United States Patent [19]

Houser

[11] **3,846,603**

[45] **Nov. 5, 1974**

[54] **HAIR CLIPPER WITH IMPROVED ON/OFF SWITCH**

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[73] Assignee: **Oster Corporation**, Milwaukee, Wis.

[22] Filed: **Nov. 13, 1972**

[21] Appl. No.: **305,952**

[52] **U.S. Cl.** ..... **200/157**, 310/68 A, 310/71

[51] **Int. Cl.** **H01h 13/08**

[58] **Field of Search** ..... 200/157, 67 C, 153 LA, 200/676, 166 J, 153 W; 74/99 R, 106, 100 R; 310/68 A, 50, 71, 32

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Assistant Examiner—William J. Smith
Attorney, Agent, or Firm—George R. Clark; Neil M. Rose; John S. Pacocha

[57] **ABSTRACT**

A flat on/off switch for a small, elongated hand-held appliance such as a hair clipper is disclosed. The switch consists of four parts. A resilient contact member, a carrier for the contact member, a knob section and an elliptical plastic spring. The contact member and the carrier are riveted together, but none of the other parts of the switch are preassembled. The carrier is pivoted about an upstanding boss on the upper housing. A downwardly directed pin on the spring engages a curved surface of the carrier while an upwardly directed pin on the spring is inserted into a hole in the knob section.

8 Claims, 14 Drawing Figures

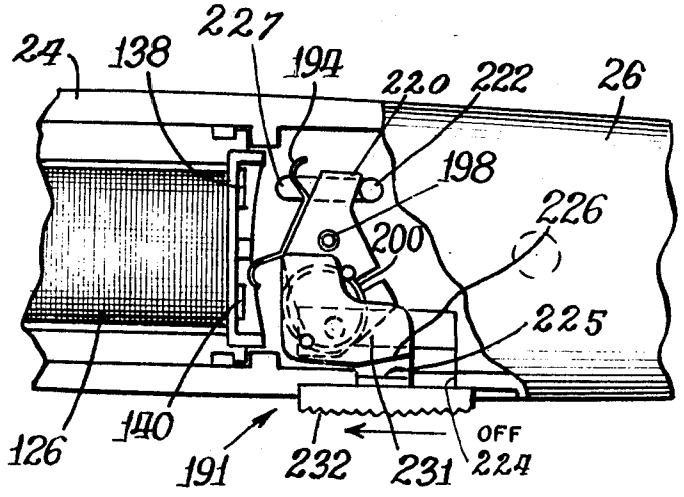


Fig. 1.

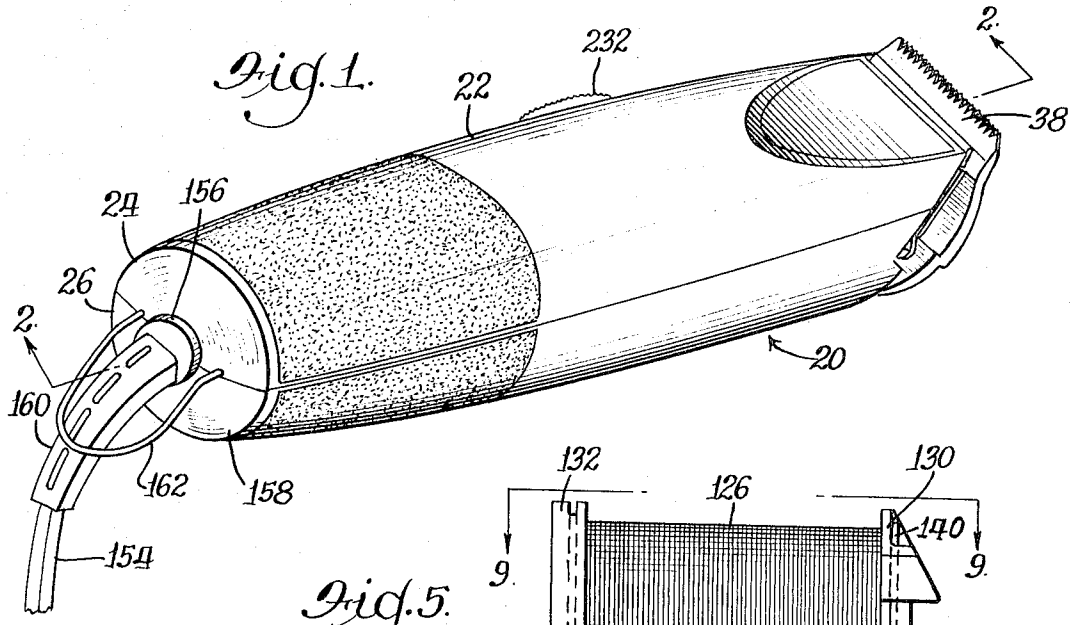


Fig. 5.

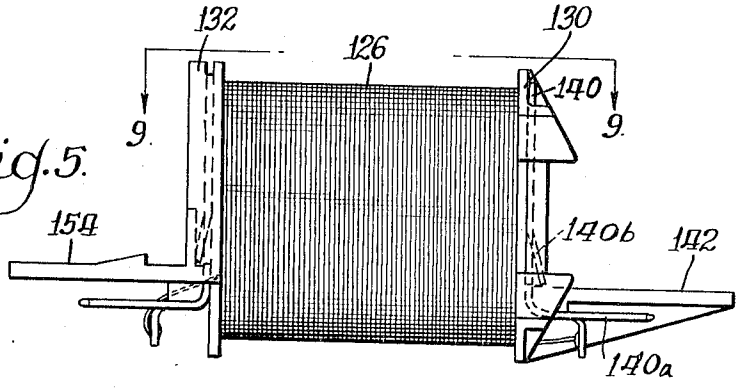
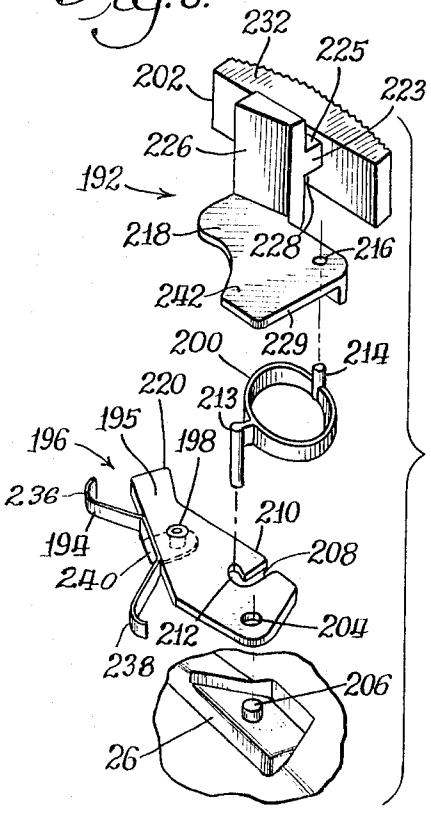


Fig. 6.



