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(54) Flex-rewinding device for domestic vacuum cleaners and the like

(57) Flex-rewinding device for domestic vacuum cleaners and the like in which the relevant spool is formed by two axially coupled flanged hubs (4, 5, 6, 7) that are produced by moulding a plastic material in a mould and counter-mould, without a sliding platen, the coupling and clamping of the hubs ensuring that the electric flex is secured to the hubs by inserting the electric flex, which is housed in a recess (10, 11) formed in the coupled faces of the hubs, between the hubs or, alternatively, by securing a terminal block (44) in the hubs which can be removed by loosening the hub-clamping means and is provided with securing means (52) and with electrical contacts (48, 49) which can move with the hubs and are in electrical contact with fixed contacts (20, 21).

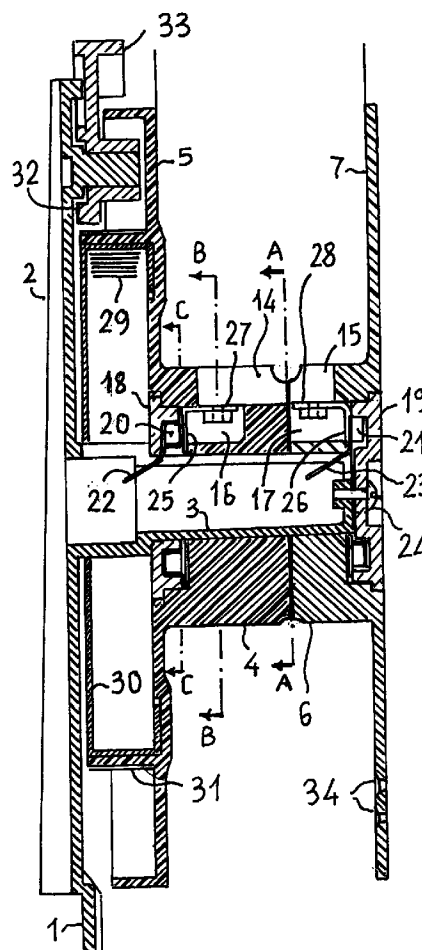


FIG. 1

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Description

The present invention relates to an automatic flex-rewinding device for domestic vacuum cleaners and the like (floor polishers, carpet sweepers), which could be defined as a universal device since, with a few minor constructional modifications which do not involve significant increases in manufacturing costs, it can be adapted to meet various requirements, whether of a dimensional or functional nature.

Domestic type vacuum cleaners with an automatic flex-rewinding device are known.

This device essentially consists of a flex-carrying spool that is pivoted on a spindle of a fixed support on the body of the vacuum cleaner and is held in a rest or retracted position by a coil spring, one end of which is attached to the support and the other to the spool.

The spool has a hub, with means for securing an electric flex, and a pair of sliding electrical contacts that engage with fixed contacts mounted on the spindle and connect the vacuum cleaner to the mains supply.

The spool in these flex-rewinding devices is made as a single piece by injection moulding a plastic material under pressure.

The fact that the spool has a considerable number of elements with undercuts makes it impossible to mould the article using a simple mould and counter-mould set, requiring the use of numerous additional sliding platens (at least two and, in practice, even three or four), in order to define the internal shape of the spool flanges as well as their external shape, together with the external shape of the hub.

Although the spool produced in this way has the advantage of being in a single piece, the costs involved in its production are extremely high and are only justifiable in the case of mass production runs and especially runs in which the size or shape of the spool does not need to be modified, since the moulds do not easily or economically lend themselves to modifications to produce spools, and therefore flex-rewinding devices, of a different size or which fulfil a different function, for example which carry flex of a different length or offer the possibility of having both automatic and manual rewinding modes.

In order to satisfy a variety of requirements, therefore, the manufacturer needs to make specific production investments, or, if he wishes to use existing flex-rewinding devices, he will have to resort to compromises that are far from ideal; alternatively, he will simply have to forget the whole idea of employing the device in appliances whose dimensions and structure do not allow the use of existing flex-rewinding devices.

