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DISCHARGING FLUID PRESSURE MEDIA

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Fig. 1

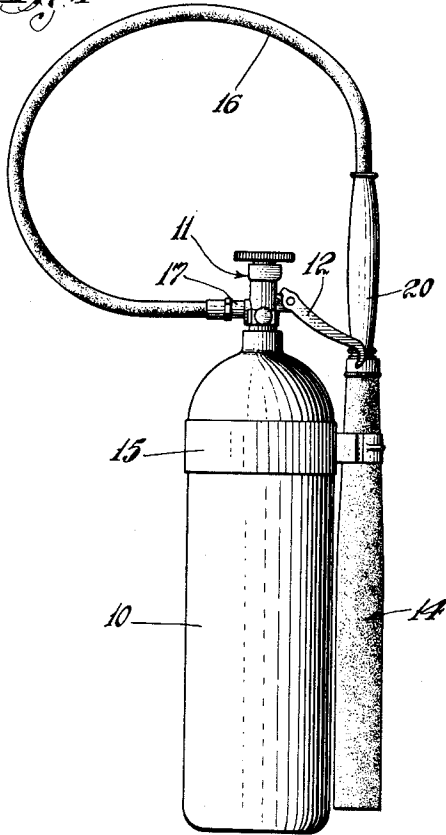


Fig. 2

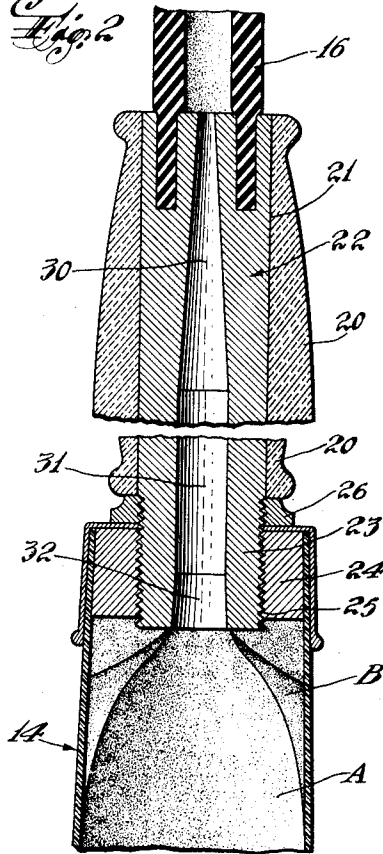
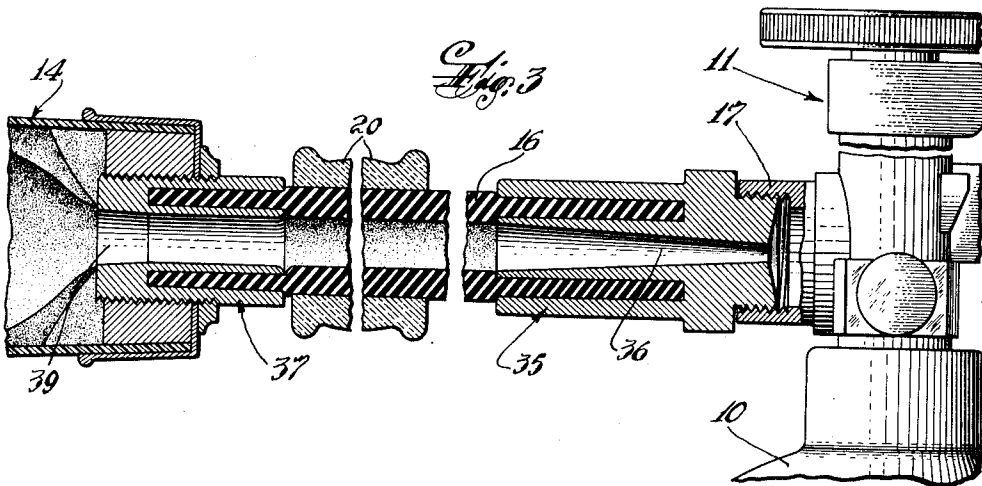


Fig. 3



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DISCHARGING FLUID PRESSURE MEDIA

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3 Claims. (Cl. 169—11)

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This invention relates to discharging fluid pressure media, and relates particularly to greatly minimizing or substantially eliminating the generation of electrostatic charges, attendant upon discharging high pressure liquid and/or gaseous carbon dioxide through a snow forming device.

In certain fire extinguishing applications, the carbon dioxide is discharged through a nozzle surrounded by a tubular shield or horn which causes liquid and/or gaseous carbon dioxide to be converted to a mixture of snow particles and gas. The carbon dioxide in passing through the nozzle expands rapidly from a relatively high pressure to nearly atmospheric pressure to produce carbon dioxide snow, while the horn reduces the forward velocity of the discharged carbon dioxide to minimize the entrainment of air. The horn is formed of dielectric material, such as fabric impregnated and coated with a phenol-formaldehyde-type resin, to enable the horn to be used safely on electrical fires.

