

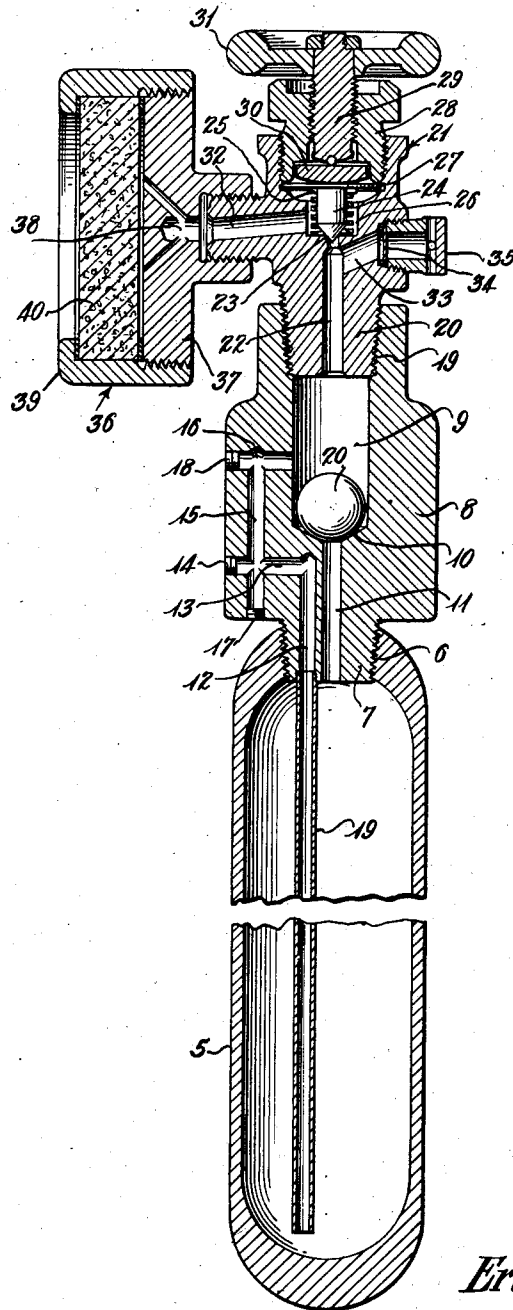
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E. GEERTZ

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FIRE EXTINGUISHER

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Inventor

Eric Geertz

334 *L. Donald Wynn*
Attorney

UNITED STATES PATENT OFFICE

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FIRE EXTINGUISHER

Eric Geertz, Aurora, Ill., assignor to Cardox Corporation, Chicago, Ill., a corporation of Illinois

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This invention relates to new and useful improvements in fire extinguishers.

The primary object of the invention is to provide an improved form of hand held portable fire extinguisher which is particularly adapted for employing carbon dioxide as the sole or primary extinguishing medium.

A further important object of the invention is to provide an extinguisher of the above noted character which is constructed in such a manner as to effect delivery of liquid carbon dioxide to the discharge head, or the like, of the same at all times regardless of the angle or position in which the extinguisher is held during use.

A still further important object of the invention is to provide a form of discharge means for liquid carbon dioxide which will bring about a drop in pressure to atmospheric pressure while the carbon dioxide is passing therethrough; which will retard or restrict the rate of flow of the discharge sufficiently to maintain within all restricted passages, or the like, leading up to the said discharge means, a pressure which is sufficiently high to prevent the formation of snow which would clog up said passages, and which will result in discharging a very uniformly dense cloud of low temperature carbon dioxide gas with fine particles of snow mixed therewith and with the said discharge occurring at a sufficiently low velocity to avoid entrainment of air.

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

In the accompanying drawing forming a part of this specification and in which like numerals are employed to designate like parts throughout the same, the figure is a longitudinal sectional view of the portable fire extinguisher embodying this invention.

In the drawing, wherein for the purpose of illustration is shown the preferred embodiment of this invention, the reference character 5 designates an elongated pressure container which is constructed of proper material to provide a strength factor sufficient to hold carbon dioxide at atmospheric temperatures and their corresponding vapor pressures. Although not necessarily so limited, the container 5 preferably should be of a size which will enable a person to readily handle the same during use in extinguishing a hostile fire. Such a container, usually, will have a volumetric capacity which will hold 5 pounds of liquid carbon dioxide. With such a sized container, it is preferred to form the same as a long body of approximately 5 feet in length

so as to permit the operator of the extinguisher to hold the same with the discharge end in reasonably close proximity to the fire while his person is positioned a safe distance from the fire.

