

HAIRDRYER

The present invention relates to hairdryer devices and in particular refers to a portable hair dryer provided with an inner diffuser of air.

The known and widely used portable hairdryers on the market, intended for both professional
5 and domestic use, are electrical devices equipped with an external casing commonly made of plastic material, provided with a handle and a hollow body forming a through duct for air. In the most common embodiment, an electric motor, a centrifugal or axial fan, which is connected to and rotated by the electric motor, and one or more electric heating elements, in particular resistors or electric resistances, for heating the air are housed inside the hairdryer
10 casing, more precisely in the hollow body forming the air duct.

When the hair dryer is in use, i.e. when the electric motor and the electric heating resistances are supplied with electric current, the fan is rotated by the electric motor and generates inside the air duct a flow of air, which is sucked into the rear part of the hair dryer through a suction opening, flows towards the front part of the hairdryer and outflows from a front opening or
15 outlet opening. The air flow passes through the electric heating resistances, which with the passage of electric current produce heat by Joule effect, thus it heats up and outflows from the outlet opening.

The electric motor of the hairdryer is generally of the commutator type and comprises a stator fixed to the casing and provided with stator windings supplied with single-phase direct
20 or alternating electric current, a rotor provided with rotor or armature windings and rotatably positioned inside the stator and aligned therewith and a commutator or switch fixed to the rotor and engaged by a pair of brushes for supplying the rotor windings with single-phase direct or alternating electric current during the rotation of the rotor for generating the magnetic fields necessary for the operation of the motor. Rotor and stator are made of
25 ferromagnetic material and have larger dimensions the greater the power required to operate the fan to generate an air flow adapted to dry hair in a reasonably short amount of time.

Since the casing and fan, made of plastic material, and the resistive wires forming the electrical resistances have a reduced weight, it is evident that the overall weight of the hairdryer is substantially due to the weight of the electric motor.

30 It is known that the prolonged use of a powerful but bulky hairdryer, especially by professionals in the field of hairstyling which keep their upper limbs raised for long periods of time and perform cyclically repetitive movements, can lead to harmful consequences on muscles and tendons of the hand-wrist-elbow-shoulder system, in some cases with the risk of the inflammatory diseases and osteo-articular pains becoming chronic.

In fact, medical studies have shown that almost 40% of hairdressers suffer from diseases of the musculoskeletal system, in particular related to posture or the biomechanical overload of the upper limbs.

5 In order to reduce the incidence of diseases of the musculoskeletal system in the population of hairdressers, in addition to measures such as maintaining correct posture during work and rotating work tasks with greater and less functional commitment, the use of manageable and lightweight hairdryers, which weigh little or nothing on the hand-wrist-elbow-shoulder system, is of fundamental importance.

10 The trend in the sector is therefore to increasingly reduce the overall size and weight of hairdryers without, however, decreasing the power with which the fan is operated and generated an adequate quantity or flow of air, in other words without increasing the time needed to dry hair.

An object of the present invention is to provide a hairdryer which overcomes the disadvantages of the known hairdryers.

15 Another object is to provide a manageable and lightweight hairdryer, which can be used for long periods of time weighing little or nothing on the muscles and tendons of the hand-wrist-elbow-shoulder system.

A further object is to provide a powerful hairdryer capable of delivering a high air flow in order to dry hair in reasonably little time.

20 Another further object is to provide a hairdryer which allows to vary the air flow precisely and in a wide range of adjustments to dry hair according to different needs.

These and other objects are achieved by a hairdryer according to claim 1.

The invention can be better understood and implemented with reference to the attached drawings which illustrate an exemplifying and non-limiting embodiment thereof, in which:

- 25 - figure 1 is a side view of the hairdryer of the invention;
- figure 2 is a rear view of the hairdryer of figure 1;
- figure 3 is a perspective and longitudinal section view of the hairdryer of figure 1;
- figure 4 is a section interrupted along the line IV-IV of figure 2;
- figure 5 is a perspective view of the hairdryer of figure 1 provided with an outer air
30 nozzle in an assembly configuration;
- figure 6 is an interrupted perspective and longitudinal section view of the hairdryer of figure 5.

With reference to figures 1 to 4, a hairdryer 1 according to the present invention is illustrated which comprises a casing 2 provided with a handle 3 and a main body 4 having a main

through cavity 13 provided with one or more rear suction openings 5 and a front outlet opening 6, respectively for the inlet and outlet of air. The main body 4, for example, has a substantially cylindrical shape, the same as the main through cavity 13 thereof and extends along a longitudinal axis X.

