Nov. 22, 1932. G. D. PEET 1,888,959

STERILIZING APPARATUS

Filed Nov. 9, 1929 3 Sheets-Sheet 1

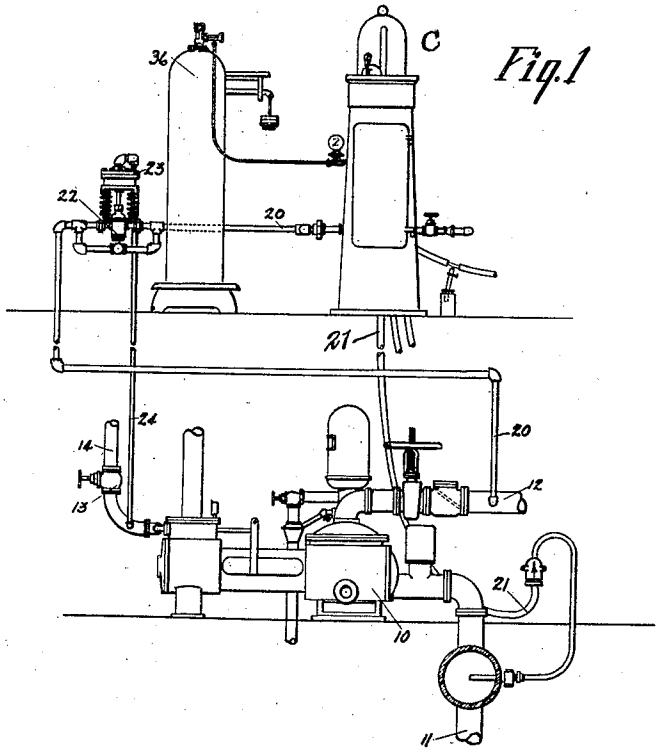

Fig. 1

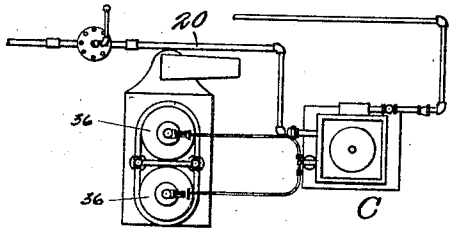

Fig. 2

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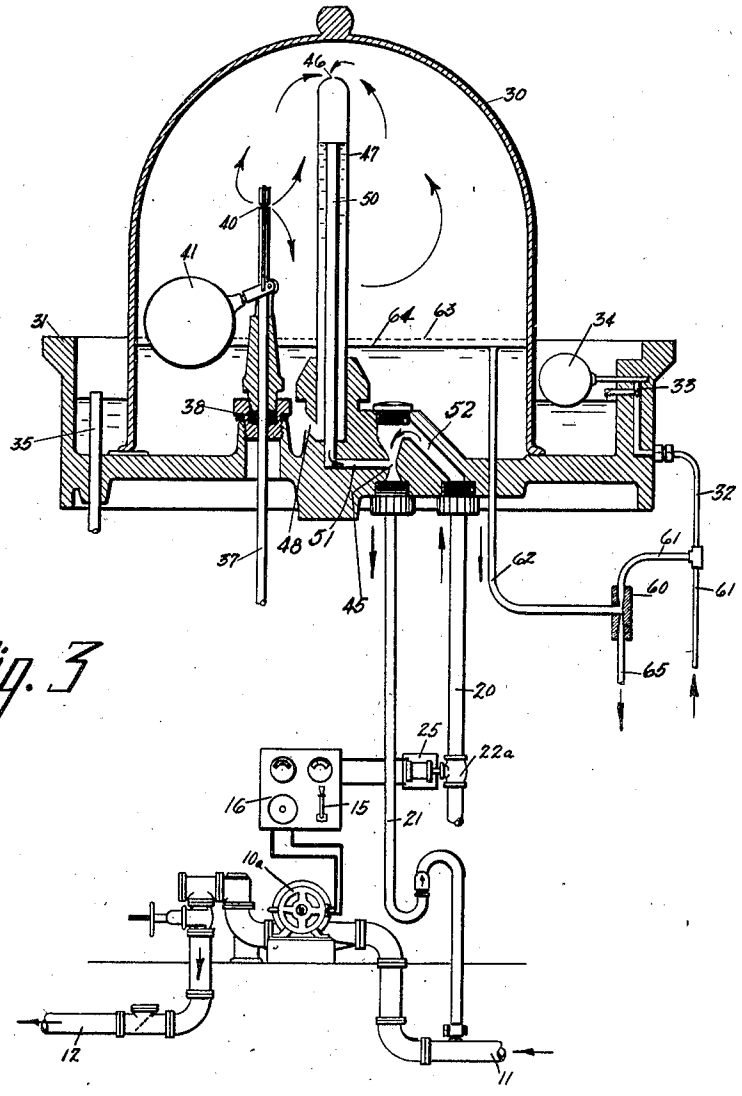

