The present invention relates to fire extinguishers of the dry carbon dioxide type and the primary object of the invention is to provide such a type of fire extinguisher in which the expense of maintaining the same is decreased and the difficulties heretofore encountered with leakage are materially reduced while at the same time providing a fire extinguisher of such type which may be readily manually manipulated and with which greater maneuverability in use is attained, as well as to provide such a fire extinguisher which will be of materially improved appearance when mounted and installed.

So-called "first-aid" fire extinguishers of the dry carbon dioxide type have been known for many years, and I have previously made improvements in such types of fire extinguishers to provide a form now widely known and successfully used, such as disclosed and described in my United States Patent No. 1,664,338. The fire extinguishers now in commercial use are all of this type or variations of or improvements on the type, and resemble the original fire extinguisher of my United States Patent No. 1,664,338 in having three separate major elements; namely, a cylinder or container for containing the carbon dioxide, with its control valve, which has been varied and improved from time to time in various ways by different manufacturers; a flexible hose; and a nozzle and horn assembly which serves to regulate the flow of carbon dioxide and also to limit the entrainment of air by the issuing stream of carbon dioxide. Some forms of such fire extinguishers have been proposed in relatively small sizes in which the conical horn is attached directly to the cylinder or container, but these have in each instance retained the feature of the manually controlled release valve and a structurally separate gas holding means and discharging means.

A further primary object of my present invention is to provide a fire extinguisher of the above referred to type in which a manually controlled release valve and the structurally separate carbon dioxide holding means and discharging means, are eliminated, and the fire extinguisher is formed by a unitary assembly which includes a structure combining therein the carbon dioxide holding means and discharging means as a unitary assembly in fixed relationship.

With the foregoing primary or general objects, as well as certain other objects, features and results in view which will be readily recognized and understood from the following detailed explanation and description of examples of my invention, the invention consists in certain novel features in design and construction and in combination and arrangement of parts and elements, all as will be more fully referred to and specified hereinafter.

Referring to the accompanying drawings—

Fig. 1 is a vertical, longitudinal, sectional view through a fire extinguisher embodying the features and characteristics of my invention.

Fig. 2 is a vertical, longitudinal, section through a modified form and arrangement of fire extinguisher of my invention of the general type of Fig. 1.

Fig. 3 is a more or less diagrammatic view partly in vertical section, showing a mounting bracket arrangement for mounting and installing a pair of fire extinguishers of the type of my present invention.

Fig. 4 is a vertical, transverse section through the closure and discharge orifice forming unit of a fire extinguisher of my invention, showing a modified mechanism for breaking or fracturing the frangible closure disk of the unit.

Fig. 5 is a vertical, longitudinal section through the discharge and portion of a fire extinguisher of the general type of my invention of Fig. 1, but showing a modified design and construction of discharge orifice forming nozzle or jet member, together with a modified arrangement of frangible disk fracturing or rupturing mechanism.

Fig. 6 is a transverse section taken as on the line 6—6 of Fig. 5, and showing particularly the design and mounting of a spider for slidably mounting the actuating rod for fracturing or rupturing the frangible closure disk of the fire extinguisher.

My present invention will be better understood by reference to Fig. 1 of the accompanying drawings, which illustrates one possible embodiment of my invention by way of an example. It will be understood, however, that my invention consists in combining elements in such a cooperative association and relationship, as to produce a compact, simple apparatus of improved characteristics in the manner claimed, and that the invention is not limited to the precise details of the example herein disclosed and described.

The embodiment of a fire extinguisher of my invention illustrated in Fig. 1 of the drawings, includes the carbon dioxide cylinder I, which may be of any type and method of manufacture known in the art, but which I have chosen to illustrate in the present example as a container made by spinning the ends of a piece of seamless drawn...
steel tubing, because a container formed by such method has a light, uniformly strong wall, with increased metal thickness at the ends, as will be clear by reference to the drawings hereto.

