April 1, 1941. J. P. DAMONTE 2,236,706

PUMP

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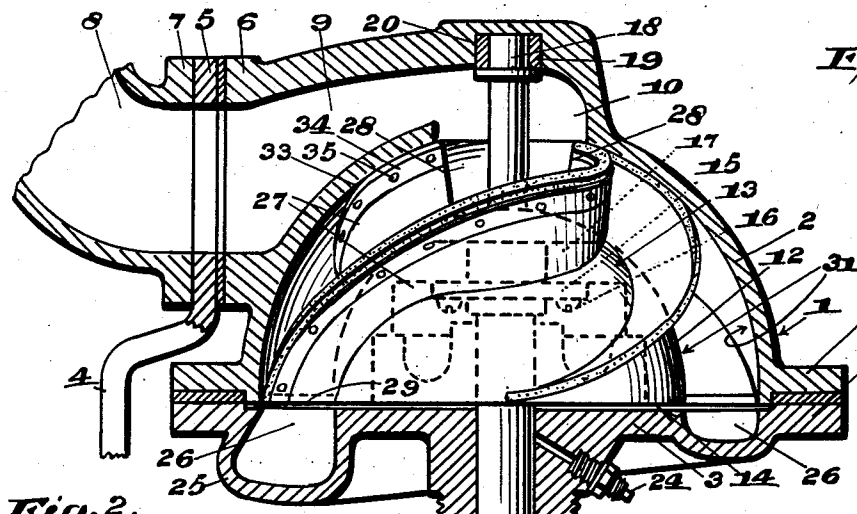


Fig. 1.

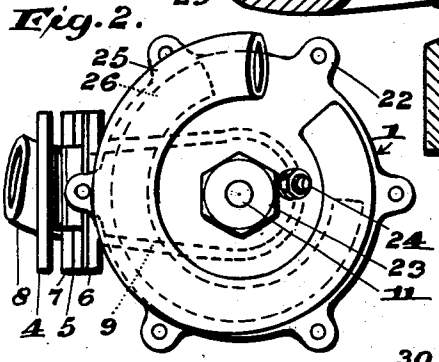


Fig. 2.

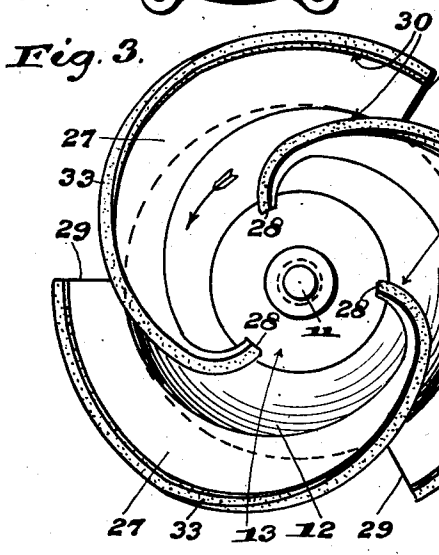


Fig. 3.

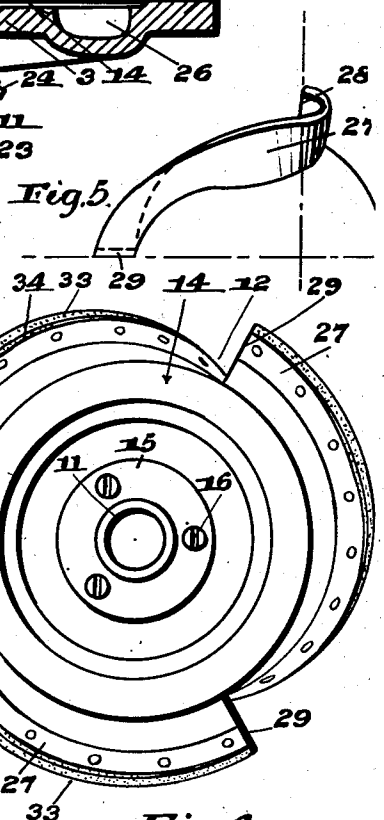


Fig. 5.

Fig. 4.

