Oct. 1, 1968 MINEHARU OMORI ET AL 3,403,440

ELECTRIC DRY SHAVER FORMED OF COAXIAL ASSEMBLIES

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Fig. 1

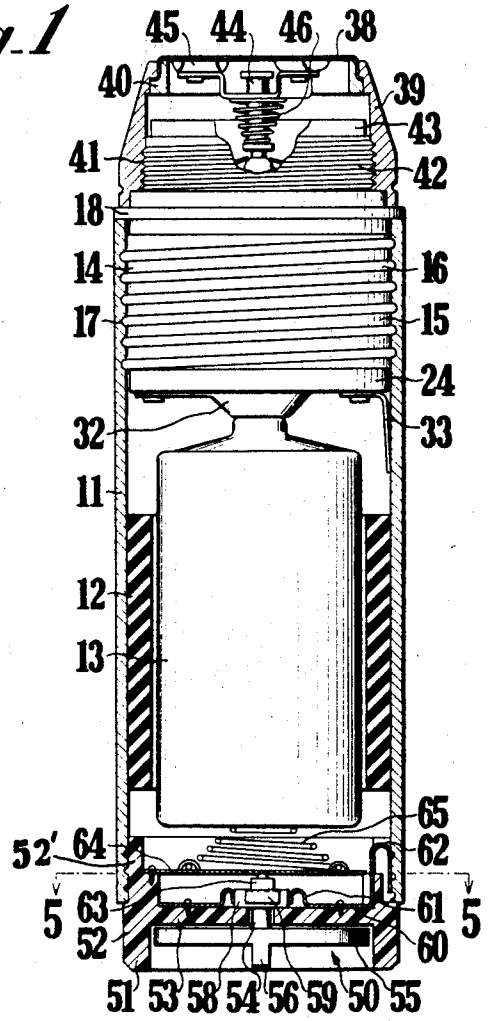
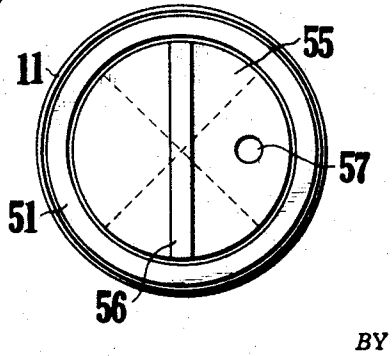


Fig. 2



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Fig. 3

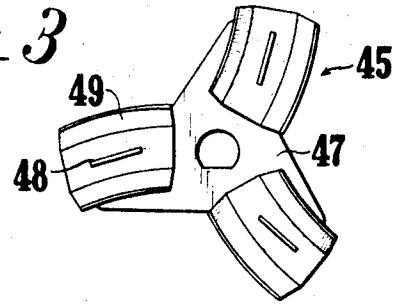


Fig. 4

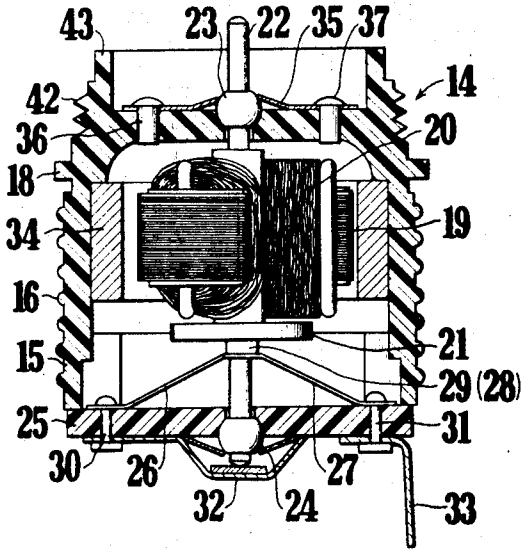
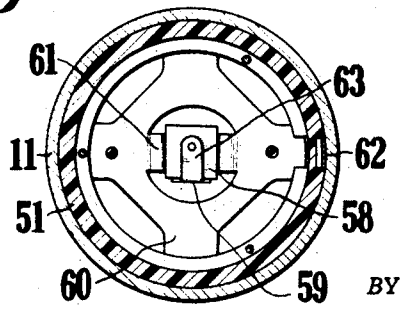


Fig. 5



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3,403,440
ELECTRIC DRY SHAVER FORMED OF COAXIAL ASSEMBLIES

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9 Claims. (Cl. 30—43.6)

ABSTRACT OF THE DISCLOSURE

An electric dry shaver consisting of a plurality of cylindrical assemblies coupled together by threaded engagements along a common axis.

