Feb. 23, 1943. C. H. LINDSAY 2,311,844

FIRE EXTINGUISHING SYSTEM

Filed Dec. 11, 1937 5 Sheets-Sheet 1

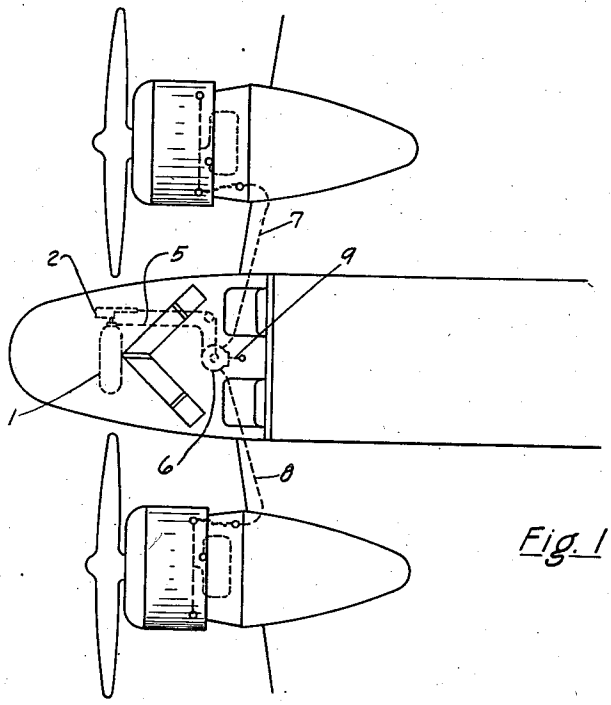


Fig. 1

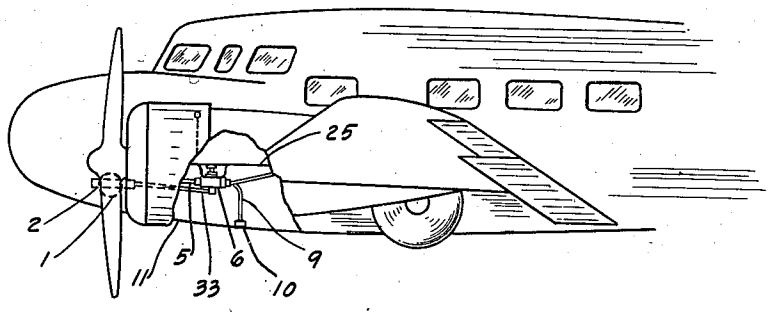


Fig. 2

Charles H. Lindsay

INVENTOR.

BY Perry Watson Bugbee

ATTORNEYS.

