APPARATUS FOR EJECTING FLUIDS UNDER PRESSURE

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7 Claims.

(C. 299-89) My invention relates to apparatus for ejecting fluids under pressure. It has to do, more particularly, with fluid-ejecting apparatus which is adapted to be used for cleaning plants, factories, et cetera, and particularly plants or factories which are difficult to keep clean and where it is necessary to maintain sanitary conditions, such as creameries, packing plants, et cetera. However, the principles of my invention may be embodied in smaller units which may be used for cleaning rugs, hats, or various other smaller articles. Although this apparatus is particularly useful for cleaning purposes, it may also be used for various other purposes, and it will be understood that, although in the following description, I describe my device as being used for cleaning purposes, I do not intend to be limited thereby, inasmuch as my device may be used for many and widely different purposes.

In the past, there have been many attempts to devise suitable apparatus for cleaning the floors, walls and equipment of creameries, packing houses and other plants where it is necessary to maintain sanitary conditions. It is usually necessary to clean such places each night. The machines which have been devised for this purpose have not been found satisfactory so that this cleaning operation must be performed by hand. This usually requires several men who must work for a considerable length of time in cleaning up the plant.

One of the objects of my invention is to provide apparatus for ejecting fluids under pressure of the type indicated, such apparatus being extremely simple and which is of such a structure that it may be supplied to the purchaser at a comparatively low cost.

Another object of my invention is to provide fluid-ejecting apparatus of the type indicated which is very effective for the purpose for which it is designed and which can be easily operated.

A further object of my invention is to provide apparatus of the type indicated which is particularly useful for cleaning purposes and which will be of such a nature that there will be little or no danger that the cleaning compositions employed therewith will cause the apparatus to become inoperative.

In its preferred form, my invention contemplates the provision of fluid-ejecting apparatus of the type indicated embodying a container which is adapted to contain the cleaning fluid. This container may be connected either to a steam line or a compressed air line which is adapted to build up pressure in the container.

The pressure is applied to the container in such a manner as to cause the cleaning fluid therein to flow into a discharge hose which is adapted to be used for applying the cleaning fluid to the surface to be cleaned. Part of the pressure fluid, that is, the steam or air, is adapted to flow directly from the source of supply into the discharge hose and serve as a medium for carrying the cleaning fluid therewith.

Various other objects and advantages will appear as this description progresses.

The preferred embodiment of my invention is shown in the accompanying drawings wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a front elevation, partly broken away, of an apparatus which is made in accordance with my invention.

Figure 2 is a side view of my apparatus taken at right angles to that of Figure 1.

Figure 3 is a detail, mainly in section, of the bottom of the tank or container which is used for containing the cleaning fluid and showing the plug which is used for closing the opening formed therein.

Figure 4 is a section of an ejector which I use with my apparatus.

Figure 5 is a side elevation of the ejector shown in Figure 4 and showing the parts thereof separated.

Figure 6 is a diagrammatic view showing how my apparatus is adapted to be used.

With reference to the drawings and, particularly to Figures 1 and 2, my apparatus is shown as embodying a tank or container 1 in which the cleaning fluid is adapted to be placed. This tank or container 1 is mainly of cylindrical form but is provided with a convex upper end 2 and convex lower end 3. This container or tank 1 is made of sufficient strength to withstand the pressure to which it is subjected, as will be more fully set out later.

The tank 1 is mounted on a pair of wheels 4 and 5 which are rotatably mounted on bracket members 4' and 5', respectively, and which are suitably secured to the lower portion of the tank. A smaller wheel 6 is mounted on a bracket 6' which is secured to the lower portion of the tank midway between the wheels 4 and 5. The wheel 6 is, however, mounted directly on a yoke member 6c which is pivoted to the bracket 6' in a suitable manner so that the wheel 6 and yoke 6c...
member 6a may swing in a horizontal plane to any desired position. Thus, it will be seen that the tank 1 will be mounted in such a manner that it may be readily moved from place to place.

