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EJECTOR TYPE PUMPING APPARATUS

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Fig. 1.

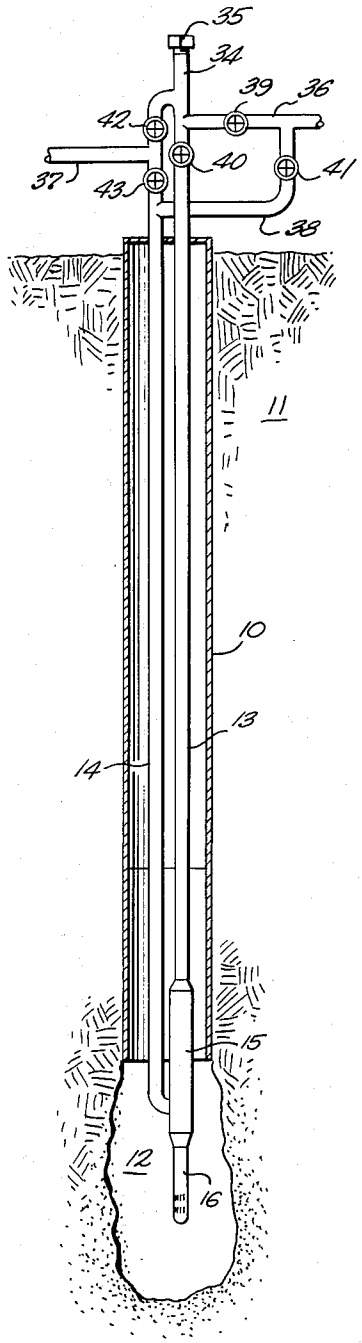
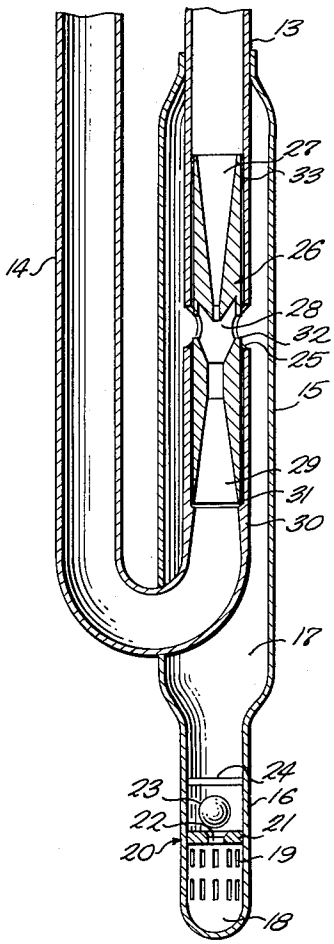


Fig. 2.



INVENTOR

Antonio Echeverria Castellot

BY Mason, Fenwick & Lawrence

ATTORNEYS

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EJECTOR TYPE PUMPING APPARATUS

Antonio Echeverria Castellot, 505 Palenque St., Mexico City, Mexico

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This invention relates to an ejector type pumping apparatus for raising fluids and more particularly to an ejector type pumping apparatus having novel means for inserting and recovering the impeller for inspection or other purposes.

In conventional ejector type pumping apparatus the impeller thereof normally is formed integral with or rigidly secured to a section of the pump tubing. Generally, whenever it is desired either to insert or remove such impellers it is necessary to remove and disassemble sections of the tubing with various types of heavy equipment including cranes, hoists and the like resulting in considerable expense and delay.

Accordingly it is the general object of the present invention to provide an improved ejector type pumping apparatus.

Another object of this invention is to provide an improved ejector type pumping apparatus having novel means for inserting and recovering the impeller thereof.

A further object of this invention is to provide an improved ejector type pumping apparatus having novel means for inserting and recovering the impeller thereof whereby no major disassembly of the pumping apparatus is required.

A still further object of this invention is to provide an improved ejector type pumping apparatus having novel means for inserting and recovering the impeller thereof whereby no additional special equipment is required.

Another object of this invention is to provide an improved ejector type pumping apparatus having novel means for rapidly positioning and recovering the impeller thereof, which involves a simple and inexpensive construction.

Other objects and advantages of the present invention will become apparent to those skilled in the art, from the following description when read in conjunction with the accompanying drawings wherein:

FIGURE 1 is an elevation view of the invention; and

FIGURE 2 is an enlarged vertical section of the invention having the top portion thereof broken away.

