

This invention relates to a hair dryer with a housing including an air inlet opening, an air directing duct and an air outlet opening, with the air directing duct accommodating a fan structure for producing an air stream and a rotatably mounted rotor structure including at least one perforation and means adapted to rotate the rotor structure on encountering the air stream.

A hair dryer of this type is described, for example, in DE 32 25 944 A1. The housing of this known hair dryer includes a device referred to as a pulsator which is arranged in the region of either the air inlet opening or the air outlet opening of the hair dryer. Functioning as a rotor, this pulsator is provided with one or several blades on which the air stream from the fan is adapted to impinge, producing a turbulent flow pattern of the air stream aimed at speeding up the hair drying process. However, this known pulsator is not suited to change the static character of the shape of the exiting air stream. In this known hair dryer, the exiting air stream may be described as having the shape of a cylinder or frustum of a cone, the pulsator being merely suitable for contributing to imposing an additional rotary motion upon the air stream within the boundaries of the cylinder or conical frustum. Although the rotor of DE 32 25 944 A1 is referred to as a pulsator, it is not suited for the formation of true individual pulses of air stream. Rather, the air stream continues to be discharged from the air exit opening in a continuous flow pattern, the air directing duct being at no time completely closed during a full revolution of the rotor.

It is an object of the present invention to devise a hair dryer which generates true pulses of air stream, producing, as the case may be, a variation of this air stream with space, in addition to variations of the exiting air stream with time. This object is accomplished in that the rotor structure of the hair dryer initially referred to is operatively associated with a stationary diaphragm which covers the air directing duct at least in part and is provided with apertures, so that in operation of the hair dryer perforations in the rotatable rotor structure will temporarily register with apertures in the diaphragm. By this means, the possibility is advantageously provided to vary the air stream discharged from the hair dryer with time and/or with space. A variation of the exiting air stream with time results in air pulses producing a swirling or lifting action of the hair away from the scalp, thus accelerating the hair drying process or aiding in forming special hair styles. In cases where

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a variation of the exiting air stream with space is provided, the air stream is directed at various regions of the hair to be dried, making it unnecessary to use the hair dryer in a to-and-fro motion as is widely practiced by its users. This last-mentioned arrangement allows drying without fatigue. The special manner in which the exiting air stream is varied with time and/or space can be adjusted by a suitable operative association and configuration of the apertures of the diaphragm and the perforations of the rotor structure.

A particularly straightforward construction of the rotor structure results by configuring it in the manner of a disk and providing it with perforations arranged in relatively opposite pairs on the rotor structure.

In a further embodiment of this invention, the perforations are of a tubular configuration, with the tube axis being preferably inclined relative to the axis of rotation of the rotor structure. Depending on the degree of inclination of the tube axis relative to the axis of rotation, the added possibility of fanning out or concentrating the exiting air stream is provided.

In a further feature of this invention, the perforations are essentially equidistantly spaced on the circumference of a circular ring of the rotor structure, with the aperture of the diaphragm being preferably of such shape that perforations and apertures are in registry in any angular position of the rotor structure relative to the diaphragm. In this embodiment, the exiting air stream is essentially varied only with space. However, the perforations of the rotor structure may be of different dimensions, thus allowing an additional variation of the air stream with time.

In a particularly advantageous embodiment of this invention, the rotor structure includes sectors with perforations and sectors without perforations, the different sectors preferably adjoining each other, and the diaphragm has preferably an aperture of such shape that perforations and apertures are not in registry over a specified range of the angle of rotation. This arrangement provides a possibility of varying the exiting air stream with time, with pulses of air stream being produced in the process. The air stream discharged varies with time between zero and maximum, causing the hair to be dried quickly and efficiently. Preferably, the rotary frequency of the rotor structure and thus the pulse recurrence frequency is set to a value in the range of between 1 and 50 Hz, in particular to values between 5

and 20 Hz. With these values, very good results are obtainable in practice.

In a further embodiment of the present invention, circumferentially adjoining perforations are at a different radial distance from the axis of rotation of the rotor structure, with the aperture of the diaphragm being preferably configured as an oblong, in particular central slot or sectorial section.

In a favorable embodiment of this invention, the means provided on the rotor structure for deflecting the air stream so as to produce a torque are configured as circumferentially spaced air directing elements, in particular blades.

In a highly advantageous further feature of this invention, the means on the rotor structure are adapted to be acted upon by a secondary air stream. By suitably dimensioning the intensity of the secondary air stream, this arrangement makes it possible to set the rotational frequency of the rotor structure to convenient values. Further, this arrangement is suited to avoid or reduce the direct dependent relationship of the rotational frequency of the rotor structure to the set amplitude of the air stream.

