July 24, 1934. D. MAPES 1,967,894

FIRE EXTINGUISHING APPARATUS

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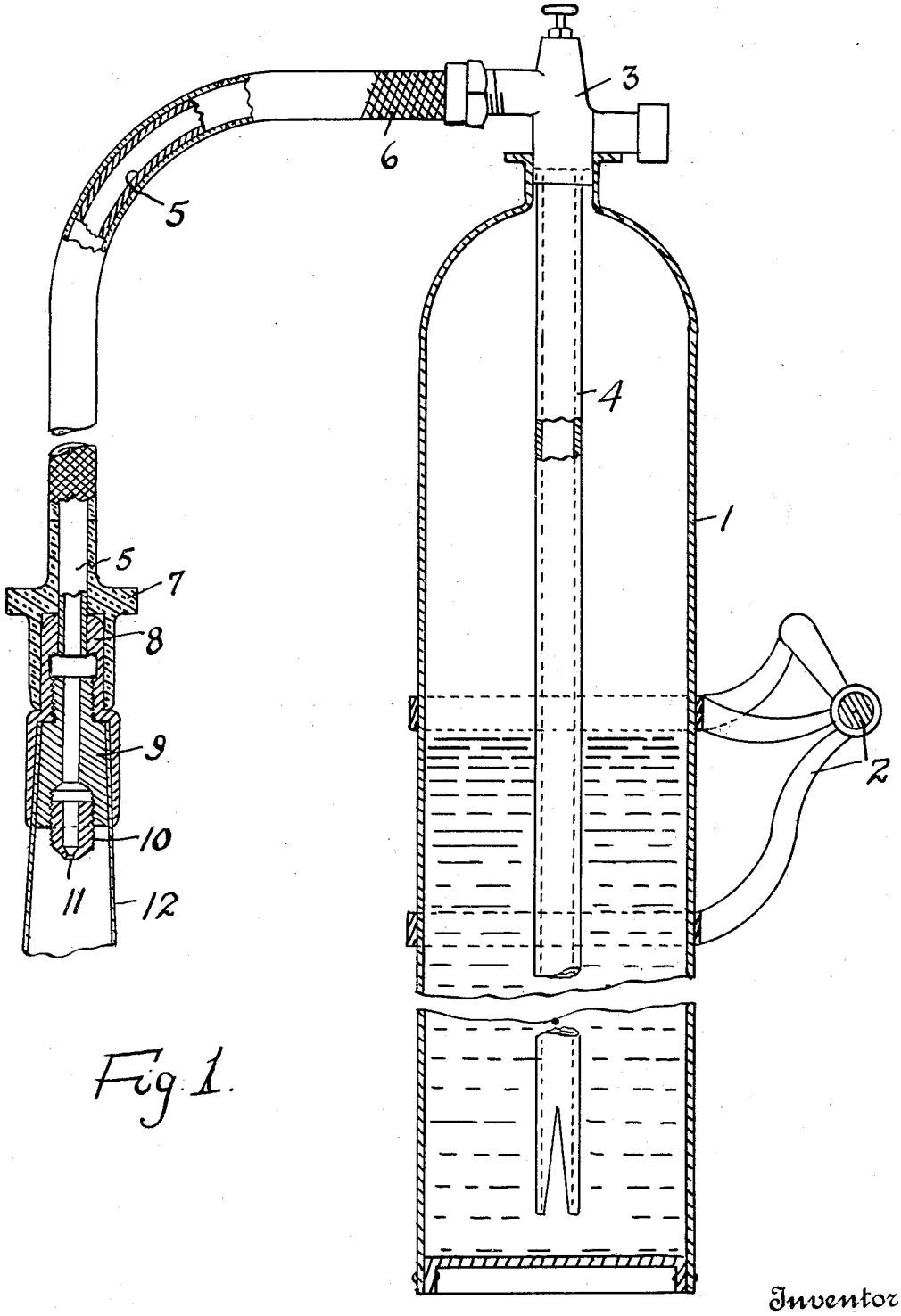


