G. B. HAINES.

FIRE EXTINGUISHER AND THE LIKE.

APPLICATION FILED AUG. 27, 1919.

1,337,130. **Patented Apr. 13, 1920.**

3 SHEETS—SHEET 1.

Fig. 1.

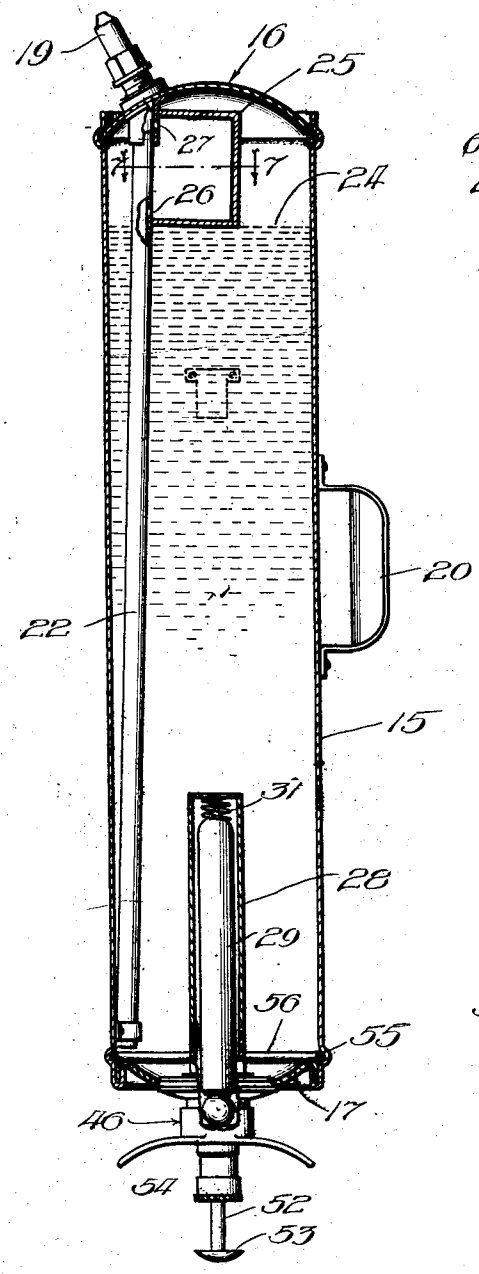
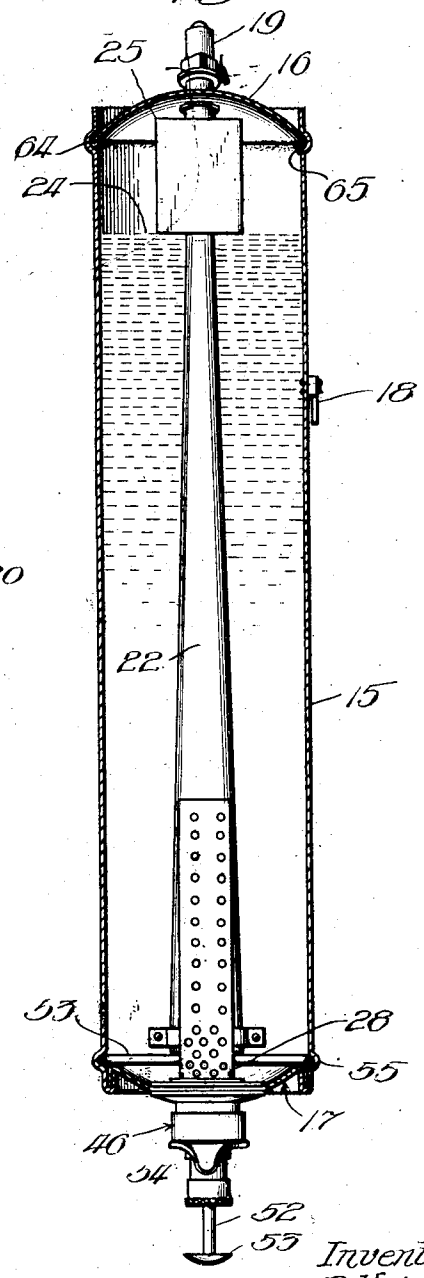


Fig. 2.



