Dec. 17, 1935. T. M. RAGSDALE ET AL 2,024,703

TRENCH PUMP

Filed Feb. 26, 1934 2 Sheets-Sheet 1

FIG. 1.

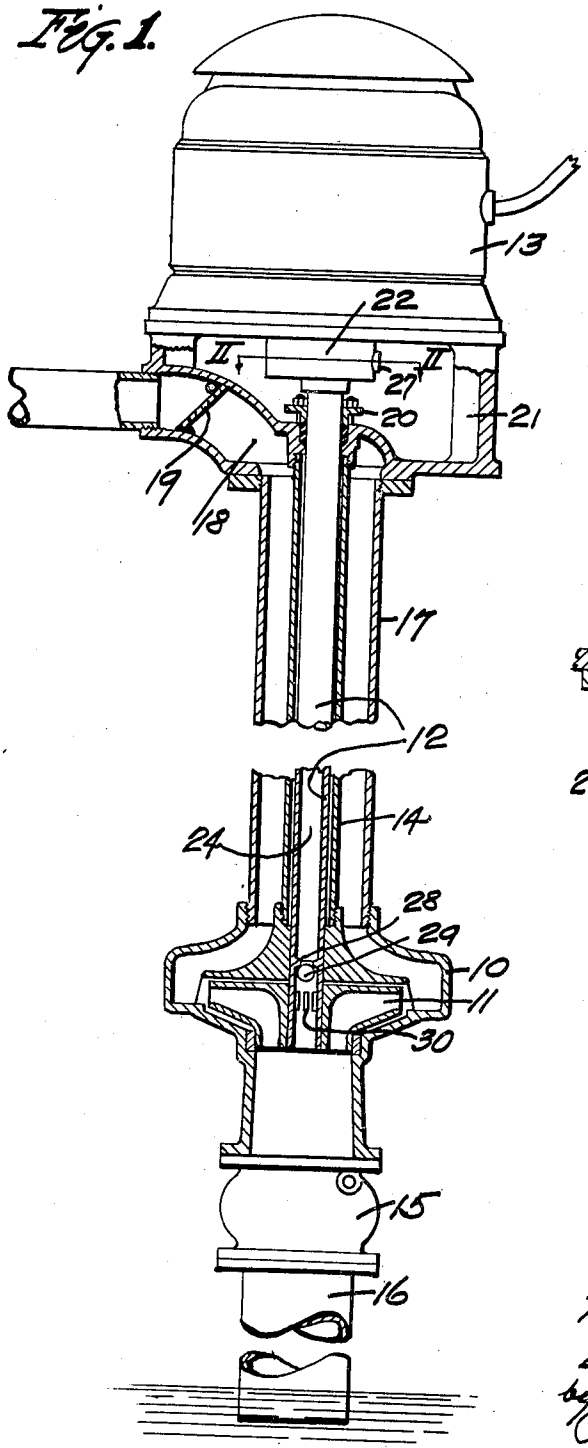
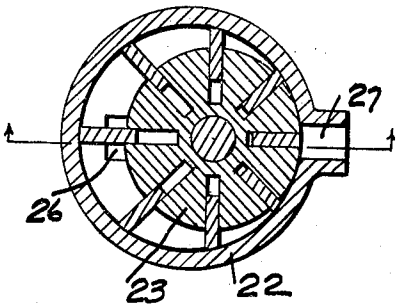


FIG. 2.



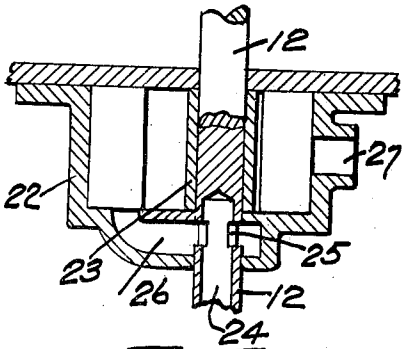


FIG. 3.