Another drawback of known flex-rewinding devices is the difficulties involved in actually fitting them, in particular in securing the mains flex to the spool, which should really be a straightforward operation so that it can be easily replaced whenever the need arises.

These drawbacks are overcome by the flex-rewind-

ing device that forms the subject of the present invention and which comprises a spool that is essentially formed by two flanged hubs, each of which is produced by moulding it in a simple mould and counter-mould, without the need for any additional sliding platens, which hubs are coupled together to form a spool by coupling and clamping means consisting, for example, of two simple self-tapping screws that can be easily screwed in via an end face of one of the hubs which is external to the spool.

In this way, using simple mould inserts, it is possible to adapt the diameter of the flanges and the axial length of the hubs, or even of only one of the hubs, in order to satisfy various requirements relating to size and flex-carrying capacity.

At least one of the flanges is provided with means that position and couple it to a box housing a rewinding spring, and with a cylindrical friction ring that engages with a rewind-locking device, while the other flange is essentially flat and is optionally provided with means (for example one or more flared holes) via which it is coupled to a manual rewinding knob.

In this way, depending on different requirements, it is possible to produce both automatic and manual rewinding devices having compact and minimal dimensions, as well as devices with a double rewinding spring, by using a combination of hubs having flanges of both types or of the same type.

In a preferred embodiment the flex is advantageously secured simply by forming a flex housing in the coupling plane between the two hubs, so that when the two hubs are clamped together, the flex is firmly secured.

A further problem encountered with flex-rewinding devices lies in the fact that the electrical connection between the mains flex and the electrical components in the appliance is provided by sliding contacts which, as a result of a faulty connection caused by dirt or oxidation of the contacts, can generate electric arcs (sparks) and high local temperatures, with the possibility of triggering combustion reactions.

This problem, too, is easily solved in the flex-rewinding device of the present invention by using bushes and washers made of fire-resistant material which are inserted in housings in the two hubs in order to form two chambers for positioning and accommodating the fixed and movable sliding contacts.

These and other features and advantages of the present invention will become more apparent from the following description of a preferred embodiment and its variants, which description is given with reference to the appended drawings in which:

- Figure 1 is a diametral section through a first embodiment of a flex-rewinding device according to the present invention,
- Figure 2 is a view of the device of Fig. 1, limited to the spool hub only, on the plane A-A in Fig. 1,

- Figure 3 is a view of the device of Fig. 1, limited to the spool hub only, on the plane B-B in Fig.1,
- Figure 4 is a view of the device of Fig. 1, limited to the spool hub only, on the plane C-C in Fig.1,
- Figure 5 is a diametral section, limited to the spool hub only, of a first variant of the device in Fig.1,
- Figure 6 is a diametral section, limited to the spool hub only, of a second variant of the device in Fig.1,
- Figure 7 is an exploded perspective view, limited to the spool hub only, of a third variant of the device in Fig. 1.

With reference to Figures 1 to 4, a flex-rewinding device according to the present invention comprises a fixed support 1, known per se, via which the device is fixed to the appliance.

The support may be provided with reinforcement ribs 2.

Attached to the support, which can be produced by moulding a plastic material, and perpendicular to it, is a hollow cylindrical body 3 that acts as a supporting pin or spindle for a flex-carrying spool.

The spindle 3 is expediently cut or opened along a cylindrical arc in order to allow electrical connections to pass from the outside into its hollow interior.

Fitted on the spindle 3 is a spool that consists of a first cylindrical hub 4 having a flat circular flange 5 at its axial end closest to the support 1, and a second cylindrical hub 6 also having a flat circular flange 7, but at its axial end furthest away from the support 1.

The hubs 4, 6, which have the same diameter as the flange 5, are preferably, but not necessarily, of different axial length.

The two hubs are rigidly coupled together by means of two or more screws, preferably self-tapping screws, that screw into two diametrically opposite holes 8, 9 that extend in the axial direction of the hub 4.

The two screws pass freely into corresponding holes in the hub 6.

