

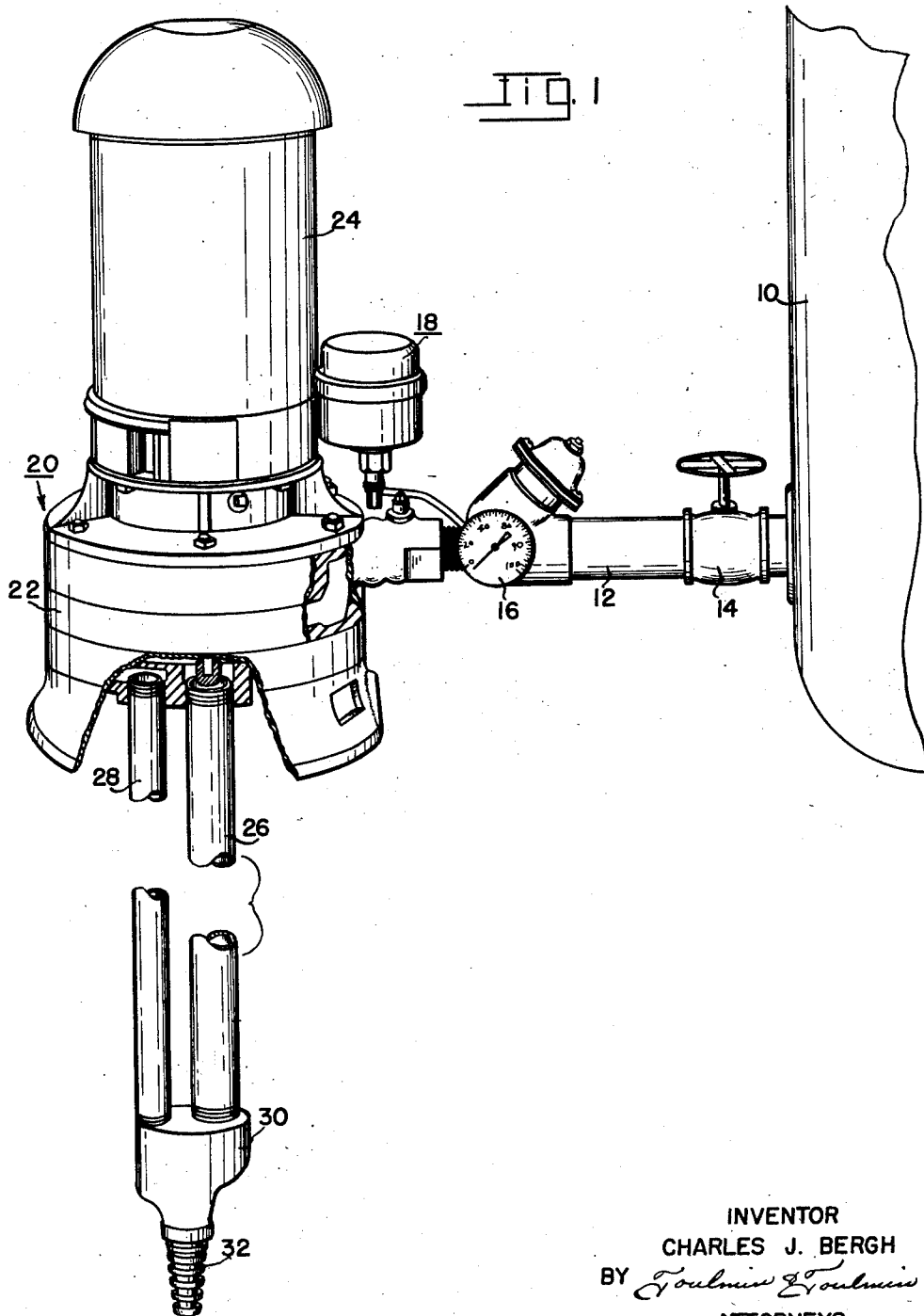
Sept. 15, 1953

C. J. BERGH
CENTRIFUGAL PUMP

2,651,998

Filed June 29, 1951

5 Sheets-Sheet 1



INVENTOR
