March 13, 1928. 1,662,443

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CENTRIFUGAL PUMP

Filed Feb. 18, 1924 2 Sheets-Sheet 1

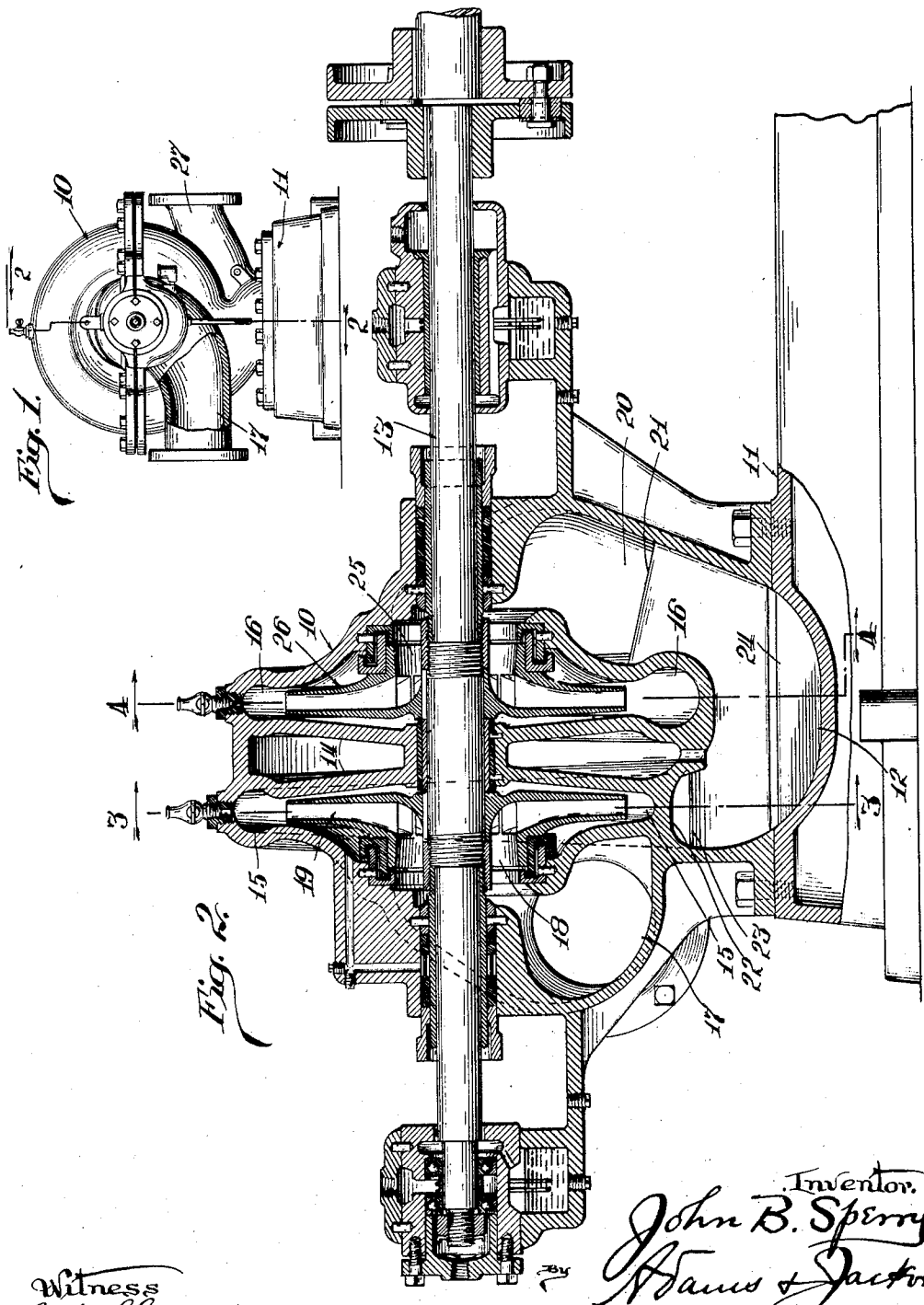


Fig. 1.

Fig. 2.

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Fig. 3.