The present invention relates in general to shaving devices, and more particularly, to an electric dry shaver which is completely portable, carrying its own self-contained power supply.

Electric dry shavers which have been in past use, either of the portable type or the type requiring an external power supply, generally have a casing consisting of a pair of half-shells which are fastened together by suitable securing means to enclose the various operating components of the shaving device. These casing half-shells are popularly constructed of a plastic or synthetic material and are provided with structural partitioning at the interior surfaces thereof for properly supporting the various operating components of the shaver, which are wired one to the other in the interior of the casing.

However, the known shavers as described above, and especially the portable shavers which are extremely suitable for travel purposes, have several drawbacks relating to their overall construction. One problem results from the fact that the casing is made from a plastic or readily destructible material which is unable to withstand the shock of travel and must therefore be carried in a protective carrying case of rigid construction for protection against damage to the shaver parts. In addition, should these shavers be dropped on a hard surface, internal parts of the shaver may be broken in addition to the casing itself as a result of the weak casing construction utilized. However, in spite of the known drawbacks in utilizing a plastic casing for electric dry shavers, it has been recognized by the industry that the manufacture of the presently used shaver casings of a more nondestructible material materially increases the weight of the shaver, due to the large size of the casing provided, thereby making it undesirable to the user from the standpoint of ease of manipulation and fatigue.

A second difficulty encountered in present day dry shavers relates to the substantially permanent construction of such shavers. In the shaving units presently available, the working parts of the shaver are secured within the half-shells of the casing by minute screws and other fastening devices which render the simple dismantling of the shaver rather difficult by those not particularly skilled or mechanically inclined. Thus, as a regular routine from time to time it is necessary to bring the shaver to a specialist for cleaning or repair, which results in periodic costs of a substantial nature in comparison to the original cost of the shaver. In addition, the hand wiring between the various working components of the shaver increases the manufacturing cost of the shaver and also results in increased costs of repair, should such become necessary.

In avoiding the above-mentioned difficulties, the present invention provides an electric dry shaver of the type

provided with a guard having a plurality of perforations and a cutting blade which is pressed elastically against the perforated guard and which is capable of being driven in rotation by an electric motor. In accordance with the invention, the shaver is provided with its own self-contained removable power supply in the form of a standard dry cell battery and is provided of such construction as to greatly facilitate the disassembly of the shaver even by those having little mechanical skill or aptitude.

Thus, an important feature of the present invention relates to the shaver construction consisting of four major shaver portions or assemblies secured together by threaded engagement thereby greatly simplifying disassembly of the shaver device and reducing the difficulties of repair to a simplified replacement of one of the four basic parts of the device.

It is another basic feature of the present invention to provide a shaver construction wherein internal wiring between the active elements of the shaver is entirely eliminated by providing a metal casing for the shaver which serves as a means of electrical interconnection between the power supply and the shaver motor. The provision of a conductive metal casing for the shaver not only provides for the elimination of the electrical wiring normally utilized in such devices, but also provides a rigid nondestructible protective cover for the operating members of the shaver, thereby eliminating any need for a further protective casing.

Another important feature of the present invention resides in a particularly suitable and convenient switch arrangement for electrically interconnecting the self-contained power source with the shaver motor via the electrically conductive shaver casing, which switch arrangement is provided as a self-contained unit removable from the shaver device and includes an indicating arrangement for visually determining the active and nonactive positions of the switch.

Another extremely important feature of the present invention is derived from the particular sectional construction of the device in accordance with the invention such that proper lineal arrangement of the various elements of the shaver device along the axis thereof is achieved making possible an extremely accurate positioning of the components with respect to one another and particularly a proper positioning of the cutting blade against the perforated guard so as to provide extremely efficient operation by the cutting head.

A primary object of the present invention is to provide an electric dry shaver capable of eliminating or otherwise materially avoiding the above mentioned drawbacks inherent in known devices of a similar nature.

It is another object of the present invention to gain high accuracy in the position of the cutting blade against the perforated guard by relatively simple means.