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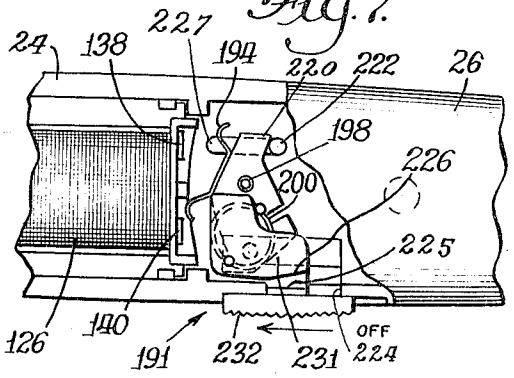

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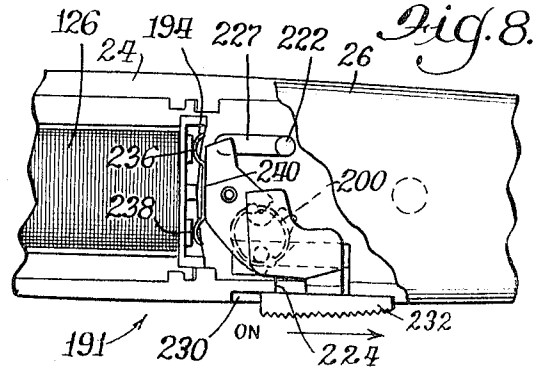
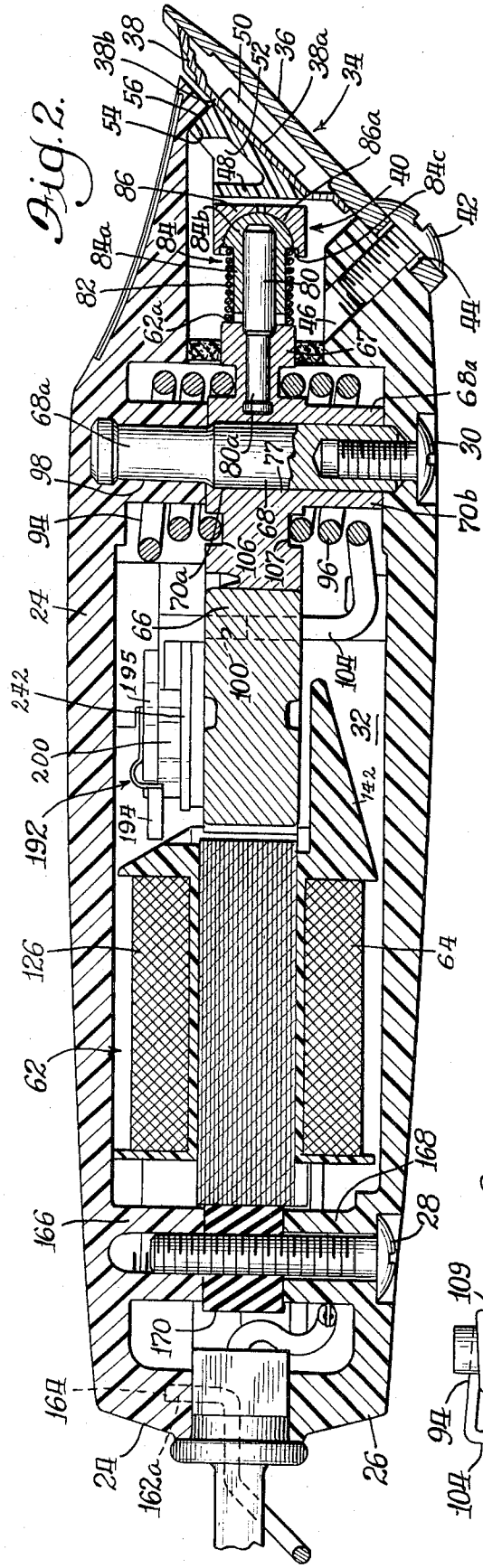


Fig. 2.



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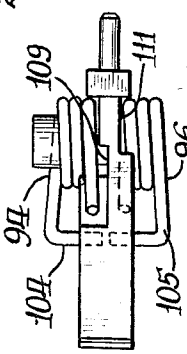


Fig. 3.

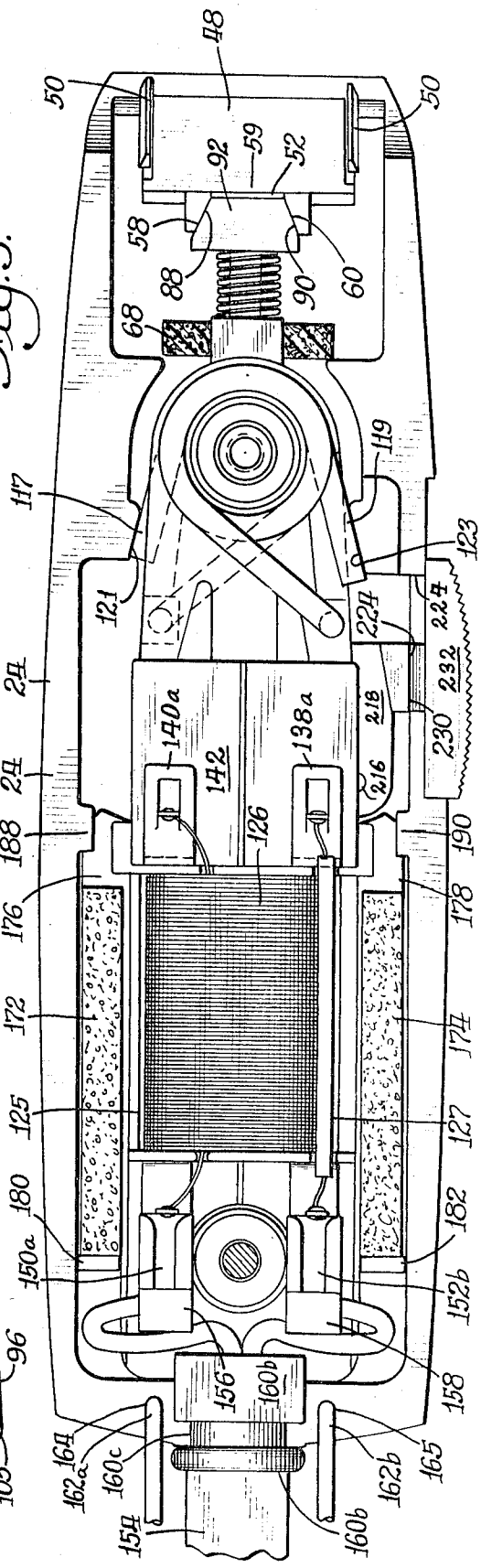


Fig. 9.

