

[54] **SYPHON LIFTING DEVICE HAVING
PISTON ACTUATED VENTING VALVE**

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[56] **References Cited**

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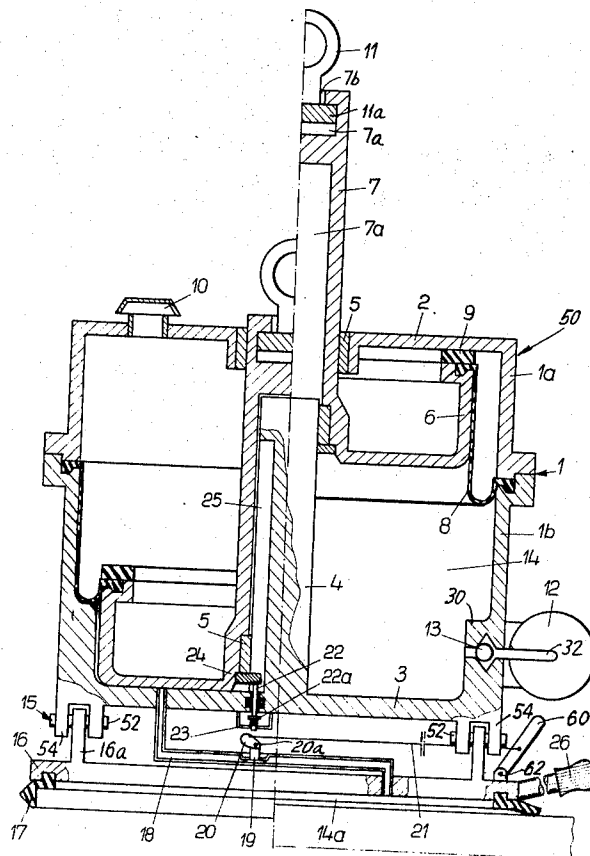
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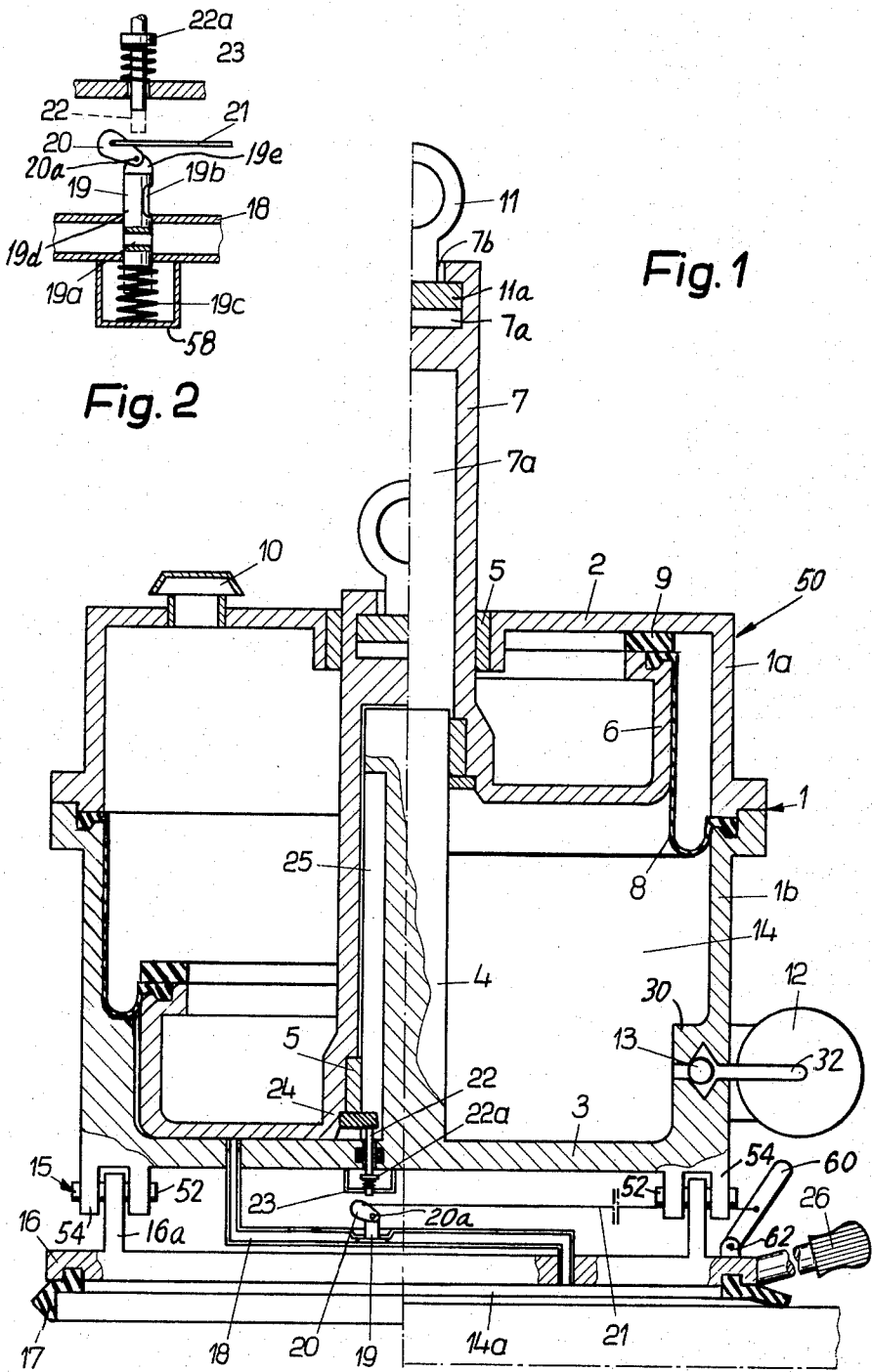
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[57] **ABSTRACT**

