

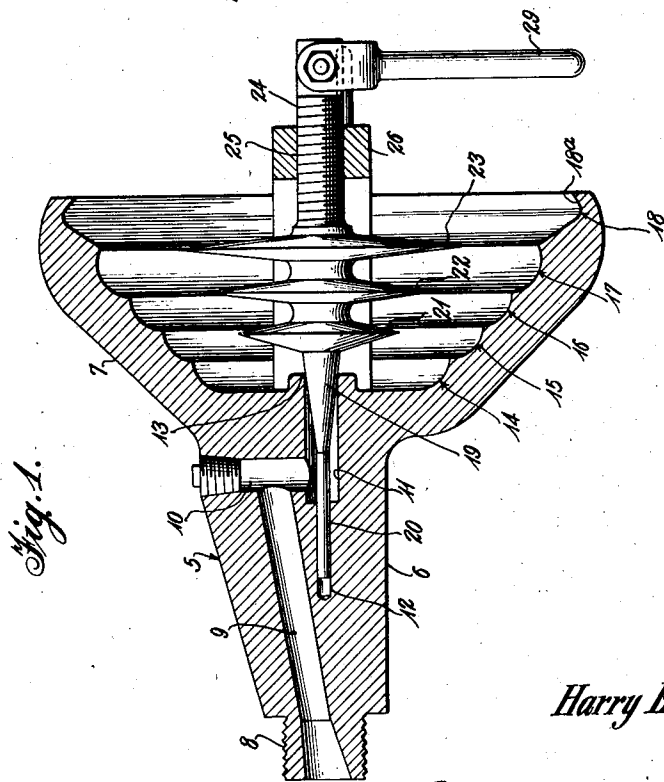
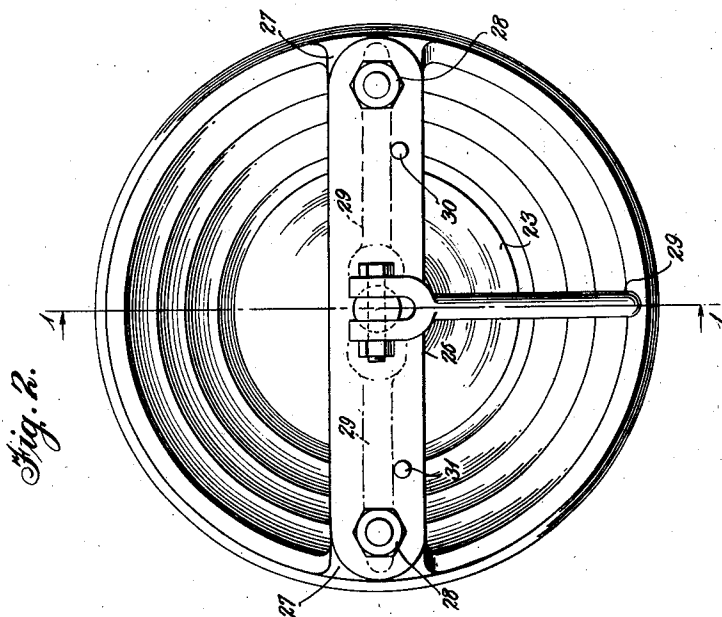
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METHOD OF EXTINGUISHING FIRES

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METHOD OF EXTINGUISHING FIRES

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This invention relates to new and useful improvements in fire extinguisher discharge devices and methods primarily intended for use with carbon dioxide restrained under a high pressure.

5 The primary object of this invention is to provide a discharge device and method for carbon dioxide capable of applying the extinguishing medium in an extremely cold condition directly to the fire in a manner to effect amazing extinguishing results due to its ability to penetrate
10 crevices and travel over and around obstructions, spreading in three dimensions.

A further important object of the invention is to provide a discharge device and method for
15 carbon dioxide, when used as a fire extinguishing medium, which is capable of delivering the medium at the proper densities and velocities for the efficient extinguishing of class A, B and C fires.

Still another object of the invention is to provide a device which is capable of discharging
20 carbon dioxide through a plurality of stages of expansion and to set up a turbulence which will result in producing an extremely high yield of snow but without causing any of the discharge control surfaces to become encrusted with the
25 snow.