Two eccentric and preferably straight grooves 10, 11, of semi-circular and semi-oval section respectively, are formed in the flat juxtaposed faces of the two hubs and, when these two hubs are coupled together, these grooves form two housings, of circular and oval section respectively, with dimensions suited to accommodating the plastic-sheathed electric flexes which are to be housed in the spool.

Transverse projections 12, 13 are formed in the grooves 10, 11 so that, when the screws that couple the two hubs together are loosened, the electric flex can easily be inserted in one of the housings formed by the grooves 10, 11, without having to disassemble the hubs completely and, when the screws are retightened, the flex is reliably secured, with the projections 12 or 13 acting as clamping jaws.

It should be noted that the projections 12, 13 can be located in a staggered position in the two hubs, in order to force the flex to follow a serpentine path which, with-

out excessively deforming the plastic sheath, gives the flex an extremely efficient grip against tensile stresses.

The ends of the grooves 10, 11 which open out on to the periphery of the hubs are suitably connected to the cylindrical surface of the hubs in order to prevent the flex from being bent sharply as it is wound on the spool hub.

These connections also allow electrical leads (each of which has its own insulating protection) to pass into a housing, formed in each of the two hubs, that has two terminals connecting up with sliding contacts.

In each of the hubs, this housing essentially consists of an axial recess 14, 15, formed on the periphery of the hub and extending from the hub face that is juxtaposed to the other hub towards the corresponding flange, and a cavity 16, 17, formed inside the hub, that extends axially and is open at least on the hub face that is aligned with the corresponding flange.

Preferably, at least one of these internal cavities, for example the cavity 16 in Figs 1 and 3, is closed at its other end by a hub wall that separates the two cavities in the two hubs and provides insulation between the terminals by means of a dielectric material that has a greater rigidity than air.

Needless to say, all these elements can be produced by moulding them in a mould and counter-mould that are coupled together on a plane perpendicular to the axis of the hub, and the views in Figures 2, 3 and 4 can refer to both the hub 4 and the hub 6 since, apart from their axial length, which is preferably different, and the diameter of the holes such as 8 and 9, the two hubs can be identical.

Formed in the face of the hubs 4, 6 that is coplanar with the flange is an annular recess that is coaxial with the axis of the hubs and houses two plastic washers 18, 19 respectively, which are in the shape of a toroidal cup and contain a fixed sliding contact ring, denoted 20, 21 respectively, which has projecting corrugations lying in the direction of the hub axis, each ring having a connection tab 22, 23 that extends radially inside the contact ring in order to connect up with the ends of electric wires provided with "faston" attachments.

The tabs 22, 23 project through the axial opening in the pin 3 and right inside the pin so that the sliding contact rings 20, 21 and the associated washers are prevented from rotating on the pin 3.

The rotation of the washers 18, 19 with respect to the pin 3 can be prevented, not only by the tabs 22, 23, but also, for example, by providing a tooth that extends radially into the washer 18 and engages in the axial groove in the pin 3.

A similar arrangement can be used for the washer 19 which is fixed to the end of the pin 3 by means of a screw 24 (or a snap-fastening tooth) which can be loosened, together with the hub-clamping screws, in order to insert the electric flex into the relevant housing where it is secured.

Housed in each of the annular recesses, located

between the fixed electrical contacts 20, 21 and an internal stop piece at the bottom of the corresponding annular recess, are movable electrical contacts 25, 26 respectively, in the form of flat washers provided with brackets 27, 28 that support clamping terminals which face the grooves 14, 15 respectively in the hubs, in order to allow electrical connection of the flex ends.

In their simplest form, as illustrated, the terminals can consist of threaded cavities which take screws for clamping eyelet terminals, but they could also be formed by conducting bushes for the insertion and screw-clamping of rheophores, or by other types of terminals known per se.

The flex-rewinding device formed by the support 1 and the spool consisting of the two flanged hubs is then completed in a known way, with an automatic rewinding spring 29 housed in a box 30 which is in turn inserted in a cylindrical ring 31 provided on the flange 5.

