Oct. 30, 1945. L. D. MYERS 2,387,935

FIRE EXTINGUISHING METHOD AND APPARATUS

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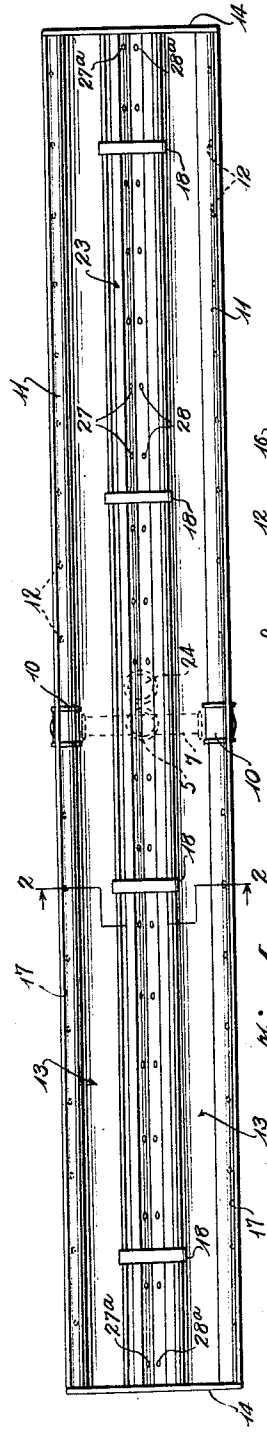


Fig. 1.

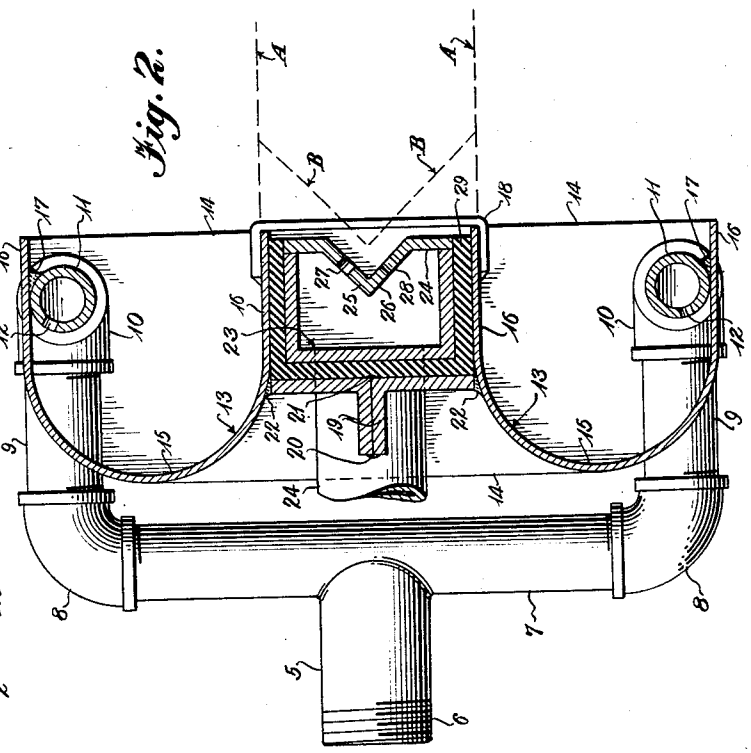


Fig. 2.

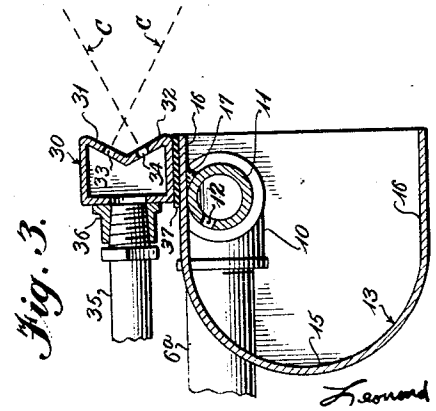


Fig. 3.

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FIRE EXTINGUISHING METHOD AND APPARATUS

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22 Claims. (Cl. 169—11)

This invention relates to methods of discharging a fire extinguishing medium composed of carbon dioxide and water fog and apparatus for carrying out said methods.

In the application of Hilding V. Williamson, Serial No. 434,556, filed March 13, 1942, there is disclosed and broadly claimed methods and apparatus for effecting discharge of liquid carbon dioxide in such a manner that the resultant stream of snow and vapor will possess highly effective range and penetrating characteristics as well as a large field of application or area of direct impingement. These highly desirable results are obtained by manipulating the mixture of carbon dioxide snow and vapor, during travel of the same from its zone of production to its zone of discharge to the atmosphere, so that the snow and vapor components of the mixture are segregated or formed into layers. These layers are superimposed in a discharge stream of substantially greater cross sectional dimension in one direction than in the other.

