Feb. 25, 1936. D. MAPES 2,031,965

FIRE EXTINGUISHING APPARATUS

Filed Feb. 10, 1934 2 Sheets-Sheet 1

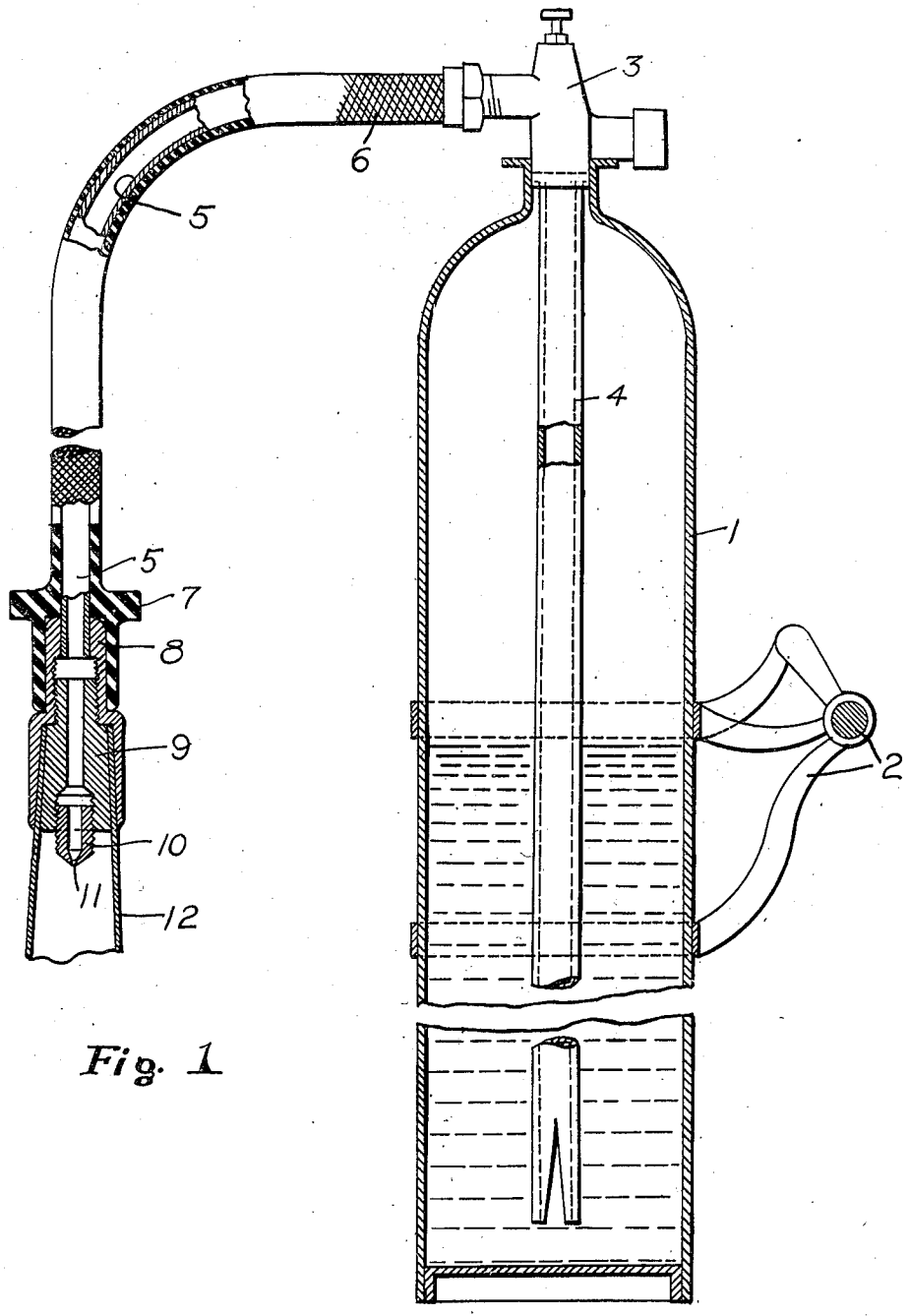


Fig. 1

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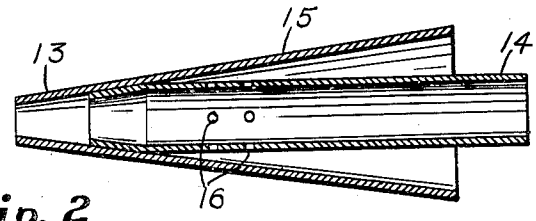


