Nov. 3, 1936. S. E. ALLEN 2,059,190

FIRE EXTINGUISHING SYSTEM

Filed Dec. 22, 1934

Fig. 1

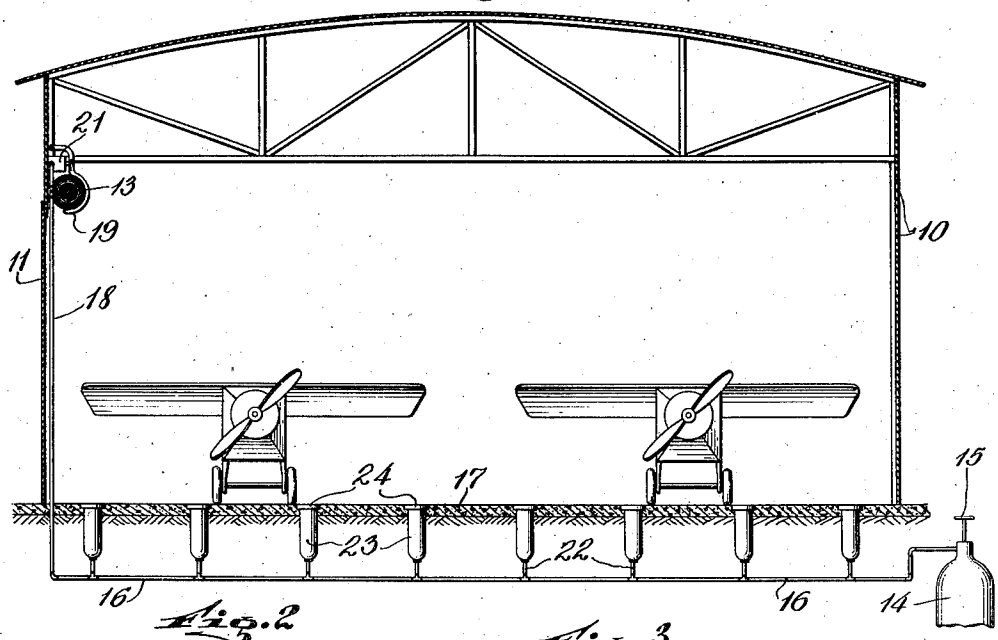


Fig. 2

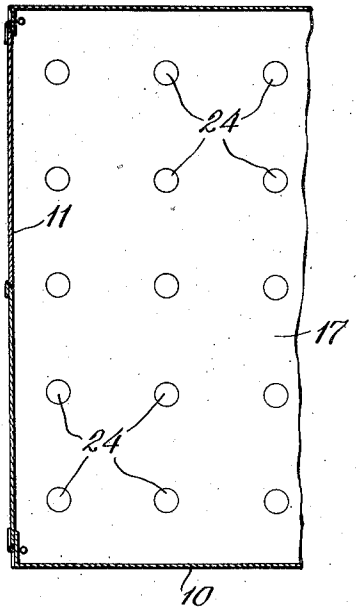


Fig. 3

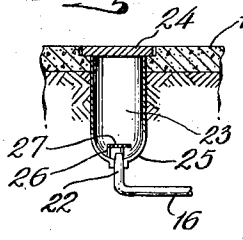


Fig. 4

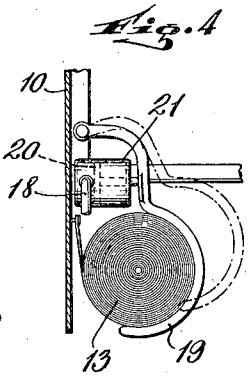
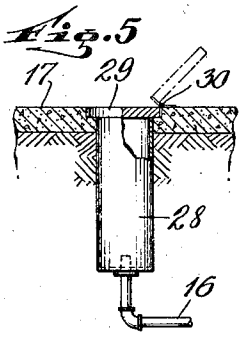


Fig. 5



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FIRE EXTINGUISHING SYSTEM

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Application December 22, 1934, Serial No. 758,819

15 Claims. (Cl. 169—11)

The present application is a continuation in part of my copending application, Serial No. 607,062, filed April 23, 1932.