Fig. 3

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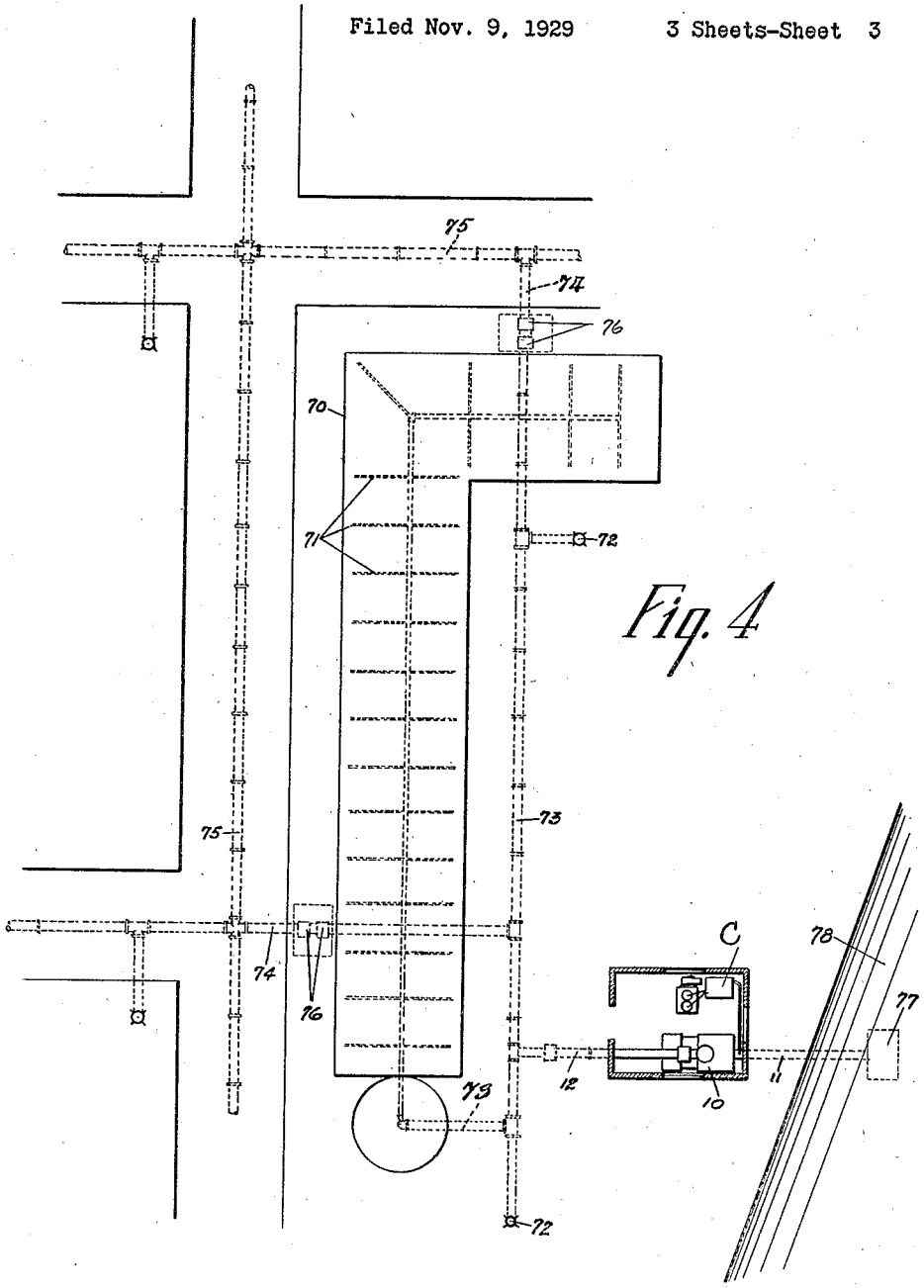

Fig. 4

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Patented Nov. 22, 1932 1,888,959

UNITED STATES PATENT OFFICE

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STERILIZING APPARATUS

Application filed November 9, 1929. Serial No. 405,869.