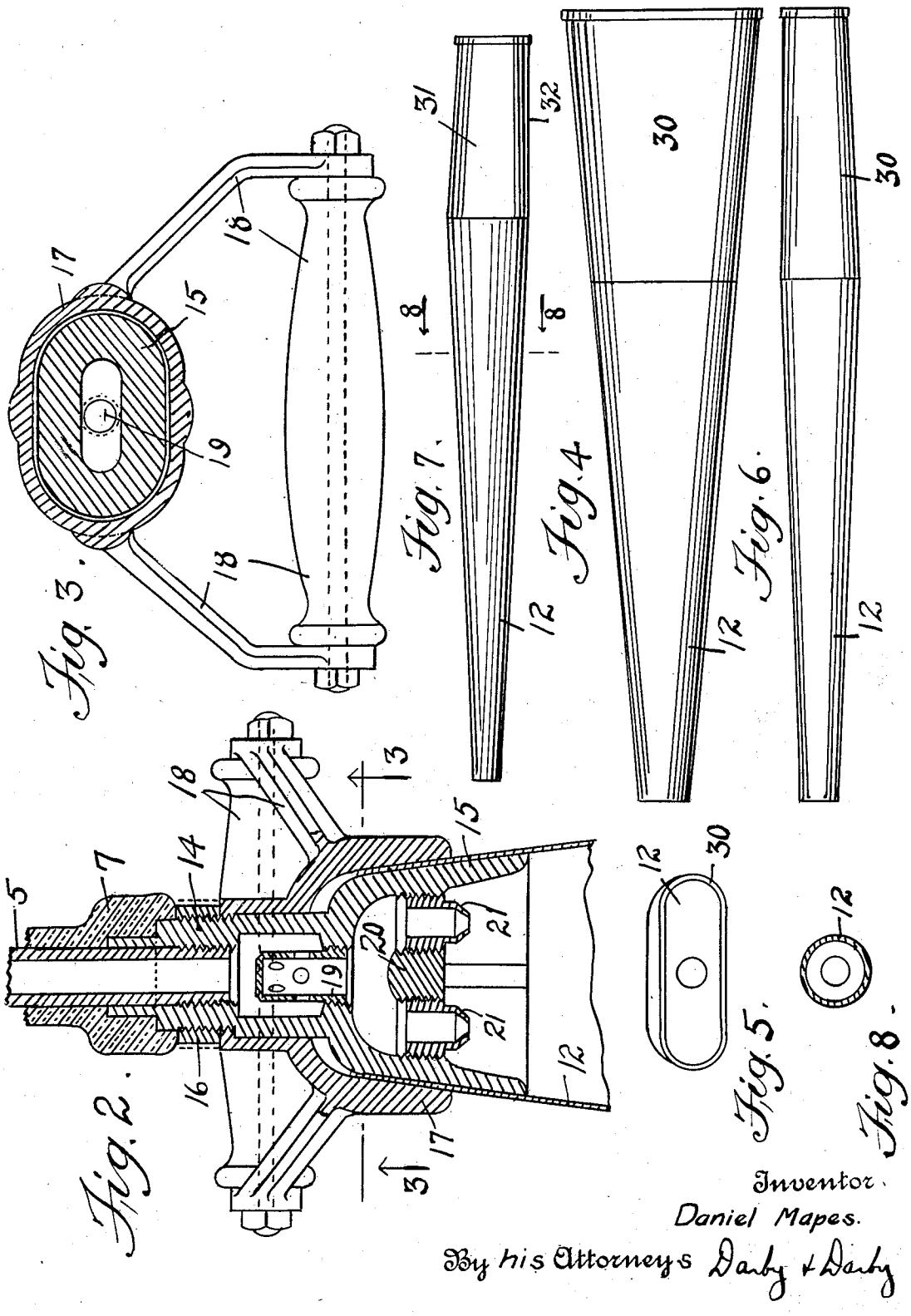
Fig. 1.

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1,967,894

FIRE EXTINGUISHING APPARATUS

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7 Claims. (Cl. 169—11)

This invention relates in general to improvements in fire extinguishing apparatus particularly of the type employing carbon dioxide.

One of the objects of this invention is the provision of an improved and simplified form of carbon dioxide fire extinguishing apparatus which is efficient in operation and not subject to clogging.