In cases where the horn is not grounded, for example, when the horn is used in connection with portable fire extinguishing apparatus carried by the operator, electrostatic charges are accumulated which are of such intensity to subject the operator to severe and disagreeable shocks when the charges are grounded through the operator.

It is believed that these charges are due to the carbon dioxide snow coming in contact with the horn. When a mixture of carbon dioxide gas and snow passes through the nozzle into the horn a very sudden explosive like expansion takes place, because the carbon dioxide is permitted to expand very quickly from several hundred pounds per square inch to nearly atmospheric pressure, whereby the mixture leaving the nozzle will have a relatively high average velocity. As a result of this rapid expansion violent expansion shocks, high local velocities and low temperatures are established. Liquid carbon dioxide droplets freeze to snow crystals and these snow crystals are blown by the gas and collide violently against the dielectric surface of the horn. Some of the snow crystals will be negatively charged before they collide with the horn, while others will be neutral. Upon such violent collision, a number of these snow crystals will lose one or more electrons, that is, negative charges, which are accumulated by the horn and may be dissipated in the form of an electrostatic discharge when the horn is grounded.

Accordingly, an object of the present invention

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is to substantially eliminate or greatly minimize the generation of static charges in connection with the discharge of carbon dioxide.

Another object is to provide simple inexpensive means for accomplishing the foregoing which are readily embodied in portable fire extinguishing apparatus.

Another object is to prevent the carbon dioxide molecule to give up electrons due to impact.

A further object is to provide an improved method of discharging carbon dioxide for use as a fire extinguishing medium which substantially eliminates or greatly minimizes the generation of static charges without impairing the efficiency of the carbon dioxide as a fire extinguishing medium.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the invention, it has been found that these objects may be accomplished by reducing the violence of the collisions of the snow particles against the side wall of the horn below a critical value. In practicing the invention, this is effected by gradually reducing the pressure of the carbon dioxide before entering the horn to a value whereby expansion at the nozzle does not take place with explosive-like violence. A condition is established where the impact energy of the molecule is reduced below the value of its ionization potential. Under such condition, only some of the outer orbit electrons are elevated to a higher energy state, allowing the giving up of their energy in the form of radiation. This does away with the building up of a high potential charge due to ionization by impact. The generation of electrostatic charges can be further minimized by introducing the carbon dioxide into the horn in the form of a forwardly flowing stream thereby reducing rapid transverse divergence of the carbon dioxide snow particles and thus reducing the impact with which they contact the side wall of the horn.

In the drawing:

Figure 1 is an elevational view illustrating a portable fire extinguisher embodying the invention.

Figure 2 is an enlarged fragmentary sectional view taken substantially along line 2—2 on Figure 1, illustrating one embodiment of the invention.

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Figure 3 is an enlarged fragmentary sectional view illustrating another embodiment of the invention.

Referring to Figure 1, there is shown a portable type fire extinguisher comprising a container 10 for storing carbon dioxide under pressure, a discharge head or valve 11 for releasing the carbon dioxide from the container, a handle 12 on the discharge head to facilitate carrying of the extinguisher, a discharge directing shield or horn 14 supported by a bracket 15 on the container when the extinguisher is not in use, and a flexible hose 16 connecting the outlet 17 of the discharge head 11 to the horn 14.

As shown in Figure 2, the horn 14 is provided with a hand grip 20 having a bore 21 extending therethrough. A generally tubular member 22 is secured in the bore 21 and has the hose 16 anchored to one end thereof and has its other end 23 extending into the horn and formed with threads. The tubular member 22 together with the hose 16 constitutes a conduit for conducting carbon dioxide to the horn.

In order to attach the hand grip and tubular member to the horn, there is provided a plug 24 having a threaded aperture 25 for receiving the threaded end 23 of the tubular member extending into the horn. A lock nut 26 is threaded on the end 23 intermediate the hand grip 20 and the closed end of the horn to clamp the closed end of the horn against the plug 24.

The tubular member 22 is provided with a generally circular, central longitudinally extending bore which comprises an elongated flared zone 30 of increasing cross-sectional area in the direction of flow, a cylindrical zone 31 of greater length than the zone 30 and adjacent thereto at the downstream side thereof, and a relatively short outwardly slightly flared nozzle portion 32 at the end 23 of the tubular member extending into the horn.