It has been determined that the fire extinguishing characteristics of the discharge provided by the methods and apparatus of the above identified application can be materially improved by combining therewith a discharge of pre-formed water fog if the water fog is projected in such a manner that the proportions of water fog and carbon dioxide are maintained substantially uniform throughout the major cross sectional dimension of the discharge stream.

It is a primary object of this invention to provide a method of discharging a fire extinguishing medium, composed of carbon dioxide and water fog, as a stream of substantially rectangular section and apparatus for carrying out said method.

A further important object of the invention is to provide a method of discharging a fire extinguishing medium as a stream of elongated cross section with the carbon dioxide snow and vapor components segregated in superimposed layers therein and with pre-formed water fog combined with one of said segregated components, and apparatus for carrying out said method.

Another important object of the invention is the provision of a method of producing an improved discharge of a fire extinguishing medium that consists of carbon dioxide snow and vapor and pre-formed water fog in which the water fog is combined with the carbon dioxide snow.

Still another important object of the invention is the provision of a method of producing an improved discharge of a fire extinguishing medium that consists of carbon dioxide snow and vapor and pre-formed water fog in which the water fog is combined with the carbon dioxide vapor.

A further object of the invention is the provision of an apparatus for producing an improved discharge of a fire extinguishing medium that consists of carbon dioxide snow and vapor and pre-formed water fog in which the water fog is combined with the carbon dioxide snow.

Another object of the invention is the provision of apparatus for producing an improved discharge of a fire extinguishing medium that consists of carbon dioxide snow and vapor and pre-formed water fog in which the water fog is combined with the carbon dioxide vapor.

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:

Figure 1 is a front elevational view of one form of fire extinguishing medium discharge apparatus embodying this invention,

Figure 2 is a transverse sectional view taken on line 2—2 of Fig. 1, and

Figure 3 is a transverse sectional view of a modified form of fire extinguishing medium discharge apparatus.

In the drawing, wherein for the purpose of illustration are shown the preferred embodiments of this invention, and first particularly referring to Figs. 1 and 2 inclusive, the reference character 5 designates a liquid carbon dioxide supply pipe for the discharge apparatus. It will be appreciated that this pipe 5 may represent a portion of a pipe line which leads from the discharge apparatus to the source of supply of the liquid carbon dioxide. This source of supply either may be a storage container of the type disclosed in Patent No. 2,143,311, issued to Eric Geertz, in which the liquid carbon dioxide is maintained at a substantially constant subatmospheric temperature, and its corresponding low vapor pressure, or a bank of cylinders in which the liquid carbon dioxide is confined at the changing high vapor pressures which correspond with the prevailing temperatures of the surrounding atmosphere. Although the size of the discharge apparatus embodying this invention may be such as to permit the apparatus to be employed on the end of a hose line for direct manual manipulation, the full benefits of the invention may best be obtained when the discharge apparatus is of such a size as

to require it to be employed as a part of a fixed fire extinguishing system, or to require it to be mounted on some form of wheeled vehicle or carriage which is movable to permit the field of application of the extinguishing medium to traverse the involved area and to wipe out the fire as the carriage or vehicle progresses. A ground fire involving flowing flammable liquids presents an excellent example of a need for mounting this type of discharge apparatus on a wheeled vehicle or carriage.

The pipe section 5 is threaded at 6 for proper connection with a suitable supply line. The remaining end of this pipe section is connected by welding, or the like, to the right angularly arranged manifold 7 that extends in opposite directions. Suitable couplings 8 are connected to the opposite ends of the manifold pipe 7 and have short nipples 9 threadedly connected in their remaining branches. These nipples are connected to the T-couplings 10 which are employed for connecting the apertured discharge pipes 11 to the said nipples. Fig. 1 discloses the use of four of these apertured discharge pipes which are arranged in parallel pairs. Each one of these discharge pipes 11 is suitably closed at its outer end and is provided with a longitudinally arranged series of apertures 12. The apertures of each series are spaced at suitable intervals and, it will be noted by inspecting Fig. 2, that they face in a general rearward direction rather than a forward direction.

