

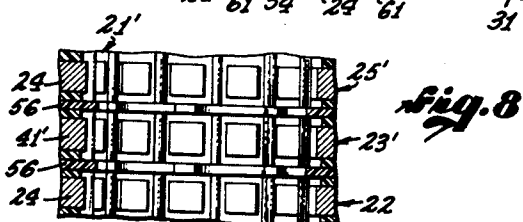
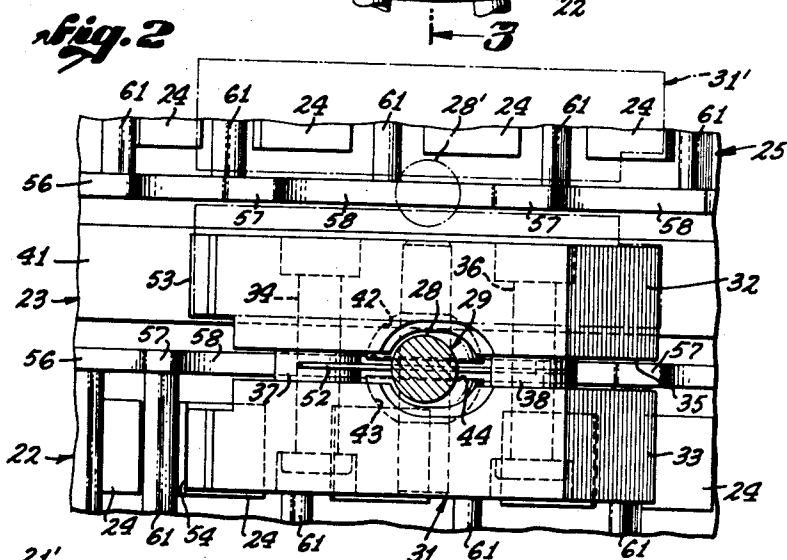
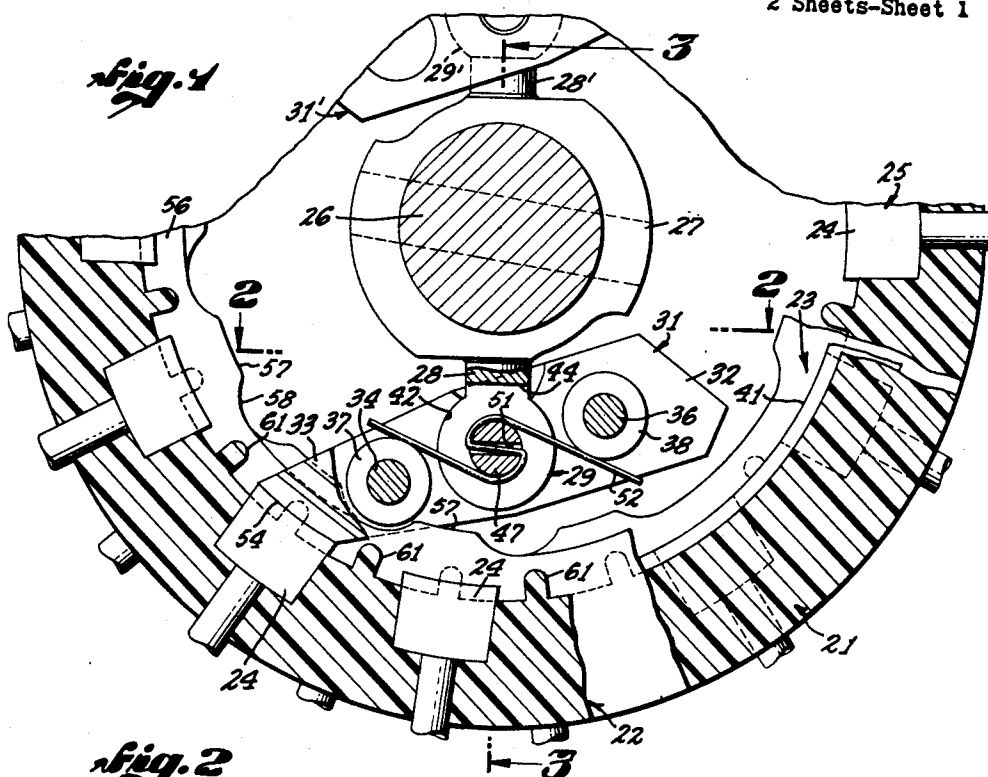
April 19, 1960