My invention relates to fire extinguishing systems in which carbon dioxide or other highly compressed fluid extinguisher is employed.

A specific object of the invention is to provide a fixed installation of a novel form by which the extinguisher is distributed over a large area and is initially expanded before being discharged into the region of the fire.

Another object is to provide a system wherein the natural draft caused by the fire is utilized to carry the extinguishing fluid to the fire. The extinguisher in the form of a gas thus replaces the air which is normally sucked into the fire and the latter being thus deprived of oxygen is smothered.

A more specific object of the invention is to provide a fire extinguishing system particularly adapted for the protection of airplane and airship hangars. Owing to the highly combustible nature of the materials of which aircraft are usually built, it is essential that the fire be extinguished immediately. In the case of airplanes, for instance, the wings, fuselage, rudders, elevators, etc., are often made merely of wood covered with linen, silk, cotton fabric or the like treated with lacquer to present a smooth surface to the air currents, and for protecting such highly combustible material distributed about a hangar which in some cases is very large, the ordinary fire extinguishing systems are entirely inadequate. It is impracticable to attempt to protect the aircraft by discharge of fire extinguishing fluid from the walls of the hangar since such protection could not be extended more than a few feet from the walls. On the other hand, if the fire extinguishing fluid were discharged from the rafters or ceiling of the building it would have to oppose the air currents set up by the fire and before sufficient of the extinguisher could be introduced in the hangar to smother out the flames, the damage would have been accomplished.

In the case of an airplane afire, the blaze may be shielded by the wings so that a gaseous extinguisher discharged from above would not reach the blaze and would not prevent the latter from being fed with air sucked up by the fire. Since the air currents usually rise to the fire, it is preferable to discharge the extinguisher from beneath so that the natural draft produced by the fire will aid in drawing the gas into the blaze.

An object of my invention, therefore, is to provide a system employing carbon dioxide or other highly compressed extinguishing fluid in which the fluid is discharged in the form of a gas from outlets in the floor of the hangar.

Another object of the invention is to provide the discharge outlets with expansion chambers which will cut down the velocity of the fluid discharged so that the fluid will be carried into the fire not so much by its own velocity as by the currents produced by the fire.

Another object of the invention is to proportion the discharge outlets to the probable height at which the fire might occur so that the jets of fluid will be carried by their own velocity to a zone near enough to the fire to be drawn thereinto by suction of the fire.

Another and more specific object of the invention is to provide a discharge outlet for fire extinguishing fluid in which there is not only an expansion chamber to reduce the pressure of the discharging fluid but also a baffle over the jet of fluid entering the expansion chamber, so as to spread the jet, check the velocity of the fluid and permit of a relatively short expansion chamber.

Another object of the invention is to provide a floor outlet for extinguishing fluid with a cover closing the outlet, said cover being free to open under pressure of the discharging fluid.

With these objects in view and others which will appear in the following description, I shall now describe a preferred embodiment of my invention and a modification thereof and thereafter shall point out the novelty and scope of the invention in the claims.

In the accompanying drawing;

Figure 1 is a view in cross-section of a hangar equipped with my improved fire extinguishing system;

Fig. 2 is a plan view of a portion of the floor of a hangar showing the distribution of the discharge outlets;

Fig. 3 is a detail view in section of one of the discharge outlets;

Fig. 4 is a detail view of a drop curtain and associated mechanism; and

Fig. 5 is a detail view partly in section of a modified form of a discharge outlet.

The hangar protected by my improved fire extinguishing system is indicated in the drawing by the numeral 10. This hangar is provided with a door 11 at one side and also with a drop curtain 13 of asbestos or other fireproof material which is adopted to close the doorway in case of emer-

gency. At a suitable point outside of the hangar is a battery 14 of containers for the extinguisher to be used. Preferably this battery consists of a set of steel bottles (only one of which is shown in Fig. 1) in which the carbon dioxide is maintained as a liquid under pressure. A discharge mechanism is indicated at 15 by which the gas from the fluid may be discharged into a pipe system 16. The discharge mechanism 15 may be of any suitable form known to the art and is merely conventionally shown in the drawing.

