July 26, 1938. J. C. WOOD 2,125,057

FIRE EXTINGUISHING SYSTEM AND APPARATUS

Filed Nov. 6, 1935 2 Sheets-Sheet 1

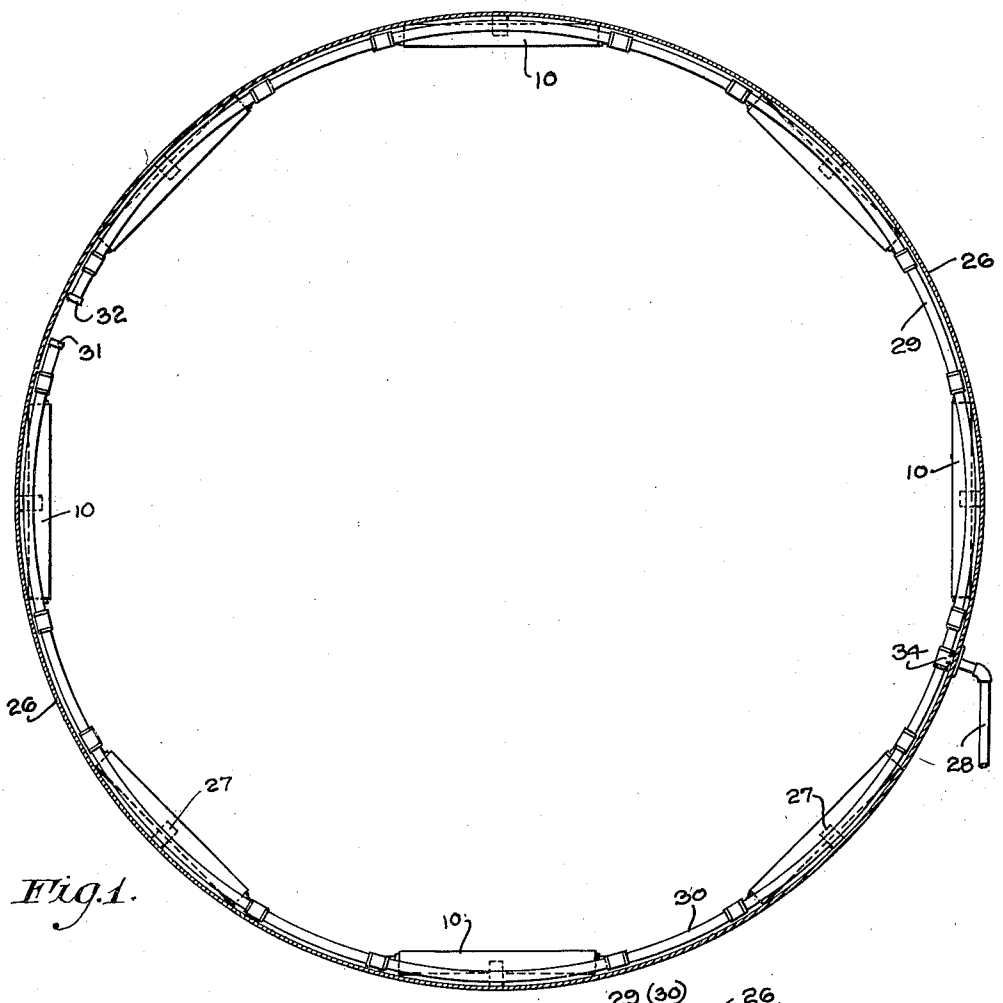


Fig. 1.

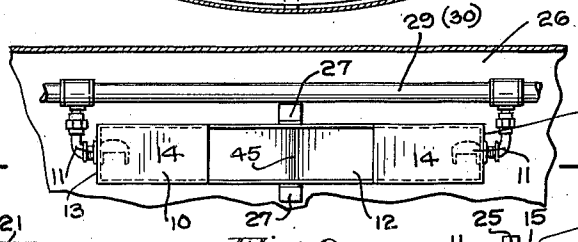


Fig. 2.

