April 16, 1935. A. HOLLANDER 1,997,824

FLUID PUMP

Filed June 6, 1933 3 Sheets-Sheet 1

Fig. 1

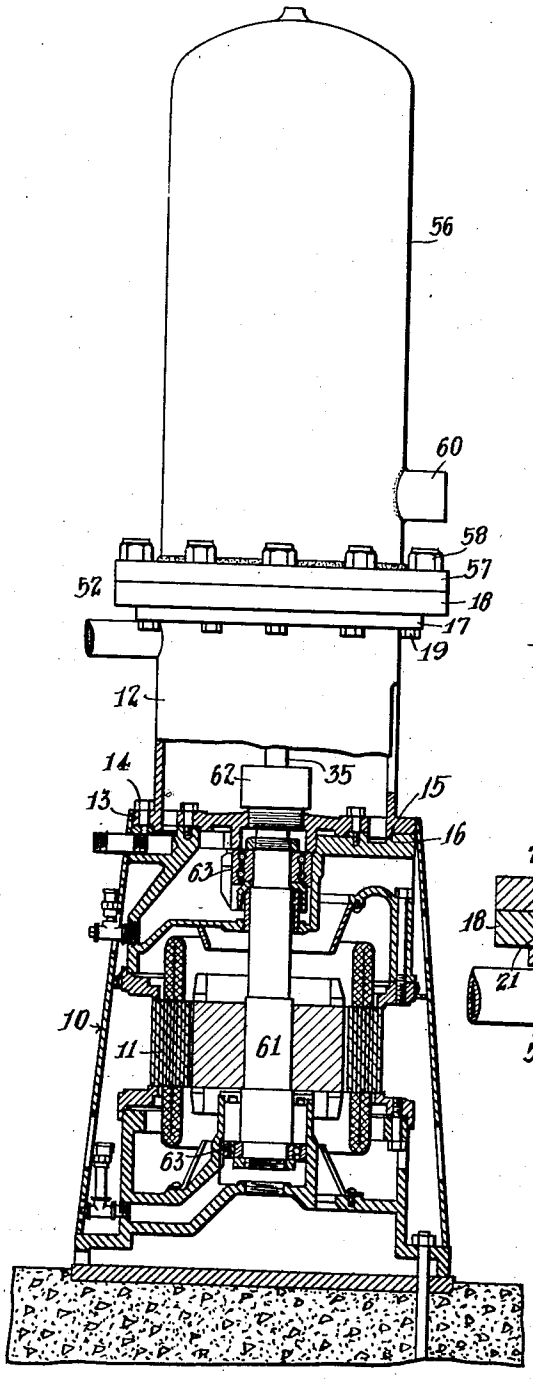
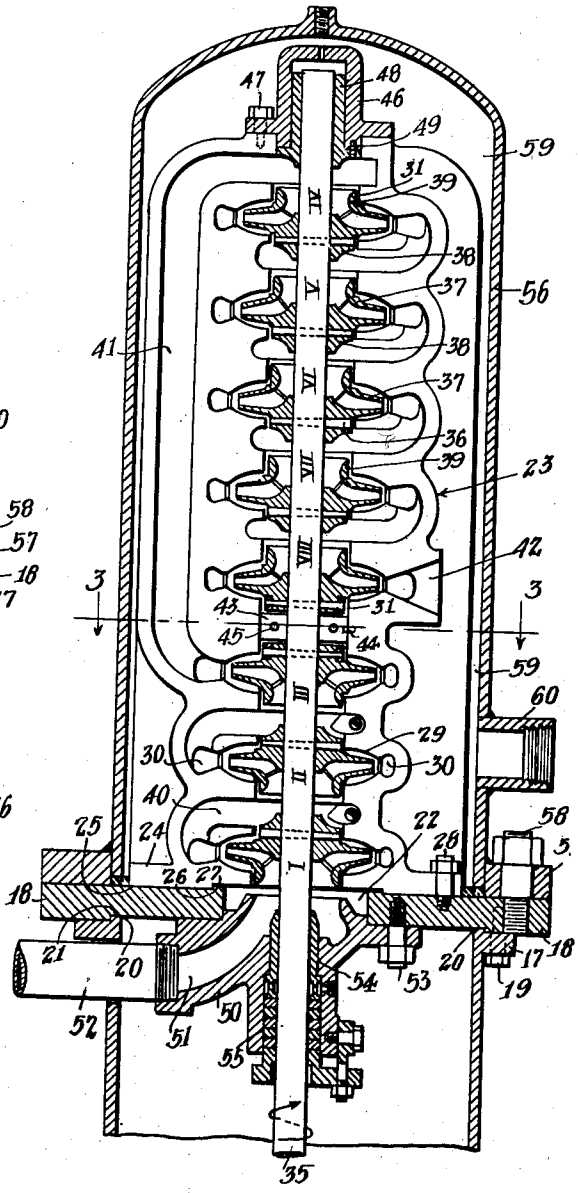


