April 1, 1941. E. H. WHITE 2,236,660

PUMP

Filed Nov. 5, 1938

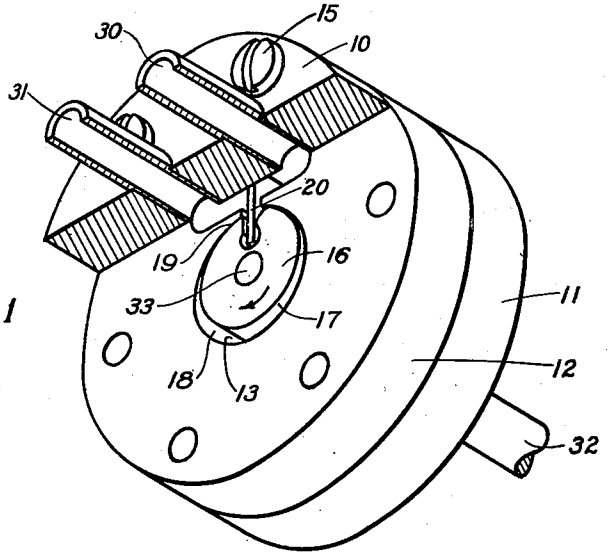


FIG. 1

FIG. 2

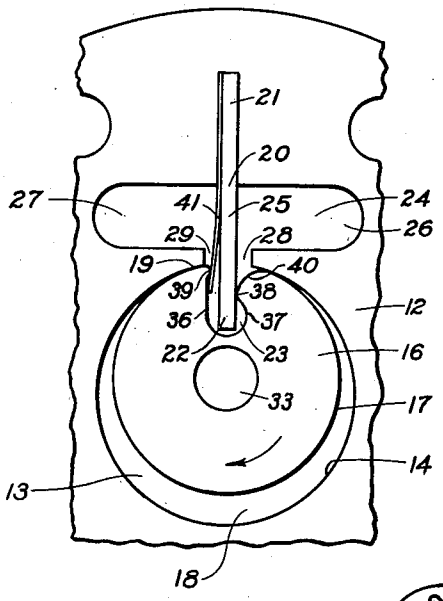
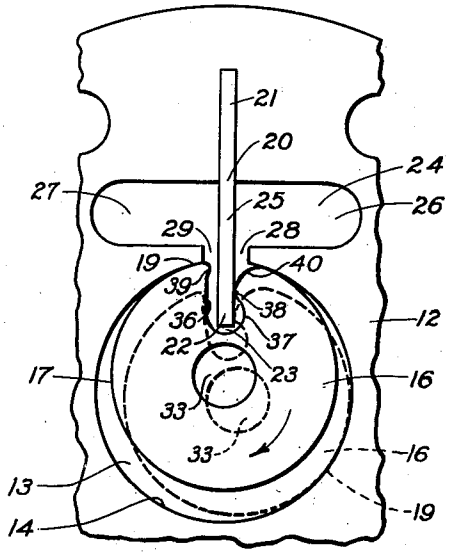


FIG. 3



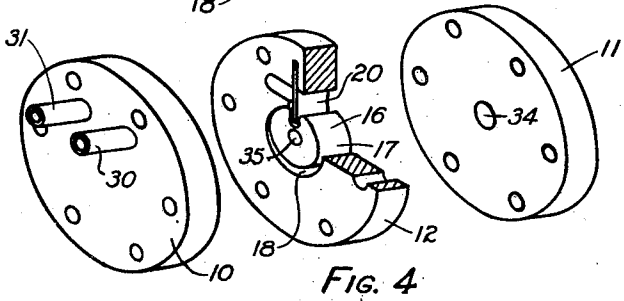


FIG. 4

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PUMP

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4 Claims. (Cl. 103—131)

This invention relates to a pump having the general characteristics of a rotary pump, or, more simply, the invention has relation to a rotary type pump.