This invention relates to apparatus for sterilizing emergency water supplies, and aims generally to provide means whereby water drawn from an unsterilized source for fire fighting or other purposes by a pump or other supply means which is normally inactive may be surely sterilized by the proper application thereto of chlorine gas or other suitable sterilizing agent so as to avoid danger from water so supplied obtaining access through cross connections to the city or town water mains.

It has been the practice for manufacturing concerns having large plants to connect the water piping for fire sprinkler systems and other fire fighting outlets to the city or town water mains from which water is taken for drinking and other purposes, and also to a pump or pumps owned by the plant which take raw water from a river or other source of raw water supply and which are operated only when needed for supplying water for fire fighting service. Usually, the supply from the city mains is inadequate for the fire fighting supply, and on the other hand, to rely solely on the emergency fire pump installation for supplying the sprinkler system and other fire fighting outlets without connection to the city mains is undesirable because of necessitating an unnecessarily large pump installation.

In order to prevent the unsterilized and often badly polluted water from the fire pump getting back into the city mains, it has been customary to provide check valves between the fire fighting piping and the city mains. There was a great health menace, however, in the possibility of the raw polluted water from the fire pump getting over into the city water mains due to unbalance of the pressure in the two systems, leaky check valves, or the like. Typhoid epidemics have been known to result from this source of pollution of city mains.

It was thought to overcome this danger by providing means for sterilizing the raw water pumped into the fire system by providing chlorine supply apparatus which would automatically come into operation upon operation of the fire pump. Such means of protection was tried out and proved a failure owing to the fact that with the available types of chlorine supply apparatus there was great danger of the supply equipment failing to operate to supply chlorine when the fire pumps were called into service. Such failure resulted from the fact that the fire pumps were called into service only at infrequent intervals during tests or upon actual fire fighting demands. The chlorine supply apparatus thus remained idle for great lengths of time, and its construction is such that under such condition valves or other parts are liable to become stuck or fine ports to become plugged, so that the apparatus fails to operate to supply the chlorine when needed. Manually operated chlorine supply equipment was not suitable because of the possibility that the operator would fail to turn on the apparatus when needed.

These conditions and difficulties led to a reaction against the use of cross-connections between the city or town water mains and emergency fire water supply mains, and in some states the use of such cross connections was prohibited by law. This meant that many large manufacturing concerns in order to have adequate fire protection would have to make a very large additional investment in fire water pumping equipment to replace the normal supply from the city water mains.

The object of the present invention is to avoid the above difficulties and to provide apparatus which will provide dependable sterilization of the water supplied by emergency fire pumps whenever the pumps are put in operation, and thus make the use of cross connections between the emergency fire water supply systems and the city mains possible without danger of contamination of the water in the city mains by the water supplied by the fire pumps. To this end, I provide in connection with the emergency water supply apparatus, sterilizing apparatus comprising a chlorinating apparatus which operates continuously to supply chlorine at a low rate, and means for automatically controlling said apparatus to cause an increased flow of chlorine whenever the emergency water supply means comes into operation and to main-

tain such increased flow of chlorine at an adequate rate so long as the emergency water supply means continues in operation. The chlorinating apparatus being continuously in operation, the danger of valves or other parts becoming stuck or of fine ports or passages becoming clogged is avoided and the apparatus is always operable and ready to supply the chlorine in the required sterilizing quantity whenever the same is needed. The objection to the use of the cross connections is thus avoided.

A full understanding of the invention can best be given by a detailed description in connection with drawings illustrating an approved embodiment of the various features of the invention, and such a description will now be given in connection with the accompanying drawings, in which:—

Fig. 1 is a view in elevation showing a steam pump for supplying emergency fire fighting water and chlorinating apparatus for chlorinating water supplied by the pump according to the invention.

Fig. 2 is a plan view of the chlorinating apparatus shown in Fig. 1.

Fig. 3 is a view showing the chlorinating control apparatus in section, somewhat diagrammatically and on an enlarged scale, and showing also an electrically driven rotary fire pump on a smaller scale.

Fig. 4 is a diagrammatic view showing the general layout of a factory or mill building equipped with a fire fighting system supplied from city water mains and also from an emergency fire pump.