To facilitate standing the fire extinguisher upright on the floor or in a simple flat-bottomed wall bracket, the lower end of the carbon dioxide container 1, is surrounded with a cylindrical sleeve 2, formed of a material of low electrical and thermal conductivity, the sleeve 2 extending downwardly or outwardly a sufficient distance beyond the adjacent end wall of container 1, to serve as a handle, the extinguisher proper, that is to say, the container 1, being of such diameter, as to permit this, say a diameter of preferably three inches or less, although a somewhat larger cylinder diameter may be employed by so shaping the sleeve that it may be readily grasped by the operator.

A similar non-conducting material sleeve 3, is mounted on and over and is attached to the upper or discharge end of the cylinder 1. It is desirable to make this sleeve 3 as long as possible, thereby forming an air entrainment shield and a discharge for conducting the extinguishing gases the greatest possible distance from the operator and as close as possible to the flames of the fire to be extinguished. For outdoor work the discharge horn and air entrainment shield formed by the extension 5 may be as much as several feet in length, but because of limited wall space, and in order to avoid an unwieldy assembly, a shorter length must be accepted for ordinary applications, say a length of nine inches measuring from the discharge end of the gas cylinder 1, in the example of Fig. 1.

In the cylindrical discharge horn and air entrainment shield formed by the sleeve 3, a puncturing or piercing mechanism is provided, embodying, in this instance, two spiders 4a fixed or secured spaced apart in and disposed transversely of the sleeve 3, with a puncturing rod 4 extending axially through the sleeve 3 and being slidably retained in and extending through the spiders 4a. Each spider 4a, referring to Fig. 1, in connection with Fig. 6, comprises a central hub portion 4e and spokes members 4d radiating therefrom and across the interior of the sleeve, with an axial bore through the hub portion 4e for receiving rod 4. The puncturing rod 4 is provided with the pointed inner end 4b, and the outer end of the rod 4 projects beyond the outer end of sleeve 3 and is provided with an actuating knob 6 or non-conducting material. An expansion spring 5 is mounted on the rod 4 between the outer spider 4a and the knob 6, and in normal, expanded condition forces the rod 4 outwardly to and maintains the rod in inactive non-puncturing position, as determined by a stop pin 5a carried by rod 4 between spiders 4a, which pin engages the inner side of the outer spider with the rod in normal inactive position. The rod 4 is elastically inwardly to puncturing position by pressure applied to knob 6 to overcome the force exerted by spring 5.

The carbon dioxide container 1 of the fire extinguisher of Fig. 1, is formed with an internally threaded axial charging and discharging opening 1a, through the end wall around which sleeve 3 is mounted, which opening is closed by means of an assembly 7 threaded into opening 1a, and having an axial discharge passage 1c there-through opening at its inner end through the orifice 1b and increasing in diameter outwardly to discharge through a relatively large diameter opening 1d at the outer side of assembly 7 within the extension formed by sleeve 3. The passage 1c is closed by a frangible disc 1e, removably secured therein by a threaded bushing 1f. The frangible disc 1e is similar to and of a character such as that described in the U. S. patent No. 927,708, which patent shows an assembly suitable for connection to the customary filling connections for refilling the container 1 with carbon dioxide in commercial carbon dioxide plants. I may, however, remove the entire frangible disc assembly 7, and rechage the container 1 of the fire extinguisher, by introducing through the container opening 1a, a suitable charge of a definite weight of crushed or pulverized commercial solid carbon dioxide. After being so charged, the closure assembly is replaced and tightened, and the solid carbon dioxide will thereafter gradually melt and warm to form a normally filled container of liquid carbon dioxide.

As will be noted in my U. S. Patent No. 1,944,338, an orifice is used to control the rate of flow, and in like manner I provide a sharp edged, outwardly flaring construction in the closure assembly 7, which embodies the discharge orifice 7b at the inner end of the outwardly flaring discharge passage 7c, extending through the closure assembly 7. Preferably, the orifice 7b of this example, is .100" in diameter. A siphon tube is indicated in the previous construction in order to insure the discharge of liquid from the container, but which cylinder in the present invention, normally always vertical. A similar siphon tube may be used in my present construction, but I have discovered that such a tube is not necessary in the extinguisher of the example of my invention illustrated in Fig. 1.