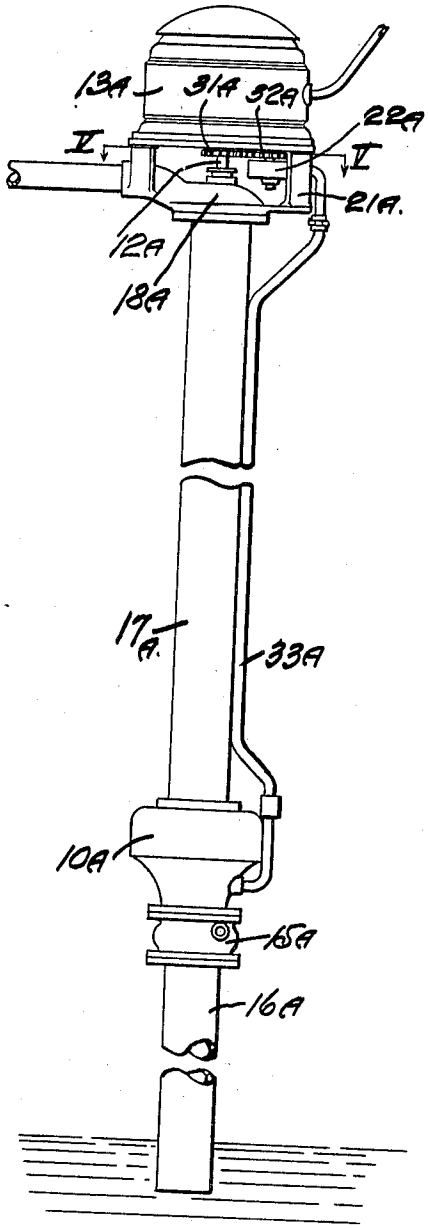
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FIG. 4



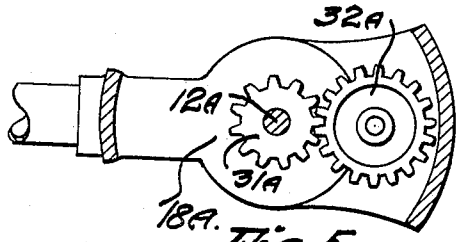
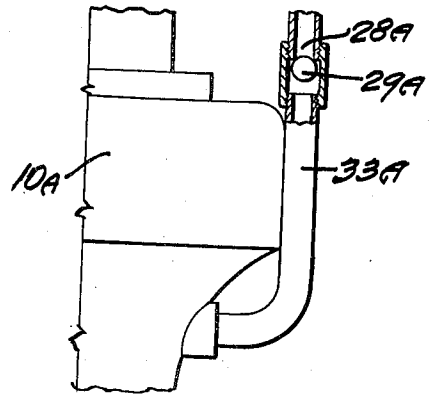


FIG. 5.

FIG. 6



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TRENCH PUMP

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Memphis, Tenn.

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7 Claims. (Cl. 103—113)

This invention relates to vertical centrifugal pumps of the high suction, self priming type. It particularly relates to a combination fluid pump and vacuum air pump, vertically spaced apart and directly driven by a common extended shaft.

The primary object of this invention is to provide means for automatically priming a fluid pump having an intake through which fluid is raised to the pump by suction.

Other objects are; to provide means for maintaining a high vacuum head in a high suction lift pump; to provide a simple and compact combination fluid and air pump; to provide a fluid pump and an air pump spaced vertically thereabove with an air conduit connecting said pumps, and to provide a fluid pump and an air pump spaced thereabove, both pumps being driven by a common hollow shaft, which serves also as the air conduit from the fluid to the air pump.

The means by which the foregoing and other objects are accomplished and the manner of their accomplishment will be fully understood from the following specification on reference to the accompanying drawings in which:—

Fig. 1 is a vertical sectional elevation of the preferred type of the assembly, the motor and air pump being shown in elevation.

Fig. 2 is an enlarged fragmentary sectional plan, taken as on the line II—II of Fig. 1, showing a typical form of vacuum pump.

Fig. 3 is a corresponding fragmentary sectional elevation of the same vacuum pump.

Fig. 4 is a vertical elevation of a modified form of the device employing a solid pump shaft and auxiliary air conduit.