It will be appreciated that when liquid carbon dioxide is released to the atmosphere through the discharge apertures 12, the carbon dioxide will vaporize and flash to a uniform mixture of vapor and snow as a result of the sudden drop in pressure. The percentage of the liquid carbon dioxide that flashes to snow will depend on the temperature of the liquid carbon dioxide at the place of storage. It will be explained more fully at a later point in the description that the mixture of carbon dioxide snow and vapor produced at each one of the discharge apertures 12 is to be manipulated in such a manner that the snow and vapor components may be discharged to the atmosphere in a segregated condition with the discharges from the apertures of the two pipes 11 connected to a T-coupling 10 being merged lengthwise of the discharge apparatus so as to provide a continuous, elongated discharge stream. For that purpose, each pair of discharge pipes 11 connected to a T-coupling 10 are suitably arranged within a merging and segregating chamber 13. It will be seen by inspecting Fig. 1 that these two chambers 13 extend the full length of the discharge apparatus and, when the apparatus is held or positioned in the manner illustrated in Figs. 1 and 2, these chambers form the top and bottom of the discharge device. The opposite ends of the merging and segregating chambers 13 are closed by the two end plates 14. That is to say, one end plate 14 is provided at each end of the discharge apparatus and closes the adjacent ends of both of the chambers 13. These end plates, therefore, help to maintain the chambers properly spaced and provide rigidity for the discharge apparatus.

Each one of these merging and segregating chambers 13 is provided with a rear wall 15 that is of semi-circular shape in section. These rear walls merge into parallel walls 16 which cooperate at their forward edges with the forward edges of the end plates 14 to provide the open fronts, or discharge openings, for the two chambers 13. These open fronts, therefore, lie directly opposite the curved rear walls 15. Fig. 2 discloses the discharge pipes 11 as being welded at 17 to the upper and lower wall portions 16 of the two chambers 13. The discharge pipes 11, therefore, cooperate with the top and bottom wall portions 16 of the two chambers to lend rigidity to these chambers and to the entire discharge apparatus. The adjacent or inner side walls 16 of the two chambers are interconnected and braced at a suitable number of points by the straps 18. To further strengthen the chambers 13, a pair of angle irons are provided for each half portion of the discharge apparatus arranged on opposite sides of a water supply pipe which will be specifically referred to later on. The angle irons of each pair are connected by welding at the points 20 and 21. The longitudinal edges of the oppositely extending branches of these two angle irons are welded at 22 to the inner side portions of the two merging and segregating chambers 13.

By inspecting Fig. 2, it will be seen that the longitudinal series of discharge apertures 12 for each pipe 11 face or point toward the zone where its associated rear chamber wall 13 merges with the outer chamber wall 16. It will be appreciated, therefore, that the separate jets of carbon dioxide snow and vapor mixture produced by the several orifices or apertures 12 will first impinge against the interiors of the two chambers 13 at these chamber wall merger zones.

The mode of operation of this form of carbon dioxide discharge apparatus now will be described. Liquid carbon dioxide of any desired temperature will flow under its own vapor pressure through the pipe members 5, 7, 8, 9, 10 and 11 so as to be discharged through the two longitudinal series of apertures 12 formed in the two pairs of parallel pipes 11. The liquid carbon dioxide in these discharge pipes 11 will be released to the interiors of the chambers 13 through the apertures 12 and, due to the sudden drop in pressure which occurs as a result of this release, the liquid carbon dioxide will be converted to a mixture of snow particles and vapor. Each aperture 12 will provide a separate jet or stream of the carbon dioxide mixture. These jets or streams will partake of straight line motion until their paths are obstructed by the inner surfaces of the chambers 13. The curved rear surfaces of these two chambers will cause the flowing mixtures of carbon dioxide snow and vapor to be deflected so that the normal straight line motion will be converted to a curvilinear motion. In addition to partaking of this curvilinear motion, the snow and vapor of the several streams or jets released into each one of the two elongated chambers 13 will be permitted to spread longitudinally of the chambers with the result that the mixtures of the several streams or jets will merge to form a continuous mass equal in length to each continuous chamber 13. It is a well recognized law or principle of physics that any object or material which is set in motion will travel in a straight line unless some force is applied thereto which will deflect it from such a path of movement. Additionally, the force required to deflect the object or material from its straight line motion depends on the velocity and the mass or density of the object or material being deflected.