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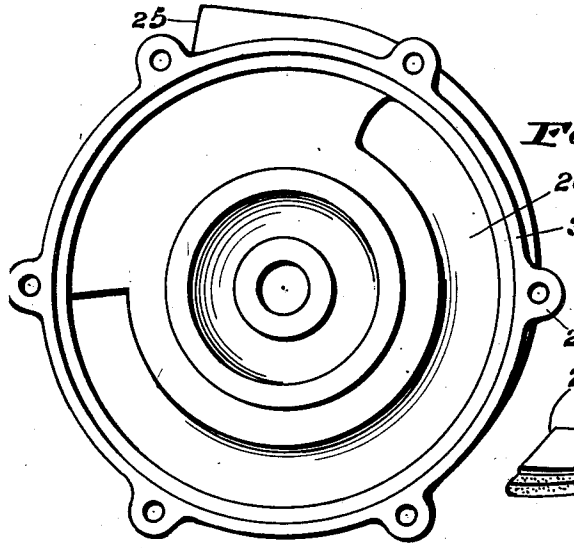


Fig. 6.

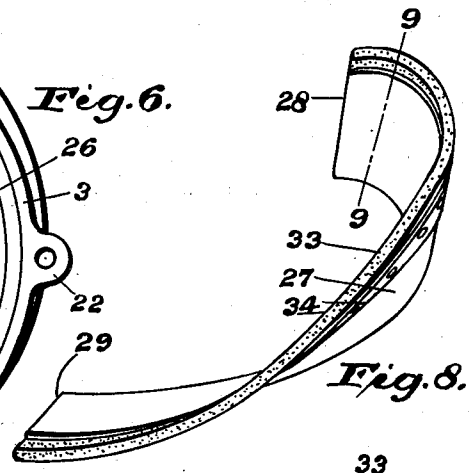


Fig. 8.

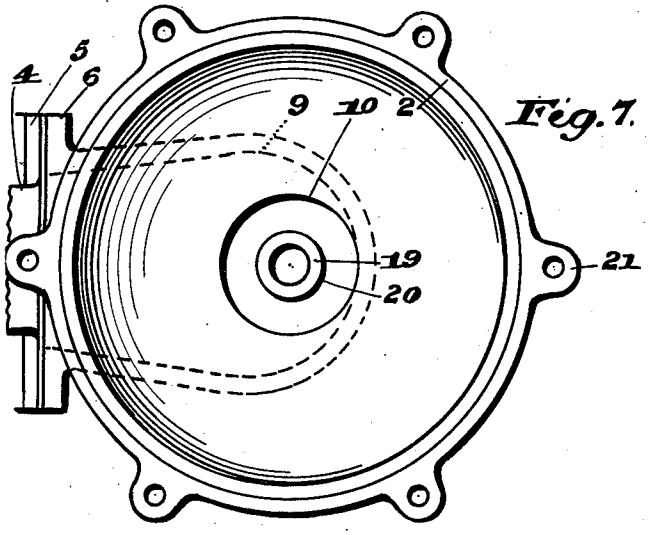


Fig. 7.

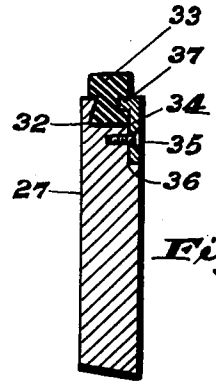


Fig. 9.

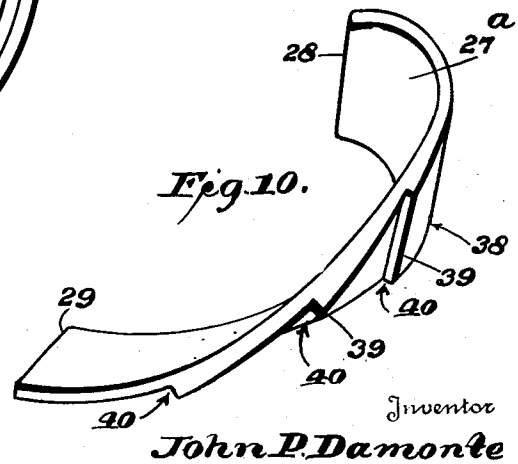


Fig. 10.

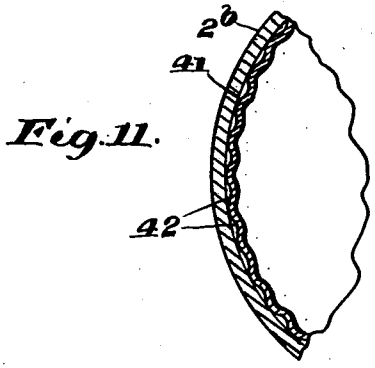


Fig. 11.

