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S. E. ALLEN ET AL

1,993,696

FIRE EXTINGUISHING APPARATUS

Filed May 9, 1932

Fig. 1.

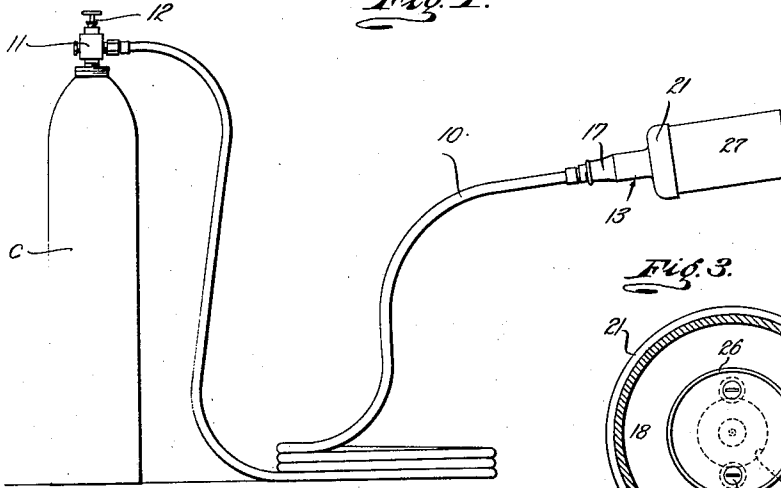


Fig. 3.

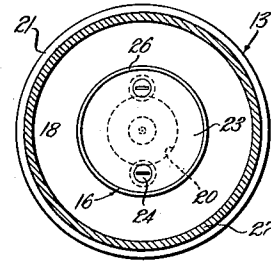


Fig. 2.

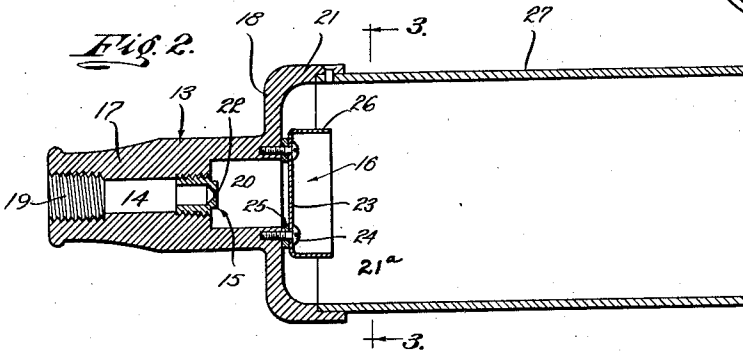


Fig. 4.

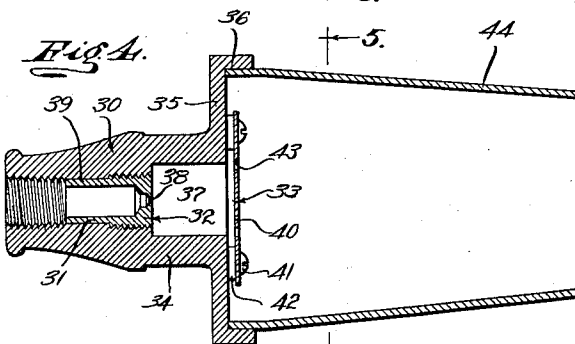


Fig. 5.

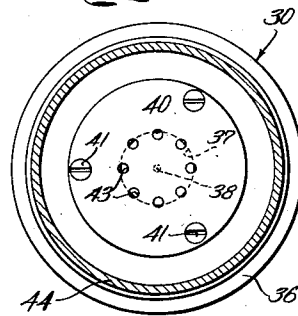


Fig. 6.