This ring is knurled on the outside so that it can engage in a known manner with a pawl 32 that is held by a spring and, when engaged, allows the flex to be unwound only from the spool (by pulling on the flex) and, when disengaged from the ring 31 by means of manual pressure on a push button 33 connected to the pawl, allows the flex to be rewound automatically.

Needless to say, the flex-rewinding device described may undergo numerous variations, for example, the structure of the spool, which is made up of two axially coupled half-elements, enables flex-rewinding devices with different characteristics to be produced, thereby satisfying the most diverse requirements.

Indeed, it is quite clear that, simply by introducing annular inserts of varying diameters into the moulds, it is possible to form flanges of different diameters.

In the same way, again by using annular inserts of varying thicknesses, it is possible to vary the axial length of the hubs and therefore produce spools having a width and diameter specifically designed to carry a predetermined length of flex and/or to comply with given size limitations.

Also, by providing radially opposite pairs of peripheral axial grooves such as 14, 15 in the hubs 4 and 6, and terminal housings such as 16, 17 (which is obviously useful from the point of view of reducing the volume of material used and of ensuring that the moulded parts have a more uniform cross-section), it is then possible and advantageous not only to position the flex-rewinding spool in either direction, but also to distance the connection terminals from one another, positioning them radially opposite each other.

In order to pass one of the wires from the exit of the securing recess (10 or 11) into the radially opposite terminal housing, the second securing recess (11 or 10) which has not been used can be used, or a special channel can be formed in the juxtaposed faces of the two hubs.

Positioning the terminals radially opposite each other is particularly important in the case of spools

which have a reduced axial length since, if the terminals were placed in the same radial position, they would be so close together that the necessary electrical insulation could not be ensured.

If a manual rewinding device is to be produced, the spool can be made with two flanged hubs of the same type, with the flange, for example the flange 7, not having a cylindrical ring.

Advantageously, the flange 7 can be provided at the moulding stage with one or more holes, such as the hole 34, for fixing a manual rewinding knob (optionally of the type that fits flush).

When using a spool with a box for housing the return spring, in which the spring is variably distributed around the spool spindle and around an attachment spindle parallel with the former, the flange 5 does not need to be provided with a cylindrical ring such as the ring 31 to house the box; instead, the periphery of the flange can be used as a stopping and braking drum that engages with a friction block or pawl.

It is also quite easy to modify the structure of the hub in order to house bushes made of fire-resistant material that form a chamber in which the sliding contacts are contained.

This ensures maximum safety and protection against electric arcs without the need to use a fire-resistant material for the entire spool.

This embodiment variant is represented in the diametral section shown in Fig. 5 (limited solely to the hubs) which differs from the embodiment of Fig. 1 only in that an annular housing for a bush or washer 35 made of fire-resistant material is formed in the hub 4, between the movable sliding contact 25 and the hub 4.

The cup-shaped washer 18, which contains the fixed sliding contact, is, of course, also made of fire-resistant material.

Similarly, an annular housing is formed in the hub 6 for a bush or washer 36 made of fire-resistant material, between the movable sliding contact 26 and the hub 6.

The washer 19 is made of fire-resistant material.

It is also quite straightforward to modify the structure of the hub in order to house three pairs of sliding contacts, in other words so that there is an earth connection for the metal parts of an appliance in addition to the connections to the mains.

Figure 6 shows this variant in diametral section (limited solely to the hubs).

Figure 6 shows two terminal housings formed in one of the hubs, for example the hub 4, these housings being radially opposite each other with respect to the axis of the hub and consisting of an axial groove 14, 37 which is open on the periphery of the hub, and of an internal cavity 16, 38 respectively.

In addition, an annular housing is formed in the end face of the hub 4, juxtaposed to the hub 6, to house a cup-shaped plastic washer 39 which in turn houses an enclosed fixed sliding contact ring 40, together with a rotating contact ring 41 in the shape of a flat washer

which is integral in rotation with the hub 4, between the hub and the plastic washer 39.

The terminal of the rotating contact 41 is housed in the cavity 38.

Preferably, but not necessarily, a bush 35 made of fire-resistant material dielectrically separates the terminal of the rotating contact 41 from the rotating contact 25, even in the event of the terminal being stressed inappropriately and deformed.