Witness:

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3 SHEETS—SHEET 2.

Fig. 3.

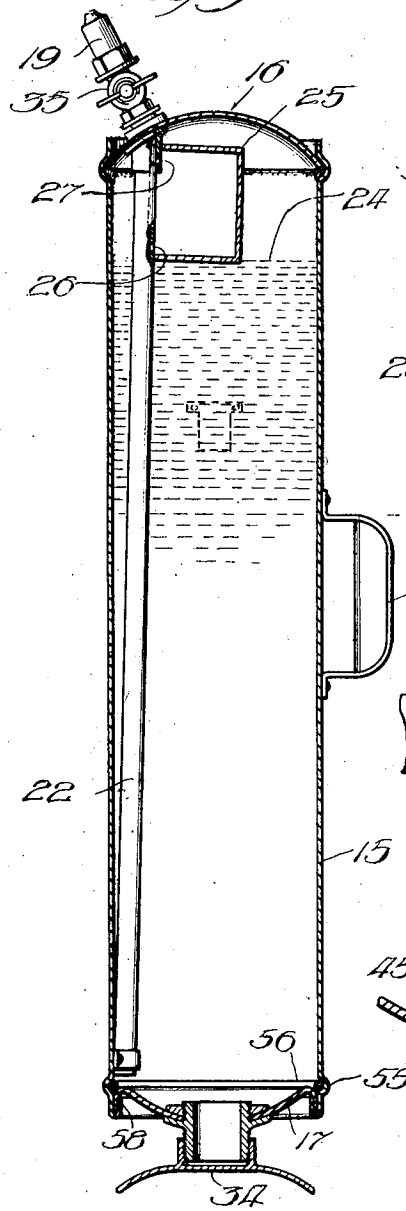


Fig. 4

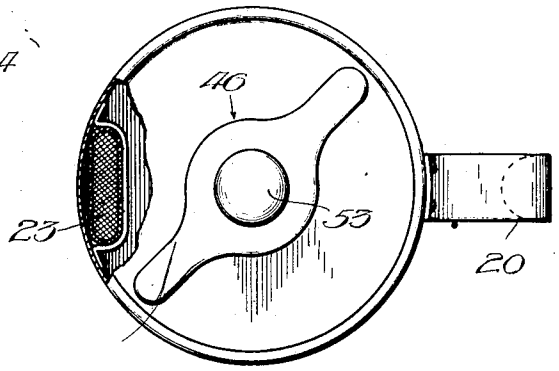


Fig. 5.

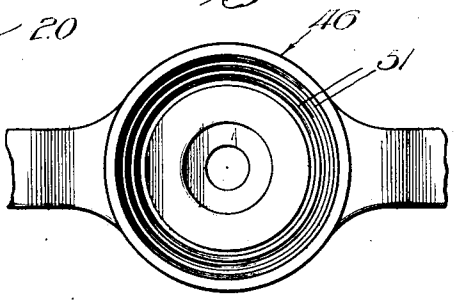


Fig. 6

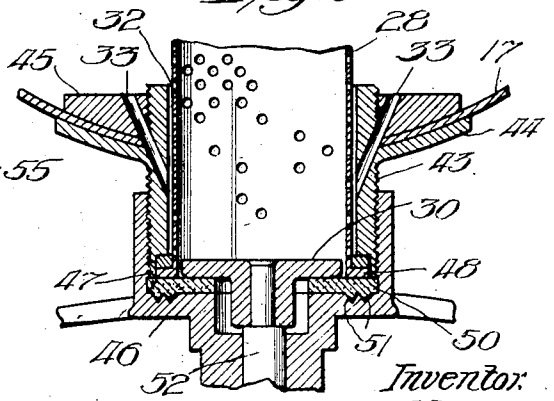
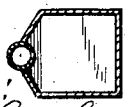


Fig. 7.



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3 SHEETS—SHEET 3.