In an embodiment of the present invention, the intensity of the secondary air stream is variable by means of a control device using, for example, an adjustable nozzle. This enables the user to adjust the rotational frequency of the rotor structure, and thus the variation of the exiting air stream with space and/or time, to his or her individual needs.

Equally, it has proven to be advantageous to provide means for slowing down the rotor structure. These means may be implemented, for example, by directing a further secondary air stream to the blades or air directing elements of the rotor structure, which produces a torque opposed to the first secondary air stream. It will be understood that also the first secondary air stream may be used as a means for slowing down the rotor structure in cases where, for example, the rotor structure is caused to rotate by the primary air stream. Finally, the possibility also exists to provide purely mechanical means for slowing down the rotor structure.

Further features, advantages and application possibilities of the present invention will become apparent from the subsequent description of embodiments

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illustrated in more detail in the accompanying drawings. It will be understood that all features described and/or represented by illustration, whether taken alone or in any desired combination, constitute the subject-matter of the present invention, irrespective of their summarization in the claims and their back-references. In the drawings,

FIG. 1 is a schematic general view of a hair dryer;

FIG. 2 is a schematic sectional view illustrating a first embodiment of the present invention;

FIG. 3 is a top plan view of the rotor structure illustrating a first embodiment thereof;

FIG. 4 is a sectional view of the rotor structure illustrating a first embodiment thereof;

FIG. 5 is a top plan view of the diaphragm illustrating a first embodiment thereof;

FIG. 6 is a schematic view illustrating the variation of the exiting air stream with space according to the first embodiment;

FIG. 7 is a schematic sectional view illustrating a second embodiment of the present invention;

FIG. 8 is a top plan view of the rotor structure illustrating a second embodiment thereof;

FIG. 9 is a sectional view of the rotor structure illustrating a second embodiment thereof;

FIG. 10 is a top plan view of a diaphragm illustrating a second embodiment thereof; and

FIG. 11 is a schematic view illustrating the variation of the exiting air stream with time according to the second embodiment.

Referring now to the drawings, there is shown a hair dryer 10 having a housing 12 and a handle 15 integrally formed therewith. The housing 12 possesses an air inlet opening 14, an air directing duct 18, and an air outlet opening 16. Arranged in the air directing duct 18 are a fan 20 and a heating means 46 for producing an air stream 26 or a stream of heated air. A rotor structure 22 is provided in the air directing duct 18 between the air inlet opening 14 and the air outlet opening 16. A

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diaphragm 30 is operatively associated with the rotor structure 22. Both components, the rotor structure 22 as well as the diaphragm 30, are conformed to the circular cross-section of the air directing duct 18, being configured as disks arranged transversely in the air directing duct 18. Both components essentially cover the air directing duct 18.

As becomes apparent particularly from the detail illustrations, the rotor structure 22 is provided with perforations 24. These perforations are either uniformly distributed on a circular ring of the rotor structure 22 (FIG. 8) or, alternatively, are disposed in individual sectors 40 (FIG. 3) adjoining imperforate sectors 38. The rotor structure 22 includes a plurality of circumferentially spaced air directing elements, in particular blades 28.

The diaphragm 30 immediately adjoining the rotor structure 22 possesses apertures 32 which are preferably configured as an oblong central slot 36, or alternatively as a sectorial section. The perforations 24 in the rotor structure 22 may be of a cylindrical 241 or a conical form 242, and a tube axis 34 of the perforation 241 may also extend at an angle to the air stream 26.

By means of an axle 54 carried in a bearing 52, the rotor structure 22 is rotatably mounted on a supporting structure 60 comprised of several arms 56 provided in the air directing duct 18. The diaphragm 30 and the rotor structure 22 are essentially concentrically arranged inside the air directing duct 18.

The housing 12 or the air directing duct 18 include means for generating a secondary air stream 42, the intensity thereof being variable by means of a control device 44 indicated schematically. In the embodiment of FIG. 2 or FIG. 7, the secondary air stream 42 may impinge on the rotor structure 22 either radially or axially. Also, the possibility exists to have a secondary air stream 42 impinge on the rotor structure 22 in addition to the primary air stream 26, or to have exclusively a secondary air stream 42 act on the rotor structure 22 for driving it. Equally, it is within the scope of the present invention to use the secondary air stream as a means for slowing down the rotor structure 22 driven by the primary air stream.