One end of the pressure container 5 is provided with an internally threaded discharge opening 6 in which is mounted the threaded stem 7 of a coupling body 8. This coupling body is provided with an enlarged bore portion 9 of tapered formation. This bore terminates in a valve seat 10 at its inner end with a reduced or restricted duct 11 extending from the center of the valve seat 10 to the end face of the stem 7.

The coupling member 8 also is provided with a duct 12 which extends in parallelism with the aforementioned duct 11. This duct 12 opens through the end face of the stem 7 at one end and communicates with a right angularly arranged duct 13 at its inner end. The outer end of this duct 13 is closed by a threaded plug 14. Intersecting the duct 13 is a longitudinally extending duct 15 which also intersects a transversely extending duct 16 which is arranged in parallelism with the duct 13. One end of the duct 15 passes through a surface of the coupling 8 and is closed by the threaded plug 17. The duct 16 extends entirely through the wall of the coupling from the outer surface of the same into the bore 9. The outer end of this duct 16 is closed by the plug 16. It will be appreciated that the arrangement of ducts 12, 13, 15 and 16 is such that they may be cored in the coupling when the latter is cast, or they may be drilled after the coupling 8 is formed. The plugs 14, 17 and 18 are necessary to close the outer ends of the ducts 13, 15 and 16. These various ducts 12, 13, 15 and 16 form a passage between the tapered bore 9 and the end face of the coupling stem 7. The open end of the duct 12 has threaded therein one end of a dip tube 19 which extends to the opposite end portion of the chamber formed in the container 5. With this arrangement, it will be seen that the passageway 11 affords communication between one end of the container chamber and the bore 9 of the coupling, while the dip tube 19 and the series of ducts 12, 13, 15 and 16 form a passage between the said bore 9 and the remaining end portion of the container chamber. A steel ball 20 is arranged within the bore 9 and is adapted to seat by gravity against the valve seat 10 whenever the extinguisher is arranged in any position where the valve seat 10 is located above a horizontal plane passing through the container. When the valve seat 10 is arranged below such a horizontal plane, the ball

valve 20 will be unseated. In other words, the ball valve 20 will remain on its seat at all times except when the extinguisher is inverted beyond an angle where the axis of the container 5 is arranged in a true horizontal plane.

The purpose of the mechanism so far described is to assure feeding of liquid carbon dioxide to the bore 9 of the coupling member 8 regardless of the position in which the fire extinguisher is held while in use. With the extinguisher in an upright position, or in any position in which the ball valve 20 is seated, the weight of the said valve is sufficient to cause the same to be seated by gravity because of the equalized pressure on opposite sides of the valve. With the duct 11 sealed by the ball valve 20, the gas above the liquid in the container 5 will force liquid carbon dioxide upwardly through the dip tube 19 and the series of ducts 12, 13, 15 and 16 into the coupling bore 9. If the container 5 is inverted, or moved into a position where the valve 20 will not seal the duct 11, the said valve will leave its seat. In such a position, however, the liquid carbon dioxide in the container 5 has moved to the other end portion of the container and the admission end of the duct 11 will be covered by the liquid. Liquid then will flow through the duct 11 into the bore 9 and past the ball valve 20. This flow of liquid through the duct 11 will occur notwithstanding the fact that the gas space at the inverted upper end of the fire extinguisher is in communication with the bore 9 through the dip tube 19 and the series of ducts 12, 13, 15 and 16. If the ball valve 20 were not provided for sealing the duct 11 when the fire extinguisher is in an upright position, gas then would be withdrawn through the duct 11 rather than liquid through the dip tube 19 and its associated series of ducts.

The outer end of the coupling member 8 has its bore portion internally threaded at 19 for connection with the stem 20 of a valve casing designated in its entirety by the reference character 21. This valve casing 21 has an inlet passage 22 which is reduced at its inner end to form a seat 23 for the needle valve 24. This needle valve has an enlarged head 25 at its outer end against which bears a spring 26 which normally tends to unseat the valve. A diaphragm 27 is clamped in place by a nut 28 and thereby seals off the top of the interior of the valve casing 21 and forms a flexible connection between the threaded operating stem 29 and its thrust button 30 and the needle valve 24. The operating stem 29 has a handle 31 suitably secured to its outer end so that manipulation of this handle will adjust the stem 29 to either force the valve 24 against its seat 23 or to release the said valve so that it may be unseated by its spring 26 and the pressure of the medium confined within the container and the various ducts leading up to the valve. When the valve 24 is unseated, the liquid carbon dioxide will flow from the bore 9 of the coupling 8 through the duct 22 and past the valve 24 into the outlet duct 32.

