Aug. 20, 1940. F. A. CARPENTER 2,212,010

PUMPING SYSTEM

Filed Jan. 30, 1939

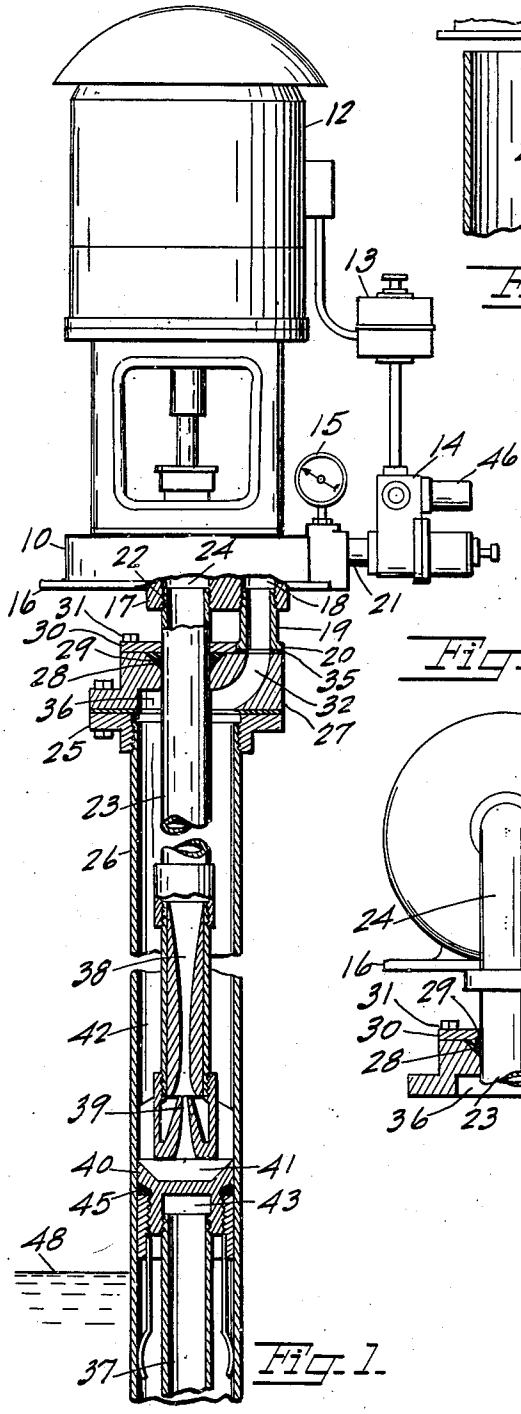


Fig. 1.

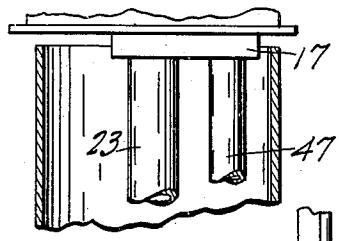


Fig. 5.

Fig. 3.

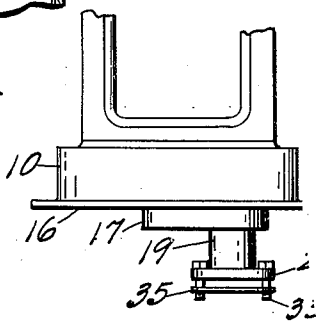


Fig. 4.

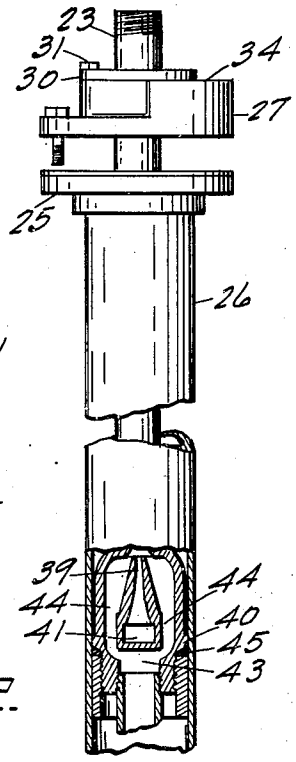


Fig. 2.

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PUMPING SYSTEM

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9 Claims. (Cl. 103—5)

This invention relates to suction lines for centrifugal pumping systems which incorporate a booster for augmenting the lift of the pump through the medium of an injector operating in the suction line and operated through the medium of water under pressure delivered from the discharge of the pump, and includes a special adapter through the medium of which, the pump can be connected to either, the parallel conduit type, or the coaxial type of suction-booster line.