With this principle in mind, it will be appreciated that the curved inner surfaces of the rear walls 15 of the two chambers will function to accomplish a change in the direction of motion of

the released carbon dioxide snow and vapor mixture and this change will be from a straight line motion to a curvilinear motion. These curved chamber wall surfaces, therefore, provide the opposing force referred to above. As the carbon dioxide snow of the mixture is many times more dense than the carbon dioxide vapor, and as the velocity of both of these components is the same, the snow offers more resistance to the deflecting force provided by the rear walls of the chamber. The snow, therefore, will force its way to the outer sides of the curvilinear paths of flow of the material with the result that the snow will displace the vapor and force it to seek a path of flow away from the inner surfaces of the two chamber walls. The difference in density of the snow as compared to the vapor, therefore, brings about a segregation of these two components. That is to say, the snow will form a flowing layer in contact with the inner wall surface of each one of the chambers while the vapor will form a superimposed layer spaced from the surface of the chamber wall.

To further explain this segregating action, it will be appreciated that the segregating of the snow and vapor components will not be complete for a small amount of the vapor will be trapped by the snow particles and be compelled to flow therewith while a small amount of the lighter, smaller snow particles will be carried along with the vapor. Furthermore, there will be a merging or blend zone between the concentrated layer of snow and the displaced layer of vapor. That is to say, the snow and vapor will not be sharply defined into two clearly distinguishable layers. Consequently, the expression "segregating the snow and vapor components into separate layers" will not be one hundred percent accurate but it is believed that the expression can be employed for defining the type of discharge provided by the apparatus and for distinguishing from a conventional discharge in which the snow and vapor are uniformly mixed.

The desired segregation of the snow and vapor is accomplished by the time the flowing material reaches the open front of each chamber 13. By inspecting Fig. 2, it will be appreciated that the snow layer for each chamber will be adjacent the inner wall 16 while the vapor layer will be arranged outwardly of the snow layer or adjacent the discharge pipe 11. It will be appreciated, therefore, that each chamber 13 will discharge a stream of carbon dioxide which will be continuous throughout its length. These two discharges will be arranged in parallelism to each other and will start out by being separated from each other a distance equal to the spacing of the dash lines A of Fig. 2. The two layers of snow from the two chambers 13 will lie adjacent each other while the two layers of vapor will be located outwardly of the snow layers and will function to shield the snow layers from the surrounding atmosphere with the exception of the regions at the opposite ends of the complete discharge apparatus. Of course, with no physical barrier lying between the two spaced discharges produced by the two chambers 13, that is beyond the open faces of these chambers, the snow of the two inner or adjacent layers will blend or flow together by moving inwardly of the lines A. This blending together or flowing toward each other will not take place immediately and will not occur until the momentum or inertia of the discharge has been substantially dissipated. Consequently, there will be provided a space or area lying between the two lines A and extending the full length of the discharge apparatus which will not be occupied by the carbon dioxide discharge from the two chambers 13. This unoccupied space is utilized in a manner now to be described.

A pocket or recess is provided by the adjacent walls 16 of the two chambers, the end plates 14 and the two pairs of angle irons 19. This pocket or recess is employed for receiving a water fog generating head 23. This head is shown in Fig. 1 as extending the full length of the discharge apparatus. It is of hollow construction and is provided with a front wall 24 that includes the angularly arranged wall portions 25 and 26. These angularly arranged wall portions are provided with two longitudinal series of spaced apertures 27 and 28 respectively. Figs. 1 and 2 disclose these apertures 27 and 28 as being arranged in transversely aligned pairs. That is to say, the apertures 27 are opposed to the apertures 28 so that the streams of water that are discharged from these opposed apertures will impinge against each other with the result that the water of both streams will be highly atomized and water fog will be generated. The angle of projection of the water fog produced by each pair of apertures 27—28 is represented by the dash lines B in Fig. 2.

Water is supplied to the interior of the water fog generating head 23 by the supply pipe 24. This water should be under a suitable pressure head. It has been determined that a pressure ranging from 90 to 200 pounds per square inch will effect proper fogging of the water.

It will be appreciated that impingement of the two streams of water from each opposed pair of apertures 27 and 28 will effect a projection angle which is represented by the lines B in Fig. 2 insofar as a section through two apertures 27 and 28 is concerned. It will be appreciated, also, that the water fog pattern produced by each pair of apertures 27 and 28 will be nearly cone shape when viewed at right angles from the section of Fig. 2. Consequently, the fog patterns of adjacent pairs of apertures 27 and 28 will merge lengthwise of the fog generating head 23, or lengthwise of the space or gap that is provided between the dash lines A of Fig. 2 which represent the inner margins of the two carbon dioxide discharge streams. Therefore, this space or gap will be filled with water fog. The angle of projection of the water fog represented by the lines B of Fig. 2 shows that some of the water fog will be caused to directly impinge the adjacent sides of the two snow layers of the spaced carbon dioxide discharges. Consequently, water fog will be entrained by the snow layers.