In a practical embodiment of the invention, the zone 30 is flared at an angle of about 3.5° and is of a length to provide an increase in cross-sectional area from about one to ten. This increase in area of the zone will effect a reduction of the velocity of the stream of liquid and/or gaseous carbon dioxide without sufficient expansion to cause the formation of appreciable amounts of snow particles. By reason of the fact that the zone is smooth and gradually tapered outwardly, the formation of snow particles is further minimized.

The cylindrical zone 31 is adapted to conduct the stream at its reduced velocity without further expansion to the portion 32 from which it is expanded into the horn. The portion 32 has a relatively slight flare in a downstream direction and is adapted to direct the major portion of the stream forwardly into the horn with a minimum of radial expansion at the point where the stream enters the horn. In this manner, the major portion A of the expanded stream comprising snow particles and gas does not contact the inner side wall of the horn until it has expanded to a value insufficient to direct the snow particles thereof against the inner wall of the horn at a velocity to effect the generation of substantial electrostatic charges due to the collision of snow particles against the horn.

Also, the minor portion B of the stream expanding in a generally radially direction at the closed end of the horn is of such a low value and is directed against the horn at such a reduced velocity that there is no appreciable generation

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of electrostatic charges. Any tendency of the portion of the stream colliding with the horn adjacent its closed end at a velocity to generate electrostatic charges is further minimized by enlarging the cross-sectional area of the horn at this point as compared with existing horns for discharging an equal mass of carbon dioxide at the same rate. This enlargement of the horn enables the portions of the stream which are directed radially to expand and attain a pressure at which snow particles therein will not collide against the horn at velocities to generate appreciable electrostatic charges.

Thus, by reduction of the velocity of the stream before reaching the nozzle, shaping of the stream to minimize radial expansion, and enlargement of the horn adjacent the nozzle, the generation of electrostatic charges is so greatly minimized that the operator of the apparatus is not subjected to objectionable shocks.

In Figure 3, another embodiment of the invention is illustrated wherein initial expansion of the stream to effect a reduction in velocity takes place in the conduit between the container and the horn adjacent the outlet 17 of the container. This may be accomplished by a tubular member or fitting 35 having one end thereof secured to the upstream end of the hose 16 and having its other end threadedly or otherwise connected to the outlet 17. The fitting 35 has a bore in the form of an elongated flared zone 36 of increasing cross-sectional area in the direction of flow which is similar to and serves the purpose of the zone 30 described in connection with the embodiment illustrated in Figure 2.

In place of the member 22 (Figure 2), a tubular member 37 is similarly secured to the horn and to the downstream end of the hose. The member 37 has a nozzle portion 39 corresponding in design and function to the nozzle portion 32 (Figure 2).

In view of the foregoing description, it will be seen that the present invention provides an improved method of and apparatus for discharging carbon dioxide through a snow forming horn without the generation of appreciable electrostatic charges. The apparatus is simple and inexpensive in construction, is readily manufactured and assembled, and once installed effects its intended purpose without further manual supervision or attendance.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

1. In a portable fire extinguisher, apparatus for discharging carbon dioxide stored under pressure, comprising an elongated snow forming discharge horn formed of dielectric material having an open end for directing the snow on the fire and a closed end provided with an orifice for conducting carbon dioxide directly into said horn, a conduit for connecting said orifice to a source of carbon dioxide under pressure, an elongated flared zone in said conduit increasing in cross-sectional area in the direction of flow and constructed and arranged to reduce the velocity of the carbon dioxide without sufficient expansion to cause the formation of appreciable amounts of snow, said orifice being flared and increasing in cross-sectional area in the direction of flow to direct a

longitudinally flowing stream of carbon dioxide into said horn and to prevent rapid radial expansion of the stream, whereby collision with the inner wall of said horn with a force sufficient to effect the generation of substantial electrostatic charges is prevented, the minimum cross-sectional area of said orifice being substantially equal to the maximum cross-sectional area of said flared zone, and a cylindrical zone in said conduit between said flared zone and said orifice and contiguous to said orifice having a bore of substantially uniform cross-sectional area and substantially equal to the minimum cross-sectional area of said orifice.

2. Apparatus according to claim 1, wherein said elongated flared zone is located adjacent the orifice end of said conduit.

3. Apparatus according to claim 1, wherein said elongated flared zone is located adjacent the end of said conduit connected to the source.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,644,338	Jones -----	Oct. 4, 1927
2,031,965	Mapes -----	Feb. 25, 1936
2,062,713	Hill -----	Dec. 1, 1936
2,117,684	Schaaf -----	May 17, 1938
2,206,541	Allen -----	July 2, 1948
2,238,686	Ensminger -----	Apr. 15, 1941

FOREIGN PATENTS

Number	Country	Date
343,926	Great Britain -----	Feb. 25, 1931