- 5 The main body 4 is adapted to contain within the aforementioned main through cavity 13 an electric motor 20 and a fan 21 drivable in rotation by the electric motor 20 in order to generate an air flow F with a settled speed inside the main through cavity 13, in particular parallel to the longitudinal axis X.

Inside the main body 4 heating means 22 are also provided, positioned downstream of the
10 electric motor 20 and the fan 21 with reference to the air flow F. The heating means 22 comprise resistive wire means adapted to produce heat when supplied by an electric current. The electric motor 20, the fan 21 and the heating means 22 are components of known type and are therefore not described in further detail.

The air flows through the main through cavity 13, sucked by the fan 21 through the rear
15 suction openings 5 and is conveyed out of the casing 2 through the heating means 22 and the front outlet opening 6.

The hairdryer 1 further comprises an inner diffuser 15 arranged inside the main through cavity 13 and at the front outlet opening 6 and provided with a respective through cavity 14 having a passage section (transversal, i.e. orthogonal, to the longitudinal axis X) decreasing
20 towards the front outlet opening 6 in order to increase the speed of the air flow F due to the known Venturi effect.

The main body 4 at the front outlet opening 6 further comprises one or more side openings 7 through which air can be sucked from the outside of the casing 2 into the main through cavity 13 due to the Venturi effect, in particular due to the air entrainment process generated
25 by the air flow F coming out from the inner diffuser 15 at high speed, so that an air output flow rate Q2 from the outlet opening 6 is increased, as better explained below.

In this manner the air output flow rate Q2 can be increased by 50%-100% compared to an air initial flow rate Q1 generated by the fan 21.

With particular reference to figures 3 and 4, the inner diffuser 15 comprises an inner tubular
30 portion 17, in particular almost cylindrical, provided with an inlet opening 17a and having a first transversal passage section for the air flow F entering and coming from the fan 21 and an outer tubular portion 18 having at least one outflow mouth 16 for the air flow F coming out and having a second transversal passage section, the latter having an area equal to 30%-50% of the area of the first transversal passage section. More precisely, the through cavity

14 of the inner diffuser 15 is formed by the respective cavity of the inner tubular portion 17 and the respective cavity of the outer tubular portion 18.

In the illustrated embodiment, the heating means 22 are housed in the through cavity 14 of the inner diffuser 15, in particular within the inner tubular portion 17. Alternatively, they
5 may be fixed outside of the inner diffuser, the latter having an inner tubular portion 17 of shorter length.

In the illustrated embodiment, the outer tubular portion 18 of the inner diffuser 15 comprises a plurality of outflow mouths 16 arranged angularly spaced around the longitudinal axis X of the main body 4, the transversal passage sections of the outflow mouths 16 having an
10 overall area equal to the area of second transversal passage section, that is smaller than the first transversal passage section for the inlet of the air flow F.

More precisely, the outer tubular portion 18 of the inner diffuser 15 comprises a plurality of outflow ducts 26 (the inner cavities of the outflow ducts forming the respective inner cavity of the outer tubular portion 18), each of which is provided with a respective outflow mouth
15 16. The outflow ducts 26 are arranged radially around the longitudinal axis X and shaped so that two adjacent outflow ducts 26 are separated by a respective groove 19, the latter in particular convergent towards the front outlet opening 6.

In order to ensure an adequate air flow rate inside the main body 4 at the front outlet opening 6, said main body 4 comprises in the illustrated embodiment a plurality of through side
20 openings 7, in the form of holes, made in several parallel and circumferential rows, on a side wall of a front portion 4a of the main body 4, the front portion 4a comprising said front outlet opening 6.

Likewise, in order to ensure adequate air suction by the fan 21, the main body 4 comprises a plurality of rear suction openings 5 made on a respective rear portion 4b of said main body
25 4. More precisely, the rear suction openings 5 comprise a plurality of holes made on a side wall and on a rear wall of the main body 4 at the respective rear portion 4b.

A micro-perforated filter element 9 is provided inside the main body 4 in the rear portion 4b to filter incoming air through the rear suction openings 5 and retain foreign bodies, dust, corpuscles and dirt which could dirty and clog the fan 21, the motor 20 and the heating means
30 22.

The hairdryer 1 further includes control means 25, of a known type and not illustrated and described in detail, capable of controlling the rotation speed of the electric motor 20 and therefore of the fan 21 in order to adjust the speed of the air flow F inside the main through cavity 13 before the inner diffuser 15.

As illustrated in figures 5 and 6, the hairdryer 1 of the invention further comprises an outer outlet element 30, which can be reversibly coupled to the front outlet opening 6 of the main body 4 in an assembly configuration A.

