POWER DRIVEN WET SHAVER
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Filed Oct. 24, 1965, Ser. No. 504,476
2 Claims. (Cl. 30—415)

ABSTRACT OF THE DISCLOSURE
A power driven wet shaver for shaving hair from the skin of the user which may be utilized with a wet shaving lather on the skin of the user. The shaver comprises a housing structure, cutting means mounted in the housing structure, power means for driving the cutting means, an enclosed passageway defined by the housing structure and having one end communicating with the cutting means and the other end communicating with the atmosphere for receiving and passing the wet lather and cut hair therethrough without interference with the power means, a driven centrifugal fan disposed within the passageway intermediate the ends thereof for creating a pressure differential resulting in suction on one side thereof and a force draft on the other side thereof, and a venturi means formed by the housing structure within the passageway in close proximity to the centrifugal fan for cooperating therewith to create a high velocity air flow for dissipating the air and moisture from the wet shaving lather as it is transported through the passageway.

This invention relates to an improved wet shaver and more particularly to a self-contained, power driven, wet shaver which may be utilized in conjunction with a wet shaving lather on the skin of the user to shave the skin of the user and to remove the shaved hair and wet shaving lather from the skin of the user without damage or interference to the operation of the wet shaver.

Heretofore, a power driven wet shaver, suitable for use with a wet shaving lather on the skin of the user, has been proposed, as disclosed in U.S. patent application Ser. No. 293,646, filed July 9, 1965, now U.S. Patent No. 3,224,305, issued Dec. 21, 1965, this prior patent application is primarily directed to a novel method of shaving and as a part of the disclosure thereof includes an illustration and description of an apparatus capable of performing the novel method of shaving.

However, the shaving apparatus illustrated and described in this prior application has certain limitations from the standpoint of providing a commercially acceptable, self-contained, power driven, wet shaver which may be utilized in conjunction with a wet shaving lather on the skin of the user. This prior shaving apparatus includes a cutter housing which is interconnected through a flexible hose to a vacuum pump and accumulator for creating a suction through the cutting elements of the shaver and for transporting the shaved hair and wet shaving lather from the cutting elements through the cutter housing and flexible hose to the accumulator and for pneumatically driving the cutting elements. As may be appreciated, ordinary use of this type of pneumatic shaving apparatus utilizing these separate mechanisms in lieu of a conventional electric shaver would be somewhat limited. Moreover the pneumatic driven cutting elements are not as efficient as electrically driven cutting elements. This prior shaving apparatus would also be bulky and cumbersome to operate and transport.

It is, therefore, an object of this invention to provide an improved, commercially acceptable, average sized, self-contained, washable, sanitary, power driven or electric shaver which can be utilized in conjunction with a wet shaving lather on the skin of the user, in accordance with the novel method set forth in the aforementioned prior patent application, and in which the wet shaving lather and the hair shaved from the skin of the user will be removed from the skin of the user and will not interfere or cause malfunctioning in the operation of the power driven shaver.

It is a more specific object of this invention to provide a power driven wet shaver, according to the above object, which will not only remove the hair and wet shaving lather from the skin of the user, but will also dissipate the air and moisture from the wet shaving lather leaving only a minute amount of residue as it travels through the shaver.

It is a further specific object of this invention to provide a power driven wet shaver, according to the above objects, which may be operated from an ordinary electrical outlet or from batteries contained within the shaver.

It has been found by this invention that the first two aforementioned objects may be accomplished by providing a power driven wet shaver comprising a housing structure, cutting means mounted in the housing structure for engaging and shaving the skin of the user, power means for driving the cutting means, an open ended, enclosed passageway defined by the housing structure and having one end thereof open to and communicating with the cutting means for receiving and passing therethrough without interference with the power means the hair and wet shaving lather removed from the skin of the user and having the other end thereof open to the atmosphere, driven means carried by the housing structure and driven by the power means and disposed within the passageway intermediate the ends thereof for creating a pressure differential resulting in suction in one end of the passageway and a forced draft through the other end of the passageway to suck the hair and wet shaving lather from the cutting means into the passageway and for transporting the hair and wet shaving lather through the passageway, and means formed by the housing structure within the passageway in close proximity to the driven means for cooperating with the driven means to create a high velocity air flow through the passageway for dissipating the air and moisture from the wet shaving lather as it is transported through the passageway.