A branch duct 33 communicates with the inlet duct 22 of the valve casing and is closed at its outer end by means of a rupturable disc 34 which is held in place by means of a plug 35. Should the pressure of the carbon dioxide within the container 5 rise to a dangerous value, the disc 34 will rupture and relieve the pressure.

Mounted on the nipple of the valve casing 21 which has the discharge duct 32 formed therein, is a discharge head which is designated in its

entirety by the reference character 36. This discharge head includes a two-part casing formed by the base 37 having a series of ducts 38 formed therein and communicating with the discharge duct 32 of the valve casing and a ring 39 which is threadedly connected to the base 37. Tightly clamped between the ring 39 and the base 37 is a disc-like block or mass of material 40 which possesses sufficient strength to withstand the pressure applied to the inner face of the same and which is formed with very small or fine pores uniformly distributed throughout the same.

The liquid carbon dioxide released from the pressure container 5 through the coupling 8 and the valve casing 21 passes through the pores of the porous disc 40 and is discharged in the form of a very dense, uniform cloud of low temperature carbon dioxide gas with extremely fine particles of snow mixed therein. The dense but porous disc 40 functions to considerably restrict the flow of carbon dioxide from the extinguisher with the result that the pressure behind the disc is at all times maintained at a relatively high value, such, for example, as 400 to 500 pounds. This dense porous disc 40 never lets the pressure in back of the same drop to the value at which snow will form in the passageways or ducts leading up to the inner face of the disc and clog these ducts or passageways. It will be appreciated that snow will form at approximately 75 pounds per square inch pressure.

Besides functioning to prevent an undesirable drop in pressure inwardly of the disc 40, this dense, porous member also functions to cause the pressure of the discharging carbon dioxide to drop to atmospheric pressure while passing through the disc. The discharge of the very dense cloud of low temperature carbon dioxide gas and fine particles of snow is at a sufficiently low velocity as to avoid entrainment of air in the discharging stream of carbon dioxide gas.

It will be appreciated that the disc 40 may be formed of numerous different materials and combinations of materials and in many different ways to provide the desired characteristics; namely, a rigid body possessing sufficient strength to withstand the internal pressure applied thereagainst and with the body possessing the proper porosity characteristics so as to be certain of maintaining a pressure on the inner or upstream side of the body which is above the pressure at which solid carbon dioxide will form. The porous body also must possess characteristics which will bring about discharge of the fire extinguishing medium to the atmosphere at a sufficiently low velocity to avoid entrainment of air in the discharging stream.

As an example of an extremely suitable disc structure, it has been determined that an ordinary vitrified, silicate bonded grinding wheel formed of grit sizes varying from No. 46 to No. 120 and with the disc body varying in thickness from one-half inch to one and one-half inches is very satisfactory. It is possible to obtain very close control of the size of the pores in making grinding wheels of this character. For a portable extinguisher of the character specifically disclosed and described herein, the intermediate grit sizes, numbered 60, 80 and 100 appear to be the best or most preferred sizes. The best results have been obtained with disc thicknesses graduating from one inch upwards. The preferred diameters of the disc will range from two and one-half inches to four inches. It has been

determined that the character of the discharge and the pressure maintained behind the porous body may be varied by altering the diameter, the thickness and the degree of porosity of the disc body.

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 sub-joined claims.

Having thus described the invention, I claim:

1. In a fire extinguisher, an elongated pressure container for carbon dioxide at atmospheric temperature and its corresponding vapor pressure and having a discharge opening at one end, a valve device for controlling discharge of the carbon dioxide from the container, means constructed and arranged to feed liquid carbon dioxide from the container to the valve device regardless of the position in which the container is held during use, a discharge head forming an expansion chamber opening directly to the atmosphere attached to the valve device to receive liquid carbon dioxide therefrom when said device is conditioned for fluid flow, and porous means practically filling the expansion chamber of the discharge head constructed and arranged to effect discharge of a uniformly dense cloud of low temperature carbon dioxide gas mixed with fine particles of snow at a sufficiently low velocity to avoid entrainment of air and to restrict the discharge from the container to a rate of flow sufficiently low to prevent such a drop in pressure inwardly of said discharge head expansion chamber as would result in the formation of snow.

2. In a fire extinguisher, an elongated pressure container for carbon dioxide and having a discharge opening at one end, a valve device for controlling discharge of the contents of the container, means constructed and arranged to feed liquid carbon dioxide from the container to the valve device regardless of the position in which the container is held during use, a discharge head attached to the valve device, and a rigid body of fine porous material in said discharge head through which the carbon dioxide passes in being released to the atmosphere.