A class or style of rotary type pump heretofore of commerce is constituted as a casing providing a cylindrical pump chamber, a cylindrical impeller eccentrically situated within said pump chamber with its external cylindrical wall engaging the internal cylindrical wall of the pump chamber, said external cylindrical wall of the impeller having diameter smaller than that of said internal cylindrical wall of the pump chamber and the impeller and the pump chamber together providing a cavity of generally crescent shape at the side of the impeller and pump chamber opposite the point or location of engagement between said impeller and pump chamber wall, an abutment associated with the impeller and the pump casing to the purpose of separating the high pressure side, so-called, and the low pressure side, so-called, of the pump from each other, and means for causing the circumferentially smaller external cylindrical wall of the impeller to be rolled, slid or frictionally moved progressively over the circumferentially larger internal cylindrical wall of the pump chamber in response to the accomplishment of rotative movement of the axis for the cylindrical wall of the impeller, thus to accomplish the pumping operation. When a rotary type pump as briefly described is operating, the impeller and the cavity of generally crescent shape are made to progress, as said axis for the cylindrical wall of said impeller is made to rotate, so that all portions of said crescent shape cavity diminish in size concurrently with movement of said portions from the low pressure side toward the high pressure side of the pump and increase in size concurrently with movement of said portions from the high pressure side toward the low pressure side of said pump. The abutment divides the crescent shape cavity into what is, in effect, a low pressure and a high pressure area or section, said low pressure area or section of said crescent shape cavity being the portion thereof at any time situated at the low pressure side of the pump and of the abutment to the rear of the point or location of engagement between the cylindrical wall of the impeller and the cylindrical wall of the pump chamber and said high pressure area or section of the crescent shape cavity being the portion thereof at any time situated at the high pressure side of said pump and of said abutment in advance of said point or location of engagement between said cylindrical wall of said impeller and said cylindrical wall of said pump chamber. During each revolution of the axis of the impeller, suction created by an increasing space of the low pressure area or section of the crescent shape cavity, at the low pressure side of the pump and of the abutment and in the rear of the point or location of engagement of the impeller with the wall of the pump chamber, causes fluid to enter the pump chamber at said low side of the pump and of the abutment and to pass into said low pressure area or section of said crescent shape cavity, and pressure created by a decreasing space of the high pressure area or section of the crescent shape cavity, at the high pressure side of the pump and of the abutment and in advance of said point or location of engagement of said impeller with said wall of said pump chamber, causes fluid to be compressed out of or removed from said crescent shape cavity and from said pump chamber at the high pressure side of said pump and of said abutment.

An object of the invention is to provide a rotary type pump of the general character as hereinbefore outlined which will be of novel and improved construction.

A further object is to provide a rotary type pump wherein will be incorporated various improved features of construction novel both as individual entities of the pump and in combination with each other.

A further object is to provide a rotary type pump which will include a novel and improved construction and arrangement for separating or shutting-off the high pressure side from the low pressure side of said pump.

A further object is to provide a rotary type pump which will include elements of the nature of those of the pump hereinbefore briefly described and operative in the general manner as set forth, and wherein the impeller of said pump and the abutment thereof associated with said impeller and with the pump casing will be of structure and will be related to each other and to said pump casing to produce a construction and arrangement dependent in its operation upon differential in pressure between the high pressure side and the low pressure side of the pump to the accomplishment or provision of an effective separation or shut-off between the high pressure side and the low pressure side of said pump.

A further object is to provide a rotary type pump which will include elements of the nature of those of the pump hereinbefore briefly de-

scribed and operative in the general manner as set forth, and wherein the impeller of said pump and the abutment thereof associated with said impeller and with the pump casing will be of structure and will be related to each other and to said pump casing to produce a construction and arrangement dependent in its operation upon retardation of the movement of the impeller due to friction between the external cylindrical wall of said impeller and the internal cylindrical wall of said pump chamber as the impeller is caused to roll, slide or move over the pump chamber wall to the accomplishment or provision of an effective separation or shut-off between the high pressure side and the low pressure side of said pump.

And a further object is to provide a rotary type pump which will include elements of the nature of those of the pump hereinbefore briefly described and operative in the general manner as set forth, and wherein the impeller of said pump and the abutment thereof associated with said impeller and with the pump casing will be of structure and will be related to each other and to said pump casing to produce a construction and arrangement dependent in its operation both upon differential in pressure between the high pressure side and the low pressure side of the pump and upon retardation of movement of the impeller due to friction between the external cylindrical wall of said impeller and the internal cylindrical wall of said pump chamber as the impeller is caused to roll, slide or move over the pump chamber wall to the accomplishment or provision of an effective separation or shut-off between the high pressure side and the low pressure side of said pump.