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UNITED STATES PATENT OFFICE

2,236,706

PUMP

John P. Damonte, New Orleans, La.

Application April 22, 1939, Serial No. 269,536

4 Claims. (Cl. 103—88)

This invention relates to improvements in pumps, particularly in the type sometimes known as a turbine pump. This particular pump is devised to meet rather widely varied conditions; in other words it is adapted to pump fluids of a gaseous nature and liquids which may or may not be clear of solid matter.

The pump is particularly advantageous when used under the last condition, mainly because of its having fairly widely spaced blades which together with the internal construction avoid the formation of close corners as well as pockets in which solid matter can lodge in the event that liquid is pumped having an accumulation of such matter therein. Regardless of the character of fluids to which the pump is adapted, it is the novel formation of the blades which is relied upon for an efficient performance. With this premise in mind the objects of the invention are as follows:

First, to provide a pump for fluids, either gaseous or liquid, an outstanding characteristic of which is the continuously varied pitch of the blades, the involute curve upon which each blade is constructed having the advantages of impelling the fluid with centrifugal force upon initial contact at the suction end so as to insure a copious influx of the fluid, then later acting on said fluid with a screw principle to add pressure thereto and thus to expel the fluid with considerable force.

Second, to provide a pump of the foregoing character wherein the discharge opening is located on the end of the casing, as distinguished from its customary location on the periphery of the casing, this arrangement being especially suited to the trailing edges of the blades.

Third, to provide a pump wherein each blade is the composite of an involute curve and a twist which develops at the leading edge and terminates at the trailing edge, the extent of the twist being substantially 90° so that the trailing edge stands at approximately 90° from the leading edge in its angular position, and spaced away from the leading edge the axial distance of the hemi-spherical rotor head of which it is a part.

Fourth, to provide a pump wherein the foregoing blade structure begins with a coarse pitch at its leading edge, enabling the utilization of the principle of centrifugal force, and ends with a fine pitch at its trailing edge, enabling the utilization of the screw principle.

Fifth, to provide a pump blade of the foregoing kind wherein the pressure face is either smooth, as is suitable for ordinary pumping, or is stepped to define a series of vacuum pockets for the purpose of insuring a greater suction factor than ordinarily possible.

Sixth, to provide a pump wherein the internal surface of the outer shell or cover may either be smooth or lined with corrugated rubber or other flexible material.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawings, in which:

Figure 1 is a horizontal section of the pump, particularly illustrating the improved rotor construction,

Figure 2 is an end view of the pump illustrating the novel arrangement of the discharge conduit,

Figure 3 is a front elevation of the rotor,

Figure 4 is a rear elevation of the rotor,

Figure 5 is a diagrammatic plan view of one of the blades, particularly illustrating the substantially 90° angular relationship between the leading and trailing edges,

Figure 6 is an elevation of the inside of the foundation plate, illustrating the reverse side of the discharge conduit in Fig. 2,

Figure 7 is an elevation of the inside of the outer shell,

Figure 8 is a detail perspective view of one of the blades, particularly illustrating the edge insert,

Figure 9 is a cross section taken on the line 9—9 of Figure 8,

Figure 10 is a perspective view of a modified form of blade, wherein the pressure face is stepped, and

Figure 11 is a detail sectional view of a portion of the stator wherein the interior is lined with corrugated flexible material.

The pump is generally designated 1, the outer shell 2 and foundation plate 3 of which constitute what is herein known as the stator or casing. The stator is mounted rigidly in any desired way, the particular mode of mounting being immaterial. One type of mount comprises a bracket 4 (Fig. 2) which in practice will have holes through which bolts can be driven into an adjacent solid support. This bracket includes an extension 5 which is secured between the flanges 6 and 7 respectively of the outer shell 2 and of the inlet pipe 8.

The direction to which the inlet pipe 8 extends off from the pump is also immaterial. If the bracket 4 were bolted down to a horizontal support, the inlet pipe 8 would extend off in a more or less horizontal direction to the source of fluid. The previously mentioned flange 6 comprises a

part of a passage 9 which is formed on the outside of the shell 2. The inner end of this passage terminates in a fluid inlet 10. This inlet is located axially of the pump. In other words, it is centered both in respect to the stator and the rotor.