CHARLES J. BERGH
BY *Toulmin & Toulmin*
ATTORNEYS

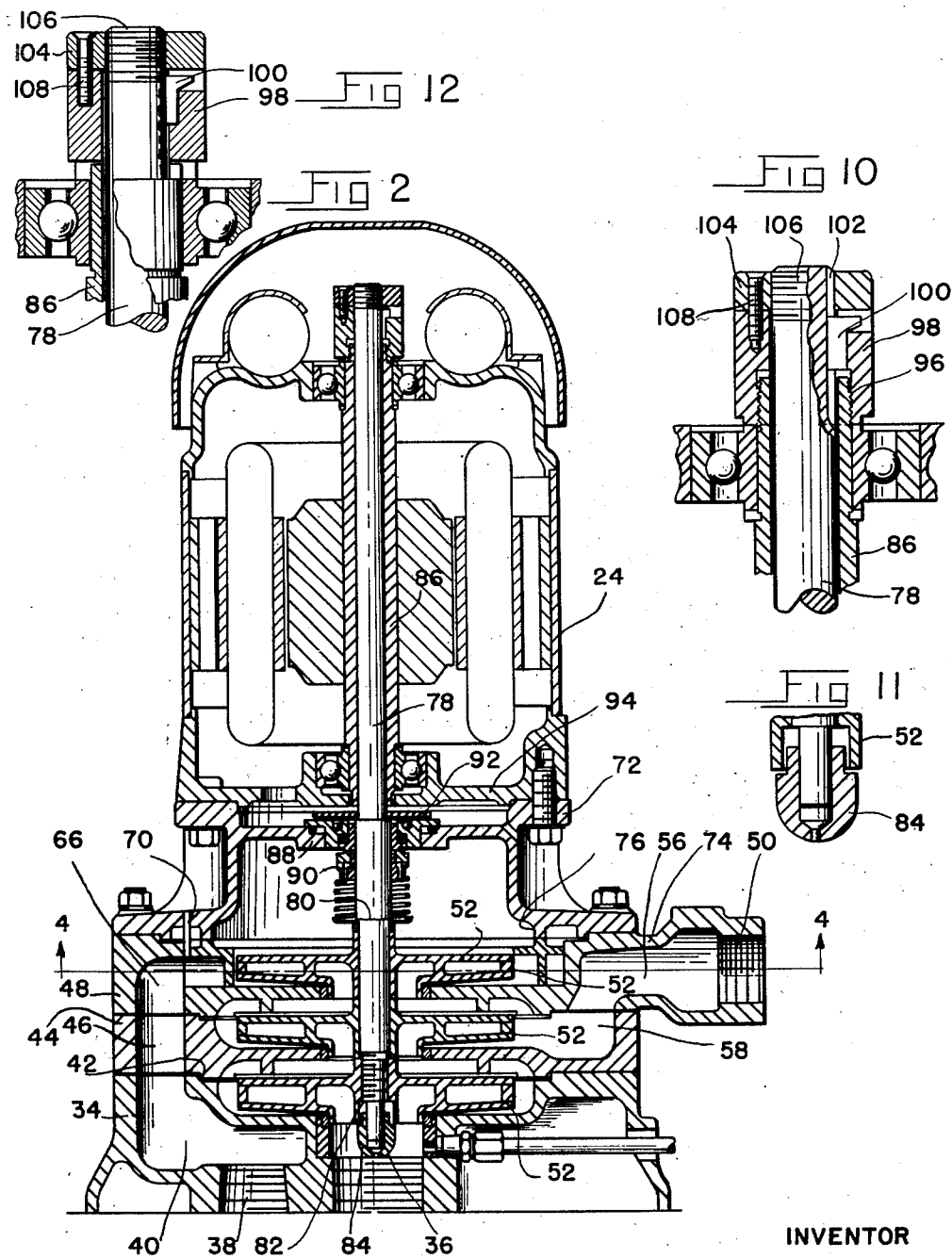
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5 Sheets-Sheet 2



