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FIRE EXTINGUISHER UTILIZING PRODUCTS OF COMBUSTION

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FIG_1

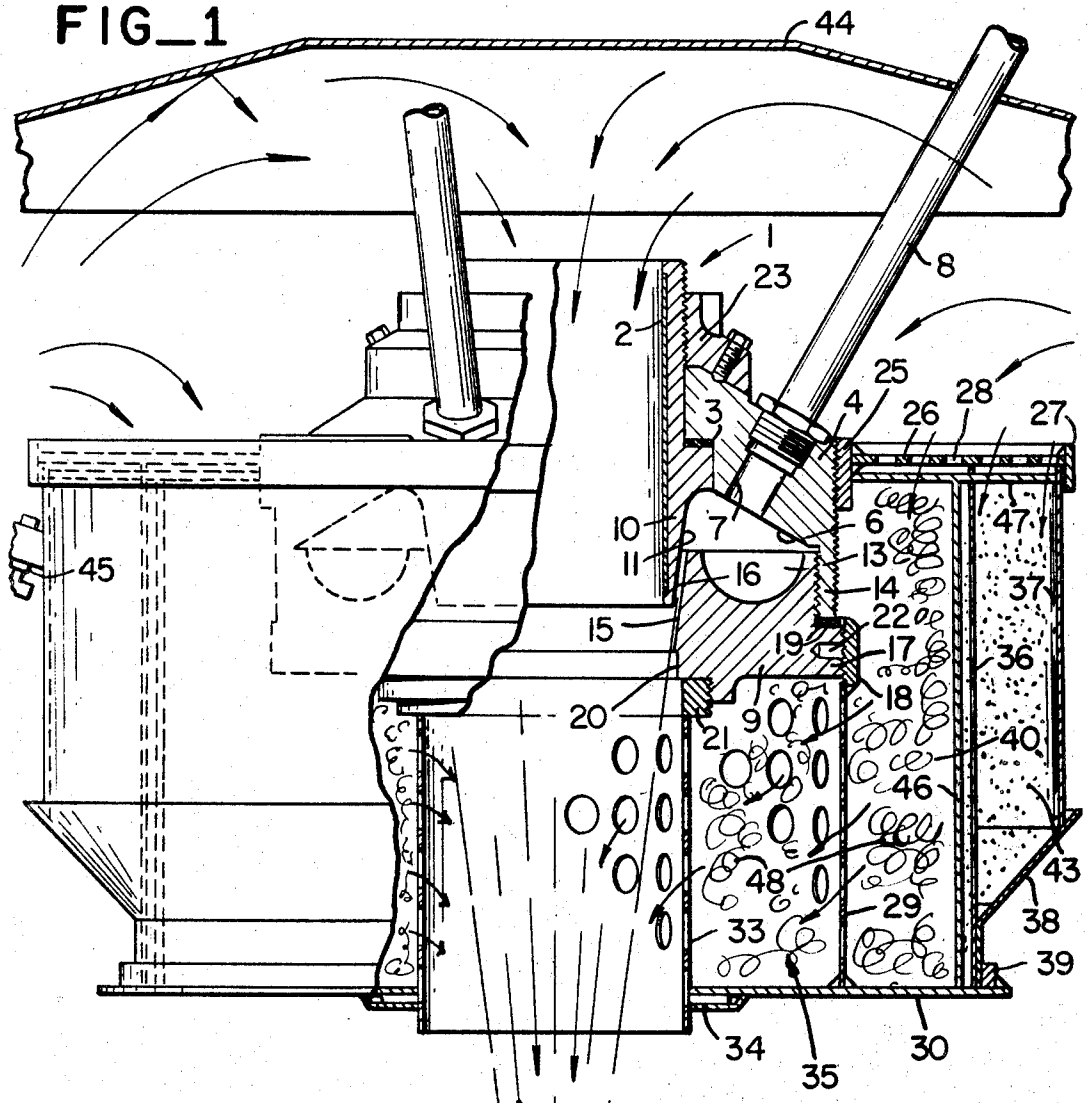
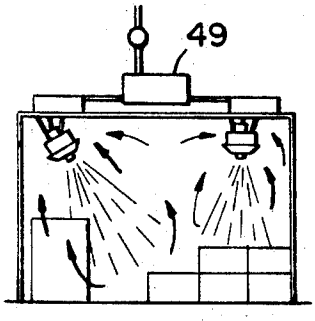


FIG_2



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FIRE EXTINGUISHER UTILIZING PRODUCTS OF COMBUSTION

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This invention relates to a fire control system and fire extinguisher adapted for installation and use in any compartment, room, or area where there is a fire hazard or where a damaging fire may occur, such as in buildings, engine rooms, paint lockers, etc., whether on land or in air, land or water vehicles.

