March 21, 1939. M. BETZLER 2,151,076

DISCHARGE HORN FOR NONCONDUCTING FLUIDS

Filed April 19, 1937

Fig. 1.

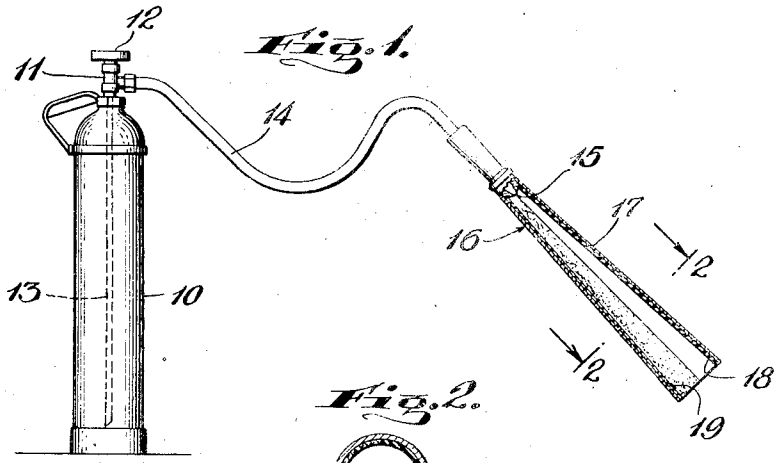


Fig. 2.

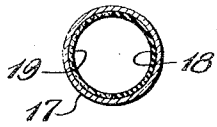


Fig. 3.

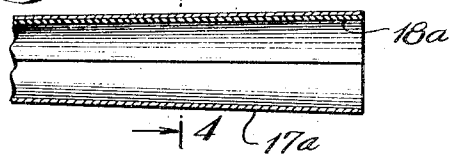


Fig. 4.



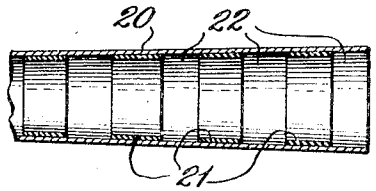
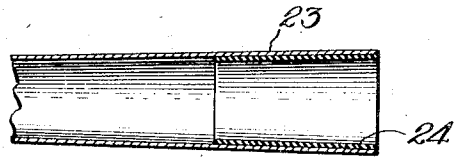


Fig. 5.

Fig. 6.



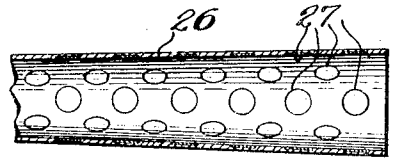


Fig. 7.

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DISCHARGE HORN FOR NONCONDUCTING FLUIDS

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Application April 19, 1937, Serial No. 137,773
In Germany April 20, 1936

16 Claims. (Cl. 169—11)

The present invention relates to discharge apparatus for highly compressed non-conducting fluids and has for an object to provide a method of and means for neutralizing electrical charges generated in a body by friction of an impinging stream of the discharging fluid.

The invention is particularly useful in fire extinguishing apparatus employing highly compressed carbon dioxide as the extinguishing medium. It is the practice to store the carbon dioxide in liquid form in suitable containers, from which the carbon dioxide may be released and directed against a fire by discharging it through a nozzle fitted with a horn. Because of the high pressure under which the carbon dioxide is maintained, it discharges with very high velocity, and the purpose of the horn is to shield the jet of fluid from the surrounding atmosphere until it has expanded to such an extent as to preclude entrainment of any appreciable amount of air. As the liquefied carbon dioxide issues from the nozzle it expands instantly into a gas and a portion of the medium is converted into flakes of carbon dioxide snow. It is found that by reason of the friction between the rapidly discharging carbon dioxide and the horn, the latter becomes charged with static electricity which may reach a tension of 10,000 volts or more. The discharge of such high tension electricity through the human body is not hazardous to life because the current may be considered to have substantially zero wattage. Nevertheless, such discharges produce shocks which are sometimes disagreeable to an operator.