J. P. WATSON
PIVOTALLY BALANCED MEMBERS

2,933,580

Filed May 6, 1958

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

fig. 3

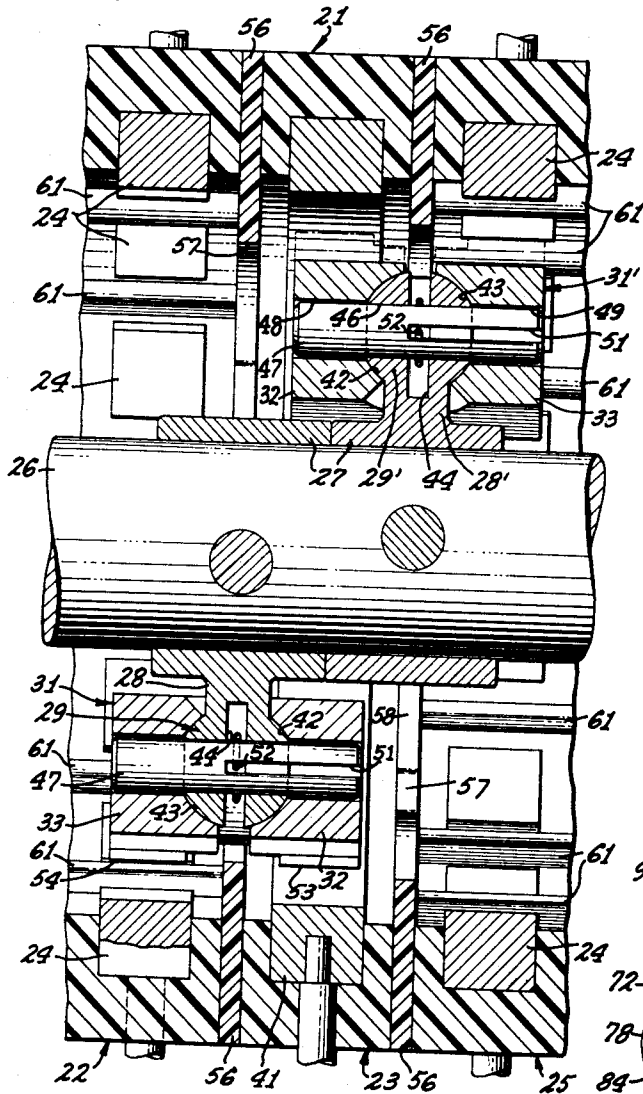


fig. 4

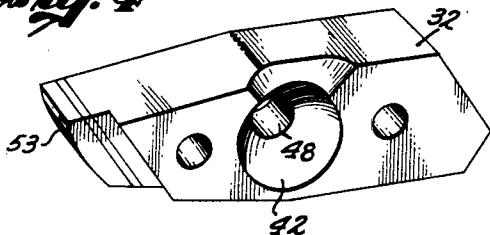


fig. 5

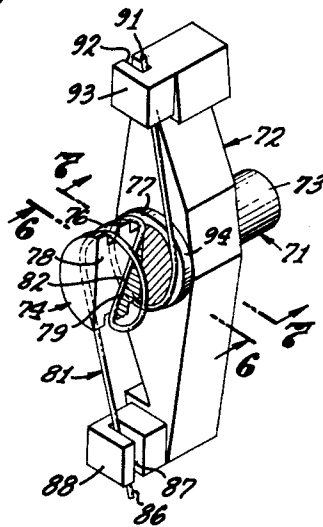


fig. 6

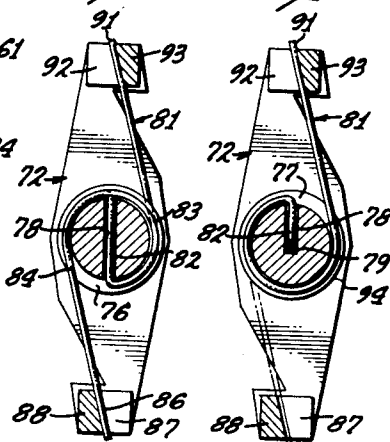
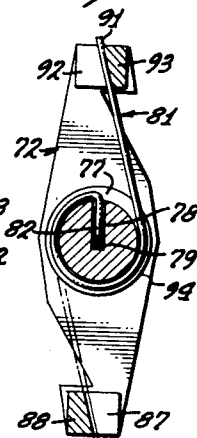


