DRY POWDER FIRE EXTINGUISHER NOZZLE

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This invention relates to fire extinguishing apparatus and particularly to a nozzle suitable to control the flow of a dry powder extinguishing agent.

It is important in a nozzle of this type that it allow the free flow of the extinguishing powder. Further, the nozzle should be so arranged as to be self-cleaning during the discharge. In addition, the dry powder extinguishing agent or powder should be expelled with sufficient force or velocity to reach a fire in an inaccessible location while the operator remains a safe distance from the fire. In obtaining sufficient projection distance of the powder, it is important that its velocity be such that a negligible amount of air will be entrained. An excess of air is disadvantageous in that it accelerates the combustion of the fire and nullifies the action of the extinguishing agent.

Prior constructions have been made in which the discharging stream is impinged against the inner surface of the outlet and then redirected outwardly in a stream. These constructions have not been wholly satisfactory as the issuing stream generally has too thin a cross-sectional shape at the edges which is misleading in appearance in that the edges of the stream are of no practical fire fighting effectiveness.

In another construction a shield has been used to prevent the entrainment of air by the issuing stream of powder and expelling agent until the stream has expanded and has been reduced in velocity by the surrounding atmosphere until its velocity has been decreased so that the entrainment of air is negligible. By reason of the comparatively large size of the horn, such a construction is unwieldy and presents difficulty in the transportation of the extinguisher as well as in its use in inaccessible locations.

The invention aims to overcome the difficulties and disadvantages of prior constructions in providing a nozzle for a dry powder fire extinguisher to discharge a stream with improved characteristics.

Another object of the invention is to provide a dry powder nozzle with a good projection characteristic without the entrainment of an appreciable amount of air.

Another object of the invention is to provide a dry powder nozzle which is simple and economical in manufacture, efficient in operation and durable in use.

In accordance with the invention, the foregoing objects are accomplished by providing a dry powder nozzle having a discharge outlet causing a turbulence therein of an issuing stream to reduce its velocity and for increasing its cross-sectional area. Preferably, a construction is utilized in which an inverted orifice cone is placed in an enlarged portion of the outlet so that the velocity of the issuing stream is reduced by turbulence while its cross-sectional area is increased and a discharge stream of the desired configuration is produced by the impingement together of streams issuing from the orifices.

A construction in accordance with the invention is advantageous in that a nozzle of ample capacity may be made of comparatively small size for ease in storage and use. Other objects and advantages of the invention will be apparent from the following description and from the accompanying drawings which show, by way of example, an embodiment of the invention.

In the drawings:

Figure 1 is a perspective view of a dry powder fire extinguisher equipped with a nozzle constructed in accordance with the invention.

Figure 2 is an enlarged side view of the nozzle in accordance with the invention in an assembly with a shut-off valve.

Figure 3 is a vertical sectional view of the nozzle shown in Figure 2.

Figure 4 is a top view of the nozzle shown in Figure 2.

Figure 5 is an end view of the nozzle shown in Figure 2.

Figure 6 is an enlarged sectional view of the diffuser for the nozzle.

Referring to the drawings there is shown a fire extinguisher 1 having a hose line 2 terminating in a nozzle 3 in accordance with the invention. The extinguishing container may be of the usual type retaining therein a charge of dry powder together with a charge of compressed gas which may be released to expel the powder by inverting the extinguisher and striking the top thereof against a surface, such as the ground. The powder is expelled by the gas charge through the hose 2 and may be intermittently discharged from the nozzle 3 as desired.

The nozzle 3 comprises a casing 4 having a horizontally extending inlet passage 5, an inclined valve chamber 6 and a discharge outlet passage 7 enlarged at its outer end to receive a baffle or diffuser member 8. A cylindrical valve member 9 is reciprocable in the valve chamber 6 to close the outlet passage 7 and is actuated by means of a squeeze grip type operating handle 10 pivotally carried by the housing and normally urged into the closed position by resilient means, such as the spring 11.

The nozzle casing 4 may be made of any suitable material, such as metal or plastic and has an enlarged portion 12 at the end of its inlet passage formed with a threaded inner surface 14 for connection to the hose 2. The other end of the inlet passage 5 is turned upwardly as indicated at 15 to intersect the valve chamber 6 which is formed with its lower end sloping toward the discharge passage 7 so as to cooperate with the inlet passage 5 to provide a free flow passage for the powder. It is preferred that the valve chamber have a somewhat enlarged portion as indicated at 16 so as to facilitate the flow of the powder about the valve member 9 when the valve is in the open position. The valve member 9 is cylindrical in shape and has its lower end 17 bevelled as indicated at 19 to guide its entrance into the lower portion of the chamber 6 defined by wall 20 as the valve is opened and closed. Upper end 21 of the valve member 9 is made of a diameter such that it closely fits the wall of the chamber 6 with small clearance, so that a seal is formed by the packing of small particles of powder in the clearance space between the valve member and the wall. The outer end of the valve member 9 is formed with an annular reduced portion 22 for engagement with U-shaped end 24 of the grip handle 10.

