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(54) **Fan.**

(57) A fan comprises a rotor mounted within a housing (1) which has a inlet and an outlet. The rotor is positioned between the inlet (2) and the outlet (4) and a motor (5) is provided to rotate it about a predetermined axis. The housing (1) defines a chamber (9) which extends around the circumference of the rotor. A diffuser (8) is mounted within the housing (1), between the rotor and the outlet (4), such that it defines passageways extending radially relative to the said axis from the chamber (9) towards the outlet (4). The arrangement is such that the chamber (9) extends around the circumference of the diffuser (8) and the radially outer ends of the passageway defined by the diffuser open into the chamber (9) in the radial direction. As a result noise output is substantially reduced and efficiency is enhanced.

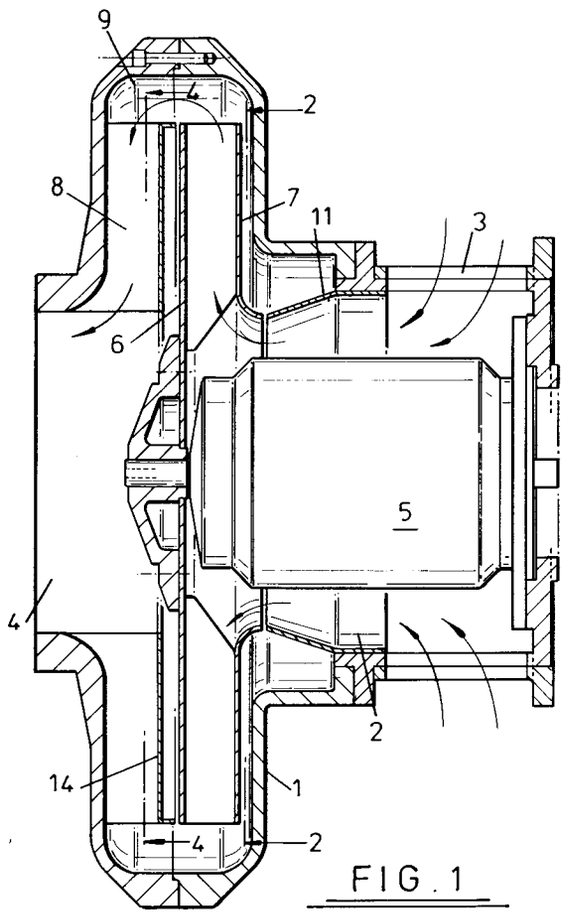

FIG. 1

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The present invention relates to a fan and in particular to a fan which is suitable for use in delivering air to a fossil fuel combustion apparatus such as an oil or gas fired boiler.

Fans for delivering combustion air to gas and oil fired boilers are well known. Typically such fans incorporate a housing defining an inlet open to the atmosphere and an outlet connected to a burner head. A rotor is mounted within the housing between the inlet and outlet so as to be rotatable about a predetermined axis which extends through the inlet and outlet. The rotor defines passageways extending radially relative to the axis and is driven by a motor such that air is drawn in through the inlet and blown radially outwards through the passageways defined by the rotor. A chamber defined by the housing extends around the circumference of the rotor and air is conveyed from that chamber through a diffuser mounted within the housing between the rotor and the outlet. The diffuser defines passageways extending radially relative to the axis of rotation from the chamber towards the outlet. The diffuser comprises a plurality of curved vane, radially extending edges of the vane being distributed around the diffuser facing the chamber.

The air within the chamber is caused to rotate in the circumferential direction as a result of the rotation of the rotor. This rotating body of air thus has a substantial component of velocity perpendicular to the radially extending edges of the vane which face the chamber. Thus air which is pushed into the passageways defined by the diffuser is forced to change its direction of movement abruptly as it is displaced in the axial direction into the diffuser passageways. As a result the fan is relatively noisy in operation and inefficient as a result of energy being wasted due to the rapid change in direction of motion of the entrained air.

It is an object of the present invention to obviate or mitigate the problem outlined above.

According to the present invention, there is provided a fan comprising a housing defining an inlet and an outlet, a rotor mounted within the housing between the inlet and outlet, the rotor being rotatable about a predetermined axis and defining passageways extending radially relative to the axis, a motor for rotating the rotor about the predetermined axis, a chamber defined by the housing and extending around the circumference of the rotor, and a diffuser mounted within the housing between the rotor and the outlet, the diffuser defining passageways extending radially relative to the axis from the chamber towards the outlet, wherein the chamber extends around the circumference of the diffuser such that the radially outer ends of the passageways defined by the diffuser open into the chamber in the radial direction.