One of the objects of the invention is the provision of a more efficient fire control system than heretofore, in which the circulatory forces generated by the fire extinguishing stream or medium are employed in a manner to neutralize and use the gases and solids of combustion, including unburned solids, for extinguishing the fire.

Another object of the invention is the provision of an improved fire extinguisher adapted to discharge, under pressure, a fire extinguishing fluid into the area of the fire and the site of combustion, and at the same time to draw the products of combustion into the extinguisher for entrainment and mixing with the fire extinguishing medium and to neutralize partially combustible matter or combustion promoting fluid and solids that may be drawn into the extinguisher and mixed with the extinguishing fluid, and for subsequent discharge of the mixture.

Another object of the invention is the provision of a fire extinguisher provided with means for generating a fire extinguishing fluid by utilization of the circulatory forces generated by discharge of a combustion inhibiting fluid into the fire area and at the site of combustion.

A still further object of the invention is the provision of means for inducing the circulation of heated products of combustion from the area of the fire to and through a fire extinguisher that is adapted to neutralize the air within a building, room or compartment to the point where it will not support combustion and to protect the building, room or compartment to the point where it will not support combustion and to protect the building, room or compartment structure against damage from said products of combustion, including unburned or partially burned solids, due to said circulation, and at the side of said extinguisher that is opposite to the side from which the extinguishing fluid is discharged.

Other objects and advantages will appear in the description and the drawings.

In the drawings:

FIG. 1 is a part sectional, part elevational view through an extinguisher illustrating the present invention.

FIG. 2 is a greatly reduced size semi-diagrammatic view of one arrangement illustrating a permanent installation in a compartment or room.

In detail, referring to FIG. 1, a straight sided, open ended, central tube generally designated **1**, is provided, which tube has a metal protective liner **2** extending almost from end-to-end of said tube. While the extinguisher may be disposed in any position most suitable for accomplishing its intended results, for purpose of description it is shown in FIG. 1 with the tube **1** in a vertical position, in which the upper open end of tube **1** is the inlet thereto, and the lower open end is the outlet.

The tube **1** is formed with an annular radially outwardly projecting flange **3** therearound, and the outer surface of said tube below said flange tapers convergently downwardly from said flange to the lower free circular edge

of said tube that is spaced slightly below the lower edge of the liner **2**.

Around and coaxial with said tube **1** is an annular body **4** having a cylindrical bore at its upper portion fitting around tube **1** above flange **3**, and which bore is counterbored at its lower end adapted to receive flange **3** with the axially downwardly facing surface at the junction between the counterbore and the bore thereabove facing the axially upwardly facing surface of the flange **3**, and an adjusting and sealing washer **5** of suitable material is disposed between and in engagement with said axially facing surfaces.

The lower surface **6** of the body **4** is slanted outwardly and downwardly from the edge of the counterbore in which flange **3** is received, and the upper surface is similarly slanted to provide a downwardly and outwardly inclined wall that, in turn, is formed with equally spaced passageways **7** extending normal to said inclined wall, in each of which is secured one end of a pressure line **8**. While three such passageways and pressure lines are indicated in the drawings, the number may vary.

The body **4** may be called an upper body, inasmuch as it forms one of a portion of a pressure chamber, and below said upper body **4** is a lower annular body **9**.

Referring back to the tube **1**, the portion of said tube projecting downwardly below flange **3** is designated **10** and its radially outwardly facing surface **11** is tapered inwardly in a downward direction to the terminating lower end of tube **1**.

