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DRY POWDER FIRE-EXTINGUISHER

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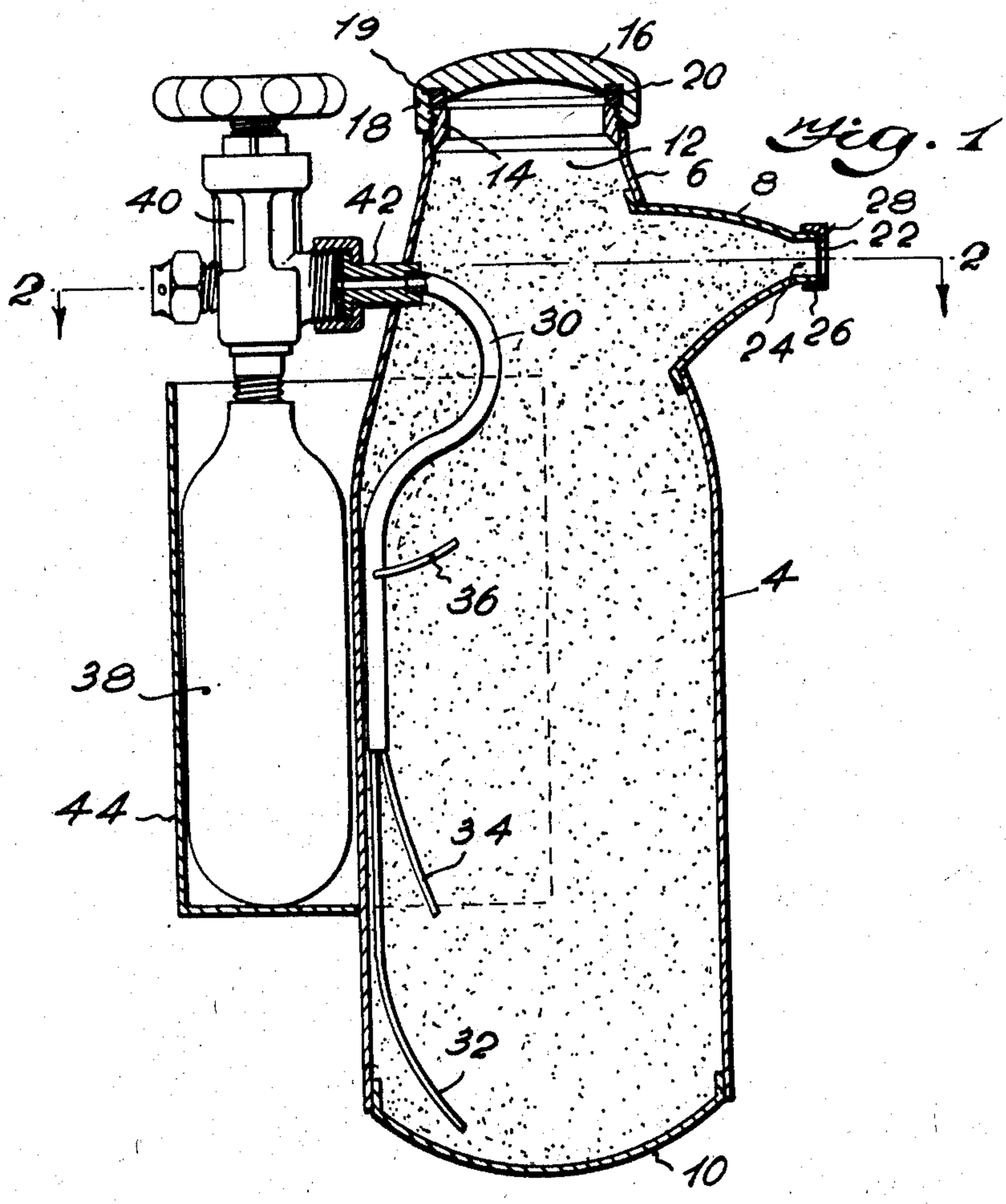

