Oct. 6, 1936. F. Y. WHEELER 2,056,240

METHOD OF AND APPARATUS FOR PRODUCING A SPRAY

Filed Sept. 28, 1934

FIG. 1

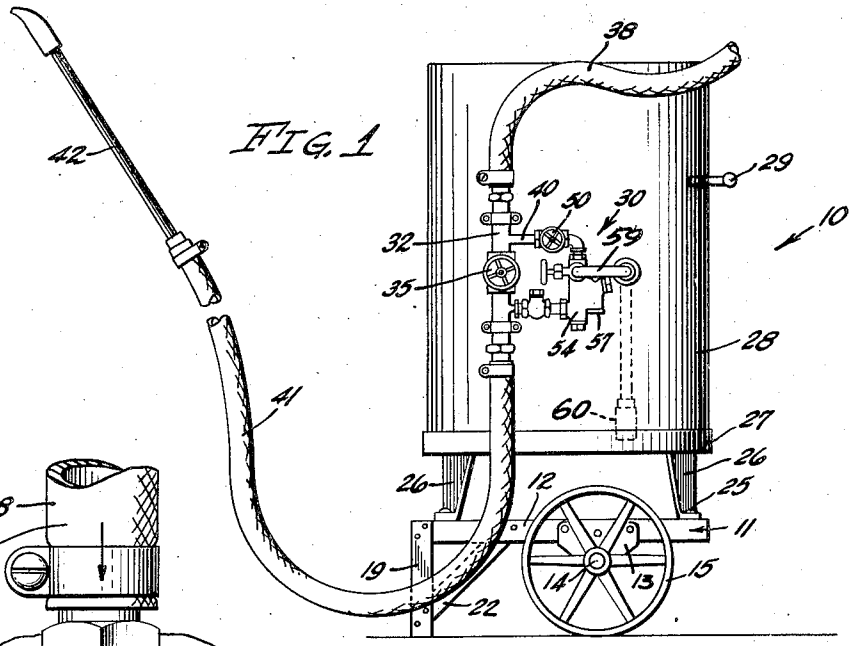
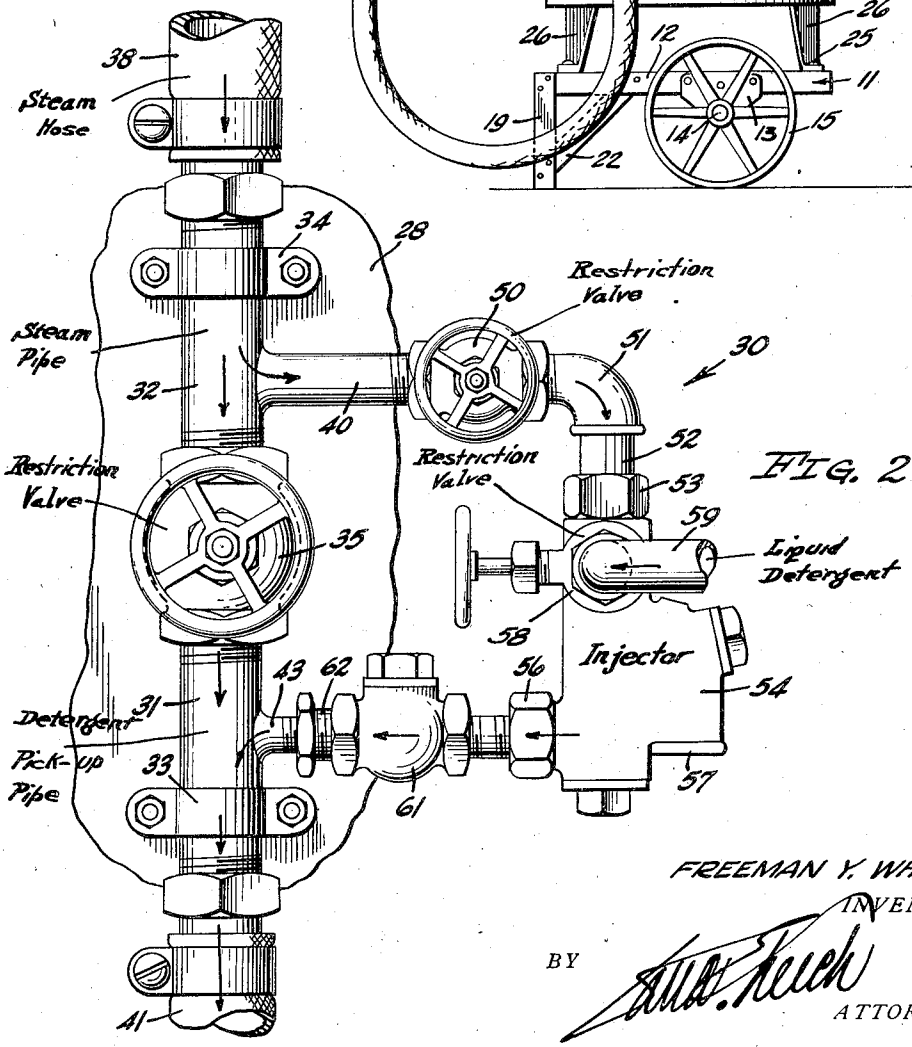