After the hair dryer is turned on, the fan 20 is set in operation, producing an air stream acting wholly or in part on the appropriately inclined blades 28 of the rotor

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structure 22 and producing a torque setting the rotor structure 22 in rotation. The rotational velocity of the rotor structure 22 can be varied by the control device 44 or other suitable means. The individual perforations 24 of the rotor structure 22 will register with the aperture 32 of the diaphragm 30 at different instants, opening at the respective instant the diaphragm-and-rotor-structure combination to allow passage of the primary air stream 26. Depending on the arrangement of the perforations 24 and the shape of the apertures 32 of the diaphragm 30, different variations with time and/or space of the air stream leaving the hair dryer 10 are obtainable. Using an approximately sinusoidal arrangement of the perforations 24 in two sectors 40 of the four sectors of the rotor structure 22 and a slotted aperture 32 of the diaphragm 30, two air stream oscillations moving towards each other will be produced (FIG. 6), these air streams further pulsating with time because the sectors 38 inhibit the passage of the primary air stream through the diaphragm 30 for about half the duration of one revolution of the rotor structure 22.

By arranging the perforations according to FIG. 8, an air stream oscillation 50 as shown in FIG. 11 will be produced. The two air streams oscillate towards and away from each other in fan shape. The perforations 24 being uniformly distributed (FIG. 8), there occurs essentially only a minor pulsation of the air stream, because for any angle of rotation of the rotor structure 22 relative to the diaphragm 30, one perforation 24 or a part thereof registers with the slot 36 of the diaphragm 30.

It will be understood that further embodiments of perforations 24 or apertures 32 are within the scope of the present invention. Thus, for example, the perforations 24 and the apertures 32 may be configured such that the exiting air stream is variable only with time, or only with space, or with any combination thereof. By means of the control device 44 for the secondary air stream 42 the rotor structure can be set at speed settings suited to the user's individual needs. In practice, rotational frequencies in the range of 1 to 50 Hz, in particular between 10 and 20 Hz, have proven to be advantageous.

Patent Claims

1. A hair dryer (10) with a housing (12) including an air inlet opening (14), an air directing duct (18) and an air outlet opening (16), with the air directing duct (18) accommodating a fan structure (20) for producing an air stream (26) and a rotatably mounted rotor structure (22) including at least one perforation (24) and means adapted to rotate the rotor structure (22) on encountering the air stream (26), characterized in that the rotor structure (22) is operatively associated with a stationary diaphragm (30), said diaphragm (30) covering the air directing duct (18) at least in part and being provided with apertures (32), so that in operation of the hair dryer (10) perforations (24) in the rotatable rotor structure (22) will temporarily register with apertures (32) in the diaphragm (30).

2. A hair dryer as claimed in claim 1, characterized in that the rotor structure (22) is configured in the manner of a disk and is provided with perforations (24) arranged in relatively opposite pairs on said rotor structure (22).

3. A hair dryer as claimed in claim 1 or claim 2, characterized in that the perforations (24) are of a tubular configuration, with the tube axis (34) being preferably inclined relative to the axis of rotation of the rotor structure (22).

4. A hair dryer as claimed in at least one of the preceding claims, characterized in that the perforations (24) are essentially equidistantly spaced on the circumference of a circular ring of the rotor structure (22), with the aperture (32) of the diaphragm (30) being preferably of such shape that perforations (24) and apertures (32) are in registry at least in part in any angular position of the rotor structure (22) relative to the diaphragm (30).

5. A hair dryer as claimed in at least one of the claims 1 to 3, characterized in that the rotor structure (22) includes sectors with perforations (40) and sectors without perforations (38), said sectors preferably adjoining each other, and that the diaphragm (30) has preferably an aperture (32) of such shape that perforations (24) and apertures (32) are not in registry over a specified range of the angle of rotation.



6. A hair dryer as claimed in at least one of the preceding claims, characterized in that circumferentially adjoining perforations (24) are at a different radial distance from the axis of rotation of the rotor structure (22), and that the apertures (32) are preferably configured as an oblong, central slot (36) or sectorial section.

7. A hair dryer as claimed in at least one of the preceding claims, characterized in that the means provided on the rotor structure (22) for deflecting the air stream (26, 42) so as to produce a torque are configured as circumferentially spaced air directing elements, in particular blades (28).

8. A hair dryer as claimed in at least one of the preceding claims, characterized in that said means on the rotor structure (22) are acted upon by a secondary air stream (42).

9. A hair dryer as claimed in claim 8, characterized in that the intensity of the secondary air stream (42) is variable by means of a control device (44) using, for example, an adjustable nozzle.

10. A hair dryer as claimed in at least one of the preceding claims, characterized in that means are provided for slowing down the rotor structure (22).

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