Dec. 6, 1966 S. E. CORRY 3,289,593

DEVICE FOR TRANSFERRING LIQUIDS

Filed Oct. 19, 1964 2 Sheets-Sheet 1

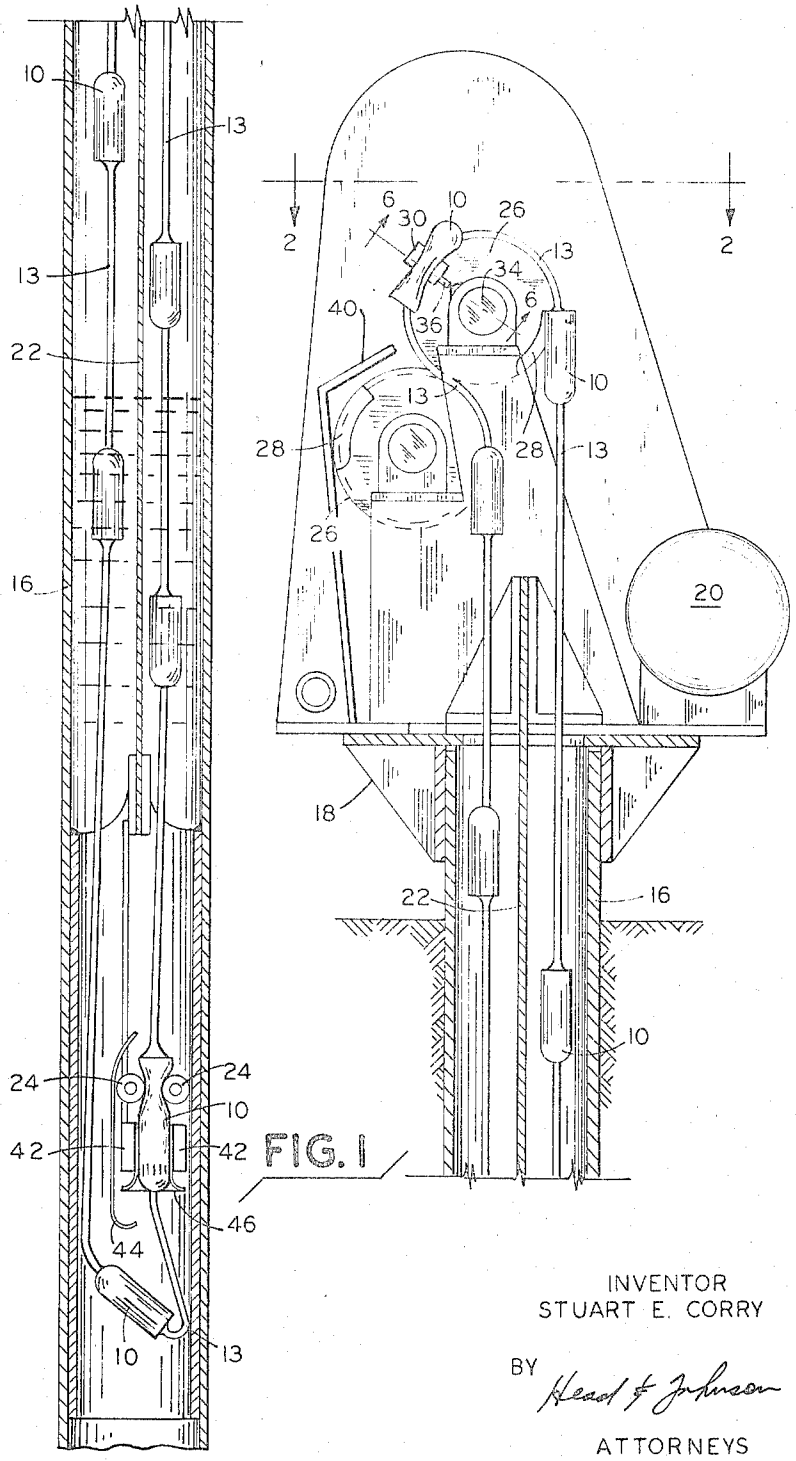


FIG. 1

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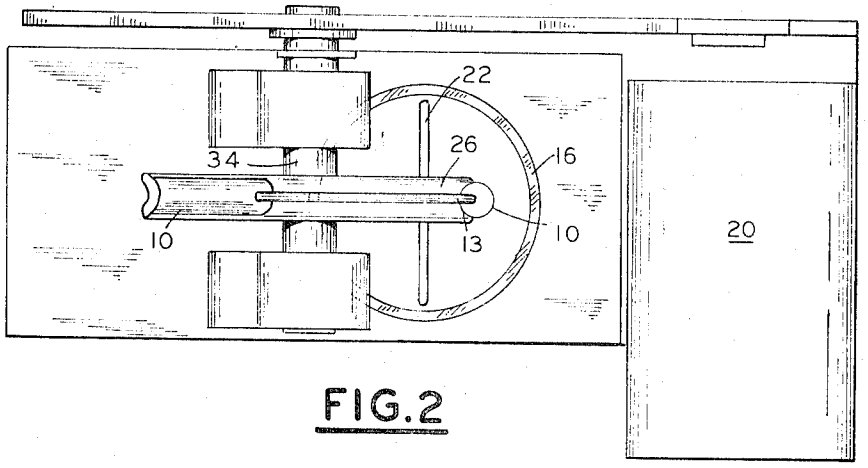


FIG. 2

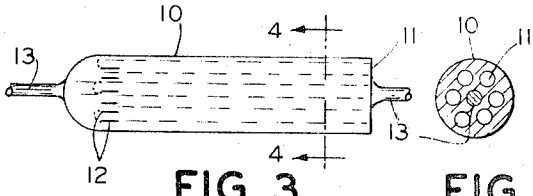


FIG. 3

FIG. 4

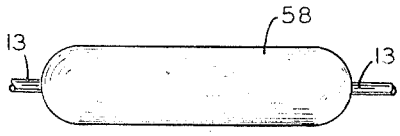


FIG. 5

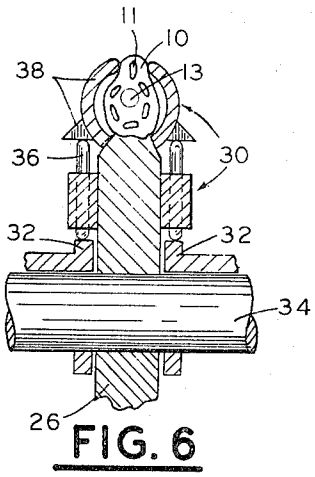


FIG. 6

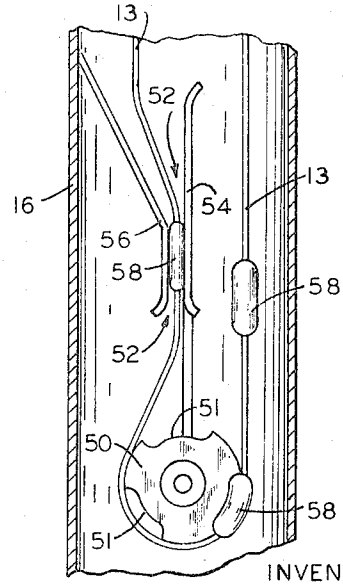


FIG. 7

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DEVICE FOR TRANSFERRING LIQUIDS

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6 Claims. (Cl. 103—72)

This invention relates to an apparatus used to transfer liquids. More particularly, this invention relates to an apparatus used to remove liquids from a large deep container. Most particularly, this invention relates to an apparatus used to remove liquids from a well.

Various types of pumps employing a series of buckets or cups attached to a flexible member, such as chain or rope, have been known for a long time. All of the heretofore suggested systems of this type have certain disadvantages. Usually the buckets are made of metal and, as in United States Patent No. 197,296, are emptied by tilting. This method of emptying limits the use of the buckets of this type to the transfer of liquids of low viscosity comparable to water. The cups which form a part of this invention are made of flexible material, and are emptied by means of squeezing. This invention is of particular value for the transfer of viscous liquids, and, most particularly, for pumping oil wells.

The main object of this invention is to provide a means of pumping liquid which is usuable without special adaptation to liquids having widely different characteristics and in different environments. Another object of this invention is to provide a more efficient, less expensive, and more easily repairable pumping system.