In accordance with the broad aspects of the present invention, there is provided an ejector type pumping apparatus for raising fluids which comprises a fluid passage means having at least one opening in a lower portion thereof and an ejector type impeller disposed in the fluid passage means and displaceable along a predetermined length thereof. The impeller is provided with at least one inlet port communicating with the entraining zone thereof and is adapted to be retained under predetermined conditions in a preselected zone in the fluid passage means so that the inlet ports thereof register with the openings in the fluid passage means. Additional means are provided for preselectively injecting a fluid in opposite directions in the fluid passage means to displace the impeller along the predetermined length thereof. By simply reversing the direction of flow of the fluid in the fluid passage means, the impeller can either be positioned for pumping or for removal from the apparatus for inspection or other purposes.

Referring to the drawing, there is shown a preferred embodiment of the invention comprising a suitable casing **10**, sunk into a stratum **11** and communicating with an underground reservoir of fluid **12** which constitutes the fluid to be raised. The pumping apparatus more particularly comprises a pair of parallel, elongated pumping tubes **13** and **14** which are joined at the upper and lower ends thereof to provide a substantially elongated O-shaped closed fluid passage means. The tubes **13** and **14** can be constructed of any suitable material and can also be constructed in sections in accordance with conventional practice. As in other similar ejector type pumping equipment, the lower portions of the pumping tubes are adapted to be submerged in the reservoir of fluid to be raised. The upper portions thereof are located above ground as shown.

Surrounding a portion of the lower end of pumping tube **13** and suitably secured thereto is a closed jacket member **15** having a reduced depending portion **16** respectively defining a suction chamber **17** and an admission chamber **18**. The reduced portion **16** is provided with a plurality of inlet ports **19** for entry of the fluid to be raised. Disposed in the reduced portion **16** is a one way valve **20** comprising a transversely disposed disc **21** formed with an opening **22** through which the fluid passes, the upper end of the opening **22** providing a seat for the ball member **23** which is restricted in vertical upward movement by means of a restraining bar **24**. The lower portion of pumping tube **13** also is provided with openings **25** which provide communication between suction chamber **17** and the interior of pumping tubes **13** and **14**.

Disposed in tube **13** and adapted to be displaced along a predetermined length thereof is an impeller **26** of substantially conventional construction having a converging zone **27**, a low pressure fluid entraining zone **28** and a diverging zone **29**. The impeller also is provided with inlet ports **32** which open into the entraining zone thereof and which are adapted to register with openings **25** when the impeller is seated on annular seat **31** provided by the shoulder portion **30** formed on the inside surface of tube **13** below openings **25**. The diameter of the impeller is slightly smaller than the inside diameter of the tube **13** to facilitate the displacement thereof along the predetermined length of travel thereof. To prevent passage of fluid through the annular spacing between the impeller and the tube **13**, the impeller is provided with a packing **33** or other suitable sealing means.

Referring to the upper end of the apparatus as shown in FIGURE 1, the tube **13** is provided with an extension tube portion **34** which is formed integral and in alignment therewith. The aligned extension tube portion **34** has a cap member **35** threadedly mounted on the upper opened end thereof which is adapted to be readily removed for purposes as will later be described. An inlet tube **36** is connected to the pumping tube **13** just below the extension tube portion **34**, which is connected at its opposite end to a suitable pump. Connected to the upper portion of pumping tube **14** is a discharge tube **37**. Finally, interconnecting the inlet tube **36** and the pumping tube **14**, below the discharge tube **37**, is a bypass tube **38**. To control the flow of fluid through the various tubes there is provided a plurality of valves including valve **39** disposed between the junctions of inlet tube **36** and tubes **13** and **38**, valve **40** in tube **13** below the junction thereof with inlet tube **36**, valve **41** in bypass tube **38**, and valves **42** and **43** in pumping tube **14** disposed on either side of the junction thereof with the discharge tube **37**.

During the normal pumping operation of the apparatus, the impeller is seated on the annular seat **31** so that the inlet ports **32** of the impeller register with the openings **25** in the tube **13**. With the impeller so positioned and the cap member firmly screwed on, valves **39**, **40** and **43** are opened and valves **41** and **42** are closed so that fluid under pressure flows from the pump through inlet tube **36**, pumping tube **13**, impeller **36**, pumping tube **14** and

discharge tube **37**. Under such conditions, a venturi effect is produced in the impeller to cause the fluid **12** to be drawn in through openings **19** into admission chamber **18**, through one way valve **20**, suction chamber **17** and through registered openings **25** and **32** into the low pressure entraining zone **28** where the fluid **12** joins the main stream of fluid in the pumping apparatus. As the fluid continues to flow through diverging zone **29** in the impeller, the velocity thereof decreases and the pressure increases sufficiently to overcome the back pressure in the apparatus and force the fluid up through pumping tube **14** and out through discharge tube **37**. The force of the fluid during the pumping operation also is sufficient to retain the impeller in the seated position as shown in FIGURE 2 to maintain openings **25** and **32** in registry. Also, it will be noted that the packing **33** between the impeller and the pumping tube **13** acts as a seal to isolate the high pressure region upstream from the low pressure region in the entraining zone.

