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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Electric motor brush holder.**

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Description

The invention relates to a brush holder for the brush of an electric motor, the holder comprising a tube that is open at one end for receiving and retaining said brush, which is slidable out of the tube through said open end while being biased by a comparison spring which is retained within the tube between the brush and the other end of the tube opposite said open end, the tube having a narrowing serving as an abutment for the spring in the direction of the open end to block the pathway of the spring out of the open end of the tube while permitting the brush in the tube to move through the open end, the brush being electrically connected with an electric supply lead outside the holder.

A brush holder of this kind is known from U.S. 3.955.113 and from FR 2.016.594.

The brush holder known from U.S. 3.955.113 is provided with a tab at the open end of the tube in a curved side wall thereof, the tab being bent inwardly towards the brush, so that it narrows the passage of the tube near the open end thereof for preventing the spring to move out of the tube beyond such narrowing.

The brush holder known from FR 2.016.594 consists of a retainer for the compression spring, to which a guidance element for the brush is snapped in. The spring is retained between the rear end wall thereof and inwardly projecting rims at the opposite open end of the tube like retainer, whereby, after being connected with the guidance element, the brush may be guided through the narrowing provided by said rims into and out of the retainer.

The disadvantage of said known brush holders is, that the end part of the brush projecting out of the brush holder may be unsteady during use of the electric motor because of clearance between the brush and the holder around almost the entire brush near the open end of the tube of the holder. Therefore, during use of the electric motor, the brush could move laterally to rotate with respect to the brush holder, which is arranged stationary with respect to said motor. Then the electric contact between the front end of the brush and the commutator of the motor will be bad, or at least unsteady, so sparks may occur, which may damage the commutator and will decrease the efficiency of the motor. Any vibrations will be amplified by this and thus said clearance between the brush and the holder near the open end thereof and therefore also said drawbacks.

It is therefore the object of the invention to provide a brush holder as mentioned in the preamble which has not said drawbacks. Therefore, according to the invention, such brush holder is characterised in that the narrowing is provided at the open end of the tube so that the cross section of the brush holder at the open end defines an opening of substantially the same cross section as the brush so as to surround the brush peripherally entirely with only a small clearance.

The narrowing of the brush holder according to the invention at the open end to surround the brush entirely with only a small clearance, ensures that lateral movement, such as due to vibration, and rotation is prevented. Because of that the brush will always be steady with respect to the motor, so that deformation of the holder due to movements like vibration of the brush is prevented. Also the front end part of the brush, which bears against the commutator, will be steady then with respect to the motor, in particular with respect to the commutator, so that wear of the brush and of the commutator is decreased and the occurrence of dangerously flying sparks is prevented.

The holder has the previously mentioned generally cylindrically rounded, or outwardly bowed opposite side walls which are shaped for receiving the cylindrical profile of the bias spring. These bowed walls extend substantially up to the open end of the holder from which the brush projects. Near that open end of the holder, the opposite side walls are slit across their width. This defines a transition that separates the spring motion stop section of the holder near the open end from the bowed wall main section of the holder. Instead of having the bowed walls, the section of the holder at the open end defines an opening into the holder that is completely rectangular. Thus, the end section of the holder provides two opposite sides which are essentially a chord across the ends of the cylindrically curved walls of the main section of the holder. The rear edges of the unbowed sides provide an abutment against which the pressure spring, at the brush end thereof, may bear so that the spring will not push itself out of the holder. The spring is thus retained in the holder at one end by the rear abutment of the holder and at the opposite end by the unbowed stop section of the holder at the open end. More generally expressed, in at least one dimension across the holder, the main section is wider than the spring stop section, so that the spring moving toward the stop section will be blocked from moving through that section.

Interengagement or attachment of the brush and of the spring which cannot leave the holder ensures that the brush will not fall out of the holder while the entire brush assembly is being transported or inserted in or removed from a motor or at the end of the useful life of the brush.

The end of the holder away from the open end carries an outwardly projecting abutment which limits the insertion of the entire holder into a retainer for the brush in the motor structure and thereby positions the brush holder within the motor structure.