It is another object of the present invention to provide a shaver case capable of firm support of the operating elements of the shaver, including the motor, and to remove previously experienced difficulties in component positioning and support within the shaver casing through the relaxation of the fitting portion.

A further object of the present invention is to provide an electric dry shaver capable of simplified assembly and disassembly and to facilitate the cleaning and repair thereof through elimination of interior electrical wiring and provision of sectioned components capable of simple replacement.

Still another object of the invention is to provide an electric dry shaver which is easily operated, simple, attractive in appearance and easily repaired and maintained in use.

It is still another object of the present invention to

provide an electric dry shaver having a self-contained power supply which provides a rigid substantially non-destructible casing of light weight and is specifically designed for long efficient and simplified use.

These and other objects, features and advantages of the present invention will become more apparent from the following detailed description thereof when taken in conjunction with the accompanying drawing, which illustrate one embodiment of the present invention, and wherein:

FIGURE 1 is a vertical sectional view of an electric dry shaver in accordance with the present invention;

FIGURE 2 is a bottom plan view of the shaver illustrated in FIGURE 1;

FIGURE 3 is a top plan view of a cutting blade of the type utilized in accordance with the present invention;

FIGURE 4 is a vertical sectional view of an individual removable assembly of the shaver in accordance with the present invention including the electrical motor thereof; and

FIGURE 5 is a sectional view of the dry shaver of the present invention taken along line 5—5 of FIGURE 1.

Referring now to the drawings, wherein like elements have been identified by similar numeral designations throughout the various views, and particularly to FIGURE 1; a cylindrical shaver case **11** made of a rigid electrically conductive material, such as aluminum or a similar lightweight metal material, serves as the main body portion of the shaver. This case **11** is preferably made of aluminum due to the lightweight substantially nondestructive properties of this metal and its ability to maintain an attractive, tarnish-free appearance provided by the layer of aluminum oxide formed on the outer surface thereof. On an inner wall of the shaver case **11** there is fixed an insulating tube **12** of a plastic or other electrically nonconductive material, which tube **12** is dimensioned to accommodate and properly position along the axis of the case **11** a self-contained power supply for the shaver in the form of a standard dry cell battery **13**. The type and rating of the battery **13** is of course determined by the requirements of the shaver motor; however, for purposes of providing a compact and lightweight shaver arrangement providing sufficient power to properly perform the shaving operation in an efficient manner it is preferred that the standard 1.5 volt alkaline manganese battery or equivalent battery be provided in combination with an electric motor suitably powered thereby.

A second self-contained portion of the electrical shaver in accordance with the present invention is a motor assembly **14** including a cylindrical plastic casing **15** having an outside diameter substantially conforming to the inside diameter of the case **11** of the shaver. On the outer side wall of the plastic casing **15**, there is provided an external screw thread **16** which cooperates with threads on the internal surface of the case **11** to provide a threaded engagement between the case **11** and the motor assembly **14**. The casing **15** of the motor assembly **14** has a flange **18** dividing the screw thread into two portions for the purpose of providing a limit to determine the proper positioning of the motor assembly **14** in the shaver case **11**. Thus, the flange **18** provides a guide which insures the consistently accurate positioning of the motor assembly **14** with respect to the shaver case **11**.

The motor assembly **14**, which will be described in greater detail hereinafter in connection with FIGURE 4, includes an extending connecting rod **44** powered by the motor within the assembly upon which is slidably mounted a cutting blade **45** which is pressed by means of a coil spring **46** into resilient engagement with a perforated guard **38** made of a thin steel disc and forming part of a third major assembly of the shaver. The guard assembly of the shaver consists of a tubular shell **39** of generally frustoconical shape having a threaded portion **41** for cooperation with an extending threaded portion **42** on the motor assembly **14** above the guide flange **18**. The tubular shell **39** may therefore be secured to the motor assembly **14** by threaded engagement between the threads **41** and **42** with the guide flange **18** serving as a means of accurately positioning this tubular shell **39** with respect to the motor assembly **14**. Thus, as a result of the flange **18** the tubular shell **39** is accurately positioned by the same flange with respect to the shaver case **11**. The tubular shell **39** carries the thin steel disc serving as the perforated guard **38**, which is held at the upper opening of the tubular shell by a locking ring **40**, dimensioned to provide a locking engagement between the guard **38** and the tubular shell **39**.