With the above objects in view, as well as others which will appear as the specification proceeds, the invention comprises the construction, arrangement and combination of parts as now to be fully described and as hereinafter to be specifically claimed, it being understood that the disclosure herein is merely illustrative and intended in no way in a limiting sense, changes in details of construction and arrangement of parts being permissible so long as within the spirit of the invention and the scope of the claims which follow.

In the accompanying drawing forming a part of this specification,

Fig. 1 is a perspective view, partially in section, of a rotary type pump wherein the features and characteristics of the invention are incorporated;

Fig. 2 is an enlarged plan view of the pump of Fig. 1, the upper closure member of the pump casing being removed and parts being broken away;

Fig. 3 is a view corresponding generally with the disclosure as in Fig. 2, but showing a rotary type pump of slightly modified construction; and

Fig. 4 is a view disclosing the several elements of the rotary type pump of Fig. 1 in disassembled relation, each of said elements being disclosed in perspective and on a reduced scale.

With respect to the drawing and the numerals of reference thereon, the casing of the novel and improved rotary type pump may consist of an upper closure member 10, a lower closure member 11, and an intermediate casing member 12. The intermediate casing member 12 is hollowed out or cut away to produce a pump chamber 13 defined or bounded as to its circumference by an internal cylindrical wall 14 which said casing member 12 provides and defined or bounded as to its depth by the adjacent surfaces of the upper closure member 10 and the lower closure member 11. Each of said members 10, 11 and 12 is of disc shape and includes upper and lower parallel flat surfaces which are perpendicular to the axis of the member, and all of said members are adapted to be secured together, in any suitable and convenient manner, as by bolts 15, in superimposed relation to each other so that the lower surface of the upper closure member 10 and the upper surface of the lower closure member 11 lie contiguous with the upper and lower ends, respectively, of said internal cylindrical wall 14.

A cylindrical impeller 16 is eccentrically situated within the pump chamber 13 with its external cylindrical wall 17 in engagement with the internal cylindrical wall 14 of said pump chamber. The external cylindrical wall of the impeller has diameter less than that of the internal cylindrical wall of the pump chamber, and said impeller and said pump chamber together provide a crescent shape cavity 18 at the side of the impeller and pump chamber opposite the point or location 19 of engagement between the external cylindrical wall 17 of said impeller and the internal cylindrical wall 14 of said pump chamber. The impeller 16 has dimension in direction axially thereof equal to the depth of the pump chamber 13, and the opposite end walls of said impeller are flat, are parallel with each other, and lie in contiguous slidable relation to the end walls of said pump chamber. Evidently, the crescent shape cavity 18 has depth equal to the width or thickness of the impeller, as well as equal to the depth of the pump chamber.

An abutment 20 is associated with the impeller 16 and with the member 12 of the pump casing to the purpose of separating or shutting-off the high pressure side of the pump, at the left side of the abutment in the disclosure as made, from the low pressure side of said pump, at the right side of said abutment in said disclosure. Said abutment 20 is constituted as a rectilinear strip of desirably rigid material. The outer end portion 21 of the abutment or strip 20 is fixedly secured in the casing member 12 and the inner end portion 22 of said abutment or strip is arranged, more or less freely, in a radially disposed slot or groove 23 at the circumference of the impeller 16 and extending the full width or thickness of said impeller perpendicularly thereto. The rectilinear strip which constitutes the abutment 20 has width equal to the thickness of the member 12, as well as equal to the depth of the pump chamber 13, and the upper and lower edges of said abutment or strip 20 terminate flush with the upper and lower surfaces, respectively, of said casing member 12 and said impeller 16. In the direction of its length the abutment or strip 20 is disposed radially of the pump chamber 13, and in the direction of its width said abutment or strip is disposed perpendicularly to the casing members 12 and the impeller 16.

Said casing member 12 includes a well 24 at the side of the pump chamber adjacent the abutment 20, and an intermediate portion 25 of the abutment extends across or through said well. The abutment divides the well 24 into an inlet chamber 26 at the low pressure side of the pump, at the right side of said abutment as disclosed, and on outlet chamber 27 at the high pressure side of said pump, at the left side of said abutment. The inlet chamber 26 communicates with the

pump chamber 13 through an elongated passageway 28 at said low pressure side of the pump and directly adjacent the abutment, and said pump chamber communicates with the outlet chamber 27 through an elongated passageway 29 at said high pressure side of said pump and directly adjacent said abutment. A pipe connection 30 for fluid to be pumped leads into the inlet chamber 26, and a pipe connection 31 for pumped fluid leads away from the outlet chamber 27.