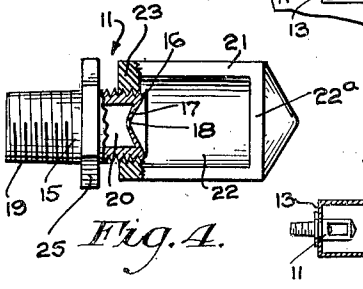


Fig. 4.

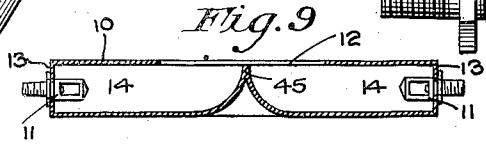


Fig. 3

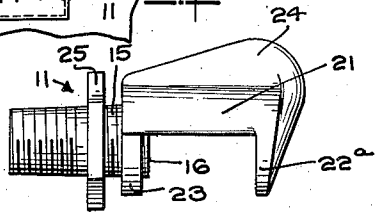


Fig. 5.

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FIRE EXTINGUISHING SYSTEM AND APPARATUS

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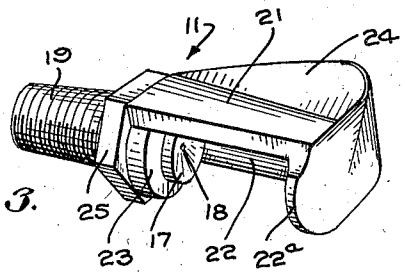


Fig. 3.

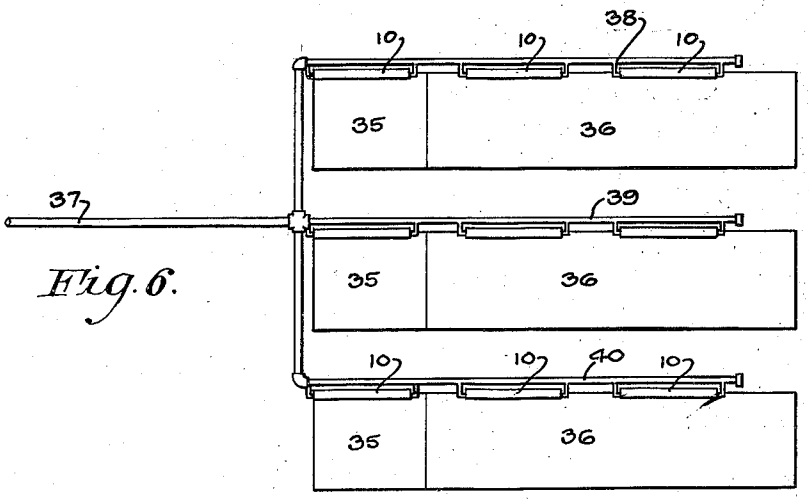


Fig. 6.

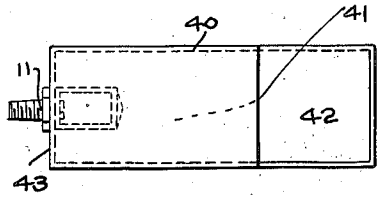


Fig. 7.

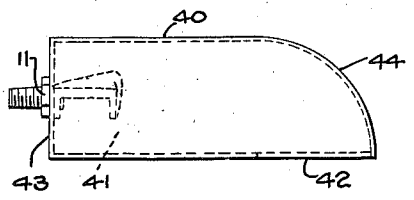


Fig. 8.

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UNITED STATES PATENT OFFICE

2,125,057

FIRE EXTINGUISHING SYSTEM AND APPARATUS

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Application November 6, 1935, Serial No. 48,452

3 Claims. (Cl. 169—11)

This invention relates to an apparatus for and method of extinguishing fires by the use of carbon dioxide or carbonic acid gas, it being among the primary objects of this invention to provide an arrangement whereby the fire extinguishing medium is effectively applied to extinguish the fire under pressure and velocity conditions which have been reduced to substantially irreduceable minimums.

A further object of the invention is to provide a system for introducing the carbon dioxide directly to the fire under such reduced pressure and velocity that the fire is quickly extinguished by a smothering blanket of the carbon dioxide, which latter, as is well known in the art, is non-supporting of combustion.