Referring first to Figs. 1 to 3, the fire pump shown as a reciprocating steam pump 10 in Fig. 1 and as an electrically driven rotary pump 10*a* in Fig. 3 is connected to draw water through a suction pipe 11 from a nearby river, pond or other available source of supply, and to discharge through a pipe 12 which is connected to the fire fighting system of the plant. The operation of the steam pump in Fig. 1 is controlled by means of a steam inlet valve 13 in a steam supply pipe 14 leading from a suitable steam generator in which steam at suitable pressure is always maintained and which may be, for example, the power steam generator of the plant. The operation of the electrically driven pump 10*a* is controlled by means of a switch 15 mounted in a convenient location, as on a starting panel 16.

When the pump is in operation, chlorine is supplied by the chlorine supply apparatus C to the pump water, the operation of the chlorine supply apparatus being controlled automatically so that whenever the pump operates, the chlorine supply apparatus will operate to supply chlorine to the pump water, and when the operation of the pump ceases, the sterilizing supply of chlorine will also cease. The invention is not limited to the use of any particular style of chlorine supply apparatus. I prefer, however, to use apparatus in which the chlorine is caused to flow in controlled amount by means of a water aspirator, the chlorine gas being mixed with the water flowing through the aspirator and supplied to the water to be sterilized in the form of a water solution. The chlorinating apparatus shown in the drawings is of this type, the water for the aspirator being supplied through pipe 20, and the chlorine solution passing from the aspirator through a pipe 21 into the pump suction pipe 11. The water supply to the aspirator may be taken from any suitable source. I find it convenient, however, to take the water from the discharge line of the pump, and the drawings show the supply pipe 20 connected to the pump discharge pipe 12 for this purpose.

Suitable means are provided for causing water in the desired quantity to flow through the pipe 20 to the aspirator of the chlorinating apparatus only when the pump is in operation. For this purpose, as shown in Fig. 1, the pipe 20 is provided with a diaphragm-operated valve 22 which is normally closed but is opened by the pressure of steam on a diaphragm within diaphragm casing 23 supplied through a pipe 24 leading to the steam inlet pipe between the steam cylinder and the steam inlet valve 13. As shown in Fig. 3, a normally closed valve 22*a* in the water supply pipe 20 is controlled by a solenoid 25 which is connected in the pump motor circuit and operates to open the valve whenever the circuit to the pump motor is closed. These valves, the steam operated valve 22 and the electrically operated valve 22*a*, are merely illustrative of other valves or other devices which may be employed for automatically causing the chlorine supply apparatus to operate to supply chlorine to the pump water line whenever the pump operates.

The chlorine supply apparatus suitable for supplying chlorine at a controlled rate to the pump line is shown in detail in Fig. 3. The apparatus comprises a bell jar 30 which stands open end down in tray 31 and provides a chlorine supply chamber in which when the apparatus is in operation a supply of chlorine gas is maintained under a constant slightly negative, or sub-atmospheric, pressure. Water is supplied to the tray through a pipe 32 and is maintained at a constant level in the tray by suitable means, such as the valve 33 controlled by a float 34 and an overflow pipe 35, and the bell jar is supported so as to provide for passage of water into the jar beneath its lower edge. Chlorine gas is supplied to the chamber within the bell jar from a suitable source of supply under pressure such as a tank of compressed liquefied chlorine 36 (see Figs. 1 and 2). The chlorine supply source is connected to a tube 37 which leads upward through the bottom of the tray 31

through a stuffing box 38 to a point above the maximum water level within the bell jar. A valve 40 adapted to seat in a valve seat provided at the upper end of the tube 37 and operated by a ball float 41 controls the escape of chlorine from the tube 37 into the chamber. Chlorine gas is drawn from the supply chamber by means of a suction device formed by a water aspirator 45 which draws the gas through a flow-controlling orifice 46 formed in the top of a flow meter tube 47 which extends upward within the bell jar from the bottom of the tray and to the bottom of which water has access through a passage 48. A gas tube 50 connects to a passage 51 leading to the aspirator throat and extends upward within the meter tube 47 with its open upper end at a distance above the operating water level within the chamber.

The aspirator 45 is formed by a small Venturi tube to the entrance cone of which leads a passage 52 to which the water supply pipe 20 connects and to the discharge cone of which the solution pipe 21 is connected. With a proper flow of water through the aspirator and the capacity of the aspirator being sufficiently great compared to the size of the gas-flow-controlling orifice 46, a partial vacuum, or negative pressure, is established in the meter tube 47 and water is raised to the top of the tube 50, and excess capacity of the aspirator being satisfied by water drawn into the tube 50, a suction head is maintained in the tube 47 which is determined by the negative head of the column of water raised in the tube 47, that is, by the height of the top of the tube 50 above the water level in the suction chamber.