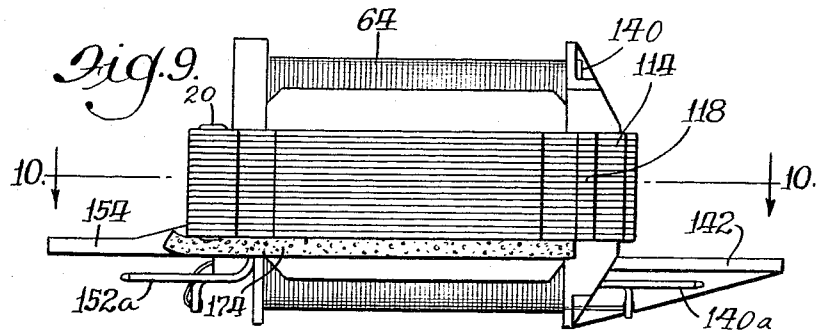
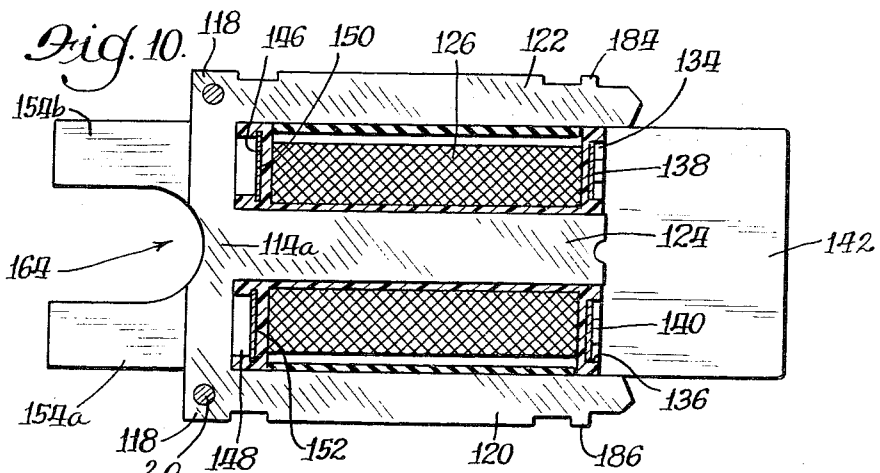


Fig. 10.



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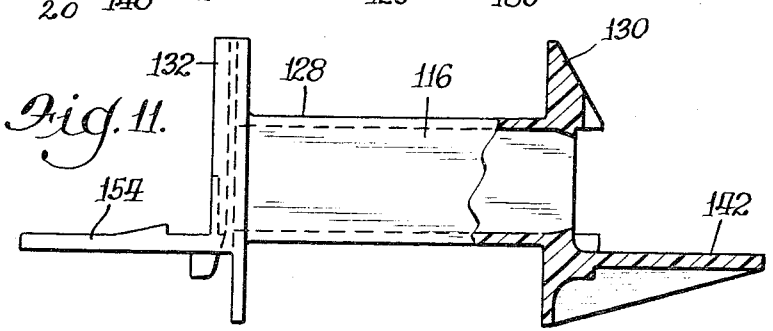

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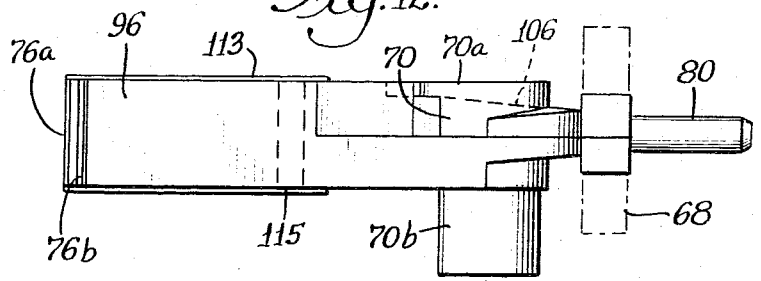


Fig. 13.

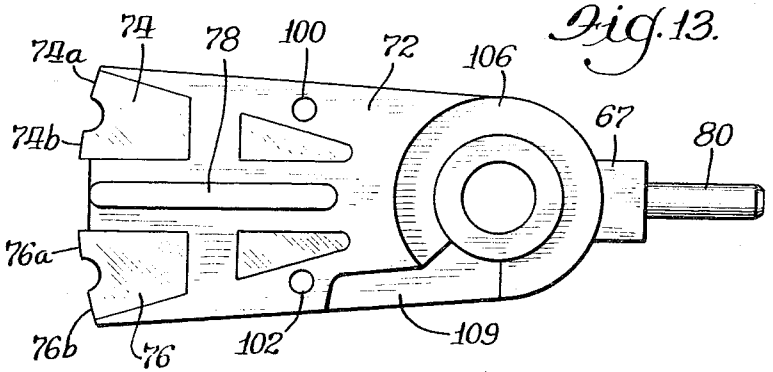
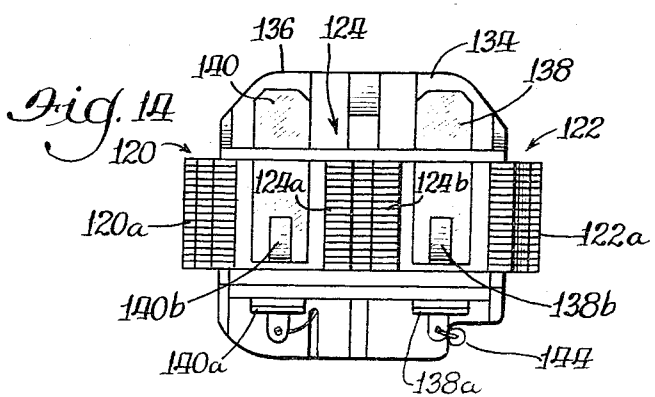


Fig. 14



HAIR CLIPPER WITH IMPROVED ON/OFF SWITCH

BACKGROUND OF THE INVENTION

The present invention relates to electric hair clippers and more specifically, to an electric hair clipper that is driven by an oscillating armature type of electric motor having an improved on/off switch. Several years ago, the assignee of the present invention introduced a hair clipper utilizing a vibratory oscillating armature type of electric motor which was especially designed for used by professional barbers. This previously introduced hair clipper of the assignee is described in U.S. Pat. No. 3,493,793, patented Feb. 3, 1970 on an application of Paul W. Niemela which was filed July 5, 1968. The present invention is described with reference to an embodiment which utilizes a motor that is similar to that of the Niemela patent, but it is not intended that the invention be limited solely thereto.