INVENTOR
CHARLES J. BERGH
BY *Toulmin & Toulmin*
ATTORNEYS

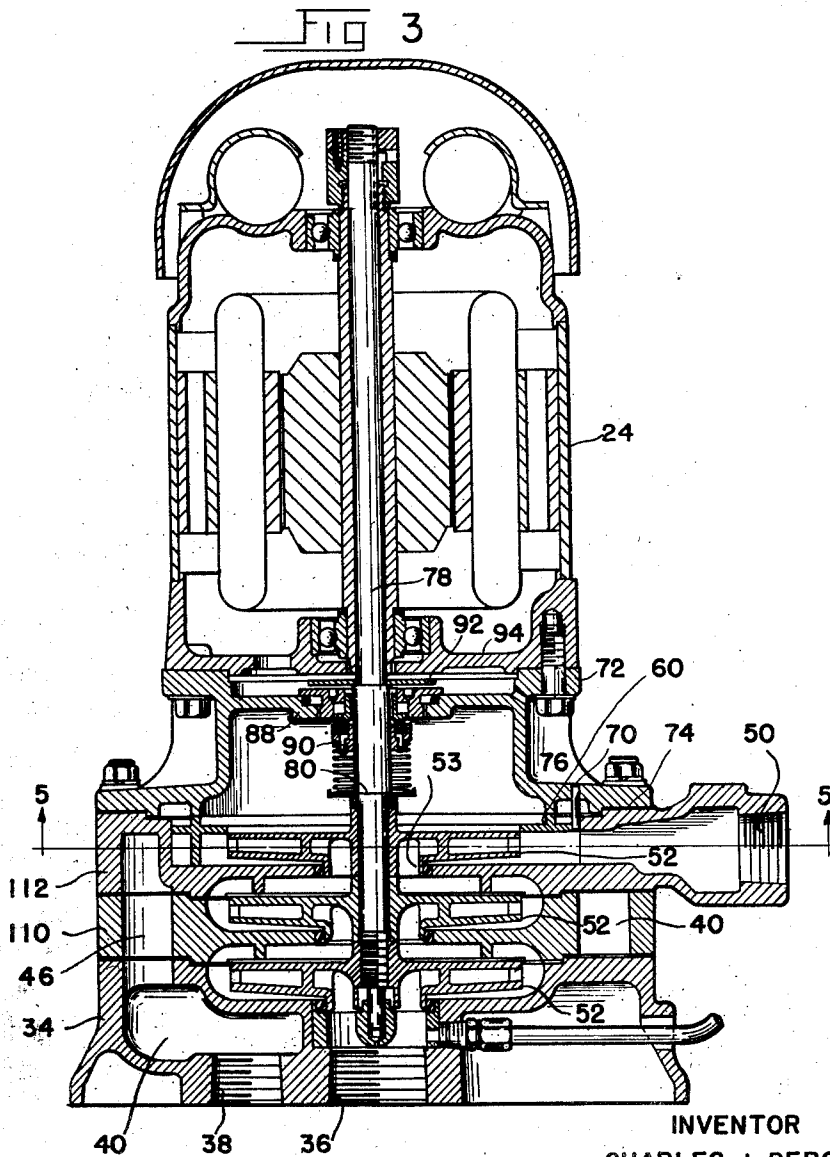
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C. J. BERGH
CENTRIFUGAL PUMP

2,651,998

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5 Sheets-Sheet 3



INVENTOR
CHARLES J. BERGH
by *Foulmin & Foulmin*
ATTORNEYS

Sept. 15, 1953

C. J. BERGH
CENTRIFUGAL PUMP

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FIG-4

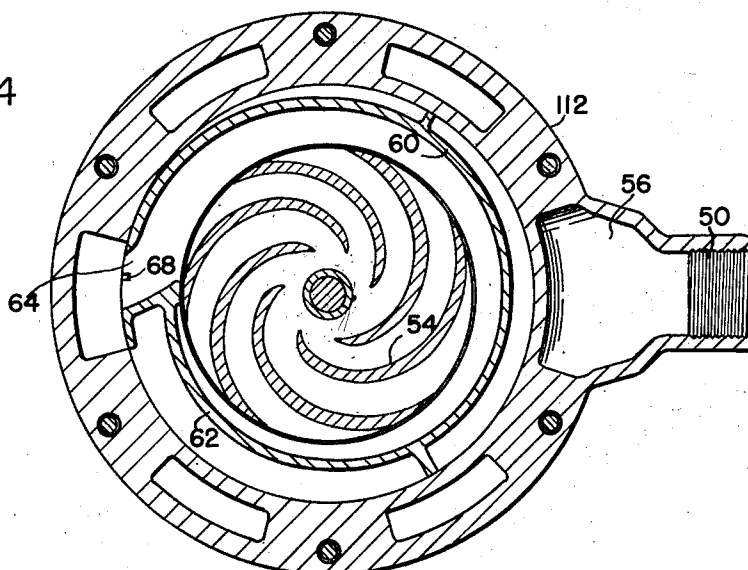
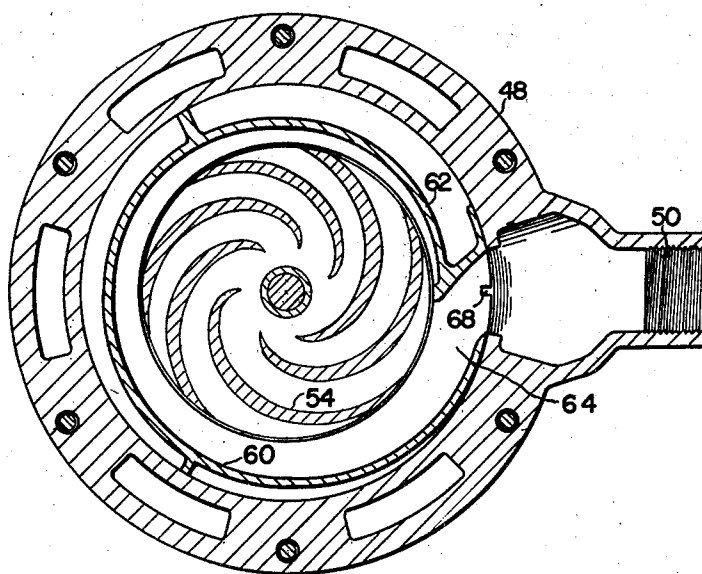


