April 12, 1949. R. KNOPP 2,466,900

TWO-VOLTAGE SHAVER MOTOR

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Fig. 1.

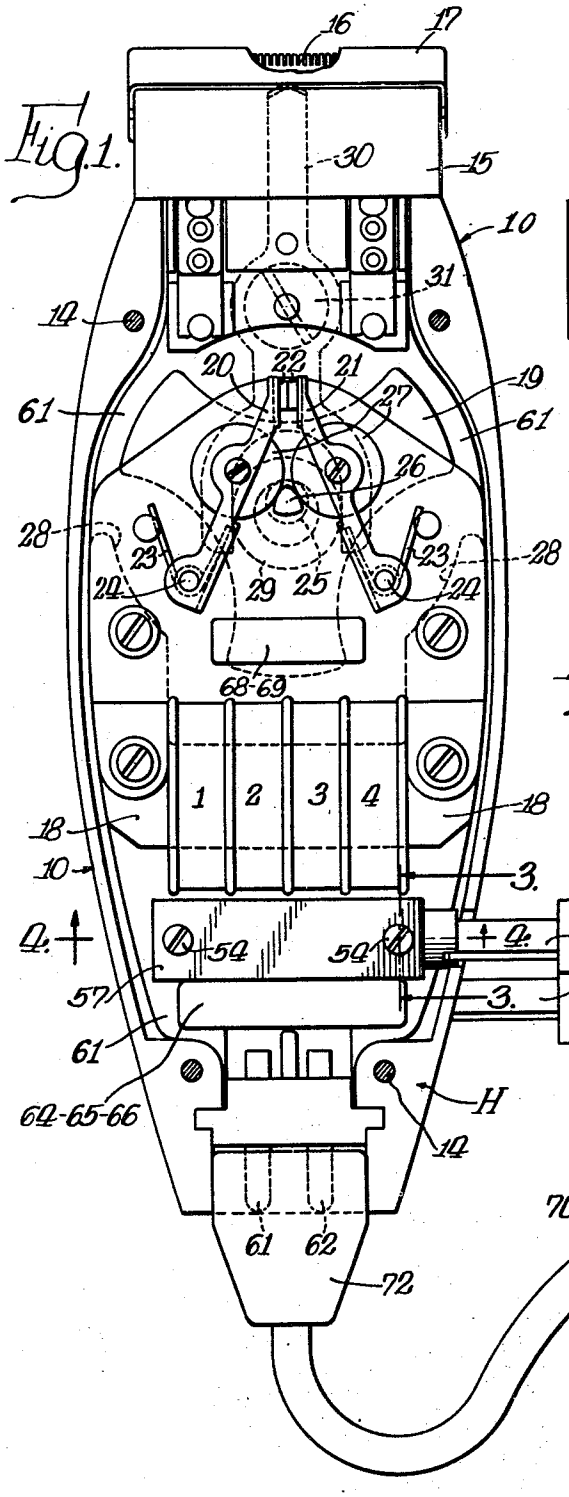


Fig. 2.

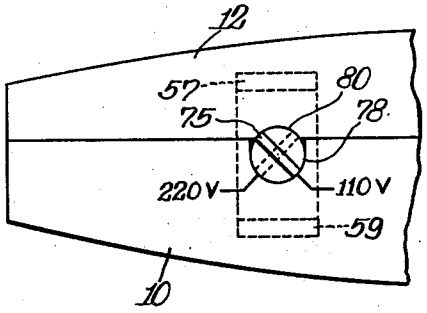
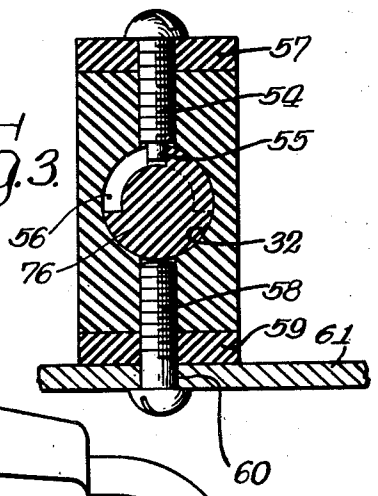


Fig. 3.