The hair clipper of the Niemela patent employed a vibratory motor that had a high power output per unit weight. Thus, the weight of a hair clipper could be reduced significantly by using this motor so as to relieve the fatigue of a barber who used the hair clipper relatively constantly during the working portion of his day. The hair clipper of the Niemela patent and the hair clipper of the described embodiment both employ armatures with a minimum mass and their armatures reverse direction with a minimum amount of noticeable housing vibration. This is also particularly important since acceptance of vibratory motor hair clippers has been limited in the past because of the presence of excessive vibration of the clipper housing. In addition, vibratory magnetic clippers were unpopular prior to the introduction of the clipper of the Niemela patent because they were sensitive to the fluctuation in the supply voltage or to change in the load. The vibratory motors of the Niemela patent and of the disclosed embodiment of the present invention herein are not inherently load sensitive as are the prior devices.

Despite the successful and highly satisfactory construction of the hair clipper of the Niemela patent, it has been found that several problems still existed with respect to the design of the hair clipper of that patent. In the hair clipper of the Niemela patent, the armature was pivoted for oscillating movement about a bearing pin which was secured to the lower housing of the clipper. On each side of the armature, a coil spring was compressed between the lower housing member and the nylon magnet supporting carrier of the armature. The housing had to be constructed so that a pair of U-shaped recesses or spring recesses were formed in it to receive the outer ends of the springs. The other ends of the springs were received by locating bosses on the nylon carrier. In order to dampen vibration noises associated with these springs, they were filled with a foam plastic material. This construction required that the housing be much wider than is optimum for the hand of the average user. The width of the housing made the clipper too bulky to be used comfortably by a user with an average or a small hand over a relatively long period of time.

The elongated hair clipper of the present invention by contrast is extremely narrow and thin and it is, therefore, very easily gripped by even the user with very small hands. The major reasons for this improved

shape being that torsion springs are employed in the hair clipper of the present invention which are coiled around the vertical axis of the bearing pin and the use of a new and improved very flat on/off switch. Thus, the elongated hair clipper can be made narrower without increasing its vertical dimension. In addition, with the use of torsion springs, much heavier springs can be employed, and thus, the problem of occasional spring breakage which occurred with the smaller coil springs of the clipper of the Niemela patent is eliminated.

The torsion springs also serve to hold the armature in place on the bearing pin. Because of this, a separate metal field locating and support member is not required in the hair clipper of the described embodiment as it is in the hair clipper of the Niemela patent. In the clipper of the present invention, the field is located by plastic abutments which are integrally formed on the housing and by a resilient bushing which is compressed when the upper and lower housing members are secured together. The bushing forces the mating cut-out surfaces on the field structure forward thereby forcing abutting members on the field structure against the locating abutments on the housing.

In the hair clipper of the Niemela patent, blade drive was achieved by means of an extension of the armature which drove the upper blade or the cutter by contact of the armature extension and the cutter along a line. The necessary pressure was maintained by an elongated biasing spring that was screwed into the lower housing of the cutter of the clipper. The biasing spring had a plastic block on its outer end which was inserted into a groove in the cutter so as to force the cutter against the comb.

The drive mechanism described in the previous paragraph has a number of disadvantages. First of all, since the armature extension makes contact with the cutter along a line, excessive wear of the cutter and of the armature may occur. In addition, the biasing spring may be subjected to bending or twisting with respect to the armature which could result in improper or uneven pressure upon the cutter which in turn would result in impaired cutting efficiency and increased load on the armature.

The previously mentioned Niemela patent employed a horizontal slideable knob which projected through the side of the housing and was connected to the on/off switch. The switch was mounted at the rear of a metal frame which located the field and was connected to the knob through an elongated extension arm. This arrangement was satisfactory from an operating standpoint, but it caused the thickness of the motor clipper to be greater than is desirable for a hand-held clipper, as previously mentioned.

In order to reduce the dimension of the hair clipper in the vertical direction, the present hair clipper employs a new and improved switch of a very flat construction. The switch of the described embodiment is useful for hand-held appliances and tools other than hair clippers. The movable part of the switch has only four parts and the only preassembly operation that is required for this assembly is the riveting of a spring contact member to a carrier member. Thus, the cost of the movable assembly of this switch is relatively low. The switch is designed so as to operate with an overcenter action when the horizontal slideable knob transmits a force through an elliptically shaped plastic spring to the carrier, thereby causing the carrier to pivot to-

ward or away from a pair of stationary contacts on the field structure of the motor.

It is an object of the present invention to provide a very flat on/off switch for portable motorized devices, including hair clippers and the like, which consists of a movable contact assembly and a fixed contact assembly.

It is an additional object of the present invention to provide a new and improved on/off switch for a motor operated device having a field structure with a bobbin which supports a plurality of stationary contacts for making connection to the field coil and to the power source and a movable assembly which preferably is formed of slideable knob section, a carrier which supports a movable contact member that engages the stationary contacts of the field structure and a resilient spring member which couples the knob section to the carrier.

It is another object of the present invention to provide an on/off switch with a movable assembly which is constructed with a minimum of preassembled parts, the only preassembled part being the carrier which consists of a movable contact member and a carrier plate to which the contact member is secured, wherein the movable assembly comprises a very flat configuration and the movable assembly functions to move the movable contact member into and out of engagement with a plurality of stationary contact members when a knob slides back and forth in the housing of the device that utilizes the switch.

It is a further object of the present invention to provide an on/off switch for energizing an electric motor that is housed in a portable device by means of a movable contact member which bridges a pair of stationary contact members that are secured to the bobbin on which the field coil for the motor is wound, wherein the movable contact member is part of a movable assembly which comprises a knob section that moves in the housing of the device, a carrier which supports the movable contact member and which is pivotally mounted with respect to the housing, and a spring member, preferably of a closed elliptical configuration, which has oppositely directed pins extending therefrom such that one of the pins is coupled to the knob section and the other pin is coupled to the carrier whereby pivotal motion of the carrier, preferably of the over-center type, is obtained by operation of the knob by the user of the device.