In the accompanying drawings hereinafter, because of its small diameter, the straight path of escape offered by the design and arrangement of the assembly 7 thereof, as compared with the tortuous passage through a valve body, and because of the possibility of clearing out stoppages, should there be any, by repeated flows on the opening knob 6, a fire extinguisher embodying the present invention is free from any possibility of a stoppage which would render it inoperative. Further, the small diameter of the extinguisher and the fact that the extinguisher is not held vertical, but is mounted on a moving device, normally always vertical, will minimize the possibility of boiling and agitation of the liquid in the cylinder, with the result that the greater portion of it is ejected from the cylinder, and is effective on the fire. With the older design of the prior art referred to hereinafter, when the siphon tube is omitted, the liquid boils in the cylinder, discharging only gas through the valve, and leaving a mass of useless solid carbon dioxide in the cylinder at the end of the operation. While there may be a residue of useless solid carbon dioxide remaining in the container 1 of an extinguisher of a design of my present invention, I have found that the ineffective portion of the charge remaining in the container 1, is so small that the effectiveness of the extinguisher in extinguishing fires is not impaired as a result thereof.

A handle 8 may be provided on a side of the fire extinguisher of Fig. 1, or in accordance with one preferred construction and arrangement shown in Fig. 2, the functions of the sleeve 2, the handle 8, and the cylindrical discharge extension formed by sleeve 3, are combined in and formed by one continuous sleeve. In this arrangement, referring to Fig. 2, the cylinder may slide loosely into position held by any suitable positioning means such as rivets 3a and...
the removable retaining pin 3b across the end of sleeve portion 2. This makes it possible to slide the entire cylinder or container 1, out of the assembly for refilling or replacement, without moving the other cylinder. Further, the cylinder or container 1 thus becomes a mere filler, which may be returned to the manufacturer for refilling without disturbing the balance of the apparatus. In Fig. 2, I have also illustrated the application of a sharp-edged pin 11a in the end of container 1, against a gasketed seat 15, as in the preceding types of Figs. 1 and 2. The threaded bushing 7e holds a fragile disc 16 against the seat 17, while the orifice restriction 7b is machined into the threaded end of assembly 7, as in preceding examples. A hole is drilled through the fragile disc 16, however, and a wire 18, preferably of bronze, is threaded through it, and through a conical cutting nib 19, this part of the assembly being sweated or soldered to prevent gas leakage. The bronze wire 18 is attached to a thumb ring 20, and it will be obvious that a violent pull on the ring 20 will tear out a patch of the disc 16 and release the contents of the carbon dioxide container 1 of the fire extinguisher.

If desired, an additional link (not shown) may be attached to the wire 18 sufficiently strong to suspend the weight of the extinguisher. The entire extinguisher link may then be hung on a wall by the ring 20, without exerting any strain on the disc 16, but on pulling down with sufficient force to break the suspension link, the disc will at the same time be fractured.

Another and generally preferable form is shown in Fig. 5, in which form the closure assembly 1, is made larger, however, to increase the size of the fragile disc 16, and to leave room in the body of the assembly 7 for the threaded filler piece 21 carrying a sharp-edged orifice 22, preferably patterned after my United States Patent 1,644,398. In place of a wire and cone as in the arrangement of Fig. 4, a round-head machine screw 23 with a knurled nut, is firmly mounted on and soldered to the fragile disc, in such a way that the rod 4 carries operating handle 24 may be threaded directly onto the screw, forming a sturdy and workmanlike operating mechanism, operated by pulling handle 24. Spiders 4a, similar to those disclosed in and described in connection with Figs. 1 and 2 are secured in sleeve 3, for slidably receiving rod 4. These spiders may be formed of a Bakelite core and radiating spokes.

I may vary the exact shape or form of parts, as for example, the discharge sleeve and air entrainment shield 3, of Fig. 1, may be of conical rather than cylindrical shape. I may vary proportions somewhat from the example given in order to vary the time of discharge, and other factors and conditions, without departing from the spirit and scope of my invention. In place of a compression piercing pin, I may use a wire soldered or attached to the disc in such a way that the disc is ruptured by pulling it out instead of pushing it in.