Another object of this invention is the provision in apparatus of this type of a nozzle and protecting shield of the proper form and construction to insure uninterrupted and effective operation.

An important object of this invention is to provide a protecting shield for a nozzle in apparatus of this type in which efficient distribution of the carbon dioxide snow formed, from liquid carbon dioxide, is obtained when discharged through a nozzle.

A further object of this invention is the provision of a shield of this type so shaped and proportioned that the snow and gas formed will have sufficient velocity to insure that the snow does not collect near the end of the shield and tend to clog it.

A still further object is to so proportion the shield as to most effectively produce snow and to effect its efficient and complete discharge therefrom without entraining air.

A still further object of this invention is the provision of apparatus employing one or a plurality of liquid discharge nozzles.

These and other objects as will appear from the following disclosure are secured by means of this invention.

This invention resides substantially in the combination, construction, arrangement and relative location of parts all as will be described in greater detail hereinafter.

Referring to the drawings—

Figure 1 is a vertical central cross-sectional view through one form of device embodying the principles of this invention with some parts broken away;

Fig. 2 is an enlarged central cross-sectional view through a modified structure employing a plurality of nozzles;

Fig. 3 is a cross-sectional view taken on the line 3, 3 of Fig. 2 looking in the direction of the arrows;

Figs. 4 and 5 are front and end elevational views of one form of shield or horn employing the principles of this invention;

Fig. 6 is a side elevational view of this horn;

Fig. 7 is a side elevational view of a modified form of horn;

Fig. 8 is a cross-sectional view taken on the line 8, 8 of Fig. 7.

In the present forms of fire extinguishing apparatus employing liquid carbon dioxide which is converted to snow and gas as the fire extinguishing medium, it is usual to surround the nozzle, through which the liquid is discharged to effect transformation into snow and gas, with a shield which extends for some distance beyond the mouth of the nozzle to direct the path of discharge of the snow and gas and to prevent entrainment of air until the snow and gas have considerably slowed down in their speed of movement. The form of shield mostly now used is continuously divergent from the nozzle outwardly and quite often assumes a conical form with a circular cross-section. It has been found in use that such shields have a tendency to clog because the snow at the area where it leaves the end of the shield has slowed down to the point where some of it collects on the inner lower surface of the shield near its mouth.

One of the purposes of this invention is to so form the shield near its end as to prevent too great a reduction in velocity of the snow to insure that it is all discharged from the mouth of the shield.

It is the prime object of this invention to produce snow efficiently, to get broad distribution of the snow and to throw the snow and vapor formed to a distance without impairing the effectiveness of the discharge for fire extinguishing apparatus by dilution of the discharge with entrained air. The first portion of the confining shield or horn is of such configuration that it most effectively produces snow and reduces the velocity of the snow without entraining air. However, to continue this flare sufficiently far out from the nozzle to produce a maximum of snow would cause such a reduction in velocity that the snow would cake and clog the horn. With the construction employed in this invention the proper breadth of the discharge is obtained while efficient production of snow is attained by the proper confinement and length of confinement of the discharge. The horn is further shaped to insure sufficient velocity of the snow so that it is discharged from the end of the horn without collecting at its mouth tending to clog it. In addition, the velocity of the discharge is sufficient to carry the snow and vapor to a considerable distance without it being excessive.

Basically then, the shape of the horn is such as to insure, by restriction of the area thereof at the point of discharge, that the maximum amount of snow is formed along with some vapor and is discharged with a minimum tendency to clog the end of the horn. A better distribution of the discharge is also secured as the area of the discharge end of the horn is proportioned to cause complete filling of the end thereof by the discharge itself.

It has been found that by preventing the entrainment of air an expanding jet of liquid carbon dioxide will produce a considerable quantity of carbon dioxide snow which is extremely effective in extinguishing fires because of its concentrated form which enables a considerable quantity of carbon dioxide gas to spread over any area on which the snow is distributed. The quantity of snow formed depends upon the proper design of horn, length being the principal factor assuming the horn has otherwise been properly designed to prevent the entrainment of air, and when this quantity approaches the maximum quantity which can be produced, the result has heretofore been that the velocity of the jet has been reduced so much that the snow is not all discharged from the end of the horn, nor is that portion which is discharged thrown to a sufficient distance. Therefore, in accordance with the present invention, the outlet end of the horn is somewhat restricted so that sufficient velocity of discharge of all of the snow formed is secured to throw it to the proper distance and keep the mouth of the horn clear.