Additional advantages and objects of the present invention will be apparent to those skilled in the art from this document.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the hair clipper of the present invention with the upper blade or cutter removed;

FIG. **2** is a cross-sectional view of the hair clipper taken along the line **2—2** of FIG. **1**;

FIG. **3** is a plan view looking into the upper housing of the hair clipper with the lower housing removed, but with other parts of the clipper in place;

FIG. **4** is a side view of the hair clipper motor with the torsion return bias spring in place on the armature;

FIG. **5** is a side view of the motor field structure and its associated electrical contacts;

FIG. **6** is an exploded perspective view of the on/off switch with the lower portion of the switch, when assembled, being shown at the top of the figure;

FIG. **7** is a top partial cut-away view of the upper housing of the hair clipper showing the on/off switch in the off position;

FIG. **8** is a partial cut-away view of the upper housing of the hair clipper showing the on/off switch in the on position;

FIG. **9** is a cross-sectional view of the field structure taken along the lines **9—9** of FIG. **5**;

FIG. **10** is a cross-sectional view of the field structure taken along the lines **10—10** of FIG. **9**;

FIG. **11** is a side and partial cross-sectional view of the bobbin of the field structure;

FIG. **12** is a side view of the armature of the clipper motor;

FIG. **13** is a top view of the armature of the clipper motor; and

FIG. **14** is a front view of the motor field structure which shows the salient magnetic poles of the field.

TECHNICAL DESCRIPTION OF THE INVENTION

With reference to the drawings, there is shown in FIG. **1** a hair clipper designated generally by reference numeral **20.** The hair clipper **20** includes a housing **22** which is made of an upper housing member **24** and a lower housing member **26.** The upper and lower housing members are secured together in abutting relationship by screws **28, 30** to form a motor enclosure **32,** as shown in FIG. **2.** The housing **22** is preferably formed of a plastic such as phenolic.

A removable blade set **34** is received on the front end of the clipper. The blade set **34** consists of a lower blade or comb **36** and an upper blade or cutter **38** which is pressed into shearing engagement with the comb **36,** by a blade drive assembly **40.** The comb **36** is secured to the lower housing member **26** by a screw **42** which passes through an opening **44** in the lower portion of the comb **36** and then into a threaded channel **46.** There is a small amount of clearance between the screw **42** and the size of the opening **44** so that adjustment of the comb **36** may be easily made in order to achieve proper alignment of the comb **36** and the cutter **38.** The comb **36** and the cutter **38** are provided with teeth which have abutting outer edges in the conventional manner so that relative movement between the cutter **38** and the comb **36** will result in the desired cutting action of the hair.

The cutter **38** is provided with a plastic "snap-fit" drive shoe **48** which is part of the blade drive assembly **40.** The drive shoe **48** has projecting ears **50** that are constructed to extend through slots **38*a*** in the cutter when the ears **50** are pressed towards each other. When the pressure is released on the ears **50,** they are forced apart by the natural resiliency of the plastic against the outer edges of the slot **38*a*** so as to lock the drive shoe **48** onto the cutter **38.** The drive shoe **48,** which is best shown in FIG. **3** where the cutter **38** has been removed, is provided with the snap-fit ears **50** so that the cutter **38** may be removed and replaced by a new blade when it is dull. The cutter **38** is made of metal and is relatively thin and lightweight, and with the ease of assembly that is provided by the present invention, it becomes more economical and convenient to replace the cutter **38** when it is dull rather than to resharpen it.

The rear end of the drive shoe **48**, which faces towards the motor enclosure **32** is formed in the shape of a trapezoidal channel **52**. The trapezoidal channel **52** is open at its bottom and has a top surface **59** and side surfaces **58, 60**. Force supplied to the drive shoe **48** through the side surfaces **58, 60** of channel **52** presses the cutter **38** and the comb **36** together and drives a guide surface **54** at the front end of the drive shoe **48** against a downwardly depending mating guide surface **56** on the upper housing member **24**. The guide surface **56** is substantially at a right angle with respect to the elongated planer surface **38***b* of the cutter **38**. At this angle, the optimum normal force between the cutter **38** and the comb **36** and the optimum normal force between the guide surfaces **54, 56** are obtained. The manner in which the required driving force is transmitted to the side surfaces **58, 60** of the drive shoe **48** by the remaining elements of the drive assembly **40** is described later herein.

The required mechanical power for the hair clipper is provided by the electrical motor **62** which includes a field or stator **64** and an oscillating armature **66**. The armature **66** is supported for oscillating movement by means of a steel bearing pin **68** which has an upper end **68***a* of reduced diameter that is molded into the housing member **24**. An oil impregnated bushing **70** is integrally formed with the armature **66** so as to reduce the friction between the armature **66** and the bearing pin **68**. The rear portion of the armature **66** consists of a rigid insulating frame or carrier **72**, which is preferably constructed of nylon and into which permanent magnets **74, 76** are integrally molded.

A permanent magnet **78**, which is preferably formed of a ferrite ceramic material is positioned in the carrier **72** between the pole pieces **74, 76**. The pole pieces **74, 76** are elongated members that are formed of a suitable, magnetically permeable material, which may be sintered iron. The pole pieces **74, 76** have at their outer ends a pair of salient pole faces **74***a*, **74***b* and **76***a*, **76***b*, respectively. The permanent magnet **78** is polarized so that the pole pieces **74, 76** are magnetized to the opposite polarities. As a consequence, the salient pole faces **74***a*, **74***b* of the pole **74** will be magnetized to the opposite polarity of the salient pole faces **76***a*, **76***b* of the pole **76**. Thus, when the pole faces **74***a*, **74***b* are of a North pole, the pole faces **76***a*, **76***b* will be a South pole; and when the pole faces **74***a*, **74***b* are of a South pole, the pole faces **76***a*, **76***b* will be of a North pole.

The front end of the carrier **72** of the armature **66** has a steel drive pin **80** which has a rear portion of a reduced diameter **80***a* that is integrally molded into the forward section of the armature **66**. The drive pin **80** passes through a rectangular boss **67** on the forward section of the armature **66**. A foam pad **68**, which is preferably formed of polyether, surrounds the boss **67** to prevent hair clippings from entering the motor enclosure **32**. A drive bearing **84** which is preferably formed of plastic and which has a hollow cylindrical bearing surface **84***a* that receives the drive pin **80** and ball socket section **84***b* transmits driving force to drive socket **86**. A coil spring **82** surrounds the hollow cylindrical bearing section **84***a* and it is compressed around this section between the surface **67***a* of the boss **67** and the surface **84***c* of the drive bearing **84**. The ball socket section **84***b* of the drive bearing **84** transmits the forwardly directed force to the plastic drive socket **86**, the concave spherical recess **86***a* which receives the ball socket section **84***b* in mating relationship.

