July 16, 1940. H. C. SKITCH 2,208,057

PUMP

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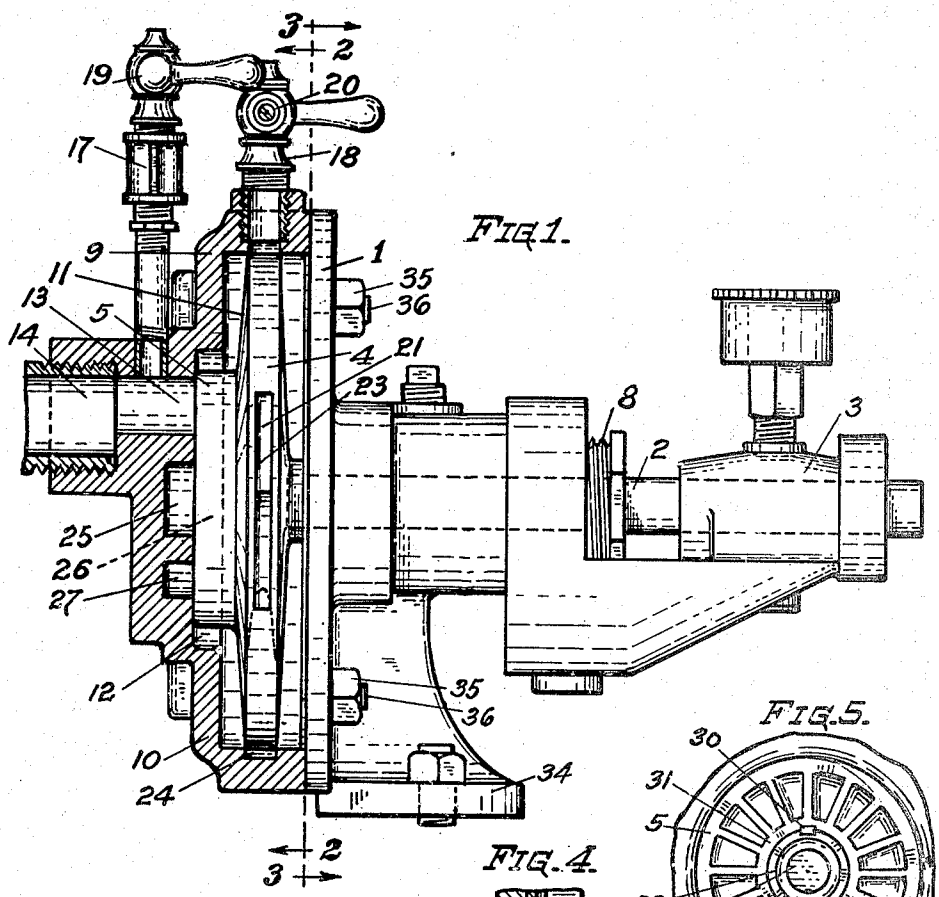


FIG. 1.

FIG. 5.

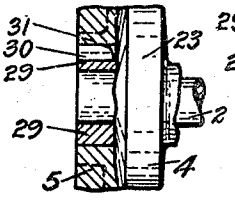


FIG. 4.

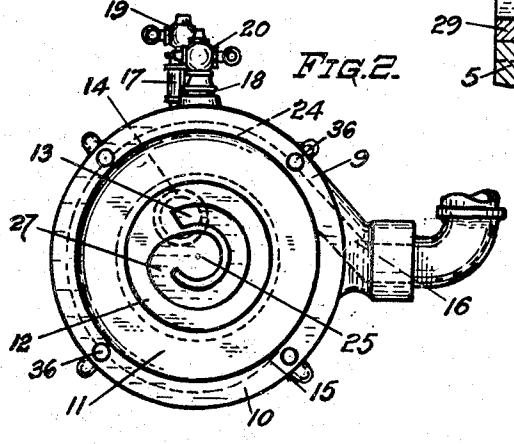


FIG. 2.

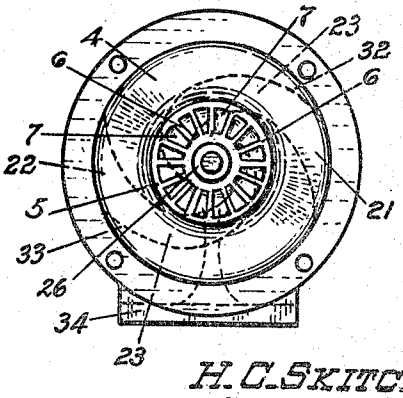


FIG. 3.

