

[54] **FLUID MACHINES**

[72] Inventors: **Michael Leslie Ryall; Guido Pezzani; Albert Bocking**, all of Glasgow, Scotland

[73] Assignee: **Weir Pumps Limited**, Glasgow, Scotland

[22] Filed: **March 9, 1971**

[21] Appl. No.: **122,353**

[30] **Foreign Application Priority Data**

March 31, 1970 Great Britain.....15,292/70

[52] U.S. Cl.....**415/207, 415/219 B, 415/143, 415/122**

[51] Int. Cl.....**F04b 29/44, F04b 29/40, F04b 1/10**

[58] Field of Search ...**415/204, 206, 213, 219 B, 207**

[56] **References Cited**

UNITED STATES PATENTS

1,914,919	6/1933	Heermans.....	415/206
2,144,417	1/1939	Schneible.....	415/219 B
2,268,358	12/1941	Turner.....	415/204
2,715,016	8/1955	Veneziani et al.....	415/219 B
3,071,077	1/1963	Hornschuch et al.....	415/206

3,162,135	12/1964	Nichols et al.....	415/206
3,244,109	4/1966	Barske.....	415/207
3,260,216	7/1966	Mann et al.....	415/207
3,333,762	8/1967	Vrana.....	415/207

FOREIGN PATENTS OR APPLICATIONS

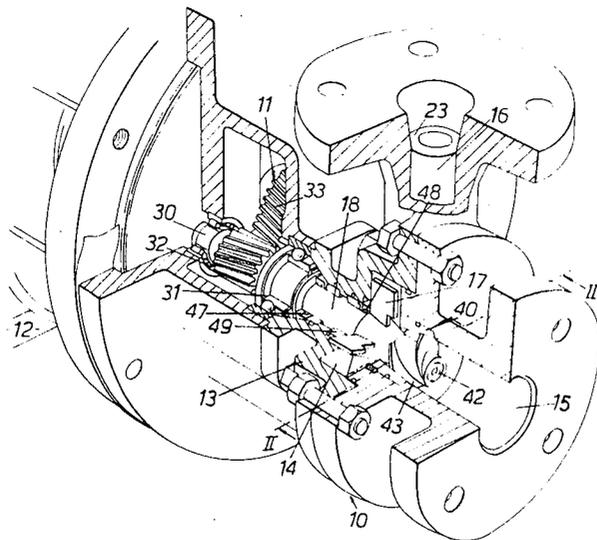
640,239	4/1962	Canada.....	415/219 B
268,677	4/1927	Great Britain.....	415/219 B

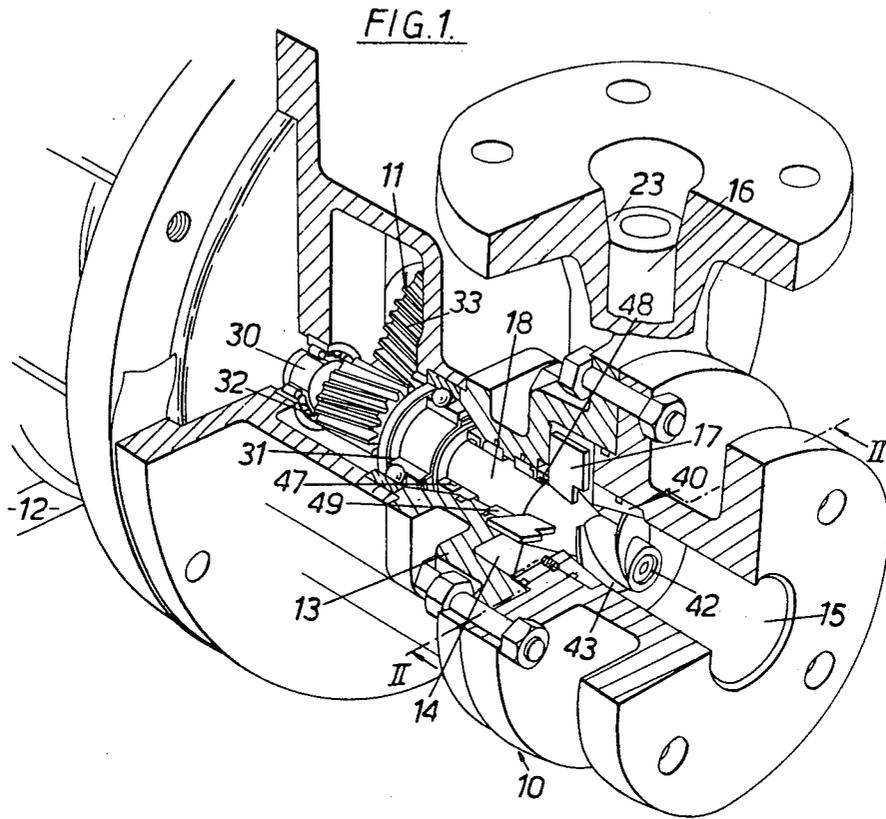
Primary Examiner—Henry F. Raduazo
Attorney—Mason, Fenwick & Lawrence

[57] **ABSTRACT**

A pump including a substantially cylindrical casing in which a radial-bladed impeller is rotatably mounted, has an axial inlet and its outlet is arranged tangentially of the casing periphery. A diffuser is arranged in the outlet passage, the diffuser comprising a cylindrical recess in communication with the pump casing, a diffusing section downstream of said recess which is divergent in the direction of fluid flow and an intermediate section which is convergent in the direction of fluid flow, the intermediate section having a convex periphery.