The lower body **9** is formed with an upwardly opening annular recess **13** facing and spaced below the lower slanted surface **6** of the upper body **4**, and a depending, interiorly threaded axially extending flange **14** on body **4** at the lower edge of slanted surface **6** extends around, and in threaded engagement, with the inside threads on flange **14**.

Said lower body **9** is formed with a radially inwardly facing surface **15** that is complementary and in opposed relation to the slanted outer surface **11** of the lower end portion **10** of the tube **1**, whereby an annular downwardly and radially inwardly tapered annular passageway defined by the opposed tapered surfaces **11, 15**.

The lower body **9** is formed with a radially outwardly projecting flange **17** around its lower end that is externally threaded for threaded engagement with an annular collar **18** for supporting a perforated wall in depending relation thereto, as will later be described in detail.

A laterally outwardly opening recess **22** may be formed in the flange **17** for a projection on a spanner wrench before collar **18** is threaded onto flange **17**, or when the recess is exposed.

Upon rotating body **9**, it will be seen that a precision adjustment of the spacing between the tapered faces **15, 16** can be made to obtain the desired discharge volume. An adjusting and sealing washer, or a plurality thereof, are positioned between the axially facing surfaces of flanges **14, 17**. These washers may be of predetermined thicknesses for different predetermined adjustments of body **9** relative to body **4** for adjusting the size of passageway **16**, and they also serve as seals.

The lower portion of the surface **15** on the lower body **9** preferably projects below the lower end of tube **1**, and body **9** projects below the lower terminating end of surface **15** and is formed to provide a short enlarged diameter bore **20**, the lower end of which is counterbored and threaded to threadedly receive an annular ring **21** of slightly greater inside diameter than that of the bore **19**.

The upper end of tube **1** projects above the annular upper body **4** and is externally threaded for threaded engagement with an annular lock nut **23** that is adapted to

tightly clamp the upper body 4 stationary against flange 3 on said tube, and set screw 24 may extend through nut 23 into engagement with said upper body to lock the nut and body against rotation relative to each other. By this structure the tube 1, nut 23 and upper body 4 are releasably held together as a unit.

The radially outwardly facing surface of upper body 4 is threaded for threaded engagement with the corresponding threads on the radially inwardly facing surface of a collar 25 that, in turn, is rigid with a horizontally disposed perforated circular plate 26 projecting outwardly therefrom, and an outer collar 27 is around and rigid with the outer edges of plate 26. Plate 26 is the cover plate for a compartment therebelow, as will be explained later, and the perforations 28 thereon are substantially equally distributed therein to provide for uniform passage of fluid therethrough at substantially all points around the plate.

Depending from collar 18, that, in turn, is threadedly secured to flange 17 of the lower body 9, is a vertically disposed perforated cylinder 29. This cylinder is rigidly secured to said collar 18 at its upper end and is coaxial with the axis of tube 1. At its lower end, the cylinder 29 is rigidly secured to an imperforate horizontally disposed circular bottom plate 30 coaxial therewith.

Ring 21 that is threadedly connected with the lower body 9 at its lower side has a depending perforated cylinder 33 rigid therewith. The bottom plate 30 is centrally apertured, and the lower end of the cylinder 33 projects downwardly therethrough and through a washer 34 forming a seal between the bottom plate and the outer surface of the lower end of cylinder 33. The cylinder 33 may be called the inner cylinder, and it is generally in downward extension of the tube 1, although of slightly larger inside diameter.

The inner cylinder 33 and cylinder 29 define opposed cylindrical walls of an annular inner compartment or chamber 35, the upper wall of which is the lower surface of the lower body 9 and the lower wall of which is the bottom plate 30.

Spaced outwardly of, and coaxial with perforated cylinder 29 is an outer perforated cylinder 36, that extends between the upper and lower plates 26, 30. The cylinder 29 may be called an intermediate cylinder since it is spaced between the inner cylinder 33 and the outer cylinder 36.

Coaxial with the outer cylinder 36 and around it is an imperforate outer cylinder 37 extending between the outer marginal portions of the upper plate 26 and the lower imperforate plate 30.