The pipe system 16 passes under the floor 17 of the hangar and leading from this system is a pipe 18 which runs to the drop curtain 13. This drop curtain as shown in Figs. 1 and 4 is normally rolled up and supported in hooks 19 which are hinged to the frame of the hangar. Only one of the hooks is shown in the drawing. Each hook is connected to a plunger 20 which fits in a cylinder 21. The hooks are so fulcrumed that they normally swing into the holding position shown in Fig. 1, but when the fluid is admitted into the piping system, a part of it flows through the pipe 18 into the cylinders 21, forcing out the plungers 20 and swinging the hooks clear of the drop curtain, so that the curtain is permitted to drop and close the doorway of the hangar should it happen to be open.

Leading upward from the piping system 16 is a series of nozzles or jets 22. Each nozzle opens into a preferably cylindrical casing 23 which constitutes an expansion chamber and discharge outlet. The casings are set into the floor of the hangar and the upper end of each casing is closed by a door 24 which fits into a recess or socket in the floor of the hangar so as to lie flush with said floor. The discharge outlets are distributed throughout the floor of the hangar, as indicated in Fig. 2. The inner end wall 25 of the expansion chamber is preferably hemispherical, as shown in Fig. 3, and secured on studs 26 projecting from this end wall is a baffle plate 27. The latter is spaced slightly above the end of the discharge nozzle 22 and also from the side walls of the expansion chamber.

In operation, when a fire is detected the discharge mechanism 15 is operated and thereby not only drops the drop curtain 13, but also discharges the fire extinguishing fluid into the hangar from points all over the floor thereof. The fluid passing up through the nozzles 22 strikes the baffle plates 27 and is spread thereby losing much of its velocity, and the volume of the expansion chamber also permits further expansion of the fluid so that the pressure thereof is considerably reduced before it issues from the expansion chamber. The trap door 24 is thrown out of its socket by the pressure of the expanding gas and the gas then issues with sufficient velocity to reach a zone from which it may be drawn into the blaze by suction produced by the fire, extinguishing the blaze by depriving it of oxygen.

In the case of carbon dioxide the pressure of the jets is considerable and it is highly important that suitable expansion be provided not only to permit the liquid to discharge into a gas if the fluid is still in liquid form when it issues from the jet, but also to overcome the velocity of the jets. If the jets were to discharge directly into the hangar without being previously expanded they would shoot up to a great height entraining large quantities of air and actually carrying air to the fire to fan the blaze.

If the fire hazard is located near the floor level the outlets are designed to reduce the directional velocity of the jets to such extent that the gas will roll out of the outlets in clouds which, if there were no fire, would normally hug the floor, but which, in case of fire, would be drawn into the fire solely, or substantially so, by the suction of the fire. If, on the other hand, the fire were located at a considerable height above the floor it might gain serious headway before sufficient draft would be developed to draw the clouds of gas from the floor up into the fire. This is particularly true in the case of carbon dioxide gas which is much heavier than air and is even heavier when chilled by expansion from its liquid form so that it has a strong tendency to cling to the floor. Hence, I proportion the jets to the level which is to be protected, that is, to the zone in which the greatest fire hazard is located. The discharge orifices of the nozzles 22 and the volume of the expansion chambers 23 are so relatively proportioned that the jets will rise to a predetermined level adjacent said zone before their directional velocity is lost and the gas mushrooms or spreads out in the form of billows. From this level the billows of gas may be drawn into said zone by the natural draft caused by the fire. By a proper proportioning of the nozzles and expansion chambers I am able to form a screen of carbon dioxide gas at and immediately under the fire so as to cut off the supply of air thereto and cause the fire to draw in carbon dioxide instead.

When carbon dioxide is used there is a tendency for snow to form in the expansion chamber and this would tend to collect in the chamber were it not provided with the hemispherical end wall 25, as shown in Fig. 3. Any snow that forms in the expansion chamber 23 is blown out with the carbon dioxide which streams around the edge of the baffle plate 26.