The plastic drive socket **86** has a front surface **92** and a pair of side surfaces **88, 90** which form a trapezoid that mates with the trapezoidal channel **52** that is formed in the drive shoe **48**. The side surfaces **88, 90** of the drive socket **86** abut against the side surfaces **58, 60** of the drive shoe **48** so as to impart a substantially uniform force to the drive shoe **48** along a relatively large surface area. By imparting the drive force along a relatively wide surface area a minimum of wear is insured. In order to prevent the binding of the socket **86** and the drive shoe **48**, space is provided between the forward surface **92** of the drive socket **86** and the rear surface **59** of the trapezoidal channel **52** of the drive shoe **48**. Although the drive shoe **48** itself could be formed with the corresponding spherical recess for receiving the ball socket section **84***b*, it is preferred that a separate drive member, such as the drive socket **86**, be provided so that tolerances in the construction of the blade drive assembly may be increased. The drive socket **86** has a hole **86***c* in the spherical recesses **86***b* which prevents compression of air between the ball socket **84***b* and the recess **86***b* which would reduce the effectiveness of the blade drive mechanism.

In operation, the armature **66** is biased to a central position by means of a pair of torsion springs **94, 96** which surround a downwardly depending boss **98** that is formed on the upper housing **24** and the downwardly depending portion **70***b* of the bushing **70**. The carrier section **72** of the armature **66** has a pair of apertures therein, **100, 102** for receiving the bent outer ends **104, 105**, respectively, of the torsion springs **94, 96**. Slightly sloped spring channels **106, 107** are formed around the upper portion **70***a* and on the uppermost part of the lower portion **70***b* of the bearing **70**. Sloped spring support bearings **75, 77** are also formed in the upper and lower housing members **24, 26**, as shown in FIG. **2**. The torsion springs **94, 96** are placed in the spring channels **106, 107**, respectively, and are coiled around the vertical axis of the drive pin **80**. A pair of cut-away landings **109, 111** are provided at the outer edge of the spring channels **106, 107**, respectively, below the level of the upper and lower exterior surfaces **113** and **115** of the carrier **72**. The ends **117, 119** of the torsion springs **94, 96** which are not inserted into the apertures **100, 102** are then placed in the landings **109, 111** so that they extend outwardly until they abut against the respective one of the shoulders **121, 123** which are formed integrally with the lower housing member **26**. Thus, the springs **94, 96** are able to return the armature **72** to its center position by means of the torsion spring effect that is exhibited by the springs **94, 96** due to the force that is applied between the outer ends **117, 119** of the springs **94, 96** and the corresponding shoulder portions **121, 123** of the housing **22**.

By employing torsion springs that are wound about the vertical axis of the bearing pin **68** instead of horizontally oriented coiled springs, such as those employed in the clipper of the previously mentioned Niemela patent, a very slim and compact hair clipper may be constructed. In addition, by using torsion springs much larger springs can be used and, therefore, the possibility of spring breakage is reduced. The torsion springs **94, 96** are preferably formed of tin plated music wire or the like.

The field **64** for the hair clipper consists of core **114** which is formed of a stack of E-shaped laminations **118** that are made of magnetically permeable material which are retained together and are secured to a plastic supporting bobbin **116** by means of rivets **20.** The E-shaped core **114** has a pair of outer legs **120, 122,** and a central leg **124.** The central leg **124** is substantially thicker than the outer legs **120, 122** and it terminates in a pair of salient poles **124***a*, **124***b*. The outer legs **120, 122** of the core **114** terminate in a salient pole pairs **120***a*, **122***a*, respectively. Surrounding the central leg **124** of the core **114** is a field coil **126** which is best shown in FIG. **5.** The bobbin **116** has a hollow cylindrical center around which the windings of the coil **126** are wound. The coil **126** is formed of magnetic wire having a conventional suitable insulation thereon. The inside surfaces of the outer legs **120, 122** are further insulated from the coil **126** by a pair of fibre insulators **126, 127** which are inserted between the legs **120, 122** and the outside of the coil **126** (FIG. **3**).

When the coil **126** is energized by electrical current flowing in either direction, it will induce magnetic flux in the core **114** which will cause the salient pole faces **124***a*, **124***b* of the central leg **124** to be magnetized to one polarity, while the salient pole faces **120***a*, **122***a* of the outer legs **120, 122,** respectively, will be magnetized to the opposite polarity. By means of the interaction that occurs between the salient poles **120***a*, **122***a*, **124***a* and **124***b* of the core **114** and the salient poles **74***a*, **74***b*, **76***a* and **76***b* of the armature **66,** the desired vibratory action of the motor is obtained. A more complete description of the operation of a motor that is employed in the present invention may be obtained by reference to the aforementioned Niemela Patent. However, it should be appreciated that the present invention is not limited to the specific type of motor shown in the Niemela patent.

The bobbin **116** on which the coil **126** is wound is formed with a pair of end panels **130, 132** which extend on opposite sides of the central section **128** so as to form a reel for the coil **126.** In addition, however, both the front end panel **130** and the rear end panel **132** are provided with a pair of grooves which are used to receive a pair of electrical contact members so as to provide the required electrical connection to the field coil **126** and to the power source. For example, the slots **134, 136** are provided in the front end panel **130** for receiving the electrically conducted connectors **138, 140,** respectively. The connectors **138, 140** extend downwardly into the slots **134, 136** along substantially the entire length of the rear end panel **132** and down beyond a forwardly extending ledge **142** of the rear end panel **132.** The lower ends of the connectors **138, 140** are then outwardly bent and end in terminals **138***a*, **140***a*. The forward end of the field coil **126** is brought out and connected to the terminal **140***a* while the jumper wire **144,** which is coupled to the power source, is connected to the terminal **138***a*.

A pair of slots **146, 148** are also formed in the rear end panel **132** of the bobbin **116** for receiving the connectors **150, 152.** The connectors, **150, 152** extend downwardly along the rear end panel **130** for a major portion of its length. The lower end of the connectors **150, 152** are bent outwardly and they end in terminals **150***a*, **152***a* (FIG. **3**). The rear end of the field coil **126** is brought out and is connected to the terminal **150***a*, and the jumper wire **144,** which is also connected to the terminal **138***a*, is connected to terminal **152***a*. The terminals **150***a*, **152***a* are interconnected with the power cord **154** through a pair of removable female connectors **156, 158** which receive the male terminals **150***a*, **152***a*, respectively.