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PUMP

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2 Claims. (Cl. 103—5)

The present invention relates to the general type of pumps known as centrifugal pumps, in which an impeller is used to pump fluids, same being enclosed in a pump casing, and in which the operation depends on the revolution of the impeller to advance the fluid through the pump in the ordinary way common to such pumps.

It is known in the present art, that the efficiency of pumps of the above described type, can be increased by providing a means whereby a pressure-head above the normal is produced before the fluid enters the impeller of the pump, but in the present newly devised type of pumps, a specially new form of specific construction is used whereby the necessary increase in pressure-head is produced by taking advantage of the centrifugal action of a suction-propeller, in combination with a spiral-shaped recess in the pump casing, as will be more fully described hereinafter.

It is also found that in addition to increasing the pressure-head of the fluid by a specific means used in this invention, that the control of the flow of fluid is improved, so that an even flow of fluid passes at all times through the pump, which enables a pump of the kind in hand, to deliver regularly a comparatively small number of gallons per minute, or a large number as desired, regardless of the "capacity" for which the pump was originally designed. In other words, a pump designed to pump a large quantity of fluid per minute, can be used to deliver a much smaller quantity per minute if desired. This feature of the present invention is a distinct advantage in this art as is readily understood.

Another desirable feature of the present invention is that due to the strong pressure which is maintained in the pump by means of a suction-propeller, a spiral-shaped recess in the pump casing, and other associated parts, practically no entrapped air is permitted to remain in the fluid being pumped, and this feature tends to maintain a steady pressure-head, thereby permitting a steady flow of fluid, and a good control of said flow. This feature will also be further explained as the description proceeds herein.

In the present pump it is found that a reduced size of motor may be used to pump the same number of gallons per minute, by actual test, that a larger horse-power motor will pump, using other pumps of like rated capacity. That is to say for example, where a pump is designed to pump a certain number of gallons per minute, using the commonly known types of pump, and requires a one-third horse-power motor to operate the pump, with the present improved type of pump only a one-quarter horse-power motor will accomplish the same purpose. This feature has been shown by actual test to be true. The commercial advantage of the last-named feature is readily appreciated when attention is called to the great difference in cost of the larger horse-power motors, in comparison with that of the lesser sized motors. This feature alone makes the present invention one of importance in the art.

It is also seen that where the fluid enters the impeller of the pump, merely using a gravity supply, or where there is even a pressure-head in the fluid at this point, it is a great advantage to increase this pressure, and deliver fluid to the impeller inlet under a strong pressure-head as obtained in the present invention, thereby increasing the efficiency of the pump, as well as regulating the flow through the pump in order to control and regulate the operation of same.

The specific means used in the present invention to accomplish the end sought is particularly ingenious and novel, and the increase in cost of manufacture due to the use of said means is very small, and said specific construction will be more fully described below. In the description of the invention reference is made to the accompanying drawing, forming part of this specification, in which is shown a principal form of the invention, and a modification thereof.

In the drawing, Figure 1 is a side elevation, partly in section of the present invention.

Figure 2 is a vertical transverse section taken on line 2—2 of Figure 1, with the impeller of the pump removed for clearness of illustration.

Figure 3 is a transverse elevational view of the part of the device on the right of line 3—3 of Figure 1, with the impeller and suctional-propeller shown revolvably carried on the central shaft of the pump.

Figure 4 is a partial enlarged elevation, partly in section, of a portion of the impeller of the pump, illustrating a modified form of the suction-propeller used.

Figure 5 is a frontal view of the modified type of impeller and suction-propeller shown in Figure 4.

In the drawing, the numeral 1 indicates the part of the pump on the right side thereof, and to the right of the line 3—3 of Figure 1. In the part 1 is found the usual pump parts such as the shaft 2, the bearing 3, and the stuffing-box 8. An impeller 4, having a specially new part 5 called the suction-propeller thereon, is rigidly mounted on the shaft 2 of the device. The suction-pro-

peller 5 has therein a plurality of vanes 6, 6 which form a series of pockets therebetween 7, 7 which create a suction in the fluid being pumped, as will be explained further hereinafter as the specification proceeds. The suction-propeller 5 is preferably formed integral with the body of the impeller 4, but in some instances may be made separate therefrom, as illustrated in Figures 4 and 5 of the drawing.

