June 10, 1941. H. NEIBERT 2,245,094

PUMP

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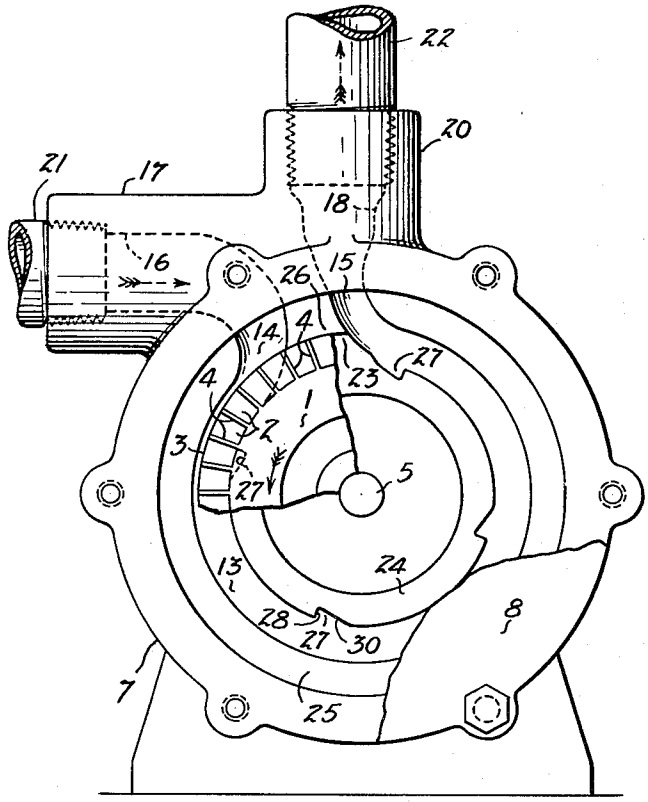


Fig. 1

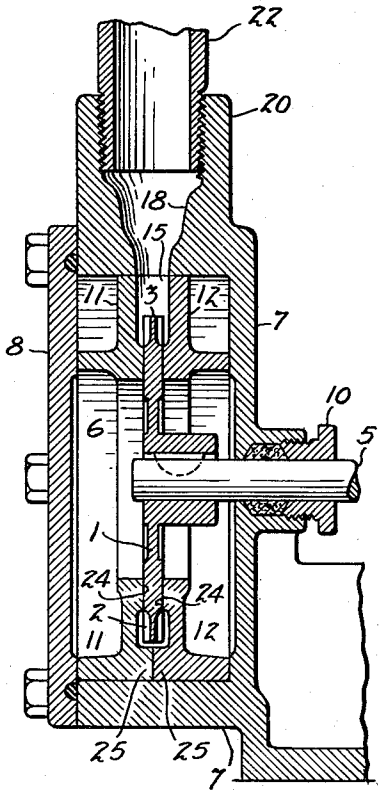


Fig. 2

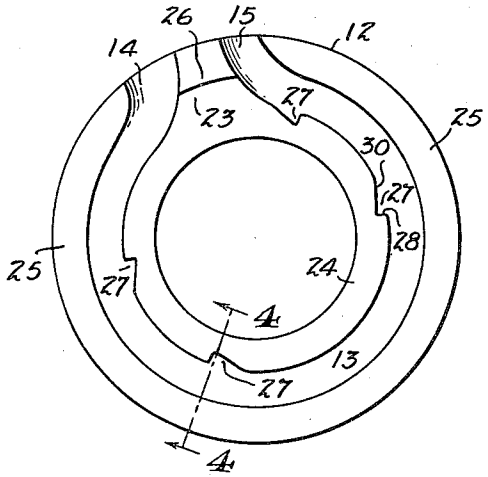


Fig. 3

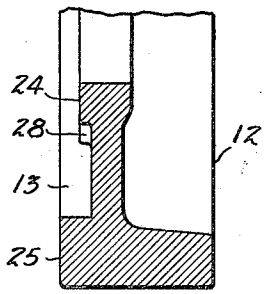


Fig. 4

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8 Claims. (Cl. 103—96)

This invention relates to pumps and in particular to rotary pumps provided with means to rid themselves of foreign particles such as sand, grit, bits of metal, and the like.

In the past it has been very disadvantageous to pump liquids which contain foreign particles without some means of separating such particles from the liquid before passing the liquid through the channel of the pump. This is due to the fact that foreign particles have a decidedly abrasive action on the parts of the pump, which is especially pronounced in pumps operating at relatively high speeds.

It is, therefore, an object of the present invention to provide a pump having means to rid itself of foreign particles readily and simply without the necessity of passing the liquid through mechanical separators such as strainers, etc., before allowing such liquid to enter the pump.

Another object is to provide a pump of the type having a channel through which an impeller moves, and a stop means between the inlet and outlet of the channel to direct water into the outlet, with means to direct foreign particles toward said outlet and assist in preventing foreign particles from being carried by the impeller past the outlet.