The open end of the holder is also provided with an extension which, preferably after insertion of the brush assembly into the retainer therefor in the electric motor, may be bent up to

assist in retaining the holder in the retainer and to provide a connector for an electric lead for the brush.

The primary object of the present invention, therefore, is to provide a holder for a brush for an electric motor, wherein a compression spring that is compressed within the brush holder biases the brush to project from one end of the brush holder.

The invention further has for its object the arrangement of the holder so that a stop for the compression spring is provided adjacent the end of the holder through which the brush projects.

Another object of the invention is to retain the brush bias spring in the holder without the need for assembly of extra elements in the holder.

A further object of the invention is to guide motion of the brush the motor operates and to keep a desired orientation for the brush.

A further object of the invention is to form the brush holder from a simple tubular structure which is rectangular at the open end from which the brush emerges and which is cylindrical back from that open end to accommodate the compression spring and which inherently provides an abutment and stop for the compression spring to ensure that the compression spring always stays within the holder.

Figure 1 is a generalized schematic view of an electric motor showing the position which the brush holder of the present invention occupies in an electric motor.

Fig. 2 is a view, partly in cross-section, of the brush holder of the present invention.

Fig. 3 is a view in perspective showing the brush and holder prior to completion.

Fig. 4 is a view in perspective corresponding to Fig. 3 showing the completed assembly of a brush holder provided with brush and spring.

Fig. 5 is a cross-sectional view of the motor taken along line 5—5 of Fig. 1 looking in the direction of the arrows and showing in particular a pair of brush holder retainers in the motor and the brush holders of the invention inserted therein.

Fig. 6 is a view taken from line 6—6 of Fig. 5 looking in the direction of the arrows and showing a brush assembly in the electric motor.

Fig. 7 is a view of one side of the brush holder, without the brush present, in the direction of arrows 7—7 of Fig. 9.

Fig. 8 is an end view of the brush holder taken from the right side in Fig. 7.

Fig. 9 is a top view of the brush holder of Fig. 7 viewed in the direction of arrows 9—9 of Fig. 7.

Fig. 10 is the opposite side view of the brush holder of Fig. 7 and showing the seam in the tube.

Fig. 11 is a side view of the brush with the biasing spring connected thereto.

In Fig. 1 and 5 one embodiment of an electric motor 20 is here shown mounted on a support 19. The illustrated motor is a by-pass-type blower motor for creating suction in an electric vacuum cleaner, but the application of the invention is not limited to any particular motor.

The motor includes a conventional commutator 21 on the armature 22 of the motor. The motor drives a shaft 23 to rotate and this in turn rotates the armature inside the stator pole pieces 24. The shaft 23 drives the blower motor main fan 25 and motor cooling fan 26 in the usual manner.

The support 19 is provided with a lower bearing 27 and an upper bearing 28 which rotatively support the shaft 23 and support the electric motor 20. The bearings 27 and 28 are in turn supported in housings 28a and 28b at the top and bottom. The housings may be directly interconnected or may be connected together by the stator pole pieces 24 of the motor. The housings 28a and 28b are respective plastic moldings, for instance.

The housing 28b carries integrally formed brush holder retainers 73, which are essentially tubular members, each adapted to receive and retain in position the brush holder hereinafter described. When the brush holders are inserted into the respective retainers 73, the front end of each brush 30 bears against the commutator 21 of the motor armature in order to provide appropriate contact therewith for electric current as is well known in the art. Each of the retainers 73 is provided with a removable cap 78 preferably of resilient insulating material in order to ensure that the brush remains within the holder retainer 73. Cap 78 is a snap-on cap having a re-entrant flange 79 which in turn engages a flange 80 on the holder retainer 73 to provide appropriate means for holding the brush in place and also for retaining the brush against being accidentally snapped out. Since the caps 78 are of resilient material they may be removed by prying against the re-entrant flange 79 in order to permit removal of the brush which is retained by the holder retainer 73 and permit replacement thereof.

The brush is a conventional carbon brush 30 with an end 40 which engages the commutator 21. The brush 30 has a rectangular cross-section, uniform along its length. The brush 30 is housed in the holder 31.