Fig. 1

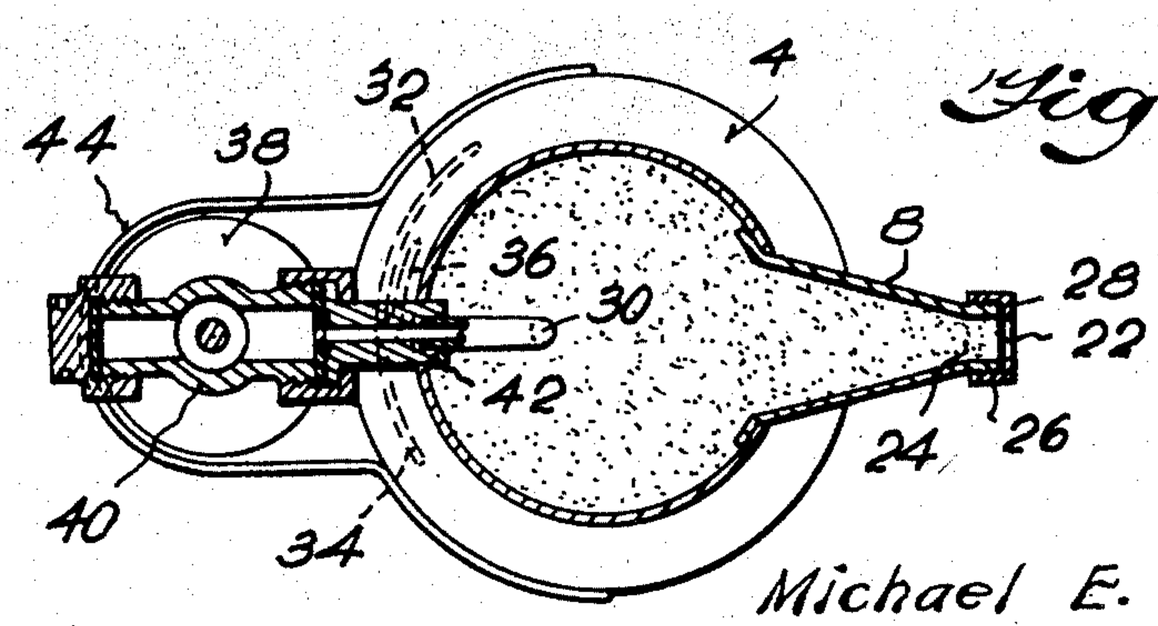

Fig. 2

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DRY POWDER FIRE EXTINGUISHER

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The present invention relates to fire extinguishing apparatus by means of which a fire extinguishing powder is blown upon the fire by the medium of a pressure gas, such as carbon dioxide. More particularly, the invention relates to a fire extinguishing apparatus of novel form in which the powder to be used is contained within a cylindrical container and is discharged through a nozzle at one end thereof, which end is normally the upper end of the container in the upright position thereof, the powder being discharged by means of a gas introduced under high pressure into the container at the opposite or lower end thereof, where it expands during the operation of the extinguisher to create the desired pressure for the expulsion of the powder.

The fire extinguisher powder must be free-flowing and remain free-flowing over a relatively long period of storage or non-use of the apparatus in order to be satisfactorily operated when put into use. The powder which is generally employed has a sodium bicarbonate base, and in the forms of fire extinguishers heretofore employed, provision is made for the discharge of the powder at the bottom of the cylindrical container through an outlet nozzle, partly by means of gas discharged through a tube which extends down within the nozzle, and partly by means of the pressure of gas which is applied through equally spaced branch tubes in the container above the outlet nozzle, by which there is a tendency to packing of the powder. Such packing of the powder in the extinguisher sometimes causes failure in operation, or retarded operation of the apparatus, resulting in additional property loss, because of failure to get the fire under immediate control.