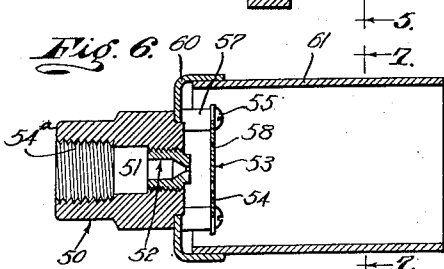
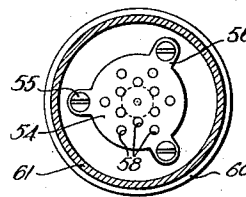


Fig. 7.



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UNITED STATES PATENT OFFICE

1,993,696

FIRE EXTINGUISHING APPARATUS

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Application May 9, 1932, Serial No. 610,067

10 Claims. (Cl. 169—11)

This invention has to do with fire extinguishing apparatus and has particular reference to fire extinguishing apparatus for handling or employing carbon dioxide as a fire extinguishing medium.

The present invention provides a simple and particularly effective means or discharge device for effecting the discharge of carbon dioxide under pressure in a manner so that it may be most efficiently employed to extinguish fires and/or prevent the spread of fires. It has been found that carbon dioxide is very easily handled and is particularly effective in the prevention and extinguishing of fires when in the form known as snow. Certain patents have issued showing fire extinguishing devices for converting carbon dioxide under pressure into snow. The operation of these devices is predicated upon the principle or theory that the prevention or limiting of the entrainment of air with the discharging carbon dioxide causes the formation of the snow. The present invention provides a device that effectively produces carbon dioxide snow or converts discharging carbon dioxide into snow by breaking up the stream of the discharging carbon dioxide in or immediately adjacent a low temperature zone.

Such devices consist of a directing tube or horn into which a jet of carbon dioxide is liberated. The rapid expansion of the liberated carbon dioxide produces an exceedingly low temperature in which part of the discharge is converted into flakes of carbon dioxide snow. The tube serves to prevent the expanding gases from absorbing heat from the outside atmosphere and thus a region of intense cold is preserved. However, heretofore it has been necessary to provide very long tubes in order to produce snow. An object of the present invention is to provide a device of this character having a very short tube. To this end means are provided for retarding the velocity of the stream of carbon dioxide providing a zone of intense cold in which the snow is formed and a short conduit then serves to direct the discharge.

It is another object of this invention to provide a nozzle or discharge device of the character mentioned that causes the stream of discharging carbon dioxide to follow a tortuous course or path in or immediately adjacent a zone of low temperatures, produced by partial or preliminary expansion of the carbon dioxide, to effectively break up the column or stream of discharging carbon dioxide.

It is another object of the invention to provide

a nozzle or discharge device of the character mentioned that is manually portable and that may include means for conveying or directing the carbon dioxide snow whereby the snow may be easily and properly directed on to the fire or combustible material.

It is another object of the invention to provide a device of the character mentioned that effectively interrupts or breaks up the stream of discharging carbon dioxide to produce snow without causing the discharge opening or orifice to freeze or become closed with frozen or solidified carbon dioxide.

It is another object of the invention to provide a device of the character mentioned that is small, compact and light in weight and therefore very easily handled.

It is a further object of the invention to provide a device of the character mentioned that is extremely simple and inexpensive of manufacture.

Further objects and features of the invention will be best and more fully understood from the following detailed description of typical applications and forms of the invention, throughout which description reference is had to the accompanying drawing, in which:

Fig. 1 is a view illustrating one embodiment of the present invention attached to the end of a hose or conduit for delivering carbon dioxide from a suitable container. Fig. 2 is an enlarged longitudinal detailed sectional view of the nozzle or device illustrated in Fig. 1. Fig. 3 is a transverse sectional view taken as indicated by line 3—3 on Fig. 2. Fig. 4 is a longitudinal detailed sectional view of another embodiment of the invention. Fig. 5 is a transverse sectional view taken as indicated by line 5—5 on Fig. 4. Fig. 6 is a longitudinal sectional view of still another embodiment of the invention, and Fig. 7 is a transverse sectional view taken as indicated by line 7—7 on Fig. 6.