Fig. 2

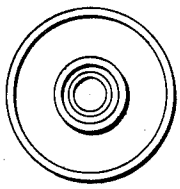


Fig. 2a

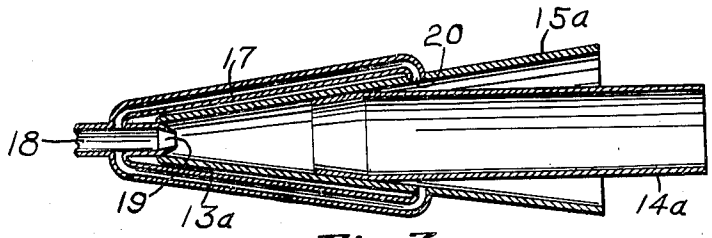


Fig. 3.

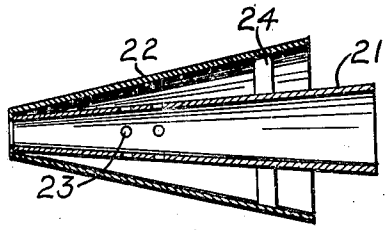


Fig. 4

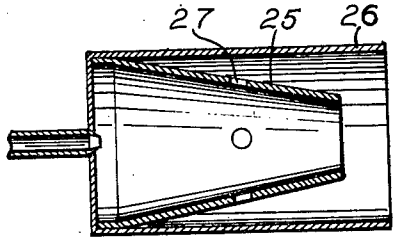


Fig. 5

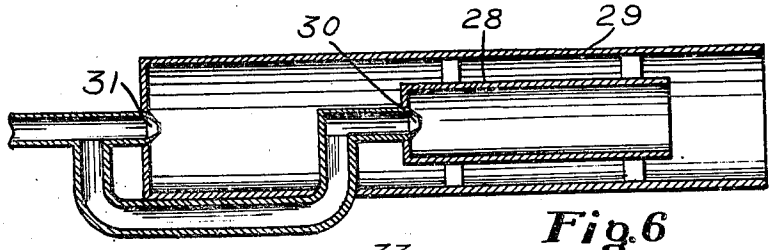


Fig. 6

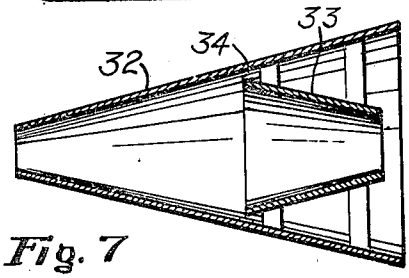


Fig. 7

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UNITED STATES PATENT OFFICE

2,031,965

FIRE EXTINGUISHING APPARATUS

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Application February 10, 1934, Serial No. 710,587

10 Claims. (Cl. 169—11)

This invention relates to improvements in fire extinguishing apparatus, particularly of the type employing carbon dioxide which is discharged through a restricted orifice from a container of liquid carbon dioxide to transform the liquid partly into carbon dioxide snow and the remainder into carbon dioxide gas, both of which when projected upon a fire act to extinguish it.

More specifically the present invention constitutes further improvements over the invention disclosed in my copending application Serial No. 418,191 filed January 3, 1930, for "Fire extinguishing apparatus" and is particularly directed to forms of snow producing shields which will have a greater range of discharge than has hitherto been obtainable, yet without detrimental entrainment of air from the surrounding atmosphere by the discharging stream of carbon dioxide snow and gas.

It is accordingly the primary object of the present invention to provide a carbon dioxide snow producing shield so constructed, shaped and proportioned that the discharging jet will have a greater range than has hitherto been obtainable, yet without detrimental entrainment of air, whereby the jet will have better directional characteristics and greater fire extinguishing effectiveness.

