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Erickson et al.

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[54] **PITOT PUMP WITH SLOTTED INLET PASSAGES IN ROTOR CASE**

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[52] **U.S. Cl.** **415/89**

[51] **Int. Cl.** **F04d 1/14**

[58] **Field of Search** 415/88, 89

[56] **References Cited**

UNITED STATES PATENTS

3,384,024	5/1968	King	415/89
3,004,495	10/1961	Macklis	415/89

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Assistant Examiner—Louis J. Casaregola
Attorney, Agent, or Firm—Harris, Kern, Wallen & Tinsley

[57] **ABSTRACT**

A pitot pump, i.e., a centrifugal pump, comprising a rotary casing, means for delivering a fluid to be pumped to a pumping chamber in the rotary casing, and a discharge duct coaxial with the rotary casing. The pitot tube is disposed in and extends radially of the rotary casing and is provided adjacent its outer end with an inlet facing in a direction opposite to the direction of rotation of the rotary casing, whereby the inlet receives fluid from adjacent the periphery of the rotary casing with a ram effect. The rotary casing is provided with open slots, generally radial, for conveying the fluid to be pumped from the central portion of the pumping chamber to the periphery thereof.

4 Claims, 2 Drawing Figures

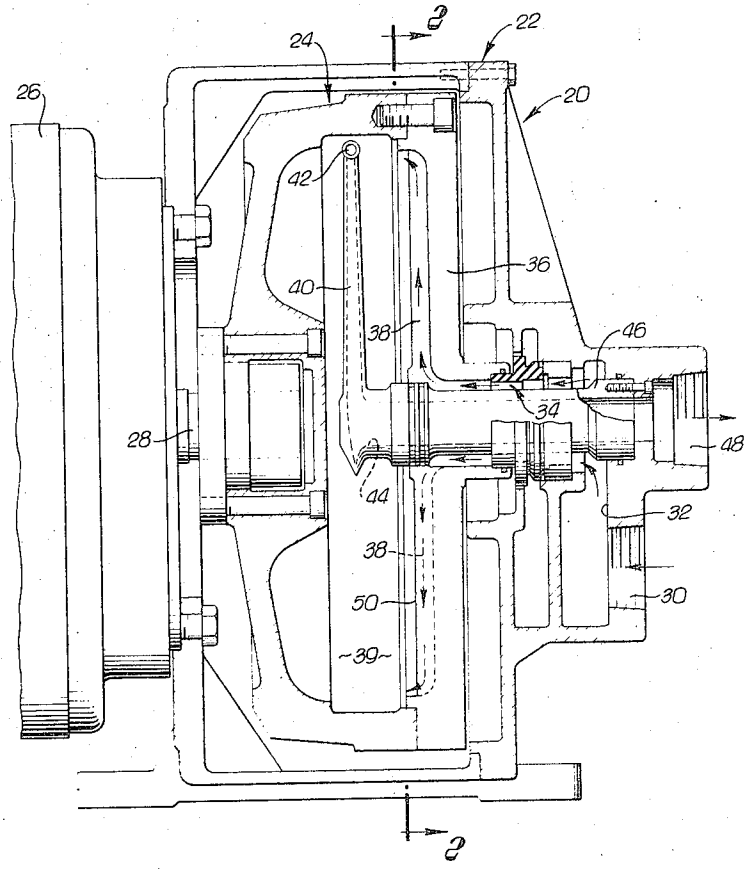


FIG. 1.