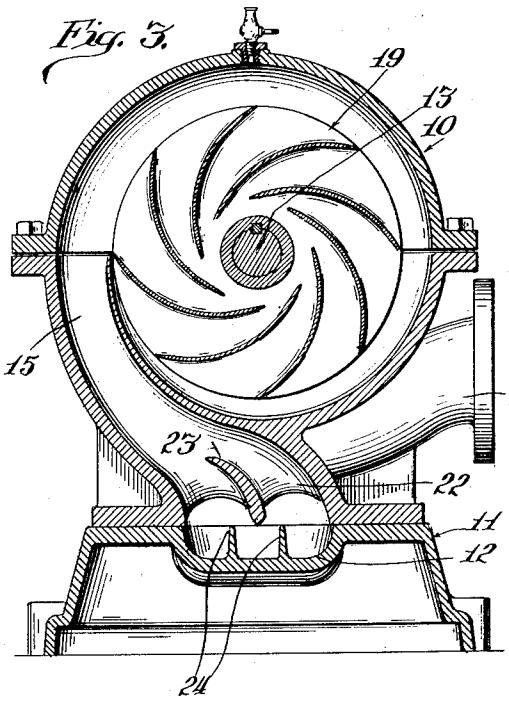


Fig. 4.

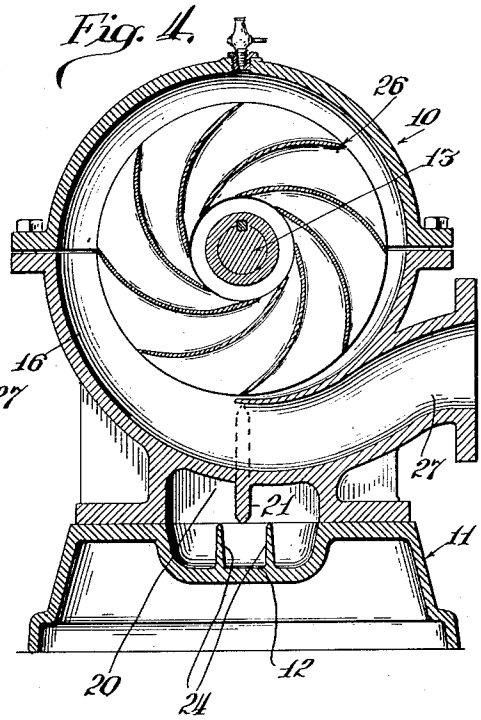


Fig. 5.

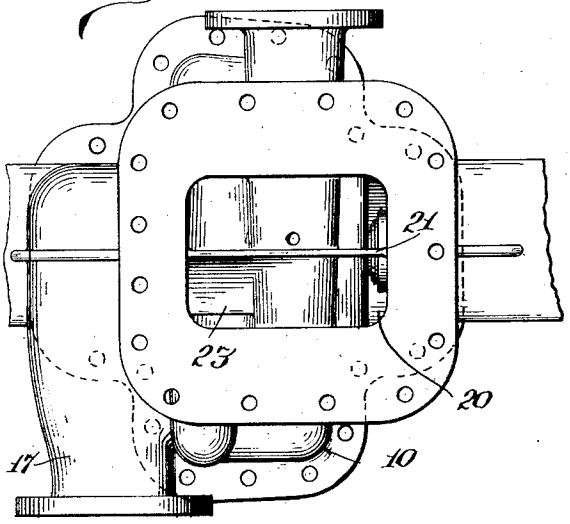
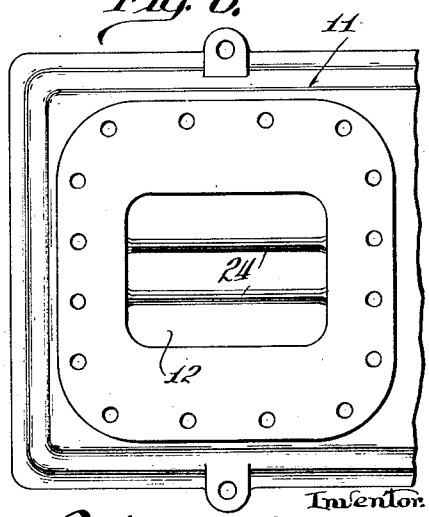


Fig. 6.



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL PUMP.

Application filed February 18, 1924. Serial No. 693,553.

