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Anna et al.

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[54] **BINDING DRY SHAVED HAIR SHAVINGS**

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Related U.S. Application Data

[63] Continuation of Ser. No. 27,793, April 18, 1970, abandoned.

[30] **Foreign Application Priority Data**

Jan. 14, 1969 Germany 57777

[52] **U.S. Cl.** **55/385,** 30/34, 30/41.6, 30/43.92, 55/124, 55/139, 55/146, 55/155, 55/DIG. 24, 55/DIG. 39

[51] **Int. Cl.** **B03c 3/45**

[58] **Field of Search** ..... 30/32, 34, 34.1, 34.2, 30/41, 41.5, 41.6, 41.9, 43.91, 43.92; 15/1.5; 55/2, 101, 103, 154, 155, 385, 124, 139, 146, DIG. 24, DIG. 39

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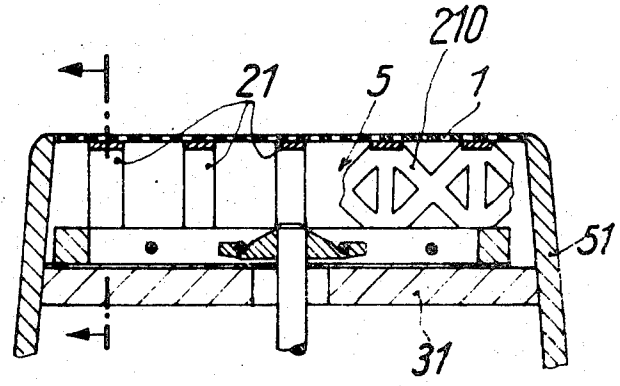
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[57] **ABSTRACT**

A d.c. voltage source is connected between the hair dust collecting electrode and the outer grooved or perforated cutting member of the shearing head of a dry shaver. The hair protruding through the grooves of the outer cutting member is polarized into an electric dipole; the projecting hair portion which has opposite polarity than the collecting electrode is subsequently cut off by the movable inner cutting member and is transferred by electrical forces of the field to the collecting electrode. This electrode may be provided with an exchangeable coating of an adhesive.

3 Claims, 7 Drawing Figures



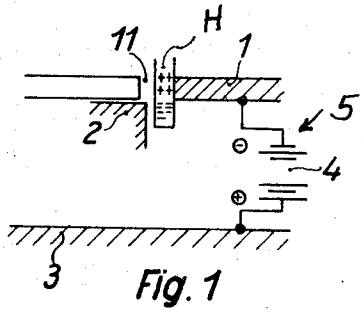


Fig. 1

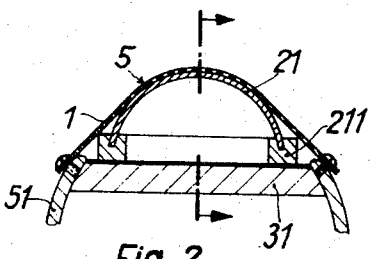


Fig. 2

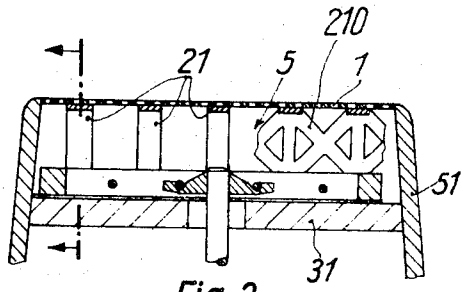


Fig. 3

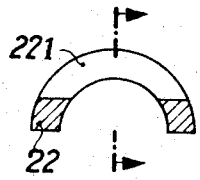


Fig. 4

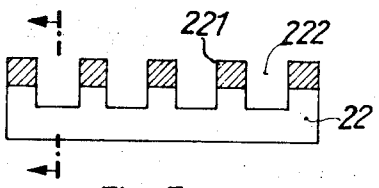


Fig. 5

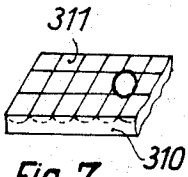


Fig. 7

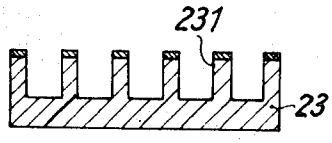


Fig. 6

BINDING DRY SHAVED HAIR SHAVINGS

This is a continuation, of application Ser. No. 27,793, filed Apr. 18, 1970 now abandoned.

The present invention relates to improvements in the method of and device for transferring and binding the cut off hair particles in motor driven dry shavers having a cutting or shearing head with outer and inner cutting members.

It has been suggested already in prior art dry shavers to collect and capture the hair dust which results from the cut off hair portions in the shearing head.

For this purpose, a suction device has been arranged at the bottom area of the shearing head. Such suction means, however, is complicated and hence too costly, as an additional blower is necessary. It has appeared, furthermore, that not all hair dust resulting during the shaving is captured and removed by such a suction device.