It will be understood that fire extinguishers of the dry powder type are particularly useful in extinguishing oil fires, fires of inflammable liquids generally, electrical fires caused by short circuits, whereby the insulation is burned, fires on busses, aircraft and other means of transportation, fires of illuminating gas, natural gas, and many other types of fires in most of which the ordinary fire extinguisher, containing a solution of sodium bicarbonate, into which sulphuric acid is introduced by some means during use of the apparatus, is entirely ineffective. The dry powder fire extinguisher operates by the use of sodium bicarbonate as a base in powder form and serves to lay a blanket of the sodium bicarbonate over the burning area, which tends to smother the fire. The sodium bicarbonate releases carbon dioxide when the temperature exceeds about 270° C. (518° F.) which assists in the formation of an atmosphere of carbon dioxide around the fire, the bicarbonate being converted to the normal sodium carbonate at or above this temperature. The carbon dioxide which is employed in expelling the powder in the extinguisher is at a relatively low temperature on expansion from the carbon dioxide cylinder into the powder container, and serves not only to displace the air around the fire but also assists in cooling the surroundings and the fire area so that the temperature is immediately reduced below the kindling point.

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In the operation of the apparatus hereinafter described in detail, the pressure of the carbon dioxide in the carbon dioxide cylinder is preferably about 800 to 900 lbs. per sq. inch, and when the control valve is opened to admit the gas into the main container, the pressure drops to about 220 to 230 lbs. per sq. inch in the container, which pressure, in addition to the kinetic energy of the gas from the branch tubes, forces the powder from the outlet nozzle of the container. It has been found that by having the discharge nozzle near the top of the container, and the outlet of the gas tubes mainly near the bottom thereof, the effect of packing or caking of the powder in the container is entirely overcome. It has been found, furthermore, that the form of extinguisher of the present invention may be operated in any position in which the extinguisher may be held, that is, in the upright position, in the inverted position, in the horizontal position, or in any inclined position. This feature in connection with the mode of operation of the form of fire extinguisher hereinafter described in detail is of extreme importance when the fire to be extinguished is not readily accessible, or where the space is low or limited, so that it requires the use of the extinguisher on its side or horizontally during operation in order to direct the nozzle toward the fire.

The difference in the mode of operation of the fire extinguisher of the present invention from that of powder fire extinguishers of the forms heretofore used may be explained by the fact that when packing of a fire extinguisher powder occurs after long standing, the upper surface becomes more or less concave, due to the sagging or packing effect of the powder induced by gravity, so that when gas, or carbon dioxide, is released in the powder in the direction of gravity, as was done in the forms of powder extinguishers heretofore used, there was an imme-

diate tendency to increase the packing and cause further compression of the powder, which frequently prevented the immediate expulsion of the powder from the extinguisher, whereas in the form of apparatus of the present invention, in which the carbon dioxide is released mainly near the bottom of the container, but with the discharge nozzle located near the top of the container, so that the gas and powder must travel upwardly to reach the discharge nozzle, the gas has a tendency to lift the body of the powder and works in a direction opposite to the force of gravity by which the powder particles are freed, thus producing immediate operation of the extinguisher.

One of the objects of the present invention is to provide a dry powder fire extinguisher capable of expelling the powder in a free-flowing stream to eliminate packing or caking in the container.

Another object of the invention is to provide a dry-powder fire extinguisher from which the powder may be expelled when the extinguisher is held in any position, either upright, inverted, horizontal, or in any inclined position.

Another object of the invention is to provide a form of dry-powder fire extinguisher apparatus in which the powder is discharged from a nozzle at the upper part of the container and in which the pressure gas normally acts on the powder in a direction opposite to the force of gravity, or in a direction opposite to that in which packing takes place, so as to free and loosen the powder particles and to overcome the effect of packing prior to the expulsion of the powder through the exit nozzle.