The lower portion of the outer cylinder 37 tapers inwardly and downwardly at 38 to join the lower marginal portion of the outer cylinder 36, and an annular collar 39, rigid with and projecting above the bottom or lower plate 30 at its outer edge extends around the lower marginal portions of the outer cylinder 37 below portion 38 and the lower marginal portion of the outer perforated cylinder 36. The outer collar 27 around the outer edge of the upper plate 26 extends around the upper marginal portion of the outer imperforate cylinder 37.

The intermediate perforated cylinder 29 and the outer perforated cylinder 36 form a cylindrical or annular chamber 40, the upper wall of which is the perforated upper plate 26 and the bottom wall of which is the imperforate bottom plate 30.

The perforated cylinder 36 and the outer imperforate cylinder 37 form the inner and outer cylindrical walls of a chamber 43, and the upper end of chamber 43 is the perforated plate 26 while the lower end is the slanted imperforate portion 38 extending downwardly from outer wall 37 to wall 36.

Extending over and spaced above tube 1, body 4 and plate 28, and projecting radially outwardly of the latter is a horizontally disposed circular shield 44 having a generally concavely shaped downwardly facing surface to provide an annular generally laterally directed passageway for passage of fluid such as smoke, etc. from around the extinguisher as described, to the upper open end of the tube 1 and to the upper ends of chambers 35, 40, 43, and which shield also functions to deflect and to guide the smoke, etc. to the upper ends of tube 1 and chambers 35, 40, 43, for passage into and through them.

This shield may be secured to the pipe lines 8 that extend therethrough or may be held to the extinguisher by any suitable brackets or other means.

Within the outer chamber 43 is a conventional powder employed for fire extinguishing purposes, and one or more valve inlets 45 may be provided, opening into the upper portion of said outer chamber, and connected with a suitable conduit, for replenishing said chamber with such powder. Also, a thin cylindrical imperforate sheet 46 of readily heat meltable material may be positioned inside and adjacent to the perforated outer cylinder 36, and a top wall 47 of the same material, such as lead or an alloy, foil, or the like, may be positioned to extend over the upper end of outer chamber 43 below the plate 26 to protect the powder in the chamber between uses of the extinguisher. These protective walls would be replaced after each use. It is understood that they are not necessarily essential to the operation of the extinguisher.

The chambers 35 and 40 are preferably filled with alloyed steel lathe and drill press turnings 48 that may be wound around the perforated inner and intermediate cylinders 33, 29. Preferably these turnings are at from 5 to 6 or more feet in length to facilitate the formation of an open, continuous mesh or tortuous passageways that will provide for a good flow of fluid therethrough without impairing the suction extinguishing action, and which turnings provide a large surface area for the extinguishing powder, that is drawn from the outer chamber 43 through chambers 35, 40 and into the central suction conduit provided by the tube 1 and the inner screen 33 when the dynamic extinguishing fluid, under pressure, is ejected into said conduit through the passageway 16.

The dynamic fire extinguishing agent may be of any suitable fluid for the conditions existing where the extinguishers are respectively positioned, the lines 8 being connected with a source 49 (FIG. 2) of fluid under pressure and any suitable control means, manual or automatic, in response to heat may be provided for opening the lines 8 to flow of the extinguishing fluid therethrough, such as conventional manual or automatic control means (not shown). Pretreated engine exhaust gas from internal combustion engines, or solid, liquid or gaseous extinguishing agents may be employed.

Preferably the jet provided by passageway 16 is adjustable to provide an output minimum of about 75 cubic feet per minute to approximately 25 cubic feet per minute at 1500 p.s.i. The degree of taper of the passageway 16 may obviously be designed to vary with the distance the extinguishing stream is to be projected. Where the distance is relatively short and the extinguisher is in a closed or semi-closed space, the degree of taper may be designed greater than where the extinguishing fluid is to be projected to a relatively great distance. In the latter case, the passageway may be substantially parallel with the axis of the tube.

The liner 2 protects the tube 1 from overheating, and distortion and extends substantially to the lower discharge end of tube 1, providing a substantial area in heat exchange relation to the products of combustion and thus prevents icing or clogging of the jet where a fire extinguishing medium such as CO_2 is used, and while there is room within the central conduit, that includes tube 1, for other elements such as filters, unburned particle arrestors, heat absorbers, etc., it is preferably left open where quick suction extinguishment is desired, such as in boats.

