Oct. 1, 1940. F. L. BOYD 2,216,509

FIRE EXTINGUISHING APPARATUS

Filed Sept. 18, 1937 2 Sheets-Sheet 1

Fig. 1

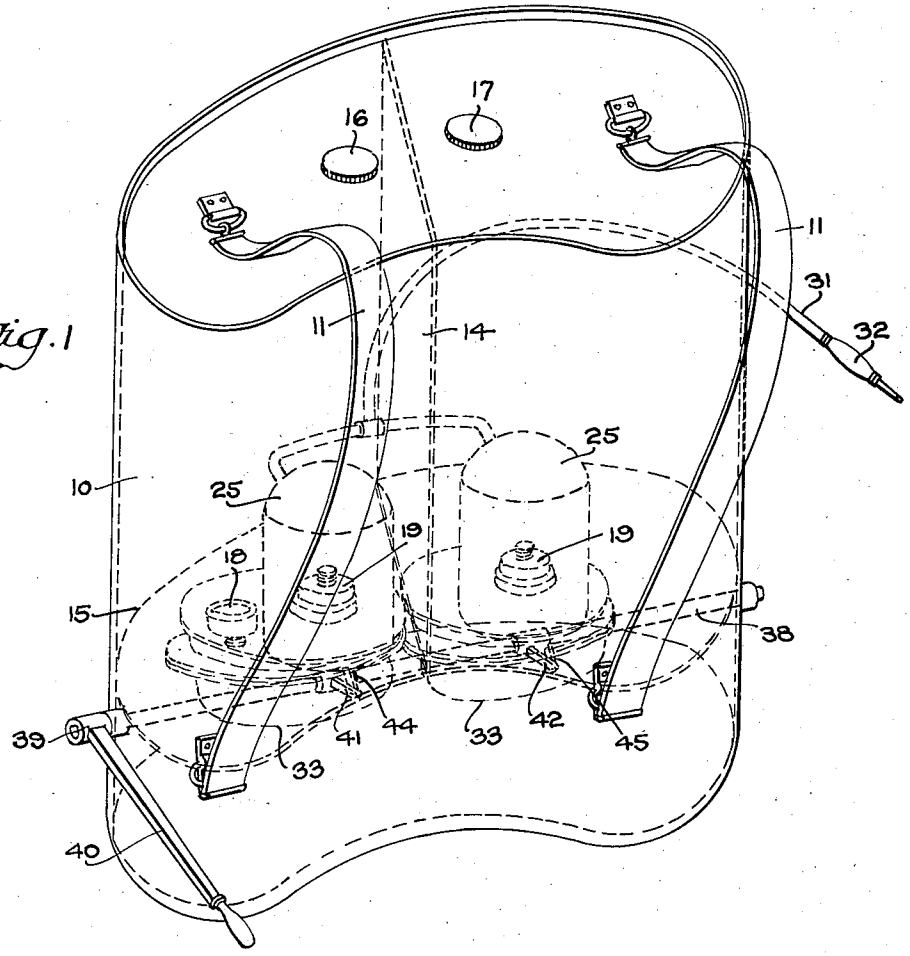
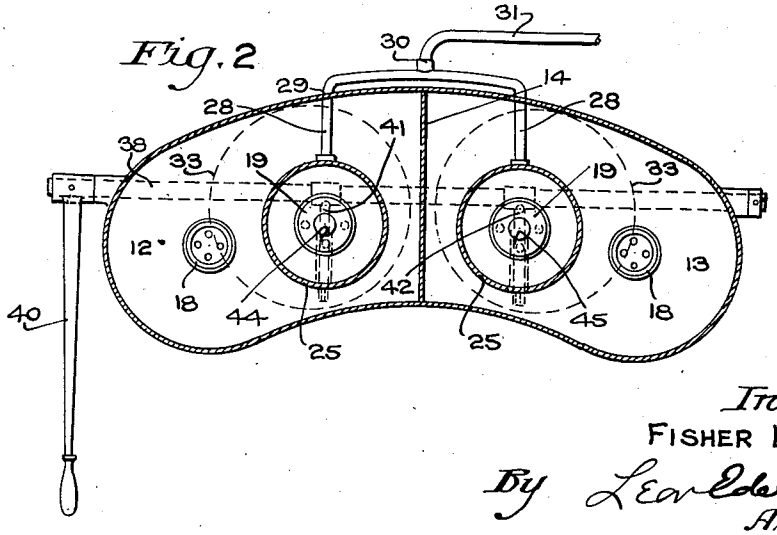