Among other objects of the invention, which are in common with the objects of my hereinabove referred to copending application are the provision of an improved and simplified apparatus of the proper form and construction to insure uninterrupted and effective operation; the provision of a discharge nozzle and a shield therefor by which efficient distribution of the carbon dioxide snow and gas formed from the liquid carbon dioxide is obtained when discharged through the nozzle; and the provision of a nozzle and shield so shaped and proportioned that the snow and gas formed will have sufficient velocity to insure that the snow does not collect in the shield near its discharge end and tend to clog it.

These, and further objects of the invention not specifically enumerated above, will be apparent as the invention is described in greater detail in connection with the accompanying drawings, wherein:

Figure 1 is a vertical cross-sectional view through one form of device employing the construction of this invention, showing some parts broken away.

Figure 2 is a central cross-sectional view through one form of shield embodying the principles of this invention.

Figure 2a is a view in end elevation of the shield shown in Figure 2.

Figure 3 is a central cross-sectional view through a modified form of shield.

Figure 4 is a central cross-sectional view through another form of shield employing the principles of this invention.

Figure 5 is a central cross-sectional view through another form of shield.

Figure 6 is a central cross-sectional view through still another form of shield.

Figure 7 is a central cross-sectional view through a still further form of shield.

As shown in Figure 1 the device includes a container 1 of well known construction in which carbon dioxide is maintained under sufficient pressure to form a liquid body. This container is provided with brackets and handle 2, by means of which the container can be readily carried about. The end of the container is provided with a discharge valve 3, to which is secured the tube 4 which extends downwardly into the container just short of the bottom thereof so as to be immersed in the liquid. The discharge connection of the valve is attached to a suitable pipe or conduit 5 which, of course, is best when in flexible form. This pipe is covered with a flexible fabric or rubber casing 6 which terminates in a suitable handle 7 of similar material. The pipe 5 is secured to a nipple 8 which has a passage therethrough and is enlarged to form a thimble at the end as shown. A hollow plug 9 is adapted to threadedly engage with the nipple 8 and to telescope with the thimble portion thereof. The shield 12 is securely held in place between the thimble and the plug. The plug 9 has secured to it a nozzle 10 having a discharge orifice 11. This structure, as is clear from the drawings, comprises a one nozzle arrangement.

The shields disclosed in this case are particularly useful in connection with apparatus of the type just referred to and will now be described in greater detail.

Referring first of all to Figure 2, the shield here shown comprises inner and outer portions of which the outer portion is of the type still extensively used, being circular in cross-section and flaring from the small end outwardly. Basically, this shield comprises an initial portion 13, which is conical and of uniformly increasing diameter, a terminal portion 14 which is longer and of uniform diameter, and an outer shield portion 15 joining the portions 13 and 14 and extending to a point adjacent the outlet end of the terminal portion 14. Constructionally, the initial

portion 13 and the outer shield portion 15 may constitute a single conical member of uniformly increasing diameter with the terminal portion 14 engaging the wall of the conical member 13—14 at a point intermediate its inlet and outlet ends. In any event the terminal portion 14 is provided with a series of circumferentially disposed orifices 16 preferably arranged near the inlet end of the terminal portion 14. In accordance with the invention the initial portion 13 and the terminal portion 14 are so proportioned as to cross-section and as to length as to produce a discharging stream of carbon dioxide snow and gas having a discharge velocity greater than has been customary since the development of the carbon dioxide snow producing shield art, thereby resulting in a greater range of discharge. However, in order to maintain the fire extinguishing effectiveness of the discharging jet against the greater tendency of the jet to entrain atmospheric air due to the higher velocity of the jet, the number and the size of the openings 16 in the wall of the terminal portion 16 are so chosen as to produce a relatively lower velocity discharge through the space formed between the terminal portion 14 and the outer shield portion 15, so as to form a protective shield of fire extinguishing gas between the main central jet from the terminal portion 14 and the laterally adjacent atmospheric air so long as the velocity of the main central jet is otherwise sufficient to entrain a detrimental quantity of air. By reason of this construction it will also be apparent that the snow and gas formed will have sufficient velocity to insure that the snow does not collect in the terminal portion near its discharge end and tend to clog it, and that the apparatus is accordingly capable of uninterrupted and effective operation.