Fig. 2



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Fig. 3

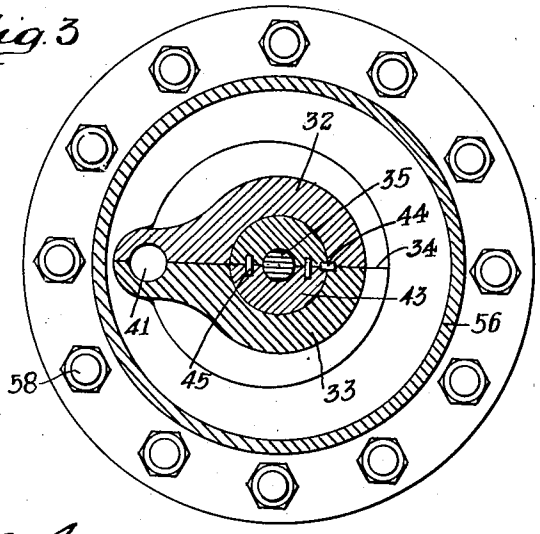
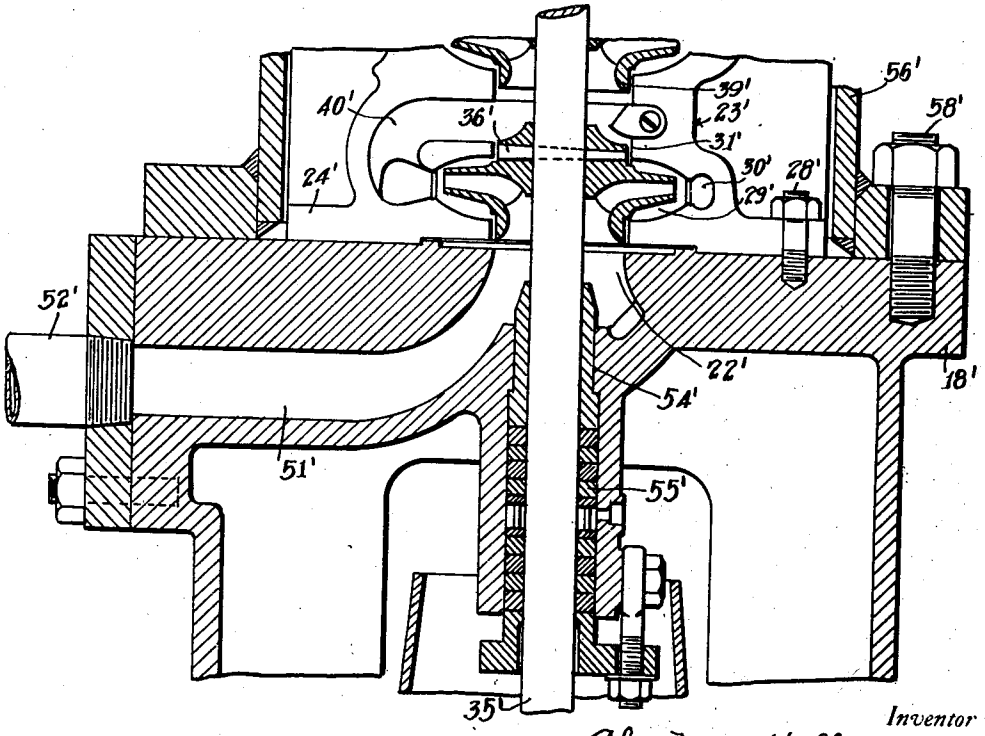