This invention relates to improvements in centrifugal pumps of the multi-stage type, and has for its object to provide an improved construction whereby the water as it passes from the volute or spiral passage adjacent to the intake or suction end of the pump and into the usual pressure chamber that communicates with said passage and also with another and similar passage adjacent to the discharge end of the pump will be so acted upon as to practically eliminate the whirling action of the water that has been caused by the velocity of the water under the influence of the rapidly revolving impeller that first acts upon it and forces it through said first-named passage,—the destruction of such whirling action resulting in the conversion of velocity head into pressure head. I accomplish this object by the means shown in the drawings and hereinafter specified. That which I believe to be new will be set forth in the claims.

In the drawings,—

Fig. 1 is an end view of the pump, a portion of the suction or inlet pipe being in section;

Fig. 2 is an enlarged central vertical section through the pump;

Figs. 3 and 4 are cross-sectional views taken respectively at the lines 3—3 and 4—4 of Fig. 2;

Fig. 5 is a bottom view of the pump detached from its supporting bed-plate; and

Fig. 6 is a plan view of the bed-plate.

Referring to the several figures of the drawings,—10 indicates the pump casing, which rests upon and is bolted to a bed-plate 11 in which is formed a comparatively deep depression 12 which, as explained later herein, forms the lower portion of the pressure chamber through which the water passes from one to the other of the two stages. 13 is the pump shaft passing through the casing 10, suitable packing, as usual, being provided around the shaft where it passes through the walls of the casing. The shaft will be journaled in suitable bearings, as usual, and lubricating means will be provided, but as those parts form no part of the present invention, and may be of any desired construction and arrangement, it is not deemed necessary to here enter into any description of them. The interior of the casing is provided with walls 14, as usual, that divide it into two parts, each of which comprises a volute or spiral shaped water passage, as is common,—that one of the passages adjacent to the suction or intake end of the pump being indicated by 15 and the other of such passages being indicated by 16. The intake pipe is indicated by 17 and, as shown in Fig. 2, it is in communication with the volute passage 15 by an opening or port 18 around the shaft. Secured to the shaft and located within the volute passage 15 is the hub of an impeller, which impeller, as usual, comprises a plurality of curved vanes adapted by their action to force the water that enters such passage around and into a pressure chamber in the lower part of the pump casing. The impeller referred to is indicated generally by 19.

The pressure chamber referred to is indicated generally at 20, and is formed partly in the lower portion of the casing 10 and also by the depression 12 in the bed-plate. Extending substantially centrally across the chamber 20 from end to end,—that is to say, between the two stages of the pump, is a division wall or vane 21, such wall being preferably cast with the casing 10 and having its lower edge adjacent to the lower edge of such casing. As best shown in Fig. 3, the lower portion of the volute passage 15 widens very considerably at 22 and thus forms, at the intake end of the pump, the inlet portion of the pressure chamber 20, and that part of the division wall 21 that is located in this part 22 of the chamber is curved to correspond to the curvature of the opposite walls. This curved portion of the division wall is indicated by 23. On the bottom of the chamber 20 are formed two vertical ribs 24, 24 which, like the division wall 21, extend from end to end of the chamber and, as here shown, are parallel with the said wall 21 and are preferably located at opposite sides of and at equal distances from the lower edge of such division wall. The wall 21 and the ribs 24 thus constitute fixed vanes which extend along the pressure chamber between the consecutive volute passages. The water that is forced by the impeller 19 around and through the ever widening passage 15 has, by reason of the movement imparted to it, a whirling tendency by the time it leaves the said passage, and it is necessary that that whirling tendency be counteracted in order that the desired pressure of the water

may be obtained. With the construction described, the whirling or eddying current of water upon being brought to the inlet portion 22 of the pressure chamber is divided into two currents by the curved part 23 of the division wall, which in some measure breaks up the tendency to whirl or eddy, and thereafter the water will flow along in the channels provided by the three fixed vanes that comprise the said division wall and the vertical ribs 24, and as the water reaches the opposite end of the chamber such whirling or eddying tendency will have been very largely destroyed. The water passes from the pressure chamber 20 through an opening or port 25 that is similar in location and size to the port or opening 18, and passes into the volute passage 16 where it is acted upon by an impeller 26 and discharged from the lower part thereof into the outlet pipe 27, as usual. The two impellers 19 and 26 are arranged back to back and with the single suction openings 18 and 25 that lead into the volute passages 15 and 16 arranged in opposite directions, as clearly shown in Fig. 2.