The brush holder 31 is a tubular member initially formed from flat sheet material that has been folded over to the generally rectangular hollow cross-section seen in Fig. 8. The folded sheet is appropriately seamed at 32, as seen in Fig. 10, in order to provide a brush holder structure which is substantially smooth inside and outside. The seam is either cold welded or otherwise interengaged and secured in order to integrate and interlock the seam ends.

A coiled, cylindrical cross-section, compression spring 35 is positioned inside the brush holder 31 and it engages the inward or rearward end of brush 30. The engagement is through the turn down section 36 at the end of the spring 35 being received in the opening 37

of the brush 30. The engagement of the spring 35 with the brush 30 ensures that the brush 30 will not fall out of the brush holder 31 at the end of the useful life of the brush and during transportation, insertion or removal of the entire brush assembly in the holder retainer 73 of the motor.

The brush holder 31 is tubular, and is a rectangular tube with at least two opposite, outwardly bowed sides. One pair of opposite side walls 41 and 42 are parallel to each other and are essentially planar. A second par of opposite side walls 44 and 45 are, at their upper and lower margins adjacent the walls 41 and 42, parallel to each other, but they are bowed to a generally cylindrically curved form longitudinally thereof along the central areas 46 and 47 thereof. The bowed areas 46 and 47 of the walls 44 and 45 accommodate the cylindrical profile of the compression spring 35.

Towards the open end of the holder 31, the bowed areas terminate at the slits 50 and 51 formed in the side walls 44 and 45, leaving the flat unbowed, front end stop sections or narrowings 52 and 53 on the opposite side which are extensions of the walls 44 and 45. More generally stated, the distance across the holder 31 in at least one dimension, the dimension through the curved or bowed areas 46 and 47 of the opposite walls 44 and 45, is greater than the same dimension through the unbowed corresponding side walls 41 and 42 defining the stop sections. The rearwardly facing edges of the flat stop sections or narrowings 52 and 53 within the holder act together as a front stop for the front end 54 of the compression spring 35. Also, they guide the axial motion and the orientation of the brush 30 through the holder. Furthermore, together with the holder side walls 41 and 42, the narrowings 52, 53 are shaped to define an opening of substantially the same cross-section as the brush 30, which prohibits lateral shifting and rotation of the brush 30.

The rear end of the tube 31, at the end opposite the narrowings 52 and 53, is provided with tabs or extensions 60, 61 which are bent inwardly from the position of Fig. 2 and 3 to the position shown in Fig. 4 after the spring 35 has been inserted, to retain the spring compressed.

The compression spring 35 is preferably made of a conductive metal. Because it bears between the rear or inside end of the brush 30 and the bent in holder extensions 61, which hold the spring in position, an electrical path is provided from the connector 65 for the electric lead through the tube to the brush 30. In addition, because the brush 30 preferably has a current conducting fit with the stop sections 52 and 53 of the tube, current conduction occurs from the tube to the brush at that point.

When the brush holder 31 is inserted into the holder retainer 73, it is pushed in from the rear end of the retainer mechanism in a direction shown by the arrow 70 in Fig. 5 and is pushed home entirely within the retainer 73 so that the contact surface 40 of the brush 30 is pushed against the commutator 21. The spring 35 is thereby compressed. The cap 78 is snapped on over the flange 80 of the holder retainer 73 after the holder is inserted.

The inward movement of the brush of the present invention into the retainer 73 is controlled by a lateral extension 74 from the rear end of one of the side walls of the brush holder 31, in this case an extension from the side wall 42—46 at the rear. The extension 74 bears against the rearward edge 75 of the holder. Retainer 73 serves as an index to position the brush holder by limiting inward movement with respect to the motor. The brush is retained in position by the brush 30 bearing with its front contact end 40 against the commutator 21, the rear end of the brush being retained in position by the cap 78.

The holder retainer 73 of the motor structure lacks longitudinal slots or openings. Therefore, the connector 65 on the holder for the electric lead which connects the brush into the motor circuit is initially arranged flat as shown in Fig. 3. After the holder is inserted into the retainer 73, the connector 65 is bent and raised to a position where a motor lead 66 may be connected to it, as shown in Fig. 6. The motor lead is, in turn, connected with the stator pole pieces 24.