Fig. 2



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Fig. 3

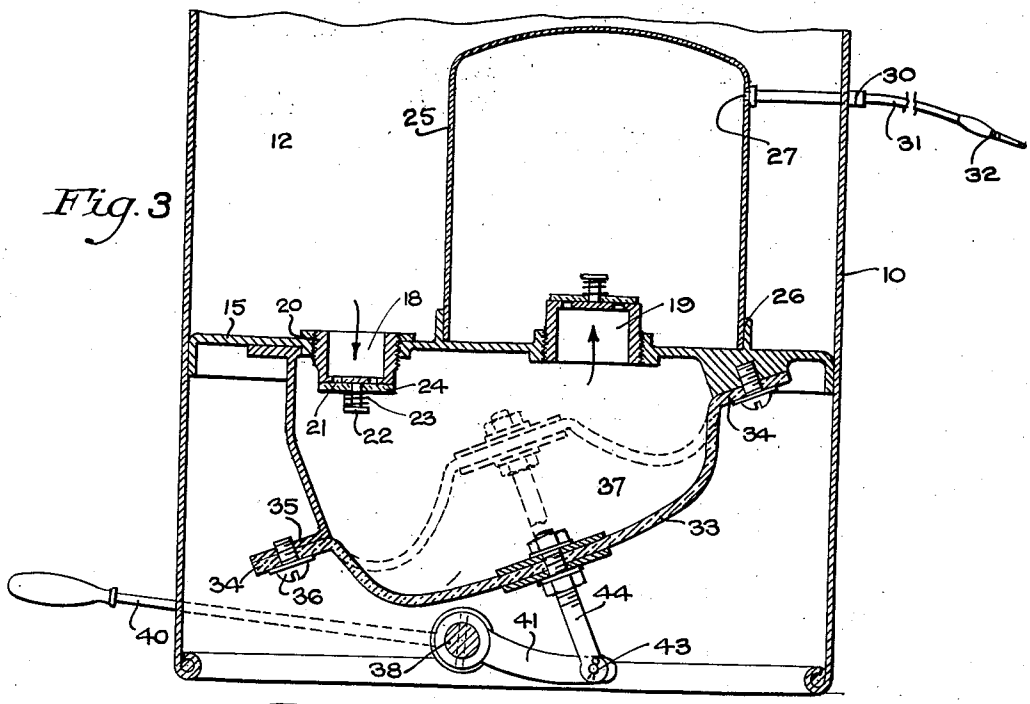


Fig. 4

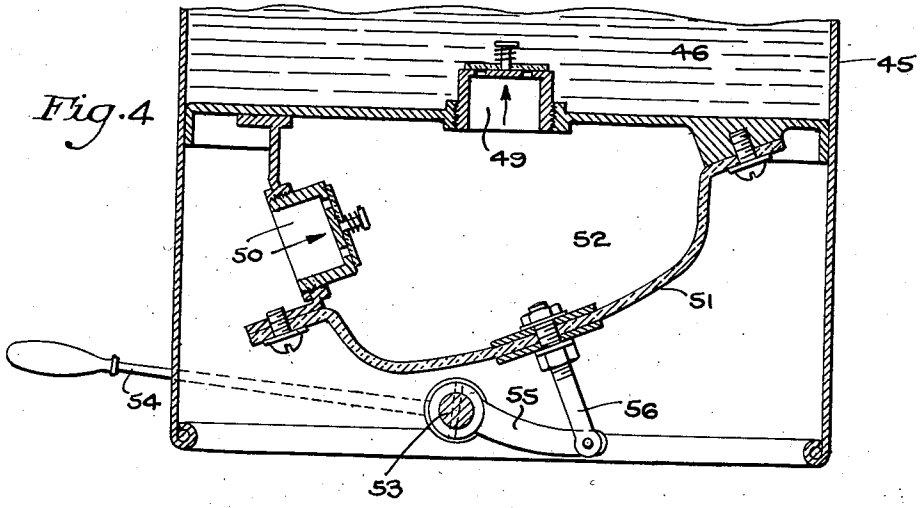
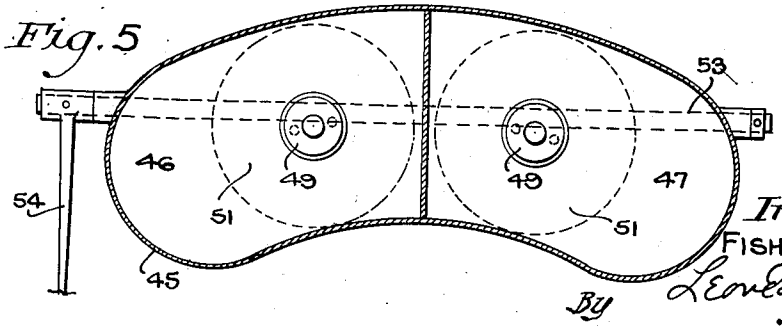