An object of the present invention is to eliminate such troublesome frictional charges of electricity in a discharge horn, baffle or other confining or deflecting member by so constructing said member as to produce charges of opposite polarity which will neutralize each other.

It has been proved by experiment that when carbon dioxide is discharged at high velocity through a horn made of a certain class of materials, such as, metal, leather, vulcanized fiber, etc. a positive charge is produced, while if the horn is made of another class of materials, such as, rubber, collodium, sealing wax, etc. the charge will be negative. It is, therefore, an object of my invention to incorporate material of both classes in the horn in such ratio that the electrical charges will neutralize each other substantially as fast as they are generated.

It is a further object of my invention to provide a discharge horn with an inner surface exposing two non-conducting materials adapted respectively to collect charges of opposite polarity when frictionally acted upon by a non-conducting fluid, and to provide a metallic or other good conducting path between the two materials so that the electric charges may pass readily from the positive to the negative side.

Other objects of my invention will appear in the following description of certain embodiments and thereafter the novelty and scope of the invention will be pointed out in the claims.

In the drawing:

Figure 1 is a view in side elevation of a fire extinguishing apparatus employing liquefied carbon dioxide and equipped with a discharge horn made in accordance with my invention, the horn being shown largely in longitudinal section;

Fig. 2 is a view of the horn in cross-section on a much larger scale, the section being taken on the line 2—2 of Fig. 1;

Fig. 3 is a view in side elevation and largely in longitudinal section of a discharge horn having a different arrangement of friction surfaces;

Fig. 4 is a view of the same in cross-section and on a larger scale, the section being taken on line 4—4 of Fig. 3; and

Figs. 5 to 7 inclusive are views in side elevation and largely in longitudinal section of discharge horns showing other arrangements of friction surfaces.

The apparatus shown in Figure 1 comprises a cylinder 10 adapted to contain a charge of liquefied carbon dioxide. The cylinder is provided with a discharge head 11 controlled by a hand wheel 12, which is operable to release the fluid in the cylinder 10. Liquid carbon dioxide thus released passes from the lower end of the cylinder through the usual syphon tube 13 and out of the discharge head, into a flexible conduit 14. This conduit is provided at its outer end with a discharge nozzle 15 equipped with a discharge horn 16. As the liquid issues from the nozzle it flashes into gas and a large part of the discharging medium is converted into carbon dioxide snow.

As shown more particularly in Fig. 2, the discharge horn comprises an outer body of metal 17 provided on its inner face with a lining divided longitudinally into two parts. One part 18 may be composed of a material, such as, hard rubber, which is electro-negative with respect to the carbon dioxide, while the other part 19 may be formed of leather or vulcanized fiber which is electro-positive with respect to the carbon dioxide gas. In other words, the friction of the high velocity stream of carbon dioxide passing through the horn will produce a negative charge on the

rubber lining and positive charge on the fiber lining. The surface areas are so proportioned that the charges are of substantially the same magnitude, and since they are of opposite polarity they will neutralize each other by a flow of electricity from one part to the other, such flow being facilitated by the metallic outer body **17**.

When a rapidly expanding fluid is used it is not absolutely necessary to provide a metallic discharge path because the refrigerating effect of the expanding fluid develops a film of moisture condensed from the atmosphere, and this film serves as a conductor for the frictional electricity generated.

Instead of providing a lining of two different materials the metal body itself may be exposed to the friction of the discharging fluid so as to build up a positive charge. Thus, in Figs. 3 and 4, I show a horn consisting of a metallic body **17***a* with a coating **18***a* of some electro-negative material, such as caoutchouc lacquer, on substantially half of its inner surface. It is desirable to balance the two surfaces with respect to their electrical reaction to the friction of the fluid stream so that the charges of opposite polarity will be completely neutralized. Although, in the course of manufacture it may not be practicable to obtain a theoretically perfect balance, nevertheless, a slight differential is of no material importance, in view of the relatively short time it takes to empty the cylinder **10**. Actually the charges do not accumulate to any great extent on either surface because the discharge of electricity takes place concurrently with the building up of the charges. Sparking is entirely eliminated because the electricity prefers the easier path from one charged area to the other, rather than to leap through non-conducting air to the operator's hand or to any other grounded object. In other words, there will be a greater voltage drop from one charged area to the other than to the ground.