Fig. 5 is a sectional plan taken as on the line V—V of Fig. 4.

Fig. 6 is a fragmentary sectional elevation showing the automatic control valve in the air conduit.

Referring now to the drawings in which the various parts are indicated by numerals;

10 is the casing of a typical vertical shaft fluid pump of centrifugal type, 11 is the impeller which is mounted on a hollow vertical shaft 12 and is driven by an electric motor 13. If desired the shaft 12 may be enclosed in a sleeve 14.

Secured to the bottom of the casing 10, is a check valve 15, from which depends a suction pipe 16 of desired length. Extending upward from the casing is a fluid discharge pipe 17, substantially concentric with the shaft 12 and sleeve 14 which discharge pipe terminates in a discharge head 18. 19 is a check valve preventing return flow through the discharge head. 20 is a stuffing box around the shaft 12.

The discharge head 18 supports a frame 21, which serves as a base for the motor 13.

Also carried by the frame 21, is a vacuum pump having a shell 22, through which the shaft 12 passes. The rotor 23, of this pump, is mounted on and turned by the shaft 12. Air inlet to the vacuum pump is upward through the central bore of the shaft. This bore as shown in Fig. 3, preferably terminates at the vacuum pump, but in any event is closed at the upper end of the shaft. 25 are openings from the shaft, leading to a passageway 26 and thence into the shell 22. 27 is a discharge opening to the atmosphere. The bore 24 is provided, adjacent the level of the impeller 11, with an annular valve seat 28, against which a ball check 29 is adapted to seat.

The ball is retained in the bore, as by lugs 30, and is preferably lighter than the liquid which is to be handled by the centrifugal pump, whereby rise of such liquid will raise the ball against the seat and cut off flow through the bore of the shaft; such condition however may be established by balancing part of the weight of the valve by a spring.

In Figs. 4, 5 and 6 a modification of the device is shown, parts corresponding to those above described being distinguished by the suffix letter A. In these views the pump shell 22A is disposed adjacent but not around the shaft 12A.

Thus disposed the vacuum pump may be driven as by complementary gears 31A, 32A, mounted respectively on the centrifugal pump shaft 12A and the vacuum pump shaft. The shaft 12A may be solid and communication between the vacuum pump shell and the centrifugal pump casing is established by a tube 33A, opening at its upper and lower ends into such shell and casing respectively. 28A is the ball check seat, and 29A the ball check, in this communicating tube.

It will be understood that, the motor, centrifugal pump and vacuum pump may be of conventional and/or usual type and such illustration and description thereof, as is introduced, is intended to be typical only of such devices.

It will also be understood that in some cases the ball check may be omitted, this being particularly evident where the vacuum pump is spaced a greater distance above the fluid pump than the vacuum lift of such fluid.

In operation, the pump is set up with the suction pipe 16, or 16A extending into the fluid to be raised. Motor 13 is started and the vacuum pump exhausts air from the centrifugal pump

casing until the fluid rises in the casing and is picked up by the pump impeller. At such time the fluid rising in the shaft bore 24, or tube 33A as the case may be, rises to the full vacuum lift until the fluid raises the ball check against its seat and cuts off flow to the vacuum pump. Also during operation should air enter the liquid pump and allow the ball check to drop, the vacuum pump will function to remove such air and restore the fluid pump to normal functioning.

Also when pumping fluid from a sump, well or basin in which the flow or the supply is limited or restricted, and air will enter with the fluid, or where the suction head of the fluid pump would normally be broken by admission of air, it is necessary to pump the air out to continue operation. Assuming that the unit is started to pump fluid with the pump case submerged, as the fluid is pumped out the level of fluid surrounding the casing will lower and finally air will be drawn in. The check valve closed when surrounded by water, opens when surrounded by air. The vacuum pump now exhausts the air from the casing reestablishing the suction head and allowing the fluid pump to remove the fluid as fast as it can enter. The check valve 15 traps the fluid in the pump casing when the unit is inoperative and upon operation the check valve 19 closes off the interior of the pump so that the vacuum pump can build up the necessary suction head.