The use of carbon dioxide gas and snow as a fire extinguishing medium has long been known of in the art and many systems and forms of apparatus have been devised in order to apply it effectively to the fire. There are many combustible materials, however, which upon being ignited, do not lend themselves readily to extinguishment by the ordinary application of carbon dioxide, but, on the contrary, become increasingly hazardous and more difficult to quench as the carbon dioxide is directed upon such flaming material. This condition is frequently obtained where the carbon dioxide is directed upon the fire with such velocity that the burning material is agitated and fanned so that a dangerously explosive mixture results. Particularly is this true where the combustible material is in the form of a powder or is composed of highly volatile liquids, such as naptha, benzine, gasolene, paints, lacquers, etc., because when such material is agitated more or less vigorously, as when a jet of carbon dioxide gas of some considerable velocity is directed upon it, the material is at once agitated or atomized to such degree that not only is its combustibility increased but also there is immediately created the danger of an explosion if the combustion gases are confined.

Also, there are many fires which are confined within such concentrated and inaccessible zones that it has been difficult, through the use of the equipment generally available at present, to adequately and effectively apply the carbon dioxide to such hazards. For example, where the combustible material is confined within a relatively small tank, it has been difficult heretofore to introduce the carbon dioxide into the tank without effecting considerable agitation of the material contained in the tank and so increasing the fire and explosion hazards.

It will be understood, of course, that the carbon dioxide gas is ordinarily supplied from a source under such pressure that it issues from a discharge nozzle with considerable velocity. In an attempt to reduce this velocity, resort has been had, in the so-called portable systems, to the use of a horn or the like. Such an expedient, however, is not practicable to use in stationary systems where the object would be to direct the fire extinguishing medium upon combustible material confined within a small area, because the horn so far increases the range of projection of the carbon dioxide gas that it could not well be used unless it were disposed outside of the fire area, which, in many instances, is not feasible because of lack of space. Moreover, although the use of a horn does considerably reduce the velocity of the carbon dioxide stream, the latter must of necessity retain a certain amount of velocity in order that the horn may function as intended to direct the stream in a desired direction and to a given point.

The present invention relates primarily to the so-called stationary systems and contemplates the provision of an apparatus which functions to reduce the velocity of the carbon dioxide stream to a value substantially approaching zero, this reduction in velocity being effected in the immediate zone of the discharge nozzle. In consequence of this, the discharge nozzle or nozzles of the carbon dioxide fire extinguishing system of the present invention may be located within the confines of the zone to be protected against fire without incurring the danger of "blowing up" the fire upon discharge of the carbon dioxide from its source of supply. In other words, by means of the present invention, the carbon dioxide which is released from the discharge nozzle under considerable velocity is, almost immediately and within an exceedingly short distance from the nozzle, deprived of that velocity so that it is, in effect, breathed upon the burning surface to form a smothering blanket of carbon dioxide gas and/or snow.

Other objects and advantages of the invention will be apparent more fully hereinafter.

The invention consists substantially in the combination, construction, location and relative arrangement of parts, all as will be described in detail in the accompanying specification, as shown in the accompanying drawings, and as finally pointed out in the appended claims.

In the said accompanying drawings, which illustrate certain preferred constructions and embodiments of the apparatus of the present invention:

Figure 1 is a diagrammatic plan view showing the application of the apparatus of the present invention to a tank of the kind ordinarily employed for storing volatile liquids, such as naptha and the like;

Figure 2 is a side elevational view of one of the velocity reducing devices as mounted within the tank adjacent the upper rim thereof;

Figure 3 is a perspective view of the carbon dioxide discharge nozzle and its associated baffle or hood;

Figures 4 and 5 show different views of the discharge nozzle and baffle assembly, Figure 4 being partially sectioned to show the internal construction of the discharge nozzle per se;

Figure 6 is a diagrammatic plan view of an arrangement showing the application of the apparatus of the present invention to a series of dip tanks and associated drain boards such as are used in paint and lacquer establishments;

Figure 7 is a side elevational view of a modified form of velocity reducing device in which only a single discharge nozzle is employed;

Figure 8 is a top plan view of the structure shown in Figure 7; and

Figure 9 is a longitudinal sectional view of the dual type velocity reducing unit taken on the line 9—9 of Figure 2.