The present invention may be embodied in forms for use in various situations and for use in connection with various classes of fire extinguishing systems and equipment, for example, it may be embodied in forms for use in connection with various kinds and makes of portable as well as stationary or permanent fire extinguishing apparatus. In the following detailed disclosure of the invention, we will describe three simple embodiments of the invention, and will describe them as used in connection with a hose or flexible conduit 10 for delivering carbon dioxide from a suitable source of supply or container C. It is to be understood that the invention is not to be con-

sidered as limited or restricted to the specific embodiments or applications about to be described, but is to be taken as including any features or modifications that may fall within the scope of the claims.

The source of supply of carbon dioxide is in the nature of a cylinder or flask C of the type commonly employed to hold carbon dioxide under pressure.

Any suitable means may be provided for releasing the fire extinguishing medium from the container C, for example, a discharge head of the character fully described in our copending application entitled Control for discharge heads, filed March 2, 1931, Serial Number 519,470, may be provided for this purpose. In the particular case illustrated, however, a filling and discharging fitting 11 of suitable design and construction is provided on the upper end of the container C. A valve 12 is embodied in the fitting 11 whereby the carbon dioxide may be released or discharged from the container C. The hose or conduit 10 is connected with the head or fitting 11 and is provided to pass the carbon dioxide to the discharge nozzle. The conduit 10 may be in the nature of a suitable flexible hose.

The discharge device or nozzle illustrated in Figs. 1, 2 and 3 of the drawing, includes, generally, a body 13 adapted to be connected with the conduit 10 and having a fluid passage 14, a jet 15 in the fluid passage 14, and means 16 for breaking up the stream of carbon dioxide discharged from the jet 15.

In accordance with the broader principles of the invention, the body 13 may be varied considerably in configuration and construction to adapt the device for use with different classes of equipment, etc. In the particular case illustrated in the drawing, the body 13 is of simple construction and consists of a handle portion or stem 17 and a radial flange 18 on the outer end of the stem. The handle or stem 17 may be of round cross section, and may be shaped so that it is easily grasped and held. The fluid passage 14 extends longitudinally through the stem 17 and the body 13 to be connected with the conduit 10 in a manner so that the fluid passage is in communication with the conduit. In the specific embodiment of the invention being described, the inner end portion 19 of the fluid passage 14 is screw-threaded to facilitate connection of the body 13 with the hose 10. An enlargement or chamber 20 is provided in the outer end of the fluid passage 14. The chamber 20 is open at the outer end of the body 13 and operates as a preliminary or initial expansion chamber for the discharging carbon dioxide as will be subsequently described. The radial flange 18 may be on the extreme outer end of the stem 17 as illustrated in the drawing. The flange 18 is preferably annular or continuous and is provided with an outwardly projecting cylindrical flange portion 21 overhanging or projecting beyond the outer end of the body 13.

An important feature of our invention is to be found in the curvature 21a at the junction of the radial flange 18 and the cylindrical flange 21. In other words, the cylinder 21 is formed interiorly with a dome-like end or base. This provides a clean sweep of the discharging fluid which prevents accumulation of snow to an extent liable under certain conditions to check or seriously retard the discharge.

The nozzle or jet 15 is provided in the fluid

passage 14 to cause the carbon dioxide to be discharged in a small stream at a comparatively high velocity. The jet 15 is arranged in the fluid passage 14 to have its outer end immediately adjacent or projecting into the chamber 20. The jet 15 may be screw-threaded in the passage 14 as illustrated in the drawing. In the particular case illustrated in the drawing, the reduced orifice 22 is provided at the outer end of the jet and the jet projects a slight distance into the chamber 20. It will be apparent how the carbon dioxide under pressure passing outwardly through the fluid passage 14 is discharged through the orifice 22 in a comparatively small stream and at a high velocity. The carbon dioxide discharging from the nozzle or jet 15 passes through the chamber 20 where it has an opportunity to partially expand and thus causes a chilling action to produce a low temperature zone.