FIG-5



INVENTOR
CHARLES J. BERGH
BY *Toulmin & Toulmin*

ATTORNEYS

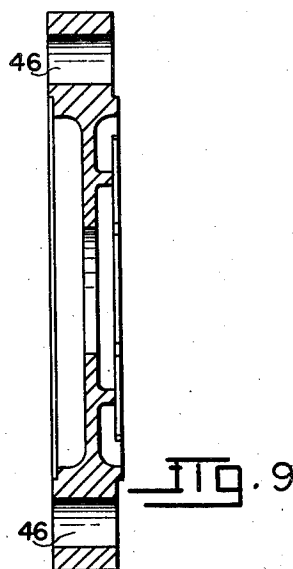
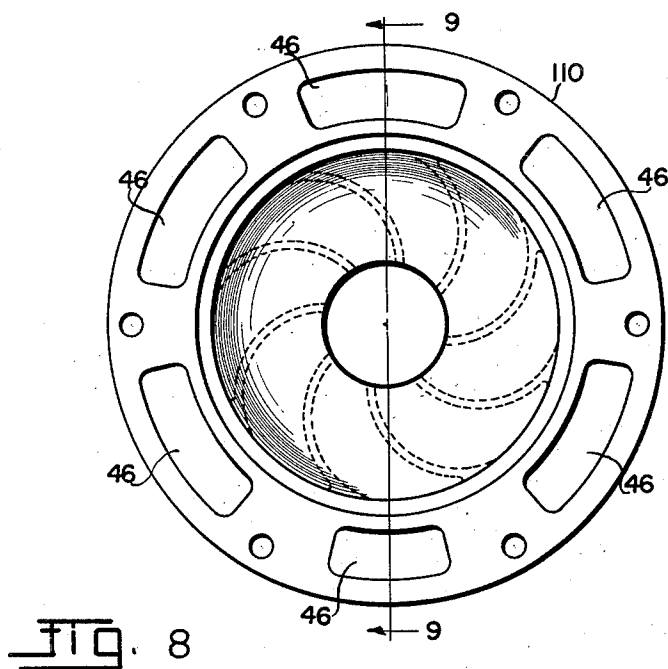
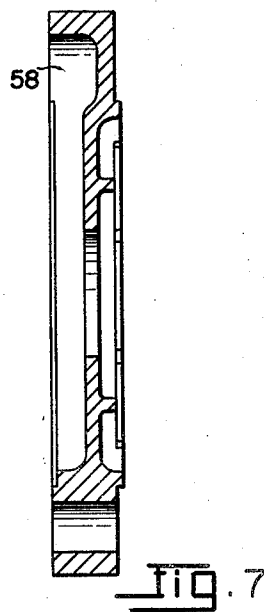
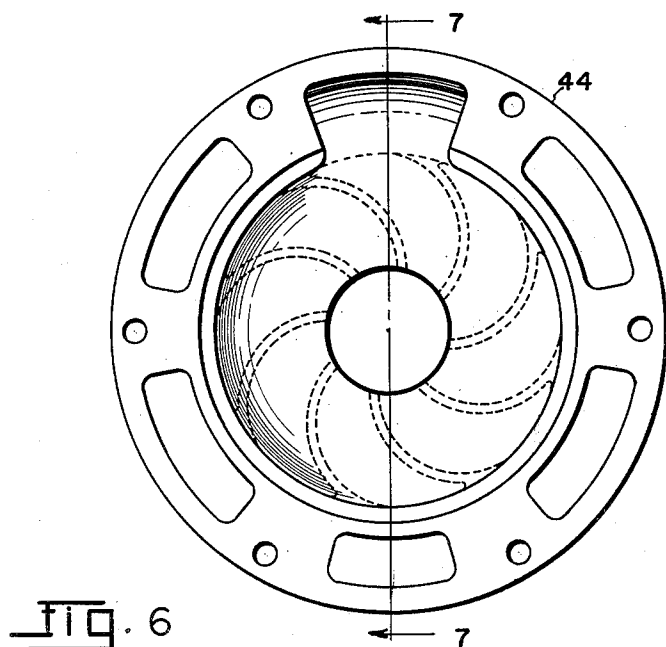
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C. J. BERGH
CENTRIFUGAL PUMP

