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PUMP IMPELLER

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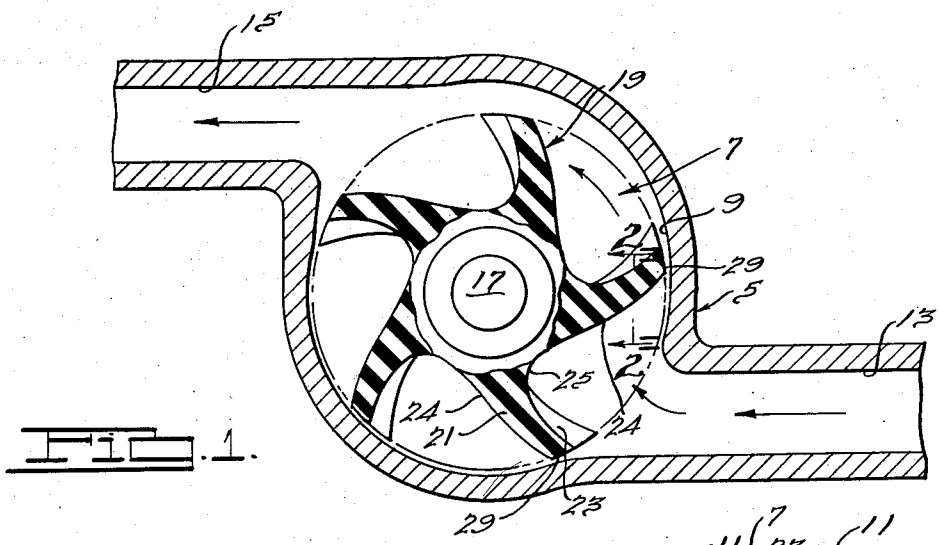

FIG. 1.

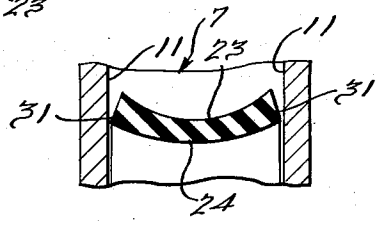

FIG. 2.

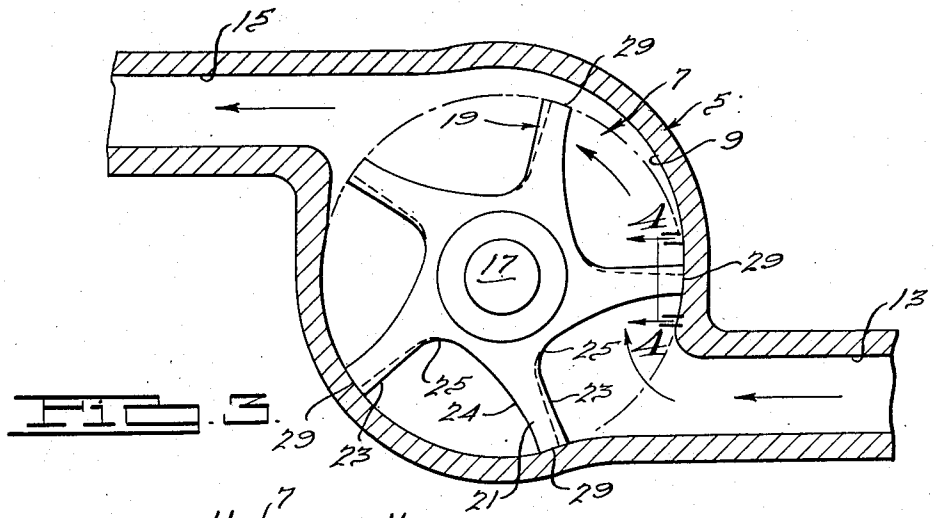

FIG. 3.

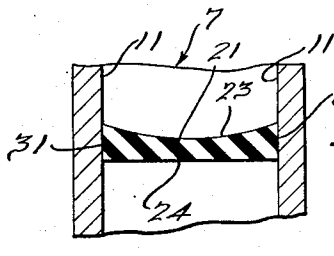

FIG. 4.

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PUMP IMPELLER

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6 Claims. (Cl. 103—96)

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This invention relates generally to fluid pumps and more particularly to a novel impeller construction for such pumps.

It is an object of this invention to provide an impeller for a fluid pump which can be rotated or started with a relatively low driving motor load and which will efficiently pump or circulate fluid, without slippage or by-passing of the fluid after it has reached a predetermined speed.

It is a still further object of this invention to provide an impeller of the aforementioned type, in which the blades are made of flexible material and are normally disposed, when the impeller is not being driven, with their end and side faces positioned relative to the walls of the pump housing chamber so that fluid can move therepast, but which will deflect or yield when the impeller is rotating at a predetermined speed so as to sealingly engage the walls of the housing and prevent a flow of fluid between the impeller blades and pump housing chamber.