Preferably the rotor comprises a plurality of blades, for example twelve, the radially outer edges of which extend parallel to the rotation axis. Each blade may be curved, having a radius of curvature of, for example, 9cm, with any section through the blade parallel to the rotation axis being straight. The direction of curvature of each blade is preferably arranged such that its radially outer edge is swept back relative to the direction of movement of the rotor.

Preferably the diffuser comprises a plurality of vanes, for example twenty, the radially outer edges of the vanes extending parallel to the rotation axis. The radially outer edges of the vanes may be located at the same radial distance from the rotation axis as the radially outer edges of the rotor blades. Each vane may be curved, having a radius of for example 9cm, with any section through the vane parallel to the rotation axis being straight. The direction of curvature of each vane is preferably arranged such that its radially outer edge is swept forward relative to the direction of movement of the rotor.

Thus, the body of air rotating within the chamber does not have to change direction abruptly as it enters the radially outer ends of the passageways defined by the diffuser. As a result noise output is substantially reduced and efficiency is enhanced. As a result of improved efficiency, the air delivered by the fan is not heated to the same extent as is the case with prior art devices and thus the fan can deliver a greater mass of air than would be the case in a less efficient fan.

Preferably the motor is located so as to be symmetrical about the rotation axis within the inlet. This enables the flow of air through the inlet to cool the motor and in addition provides a compact overall structure.

The fan may be used with any device such as a gas, oil or multi-fuel combustion unit which requires an efficient means for delivering air.

The invention also provides a rotor for a fan comprising a plurality of blades the radially inner edges of which are tapered towards the rotation axis. Each blade may be curved, having a radius of curvature of for example 9cm with any section through the blade parallel to the rotation axis being straight. The direction of curvature of each blade is preferably arranged such that its radially outer edge is swept back relative to the direction of movement of the rotor. The blades may be formed from strips of material secured between a pair of plates. Preferably a line drawn to the radially outer edge of the blade from its centre of curvature subtends an angle of 30° with a radial line drawn from the centre of rotation of the rotor.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view through a fan in accordance with the present invention;

Fig. 2 is a front view of a rotor incorporated in the embodiment of Fig. 1 taken on the line 2-2;

Fig. 3 is a plan view of a blade of the rotor of Fig. 2; and

Fig. 4 is a view taken on the line 4-4 of Fig. 1 illustrating the configuration of vanes provided within a diffuser of the embodiment of Fig. 1.

Referring to the accompanying drawings, the illustrated embodiment of the invention comprises a housing 1 defining an inlet 2 to which air gains access through a side aperture 3, and an outlet 4. A motor 5 is located within the inlet 2 and drives a rotor comprising a backplate 6 and a shroud 7. A diffuser defined by a series of vanes 8 is fixed within the housing and a chamber 9 extends around the circumference of both the rotor and the diffuser.

Fig. 2 illustrates the rotor structure in greater detail. The backplate 6 defines a central aperture 10 through which a spindle of the motor 5 extends. The backplate 6 is secured so as to rotate with the spindle as illustrated in Fig. 1. The radially inner edge of the shroud 7 is curved towards the inlet 2 so as to define with a frusto-conical member 11 secured within the inlet 2 an air flow passageway. Twelve blades 12 are secured between the backplate 6 and the shroud 7 so as to define twelve radially extending passageways. Each of the blades 12 is formed from a flat strip of metal having castellated edges as shown in Fig. 3. The projections on the castellated edges are inserted through apertures (not shown) in the backplate 6 and the shroud 7 and secured in position by suitable deformation.

As shown in Fig. 2, the rotor assembly turns in the clockwise direction and thus the outer edges of the blades are swept back relative to the direction of rotation of the rotor. The radially outer edges of the blades 12 extend parallel to the rotation axis of the rotor and any section taken through any one blade in a direction parallel to the rotor axis is straight. Thus, the individual passageways defined between adjacent pairs of blades are of substantially rectangular cross-section. In the illustrated arrangement, the radius of curvature of the blades 12 is approximately 9cm and a line drawn to the radially outer edge of the blade from its centre of curvature subtends an angle of 30° with a radial line drawn from the centre of rotation of the rotor through that radially outer edge.