Fig. 4



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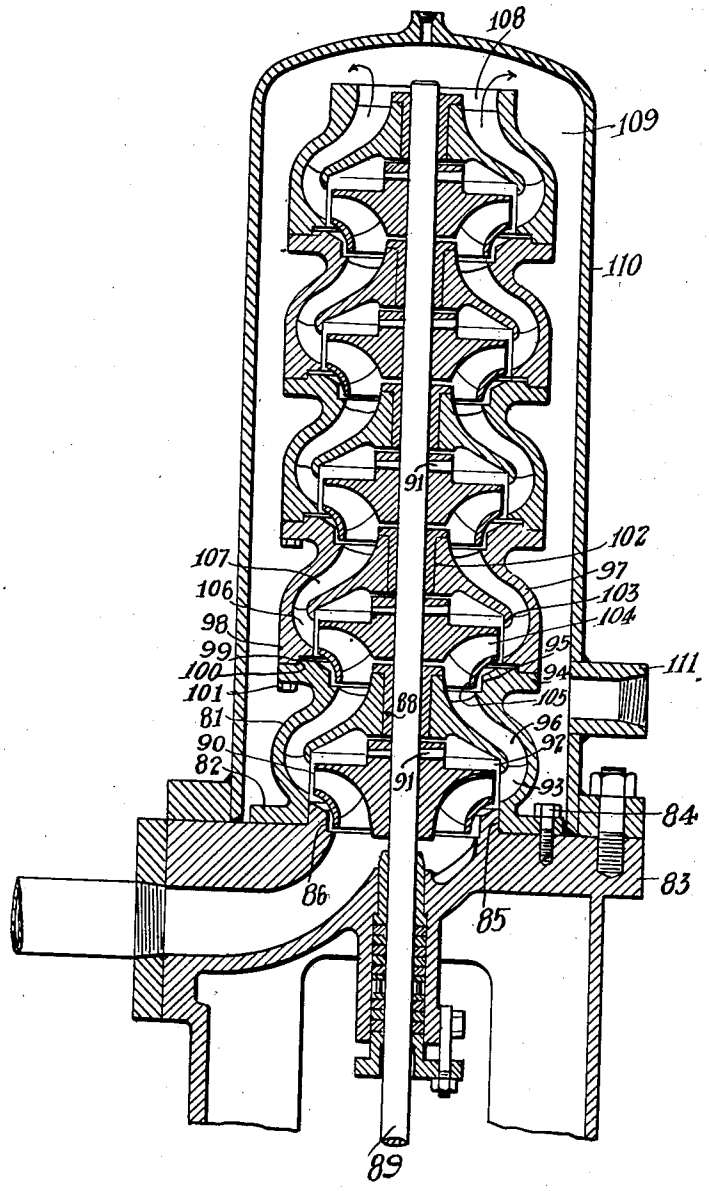
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Fig. 5



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Patented Apr. 16, 1935 1,997,824

UNITED STATES PATENT OFFICE

1,997,824

FLUID PUMP

Aladar Hollander, Berkeley, Calif., assignor to Byron Jackson Co., Berkeley, Calif., a corporation of Delaware

Application June 6, 1933, Serial No. 674,485

6 Claims. (Cl. 103—108)

This invention relates to a fluid pump having numerous novel features of design.

