June 28, 1960 W. H. GROWALL 2,942,556

FLUID PUMP

Filed April 9, 1956 2 Sheets-Sheet 1

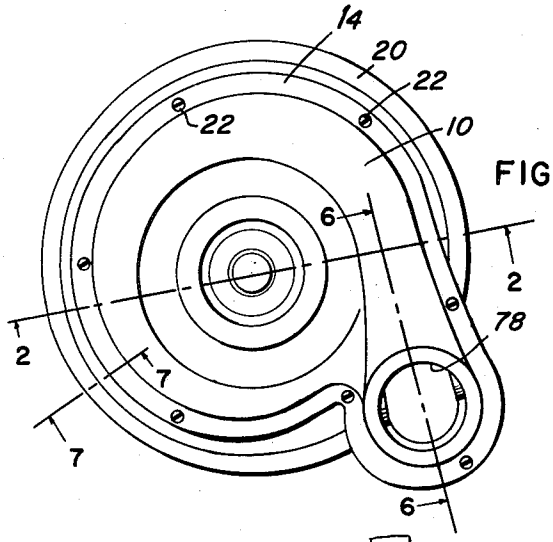


FIG. 1

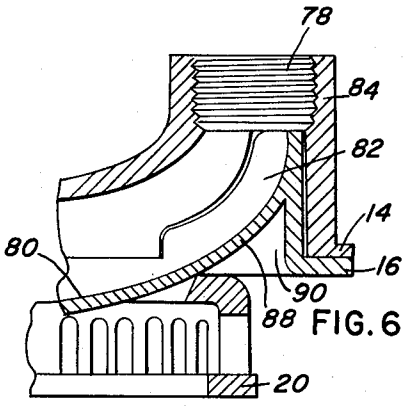


FIG. 6

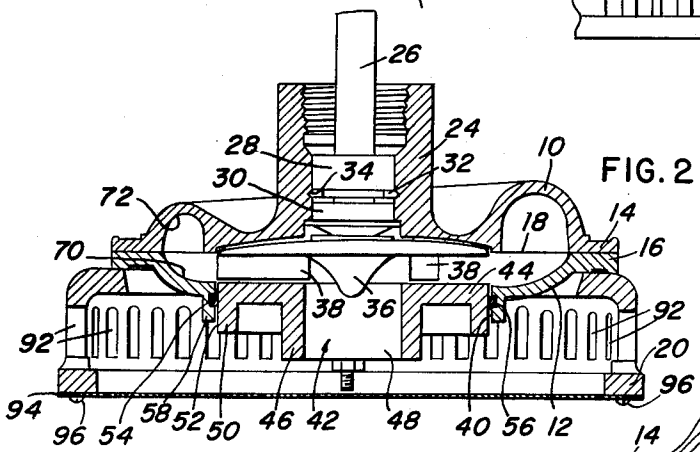


FIG. 2

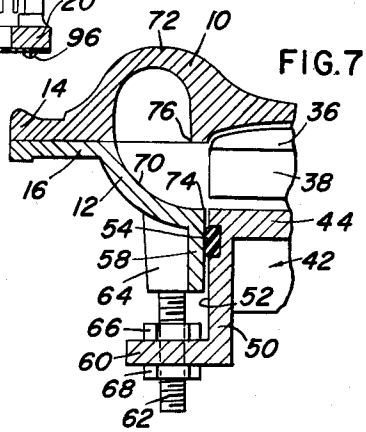


FIG. 7

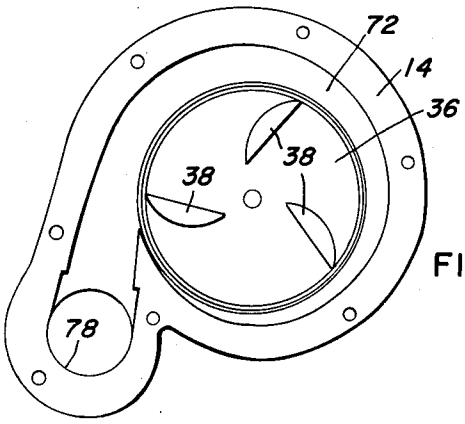


FIG. 3

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June 28, 1960 W. H. GROWALL 2,942,556