Referring now to Fig. 4, this illustrates the disposition of the vanes within the diffuser. Each vane 8 is formed as a casting on the housing, for example twenty diffuser vanes being provided to define twenty radially extending passageways. It will be appreciated however that the vanes could be formed other than by cutting, for example by fabrication. Each vane is curved having a radius of curvature of, for example 9cm, disposed such that any section through a vane taken parallel to the axis of rotation is substantially straight. The radially outer edges of the vanes 8 are swept forward relative to the direction of rotation of the rotor and thus a body of air within the chamber 9 which is caused to rotate as a result of rotation of the rotor travels in the direction of the arrow 13 in Fig. 4.

It will be noted from Fig. 1 that the chamber 9 extends circumferentially around the diffuser. In prior art devices the individual vanes 8 extended radially outwards into contact with the radially inner surface of the housing and thus radially extending vane edges were defined adjacent the chamber surrounding the rotor. Such an arrangement caused air entering the diffuser passageways to change direction abruptly. In the case of the present invention however as the chamber 9 extends over the radially outer edges of the diffuser vanes the direction of flow of air changes relatively slowly as it enters the passageway defined between the vanes 8. Thus relatively little energy is lost and noise and unwanted heating is substantially reduced.

Referring again to Fig. 1, a plate 14 is secured to the axial edges of the diffuser vanes 8 so as to separate the passageways defined between the vanes 8 from the backplate 6 of the rotor. Thus air blown radially outwards by the rotor into the chamber 9 is then directed radially inwards through the passageways defined between the vanes 8 into the outlet 4.

Claims

1. A fan comprising a housing defining an inlet and an outlet, a rotor mounted within the housing between the inlet and outlet, the rotor being rotatable about a predetermined axis and defining passageways extending radially relative to the axis, a motor for rotating the rotor about the predetermined axis, a chamber defined by the housing and extending around the circumference of the rotor, and a diffuser mounted within the housing between the rotor and the outlet, the diffuser defining passageways extending radially relative to the axis from the chamber towards the outlet, wherein the chamber extends around the circumference of the diffuser such that the radially outer ends of the passageways defined by the diffuser open into the chamber in the radial direction.

2. A fan as claimed in claim 1, wherein the rotor comprises a plurality of blades, whereof the radially outer edges extend parallel to the said

rotation axis.

3. A fan as claimed in claim 1 or 2, wherein each blade is curved such that any section through a blade parallel to the rotation axis is straight.

4. A fan as claimed in claim 3, wherein the direction of curvature of each blade is such that its radially outer edge is swept back relative to the direction of movement of the rotor.

5. A fan as claimed in any one of the preceding claims, wherein the diffuser comprises a plurality of vanes, whereof the radially outer edges extend parallel to the said rotation axis.

6. A fan as claimed in claim 5, wherein the radially outer edges of the vanes are located at the same radial distance from the rotation axis as the radially outer edges of the rotor blades.

7. A fan as claimed in claim 6, wherein each vane is curved such that any section through a vane parallel to the rotation axis is straight.

8. A fan as claimed in claim 7, wherein the direction of curvature of each vane is such that its radially outer edge is swept forward relative to the direction of movement of the rotor.

9. A fan as claimed in any one of the preceding claims, wherein the motor is located so as to be symmetrical about the rotation axis within the inlet of the housing.

10. A rotor for a fan comprising a plurality of blades, the radially inner edges of which are tapered towards the rotation axis of the rotor.

11. A rotor as claimed in claim 10, wherein each blade is curved such that any section through the blade parallel to the rotation axis is straight.

12. A rotor as claimed in claim 11, wherein the direction of curvature of each blade is such that its radially outer edge is swept back relative to the direction of movement of the rotor.

13. A rotor as claimed in any one of claims 10 to 12, wherein the blades are formed from strips of material secured between a pair of plates.

14. A rotor as claimed in any one of claims 10 to 13, wherein a line drawn to the radially outer edge of a blade from its centre of curvature subtends an angle of 30° with a radial line drawn from the centre of rotation of the rotor.