The means 16 causes the fast flowing or jetted carbon dioxide discharging from the jet 15 to follow a tortuous path or course and thus disturbs or breaks up the stream to bring about the formation of the snow. The snow forming means 16 is in the nature of a baffle means and is located immediately forward of or within the zone of low temperatures such as may be created by the initial expansion of the carbon dioxide passing through the chamber 20 and/or the expansion in the vicinity of the baffle.

Figs. 2 and 3 of the drawing disclose a simple baffle means 16 that has been proven to be very effective in the conversion of a substantial part of the discharging carbon dioxide into snow. The means 16 includes a plate or baffle 23 arranged in front of the open ended chamber 20. The baffle plate 23 extends across the mouth of the chamber 20 and is spaced a comparatively short distance from the outer end of the body 13. In the particular embodiment of the invention being described, the baffle plate 23 is disc shaped in end elevation and is proportioned to have its edge overhang or project beyond the walls of the chamber 20. The plate 23 is carried by the body 13 and we have illustrated suitable screws 24 attaching the plate to the outer end of the body. Spacers 25 may be provided on the screws 24 to space the plate 23 the desired distance from the outer end of the body 13. The particular baffle 23 illustrated in Figs. 2 and 3 is cup shaped, that is, it has a forwardly projecting cylindrical flange 26 at its periphery. The flange 26 is substantially parallel to and is spaced inwardly from the flange portion 21 to provide an annular fluid passage. The stream of carbon-dioxide discharge from the orifice 22 strikes the baffle plate 23 and is thereby diverted laterally outward between the baffle and the outer end of the body 13, and then discharges outwardly through the annular space between the flanges 21 and 26. The carbon dioxide, in striking the baffle plate 23 is effectively broken up and a substantial part thereof is frozen into flakes of snow. The production of the snow is further insured by the fact that the baffle 23 is located immediately adjacent or within the zone of low temperatures prevailing in the chamber 20, and the portions of the device adjacent the chamber.

Suitable means may be provided on the body 13 for conveying or directing the carbon dioxide snow so that the user or operator may readily direct the snow on to the fire or fire hazard. A suitable tubular conduit or directing spout 27 may be attached to the forward or outer end of the body 13. In the particular case illustrated,

the directing conduit 27 is cylindrical, and is of substantial length. The directing conduit 27 may be attached to the inner side of the flange portion 21.

5 It is believed that the operation of the device illustrated in Figs. 1, 2 and 3 of the drawing will be readily apparent from the foregoing detail description. The stem 17 may be readily attached to the outer end of the delivery conduit 10 in any suitable manner. Upon opening of the valve 12 the carbon dioxide is released from the source of supply C and passes through the hose 10 to the fluid passage 14. The fire extinguishing medium is then discharged or jetted from the jet orifice 22, and passes through the chamber 20 in a small stream, and at a high velocity. This discharging of the carbon dioxide under pressure allows a sudden expansion of the carbon dioxide, with a resultant cooling or chilling effect. A low temperature zone is thus created in the chamber 20 and the parts immediately adjacent. When the stream of discharging carbon dioxide strikes the transverse baffle plate 23, it is suddenly interrupted or broken up and caused to pass laterally outward between the baffle and the outer end of the body 13. The broken stream then flows outwardly through the annular space between the flanges 21 and 26. The breaking up of the stream of discharging carbon dioxide in a low temperature zone effectively converts a large part thereof into snow which has proven to be most effective in the extinguishing and prevention of fires. It will be noted that the nozzle or discharge device is particularly small and compact, and easy to handle. The device does not include any shiftable or adjustable parts and therefore operates effectively under any condition without regulation, or adjustment.

40 It is necessary to provide a restriction such as is formed at the nozzle 15 so as to prevent as far as possible any expansion of the carbon dioxide stream in the conduit 10. Theoretically, the carbon dioxide should reach the nozzle 15 in liquid form so that as it issues from the jet there will be a maximum of expansion and a maximum drop in temperature. In actual practice some expansion may take place immediately back of the nozzle but such slight expansion is negligible. Were there no constriction of the stream immediately before it entered the expansion chamber there would be a continuous expansion of the carbon dioxide throughout the conduit and this would be evidenced by the formation of frost on the outside of the conduit. At the expansion chamber there would not be sufficient further expansion to produce snow. Theoretically, snow is formed by sudden cooling of liquid particles and hence it is essential that the carbon dioxide reach the snow forming zone in liquid form.