It is a still further object of this invention to provide a pump impeller of the aforementioned type which is so constructed that it will deflect or yield only a desired amount so as to remain in engagement with the walls of the housing until the rotative speed of the impeller is reduced beyond a predetermined speed or is completely stopped.

It is a still further object of this invention to provide an impeller of the aforementioned type, which may be molded as a one-piece article.

It is a still further object of this invention to provide an impeller of the aforementioned type, which may be used with a fluid pump having its fluid intake or inlet at either the center or side of the housing.

It is a still further object of this invention to provide an impeller of the aforementioned type which is efficient in operation, durable in use, relatively inexpensive to manufacture, and which will provide longer life for the impeller driving motor than has been heretofore possible.

These and other objects of this invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a view, partially in section and partially in elevation, of a fluid pump incorporating the impeller of this invention, and showing the impeller in its normal, at rest position;

Fig. 2 is a sectional view of the structure illustrated in Figure 1, taken along the line 2—2 thereof;

Fig. 3 is a view, partially in section and partially in elevation, similar to Figure 1, but showing the position of the impeller blades when the impeller is rotating at a predetermined speed and circulating fluid; and

Fig. 4 is a sectional view of the structure illustrated in Fig. 3, taken along the line 4—4 thereof.

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Referring now to the drawing, it will be seen that a fluid pump is illustrated which includes a housing 5, of any suitable type. The housing illustrated is provided with a chamber 7 having an annular side wall 9 and relatively flat end walls 11. The housing 5 has a fluid inlet 13 which communicates with one side of chamber 7, adjacent the lower portion thereof, and an outlet 15 which communicates with the opposite side of the housing adjacent the upper portion thereof. It will, however, be appreciated that the inlet and outlet could be located in any desired relationship with respect to the chamber. For example, the inlet could be located at the center of the housing without departing from the scope of the invention. A shaft 17 is rotatably supported in the end walls 11 of the housing 5, in any suitable manner, and has an impeller 19 mounted thereon and connected therewith. The shaft 17 is adapted to be rotatably driven by a suitable motor and driving mechanism, (not herein shown), so as to rotate the impeller within the housing chamber 7. The impeller 19 includes a hub portion and a plurality of outwardly projecting, circumferentially spaced blade portions 21. The blades 21 extend outwardly from the hub portion and are directed away from radial lines extending outwardly from the axis of rotation of the impeller and shaft 17, in the direction of rotation of the impeller. One face 23 of each blade portion is concave (see Fig. 2), and is of a shorter extent than the other face 24, which is of a convex shape. The face 23 terminates at its inner end in a radius 25, which joins with the convex face 24 of another blade 21. Each blade face 24 is of a relatively long extent and sweeps back to join with the radius 25, for reasons which will hereinafter appear.

The impeller 19 is preferably molded as a one-piece article in a rubber molding machine, or the like, so that the blades are curved as illustrated in Fig. 1, and the outer ends 29 thereof will not sealingly engage the annular side wall 9 of the chamber 7. The outer ends 29 are disposed in a cylindrical path, the radius of which is less than the radius of the pump chamber wall 9 measured from the same center or the axis of rotation of the impeller. Likewise the blades are curved in the opposite plane and form the concave faces

23 and convex faces 24, as can be seen in Fig. 2, so that the side faces 31 of the blades will not sealingly engage the end walls 11 of the housing chamber. That is, the blades 21 are curved in a transverse plane relative to the end walls 11 and are of a width less than the distance between the chamber end walls, so as to provide a space between the blades and the end walls. The amount of space between the end faces of the blades and the chamber side wall and the side faces of the blades and the chamber end walls may vary in accordance with the pump construction and requirements, but it is important that the impeller not sealingly engage the chamber walls when the impeller is at rest.

When fluid is flowing into the housing chamber 7 and the impeller is rotatably driven by the motor, centrifugal force and the force of the fluid acting against the impeller blades will cause the blades to yield or deflect and in effect straighten out or expand so that, at a predetermined speed and/or fluid pressure, the end faces 29 of the blades will sealingly engage the annular side wall of the chamber 9 and so that the side faces 31 will sealingly engage the end walls of the housing 5. That is, the curvature of the blades, in both planes, previously pointed out, is eliminated or reduced so that the blades will properly engage the housing chamber walls, and fluid can no longer flow between the impeller and chamber walls. The construction of the blades, as previously pointed out, is such that when the blades are deflected into engagement with the chamber walls, sufficient stiffness or resistance is present in the blades to prevent them from moving out of engagement with the walls in the opposite direction from their original position. This results from the shape and manner in which the blade portions are interconnected so that portions of the impeller which include the sloping faces 24 act in tension and portions of the impeller which include the faces 23 act in compression to prevent the blades from moving beyond engagement with the walls of the chamber and thereby maintain the proper blade and wall engagement until the rotation of the impeller is decreased below a predetermined speed, or completely stopped.