In connection with the installation of the usual types of suction-booster lines, special bases or housings are used to connect the pump to the suction and booster lines; the pump bases are modified and in some cases even the suction line is changed or altered for adaption to different systems. An entirely different type of connection is required for systems in which a separate booster line is used than for such as utilize the well casing as one of the lines. Thus, even the pump connections must be designed differently for each type of booster system.

It is the principal object of this invention to provide centrifugal pumps of both, horizontal and vertical type, with a standard base and connections for connecting to either type of suction-booster system, such as the parallel conduit type and the well casing type of booster line, and to provide a standard pair of connections on the pumps for direct connection to the parallel type, and to provide an adapter for connecting through the same standard pair of connections, to the well casing type.

Another object is to provide a booster-suction line in which the suction line extends axially down into the well casing and in which the well casing is utilized as the booster line, which, being under pressure of a contained liquid, obviates any possibility of air leakage into the casing and its eventual delivery to the suction line, the introduction of which air would seriously affect operation of the pump and which may be carried to the stage of inoperativeness thereby.

A further object is to provide a special type of injector with a nozzle and including bypass means for the suction stream about the nozzle and directing means for directing the fluid under pressure in the well casing into and through the nozzle, with complete isolation of both streams up to the tip of the nozzle with complete encompassment of the nozzle by the suction stream.

A further object is to provide the suction line, intermediate its height, with a venturi and an injector nozzle for suitably diverting water under pressure, from the well casing, through the nozzle into the venturi for boosting the lift of water, while efficiently bypassing water from the well about the nozzle into the venturi, with admixture of the two streams occurring only after ejection beyond the tip of the nozzle.

Other objects and advantages of the invention will become apparent as the following description is read on the drawing forming a part of this specification, and in which similar reference characters are used to indicate similar parts throughout the several views, of which:

Fig. 1 is a sectional elevation through the invention as applied to a vertical centrifugal pump.

Fig. 2 is a sectional elevation taken at right angles to that of Fig. 1, and shows the suction-booster line in a state of partial dis-assembly, and disconnected from the pump Fig. 3, to clearly illustrate the means of attachment.

Fig. 3 is a fragmentary view showing the pump with the booster line connection nipple assembled therewith.

Fig. 4 is a fragmentary view showing the same suction-booster line using the same adapter as in the previous views, and connected to a horizontal pump.

Fig. 5 is a fragmentary view showing the pump connection head with the parallel type of suction and booster conduits connected thereto.

The pump may be either, the vertical type 10 shown in Figs. 1 and 3, or the horizontal type 11 shown in Fig. 4, and which are driven by a motor 12 having a pressure-controlled switch 13 and a pressure controlled valve 14 for controlling the pressure of the supply for boosting the lift of the pump, the usual pressure gauge 15 also being provided.

Both types of pumps are provided with a base 16 which includes identical connection heads 17 having one passage 18 threaded for securing the nipple 19 in the connection head 17. This nipple 19 terminates at its lower end in a bolting flange 20, and the passage 18 communicates directly with the discharge 21 of the pump.

The connecting head 17 also includes a threaded passage 22 into which the suction pipe 23 is threadedly secured, and this passage communicates directly with the intake 24 of the pump.

This same type of connection head 17 is illustrated in copending application, serial number 232,642, filed September 30, 1938, covering an automatic water system, but in that disclosure, an outside booster, or pressure line, is connected in place of the nipple 19. For this reason, the disclosure so far made, minus the nipple 19,

is adaptable without change for assembly with the suction and booster lines in that application.

To adapt this same connection head to the casing type booster, or self-contained suction-booster line illustrated in this instant application, an adapter is provided which consists of a pipe flange 25 threadedly secured to the top end of the well casing 26, and, a manifold 27 has an axial bore provided with a packing ring recess 28 which in turn is provided with resilient packing 29 which packs the bore against leakage about the suction pipe 23 when the gland plate 30 is drawn down by means of the screws 31, thus effectively sealing the adapter to the outside periphery of the suction line in any desired adjusted position.

The manifold 27 also has the booster passage 32 formed therein and which communicates directly with an annular chamber formed coaxially with the bore for the suction line, and this passage terminates in radially spaced relation to the bore for the suction line and in registrable relation to the passage 18, and is provided with tapped holes for cooperation with the screws 33 for bolting the flange 20 down onto the top face 34 of the manifold; a suitable gasket 35 being provided for effectively sealing the joint.

As will be noted, the passage 32 expands into the annular chamber 36 which encompasses the suction line 23 and communicates freely with the annular space between the suction line 23 and well casing 26.

