Sept. 28, 1948. G. P. E. HOWARD ET AL 2,450,143

CENTRIFUGAL PUMP PROVIDED WITH DIFFUSER

Filed Aug. 2, 1946 2 Sheets-Sheet 1

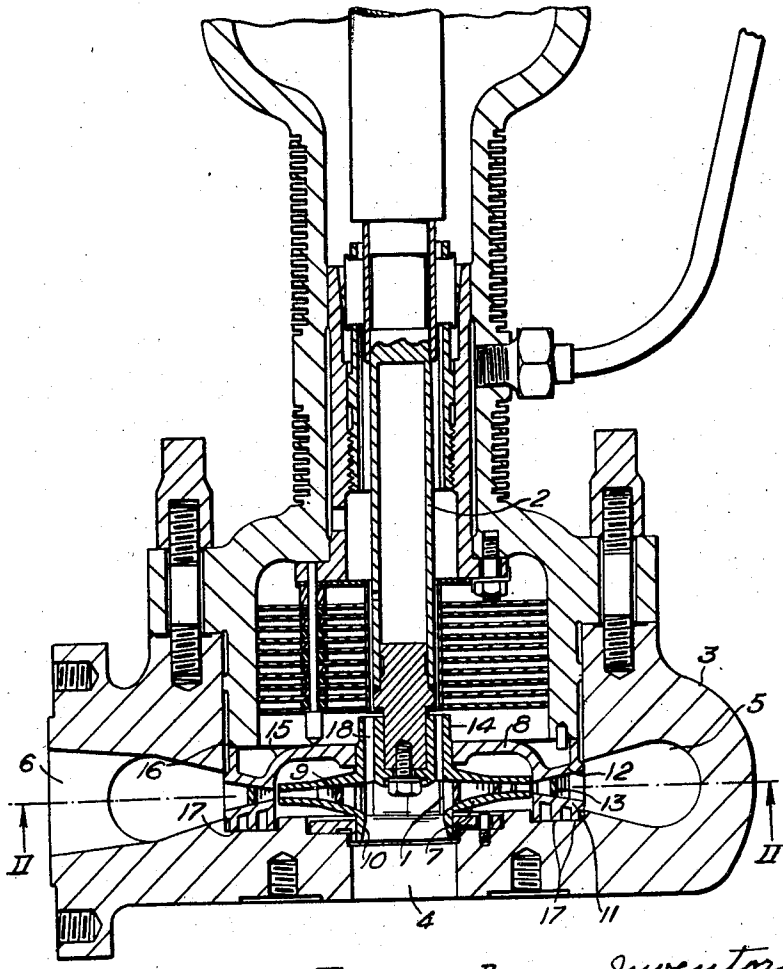


FIG. 1.

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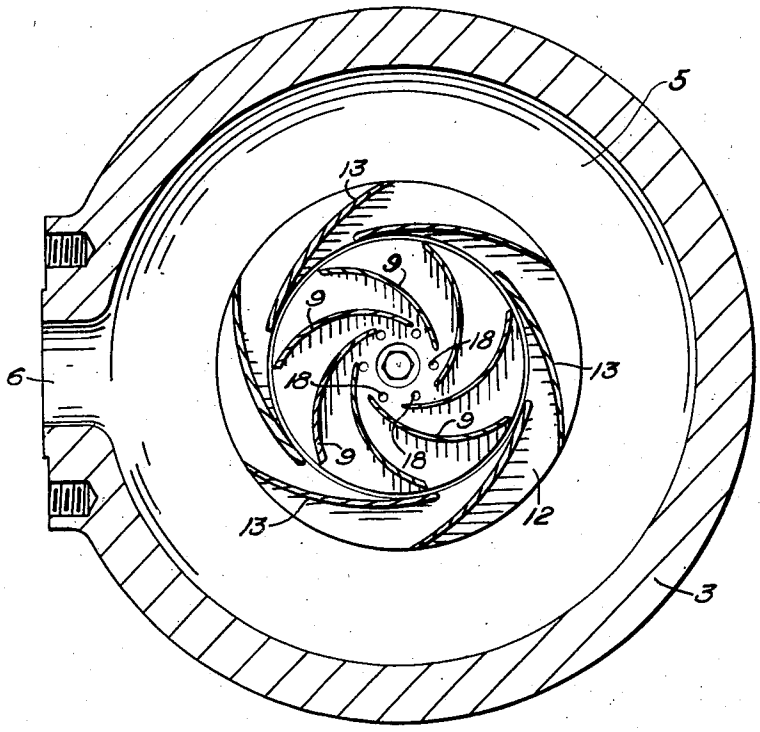


FIG. 2.