This invention is, more specifically, an improvement upon the invention set forth in the Minor Patent 1,760,274 and has the prime object of increasing the efficiency and effectiveness of the Minor invention. An expanding jet of liquid carbon dioxide within a shield encounters a reduction in velocity due to the formation of carbon dioxide snow, which, being more dense than the liquid or gaseous form, directly contracts the volume of the mixture which must flow through a given cross-sectional area of the horn so that the velocity is considerably reduced. A further reduction of velocity occurs by reason of the cooling effect of the carbon dioxide snow which produces a further contraction in the volume of the gaseous portion of the mixture which must pass through the area referred to. If, therefore, the design of the horn is such as to produce substantially a maximum quantity of carbon dioxide snow, a still greater reduction in velocity results; this reduction in velocity being greater than would normally be expected by reason of the change in area of the horn. It is on account of this great reduction in velocity that the present invention was developed.

By contracting the end of the flaring horn of Minor several important and useful results are secured. The production of carbon dioxide snow is more efficient and greater quantities are produced from a given discharge jet. The velocity of the snow and gas is at least maintained in the converging portion of the horn to insure effective discharge without clogging. A more effective and wider distribution of the mixture which is discharged from the horn is secured.

Describing the invention in somewhat different terminology, there is a certain optimum length for every horn in accordance with the Minor patent, in accordance with which a maximum amount of carbon dioxide snow can be produced. However, it has not been feasible to employ horns of such optimum length because of the resulting accumulation of snow within the horn. The present invention, providing as it does for maintaining the velocity of discharge, overcomes this difficulty and makes it possible to approximate this ideal length more closely, or quite fully.

The invention will now be described in more detail in connection with the drawings.

As shown in Fig. 1, the device includes a container 1 of well known construction in which carbon dioxide is maintained under sufficient pressure to form a liquid body. This container is provided with brackets and handle 2, by means of which the container can be readily carried about. The end of the container is provided with a discharge valve 3, to which is secured the tube 4 which extends downwardly into the container just short of the bottom thereof so as to be immersed in the liquid. The discharge connection of the valve is attached to a suitable pipe or conduit 5 which of course is best when in flexible form. This pipe is covered with a flexible fabric or rubber casing 6 which terminates in a suitable handle 7 of similar material. The pipe 5 is secured to a nipple 8 which has a passage therethrough and is enlarged to form a thimble at the end as shown. A hollow plug 9 is adapted to threadedly engage with the nipple 8 and to telescope with the thimble portion thereof. The horn or shield 12 is securely held in place between the thimble and the plug. The plug 9 has secured to it a nozzle 10 having a discharge orifice 11. This structure as is clear in the drawings comprises a one nozzle arrangement.

The arrangement of Figures 2 and 3 shows a plurality of discharge nozzles. As before the flexible conduit 5 is enclosed by means of the protecting casing terminating in the handle 7. Conduit 5 connects with a hollow nipple member 14 having a continuation therein in the form of a thimble 15. Fitting over the nipple 14 to telescope with it is a collar-like member flared to form a thimble 17. Mounted on this thimble are the brackets and handle 18. A nut 16 threadedly engages the nipple 14 to hold the member 17 in place. Within the nipple 14 and lying in a chamber formed therein is thimble 19 having a number of openings through the walls thereof. The thimble 15 is provided with a transverse wall 20 in which are mounted a plurality of discharge nozzles 21. As before the horn or shield 12 is gripped between the thimble 15 and the member 17. The structures so far described are particularly useful in connection with apparatus of this type and of course may be used with horns or shields of various constructions.