One object of this invention is to provide a fluid pump including a supporting member provided with a suction inlet passage; mounting an inner pump casing upon the supporting member so as to communicate the suction inlet passage of the supporting member with the suction inlet passage of the casing; also mounting an outer casing upon the supporting member so that the outer casing with the supporting member will entirely enclose the inner casing; providing the inner casing with a passage for discharging the pressure fluid of the pump into the space formed between the inner and outer casings and providing the outer casing with a fluid discharge passage communicating with this space formed between these two casings. A fluid pump so arranged may have many advantages, a few of which may be stated as follows: The pressure fluid contained within the space formed between the inner and outer casings will act to firmly and tightly seat the attached or proximal end of the inner casing upon or to the supporting means, and thereby plain machined surfaces with or without gaskets may be utilized without danger of leakage of the pressure fluid through the joint formed between the inner casing and supporting member; the inner casing may be formed of two halves parted in an axial plane and the complicated sections thereof may be cast thinner, thus insuring a more uniform casting without danger of the inner casing rupturing due to internal pressure therein as the force upon the exterior of the inner casing, due to the pressure fluid contained in the space between the casings, will be far greater than the bursting force generated within the inner casing; the force of the pressure fluid acting upon the external surface of the inner casing will act to force the two half sections thereof into close sealing engagement to form an effective seal against leakage of the pressure fluid into or from the interior of the pump casing whether a gasket is or is not used; the outer casing may be made from drawn steel tubing or fabricated from rolled steel plates and, therefore, will be far less clumsy and liable to disastrous bursting than in the case the outer casing were made of a casting; the outer casing may be a structure entirely independent of the inner casing, thereby making the assembly and disassembly of the structure easier; distortion of the outer casing due to heat or pressure cannot act to throw or force the pump structure out of true axial alignment, thus avoiding binding and undue wear; the surfaces forming the joint between the inner casing and supporting member are fully exposed and thus easily and accurately machined; the force of the pressure fluid in the space acts to maintain the inner casing firmly seated upon the supporting member, for which reason leakage from the pressure space to the suction inlet passage may be effectively sealed off; and when the structure is arranged vertically the discharge passage through the outer casing may be positioned well toward the bottom thereof so that the upper portion of the pressure space may act as a water and air receiver, thus eliminating the necessity of an extra air tank for this purpose.

A further object is to part the inner casing upon the axial plane thereof for simplicity of casting, machining and assembly and relying mainly upon the force of the pressure fluid contained within the space for maintaining the half portions in fluid sealing contact.

A further object is to provide the inner casing with a plurality of impellers and for arranging one set of impellers to face in one direction and a second set of impellers to face in the opposite direction and for providing a fluid channel for appropriately communicating the two sets of impellers.

Other objects and advantages of the invention will become apparent as the nature of the same is more fully understood from the following description and accompanying drawings, wherein is set forth what is now considered to be a preferred embodiment. It should be understood, however, that this particular embodiment of the invention is chosen principally for the purpose of exemplification and that variations therefrom in details of construction or arrangement of the parts may accordingly be effected and yet remain within the spirit and scope of the invention as the same is set forth in the appended claims.

In the drawings:

Figure 1 illustrates a side view of the invention partly in section;

Figure 2 illustrates an enlarged sectional view of the double casing pump;

Figure 3 illustrates a section view taken substantially in the plane of lines 3—3 of Figure 2;

Figure 4 illustrates a fragmental sectional view on even larger scale of a somewhat different arrangement of the pump supporting member;

Figure 5 illustrates a fragmental sectional view of a modified form of the invention.

In all of the figures of the drawings the invention has been illustrated as applied to the vertical type of pump but it is to be understood that

the features of this invention may be applied to the horizontal type of pumps.