Referring now to the drawings and more particularly to Figures 2, 3, 4 and 5 thereof, it will be observed that the apparatus of the present invention which is utilized to reduce the velocity of the carbon dioxide jet to a value substantially approaching zero, that is, to an irreduceable minimum, comprises essentially a box-like chamber 10 fitted at each end thereof with a discharge nozzle and baffle assembly 11. Generally, the box-like chamber 10, which may be termed a diffusion or sublimation chamber, is closed upon all sides thereof except for a substantially rectangular opening 12 provided in one of its side walls, this opening being located centrally between the opposite ends 13—13 of the box. There is thus provided in effect a pair of sublimation chambers 14—14 which are longitudinally spaced apart and which commonly communicate to atmosphere by way of the opening 12 provided in the side wall of the box.

The discharge nozzle 15 is of the type shown in the patent to Camus, No. 726,214, patented April 21, 1903, this type of nozzle being characterized by the fact that its discharge end 16 is in the shape of a reentering cone 17 having relatively sharp cutting edges surrounding the discharge aperture 18. The nozzle is externally threaded, as at 19, and is further internally bored, as at 20, it being understood that the threaded end 19 of the nozzle threadedly engages a suitable conduit (not shown) which is in communication with the source of supply of the carbon dioxide. The opposite extremity 20 of the nozzle is also externally threaded to receive the baffle or hood 21.

This baffle or hood 21, which functions to deflect the jet of carbon dioxide gas as it issues from the discharge nozzle under considerable pressure and velocity, is of the form best shown in Figure 3 wherein it will be observed that it is provided with an integral body 22 of substantially semi-circular cross section, the outer extremity of this body being provided with a deflecting member or plate 22*a* which extends at right angles to and across the longitudinal axis of the discharge nozzle. The opposite extremity of the body 21 of the baffle is provided with an internally threaded boss 23 within which is threaded the discharge end of the discharge noozzle. Preferably, in order to strengthen and reinforce the baffle or hood 21, it is provided with a rib 24 extending longitudinally thereof.

In fitting the nozzle and baffle assembly to each end of the box-like chamber 10, the discharge end of the nozzle is projected through a suitable opening provided therefor in the end wall 13 of the chamber 10, the baffle 21 being then threaded upon the interiorly projecting portion of the nozzle. Preferably, a backing nut 25 is employed to coact with the boss 23 of the baffle to securely clamp therebetween the said end wall 13, the baffle 21 and the nut 25 thereby engaging opposite surfaces of the said end wall 13. Preferably, the baffle 21 is so adjusted angularly with respect to the nozzle that in its finally secured position the mouth of its semi-circular body presents downwardly or upwardly rather than sidewardly. In Figure 2, the baffles 21 are shown with the mouths thereof presenting toward the bottom walls of the diffusion chambers 14—14. By easy manipulation of the nut 25, it will be understood that the nozzle 15 may be adjusted axially toward and away from the deflecting plate 22, thus decreasing or increasing, within certain limits, the distance between the nozzle orifice 18 and the deflecting plate 22*a*. By means of this latter adjustment, the velocity of the carbon dioxide jet as it impinges against the deflecting plate 22*a* may be varied somewhat as circumstances warrant, it being obvious that as the discharge orifice 18 is brought closer to the deflecting plate 22*a*, the jet of carbon dioxide gas which issues from the orifice will impinge against the deflecting plate 22*a* with greater force and will, accordingly, be deflected to a somewhat greater degree than would be the case were the discharge orifice adjusted away from the deflecting plate.

