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[54] **CENTRIFUGAL PUMPS**

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[52] **U.S. Cl.** **416/144,** 416/186, 415/213, 415/206

[51] **Int. Cl.** **F01d 5/00**

[58] **Field of Search** 415/106, 104, 204, 415/206, 213; 416/144, 500

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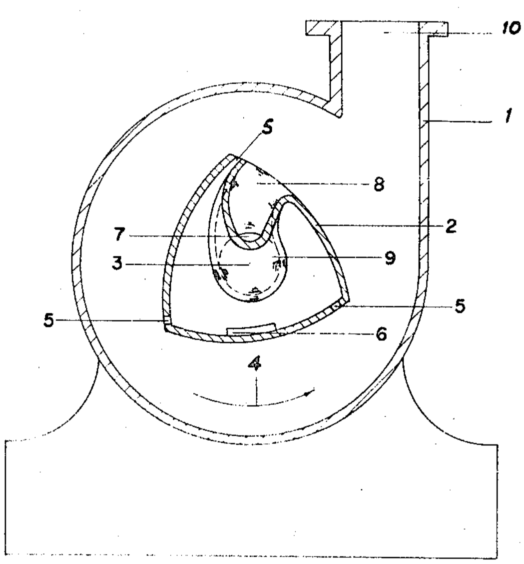
[57] **ABSTRACT**

The invention relates to an impeller for a centrifugal pump permitting the passage of solids through the pump and which maintains a high delivery pressure and capacity in which the impeller has a body having, in cross section, a regular polygonal configuration, an axis of rotation located substantially equidistant the corners of the body, an inlet to the body located at the axis of rotation, an outlet from the body provided in a sidewall of the body and a conduit communicating between the inlet and the outlet.