Said rotor comprises a shaft 11 which carries a hemispherical head 12. The crown 13 comprises a rounded dome, and obviously so because of the hemispherical nature of the head. This dome confronts the fluid inlet 10 as plainly shown in Fig. 1, the free edge 14 confronting the previously mentioned foundation plate 3. The head 12 can be made a part of the shaft 11 in any one of a variety of ways. Usually it is not practicable to make the two parts integral, the preferred mode of manufactured being to provide the shaft with a flange 15 which is screwed at 16 into the hub 17 of the head 12.

The end 18 of the shaft (Fig. 1) is supported by a bearing 19 which occupies a recess in the wall of the passage 9. The opposite end of the shaft is adapted to be driven by a motor of any conventional type. The outer shell 2 and the foundation plate 3 are flanged at 21, 22, these flanges being in the nature of outstanding ears (Figs. 7 and 6) which have holes for securing bolts.

A fairly heavy bearing 23 (Fig. 1) completes the support of the shaft 11. This bearing is lubricated in any known way, for example, by means of the grease nipple 24. A discharge conduit 25 is made integral with the foundation plate 3 (Fig. 1). This conduit comprises part of the fluid outlet 26 (Fig. 6) which is almost three-fourths of a circle in extent.

It is noted in Fig. 1 that the discharge conduit 25 lies against or is an integral part of the end of the foundation plate 3. This is in contradistinction to the prevailing disposition of the discharge conduit on the periphery of the pump casing. The fluid outlet 26 and the conduit 25 are, virtually, the same part because of their being in direct connection. The conduit 25 is helical in nature, that is to say, if it were continued (Fig. 2) it would define a helix. This formation of the conduit causes the fluid outlet 26 to have a progressively increasing internal size.

This is readily observed in Fig. 1 wherein the outlet 26 is fairly shallow at the right and much deeper at the left. Although said outlet is of the progressively increasing size mentioned, it is, nevertheless, located solely in the plane of the plate 3. This is in strict accordance with the location of the conduit 25 on the end of the casing.

Particular attention is directed to the formation of the rotor blades. Inasmuch as these are all alike, the description of one will suffice for all. The blade 27 (Fig. 8) has an involute curvature. When viewing this blade from its leading edge 28 to its trailing edge 29 (Fig. 3), it is seen that the curvature is generated on a spiral order. But this curvature is not the generation of a given point in a common plane because it is obviously necessary to make the blade so that it will fit the rounded dome 13.

This makes it necessary to give the blade a twist on a spiral order so that it will fit the foregoing contour of the head. The extent of this twist is well shown in Figs. 1 and 5. These views illustrate the spacing of the trailing edge 29 from the leading edge 28 as amounting to the axial dimension of the head 12. In other words, the blade 27 starts with its leading edge 28 at the crown of the dome 13 and ends with its trailing edge flush with the free edge 14 of the head 12.

Thus the blade 27 has a composite involute curvature and twist. Besides providing a fit of the blade on the rounded dome of the head 12, this blade structure disposes the leading and trailing edges at substantially right angles to each other. The leading edge 28 coincides approximately with the fluid inlet 10 and is substantially parallel thereto. Said leading edge is also substantially parallel to the axis of the rotor. The advantage of this arrangement is that the leading portion of the blade exercises a definite centrifugal action on the fluid as the latter is drawn in at the inlet 10.

This centrifugal action drives the fluid back into the shell 2 toward the outlet 26, into which outlet the fluid is driven with considerable force due to the fact that the trailing portion of the blade is resolved into what closely resembles a screw pitch. This is readily seen in Fig. 1; the leading portion of the blade defines a very course pitch, driving the fluid with a centrifugal action, whereas the trailing portion of the blade defines a fine pitch, completing the driving of the fluid with a screw action.

Referring now to the collective blades (Fig. 3) it will be noted that the spacing 30 between the blades is fairly wide. The fluid is conducted through the pump on an internally streamlined order. The channel 31 (Fig. 1) comprising the distance between the confronting surfaces of the head 12 and shell 2 is equal in depth to the radial dimensions of the blades. The ample internal spacings thus afforded permit the use of the pump on liquids which are loaded with more or less solid matter, the virtual absence of sharp ends preventing the likelihood of internal clogging.