fig. 7



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2,933,580

PIVOTALLY BALANCED MEMBERS

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Application May 6, 1958, Serial No. 733,449

11 Claims. (Cl. 200—166)

This application relates to pivotally balanced members, and more particularly such members as are used in stepping switches and motors.

This invention relates to improvements in pivoted components of the type disclosed in co-pending applications Serial Nos. 607,422, now Patent No. 2,866,109, and 662,109, both filed in the name of James P. Watson.

It is an object of this invention to provide improved electric brush means for switching electric current from one terminal to another.

It is a further object of this invention to provide such a brush means or mechanism as will be completely balanced against accelerating forces or shocks from all directions.

It is the further object of this invention to provide electric brush mechanisms of such design that a large number of individual contacts may be grouped in a very small space.

It is another object of this invention to provide improved brush actuating means for separating a brush from a contact with a minimum of arc burning.

It is another object of this invention to provide improved means for mounting an electric brush so as to permit unlimited resilient bearing of the brush against a contact, while at the same time inhibiting the brush against a large transverse movement, thereby to protect the biasing spring.

It is a further object of this invention to provide an improved brush mechanism uniquely suitable for use in a rotary stepping switch wherein there is a double break in the circuit with each step of the switch.

It is a further object of this invention to provide a brush which may be easily manufactured and assembled and into which a pre-formed biasing spring may be easily inserted during assembly.

It is a further object of this invention to provide an improved brush mechanism uniquely adapted to a rotary stepping switch having means for inhibiting the creation of short circuits between switch contacts by the gradual accumulation of conducting articles.

It is another object of this invention to provide an improved balanced pawl structure.

It is a further object of this invention to provide a pawl structure which is easier and cheaper to manufacture and assemble and which has increased longevity.

It is another object of this invention to provide a design for a resiliently biased pivoted pawl structure wherein a heavier spring wire may be used without proportionate increase in biasing torque, thereby permitting use of stronger and longer lived spring components.

It is another object of this invention to provide a spring biased rotary balanced pawl wherein the biasing spring is free to perform its rotary bias on the pawl without being required to absorb an axial force to restrain the pawl in place on its mounting pin.

It is another object of this invention to provide a balanced, biased pawl wherein consistent operation may be obtained without maintenance of critical structural tolerances.

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In accordance with these and other objects which will become apparent hereinafter, preferred forms of the present invention will now be described with reference to the accompanying drawings wherein:

Fig. 1 is a cross-sectional view of the brush mechanism of a stepping switch embodying the balanced brush of the present invention;

Fig. 2 is a fragmentary sectional view taken on line 2—2 in Fig. 1;

Fig. 3 is a sectional view taken on line 3—3 in Fig. 1;

Fig. 4 is a perspective view showing one of the two complementary segments of the balanced brush;

Fig. 5 is a perspective view illustrating the balanced pawl of the present invention;

Fig. 6 is a section taken on line 6—6 in Fig. 5; and

Fig. 7 is a section taken on line 7—7 in Fig. 5.

Fig. 8 is a fragmentary plan view generally similar to Fig. 3, with the shaft and brushes removed, showing an alternative form of the present invention.

Referring to Fig. 1, there is shown a brush mechanism generally of the type shown in said Serial No. 662,109, and particularly Figs. 15 and 16 thereof, to which reference is made for a further understanding of the environmental structure.

The mechanism comprises a frame 21 carrying a pair of ring structures 22 and 23. The ring structure 23 comprises a continuous conducting ring, while 22 comprises a plurality of discrete conducting contact segments 24 imbedded or otherwise mounted in the insulating frame 21.