FIG. 2



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METHOD OF AND APPARATUS FOR PRODUCING A SPRAY

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5 Claims. (Cl. 299—84)

My invention relates to apparatus for applying liquid detergent in the form of a mist or spray.

One form of such apparatus which is in commercial use utilizes a flow of steam under fairly high pressure to effect the dissemination and application of a detergent to a surface to be cleaned and includes an electric-motor-driven pump for injecting the detergent into the steam lines. This apparatus is very satisfactory excepting that considerable expense is involved in providing it with the motor and pump, and considerable inconvenience suffered in always having to run an electric cable to the motor to supply this with electrical energy.

It is accordingly an object of my invention to provide an improved apparatus of the general type above described in which the motor and pump may be eliminated without impairing the efficiency of the apparatus.

The manner of accomplishing the foregoing object as well as further objects and advantages will be made manifest in the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a side elevational view of a preferred embodiment of the apparatus of my invention.

Fig. 2 is an enlarged detail view of the mixer unit of the apparatus shown in Fig. 1.

Referring specifically to the drawing, the cleaning apparatus shown in Fig. 1 is indicated generally by the reference numeral 10 and includes a wheeled carriage 11 which has longitudinal angle iron members 12 carrying bearings 13 in which an axle 14 is journalled, the latter having wheels 15 which rest upon the floor. Secured to front ends of the members 12 are supporting feet 19. The feet 19 are braced to the members 12 by braces 22.

Secured upon the frame members 12 as by bolts 25 are the legs 26 of a tank supporting base 27. Fixed to the base 27 and resting thereon is a tank 28 which comprises the liquid detergent or cleaning solution reservoir of my invention. Secured to the tank 28 on the opposite side from the legs 19 is a handle 29.

Mounted on the front face of the tank 28 is a steam and detergent mixing unit 30. This unit is clearly shown in Fig. 2 and includes a detergent pick-up pipe 31 and a steam supply pipe 32 which are rigidly secured as by brackets 33 and 34 to the tank 28. Inner ends of the pipes 31 and 32 are connected by a control valve 35. The opposite end of the steam pipe 32 is connected directly with a steam hose 38. Leading from the steam pipe 32 and formed integral therewith is a steam diverting pipe 40.

The detergent pick-up pipe 31 connects directly with one end of a cleaning spray hose 41 which is provided at its other extremity with a cleaning spray nozzle 42 as clearly shown in Fig. 1. The detergent pick-up pipe 31 has a detergent injecting pipe 43 opening thereinto and formed integral therewith.