Attention is directed to Figs. 8 and 9. The rim of the blade 27 is rabbeted at 32 for the occupancy of an insert 33. The inside of the rabbet is desirably undercut. The insert may comprise any desired material, for example, a rubber strip. Regardless of the nature of the insert, the rabbet 32 is supplemented by a retainer 34 which is secured at 35 in a channel 36 on one side of the blade 27. This retainer has gripping means 37 which bites into the insert and coacts with the undercut in securely holding the insert in the rim of the blade.

The obvious purpose of the insert is to secure a tight engagement of the blade with the interior of the shell 2. While the insert 33 is intended to be used in most instances yet it is conceivable that the rim of the blade can be machined so carefully as to secure a tight working fit against the shell without an insert.

The convex side of the blade comprises the pressure face. It is this face which actually drives against the fluid in expelling it from the channel 31 into the outlet 26. In most instances the pressure face is smooth (Figs. 5 and 8) but in some instances an improved effect is derived from the arrangement in Fig. 10. Here the blade 27*a* has the previously mentioned pressure face 38 arranged in a series of steps 39. These steps define an equal series of vacuum pockets 40. These pockets, as their name implies, have a tendency to produce a partial vacuum as the blade sweeps across the channel 31. The use of the steps 39 is of particular advantage in the larger sizes of pumps wherein the creation of a greater suction is desirable.

In Fig. 11 the pump shell is designated 2b. The internal surface 41 is lined with a corrugated flexible material 42. Usually this material will comprise rubber, but it may comprise some other flexible substance. When the blades pass over the lining 42 they cause a compression of the corrugations of the surface and cause a positive displacement effect. This, in turn, creates a partial vacuum and adds considerably to the efficiency of the pump.

It has been found in practice that the advantage of having the blade traverse the corrugated surface as in Fig. 11, is that the expansion and contraction of the inward crests of the corrugations caused by the passage of the blades causes a very definite displacement effect which is more pronounced than in the instance wherein the blades traverse a smooth surface. The definitely constituted suction or vacuum derived from said increased displacement results in an increase in efficiency of the pump.

It is believed unnecessary to amplify the description with a statement of the operation of the pump, other than to say that when the rotor is driven in the proper direction (Fig. 3) a suction will be set up at the inlet 10, drawing in the fluid for displacement into the outlet 26. The pump is well adapted as a supercharger for internal combustion engines or as an air pump for ventilating and air conditioning systems. But when pumping air instead of liquids it would not be necessary to line the pump with corrugated material as in Fig. 11.

I claim:

1. A pump comprising a stator having a fluid inlet at one end in the axial center of said stator, and a fluid outlet at the other end of the stator and situated solely in a plane perpendicular to the stator axis, a rotor revolubly supported by the stator, having a hemi-spherical head confronting said inlet, and at least one blade of involute curvature carried by the rotor, said blade being twisted to fit the contour of the head on a spiral order, the composite involute curvature and twist providing a leading edge substantially parallel to the axis and a trailing edge substantially at right angles to said axis.

2. A pump comprising a stator having an outer shell of internal hemi-spherical shape, said shell having an inlet in the axial center of the hemisphere, and a foundation plate, carrying said outer shell and having a fluid outlet located solely in the plane of said plate and in perpendicularity to the stator axis, a rotor revolubly supported by the stator, having a hemi-spherical head matching and confronting the hemi-spheric shape of the shell and at least one blade carried by the rotor having a leading edge substantially parallel to the stator and rotor axes, said blade having an involute curvature and developing spirally to fit the hemi-spherical contour of said head, said blade also having a continuous twist adapting it to said head and terminating in a trailing edge standing at substantially 90° in angular position from the leading edge.

3. In a pump, a hemispherical shell having a fluid inlet, a revoluble rotor having a hemispherical head spaced from and matching the shell, a blade on the head being of involute curvature and of spiral shape to conform to the spherical form of the head, said blade having leading and trailing edges standing substantially at right angles to each other, said blade having a pressure face provided with a succession of steps defining a series of vacuum pockets.

4. In a pump, a stator shell, a rotor revoluble in respect to said shell and having a blade, the rim and an adjacent side of the blade having a rabbet and a channel respectively, an insert fitted in said rabbet to bear against the interior of the shell, and retainer means secured in the channel having gripping means biting into the material of the insert to hold the insert in place.

JOHN P. DAMONTE.