In the modification shown in Fig. 5, no baffle plate is provided but the necessary expansion of the fluid is obtained by providing a deeper expansion chamber 28. This expansion chamber is closed by a lid 29 which is preferably hinged to the floor of the hangar, as indicated at 30. The pressure of the discharging fluid will swing the door open as indicated by broken lines, but under normal conditions the door will be closed and will lie flush with the floor of the hangar, as indicated in full lines. Obviously, a door of this sort could also be used with the expansion chamber shown in Fig. 3.

While I have described my improved fire extinguishing system as applied to a hangar it will be obvious that it may also be used in other buildings, rooms, or enclosures, and is not limited to the protection of hangars.

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

1. The method of extinguishing a fire in an enclosure having a floor, the fire being located above the floor level, which consists in forming a screen of carbon dioxide gas immediately under the fire in position to be drawn up into the fire by suction produced by the fire, and continuously supplying said gaseous screen with jets of gas issuing through said floor but of insufficient velocity to reach the fire in the form of jets.

2. The method of extinguishing fire in an enclosure having a floor, with a fire extinguishing fluid liquefied under pressure but gaseous under normal atmospheric conditions, which comprises the steps of conducting the fluid to a point in the

immediate vicinity of the enclosure, continuously expanding the liquid at said point to reduce its pressure and convert it into billows of gas, and continuously releasing the gas into the enclosure through the floor and close to the floor level.

3. The method of extinguishing a fire in an enclosure having a floor, the fire being located above the floor level, which comprises the steps of discharging below the floor level a jet of fire extinguisher liquefied under pressure, said extinguisher being gaseous under normal atmospheric conditions, expanding the liquid extinguisher into a gas and thereby materially reducing the directional velocity of the jet, and liberating the gas into the enclosure through the floor and close to the floor level, the velocity being reduced by said expansion to such extent as to prevent the jet from carrying any substantial amount of air into the fire.

4. The method of extinguishing a fire in an enclosure having a floor, the fire being located above the floor level which comprises the steps of discharging below the floor level a jet of fire extinguisher liquefied under pressure, said extinguisher being gaseous under normal atmospheric conditions, expanding the liquid extinguisher into a gas and thereby materially reducing the directional velocity of the jet, and liberating the gas into the enclosure through the floor and close to the floor level, the velocity of the jets being so reduced by such expansion that the gas will not reach the fire as a jet but will form billows at a level from which the gas may be carried into the fire by suction produced by the fire.

5. The method of extinguishing fire in an enclosure having a floor, which comprises the steps of discharging below the floor level a jet of fire extinguisher liquefied under pressure, said extinguisher being gaseous under normal atmospheric conditions, baffling the jet and expanding the same so as to materially reduce the directional velocity of the jet, liberating the gas into the enclosure through the floor and close to the floor level, the velocity of the jet being so reduced by such baffling and expansion that the gas will not reach the fire as a jet but will form billows at a level from which the gas may be carried to the fire by suction produced by the fire.

6. The method of extinguishing a fire which comprises the steps of discharging a high velocity jet of highly compressed fire extinguishing fluid directly under the fire, baffling the jet to reduce the velocity thereof, expanding the fluid, laterally confining the fluid until it has expanded to a predetermined extent and liberating the expanded fluid at a point where it will be drawn into the fire by suction produced by the fire.

7. A fire extinguishing system for extinguishing a fire in an enclosure, which comprises a supply of extinguishing fluid liquefied under pressure, said fluid being gaseous under normal atmospheric conditions, a distributor pipe leading from said supply under the enclosure, a plurality of nozzles opening upwardly from the pipe to direct jets of the extinguishing fluid toward the fire, and means for reducing the velocity of the jets issuing from the nozzles to such extent that the extinguishing gas will not reach the fire in the form of jets but will form billows at a level from which the gas may be carried into the fire by suction produced by the fire.