The cup-shaped washer 39 is then held in position by coupling the two hubs 4 and 6 together.

In this variant, in order to avoid interference between the plastic washer 39 and the grooves in which the electric flex is housed and secured (such as 10 and 11 in Fig. 2), it is sufficient to increase the external diameter of the hubs by a few millimetres.

In the embodiments described above, the hubs are easily clamped together by screws that can be accessed on an external face of one of the spool flanges.

The electric connection terminals, on the other hand, are clamped by working between the flanges and, although quite straightforward, this may present some problems to an inexperienced operator.

It is, however, possible to avoid this limitation too by providing an insulating block which supports the movable contacts, the associated terminals and the devices which secure the electric flex, and which is fully removable from the spool, fitting between the two hubs and being removable therefrom by simply loosening the latter.

In this way all the operations involving securing the flex and clamping the terminals can be carried out comfortably, easily and reliably and, once these operations are complete, the insulating support block can be inserted into the spool and fixed therein by clamping the two hubs together.

Figure 7 shows this embodiment in a perspective exploded view which is limited to a single hub 4 and to the terminal block.

On its end face which is coupled to the other hub, the hub 4 has a prismatic opening 42 that extends as far as the diametric centre line of the hub, or even beyond this.

On the periphery of the hub 4, a segment-shaped tooth 43, formed integrally with the hub, extends into the opening 42.

As in the previous figures, a fixed sliding contact 20 is housed in the hub 4 and faces the opening 42, at least over a semi-circular arc.

The structure of the other hub which is juxtaposed to the hub 4 is identical.

The opening 42 (and the corresponding opening in the other hub) houses a removable plastic, and optionally fire-resistant, terminal block 44, which has a semi-cylindrical groove 45 in which the spool support pin is accommodated.

Two movable sliding contacts, in the shape of flat

half-rings 48, 49, are snap-fastened by means of retention teeth 46, 47 on to the end faces of the terminal block 44, perpendicular to the axis of the semi-cylindrical groove 45. These movable sliding contacts have connection terminals 50, 51 that are housed in suitable recesses in the terminal block 44 body formed in the opposite face to that with the semi-cylindrical groove 45.

This same face has openings for fixing a flex grip 52 and two projections 53, 54 that engage with the segment 43 and the corresponding segment in the other hub respectively.

The terminal block 44 can also be produced by moulding it in a mould and counter-mould, without the need for sliding platens.

In order to insert the terminal block into its housing in the spool, all that needs to be done is to loosen the screws that couple the two hubs together so as to allow it to pass between the retention segments.

Once the hubs have been retightened, the projections 53, 54 engage with the retention segments and the terminal block is immobilized in the spool.

At the same time the movable contacts 48, 49 come into contact with the corresponding fixed contacts of the spool.

Many other modifications can be made to the embodiments described.

For example, in addition to a first automatic rewinding spring, located on a first flange of the spool, a second spring can be provided which is juxtaposed to the second flange and wound in the same direction as the first spring but is coupled to the spool with a mechanism that inverts the direction of rotation.

The second spring is advantageously stressed when the first is relaxed.

The two springs work together to apply torques in the same direction to the spool, their strengths varying inversely according to the winding conditions.

In this way it is possible to even out the winding torque and the pull exerted on the flex, optionally also taking into account the varying diameter of the quantity of flex on the spool with respect to the different winding conditions.

Claims

1. Flex-rewinding device for domestic vacuum cleaners and the like, of the type in which a flex-carrying spool (4, 5, 6, 7) is pivoted on a spindle (3) of a fixed support (1) and may be held in a rest position by a coil spring (29), one end of which is attached to said support (1) and the other to said spool, said spool being provided with means for securing the electric flex and with at least one pair of sliding contacts that engage with fixed contacts on said spindle, characterized in that said spool comprises

- a first flanged hub (4, 5) pivoted on said spindle (3) and produced by moulding a plastic mate-

rial in a mould and countermould which are coupled together in a plane perpendicular to the axis of said first hub (4), without any transverse sliding platen;