The mixing unit 30 also includes a steam valve 50 which is connected by an elbow 51 and nipple 52 to the steam inlet 53 of a steam injector 54. This injector is of any of the well known types but is preferably a Penberthy injector which is well known in the art and which is ordinarily utilized in the injection of water into steam boilers. Because the construction of the injector 54 is well known, a further description of this is believed unnecessary beyond noting that it has besides the steam inlet 53 a water discharge opening 56, an overflow passage 57, and a water inlet opening which is connected by suitable fittings with a valve 58. This valve has a pipe 59 which extends through the wall of the tank 28 and downwardly so its lower end is just above the bottom of the tank where it is provided with a strainer 60. The water discharge opening 56 is connected by suitable fittings including a check valve 61 and an adapter 62 with the detergent discharge pipe 43. The operation of my invention is as follows:

Operation

The apparatus 10 is adapted to be used in connection with a supply of steam (which is generally provided by a system of pipes and valves not shown), the steam hose 38 being attached to said source so that steam under pressure varying from twenty pounds to the square inch to two hundred pounds to the square inch (depending upon the amount of pressure required in the cleaning operation) is delivered to the mixer unit 30 through the steam hose 38.

The tank 28 is first filled in the ordinary manner by pouring thereinto a liquid detergent or cleaning solution of any desired characteristics, such as a solution of soap in soft water or a hydrocarbon derivative such as gasoline.

When the steam hose 38 is filled with live steam and the apparatus 10 is out of use the valves 35 and 50 are both turned off. To cause a spray of the liquid detergent in the tank 28 to be delivered under pressure of the steam in the hose 38 from the nozzle 42 the valve 50 is first opened to permit steam to be fed from the steam pipe 32 into

the injector 54. The valve 58 is now opened to permit liquid detergent to be admitted from the tank 28 into the injector 54. At the commencement of the operation of the injector 54 there is a slight overflow through the passage 57, after which the liquid detergent is fed through the water discharge opening 56, through the check valve 61, and through the discharge pipe 43 into the detergent pick-up pipe 31. As soon as the cessation of overflow through the passage 57 of the injector 54 indicates the feeding of liquid detergent into the pipe 31, the operator opens the valve 35 permitting a flow of steam through this valve and the pipe 31 so as to pick up the liquid detergent being discharged therein and form this into a spray which is carried by the force of the steam through the hose 41 and discharged from the nozzle 42.

By suitable regulation of the valves 35, 50, and 58, a spray may be secured from the nozzle 42 with any desired amount of detergent and with any desired portion of the steam pressure available in the hose 38 utilized in the ejection of the spray from the nozzle.

The valve 35 is extremely helpful in starting the operation of the mixing unit 30, yet this valve may be practically entirely opened after the injector 54 has started to discharge liquid detergent into the pick-up pipe 31 and a suitable feed of detergent into the pipe 31 maintained.

It is to be understood that the apparatus of my invention is adapted to be used with hot or cold liquid detergent and with either high or low pressure steam supplied through the hose 38, although a steam pressure of about seventy-five pounds is preferable. The term "steam" is used herein to broadly cover all forms of vapor under superatmospheric pressure. In some circumstances I have found it advantageous to force a wet or saturated vapor through the steam supply hose 38, the free vapor therein being sufficient in such a case to operate the injector 54 and feed detergent from the tank 28 into the detergent pick-up pipe 31. The detergent thus injected into the stream of saturated vapor thoroughly mixes therewith and results in a much wetter spray being emitted from the nozzle 42 than where dry steam is used. Such a wet spray is highly desirable in meeting certain cleaning problems.

Another very important advantage of my invention hereinabove described is that I am able to connect the hose 38 with steam lines varying greatly in steam pressure and still obtain a flow of steam through the hose 41 at a uniform pressure regardless of the pressure in the hose 38. This is accomplished by regulating the degree which the valve 35 is opened during the operation of the device.