3 Claims, 3 Drawing Figures

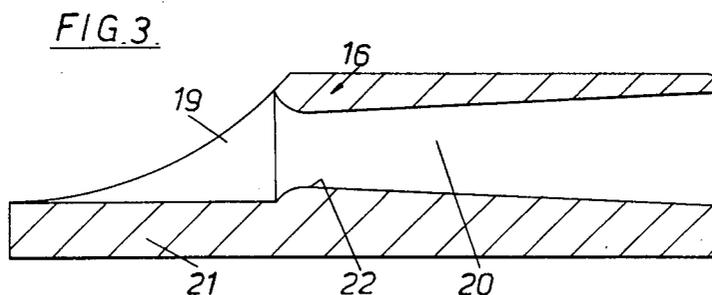
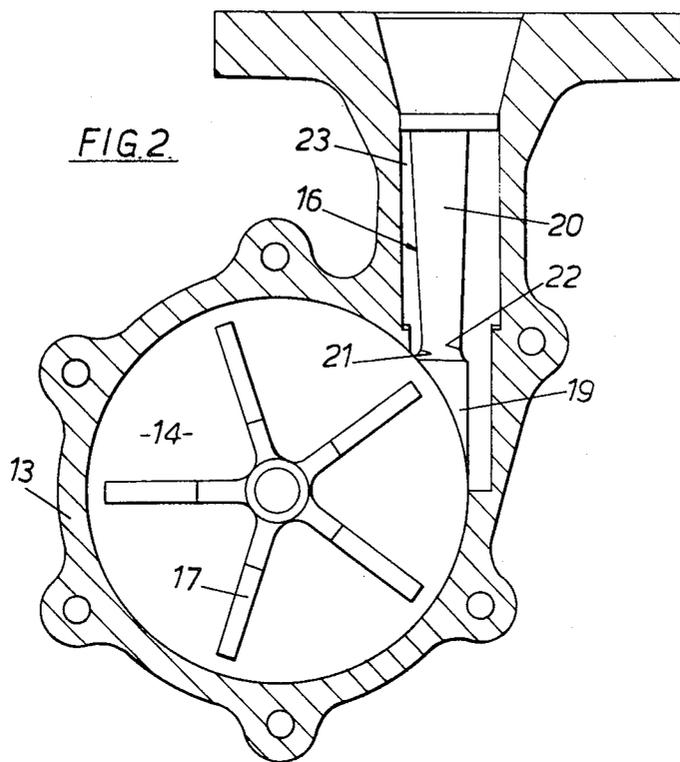




Inventors
**MICHAEL LESLIE RYALL,
GUIDO PEZZANI & ALBERT BOCKING**

By
Mason, Fenwick & Lawrence

Attorneys



Inventors
**MICHAEL LESLIE RYALL,
GUIDO PEZZANI & ALBERT BOCKING**
By
Mason, Fenwick & Lawrence
Attorneys

FLUID MACHINES

This invention relates generally to fluid machines and more particularly to a pump and a diffuser for the pump, the axis of the diffuser being arranged tangentially relative to the circle defined by the tips of the pump impeller blades on rotation thereof.

The present invention relates to a pump including a casing defining a cylindrical chamber, an inlet passage co-axial with the axis of the chamber, a radial-bladed impeller rotatable about the axis of the chamber, and an outlet passage extending tangentially from the periphery of the chamber, such pump being referred to hereinafter as a "pump of the type aforesaid."

According to the present invention there is provided a pump of the type aforesaid having, for an outlet passage, a diffuser comprising a substantially cylindrical passage in communication with the pump casing, a diffusing section downstream of said cylindrical passage, said section being divergent in the direction of fluid flow, and an intermediate section convergent in the direction of fluid flow and having a convex periphery, the intersection of said intermediate section and said diffusing section defining a throat.

Further according to the present invention there is provided for a pump a diffuser having a substantially cylindrical passage, a diffusing section divergent in the direction of fluid flow and downstream of said passage, and an intermediate section convergent in the direction of fluid flow and having a convex periphery, the intersection of said intermediate section and said diffusing section defining a throat.