Further objects and advantages of this invention will become apparent from the following description and claims and from the accompanying drawings wherein:

FIGURE 1 is a cross-sectional view of the pumping system of this invention showing the continuous loop arrangement and relationship of individual liquid carriers to the rest of the system.

FIGURE 2 is a sectional view of the section 2—2 of FIGURE 1.

FIGURE 3 is an elevation of one of the liquid cups.

FIGURE 4 is a cross-sectional view across the section 4—4 of FIGURE 3.

FIGURE 5 is a perspective view of a sponge type liquid carrier.

FIGURE 6 is a sectional view of the upper pressure squeezers.

FIGURE 7 is a sectional view of a specific embodiment of the lower portion of the pumping system.

Referring now to the drawings in general, compressible cups **10** are designed to carry the liquid. These cups may be constructed of any suitable material, the only requirement being that the material used be capable of being flexed numerous times without showing excessive fatigue. The cup recesses are indicated generally by the numeral **11**, as in FIGURES 3 and 4. Although the cups themselves may be formed of only one large recess to carry the liquid, the preferred embodiment is to have a number of individual recesses running longitudinally of the cup. Any number and size of recess may be used, however, the size and number of recesses as well as the size of the individual cups will depend upon the circumstances of the overall operation. These cups **10** are mounted on a cable **13** by passing the cable longitudinally through the center of each cup **10** as best shown in FIGURES 3 and 4. After the desired number of cups have been attached to the cable **13**, the cable **13** is formed into one continuous loop by connecting the ends. The means of connection used to connect the ends of the cable may be conventional. The continuous cable **13** is wound around and between the upper roller wheels **26** outside the liquid container and then down into the liquid container.

Operation

One particular cup **10** is chosen to describe the operation of the invention in removing liquid from a well.

The direction of movement is such that the compressible cup **10** enters the well casing with the open end of the cup recesses **11** facing downward. The cup **10** travels downward on one side of the divider wall **22** and eventually begins its upward journey on the other side of this divider wall **22**. Thus, in effect, the divider wall divides the path of the cups and cable into two components, a downward path and an upward path and keeps the cable and cups from being entangled. Well below the liquid surface and at the extremity of the divider wall **22** is located the bottom cup guide **44** which is really an extremity of the divider wall **22** and acts to guide the cup and keep it in position when it makes its loop to begin the upward tour. A variation of the cup guide **44** located here would be a lower guide wheel **50** which has a series of guide grooves **51** as shown in FIGURE 7. In turning into the upward side of the divider wall **22**, the cup is now in position with the cup recesses **11** pointing upwards. The cup is guided into the lower cup positioning flange **46** into which it fits closely and which flange guides the cup through the bottom rollers **24**. The bottom rollers **24** are positioned closer together than the diameter of the cup and, thus, as the cup proceeds between the rollers, presents a squeezing effect on the cup. This squeezing effect causes any air trapped in the cup to be forced out through the cup slots **12**. The air is forced out in the form of small bubbles and passes through the vent **32** to be removed. Upon leaving the bottom rollers, the cup immediately fills with liquid. Since all or practically all of the gas or air has been forced from the cup by passing through the rollers **24**, the cup may fill more completely and efficiently as it passes through the liquid. As the cup travels upward, the cup slots **12** through which the air was previously squeezed now resume their effectively closed position and hold the liquid in place.

As the liquid filled cup **10** eventually emerges from the well casing **16**, it eventually comes into contact with the upper roller wheel **26** and automatically slides into place in one of the recesses **28** in this upper roller wheel. As the cable **13** and the compressible cup **10** travel around the upper roller wheel **26**, the cup **10** comes into contact with the upper pressure squeezer assembly, shown generally by the numeral **30**. Of course, by the time the cup **10** makes contact with the upper pressure squeezer assembly **30**, the cup is already in an inverted position with the cup recesses **11** pointing downward, thus permitting some of the liquid to escape from the cup and collect on the liquid deflecting plate **40**. Then, because in some cases the liquid may be of high viscosity, a significant amount of liquid remains in the cup when it contacts the pressure squeezers **30**. The pressure squeezers **30** are designed to remove this last trace of liquid. It can be seen from the figures that, mounted on the shaft **34** directly opposite the recesses **28** in the upper roller wheels, is a cam **32**. As the cup **10** enters the upper pressure squeezer assembly **30**, the cam **32** contacts the upper plunger **36** which then contacts the upper pressure squeezers **38**, one on each side of the cup **10**, and squeezes the cup **10**, forcing the remaining liquid out of the cup **10** through the cup slots **12**. The liquid forced out of the cup slots **12** also collects on the liquid deflecting plate **40** with the rest of the liquid. After being emptied of its liquid, the cup passes between the two upper roller wheels **26** in such a manner that the two recesses in each of these wheels **28** coincide so that the cup **10** is not subject to any additional pressure as it passes through these wheels. Upon emerging from between these wheels, the cup descends and is ready to begin its next cycle.