It will thus be seen that the brush holder of the present invention is one in which a simplified brush holder tube is created, wherein a compression spring is captured between the closed rear end of the tube and the opposite front end out of which the brush is spring biased. The compression spring is thus compressed between the brush and the rear end of the holder tube. However, when the tube is being transported and prior to this insertion in the motor or its removal from the motor, and therefore when the brush is not engaged with the commutator, a stop is provided in the holder for the spring so that it will not be ejected from the tube. The tube itself is configured at a stop section, which has a smaller cross-section than the spring, to provide the stop for the spring. Interconnection of the brush and the spring prevents the brush from being separated. The tube itself provides a simple way of connecting the brush in circuit with the motor and provides inherently within it appropriate electrical connection to the brush so that a connection to a tab extending from the tube will provide full electrical connection between the brush and the remainder of the circuit.

Claim

Brush holder (31) for the brush (30) of an electric motor (20), the holder (31) comprising a tube that is open at one end for receiving and retaining said brush (30), which is slidable out of the tube through said open end while being biased by a compression spring (35) which is re-

tained within the tube between the brush (30) and the other end of the tube opposite said open end, the tube having a narrowing serving as an abutment for the spring (35) in the direction of the open end to block the pathway of the spring out of the open end of the tube while permitting the brush in the tube to move through the open end, the brush (30) being electrically connected with an electric supply lead (65, 66) outside the holder, characterised in that the narrowing (52, 53) is provided at the open end of the tube so that the cross section of the brush holder at the open end defines an opening of substantially the same cross section as the brush (30). So as to surround the brush peripherally entirely with only a small clearance.

Revendication

Porte-balai (31) pour le balai (30) d'un moteur électrique (20), comprenant un tube ouvert à une extrémité pour loger et maintenir le balai (30), qui peut coulisser hors du tube par cette extrémité ouverte sous l'action d'un ressort de compression (35) qui est maintenu dans le tube, entre le balai (30) et l'autre extrémité du tube opposée à l'extrémité ouverte, le tube ayant un rétrécissement servant de butée au ressort (35) vers l'extrémité ouverte pour bloquer le passage au ressort, l'empêchant ainsi de sortir par l'extrémité ouverte du tube tout en permettant au balai qui s'y trouve de dépasser par l'extrémité ouverte, le balai (30) étant relié électriquement à un fil d'alimentation électrique (65, 66) extérieur au porte-balai, caractérisé en ce que le rétrécissement (52, 53) se trouve à l'extrémité ouverte du tube (50), de telle façon que la section du porte-balai à l'extrémité ouverte délimite une ouverture ayant sensiblement la même section que le balai (30), afin d'entourer le balai (30) sur toute sa périphérie avec seulement un faible jeu.

Patentanspruch

Bürstenhalter (31) für die Bürste (30) eines Elektromotors (20) umfassend ein rohrartiges Gehäuse, welches einseitig zur Aufnahme und Lagerung der Bürste (30) offen ist, welche durch dieses offene Ende aus dem rohrartigen Gehäuse herausgleiten kann, wobei sie von einer Druckfeder (35) beaufschlagt wird, welche in dem rohrartigen Gehäuse zwischen der Bürste (30) und dem dem offenen Ende gegengesetzten Ende des rohrartigen Gehäuses aufgenommen ist, und wobei das rohrartige Gehäuse eine als Anschlag für die Feder (35) in die Richtung auf das Ende zu dienende Verengung aufweist, um den Durchtritt der Feder durch das offene Ende des rohrartigen Gehäuses zu unterbinden und gleichzeitig die Bewegung der Bürste durch das offene Ende zu ermöglichen, wobei die Bürste (30) elektrisch mit einer elektrischen Zuführleitung (65, 66) außerhalb des Halters verbunden ist, dadurch gekennzeichnet, daß die Verengung (52, 53) am offenen Ende des rohrartigen Gehäuses angeordnet ist, so daß der Querschnitt des Bürstenhalters (31) am offenen Ende eine Öffnung ausbildet, welche im wesentlichen den gleichen Querschnitt wie die Bürste (30) aufweist, so daß sie die Bürste (30) außen ringsum mit nur einem geringen Zwischenraum umgibt.