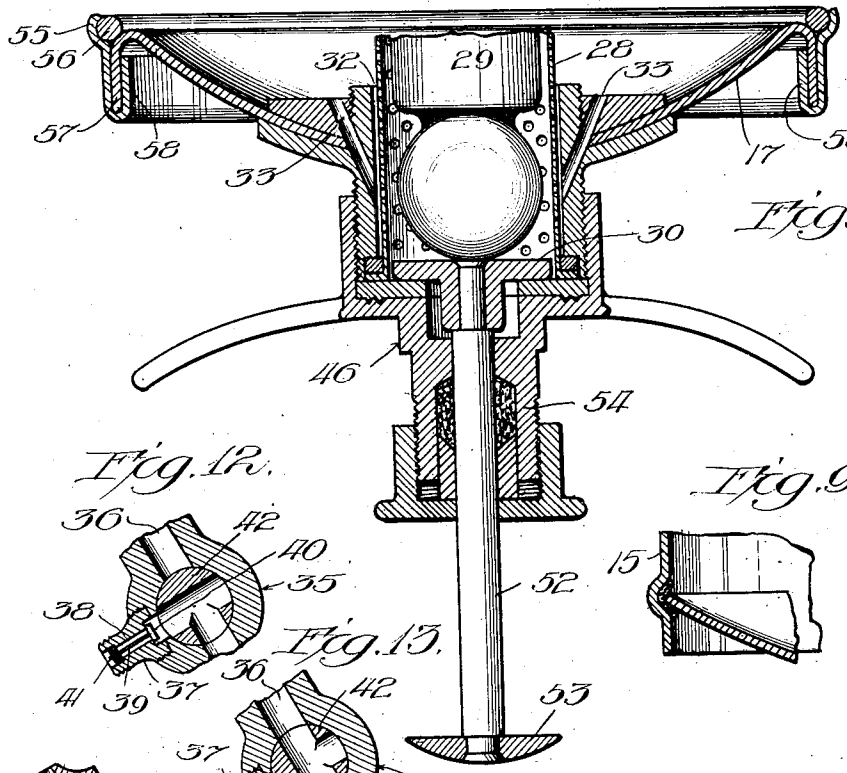

Fig. 8.

Fig. 12.

Fig. 13.

Fig. 9.

Fig. 11.

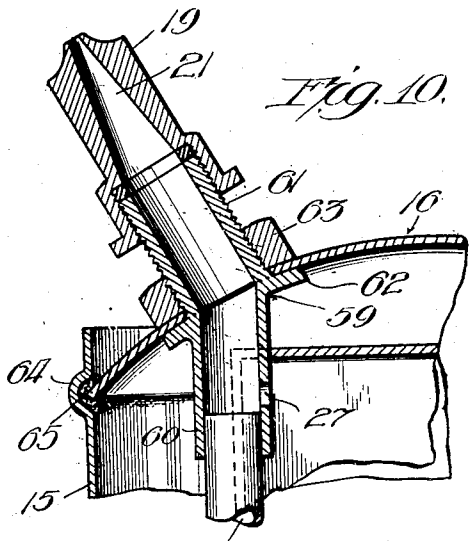

Fig. 10.

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UNITED STATES PATENT OFFICE.

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FIRE-EXTINGUISHER AND THE LIKE.

1,337,130. Specification of Letters Patent. Patented Apr. 13, 1920.

Application filed August 27, 1919. Serial No. 320,086.

To all whom it may concern:

Be it known that I, GEORGE B. HAINES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Fire-Extinguishers and the like, of which the following is a specification.

The present invention has to do with certain improvements in fire extinguishers and like appliances, but it will presently appear that certain of the features of the invention are in nowise limited to use in connection with fire extinguishers. In fact, certain of the features of invention have to do with an improved tank construction, but as the same is herein illustrated and described, said construction has peculiar reference and applicability to use in fire extinguishers.

In order that the features of the invention may be better understood and appreciated, I will first explain briefly certain matters in connection with the construction and operation of fire extinguishers.

The general type of fire extinguisher to which the present invention relates is of that type or kind shown as a chemical or tank extinguisher. It includes a gas or fluid pressure tank having a suitable discharge nozzle or outlet, and having on its interior suitable chemicals and mechanism for causing said chemicals to act or re-act with each other so as to produce the necessary fluid pressure to expel the contents of the tank and direct them in the proper manner. In some cases, the fluid pressure is also produced by air or gas pressure retained within the tank more or less permanently instead of being generated or produced momentarily at the time of use.