FLUID PUMP

Filed April 9, 1956 2 Sheets-Sheet 2

FIG. 8

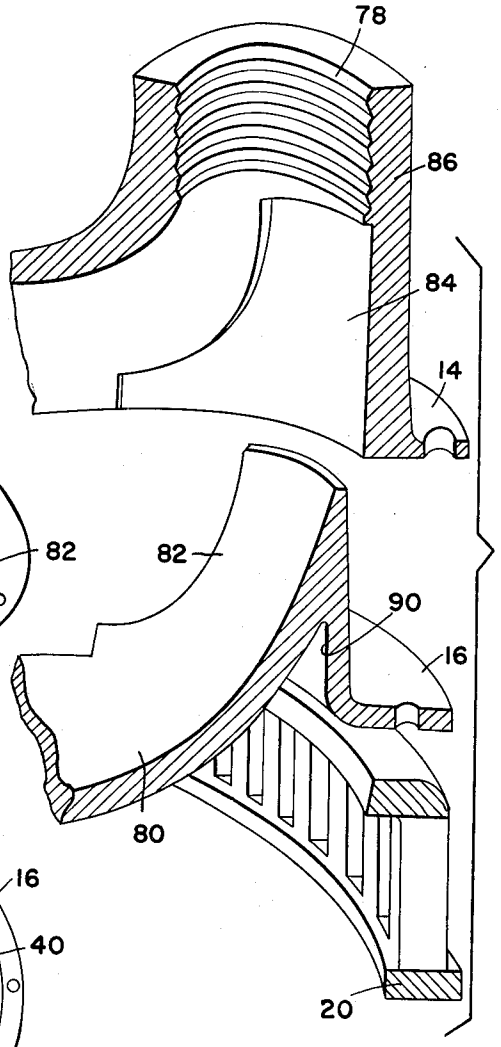
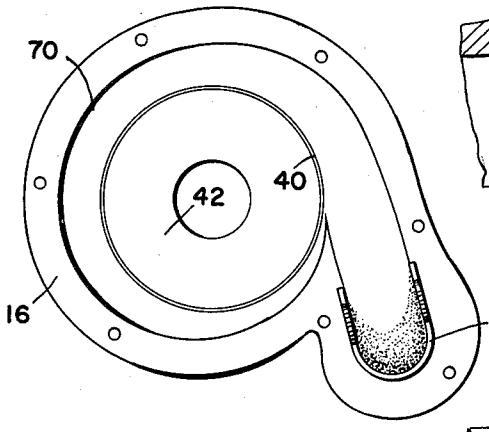


FIG. 4



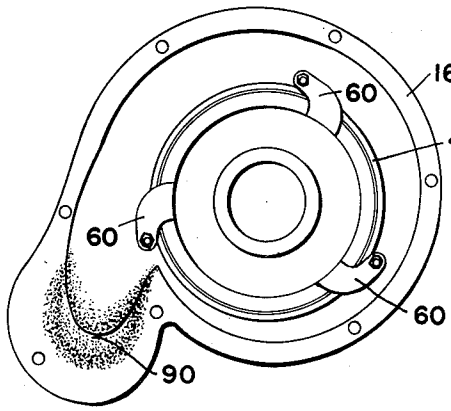


FIG. 5

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2,942,556

FLUID PUMP

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2 Claims. (Cl. 103—103)

This invention relates to centrifugal fluid pumps capable of producing high velocity flows and large volumes. The design contemplated permits the handling of liquids containing sand, muck, silt, leaves, paper, wood, ice and other foreign bodies frequently encountered in the pumping of liquids wherever they are small enough to pass the screen and enter the suction port of the pump.