The chamber 13 is the pressure chamber that is sup-

plied with the extinguishing agent, under the desired pressure. Approximately 1500 lbs. per square inch has been found to be suitable, but the invention is not to be considered limited to pressures or other measurements herein set out, inasmuch as they are merely by way of illustration, and may vary.

In operation, assuming a fire commences within the area toward which the discharge end of tube **1** or cylinder **33** is directed, the lines **8** will be opened, either manually or in response to operation of any suitable mechanical means that is actuatable upon the breaking out of a fire, and the extinguishing medium will be ejected from the jet into cylinder **33** and out of the discharge end of the latter. A strong suction at the inlet or upper end of tube **1** will immediately function to induce a flow of the smoke and heated air into the space between shield **44** and the upper end of tube **1**. This concentration of heated gas will melt the protective sheets **46, 47**, if not earlier destroyed, by heat, resulting in passage of the hot gas through the chambers **43, 40** and **35** and into the stream of the fire extinguishing medium ejected from the jet. Powder in chamber **43** will be drawn into the chambers **40, 35** in succession where it will be trapped by the steel turnings to generate combustion inhibiting gas that will be mixed with the extinguishing medium to neutralize the capacity of gas drawn into the tube **1** to support combustion and this mixture will be ejected to the site of combustion and into the fire area to extinguish the fire. The circulation and re-circulation of the gas or fluid within an enclosed space will quickly neutralize the gas within such space, and in any event whatever gases or unburned solids are mixed with the fire extinguishing medium, and the powder and with the gas generated by the latter will be neutralized or extinglished.

The steel turnings provide the walls of a tortuous path through said chambers **35, 40** against which the substantially static extinguishing agent, such as the powder, is supported for wiping engagement with the smoke and heated unburned particles. While the steel lathe and drill press turnings have been found to be preferable, it is to be understood that the invention is not necessarily restricted to the use of such turnings.

The shield **44** is an important part of the extinguisher since the hot smoke and gases are concentrated at the inlets to the central tube **1** and to the several chambers or compartments around it.

It is to be understood that the invention is to be limited only by the spirit and scope of the claims herein.

I claim:

1. A method of extinguishing fire within a substantially enclosed area that comprises the steps of:

(a) circulating the heated air and products of combustion within said room through an open ended passageway within said area by

(b) ejecting a fluid fire extinguishing fluid into said passageway from a point between its ends in a direction toward and out of one end thereof to induce said circulation and, at the same time

(c) entraining a fire neutralizing agent with said fluid within said passageway between said point and said one end, which agent is adapted to neutralize partially combustible matter and combustion promoting fluids and solids that may be circulated with said heated air and products of combustion.

2. The method as defined in claim **1**, and

(d) said neutralizing agent being subjected to direct contact with the heated air and products of combustion within said area immediately prior to being entrained with the fluid within said passageway.

3. The method as defined in claim **2**,

(e) said neutralizing agent being a powder held against unobstructed movement into said passageway within a plurality of tortuous passageways through which said air and the products of combustion are adapted to move to said passageway.

4. A fire extinguishing device adapted to be spaced within an enclosed area comprising,

(a) a main passageway having an inlet at one end and an outlet at the opposite end, and an annular injection orifice coaxial therewith around the sides thereof at a point intermediate the ends thereof providing an inlet end portion between said orifice and said inlet, and an outlet end portion between said orifice and said outlet,

(b) said orifice being directed generally toward said outlet and means for connecting said orifice with a source of extinguishing fluid under pressure for ejection of such fluid into said main passageway and toward said outlet for discharge from the latter, and for inducing a flow of ambient air and gas through said main passageway from said inlet to said outlet for mixing with said fluid, within said passageway,

(c) means around said main passageway providing a plurality of passageways communicating between the outside air and gas around said device and a portion of said passageway for conducting such air and gas to said main passageway for entrainment with the said air and gas adapted to be moved therethrough upon ejection of said fluid into said main passageway through said orifice,

(d) means for supplying a fire extinguishing agent to said passageways for contact with the air and gas adapted to move therethrough to said main passageway.