60 The form of the invention disclosed in Figs. 4 and 5 of the drawing, includes, generally, a body 30 having a fluid passage 31, a nozzle or jet 32 in the fluid passage 31, and means 33 for breaking up the stream of carbon dioxide discharged from the nozzle 32.

70 The body 30 may be similar generally to the body 13 described above, that is, it may include a handle or stem 34 and a radial flange 35 at the outer end of the stem. The stem 34 may be suitably shaped so that it may be readily engaged or grasped. The flange 35 is integral with the stem 34 and is provided at the extreme outer end of the stem. An outwardly projecting cylindrical flange portion or rim 36 is provided on the

periphery of the flange 35. The fluid passage 31 extends longitudinally through the stem 34 and is screw-threaded at its inner end to facilitate connection of the body 30 with the delivery hose or conduit. An enlargement or chamber 37 is provided in the outer end of the fluid passage 31. The chamber 37 is preferably open at the outer end of the body 30, as clearly illustrated in Fig. 4 of the drawing.

10 The nozzle or jet 32 is arranged in the fluid passage 31 at the inner end of the chamber 37. The reduced opening or orifice 38 is located at the outer end of the jet 32 which may be flush with the inner wall of the chamber 37. In the particular embodiment of the invention being described, the jet 32 includes a sleeve or bushing 39 lining the fluid passage 31 and terminating at the screw threads in the inner end of the passage.

20 The means 33 for converting the stream of discharging carbon dioxide into carbon dioxide snow is in the nature of a baffle means and operates to break up the stream and cause it to follow a tortuous course. The means 33 includes a baffle plate 40 arranged across or transversely of the outer end of the chamber 37. The plate 40 is spaced a comparatively short distance from the outer end of the body 30 and is preferably parallel with the end of the body. In the particular case illustrated, the baffle plate 40 is disc shaped and is coaxial with the fluid passage 31. In accordance with the invention, the baffle plate 40 is of greater diameter than the chamber 37 to have its edge portions overlying or projecting beyond the end of the chamber 37. Screws 41 may mount the plate 40 on the outer end of the body 30, and spacers 42 on the screws may space the plate from the outer end of the body. A plurality of perforations or openings 43 is provided in the plate 40. The openings 43 may be arranged in an annular series concentric to the centre of the disc shaped plate.

45 The stream of carbon dioxide discharged from the nozzle 32 strikes the baffle 40 with considerable force and is divided thereby to pass laterally outward between the baffle and the outer end of the body 30. The rim 36 then directs the carbon dioxide snow forwardly. A certain amount of the carbon dioxide passes through the perforations 43. The plate 40, in being located immediately in front of the body 30 breaks up the stream of carbon dioxide in the zone of the low temperatures present in and adjacent the chamber 37. Due to this relationship, the baffle 40 is effective in causing the formation of carbon dioxide snow.

60 A directing spout or conduit 44 may be provided on the body 30 to aid in directing the snow on to the fire or hazard. The conduit 44 may be attached to the rim 36 and projects outwardly from the outer end of the body. If it is desired to discharge the carbon dioxide snow at a suitable velocity, the spout or conduit 44 may be outwardly convergent or frusto-conical as illustrated in Fig. 4.

65 The embodiment of the invention illustrated in Figs. 6 and 7 of the drawing, includes, generally, a body 50 having a fluid passage 51, a nozzle or jet 52 in the passage 51, and means 53 for converting the stream of carbon dioxide discharged from the jet 32 into snow.