It has been further found by this invention that the third aforementioned object may be accomplished by providing the above-described power means of the shaver with connections for receiving electrical energy from an ordinary electrical outlet or by providing the shaver with self-contained batteries for providing electrical energy to the power means.

It has also been found by this invention that the above-described power driven wet shaver provides additional advantages not normally obtained with the conventional types of power driven or electric shavers. The suction created at the cutting means will ventilate the area of the skin being shaved and will pull the skin closer to the cutting means to provide a cool, close shave resulting in additional comfort and efficiency in the shaving operation. The cutting blades are cooled by the air flow eliminating the heat and burn inherent in conventional electric shavers. Also, the cut hair may be pulled into and collected in the shaver, rather than remaining in the cutting means to be regrown and distributed in the atmosphere to be breathed by the user. The aforementioned suction will also continuously clean the blades of the cutting means for a more efficient cutting and shaving operation and will cause long hairs to be pulled into the shaver for cutting by the cutting means, which is not normally attained with conventional power driven or electric shavers.

Some of the objects of the invention having been stated,
other objects will appear as the description proceeds when taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a perspective view of the power driven wet shaver of this invention;

FIGURE 2 is a front elevational view of the shaver of FIGURE 1 with the cutting means and support therefor removed;

FIGURE 3 is a side elevational view of the shaver of FIGURE 1 with the cutting means and support therefor removed;

FIGURE 4 is a cross-sectional view of the shaver of FIGURE 1 taken substantially along the line 4—4 of FIGURE 1;

FIGURE 5 is a bottom plan view of the cutting means and support thereof, shown in FIGURE 1 and removed from the shaver;

FIGURE 6 is a cross-sectional view of a portion of the shaver taken substantially along the line 6—6 of FIGURE 2;

FIGURE 7 is a perspective view of a portion of the power means for driving the cutting means of the shaver;

FIGURE 8 is a bottom plan view of a portion of the shaver shown in FIGURE 1;

FIGURE 9 is a perspective, exploded view of portions of the shaver of FIGURE 1;

FIGURE 10 is a partial cross-sectional view of a portion of the shaver taken substantially along the line 10—10 of FIGURE 2; and

FIGURE 11 is a schematic illustration of the wiring for the power means of the shaver of this invention.

Referring now to the drawings, the power driven wet shaver is generally indicated by the reference numeral 10. As may be seen, the shaver 10 includes a composite housing structure, generally indicated by the reference numeral 11. The composite housing 11 includes a base cover plate 12, an inner mounting plate 13 and a body portion 14. The base cover plate 12, the inner mounting plate 13 and the body portion 14 are secured together by threaded screws 15 passing through suitable apertures 16 and 17 in the corners of the cover base plate 12 and inner mounting plate 13, respectively, and into threaded apertures in stud portions 18 on the inside corners of body portion 14, as shown in dotted lines in FIGURE 4.

The composite housing 11 further includes a fan housing structure, generally indicated by the reference numeral 11. Also included in the composite housing structure 11 is a venturi housing 22, a base gear housing 23 and a cover gear housing 24. The venturi housing 22 and the base gear housing 23 are secured to the fan housing 20 by a pair of threaded screws 25, shown in FIGURE 4, which pass through suitable apertures in the base gear housing 23 and the venturi housing 22 and are inserted into threaded apertures in upstanding portions of the fan housing 20. The cover gear housing 24 is secured to the base gear housing 23 by a pair of threaded screws 26, shown in FIGURES 4 and 9, which pass through suitable apertures in the cover gear housing 24 and into suitable threaded apertures in the base gear housing 23.

These above-described portions of the composite housing structure 11, when secured together in the manner described above, are effectively sealed from the external thereof to prevent moisture or the like from the wet shaving latter from entering therein to cause malfunctioning of the driving and driven mechanism contained therein, to be described hereinafter. This also allows the shaver to be cleaned by washing or any desired method without damage.

The composite housing structure finally includes a cutting head support and cover member 27 which is adapted to cover the venturi housing 22 and is removably held on the shaver 10 by latch members 30, shown in FIGURE 6. The latch members 30 are slidably retained between the fan housing plate 20 and the body portion 14 of the composite housing 11 and are biased outwardly by spring members 31 secured to the fan housing plate 20 and the latch members 30. As may be seen in FIGURE 6, the latch members 30 have protruding lip portions 30' which are adapted to be received in cut-out portions 27' of the cutting head support member 27 to latch the cutting head support member 27 into the position shown in FIGURE 6 and to allow easy removal of the cutting head support and cover member for cleaning as desired by water, air or the like.