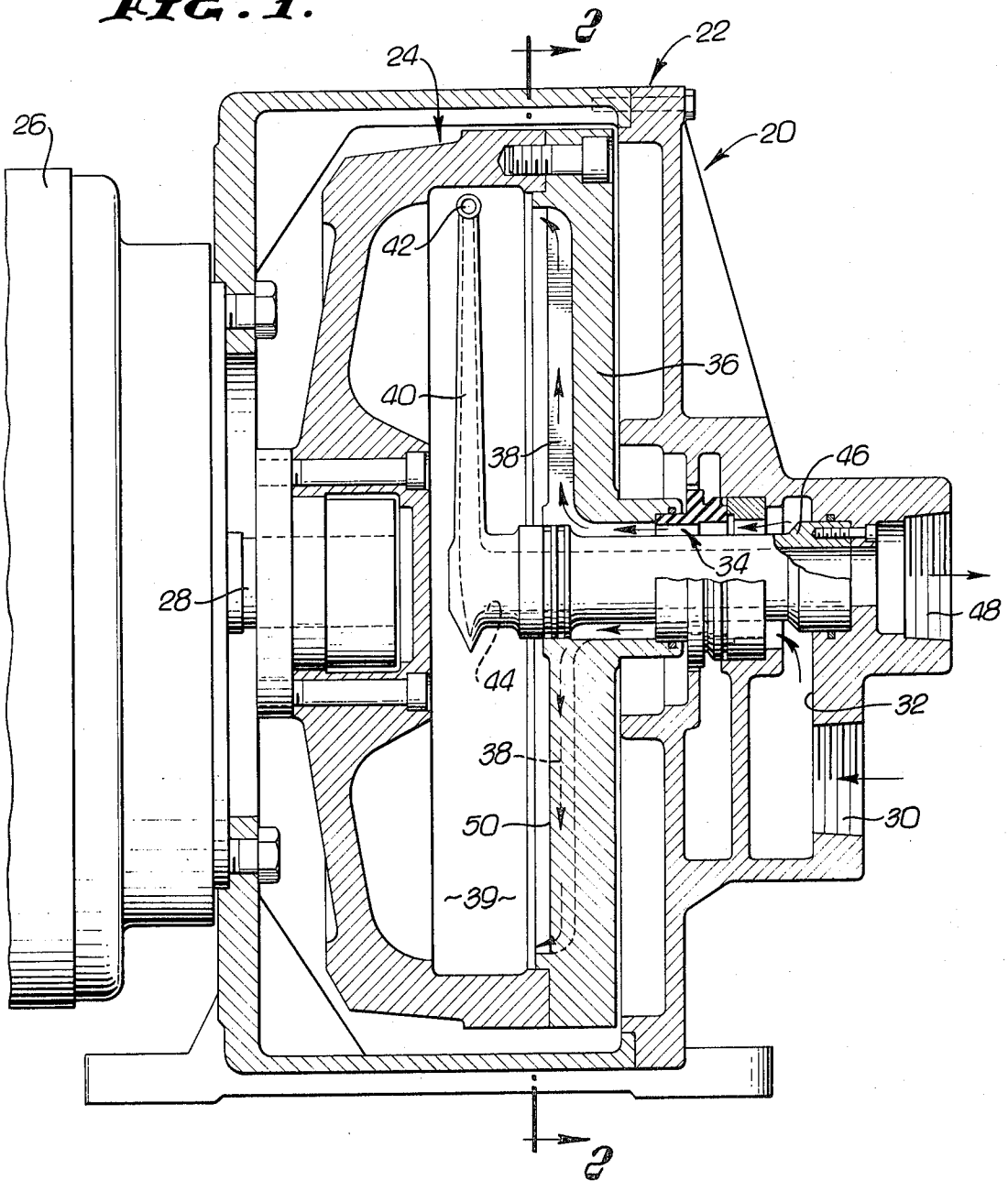