Another object of the invention is to provide a form of fire extinguisher for use with powder which may be manufactured at a relatively low cost and which is adapted to be assembled or taken apart with ease.

Another object of the invention is to provide a form of fire extinguisher for use with powder which is so constructed as to operate positively and rapidly under substantially all conditions of operation in any desired holding position of the extinguisher.

With these and other objects in view, the invention comprises the various features and combinations hereinafter more fully described and particularly defined in the claims.

The various features of the invention are illustrated in the accompanying drawings showing the preferred embodiment of the invention, in which:

Fig. 1 is a view in elevation, partly in section, of the powder fire extinguisher apparatus, and

Fig. 2 is a transverse sectional view taken on the section line 2—2 of Fig. 1.

Referring more in detail to the drawings, the numeral 4 designates a substantially cylindrical container having a conical upper portion 6 which is provided with a lateral tapering discharge nozzle 8 at substantially the mid portion thereof. The bottom 10 of the container is preferably dome-shaped, or convex, as shown in the drawing. The top of the container 6 is provided with a filler opening 12 having a threaded sleeve 14. The opening 12 may be closed by a knurled cap 16 which is provided with a female thread on the inner surface of the flange member 18 so as to engage the male thread of the sleeve 14. The cap member is provided with a recess 19 in which is a gasket 20 of fibrous material which insures a tight closure and pressure engagement of the cap with the sleeve member 14 when the cap is

screwed tightly in place, thereby preventing escape of gas around the cap during the operation of the fire extinguisher.

Premature discharge or loss of the powder in the container 4 through the nozzle 8 is prevented by means of a frangible disc member 22 of a wafer-thin material, such as treated paper, for example, which may be held in place over the opening 24 of the nozzle by means of a screw ring fastener 26 having an inwardly extending flange 28 adapted to contact with and hold the disc member in place. The frangible disc member 22 is so designed as to be ruptured at a relatively low internal pressure, whereby when the valve 40 of the carbon dioxide cylinder is opened, the disc is ruptured and the powder charge is immediately expelled through the orifice 24 of the nozzle 8.

The gas to be employed for expelling the powder in the container 4 through the nozzle 8 is preferably introduced into the container by means of a tubing 30, which may be fastened to the inside of the container wall parallel to an element of the cylindrical surface, or in a perpendicular position adjacent to the wall in the upright position of the container. The tubing 30 preferably extends from a point about midway in the side of the conical portion of the container to a point above the beginning of the dome portion 10 at the bottom of the container. Connected to the lower end of the tube 30 are two branch tubes, or smaller tubes 32 and 34, which extend downwardly toward the central portion of the container and preferably circumferentially in an arc, as indicated in Fig. 2 of the drawings, although extending obliquely with reference to an element of the inner cylindrical surface of the container. The longer tube 32 preferably extends downwardly in an arc into the lower portion of the dome-shaped bottom 10 and terminates to one side of the center of the dome portion. The other or shorter tube 34 preferably passes downwardly and inwardly at an angle following the contour of the inner wall of the container 4 and terminates substantially above the end portion or terminal of the longer branch tube 32. The branch tubes 32 and 34 are spaced apart so that the gas discharged therefrom will be expelled at different levels and in different tangential directions above the bottom 10 of the container. Another branch tube 36 is connected to the main tube 30 at a level above the tubes 32 and 34 but below the level of the discharge nozzle 8, and extends for a short distance around the internal periphery of the container in the portion thereof substantially opposite the discharge nozzle 8, whereby the gas discharged from the tube 36 assists in directing the discharge of the powder in the container through the nozzle 8 without substantial loss of pressure.