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Fig. 4.

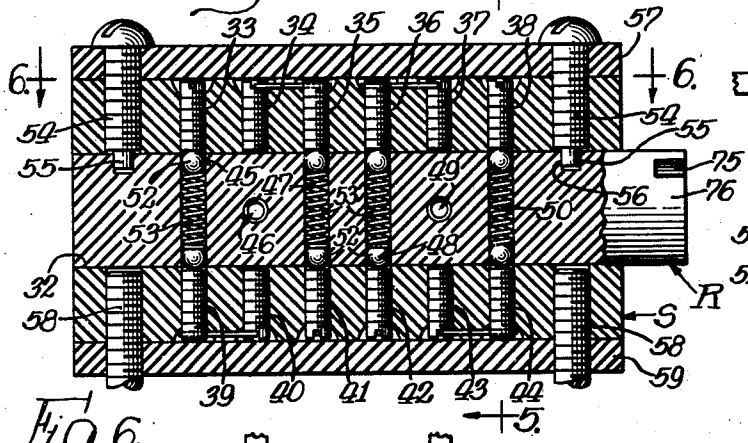


Fig. 5.

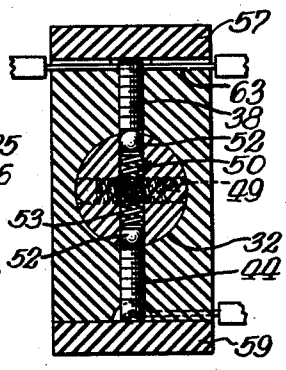


Fig. 6.

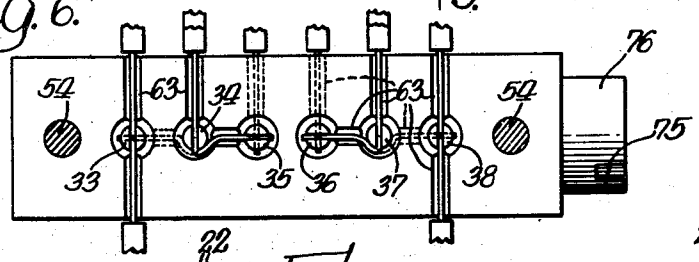


Fig. 7. (110 V)

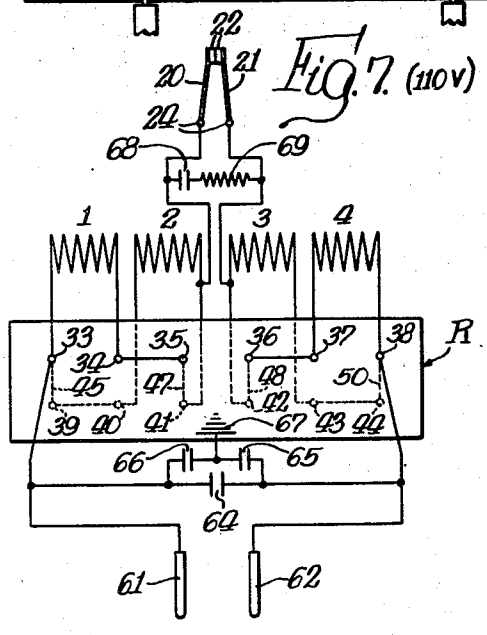
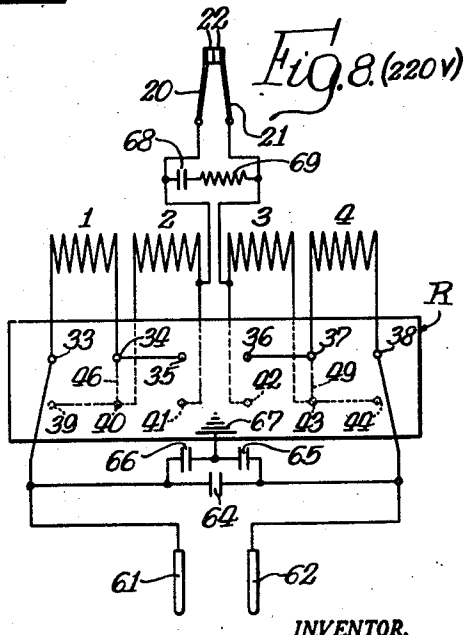