A still further object of the invention is to provide a discharge device for carbon dioxide which is capable of producing a high yield of
30 snow; which is capable of causing the small particles of snow produced by expansion of the carbon dioxide to combine into larger flakes, and which is capable of effecting final discharge of the medium at a plurality of different velocities
35 and degrees of density to more effectively extinguish different classes of fires.

Another object of the invention is to provide a method for converting liquid carbon dioxide
40 into an extremely effective fire extinguishing medium.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawing forming a part
45 of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a central longitudinal sectional view of a fire extinguisher discharge device embodying this invention and taken on line 1—1
50 of Fig. 2, and

Figure 2 is an end elevational view of the discharge device disclosed in Fig. 1.

In the drawing, wherein for the purpose of illustration is shown the preferred embodiment
55 of this invention, the reference character 5 designates in its entirety the body of the fire extinguisher discharge device embodying this invention. This body preferably is cast as a one-piece unit and includes a stem portion 6 and an out-
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wardly flared nozzle portion 7. One end of the stem 6 is provided with an exteriorly screw threaded nipple 8 by means of which the device may be suitably connected to any appropriate
5 source of supply of carbon dioxide confined at a high pressure. This discharge device may be employed in connection with a source of supply where the carbon dioxide is maintained at a controlled, sub-atmospheric temperature and in liquid form or in connection with a source of
10 supply of carbon dioxide wherein the extinguishing medium is subjected to the temperature of the surrounding atmosphere. Furthermore, the discharge device may be directly attached to a portable or hand-operated extinguisher, the discharge end of a hose line, or a pipe of a fixed
15 sprinkler system.

The stem 6 is cored to form the longitudinally extending duct 9 which communicates at its inner end with the transversely extending duct
20 10. One end of the duct 10 opens into a longitudinally extending duct 11. A reduced extension 12 is provided at the inner end of the duct 11 and functions as a bearing or guide in a manner to be explained at a later point. The remain-
25 ing end of the duct 11 opens into the interior of the flared nozzle 7 and functions as a discharge orifice 13.

The interior surface of the nozzle 7 is formed or shaped to provide a series of concentric, progressively or successively functioning, annular
30 grooves 14, 15, 16, 17 and 18. The grooves 14 to 17, inclusive, are of curved formation in profile or section and the curvature of each one of these grooves is formed on a radius which may vary
35 from 4% to 20% of the internal mean or average diameter of the nozzle. The annular groove 18, which is the outermost groove, is of substantially L-shape in profile or section with the shorter branch 18a arranged at the edge of the
40 nozzle mouth.

Arranged within the orifice 13 and operating to control the effective area of said orifice is a tapered or substantially frusto-conically shaped
45 valve 19. This valve body extends partly within the duct 11 and partly within the cavity or interior of the nozzle 7. At the inner end of the valve body 19, a guiding stem 20 is provided which is slidably received within the bearing or
50 guide 12. It will be appreciated that by moving the valve 19 axially inwardly and outwardly, the total area of the discharge orifice 13 may be varied and by moving the valve 19 into its innermost position, where it actually contacts the edge of the orifice 13, flow through the orifice may be
55 entirely shut off.

Joined with the valve body 19 is a series of disc-shaped deflectors 21, 22 and 23. These deflectors are concentrically arranged with respect to each other and with respect to the valve body
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19 and are axially spaced, as best illustrated in Fig. 1. Each deflector disc is provided with a thin edged periphery and gradually increases in thickness from the periphery toward its central region.

Joined to the integral valve body 19 and the united deflector discs 21, 22 and 23 is a threaded stem 24 which is threadedly adjustably received within an aperture 25 formed in a bar 26 which traverses the mouth of the nozzle 7. This bar may be formed integrally with the discharge edge of the nozzle or it may be formed as a separate member, see Fig. 2, which is joined to the lugs 27 by means of the fastening devices 28.

Swiveled to the outer end of the threaded stem 24 is a bar type handle 29. This handle is intended to cooperate with axially extending stop pins 30 and 31 carried by the bar 26.

The method of operation of this discharge device may be described as follows.