The chambers 14—14 which are respectively provided at opposite ends of the box 10 have been referred to above as diffusion or sublimation chambers. This terminology has been adopted because of the action which is believed to take place within these chambers as the jet of carbon dioxide issues from the discharge orifice 18 and impinges against the deflecting head 22*a* of the baffle 21. As is well known in the art to which this invention pertains, the carbon dioxide may issue from the discharge orifice either in the form of a gas or in the form of a liquid. In either form, the carbon dioxide issues from the discharge orifice under very considerable pressure and velocity and as the jet strikes the deflecting hood or plate 22*a* of the hood 21, it is deflected and directed against the surrounding walls of the chamber 14. This latter chamber serves in the nature of an expansion chamber in consequence of which simultaneously as the carbon dioxide jet is deflected from its original direction (axially of the discharge nozzle), it is permitted to expand and so is converted into snow. The chamber 14 thus tends to become filled with carbon dioxide snow having no appreciable velocity or pressure. Inasmuch as the carbon dioxide continues to issue from the discharge orifice at considerable pressure and velocity so long as the original supply thereof continues in effect, the carbon dioxide snow is continually being displaced from the chambers 14 with the result that it passes out of the box 10 by way of the opening 12. Immediately as the carbon dioxide passes through the opening 12 into the surrounding atmosphere, it is wholly or partially recon-

verted into its gaseous state in which form it functions as a smothering blanket to extinguish any fire, the extent of conversion of the carbon dioxide snow into the gaseous state being dependent upon the temperature of the surrounding atmosphere, as will be well understood by those familiar with this art.

From the foregoing it will be apparent that the carbon dioxide gas issues from the opening 12 of the box 10 with no appreciable pressure or velocity and so in effect floats over the surface of the area which is to be protected against fire. In the device of Figure 2, it will be understood that the sublimation of the carbon dioxide simultaneously occurs in the chambers located at either end of the box 10 with the result that the carbon dioxide snow which is formed in each of the sublimation chambers 14—14 commonly issues from the central opening 12 in the form of a cloud of carbon dioxide gas and/or snow.

Figure 1 illustrates the application of the present invention to provide a system for protecting against fire volatile liquids, such as naptha, gasolene, etc., which may be contained in a tank 26. To protect such a tank, a plurality of the velocity reducing devices 10 are mounted in circumferentially spaced relation upon the internal surface of the tank wall at an elevation above the normal level of the inflammable liquid contained in the tank. The devices 10 are, of course, all mounted so that their respective openings 12 present radially inwardly of the tank. Preferably, each of the devices 10 is permanently and rigidly secured in position by means of supporting brackets 27—27 which are commonly welded to the tank wall and to the devices 10. As appears quite clearly in Figure 1, the carbon dioxide is delivered under considerable pressure and velocity from a suitable source of supply (not shown) by way of a supply conduit 28, this conduit being in communication with a pair of geometrically balanced feed conduits 29 and 30 respectively extending in opposite directions about the circumference of the tank to the points 31 and 32. The feed conduits 29 and 30 are each provided with a plurality of T connections 33 by means of which each of the discharge nozzles 15 is tapped into the said feed conduits 29 and 30. The ends 31 and 32 of these latter conduits being closed, it will be appreciated that the carbon dioxide supply, which is delivered to the tank by the conduit 28, divides at the point 34 (see Figure 1) and is then fed in opposite directions through the feed conduits 29 and 30 with the result that carbon dioxide is commonly discharged from all of the discharge nozzles 11. Inasmuch as the latter nozzles are more or less uniformly spaced about the periphery of the tank 26, a series of clouds of carbon dioxide gas and snow issue from the several devices 10 to form a fire smothering blanket covering the entire surface area of the inflammable liquid.

In the arrangement shown in Figure 6, a plurality of velocity reducing devices 10 are arranged in longitudinally spaced relation along one edge of a paint dip tank 35 and its associated drain board 36. In the particular installation shown, a battery of combined dip tanks and drain boards is employed, each unit of which is similarly protected by a series of devices 10, all of the latter being supplied with carbon dioxide from a source of supply (not shown) by way of the main supply conduit 37 and the branch conduits 38, 39 and 40. The devices 10 are ideal for protecting against fire work units of the type illustrated in Figure 6 inasmuch as the clouds of fire quenching gas issue from the devices under such reduced pressure and velocity as to avoid the danger of fanning any fire which may have started in the dip tank or upon the drain board of the work unit. Moreover, the devices 10 of the present invention insure that the fire quenching gas uniformly blankets every portion of the area which is exposed to the hazard of fire, this in spite of the fact that the devices 10, which handle carbon dioxide having original pressure and velocity of very high order, are installed directly upon the unit to be protected.