As will be further noted, the only change necessary for connecting either type of pump to the type of suction-booster line disclosed in the previously mentioned copending application is, to omit the adapter, including the pipe flange, manifold and nipple, and connect the individual suction and booster lines directly, as is fragmentarily illustrated in Fig. 5.

The suction line terminates in a foot section 37 which is provided at its lower end with the usual foot valve (not shown), and has installed intermediate its length, a venturi 38 and a nozzle 39, forming together, an injector, for boosting the lift of the pump.

The nozzle 39 is formed integral with a booster foot sealing member 40 which has a passage 41 extending horizontally therethrough and sealed from the suction line and communicating between the nozzle 39 and the annular space 42 between the suction line 23 and well casing 26; and another passage 43 straddles the walls of the passage 41 as indicated at 44, and forms a through passage between the foot section 37 of the suction line and the venturi 38 and completely encompassing the nozzle, passes through the venturi to the main line 23.

This provides for substantially unimpeded flow of water through both, the nozzle, and the suction line, and provides a structure of high efficiency. A resilient seal 45 is provided to seal the annular space 42 from the portion of the casing below the plane of the nozzle, and the seal is made effective by screwing the suction pipe down a few turns to cause annular expansion of the packing through axial compression. Since the nipple is separately attachable to the manifold, the suction line can be screwed into the connection head, and the suction pipe can then be rotated by rotating the pump, to create the sealing effect, after which the flange of the nipple is bolted in position.

In operation, the pressure of the supply line 46, which usually communicates with a pressure tank, is always in communication with the booster line, such as the separate booster pipe 47, Fig. 5, or, through the nipple 19 and manifold 27 with the annular space 42 in the casing 26.

When the pump 10 or 11 is placed in operation, the water is discharged through a control valve 14 into the supply or distributing conduit 46, and as the pressure builds up in this conduit, the valve acts to increase the pressure in the passages 18 and 42, diverting more water under higher pressure down through the passage 42 and up through the nozzle 39, acting on the water drawn by suction and boosting its velocity through the venturi 38, and a similar effect is created as the level 48 of the water recedes, the increased vacuum set up by the pump reducing the resistance against the jet issuing from the nozzle.

As will be noted, the booster line, being formed by the annular space between the well casing 26 and suction line 23, is always under pressure and filled with water, therefore there is no possibility of air leakage into either the suction line or the pressure line for the booster. As is well known, the introduction of air into the suction line would create an inoperative condition of the pump. In case of leakage at any joint in the system, water might leak out but no air can leak in, therefore this system provides a perfect seal against the possibility of air introduction to the suction.

The system is easily and conveniently installed and economical in construction, and the adapter is simple, economical to construct and easily applied.

It will be understood that variations in construction and arrangement of parts, which variations are consistent with the appended claims, may be resorted to without detracting from the spirit or scope of the invention, or sacrificing any of the advantages thereof.

I claim:

1. In a pumping system, a well casing, a centrifugal pump having an intake and a discharge, a suction line extending into said well casing and communicating with said intake, a booster jet operatively associated with said suction line and communicating with the annular space between the suction line and the well casing, a connection communicating between said discharge and said annular space and forming in combination a booster line; and an adapter attached to the top of said well casing and encompassing said suction line and including sealing means sealing the top of said casing against escape of fluid; said connection comprising a passage formed in said adapter and a manually-disconnectable, non-obstructional communicating member communicating between said passage and said discharge for connecting said adapter to said pump and permitting free and unrestricted relative rotation of adapter and pump when said member is disconnected.

2. A structure as defined in claim 1; said adapter comprising a flange for the top end of said well casing; a manifold forming a head and attached to said flange and having a suction line passage with said sealing means cooperating with the suction line passing therethrough, and a booster passage forming a part of said connection and communicating with the annular space between the inside of the well casing and outside of the suction line; said disconnectable communicating member comprising a

nipple detachably connected to said adapter with the connecting cooperative surfaces free of obstructional influences against relative rotation of adapter and pump when said nipple is disconnected.

3. A centrifugal pump having a base, an intake and a discharge; a well casing; a suction line; a booster line and a booster jet operating in said suction line; said suction line being in communication with said intake; a connecting head formed on said base and having a booster passage communicating with said discharge, and a suction passage in direct communication with said intake, said passages being adapted for direct connection to said booster line and said suction line respectively in parallel, and, an adapter connectable between said head and the head of said well casing for connecting the well casing to said booster passage to convert the well casing into the booster line, and including sealing means for sealing the adapter to the outer periphery of the suction line with the suction line located axially within the well casing to form an annular booster passage between the suction line and the casing said adapter comprising a connecting head and a nipple, a flange face formed on the top surface of said connecting head and in a plane at right angles to the axis of the suction line and well casing; said nipple having a plane flange face for bolted connection to said plane flange face on said connecting head to provide for unobstructed relative rotation of said pump and said head when said nipple is unbolted.