The upper end of the tank is provided with an inlet member 7 having a plug 8 screwed therein. When the plug 8 is removed, the cleaning fluid is poured into the tank through the member 1. A wrench 9 is provided for removing and replacing the plug 8, inasmuch as it is necessary to have this plug screwed tightly in position to prevent escape of pressure from the tank 1. The wrench may be hung on a hook 10 on the container or tank 1 so that it will always be at hand. A funnel 11 may also be hung on a hook 12 on the container or tank and this funnel is adapted to be used when the cleaning fluid is poured into the tank.

As previously stated, the bottom of the tank is of convex form on the outside. As shown in Figure 3, this produces a cavity 13 in the lower end of the tank. A tubular extension 14 extends downwardly from the bottom of the tank and is provided with threads on the inner surface thereof, as indicated at 15, for the reception of a threaded plug 16. This plug 16 has a nut formed on the lower end thereof which is preferably of the same size as the nut on the plug 8 so that both of these plugs may be removed by the same wrench 9.

The plug 16 preferably has a strainer member 17 of cylindrical form attached thereto in a removable manner. When the plug is screwed into the bottom of the tank, this strainer member 17 loosely slips up over the lower end of a pipe 18. When the plug 16 is screwed up into the extension 14 as far as it will go, the lower end of the pipe 18 is preferably spaced a considerable distance above the upper surface of the plug, as indicated at 19. When the plug 16 is removed, the strainer member 17 will also be removed. The strainer member may, therefore, be readily removed at any time so that it may be cleaned. Also, the plug 16 and the strainer may be removed at any time to permit cleaning out of the bottom of the tank.

The pipe 18 extends from the bottom of the tank up through the tank and out through a fitting 20 on the top of the tank. Obviously, the fitting 20 is placed at the center of the cylindrical tank 1. The upper end of the pipe 18 has a hand-operated valve 21 interposed therein which may be used for restricting the flow of fluid through the pipe or for shutting off the flow entirely. The pipe 18 which is adjacent the valve 21 also has a flow gauge 22 placed therein. This flow gauge may be of any suitable, well known type and is adapted to indicate the amount of fluid flowing through the pipe 18 at this point.

Thus, it will be apparent that the pipe 18 is passed to the outside of the tank so that the control valve 21 and the flow indicator 22 will be on the outside of the tank in a suitable location. The pipe 18 again passes downwardly through the top of the tank and is connected to the ejector 23 of my apparatus. This ejector is disposed inside of the tank so that it cannot be tampered with by the workman using my apparatus. At the end of the pipe 18 is threaded into a tubular extension 24 on the casing 25 of the ejector, as shown in Figure 4.

This ejector 23 embodies the main casing 25 which is of the shape shown in Figure 4 and which is adapted to have inserted therein a removable inner member 26. The casing 25 is mainly of cylindrical form and is provided with an annular shoulder 27 projecting from the inner surface thereof. The inner member 26, as previously stated, is adapted to be inserted into the casing 25 and is provided with an enlarged portion 28 which is adapted to be disposed into a central portion 29 of the left of the shoulder 27. This enlarged portion 28 is adapted to contact with the inner surface of the casing 25. The forward portion of the removable member 26 comprises a nozzle portion 29 which is adapted to extend into that portion of the casing 25 which is at the right of the shoulder 27. This nozzle portion 29 is of considerably less diameter than the inner surface of the casing 25 which surrounds it so that an annular space 30 is produced between the outer surface of the nozzle portion 29 and the inner surface of the casing 25.

When the removable portion 26 is inserted into the casing 25, these two members will be disposed in the positions relative to each other which are shown in Figure 4. A gasket 31 is placed between the shoulder formed by the enlarged portion 28 of the member 26 and one side of the shoulder 27. Thus, a pressure-tight joint will be produced at this point between the member 26 and the casing 25. The right hand end of the casing 25 is threaded on its outer surface as indicated at 32 for the reception of the enlarged threaded portion 33 of the coupling 34. When this coupling 34 is threaded onto the end of the casing 25, it will maintain the member 26 in position as indicated in Figure 4. A gasket 35 is preferably disposed between the outer end of the member 26 and the inner surface of the vertical portion of the coupling 34. Thus, a pressure-tight joint will be produced at this point.