Referring now to Figure 3, the shield here shown is basically the same as that shown in Figure 2, while constructionally the elements 13*a*, 14*a* and 15*a* are the same as the elements 13, 14 and 15 of Figure 2. However, the means here employed for supplying fluid to the space between the terminal portion 14 and the outer shield portion 15 consists in conducting passages 17 communicating with the main supply passage 18 of the central orifice 19, a plurality of such conducting passages 17 being provided, each terminating in a suitable orifice 20 communicating with the space between the terminal portion 14 and the outer shield portion 15. With this arrangement the orifices 20 are in communication with the source of supply of liquid carbon dioxide before it has expanded through the central orifice 19, so that by properly proportioning the passages 17 and the orifies 20 the velocity of the discharging protective layer of gas can be suitably determined to meet the requirements of a particular design of apparatus.

The form of construction shown in Figure 4 differs in certain respects from the shields of Figures 2 and 3, but nevertheless embodies the basic principles of the present invention. In this figure the shield comprises an inner portion 21 of lesser flare and hence with a greater discharge velocity than have been customary since the developement of the carbon dioxide snow producing shield art, and an outer shield portion 22 corresponding to the outer shield portions 15 and 15*a* of Figures 2 and 3 respectively. The inner portion 21 is provided with a series of circumferentially disposed orifices 23, corresponding to the orifices 16 of Figure 2, preferably arranged nearer the inlet end thereof than the outlet end, yet not too near the inlet end, as this would have a tendency to result in drawing air in through the orifices instead of discharging gas therethrough. Webs 24 may be employed to space the inner and outer portions of the shield.

The shield shown in Figure 5 comprises an inner portion 25 of decreasing cross-sectional area toward its outlet end, and an outer portion 26 of uniform diameter. The inner portion 25 is provided with a series of circumferentially disposed orifices 27. As with the construction shown in Figure 4, the orifices 27 should not be arranged too near the inlet end of the inner portion of the shield.

Figure 6 illustrates a further type of shield comprising an inner portion 28 of uniform diameter mounted within and spaced from an outer portion 29 of uniform diameter also. A nozzle 30 supplies the relatively high velocity jet of carbon dioxide snow and gas from the central portion of the shield, while a nozzle 31 supplies the relatively low velocity layer discharging at the periphery of the shield.

In Figure 7 the shield comprises an outer portion 32 flaring uniformly outwardly from its small end to its large end, and an inner portion 33 of decreasing cross-sectional area mounted within the outer portion 32 and spaced from it at both the inlet and outlet ends of the inner portion 33.

While the foregoing description has dealt with certain specific embodiments of the invention, it should be noted that the invention is not restricted to shields of the particular configurations illustrated in the drawings, since it is clearly within the scope of this invention to employ shields of any suitable and desirable geometric form both in cross-section and in longitudinal section; and I accordingly do not wish to be strictly limited to the disclosure, but rather to the scope of the appended claims.

I claim:—

1. In combination a source of carbon dioxide under pressure, a discharge nozzle communicating therewith, a shield, said shield having an inner portion constructed and arranged to cooperate with said nozzle to form and deliver a jet of carbon dioxide of sufficient velocity to entrain air, said shield having an outer portion in communication with the inner portion and constructed and arranged to deliver a jet of carbon dioxide surrounding said first mentioned jet and of sufficient velocity to surround said first mentioned jet so long as said first mentioned jet is capable of entraining substantial amounts of air, the shield cooperating with said nozzle in such a manner as to prevent substantial entrainment of air between said nozzle and shield.

2. In combination a source of carbon dioxide under pressure, a discharge nozzle for said source, a shield into which said nozzle discharges carbon dioxide constructed and arranged to prevent substantial entrainment of air therebetween, said shield comprising an initial portion flaring outwardly in all directions from one end to the other, a terminal portion contracting within the flare of the initial portion constructed and arranged to discharge carbon dioxide with a velocity sufficient to entrain air, an outer portion constructed and arranged to discharge carbon dioxide with a velocity sufficient to surround the discharge of the inner portion so long as it has a velocity sufficient to entrain air, said outer portion commencing at the wall defined by the initial and terminal portions and extending adjacent

the outlet end of the terminal portion, and a space between the terminal and outer portions, said terminal portion having openings in the wall thereof for establishing communication between said space and the interior of said shield.