In Fig. 5, I show a horn **20** which differs from that shown in Figs. 1 and 2 in that the surfaces of opposite electrical reaction are arranged in alternate circumferential stripes or bands. Thus, a metal horn may have stripes of caoutchouc lacquer **21** applied thereto, leaving intermediate stripes **22** of bare metal.

A different design is shown in Fig. 6. In this case, a horn **23** has its inner surface area divided transversely. The outer part may be coated with caoutchouc lacquer, as indicated at **24**, while the inner part **25** is left bare.

In Fig. 7, I show still another form of horn which comprises a metal body **26** with spots **27** of vulcanized rubber or other suitable electro-negative material inlaid therein. The spots **27** may also be applied in the form of lacquer painted on the surface.

In any of the horns shown in Figs. 5, 6 and 7 the surface exposed to the stream of carbon dioxide may be composed of two non-conducting materials, one being electro-positive and the other electro-negative in its reaction to the friction of said stream. Preferably, however, a metallic horn is used and the electro-negative surface is provided by applying a suitable coating thereon.

I have described my invention as applied to the so-called "snow" horns used to shield the discharge of carbon dioxide, but the invention is not limited thereto. Obviously, any dry non-conducting fluid discharging at high velocity in contact with a deflecting or confining surface will generate charges of static electricity, and it is within the scope of my invention to form such a surface of balanced areas adapted to react in one case electro-positively and in the other electro-negatively to the friction of said fluid, so that the electrical effects will neutralize each other. The term "fluid" is not to be limited to gases or liquids but is intended to include solids in more or less comminuted form.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is as follows:

1. The method of neutralizing a charge of electricity generated in a device by friction of a high velocity stream of electrically non-conducting fluid, which consists in using said stream to generate an electrical charge of substantially the same magnitude as the first named charge but of opposite polarity, and providing a path of electrical conductivity interconnecting said charges.

2. The method of neutralizing a charge of electricity generated in a device by friction of a high velocity stream of electrically non-conducting fluid, which consists in exposing to frictional contact with said stream a body in electrical communication with said device, said body being composed of a material adapted to generate by friction of said stream an electric charge of a potential substantially as great as that generated in said device but of opposite polarity.

3. The method of neutralizing a charge of electricity generated in a device by friction of a high velocity stream of electrically non-conducting fluid, which consists in exposing to frictional contact with said stream a body adapted to generate by friction of said stream an electric charge of a potential substantially as great as that generated in said device but of opposite polarity, and providing a path of electrical conductivity between said device and said body.

4. In combination with a discharge nozzle for highly compressed electrically non-conducting fluid, a device adapted to confine, at least in part, a stream of said fluid issuing from the nozzle, said device comprising a wall formed of two electrically intercommunicating materials, one material being electro-positive and the other electro-negative in its reaction to friction of said stream, said materials exposing separate surface areas to the stream and said areas being proportioned to generate electric charges of substantially equal magnitude.

5. In combination with a discharge nozzle for highly compressed, electrically non-conducting fluid, a device adapted to confine, at least in part, a stream of said fluid issuing from the nozzle, said device comprising a wall formed of two materials, one material being electro-positive and the other electro-negative in its reaction to friction of said stream, said materials exposing separate surface areas to the stream and said areas being proportioned to generate electric charges of substantially equal magnitude, one of said materials being a conductor of electricity.