The pump includes means for causing the cylindrical wall 17 of the impeller 16 to be rolled, slid or frictionally moved progressively over the cylindrical wall 14 of the pump chamber 13. A shaft 32, adapted to be driven in any suitable manner, has thereon a crank or eccentric 33 adapted to the purpose of accomplishing rotative movement of the axis for the impeller 16 and its cylindrical wall 17. The shaft 32 is rotatably mounted in a centrally arranged opening 34 through the lower closure wall 11, and the crank or eccentric 33 is rotatably mounted in a centrally arranged opening 35 through the impeller 16. Rotation of the shaft 32 causes the crank or eccentric 33 to revolve and thus accomplish rotative movement or movement in a circle of the axis for the impeller 16 and its external cylindrical wall 17 in the direction of the arrows as in Figs. 2 and 3. Such movement of the impeller axis causes said impeller to be moved in direction toward and away from the abutment 20 so that the inner end portion 22 of said abutment becomes situated at variable depths in the slot or groove 23 as said axis for the impeller is rotated or moved in a circle. But the construction and arrangement is such that said abutment is never removed from said slot or groove. Rotative movement of the axis for the impeller also causes the external cylindrical wall 17 of said impeller to be rolled, slid or frictionally moved or advanced over the internal cylindrical wall 14 of the pump chamber, thus to accomplish the pumping operation. As the pump operates, the crescent shape cavity decreases in size as it is moved in direction from the low pressure side toward the high pressure side of the abutment and increases in size as it is moved from the high pressure side toward the low pressure side of said abutment. During each revolution of the impeller axis, suction is created in the crescent shape cavity at the low pressure side of the pump, due to increasing space of the low pressure area or section of said crescent shape cavity, to cause fluid to enter the crescent shape cavity from the inlet chamber 26, and pressure is created in said crescent shape cavity at the high pressure side of the pump, due to decreasing space of the high pressure area or section of the crescent shape cavity, to cause fluid to be compressed out of said crescent shape cavity and delivered to the outlet chamber 27.

The slot or groove 23 is constructed to provide a side wall 36 thereof at the side of the abutment 20 adjacent the pump outlet which will have larger surface area than does a side wall 37 of said slot or groove at the side of said abutment adjacent the pump inlet, no matter what may be the relative positions of the abutment 20 and the slot or groove 23 during operation of the pump. In the disclosure as made, the side wall 37 includes an elongated rib 38 which is well within the perimeter of the cylindrical impeller 16, is parallel with the abutment and extends toward said abutment, while the side wall 36 includes a similar elongated rib 39, but disposed at the perimeter of said cylindrical impeller. The side wall 37 is cut back, as indicated at 40, at the outer side of the elongated rib 38. The construction and arrangement is such that pressure of the high pressure side of the pump will be applied against an area of the side wall 36 of the slot or groove 23 at the adjacent side of the abutment which is of greater magnitude than is the area of the side wall 37 against which said pressure is applied at the opposite side of said abutment. Stated differently, the elongated rib 38 constantly will be held in pressing engagement with or against the abutment 20 at the low pressure side of said abutment and of the pump, as disclosed in the drawing, by reason of the fact that pressure at the high pressure side of said pump is exerted over a larger surface area of the side wall 36 than of the portion of the side wall 37 which is between the base of the slot or groove 23 and said elongated rib 38. The cut-back portion 40 of the side wall 37 will be subjected only to low pressure at the low pressure side of the abutment and of the pump. Thus, differential in pressure between the high pressure side and the low pressure side of the pump is operative to the accomplishment of an effective separation or shut-off between said high pressure side and said low pressure side of said pump, said separation or shut-off of course being provided by the abutment 20 in cooperation with the elongated closure element or rib 38 retained in pressing engagement with or against said abutment under pressure of fluid at the high pressure side of the pump in excess of the pressure of fluid at the low pressure side of said pump.