Fig. 5



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UNITED STATES PATENT OFFICE

2,216,509

FIRE EXTINGUISHING APPARATUS

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Application September 18, 1937, Serial No. 164,485

5 Claims. (Cl. 299—97)

This invention relates to fire extinguishing apparatus and more particularly to an improved construction of a portable apparatus capable of generating and delivering fire-extinguishing foam.

The efficacy of foam obtained by mixing together solutions of acid and basic foam forming ingredients for extinguishing fires is well-known in the art, and while various satisfactory constructions of apparatus have been employed for efficiently generating and discharging such foam upon a fire, heretofore and prior to this invention no such apparatus has been devised which was suitable to be carried upon the back of an individual ready for instantaneous use as desired. To provide a portable apparatus of this character is one of the principal objects of the present invention.

A further and important object of the present invention is the provision of a portable apparatus capable of being carried upon the person and which includes a fire-extinguishing solution tank and a hand-operated pump associated therewith for effecting the discharge of the solution from the tank as the same may be required, the apparatus being of such design that when properly mounted in position one hand of the operator is free to operate the pump while the other hand is free to accurately control the direction of discharge of the fire extinguishing medium.

It is characteristic of foam produced by reactively combining acid and basic foam forming solutions that the generation and delivery thereof through the discharge conduit is effected instantaneously upon mixture of the solutions and continues to be generated until the supply of one or the other or both of the solutions is exhausted. In order to avoid the reacting of the acid and basic solutions except when necessary to generate foam, they are maintained in separated compartments from which they are withdrawn for delivery to a mixing head or chamber in which they combine and react to form the desired fire-extinguishing foam. It is, of course, advantageous to control the delivery of the solutions to the mixing chamber and so control the generation of the foam and to effect this advantage this invention has as its object to provide a pump which at once functions to withdraw the solutions from their separated compartments and deliver them in combined, reacting state to a discharge conduit from which foam is delivered to the fire to be extinguished.

A further and important object of the present invention is the provision of an apparatus in which means is provided not only for producing foam as required through the mixing and reaction of separate foam forming solutions but also for controlling the production of foam by the simple expedient of operating or interrupting the operation of the pump. In other words, the production of foam in the present apparatus may be controlled through the operation or non-operation of the pump. Inasmuch as the present apparatus is essentially and primarily of the portable type adapted to be transported from place to place, this means of controlling the production of foam as desired provides a distinct advantage in that only so much foam need be generated as may be required to extinguish a particular fire, thereby permitting the conservation of the remaining uncombined and unreacted foam-forming solutions for subsequent use in the generation of foam. Thus, the present apparatus provides for interrupting the production of foam as frequently as may be necessary, thereby assuring a minimum waste of foam during the use thereof.

Still another object of the invention is to provide a fire-extinguishing apparatus of the portable type in which means is provided to eject any suitable liquid fire extinguishing compound in the form of a steady stream and under adequate pressure and the operation of which may be interrupted at will to conserve and employ to best advantage the supply of fire extinguishing compound contained in the apparatus.

Still other objects of the invention and advantages and economies effected by the apparatus constructed in accordance therewith will be apparent more fully hereinafter.

The invention consists substantially in the combination, construction, location and relative arrangement of parts, all as will be described more fully in the following detailed specification, as shown in the accompanying drawings, and as finally pointed out in the appended claims. In the said accompanying drawings, which are illustrative of certain preferred constructions of the present apparatus:

Figure 1 is a perspective view of a two-solution foam forming apparatus constructed in accordance with and embodying the principles of the present invention;

Figure 2 is a horizontal sectional view of the apparatus of Figure 1;

Figure 3 is a vertical sectional view thereof on a somewhat enlarged scale;

Figures 4 and 5, respectively, are vertical and

horizontal view of a modified construction of the apparatus;