2,651,998

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5 Sheets-Sheet 5



INVENTOR
CHARLES J. BERGH
BY *Paulman & Paulman*
ATTORNEYS

UNITED STATES PATENT OFFICE

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CENTRIFUGAL PUMP

Charles J. Bergh, Vandalia, Ohio, assignor to The
Dayton Pump & Manufacturing Company,
Dayton, Ohio, a corporation of Ohio

Application June 29, 1951, Serial No. 234,327

6 Claims. (Cl. 103—108)

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This invention relates to pumps, particularly to centrifugal pumps and especially to centrifugal pumps adapted for selective operation either as shallow well pumps or as jet type deep well pumps.

Shallow well centrifugal pumps and deep well centrifugal pumps operating on the jet principle are well known and it is also known to provide a centrifugal pump that can be converted from one type of operation to another. All pumps of this nature however have had certain drawbacks in that an excessive number of parts were required to have an inventory of both types of pumps and, furthermore, the change of a pump from one type of operation to another was usually accompanied by a great deal of labor.

The primary object of the present invention is the provision of a centrifugal pump which can readily be converted from deep well to shallow well operation with a minimum of labor and a minimum of time.

It is also an object of this invention to provide a centrifugal pump which can readily be built up to a plurality of stages in order to produce any desired pumping pressure.

A particular object of the present invention is to provide an arrangement where one of the impellers of a plural impeller centrifugal pump is utilized for supplying fluid to the jet when the pump is operated as a deep well jet pump.

A still further object of the present invention is the provision of an arrangement for mounting a plurality of impellers on the drive shaft of the pump which eliminates the use of keys, set screws, locking pins, and the like.

A particular object of the present invention is the provision of a special adapter element for mounting about the periphery of one of the impellers of a multiple impeller centrifugal pump which can be adjusted for directing the discharge of the impeller either into the passage leading to the jet when the pump is operated as a deep well jet type pump or into the discharge passage when the pump is operated as a shallow well pump.

Another particular object of this invention is a provision of a novel arrangement for connecting the drive shaft of the pump with the shaft of the drive motor for the pump.

A still further object is the provision of a centrifugal pump adapted for operation as a deep well pump by employing a jet in which the fluid passage for supplying fluid to the jet is completely enclosed within the body of the pump.

These and other objects and advantages of this invention will become more apparent upon refer-

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ence to the following description taken in connection with the accompanying drawing in which:

Figure 1 is a perspective view showing a pump according to my invention arranged for operation as a deep well pump.

Figure 2 is a vertical section through the pump illustrated in Figure 1.

Figure 3 is a vertical section like Figure 2 but showing the pump arranged for operation as a shallow well pump.

Figure 4 is a sectional view indicated by line 4—4 on Figure 2.

Figure 5 is a sectional view indicated by line 5—5 on Figure 3.

Figure 6 is a plan view looking down on top of one of the housing elements employed in Figure 2.

Figure 7 is a vertical section indicated by line 7—7 on Figure 6.

Figure 8 is a view like Figure 7 but looking down on another of the housing elements employed in Figure 3.

Figure 9 is a vertical section indicated by line 9—9 on Figure 8.

Figure 10 is an enlarged view showing the manner in which the shaft for the pump rotor is connected with the shaft of the drive motor for the pump.

Figure 11 is a fragmentary view showing the manner in which an end cap is mounted on the lower end of the pump rotor shaft, and

Figure 12 is a fragmentary view similar to Figure 10 but showing a somewhat modified arrangement for drivingly interconnecting the motor shaft with the pump shaft.