Feb. 23, 1943. C. H. LINDSAY 2,311,844

FIRE EXTINGUISHING SYSTEM

Filed Dec. 11, 1937 5 Sheets-Sheet 2

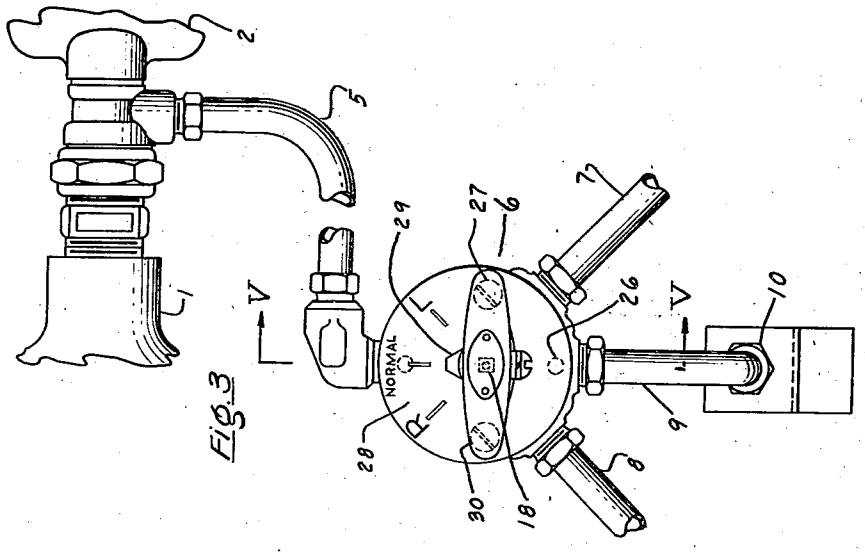


Fig. 3

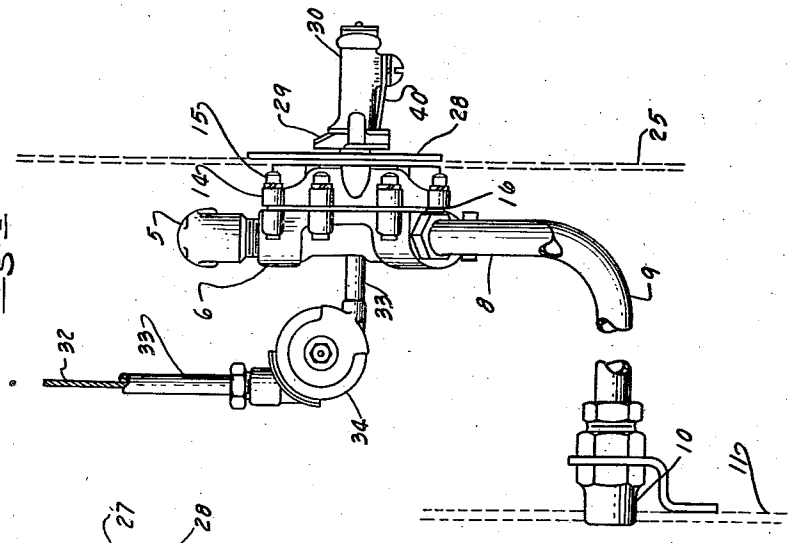


Fig. 4

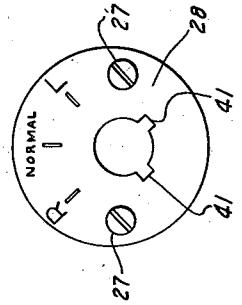


Fig. 11

Charles H. Lindsay

INVENTOR.

BY Gray, Kimball & Baker

ATTORNEYS.