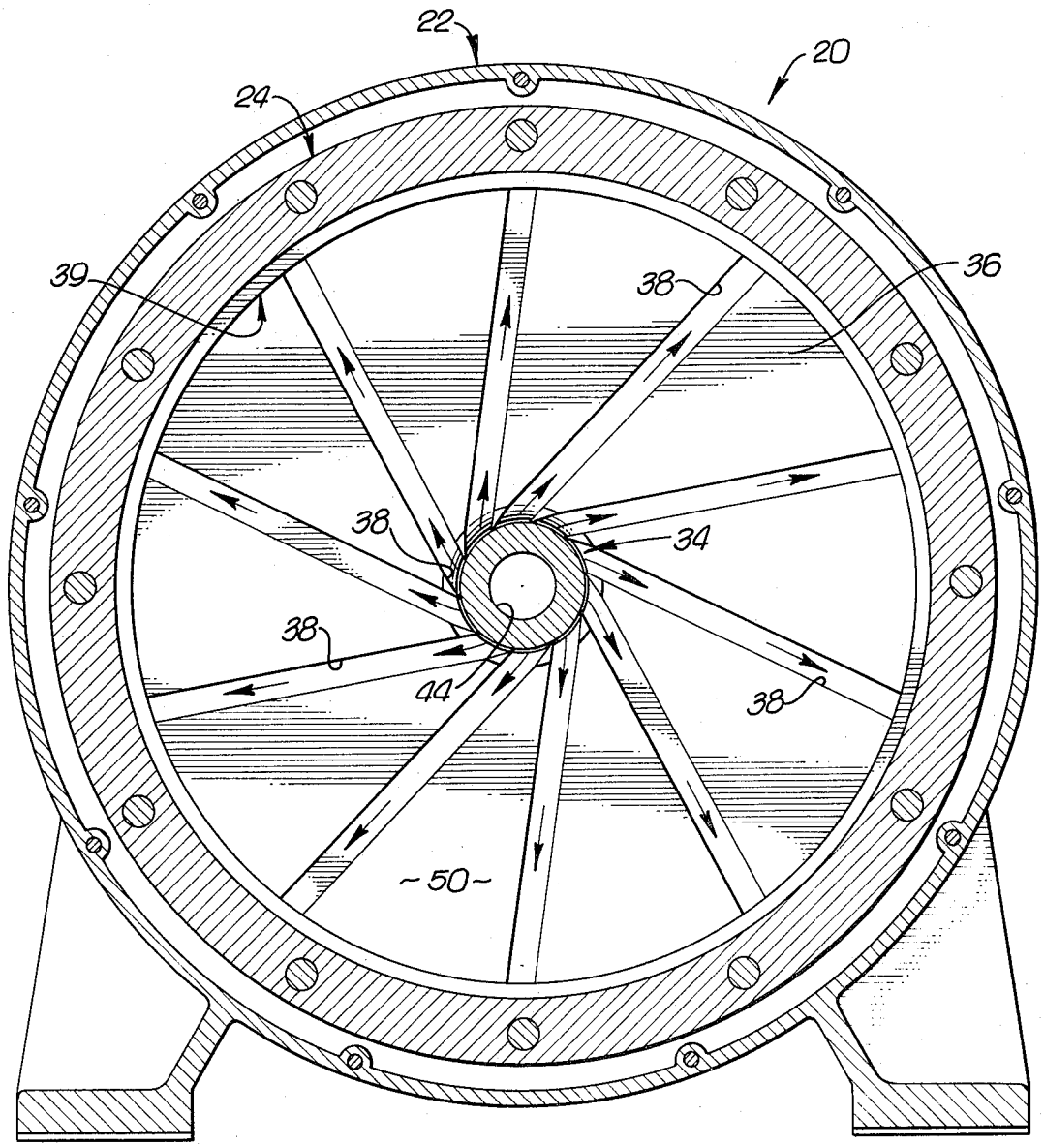