The outer outlet element 30 comprises an outflow tubular portion 31 of the air flow F and a coupling tubular portion 32, in particular having a cylindrical shape, adapted to be inserted, in particular with a slight interference fit, into the front outlet opening 6. The length of the coupling tubular portion 32 is such as to close the side through openings 7 in order to prevent the air from entering in the main through cavity 13 due to the air entrainment process and to have an air output flow rate Q2 at the front outlet opening 6 that is substantially equal to an air initial flow rate Q1 generated by the fan 21. At the same time, by closing the side through openings 7 the pressure of the air coming out from the inner diffuser 15 is maintained unchanged.

In the embodiment illustrated in figures 5 and 6, the outer outlet element 30 comprises a nozzle of known type having an outflow tubular portion 31 with varying shape and size and an inner section that decreases and converges towards a respective outflow opening 31a so as to increase the speed of the outflow of air, in this case the air flow rate generated by the fan 21 remaining constant. For example, the outflow opening 31a has an elongated rectangular shape.

The section or area of the outflow opening 31a of the outflow tubular portion 31 is, for example, substantially equal to the area of the second transversal passage section of the inner diffuser 15 i.e., the overall area of the outflow mouths 16 of the outflow ducts 26.

The outflow opening 31a can have shapes other than rectangular and areas less than or greater than the overall area of the outflow mouths 16 of the outflow ducts 26.

For example, the outer outlet element can comprise a diffuser having an outflow tubular portion 31 of varying shape and a section that increases and diverges towards one or more outflow openings having an overall area greater than the overall area of the outflow mouths 16 of the outflow ducts 26, so as to decrease the speed of the air flow coming out.

In the operation of the hairdryer 1 of the invention, the air sucked by the fan 21 through the rear suction openings 5 and conveyed through the main through cavity 13 reaches the inner diffuser 15, which has a respective through cavity 14 having a passage section decreasing towards the front outlet opening 6, in order to increase the speed of the air flow F due to the known Venturi effect.

As a further consequence, through the plurality of side openings 7 made on the side wall of the front portion 4a of the main body 4, the air is sucked from outside of the hairdryer 1

towards the inside of the main through cavity 3 due to the known Venturi effect and in particular due to the air entrainment process generated by the air flow F coming out of the inner diffuser 15 at high speed and the consequent local decrease of pressure at the output of the inner diffuser 15 (according to Bernoulli's theorem). Therefore, an additional flow rate
5 of air sucked and dragged through the through side openings 7 is added to the air initial flow rate Q1 generated by the fan 21 so as to considerably increase the air output flow rate Q2 from the front outlet opening 6.

Suction or dragging of air from the side openings 7 is also facilitated by the shape of the outer tubular portion 18 of the inner diffuser 15 which comprises a plurality of outflow ducts
10 26 separated from each other by respective grooves 19, having a converging shape towards the front outlet opening 6. Said converging grooves 19, in addition to facilitating suction of the air from the side openings 7, allow the conveyance of the air with radial concentric motion towards the inside of the main through cavity 3, parallel to the longitudinal axis X. Tests carried out by the applicant have shown that thanks to the specific configuration of the
15 inner diffuser 15 and the side openings 7 the air output flow rate Q2 of the hairdryer of the invention can be increased by 50%-100% compared to the air initial flow rate Q1 generated by the fan 21.

Thanks to the hairdryer 1 of the invention provided with an inner diffuser 15 and side openings 7 which exploit the known Venturi effect and air entrainment process, it is therefore
20 possible to significantly increase the air flow rate supplied without the need to increase the power, i.e., size and weight of the electric motor 20. In this way, while having a hairdryer which ensures a high flow rate, for example between 60 and 110 m³/h, so as to dry hair in reasonably little time, it is possible to have an appliance which is compact, manageable and of a small weight and size, which can be used for long periods of time weighing little or
25 nothing on the muscles and tendons of the hand-wrist-elbow-shoulder system.

The use of the outer out element 30, adapted to inhibit the Venturi effect and the air entrainment process by closing the side openings 7, also allows to reduce the air output flow rate Q2 of the hairdryer 1 of the invention which is therefore substantially equal to the air
initial flow rate Q1 generated by the fan 21, whose speed (and therefore whose air flow rate)
30 can still be precisely varied by the control means 25, which allow to control the rotation speed of the electric motor 20.

The hairdryer 1 of the invention therefore allows to vary precisely and in a wide adjustment range the air flow rate to dry hair according to different and specific needs also using or not using the outer outlet element 30.