In those cases in which the fluid pressure is to be generated automatically by the reaction of chemicals on or between themselves, use is made of a bottle or other fragile container on the interior of the tank, which bottle or the like carries one of the essential chemicals to bring about the reaction for the generation of gas pressure. Means are provided for breaking or disrupting said bottle when the pressure is to be generated. The rate at which the pressure will be generated by the liberation of gases within the tank as a result of such re-action will depend largely upon the rapidity with which the acid or other chemical substance in the bottle is allowed to mingle and re-act with the other chemical constituents. In many cases it has been found that the chemical re-action takes place so suddenly that an excessive amount of pressure is generated with danger to the tank and operator.

One of the objects of the present invention is to provide a flask or fragile container or bottle of such construction that when the bottle is disrupted in the ordinary manner, the liquid contents of the bottle will be discharged or liberated at a slower rate, and at such a rate as to generate only the desired amount of pressure. Another feature of the invention has to do with the construction of the tank and associated or related parts by which the bottle or fragile container is held in operative position. In order to bring about the chemical reaction in the most advantageous manner and under the most favorable conditions, the acid or like chemical when liberated should be free to fully mingle and re-act with the other chemical constituents within the tank. In the past it has been found that a considerable or substantial portion of the acid contents tends to collect or become trapped within the lower portion of the tank or container, so that this portion of the acid is to a large extent inactive and ineffective for any useful purpose.

One of the objects of the present invention is to so construct and arrange the tank or container, and particularly the lower portion thereof, that all portions of the acid will be easily reached and re-acted with by the other chemical constituents, so as to insure a perfect and complete re-action.

Another feature of the invention has to do with the construction of the fittings or structural parts of the tank through and by means of which the bottle or fragile container is broken. This feature of the invention has to do with the provision of a construction such that these parts will be made thoroughly gas-tight at all times and extremely well able to withstand and retain the gas and fluid pressures generated.

Another feature of the invention has to do with the provision of a tank construction which can be readily put together in a very simple and cheap manner in the manufacturing thereof, thereby reducing the cost of

manufacture, while at the same time insuring a construction which will be mechanically strong enough to fully withstand the large pressures generated or used within the tank.

Another feature of the invention has to do with the provision of an arrangement such that in the ordinary handling and usefulness of the apparatus, the liquid or fluid contents will not be expelled or discharged in any degree by expansion taking place with the ordinary changes of temperature to be encountered by the apparatus. In this connection I will state that in the past one objection to an apparatus of this kind has been the fact that when filled in the usual manner at normal temperature, a rise of temperature or heat, or the use of the apparatus in engine and boiler rooms or similar places at high temperature, will cause such an expansion of the contents as to expel a portion thereof with consequent damage to surrounding objects and furniture, and loss of a portion of the effective contents of the apparatus. One of the objects of the present invention is to provide a construction such that such increase in temperature will not result in any such expulsion of fluid contents.

Other objects and uses of the invention will appear from a detailed description of the same which consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings:

Figure 1 shows a vertical longitudinal section through a fire extinguisher or apparatus embodying the features of the present invention;

Fig. 2 is a view similar to that of Fig. 1, with the exception that it is taken at right angles to said figure;

Fig. 3 is a view similar to that of Fig. 1, with the exception that the apparatus has been modified by the elimination of the acid bottle and basket and the disrupting mechanism, and with the further exception that an air pressure valve has been inserted adjacent to the nozzle;

Fig. 4 shows a bottom view corresponding to Fig. 1, but on slightly enlarged scale, a portion of the bottom head being broken away so as to reveal the lower end of the ejector tube;

Fig. 5 is an enlarged detail view of the interior of the bottom cap, the ends of the wings or handles being broken away;

Fig. 6 is an enlarged fragmentary detail view of the lower portion of the apparatus illustrated in Fig. 1, the acid container or bottle being removed;

Fig. 7 is a fragmentary detail section taken on the line 7—7 of Fig. 1, looking in the direction of the arrows;

Fig. 8 is an enlarged detail sectional view of the lower portion of the apparatus shown in Fig. 1, showing the lower end of the acid bottle in position;

Fig. 9 is a fragmentary detail view of a modified form of attachment of the lower head to the tank or container;

Fig. 10 is an enlarged fragmentary detail view of a portion of the upper head and upper end of the tank, the discharge nozzle being attached directly to the upper head fitting;

Fig. 11 is a view similar to that of Fig. 10, with the exception that a suitably constructed valve or cock has been inserted between the fitting and nozzle so as to adapt the apparatus to use with air pressure or the like;

Fig. 12 is a fragmentary view of the valve shown in Fig. 11, the said valve being turned in position for charging the apparatus with air; and

Fig. 13 is another fragmentary detail view of the valve turned in position for discharging the contents under air pressure.