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 perspective view of a pump;

FIG. 2 is a sectional end elevation on the plane containing line II, II of FIG. 1; and

FIG. 3 shows a diffuser.

With reference to the drawings and initially to FIG. 1 there is shown generally a pump 10 mounted on a step-up gear box 11 which is supported on an end of an electric motor 12 by means of which the pump is driven.

The pump 10 includes a casing 13 defining a cylindrical chamber 14 into which leads an inlet passage 15 for fluid to be pumped, this passage being co-axial with the axis of the chamber 10. A fluid outlet passage in the form of a diffuser 16 extends tangentially from the periphery of the chamber 14 within which is housed a radial-bladed impeller 17 carried on a shaft 18 which is co-axial with the axis of the chamber.

With particular reference to FIGS. 2 and 3, the diffuser 16 includes a cylindrical recess 19 in the wall of the chamber 14, a diffusing section 20 downstream of the recess 19, the section 20 being frusto-conical in shape and divergent in the direction of fluid flow, and an intermediate section 21 which is convergent in the direction of fluid flow and has a convex periphery. The recess 19 and the sections 20 and 21 are coaxial and the intersection of the intermediate section 21 and the diffusing section 20 defines a throat 22. As may be seen from FIG. 2, the intermediate section 21 is of short length compared to the section 20 and section 21 serves to provide a smooth passage into the section 20. The diffuser is formed in a sleeve 23 which may be detached from the pump 10.

The shaft 18 is the output shaft of the gear box 11 which is of the overhung close-coupled type, the shaft 18 being supported in bearings 30 and 31 located on either side of a pinion gear 32, this gear meshing with a gear 33 on the output shaft of the motor.

The inlet passage 15 includes a sleeve 40 having a frustoconical bore which converges towards the chamber 14. An extension 42 of the shaft 18 projects into the passage 15 and carries an induction impeller 43 consisting of a blade extending helically around the extension 42. The tip diameter of the blade reduces towards the chamber 14 so that it corresponds to the diameter of the bore of sleeve 40.

Oil sealing of the gear box 11 is effected by a lip seal (not shown) on the motor shaft and a mechanical seal 47 on the shaft 18. A similar seal 48 acts as a water seal between the pump and the gear box. Contact rings 49 are also provided on the shaft 18.

In operation fluid to be pumped is drawn through the inlet passage 15 by the induction impeller 43 which rotates with the impeller 17, the fluid then passing into the chamber 14. Once in the chamber 14 the fluid is rotated until it reaches the periphery of the chamber 25 where it enters the recess 19 of the diffuser 16 and then passes through the intermediate section 21 into the diffusing section 20 where most of the kinetic energy imparted to it is converted to pressure energy. The diffuser 16 is so shaped that a falling head/flow characteristic is obtained as the pump out-put increases from zero to a predetermined level.

The head delivered by the pump may be varied by changing the diameter of the impeller and a running clearance of one-sixteenth inch or more between the impeller blades and the casing has been found to give acceptable performance.

The pump is intended to operate at impeller speeds of up to 18,000 r.p.m. and the induction means is provided to inhibit cavitation at such speeds with low-pressure incoming fluid.

The dimensions of the pump described in the embodiment are as follows:

Radius of cylindrical chamber	2.625 in.
Diameter of cylindrical recess	0.75 in.
Diameter of throat	0.5 in.
Radius of convex curvature of periphery of intermediate section	2.875 in.
Length of diffusing section	2.875 in.
Taper of diffusing section	1 in 10

Because of the falling head/flow characteristic achieved by diffusers according to the invention pumps may be readily connected in parallel or be used in conjunction with a regulating valve such as is fitted to boilers.

Pumps as described above are intended for use in boiler feed applications and mobile and fixed cleaning installations such as an automatic car wash and other general pumping duties.

We claim:

1. A pump including a casing defining a cylindrical chamber, an inlet passage co-axial with the axis of the chamber, a radial-bladed impeller rotatable about the axis of the chamber, and an outlet passage extending tangentially from the periphery of the chamber, said outlet passage including a diffuser comprising a substantially cylindrical passage in communication with

3

the pump casing, a diffusing section downstream of said cylindrical passage, said section being divergent in the direction of fluid flow and an intermediate section convergent in the direction of fluid flow and having a convex periphery, the intersection of said intermediate section and said diffusing section defining a throat, and in which the ratio of the diameter of the cylindrical passage to the greatest length of this passage between the chamber and the throat is approximately 2.7 and

4

the ratio of the diameter of the passage to the diameter of the throat is approximately 1.5, whereby a stable pump characteristic is obtained.

2. A pump as claimed in claim 1, in which the taper of the diffusing section is approximately 1 in 10.

3. A pump as claimed in claim 1, in which the radius of the throat is approximately equal to the radius of curvature of the convex intermediate section.

* * * * *

10

15

20

25

30

35

40

45

50

55

60

65