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UNITED STATES PATENT OFFICE

2,450,143

CENTRIFUGAL PUMP PROVIDED WITH DIFFUSER

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Application August 2, 1946, Serial No. 687,824
In Great Britain July 11, 1945

Section 1, Public Law 690, August 8, 1946
Patent expires July 11, 1965

6 Claims. (Cl. 103—103)

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This invention relates to centrifugal pumps provided with diffusers. In centrifugal pumps, the liquid issues from the outer periphery of the rotor or impeller at high velocity, and a diffuser is a device which immediately surrounds the impeller and is adapted to receive the issuing liquid and gradually reduce the velocity, and therefore increase the pressure, thereof. The diffuser generally consists of a stationary integral annular casting surrounding the impeller and having front and back annular walls whose inner edges are immediately outside the outer edges of the front and back annular walls of the impeller. The annular walls of the diffuser have between them a number of arcuate vanes arranged somewhat similarly to the arcuate vanes between the annular walls of the impeller but in the opposite sense.

The present invention has for its object the provision of an improved construction of centrifugal pump provided with a diffuser, which will both simplify the assembly and enable a closer clearance to be obtained between the diffuser and the impeller without danger of seizing. In accordance with the invention the diffuser is free to adjust itself relative to the pump casing and is held in position by being biased against a fixed abutment.

In order that the invention may be the more clearly understood, a pump structure in accordance therewith will now be described, reference being made to the accompanying drawings, wherein:

Figure 1 is a sectional side elevation of said pump structure.

Figure 2 is a cross section on line II—II of Figure 1.

Referring to the drawings the pump structure illustrated therein is identical with that described and illustrated in our co-pending U. S. application Serial No. 687,823, filed of even date herewith, Figure 1 being identical with the single figure of said co-pending specification. Only so much of said structure which specifically relates to the present invention will therefore be described.

Thus the pump impeller 1 is mounted on the lowermost end of a vertical shaft 2. The impeller 1 is located within a pump casing 3. The liquid enters the impeller 1 axially in the usual way through a port 4 in the bottom wall of said casing 3 and flows outwardly from the impeller into a surrounding annular space 5 in the casing 3 and from said space 5 flows radially out through an outlet port 6.

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The impeller 1 in the usual way is an integral casting consisting of two concentric disc-like walls 7 and 8 with a plurality of curved vanes 9 between them. The lower 7 of said disc-like walls has a central opening surrounded by a flange 10 which rotates in sealed relation within the port 4 and thus the liquid is admitted into the impeller. The upper 8 of said disc-like walls is rigidly secured to the shaft 2.

Surrounding the outer periphery of the impeller is a stationary diffuser. This is an integral casting consisting of lower and upper annular walls 11 and 12 with curved vane 13 between them. The inner edges of the walls 11 and 12 closely surround the outer edges of the walls 7 and 8, and the vanes 13 are curved in the opposite sense to the vanes 9. As shown, the aforesaid annular space 5 immediately surrounds the diffuser and the liquid flows through said diffuser from the impeller to the said annular space, and, in passing through said diffuser has its velocity head converted into pressure head as heretofore stated.

In the present construction the impeller 1 is formed with a central boss 14 extending from its upper wall 8 in a direction away from the pump inlet. The diffuser is cast with an integral web 15 in the form of a dished disc whose outer edge joins the upper annular wall 12 of said diffuser, and which has a central bossed opening which surrounds, and bears upon, the said boss 14 of the impeller. In this way correct axial alignment of the diffuser relative to the impeller is ensured.

For ensuring the correct axial positioning of the diffuser, an upper surface 16 of the diffuser is adapted to abut against a surface of the casing above it as shown. The diffuser is forced upwardly by the differential pressure of the liquid being pumped, and thus its said rear surface 16 is held hard up against the said surface of the casing behind it. To minimize leakage between the lower annular wall of the diffuser and the corresponding bottom wall of the casing, said lower annular wall of the diffuser may have a number of circular ribs 17 extending from it with their front edges very close to said bottom wall of the casing. Thus a species of labyrinth is provided through which any leaking liquid must pass.