Referring now to the drawings, I have illustrated the features of the present invention as being applied to an apparatus having a cylindrical tank 15 of uniform diameter. An upper head 16 and a lower head 17 are provided for said tank, and I will describe the said heads and the manner of their attachment to the tank in detail presently.

The apparatus ordinarily occupies an upright or vertical position such as shown in Figs. 1, 2, and 3, and for this purpose a suitable hook or the like 18 is provided for suspending the tank on a suitable bracket or catch from a wall or other structure. A discharge nozzle 19 is located at the upper end of the apparatus, and as will be observed by an examination of Figs. 1, 2 and 3 said nozzle is tilted outwardly at a slight angle, so that the contents of the tank will be discharged in the proper direction. A handle 20 is secured to the central portion of the body of the tank preferably substantially at right angles to the position of the nozzle, so that upon grasping the handle 20 and lifting the apparatus away from its wall or other support, it may then be tilted to direct the contents from the nozzle in the desired direction. Examination of Figs. 10 and 11 in particular will show that the bore 21 of the nozzle is centrally located in said nozzle so as to provide a substantially central discharge of the contents.

An ejector tube 22 extends vertically through the tank, the upper end of said ejector tube delivering its contents ultimately through the nozzle, and the lower end of said ejector tube reaching close to the lower end 17 so that when fluid pressure exists within the tank substantially the entire contents thereof can be readily dis-

charged. Examination of Figs. 1 and 2 in particular will reveal that the ejector tube is of much larger cross section at its lower end than its upper end, being of substantially uniform dimension in one direction and tapering in width in a direction at right angles thereto. Since the rate of fluid discharge at the nozzle is substantially equal to the rate of fluid input at the lower end of the tube 22, and since the linear velocity of the fluid in the tube varies inversely as its cross sectional area, it follows that the fluid contents will enter the tube at a low linear velocity, and said velocity will increase as the fluid travels upwardly through the tube until a maximum velocity is reached at the point of discharge. By this arrangement, the static energy of pressure within the tank is gradually converted into dynamic energy of velocity as the fluid approaches the discharge, so that a much more efficient discharge is secured, and experience has demonstrated that this arrangement will permit the contents to be thrown very much farther from the nozzle with a given pressure in the tank than is otherwise possible.

Ordinarily a screen 23 will be placed over the lower end of the ejector tube so as to prevent the entrance of particles of chemical or other solid contents. Ordinarily the liquid within the tank will stand at the elevation shown by the line 24 in Figs. 1, 2, and 3, being close to the upper head 16.

This leaves only a relatively small gas capacity above the liquid. As a result, a relatively small rise of temperature of the apparatus and its contents will cause a portion of the liquid to be discharged through the nozzle by reason of the expansion taking place, and, in some cases, this is a very serious and annoying matter. In order to prevent such a possibility, I have provided a receptacle or chamber in communication with the upper portion of the tube 22, of such capacity as to fully accommodate and take care of any liquid raised by such expansion, so that the same will not be expelled. This is the receptacle 25. It comprises a small chamber preferably secured to the upper portion of the tube 22 and communicating therewith by means of lower and upper holes 26 and 27 respectively. Any relatively small amount of liquid forced up through the tube 22 will enter said container 25, and the same will be of sufficient capacity to accommodate such liquid raised by ordinary expansion with change of temperature. As shown in detail in Fig. 7, this container 25 is conveniently made of sheet metal, the vertical edge portions of which are soldered or otherwise attached to the tube and supported thereby.