In another known embodiment, the cut off hair particles have been introduced into an electric field in order to be transferred by the electric field flux to a counter-electrode. Nevertheless, even this solution does not provide the desired successful results: The electric field, it will be noted, does not affect the hair particles immediately after their shearing. In the prior art devices of this type, the electric flux lines of the applied electric field do not terminate at the cutting or shearing surface but they end at the metal blades of the inner cutting member. As a result, a field-free space occurs between the beginning of the electric field and the actual cutting edge and the hair dust particles must first pass through that field-free space. As soon as a cut off hair particle enters the space of the electric field, it becomes polarized therein and forms an electric dipole. Such dipole, however, cannot be transferred by a homogeneous electric field, since it carries on its surface equal charges of opposite polarities. For this reason, the transfer of such dipole hair particles can be accomplished by the application of an inhomogeneous electric field only. The field intensity of such an inhomogeneous field must be so adjusted as to lie close to the break-through field intensity of the air.

The disadvantage of the above solution resides in the fact that the cut off hair particles remain too long in the field-free space, and it is not certain that all hair dust particles are collected by the electric field. Consequently, even this known embodiment cannot be considered as satisfactory. Moreover, due to the extreme magnitude of the electric field intensity, disruptive discharges may easily occur and put the entire arrangement out of operation.

The fact that no satisfactory solution of this problem has hitherto been presented, is evident from the fact that the U.S. astronauts had to give up shaving during their sojourn in outer space. In space, where practically no gravitational field exists, dry shaved hair shavings tend to disperse evenly over the entire spatial area. The dissipated hair dust can cause irritation of the breathing tracts as well as of the eyes, and furthermore since the hair particles are good insulators they may disturb electrical contacts or the entire electrical equipment.

BRIEF SUMMARY OF THE INVENTION

It is, therefore, among the principle objects of the present invention to remove the drawbacks of the prior art devices for collecting and binding dry shaved hair dust.

It is another object of the invention to provide a method of and a device for reliably collecting and binding all shavings in motor driven dry shavers.

It is still another object of the invention to modify the inner movable cutting member in order to insure an undisturbed cooperation with the hair dust collecting and binding means.

It is a further object of the invention to provide an improved hair dust binding member.

According to the present invention, the above objects are attained by applying a direct current voltage source between the outer cutting member of the shearing head and a hair dust collecting electrode that is operatively disposed within this head. Supporting parts of the inner cutting member are made of electrically insulating material and the inner cutting blades are spaced one from another so as to allow a formation of an undisturbed electric field between the outer cutting member and the collector electrode. The hair portion to be cut off is first projected through a perforation of the outer cutting member and the entire hair becomes polarized into an electric dipole. Subsequently, the projecting hair tip which is charged with the opposite polarity than the hair portion abutting the perforated outer cutting member, is cut off by the inner cutting member and the charged hair particle travels along the lines of the electric field flux to the surface of the collecting electrode closest to the shearing head.

The voltage source is advantageously in the form of a generator driven by the driving motor of the shaver; or as an electret disposed in the shaver; or as an external source connected to the head electrodes. The motor driven generator comprises preferably a rotatable plate for the generation of electrostatic influence charges.

In a further development of the present invention, the collecting electrode is exchangeably arranged within the shearing head and is provided with an adhesive layer for binding the hair particles. It is also possible to employ a fixed collecting electrode and replaceable adhesive tapes or sheets.

The upper surface of the collecting electrode can be, in another variation, provided with honeycombed recesses containing adhesive material for binding the shavings. These honeycombed recesses are preferably made on the upper surface of a replaceable layer of dielectric material which is applied on a smooth surface of a stationary metal collecting electrode.

To insure, as far as possible, a homogeneous electric field between the outer cutting member and the collecting electrode, the latter is shaped in accordance with the shape of the outer cutting member.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWING

For a better understanding of this invention, reference is made to the accompanying drawing in which;

FIG. 1 is a schematic fragmentary sectional view illustrating the principle of the present invention;

FIG. 2 is a fragmentary sectional view, taken on the secant line of FIG. 3, of a shearing head with a perfo-

rated outer cutting sheet and an inner cutting member having a plurality of flattened curved razor blades;

FIG. 3 is a sectional view through the shearing head taken on the secant line of FIG. 2;

FIG. 4 is a sectional view of a modified inner cutting member taken on the secant line of FIG. 5;

FIG. 5 is a sectional view through the cutting member taken on the secant line of FIG. 4;

FIG. 6 is a sectional view of an inner cutting member embodying a modification; and

FIG. 7 is a fragmentary perspective view of an embodiment of the collecting electrode, with a replaceable binding cover on its top surface.

DETAILED DESCRIPTION

In FIG. 1, there is schematically illustrated the basic arrangement of a shearing or cutting head 5 which is adapted for collecting and binding the hair dust in dry shavers. According to this invention, the shearing head 5 comprises a stationary outer cutting sheet 1 which is in a conventional manner provided with grooves or perforations 11 for receiving the hair H to be cut off; the cutting sheet 1 is of electrically conductive material and is connected to one pole, for example to the minus pole, of a direct current high voltage source.