Referring now to the drawings and more particularly to Figures 1 to 3 thereof, it will be observed that the apparatus of the present invention includes a main tank 10 adapted to receive and hold the supply of fire-extinguishing material. This tank 10 is of a shape conforming comfortably to the back of the person carrying the apparatus and is equipped with the carrier straps 11—11 for supporting it upon the back of a carrier. In the form of apparatus shown in Figures 1 to 3, the tank 10 is divided into two separate compartments 12 and 13 by a central partition 14, these compartments 12 and 13 being adapted respectively to receive the separate acid and basic foam-forming solutions hereinabove referred to. A horizontally disposed member 15 fitted into the bottom of the shell forming the tank 10 somewhat above the lower edge of the shell commonly forms the bottom walls of the compartments 12 and 13. Provided in the top walls of the compartments are suitable filling openings normally closed by the closure caps 16 and 17 (see Figure 1).

Fitted in the bottom of each of the compartments 12 and 13 are a pair of valve assemblies 18 and 19, these assemblies being arranged in the laterally spaced relation best shown in Figures 2 and 3. The valve assemblies 18 and 19 are structurally substantially identical in that each comprises a main body 20 adapted to be threadedly fitted in an opening provided therefor in the bottom wall of the compartment, this body being provided with a plurality of apertures 21 in the head thereof and with an axially extending headed pin 22. Embracing the said headed pin 22 and adapted for axial movement thereon against the action of a coil spring 23 is a valve disc 24 which normally covers and maintains sealed the apertures 21 of the valve body 20. It will be observed that the valves 18 and 19 of each compartment are reversely mounted to permit the passage of fluid therethrough in the manner and by the means hereafter described only in the directions indicated by the arrows (see Figure 3).

Disposed interiorly of each of the compartments 12 and 13 and in embracing relation to each of the valves 19 is a dome-shaped member 25, this latter member being securely fitted to the upper surface of the member 15, as at 26. These dome-like members 25 each serve as internal pressure chambers for the separate compartments 12 and 13 of the apparatus and are provided below the tops thereof with discharge outlets 27. Connected to each of the discharge outlets 27 of the pressure chambers is a conduit 28, each of which project through the rear wall of the tank 10, as at 29, (see Figure 2) for subsequent discharge at the point 30 into a common conduit 31. This common discharge conduit 31 is preferably in the form of a flexible hose fitted at its discharge end with a discharge nozzle 32.

Fitted to the under side of the bottom wall of each of the compartments 12 and 13 and in embracing relation to both of the valves 18 and 19 is a flexible diaphragm 33 of rubber or like material. This diaphragm 33 is substantially dish-shaped, as shown in Figure 3, and is provided with a marginal flange 34 for securement to an annular rigid base 35 therefor by means of the screws 36, the arrangement being such that the diaphragm, the supporting structure and the portion of the member 15 encompassed thereby, form a substantially sealed chamber 37 into the interior of which may be alternately drawn and expelled the solution contained in the compartment with which it is immediately associated. It will be understood that in the form of apparatus illustrated in Figures 1 to 3, two such sealed chambers 37 are provided, one for each of the compartments 12 and 13.

Journalled beneath the bottom of the tank compartments 12 and 13 and extending from side to side of the tank shell is an oscillatable shaft 38 to one extremity of which is fitted, as at 39, an operating handle 40 for oscillating the shaft. Keyed to the shaft at spaced points thereof are a pair of lever arms 41 and 42, the outer extremities of which are respectively pivoted, as at 43, to the rods 44 and 45 carried by and projecting axially of the diaphragms 33—33. It will be observed that the arrangement is such that when the operator upon whose back the tank is carried moves the operating handle or lever 40 upwardly and downwardly, a corresponding movement is imparted to the flexible diaphragms 33, the latter being operated in unison. In other words, as the operating handle 40 is disposed the diaphragms 33—33 are forced inwardly into the dotted line position shown in Figure 3 and as the operating handle 40 is raised the diaphragms 33—33 are retracted into the full-line position shown in Figure 3. The interior of the chamber 37 is thus subjected alternately to suction and pressure and this action is employed to alternately draw into and expel from the chamber 37 the solution contained in the solution compartment immediately associated therewith.

In the operation of the apparatus shown in Figures 1 to 3, it will be assumed, of course, that the compartments 12 and 13 are respectively filled with acid and basic foam-forming solutions. As the handle 40 of the apparatus is "pumped" by the operator, these solutions are drawn from their respective compartments into the chambers 37 and then expelled from the latter into the pressure chambers 25, it being noted that for each upthrust of the operating handle 40 which subjects the interior of the chamber 37 to suction, the valve 18 is caused to open at the same time permitting the solution from the solution chamber to pass into the chamber 37, the valve 19 being, of course, maintained closed. On the other hand for each down-thrust of the operating handle 40 a reverse action takes place, the interior of the chamber 37 being subjected to pressure, thereby forcing the solution previously drawn therein into the pressure chamber 25 by way of the valve 19, the valve 18 being of course, maintained closed.