3. In combination a source of carbon dioxide under pressure, a discharge nozzle for said source, a shield into which said nozzle discharges carbon dioxide constructed and arranged to prevent substantial entrainment of air therebetween, said shield comprising means to form a central jet of carbon dioxide discharging from the shield with a velocity sufficient to entrain air and means to form a layer of carbon dioxide having a velocity sufficient to surround said central jet as long as it has a velocity sufficient to entrain air.

4. In combination a source of carbon dioxide under pressure, a discharge nozzle for said source, a shield cooperating with said nozzle in a manner to prevent substantial entrainment of air therebetween, said shield comprising an outer portion having an outlet and inlet end, and an inner portion commencing at a location intermediate the ends and terminating adjacent the outlet end of said outer portion, said inner portion being constructed and arranged to discharge carbon dioxide with a velocity sufficient to entrain air, said outer portion being constructed and arranged to discharge carbon dioxide with a velocity sufficient to surround the discharge of the inner portion so long as it has a velocity sufficient to entrain air.

5. In combination a source of carbon dioxide under pressure, carbon dioxide discharge means for said source, shielding means cooperating with said discharge means in a manner to prevent substantial entrainment of air therebetween, said discharge means comprising means to supply adjacent the central axis of the shielding means a jet of carbon dioxide having a velocity sufficient to entrain air and means to supply adjacent a periphery of the shielding means a layer of carbon dioxide having a velocity sufficient to surround said jet so long as it has a velocity sufficient to entrain air.

6. In combination a source of carbon dioxide under pressure, a carbon dioxide discharge nozzle for said source, a shield cooperating with said nozzle in a manner preventing substantial entrainment of air therebetween, said shield comprising an outer portion having an outlet and inlet end, an inner portion commencing at a location intermediate said ends and terminating adjacent said outlet end constructed and arranged to discharge carbon dioxide with a velocity sufficient to entrain air, a space between said portions, and openings in the wall of said inner portion to establish communication between said inner portion and said space to permit carbon dioxide to discharge from said outer portion with a velocity sufficient to surround the discharge of the inner portion so long as it has a velocity sufficient to entrain air.

7. In combination a source of carbon dioxide under pressure, a discharge nozzle for said source, a shield into which said nozzle discharges carbon dioxide constructed and arranged to prevent substantial entrainment of air therebetween, said shield comprising an initial and a terminal portion, said terminal portion contracting within the longitudinal contour of the initial portion and constructed and arranged to discharge carbon dioxide with a velocity sufficient to entrain air, an outer portion commencing at the junction of the initial and terminal portions and extending adjacent the outlet end of said terminal portion, said outer portion being constructed and arranged to surround the discharge of the initial portion as long as it has a velocity sufficient to entrain air with a layer of carbon dioxide, and a space between said terminal portion and said outer portion, said terminal portion having means to establish communication between the interior thereof and said space.

8. In combination a source of carbon dioxide under pressure, discharge means for said source, shielding means associated with said discharge means constructed and arranged to prevent entrainment of air therebetween, said shield comprising means to discharge carbon dioxide with a velocity sufficient to entrain air, and means to discharge carbon dioxide with a velocity sufficient to surround said discharge as long as it has a velocity sufficient to entrain air.

9. In combination a source of carbon dioxide under pressure, a plurality of discharge nozzles for said source, a shield cooperating with said nozzles in a manner preventing substantial entrainment of air therebetween, said shield comprising an inner portion associated with one nozzle constructed and arranged to discharge carbon dioxide with a velocity sufficient to entrain air, an outer portion associated with a different nozzle and completely surrounding said inner portion constructed and arranged to discharge carbon dioxide with a velocity sufficient to surround the discharge of the inner portion so long as it has a velocity sufficient to entrain air.

10. In combination a source of carbon dioxide under pressure, a plurality of discharge nozzles for said source, a shield cooperating with said discharge nozzles in a manner to prevent substantial entrainment of air therebetween, said shield comprising an inner portion in communication with one discharge nozzle and constructed and arranged to discharge carbon dioxide with a velocity sufficient to entrain air and an outer portion in communication with other discharge nozzles to discharge carbon dioxide with a velocity sufficient to surround the discharge of said inner portion as long as it retains a velocity sufficient to entrain air.

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