The enlarged portion 28 of the member 26 is provided with an annular groove 36 extending around the periphery thereof. When the member 26 is in position in the casing 25, this groove 36 will lie directly over an orifice 37 formed in the casing 25. A bore 38 is provided through the wall of the member 26 to establish communication between the inner surface of the member 26 and the space formed by the groove 36 between the outer surface of member 26 and the inner surface of the casing 25 to a point outside the casing 25. If these openings are not in alignment, fluid from the inner portion of the member 26 will flow through the opening 38 into the groove 36 and through the groove 36 and out through the orifice 37.

As previously stated, the nozzle portion 29 of the member 26 extends into that portion of the casing 25 which is disposed at the right of the flange 21 and an annular space 40 is formed therearound. The right hand end of the casing 25 is provided with a vertical wall 33 having an opening 40 formed therein. The opening 40 establishes communication between the annular space 30 and an extension 44 disposed on the casing 25. The walls of the opening 40 are beveled, as indicated at 42, and the extreme outer edge of the nozzle portion 29 is also correspondingly beveled, as indicated at 43. The beveled edge 43 is spaced from the beveled edge 42 a slight distance so that a small annular space 44 is formed therebetween. The nozzle portion 29 is also provided with a plurality of small passageways 45 spaced around its periphery. Each of these passageways communicates with
the annular space 30 and the inner portion of the nozzle portion 29. A shoulder or flange 46 extends outwardly from the inner surface of the nozzle portion 28 at a point spaced slightly to the extent of the passageway 45. This shoulder serves to produce a restricted passageway 47 in the nozzle portion and which is of comparatively less diameter than the inner surface of the nozzle portion. This restricted opening or passageway is provided for a purpose which will be explained in detail later.

The extension 41 at the right hand end of the valve 23 is adapted to receive the threaded end of the pipe 48. As shown in Figure 1, the ejector 23 is disposed substantially midway between the sides of the tank. This pipe 48 extends from the ejector out through an opening 49 in the tank and projects from the outer surface of the tank a considerable distance. A fitting 50 is provided for securing the inner end of a flexible hose 51 to the outer end of the pipe 48. This fitting is of such type as to produce a fluid-tight and pressure-tight connection.

The flexible hose 51 may be of any desired length and its outer end is connected to a pipe member 52 by a suitable connecting member 53. The pipe member 52 is of rigid construction and of considerable length. A wooden handle 54 is provided on the pipe 52. The outer end of the pipe 52 is provided with a nozzle 55 which is preferably connected thereto in such a manner that it may be rotated relative to the end of the pipe to any desired position.

The fitting 54 at the left hand end of the ejector 23 is connected to a pipe 56 which extends from the ejector through an opening 57 in the tank and which projects a short distance from the tank. This pipe 56 is connected to a flexible hose 58 by a suitable connecting member 59. The flexible hose 58 may be of any desired length and its opposite end is connected to a steam pipe or compressed air pipe 60 having a valve 61 in the end thereof. I preferably provide a plurality of large hook members 62 adjacent the upper end of the tank so that the flexible hose may be wound around the tank and supported by these members.

In the operation of my apparatus, the hose 58 is connected to the pipe 60 which will be disposed in the part of the building or plant to be cleaned. In this instance, we will say that the pipe 60 is part of a steam pressure supply system of the plant. The tank is moved to the desired position and the valve 61 is opened. It will be understood, however, that the tank has previously been provided with a supply of cleaning fluid of any desired type. This cleaning fluid usually consists of some chemical in powdered form which is mixed with water. The tank is preferably filled only to a level slightly below the ejector 23.