The pump is characterized by a discharge passage disposed with respect to the impeller and formed in such a way as to produce rotation of the fluid body about its own axis, thereby eliminating the adverse effects of eddies and air pockets.

Pumps in accordance with the present invention are also characterized by a high degree of adjustability so as to maintain a desired tolerance between the impeller and its casing and to permit variation in accordance with the characteristics of the fluid and compensation for wear.

It is also among the objects of the present invention to provide a deflecting portion for the discharge passage of relatively large radius so as to direct fluid from its peripheral path relative to the impeller to an axial path parallel to the impeller shaft.

The centrifugal fluid pump of the present invention comprises a casing having inlet and discharge ports, a shaft journaled in the casing for rotation about an axis and an impeller within the casing secured to the shaft for rotation therewith, the casing having an inner wall defining a divergent discharge passage extending radially outwardly and axially to one side of the impeller, the passage having a substantially spiral peripheral portion and each radial cross section having a substantially spiral configuration of diminishing radius.

In accordance with one preferred form of the invention, the casing is divided into a plurality of complementary sections each containing a portion of the discharge passage and the division in such a case is preferably radially perpendicular to the axis of rotation of the shaft.

A preferred form of the invention contemplates the casing provided with an axial opening in substantial registry with the impeller, a closure for the opening adjustably secured to the casing to modify impeller clearance, and securing means positioning the closure relative to the casing. In such a construction, packing is preferably interposed between the closure and casing and the packing is preferably in the form of a resilient toroid of the O-ring type.

A preferred form of the invention contemplates the discharge port having an axis substantially parallel to the axis of rotation of the shaft and the discharge passage terminating in a deflecting portion interconnecting the spiral portion with the discharge port. This form of the invention preferably includes a casing divided into sections substantially radially at a plane intermediate the passage, one of the sections having a portion projecting axially from the plane to define part of the deflecting portion, another of the sections containing a pocket to receive the projecting portion and defining the remainder of the deflecting portion. This form also preferably includes a projecting portion having an arcuate wall of substantially uniform thickness throughout the major portion of its length.

A more complete understanding of the invention will follow from a detailed description of the accompanying drawings wherein:

Fig. 1 is a top plan view of a pump embodying the present invention;

Fig. 2 is a sectional elevation taken along line 2—2 of Fig. 1 on a somewhat enlarged scale;

Fig. 3 is a bottom plan view of the upper casing section and impeller of the preceding figures;

Fig. 4 is a top plan view of the lower casing section;

Fig. 5 is a bottom plan view of the lower casing section;

Fig. 6 is a fragmentary section on an enlarged scale taken along line 6—6 of Fig. 1;

Fig. 7 is a fragmentary section on an enlarged scale taken along lines 7—7 of Fig. 1; and

Fig. 8 is an exploded fragmentary view, partially in section depicting a detail.

The pump casing as depicted in the drawings is composed of an upper section 10 and a lower section 12 whose flanges 14 and 16 respectively, meet in a plane 18 and are secured together and to a screen member 20 by means of screws 22.

The upper casing member 10 is provided with a hub 24 in which an impeller shaft 26 is journaled by means of a bearing 28 secured in a suitable fashion as by a resilient ring 32 seated in a groove 34 formed in the bore of the hub. This bearing is protected against contact with abrasive or other foreign materials by means of a mechanical seal 30 which also serves to maintain a suitable lubricant supply available to the bearing as well as to the seal itself. To the lower end of the shaft 26 an impeller 36 is suitably secured, the impeller being provided with a set of vanes 38.

The lower casing section 12 contains an axial opening 40 in substantial registry with the impeller 36, for the reception of a closure 42 comprising an annular plate 44 provided with an inner depending skirt 46 defining an inlet or suction port 48 and an outer depending skirt 50 defining a cylindrical outer wall 52 serving as a bearing surface for a resilient toroidal ring 54 such as an O-ring seated in an annular groove 56 formed in a skirt 58 depending from the lower casing section.