While I do not wish to limit myself to any specific theory of the operation of the method or apparatus of my invention I desire to state that my present best understanding of the operation of the injector 54 is as follows: This injector may be a standard Penberthy injector, such as is well known in the art and which is commonly used for the injecting of water into boilers, the injector being actuated by steam delivered from the boiler into which the injector injects water. As the steam enters the injector through the pipe 52 it passes through a small nozzle and expands in a confined space to a pressure which is less than atmospheric, thereby causing liquid detergent to be sucked up through the pipe 59 into this confined space. This liquid detergent, which is many times the weight of the steam involved, condenses the steam, and the resulting mixture, which is now hot detergent solution, acquires enough energy from the latent heat of vaporization of the steam to build up a pressure greater than the initial steam pressure in the pipe 32 and thus force its way into the detergent pick-up pipe 31.

What I claim is:

1. In a cleaning apparatus the combination of: a liquid detergent reservoir; a pipe adapted to allow relatively free passage therethrough of a sufficient volume of steam to form a substantially high velocity stream to be used for cleaning purposes when discharged into the atmosphere, said pipe comprising a detergent pick-up pipe; a steam pipe for supplying steam under pressure to said pick-up pipe; a control valve connecting said steam pipe to said pick-up pipe; a steam injector; a valved pipe connecting the water inlet of said injector to said reservoir; a valved pipe connecting the steam inlet of said injector to said steam pipe; and a pipe connecting the water-under-pressure outlet of said injector with said detergent pick-up pipe.

2. A combination as in claim 1 in which all except the first of the elements recited therein are mounted as a unit upon a side wall of said reservoir; means for passing said valved water pipe through said wall and downwardly adjacent the bottom of said reservoir; and a screen covering the outlet on the lower end of said valved water pipe.

3. In an apparatus for cleaning a surface by a spray of detergent directed thereagainst, the combination of: means for confining and conducting a continuous stream of steam to a given point and for releasing said stream of steam from confinement at said point and discharging said stream at a relatively high velocity; means forming a liquid detergent reservoir; a steam operated water injector; means for connecting the water inlet of said injector to said detergent reservoir; means for connecting the water outlet of said injector with said first-above-mentioned means; and means for diverting steam from said first-above-mentioned means at a point in advance of its connection with said injector and conveying the steam so diverted to said injector to operate the same to draw liquid detergent from said reservoir and inject the same into said first-above-mentioned means at the point where said injector is connected therewith.

4. The method of producing a cleaning spray which comprises: confining and conducting a continuous stream of steam to a given point, releasing said stream of steam from confinement at said point and discharging said steam from said point at a relatively high velocity, diverting a portion of steam from the aforesaid confined stream, permitting said portion of steam to expand rapidly to a pressure less than atmospheric, confining the space in which said expansion takes place, providing a tank of detergent, connecting said space with said detergent to cause said sub-atmospheric pressure to suck said detergent from said tank into said space thereby permitting said detergent to mix with said released portion of steam, connecting said confined space with the first aforementioned stream of steam thereby permitting pressure built up by energy acquired from the latent heat of vaporization of said diverted portion of steam to force said detergent from said confined space into said first aforementioned stream of steam thereby causing said de-

tergent to mix therewith and be discharged as a spray.

5. The method of producing a spray in which steam is used as a vehicle and in which a liquid is disseminated throughout said steam in finely divided condition which comprises: confining and conducting a rapid and continuously flowing stream of steam to a given point, releasing said stream of steam from confinement at said point so as to discharge said steam into the atmosphere at a relatively high velocity, providing a reserve body of the aforesaid liquid, diverting a portion of steam from the aforesaid confined stream, expanding said diverted steam into a confined space, connecting said space with said reserve body of liquid and with the first aforementioned stream of steam beyond the point of diversion from the latter as aforesaid, utilizing the principle of the injector to inject said liquid into said stream of steam thus causing said liquid to mix therewith and be diffused therein and be discharged with said steam at said point in the forming of the spray.

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