Fig. 8. (220 V)



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2,466,900

TWO-VOLTAGE SHAVER MOTOR

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Application March 13, 1947, Serial No. 734,351

4 Claims. (Cl. 172—36)

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This invention relates to a dry shaver or the like including an electric motor having a double set of electrically energizable coils for operating the motor and a switch which is operable to connect the coils either in series for high voltage operation or in a parallel-series arrangement for operation at a lower voltage.

One object of the invention is to provide a coil and switching arrangement which permits of a symmetrical circuit pattern so that noise elimination condensers can be connected in the circuit in such manner that the supply cord can be plugged into a service outlet and on to the shaver in either one of two positions instead of necessitating the connection of the shaver to the supply wires in only one way in relation to the grounded and hot wires thereof.

Another object is to provide a coil arrangement that makes possible the use of either high voltage or low voltage for the shaver, electrical control of the coil arrangement being effected by a simple and inexpensive switch movable to either of two positions for operation of the shaver at either of two voltages such as 110 volts or 220 volts.

Still another object is to provide a switch of simple and inexpensive construction particularly adapted for compactness and for mounting within the limited space to be found in the usual type of dry shaver, the housing of which is relatively small so that the shaver can be held in the palm of the hand during use.

A further object is to provide a switch so designed as to minimize the wiring connections to the coils of the motor and to the contact breaker and current supply terminals thereof.

Still a further object is to provide a switch rotor with a means to eliminate the possibility of rotating it from one position to another while current is being supplied to the shaver.

An additional object is to provide a rotor which has a slot or the like in an exposed end thereof, and which may receive the prong of a supply cord that supplies current to shaver thereby insuring that the cord is disconnected from any source of current supply during the oscillation of the rotor from one position to the other.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawings, wherein:

Figure 1 is a plan view of a dual voltage shaver embodying my invention, the upper half of the housing thereof being removed and the screws for holding it in position being shown in section.

Figure 2 is a side elevation of a portion of Figure 1 showing the slotted end of a rotor and by

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dotted lines the relative position of the entire switch within the shaver housing.

Figure 3 is an enlarged sectional view on the line 3—3 of Figure 1 showing details of construction.

Figure 4 is an enlarged sectional view on the line 4—4 of Figure 1 taken longitudinally through the rotor of the switch.

Figure 5 is a sectional view on the line 5—5 of Figure 4 showing a contactor arrangement and wiring details.

Figure 6 is a sectional view on the line 6—6 of Figure 4 showing a plan view of the stator of the switch, and

Figures 7 and 8 are electro-diagrammatic views showing the wiring arrangements for low voltage and high voltage, respectively.

On the accompanying drawings I have used the reference character H to indicate generally a housing. The housing H is formed of a lower part 10 and an upper part 12 secured together in the usual manner by means of screws or the like 14. A head member 15 is associated with the housing H and is adapted to receive the usual stationary and movable elements of a dry shaver cutter head indicated generally at 16, the element 17 being a cover therefor when the shaver is not in use.

A dry shaver of the character shown usually includes field laminae 18 on which are wound one or more coils. In the present invention there are four coils indicated as 1, 2, 3 and 4. A tripole armature 19 magnetically coacts with the field laminae 18 so as to effect rotation of the armature through properly timed impulses of electric current supplied to the coils 1, 2, 3 and 4. Such impulses are controlled by a circuit breaker consisting of arms 20 and 21 provided with contacts 22 normally held engaged by springs 23. The arms 20 and 21 are pivoted on pins 24.

