Jan. 10, 1939. G. SCHAAF 2,143,635

FIRE EXTINGUISHER

Filed June 6, 1936

FIG. 1.

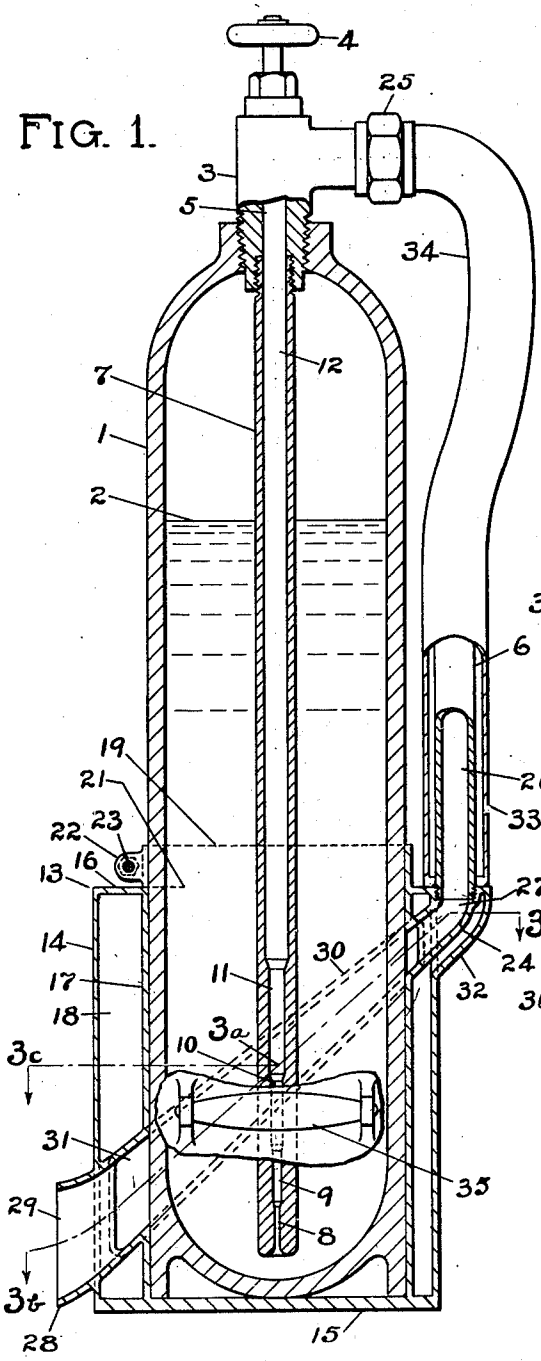


FIG. 2.

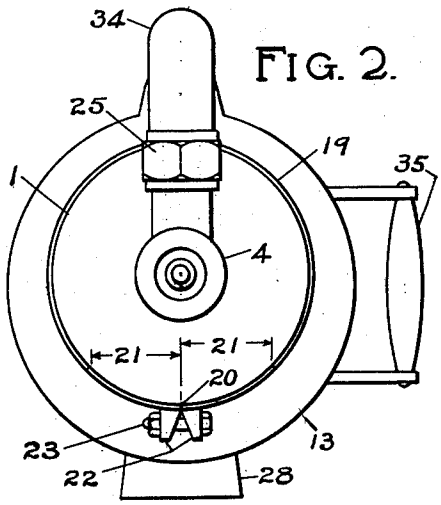
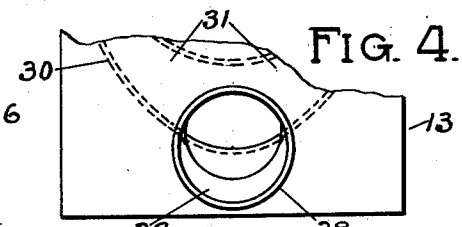


FIG. 4.



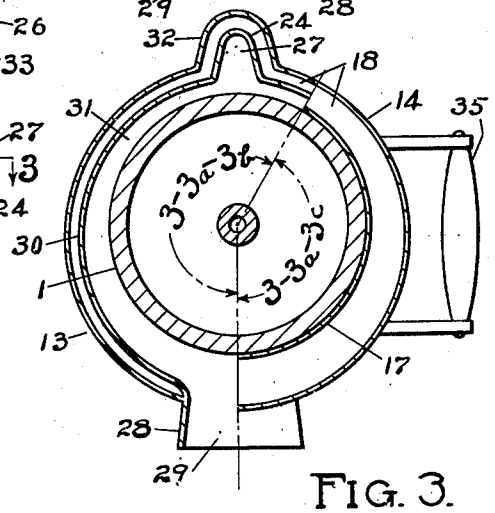


FIG. 3.