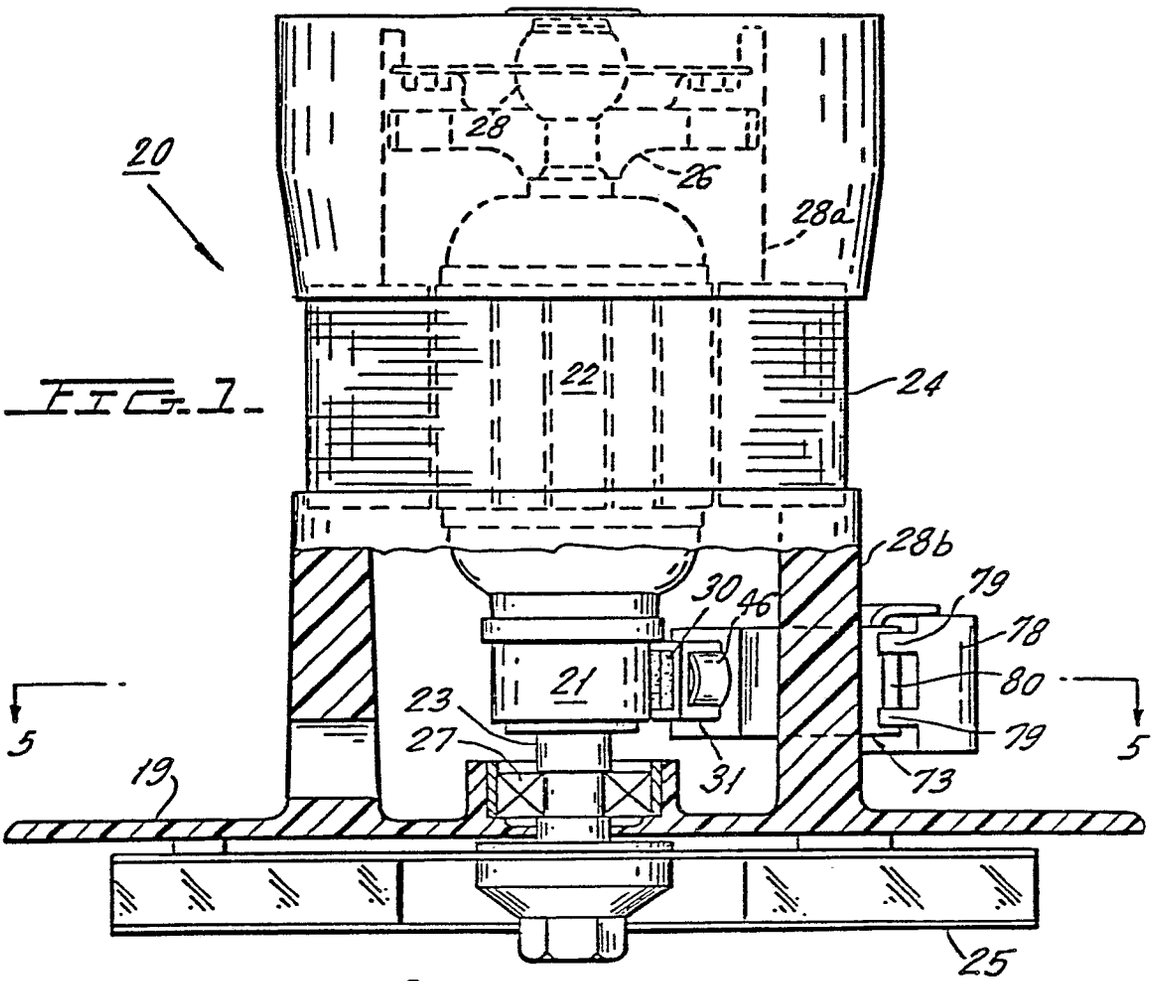

FIG. 1

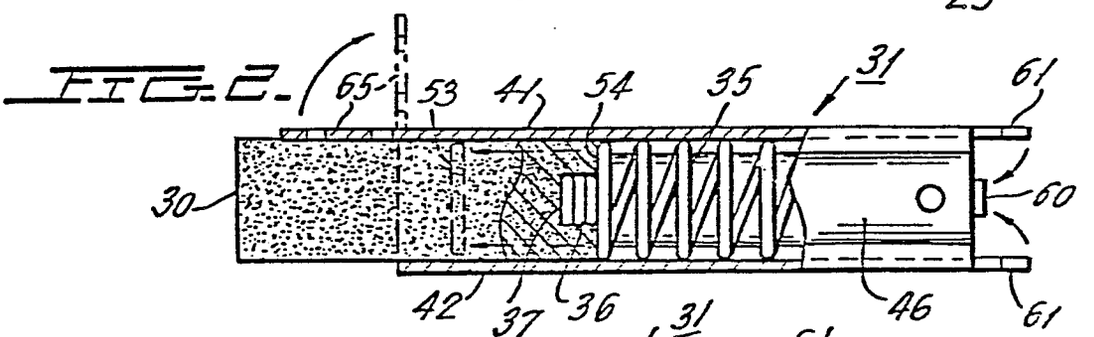