The pressure gas employed in the apparatus is preferably carbon dioxide, which is supplied thereto by means of a cylinder 38, which is preferably mounted directly adjacent to the container 4 on the side thereof opposite the outlet nozzle 8. The carbon dioxide cylinder is provided with a standard valve 40, the outlet from which is securely coupled to an inlet tube 42, which is permanently connected to the container 4 in the conical shaped upper portion 6 substantially opposite to the outlet nozzle 8. The tubing 30 is securely inserted into and attached to the outlet side of the tube 42 in any suitable manner. A shield 44 is preferably provided for the gas pressure cylinder 38, which passes around the

cylinder and serves to protect the operator from contact with the cylinder during discharge of the pressure gas therefrom, which due to the expansion effect of the gas is cooled to a relatively low temperature. A support for the cylinder may be provided within the shield in order to relieve the stress upon the connection **42**.

The operation of the fire-extinguisher apparatus above described is as follows:

When it is desired to operate the fire-extinguisher apparatus, the valve **40** is opened, by which compressed gas or carbon dioxide enters the container **4** through the connection **42** and the tubing **30**, from which it is discharged through branch tubes **32**, **34** and **36**. The gas from branch tubes **32** and **34** is discharged downwardly and tangentially in the container **4**, by which it is distributed through the powder mass until the pressure in the container is built up sufficiently to rupture the closure member **22** in the discharge nozzle **8**. The branch tube **36** is inclined upwardly towards the discharge nozzle **8**, and serves during operation of the extinguisher to add pressure and direction to the discharge of the powder mass through the nozzle. As soon as the disc member **22** is ruptured, the pressure of the carbon dioxide throughout the powder mass causes a sudden explosion or expansion in the powder which puffs it up as a portion of the powder is discharged into the atmosphere and overcomes any packing or caking which may have taken place in the powder mass on standing or non-use of the extinguisher. After the initial discharge of the powder at the time of the rupture of the disc closure **22**, the gas from the carbon dioxide cylinder continues to pass through the valve member **40** until all of the powder in the container **4** has been discharged. It generally requires about 22 seconds to completely discharge the powder in the forms of the extinguisher apparatus which have been made embodying the invention herein described. It will be apparent in the operation of the device, that the conical portion **6**, at the upper portion of the container, serves to assist in directing the flow of the powder and gas through the nozzle **8** during the operation of the extinguisher, and by passing through a gradually reduced cross sectional area, the kinetic energy or speed of discharge is increased before discharge through the orifice **24**.

It will be understood that the disc or closure **22** may be made of any suitable material having the desired strength in thin sections to remain intact up to the desired rupturing pressure. The rupturing pressure is preferably between 100 and 150 lbs. per square inch, although any desired rupturing pressure between about 10 and 150 lbs. per square inch may be used. In the event that the extinguisher apparatus is likely to remain unused for a long period of time, so that considerable "packing" may have taken place, it is preferable to employ a disc having a high rupturing point, such as at 125 lbs. per square inch, in order to produce a greater "explosion" in rupturing, or a higher initial discharge pressure, in order to "unpack" the powder, or to overcome the packing effect after long standing. The disc may be made, if desired, from a moisture-proof "Cellophane" cellulose film, which is strong, flexible, grease proof, oil proof, dust proof and air proof, and which may be obtained in a thickness to provide substantially any desired rupturing strength.

The shield member **44** may be of any desired form and may, if desired, completely surround the container **4** and the carbon dioxide cylinder **38**, covering both the bottom of the container and that of the cylinder, instead of extending around only a part of the container in the manner illustrated in the drawings.

It will be understood that various changes or modifications may be made in the form and structure of the fire-extinguisher apparatus above described without departing from the spirit of the invention and scope of the claims annexed hereto.

Having thus described the invention, what is claimed as new is:

1. A dry powder fire-extinguisher apparatus adapted for discharge in any position thereof which comprises a container for dry powder having a cylindrical main body portion, a concave rounded bottom portion and a conical upper portion, a progressively narrowed discharge nozzle connected to said conical upper portion, a tube within the container having its inlet at the said conical upper portion and its outlet near the said rounded bottom portion, said outlet being offset from the center of said rounded bottom portion so as to discharge gas in substantially a tangential direction with reference to said rounded bottom portion, and means for introducing gas under pressure into said tube, whereby dry powder will be unseated from said bottom portion and dry powder and gas will pass from said cylindrical main body portion into the said conical upper portion and through said discharge nozzle.