- a second flanged hub (6, 7) pivoted on said spindle (3) and produced by moulding a plastic material in a mould and countermould which are coupled together in a plane perpendicular to the axis of said hub,
 - said first (4) and second (6) hubs being coupled together in axial alignment on a plane perpendicular to the axis of said hubs,
- means (8, 9) for axially coupling and clamping said first and second hubs together, which means can be screwed in on the opposite end face of one of said hubs to that on the said coupling plane;
- a first plastic cup-shaped washer (18) that supports and accommodates a first fixed electrical contact (20), which washer can rotate with respect to said first hub, is housed in a first annular housing formed in the opposite face of said first hub (4) to that on the said coupling plane, and is provided with rotation-locking means that engage with said support spindle;
- a second plastic cup-shaped washer (19) that supports and accommodates a second fixed electrical contact (21), which washer can rotate with respect to said second hub, is housed in a second annular housing formed in the opposite face of said second hub (6) to that on said coupling plane, and is provided with rotation-locking means that engage with said support spindle;
- at least one pair of sliding contacts (25, 26, 48, 49) that can rotate together with said hubs (4, 6), are in electrical contact with said first (20) and second (21) fixed electrical contacts respectively, and are housed in said first and second hubs respectively, each of the sliding contacts having a terminal (27, 28, 50, 51) that provides the electrical connection with an electric flex wound on said hubs.

2. Flex-rewinding device according to Claim 1, in which said first and second hubs form, in the coupling plane, an eccentric through housing for an electric flex which is secured therein when said hubs are clamped together by means of said coupling means.
3. Flex-rewinding device according to Claim 1 or 2, in which said first (4) and second (6) hubs form a third (14, 16) and fourth (15, 17) housing respectively, these housings being open along the periphery of said hubs and communicating with said first and second annular housings respectively so that each of them houses one of said electrical connection

terminals (27, 28).

4. Flex-rewinding device according to Claim 1, 2 or 3 in which said first (18) and second (19) washers are made of fire-resistant insulating material and which also comprises a pair of bushes (35, 36) made of fire-resistant insulating material which are housed in said first and second housings respectively.
5. Flex-rewinding device according to Claim 3, in which said third (14, 16) and fourth (15, 17) housings are respectively repeated in diametrically opposite positions on their respective hubs.
6. Flex-rewinding device according to Claim 1, in which said hubs form a third housing (42) for a terminal block (44), which housing is open along the periphery of said hubs and communicates with said first and second housings, said block having means (52) for securing the electric flex, supporting said pair of sliding contacts (48, 49), said electrical-connection terminals (50, 51), and being removable from said third housing by loosening said coupling and clamping means.