It will be apparent that as the external cylindrical wall 17 of the impeller 16 is caused to roll, slide or frictionally move or advance over the internal cylindrical wall 14 of the pump chamber 13, there will be retardation of the forward movement of said external cylindrical wall of said impeller due to the fact that the cylindrical wall of the impeller has circumference less than that of the cylindrical wall of the pump chamber. Such retardation of movement of said impeller will cause the closure element or elongated rib 38 of the impeller constantly to pressingly engage the low pressure side of the abutment to accomplish effective separation or shut-off between the high pressure side and the low pressure side of the pump. In fact, save for the abutment itself and the engagement of the closure element 38 of the impeller 16 therewith, said impeller would rotate in direction opposite that in which bodily moved during the operation of the pump. This for the reason that the frictional movement or advancement of the smaller external cylindrical surface of the impeller over the larger internal cylindrical surface of the pump chamber exerts a force upon said impeller which tends to rotate it on the crank or eccentric 33 in direction counter to that in which the impeller is moved. The engagement between the abutment 20 and the closure element 38 of the impeller resists the tendency of said impeller to rotate in direction opposite that in which it is forced to travel bodily, and the frictional force exerted against the impeller tending to rotate it in reverse direction is the measure of the pressure under which the separation or shut-off between the high pressure side and the low pressure side of the pump is accomplished.

In the disclosure of Figs. 1, 2 and 4 a spring arm 41 is secured to the abutment 20 at the

high pressure side thereof and is engaged with the side wall **36** of the slot or groove **23** in such manner as to cause the closure element or elongated rib **38** upon the side wall **37** of said slot or groove to be resiliently urged into pressing engagement with said abutment at the low pressure side thereof. Said spring arm **41** is omitted from the disclosure of Fig. 3.

It will of course be understood that each construction and arrangement as hereinbefore described for accomplishing or providing separation or shut-off between the high pressure side and the low pressure side of a rotary type pump of the nature as set forth is operative in and of itself to the production of its intended service, although all or several of the constructions and arrangements can be incorporated and made to be operable in a single pump.

What is claimed is:

1. A rotary type pump comprising a casing providing a pump chamber including an internal cylindrical wall, an impeller eccentrically situated within the pump chamber and including an external cylindrical wall in proximity to said internal cylindrical wall of said pump chamber, the external cylindrical wall of said impeller having diameter smaller than that of the internal cylindrical wall of said pump chamber and said external cylindrical wall of the impeller and said internal cylindrical wall of the pump chamber together providing a crescent shape cavity at the side of said impeller and said pump chamber opposite the location of proximity between the external cylindrical wall of said impeller and the internal cylindrical wall of said pump chamber, an abutment stationarily supported by the pump casing and slidably associated with the impeller to separate the high pressure side from the low pressure side of said pump fluid inlet and outlet ports for said casing on opposite sides of said abutment, said abutment in cooperation with said impeller and pump casing being so constructed and arranged that fluid pressure at the high pressure side of the pump acts between the abutment and the impeller so as to urge the impeller into contact with the abutment on the low pressure side thereof to provide a positive shut-off between said high pressure side and said low pressure side of the pump dependent in its operation upon differential in fluid pressure between the high pressure side and the low pressure side of said pump, and means for moving said impeller in directions longitudinally and transversely of said abutment and for simultaneously advancing said external cylindrical wall of the impeller progressively over said internal cylindrical wall of the pump chamber to cause said crescent shape cavity to progress in direction causing all portions thereof to increase in size with movement of said portions from the high pressure side toward the low pressure side of the pump and to decrease in size with movement of said portions from the low pressure side toward the high pressure side of said pump.

2. A rotary type pump comprising a casing providing a pump chamber including an internal cylindrical wall, an impeller eccentrically situated within the pump chamber and including an external cylindrical wall in proximity to said internal cylindrical wall of said pump chamber, the external cylindrical wall of said impeller having diameter smaller than that of the internal cylindrical wall of said pump chamber and said external cylindrical wall of the impeller and said internal cylindrical wall of the pump chamber together providing a crescent shape cavity at the side of said impeller and said pump chamber opposite the location of proximity between the external cylindrical wall of said impeller and the internal cylindrical wall of said pump chamber, an abutment having its outer end portion fixed in the pump casing and its inner end portion disposed in a circumferentially arranged slot in the impeller to separate the high pressure side from the low pressure side of said pump fluid inlet and outlet ports for the pump chamber on opposite sides of said abutment, the impeller being adapted to have movement longitudinally and transversely relatively to the abutment, said circumferentially arranged slot including a wall thereof adjacent the low pressure side of the pump and a wall thereof adjacent the high pressure side of said pump having surface area greater than that of the first mentioned slot wall, and said abutment in cooperation with said impeller and pump casing being adapted to provide a positive shut-off between said high pressure side and said low pressure side of the pump constituted by engagement under pressure between said abutment and the wall of said slot adjacent said low pressure side of the pump and dependent in its operation upon differential in fluid pressure between the high pressure side and the low pressure side of said pump, means transmitting fluid pressure from the high pressure side of the pump to the wall of the impeller slot which is adjacent the high pressure side of the pump, and means for moving said impeller in directions longitudinally and transversely of said abutment and for simultaneously advancing said external cylindrical wall of the impeller progressively over said internal cylindrical wall of the pump chamber to cause said crescent shape cavity to progress in direction causing all portions thereof to increase in size with movement of said portions from the high pressure side toward the low pressure side of the pump and to decrease in size with movement of said portions from the low pressure side toward the high pressure side of said pump.