Figures 7 and 8 show a somewhat simplified type of velocity reducing device wherein the box-like member 40 is provided with a single sublimation chamber 41 which communicates with atmosphere through the opening 42. In this type unit a single discharge nozzle and baffle assembly is employed, this assembly being mounted upon the end wall 43 of the box 41 in the same manner as heretofore described. In the single type of unit, it is preferable to arcuate the back wall of the box in the vicinity of the opening 42, as at 44, thereby insuring a more uniform issuance of the carbon dioxide cloud from within the sublimation chamber 41. It will be understood, of course, that the single type of pressure and velocity reducing unit shown in Figures 7 and 8 may be substituted for the dual type illustrated in the systems of Figures 1 and 6, although it is preferable to employ the dual type wherever possible because of the greater volume of carbon dioxide gas and snow which is obtained by their use over a given time of discharge.

If desired, the dual unit of the type illustrated in Figure 2 may be provided, in the vicinity of the opening 12 thereof, with an intermediate dividing partition 45 having oppositely curved surfaces 46 which function respectively to direct the gas and/or snow cloud outwardly from each of the sublimation or diffusion chambers 14—14. The partition 45 further serves to prevent any of the pressure-and-velocity-free gas and/or snow from passing from one of the chambers 14—14 into the oppositely disposed chamber and there becoming entrained. By employing the dividing partition 45, the dual unit functions in substantially the same manner as though two of the single units of the type shown in Figures 7 and 8 were disposed in end to end relation. It will be understood, however, that in the use of the dual type unit, the dividing partition 45 is not an indispensable member and it may be eliminated entirely, if desired, without materially affecting the efficiency of operation of the unit.

The invention is, of course, susceptible of various other changes and modifications which may be made from time to time without departing from the real spirit or general principles thereof. For example, the discharge nozzle and baffle assembly, which in the accompanying drawings are shown as separate members removably secured together, may, on occasion, be formed as an integral unit, the effect of which may be readily obtained by providing a discharge nozzle of the aforesaid Camus type with an axially spaced contact head which is so related to the discharge orifice as to interrupt and deflect the jet of carbon dioxide which issues from the orifice under considerable pressure and velocity. And it will be understood further that the invention is not limited to the use of this Camus type nozzle but instead may employ any suitable nozzle which functions to deliver the carbon dioxide in the

form of a jet having considerable velocity and pressure. Moreover, the cross sectional shape of the sublimation box may be varied as desired and instead of its being of the rectangular cross-section shown, it may be of semi-circular or other such cross-sectional shape. The invention is intended to be claimed broadly, as well as specifically, as indicated by the appended claims.

What is claimed as new and useful is:—

1. In a gas velocity and pressure reducing unit, in combination, a discharge nozzle providing for the discharge of a gas in the form of a jet having high velocity and pressure, means operatively associated with the nozzle for disrupting the jet and causing the gas to flow laterally and reversely of the original direction of the jet, said means including a baffle traversing the jet axis and a substantially semi-cylindrical shell coaxial with said axis, said shell being operative to direct the gas deflected by said baffle across the path of the jet as the latter issues from said nozzle.

2. In a device of the character described, in combination, a discharge nozzle for a fire extinguishing gas operative to discharge the medium in the form of a jet having considerable velocity and pressure, and a jet-impinging target operatively associated with the nozzle for deflecting the stream of the discharge gas laterally and reversely of its original direction, said target having operatively associated therewith a baffle extending coaxially of the jet to direct the gas deflected by the target into and across the path of the jet.

3. In a device of the character described, in combination, a discharge nozzle operative to discharge fire extinguishing gas in the form of a jet having considerable velocity and pressure, and a hood in the form of a substantially semi-cylindrical shell operatively associated with the discharge nozzle and extending coaxially of the jet for intercepting said jet in the immediate vicinity of the discharge orifice of the nozzle, said hood being provided with means in the form of a deflector located at the outer extremity of said hood and disposed transversely to the axis of said jet for disrupting the jet and causing the gas to eddy about the initial axis of discharge thereof.

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