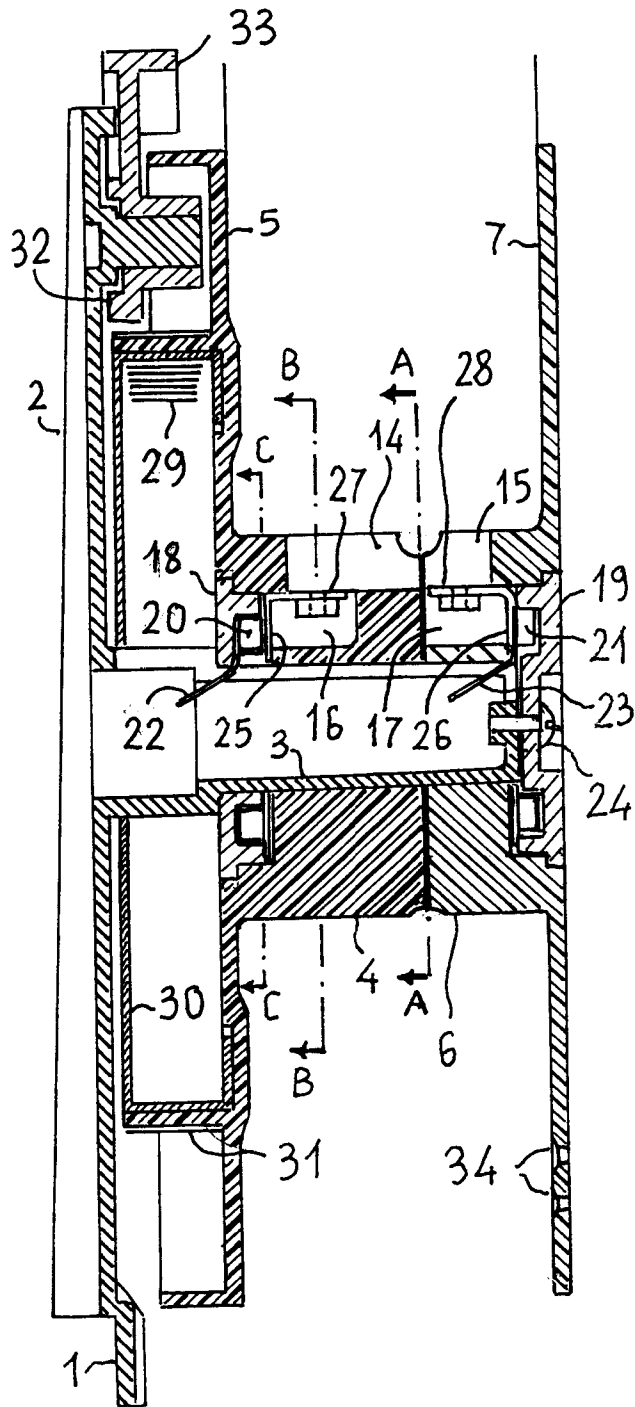


FIG. 1

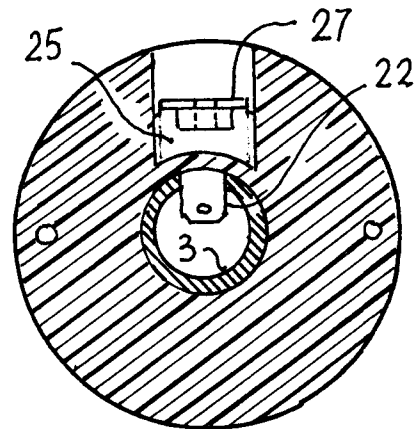
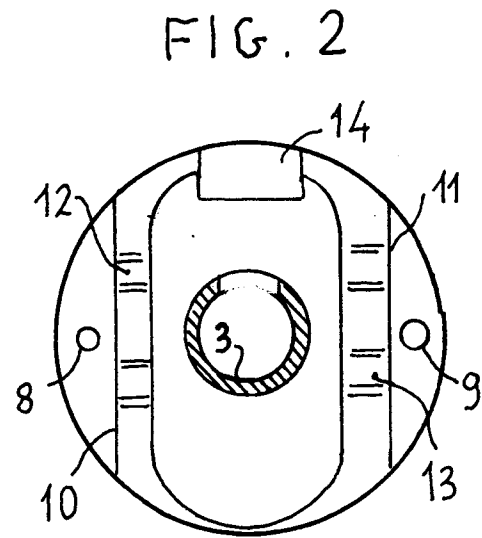