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FIRE EXTINGUISHER

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12 Claims. (Cl. 169—11)

This invention relates to fire extinguishers of the type which employ a liquid carbon dioxide stored in a container under pressure and more particularly to the method and apparatus for handling and discharging the liquid to expand into a gas and to form a snow.

My present invention provides a device for effectively discharging carbon dioxide from a high pressure by expanding a stream of said carbon dioxide through an expansion chamber which is kept at low temperature to break up and retard said stream and produce snow.

Various devices have been produced to use carbon dioxide as a fire extinguishing medium and in such use to produce a snow as the most effective form to blanket a fire. Most of these devices employ a method of carrying the fluid at a high pressure to a restriction at the point of emergence which produces a high velocity of the issuing stream at said point.

My method and apparatus for discharging carbon dioxide from a container holding said carbon dioxide under a high pressure is to partly expand the dioxide in a conduit which is in the container leading from near the bottom to the top thereof and so to convey the fluid at a reduced pressure but liquid form through a passage of uniform diameter to an expansion chamber which is maintained at a low temperature and to prevent the interchange of heat between the outside air and the fluid in its passage by insulating the passage ways from the container to a discharge opening into the air.

This is accomplished by introducing the liquid into the lower end of a conduit near the bottom of the container through the smallest passage in the discharge system, successively enlarging the passage in said conduit toward the top to partly expand the liquid in said conduit, conveying the liquid at a reduced pressure through a passage of uniform diameter which is insulated, and then breaking up the liquid by expanding and spraying it in a chamber surrounding the bottom of the container which is a region of low temperature and preserving this low temperature by insulating the said chamber. The fluid passages and expansion chamber are calculated to expand the fluid to a point where the pressure at the discharge opening into the atmosphere will propel the issuing stream the distance necessary to blanket a fire from a self contained hand apparatus.

An object of the invention is to provide a self contained hand fire extinguisher with means for conveying and directing a stream of carbon dioxide gas and snow from an expansion chamber near the bottom of the container into the air.

Another object of the invention is to provide a fire extinguisher with a housing to inclose the bottom of a tank of carbon dioxide as an expansion chamber in which the discharging carbon dioxide is kept at a low temperature by the cooling of said tank during discharge.

Another object is to provide a self contained fire extinguisher in which a tank is inclosed in an expansion chamber housing and which can be readily disconnected to replace a partly discharged or empty tank with a full tank and so provide a replaceable part to constantly maintain the extinguisher ready for use.

Another object is to provide a fire extinguisher with the smallest aperture at the beginning of the discharge system to reduce the pressure to, and through an expansion chamber; to keep the expanding carbon dioxide at a low temperature and constantly slow up the movement to the point of exit from the chamber and to insulate the discharge system.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists in certain features of novelty in the construction, combination and arrangement of parts by which the said objects are attained, the invention being more particularly pointed out in the claims.

In the accompanying drawing:

Figure 1 is a side elevation, mostly in section, of a container with its housing and connections which constitute a fire extinguisher embodying my invention.

Fig. 2 is a top or plan view of the fire extinguisher.

Fig. 3 is a sectional plan through the housing and container in two portions, one portion on line 3—3*a*—3*b* of Fig. 1 (also indicated on Fig. 3) to show the expansion chamber and the other portion on line 3—3*a*—3*c* of Fig. 1 (also indicated on Fig. 3) to show the air insulation.

Fig. 4 is a side elevation of the bottom portion of the housing showing the discharge opening and the discharge passages in dotted lines leading to said opening.

In the drawing, 1 is a storage tank or container to hold a charge of liquid carbon dioxide 2 under pressure. The L shaped plug 3 is screwed into the top of container 1 and has a valve which can be represented by handle 4 for controlling the passage 5 in plug 3 to the outside pipe 6 which is preferably a copper tube. Screwed into the bottom of plug 3 is a discharge conduit 7

which extends to near the bottom of container 1. The conduit 7 has a small passage 8 at the bottom, with a graduated opening into said passage 8, and a passage which increases in size from said bottom passage 8 by successive steps as 9, 10, 11 and 12 to the top as shown. The passage 12 at the top of conduit 7 is the same size as the passage 5 in plug 3 and passage 26 in tube 6. For example if the size of the passage 12 at the top is 3/16" the bottom passage 8 may be 1/16", passage 9 may be 3/32", passage 10 may be 1/8" and passage 11 may be 5/32". The lengths of different sized passages 8 to 12 also proportionately vary somewhat as shown. I do not limit myself to these dimensions but give them as illustrative of the successive steps of enlargement of the passage in the conduit 7 and as a convenient method of forming said passage.