An inner cutting blade 2 is movably arranged in slidable contact with the inner surface of the cutting sheet 1. An electrically conductive collecting electrode 3 is disposed in a spaced relation to the outer cutting sheet 1 and is connected with the second (plus) pole of the voltage source 4.

The hair H to be sheared is first inserted into the perforation 11 of the cutting sheet 1 and protrudes into the interior of the shearing head 5. Due to the effect of the d.c. electric field which is generated between the outer cutting sheet 1 and the collecting electrode 3, the hair H becomes polarized in such a manner that the portion thereof which is in contact with the outer cutting sheet 1, carries an electric charge of opposite polarity (positive) than that of the cutting sheet 1 and, consequently, the projecting tip portion of the hair H carries a uniform charge of negative polarity.

Subsequently, the inner cutting blade 2 cuts the electrically neutral central zone of the hair dipole and separates the uniformly (negatively) charged hair particle. The separated hair particle, due to the action of the electric field flux, is then transported to the positively charged collecting electrode 3.

One example of the actual embodiment of the hair dust binding device according to this invention is shown in FIGS. 2 and 3. The shearing head 5 consists of the grooved or perforated outer cutting sheet 1 of arched configuration. Bottom portions of the cutting sheet 1 are clamped to a chassis 51 of the dry shaver. The inner cutting member includes a movable support 211 of insulating material wherein semicircular band-shaped metal cutting blades 21 are embedded. The collecting electrode is in the form of a metal collector plate 31 which is attached to the chassis 51 between the bottom portions of the outer cutting sheet 1. The collector plate 31 slidably supports the movable support 211.

The configuration of the cutting blades 21 as shown in the left hand portion of FIG. 3, corresponds to the configuration of the cutting blades 21 shown in FIG. 2. More particularly, the blades 21 are in the form of semicircular flat metal strips and are regularly spaced from each other arranged in series on the support 211, and cooperate with the shearing edges of perforations in the cutting sheet 1.

As seen from the right hand portion of FIG. 3, however, the inner cutting blades can be modified into a grid-like configuration 210 resulting from a transverse interconnection of respective blades. The latter grid-like arrangement is preferably punched out from a single metal sheet. The collecting plate 31 is provided with an aperture through which a connecting rod to the driving motor (not shown) is protruding.

It is advantageous that the pole of the d.c. high voltage source 4, which is connected to the outer cutting sheet 1, be also connected to all the remaining metal parts of the dry shaver housing, and grounded.

To prevent leakage or shunts due to the humid atmosphere in the space of the electric field, this space can be dehumidified by means of a suitable conventional hygroscopic preparation disposed in the interior of the shaving head 5.

Another modification of the inner cutting member is illustrated in FIGS. 4 and 5. The cutting blades 221 are produced from a ceramic cylindrical tube which is first cut in half and subsequently provided with regularly spaced notches 222. The resulting ceramic blades 221 are integral with the support 22. If the employed ceramic material is not sufficiently durable to serve as a shearing blade, it is advantageous to coat the cylindrical tube with a hard metal coating. Subsequently, the coated tube will be processed in the same manner as described above and the resulting blades 221 will be provided with hard metal cutting edges.

A further modification of the inner cutting member is illustrated in FIG. 6. The cutting blades 231 and a supporting member 23 are produced from a massive plastic or ceramic rod, which can be processed in the same manner as the ceramic tube of FIG. 5.

FIG. 7 shows in greater detail one embodiment of the hair dust binding member for the collecting electrode. As mentioned above, the collecting electrode can be either fixedly or exchangeably arranged within the shearing head 5 of the dry shaver. The replaceable electrode has on its upper surface recesses 311 which contain adhesive material for binding the collected shavings. The fixedly mounted collecting electrode is preferably provided with an exchangeable hair dust binding dielectric member 310 of dielectric material. Honeycomb or square recesses 311 with adhesive coatings are made in the top surface of the member 310.

We wish it to be understood that we do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus described the invention, what we claim as new and desire to be secured by Letters Patent, is as follows:

1. A dry shaving apparatus comprising a shearing head, outer and inner cutting means,

a collecting electrode disposed in said shearing head in spaced relation from said outer and inner cutting means,

said outer cutting means and said collecting electrode being connectable to a voltage source to produce an electric field therebetween for polarizing the hair protruding through said outer cutting means to induce opposite charges thereon like in a dipole,

said inner cutting means including a movable support member of dielectric material and cutting blades discretely arranged on said support member, the structure of said inner cutting means snd said support member allowing the flux of the electric field to extend substantially unobstructedly between said outer cutting means and said collecting electrode wherein said collecting electrode is provided with an adhesive layer for retaining said hair shavings, said blades of said inner cutting means are arranged in a grid-like configuration.

2. The device according to claim **1** wherein the top

surface of said collecting electrode is substantially smooth and covered by an exchangeable sheet of dielectric material, said dielectric sheet being provided with honeycombed shaped recesses filled with adhesive material.

3. The device as claimed in claim **1**, wherein said collector electrode is

an electrically conductive body having a top surface thereof provided with honeycombed recesses, said recesses being filled with said adhesive material.

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