In the figures, this invention is shown as being held in place upon a platform **18** and as being operated by motor **20**. It is obvious that platform **18** and motor **20** are both conventional devices.

It should be clear to anyone skilled in the art that the cups **10** may be formed of any suitable material such as, for example, rubber, any of the various plastics, or suitable natural occuring materials such as hemp, cotton, linen or sisal. FIGURE 5 shows a view of a sponge type liquid carrier **58** formed from an absorbent sponge-like material, either natural sponge, natural or synthetic rubber, or plastic. In addition, the cups could be designed as being closed at each end with either flexible coverings or integral valves at each end. It should also be clear that the continuous cable **13** may be formed of any suitable material such as any metallic cable, rope, nylon or other plastics or even metallic chain of small links. FIGURE 7 also shows another variation of cup squeezing means below the surface of the liquid. The lower cup squeezing aperture **52**, generally, is formed from the arrangement of the interior cup squeezing flange **54** and the side wall cup squeezing flange **56**.

Although this specific embodiment of the invention is comprised of a continuous cable **13** with compressible cups **10**, the invention is also broad enough to cover a continuous cable which is covered over its entire length and area by a compressible absorbent material and will operate in the same manner as this specific embodiment set out here.

Since many widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that the specific embodiment described in detail herein is not to be taken in a limiting sense since the scope of the invention is best defined by the appended claims.

What is claimed is:

1. A device useful for transferring liquids comprising:

a series of compressible cups attached to a continuous cable, each of said cups having an open end and a closed end and having perforations in the side walls near said closed end;

a first power-driven upper roller wheel which contains an upper pressure squeezer assembly and an upper roller wheel recess;

a second upper roller wheel parallel to said first upper roller wheel; and

a divider wall having a lower cup guide, a vent, a cup-positioning flange, and bottom rollers.

2. A device for transferring liquid out of a lower liquid container comprising, in combination:

an upper liquid collector;

a continuous cable a portion of which extends into said lower liquid container and a portion of which extends adjacent said upper liquid collector;

a plurality of compressible fluid transporting cups affixed in spaced relationship with each other to said cable;

a wheel rotatably supported adjacent said upper liquid collector, said cable being received on the periphery of said wheel whereby said cable is supported;

means of transporting said cable in a continuous path, said cable passing downwardly into and upwardly out of said lower liquid container and passing adjacent said upper liquid collector; and

means of engaging and squeezing each of said cups sequentially to extract at least a portion of the liquid therefrom, the liquid discharging into said upper liquid collector.

3. A device for transferring liquid out of a lower liquid container according to claim **2** wherein each of said cups coaxially encompasses said cable.

4. A device for transferring liquid out of a lower liquid container according to claim **2** including means of sequentially compressing said cups within said liquid container to augment filling of said cups.

5. A device for transferring liquid out of a lower liquid container according to claim **2** including a casing extending from said upper liquid collector into said lower liquid container and including a longitudinal divider wall in said casing dividing said casing into two longitudinal compartments, the downwardly traveling portion of said cable being received in one compartment and the upwardly traveling portion of said cable being received in the other compartment.

6. A device for transferring liquid out of a lower liquid container according to claim **2** wherein said means engaging and squeezing each of said cups sequentially includes spaced paralleled squeezer plates each pivotally supported to said wheel, said squeezer plates receiving a compressible cup therebetween; and means pivoting said squeezer plates towards each other to squeeze a said cup therebetween.

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