When the chlorine supply apparatus is in operation, therefore, the suction of the aspirator will establish and maintain a constant partial vacuum, or negative pressure, within the meter tube 47 causing the chlorine gas to flow from the supply chamber through the orifice 46 into the tube 47. The gas then flows downward through the inner tube 50 and enters the aspirator throat, joining the water passing through the aspirator and going into solution therein, the chlorine solution thus formed being delivered by the pipe 21 to the pump suction pipe 11 to mix with the water passing through the pump. The flow of chlorine gas from the supply chamber through the orifice 46 tends to reduce the pressure within the supply chamber. Pressure reduction within the supply chamber causes the water to rise within the chamber, and when the water level within the chamber has risen sufficiently to slightly lift the float 41, the chlorine valve 40 is opened to permit chlorine gas to flow into the chamber and prevent further reduction of the pressure in the chamber. If the chlorine gas should flow into the chamber at a rate faster than it is being drawn from the chamber through the orifice 46, the increased pressure in the chamber would cause the water level within the chamber to drop, permitting the float 41 to drop and close the valve 40, thus shutting off the supply of chlorine gas to the chamber until the reduction of pressure within the chamber again resulted in a rise of the water level causing the float to open the valve. A constant pressure is thus maintained within the chamber, this pressure as shown in the drawings being a slightly negative pressure determined by the operating water level within the chamber.

Chlorine is thus supplied to the fire pump water whenever the pump is in operation at a controlled rate which is determined by the size of the orifice 46 and the suction head maintained in the tube 47. With the apparatus shown, this rate is a pre-determined fixed rate which may be and desirably is higher than necessary for sterilizing the pump water at the maximum rate of pumping, since a slight, or even somewhat considerable, excess of chlorine introduced into the fire water is not objectionable, inasmuch as this water is not intended for drinking or household purposes and only very small amounts of this heavily chlorinated water can possibly get back into the city water mains.

Chlorine supply apparatus substantially like that shown in Fig. 3 and above described is more fully disclosed in patent of Wallace, No. 1,514,939, dated November 11, 1924. While chlorine supply apparatus such as that shown, or other suitable apparatus for supplying chlorine to the fire pump water at a pre-determined fixed rate meets the practical requirements of the present invention, apparatus which automatically proportions the rate of supply to the rate of flow of the water to which the chlorine is supplied, may, of course, be used.

In order to maintain the chlorine supply apparatus in operation with chlorine passing through it at a very low rate during the time that the fire pump is not in operation, an auxiliary aspirator 60 is provided to which operating water is supplied through a pipe 61 and which acts to draw chlorine gas from the supply chamber within the bell glass 30 through a small pipe 62 which extends up through the bottom of the tray 31 and has its inlet end positioned at a level slightly below the normal operating water level within the chamber. This normal operating water level at which the water stands when the fire pump is in operation and the chlorine apparatus is operating to supply chlorine at full rate to the pump water is indicated in Fig. 3 by the dotted line 63. The aspirator 60 is maintained in constant operation, water being supplied to it through the pipe 61 from a city water main or other suitable dependable source of supply.

When the fire pump is in operation and

the main aspirator 45 is working to draw chlorine from the supply chamber and feed it to the pump water, the water in the supply chamber is maintained at the level 63 slightly above the inlet to the pipe 62 and the auxiliary aspirator 60 then draws only, or at least mostly, water through the pipe 62. When the fire pump is shut down, however, and the main aspirator is not operating, the water level in the supply chamber drops to the level 64 corresponding to the level of the inlet opening of the pipe 62, and the auxiliary aspirator then operates to draw chlorine gas and water from the chamber. By the lowering of the water level in the chamber, the float 41 is permitted to move downward and partially close the chlorine valve 40. The water level maintained by the action of the auxiliary aspirator is such, however, that the chlorine valve is not completely closed but is maintained in a partly opened position such as to permit a low rate flow of chlorine into the chamber and the suction capacity of the auxiliary aspirator is sufficient to withdraw such chlorine from the chamber and maintain the required partial vacuum, or negative pressure, to hold the water at the level 64. There will, of course, be some slight fluctuation of the water level with corresponding slight movement of the float 41 and valve 40, which together with the maintained small flow of chlorine keeps these parts from sticking. The chlorine solution from the auxiliary aspirator is discharged through a waste pipe 65 which leads to any convenient place of discharge. The rate at which chlorine is withdrawn from the supply chamber by the auxiliary aspirator may be so low that the loss of chlorine is inconsiderable compared to the advantage gained.