A syphon for lifting solid articles includes a piston which is guided within a cylinder on a centrally arranged upstanding guide member and it is connected to a rod portion having means for connecting the device to a hoisting unit. A rolling diaphragm is connected from the upper end of the piston to an intermediate annular wall portion of the cylinder so that upward movement of the piston creates a vacuum in the space therebelow which is communicated through a conduit to a sealing area defined below a suction plate. The plate may be guided into association with an article to be lifted by a handle and the interior of the cylinder may be vented by a hand operated valve control which will open the lower portion of the cylinder to the atmosphere only when the piston has been lowered so as to permit actuation of the valve control.

9 Claims, 2 Drawing Figures





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SYPHON LIFTING DEVICE HAVING PISTON ACTUATED VENTING VALVE

SUMMARY OF THE INVENTION

This invention relates in general to lifting devices and in particular, to a new and useful syphon for lifting solids and which includes a piston which is adapted to be attached to a hoisting device and which is movable in a cylinder to create a vacuum during its upward movement in a lower cylinder space which space is communicated to a suction plate and to an improved venting valve arrangement therefore.

A syphon of the general type which includes a piston movable in a cylinder to create a vacuum in the lower space of the cylinder which is communicated to a suction plate is known. In a syphon of this nature the piston is locked during every second stroke with the cylinder to make it possible to disengage the syphon from the deposited material on the suction plate. This locking mechanism is of very involved construction and comprises many structural elements which can be manufactured only at great expense and it requires the alternate lifting and depositing of objects. This is frequently not the purpose of such a load handling device. A syphon of this type also includes a venting valve which has a large sealing area which, by its nature, means that it can be manufactured only with extreme care. For a longer lifting times and when the lifting vacuum seal is not intact, it is therefore possible that the air will penetrate through the seal into the suction space and thereby reduce the vacuum.

In accordance with the present invention, there is provided a syphon which is capable of operation without an expensive locking mechanism. The apparatus includes an inexpensive venting valve which is connected between the vacuum space of the cylinder and the suction space defined beneath a lifting plate. The valve is such that it can be mass produced inexpensively. The venting valve is actuated only when the piston has been lowered to permit manual operation of the valve by the deflection of an actuating member which is engaged by a pin which is set by the lowering of the piston. In the venting position, the valve separates the suction space defined beneath the suction plate from the suction space in the cylinder and also closes off the space from the outside air. When the piston is raised with the valve in the vented position, it produces a slight vacuum in the cylinder and the syphon is lifted while air enters into the suction plate space and makes the detachment of the suction plate possible. After placing the syphon on the material to be lifted, the venting valve is switched and the suction space in the cylinder is again connected with the suction plate suction space. The atmospheric air cannot penetrate into the suction plate suction space when the piston is rising because the valve will be biased to a closed position after the pin, which has been set by the downward movement of the piston, is released. The rising action of the piston therefore again produces a vacuum beneath the suction plate to permit engagement of an article and the rising of the piston in the cylinder by an amount corresponding to the weight of the device which has been picked up. The venting valve of the invention is a commercially available valve and replaces the special valve which has been used up to the present time and also replaces the expensive locking mechanism.