Referring to the drawings somewhat more in detail the arrangement shown in Figure 1 comprises a storage tank 10 and which is adapted for being filled with the pumped fluid such as water by means of a conduit 12. Conduit 12 may comprise a shut-off valve 14, a pressure indicating instrument 16, and suitable automatic control for starting and stopping the pumping mechanism as exemplified by the unit generally indicated at 18.

The pump itself is indicated at 20 and comprises the pumping unit proper at 22 driven by an electric motor 24. The arrangement illustrated Figure 1 is for deep well pumps and to this end there is a main suction conduit 26 extending down into the well and a smaller conduit at 28 also extending down into the well for supplying fluid to the jet of the pump. The jet of the pump is embodied in the fitting indicated

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at 30 and this fitting also has a suction connection at 32.

Turning now to Figure 2, the arrangement of the pump and motor for deep well operation is shown somewhat more in detail. In this figure will be seen that the pump unit comprises a bottom member 34 which forms a portion of the housing for the first stage of the pump and also provides a support for the pump. This member is provided with a central inlet opening 36 to which is connected suction conduit 26, and another opening 38 to which is connected the conduit 28 leading to the jet. Opening 38 communicates with a chamber 40 cored in the inside of member 34.

Member 34 has its upper surface face faced off and shouldered as at 42 and resting thereon is a second housing member 44. Housing member 44 comprises a central part immediately surrounding the pump impeller and forming the remainder of the chamber referred to in connection with part 34. Around the periphery of housing part 34 are a number of axial passages 46 and one of which communicates with chamber 40 as indicated in Figure 2.

Resting on top of housing part 44 is still another housing part 48 which includes a discharge opening 50 and to which the conduit 12 referred to in Figure 1 is connected.

Each of the said housing parts is centrally apertured for receiving a central flange projecting outwardly from about the hub of the associated impeller. The impellers in the pump are identified by the reference numeral 52 and it will be seen that they are three in number. As many of the impellers could be supplied as desired in order to build up whatever pressure was necessary merely by adding additional housing elements between the upper housing part 48 and the lower housing part 34.

As will be seen in Figure 2 the fluid entering opening 36 is directed into the inlet of the first impeller and discharged from about the periphery of said impeller. This fluid is then directed into the eye of the next impeller above and subsequently discharged from about its periphery.

Each of the housing parts 44 and 48 have dependent from their lower walls guide vanes as at 54 which direct the fluid flow toward the eye of the next impeller. These guide vanes are illustrated somewhat more in detail in Figures 6 and 7, these views being showings of the housing part 44. The guide vane arrangement is the same for the several different housing parts except for the lowermost part 34 which includes no guide vanes.

In the Figure 2 arrangement the discharge opening 50 communicates through a cored passage 56 with a passage 58 formed in the housing part 44 and which communicates with the space around the periphery of the impeller 52 associated with the said part 44. In this manner substantially all of the fluid pumped by the two lowermost impellers is directed to the discharge opening 50. However, in the Figure 2 arrangement the uppermost impeller 52 that is associated with the housing part 48 has its eye connected to draw fluid from about the periphery of the intermediate impeller and a certain amount of the delivery of this intermediate impeller is thus by-passed through the uppermost impeller.

Mounted about the periphery of the uppermost impeller is an adapter member which will also be

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seen in Figure 4. This adapter member which is identified by reference numeral 60, comprises a scroll like wall part 62 that forms a housing around the impeller and has a discharge opening at 64 discharging into the cored passage 56 in housing part 48 that is in communication with cored passage 46 of housing part 44. This latter passage is, in turn, in communication with passage 40 of the lowermost housing part 34 which delivers to the outlet 38 connected with the conduit 28 that supplies the jet of the pump. It will be seen that the foregoing arrangement provides for a continuous supply of fluid to the jet of the pump.

In order to position the adapter 60 properly it may be provided with a notch indicated at 68 Figure 4 which engages a pin 70 that is fixed in the support frame 72 between the motor and pump. In this manner the adapter member 60 is precisely located in its proper position.

The support member 72 is preferably so formed as to fit around the top machined surface 74 of the upper housing part 48 and includes a machined dependent flange 76 that engages the top service of the adapter member 60, in this manner forming an effective seal about the adapter member to prevent loss of fluid therefrom.