8. A fire extinguishing system for extinguishing a fire in an enclosure having a floor, the fire being located above the floor level, said apparatus comprising a supply of extinguishing fluid liquefied under pressure, said fluid being gaseous under normal atmospheric conditions, a distributor pipe leading from said supply under the floor, a plurality of outlets from the pipe opening upwardly through the floor into the enclosure and close to the floor level, so as to direct jets of extinguishing gas at the fire, and means for reducing the velocity of the jets to such extent that the gas will not reach the fire in the form of jets but will form billows at a level from which the gas may be carried into the fire by suction produced by the fire.

9. In a fire extinguishing system for an enclosure having a floor, a supply of extinguishing fluid liquefied under pressure, said fluid being gaseous under normal atmospheric conditions, a distributor pipe leading from said supply under the floor, a plurality of outlets from the pipe for discharging the fluid through the floor into the enclosure close to the floor level, and means for reducing the velocity of the discharging fluid before it enters the enclosure to an extent below that at which the velocity of the fluid is sufficient to entrain any substantial amount of air.

10. In a fire extinguishing system for an enclosure having a floor, a plurality of expansion chambers in the floor and opening therethrough into the enclosure close to the floor level, a nozzle in each chamber, a supply of extinguishing fluid liquefied under pressure, said fluid being gaseous under normal atmospheric conditions, and a distributor pipe leading from said supply to said nozzles, each chamber being constructed and arranged to permit expansion of the fluid therein to such extent as to reduce its velocity below that at which it will entrain any substantial amount of air.

11. In a fire extinguishing system for an enclosure having a floor, a supply of highly compressed extinguishing fluid which is gaseous under normal atmospheric pressure, a distributor pipe leading therefrom, a plurality of discharge outlets leading from the pipe through said floor and discharging close to the floor level, means for releasing said fluid into said pipe, each outlet providing a chamber for expansion of the fluid, and a closure for each outlet adapted to be opened by pressure of the fluid expanded in said chamber, each of said chambers being constructed and arranged to permit expansion of the fluid therein to such an extent as to reduce its velocity below that at which it will entrain any substantial amount of air.

12. In a fire extinguishing system for an enclosure having a floor, a supply of highly compressed extinguishing fluid which is gaseous under normal atmospheric pressure, a distributor pipe leading therefrom, a plurality of discharge outlets leading from the pipe through the floor and discharging close to the floor level, means for releasing said fluid into said pipe, each outlet providing a chamber for expansion of the fluid, and a trap door covering each outlet lying flush with the floor when in closed position, such door being free to open under pressure of the fluid expanded in said chamber, each of said chambers being constructed and arranged to permit expansion of the fluid therein to such an extent as to reduce its velocity below that at which it will entrain any substantial amount of air.

13. A fixed fire extinguishing installation comprising a source of highly compressed fire extinguishing fluid, a plurality of outlet devices,

and means for controlling discharge of fluid from said source through said devices, each of the latter comprising an expansion chamber open at one end and closed at the other, a discharge nozzle connected to said source and opening through said closed end, the latter having a smoothly curved concave inner face, and a baffle plate overlying but spaced from the nozzle adjacent said wall.

14. A fixed fire extinguishing installation, comprising a source of highly compressed fire extinguishing fluid, a plurality of outlet devices, and means for controlling discharge of fluid from said source through said devices, each of the latter comprising an expansion chamber open at one end and having a substantially hemi-spherical wall closing the opposite end, a discharge nozzle connected to said source and opening through said wall, and a baffle plate overlying but spaced from the nozzle adjacent said wall.

15. A fixed fire extinguishing installation comprising a source of highly compressed fire extinguishing fluid, a plurality of outlet devices, and means for controlling discharge of fluid from said source through said devices, each of the latter comprising an expansion chamber open at one end and closed at the other, a discharge nozzle connected to said source and opening through said closed end, the latter having a smoothly curved concave inner face, a baffle plate overlying but spaced from the nozzle adjacent said wall, and a closure member normally closing the open end of said chamber, but adapted to be opened by pressure of the fluid in the chamber.

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