13 is a housing, rectangular in vertical section as shown in Fig. 1 and circular in form as shown by its plan in Figs. 2 and 3. The vertical side wall 14 of the housing 13 is in the form of a circular shell with bottom 15 and top 16. An inner shell with a vertical side wall 17 parallel to the outer wall 14 is located between the bottom 15 and top 16. Inner shell 17 is of a size to accomodate a tank 1, the lower end of which is inclosed as shown in Fig. 1. Inner shell 17 is located eccentric with outer shell 14 to inclose an eccentric air space 18 between them.

As a means of fastening the tank 1 into the housing 13 a vertical flange 19 is provided on the top 16 of housing 13. Flange 19 is split at 20 and separated from the top 16 for a short distance as 21 on each side of said split 20 and by means of lugs 22 and bolt 23 the tank 1 is clamped into the housing 13.

Connected to the inner shell 17 near its top and on the side located nearest to the outer shell 14 is a nozzle 24 extending up diagonally to the top 16 to which said nozzle is also connected. The lower end of tube 6 is shown connected by threads into the top of the nozzle 24 and at the upper end to plug 3 by means of a union 25. The passage 27 in the top of nozzle 24 is the same size as the passage 26 in the tube 6 (Fig. 1) but increases in size as it approaches the inner shell 17 by spreading out horizontally (Fig. 3).

Near the bottom of housing 13 and on the opposite side from nozzle 24 is a discharge cone 28 having a discharge opening 29. Running diagonally downward from the nozzle 24 to the discharge cone 28 and extending on opposite sides of the tank 1 is a horn 30 inclosing an expansion chamber 31. The portion of the horn 30 on each side of the tank 1 is complete in itself but carries only one half of the stream from the nozzle to the discharge cone so the portions on each side of the tank might be considered as one horn divided by the tank 1. The horn is built in as a portion of the inner shell 17, and being shown rectangular in shape, one side is open and the open side is closed by the side of the tank 1. The taper of the horn 30 is such as to form an expansion chamber 31 through which a stream will expand from the nozzle 24 to the discharge opening 29.

The tank 1 is insulated by the air in the air space 18 and the horn 30 is also insulated as it is in said air space 18. A boss 32 on the housing 13 surrounds, but is spaced from, the nozzle 24 and insulates said nozzle by air in said housing 13. The tube 6 is insulated by air in the casing 33 surrounding it as shown in Fig. 1.

35 is a lower handle attached to the side wall 14 of the housing 13 and located as shown in Figs. 1, 2 and 3. The upper end of tube 6 and its casing 33 are curved at 34 to form an upper handle and together with lower handle 35 form means to carry and hold tank 1 and housing 13 to direct a stream of discharged gas and snow from cone 28 onto a fire.

The insulating of the tube 6 prevents the interchange of heat between the outside air and the carbon dioxide while passing from the tank 1 to the expansion chamber 31 in the horn 30 and to maintain the carbon dioxide in its liquid state.

When the tank 1 is completely discharged it is disconnected from the tube 6 by unscrewing the union 25 and loosening the nut on the clamping bolt 19 and the tank 1 then lifted from the housing 13 to be replaced by a full tank.

The operation of my fire extinguisher consists in opening the valve 4 to release the carbon dioxide 2 which is confined in tank 1 under a pressure which is normally about 750 pounds per square inch. The liquid 2 traverses the passages 8, 9, 10, 11 and 12 in the conduit 7, the passage 5 in the plug 3, the passage 26 in tube 6, the expansion chamber 31 in horn 30 and is discharged into the air through the opening 29 in the discharge cone 28.

A partial drop in pressure and some expansion will occur in the carbon dioxide liquid as it passes through the conduit 7 from the passage 8 at the bottom to passage 12 at the top and also a slowing down of the stream from the passage 8 as it expands. The speed of the stream through the uniform passages 12, 5, 26 and 24 will be uniform and with practically no expansion until it reaches passage 27 in the lower part of nozzle 24 where it suddenly expands to spray the liquid into and through the expansion chamber 31 of the horn 30 with a consequent slowing down to the discharge opening 29.

The breaking up of the stream of discharging carbon dioxide liquid as it issues from the nozzle 24 to strike against the tank 1 separating it into two streams and expanding it from the said nozzle to the discharge opening 29 forms a gas and snow. There being no restriction at the point where the liquid is broken up and sprayed to form snow but an expansion chamber which increases rapidly in size the snow which is formed is readily discharged without piling up to clog the passage. The partal expansion of the liquid 2 in the conduit 7 cools the tank 1 and helps to maintain the zone of low temperature in the horn 30 which is induced by the expansion of the stream in said horn.

Having thus described my invention, I claim:

1. A fire extinguishing apparatus including a container for carbon dioxide under pressure, a conduit in said container having a passage increasing in size from the bottom of said conduit for expanding the fluid, an expansion chamber surrounding said container, means to form an air chamber about said expansion chamber, means to convey the fluid from said conduit to said expansion chamber through a passage of uniform diameter, and a discharge nozzle from said expansion chamber.