The invention as illustrated in Figures 1 and 2 may include a base structure **10** having mounted therein an electric motor **11** arranged for vertical operation. A tubular spacer **12** may be suitably mounted upon the base structure as by means of flange **13** and cap screws **14** and may be centered thereon by means of the annular ring **15** closely fitting into the counter-bored annular groove **16** of the base structure. The upper end of the spacer member **12** may be flanged as at **17** to receive the pump supporting member or diaphragm **18** and these two parts may be securely fastened together as by suitable bolt means **19** and centered by means of the annular ring **20** of the spacer closely fitting the counterbore **21** of the supporting member.

In place of the pumping head illustrated in Figures 1 to 4, inclusive, a pumping head including a series of superimposed turbine pumps may be provided, as illustrated in Figure 5. The turbine pumping head disclosed in Figure 5 may include the form of pump supporting means illustrated in Figure 4 and an outer casing as illustrated in Figures 1 and 2 and as these portions have been previously described their description will not be repeated. The principal difference lies in the arrangement of the inner casing or pumping head, which pumping head may include a plurality of superimposed serially connected turbine pumps, in this case five, and as all of the turbine pumps are alike the first two only need be described in detail.

The first turbine bowl **81** may be provided with a flange **82** securely fastened to the pump supporting member **83** by suitable bolt means **84**.

The turbine bowl may be centered in true axial alignment with the supporting member **83** by means of an annular flange **85** formed upon the member **83** concentric with the axis thereof. The annular flange **85** may be provided with a concentric bore **86** to which the inlet passage **87** may be suitably communicated. The turbine bowl may be provided with a bearing **88** for operatively supporting the impeller shaft **89**. A turbine impeller **90** may be suitably mounted upon shaft **89** and made to rotate therewith as by means of a suitable taper pin **91** and positioned in the impeller cavity **92** of the turbine bowl.

Adjacent the periphery of the impeller the bowl **81** may be provided with an annular channel **93** for receiving the fluid discharged from the impeller.

The upper portion of bowl **81** may be provided with a flange **94** having a concentric annular bore **95**. By means of a plurality of fluid passages **96** the fluid received in the annular channel **93** may be conveyed to the annular bore **95**.

The second turbine bowl **97** may be provided with a flange **98** counterbored as at **99** to engage the annular shoulder **100** formed upon the upper flange **94** of the first bowl in order to center the second turbine bowl with relation thereto.

The second bowl **97** may be firmly fastened to the first bowl by means of suitable bolts **101**. Like the first bowl, each of the other bowls may be provided with shaft bearings **102** for operatively supporting the impeller shaft **89**. Also each bowl may be provided with an impeller cavity **103**. The second impeller **104** may be operatively mounted in cavity **103** of the second bowl and may have an inlet portion **105** projecting into the annular bore **95** of the first turbine bowl and forming therewith an operative fluid seal. The second turbine bowl may be provided with an annular channel **106** for receiving the fluid discharged from the second impeller, which fluid may be conveyed through a plurality of fluid passages **107** to the next succeeding impeller and so on until the fluid is finally discharged from the pump structure through the discharge nozzle **108** into the upper end of the receiver space **109** formed between the inner casing and outer casing **110**. A fluid discharge nozzle **111** may be provided upon the outer casing and arranged to communicate with the receiver space. However, should it be desired, the discharge nozzle may be formed in the pump supporting member **83** similar to the arrangement as depicted in Figure 5.

As in the previous case, the fluid pressure within the receiver space **109** acts upon the exterior of the pump structure and results in a substantial downward force acting to maintain flange **82** of the pump structure tightly compressed against the supporting member **83** and thus maintaining these two parts in effective sealing engagement and thereby preventing the pressure fluid of the receiver space **109** from leaking into the suction inlet passage **86** of the supporting member. Also this downward force acts to maintain each of the turbine bowls tightly seated upon its supporting bowl.

A common form of thrust bearing, not shown, may be provided for operatively carrying the axial thrust of the pump impellers and shaft.