The fluid pressure may be generated either by chemical re-action or by the retention of air pressure within the tank. I will first describe the apparatus as the same may be used for the generation of special pressure by chemical re-action. For this purpose a basket or the like 28 is provided in the lower portion of the apparatus, within said basket being a bottle or other fragile container 29. This bottle contains acid or one of the chemical constituents which is to re-act with the fluid or other material when the bottle is broken. The lower end of the bottle rests on a plunger or the like 30 which may be suddenly forced upwardly in the manner to be presently explained when the pressure is to be generated. The upper end of the bottle is conveniently supported by a spring or the like 31 which exerts a sufficient pressure thereon to hold the bottle in position and prevent rattling or vibration which might break the bottle prematurely.

The lower portion, ordinarily the lower one-fourth to one-third of the basket 28, is perforated or foraminated, as is well shown in Figs. 1, 2, 3, 6, and 8, so that when the bottle is broken, its fluid contents will run down into the lower end of the basket and be discharged into the interior of the tank through said perforations. Examination of Figs. 1, 6, and 8 in particular will show that a considerable portion of the basket lies below the lower head 17, so that there is a possibility in some cases that a portion of the acid will be retained in said lower portion, where it will not properly or rapidly re-act with the other chemical constituents of the tank. In order to avoid this possibility, I have provided the construction which I will now describe in detail. For this purpose, I have provided means for insuring the free admission of the other contents of the tank down and into the lower end of the basket, so that the material so introduced will encounter the acid in the lower portion of the basket, and by re-action therewith will generate gas which will tend to blow or lift the acid out of the basket and force the same to thoroughly mingle with the remaining fluid contents of the tank. For this purpose I sometimes leave a space around the lower end of the basket, as shown at 32 in Figs. 6 and 8, so that the fluid contents of the extinguisher can readily flow down around the extreme lower portion of the basket and under the same through its foraminations. In some cases I also provide additional passages or openings 33 which reach down close to the lower end of the basket and further facilitate the entrance of the liquid contents thereinto.

It was previously mentioned that the perforations ordinarily occupy approximately the lower one-fourth to one-third of the height of the basket. This arrangement is of advantage and desirability, since the acid from the bottle naturally settles into the lower portion of the basket, so that it is

unnecessary to provide for foraminations over the entire height of the basket; and by leaving the upper portion of the basket unperforated the mingling of the acid with the liquid contents of the tank is controlled in a better and more effective manner.

I will now describe the use of the apparatus in those cases in which the liquid contents are to be discharged by the air pressure. In such case the basket, acid bottle, and plunger may be eliminated, and the lower end of the apparatus may be closed by a cap 34, as shown in Fig. 3. In this case, a valve 35 is to be inserted adjacent to the nozzle 19 for permitting the introduction of compressed air or other gas, and for subsequently controlling the discharge of liquid contents. Said valve is shown in detail in Figs. 11, 12, and 13. It has a longitudinal passage 36 and a side connection at right angles thereto. Within this side connection is fastened a plug 37, which plug has a longitudinal bore 38 through which extends a pin 39. A small lead or other valve 40 is connected to the inner end of the pin, and a spring 41 works against the outer end of the pin to hold the valve normally seated in closed position, as shown in Figs. 11, 12, and 13. The plug 37 has its ends recessed for the accommodation of the valve 40 and spring 41, so that said plug may be assembled as a unit and then set into position in the valve 35. The valve 35 carries an operating plug 42 having two bores at right angles to each other, so that when said plug is turned into the position of Fig. 12, air or other gas may be forced down into the tank or apparatus through the plug 37; and so that when said plug 42 is turned into the position of Fig. 11, the air or other gas will be held in the tank under pressure; and so that when the plug 42 is turned into the position of Fig. 13, the liquid contents of the tank will be discharged through the nozzle 19.

I will now describe in detail the construction of the heads 16 and 17 and the method of their attachment to the body of the tank as well as the fittings for said heads. The lower head 17 is provided with a fitting 43 comprising a neck or throat which extends through the lower head 17 from the outside to the inside thereof, and an integral flange or the like 44. Said flange seats against the outer surface of the head 17 and is curved or formed to seat evenly against said surface in a tight manner. A nut or the like 45 is threaded onto the inner end of the neck of the fitting and seats evenly against the inner surface of the head 17 and clamps the same against the flange 44. Ordinarily when the parts are put together, the flange 44 and nut 55 will be brazed or soldered to the head 17 so as to improve the connection and insure a gas and fluid tight connection.