In accordance with a further feature of the invention, the actuating element in the form of a cam is supported rotatably on the venting valve stem and when it is pivoted by movement of an actuating handle, it will be depressed downwardly to open the valve by the action of a pin which has been set by the downward movement of the piston. Whenever the piston moves upwardly, however, the pin will be biased by an associated spring to an upper position in which it is clear of the cam so that the venting cannot take place when the piston is moved off the lowermost position. Therefore unintentional opening of the valve with the syphon loaded is not possible because the opening pin is pushed upwardly by its spring and cannot serve as a support for the valve actuating cam to ensure its downward movement when it is deflected. The venting

valve is advantageously located in a conduit which extends from the interior of the cylinder in the space defined below the piston (the vacuum space) to the suction space defined on the opposite sides of a suction plate which is suspended from the lowermost end of the cylinder. The actuating cam is connected through a linkage to a manual switch but it can also be connected for electric or magnetic operation as desired. The suction plate advantageously includes a handle at one end for guiding the plate into association with an article to be lifted and the venting valve actuator is located adjacent the handle.

In order to prevent a hard impact with the cover in the event of an overload of this syphon, the upper edge of the piston is equipped, according to the preferred form of the invention, with damping means which are carried by the piston and move therewith against the cover for the cylinder. The damping means may be for example, an elastic ring which is made of a material such as rubber. One or more of these rings for spring means may be attached to the piston.

Accordingly, it is an object of the invention to provide an improved syphon or lifting device for articles which includes a suction plate member having a suction space, defined on the lifting side thereof, which is communicated with the interior of a cylinder which includes a piston having a rod portion which is adapted to be carried on a hoisting device and which during its upward movement creates a vacuum in the lower portion of the cylinder which is communicated to the suction space of the suction plate, and to an improved valve means for venting the suction space which may be operated only upon the locating of the piston in a lowermost position of movement.

A further object of the invention is to provide a syphon which includes an inexpensive valve for venting a suction lifting member and which may be actuated only in a preset condition.

A further object of the invention is to provide a syphon which is simple in design, rugged in construction, and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a longitudinal cross sectional view of a syphon with the left hand portion of the Figure indicating the lower position of the piston thereof and the right hand portion indicating the upper position of the piston; and

FIG. 2 is an enlarged sectional view of the venting valve mechanism for the syphon.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in particular the invention embodied therein comprises a syphon generally designated 1 which includes a cylinder generally designated 2 formed by a flanged upper part 1a and a flanged lower part 1b which are arranged together, with their flanges abutting, over a thickened outer rim of a rolling diaphragm 8. The other end of the rolling diaphragm 8 is engaged to the upper edge of a cylindrical piston 6. The attachment of the upper end of the rolling diaphragm 8 on the piston is covered by damping means in the form of a resilient ring 9. This damping means 9 prevents the piston 6 from striking the cylinder cover 2 for example, when the piston is moved upwardly when the device is subject to an unusually large load.

In accordance with a feature of the invention, a cylinder bottom wall 3 is provided with a central upstanding guide member or column 4 which provides a vertical guide for a hol-

low rod portion 7 of the piston 6. The piston carries a guide bushing 5 which is movable vertically within a guideway 25 of the guide 4. A combined lug ring actuator and guide member 24 is oriented by the bushing within the guide way 25 and it ensures that the piston 6 may be reciprocated without rotatable movement. The hollow piston rod 7 includes a cavity 7a at its upper end having an opening 7b through which a shank portion of an eyelet 11 extends. A base portion 11a of the eyelet is rotatable within the upper cavity 7a of the hollow piston rod 7. The piston rod 7 and the piston 6 are guided during its vertical reciprocable movement by a guide bushing 5 together with the guide pin 4 and the guide means prevent the lateral squeezing of the rolling diaphragm 8.

The lower part of the cylinder 1b is provided on its interior within an annular widened portion or thickened portion 30 which provides a reinforcement for the mounting of a vacuum pump 12. The pump 12 is connected through a line 32 to the interior space 14 which may be placed under vacuum. The line 32 is provided with a ball check valve 13 and the suction line 32 may be connected to make possible even the extended lifting of porous material.

In accordance with another feature of the invention, a suction plate member or lifting member 16 includes bracket portions 16a and 16b which are pivotally suspended on pins 52 carried on brackets 54 which extend downwardly from each side of the bottom 3. The pivotal suspension for the suction member 16 is generally designated 15.

The cylinder cover 2 carries a vent or venting hood 10 into which a battery operated bell can be built.

The suction plate 16 is provided with a sealing attachment 17, and below the suction plate 16 there is a suction plate suction space 14a which is connected with the suction space 14 of the cylinder 1 through a connecting line 18. In the connecting line 18, there is located a venting valve 19 which controls the communication between the cylinder space 14 and the suction space 14a and the atmosphere.

As best seen in FIG. 2, the venting valve 19 includes a body 19d having a cross passage 19a defined therein and a lowermost end which is biased upwardly by a spring 19c which has an opposite end held in a retainer cup 58. The spring 19c holds the venting valve 19 in a position at which it connects the suction space 14 with the suction space of the suction plate 14a. Valve actuating means includes a cam 20 which is pivotally mounted at 20a on a bracket extension 19e of the valve 19 and it may be rocked on its pivotal mounting by a control member such as a link 21 which connects to a hand operated lever 60 pivotally mounted on a bracket 62 adjacent a positioning handle 26 carried on the suction plate 16.