To remove the impeller from the apparatus, valves **40**, **41** and **42** are opened and valves **39** and **43** are closed. This essentially will reverse the flow of fluid in the apparatus so that the fluid will flow through inlet tube **36**, bypass valve **38**, pumping tube **14**, pumping tube **13**, through the top portion of tube **14** and out through discharge tube **37**. Under such reverse flow, the impeller will be unseated and forced up through tube **13** into extension tube **34** from which it may be recovered by removing cap member **35**. It will be noted that when the direction of fluid is thus reversed, fluid is prevented from escaping through openings **19** by means of closed valve **20**.

It would also be possible to recover the impeller without the use of fluid flow in the apparatus simply by the use of a fishing tool which could be inserted through tube **13** from the top opening in extension tube **34**. To replace the impeller in the apparatus it would only be required to open valve **40** and insert the impeller in the aligned extension tube **34** permitting it to fall into position at rest on the annular seat **31**. To more quickly and positively seat the impeller a small amount of fluid may be injected into tube **13**.

It will thus be appreciated that the present invention provides an improved ejector type pumping apparatus wherein the impeller may be quickly inserted and recovered simply by means of reversing the direction of flow of the pumping fluid, requiring no major disassembly of the apparatus nor any special type of recovery equipment.

From the foregoing detailed description, it will be evident that there are a number of changes, adaptations, and modifications of the present invention which come within the province of those skilled in the art. However, it is intended that all such variations not departing from the spirit of the invention be considered as within the scope thereof as limited solely by the appended claims.

What I claim is:

1. An ejector type pumping apparatus for raising fluids comprising a fluid passage means having at least one opening in a lower portion thereof, a closed jacket member surrounding and secured to a lower end of said fluid passage means defining a suction chamber communicating with said opening in said fluid passage means, said closed jacket member having intake openings, one way valve means disposed in said suction chamber between said intake openings and said opening in said fluid passage means, an ejector type impeller having an entraining zone disposed in said fluid passage means and displaceable along a predetermined length thereof, said impeller having at least one inlet port communicating with the entraining zone thereof, means disposed in said fluid passage means at one end of said predetermined length for seating said impeller so that the inlet port therein registers with said opening in said fluid passage means and fluid means for displacing said impeller along said predetermined length of said fluid passage means.

2. An ejector type pumping apparatus for raising fluids comprising fluid passage means having at least one opening in a lower portion thereof, a closed jacket member surrounding and secured to a lower end of said fluid passage means defining a suction chamber communicating with said opening in said fluid passage means, said closed jacket member having intake openings, one way valve means disposed in said suction chamber between said intake openings and said opening in said fluid passage means, an ejector type impeller having an entraining zone disposed in said fluid passage means and displaceable along a predetermined length thereof, said impeller having at least one inlet port communicating with the entraining zone thereof, means disposed in said fluid passage means at one end of said predetermined length thereof for seating said impeller so that the inlet port therein registers with said opening in said fluid passage means and means for pre-selectively injecting fluid under pressure in opposite directions selectively in said fluid passage means to displace said impeller along said predetermined length thereof.

3. An ejector type pumping apparatus for raising fluids comprising fluid passage means having at least one opening in a lower portion thereof, a closed jacket member surrounding and secured to a lower portion of said fluid passage means defining a suction chamber in communication with said opening in said fluid passage means, said closed jacket member having intake openings, one way valve means disposed in said suction chamber between said intake openings and said opening in said fluid passage means, an ejector type impeller having an entraining zone disposed in said fluid passage means and displaceable along a predetermined length thereof, said impeller having at least one inlet port communicating with the entraining zone thereof, means disposed in said fluid passage means at one end of said predetermined length thereof for seating said impeller so that the inlet port therein registers with said opening in said fluid passage means, means for preselectively injecting a fluid under pressure in opposite directions selectively in said fluid passage means to displace said impeller along said predetermined length thereof and sealing means disposed on said impeller and extending between said impeller and said fluid passage means for isolating the high pressure upstream region in said fluid passage means from the low pressure region at the entraining zone of said impeller when said impeller is positioned on said seating means and fluid under pressure is injected in said fluid passage means urging said impeller in the seated position.