2. A dry powder fire-extinguisher apparatus adapted for discharge in any position thereof which comprises a container for dry powder having a cylindrical main body portion, a concave rounded bottom portion and a conical upper portion, a progressively narrowed discharge nozzle connected to said conical upper portion, a frangible closure for said nozzle adapted to be ruptured at a predetermined superatmospheric pressure, a tube within the container having its inlet at the said conical upper portion and its outlet near said rounded bottom portion, said outlet being offset from the center of said rounded bottom portion and directed so as to discharge gas in substantially a tangential direction with reference to said rounded bottom portion, and means for introducing gas under superatmospheric pressure into said tube to cause rupture of said frangible closure and to cause dry powder to be unseated from said bottom portion and pass from said cylindrical main body portion into said conical upper portion and through said discharge nozzle.

3. A dry powder fire-extinguisher apparatus adapted for discharge in any position thereof which comprises a container for dry powder having a cylindrical main body portion, a concave rounded bottom portion and a conical upper portion, a progressively narrowed discharge nozzle connected to said conical upper portion, a frangible closure for said nozzle adapted to be ruptured at a predetermined superatmospheric pressure, a tube within the container having its inlet at the said conical upper portion and its outlet near said rounded bottom portion, said outlet being offset from the center of said rounded bottom portion and directed so as to discharge gas in substantially a tangential direction with reference to said rounded bottom portion, a container for carbon dioxide, supporting means for holding said carbon dioxide container adjacent to said dry powder container, means for connecting said carbon dioxide container to said tube and valve means for controlling the passage of

carbon dioxide from said carbon dioxide container into said tube to cause discharge of gas and dry powder through said nozzle.

4. A dry powder fire-extinguisher apparatus adapted for discharge in any position thereof which comprises a container for dry powder having a cylindrical main body portion, a concave rounded bottom portion and a conical upper portion, a progressively narrowed discharge nozzle connected to said conical upper portion, a tube within the container having its inlet at the said conical upper portion and its outlet near said rounded bottom portion, said outlet being offset from the center of said rounded bottom portion so as to discharge gas in substantially a tangential direction with reference to said rounded bottom portion, a branch tube extending from said tube toward said discharge nozzle at a point substantially opposite said discharge nozzle to assist in directing discharge of powder from said container through said nozzle, a frangible closure for said nozzle adapted to be ruptured at a predetermined superatmospheric pressure within said container, and means for introducing gas under superatmospheric pressure into said tube to cause rupture of said frangible closure, whereby dry powder will be unseated from said bottom portion and passed with said gas into said conical upper portion and discharged through said discharge nozzle.

5. A dry powder fire-extinguisher apparatus adapted for discharge in any position thereof which comprises a container for dry powder having a cylindrical main body portion, a concave rounded bottom portion and a conical upper portion, a progressively narrowed discharge nozzle extending outwardly from said conical upper portion, a tube within said container having its inlet at the said conical upper portion and its outlet near said rounded bottom portion, said

outlet being offset from the center of said rounded bottom portion so as to discharge gas in substantially a tangential direction with reference to said rounded bottom portion, a branch tube extending from said tube toward said discharge nozzle at a point substantially opposite said discharge nozzle to assist in directing discharge of powder from said container through said nozzle, a second branch tube extending from said tube below said branch tube and terminating above the outlet of said tube, a frangible closure for said nozzle adapted to be ruptured at a predetermined superatmospheric pressure and means for introducing gas under superatmospheric pressure into said tube, whereby dry powder will be unseated from said bottom portion and discharged from said container through said discharge nozzle.

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