Referring now to Fig. 4, this figure illustrates a typical arrangement for supplying fire fighting equipment of a factory or mill building both with water from city mains and with chlorinated water from an emergency fire pump according to the invention. As shown, the factory or mill building 70 is provided with sprinkler lines 71, and fire plugs 72 are provided at suitable locations, connected by mains 73. Pipes 74 connect the system to city mains 75, and the discharge pipe 12 from the fire pump 10 connects to one of the pipes 73, so that when the pump is in operation pump water will be supplied both to the sprinkler lines and to the fire plugs. Check valves 76 are provided in each of the connections 74 between the city mains and the fire fighting piping. Double check valves may be used if required by law, but with my apparatus single check valves are sufficient. The pump suction pipe 11 is shown as having its intake 77 submerged in a source of supply of water indicated at 78 and which may be a river or lake or other suitable source, and which may be water of such character that it would be unsafe to permit it in its raw state to have access to the city water mains. With the system illustrated, the fire fighting piping will normally be kept filled by the pressure from the city mains. In case of fire, however, when the fire pump 10 is put in operation to provide an additional supply of water to the fire fighting piping, the water so supplied by the pump is sterilized by the addition thereto of chlorine supplied by the fire pump chlorinating apparatus C which comes into operation automatically when the pump is put in operation, and which may be as illustrated in Figs. 1 to 3. The fire pump water being thus chlorinated, no harm can result if some of it should pass the check valves 76 and enter the city mains, nor can harm result from such water reaching any outlets provided from the fire fighting system.

What is claimed is:

1. The combination with normally inoperative emergency water supply means, of chlorine supply apparatus, means for maintaining said apparatus normally in operation to feed chlorine at a low rate, and automatic means for causing said apparatus to operate when the emergency water supply means is in operation to supply the chlorine at full rate to the water supplied by said emergency means.

2. The combination with normally inoperative emergency water supply means, of chlorine supply apparatus for supplying chlorine when said water supply means is in operation to sterilize the water supplied by said means, said chlorine supply apparatus comprising chlorine-flow-controlling apparatus and a normally inoperative main water aspirator for drawing chlorine through the control apparatus and discharging it into water supplied by said means and a constantly operative auxiliary aspirator for drawing chlorine through the control apparatus at a low rate when the main aspirator is not in operation and automatic means for causing the main aspirator to operate when the emergency water supply means is in operation.

3. The combination with a normally inoperative pump for supplying fire-fighting water, of chlorine supply apparatus for supplying chlorine when said pump is in operation to sterilize the water supplied by the pump, said chlorine supply apparatus comprising chlorine-flow-controlling apparatus and a normally inoperative main water aspirator for drawing chlorine through the control apparatus and discharging it into water supplied by the pump and a constantly operative auxiliary aspirator for drawing chlorine through the control apparatus at a low rate when the main aspirator is not in operation and means for causing water from the pump discharge line to be supplied to the main aspirator when the pump is in operation where-

by when the pump is in operation the chlorine supply apparatus is operated to supply chlorine at full rate to the water supplied by the pump.

4. The combination with a normally inoperative pump for supplying fire-fighting water, of chlorine supply apparatus for supplying chlorine when said pump is in operation to sterilize the water supplied by the pump, said chlorine supply apparatus comprising chlorine-flow-controlling apparatus, a normally inoperative water aspirator for drawing chlorine through the control apparatus and discharging it into water supplied by the pump, means for maintaining a constant flow of chlorine through the control apparatus at a low rate when said aspirator is not in operation, a valve for controlling the supply of water to said aspirator, and means operative to open said valve when the pump is put in operation.

5. The combination with normally inoperative emergency water supply means, of chlorine supply apparatus for supplying chlorine when said water supply means is in operation to sterilize the water supplied by said means; said chlorine supply apparatus comprising chlorine-flow-controlling apparatus, a normally inoperative water aspirator for causing chlorine to pass through the control apparatus and into water supplied by said means, means for maintaining the control apparatus in operation to feed chlorine at a low rate when said aspirator is not in operation, a valve for controlling the supply of water to said aspirator, and means operative to open said valve when the emergency water supply means is put in operation.

In testimony whereof I have hereunto set my hand.

GERALD D. PEET.