FIG. 3

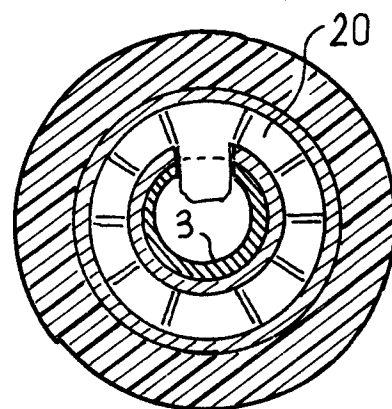


FIG. 4

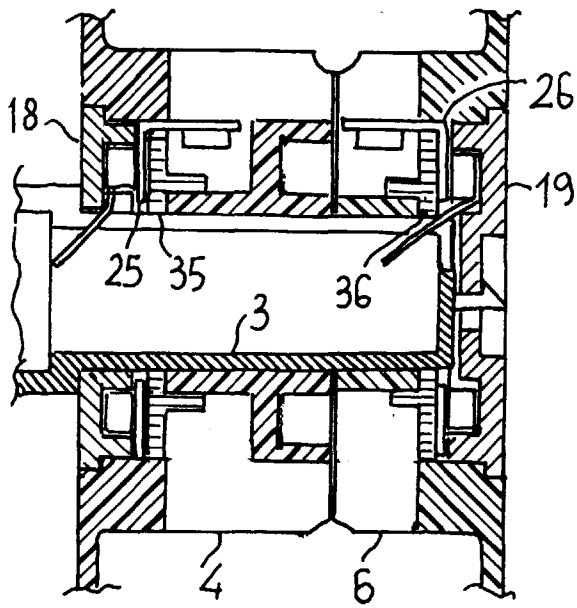


FIG. 5

FIG. 6

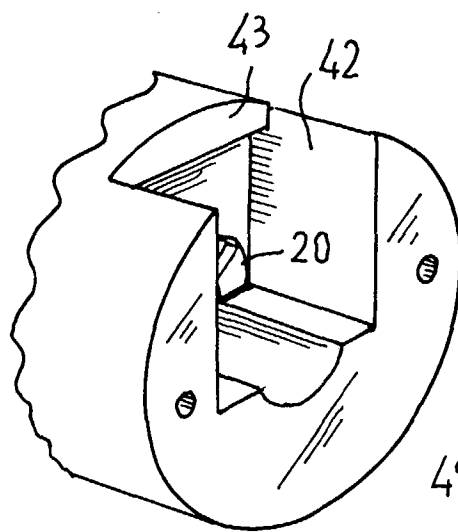
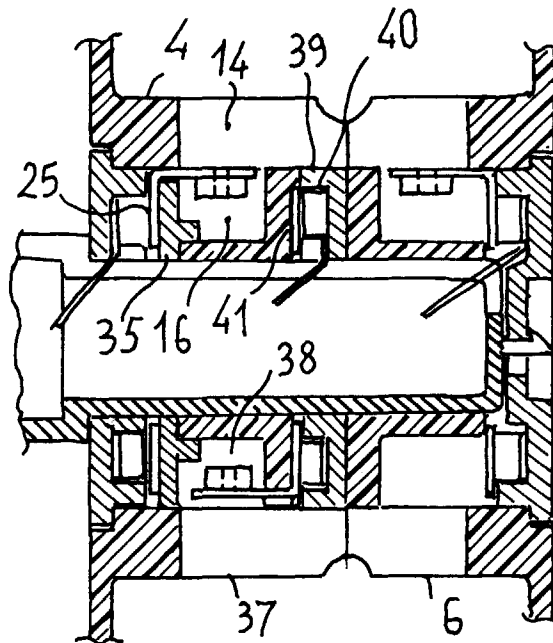
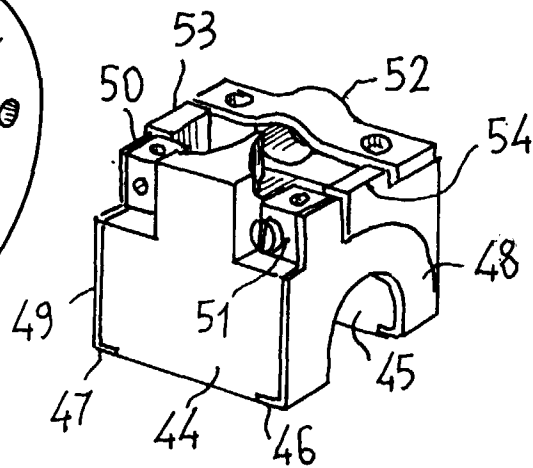


FIG. 7





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 97 83 0074

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	GB 1 356 388 A (BRITISH DOMESTIC APPLIANCES LTD) * page 2, line 63 - line 107; figures 1-13 *	1	A47L9/00 A47L9/26
A	US 3 808 382 A (BLANCH ET AL) ---		
A	US 3 450 369 A (BLANCH ET AL) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A47L H02G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 30 July 1997	Examiner Van Gelder, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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