In Fig. 1 the extreme end pairs of water discharging apertures of the fog generating head 27 are identified by the reference characters 27*a* and 28*a* to distinguish them from the remaining apertures 27 and 28. The water fog generated by these two pairs of end apertures 27*a* and 28*a* will function to close off the opposite ends of the gap or space that is left between the two carbon dioxide discharges produced by the chambers 13. That is to say, the water fog generated by the opposite end pairs of apertures 27*a* and 28*a* seal off the opposite ends of this gap or space from the surrounding atmosphere and thereby excludes air from the gap or space in which the remainder of the water fog is generated. This enables the water fog generated by all of the pairs of apertures 27 and 28 to have the voids between the individual water droplets to be filled

with a carbon dioxide atmosphere instead of an air atmosphere. It will be appreciated, therefore, that the water fog delivered to the zone of the fire will not carry trapped or entrained air to the fire. The delivery of air to a fire by an extinguishing medium is very objectionable because the air provides the fire with combustion supporting oxygen.

From the above description, it will be appreciated that the discharge provided by the apparatus of Figs. 1 and 2 will consist of a composite stream of elongated or rectangular shape in transverse section. This stream will be made up of a top layer and a bottom layer of carbon dioxide vapor. Inwardly of these two vapor layers will be two layers of carbon dioxide snow with water fog entrained therein. Between these two carbon dioxide snow and water fog layers there will be a core of water fog with the voids between the water droplets filled with carbon dioxide. Due to the extremely low temperature of the carbon dioxide snow, the water droplets entrained thereby will be frozen to water-ice particles.

To prevent too rapid a transfer of heat from the water flowing through the head **23** to the carbon dioxide snow flowing in contact with the inner walls **16** of the two chambers **13**, a suitable layer of insulating material **29** may be interposed between the rear and side walls of the fog generating head **23** and the opposed walls **16** and angle irons **19**.

It will be obvious to any one skilled in the art that the discharge pipe **11** may be moved to the inner sides of the chambers **13**, or into positions adjacent the inner walls **16** of these chambers that are positioned next to the water fog generating head **23**. With the discharge pipes positioned in this manner and rotated approximately 30° to cause the apertures **12** to deliver their jets of carbon dioxide snow and vapor mixtures against the proper zones of the inner surfaces of the chambers **13**, the positioning of the carbon dioxide snow and vapor layers relative to the water fog will be changed. This modified discharge stream will consist of top and bottom layers of carbon dioxide snow with layers of carbon dioxide vapor and entrained water fog lying inwardly of the snow layers, and with a core of water fog.

It, also, will be appreciated that by placing control valves in the carbon dioxide and water supply lines that are connected to the pipes **6** and **24** respectively, the flow of the carbon dioxide or the water to the discharge apparatus may be stopped at any time to provide a discharge of water fog by itself or a discharge of the carbon dioxide by itself. The water fog discharge pattern and the carbon dioxide discharge pattern are such that these materials can be used separately at different stages of the extinguishment of different types of fires.

Fig. 3 has been presented to illustrate certain modifications that can be made in the methods and apparatus embodying this invention. This figure specifically illustrates the use of one pair of apertured carbon dioxide discharge pipes **11** carried by the T-coupling **10** and associated with a single merging and segregating chamber **13**. The discharge pipes **11** are provided with the same longitudinal series of apertures **12** that are directed to cause the jets of carbon dioxide snow and vapor mixture to impinge against the point of merger between the straight wall portion **16** and the rear curved wall portion **15** of the chamber. The opposite side of this chamber is provided with the second straight wall **60**. The discharge pipes **11** are welded at **17** to the adjacent wall **16** of the chamber. When only one pair of discharge pipes **11** is employed, the T-coupling **10** can be connected to the pipe **6a** that extends directly to the carbon dioxide supply line.

The water fog for this carbon dioxide discharge is produced by the head **30** that extends longitudinally of and is closely positioned with respect to the chamber side wall **16** to which the discharge pipes **11** are attached. The front wall of this water fog generating head **30** is provided with the angularly arranged wall portions **31** and **32** and these wall portions are provided with the longitudinal series of apertures **33** and **34**, respectively. The jet of water delivered by the opposed apertures **33** and **34** will impinge to generate the water fog that is projected through the angle represented by the dash lines C. Water under the desired pressure head is supplied to the fog generating head **30** by the pipe line **35** that is threadedly connected to the nipple **36** properly secured to the rear wall of the fog generating head **30**. A suitable layer of insulating material **37** may be interposed between the fog generating head **30** and the adjacent side wall **16** of the carbon dioxide snow and vapor segregating chamber **13**.