If the piston 6 is in a lowermost position, the lug ring 24 will engage the top of a pin 22 to cause it to move from the solid line position indicated in FIG. 2 to the dotted line position. This movement is accomplished against the force of a biasing spring 23 which urges the pin upwardly by bearing against a collar 22a thereof. When the pin is in a dotted line position, indicating that the piston 6 is in the lowermost position; and then the handle actuator 60 is actuated, the cam 20 will be deflected by the pin downwardly to cause the valve body 19d to move downwardly. This causes a notched portion 19b of the body 19d to permit entry of the atmospheric air into the passage 18 and into the suction space 14a and will also prevent a vacuum from forming there when the piston 6 is raised within the associated cylinder 1. The suction space 14 is closed off by the venting valve 19. When the piston 6 is lifted a vacuum forms in the space 14 corresponding to the syphon zone weight.

The above described device prevents the release of the vacuum whenever the piston is in a withdrawn position in relation to its associated position in order to ensure that the lifted load is only released when this piston is in a lowermost position at which the vacuum is not too great and the load is not supported by the lifter. Thus, when the load is being lifted, there is no possibility that the load will be dropped by the sudden release of the vacuum. It is only possible to drop the load

when the load is resting on some support and the piston is moved downwardly and thus it is unlikely that accidents will occur by opening the valve too soon.

What is claimed is:

1. A syphon, comprising a cylinder, a piston movable in said cylinder having a rod portion adapted to be connected to a lifting device and being movable toward one end of said cylinder to create a suction on the opposite end, a suction member carried by said cylinder and having a suction space which is adapted to be connected to the vacuum of said cylinder for establishing suction engagement of an article, venting valve means connected to said suction space for venting said space, actuating means connected to said venting valve means and settable by said piston when said piston is at a predetermined position to open said valve means and vent said suction member suction space, said venting valve means including a line connecting said cylinder from the side having the vacuum to said suction space, a valve in said line having a movable valve portion with a cam pivotal thereon, a pin mounted in the bottom of said cylinder, means biasing said pin upwardly, said piston being engageable with said pin to deflect it downwardly when said piston is at its lowermost position into a position at which it engages said cam, and an actuator connected to said cam to rotate said cam whereby when it engages said pin it opens said valve.

2. A syphon, according to claim 1, wherein said actuating means comprises a manual switch connected to said cam and being movable to move said cam.

3. A syphon, according to claim 2, including control means located on the exterior of said suction plate and constituting said actuating means for operating said venting valve means.

4. A syphon, according to claim 1, wherein said actuating means comprises a magnetic switch connected to said cam for actuating said cam.

5. A syphon, comprising a cylinder, a piston movable in said cylinder having a rod portion adapted to be connected to a lifting device and being movable toward one end of said cylinder to create a vacuum on the opposite end, a suction member carried by said cylinder and having a suction space which is adapted to be connected to the vacuum of said cylinder for establishing a suction engagement of an article, venting valve means connected to said suction space for venting said space including a suction space vent having a valve setting member for opening and closing said vent arranged in line with said piston, an actuator connected to said setting member and located outside of said cylinder and being movable to shift said setting member between a non-active position in which it will not be contacted by said piston when said piston moves downwardly to a position adjacent the bottom of its stroke and being movable to an active projecting position in which it will be contacted by said piston when said piston moves to a position adjacent the bottom of its stroke to move said valve setting member to cause it to open said vent.

6. A syphon, according to claim 5, wherein said piston includes damping means engageable with said cylinder to absorb stresses when said rod portion is engaged and said piston moves upwardly against said cylinder rapidly.

7. A syphon, according to claim 5, wherein said cylinder comprises upper and lower flanged portions having their flanges abutting, said piston including a rolling diaphragm connected thereto and connected between the flanges of said cylinder.

8. A syphon, according to claim 7, including a vertical guide member extending upwardly from the bottom of said cylinder, said piston rod portion being hollow and being of a size to accommodate said guide member during upward and downward movement of said piston, and guide bushing means defined on the end of said piston through which said piston rod portion extends forming a guide with said guide member.

9. A syphon, according to claim 5, wherein said valve setting member includes a pin disposed in the path of movement of said piston and being deflectable thereby, said venting valve means including a valve for said suction space vent for

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opening and closing communication of said suction space to atmosphere and having a cam portion, which is movable to actuate said valve, said cam portion being located to contact said pin only when said pin has been depressed by said piston to cause opening of said valve.

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