6 Claims, 2 Drawing Figures



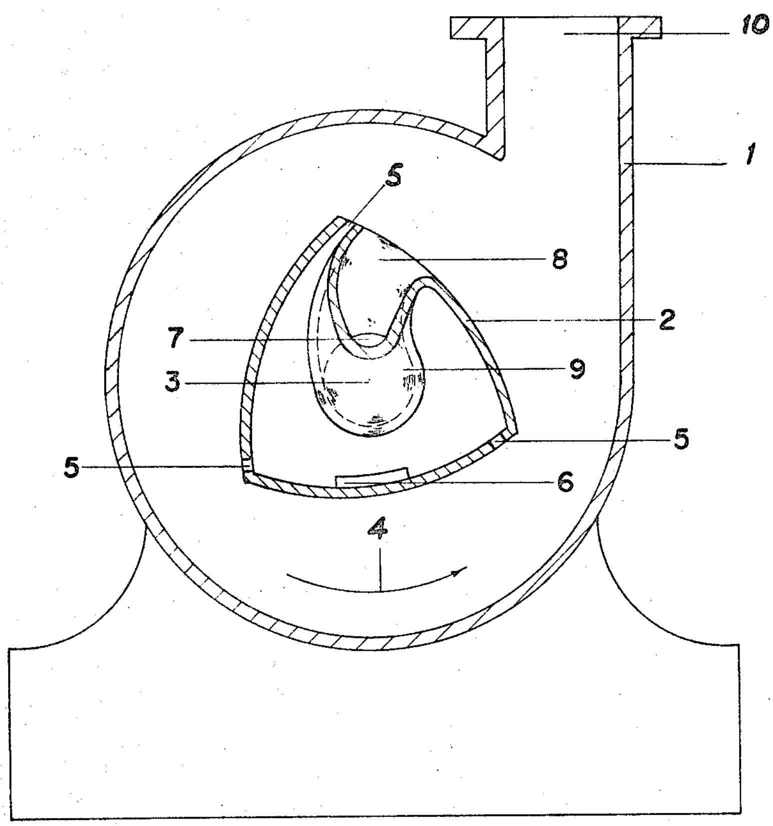


fig. 1

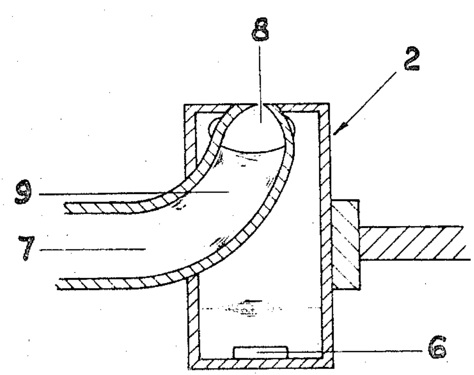


fig. 2

CENTRIFUGAL PUMPS

This invention relates to centrifugal pumps and more particularly single channel pumps.

Conventional centrifugal pumps provided with an axially disposed passage feeding into a plurality of passages formed between radially extending vanes are not suitable for pumping liquids in which is suspended grit or stones. Generally solid matter entrained in the pumped liquid tends to clog at the inlet end to the passages formed between adjacent vanes due to the fact that at this point the passage between the vanes is narrower than the axially disposed passage.

Vaned centrifugal pumps are also not suitable for pumping liquids containing long fibrous or stringy material. Such liquids may for instance be encountered at sewage disposal works. The outer edge of the trailing vane tends to "bite" in along the length of the thread as a result of which the thread wraps itself around the rotor causing a blockade. Furthermore, a length of rope or rag passing down the axial passage may be forced into two or more passages between the vanes.

A further disadvantage of vane type centrifugal pumps is that the passage between adjacent vanes tends to increase in cross-sectional area as the distance from the axis of rotation increases. This decreases the delivery pressure and capacity of the pump.

Various arrangements have been suggested for overcoming this difficulty. One arrangement provides a stationary impeller with the pump casing rotating about it. This arrangement suffers from the disadvantage that the pump is capable only of low pumping capacity and delivery pressure.

In another arrangement aimed at overcoming these disadvantages, an impeller is provided, comprising a single spiral vane which starts substantially at the point of rotation and completes a single spiral. This arrangement also suffers from a number of disadvantages. Inherent in the structure is an ever-increasing passage width which precludes high delivery pressure and capacity. Furthermore, solid material entrained in the liquid pumped has to travel a greater distance, when compared with conventional vaned pumps, before it passes out from the area swept by the spiral vane. As a result, solids passing into the downstream side of the vane fail to pass from the area swept by the vane and tend to impinge against the leading face of the vane during the subsequent revolutions. Not only does this cause wear of the vane, but it introduces additional loads into the system that may damage the vane and the pump bearings.

An object of the present invention is the provision of an impeller in which these disadvantages are at least reduced in their effect.

According to the invention, there is provided an impeller having a body of regular polygonal configuration, an axis of rotation located equidistant the corners of the body, an inlet to the body located at the axis of rotation, an outlet from the body provided in a sidewall of the body and a conduit communicating between the inlet and the outlet.

Further features of the invention provide for the body to be three-sided, for the sidewalls to be bowed outwardly, for the body to be hollow, for the sidewalls to be perforated, in corresponding positions towards the corners of the body, for the outlet to be located in a

sidewall between a perforation and the body corner remote from the perforation.

The invention is also directed towards a pump including an impeller as set out in the above consistory clauses.

A preferred form of the invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a section through the impeller transverse its axis of rotation, the impeller being shown in position in a pump;

FIG. 2 is a section through the impeller along its axis of rotation, the impeller being shown in position in a pump.

The pump comprises a casing **1** of conventional design. Located inside the pump is an impeller **2** which rotates about axis **3**. The impeller is of hollow construction and may be cast conventionally or pressed out of a suitably rigid metal plate. When viewed in an axial direction, as shown in the accompanying FIG. **1**, the impeller has the shape of an isoscles triangle with the sides thereof bowed outwards.

During operation of the pump, the impeller is caused to rotate in the direction indicated by arrow **4**.