With this form of discharge apparatus, a discharge stream will be provided that will consist of a bottom segregated layer of carbon dioxide snow with a layer of carbon dioxide vapor lying above the snow layer. Above this carbon dioxide discharge there will be projected a pattern of water fog. Due to the angle of projection of this water fog, a portion of the same will impinge against the carbon dioxide vapor layer and will be entrained by this layer. The projection angle of the water fog is such, however, that a portion of the water fog will not be entrained by the carbon dioxide vapor layer of the carbon dioxide discharge.

It will be perfectly obvious to persons skilled in the art that two assemblies of the character shown in Fig. 3 may be associated with each other so that the two carbon dioxide snow and vapor segregating chambers **13** will lie in contact with each other and the two water fog generating heads **30** will lie on the outer sides of the two chambers **13**. This combined type of discharge apparatus will produce a fire extinguishing discharge that will consist of a dense carbon dioxide snow core that is produced by the snow layers discharged by the two chambers **13** with carbon dioxide vapor layers arranged above and below the dense snow core layer and with top and bottom layers or patterns of water fog in which portions of the water fog will be entrained by or carried along with the carbon dioxide vapor layers.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same and that various changes in practicing the hereindescribed method and in the shape, size, and arrangement of parts of the apparatus that is shown as being capable of carrying out the method, 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. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide to lower its pressure sufficiently to form snow and vapor, discharging the

carbon dioxide snow and vapor to the atmosphere in the form of a stream of rectangular shape in cross section, separately generating water fog in a zone paralleling and co-extensive with the major cross sectional dimension of the rectangular carbon dioxide stream, and projecting the generated water fog so that a portion of the same will be entrained by the carbon dioxide stream.

2. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide along the length of two zones to lower its pressure sufficiently to form snow and vapor, discharging the carbon dioxide snow and vapor to the atmosphere from both of said zones to form parallel streams of rectangular shape in cross section, separately generating water fog in a zone paralleling and coextensive with the major cross sectional dimension of each of the two rectangular carbon dioxide streams, and projecting the generated water fog so that portions of the same will be entrained by the carbon dioxide streams.

3. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide along the length of two elongated zones to lower its pressure sufficiently to form snow and vapor, discharging the carbon dioxide snow and vapor to the atmosphere from both of said zones to form parallel streams of rectangular shape in cross section, separately generating water fog in a zone lying between and co-extensive with the major cross sectional dimension of each of the two rectangular carbon dioxide streams, and projecting the generated water fog so that portions of the same will be entrained by the carbon dioxide streams.

4. A method of discharging a fire extinguishing medium, comprising effecting sudden release of carbon dioxide to lower its pressure sufficiently to form snow and vapor, flowing said snow and vapor along a curvilinear path arranged to terminate in a discharge zone of greater width than depth in cross section to effect segregation of these components, forming the segregated snow and vapor components into a stream discharging from the entire width of the discharge zone, separately generating water fog in a zone paralleling and co-extensive with the width of the said discharge zone, and projecting the generated water fog so that a portion of the same will be entrained by the carbon dioxide stream.

5. A method of discharging a fire extingushing medium, comprising effecting sudden release of liquid carbon dioxide to lower its pressure sufficiently to form snow and vapor, flowing said snow and vapor along a curvilinear path arranged to terminate in an elongated discharge zone to effect segregation of these components, forming the segregated snow and vapor components into a discharge having a width substantially corresponding with the length of the elongated discharge zone and with the segregated snow component defining one surface of the discharge while the segregated vapor defines the other surface, separately generating water fog in a zone paralleling and co-extensive with the length of the said elongated discharge zone, and projecting the generated water fog so that a portion of the same will be entrained by the segregated vapor portion of the carbon dioxide discharge.

6. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide to lower its pressure sufficiently to form snow and vapor, flowing said snow and vapor along a curvilinear path arranged to terminate in an elongated discharge zone to effect segregation of these components, forming the segregated snow and vapor components into a stream having a width substantially corresponding with the length of the elongated discharge zone and with the segregated snow defining one surface of the stream while the segregated vapor defines the other surface, separately generating water fog in a zone paralleling and co-extensive with the length of the said elongated discharge zone, and projecting the generated water fog so that a portion of the same will be entrained by the segregated snow portion of the carbon dioxide stream.

7. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide to lower its pressure sufficiently to form snow and vapor, flowing said snow and vapor along a curvilinear path arranged to terminate in an elongated discharge zone to effect segregation of these components, forming the segregated snow and vapor components into a stream having a width substantially corresponding to the length of the elongated discharge zone and with the snow and vapor segregations arranged in the stream so that the vapor segregations will lie outwardly of the snow segregation, separately generating water fog, and projecting the water fog so that portions of the same will be entrained by the snow aggregations.

8. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide to lower its pressure sufficiently to form snow and vapor, flowing said snow and vapor along parallel curvilinear paths arranged to terminate in parallel elongated discharge zones to effect segregation of these components as a result of their difference in density, forming the segregated snow and vapor components of said parallel paths into streams discharging from the entire lengths of the elongated discharge zones, separately generating water fog in a zone paralleling and co-extensive with the length of the said elongated discharge zones, and projecting the generated water fog so that portions of the same will be entrained by the two carbon dioxide streams.

9. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide along the lengths of two spaced zones to lower its pressure sufficiently to form snow and vapor, discharging the carbon dioxide snow and vapor to the atmosphere from both of said zones to form parallel, spaced streams of elongated cross section, separately generating water fog, and projecting the water fog into the the space that lies between the carbon dioxide streams.

10. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide along the lengths of two spaced zones to lower its pressure sufficiently to form snow and vapor, flowing said snow and vapor along parallel curvilinear paths arranged to terminate in spaced elongated discharge zones to effect segregation of these components as a result of their difference in density, forming the snow and vapor components of said parallel paths into two spaced streams each of which has a greater width than thickness, separately generating water fog, and projecting the water fog into the space that lies between the two carbon dioxide streams.

11. A method of discharging a fire extinguish-

ing medium, comprising effecting sudden release of liquid carbon dioxide along the lengths of two spaced zones to lower its pressure sufficiently to form snow and vapor, flowing said snow and vapor along parallel curvilinear paths arranged to terminate in spaced elongated discharge zones to effect segregation of these components as a result of their difference in density, forming the snow and vapor components of said parallel paths into two spaced streams each of which has a greater width than thickness and with the snow and vapor components of each stream arranged in separate layers, separately generating water fog, and projecting the water fog into the space that lies between the two carbon dioxide streams.

12. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide along the lengths of two spaced zones to lower its pressure sufficiently to form snow and vapor, flowing said snow and vapor along parallel curvilinear paths arranged to terminate in spaced elongated discharge zones to effect segregation of these components as a result of their difference in density, forming the snow and vapor components of said parallel paths into two spaced streams each of which has a greater width than thickness and with the snow and vapor components of each stream arranged in separate layers with the snow layers arranged adjacent each other, separately generating water fog, and projecting the water fog into the space that lies between the snow layers of the two carbon dioxide streams.

13. A method of discharging a fire extinguishing medium, comprising conducting liquid carbon dioxide to a relatively long region of release, discharging the liquid carbon dioxide through a plurality of constricted orifices arranged along said region to permit sudden expansion of the liquid to effect its conversion into snow and vapor, maintaining the flowing snow and vapor in confinement until they merge along the length of said region, causing the snow and vapor to partake of curvilinear motion while thus confined so that the difference in density of the snow and vapor will effect the segregation of these components, finally discharging to the atmosphere along the length of said region the thus segregated snow and vapor, separately generating water fog in a zone paralleling and co-extensive with the length of the long region of release for the liquid carbon dioxide, and projecting the generated water fog so that a portion of the same will be entrained by the carbon dioxide stream.

14. A method of discharging a fire extinguishing medium, comprising conducting liquid carbon dioxide through spaced parallel flow paths extending longitudinally of a relatively long region of release, discharging the liquid carbon dioxide through a plurality of constricted orifices arranged along each flow path to permit sudden expansion of the liquid to effect its conversion into snow and vapor, maintaining the flowing snow and vapor for each flow path in a separate zone of confinement until they merge lengthwise of their zone, causing the snow and vapor in each zone to partake of curvilinear motion while thus confined so that the difference in density of the snow and vapor will effect segregation of these components, finally discharging to the atmosphere from said zones their segregated snow and vapor as two parallel, spaced streams of elongated cross section, separately generating water fog, and projecting the water fog into the space that lies between the two carbon dioxide streams.