In the claims, the expression "an outer casing in circumferentially spaced relation to said inner casing" has been used and it is to be understood to mean that the two casings are not brought into direct contact at any point; however, both casings are fastened to a common supporting member.

Having fully described the invention, it is to be understood that it is not to be limited to the details herein set forth, but the invention is of the full scope of the appended claims.

I claim:

1. In a vertical multi-stage centrifugal pump, a supporting means, an inner casing mounted thereon, an outer casing mounted upon said supporting means in circumferentially spaced relation to said inner casing, a shaft and impeller means within the inner casing, said shaft extending through the supporting means, a bearing for the other end of said shaft carried by the distal end of said inner casing, said inner casing being free from contact with the outer casing, said supporting means having a suction inlet means communicating with said inner casing, a discharge passage from said inner casing communicating with the space between the casings, a discharge passage leading from said outer casing and communicating with the space between said casings, and means for sealing the suction inlet from the space between the casings, whereby differences in temperature in the two casings will not cause distortion of the pump shaft.

2. In a vertical multi-stage centrifugal pump, a supporting means, an inner casing mounted thereon, an independent outer casing mounted upon said supporting means in circumferentially spaced relation to said inner casing, a shaft and impeller means within the inner casing, said shaft extending through the supporting means, a bearing for the other end of said shaft carried by the distal end of said inner casing, said inner casing being free from contact with the outer casing, said supporting means having a suction inlet means communicating with said inner casing, said inner casing having a discharge pas-

sage communicating with the space between said casings, said outer casing having a discharge passage communicating with the space between said casings, and means for sealing the suction inlet from the space between said casings including contacting machined surfaces formed upon said supporting means and the proximal end of said inner casing, whereby differences in temperature in the two casings will not cause distortion of the pump shaft.

3. In a vertical multi-stage centrifugal pump, a supporting means having a suction inlet passage therethrough, an inner casing mounted upon said supporting means in operative communication with said inlet passage, an independent outer casing mounted upon said supporting means in circumferentially spaced relation to said inner casing, shaft and impeller means operatively mounted within the inner casing, said shaft extending through said supporting means, a bearing for the other end of said shaft carried by the distal end of the inner casing, said inner casing being free from contact with the outer casing, said inner casing having a discharge passage communicating with the space between said casings, and said outer casing having a discharge passage communicating with the space between said casings, whereby differences in temperature in the two casings will not cause distortion of the pump shaft.

4. In a vertical multi-stage centrifugal pump, a supporting member having a fluid inlet passage, an inner casing mounted thereon so that the fluid inlet passage formed in the end thereof will communicate with the fluid inlet passage of said member, a shaft with impeller means operatively mounted within the casing and having one end of the shaft extending through the end of the casing and through the supporting member, an independent outer pressure casing mounted upon the supporting member for enclosing the inner casing, said inner casing being free from contact with the outer casing, said inner casing having a discharge passage communicating with the space formed between the two casings, and a discharge means for withdrawing the pressure fluid from said space, whereby differences in temperature in the two casings will not cause distortion of the pump shaft.

5. In a vertical multi-stage centrifugal pump, a member having a fluid inlet passage, an inner casing secured to said member and mounted so that the fluid inlet passage formed in the end thereof will communicate with the fluid inlet passage of said member, a shaft with impeller means operatively mounted within the casing and having one end of the shaft extending through the casing and through the member, an independent outer pressure casing enclosing the inner casing, said inner casing being free from contact with the outer casing, said inner casing having a discharge passage communicating with the space formed between the two casings, and a discharge means for withdrawing the pressure fluid from said space, whereby differences in temperature in the two casings will not cause distortion of the pump shaft.