The numeral 9 indicates the left hand side of the pump as seen in Figure 1, same being on the left of line 2—2 of said Figure 1, and contains the casing 10, which has several recesses therein, such as 11, designated the impeller recess, and which is of circular outline seen clearly in Figures 1 and 2; the recess 12, designated the suction-propeller recess, also of circular outline, and in which the end of the said propeller operates; and a centrally disposed spiral-shaped recess 27, which connects through the orifice or opening 13 with the fluid supply pipe 14. In addition to the above recesses in the casing, there is a circumferential groove or recess 24 in said casing, shown in Figures 1 and 2 clearly, and which begins at point 15 of Figure 2, and ends by communicating with the outlet pipe 16 as shown. This groove 24 it will be seen corresponds with the width of the impeller rim, and coacts with the opposed orifices 21 and 22 of the impeller 4. The pipes 17, 18 with their valves 19 and 20 respectively are vent pipes which provide a means of freeing the pump of entrapped air or other gases when the pump is started into operation, and thereafter said valves are usually closed.

The impeller 4 is of the usual type used for the purpose, comprising a hollow disc, with the usual openings 21, 22, and interior vanes 32, 33, for impelling the fluid being pumped in a centrifugal manner as is at once understood.

The central spiral-shaped recess 27 of the casing 10, communicates with the supply pipe 14 and terminates at point 25 where it communicates with the axial passage 26 which forms the inlet to the impeller 4 and leads to the interior cavity thereof.

The pump is also provided with a base portion 34, which carries the part 1, and provides a support for the whole device, as clearly illustrated in Figures 1 and 3 of the drawing.

The impeller is revolved by means of external power (not shown) which revolves the shaft 2, and when the impeller revolves it carries the suction propeller 5 with it. The nuts 35, 35 and the bolts 36, 36 secure the two parts of the device 1 and 9 to each other, as is at once understood.

The parts of the improved device, which are of especial note are the spiral-shaped recess 27 in the casing, and which is provided with a sharply inturned inner end as shown in Figure 2 of the drawing, and the suction-propeller 5 mounted on the impeller 4, containing the vanes 6, 6 and the suction pockets 7, 7. While the propeller 5 is preferably made integral with the body of the impeller 4, yet it may be found desirable to have the part 5 made demountable from the impeller, in which case the said part is made with an inner rim or collar 31, and the impeller made with an outstanding hub 29, such as is shown in Figures 4 and 5 of the drawing, and the part 5 is then secured on the hub, by means of a key 30 between the rim 31 and the hub 29 as shown.

Operation of the device in hand is as follows: When fluid is admitted through the supply pipe 14 same travels when the pump is operated through the opening 13 into the spiral-shaped recess 27 to point 25 due to the suction created by the pockets 7, 7 of the suction-propeller 5, which is connected with the recess 27, as is at once understood. The liquid having reached point 25 has received also by the revolution of the same in the spiral recess a centrifugal action, which is converted into a centripetal flow, due to the inward turning of the said groove or recess to the central point 25, and this inward centripetal flow accumulates at said point as increased pressure-head in the fluid, before it is discharged into the centrally disposed inlet passage 26 of the impeller 4.

It is seen from Figure 2, of the drawing, that the spiral-shaped recess 27, is of comparatively short circumferential length, so that the internal friction of the fluid created in the recess is very small, and that this is a factor which tends also to assist in the amount of pressure created in the fluid which accumulates at the central point 25 of the recess.

It will be noted that this pressure-head so created by the suction-propeller 5 as just described, is independent of any pressure head which was initially in the fluid as received from the supply pipe 14. The fluid with the increased pressure-head is next received by the impeller cavity 23, and receives the centrifugal motion due to the revolution of the impeller 4, and is discharged into the circumferential groove 24, through the action of the vanes of the impeller, and through the openings 21, 22 in the impeller periphery. From the groove or recess 24, the fluid is discharged through the outlet 16 in the usual manner common to centrifugal pumps.

It should be emphasized that the pressure-head which accumulates at point 25, of the spiral recess 27, is accomplished before the fluid enters the impeller 4, and accordingly assists in the positive transfer of fluid through the pump. In other words there is a positive beneficial pressure-head created by the action of the suction-propeller 5, in combination with the specific form of the spiral recess 27, even though there is a pressure head in the fluid which is obtained from the supply pipe 14, and independent of said initial pressure-head.