In the preferred forms, the fire extinguisher, in order to carry out the principle of my present invention, by which it may be readily grasped in the hand of an operator for ease of manipulation and efficiency of maneuvering in use, will have an external diameter for the body of the fire extinguisher, that is sleeve 2-3, or of the portion thereof to form the handle, of not to exceed approximately three and one-half (3½)
it is also evident that various other changes, modifications, variations, substitutions and additions may be resorted to without departing from the broad scope of my invention, and hence I do not desire to limit my invention in all respects to the exact and specific disclosures of the examples of my invention disclosed herein.

What I claim is:
1. A carbon dioxide fire extinguisher embodying a substantially cylindrical, elongated body having a substantially unrestricted large diameter discharge opening in one end thereof spaced a distance inwardly from the adjacent open end of the body, said body being of an external diameter not over approximately three and one-half (3 1/2) inches and being of a length not to exceed approximately sixty (60) inches, a valveless puncturable disk closure for the discharge opening of said carbon dioxide container, means for rupturing said disk closure for discharge of carbon dioxide from said container into said body, and the rear end of said container to the open end of the body forming an air entrainment shield for passage of carbon dioxide therethrough and discharge therefrom through the open end of the body.

2. A carbon dioxide fire extinguisher embodying an elongated tubular body having one end thereof open, said body including a container for carbon dioxide therewithin having a discharge opening in the end thereof adjacent the open end of the body, the end of said container having the discharge opening being located within the body spaced a distance inwardly from the body open end, said body being of an external diameter of not over approximately three and one-half (3 1/2) inches, a frangible disk closing the discharge opening of said container, a member mounted within said body for rupturing said disk, means for normally maintaining said member in inactive position out of contact with said disk, and the said member adapted to be moved from normal, inactive position to position engaged with and rupturing said disk.

3. A carbon dioxide fire extinguisher comprising a body providing a carbon dioxide container having a discharge opening therefrom, said body being of an external diameter such that the body can be securely grasped in one hand of an operator, a tubular air entrainment shield mounted in fixed relation to said carbon dioxide container and discharge opening therefrom, said shield being mounted in substantially axial alignment with and in longitudinal extension of said container from and around said discharge opening for discharge of carbon dioxide therethrough from said container discharge opening, a frangible disk closing the discharge opening of said container, and a mechanism located and mounted within said shield for operation to fracture said disk for discharge of carbon dioxide from said container and outwardly through said shield.

4. A carbon dioxide fire extinguisher having a body comprising, in combination, a container for carbon dioxide having a discharge opening from one end thereof, a tubular air entrainment shield mounted in fixed co-axial relation to and in substantial longitudinal extension of said container, said shield at its inner end surrounding the discharge opening of said container and at its outer end providing a substantially unrestricted, large diameter discharge opening therefrom, said body constituting that portion of such external diameter as to be capable of being securely grasped in one hand of an operator, a valveless puncturable disk closing the discharge opening from said container, a puncturing member mounted in and extending axially through said shield, and said puncturing member being adapted for axial movement and being adapted to be forced through said frangible disk to rupture the same and open said container discharge into said shield and to be returned to normal position removed from the disk and unobstructed said discharge opening, said body providing a container for carbon dioxide therewithin having a discharge opening in one end thereof spaced a distance inwardly from the adjacent open end of the body, said body being of an external diameter not over approximately three and one-half (3 1/2) inches and being of a length not to exceed approximately sixty (60) inches, a valveless puncturable disk closure for the discharge opening of said carbon dioxide container, means for rupturing said disk closure for discharge of carbon dioxide from said container into said body, and the rear end of said container to the open end of the body forming an air entrainment shield for passage of carbon dioxide therethrough and discharge therefrom through the open end of the body.

5. A carbon dioxide fire extinguisher having a body comprising, in combination, a container for carbon dioxide, a tubular air entrainment shield mounted in fixed co-axial relation to and extending in substantial longitudinal extension of said container from one end thereof, said body constituting having an external diameter such that the body can be securely grasped in one hand, said container having an opening in the end thereof at said shield, a closure assembly in said opening including a restricted discharge orifice for conduction of said air and said carbon dioxide from said container into said entrainment shield, said entrainment shield formed to provide a straight, non-tortuous outlet passage therefrom from said container discharge orifice to the outer discharge end of said shield, said passage being co-axial with said container and shield, a gasketed puncturable disk for normally closing the discharge orifice from said container to retain the charge of carbon dioxide in the container, said disk adapted to be punctured for opening the orifice for discharge from the container, a puncture pin mounted disposed axially through said shield for axial movement toward and from puncturing engagement with said disk, yielding means normally maintaining said pin in position out of engagement with said disk, and said pin terminating at said outer end of said shield in an electrically non-conducting material.