What is claimed is:—

1. In a device of the character described, a centrifugal pump for fluids, having a casing, a suction intake depending from said casing, a discharge pipe extending upward therefrom, a motor carried by said discharge pipe, said motor having a shaft extending downward therefrom and carrying the impeller of said pump, a vacuum pump having a casing disposed around said shaft and having a rotor mounted on said shaft, said shaft having a bore connecting the inlet of the vacuum pump with the intake of the centrifugal pump and having in said bore a valve seat, a valve supported in said bore below said seat, said valve being lighter than the fluid to be pumped, whereby to be seated by rise of said fluid and prevent flow of fluid to said vacuum pump.

2. In a device of the character described a centrifugal pump for fluids, having a casing, an impeller, a suction intake depending from said casing, a discharge pipe extending upward therefrom, a motor supported above said pump, said motor having a shaft extending downward therefrom and carrying said impeller, a vacuum pump having a casing around said shaft and having a rotor mounted on said shaft, said shaft having a bore connecting the inlet of the vacuum pump with the intake of the centrifugal pump and having in said bore a valve seat, a valve supported in said bore below said seat, said valve being lighter than the fluid to be pumped, whereby to be seated by rise of said fluid and prevent flow of fluid to said vacuum pump.

3. In a device of the character described a centrifugal pump for fluids, a motor spaced above said pump, said motor having a depending shaft, said pump having a casing, an impeller, a suction intake depending from said casing, a discharge pipe extending upward therefrom substantially concentric with said shaft, and supporting said motor, a vacuum pump having a casing disposed around said shaft and having a rotor mounted on said shaft, said shaft carrying said impeller and having a bore connecting the inlet of the vacuum pump with the intake of the centrifugal pump and having in said bore a valve seat, a valve supported in said bore below said bore below said seat, said valve being lighter than the fluid to be pumped, whereby to be seated by rise of said fluid and prevent flow of fluid to said vacuum pump.

4. In a device of the character described, a centrifugal pump for fluids, having a casing, a suction intake depending from said casing, a discharge pipe extending upward therefrom, driving means carried by said discharge pipe, a shaft extending downward from said driving means and carrying the impeller of said pump, a vacuum pump having a casing disposed around said shaft and having a rotor mounted on said shaft, said shaft having a bore connecting the inlet of the vacuum pump with the intake of the centrifugal pump, and means for preventing flow of liquid to said vacuum pump.

5. In a device of the character described a centrifugal pump for liquids, having a casing, an impeller, a suction intake depending from said casing, a discharge pipe extending upward therefrom, driving means supported above said pump, a shaft extending downward from said driving means and carrying said impeller, a vacuum pump having a casing around said shaft and having a rotor mounted on said shaft, said shaft having a bore connecting the inlet of the vacuum pump with the intake of the centrifugal pump, said vacuum pump being spaced above said liquid pump a distance in excess of the vacuum lift of said liquid, whereby to prevent flow of liquid to said vacuum pump.

6. In a device of the character described, a centrifugal pump for liquids, driving means spaced above said pump, a shaft depending from said driving means, said pump having a casing, an impeller, a suction intake depending from said casing, a discharge pipe extending upward therefrom substantially concentric with said shaft, and supporting said driving means, a vacuum pump having a casing disposed around said shaft and having a rotor mounted on said shaft, tubular means connecting the inlet of the vacuum pump with the intake of the centrifugal pump, said vacuum pump being spaced above said liquid pump a distance in excess of the vacuum lift of said liquid, whereby to prevent flow of liquid to said vacuum pump.

7. In a device of the character described, a centrifugal pump for liquids, having a casing, an impeller, a suction intake depending from said casing, a discharge pipe extending upward therefrom, driving means supported by said pipe above said pump, a shaft extending downward from said driving means and carrying said impeller, a vacuum pump, means for driving said vacuum pump, tubular means connecting the inlet of the vacuum pump with the intake of the centrifugal pump, said vacuum pump being spaced above said liquid pump a distance in excess of the vacuum lift of said liquid, whereby to prevent flow of liquid to said vacuum pump.

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