4. A centrifugal pump having a base, an intake and a discharge; a well casing; a suction line; a booster line, and a booster jet operating in said suction line; said suction line being in communication with said intake; a connecting head formed on said base and having a booster passage communicating with said discharge, and a suction passage in direct communication with said intake and forming the medium of communication between the suction line and the intake; said passages being adapted for direct connection to said booster line and to said suction line respectively, in parallel, and, an adapter connectable between said head and the head of said well casing for connecting said well casing to said booster passage to convert said well casing into the booster line, and including sealing means for sealing the adapter to the outer periphery of the suction line with the suction line located axially within the well casing to form an annular booster passage between the suction line and the casing; and in which said suction and booster passages in the connecting head are threaded for threaded connection directly with the suction line and the booster line in parallel, and in which said adapter includes a manifold and a nipple threaded at one end and flanged at the other end for bolted connection to the top of the manifold to facilitate installation and permit adjustments of the pump and suction line relative to the well casing when said flange is free.

5. A centrifugal pump having a base, an intake and a discharge; a well casing; a suction line; a booster line, and a booster jet operating in said suction line; said suction line being in communication with said intake; a connecting head formed on said base and having a booster passage communicating with said discharge, and a suction passage in direct communication with said intake and forming the medium of communication between the suction line and the intake; said passages being adapted for direct connection to said booster line and to said suction line respectively, in parallel, and, an adapter connectable between said head and the head of said well casing for connecting said well casing to said booster passage to convert said well casing into the booster line, and including sealing means for sealing the adapter to the outer periphery of the suction line with the suction line located axially within the well casing to form an annular booster passage between the suction line and the casing; and in which said adapter comprises a flange for the top of the well casing; a manifold having an axial passage for the suction line and sealing means therefor and including sealing connecting means for securing said manifold to said flange; a nipple threaded at its upper end for connection to said booster passage and having a flange at its lower end for bolted connection to the top of said manifold, and a passage formed in said manifold and communicating between said nipple and said annular booster passage.

6. A centrifugal pump provided with a suction connection and a booster connection; a well casing; a suction line connected to said suction connection and extending into said well casing and having a booster jet operatively associated therewith; a booster line formed as an annular passage between said suction line and the encompassing well casing and having communication with said jet; and adapter, comprising a device sealable and securable to the top of said well casing and having an axial passage for said suction line and means sealing the passage externally of said suction line against leakage; a discharge for said pump; a nipple for said booster connection and removably connected to said device in radially spaced relation to said suction line and in communication with said discharge for said pump; said adapter having a passage communicating between said nipple and said annular passage.

7. A structure as claimed in claim 6 in which said device comprises a flange secured to the top of the well casing, and a manifold boltedly secured to said flange with said nipple boltedly secured to the top face of said manifold.

8. A centrifugal pump; a well casing; a suction line extending into said well casing and having a booster jet and forming a booster line in the annular space between the suction line and the encompassing well casing with the booster line in communication with said jet; an adapter for connecting said booster line to said well casing comprising a flange for the upper end of the well casing; a manifold securable to said flange and having an axial suction-line passage and sealing means therefor, and an annular chamber communicating with said annular space between the suction line and casing; said pump having an intake and a discharge; a nipple boltedly secured to the top surface of said manifold in spaced relation to said axial passage and communicating with said discharge, and a booster passage formed in said manifold and communicating between said nipple and said annular chamber; and a communicating connection between said suction line and said intake.

9. In a pumping system; a centrifugal pump having an intake and a discharge, a suction line connected to said intake and having a booster jet operatively associated therewith; a well casing surrounding said suction line and forming a booster line in the annular space therebetween with said booster line in communication with

said jet; a head secured and sealed to the top of said well casing and having an axial passage for said suction line and means for sealing said suction line in said passage; a booster passage formed through said head and communicating with said annular passage; and a removable connection for connecting said head to said pump and establishing communication between said discharge and said booster passage; one end of said removable connection being manually releasable and free of obstructional influences between the cooperative connecting surfaces when released to permit rotation of said pump relative to said head while said pump is connected to said suction line.

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