6. In combination with a discharge nozzle for highly compressed, electrically non-conducting fluid, a device adapted to confine, at least in part, a stream of said fluid issuing from the nozzle, said device comprising a wall formed of two materials, one material being electro-positive and the other electro-negative in its reaction to friction of said stream, said materials exposing separate surface areas to the stream and said areas being proportioned to generate electric charges of substantially equal magnitude, both of said materials be-

ing non-conductors of electricity, and a conductor connecting said materials.

7. In combination with a discharge nozzle for highly compressed, electrically non-conducting fluid, a device adapted to confine, at least in part, a stream of said fluid issuing from the nozzle, said device comprising a wall formed of two materials, one material being electro-positive and the other electro-negative in its reaction to friction of said stream, said materials exposing separate surface areas to the stream and said areas being proportioned to generate electric charges of substantially equal magnitude, both of said materials being non-conductors of electricity, and a metallic backing for said materials providing a path of electrical discharge therebetween.

8. In combination with a discharge nozzle for liquefied carbon dioxide, a device adapted to confine, at least in part, a stream of carbon dioxide issuing from the nozzle, said device comprising a wall exposing two surface areas to friction of said stream, one being formed of a material of the class consisting of metal, leather and vulcanized fiber and the other area being formed of the material of the class consisting of hard-rubber, collodium, sealing wax, and caoutchouc lacquer, said areas being proportioned to generate electric charges of substantially equal magnitude, said materials being in electrical intercommunication.

9. A discharge horn for a high velocity, rapidly expanding electrically non-conducting fluid, said horn being formed of two materials exposed to friction of said fluid and in electrical intercommunication, one material being electro-positive and the other electro-negative in its reaction to friction of the stream of said fluid discharging through the horn, said materials being relatively proportioned to generate electric charges of substantially equal but opposite magnitude.

10. A discharge horn for shielding the discharge to atmosphere of liquefied carbon dioxide, said horn being formed interiorly, at least, of two electrically intercommunicating materials, one material being electro-positive and the other electro-negative in its reaction to friction of the stream of carbon dioxide discharging through the horn, said materials exposing separate surface areas to the stream, and said areas being proportioned to generate electric charges of substantially equal but opposite magnitude.

11. A discharge horn for shielding the discharge to atmosphere of liquefied carbon dioxide, said horn being formed interiorly of two electrically non-conducting materials, one material being electro-positive and the other electro-negative in its reaction to friction of said stream, said areas being proportioned to generate electric charges of substantially equal but opposite magnitude, and a metallic backing for said materials providing a path of electrical discharge therebetween.

12. A discharge horn for shielding the discharge to atmosphere of liquefied carbon dioxide, said horn consisting of a metallic body, and a coating covering part of the inner surface of the horn, the rest of said surface being bare, said coating consisting of a material adapted to generate a negative charge of electricity by friction of the discharging stream of carbon dioxide, the areas of the coating and the bare metal exposed to the stream being so relatively proportioned as to generate electric charges of substantially equal but opposite magnitude.

13. A discharge horn for shielding the discharge to atmosphere of liquefied carbon dioxide, said horn being constructed to expose two surface areas to friction of the stream of discharging carbon dioxide, one area being formed of a material of the class consisting of metal, leather and vulcanized fiber, and the other area formed of a material of the class consisting of hard rubber, collodium, sealing wax, and caoutchouc lacquer, said areas being proportioned to generate electric charges of substantially equal magnitude, said materials being in electrical intercommunication.

14. The method of controlling electric charges on a conduit carrying a high velocity stream of electrically non-conducting fluid, which consists in exposing to said stream non-conducting electrically connected conduit surface areas of such substances and proportion as to produce charges of opposite polarities and equal magnitude.

15. The method of controlling electric charges on a conduit carrying a high velocity stream of electrically non-conducting fluid, which consists in exposing to said stream electrically connected conduit surface areas of such substances and proportion as to produce charges of opposite polarities and equal magnitude.

16. The method of controlling electric charges produced by a high velocity stream of electrically non-conducting fluid on a conduit which consists in electrically associating substances generating by contact of said stream electric charges of opposite polarities and equal magnitude.

MARTIN BETZLER.