As best depicted in Fig. 7, the closure 42 is provided with a plurality of projections 60 extending outwardly from its outer skirt 50 for registry with bolts 62 carried by enlargements 64 formed on the lower surface of the lower casing section. Suitable adjusting nuts 66 and 68 permit the closure to be advanced and retracted relative to the impeller 36 for adjusting clearance and compensating wear.

As will be evident from Fig. 2, the portion of the lower casing section peripherally disposed with respect to the impeller has a dished upper surface 70 which curves outwardly and upwardly towards the plane 18 where it merges with a curved channel 72 defined in the upper casing section 10. The dished portion 70 and channel 72 combine to form a discharge passage extending radially outwardly and axially to one side of the impeller, the passage having a substantially spiral peripheral portion and its radial cross section, taken at any portion thereof, having a substantially spiral configuration of diminishing radius proceeding from the edge 74 of the dished surface 70 to the edge 76 of the channel 72 as indicated in Fig. 7. By virtue of this configuration, when fluid is directed radially from the impeller it climbs the wall 70 and flows along the surface of the channel

72 at the same time it is advancing along the divergent discharge channel so that it assumes a movement along a somewhat helical path much like that imparted to a projectile by a rifle barrel. By referring to Figs. 3 and 4, the configuration of the walls defining the discharge passage will be evident insofar as the spiral and divergent aspects are concerned. Reference to Fig. 2 will show clearly how the discharge passage increases in height as well as width in the direction of the discharge port **78** defined by the upper casing section and having an axis parallel with that of the impeller shaft **26**.

As clearly shown in Figs. 6 and 8, as the dished surface **70** approaches the discharge port **78**, it receives an additional curvature axially to define an elbow portion **80** serving to deflect the fluid from its peripheral path towards an axial path. This elbow portion includes a projection **82** which is received in a complementary pocket **84** formed in an axially directed portion **86** of the upper casing section. By virtue of this construction, the parts may be cast or otherwise formed and readily retracted from a mold while presenting a curvature of large radius with the resulting beneficial flow characteristics. In the interests of economy in weight and material, the wall **88** of the deflecting portion is substantially uniform in thickness providing a recess **90** between it and the flange **16**.

The strainer member **20** on which the upper and lower casing sections are supported is provided with a suitable number of slots **92** for the ingress of fluid, and a suitable closure plate **94** secured to its lower surface by means of screws **96**.

When rotary motion in a clockwise direction as viewed in Fig. 1 is imparted to the shaft **26** and its impeller, liquid will be drawn through the strainer slots **92** and the suction port **48** by the impeller which will direct it by centrifugal force across the dished surface **70** of the lower casing section and along the wall of the channel **72** of the upper casing section to produce a whirling or rotating motion along the discharge passage which is both divergent and spiral whereby the velocity head will be converted to a pressure head, the rotating stream being then directed from its spiral peripheral path by the elbow **80** towards the axially disposed discharge port **78** from which the fluid will be delivered to the point at which it is required.

Whereas only one form of the invention has been shown and described in detail, the scope should not be limited beyond that prescribed by the appended claims.

I claim:

1. A centrifugal fluid pump comprising a casing having inlet and discharge ports, a shaft journaled in said casing for rotation about an axis and an impeller within said casing secured to said shaft for rotation therewith, said casing having an inner wall defining a divergent discharge passage extending radially outwardly of said impeller and being axially unsymmetrical with respect to said impeller, said passage having a substantially spiral peripheral portion and each radial cross section having a substantially spiral configuration of diminishing radius, said discharge port having an axis substantially parallel to said axis of rotation and said discharge passage terminating in a deflecting portion interconnecting said spiral portion with said discharge port, said casing being divided into sections substantially radially at a plane intermediate said passage, one of said sections having a portion projecting axially from said plane to define part of said deflecting portion, another of said sections containing a pocket to receive said projecting portion and defining the remainder of said deflecting portion.

2. A centrifugal fluid pump as set forth in claim 1 wherein said projecting portion has an arcuate wall of substantially uniform thickness throughout the major portion of its length.

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