As may be seen from the above description, most of the separate members of the composite housing structure 11 are capable of being removed from each other for purposes of cleaning and/or repair of the portions of the shaver contained within this housing structure, to be described hereinafter.

The shaver 10 includes a pair of cutting heads, generally indicated at 35. Each of the cutting heads 35 comprises a pair of cutter combs 36 having generally radially extending hair receiving slits therein and rotatable cutter blades 37 disposed within the cutter combs 36 and adapted to rotate relative thereto for cooperating with the hair received in the slits in the cutters combs 36. The cutter combs 36 and the cutter blades 37 are disposed within circular openings in the cutting head support member 27 and are held in place by spring clips 38, as may be seen in FIGURE 5, which are retained in suitable apertures within the cutter head support member 27. Operation of these conventional type rotary cutting heads are well known to those of ordinary skill in the art and therefore, further explanation herein is not deemed necessary.

For driving the cutting blades 37, a first pair of toothed gear members 40 are disposed within the gear housing 23 and 24 and are rotatably supported therein on studs 41. The gear members 40 include hollow openings in upstanding portions thereof, as shown in FIGURE 4, for receiving cutter driving shafts 42 which are slidably received in the upstanding portions of the gear 40 for vertical movement and are adapted to rotate with the gear members 40. The cutter driving shafts 42 extend through apertures in the cover gear housing 24 and are biased toward the cutting heads 35 by springs 43. Seals 46 are provided in these apertures around the shafts 42 to prevent any hair or shaving lather from entering the interior of the gear members 40 and 42. The cutter driving shafts 42 are held within the hollow openings in the upstanding portions of the gears 40 by flanges 42' on the shafts 42 and by retaining rings 44 on the upstanding portions of the gears 40.

The upper ends of the cutter driving shafts 42 are generally elliptical shaped to be received within mating elliptical-shaped apertures 45 in the cutting blade members 37 when the cutting head support and cover member 27 is secured in place on the shaver 10, as shown in FIGURE 4, so that the cutting blade members 37 will be rotated with the cutter driving shafts 42 and the gears 40.

For driving the rotatable gears 40, there is provided a shaft 50 which passes through suitable apertures in the body portion 14, the fan housing plate 20 and the base gear housing 23 and is held therein for rotation by suitable bearing members 51 and 52. A toothed gear member 53 is secured to the upper end of the shaft 50 for engagement with the teeth on the rotatable gears 40 for driving of the gear members 40.

Another toothed gear 54 is mounted on the lower end of the shaft 50 for rotation therewith within the body housing portion 14. The gear 54 is adapted to mesh with and be driven by another toothed gear member 55 rotatably mounted on a motor shaft 56 extending from an electric motor 57 and supported in a suitable bushing 58 disposed within body portion 14 and the fan housing plate 20. The electric motor 57 may be of any suitable type and is contained within the body portion 14 and is supported on
upstanding portions of the inner mounting plate 13, as shown in FIGURES 4 and 7. The electric motor 57 may be driven from electrical connections adapted to receive energy from an ordinary residential electrical outlet or alternatively from batteries contained within the shaver 10, as described hereinafter.

For supplying electrical energy to the electric motor 57 from batteries contained within the shaver 10, a suitable line 60 is connected to one end of the motor 57 and at the other end to a contact 61 of a manually operated, multi-position switch, generally indicated at 59. The contact 61 is adapted to be engaged by a contact 62 of the multi-position switch 59 which leads from a line 63 connected to one of three batteries 64 which are interconnected by lines 65 and 66. The batteries 64 are contained within the body portion 14 of the composite housing 11 and are suitably mounted on the inner mounting plate 13. There is also provided a line 67 leading from another of the batteries 64 to the electric motor 57 to complete the circuit when the contacts 61 and 62 are engaged, thus providing electrical energy from the batteries 64 to the electric motor 57 for rotating the cutter blades 37 through the gear and shaft means as described above.