The casing 4 is apertured and fitted with a pin 26 for the pivotal mounting of the grip handle 10. The casing also has an upwardly and forwardly extending projection 27 adapted to maintain in position the lower end of the spring 11.

The grip handle 10 is generally of channel cross-section and has its valve engaging end turned downwardly and inwardly, it being slotted as indicated at 29 to receive the reduced portion 25 of the valve operating member 9.

The lower surface of the grip handle 10 has a downwardly and rearwardly extending portion 30 oppositely positioned...
to the projection 27 of the casing 4 so as to provide means for the engagement of the ends of the spring 11 therebetween. The outer end 31 of the grip handle 10 is given a hand-conforming shape so that the nozzle may be readily carried by engaging the fingers about the valve casing 4, the valve being operated by squeezing the grip handle 10 with the palm of the same hand.

The construction of the nozzle thus far described has been shown and claimed in a co-pending application of Frank B. Allen and Norman H. Siebens, Serial No. 74,355, filed February 3, 1949, and titled "Nozzle For Powder Fire Extinguisher," now abandoned.

In general, the invention, the baffles or diffuser member 8 may be made of any suitable material such as metal or plastic and may be fabricated by die casting or other conventional construction. The baffle or diffusion member 8 has a conical end 34 adapted to be inserted in an enlarged outer portion 35 of the outlet passage 7. Base end 36 of the diffusion member 8 is turned outward. An annular groove 37 is made about the baffle member to receive the inner end of a set screw 39 threadedly engaged in the outer end of the nozzle housing 4 to secure the baffle or diffuser member 8 in position. The outer surface 40 of the conical end 34 (facing inwardly into the nozzle) is formed with an angle approximately 60° while the inner surface 41 is formed at an angle of approximately 45°. A pair of oppositely positioned orifices 44 and 45 are formed on the wall of the tubular member, the axes of the orifices being perpendicular to the outer surface 40. The orifices 44 and 45 are positioned downwardly on the wall of the diffusion member so that the forward edges 46 and 47 of the orifices provide smooth surfaces with wall 49 of the recess 37 so as to provide free flow of the powder without making a dead pocket. The total area of the orifices 44 and 45 is slightly greater than the area of the passage 7 so as to take care of the volume of the slightly expanded fluid stream in the enlarged portion of the orifice. In some cases it may be desirable to make each orifice at least of the same diameter or greater than the passage 7 so as to prevent any clogging of the orifice by any particle which may pass through the passage 7. It should be noted that the angle of impingement of the flow through the orifices 44 and 45 is such as to provide a forward component to the issuing stream.

The enlarged outer portion 35 of the outlet passage 7 is enlarged to receive the baffle or diffusion member 8 and to provide for an expansion of the discharge stream. The expansion chamber functions in conjunction with the conical tip of the diffusion member 8 to give a distorted path to the fluid stream prior to its entering the orifices 44 and 45 resulting in an energy dissipation both in expansion and in frictional loss. Generally speaking the diameter of the expansion chamber 35 is approximately double the diameter of the passage 7 and the length of the expansion chamber 35 should be approximately slightly smaller than its diameter. If the conical tip 34 of the diffusion member 8 is too far away from the outlet passage 7 the fluid flow will streamline itself rather than be baffled, that is, if the spacing is too great, a gradual sweep is made by the discharging stream without achieving a baffled effect. In making the baffle or diffusion member 8, its outer surface 40 is formed with an angle of approximately 60° to open up the angle of approach to the flow stream while its inner surface 40 is formed at an angle of approximately 45° to limit the fan or spread of the discharge to a suitable amount satisfactory for fire extinguishing purposes. In the event that an appreciable angular spread were provided, for example, an angle of 60°, the spread of the discharge stream would be too wide and too thin, the narrower or 45° angular surface causing the discharge to be thickened and narrowed resulting in a more suitable fire extinguishing stream with a satisfactory throw or carrying capacity. In the diffusion member 8 it should be noticed that the edges 46 and 47 of the orifices 44 and 45 are thicker than edges 50 and 51 of the orifices towards the conical end 34. The purpose of this construction is to practically prevent a streamline flow through the orifices 44 and 45 as may be seen in Figure 5 the edges 50 and 51 of the orifices 44 and 45 are discernible to permit a slight amount of through flow which adds to the carrying quality of the issuing stream.