The mounting of the several impellers 52 on the drive shaft or the pump will be seen in Figure 2. In this figure it will be noted that the shaft 78 is shouldered as at 80 and against which shoulder the hub of the uppermost impeller rests. The intermediate impeller then abuts the uppermost impeller and the lowermost impeller abuts the intermediate impeller. The lowermost impeller has its bore threaded and engages the threaded part 82 of the shaft 78. Merely by placing the impellers on the shaft and then threading the lowermost one tightly against the upper impellers, all of the said impellers are tightly clamped in position thereby eliminating keys, set screws, lock pins and the like. By selecting the pitch of threads 82 so that the tendency is for the lower impeller to tighten itself on the threaded part 82 of the shaft, all of the impellers are firmly and positively locked in position in this simple manner.

The lowermost end of shaft 78 may advantageously be faired out by the fairing piece 84 which may be pressed in position if desired.

The shaft 78 extends vertically upwardly a substantial distance and traverses the entire length of the hollow shaft 86 of the drive motor 24. At the lower end of the drive motor and beneath the upper wall part 88 of the support member 72 there is arranged a seal 90 which prevents leakage of fluid up the shaft and into the motor. For the purpose of preventing any creeping of water up the shaft beyond this seal or the leaking of oil downwardly along the shaft through the seal there may be also provided the slinger element 92 positioned between the said upper wall 88 of support member 72 and the lower wall 94 of the electric motor frame.

The connection of the drive shaft 78 of the pump and the shaft 86 of the motor is best illustrated in Figure 10. In the view it will be noted that the upper end of the motor shaft 86 is threaded as at 96. Threaded on to this threaded part of the motor shaft is a sleeve member 98 and this sleeve member is slotted for receiving a key 100 that also extends into a key way 102 in the shaft 78. The purpose of threadedly connecting sleeve 98 and shaft 86 is that sleeve 98 can be availed of for making adjustments axially of

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shaft 78 in order precisely to position the several impellers 52 within their housing. When such an adjustment has been made the entire assembly can be firmly locked in place by means of the lock nut 104 threaded on the upper threaded end 106 of pump shaft 78 and which lock nut is screwed tightly down against the upper end of sleeve 98 and then locked thereto by the lock screw 108.

The described arrangement obtains when the pump is used as a deep well pump employing the lower stages for pumping fluid through the discharge and employing the uppermost stage for bleeding off a portion of the pump discharge for use at the jet of the pump. It will be understood of course that as many stages could be provided as desired and this could be done by merely supplying additional auxiliary housing units and added impellers. Furthermore, should it be desired to increase the pressure of the fluid supplied to the jet it will be apparent there could be more than one stage supplied above the uppermost of the impellers 52 delivering to the outlet 50. In this manner the pump can readily be made multiple stage as to both of the sections thereof.

Turning now to Figure 3 there is illustrated the arrangement of the pump of this invention for use as an ordinary shallow well pump with all of the stages thereof operating as ordinary centrifugal pump.

In Figure 3 substantially the same parts are employed in assembling the pump and where these parts are identical with those in Figure 2 the same reference numeral has been applied.

In Figure 3 however, inasmuch as no fluid needs be supplied to the jet, the passage leading to the jet is interrupted and the adapter member 60 associated with the upper-most stage is rearranged so that the discharge from the uppermost stage is directed to the discharge port 50.

This is accomplished by replacing the intermediate housing member 44 as it is illustrated in Figure 2 by another housing member indicated at 110 in Figure 3. Housing member 110 also comprises the axial passages 46 but which are, in the case of the Figure 3 arrangement, without effect.

The upper housing member 48 in Figure 2 is likewise replaced by a somewhat different but similar housing member indicated at 112 in Figure 3. The housing member 112 differs from housing member 48 in that the discharge passage 50 is connected with the periphery of the impeller that rotates within the housing member 112 rather than with the periphery of the impeller that is rotating in the next housing member beneath.

The adapter member 60 in Figure 3 is also turned 180° from its Figure 2 position so that the opening 64 in the periphery of the said adapter member is communicating with the discharge opening 50 in housing member 112. The arrangement of the adapter member in the Figure 2 pump is illustrated in Figure 4 whereas the arrangement of the adapter member in the Figure 3 pump is illustrated in Figure 5.

It will be apparent that the Figure 3 arrangement of the pump of this invention, similarly to the Figure 2 arrangement thereof, is adapted for being constructed with as many pumping stages as desired merely by providing more of the housing sections 110 between the upper housing section 112 and the lower-most section 34. It will be understood of course that the shaft on which

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the impellers are mounted would be lengthened in order to provide the additional length between shoulder 80 and the threaded portion 82 thereof for receiving the additional impellers.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and customs and it is accordingly desired to comprehend such modifications as may be considered to come within the scope of the appended claims.