When the valve 61 is opened, the live steam will be permitted to flow under pressure through the flexible hose 58 into the pipe 60 and then into the ejector 23 through the coupling 34. The steam will then pass through the cylindrical passageway 25 in the member 26 and then pass through the opening 47 past the shoulder 46. This restricted passageway will reduce the pressure at this point for a purpose which will be explained later. After the steam passes this point, it will continue through the nozzle portion and be discharged into the pipe 48. All of the steam does not pass through the member 26, however, but part of it will flow through the opening 30 in the wall thereof into the groove 38 and around such groove until it passes out through the orifice 37. It will then be discharged above the cleaning fluid disposed in the tank 1 and build up pressure therein above the fluid.

The pressure built up by the steam in the tank above the cleaning fluid will exert sufficient force thereto to cause the fluid in the bottom of the tank to flow through the strainer 17 and then up into the pipe 18. This pressure will cause the cleaning composition to flow upwardly through the pipe 18 past the valve 21 which will be opened to a desired extent and then past the flow indicator 22 which will indicate the velocity of the cleaning composition flowing past such indicator. In case the tank becomes empty, or almost empty, the indicator 22 will show this to the operator. The cleaning fluid under pressure will flow from the pipe 18 into the annular space 30 surrounding the nozzle portion of the 20 valve.

As previously stated, the restricted opening 47 will reduce the pressure of the steam in the nozzle portion of the valve. This opening is restricted to such an extent that the pressure of the main steam stream of the steam which flows directly through the member 26, will be slightly less in that portion of the nozzle 29, at the right of the shoulder 46, than in that portion of the member 26, at the left of the shoulder 46. I provide an ejector 50 of this type in order that the pressure built up in the tank by steam passing from the main portion of the member 26 through the opening 38 into the tank will be slightly greater than the pressure in the nozzle portion 29 at the location at the right of the shoulder 46.

Therefore, when the pressure in the tank forces the cleaning fluid into the annular chamber 30 of the valve which surrounds the nozzle portion 29, it will cause the cleaning fluid to flow through the passageway 45 into the main steam of the main steam and be carried along thereby. Also, part of the cleaning fluid will flow past the forward end of the nozzle portion through the passageway 44 and will join the main steam of steam. Both the passageways 45 and the annular passageway 44 are directed toward the line of movement of the main steam through the steam so that the cleaning fluid with the main steam of steam will be enhanced. Due to the fact that the steam will flow through the nozzle portion at a comparatively high velocity, there will be an inspirator action set up which will aid in causing the fluid to be drawn into the annular space 30 and into the main stream of steam.

When the main stream of steam with the cleaning fluid mixed therein leaves the ejector 23, it will flow into the pipe 48. From the pipe 48, it will flow into the flexible hose 51, pipe 52 and finally out through the nozzle 55. The pipe 60 may be used as a handle so that the steam of steam and cleaning fluid coming from the nozzle 55 may be directed to the desired point on the surface to be cleaned. Furthermore, the wooden handle 54 will not readily become heated by the steam passing through the pipe 52.

It will be apparent that the ejector 23 is of such a type as to permit mixing of the cleaning fluid with the main steam of steam. Also, this ejector is of such a type as to permit building up a pressure in the tank which causes ejection of the cleaning fluid therein. A particularly advantageous feature of this apparatus, when using steam pressure, is the fact that the cool cleaning fluid is mixed with the live steam as it leaves 75
This will cool the steam so that, by the time it is discharged through the nozzle 25, it will be much cooler than when it entered the valve. In fact, the steam is cooled so much that my device may be used for cleaning painted or other such surfaces without injury thereto. As previously stated, these cleaning fluids usually have water as a part thereof. Since water is such a poor conductor of heat, the steam discharged on top of the cleaning fluid in the tank will not affect the air in the lower portion of the tank to any considerable extent. Consequently, this cleaning fluid in the lower portion of the tank will be comparatively cool and, when it is forced up through the pipe 10 into the ejector 23 and is mixed with the main stream of steam, it will cool this steam to a considerable extent. Furthermore, by adding water or cleaning fluid to the steam in this manner, the fluid which flows from the nozzle 25 will be heavier and there will be a greater reaction thereto than if live steam only were discharged from the nozzle.