6. In a vertical multi-stage centrifugal pump, an outer pressure casing, an inner casing mounted within said outer casing and spaced therefrom, a centrifugal pump comprising said inner casing, a shaft, a bearing for said shaft carried by said inner casing, impellers on said shaft and a suction inlet and discharge, the discharge from said pump communicating with the space between the casings, sealing means between said casings separating the suction inlet from said space, said inner casing being free from contact with said outer casing beyond said sealing means, and a discharge outlet leading from the outer casing communicating with the space between the casings, whereby differences in temperature between the two casings will not cause distortion of the pump shaft.

ALADAR HOLLANDER.

Certificate of Correction

Patent No. 1,997,824. April 16, 1935.

ALADAR HOLLANDER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 18, after the word and period "member." insert the following paragraphs:

The pump supporting member 18 may be provided with an annular axially concentric fluid inlet passage 22. A pump casing 23, which for convenience will be referred to as the inner casing, may be flanged as at 24 for mounting upon the upper flat surface 25 of the pump supporting member 18 and may be centered with relation thereto as by means of the annular ring 26 formed upon the member 18 and the counter-bore 27 of the inner casing so that the suction inlet passage of the inner casing will communicate with the fluid inlet passage 22 of the supporting member 18. The inner casing may be secured to the member 18 as by suitable bolt means 28. If desired, a suitable gasket means may be mounted between the inner casing flange 24 and the supporting means 18.

The inner casing 23 may be provided with any appropriate number of impeller cavities 29 and discharge fluid volute passages 30.

All of the impeller cavities may be connected by an axial concentric bore 31 of uniform diameter through the entire length of the inner casing.

The inner casing may be formed in halves 32 and 33 parted along the axial plane 34 as may be observed from Figure 3.

A shaft 35 has suitably mounted thereon, as by means of a close fit and taper pins 36, a number of pump impellers 37 of the single suction type corresponding in number to the number of impeller cavities 29 of the inner casing.

Shaft 35 together with its impellers 37 may be operatively mounted within the inner casing and it will be noted that the external diameter of each impeller hub section 38 and the external diameter of each impeller inlet section 39 are all of substantially the same diameter and closely fit the uniform bore 31 so as to form therewith operative fluid seals for preventing fluid leakage from the pressure to the suction sides of the impellers.

As may be observed from Figure 2, the inlet side of the first three impellers face downwardly while the inlet side of the other impellers all face upwardly; by thus arranging the impellers in two groups or sets, a more nearly perfect state of balance is effected. As may be noted, there are two more impellers having their inlet sides facing upwardly for the purpose of substantially counter-balancing the hydraulic forces acting against the upper end of the impeller shaft. The pump is a multi-stage machine, that is, the fluid is conducted serially through each of the impellers. The stage of each impeller has been noted on the shaft in Figure 2 in Roman numerals.

The suction inlet of the first stage impeller communicates with the fluid inlet passage 22 of the supporting member 18 and discharges into the volute 30, from which volute the fluid is conveyed to the next stage as by means of the fluid passage 40 and so on until the fluid is discharged into the third stage volute, whereupon by means of channel 41 the fluid is conveyed to the second group of impellers, that is, the group of impellers having all of their inlet sides facing upwardly. The channel 41 conveys the fluid to the suction side of the uppermost impeller of the second group, which runner thus becomes the fourth stage impeller from which the fluid passes serially through the remaining impellers and finally discharges from the eighth stage impeller volute through the outlet passage 42. As may be noted from Figure 3, the fluid channel 41 may be substantially of pipe section defined by complementary concave portions formed in the opposing halves of the split casing. As will be later described, the relatively greater pressure upon the outer surface of the inner casing acts to so tightly clamp the two half sections together that the two engaging machined surfaces will form a fluid tight joint without the aid of a gasket; however, a gasket may be used if desired.

A shaft bearing 43 may be fitted in the uniform bore 31 between the two groups of impellers and may be locked against rotation as by means of key 44.

Bearing 43 may be formed in halves and the two halves may be retained in operative position by means of dowel pins 45.