The horns or shields disclosed in this case are particularly useful in connection with this apparatus and will now be described in greater detail. As shown in Figs. 4, 5 and 6, the horn comprises two portions of different configuration. It may be well to here refer again to the fact that the horns now generally used are circular in cross-section and are in conical form flaring continuously from the small end to the large end. The horn in these figures is substantially of a continuously diverging form from the small end for about ⅔ of its length as shown at 12. The remaining portion 30 of the horn then

converges in two opposing planes towards the free end. In other words, the planes of the upper and lower surface of the portion 30 incline to the central axis of the horn in a direction converging towards the outer end of the horn. As is clear in Fig. 4, the discharge continues to flare outwardly at the sides but is caused to converge towards the central axis with regard to the upper and lower surfaces. By reason of this construction the velocity of discharge of the snow and vapor is maintained or prevented from falling too low so that snow does not collect near the outer end of the horn on its lower inner surface. The portion 12 is kept as uniform as possible in cross-section continuously flaring outwardly and is only varied from this form in so far as it is necessary in order that outer end of the portion 12 may join with the inner end of the portion 30. The form of horn shown in Fig. 7 is substantially the same except that only the upper surface of the portion 31 converges towards the central axis. The lower surface indicated on 32 is horizontal or parallel to the axis of the horn. In this arrangement the portion 12 of the horn is substantially circular as shown in Fig. 8.

At this point it may be well to emphasize that this invention is not limited in the manner of the cross-sectional or longitudinal configuration of the horn since it is considered within the invention to employ horns of any suitable and convenient geometric form. It is also to be noted that the invention is not limited as to the direction in which the restriction of the discharge end of the horn is effected, as for example as shown in the drawings, since restriction in any other direction or in all directions is considered to be within the scope of this invention. Another point to be remembered is that the portion 30 of the horn to get the advantages of this invention does not necessarily decrease in cross-sectional area but may in fact increase in area at a slower rate than if the horn continued to flare at its initial rate, or it may constitute merely the continuance of a given cross-sectional area without further increase such as would accompany continued flaring. Finally there may be an actual decrease in cross-sectional area of the portion 30 of the horn.

From the foregoing disclosure it will be apparent that this invention resides in certain principles of construction and operation which may be embodied in many physical forms without departure therefrom. It is to be understood therefore that the forms shown in the drawings for purposes of illustration have been given solely in an illustrative sense and not in any limiting sense. It is to be understood that the scope of this invention is defined in the appended claims.

What I seek to secure by United States Letters Patent is:

1. A shield of the type described, comprising a portion flaring outwardly in all directions from one end toward the other, and a portion converging on two opposed planes towards the outer end continuing to flare at the other portions.

2. A shield of the type described, comprising a portion flaring outwardly in all directions from one end toward the other, and a second portion converging on the top and bottom surfaces continuing to flare at the sides.

3. A shield of the type described, comprising a portion flaring outwardly in all directions from one end toward the other and a second portion converging on the top thereof while the lower surface is parallel to the central axis of the shield.

4. A shield for carbon dioxide fire extinguishers of the type described, comprising a portion flaring outwardly in all directions from one end toward the other and having a length approximating that required to insure the formation of substantially a maximum amount of carbon dioxide snow, and a contiguous portion tapering inwardly towards the end to insure sufficient velocity of the snow to effect complete discharge thereof from the end of the shield.

5. In a shield for use in connection with carbon dioxide fire extinguishing apparatus, a combination comprising a portion flaring outwardly in all directions from one end toward the other for a distance sufficient to insure the formation of substantially a maximum amount of snow, and a portion contracting within the flare of the first portion in at least one plane towards the outer end and continuing to flare in other planes to insure sufficient velocity of the snow to effect complete discharge thereof from the end of the shield.

6. A protective shield for a stream of carbon dioxide fire extinguishing medium moving at high velocity, comprising a tubular body composed of two distinct portions, one portion increasing in cross-sectional area from one end toward the other to define an expanding path and a contiguous portion changing in cross-sectional area to define a restraining path with respect to the first portion, said shield having a length sufficient to insure the formation of substantially a maximum amount of snow.

7. In a shield for use in connection with carbon dioxide fire extinguishing apparatus, the combination comprising a portion flaring outwardly in all directions from one end toward the other for a distance sufficient to insure the formation of substantially a maximum amount of snow, and a portion contracting within the flare of the first portion on at least one portion of its circumference to insure sufficient velocity of the snow to effect complete discharge thereof from the end of the shield.

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