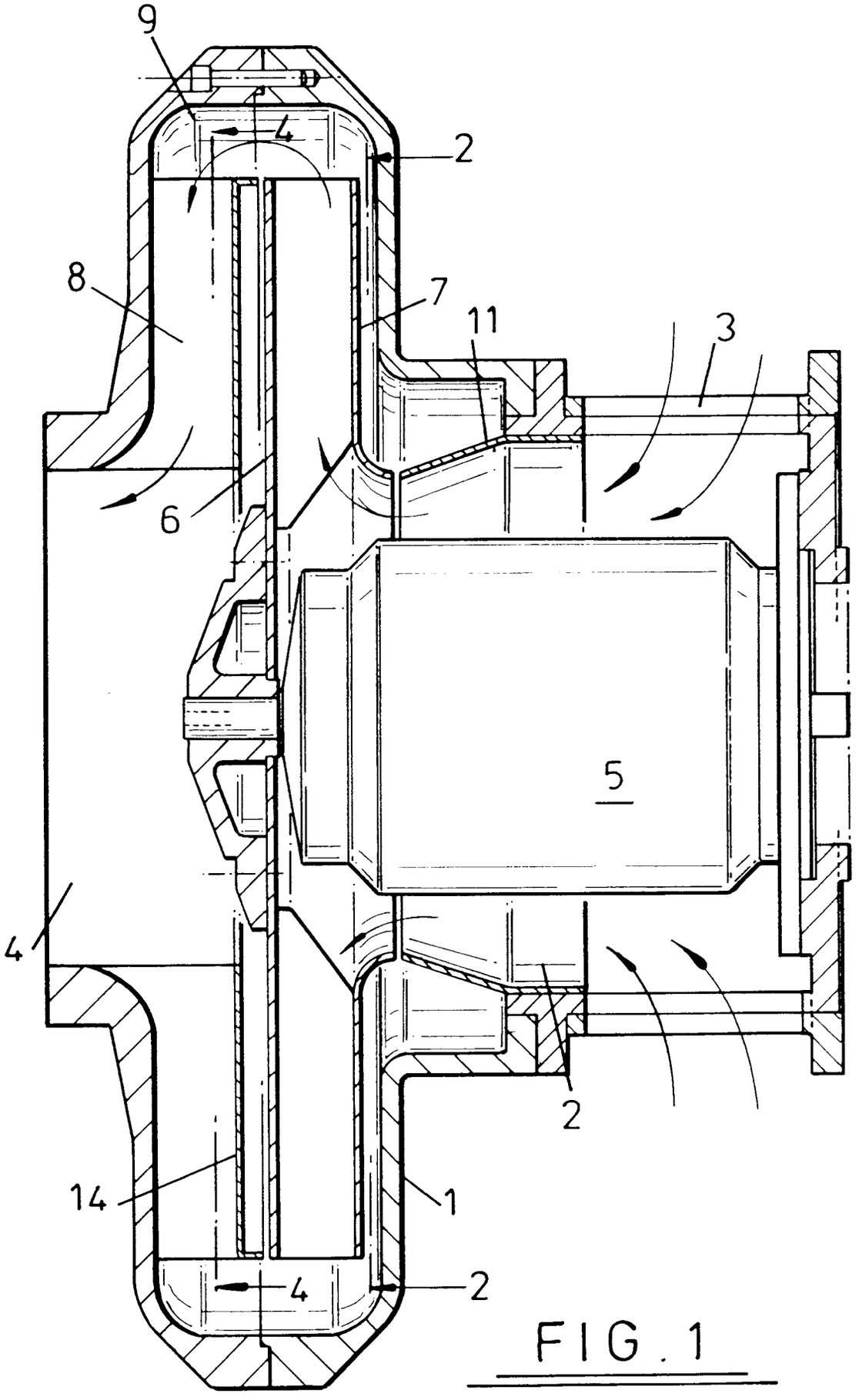

FIG. 1

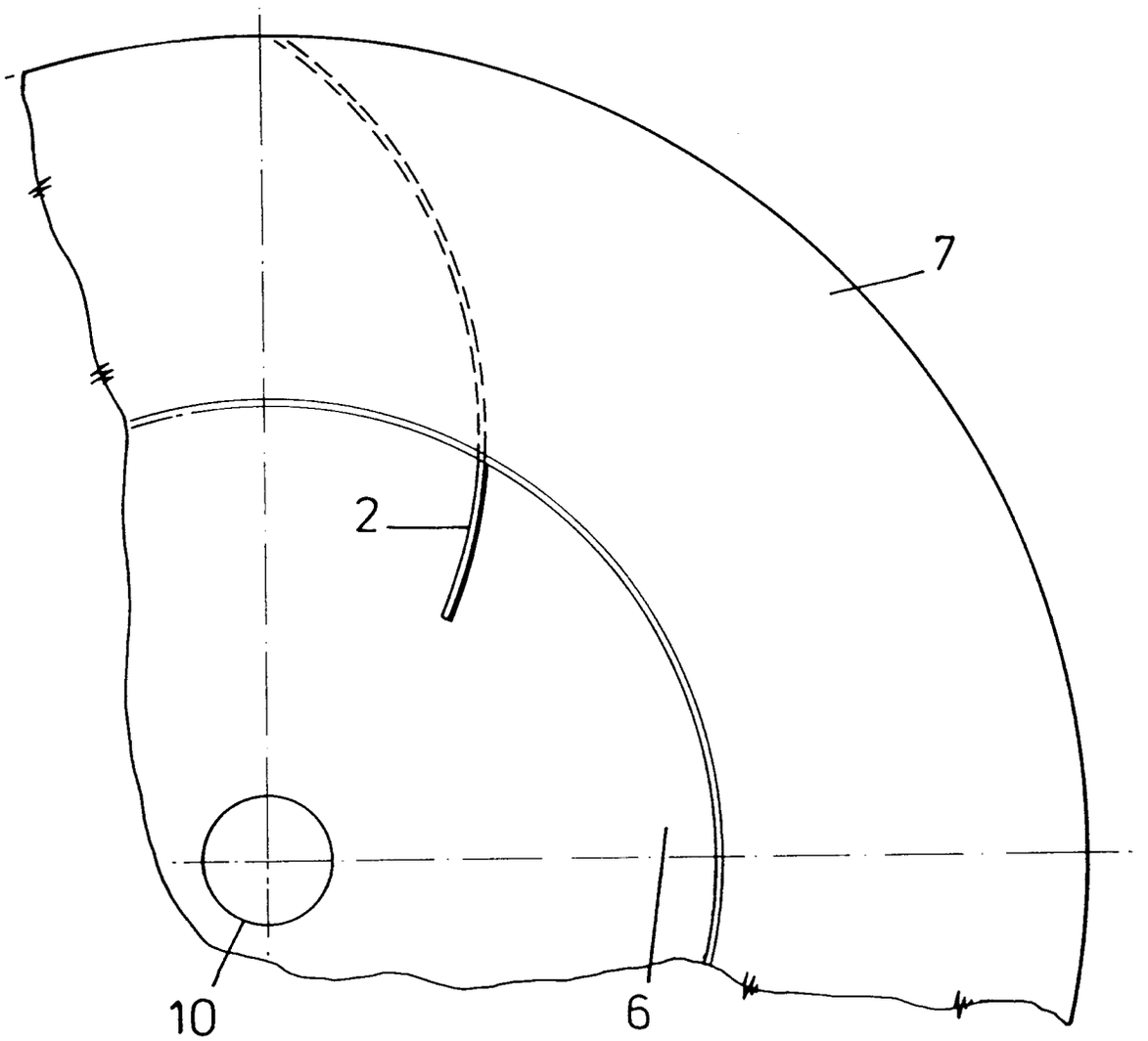

FIG. 2

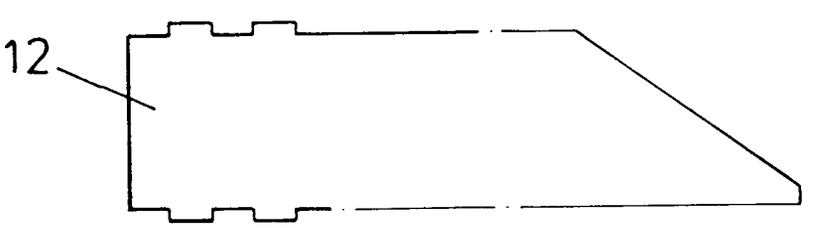

FIG. 3

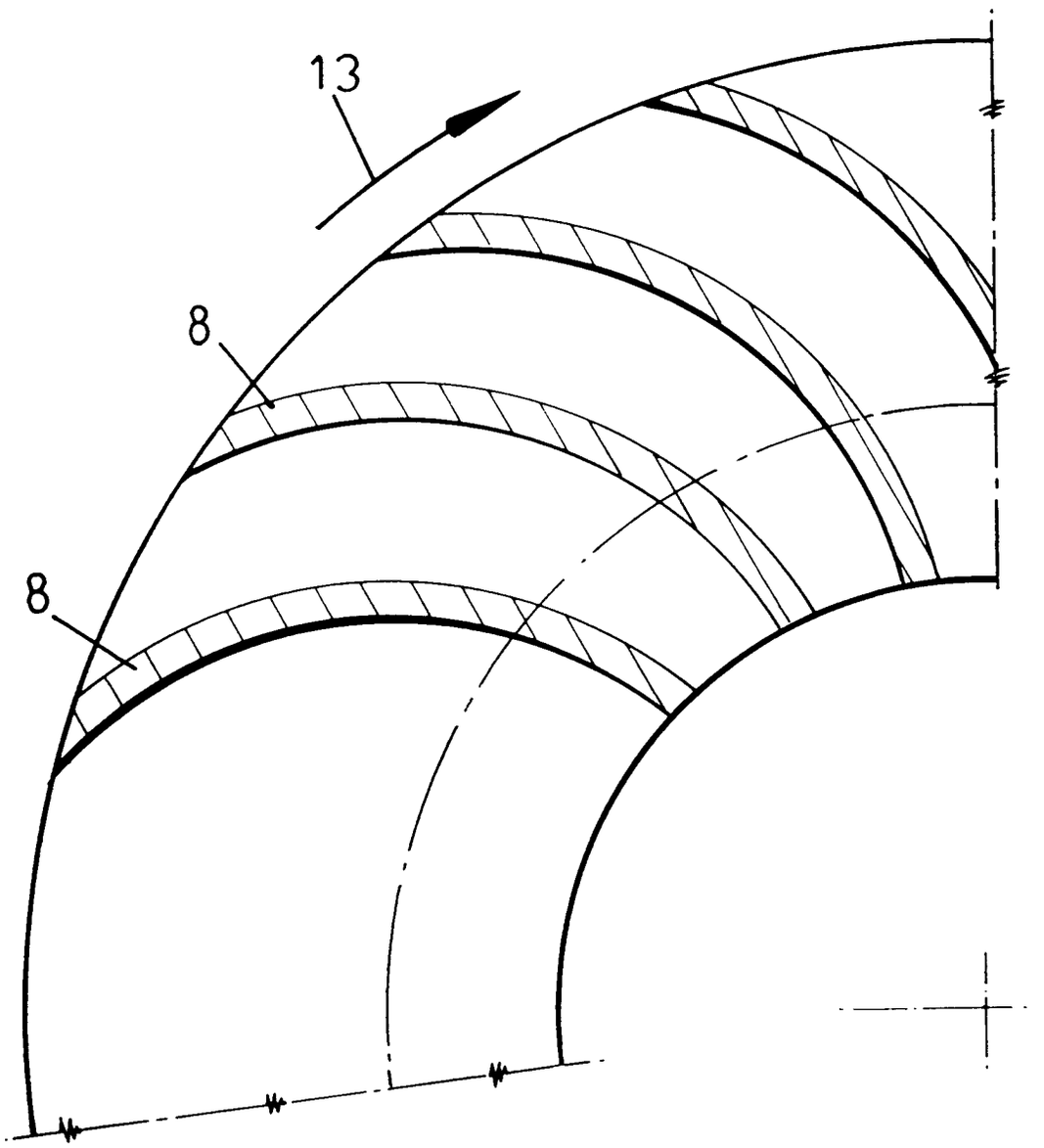

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number

EP 91 30 8260

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-A-1 403 032 (ELECTROLUX) * page 4, line 16 - page 6, line 13; figures 1-3 * ---	1-8	F04D17/16 F04D29/30
X	GB-A-2 209 474 (CHAPMAN & SMITH) * page 3, line 14 - line 26; figures 2,4 * ---	1,9,10	
X	DE-A-2 502 988 (KÜHNLE, KOPP & KAUSCH) * page 2, line 22 - page 3, line 16; figures 1,2 * ---	10	
Y		14	
Y	CH-A-164 929 (MITSUBISHI) * figure 4B * ---	14	
X	US-A-4 269 571 (SHIKUTANI) * column 2, line 53 - line 67; figures 2-4 * ---	1,10 2-9	
A	DE-A-2 024 023 (AIR CONTROL INSTALLATIONS) * page 3, line 3 - page 4, line 30 * * page 5, line 28 - page 6, line 19; figures 1-3 * -----	1-9,12,13	TECHNICAL FIELDS SEARCHED (Int. Cl.5) F04D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 MARCH 1992	TEERLING J.H.

CATEGORY OF CITED DOCUMENTS

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