FIG. 2

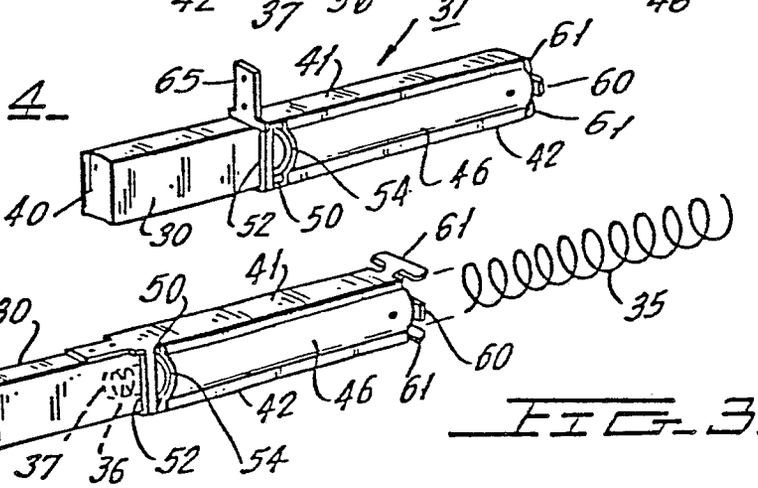

FIG. 4

FIG. 3

FIG. 5.