4. An ejector type pumping apparatus for raising fluids comprising first and second elongated tubes joined at the upper and lower ends thereof defining a closed fluid passage means, said first elongated tube having at least one opening disposed in a lower portion thereof, an ejector type impeller having an entraining zone disposed in said first elongated tube and displaceable along a predetermined length thereof, said impeller having at least one inlet port communicating with the entraining zone thereof, said first elongated tube having a shoulder portion on the inside surface thereof providing an annular seat, said annular seat being disposed below said opening in said first elongated tube so that the inlet port in said impeller will register with the opening in said first elongated tube when said impeller is seated on said annular seat, an extension tube connected in alignment with the upper end of said first elongated tube, said extension tube having an opening in the free end thereof and a cap member threadedly mounted thereon, an inlet tube connected to said first elongated tube below said extension tube, a bypass tube interconnecting said inlet tube and said second elongated tube, a discharge tube connected to said second elongated tube between the junction of said bypass tube and said second elongated tube and the junction of the upper ends of said elongated tubes, a valve disposed in said inlet tube between the junctions thereof and said bypass tube and said first

elongated tube, a valve disposed in said bypass tube, a valve disposed in said first elongated tube below the junction thereof with said inlet tube, and valves disposed in said second elongated tube on either side of the junction thereof with said discharge tube.

5. An ejector type pumping apparatus for raising fluids comprising first and second elongated tubes joined at the upper and lower ends thereof defining a closed fluid passage means, said first elongated tube having at least one opening disposed in a lower portion thereof, a closed jacket member surrounding and secured to a portion of the lower end of said first elongated tube, said closed jacket member defining a suction chamber in communication with the interior of said first elongated tube by means of said opening in the lower portion of said first elongated tube, said closed jacket member having inlet openings, a one way valve disposed in said suction chamber intermediate said inlet openings in said closed jacket member and said opening in said first elongated tube, an ejector type impeller having an entraining zone disposed in said first elongated tube and displaceable along a predetermined length thereof, said impeller having at least one inlet port communicating with the entraining zone thereof, said first elongated tube having a shoulder portion on the inside surface thereof providing an annular seat, said annular seat being disposed below said opening in said first elongated tube so that the inlet port in said impeller will register with the opening in said elongated tube when said impeller is seated on said annular seat, an extension tube connected in alignment with said first elongated tube, said extension tube having an opening in the free end thereof and a cap member threadedly mounted thereon, an inlet tube connected to said first elongated tube below said extension tube, a bypass tube interconnecting said inlet tube and said second elongated tube, a discharge tube connected to said second elongated tube between the junction of said bypass tube and said second elongated tube and the junction of the upper ends of said elongated tubes, a valve disposed in said inlet tube between the junctions thereof and said bypass tube and said first elongated tube, a valve disposed in said bypass tube, a valve disposed in said first elongated tube below the junction thereof with said inlet tube, and valves disposed in said second elongated tube on either side of the junction thereof with said discharge tube.

6. An ejector type pumping apparatus for raising fluids comprising first and second elongated tubes joined at the upper and lower ends thereof defining a closed fluid passage means, said first elongated tube having at least one opening in a lower portion thereof, a closed jacket member surrounding and secured to a portion of the lower end of said first elongated tube, said closed jacket member defining a suction chamber in communication with the interior of said first elongated tube by means of said opening in the lower portion of said first elongated tube, said closed jacket member having inlet openings in a bottom portion thereof, a one way valve disposed in said suction chamber intermediate said inlet openings in said closed jacket member and said opening in said first elongated tube, an ejector type impeller having an entraining zone disposed in said first elongated tube and displaceable along a predetermined length thereof, said impeller having a diameter slightly less than the inside diameter of said first elongated tube and at least one inlet port communicating with the entraining zone thereof, said first elongated tube having a shoulder portion on the inside surface thereof providing an annular seat, said annular seat being disposed below said opening in said first elongated tube so that the inlet port in said impeller will register with the opening in said elongated tube when said impeller is seated on said annular seat, an extension tube connected in alignment with said first elongated tube, said extension tube having an opening in the free end thereof and a cap member threadedly mounted thereon, an inlet tube connected to said first elongated tube below said extension tube, a bypass tube interconnecting said inlet tube and said second elongated tube, a discharge tube connected to said second elongated tube between the junction of said bypass tube and said second elongated tube and the junction of the upper ends of said elongated tubes, a valve disposed in said inlet tube between the junctions thereof and said bypass tube and said first elongated tube, a valve disposed in said bypass tube, a valve disposed in said first elongated tube below the junction thereof with said inlet tube, valves disposed in said second elongated tube on either side of the junction thereof with said discharge tube and sealing means disposed on said impeller and extending between said impeller and said fluid passage means for isolating the high pressure upstream region in said first elongated tube from the low pressure region in the entraining zone of said impeller when said impeller is seated on said annular seat in said first elongated tube and fluid under pressure is injected in said first elongated tube urging said impeller in the seated position.

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LAURENCE V. EFNER, *Primary Examiner.*

WARREN E. COLEMAN, *Examiner.*