A practical illustration of the effects of the increased pressure-head created by the suction propeller is seen in the fact that a smaller horse-power motor can be used to deliver an equal supply of fluid from the outlet pipe 16, of any "capacity" of pump selected. This shows an increased efficiency in the operation of the pump. Another effect is that probably due to the various parts of the pump being kept full of fluid at all times, all air is excluded from the fluid, and this results in an operative control of the fluid being pumped, as well as a smoother and steady action of the pump, as it is evident that when air is entrapped in the fluid, the pump suction is thereby destroyed, and results in a jerky, uncertain revolution of the impeller. This also explains why a large capacity pump using the present invention, due to its smoother operation, can be used to pump a comparatively small quantity of fluid, on the same principle that a smoothly operating internal combustion engine may be made to workably operate on a comparatively small quantity of fuel, due to the perfect operation of its various parts.

From the above, it is seen that both the efficiency and the operation of the pump are greatly

improved by the use of the present invention. Added to the above is the advantage of being able to use a smaller and less expensive motor to drive a larger capacity pump as explained above in this specification, and the fact that the increased cost to manufacture the improved pump is comparatively small in comparison to the advantages gained; from which it is seen that I have produced a very desirable type of pump, which is serviceable in the art to which it appertains.

Some of the advantages of the present type of pump may be briefly stated as follows: Fluid enters the charging orifice of the impeller under positive pressure, thereby increasing the efficiency of the pump; the spiral-shaped recess in the pump casing induces a rotative velocity in the fluid being charged into the impeller, which increases the efficiency of the pump, by reducing charging shock in the impeller, at the point where the fluid enters the blades of the impeller; the present pump is non-over-loading in its operation, since the power required to drive the pump is kept uniform when operating under low as well as high pressure-heads, due to the regulation of flow which obtains by the use of the spiral-shaped recess, and consequent pressure maintained in the fluid as it is charged into the impeller of the pump; the improved pump in hand has less tendency to "air-bind" than the usual centrifugal pumps. As there is always a positive pressure-head in the spiral-shaped recess there is positively no separation of air and fluid, and no air-pockets form in the fluid being charged into the impeller of the pump. Moreover any air in the impeller cannot collect and remain at the charging orifice of the impeller, as the positive pressure in the fluid forces any air as well as the fluid into the blades of the impeller; leakage of fluid from the impeller chamber of the device backward into the suction-parts of the device, such as the pockets of the suction-propeller is prevented due to the positive pressure-head which is maintained in the spiral-shaped recess at all times, and this offers a strong resistance to such leakage. This prevention of leakage insures always a proper operation of the suction which is necessary to the successful operation of the pump; limitations of foundry practice make it difficult to cast the narrow internal passages of many impellers in common use, whereas wider and more easily formed passages may be used with the present type of pump, due to the fluid regulating action of the spiral-shaped recess; certain existing types of pumps are designed for the use of high fluid velocities for efficiency and operating purposes. This necessitates the use of contracted waterways with consequent tendency to clogging in the various parts of the device; the present pump can be adapted to the use of comparatively low fluid velocities, and it is unnecessary to make any passage such as for instance the charging orifice of the impeller less than the peripheral discharge orifices of the impeller in order to operate the pump satisfactorily, as is often the case with other types of pumps in common use.

I claim:

1. A part for a pump casing having a fluid inlet therein, an impeller recess, and a suction-propeller recess formed in the casing, a spiral-shaped recess of comparatively short circumferential length in the casing, and connected at its outer end with the fluid inlet, and a sharply-inturned inner end on the spiral-shaped recess, adjacent to the center of the casing, and in the same plane as said recess.

2. In a fluid pressure-feed device, for a pump having a propeller, and an impeller with a centrally disposed intake orifice therein, a casing with a suction-propeller recess therein, a short spiral-shaped recess of less than one revolution in spiral length, formed in the casing, a fluid inlet in the casing located at the outer periphery of the propeller recess, and connected with the outer end of the spiral-shaped recess thereat, a sharply-inturned inner end on the spiral-shaped recess, in the same plane therewith, and connected with the impeller intake orifice, and a plurality of suctional pockets formed in the propeller, each of which is in close suctional contact with the fluid in the spiral-shaped recess from the point of intake of said fluid, to its point of delivery at the inturned inner end of the recess, adjacent to the impeller intake orifice.

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