A further object is to provide a means for enabling pumps to rid themselves of foreign particles which may be applied to previously built pumps by a small alteration which may be inexpensively done.

Other objects and advantages of the present invention will become apparent from the following detailed description accompanied by the drawing, in which:

Figure 1 is an end elevational view, partly in section, with parts broken away, of a rotary pump embodying the present invention;

Fig. 2 is a side elevational view, partly in section, and with parts broken away, of the pump illustrated in Fig. 1;

Fig. 3 is an elevational view showing a detail of a portion of the pump channel; and

Fig. 4 is a fragmentary sectional view taken substantially on the line 4—4 of Fig. 3.

Briefly, the present invention in its application to rotary pumps comprises an abrupt enlargement of the pressure-developing passage or channel followed by a gradual contraction of the channel in the direction of liquid movement through the pump so that foreign particles will be directed to the central portions of the channel, carried through the channel and discharged through the outlet.

In the drawing, which shows a rotary pump embodying the invention, identical parts throughout the several views are indicated by the same reference numerals. Looking at Figs. 1 and 2, a rotor or impeller is indicated by the numeral 1 and comprises a relatively flat, disk-like member provided with a plurality of radially directed buckets 2 formed on its peripheral marginal edges. A set of buckets is formed on each side of the rotor or impeller 1, separated by a circumferentially extending web 3. The individual buckets in each set are separated from one another by radial webs 4.

The impeller is secured on a shaft 5 and is disposed in a pump chamber 6 formed by a pump casing 7 and a cover plate 8. The shaft may be rotated by a suitable motor (not shown). A suitable gland 10 is provided to seal the pump casing at the point where the shaft 5 enters the casing.

A pair of annular channel rings 11 and 12 are received in the pump chamber 6 and are grooved to cooperatively define a pressure-developing channel 13 which surrounds marginal portions of the impeller so that the buckets move through the channel on rotation of the impeller. The channel 13 is substantially annular and is provided with an inlet 14 and an outlet 15. The inlet communicates with an intake passage 16 formed in a boss 17 at the top of the casing 7 while the outlet communicates with a discharge passage 18 formed in a boss 20 at the top of the casing 7 and adjacent the boss 17. Each of the bosses 17 and 20 are suitably threaded so that intake and discharge pipes 21 and 22, respectively, may be secured thereto.

Between the inlet 14 and the outlet 15 the channel rings 11 and 12 fit closely around the impeller so that during operation of the pump, liquid flowing through the channel 12 is directed toward the outlet 15. This part of the rings is referred to as a stop or stop means and is indicated by the numeral 23.

Radially inward from the channel 13 each of the rings 11 and 12 is formed with an annular sealing rib 24 which has a running fit with one side of the impeller and prevents substantial leakage from the channel 12 into the center portion of the pump chamber 6. Radially outward of the channel 13 the rings 11 and 12 have circumferential ribs 25 which meet one another and cooperatively define the outer wall of the channel. The ribs 25 are, of course, discontinued across the inlet and outlet of the channel to permit liquid to pass through the inlet and outlet openings 14 and 15, respectively. In the region of the

stop 23 portions 26 of the ribs 25 extend farther radially inward than at other portions of the channel, are closely adjacent the periphery of the impeller, and have a running fit therewith to cooperate with the stop in directing liquid through the outlet.

To accomplish the objects of the present invention the rings 11 and 12 are provided with at least one, and usually a plurality, of recesses 27 disposed circumferentially around the channel 13 as shown in Fig. 3. The recesses are shown in their preferred location, that is, in the sealing ribs 24 of the rings 11 and 12. This location is preferred because the greatest amount of trouble caused by foreign particles in the channel is encountered when the foreign particles become lodged between the sealing ribs 24 and the impeller 1. The abrasive action of foreign particles is pronounced between these close fitting parts, and where the impeller is moving at a high rate of speed serious damage may be done to the pump in a relatively short time.

The preferred shape of the recesses is shown in Fig. 3, and moving in the direction of rotation of liquid these recesses 27 are defined by a wall 28, cut into the sealing ring in an almost radial direction, followed by a wall 30 which gradually tapers from the bottom of the recess toward the channel 13. In this manner the recesses 27 cause an abrupt enlargement of the channel followed by a gradual contraction, so that foreign particles lodged between the impeller and the sealing ribs 24 are freed upon passing the wall 28 and are directed by the wall 30 toward the central portion of the channel, where they may be carried along by the liquid through the channel 13 and out the discharge pipe.

A pump provided with the above described feature is very advantageous. Liquid containing relatively small amounts of foreign particles may be pumped readily and economically, since the useful life of the pump is prolonged by freeing the channel of foreign particles. Furthermore, liquids containing relatively large quantities of foreign particles may be moved by such a pump without serious damage to the mechanism of the pump and without the necessity of frequent replacement of parts of the pump, which materially increases the cost of pumping.

