end of said pivot pin engaging said keylock cylinder to minimize rattling thereof in said housing.

5. A switch apparatus comprising an open-ended housing, a keylock in one end of said housing, said keylock having a cylinder axially inserted in said one end of said housing, detent means between said cylinder and said housing to prevent axial withdrawal of said cylinder, a key actuated shaft extending through said cylinder into said housing, a rotary contact carrier assembly in said housing having a driven connection with said shaft, said housing having a wall portion adjacent said contact carrier assembly formed with a plurality of depressions, said rotary contact assembly having a plurality of spring biased balls received in said depressions, said depressions being tapered and providing inclined raceways for said balls, whereby said balls will move toward the deeper portions of said raceways and said carrier assembly will be rotatably driven to a predetermined angular position, a base assembly closing the other end of said housing and having contact means cooperable with said rotary contact carrier assembly, said base assembly further including a pivot pin assembly extending into said housing and journaling said contact carrier assembly for rotation in said housing, said pivot pin assembly including continuous biasing means engaging said keylock to minimize rattling thereof.

6. A switch comprising angularly aligned adjacent relatively rotatable parts having switch

7

contact members selectively engaging one another, resilient means connecting said relatively rotatable parts, and actuating means to selectively relatively rotate said parts including shiftable members engaging one of said parts and said resilient means, said one of said parts having inclined camming surfaces engaging said shiftable members and increasingly compressing said resilient means upon relative rotation between said parts in one direction, said parts being automatically rotatably returned in an opposite direction upon inactivation of said actuating means under the increased bias exerted by said resilient means.

7. A switch comprising adjacent rotatable parts having cooperating switch contact members, deflectable means between said parts and arranged to spring load said parts axially, shiftable members between said deflectable means and one of said parts, said shiftable members engaging said one of said parts at inclined camming surfaces provided thereon and tending to drive the other of said parts in rotative direction whenever the deflectable means is under increased axial load.

8. In a switch assembly, a housing, a contact carrier assembly having switch contact members and being rotatable in said housing, resilient means between said carrier assembly and said housing and being pre-loaded to exert a bias in direction parallel to an axis intersecting said carrier assembly and said housing, said housing having an arcuate groove facing said carrier assembly, a shiftable element engaging said resilient means and received in said groove, said groove having a tapered bottom wall providing an inclined raceway for said shiftable element, and actuating means to selectively angularly displace said carrier assembly relative to said housing, and to concurrently move said shiftable element to the shallow end of said raceway, thereby to increasingly compress said resilient means, said shiftable element arranged to rotatably drive said carrier assembly in opposite angular direction upon inactivation of said actuating means and movement of said shiftable element toward the deeper end of the raceway under the increased resilient bias of said resilient means, and stationary switch contact members in said housing cooperating with the switch contact members of said contact carrier assembly.

9. In a switch assembly, a generally cylindrical open-ended housing having a reduced diameter portion at one end and a radially extending medial wall, switch means in the large end of said housing including a rotatable carrier adjacent said wall, axially aligned springs between said wall and said carrier, said wall having circumferentially arranged recesses, a ball engaging each of said springs and received in a corresponding one of said recesses, said recesses each having tapered bottoms forming an inclined raceway for said balls, said balls being moved toward the deeper end of said raceway under the bias of said springs to rotatably drive said carrier to a predetermined angular position in said housing, and switch contact members in the large end of said housing cooperating with said carrier.

10. In a switch assembly, a carrier rotatable around a predetermined axis, casing means providing a stationary wall adjacent said carrier and extending radially of said axis, a recess in said wall facing said carrier and circumferentially ar-

8

ranged relative to said axis, an axially biased shiftable means between said carrier and said wall and seated in said recess, said recess having a tapered bottom providing an inclined raceway and directing said axially biased shiftable means in angular direction to rotatably drive said carrier to a predetermined angular position relative to said wall, and circumferentially align switch contact members between said carrier and said casing means to control circuit means upon selective rotation of said carrier.

11. In a switch assembly, a carrier rotatable around a predetermined axis, a housing enclosing said carrier and having a wall adjacent said carrier and extending radially of said axis, a plurality of circumferentially arranged recesses in said wall, an axially biased shiftable means between said carrier and said wall, said recesses including a first recess means receiving said shiftable means and retaining said carrier in a first angularly aligned position, said recesses further including a second recess means having a tapered bottom providing an inclined raceway and directing said axially biased shiftable means in angular direction to rotatably drive said carrier to a second angularly aligned position, and actuating means engaging said carrier to rotatably displace said carrier and to selectively angularly shift said shiftable means between said first and said second positions and to selectively angularly shift said shiftable means up said inclined raceway to a third angularly aligned position, said carrier being automatically returned to said second position from said third position upon inactivation of said actuating means.

12. A combination ignition-starter switch, comprising, generally cylindrical housing having a reduced end portion bounded by a radially extending medial wall, the large end of said housing having a bore formed with a relieved arcuate recess extending between a pair of spaced-apart axially extending shoulders, said wall having a plurality of circumferentially aligned depressions forming alternately spaced ball seating recesses and elongated ball guiding recesses, a rotatable contact carrier assembly in said housing and including a torque spring between said carrier assembly and said housing, said carrier assembly having a radially extending lug received in said relieved arcuate recess and engaging said shoulders to limit rotation, said torque spring having one end connected to said carrier assembly and the other end projecting radially outwardly into said arcuate recess in spaced relationship to said lug and arranged to engage one of said shoulders, a base assembly closing the large end of said housing and having contact means arranged to be controlled by said carrier assembly, a key actuated lock in the reduced end of said housing, said base assembly having a pivot pin extending into said housing and journaling said carrier assembly and having biasing means engaging said lock to minimize rattling thereof, and spring biased balls normally seated in said ball seating recesses and aligning said carrier assembly in said housing in a first position, said carrier assembly being angularly displaceable into a second position wherein said balls seat in one end of said elongated ball guiding recesses, and said one end of said torque spring engages one of said shoulders, said carrier being further angularly displaceable against the bias of said torque spring to a third position wherein said lug engages said one of said shoulders, the bottom of said elongated recesses being tapered to provide an in-

9

clined raceway for said balls, said balls and said inclined raceways operative to increase the spring biasing force between said carrier and said wall and improving the return action of said carrier to said second position.

13. A keylock actuated switch comprising a housing, a keylock in one end of said housing, and a pivot pin assembly fixed in said housing coaxially align with said keylock to journal a switching mechanism for rotation in said housing, said pivot pin assembly having biasing means engaging said keylock and minimizing rattling thereof.

NELSON H. WEBER.

10

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