The cap 46 which is used when the apparatus is to be operated by fluid pressure threads onto the outer end of the neck 43, as is clearly illustrated in Fig. 6. The lower end 47 of the neck 43 is undercut, as shown in Fig. 6, and the lower end of the basket 28 has an out-turned flange 48 which sets into said undercut. A washer 49 may be set between the flange 48 and the shoulder of the undercut portion of the neck 43. A gasket 50 is ordinarily seated between the lower face of the flange 48 and the underside face of the cap 46. Said gasket may be of lead or other material which, when compressed, will yield or flow sufficiently to insure a perfectly tight connection. In order to improve the air-tight connection of the cap, I have provided a pair of circular grooves or threads 51 on the underside face of the cap, as shown in Fig. 6, said grooves preferably lying beneath the position of the flange 48. Consequently, when the cap is tightened up, sufficient pressure will be exerted on this gasket to force a portion of its metal or material into the grooves 51 and thereby materially improve the gas and fluid tightness of the apparatus.

The plunger 30 is carried by the upper end of a pin 52 which extends through the cap 46 and has an operating button 53 on its lower end. When the acid bottle is to be broken, said button is jammed or knocked forcibly against the floor or any other suitable or convenient object. The pin 52 extends through a stuffing box 54 in the cap 46, so as to provide a gas and fluid-tight joint at this point.

Owing to the fact that the operating button 53 is ordinarily knocked with great violence against the floor or other object a large force is exerted on the lower head 17 tending to displace the same upwardly along the body 15. After the fluid pressure is generated within the tank, there exists a very large force tending to displace the head 17 outwardly away from the body 15. I have, therefore, provided a construction or attachment for the head to the body which is well able to resist both of these forces, and which is as follows: A circular groove 55 is provided around the lower portion of the cylindrical tank 15 into which is forced a split ring 56 of wire or other suitable material. This split ring thus projects inwardly somewhat farther than the inner surface of the tank 15. The lower head 17 is of concavo-convex form and has a downwardly extending flange 57 which seats closely against the inner surface of the body 15. Assuming that the ring 56 is in position, the head 17 is then set into place against said ring, and afterward the lower edge 58 of the body 15 is spun over against the flange 57 so as to clamp the same in position. If desired, the parts may

also be brazed or soldered during these operations. It will be observed that the arrangement is such that the ring 56 assists in holding the head 17 against any upward displacement, and the spinning of the lower edge 58 against the inner surface of the flange 57 effectively prevents any outward displacement of the head 17 under gas or fluid pressure.

I will now describe the upper head 16 and its fitting. The fitting 59 comprises inner and outer necks 60 and 61 respectively, which are conveniently formed at an angle with respect to each other, as shown in Figs. 10 and 11. There is provided an integral flange 62 which is adapted to seat evenly against the inner surface of the head 16, a nut 63 threading onto the outer threaded neck 61 and clamping the head 16 against the flange 62. Ordinarily these parts will also be soldered or brazed to the head.

The provision of the flange 62 integrally on the fitting and of proper form to seat uniformly against the inside surface of the head 16 bears a peculiar relationship to the remaining elements or portions of the apparatus, as will be evident from the following explanation. The ejector tube 22 is connected to the inside neck 60, and owing to the fact that these parts are close to the upper head 16, it is very desirable to attach the ejector tube to the neck 60 prior to the attachment of the fitting 59 to the head 16. For purposes of convenience in assembling, the head 16 is first attached to the body 15 and then the threaded neck 61 is passed up through the hole in the head 16 by reaching up through the inside of the tank, the lower head 16 not yet being in place. Thereafter the nut 63 can be very easily threaded into place and the parts soldered or brazed together in a very convenient manner. Afterward the lower head 17 with its fitting can be set into place and secured to the lower end of the tank.