As best seen in Fig. 1, the frame is generally cylindrical and on the axis thereof is disposed a rotatively mounted shaft 26, to which is splined, or otherwise secured against rotation, a brush support means 27, including a projecting post 28, the end of which is formed as a sphere to constitute a ball support member 29.

The ring structures 22 and 23 are mounted axially adjacent to each other, as shown in Fig. 2, and have substantially the same internal diameter, thereby to be engaged by a balanced brush 31 composed of a pair of complementary segments 32 and 33 suitably secured together, as by rivets 34 and 36, but spaced apart by washers or spacers 37 and 38, circumjacent the rivets 34 and 36 respectively, and disposed between the two segments 32 and 33.

The two halves or segments of the brush 31 engage the respective rings 22 and 23 to transfer current from a given segment 24 in the ring 22 to the ring 23, or vice versa.

The brush 31 is secured to the ball 29 by the provision of two facing complementary semi-sockets 42 and 43 (formed in parts 32 and 33) in which the ball 29 resides. The brush 31 is assembled over the ball 29 by placing the two segments 32 and 33 over the ball 29 and then riveting them together with the rivets 34 and 36.

The ball 29 is provided with a deep central slot 44 cut along a plane substantially midway between the two ring structures 22 and 23 as best seen in Fig. 2. The ball 29 is further provided with a central bore 46 passing there-through substantially normal to the slot 44. Pressed into the bore 46 is a pin 47 which extends outwardly from each side of the ball 29 to reside in oversize bores 48 and 49 formed in the respective brush segments 32 and 33. The pin 47 is provided with a longitudinal slot 51 extending from one end thereof and fully into the ball slot 44, thereby providing passage for a biasing spring 52 formed into a general S shape, as shown in Fig. 1 and lying substantially in the plane of the ball slot 44. The spring 52 passes through the pin slot 51, as best seen in Fig. 1, and then is wrapped back partially around the pin 47 symmetrically. The respective ends of the spring extend away from the pin 47 and outside of the ball slot 44 to

engage the spacers 37 and 38, respectively, thereby to apply a biasing torque to the brush 31. This biases the respective outer or contacting ends 53 and 54 into resilient engagement with the respective ring structures 23 and 22.

It will be noted that the universality of the mounting provided by the ball 29 permits the brush to tilt slightly from side to side, thereby allowing the faces 53 and 54 to engage firmly against the respective ring structures 23 and 22. This tilting is permitted by the fact that the bores 48 and 49 are appreciably larger than the pin 47. The two ends of the pin 47 project outwardly into the brush 31 to limit the extent of transverse movement and thereby protect the spring 52 from being sheared off or otherwise damaged during assembly or disassembly of the mechanism.

The pin 47 has a diameter slightly larger than the bore 46 whereby a press fit is required to install the part, thereby securing the pin 47 in the bore 46 against rotation.

It will be noted that a duplicate balanced brush structure is provided by forming posts 28' on the diametrically opposite side of shaft 26 (Figs. 1 and 3) thereby doubling the operating capacity of the switch, as well as balancing the structure dynamically, another brush 31' being indicated mounted on an opposing post 28' and ball 29' and electrically connecting the ring structure 21 with a ring structure 25 similar to the ring structure 22.

The segmental structure of the brush 31 results in the spacers 37 and 38 performing simultaneously the multiple functions of spacing the segments 32 and 33 apart; carrying current from one segment to the other; acting as abutments or stops for the respective ends of the spring 52; and serving to lift the engaging faces 53 and 54 away from the respective ring segments upon rotation of shaft 26 in a manner which will now be described.