15. A method of discharging a fire extinguishing medium, comprising conducting liquid carbon dioxide through spaced parallel flow paths extending longitudinally of a relatively long region of release, discharging the liquid carbon dioxide through a plurality of constricted orifices arranged along each flow path to permit sudden expansion of the liquid to effect its conversion into snow and vapor, maintaining the flowing snow and vapor for each flow path in a separate zone of confinement until they merge lengthwise of their zone, causing the snow and vapor in each zone to partake of curvilinear motion while thus confined so that the difference in density of the snow and vapor will effect segregation of these components, finally discharging to the atmosphere from said zones their segregated snow and vapor as two parallel, spaced streams of elongated cross section, separately generating water fog, and projecting the water fog into the space that lies between the two carbon dioxide streams with the angle of projection of the water fog being arranged relative to the two carbon dioxide streams so that portions of the water fog will be delivered to and entrained by the two carbon dioxide streams.

16. Fire extinguishing apparatus comprising a chamber of greater width than depth in cross section having a discharge opening co-extensive with the cross section of the chamber and a transversely curved wall lying opposite said opening, means for releasing throughout the width of said chamber carbon dioxide snow and vapor in such a manner as to cause the snow and vapor to flow over said curved wall in reaching the discharge opening whereby the snow and vapor will be segregated into different portions of the stream discharged through the chamber opening, and a water fog generating head extending lengthwise of the aforesaid chamber and positioned to project the water fog so that a portion of the same will impinge against and be entrained by the carbon dioxide stream.

17. Fire extinguishing apparatus, comprising parallel elongated chambers arranged adjacent each other, each one of said chambers having a discharge opening extending the length thereof and a transversely curved wall lying opposite said opening, means in each chamber for releasing into the length thereof carbon dioxide snow and vapor in such a manner as to cause the snow and vapor to flow over said curved wall in reaching the discharge opening whereby the snow and vapor of each chamber will be segregated into different portions of the stream discharging through the chamber opening, and an elongated water fog generating head arranged lengthwise of the aforesaid elongated chambers for projecting water fog into the paths of the two carbon dioxide streams.

18. Fire extinguishing apparatus comprising a chamber of greater width than depth in cross section having a discharge opening co-extensive with the cross section of the chamber and a transversely curved wall lying opposite said opening, means for releasing throughout the width of said chamber a plurality of longitudinally spaced jets of carbon dioxide snow and vapor with the jets so directed that the snow and vapor will be caused to flow over said curved wall in reaching the discharge opening whereby the snow and vapor will be segregated into different portions of the stream discharged through the chamber opening, and a hollow head extending lengthwise of and adjacent to the aforesaid chamber, said

head having formed therein two longitudinal series of angularly arranged apertures for discharging streams of water which will impinge to produce water fog that is projected partly into the path of the carbon dioxide stream discharged through the chamber opening.

19. Fire extinguishing apparatus, comprising two parallel elongated chambers arranged in spaced relation to each other, each one of said chambers having a discharge opening extending the length thereof and a transversely curved wall lying opposite said opening, means in each chamber for releasing a plurality of longitudinally spaced jets of carbon dioxide snow and vapor with the jets so directed that the snow and vapor will be caused to flow over said curved wall in reaching the discharge opening whereby the snow and vapor will be segregated into different portions of the discharges through the chamber openings, and a water fog generating head positioned in the space between the two elongated chambers and arranged to project the generated water fog partly into the paths of the carbon dioxide discharges from the two chamber openings.

20. Fire extinguishing apparatus, comprising means for projecting carbon dioxide snow and vapor as a stream of greater width than depth in cross section, and means for separately generating water fog and projecting the water fog in such a manner that a portion of the same will be entrained by the carbon dioxide stream.

21. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide to lower its pressure sufficiently to form snow and vapor, discharging the carbon dioxide snow and vapor to the atmosphere in the form of a stream of greater width than depth in cross section, releasing to the atmosphere along a zone paralleling and co-extensive with the width of the carbon dioxide stream a second and different fire extinguishing fluid, and so projecting the second fire extinguishing fluid that it will be delivered to the point of application conjointly with the carbon dioxide.

22. A method of discharging a fire extinguishing medium, comprising effecting sudden release of liquid carbon dioxide along the length of two zones to lower its pressure sufficiently to form snow and vapor, discharging the carbon dioxide snow and vapor to the atmosphere from both of said zones to form parallel streams each of which is of greater width than depth in cross section, releasing to the atmosphere along a zone lying between the parallel carbon dioxide streams a second and different fire extinguishing fluid, and so projecting the second fire extinguishing fluid that it will be delivered to the point of application conjointly with the carbon dioxide.

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