The fourth and final assembly portion of the shaver consists of a bottom cap **51** containing a rotary switch **50** for effecting electrical interconnection between the battery **13** and the motor in the assembly **14** via the electrically conducting case **11**. The cap **51** containing the rotary switch **50** is made from a plastic material and is provided at the outer surface of the upwardly extending portion **52'** thereof with an external thread capable of engaging with an internal thread at the inner surface of the lower portion of the case **11** to thereby provide threaded engagement between the lower switch assembly and the shaver case **11**. The bottom cap **51** is a plastic frame consisting of a cylindrical wall **52** and an inner web **53** in the center of which is inserted a connecting shaft **54**. On the outer end of the connecting shaft **54** is fixed a rotary disc **55** having a knob **56** and an aperture **57**. On the inner end of the connecting shaft **54** there is fixed a rotary square plate **58** having an electrically conductive contact segment **59** on one side thereof. A conductive plate **60** placed on the inner surface of the web **53** includes springy elements **61** and also includes a springy conductor **62** maintaining electrical contact with the conductive shaver case **11**. A top contact **63** is formed integrally with the contact segment **59** and is provided in firm electrical contact with a metal conducting plate **64** secured by suitable fastening means on an inner step of the plastic cap **50** so that electrical contact is maintained at all times between the plate **64** and the contact **63**. A conductive helical spring **65** is positioned upon the metal disc **64** and presses against the negative pole of the battery **13** to force the battery in the direction of the motor assembly **14**. As a result, the positive pole of the battery **13** is maintained in firm electrical contact with the positive plate **32** of the motor assembly **14** and forceful electrical contact between the plate **64** and the contact **63** is also assured as a result of this combination.

The contact segment **59** coming into contact with the springy element **61** by the rotation of the rotary disc **55** results in electrical connection from the motor assembly **14** via the positive plate **32** through the battery **13**, helical spring **65**, conducting plate **64**, contact **63**, contact segment **59**, springy elements **61**, conductive plate **60**, springy conductor **62**, shaver case **11** and springy contact **33** connected to the lower end of the motor assembly **14** forming the negative terminal thereof. Thus, rotation of the disc **55** serves to effect engagement and disengagement of the contact segment **59** with the springy segment **61** of the conductive plate **60** thereby providing for electrical connection and disconnection of the battery **13** from the motor assembly **14**.

As a result of the square configuration of the plate **58**, and due to the elastically pressed springy elements **61** in firm contact with the sides of the rotary plate **58**, the rotary disc **55** is able to remain in only four equilibrium positions separated by 90 degrees of rotation. There are thus two distinct equilibrium positions of the rotary disc **55** wherein the motor is energized and two distinct equilibrium positions where the motor is deenergized. This is due to the fact that a segment **59** in contact with the battery through contact **63**, plate **64** and spring **65** is located on only one side of the square plate **58** and will thus be connected to the conducting plate **60** only in the two posi-

tions of the square plate wherein the springy elements **61** are engaged.

In order to provide visual indication of the postiion or status of the switch element, the underside of the web **53** facing the rotary disc **55** is divided into four equal arcs, as shown in dotted line in FIGURE 2 with oppositely disposed quadrants being provided with a common color so that the color visible through the aperture **57** in the rotary disc **55** provides a visual indication of the engaged or disengaged condition of the switch assembly.

Turning now to FIGURE 3, the cutting blade **45** used with the shaver in accordance with the present invention consists of a supporting plate **47** having three wings offset from the main body portion of the plate **47**, as illustrated in FIGURE 1. A blade element **49** of substantially elongated U-shaped construction is provided on each of the three wings of the supporting plate **47** and is loosely fastened to each of the respective wings by means of stoppers **48**. As a result of the relatively loose fastening of the blade elements to the wings of the supporting plate **47** by the stoppers **48** in conjunction with the coil spring **46** bearing between a collar on the connecting rod **44** and the lower surface of the supporting plate **47**, the blade elements **49** are always pressed elastically against the inner face of the guard **38** providing for a uniform sweeping motion of the blade elements across the inner surface of the perforated guard **38** providing continuous uniform contact therewith.