3. In a fire extinguisher, an elongated pressure container for carbon dioxide and having a discharge opening at one end, a valve device for controlling discharge of the carbon dioxide from the container, a discharge head attached to the valve device to receive liquid carbon dioxide therefrom when said device is conditioned for fluid flow, and rigid porous means in the discharge head constructed and arranged to effect discharge of a uniformly dense cloud of low temperature carbon dioxide gas mixed with fine particles of snow at a sufficiently low velocity to avoid entrainment of air and to restrict the discharge from the container to a rate of flow sufficiently low to maintain a pressure value inwardly of the discharge head means above that at which snow will form.

4. In a fire extinguisher, an elongated pressure container for carbon dioxide and having a discharge opening at one end, a valve device for controlling discharge of the contents of the container, a hollow discharge head attached to the valve device and constructed to discharge the carbon dioxide in an unconfined condition directly to the atmosphere, and a rigid body of fine porous material substantially filling the cavity of

said head through which the carbon dioxide passes just prior to being discharged in said unconfined condition to the atmosphere.

5. In a fire extinguisher, a pressure container for carbon dioxide, means for controlling discharge from said container, means for supplying liquid carbon dioxide to said control means, a discharge head attached to said control means to receive liquid carbon dioxide from the control means when it is conditioned for fluid flow, and rigid porous means in the discharge head constructed and arranged to effect discharge of a uniformly dense cloud of low temperature carbon dioxide gas mixed with fine particles of snow at a sufficiently low velocity to avoid entrainment of air.

6. In a fire extinguisher, a pressure container for carbon dioxide, means for controlling discharge from said container, means for supplying liquid carbon dioxide to said control means, a discharge head attached to said control means, and a rigid body of fine porous material in said head through which the carbon dioxide passes in being discharged to the atmosphere.

7. In a fire extinguisher for discharging liquid carbon dioxide, a hollow discharge head adapted to receive liquid carbon dioxide and to discharge direct to the atmosphere a dense cloud of gas and snow incapable of entraining air, and a rigid body of fine porous material entirely filling the cross-sectional area of the cavity of said head through which the carbon dioxide passes in being discharged to the atmosphere, the porosity and thickness of said body causing the liquid carbon dioxide to be converted to the dense gas and snow in passing therethrough.

8. In a fire extinguisher for liquid carbon dioxide, means providing a passageway for said carbon dioxide between a source of supply and a point of discharge, and discharge means at the outer end of said passageway forming means through which the carbon dioxide passes and from which it is discharged to the atmosphere in an unconfined condition and at a sufficiently low velocity to avoid entrainment of air, said discharge means comprising a fine porous body possessing sufficient strength to withstand the pressure of the liquid carbon dioxide applied thereagainst and having the proper porosity characteristics to effect a combined gas and snow discharge of a uniform density.

9. In a fire extinguisher, a source of liquid carbon dioxide under high pressure, means for conducting the said liquid to a point of discharge, and means at said point of discharge for effecting delivery of the carbon dioxide to the atmosphere in the form of a uniformly dense cloud of mixed gas and snow at a sufficiently low velocity to avoid entrainment of air, said last mentioned means including a porous body possessing sufficient inherent rigidity and strength to withstand the pressure of the carbon dioxide without being deformed.

10. In a fire extinguisher, a source of liquid carbon dioxide under high pressure, means for conducting the said liquid to a point of discharge, and means at said point of discharge for effecting delivery of the carbon dioxide to the atmosphere in an unconfined condition in the form of a uniformly dense cloud of mixed gas and snow at a sufficiently low velocity to avoid entrainment of air, said last mentioned means including a porous body formed of bonded grit particles.

11. In a fire extinguisher, a source of liquid carbon dioxide under high pressure, means for

conducting the said liquid to a point of discharge, and means at said point of discharge for effecting delivery of the carbon dioxide to the atmosphere in the form of a uniformly dense cloud of mixed gas and snow at a sufficiently low velocity to avoid entrainment of air, said last mentioned means including a rigid porous body which may vary in thickness from one-half to one and one-half inches and in diameter from two and one-half to four inches.

12. In a fire extinguishing device, a discharge head adapted to receive liquid carbon dioxide, and

a porous body in the discharge head exposed to the liquid carbon dioxide on one side and to the atmosphere on the other and through the pores of which the carbon dioxide passes to effect discharge of a uniformly dense cloud of low temperature carbon dioxide gas mixed with fine particles of snow at a sufficiently low velocity to avoid entrainment of air and to restrict the discharge to a rate sufficiently low to prevent such a drop in pressure inwardly of said discharge head as would result in the formation of snow.

ERIC GEERTZ.