When the handle 29 is in the full line position illustrated in Figs. 1 and 2, the valve 19 is seated against the edge of the orifice 13 and carbon dioxide will not be discharged into the nozzle 7. When the handle 29 is actuated to move it up over the extremity of the stop pin 30 and into the dotted line position at the right of Fig. 2, the valve body 19 is moved away from the edge of the discharge orifice 13 a sufficient distance to permit a continuous discharge of carbon dioxide into the nozzle 7 for the extinguishment of B and C fires. When the handle is manipulated to further rotate the threaded stem 24 in a counterclockwise direction until the handle engages stop pin 31 and occupies the dotted line position shown at the left of Fig. 2, a continuous discharge of carbon dioxide is obtained which is suitable for extinguishing class A fires.

The carbon dioxide discharged through the orifice 13, when the valve 19 is in either of its open positions, impinges against the inner deflector disc 21 and is caused to change its direction of flow from axially to radially of the nozzle. This first deflector disc 21 cooperates with the annular grooves 14 and 15 and the inner end wall of the nozzle to form what will be termed a first stage expansion chamber. As the carbon dioxide is admitted to this first chamber, it expands and is converted into a mixture of carbon dioxide gas and small particles of snow. The impingement of the mixture against the adjacent surface of the inner disc 21 and the change of direction of flow caused by this disc results in joining or uniting certain of the small particles of snow to form larger snow flakes. The annular grooves 14 and 15 act on the carbon dioxide mixture in the first stage expansion chamber to create turbulence.

As the carbon dioxide mixture flows axially of the nozzle past the periphery of the inner deflector disc 21, it is caused to impinge upon the second or intermediate deflector disc 22 and again changes its direction of travel from axially to radially of the nozzle. The space between the two deflector discs 21 and 22 and the annular groove 16 acts as a second stage expansion chamber for the carbon dioxide mixture is permitted to further expand radially. The expansion in this second stage chamber results in the formation of a greater amount of snow while the impingement and the change in direction of flow produced by the deflector disc 22 causes more snow particles to join or unite to form larger snow flakes. In this second stage expansion

chamber, the annular groove 16 also functions to produce turbulence.

As the mixture flows around the periphery of the second or intermediate disc 22, it impinges against the outer disc 23 and is again caused to change its direction of flow from axially to radially of the nozzle. A third stage expansion chamber is formed by the discs 22 and 23 and the annular groove 17. The contour of this annular groove 17 results in the formation of a turbulence within the third stage expansion chamber. Additional snow is formed in this third stage chamber and, due to impingement against the disc 23 and the change in the direction of flow, additional large flakes of carbon dioxide snow are formed.

The mixture of carbon dioxide gas and snow finally passes around the periphery of the outer deflector disc 23 and outwardly of the nozzle 7 through its open mouth. The outermost annular groove 18 functions to control the character of discharge streams; i. e., this particular groove contour or profile prevents the discharged extinguishing medium from flaring or spreading to too great an extent radially or perpendicularly of the axis of the nozzle.

Permitting the carbon dioxide mixture to expand in each one of the three chambers naturally has the effect of lowering the velocity of the final discharge. This velocity of final discharge also is varied by movement of the valve 19 inwardly and outwardly with respect to the orifice 13. The velocity of discharge, naturally, is lower when the handle 29 is arranged in engagement with the stop pin 30 than it is when the handle is in engagement with the stop pin 31. This is due to the fact that the total area of the orifice 13 is less when the handle engages the pin 30. Movement of the deflector discs 21, 22 and 23 inwardly and outwardly relative to the grooves 14 to 17, inclusive, has the effect of varying the degree of turbulence created in the respective expansion chambers and, of course, varies the amount or yield of snow produced by this discharge device.

The grooves 14 to 17, inclusive, have been described above as being formed on radii which may vary from 4% to 20% of the mesne or average diameter of the interior of the nozzle 7. This range has been found to be critical for radii greater than 20% are not effective in creating turbulence and radii less than 4% result in causing ice to form in the grooves with the result that they will lose their effectiveness as turbulence creating means.

It has been found that discharge of carbon dioxide through this device permits a slight entrainment of air but the percentage of air is so small that it has no detrimental effect.

It is to be understood that the form of this invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, I claim:

1. The method of employing carbon dioxide as a fire extinguishing medium which comprises discharging carbon dioxide through a constricted orifice to produce a mixture of carbon dioxide gas and small particles of snow, effecting radial expansion of the discharged medium in a series of successively occurring stages and creating turbulence in each stage of expansion to produce