3. A rotary type pump comprising a casing providing a pump chamber including an internal curved wall, an impeller eccentrically situated within the pump chamber and including an external curved wall adapted to be in proximity to said internal curved wall of said pump chamber, the external curved wall of said impeller having diameter smaller than that of the internal curved wall of said pump chamber and said external curved wall of the impeller and said internal curved wall of the pump chamber being adapted to together provide an approximately crescent shape cavity at a side of said impeller and said pump chamber opposite a location of proximity between the external curved wall of said impeller and the internal curved wall of said pump chamber, an abutment having its outer end portion situated in the pump casing and its inner end portion disposed in a circumferentially arranged slot in the impeller to separate the high pressure side from the low pressure side of said pump fluid inlet and outlet ports for the pump chamber on opposite sides of said abutment, the impeller being adapted to have movement longitudinally and transversely relatively to the abutment, said circumferentially arranged slot including a wall thereof adjacent the low pressure side of the pump and a wall thereof adjacent the high pressure side of said pump having surface

area greater than that of the first mentioned slot wall, means transmitting fluid pressure from the high pressure side of the pump to the wall of the impeller slot which is adjacent the high pressure side of the pump and said abutment in cooperation with said impeller and pump casing being adapted to provide a positive shut-off between said high pressure side and said low pressure side of the pump constituted by engagement under pressure between said abutment and the wall of said slot adjacent said low pressure side of the pump and dependent in its operation upon differential in fluid pressure between the high pressure side and the low pressure side of said pump, the pressure at the high pressure side of said pump operative toward providing said positive shut-off being dependent in its value upon the magnitude of the surface area of the wall of said slot adjacent said high pressure side of said pump as this is greater than the magnitude of the surface area of the wall of said slot adjacent the low pressure side of said pump, and means for moving said impeller in directions longitudinally and transversely of said abutment and for simultaneously advancing said external curved wall of the impeller progressively over said internal curved wall of the pump chamber to cause said approximately crescent shape cavity to progress in direction causing all portions thereof to increase in size with movement of said portions from the high pressure side toward the low pressure side of the pump and to decrease in size with movement of said portions from the low pressure side toward the high pressure side of said pump.

4. A rotary type pump comprising a casing providing a pump chamber including an internal curved wall, an impeller eccentrically situated within the pump chamber and including an external curved wall in proximity to said internal curved wall of said pump chamber, the external curved wall of said impeller having diameter smaller than that of the internal curved wall of said pump chamber and said external curved wall of the impeller and said internal curved wall of the pump chamber together providing a crescent shape cavity at the side of said impeller and said pump chamber opposite the location of proximity between the external curved wall of said impeller and the internal curved wall of said pump chamber, an abutment stationarily supported by the pump casing and slidably associated with the impeller to separate the high pressure side from the low pressure side of said pump, fluid inlet and outlet ports for said casing on opposite sides of said abutment, said abutment in cooperation with said impeller and pump casing being so constructed and arranged that fluid pressure at the high pressure side of the pump acts between the abutment and the impeller so as to urge the impeller into contact with the abutment on the low pressure side thereof to provide a positive shut-off between said high pressure side and said low pressure side of the pump dependent in its operation upon differential in fluid pressure between the high pressure side and the low pressure side of said pump, and means for moving said impeller in directions longitudinally and transversely of said abutment and for simultaneously advancing said external curved wall of the impeller progressively over said internal curved wall of the pump chamber to cause said crescent shape cavity to progress in direction causing all portions thereof to increase in size with movement of said portions from the high pressure side toward the low pressure side of the pump and to decrease in size with movement of said portions from the low pressure side toward the high pressure side of said pump.

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