The upper head 16 is conveniently attached to the upper portion of the tank 15 in the following manner: In the upper portion of the tank 15 there is formed a circular groove or the like 64. The upper head 16 is of dish shape, and its outer periphery is such that it can be sprung into the groove 64, and when once sprung into position will lock therein in a very tight manner. Ordinarily a bead of solder 65 will be formed around the lower lip of the groove 64 before the head 16 is sprung into place, and afterward additional solder may be run in around the outside edge of the head and to fill in the bead. It will be found that this method of attachment is very effective and satisfactory. In Fig. 9, I have shown a modified attachment for the lower head 17 which is very similar to the method of attaching the upper head 16, and, in some cases, may be substituted for the split ring arrangement previously described.

Reference particularly to Fig. 2 will show that the basket also has a relatively few perforations in its upper portion, usually from five to ten rows. These perforations are relatively few as compared to those in the lower portion. These perforations, when used, are to allow the gas generated to equalize on the acid, so that the acid will not be trapped in the upper portion of the basket or bottle.

While I have herein shown and described only a single embodiment of the features of my invention, still I wish it clearly understood that I do not limit myself to the said embodiment, except as I may do so in the claims.

I claim:

1. In a fire extinguisher, the combination of a cylindrical tank of uniform diameter, heads closing the upper and lower ends of the same, a discharge nozzle in conjunction with the upper head, an ejector tube extending from said nozzle downwardly through the interior of the tank to a point adjacent to the lower head, the cylindrical tank being normally filled with liquid up to a level somewhat below the upper head, and an expansion tank in conjunction with the upper portion of the ejector tube, said expansion tank communicating with the ejector tube to receive liquid therefrom and deliver liquid thereto, and being located within the upper portion of the cylindrical tank and above the normal liquid level aforesaid, whereby an expansion tank of sufficient capacity to accommodate the maximum probable expansion of liquid may be placed within the cylindrical tank without increase of size or proportions thereof, substantially as described.

2. In a fire extinguisher, the combination of a rectangular sheet of metal curved to provide a cylindrical tank of uniform cross section throughout its height, upper and lower closures therefor, a discharge nozzle in conjunction with the upper closure, an ejector tube in conjunction with said nozzle and extending down through the cylindrical tank to a point adjacent to the lower closure, the cylindrical tank being normally filled with liquid up to a level somewhat below the upper closure thereof, and an expansion tank in conjunction with the upper portion of the ejector tube and in communication with the ejector tube and adapted to receive liquid from and deliver liquid to the ejector tube, said expansion tank being located within the cylindrical tank and above the normal liquid level therein, whereby an expansion tank of maximum capacity may be accommodated within the upper portion of the main tank and above the normal liquid

level without necessary increase in capacity of the upper portion of the cylindrical tank and without change of design of the sheet forming the cylindrical tank, substantially as described.

3. In a fire extinguisher, the combination with a pressure tank of a closure for the lower end of said tank, a vertical basket extending upwardly from said closure on the interior of the tank, the lower portion of said basket being below the position of the closure aforesaid, a sleeve surrounding and inclosing the said lower portion of the basket, an acid bottle within the basket, means for breaking the lower end of the bottle to liberate the acid from the same into the lower portion of the basket, there being a passageway leading from the lower portion of the space within the tank into direct communication with the lower portion of the basket, whereby when the bottle is broken and the acid is liberated into the lower portion of the basket, liquid may pass downwardly through said passageway and react with the acid in the lower end of the basket, the basket being provided with side perforations of relatively large total cross sectional area in its lower portion, and with side perforations of relatively small total cross sectional area in its upper portion, whereby when the acid and liquid react together in the lower portion of the basket, gas is generated to drive the acid upwardly into the upper portion of the basket, whence said acid will enter the body portion of the fire extinguisher in a retarded manner, owing to the relatively small total cross sectional area perforations in the upper portion of the basket, substantially as described.

4. In a fire extinguisher, the combination with a pressure tank of a closure for the lower end of said tank, a vertical basket extending upwardly from said closure on the interior of the tank, the lower portion of said basket being below the position of the closure aforesaid, a sleeve surrounding and inclosing the said lower portion of the basket, an acid bottle within the basket, means for breaking the lower end of the bottle to liberate the acid from the same into the lower portion of the basket, there being a passageway leading from the lower portion of the space within the tank into direct communication with the lower portion of the basket, whereby when the bottle is broken and the acid is liberated into the lower portion of the basket, liquid may pass downwardly through said passageway and react with the acid in the lower end of the basket, substantially as described.

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