I also preferably provide a pressure relief valve 63 of any suitable type in the top of the tank to prevent the building up of too much pressure in the tank.

It will be apparent that, although I have described the operation of my apparatus when employing steam pressure, it will be obvious that I may use compressed air in place of steam and the device will operate in a similar manner.

In Figure 7, I have shown a slightly different type of ejector which may be used in place of the valve shown in Figures 4 and 5. In this instance, the ejector 23a embodies a casing 26a having a threaded extension 24a which is adapted to receive the pipe 10 which runs to the bottom of the tank 1. This casing 26a has a passageway 26a formed in the left hand portion thereof and an orifice 38a formed in the wall of said passageway. This orifice 38a is adapted to permit escape of part of the fluid under pressure into the tank. The right hand portion of the casing 26a is provided with an enlarged cylindrical chamber 39a. This chamber 39a has a threaded portion 41a and a shoulder 42a formed at the point where the threaded portion 41a terminates. Between the passageway 26a and the chamber 39a is a restricted orifice 41a. The chamber 39a is adapted to receive a nozzle member 28a which is threaded thereinto. When this nozzle member is threaded into position, there will be an annular space 30a formed therearound. Small passageways 45a are provided for establishing communication between the inner portion of the nozzle and the annular space 30a.

In the operation of this ejector, the main stream of steam or other fluid under pressure will flow through the passageway 26a, the reduced area 40a and then through the nozzle portion 28a. Part of the steam, however, will escape through the orifice 38a into the tank, which pressure will cause the cleaning fluid or other fluid to be ejected to flow from the tank through the inlet 25a and into the annular chamber 39a. Due to the restricted orifice 41a, pressure of the steam in the nozzle portion at the location of the aperture 45a will be less than pressure in the passageway 26a at the location of the orifice 38a.

Therefore, the cleaning fluid will be permitted to flow from the annular chamber 39a, through the aperture 45a and into the nozzle portion 28a, where it will mix with the main stream of steam.

From the description above, it will be clear that I have provided a device which is especially applicable for cleaning purposes and which has many desirable features. This apparatus is of simple construction and inexpensive to make. It is of such a type that there will be substantially no danger of its being rendered inoperative by the cleaning composition used therein. The main ejector is of a novel type and has many desirable features which will readily appear from the preceding description. However, it is disposed inside the tank to prevent unauthorized persons from tampering therewith. The strainer member which is provided in the tank and at the top thereof will prevent large particles of the cleaning composition from reaching the ejector and causing clogging thereof. This strainer member may be readily removed so that it may be cleaned.

Although I have described my invention as being used for cleaning purposes, it is capable of many other applications. For example, it may be used for orchard or plant spraying, sand blast-0 painting, air spraying, as an air conditioner, and for many other purposes. Also, the novel ejector which I have devised and described can be used for many other purposes.

Having thus described my invention, what I claim is:

1. Apparatus of the type described comprising a tank for containing fluid adapted to be ejected therefrom, a conduit adapted to be connected to a source of supply of fluid under pressure, a discharge conduit adapted to conduct the fluid to be ejected from the tank, said discharge conduit being connected to said fluid pressure conduit through the medium of an ejector, said fluid being disposed in said tank and having an orifice therein for permitting escape of fluid under pressure into the tank, and said tank having a conduit extending into the lower portion thereof, the upper end of said conduit being connected to said ejector, said conduit having a portion thereof extending outside of said tank, said portion having a regulating valve interposed therein.

2. Apparatus of the type described comprising a tank for containing fluid adapted to be ejected therefrom, a conduit connected to a source of supply of fluid under pressure, a discharge conduit adapted to conduct the fluid to be ejected from the tank, said discharge conduit being connected to said fluid pressure conduit through the medium of an ejector, said fluid being disposed in said tank and having an orifice therein for permitting escape of fluid under pressure into the tank, and said tank having a conduit extending into the lower portion thereof, the upper end of said conduit being connected to said ejector, said conduit having a portion thereof extending outside of said tank, a regulating valve interposed in said portion, and a flow indicator mounted on said portion.