The detailed construction of the motor assembly **14** is illustrated in FIGURE 4. A rotary core **19** carrying a wound coil **20** and a commutator **21** connected to the coil **20** in the well-known manner are fixed to a motor shaft **22**, which is supported by a bearing **23** mounted in a suitable bearing surface on a webbed portion of the plastic casing **15** of the motor assembly **14**. In a like manner, a bearing **24** fitted on a plastic bracket **25** at the lower end of the casing **15** rides in a suitable bearing surface therein and is secured to the lower end of the motor shaft **22**. A metal plate **35** is fixed to the casing **15** by means of rivets **36** and **37**, elastically presses the bearing **23** against the casing **15** to provide for proper positioning of the motor within the casing **15**. A rivet **30** fastens a positive plate **32** into contact with the lower end of the motor shaft **22** and a rivet **31** fastens a negative plate **33** into constant electrical contact with the casing **11**. The rivets **30** and **31** also serve to secure flat springs **26** and **27** having respective brushes **28** and **29** maintained in contact with the commutator **21** on opposite sides thereof thereby providing the means for applying the electrical energy from the power supply **13** to the motor. A cylindrical magnet **34** is held on the inner wall of the casing **15** opposite to the rotary core **19** and serves in the well known manner for providing a field to interact with the field generated by the coils **20** on the rotor portion of the motor.

As is stated above, the tubular shell **39** carrying the perforated guard plate is directly screwed to the outer wall of the projecting top portion **43** of the casing **15**. Therefore, in accordance with the present invention, it is possible to gain in a relatively simple manner high accuracy of position of the cutting blade **45** against the guard **38**. The motor assembly **14** can be fitted to the shaver case **11** firmly in an easy manner by screwing the casing **15** of the motor **14** to the upper opening of the case **11** thereby placing the flange **18** on the upper end of the case **11** determining accurate positioning between the assembly **14** carrying the blades and the guard assembly carrying the perforated guard plate **38**.

The negative plate **33** of the motor assembly **14** comes into firm and constant contact with the electrically conducting case **11** of the shaver by screwing the motor **14** to the upper opening of the case **11** and the spring conductor **62** comes into contact with the case **11** by screwing the bottom cap **50** to the lower opening of the case **11**. Consequently, the conductive case **11** serves as the lead connecting the motor **14** with the battery **13** thereby eliminating any need for internal wiring of the shaver. In this manner, the shaver is greatly simplified both as far as assembly and subsequent maintenance is concerned and materially diminishes the troubles inherent in known devices. In addition, by providing the motor assembly **14** as a self-contained unit easily assembled with other units of the shaver, the motor can be provided as a sealed arrangement preventing waste accumulated during the shaving operation from penetrating into the moving parts of the motor, which has been known to result in improper operation or complete failure thereof.

The dry shaver in accordance with the present invention provides an especially advantageous construction consisting of only four major assemblies or parts, i.e., the tubular shell holding the perforated guard, the motor assembly including the rotating cutting blade, the lightweight nondestructive case containing the battery and serving as the conductive lead between the power supply and the motor assembly, and the bottom cap assembly containing the rotary switch. By providing each of these four assemblies as individual elements which may be easily assembled through threaded engagement, disassembly for purposes of cleaning and repair as a result of failure of one portion or another can be carried out in a relatively simple manner by people having little or no mechanical or electrical skill. In addition, the repair of the shaver is simplified as a result of the sectionalized construction since such can be accomplished by a mere exchange of broken parts. In addition, the dry shaver in accordance with the present invention is easily operated and is simple and beautiful in appearance due to the fact that the rotary switch controlling the operation of the shaver is contained in the bottom cap of the shaver and therefore does not disturb the clean outer appearance thereof.

It should also be noted that the foregoing construction provides a light weight non-destructible casing which is particularly suitable for travel purposes since dropping or subjecting the device to forceful shocks will not result in a destruction of the casing or the active elements therein as is the case with known arrangements utilizing a plastic casing, and therefore a separate protective rigid casing for the shaver is not necessary during transportation thereof.