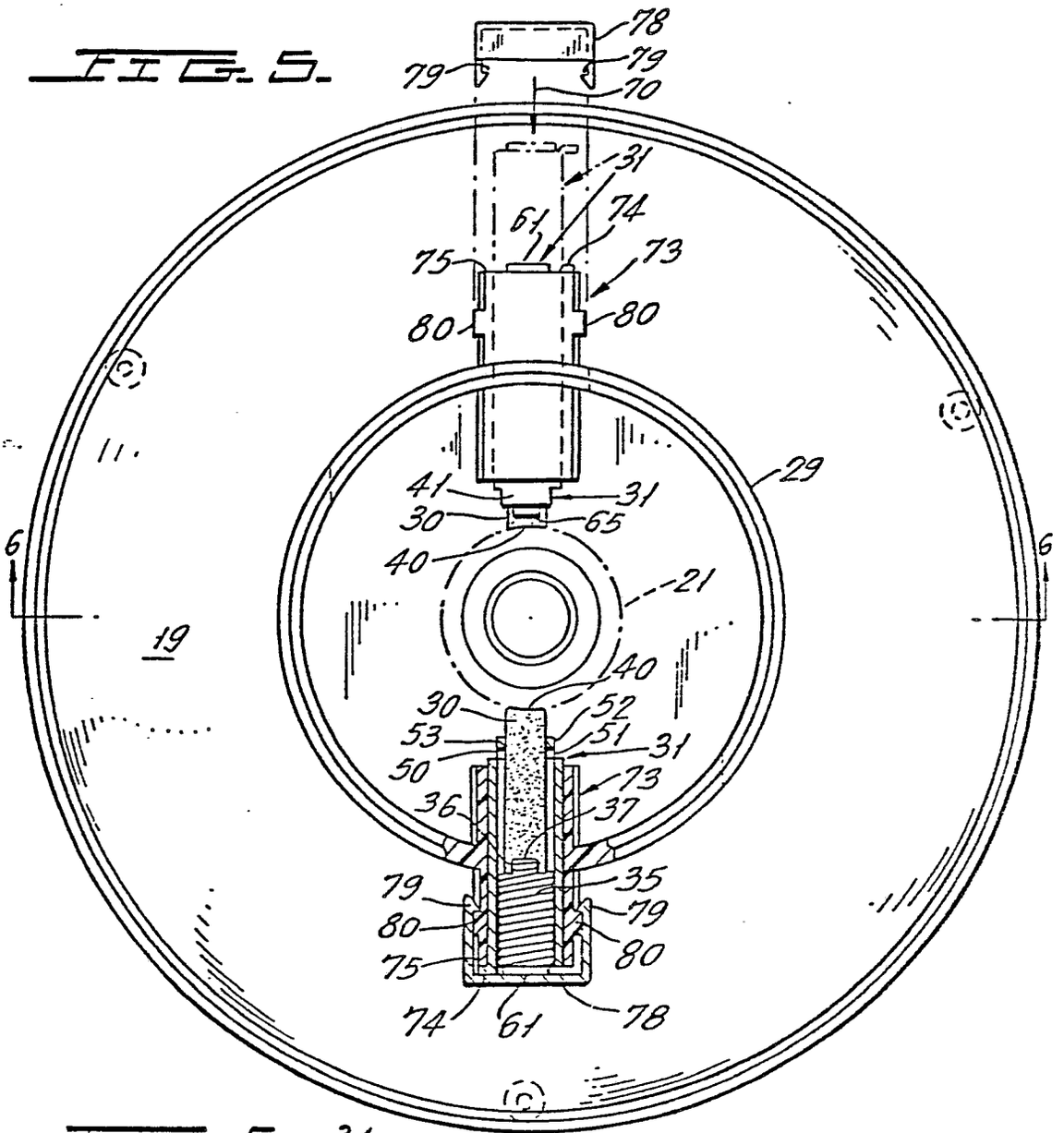
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FIG. 6.

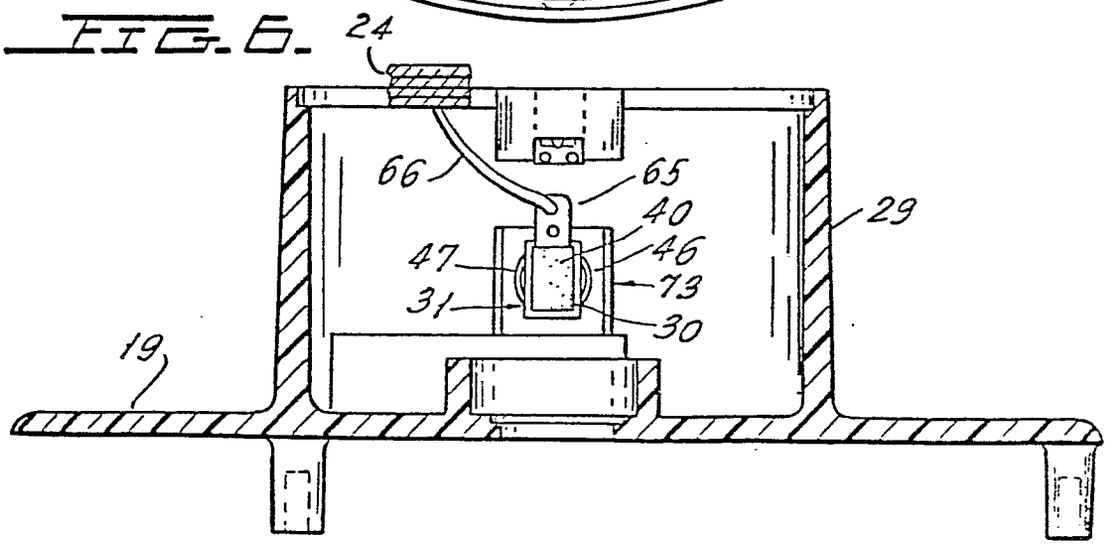
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FIG. 7