The invention is particularly useful in the case of pumps handling liquid of high temperature, and, in the arrangement being described, is employed, as before stated, in combination with the exact construction described in our co-pending application aforesaid. The abutting surface 16

of the diffuser is constituted by the upper edge of a circular rib extending upwardly from the upper wall of the diffuser as shown and the corresponding surface of the pump is the lower surface of the upper portion of said pump casing.

The aforesaid differential pressure pressing the diffuser upwardly exists by virtue of the fact that the pump inlet is in direct communication with the upper side of the diffuser by way of holes 18 through the boss 14. The underside of the diffuser, at the region of the ribs 17 is in leakage communication with the relatively high pressure liquid in the annular space 5.

What we claim and desire to secure by Letters Patent is:

1. In a centrifugal pump comprising a fixed pump casing and a pump impeller rotatably mounted within said casing, said impeller having a central axially open liquid intake and having means for ejecting the liquid radially outwardly therefrom, a stationary diffuser surrounding said pump impeller within said pump casing and adapted to receive the ejected liquid, said diffuser being free to adjust itself relative to said pump casing and being biased against a fixed surface associated with said pump casing to hold the diffuser in position.

2. In a centrifugal pump comprising a fixed pump casing and a pump impeller rotatably mounted within said casing, said impeller having a central axially open liquid intake and having means for ejecting the liquid radially outwardly therefrom, a stationary diffuser surrounding said pump impeller within said pump casing and adapted to receive the ejected liquid, said diffuser being free to adjust itself relative to said pump casing and being biased by the pressure of the liquid being pumped against a fixed surface associated with said pump casing to hold the diffuser in position.

3. In a centrifugal pump comprising a fixed pump casing and a pump impeller rotatably mounted within said casing, said impeller having a central axially open liquid intake and having means for ejecting the liquid radially outwardly therefrom, a stationary diffuser surrounding said pump impeller within said pump casing and adapted to receive the ejected liquid, said diffuser being rotatable and axially movable relative to said pump impeller, and said diffuser being biased axially against a fixed surface associated with said pump casing to hold the diffuser in position.

4. In a centrifugal pump comprising a fixed pump casing and a pump impeller rotatably mounted within said casing, said impeller having a central axially open liquid intake and having means for ejecting the liquid radially outwardly therefrom, a stationary diffuser surrounding said pump impeller within said pump casing and adapted to receive the ejected liquid, said diffuser being rotatable and axially movable relative to said pump impeller, said casing defining an annular space surrounding said diffuser and having an outlet communicating with the annular space aforesaid, and means for subjecting one side of said diffuser to the pressure of the intake of the impeller and the other side of said diffuser to the pressure of said annular space, whereby said diffuser is biased axially against a fixed surface associated with said pump casing and is thereby held in position.

5. A centrifugal pump comprising a fixed pump casing, a pump impeller rotatably mounted within said casing, said impeller having a central axially open liquid intake and having means for ejecting the liquid radially outwardly therefrom, a central boss extending coaxially from the side of the pump impeller opposite to said intake opening, a stationary diffuser surrounding said pump impeller within said pump casing and adapted to receive the liquid ejected from said pump impeller, a disc-shaped web rigid with said diffuser on the side thereof corresponding to the side of the pump impeller from which the central boss extends, said disc-shaped web having a central opening which surrounds said central boss in bearing relation thereto while permitting relative rotary and axial movement between said pump impeller and said diffuser, said boss having holes extended therethrough and establishing direct communication of the intake opening of said impeller with the side of said web remote from said intake opening, said pump casing having an inlet port, means for establishing a fluid seal between the intake opening of the impeller and said inlet port, said pump casing defining an annular space surrounding said diffuser and having an outlet communicating with the annular space aforesaid, and means establishing a leakage communication between said annular space and the side of the diffuser opposite to the web for producing a net axial thrust on said diffuser serving to bias the same axially against a fixed surface associated with said pump casing and to hold the diffuser in position.

6. A centrifugal pump as defined in claim 5, wherein the means affording a leakage communication between said annular space and the side of the diffuser opposite to the web constitute a plurality of annular ribs formed on one side of said diffuser and extended close to the adjacent surface of the pump casing.

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