For supplying electrical energy to the electric motor 57 from an ordinary, residential, electrical outlet, there is provided a line 70 leading from the line 60 to another contact 71 of the manually operated, multi-position switch 59. The contact 71 is adapted to be engaged by contact 72 which is connected with a line 73 leading from an electrical socket 74 secured in the bottom of the base cover plate 12. The socket 74 is adapted to receive an ordinary electrical shaver cord 75 which may be inserted into a conventional residential electrical outlet for conveying electrical energy from the outlet to the socket 74. Thus, when the contacts 71 and 72 of the manually operated, multi-position switch 59 are closed, electrical energy is conveyed from the residential electrical outlet to the motor 57 for operating the cutter blades 37 through the above-described gear and shaft means.

For recharging the batteries 64 during periods in which the shaver 10 is not being utilized, a plate 80 is provided in the base cover plate 12 which has a slot 81 into which the contact 82 is also provided which leads from the wall of the socket 74 to one of the batteries 64 such that electrical contacts from a suitable power source may engage the wall of the socket 74 and the plate 80 to complete a circuit through the battery 64 for recharging the same. The contacts 61 of the multi-position switch 59 are shown in FIGURE 10.

For an understanding of the manual operation of the multi-position switch 59, reference may be had to the FIGURE 10 wherein the contacts 61, 62, 71 and 72 are illustrated as being movably held in position on the base cover plate 12. A manually operated, switch actuating member 90 is shown movably retained and extending from the bottom portion of the base cover plate 12 for manual movement by the user of the shaver 10. As may be appreciated, when the switch actuating member 90 is in position shown in FIGURE 10, none of the contacts 61, 62, 71 and 72 will be engaged and no electrical energy will be supplied to the motor 57 for operating the cutting elements 37. This is the position in which the battery 64 of the shaver 10 may be recharged.

When the switch actuating member 90 is moved to the left, as viewed in FIGURE 10, it will engage a downwardly projecting portion of the contact 62 to move the same into engagement with the contact 61 for completing the circuit through the batteries 64 to the motor 57 for supplying electrical energy to the motor 57. Also, when the switch actuating member 90 is moved to the right, as viewed in FIGURE 10, it will engage a downwardly projecting portion of the contact 71 to move the same into engagement with the contact 72 for completing the circuit to the socket 74 and thus from the cord 75 which is inserted into an ordinary residential electrical outlet for supplying electrical energy therefrom to the motor 57.

Referring now to FIGURES 4 and 6, the shaver 10 further includes an open ended, enclosed passageway, generally indicated at 100, which is defined by the cut-off head support member 27, the gear housing members 23 and 24, the venturi housing 22, the fan housing 20 and the body portion 14. As may be seen, the enclosed passageway 100 has one end thereof open to and communicating with the cutting heads 35 for receiving therein and passing therethrough the hair and wet shaving lather removed from the skin of the user at the cutting heads 35. The passageway 100 has the other end thereof open to the atmosphere and is surrounded by a generally circular or elliptical-shaped screen 101 for collecting any residue of hair and shaving lather which might pass completely through the passageway 100. The passageway 100 is completely sealed from the gear and shaft means and the electrical motor by the above-described housing members and therefore, the hair and wet shaving lather passing therethrough will not cause any malfunctioning or interference with the driving means for the cutter heads.

A high speed, centrifugal fan 105 having forwardly curved blades is mounted on the shaft 50 to be driven thereby and is disposed within the enclosed passageway 100. The centrifugal fan 105 is adapted when driven to create a pressure differential within the passageway resulting in a suction on one side of the fan through the portion of the passageway leading from the cutting heads 37 to the fan and a forced draft on the other side of the fan through the portion of the passageway leading from the fan to the screen member 101. This action will suck the hair and wet shaving lather from the cutting heads 37 into the enclosed passageway 100 and will transport the hair and wet shaving lather through the passageway, in the direction shown by the arrows in FIGURES 4 and 6.

As may be seen more clearly in FIGURE 6, a venturi is formed within the passageway 100, generally indicated by the reference numeral 106, by the venturi housing 22. This venturi 106 is located in the passageway 100 in advance of and in close proximity to the centrifugal fan 105 to cooperate with the centrifugal fan to create a high velocity air flow through the passageway 100 for dissipating the air and moisture from the wet shaving lather as it is transported through the passageway, thus leaving a relatively small or minute amount of residue of the shaving lather within the passageway 100.