The nozzle is operated by depressing the squeeze handle 10 to raise the valve member 9 in the valve chamber 6 and permit the flow of the stream of dry powder and its expelling gas past the lower end 17 of the valve member through passage 7 into the enlarged portion 35 where a slight expansion and turbulence takes place. The issuing stream then flows through the orifices 44 and 45 to angularly impinge against each other, the resulting forward movement causing the stream to issue from the end of the diffusion member, the conical surface 41 limiting the spread of the flow. The result of the effect of the diffusion member in directing and limiting the stream may be observed by a slight polishing action which takes place on the sides on the inner surface of the diffusion member 8 intermediate the orifice 45 at a location approximately indicated by the numeral 52.

While the invention has been described and illustrated with reference to a specific embodiment thereof, it will be understood that other embodiments may be resorted to without departing from the invention. Therefore, the form of the invention set out above should be considered as illustrative and not as limiting the scope of the following claims.

1. A nozzle for a dry powder fire extinguisher for reducing discharge velocity and for providing a discharge pattern of desired cross sectional shape comprising a housing having an expansion chamber, inlet and outlet means for the expansion chamber, the inlet of lesser diameter than the outlet, and a diffusion member closing the outlet, the diffusion member of conical shape with its apex turned inwardly into the expansion chamber and having a pair of oppositely opposed orifices in its conical wall, the outer end of the nozzle defined by the base of the conical-shaped diffusion member.

2. A nozzle for a dry powder fire extinguisher for reducing discharge velocity and for providing a discharge pattern of desired cross sectional shape comprising a housing having an expansion chamber, inlet and outlet means for the expansion chamber, the inlet of lesser diameter than the outlet, and a diffusion member closing the outlet, the diffusion member of conical shape with its apex turned inwardly into the expansion chamber and having a pair of oppositely opposed orifices in its conical wall, the outer end of the nozzle defined by the base of the conical-shaped diffusion member.

3. A nozzle for a dry powder fire extinguisher for reducing discharge velocity and for providing a discharge pattern of desired cross sectional shape comprising a housing having an expansion chamber, inlet and outlet means for the expansion chamber, the inlet of lesser diameter than the outlet, and a diffusion member closing the outlet, the diffusion member of conical shape with its apex turned inwardly into the expansion chamber and having a pair of oppositely opposed orifices in its conical wall, the outer end of the nozzle defined by the base of the conical-shaped diffusion member.
housing having an expansion chamber, inlet and outlet means for the expansion chamber, the inlet of lesser diameter than the outlet, and a diffusion member closing the outlet, the diffusion member of conical shape with its apex turned inwardly into the expansion chamber and having a pair of angularly oppositely positioned orifices in its conical wall, the thickness of the conical wall being such with respect to the angular position and diameter of the nozzle that axial flow is almost wholly restricted, the outer end of the nozzle defined by the base of the conical-shaped diffusion member.

5. A nozzle for a dry powder fire extinguisher for reducing discharge velocity and for providing a discharge pattern of desired cross sectional shape comprising a housing having an expansion chamber, inlet and outlet means for the expansion chamber, the inlet of lesser diameter than the outlet, and a diffusion member closing the outlet, the diffusion member of conical shape with its apex turned inwardly into the expansion chamber and having a pair of angularly oppositely positioned orifices in its conical wall, the surface of the conical member facing the expansion chamber forming an angle of approximately sixty degrees, the surface of the conical member facing outwardly from the nozzle forming an angle of approximately forty-five degrees, the total area of the orifices being at least as large as the area of the inlet, the outer end of the nozzle defined by the base of the conical-shaped diffusion member.

7. A nozzle for a dry powder fire extinguisher for reducing discharge velocity and for providing a discharge pattern of desired cross sectional shape comprising a housing having an expansion chamber, inlet and outlet means for the expansion chamber, the inlet of lesser diameter than the outlet, and a diffusion member closing the outlet, the diffusion member of conical shape with its apex turned inwardly into the expansion chamber and having a pair of angularly oppositely positioned orifices in its conical wall, the surface of the conical member facing the expansion chamber forming an angle of approximately sixty degrees, the surface of the conical member facing outwardly from the nozzle forming an angle of approximately forty-five degrees, the total area of the orifices being at least as large as the area of the inlet, the orifices positioned with their axes approximately perpendicular to the exterior wall of the conical member, the outer end of the nozzle defined by the base of the conical-shaped diffusion member.

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