After a few strokes of the operating handle 40, the pressure chamber 25 will be filled with solution derived from the solution compartment immediately surrounding said chamber and continued operation of the operating handle thereafter will build up the pressure of the solution in the pressure chamber 25 sufficiently to cause it to discharge therefrom by way of its discharge conduit 28. Inasmuch as both of the pressure chambers 25 are simultaneously filled with the acid and basic foam-forming solutions, it will be apparent that the two solutions will be expelled under pressure from their respective pressure chambers 25 simultaneously and in substantially constant proportions so that upon merger thereof at the common union or mixing head 30, foam will

be produced for delivery and discharge through the conduit 31 and its discharge nozzle 32. The production of foam and the discharge thereof from the apparatus will be continued as long as the supply of the two foam-forming solutions remains and so long as the operating handle 40 is "pumped." As soon, however, as the latter operation ceases, the production of foam is interrupted, and even though an adequate supply of foam-forming solutions still remains in the tank. With this apparatus the operator is thus enabled to move from place to place and produce foam as required, thereby preventing any such excessive waste of foam as is ordinarily entailed where no means is provided to interrupt the generation or production of foam once such action is commenced.

Figures 4 and 5 illustrate a modified form of unit in which the pressure chambers 25 of Figure 1 have been eliminated. In this modified form of construction, the tank 45 is divided into two compartments 46 and 47 by means of a central partitioning member 48 substantially as in the above described unit. Provided in the bottom wall of the compartments 46 and 47 is a valve assembly 49 similar to and functioning in the same manner as the valve 19 of Figures 1 to 3. The second valve assembly 50 is, however, so associated with the flexible pump diaphragm 51 that as the latter is actuated air from atmosphere is alternately drawn into the interior of the pump chamber 52 by way of said valve assembly 50 and then expelled therefrom by way of the valve assembly 49 directly into the solution containing compartment 46 or 47. The flexible diaphragm 51 is actuated by means of the same mechanism as is employed for actuating the diaphragm 33 of Figures 1 to 3 and includes a main oscillating shaft 53, an operating handle 54, and the pivotally connected members 55 and 56 interconnecting the oscillating shaft 53 and the flexible diaphragms 51—51. It is to be understood, of course, that each of the compartments 46 and 47 is provided with one of these flexible diaphragm pumps and that both pumps are operated in unison by means of the single handle 54.

In the operation of this modified form of apparatus, continued pumping of the handle 54 forces air from atmosphere into the interiors of the solution compartments 46 and 47, thereby subjecting the solutions contained therein to an air pressure of an amount sufficient to expel the solutions from their respective compartments. The solutions so expelled under air pressure are discharged by way of suitable conduits to a suitable mixing head or union (not shown) at which point the solutions combine and react to form foam, the foam so produced being delivered and discharged through a nozzle-equipped flexible hose similar to that employed in the form of unit shown in Figures 1 to 3.

In the apparatus of the type illustrated in Figures 4 and 5 wherein separate pumping elements are employed for subjecting the separate solutions to pressure, it will be understood that a single pumping element may be employed in lieu of the two shown and described, in which latter event it would only be necessary to so rearrange the flexible diaphragm pump with respect to the valves 49—49 that actuation of the pump would impel air into both of the compartments 46 and 47 simultaneously. It will also be understood that the present invention is not necessarily limited to apparatus for ejecting fire extinguishing foam produced by the reaction of separate acid and basic foam-forming solutions. Certain constructional features of the present invention may well be employed in apparatus of the type designed to discharge any suitable fire-extinguishing solutions. For example, the tank 10 of Figure 1 may be for but a single-compartment containing any suitable non-freeze fire-extinguishing solution which may be expelled therefrom by means of a single pump consisting of the pressure chamber 25, the valve units 18 and 19, the flexible diaphragm 33 and the parts associated with the latter for actuating the same. Or, the single fire-extinguishing solution may be expelled from its tank compartment by means of a single pump mechanism of the order illustrated in Figure 4 and by means of which adequate discharge pressure may be built up directly in the tank containing the solution. In whatever form the invention may be employed, its chief characteristics are positive control of the fire-extinguishing medium regardless whether it be in the form of foam or liquid, portability of the apparatus, ease of operation thereof, adequate supply of the fire-extinguishing medium under adequate pressure and in the form of a steady stream, and free use of one hand of the operator for directing the stream to the point desired.