2. A fire extinguishing apparatus including a container for carbon dioxide under pressure, an expansion chamber surrounding said container, a nozzle to discharge the fluid from said expansion chamber, means to insulate said expansion chamber and means to convey the fluid from near the bottom of said container to said expansion chamber whereby the fluid entering said expansion

chamber will separate and flow in opposite directions around said container to reunite before discharge from said nozzle.

3. A portable fire extinguishing apparatus including a container for carbon dioxide under pressure, an expansion chamber surrounding said container, a nozzle to discharge the fluid from said expansion chamber, passage means from near the bottom of said container to said expansion chamber said passage means including a conduit in said container and an outside tube connecting the conduit passage with the expansion chamber and an upper and a lower handle for carrying and directing a stream of fluid from said apparatus onto a fire, one of said handles formed from said outside tube.

4. A portable fire extinguishing apparatus including a container for carbon dioxide under pressure, an expansion chamber surrounding the lower part of said container, a nozzle to discharge the fluid from near the bottom of said expansion chamber and passage means from near the bottom of said container to near the top of said expansion chamber, said passage means including an outside tube from the top of said container to said expansion chamber and forming a handle to said apparatus.

5. A portable fire extinguishing apparatus including a container for carbon dioxide under pressure, an expansion chamber surrounding the lower part of said container, a nozzle to discharge the fluid from near the bottom of said expansion chamber and passage means from near the bottom of said container to near the top of said expansion chamber, said passage means including an outside tube from the top of said container and connected to said expansion chamber on the side opposite to said discharge nozzle.

6. In a portable fire extinguishing apparatus for holding a fire extinguishing fluid liquefied under pressure and expanded in said apparatus to a low pressure to a nozzle and to discharge the fluid into the atmosphere through the nozzle at a low velocity, the combination of a container for carbon dioxide, a plug in the top of said container, a valve in said plug, an expansion chamber eccentrically surrounding the lower part of said container, a discharge nozzle near the bottom of said expansion chamber, passage means from near the bottom of said container to near the top of said expansion chamber and controlled by said plug valve, said passage means including a conduit in said container and having a passage increasing in size toward said plug and a tube from said plug to said expansion chamber, means to insulate said tube and means to insulate said expansion chamber.

7. A fire extinguishing apparatus comprising a container for carbon dioxide under pressure and a discharge system for said container and having a passageway increasing in successive stages from the opening into said discharge system to the discharge opening into the atmosphere, said discharge system including a conduit in said container extending from the top to near the bottom of said container, an expansion chamber, a discharge nozzle, and connecting passage means between said conduit and said nozzle, said expansion chamber located adjacent to said nozzle at the discharge end of said system.

8. A fire extinguishing apparatus including a container for liquid carbon dioxide under pressure, a conduit in said container having a passage increasing in size by successive steps from near the bottom of said conduit, a nozzle and connecting passage means between said conduit and said nozzle, said conduit passage so proportioned as to maintain the carbon dioxide in liquid form while passing therethrough.

9. A fire extinguishing apparatus including a container for carbon dioxide under pressure, a conduit in said container having a passage increasing in diameter from one to four times toward its outlet to partly reduce the pressure of the fluid, an expansion chamber, means having a uniform diameter to convey the fluid from said conduit to said expansion chamber and a discharge nozzle from said expansion chamber whereby the fluid is discharged into the atmosphere from the zone of greatest expansion.

10. A fire extinguishing apparatus including a container for carbon dioxide under pressure and a discharge system for expanding and conveying the fluid to the atmosphere at a low pressure, said discharge system consisting of an expansion chamber, a discharge nozzle from said expansion chamber, connecting passage means from said container to said expansion chamber and means to insulate said passage means, said insulating means including a casing having closed ends, said casing conforming to the shape of said connecting passage means and spaced therefrom.

11. A fire extinguishing apparatus including a container for carbon dioxide under pressure, a conduit in said container, an expansion chamber surrounding said container, a discharge nozzle from said expansion chamber, passage means to convey the fluid from said conduit to said expansion chamber, a valve in said passage means, and means to insulate said passage means.

12. A fire extinguishing apparatus comprising a container for liquid carbon dioxide under pressure and a discharge system for said container and having a passageway increasing in successive stages from the opening into said discharge system to the discharge opening into the atmosphere, said discharge system including a conduit in said container extending from said container top toward the bottom and having a passage increasing in diameter near its inlet end from one to four times to partly reduce the liquid pressure, a valve at the top of said container, a horn, a discharge nozzle from said horn, and a tube from said valve to said horn, said conduit, valve and tube having a continuous passage of a uniform diameter from the largest diameter in said conduit to said horn.

GEORGE SCHAAF.