5. In a device as defined in claim **4**,

(e) the walls of said outlet end portion of said main passageway being formed with perforations in communication with said passageways, and

(f) the walls of said inlet end portion being imperforate, whereby said agent will enter said passageway at the outlet side of said aperture to be mixed with said extinguishing fluid within said passageway.

6. In a device as defined in claim **4**,

(e) a retaining wall for the means providing said plurality of passageways, spaced around said main passageway, and coaxial with the latter, and formed with perforations in communication with said passageways,

(f) said passageways being tortuous to resist free and unimpeded movement of solids therethrough, and the means for providing said tortuous passageways being held between said main passageway,

(g) the walls of the outlet end portion of said main passageway being formed with perforations in communication with said tortuous passageways,

(h) means around said retaining wall coaxial therewith for supporting a body of a fire extinguishing agent for movement into said tortuous passageways for engagement with outside air and gas adapted to pass through said tortuous passageways to said central passage.

7. In a device as defined in claim **6**,

(i) said means providing said tortuous passageways being lathe and drill press turnings of metal resistant to melting under temperatures substantially above the melting point of lead.

8. In a device as defined in claim **7**,

(j) said means around said retaining wall including walls of a relatively low melting point, such as lead or lead alloy, enclosing said agent when the latter is supported around the means providing said plurality of passageways to access of outside air and gas thereto and to passage of said agent into said passageways until said walls are melted.

9. In a device as defined in claim **4**,

(e) a shield spaced over the inlet end of said main passageway and projecting in a direction radially outwardly of the axis of said main passageway and projecting beyond the limits of the entire device in

said direction for guiding the air, gas, and solids carried thereby to said inlet during circulation of said air and gas when said fire extinguishing fluid is ejected through said orifice into said passageway,

(f) said inlet end portion of said passageway being movable axially of said passageway relative to said outlet end portion, and the end of the walls of said inlet end portion adjacent to said outlet end portion defining one of the sides of said orifice whereby the size of said orifice may be adjusted to different degrees of opening,

(g) means for moving the walls of said inlet end portion of said passageway toward and away from said outlet portion to adjust the size of said orifice to said different degrees, and means for securing the walls of said inlet portion in adjusted position.

10. A fire extinguishing device comprising,

(a) a central, open ended tube providing an inlet at one end and an outlet at the opposite end, said tube being straight and of approximately uniform diameter, and having an inlet orifice coaxial therewith around the sides thereof at a point intermediate ends thereof providing an inlet end portion between said orifice and said inlet, and an outlet end portion between said orifice and said outlet,

(b) a body around said tube providing an annular pressure chamber around said orifice for extinguishing fluid under pressure, in communication with said orifice at all points around said chamber, and means for connecting said chamber with a source of fire extinguishing fluid under pressure,

(c) said orifice being directed to inject fluid from said chamber under pressure, into said outlet end portion and in a direction toward said outlet for inducing circulation of ambient air and gas through said tube from said inlet to said outlet and for mixing said air and gas with the said fluid injected into said outlet end portion,

(d) a perforated wall spaced around said outlet end portion coaxial therewith providing an annular space between said outlet end portion and said perforated wall, and said outlet end portion being formed with perforations, one end edge of said perforated wall being adjacent to said inlet end portion,

(e) means for supporting metal lathe and drill press turnings or the like in said space between said outlet end portion and said perforated wall including a perforated head at said one edge of said perforated wall and said outlet end portion, and an imperforate head closing the end of said annular space opposite to said perforated head,

(f) an imperforate wall spaced around and coaxial with said perforated wall, including an imperforate end wall adjacent to said imperforate head, for supporting a fire extinguishing agent, such as powder, around said perforated wall and for passage therethrough into said annular space,

(g) a body of irregularly formed metal pieces such as lathe and drill press turnings supported in said annular space providing tortuous passageways communicating between powder adapted to be supported around said perforated wall and said outlet end portion and between said perforated head and the said outlet end portion through which ambient air and gas is adapted to move into said outlet end portion for entrainment with said fire extinguishing fluid when the latter is injected into said outlet end portion.

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