The upper or distal end of the inner casing may be provided with a suitable shaft bearing 46 centered in the uniform casing bore 31 and securely fastened in place by bolt means 47. The bearing may be provided with a suitable journal bushing 48 keyed against rotation as by means of screw 49.

A fluid inlet nozzle 50 may be suitably mounted upon the pump supporting member 18, as illustrated in Figure 2, or may be formed integral therewith, as illus-

trated in Figure 4. The inlet nozzle may be provided with an inlet passage 51 to the outer end of which a duct 52 may be suitably mounted, while the inner end thereof may communicate with the fluid inlet passage 22 of member 18. The inlet nozzle 50 may be centered in the annular inlet bore 22 of the pump supporting member and securely fastened thereto by suitable bolt means 53. The inlet nozzle 50 may be provided with a shaft bearing 54 and a common form of stuffing box means 55.

An outer casing 56 may be provided with a flange 57 and thereby mounted upon the supporting member 18 and securely fastened thereto by suitable bolt means 58.

The outer casing may be circumferentially spaced from the inner casing so as to leave considerable room therebetween which will be referred to as the space 59. A fluid discharge nozzle 60 communicating with space 59 may be provided upon the side of the outer casing toward the lower end thereof. It may be observed that the fluid discharge passage 42 of the inner casing communicates directly with the space 59, thus building up a fluid pressure within space 59 equal to the operating discharge pressure of the pump. The fluid pumped into space 59 may be discharged therefrom through the fluid discharge nozzle 60 and by placing the nozzle adjacent the lower end of the outer casing the portion of the outer casing above the discharge nozzle may be utilized as a water and air receiver, thus eliminating the necessity of an extra air tank. It is to be understood that the outer casing may be made proportionately larger in diameter or longer or both, to provide any desired receiver capacity.

The impeller shaft 35 may be coupled to the motor shaft 61 by a suitable coupling means 62. The motor shaft may be suitably journalled in bearings 63.

As space 59 is maintained at all times at the maximum working or discharge pressure of the final impeller stage, while the greater portion of the internal area of the inner casing varies from the fluid inlet to the discharge pressure, there is, therefore, a far greater force tending to force the two half portions of the inner casing together than tending to part these portions and thus the two half portions of the inner casing are held in close sealing engagement. Due to the external pressure acting to hold the inner casing together, it is not necessary to provide a gasket means between the half portions thereof but, of course, a gasket may be used if desired. Also, due to the external pressure upon the inner casing, this casing may be safely made of castings of relatively thin section, as compared with the section of metal necessary should there be no external pressure thereon. The outer casing may be fabricated from drawn steel tubing or made from rolled steel plates and, therefore, will have sufficient tensil strength to withstand the internal pressure even though of relatively thin section.

A further and important advantage due to this high pressure fluid acting upon the inner casing is the downward force created thereby which acts to force and hold the inner casing flange 24 tightly compressed against the supporting member 18 and thereby aiding in the maintenance of a fluid tight joint between the engaging surfaces of these two parts and thus effectively preventing the high pressure fluid of the receiver space 59 from leaking into the suction inlet passage 22 of the supporting member.

In Figure 4 there is illustrated a fragmental sectional view of an arrangement in which the spacer member, supporting member and inlet nozzle are all formed in an integral casting, and, therefore, the parts thereof which correspond with the similar portions or parts of the structure of Figures 1, 2 and 3 have been given corresponding numbers primed. This same arrangement of the single casting including the spacer member, pump supporting member, and inlet nozzle is included in the modified form of the pump, as illustrated in Figure 6.

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of August, A. D. 1936.

[SEAL]

LESLIE FRAZER,
Acting Commissioner of Patents.

DISCLAIMER

1,997,824.—*Aladar Hollander*, Berkeley, Calif. FLUID PUMP. Patent dated April 16, 1935. Disclaimer filed February 5, 1945, by the assignee, *Byron Jackson Co.*

Hereby enters this disclaimer to each and every claim of said patent.

[*Official Gazette March 6, 1945.*]