The shaft of the armature 19 is indicated at 25. The shaft 25 has a trilobe cam 26 thereon coacting with rollers 27 carried by the circuit breaker arms 20 and 21. The lobe and roller combination causes the circuit breaker to operate three times per revolution of the shaft 25 as the three poles 19 approach and recede from pole faces 28 of the field laminae 18.

On the shaft 25 is an eccentrically located roller 29 which coacts with the forked lower end of an operating arm 30. The arm 30 is pivoted at 31 and is adapted to impart oscillations to the movable cutter member of the cutter head 16.

My control switch for the coils 1, 2, 3 and 4 consists of a stator S and a rotor R. The stator is rectangular in cross section as shown in Figures 3 and 5 and has a bore 32 to rotatably receive the rotor. The stator is provided with six upper contacts 33, 34, 35, 36, 37 and 38 and six lower contacts 39, 40, 41, 42, 43 and 44. These

contacts are in the form of screws with slotted outer ends to receive a screw driver when inserting the screws and into which wires may be soldered after the screws are inserted. The rotor has six cross contacts indicated generally at **45**, **46**, **47**, **48**, **49** and **50**. Each of these contacts consists of two balls **52** separated by a spring **53**, the spring tending to engage the balls with opposite screws **33** to **44** when in alignment therewith as shown in Figure 4 and by solid lines in Figure 5.

The rotor R is rotatably mounted in the bore **32** and held against axial movement by means of two screws **54** having reduced inner ends **55**. The rotor is provided with two arcuate grooves **56**, the extent of which is such as to permit a 90° turn of the rotor as best shown in Figure 3. The screws **54** also serve to hold a cover plate **57** of insulation on top of the stator S. Other screws **58** are adapted to retain a cover plate **59** on the bottom of the stator S and the screws **58** may also retain the switch in mounted position in the housing by extending upwardly through openings **60** in a frame element **61** on which the dry shaver motor is mounted as shown in Figure 3.

The coils **1**, **2**, **3** and **4** are wired to the contacts **33** to **44** as shown in Figure 6 and diagrammatically in Figures 7 and 8. It will be noted that the coil **1** is connected to the screws **33** and **34**. The coil **2** is connected to the screws **40** and **41**. The coil **3** is connected to the screws **42** and **43** and the coil **4** is connected to the screws **37** and **38**. Also the left side of the coil **1** is connected to a supply prong **61** and the right side of the coil **4** is connected to a supply prong **62**. The screw **39** is connected to the screw **40**, **34** is connected to **35**, **36** is connected to **37**, and **43** is connected to **44**.

The arrangement is such that a symmetrical circuit pattern results and a minimum of crossing wires is had with a minimum of wire used in the wiring arrangement as perhaps best shown in Figure 6. The top and bottom surfaces of the stator S is provided with connecting grooves **63** to accommodate the various wires with the wires thereafter being covered by the cover plates **57** and **59**.

Across the supply prongs **61** and **62** condensers **64**, **65** and **66** are connected with a connection to ground at **67** between the condensers **65** and **66**. Between coils **2** and **3** the circuit breaker arms **20** and **21** and the contacts **22** are connected with a condenser **68** and a resistor **69** shunting the circuit breaker arms to reduce sparking at the contacts.

In my Patent No. 2,228,665 I show a two voltage shaver having two coils which is satisfactory as far as the coil and switching arrangement is concerned, but when a noise elimination condenser circuit is applied to this type of shaver the condenser circuit can only be arranged so that the supply cord has to be plugged into the outlet in a predetermined manner to connect the condenser circuit properly with the grounded wire of the circuit.