70 The body 50 may be a simple member provided with a central longitudinal opening or fluid passage 51. The body 50 may be somewhat shorter than the bodies of the forms of the invention de-

scribed above. The exterior of the body 50 may be finished and shaped so that the device may be readily engaged and handled. In accordance with this embodiment of the invention, the fluid passage 51 may be of substantially uniform diameter throughout its length. The inner end portion 54a of the fluid passage 51 may be screw-threaded to facilitate connection of the device with the delivery conduit.

10 The nozzle or jet 52 is provided in the outer end part of the fluid passage 51 to cause the carbon dioxide to be discharged from the passage in a small stream and at a high velocity. The jet 52 may be screw-threaded in the outer end of the passage 51.

The means 53 for converting the discharging carbon dioxide into snow acts to break up the stream of discharging carbon dioxide and causes it to pursue a tortuous route or course. The means 53 includes a baffle plate 54 arranged in the path of the stream discharging from the jet 52. The baffle plate 54 is spaced outwardly from the outer end of the body 50, and is transverse of the stream of discharging carbon dioxide. Screws 55 pass through openings in lugs 56 on the periphery of the disc shaped plate 54 to attach the plate to the body 50. Washers or spacers 57 are provided on the screws 55 to space the plate from the outer end of the body. In this embodiment of the invention, the baffle plate 54 is spaced a substantial distance from the outer end of the body 50 to provide a space or chamber between the nozzle 52 and the baffle plate. The stream of carbon dioxide passing through the space or chamber produces a chilling or cooling effect creating a zone of low temperatures on the outer end of the body. The discharging stream, in striking the baffle plate 54, is thus broken up in the zone of low temperatures and a large part thereof is converted into snow. The plate 54 may be provided with a plurality of perforations 58. A flange ring 60 is arranged on the outer end of the body 50 to direct the laterally moving carbon dioxide snow forwardly. The ring 60 may be held on the body 50 by the screws 55. A suitable directing conduit 61 may be carried by the ring 60 to direct or convey the snow outwardly. In the particular case illustrated, the conduit 61 is cylindrical and has its inner end telescoped within the flange ring 60.

The operation of the form of the invention disclosed in Figs. 6 and 7 of the drawing is substantially the same as the operation of the previously described embodiments. The stream of carbon dioxide discharged from the nozzle 52 strikes the baffle plate 54 and is thereby caused to pass laterally outward. The stream is thus broken up in an area or zone of low temperatures and a substantial portion thereof is converted into flakes of snow. The flange ring 60 and the conduit 61 direct or carry the snow outwardly.

Having described only typical preferred forms of our invention, we do not wish to limit ourselves to the specific details set forth, but wish to reserve to ourselves any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described our invention, we claim:

70 1. A fire extinguishing apparatus including a body having a passage therethrough for a stream of fire extinguishing medium liquefied under pressure, the passage being sufficiently enlarged at its outer end to provide a zone of low temperature caused by expansion of said medium, a per-

forated plate carried by said body in axially and peripherally spaced relation to the outer end of the passage, said plate being constructed and arranged to retard and spread the stream of discharging medium to sufficiently form snow, and a directing tube secured to the body and peripherally spaced from the plate.

2. A fire extinguishing apparatus including a body having a passage therethrough for the discharge of a fire extinguishing medium liquefied under pressure, said passage having a restriction to form a jet of the medium, a baffle spaced from said restriction for dispersing the jet laterally, thereby reducing the velocity of the discharging stream and forming an expansion zone of low temperature in which a substantial part of the medium will be frozen into flakes, and means limiting such lateral dispersion and redirecting the stream, said means including a redirecting wall of smoothly curved section both in the direction of the passage and transversely thereto adapted to prevent accumulation of said flakes.

3. A discharge nozzle for fire extinguishing fluid liquefied under pressure, said nozzle comprising a tube having an open discharge end and closed at its opposite end, said closed end having a dome-like inner surface, a jet for admitting a stream of said fluid into the closed end of the tube, and means spaced from the jet for dispersing the stream laterally against said dome-like surface.