6. A carbon dioxide fire extinguisher comprising a body comprising, a container for carbon dioxide, a tubular shell of electrical non-conducting material, said container being mounted in said shell in co-axial relation therewith, said shield being of materially greater length than the length of said container and being extended from one end of said container to form a tubular air entrainment shield having a discharge opening therefrom at its outer end, said shield providing a straight non-tortuous carbon dioxide passage therethrough substantially co-axial to said container from one end of said container to the outer end discharge opening of the shield, said shield having an external diameter such that the body of the fire extinguisher can be securely grasped in one hand of an operator, said container being provided with a discharge opening at the inner end thereof for discharging carbon dioxide outwardly through said shield, a disk closing said container discharge opening, and means mounted and substantially enclosed within said shield for operation to puncture said disk, said means being accessible for operation at the outer end of the shield..

7. A carbon dioxide fire extinguisher embodying a tubular shell of electrical non-conducting material, a container mounted in said shell in
co-axial relation therein and being of a length materially less than the length of said shell, said shell being extended beyond one end of said container in axial continuation thereof to form an air entrainment shield having a straight non-tortuous carbon dioxide passage therethrough from the outer end open discharge end of said shield, said shell being of an external diameter such as to enable the shell to be securely grasped in one hand of an operator, said container having a discharge opening in the inner end thereof within the shell for discharge of carbon dioxide therefrom outwardly through said shield, a frangible disk closing said container opening, and means for rupturing said disk.

8. In a carbon dioxide fire extinguisher in which substantially all of the parts of the extinguisher are enclosed within a shell, in combination, a tubular shell having an external diameter such as to enable the extinguisher to be securely grasped in one hand of an operator, a carbon dioxide container provided within said shell in co-axial relation therewith and being of a length less than the length of the shell, said shell extending a distance beyond one end of said container in substantial axial alignment therewith to form an air entrainment shield for passage of carbon dioxide therefrom from the container, the outer end of said shell providing a discharge opening therein for discharge into the inner end of said shield, a frangible disk closing said container discharge opening, and a member mounted in said shield disposed axially thereof for movement between position engaged with said disk to rupture the disk for discharge of carbon dioxide from the container into said shield and position held out of engagement with said disk.

9. In a carbon dioxide fire extinguisher having substantially all of the parts thereof enclosed within a substantially unitary shell, in combination, a tubular shell having an external diameter of not more than approximately three and one-half (3 1/2) inches, a carbon dioxide container provided within said shell in co-axial relation therewith and being of a length materially less than the length of said shell, said shell extending a material distance beyond one end of said container in substantial axial alignment therewith to form an air entrainment shield having a substantially straight, non-tortuous passage for unobstructed discharge of carbon dioxide therethrough from the container, the outer end of said shield being open and providing a substantially unrestricted diameter discharge opening from the shield, the carbon dioxide container being provided with a discharge opening in the end thereof at the inner end of said shield, a valveless puncturable disk closing the discharge opening of said container, a puncture pin mounted in and extending axially through said entrainment shield, spring means normally maintaining said pin out of engagement with said disk, and an actuating knob at the outer end of said pin and protruding from said shield for the application of forces thereto to force said pin inwardly against said spring means into puncturing engagement with said disk.

10. A carbon dioxide fire extinguisher including a carbon dioxide container having a discharge opening, a removable closure for said opening, and discharge means, said extinguisher embodying a substantially cylindrical shell of an external diameter capable of being grasped in the hand of an operator and manipulated to direct the contents thereof toward a fire, said cylindrical shell enclosing and having mounted therein said carbon dioxide container, removable closure and discharge means, and said cylindrical shell forming an extension providing an air entrainment shield for and through which said discharge means discharge the operation of said extinguisher.

CHARLES L. JONES.

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