FIG. 2.



PITOT PUMP WITH SLOTTED INLET PASSAGES IN ROTOR CASE

BACKGROUND OF INVENTION

The present invention relates in general to centrifugal pumps and, more particularly, to a centrifugal pump of the pitot type, such a pump comprising, as its general elements, a rotary casing including a pumping chamber, means for delivering a fluid to be pumped to the pumping chamber, a discharge duct coaxial with the rotary casing, and a stationary pitot tube in the rotary casing for picking up fluid adjacent the periphery of the casing with a ram effect and for delivering the fluid to the discharge duct. More particularly, the pitot tube extends radially of the rotary casing and is provided adjacent its outer end with an inlet adjacent the periphery of the rotary casing and facing in a direction opposite to the direction of rotation of the rotary casing. The pitot tube is provided adjacent its inner end with an outlet communicating with the discharge duct.

Centrifugal pumps of the foregoing type are well known and have the advantage of providing a very simple structure for pumping fluids at high pressures and in relatively large volumes. A pitot pump typical of the prior art is disclosed in U.S. Pat. No. 3,384,024, granted May 21, 1968 to William L. King.

The above King patent discloses a pitot pump in which fluid to be pumped is supplied to the periphery of the pumping chamber through radial passages enclosed within an end wall of the rotary casing. Another common way to supply such fluid to the periphery of the pumping chamber of such a pump is merely between thin radial vanes attached to the inner surface of one or both side walls of the pumping chamber as shown, for example in the U.S. Pat. to Singelmann, No. 3,049,081, issued Aug. 14, 1962, and the Great Britain Pat. No. 737,933, published Oct. 5, 1955, hereinafter referred to as "vane type" pumps.

A primary difficulty with such vane type pumps is the accumulation of air in the rotary pumping chamber, as explained in the U.S. Pat. to Macklis, No. 3,004,495, issued Oct. 17, 1961, which provides positive means for continuously purging the pump chamber of such accumulated air.

Such vane type pitot pumps are relatively inefficient, due to fluid turbulence created in the pumping chamber by their vanes. Pumps of the type disclosed in said King patent are relatively expensive to build.

THE INVENTION — GENERALLY

The primary object of this invention is to provide a pitot type pump of the general type disclosed in said King patent, but in which the generally radial passages supplying fluid to be pumped to the periphery of the pumping chamber are slots left open on the side of each facing the pumping chamber and in direct communication with the chamber throughout the length of each, thereby substantially reducing the cost of manufacture of such a pump, as compared with the pump of the King patent.

Another object of the invention is to provide such substantially radial slots of substantially uniform cross section throughout the length of each, each slot being formed in an end wall of the rotary casing of the pump, to avoid the inefficiency of said prior art vane type pumps resulting from the fluid turbulence created by the use of radial vanes with diverging wall spaces therebetween.

A further object of such radial slots is to continuously purge the pump of any gas accumulating in the liquid being pumped.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results which will be evident to those skilled in the pitot pump art in the light of this disclosure, may be achieved with the exemplary embodiment of the invention illustrated in the accompanying drawings and described in detail hereinafter.

DESCRIPTION OF DRAWINGS

FIG. 1 is a longitudinal sectional view of a pitot pump which embodies the invention; and

FIG. 2 is a vertical sectional view taken on the line 2—2 of FIG. 1.

DETAILED DESCRIPTION OF INVENTION

Referring to FIG. 1 of the drawings, illustrated therein is a pitot pump 20 comprising an outer housing 22 containing a rotary casing 24. In the particular construction illustrated, the rotary casing 24 is driven by an electric motor 26 mounted on the housing 22, the rotary casing being supported by the motor shaft 28. However, it will be understood that the rotary casing 24 may be mounted on bearings within the housing 22 itself.

The housing 22 is provided with an inlet 30 for the fluid to be pumped, which inlet communicates with a chamber 32 leading to an annular passage 34 extending into one end wall 36 of the rotary casing 24. Within such end wall are generally radial slots 38 which communicate at their inner ends with the annular passage 34 and which communicate at their outer ends with the periphery of a pumping chamber 39 of the casing 24.

Within the pumping chamber 39 is a stationary pitot or pickup tube 40, which is radially oriented and is provided adjacent its outer end with an inlet 42 facing in a direction opposite to the direction of rotation of the rotary casing 24. The pitot tube 40 is provided adjacent its inner end with an outlet 44 coaxial with the rotary casing 24 and communicating with a discharge duct 46, also coaxial with the rotary casing 24, leading to an outlet 48 in the housing 22. The annular passage 34 surrounds the discharge duct 46 throughout a portion of the length of the latter.