While we have described several examples in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications within the spirit and scope of the invention, and we therefore do not wish to be limited to the details described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

We claim:

1. An electric dry shaver comprising, a plurality of cylindrical assemblies coupled together along a common axis by threaded engagement;

a self-contained D.C. power supply having positive and negative terminals and enclosed by one of said cylindrical assemblies;

a second one of said cylindrical assemblies including a motor to be energized by said power supply and first cutting means in driven engagement with said motor;

a third one of said cylindrical assemblies adjacent said one cylindrical assembly including switch means for effecting interconnection of said motor and said power supply; and

a fourth one of said cylindrical assemblies including second stationary cutting means in contact with said first cutting means;

said one cylindrical assembly consisting of a tubular electrically conducting shell and a nonconductive sleeve secured within said tubular shell, said power supply being positioned within said nonconductive sleeve;

said third cylindrical assembly including a cylindrical cap coupled by threaded engagement with said tubular shell and contact means for electrically connecting

the negative terminal of said power supply to said switch means;

said switch means including means for selectively electrically connecting said contact means to said tubular shell;

said second cylindrical assembly including a cylindrical casing coupled by threaded engagement with said tubular shell and enclosing said motor, positive and negative terminals secured to said casing and connected to said motor, said positive terminal contacting the positive terminal of said power supply and said negative terminal contacting said tubular shell;

said cylindrical casing including an annular guide flange intermediate the ends thereof and having a diameter equal to the outer diameter of said tubular shell to accurately determine the position of said second assembly with respect to said one assembly.

2. An electric dry shaver as defined in claim 1 wherein said first cutting means includes a connecting shaft in driven engagement with said motor, a supporting plate having a plurality of arms slidingly mounted on said connecting shaft, spring means on said shaft for biasing said supporting plate in a direction away from said motor, and a substantially U-shaped elongated cutter blade mounted loosely on each of said arms of said supporting plate.

3. An electric dry shaver as defined in claim 2 wherein said fourth assembly includes a tubular body coupled by threaded engagement with the cylindrical casing of said second assembly and engaging the annular guide flange thereon to determine the accurate positioning between said second and fourth assemblies.

4. An electric dry shaver as defined in claim 3 wherein said second cutting means is in the form of a thin perforated guard plate secured across the open end of said tubular body opposite the end engaging said cylindrical casing, said cutter blades being biased into engagement with the inner surface of said guard plate by said spring means.

5. An electric dry shaver comprising, a plurality of cylindrical assemblies coupled together along a common axis by threaded engagement including,

a tubular body assembly having a perforated guard plate extending across one open thereof and a screw thread in the surface of the other open end thereof,

a motor assembly including a motor enclosed by a cylindrical casing secured to said tubular body by means of said screw thread and a rotary cutting blade in driven engagement with said motor and cooperating with said perforated guard plate to produce a shearing action;

a tubular shell assembly including a tubular shell of electrically conductive material secured to said cylindrical casing by threaded engagement and adapted to have a battery enclosed by said tubular shell and having one side in contact with one terminal of said motor, said motor having another terminal in contact with said tubular shell;

a cylindrical cap assembly enclosing a rotary switch and secured to said tubular shell by threaded engagement, said rotary switch interconnecting said motor and said battery through said conductive tubular shell assembly.

6. An electric dry shaver as defined in claim 5 wherein the cylindrical casing of said motor assembly is provided on the outer surface thereof with a screw thread divided into two threaded portions by an annular guide flange, one threaded portion serving to engage with the screw thread in said tubular body assembly with said annular guide flange accurately determining the extent of engagement.

7. An electric dry shaver as defined in claim 6 wherein said tubular shell is provided with a threaded portion on the surface adjacent each open end thereof, one threaded portion serving to engage with the other threaded portion on said cylindrical casing with said annular guide flange accurately determining the extent of engagement.

8. An electric dry shaver as defined in claim 7 wherein said cylindrical cap includes an annular frame having a transverse web, said rotary switch including a connecting shaft extending through said transverse web, a rotary disk having a knob and a through aperture and fixed to one end of said shaft, a rotary square plate having an electrical contact segment on one side thereof and fixed on the other end of said connecting shaft, a conductive plate having spring members pressing against opposite sides of said square plate and a spring terminal in electrical contact with said conductive tubular shell, a metal plate secured to said annular frame in electrical contact with said contact segment, and a conductive helical spring in forceful contact with said metal plate and positioned to contact with the other side of said battery.

9. An electric dry shaver as defined in claim 8 wherein the face of said transverse web adjacent said rotary disk is divided into four segments, aligned with the faces of said square plate, alternate segments being provided with a common indicator visible through said through aperture.

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