The sidewalls of the impeller are perforated at corresponding positions **5** which are towards the corners of the impeller. During operation of the pump, these positions are downstream of the nearest impeller corner and in a zone of reduced pressure relative to other positions along the sidewalls of the impeller.

The perforated sidewalls of the impeller allow for the interior of the impeller to be flooded with the liquid being pumped which in turn assists in balancing the impeller. Additional balancing of the impeller is achieved by weight **6** which is attached to an interior wall of the impeller. By locating the balancing weight on the interior wall of the impeller, the weight is not subject to wear in the same way that it would have been had it been attached to an exterior wall of the impeller. Furthermore, the weight does not lead to clogging between the impeller and the pump casing as is often the case with impellers balanced on an exterior wall. An axial inlet to the impeller is provided at **7** which communicates through conduit **9** with an outlet from the impeller located at **8**. The impeller outlet is provided in a sidewall between a perforation and the corner remote from the perforation. From FIG. **1** it will be noted that the outlet is therefore located downstream from the perforation on the same sidewall.

The conduit **9** is of uniform cross-sectional area throughout its length. Under certain circumstances it may be found to be advantageous to decrease the cross-sectional area of the conduit slightly as the distance from the axis of rotation increases.

In operation the impeller is rotated in the direction indicated by the arrow **4** and centrifugal forces cause liquid to be drawn from the inlet **7** into the conduit **9** and discharged via outlet **8** into the casing **1**. An increase in the pressure of liquid in the casing **1** causes liquid to be forced into the outlet **10**. The corners of the impeller assist in forcing liquid out through outlet **10**.

A zone of relatively reduced pressure develops behind the corners and this facilitates flow through outlet **8** from passage **9**.

It is believed that there is minimum contact between solid materials pumped and the sides of the impeller, particularly rebound of solid material off the casing onto the impeller is reduced. This results in the impeller being subject to less wear than would be expected. It has also been found that when compared with conventional centrifugal pumps, a higher feed pressure is attained together with an increase in pumping capacity. The pump appears to have a decreasing tendency towards clogging when pumping liquids containing solid material and fibrous matter than is the case with a conventional centrifugal pump. Lastly, the single vane-type centrifugal pump has a tendency to generate a pulse as the vane extremity passes the pump casing outlet. It will be appreciated that such pulse causes uneven running of the pump which in turn leads to greater wear on the pump parts. This pulse is not generated, to any appreciable intensity, in pumps fitted with impellers according to the present invention.

Location of the perforations in a low pressure zone has the effect of limiting intrusion of dirt and other solid matter into the impeller interior. Furthermore, should wear of conduit **9** result in a hole being formed, solid material passing into the impeller interior would be expelled through the perforations. This has the advantage that the impeller always retains its balance.

The design of the impeller is such as to reduce the development of eddy currents in the pump casing. It is believed that this contributes towards a greater pumping efficiency.

Many other forms of the invention exist, each differing in matters of detail only. Thus instead of a three-sided impeller, four or five sides may be provided. The perforations through the sidewalls of the impeller may only be provided along one or two sides.

What I claim as new and desire to secure by Letters Patent is:

1. A pump impeller comprising a body having, in cross section, a regular polygonal configuration and a hollow interior, an axis of rotation located substantially equidistant the corners of the body, an inlet to the body located at the axis of rotation, a single outlet from the body provided in a sidewall of the body, each sidewall being perforated, in corresponding sidewall positions, towards a corner of the body, means balancing the impeller, and a conduit communicating between the inlet and the outlet.

2. An impeller as claimed in claim 1 in which the body is three-sided.

3. An impeller as claimed in claim 2 in which the sidewalls of the body are bowed outwardly.

4. An impeller as claimed in claim 1 in which the outlet is provided in a sidewall between a perforation through the sidewall and a corner of the body remote from the perforation.

5. An impeller as claimed in claim 4 in which the outlet is located closer to the perforation than the corner remote from the perforation.

6. An impeller as claimed in claim 1 in which the impeller is balanced internally.

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