Thus, when the rotation of the impeller begins, fluid flowing to the chamber through the inlet 13 may escape past the end and side faces of the impeller so that there will be a relatively light load on the driving motor during the start-up operation. However, as the speed of the impeller increases so that the impeller blades are subjected to greater centrifugal force and are subjected to more force from the fluid, the blades will move into sealing engagement with the walls of the housing and will thus circulate fluid from the inlet 13 to the outlet 15, in an exceptionally efficient manner, so that the pump will circulate the water at high speeds in the same manner as if the impeller were solid and were engaging the walls of the housing chamber at all times. It can thus be appreciated that the impeller of this invention will operate smoothly and efficiently and will not overload or tend to excessively wear the driving motor therefor, especially in the start-up stage of operation, which is the hardest on the driving motor.

What is claimed is:

1. A fluid pump including a housing having an annular chamber therein and a fluid inlet and an outlet, an impeller including a hub portion rotatably supported in said chamber and including a plurality of circumferentially spaced resilient blades extending outwardly from said hub portion and directed away from radial lines extending outwardly from the impeller axis of rotation, in the direction of rotation of said impeller, the outer ends of said blades being disposed in a cylindrical path, the radius of which is less than the radius of the pump chamber measured from the same center, the resiliency of said impeller blades being such that when the impeller is rotating at a predetermined speed and circulating fluid through the chamber, the blades will move toward said radial lines and into substantial sealing engagement with the walls of said housing chamber.

2. A fluid pump including a housing having an annular chamber therein and a fluid inlet and an outlet, an impeller including a hub portion rotatably supported in said chamber and including a plurality of circumferentially spaced resilient blades extending outwardly from said hub portion and directed away from radial lines extending outwardly from the impeller axis of rotation, in the direction of rotation of said impeller, the outer ends of said blades being disposed in a cylindrical path, the radius of which is less than the radius of the pump chamber measured from the same center, the resiliency of said impeller blades being such that when the impeller is rotating at a predetermined speed and circulating fluid through the chamber, the blades will move toward said radial lines and into substantial sealing engagement with the walls of said housing chamber, and means controlling the movement of said blades so as to prevent the end and side faces of the blades from moving out of engagement with the walls of the chamber until the rotation of the impeller diminishes below a predetermined speed.

3. A fluid pump including a housing having a chamber defined by an annular wall and substantially flat end walls, a fluid inlet and an outlet communicating with said chamber, an impeller including a hub portion rotatably supported in said chamber and including a plurality of circumferentially spaced resilient blades extending outwardly from said hub portion and directed away from radial lines extending outwardly from the impeller axis of rotation, in the direction of rotation of said impeller, the outer ends of said blades being disposed in a cylindrical path, the radius of which is less than the radius of the pump chamber measured from the same center, said blades being curved in a transverse plane relative to said end walls and being of a width less than the distance between said chamber end walls so as to provide a space between the blades and said end walls, said impeller blades being of such resiliency that when the impeller is rotating at a predetermined speed the blades will move into substantial sealing engagement with the annular wall and the end walls of the housing chamber so that the impeller will effectively move fluid from the inlet to the outlet.

4. A fluid pump including a housing having a chamber therein, an impeller rotatably supported in said chamber and including a plurality of spaced resilient blades adapted to sealingly engage the walls of the chamber, said blades extending toward the walls of said chamber along paths curved both radially and transversely and being of a length and width relative to the dimensions of the housing chamber such as not to engage the walls of said chamber, the resiliency

of said blades being such that the blades will be deflected from their curved paths toward straight elongated paths, and thus into sealing engagement with the walls of the chamber when the impeller is rotating at a predetermined speed and circulating fluid.

5. A fluid pump including a housing having an annular chamber therein and a fluid inlet and outlet, an impeller including a hub portion rotatably supported in said chamber and including a plurality of circumferentially spaced resilient blades extending outwardly from said hub portion and being radially curved, with the concave face thereof forming the front face of each blade relative to the direction of rotation of the impeller, the outer ends of said blades being disposed in a cylindrical path, the radius of which is less than the radius of the pump chamber, measured from the same center, the resiliency of said impeller blades being such that when the impeller is rotating at a predetermined speed and circulating fluid through the chamber the blades will move toward said radial lines and into substantial sealing engagement with the walls of said housing chamber.

6. A fluid pump including a housing having a chamber defined by an annular wall and substantially flat end walls, a fluid inlet and an outlet communicating with said chamber, an impeller including a hub portion rotatably supported in said chamber and including a plurality of circumferentially spaced resilient blades extending outwardly from said hub portion, said blades being radially curved, with the concave face thereof forming the front face of each blade relative to the direction of rotation of the impeller, the outer ends of said blades being disposed in a cylindrical path, the radius of which is less than the radius of the pump chamber, measured from the same center, said blades being also curved in a transverse plane relative to said end walls and being of a width less than the distance between said chamber end walls so as to provide a space between the blades and end walls, said impeller blades being of such resiliency that when the impeller is rotating at a predetermined speed the blades will move into substantial sealing engagement with the annular wall and the end walls of the housing chamber so that the impeller will effectively move fluid from the inlet to the outlet.

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