4. A fire extinguishing apparatus including a body having a passage therethrough for the discharge of fire extinguishing medium liquefied under pressure, said passage being materially constricted near its outer end to form a nozzle and being sufficiently enlarged at its outer end immediately beyond the nozzle to provide a zone of low temperature caused by the expansion of said medium, means spaced from said nozzle and constructed and arranged to reduce the velocity of said discharging medium sufficiently to form fine particles of snow, and a tube constructed and arranged to prevent substantial entrainment of air and to redirect the discharging medium after it passes the velocity reducing means, the latter and the tube cooperating to produce turbulence in the discharging medium and thereby cause the fine particles of snow to build up into flakes of substantial size.

5. A fire extinguishing apparatus including a body having a passage therethrough for the discharge of fire extinguishing medium liquefied under pressure, said passage being materially constricted near its outer end to form a nozzle and being sufficiently enlarged at its outer end immediately beyond the nozzle to provide a zone of low temperature caused by the expansion of said medium, a baffle spaced from said nozzle and constructed and arranged to reduce the velocity of said discharging medium sufficiently to form fine particles of snow, and a tube constructed and arranged to prevent substantial entrainment of air and to redirect the discharging medium after it passes the baffle, the baffle and the tube cooperating to cause the fine particles of snow to build up into flakes of substantial size.

6. A fire extinguishing apparatus including a body having a passage therethrough for the discharge of fire extinguishing medium liquefied under pressure, said passage being materially constricted near its outer end to form a nozzle and being sufficiently enlarged at its outer end

immediately beyond the nozzle to provide a zone of low temperature caused by the expansion of said medium, a baffle spaced from said outer end and constructed and arranged to reduce the velocity of said discharging medium sufficiently to form fine particles of snow, and a tube constructed and arranged to prevent substantial entrainment of air and to redirect the discharging medium after it passes the baffle, the baffle and the tube cooperating to cause the fine particles of snow to build up into flakes of substantial size.

7. A fire extinguishing apparatus including a body having a passage therethrough for a stream of fire extinguishing medium liquefied under pressure, the passage being sufficiently enlarged at its outer end to provide a zone of low temperature caused by expansion of said medium, a plate carried by said body in axially and peripherally spaced relation to the outer end of the passage, said plate being constructed and arranged to retard and spread the stream of discharging medium sufficiently to form snow, and a directing tube secured to the body and peripherally spaced from the plate.

8. A fire extinguishing apparatus including a body having a passage therethrough for a stream of fire extinguishing medium liquefied under pressure, a constricting nozzle in the passage, said passage being sufficiently enlarged at its outer end to provide a snow forming zone of low temperature caused by expansion of said medium, means for abruptly changing the direction of said stream as it passes out of said zone, and a tube for redirecting the stream after it passes said means, the tube being constructed and arranged to prevent substantial entrainment of air.

9. A fire extinguishing apparatus including a

body having a passage therethrough for the discharge of fire extinguishing medium liquefied under pressure, such passage being materially constricted near its outer end to form a nozzle and being sufficiently enlarged at its outer end immediately beyond the nozzle to provide a zone of low temperature caused by the expansion of said medium, means spaced from said nozzle and constructed and arranged to reduce the velocity of said discharging medium sufficiently to form fine particles of snow, and a tube constructed and arranged to prevent substantial entrainment of air and to redirect the discharging medium after it passes said means into substantial alignment with said passage, said means and the tube cooperating to cause the fine particles of snow to build up into flakes of substantial size.

10. A fire extinguishing apparatus including a body having a passage therethrough for the discharge of fire extinguishing medium liquefied under pressure, said passage being materially constricted near its outer end to form a nozzle and being sufficiently enlarged at its outer end immediately beyond the nozzle to provide a zone of low temperature caused by the expansion of said medium, means spaced from said nozzle and constructed and arranged to reduce the velocity of said discharging medium sufficiently to form fine particles of snow, and a tube constructed and arranged to prevent substantial entrainment of air and to redirect the discharging medium after it passes said means, the latter and the tube cooperating to cause the fine particles of snow to build up into flakes of substantial size, and said tube converging to a smaller diameter at its outer end.

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