I claim:

1. In a centrifugal pump; a rotary centrifugal impeller, a pump housing member extending across one face of said impeller and about the eye thereof so fluid to be pumped can enter said impeller and will be discharged about the periphery thereof, there being a substantial clearance between the periphery of said impeller and said pump housing member, and an adapter member fitting within said pump housing member and about the periphery of said impeller and comprising a scroll like wall part extending from a point closely adjacent the periphery of the impeller about the said impeller to a point closely adjacent the inner surface of said pump housing member, and a partition extending from the first mentioned end of said scroll like wall part outwardly to adjacent the wall of said pump housing member and spaced from the other end of the said scroll like wall part whereby a discharge opening is provided for said adapter member.

2. In a centrifugal pump; a rotary centrifugal impeller having an annular projecting flange on one side forming the eye of the impeller, a pump housing member having a wall extending across the said one side of said impeller and enclosing said flange to form an inlet for the pump, said housing member having an annular recess within which said impeller is disposed and there being a radial space between the periphery of said impeller and the periphery of said recess, and an adapter member mounted in said recess about the periphery of said impeller and comprising a scroll like wall portion extending from a point adjacent the periphery of said impeller about said impeller and terminating at a point adjacent the periphery of said recess thereby to form a discharge volute for said impeller.

3. In a centrifugal pump; a rotary centrifugal impeller having an annular projecting flange on one side forming the eye of the impeller, a pump housing member having a wall extending across the said one side of said impeller and enclosing said flange to form an inlet for the pump, said housing member having an annular recess within which said impeller is disposed and there being a radial space between the periphery of said impeller and the periphery of said recess, and an adapter member mounted in said recess about the periphery of said impeller and comprising a scroll like wall portion extending from a point adjacent the periphery of said impeller about said impeller and terminating at a point adjacent the periphery of said recess thereby to form a discharge volute for said impeller, and said adapter member having a wall part extending substantially in the plane of the impeller and forming a closure about the back wall of said impeller to confine the pumped fluid to the above referred to volute passageway.

4. In a centrifugal pump; a pump housing member having a circular recess therein, a rotary centrifugal impeller mounted within said recess coaxially therewith, and an adapter member

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mounted in said recess about the periphery of said impeller and comprising a scroll like wall part extending from a point adjacent the periphery of the impeller about the impeller to a point adjacent the periphery of the said recess thereby to form a discharge volute for said impeller, and means keying said adapter member in position in said housing member.

5. In a centrifugal pump; a pump housing part having a circular recess in one face thereof, a centrifugal pump impeller positioned within said recess co-axially therewith, an adapter member mounted in said recess about the periphery of said impeller and comprising a scroll like wall part extending from a point adjacent the periphery of said impeller about the impeller to a point adjacent the periphery of said recess, said scroll like wall part extending in a direction substantially parallel with the axis of said recess and impeller, one wall of said impeller having an inlet opening therein, and a wall part on said adapter member extending substantially at right angles to the said axis and enclosing the periphery of the said other wall of the said impeller whereby said volute is substantially enclosed.

6. In a centrifugal pump; a pump housing part having a circular recess in one face thereof, a centrifugal pump impeller positioned within said recess co-axially therewith an adapter member mounted in said recess about the periphery of said impeller and comprising a scroll like wall

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part extending from a point adjacent the periphery of said impeller about the impeller to a point adjacent the periphery of said recess, said scroll like wall part extending in a direction substantially parallel with the axis of said recess and impeller, one wall of said impeller having an inlet opening therein, and a wall part on said adapter member extending substantially at right angles to the said axis and enclosing the periphery of the said other wall of the said impeller whereby said volute is substantially enclosed, a closure member mounted on said housing part to cover the open side of said recess, and means on said closure member engaging said adapter member for clamping it in position in said recess.

CHAS. J. BERGH.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,997,824	Hollander	Apr. 16, 1935
2,139,379	Myers	Dec. 3, 1938
2,344,958	Armstrong et al.	Mar. 28, 1944
2,395,793	Stratford et al.	Feb. 26, 1946
2,424,285	Piccardo et al.	July 22, 1947
2,477,079	Mueller	July 26, 1949
2,478,706	Peters	Aug. 9, 1949
2,478,941	Piccardo	Aug. 15, 1949
2,480,435	Aspelin	Aug. 30, 1949