The invention is, of course, susceptible of other changes and modifications than those herein shown and described without departing from the general principles thereof and it is accordingly intended to claim the same broadly, as well as specifically, as indicated by the appended claims.

What is claimed as new and useful is:

1. An apparatus of the class described comprising: a tank elongated vertically and horizontally, a transverse partition in the tank providing an upper closed section and lower open bottomed section, a vertical partition in the upper section forming two separated liquid holding compartments; a pair of pump chambers disposed in said lower section, one for each compartment; each chamber being formed by said transverse partition, side walls depending from said partition, and a flexible diaphragm mounted on the lower ends of said side walls; each of said chambers having an outlet valve carried by said partition and an inlet valve; a rock shaft disposed transversely of the lower section thereof and along its elongated dimension, means interposed between the rock shaft and each diaphragm to operate the same by the oscillations of the shaft and a handle carried by the rock shaft for operating said pumps.

2. An apparatus of the class described comprising: a tank elongated vertically and horizontally, a transverse partition in the tank providing an upper closed section and lower open bottomed section, a vertical partition in the upper section forming two separated liquid holding compartments; a relatively small pressure chamber mounted within each compartment and on the bottom thereof, outlet conduits connected to each pressure chamber and meeting exteriorly of the tank to mix the liquids; a pair of pump chambers disposed in said lower section, one for each compartment; each chamber being formed by said transverse partition, side walls depending from said partition, and a flexible diaphragm mounted on the lower ends of said side walls; each of said chambers having an inlet valve and an outlet valve carried by said partition; a rock shaft disposed transversely of the lower section thereof and along its elongated dimension, means interposed between each diaphragm and the rock shaft

to operate the same by the oscillations of the shaft and a handle carried by the rock shaft for operating said pumps to pump liquid from each compartment into its corresponding pressure chamber and thence through the outlet conduits.

3. An apparatus of the class described comprising; a tank elongated vertically and horizontally, a transverse partition in the tank providing an upper closed section and lower open bottomed section, a vertical partition in the upper section forming two separated liquid holding compartments; a pair of pump chambers disposed in said lower section, one for each compartment; each chamber being formed by said transverse partition, side walls depending from said partition, and a flexible diaphragm mounted on the lower ends of said side walls; each of said chambers having an outlet valve carried by said partition and an inlet valve carried by its side walls; a rock shaft disposed transversely of the lower section thereof and along its elongated dimension, means interposed between each diaphragm and the rock shaft to operate the same by the oscillations of the shaft and a handle carried by the rock shaft for operating said pumps to force compressed air into each compartment and to force the liquid therefrom through outlet conduits to mix the liquids.

4. An apparatus of the class described comprising; a tank elongated vertically and horizontally, a transverse partition in the tank providing an upper closed section and a lower section, a vertical partition in the upper section forming two separated liquid holding compartments; a pair of pump chambers disposed in said lower section, one for each compartment; each chamber being formed by said transverse partition, side walls depending from said partition, and a flexible diaphragm mounted on the lower ends of said side walls; each of said chambers having an outlet valve carried by said partition and an inlet valve; a rock shaft disposed transversely of the lower section thereof and along its elongated dimension, means interposed between the rock shaft and each diaphragm to operate the same by the oscillations of the shaft and a handle carried by the rock shaft for operating said pumps.

5. An apparatus of the class described comprising: a tank elongated vertically and horizontally, a transverse partition in the tank providing an upper closed section and a lower section, a vertical partition in the upper section forming two separated liquid holding compartments; a relatively small pressure chamber mounted within each compartment and on the bottom thereof, outlet conduits connected to each pressure chamber and meeting exteriorly of the tank to mix the liquids; a pair of pump chambers disposed in said lower section, one for each compartment; each chamber being formed by said transverse partition, side walls depending from said partition, and a flexible diaphragm mounted on the lower ends of said side walls; each of said chambers having an inlet valve and an outlet valve carried by said partition; a rock shaft disposed transversely of the lower section thereof and along its elongated dimension, means interposed between each diaphragm and the rock shaft to operate the same by the oscillations of the shaft and a handle carried by the rock shaft for operating said pumps to pump liquid from each compartment into its corresponding pressure chamber and thence through the outlet conduits.

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