Secured to the frame 21 and disposed in a plane substantially coincident with the gap 35 in the brush 31 is a circular non-conducting ring 56 having high portions 57 of relatively small radius and low portions or recesses 58 of larger radius. As the brush 31 is carried in a circular path by rotation of the shaft 26, the lower spacer 37 engages a lobe or high area 57, as shown in Fig. 1, lifting the engaging faces 53 and 54 radially inward away from the respective contacts 41 and 24 and rotating the brush 31 slightly on its ball mounting about the axis of the pin 47. The lift portion 57 of rail 56 is of sufficient height to cause the ends 53 and 54 to clear barriers 61 interposed transversely between adjacent contact segments 24. The segments 24 are thus, by virtue of the barriers 61, housed in separate individual pockets. The barrier 61 serves not only to inhibit arcing between adjacent segments 24 but also serves to block the interposition of fine bits of conducting debris which might otherwise cause a short circuit to appear between adjacent contacts.

In the rotation of the shaft 26, after the brush ends 53 and 54 have cleared the barrier 61, the lift rail 56 is so cut that the spacer 37 drops into a recess 58 allowing the spring 52 to firmly bias the two ends of the brush into firm electrical engagement with the respective ring structures 22 and 23.

The brush 31 is so shaped and constructed that its center of mass coincides substantially with the center of the ball support member 29; thereby bouncing of the brush out of contact with the ring structures 22 and 23 under shock of high acceleration is obviated, because even under high acceleration there is no resultant torque to rotate the brush about the ball 29.

In Fig. 8 an alternative form of ring structure is illustrated, in which the parts carry corresponding numerals primed. In this figure, the ring structure 23 has been replaced with a ring structure 23' consisting of a plurality of individual discrete conducting contact segments 41' instead of a continuous ring 41. It will be readily seen that this provides a double circuit break with each open-

ing of the switch, rather than the single break which is provided when the ring 41 and segments 24 of Figs. 2 and 3 are employed.

Referring now to Figs. 5-7, the balanced pawl of the present invention will now be described. This pawl is generally of the type described in said Patent No. 2,866,109, particularly at Figs. 11-14, and in said Serial No. 662,109, particularly at Figs. 6-10. Reference to these specifications is hereby made for a fuller understanding of the environment in which the pawl shown in Figs. 5-7 is employed.

Referring to these figures, 71 designates an arbor or pin forming a bearing for a pawl 72. The bearing portion of the pin 71 is ensmallled as shown at 73 where it passes through a bore (not shown) in the pawl 72, leaving a head 74 which restrains the pawl 72 against axial movement of the pin 71 in one direction. The pawl is prevented from moving axially in the other direction by bearing against a suitable mounting member (not shown) in which the pin 71 is mounted. The head 74 of the pin 71 has a pair of axially spaced circumferential grooves 76 and 77. A diametral slot on kerf 78 is also provided in the head, and the slot 78 has a sloping floor or bottom 79 communicating between the grooves 76 and 77.

A spring wire 81 engages the pin 71 and pawl 72 to rotatively bias the pawl, in the following manner. The central portion 82 of the wire 81 resides in the slot 78 adjacent the floor 79 thereof, the respective ends of the wire 81 are then wrapped around the pin 71 in the same rotative direction, residing in the respective circumferential grooves 76 and 77. Thus, one end of the wire 81 emerges from the shallow end of the kerf or slot 78 and proceeds around the groove 76 as shown at 83 through an arc of approximately 270° and then leaves the groove 76 tangentially as shown at 84. The tip 86 of the wire is then engaged in a notch or pocket 87 formed in a lateral post 88 at one end of the pawl 72. The notch or pocket 87 is in substantial alignment with the circumferential groove 76 so that the spring wire 81 may proceed directly from the pin 71 to the pocket 87 without further bending. This obviates canting of the spring ends with consequent danger of chafing.

The opposite tip 91 of the wire 81 resides in a pocket or notch 92 formed in a post 93 at the opposite end of the pawl 72, which faces oppositely from the pocket 87. The pocket 92 is spaced transversely of the pocket 87 so as to lie in substantial longitudinal alignment with the other circumferential groove 77 from which the tip and 91 emerges. This end is thus likewise prevented from canting and chafing.

That portion of the head 74 between the groove 77 and the pawl 72 constitutes a flange 94 which serves to hold the pawl 72 against axial removal from the pin 71.