Input power is supplied to the motor **62** the hair clipper through the power cord **154** which passes into the clipper **20** through an aperture **156** in the rear face **158** of the housing **22.** A flexible strain relief bushing **160** is secured around the power cord **154** at its end where it passes through the aperture **156.** The strain relief bushing **160** has a forward rectangular section **160***a* and a ring-like section **160***b* which is separated from section **160***a* sufficiently to form an intermediate groove **160***c* that mates with a corresponding pair of ribs (not shown) formed on the upper and lower housing members **24, 26.** This groove and rib thereby holds the bushing **160** in place in the housing **22.**

In order that the clipper may be hung on a nail or hook when it is not in use, a bail **162,** is preferably formed out of stainless steel, is also provided at the rear face of the clipper **20.** The bail **162** is bent so as to act as a spring and the outer ends **162***a*, **162***b* of the bail **162** are bent upwardly so as to extend into the holes **164, 165** in the upper housing member **124,** thereby securing the bail **162** to the housing **22.**

One desirable feature of the hair clipper of the described embodiment is that the field **64** is held in place in the housing of the clipper without the necessity of coupling any external securing means to the field **64.** Screws **28, 30** are screwed into the threaded boss **166** at the rear of the upper housing **24** and into the threaded lower end **68***a* of the bearing pin **68,** respectively, to hold the upper and lower housing members **24, 26** together. The lower housing member **26** has an upwardly projecting cylindrical boss **168** through which the screw **28** also projects. The ledge **154** of the bobbin **116** is formed with two legs **154***a*, **154***b*, while the forward portion of the ledge **154** and the core **114** both have a semicircular cutout section **164** so that the legs **154***a*, **154***b* of the ledge **154** extend around the lower boss **168.** A resilient, compressible cylindrical bushing **170** which is made of neoprene, or other suitable material, is positioned between the bosses **166, 168** and positioned so that the semicircular cutout portion **164** of the edge **114***a* of the core **114** conforms to the cylindrical outer surface of the bushing **170,** as best shown in FIG. **2.** The insulating member **170** is compressed between the bosses **166** and **168** when the screws **28, 30** are screwed into their respective bosses and as the bushing **170** is compressed, it presses forward against the edge **114***a* of the core **114** to urge the field **64** forward. As the field **64** is pressed forward by the compressed bushing **170,** the abutments **184, 186** on the outer legs **120, 122** of the laminations of the core **114** are pressed into contact with abutments **188, 190** that are integrally formed on the upper housing member **24.** When the abutments **184, 186** of the field **64** are pressed into contact with the abutments **188, 190,** respectively, of the housing **22** and the rear edge **114**a of the core **114** is wedged against the compressed bushing **170,** the field **74** is secured firmly in place in the housing.

A pair of resilient foam pad strips **172, 174** are cemented to the bottom of the core **114.** The foam pad strips **172, 174** are compressed against the integrally formed runners **176** of the lower housing member **26**

when the housing is secured together. These strips **172, 174** are also bent up as the upwardly forward portion of the core **114** so as to abut against the upwardly projecting abutment members **180, 182** of the lower housing member **26.** The foam strips **172, 174** are then flattened out when the housing is assembled to take up any looseness that might otherwise exist between the field **64** and the housing **22** to cushion movement of the field **64.**

The described construction for positioning the field in its proper place eliminates the need for special mounting frames and also the necessity of putting holes in the core structure. In the motor of the described embodiment, the core laminations **114** are preferably very thin in order to minimize core losses, and if holes were drilled in the laminations and mounting screws were inserted in these holes the magnetic properties of the core would be substantially deteriorated.

The on/off switch **191** of the hair clipper of the described embodiment is very flat, which allows for a reduction in the exterior dimensions of the housing. The on/off switch **191** is very simple to assemble since only one pre-assembly operation is required for the movable assembly **192** of the switch. As will be apparent, the construction details on the movable assembly **192** of the on/off switch **191** are best shown in the exploded perspective view of FIG. **6.** In FIG. **6,** the bottom of the movable assembly **192** appears at the uppermost portion of the figure while the upper housing **26** is at the lower end of the figure. The connectors **138, 140** which are inserted into slots **134, 136** of the front end panel **130** of the bobbin **116** form the stationary contact members for the on/off switch **191.**

The contact members **138, 140** have punched tab sections **138***b*, **140***b* located just above the ledge **142.** The punched tab sections **138***b*, **140***b* hold the contacts **138, 140** on the bobbin **116.**

The movable assembly **192** consists of three parts which are assembled together. The three parts are the carrier **196,** the closed spring **200** and the knob section **202.** The carrier **196** of the movable assembly **192** consists of the spring contact member **194** and the carrier plate **195** to which the spring contact member **194** is secured by means of a rivet **198.** The carrier plate **195** may be formed of any suitable rigid insulating material. A hole **204** is provided at the forward end of the carrier plate **195** so that a projecting pin **206** which is integrally formed in the upper housing member **24** passes through the hole in the vertical direction to allow for pivoting of the carrier plate **195** about the pin **206.** A slotted channel **208** which is formed in the inner edge **210** of the carrier plate **195** has a curved segment **212** at its inner end.

The spring **200** is preferably formed of a closed resilient plastic ring which is preferably of an elliptical shape, however the resilient spring form of any suitable material may be used and it is not necessary that the spring be of elliptical shape. It has a pair of diametrically opposite integrally formed pins which project in opposite directions from its outer periphery. One of the pins is a relatively long pin **213** which extends into the curved segment **212** of the carrier plate **195** couples the carrier plate **195** to the spring **200.** The other pin **214** is a shorter pin which projects through a hole **216** which is provided on the horizontally extending plate **218** which is integrally formed on the knob section **202.** In this manner, the knob section is coupled to the carrier plate **195** through the resilient spring **200.**

The knob section **202** is formed with a slide member **226** which is positioned inside of the housing **22** and a knob **232** which is positioned outside of the housing. The upper housing member **24** and the lower housing **26** are constructed so that an opening **224** is provided in the outer wall of the housing **22** whereby the connecting member **223** passes through the opening **224.** The slide member **226** is provided with a first slot **225** in the vicinity of the opening **224** which receives a corresponding rib that is formed on the lower housing member **26** and a second slot **228** in the vicinity of the opening **224** which fits over the recessed segment **230** of the upper housing member **24.** Thus, the rib which is formed in the lower housing member **26** will ride in the slot **225** and the recessed segment **230** of the upper housing member **24** will ride in the slot **228** when the knob **232** is pushed back and forth along the elongated direction of the hair clipper.