It will be seen that the present invention is applicable to pumps in which water is returned from a separating chamber to the liquid passageway in advance of the stop means to aid in priming the pump.

Another feature of the present invention is that previously constructed pumps may be readily converted to enable them to pump liquids containing foreign particles, without damage to the mechanism of such pumps. All that is required in the case of a pump having removable rings is the conversion thereof to embody the invention or the replacement thereof with rings which embody the invention.

It may be seen that this invention may be applied to all types of rotary pumps having rotors and sealing means surrounding the rotors, the specific construction of pump shown and described having been arbitrarily chosen for purposes of description and illustration. Furthermore, the size and shape of the recesses may be varied considerably without departing from the spirit of the invention as defined in the appended claims.

What I claim is:

1. In a rotary pump, a casing, an impeller in the casing, buckets on the impeller and an annular channel in the casing adjacent the buckets, an inlet and an outlet for the channel, stop means closely surrounding the impeller between the inlet and the outlet, means for sealing the channel radially inwardly therefrom, and a plurality of recesses disposed in the sealing means to free foreign particles from between said sealing means and said impeller, one of said recesses disposed near the outlet in the region of said stop to direct foreign particles toward the outlet and assist in preventing foreign particles from being carried through the channel in the region of the stop.

2. In a rotary pump, a casing, a pair of annular removable rings in the casing, channels formed in faces of the rings to cooperatively form a pressure-developing passage, an inlet and an outlet through the casing for the passage, stop means between the inlet and the outlet to direct liquid into said outlet, a rotary impeller in the passage, buckets on the impeller disposed in the passage, sealing ribs on the rings inwardly of the channels, and a plurality of recesses in the sealing ribs to throw foreign particles lodged between the impeller and said ribs radially outward, one of said recesses disposed near the outlet in the region of the stop to direct foreign particles into the outlet and assist in preventing foreign particles being carried through the passage beyond the outlet.

3. In a rotary pump, a casing, a rotary impeller in the casing, buckets on the impeller, an annular channel formed in the casing in the region of the buckets, an inlet and an outlet for the channel, cooperative portions of said casing and impeller to form a seal for the channel inwardly thereof, and a plurality of recesses disposed in said cooperative portions to free foreign particles between the impeller and said portions, said recesses comprising a wall extending substantially radially inward from the channel and a wall sloping gradually from said first wall outwardly to the channel in the direction of rotation of the impeller.

4. In a rotary pump, a casing, a pair of annular removable rings in the casing, channels formed in faces of the rings to cooperatively form a pressure-developing passage, an inlet and an outlet for the passage through the casing, a rotary impeller in the casing, buckets on the impeller disposed in the passage, circumferential ribs on the rings inwardly of the channels to cooperatively form with the impeller a seal for the passage, and a plurality of recesses in the ribs opening to said impeller and said channel, said recesses comprising in the rotational direction of the impeller an abrupt opening from the channel followed by a gradual merging of the recess with the channel.

5. In a rotary pump, a casing, a channel in the casing, an inlet to said channel, an outlet from said channel, an impeller, said casing having a wall which is relatively closely adjacent the impeller and defines therewith the radial extent of the channel, and at least one recess in said wall opening toward the impeller in the region of the channel, said recess causing a relatively abrupt enlargement of the channel followed by a merging of the recess with the normal channel wall in the direction of fluid movement through the channel.

6. In a rotary pump, a casing, a channel in the casing, an inlet to said channel, an outlet from said channel, an impeller, cooperative portions

carried by the casing and the impeller defining the radially inward extent of the channel and at least one recess disposed in said cooperative portions to free foreign particles, said recess causing a relatively abrupt enlargement of said channel followed by a relatively gradual contraction of said channel to its normal size in the direction of fluid movement through the channel.

7. In a rotary pump, a casing, a channel in the casing, an inlet to said channel, an outlet from said channel, an impeller, stop means closely fitting said impeller in the region of the outlet to prevent fluid being carried past the outlet, cooperative portions carried by the impeller and the casing to define the radially inward extent of the channel, and a plurality of recesses disposed in said cooperative portions open to the impeller and the casing, one of said recesses disposed in the region of the outlet to direct foreign particles toward the outlet and assist in preventing foreign particles being carried past the outlet.

8. In a rotary pump, a casing, a pair of annular rings removably mounted in the casing, grooves formed in faces of said rings to cooperatively form a channel, an impeller between said rings to rotate in the channel, an inlet to said channel, an outlet from said channel, cooperative portions carried by the rings and the impeller to define the radial extent of the channel, and a plurality of recesses disposed in said cooperative portions open to the impeller and the casing and comprising a relatively abrupt enlargement of the channel followed by a relatively gradual contraction of the channel to its normal size.

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