The flange 94 obviates requiring the spring wire 81 to hold the pawl 72 against axial removal from the pin 71, consequently decreasing the loading on the spring and eliminating chafing. The large wrap-around of approximately 270° provided for each end of the spring 81 permits the use of heavier spring wire and also makes the positioning of the kerf 78 much less critical than if the extensive wrap-around were not employed.

While the instant invention has been shown and described herein in what is conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention which is therefore not to be limited to the details disclosed herein but is to be afforded the full scope of the claims.

What is claimed is:

1. Brush mechanism comprising a frame, a pair of contact structures mounted to said frame parallel and adjacent to each other, brush support means movably mounted to said frame and disposed for movement along said contact structures, said support means comprising

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a ball support member, brush means having socket means universally mounting said brush means to said ball support member, one side of said brush means bearing against one of said structures, the other side of said brush means bearing against the other of said structures, said brush means and ball support member each having a bore therethrough transverse of said contacting structure, a pin residing in said bore and having an external diameter slightly smaller than the internal diameter of said bore through said brush means, said pin being secured in said ball support means against rotation and axial movement, and spring means engaging said pin and said brush means for biasing said brush means into engagement with said contact structures.

2. Mechanism in accordance with claim 1 wherein said pin has a longitudinal slot extending from one end thereof at least to the center of said ball support member, said spring passing through said slot and being wrapped at least partly around said pin and having its ends engaged by said brush means.

3. Mechanism in accordance with claim 1 wherein said ball support member has a central slot substantially normal to said bore and communicating with said bore, said spring passing through said slot.

4. Mechanism in accordance with claim 1 wherein said brush means is formed of two complementary segments having complementary semi-sockets assembled over said ball support member, a pair of spacer means between said segments on opposite sides of said ball support member, and means for securing said segments together around said ball support member, said spring means being disposed in the space between said segments.

5. Mechanism in accordance with claim 2 wherein said brush means is formed of two complementary segments having complementary semi-sockets assembled over said ball support member, spacer means between said segments on opposite sides of said ball support member, and means for securing said segments together around said ball support member, the ends of said spring engaging said spacer means to rotatively bias said brush means into engagement with said contact structures.

6. Mechanism in accordance with claim 1 wherein the center of mass of said brush means coincides substantially with the center of said ball support member.

7. Brush mechanism comprising a frame, a pair of ring structures mounted to said frame axially adjacent to each other and having substantially the same internal diameter, brush support means rotatably mounted to said frame and disposed within said ring structures, said support means comprising a ball support member, brush means having socket means universally mounting said brush means to said ball support member, one side of said brush means bearing against one of said structures and the other side of said brush means bearing against

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the other of said structures, said brush means and ball support member each having a bore therethrough substantially parallel to the axis of said ring structures, a pin residing in said bores and having an external diameter slightly smaller than the internal diameter of said bores through said brush means, said pin being secured in said ball support means against rotation and axial movement, and spring means engaging said pin and said brush means for biasing said brush means into engagement with said ring structures.

8. Mechanism in accordance with claim 7 comprising in addition a ring-like lift rail disposed coaxially between said ring structures and fixed with respect thereto and means on said brush means for engaging said lift rail for supporting said brush means against the bias of said spring means during those portions of the rotation of said brush support means when said brush means is not in engagement with at least one of said ring structures.

9. Mechanism in accordance with claim 8 wherein the engagement of said engagement means on said brush means with said lift rail means serves to rotate said brush means radially inward away from said ring structures and subsequently permits said spring means to rotate said brush means radially outward back into engagement with said ring structures, during rotation of said brush support means.

10. Mechanism in accordance with claim 9 wherein said brush means is formed of two complementary segments having complementary semi-sockets assembled over said ball support member, and wherein said lift rail engaging means on said brush means comprises one of a pair of spacer means between said segments disposed on opposite sides of said ball support member for spacing said segments apart, means for securing said segments together around said ball support member, the ends of said spring means engaging said spacer means to rotatively bias said brush means into engagement with said ring structures.

11. Mechanism in accordance with claim 1 wherein said brush means is formed of two complementary segments having complementary semi-sockets assembled over said ball support member, a pair of spacers between said segments on opposite sides of said ball support member, and securing rivets passing through said spacers and securing said segments together around said ball support member.

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