The general mode of operation of the pitot pump 20 is well known so that it does not need to be described in detail. Briefly, the centrifugal force produced by rotation of the casing 24 generates a high fluid pressure adjacent the outer periphery of the pumping chamber 39. The fluid at this high pressure enters the inlet 42 of the pitot tube 40, the pressure being further increased by the ram effect resulting from so orienting the inlet 42 that it faces in a direction opposite to the direction of rotation of the rotary casing 24. The fluid entering the pitot tube 40 flows through the outlet 44 and the discharge duct 46 to the main outlet 48 in the housing 22. It will be understood that the pitot tube 40 is stationary, being mounted on and suitably secured to the discharge duct 46.

As illustrated in FIGS. 1 and 2, the generally radial slots 38 are substantially uniform in cross-sectional area throughout their length, and, except for such slots, the inner surface 50 of the end wall 36 is substantially flat and perpendicular to the axis of the pump, which is another feature of the invention. It is also to be noted from FIG. 2 that the slots are not exactly radial with respect to the longitudinal axis of the pump, but each is angled slightly with respect to a radius to intersect the annular passage 34 at a slight angle to improve the feed of fluid to the slots from the annular passage and therethrough, and this is another feature of the invention. It is also to be noted from FIG. 2 that the inner ends of the slots 38 almost join, so that the combined cross-sectional areas of the slots approximately equal the area of the periphery of the annular passage 34 opposite the slots, and this is a further feature of the invention. Such slots 38 may be formed by merely casting them into the inner surface 50 of the end wall 36 of the rotary casing, which contributes to the economy of manufacture of the invention, another important feature.

Contrary to our expectations, we have found that by leaving the slots 38 open on their sides communicating with the pumping chamber 39, there is no substantial loss of fluid from the slots into the chamber during the passage of fluid through the slots from their inner to their outer ends, and that most of the fluid flowing in the slots stays therein during its passage through the slots, with the result that little if any additional fluid turbulence is created in the pumping chamber by leaving the slots open sided, with the final result that the efficiency of our pump is almost as high as that of a pump having the slots enclosed, as shown in said King patent.

Furthermore, we have found by tests that with the use of such open radial slots 38, the pump is continuously self-purging of most gas accumulating in the flow of liquid being pumped, which otherwise would substantially reduce pump efficiency, requiring no separate means for such purging.

Although an exemplary embodiment of the invention has been disclosed for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the spirit of the invention as defined by the following claims.

We claim:

1. In a pitot pump, the combination of:

a rotary casing having an annular pumping chamber therein, one side wall of said chamber being provided with generally radial slots therein having one side throughout its length in open communication with said chamber, each of said slots being of substantially uniform cross section throughout its length and extending from a point adjacent to the rotational axis of said casing to a point adjacent to the inner periphery of said chamber;

housing means surrounding said rotary casing and having an inlet port and a discharge port;

a tubular member rigidly mounted on said housing and extending into said chamber, there being an annular passage around said tubular member and communicating between said inlet port and the inner ends of said slots, said tubular member having an axial passage therein communicating at one end with said discharge port;

a pitot tube rigidly mounted on said tubular member and extending radially in said chamber, said pitot tube having adjacent its outer end a pitot inlet facing in a direction opposite to the direction of rotation of said casing, said pitot tube having a central passage therein communicating between said pitot inlet and the other end of said axial passage; and

drive means extending into said housing and rigidly connected to said casing for rotating said casing.

2. A device as defined in claim 1 in which said side wall of the pumping chamber is substantially flat, except for said slots therein, and substantially perpendicular to the rotational axis of said casing.

3. A device as defined in claim 1 in which each of said slots is oriented at an angle to a radius through the rotational axis of the casing and the inner end of the slot in a direction opposite to the direction of rotation of said casing, to provide the inner end of each slot with a scoop effect on fluid in said annular passage.

4. A device as defined in claim 1 in which the combined cross-sectional area of the inner ends of said slots is substantially equal to the total annular area of said annular passage intersected by said slots.

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