To create the high velocity air flow and a maximum pressure differential within the passageway 100, which is required for creating a sufficient suction at the cutting heads 35 and to dissipate the air and moisture from the wet shaving lather as it passes through the passageway 100, it is important that the centrifugal fan 105 be operated at a very high speed. The speed of the fan necessary for creating the desired environment within the passageway 100 is related to the diameter of the fan. It has been found necessary to drive the centrifugal fan 105 at speeds much higher than the speed of the cutting blades 37. If the cutting blades 37 were driven at the same high speed as the centrifugal fan 105, an efficient cutting action probably would not be obtained because the blades would be traveling too fast to allow hair to enter the hair receiving slits in the combs 36.

As may be seen from the sizes of the gears 55, 54, 53 and 40, the centrifugal fan 105 is driven at a much higher speed than the cutting blades 37. For a 3/4 inch diameter centrifugal fan 105, it has been found that the high speed operation of the shaver may be obtained when the motor shaft 56 is rotating at approximately 6,500 r.p.m., the centrifugal fan 105 is rotating at approximately 20,000 r.p.m., and the cutting blades 37 are rotating at approximately 5,000 r.p.m. It may also be appreciated that if the diameter of the centrifugal fan 105 is increased then the desired speed of the fan may be decreased and vice-
versa. However, it has been found that the centrifugal fan 105, for an average size shaver of this type, should always be driven at a speed faster than the speed of rotation of the cutter blades 37.

It has been further found that the location of the venturi relative to the centrifugal fan 105 is important for producing the high velocity air flow through the passageway 101 necessary to dissipate the air and moisture from the wet shaving lather as it passes through the passageway 100. The venturi is preferably located in advance of but in close proximity to the centrifugal fan for producing the desired high velocity air flow.

Thus, it may be seen from the above description, that this invention has provided an improved, commercially acceptable, average sized, self-contained, washable, sanitary, power driven or electric shaver which can be utilized in conjunction with a wet shaving lather on the skin of the user and in which the wet shaving lather and the hair shaved from the skin of the user will be removed from the skin of the user and will not interfere or cause malfunctioning in the operation of the power driven shaver and in which the air and moisture will be dissipated from the wet shaving lather during its travel through the shaver leaving only a minute amount of residue in the shaver.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

What is claimed is:

1. A power driven wet shaver for shaving hair from the skin of the user which may be utilized with a wet shaving lather on the skin of the user, said shaver comprising:
   (a) a housing structure;
   (b) cutting means mounted in said housing structure for engaging and shaving the skin of the user;
   (c) power means for driving said cutting means;
   (d) an open-ended enclosed passageway defined by said housing structure, said passageway having one end thereof open to and communicating with said cutting means for receiving and passing therethrough without interference with said power means the hair and wet shaving lather removed from the skin of the user, said passageway having the other end thereof open to the atmosphere;
   (e) a driven centrifugal fan adapted to be driven by said power means at a speed substantially greater than said cutting means and being disposed within said passageway intermediate the ends thereof for creating a pressure differential resulting in a suction on one side of said fan through one end of said passageway and a force draft on the other side of said fan through said other end of said passageway to suck the hair and wet shaving lather from said cutting means into said passageway and for transporting the hair and wet shaving lather through said passageway; and

(f) a venturi means formed by said housing structure within said passageway in advance of and in close proximity to said centrifugal fan for cooperating therewith to create a high velocity air flow through said passageway for dissipating the air and moisture from the wet shaving lather as it is transported through said passageway.

2. A power driven wet shaver, as set forth in claim 1, in which said power means comprises:
   (1) an electric motor disposed within said housing structure,
   (2) gear and shaft means carried within said housing structure and interconnecting said motor with said cutting means and said centrifugal fan for driving said cutting means and said centrifugal fan from said motor, and
   (3) a source of electrical energy comprising batteries disposed within said housing structure and operatively connected to said electric motor for supplying electrical energy to said motor and including means associated with said batteries for recharging said batteries, electrical connections operatively connected to said motor and leading therefrom for receiving electrical energy directly from an ordinary electrical outlet for supplying the electrical energy to said motor, and manually operated, multi-position switch means carried by said housing structure and operatively associated with said batteries and with said electrical connections so that said electrical energy is conveyed from said batteries to said motor in one position of said switch and so that electrical energy is conveyed from said electrical connections to said motor in another position of said switch.

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