The operation of the switch mechanism **204** is best shown by reference to FIGS. **7** and **8.** In order to turn the hair clipper on, an electrical connection must be made between the connectors **138, 140.** The contact **140** is directly wired to one end of the field coil **126** through the terminal **140***a* while the contact **138** is wired through the jumper lead **144** which is connected to the terminal **138***a* to one side of the input power source via the power cord **154.**

The rear end of the carrier plate **195** has an angular abutment **220** which extends outwardly therefrom. During the movement of the knob **232** of the knob section **202** towards the rear of the clipper, the abutment **220** slides on the elongated, integrally formed runner **227** of the upper housing **24** towards the post **222** of the upper housing member **24.** When the switch is in the off position, the outwardly extending abutment **220** of the carrier plate **195** will be in contact with the post **222.** Further movement of the switch knob section **202** and the abutment **220** is thus prevented and the contact or bridging member **194** is out of engagement with the connectors **138, 140.** The position of the resilient contact **194** with respect to the stationary connectors **138, 140** when the switch **191** is in the off position is shown in FIG. **7.**

When the knob **232** is pushed toward the front end of the clipper **20** to which the cord **154** is connected the switch **191** is switched to its on position and the position of the contact **194** with respect to the stationary connectors **138, 140** is shown in FIG. **8.** As the carrier **196** is moved backward, the two arms **236, 238** of the contact member **194** that extend forward of the flat section **240** come into contact with the connectors **138, 140.** Once electrical connection is made in this manner, the field coil **126** is supplied with electrical current through the power cord **154** and the motor **62** is thereby set into vibratory motion.

As shown in FIGS. **7** and **8,** the pin **213** is positioned in the curved segment **212** both when the switch **191** is in its off position and when it is in its on position. When the carrier plate **195** pivots relative to the knob plate **218** as the knob **232** is moved, the spring **200** yields somewhat and rotates in a counter-clockwise direction when the knob **232** is moved forward toward the on position and in a clockwise direction when the switch is moved backward toward the off position.

The extension **242** of the plate **218** which projects outwardly from the bottom of the slide member **226** of the knob section **202** has another function in addition to being part of the structure that couples the knob section **202** to the carrier **196.**

While there has been illustrated and described a particular embodiment of the present invention, it will be understood that changes and modifications may occur to those skilled in the art, and it is, therefore, contemplated by the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed.

1. An electric appliance comprising a housing enclosing a motor which is drivingly connected to an implement mounted exteriorly of said housing, a power cord connected to said housing, a switch for electrically connecting said motor to said power cord including a manually operable member slidably in the wall of said housing and having a knob outside of said housing and an operating portion within said housing, spaced fixed contacts supported by insulating means on said motor, movable contact bridging means supported on a carrier pivotally mounted on the inside wall of said housing, over center spring means pivotally connected to said carrier and to said operating portion to urge said movable contact bridging means into or out of engagement with said fixed contacts when said manually operable member is moved to the limit of its sliding movement in either direction, said housing including stop means to limit pivotal movement of said carrier when said over center spring means is urging said contact bridging means out of engagement with said fixed contacts, said over center spring mechanism comprises a plastic ring having integral parallel projections extending in opposite directions from diametrically opposed portions of said ring, said projections being received in openings in said carrier and said operating portion.

2. An electrical appliance comprising a housing and an electrical motor in said housing with a field means including a bobbin, magnetic laminations supported by said bobbin and a field coil wound on said bobbin, a switch including a pair of stationary contacts secured to said bobbin and a movable contact assembly positioned in and supported on said housing, said movable contact assembly comprising a knob section having a knob and coupling portion, said housing having walls mounting said knob section extending through said walls for slideable back and forth movement between a first position and a second position, said movable contact assembly including a carrier having movable contacts thereon, means for pivotally supporting said carrier on said housing, coupling means for interconnecting said carrier and said coupling portion of said knob section whereby said carrier pivots to engage said movable contacts with said pair of stationary contacts when said knob in its first position and said movable contacts are disengaged from said pair of stationary contacts when said knob is in its second position.

3. An electrical appliance comprising a housing enclosing a motor having a field with a coil bobbin, a switch for controlling energization of said motor, said housing including housing members which abutt along a common plane, a slot formed in said housing between said housing members, a manually operable switch control slidably mounted in said slot and guided for movement by the portions of said housing members defining or adjacent to said slot, said motor including fixed contacts mounted on said coil bobbin, a contact supporting member pivotally supported on one of said housing members and having movable contacts supported thereon, said contact supporting member being pivotal between a first position with said movable contacts in engagement with said fixed contacts to connect said coil to a source of electrical power and a second position in which said movable contacts are disengaged from said fixed contacts, an overcenter spring mechanism pivotally connected to said contact supporting member and said switch control, said mechanism urging said supporting member to either said first or second position in response to sliding movement of said control.

4. The electrical appliance as set forth in claim **3** wherein said housing has stop means thereon and said supporting member has one or more edges which are in engagement with said stop means when said supporting member is in said second position.

5. The electrical appliance as set forth in claim **3** wherein said mechanism is a resilient means having a closed configuration, said control having a first opening therein, said supporting member having a second opening therein, a first pivot member is located on the periphery of said mechanism extending into said first opening and a second pivot member is located on the periphery of said resilient means diametrically opposite to said first member and extending into said second opening.

6. An electrical switch as set forth in claim **3** wherein said movable contacts on said supporting member comprise a plurality of spring arms, each of which contact one of said fixed contacts when said supproting member is in said first position.

7. The combination of claim **3** wherein said bobbin includes spaced end walls, said fixed contacts being L-shaped members mounted on one of said end walls, each L-shaped member having one leg extending in the plane of said one end wall, each said one leg being parallel to the other, said field including a coil wound on said bobbin and having a terminal end connected to the other leg of one of said L-shaped members, a lead to a power source connected to the other leg of the other one of said L-shaped members, said movable contacts engaging the L-shaped members near the free end of each said one leg to electrically interconnect said L-shaped members.

8. The combination of claim **3** wherein said bobbin includes spaced end walls, said fixed contacts being L-shaped members mounted on one of said end walls, each L-shaped member having one leg extending in the plane of said one end wall and another leg extending outwardly from said one end wall, said movable contacts engaging each of the fixed contacts at the end of said one leg remote from said other leg.

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