In my co-pending application, Serial No. 628,520, filed November 14, 1945, I show a condenser circuit arrangement which is symmetrical in relation to two shaver motor coils but when the two-voltage switch of the Patent No. 2,228,665 is applied thereto the symmetry of the condenser circuit is destroyed, at least with one or the other voltage settings. In order to provide a circuit in which symmetry is retained, I split the coil

arrangement into four coils as herein disclosed and provide a switch that connects the circuits together in a manner which will now be described.

When the rotor R is in the position shown in Figure 2, the cross contacts **45**, **47**, **48** and **50** only are in the circuit as shown in Figure 7. This results in coils **1** and **2** being in parallel with each other and coils **3** and **4** being in parallel with each other, the group of coils **1** and **2** being in series with the group of coils **3** and **4** as shown in Figure 7. This parallel-series arrangement permits energization with one voltage such as 110 volts whereas the rotor can be rotated a quarter turn so that only the cross contacts **46** and **49** are in the circuit and then the coils **1**, **2**, **3** and **4** are in series for operation on twice the voltage of the circuit arrangement of Figure 7.

Tracing the circuit in Figure 7, from the supply prong **61**, the current flows to the contact **33** where it splits, half flowing through the elements **1**, **34**, **35**, **47** and **41** to the circuit breaker arm **20** and the other half flowing through the elements **45**, **39**, **40** and **2** to the arm **20**. From the arm **21** current flows to the coil **3** where it divides so that half goes through the elements **42**, **48**, **36**, **37** and **4** to the contact screw **38** and the other half of the current flows through elements **3**, **43**, **44** and **50** to the contact screw **38** and then to the return supply prong **62**. Thus the coils **1** and **2** in parallel are in series with the coils **3** and **4** which are also in parallel and the resistance value is half what it would be if all the coils were in series with each other, thus making possible proper operation at one voltage.

When the rotor R is in the 220 volt position indicated in Figure 2 and shown by dotted lines in Figure 3 then the circuit arrangement is that shown in Figure 8. Current from the prong **61** flows through the elements **33**, **1**, **34**, **46**, **40**, **2**, **20**, **22**, **21**, **3**, **43**, **37**, **4** and **38** in succession to the prong **62**. In this arrangement the coils are all in series so that the resistance is twice that of Figure 7 and capable of energization and proper operation with twice the voltage. At the same time both circuit arrangements provide for a symmetrical circuit pattern in which the condenser circuit, consisting of the condensers **64**, **65** and **66**, can be connected. The ground connection **67** to the frame of the shaver (for instance, the laminae **18**), completes the condenser circuit.

The desired symmetrical arrangement of the circuit pattern for both low and high voltage is secured with a relatively simple switch that involves a minimum number of wires and connections and a simple wiring arrangement when the switch is constructed in accordance with the foregoing description. The switch is easy to fabricate and assemble and the connection of wires thereto is a simple soldering operation consisting of a drop of solder in the screw driver slot of each screw **33** to **44**. Insulated wires may be used as shown in Figure 6 with the insulation stripped where they pass through the grooves **63**. A connection across from one screw to an adjacent screw is readily made by bending the wire after it passes through one slot and extending it toward the adjacent screw, all as clearly shown.

For the purpose of supplying current to the prongs **61** and **62**, I provide a supply cord **70** having plugs **72** and **73** at its ends. The plug **72** is a female plug adapted to coact with the supply prongs **61** and **62** and the plug **72** is a male plug having the usual type of flat prongs **74**. One

of these is adapted to coact with a slot 76 formed in a reduced portion 76 of the rotor R, which reduced portion rotates in a notch 78 of the lower housing half 10 and a notch 80 of the upper housing half 12. As long as the prong 74 is used for the purpose of changing the switch from one voltage position to another, it is impossible to cause such a change while the shaver is in operation, as the plug 73 of course at that time is plugged into the service outlet. Thus the danger of switching the shaver from 220 volts to 110 volts at a time when a 220 volt circuit is applied to the shaver is eliminated. Such switching of course would burn out the shaver coils. This cannot be done accidentally when using one of the prongs 74 as a means to rotate the rotor as current is off during the switch.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim as my invention:

1. In a dual voltage shaver motor, a housing, a pair of current supply terminals thereon, a motor having two pairs of electrical coils, an armature operated circuit breaker connected between said two pairs of coils, a control switch for said coils comprising a rotor having six cross contacts, a stator therefor having opposite contacts to be engaged by said cross contacts, said rotor being movable to two positions, one in which four of said cross contacts connect opposite stator contacts together for connecting the coils of one pair in parallel and the other in which the other two of said cross contacts connect opposite stator contacts together for connecting all of said four coils in series, said stator contacts being connected with said coils, said supply prongs and said circuit breaker, and a noise elimination condenser circuit connected across said supply prongs and having a center connection grounded to the frame of said shaver motor, said condenser circuit being symmetrical in relation to said center connection and said two pairs of coils being thereby connected symmetrically in relation to said prongs, condenser circuit and circuit breaker by said control switch whereby said prongs when in either position relative to a service outlet will result in equal noise elimination performance of said condenser circuit.

2. In a two-voltage coil operated device of the character disclosed, two pairs of coils and a circuit breaker for operating said device and a switch for connecting said coils in series or in parallel-series, said switch comprising a stator having six upper contacts and six lower contacts, a rotor having four cross contacts in one plane and two cross contacts in another plane, terminal supply prongs, and connections between said two pairs of coils and said stator contacts as follows: one end of the first coil connected to one of said prongs and to the first upper contact and its other end to the second and third upper contacts, one end of said second coil connected to the first and second lower contacts and its other end to the third lower contact and said circuit breaker, one end of the third coil connected to said circuit breaker and to the fourth lower contact and its other end to the fifth and sixth lower contacts, one end of said fourth coil connected to the fourth and fifth upper contacts and its other end connected to the sixth upper contact and to the other of said prongs, and a condenser circuit across said prongs having a symmetrically centered connection grounded in relation to said coil operated device, said condenser circuit being thereby symmetrical in relation to said coils whether connected in series or in parallel-series.

3. In a two-voltage coil operated device of the character disclosed, two pairs of coils and a circuit breaker for operating said device and a switch for connecting said coils in series or in parallel-series, said switch comprising a stator having six upper contacts and six lower contacts, a rotor having four cross contacts in one plane and two cross contacts in another plane, terminal supply prongs, and connections between said two pairs of coils and said stator contacts as follows: one end of the first coil connected to one of said prongs and to the first upper contact and its other end to the second and third upper contacts, one end of said second coil connected to the first and second lower contacts and its other end to the third lower contact and said circuit breaker, one end of the third coil connected to said circuit breaker and to the fourth lower contact and its other end to the fifth and sixth lower contacts, one end of said fourth coil connected to the fourth and fifth upper contacts and its other end connected to the sixth upper contact and to the other of said prongs.

4. In a dual voltage shaver, the combination of first and second current supply terminals, a motor having four coils, and a switch for connecting said coils in series or in parallel-series comprising a two-position element having six cross contacts and one set of four opposite contacts, said opposite contacts being connected in succession with said coils, and said rotor having two sets of cross contacts and one set of two cross contacts, said sets of cross contacts being at different angles relative to each other for electrically connecting opposite stator contacts and thereby effecting a series circuit pattern in the position of said rotor with said four cross contacts engaging certain contacts of said two sets of opposite contacts and a series-parallel circuit pattern in the other position thereof with said two cross contacts engaging the remaining contacts of said two sets of opposite contacts.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
405,668	Hunter	June 18, 1889
1,646,924	Mauk	Oct. 25, 1927
2,228,665	Knopp	Jan. 14, 1941
2,231,627	Jansen	Feb. 11, 1941
2,238,696	Hanley	Apr. 15, 1941
2,279,240	Miner	Apr. 7, 1942
2,422,906	Johnson	June 24, 1947

FOREIGN PATENTS

Number	Country	Date
263,884	Great Britain	May 24, 1928