By the provision of fixed vanes in a pressure chamber of relatively large capacity, as here shown, a multi-stage volute type of centrifugal pump is produced that enables the conversion of velocity head into pressure head with practically the same efficiency and at much less expense than a diffuser in the diffuser type of pumps.

What I claim as my invention and desire to secure by Letters Patent, is—

1. A multi-stage centrifugal pump comprising in combination a plurality of impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity to which one volute passage delivers at relatively high velocity and through which the fluid being pumped passes at relatively low velocity to the suction of the next volute passage, and oppositely disposed vanes in offset relation to each other extending along said pressure chamber between consecutive passages for causing the fluid to pass smoothly from one stage of the pump to the next succeeding stage.

2. A multi-stage centrifugal pump comprising in combination a plurality of impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity to which one volute passage delivers at relatively high velocity and through which the fluid being pumped passes at relatively low velocity to the suction of the next volute passage, and a plurality of oppositely disposed approximately parallel vanes extending along said chamber.

3. A multi-stage centrifugal pump comprising in combination a plurality of impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity to which one volute passage delivers at relatively high velocity and through which the fluid being pumped passes at relatively low velocity to the suction of the next volute passage, and a plurality of fixed vanes in spaced relation to each other extending longitudinally of said chamber from one stage of the pump to the next.

4. A multi-stage centrifugal pump comprising in combination, a plurality of impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity to which one volute passage delivers at relatively high velocity and through which the fluid being pumped passes at relatively low velocity to the suction of the next volute passage, and a plurality of oppositely disposed vanes forming channels extending lengthwise of said chamber from one stage to the next.

5. A multi-stage centrifugal pump, comprising in combination a plurality of impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity to which one volute passage delivers at relatively high velocity and through which the fluid being pumped passes at relatively low velocity to the suction of the next volute passage, said pressure chamber having an inlet portion comprising a fixed vane forming a plurality of passages, and vanes in said chamber approximately parallel with said fixed vanes, forming channels extending lengthwise of said chamber.

6. A centrifugal pump comprising in combination two impellers arranged back to back with their single suctions leading in opposite directions, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity communicating with the discharge of the first passage and the suction of the second passage, and a plurality of approximately parallel fixed vanes extending longitudinally in said chamber between said passages for causing the fluid that is forced thereinto by one impeller to flow smoothly therethrough to the other impeller.

7. A centrifugal pump comprising in combination two impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity, the inlet portion of which is formed of a widened part of one of said passages and the outlet of which is the suction port of the other passage, and a fixed vane extending longitudinally of said chamber, said vane being curved at that end that extends into said inlet portion of the chamber.

8. A centrifugal pump comprising in

combination two impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity, the inlet portion of which is formed of a widened part of one of said passages and the outlet of which is the suction port of the other passage, and a plurality of fixed vanes extending longitudinally of the chamber, one of said vanes having its lower edge at a distance from the bottom of said chamber.

9. A centrifugal pump comprising in combination two impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity, the inlet portion of which is formed of a widened part of one of said passages and the outlet of which is the suction port of the other passage, and a fixed vane extending longitudinally of said chamber with its lower edge at a distance from the bottom of the chamber, said bottom of the chamber being provided with channels extending in the same direction as said vane.

10. A centrifugal pump comprising in combination two impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity, the inlet portion of which is formed of a widened part of one of said passages and the outlet of which is the suction port of the other passage, a bed-plate upon which the casing of the pump rests, said bed-plate having a recess that forms the lower part of said chamber, longitudinally-extending channels in said recessed portion, and a fixed longitudinally-extending vane in that portion of said chamber above the bed-plate.

11. A centrifugal pump comprising in combination two impellers, separate volute passages in which said impellers are respectively located, a pressure chamber of large capacity, the inlet portion of which is formed of a widened part of one of said passages and the outlet of which is the suction port of the other passage, a bed-plate upon which the casing of the pump rests, said bed-plate having a recess that forms the lower part of said chamber, longitudinally-extending channels in said recessed portion, and a fixed longitudinally-extending vane in that portion of said chamber above the bed-plate, the end portion of said vane that is in said inlet portion of the chamber being laterally curved to conform substantially to the wall of said inlet portion.

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