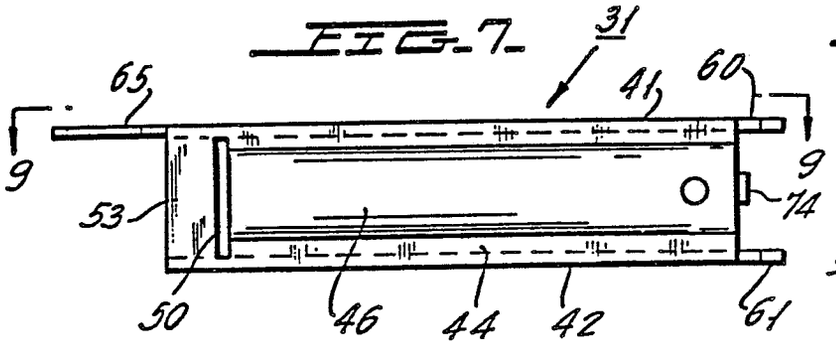
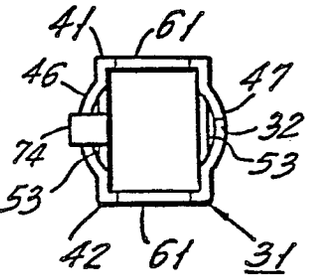


FIG. 8



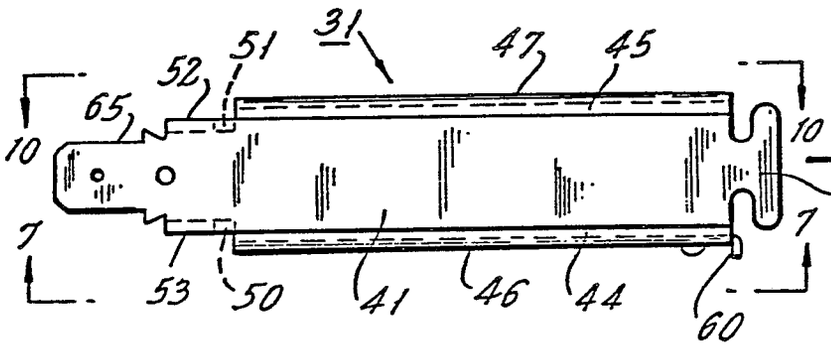


FIG. 9

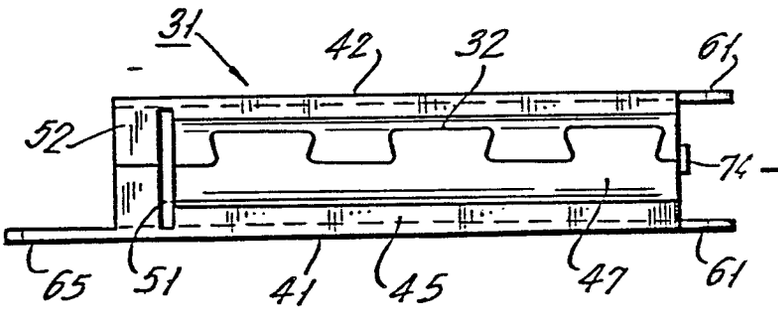


FIG. 10

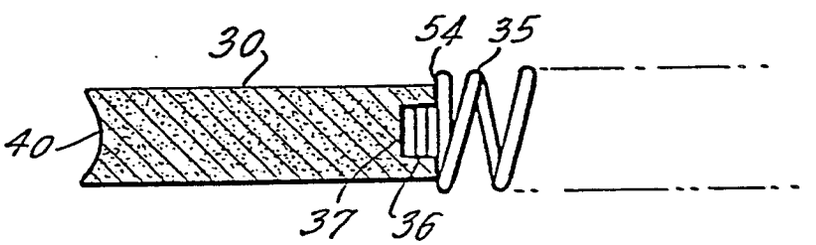


FIG. 11