3. Apparatus of the type described comprising a tank adapted to contain fluid to be ejected therefrom, said tank being mainly of cylindrical form but having a bottom which is of convex form on its outer surface and which consequently produces a concavity in the bottom of said tank and inside thereof, the bottom of said tank having a depending cylindrical extension disposed substantially at the center thereof, a plug or head being interposed in the lower end of said extension, said plug having a substantially cylindrical strainer mounted thereon which projects upwardly from the plug into the tank and which is removable with the plug, a pipe extending from the bottom of said tank to the lower end of said tank where it is disposed within said strainer up through the tank to the
upper end of said container, said pipe passing out of said container and then back into said container again, the portion of the pipe outside of said container being a regulating valve interposed therein and a flow indicator mounted on said portion, a fluid ejector disposed within said tank and to which said pipe is connected after it passes back into said tank, said fluid ejector having a main inlet to which a pressure supply line is connected and a main outlet to which a discharge line is connected, and a second outlet in said ejector to permit escape of part of the fluid under pressure into the tank above said fluid to be ejected.

5. Apparatus of the type described comprising a tank, adapted to contain fluid to be ejected therefrom, said tank having a concavity formed in the bottom thereof, a depending extension disposed substantially at the center of the bottom, a plug disposed in the lower end of said extension, said plug having a strainer member mounted thereon which projects upwardly from the plug into the tank and which is removable with the plug, a pipe extending from the lower end of said tank where it is disposed within said strainer up through the tank to the upper end of said tank, said pipe passing out of said container and then back into said container again, the portion of the pipe outside of said container having a regulating valve disposed therein and a flow indicator mounted on said portion, a fluid ejector disposed within said tank and to which said pipe is connected after it passes back into said tank, said fluid ejector having a main inlet to which a pressure supply line is connected and a main outlet to which a discharge line is connected and a second outlet in said ejector to permit escape of part of the fluid under pressure into the tank above said fluid to be ejected.

6. In apparatus of the type described a fluid ejector embodying a main casing mainly of cylindrical form, an annular flange on the inner surface of said main casing, a nozzle member fitting within said main casing and being mainly of cylindrical form, said nozzle member having a passageway extending entirely therethrough, a coupling fitting on the rear or inlet end of said casing to hold said nozzle member in position in said casing, an outlet orifice in said casing, which is in communication with an outlet orifice formed in the said nozzle at a point rearwardly of said flange, a chamber formed within said casing in surrounding relation to the forward end of said nozzle forwardly of said flange, a second inlet in said casing communicating with said chamber, and an orifice at the forward end of said nozzle for permitting escape of fluid from said chamber into the path of fluid flowing through said nozzle, and a reduced orifice within said nozzle and disposed between said outlet orifice in said nozzle and said orifice at the forward end of said nozzle.

7. In apparatus of the type described, a fluid ejector embodying a main casing mainly of cylindrical form, a nozzle member removably mounted within said main casing, means for normally retaining said nozzle member within said casing, said nozzle member having a passageway extending entirely therethrough, an outlet orifice in said casing, said orifice being disposed in the rear of said flange and being in communication with an annular groove formed on the outer surface of the enlarged portion of said nozzle member, means establishing communication between said groove and the interior of said nozzle member, a chamber formed in surrounding relation to the forward end of said nozzle member forwardly of said flange, a second inlet in said casing communicating with said chamber, a plurality of orifices formed in the forward end of said nozzle member and establishing communication between said chamber and the passage therein, said orifices being directed forwardly, the forward end of said nozzle member being slightly spaced from the forward end of said casing to form an annular orifice which is directed forwardly and which also permits escape of fluid from said annular chamber, and a flange formed on the inner surface of said nozzle between said outlet and said orifices in said nozzle to produce a reduced orifice in said passageway of said nozzle.

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