Feb. 23, 1943. C. H. LINDSAY 2,311,844

FIRE EXTINGUISHING SYSTEM

Filed Dec. 11, 1937 5 Sheets-Sheet 3

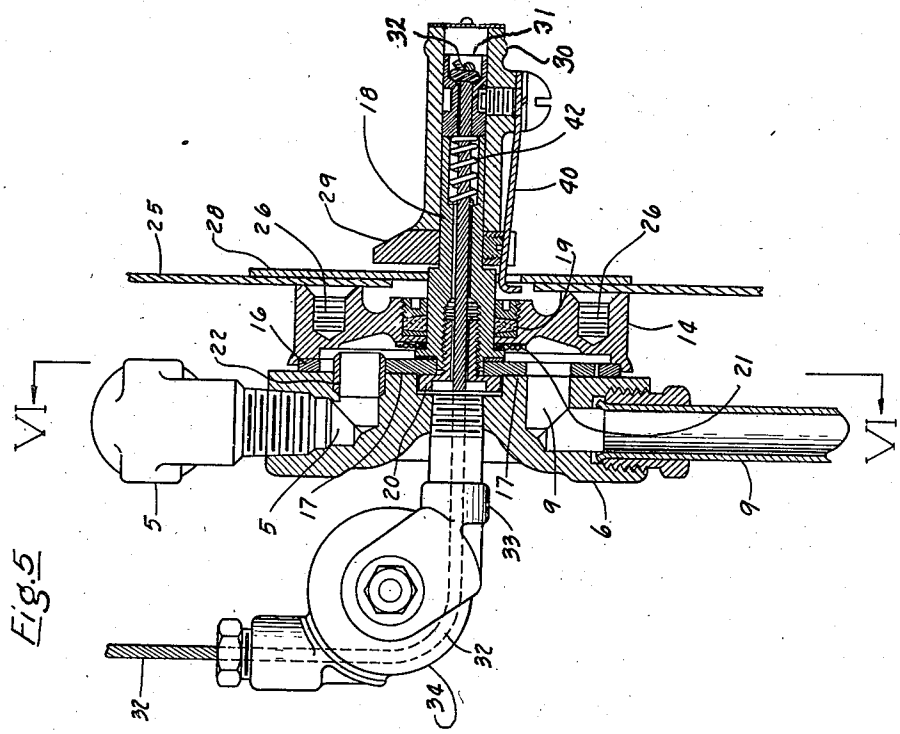


Fig. 5

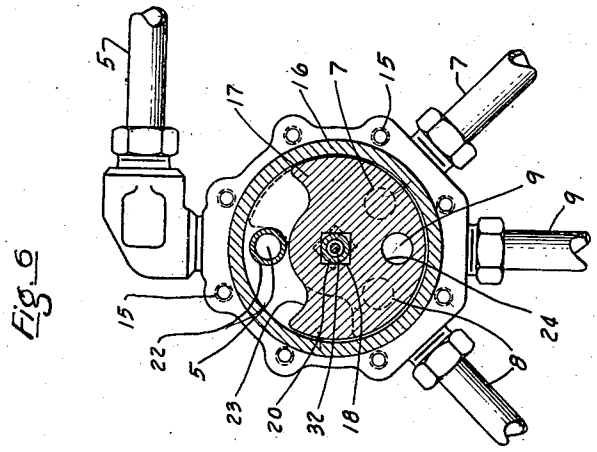


Fig. 6

Charles H. Lindsay
INVENTOR.

By Jeffery Whitman Ryan & Co
ATTORNEYS.

Feb. 23, 1943. C. H. LINDSAY 2,311,844

FIRE EXTINGUISHING SYSTEM

Filed Dec. 11, 1937 5 Sheets-Sheet 4

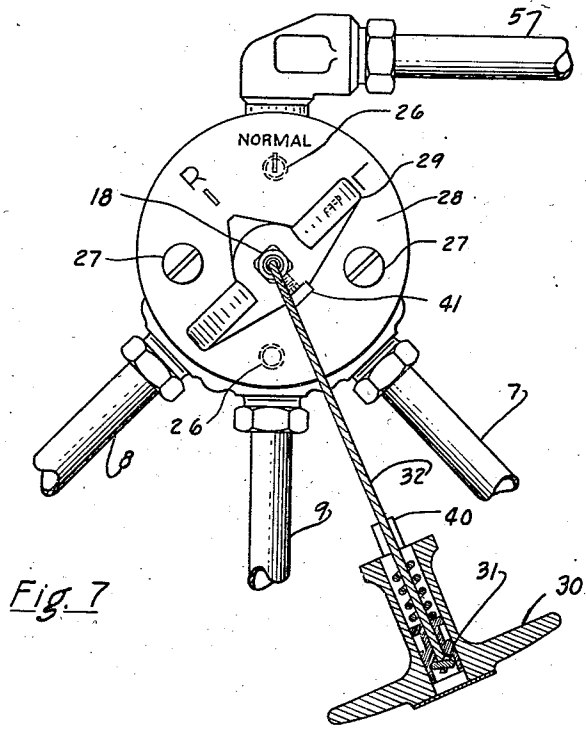


Fig. 7

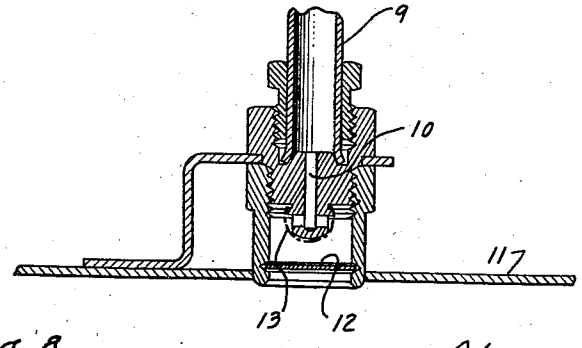


Fig. 8

Charles H. Lindsay

INVENTOR.

By Jeffery, Whittemore & Eggleston

ATTORNEYS.

Feb. 23, 1943. C. H. LINDSAY 2,311,844

FIRE EXTINGUISHING SYSTEM

Filed Dec. 11, 1937 5 Sheets-Sheet 5

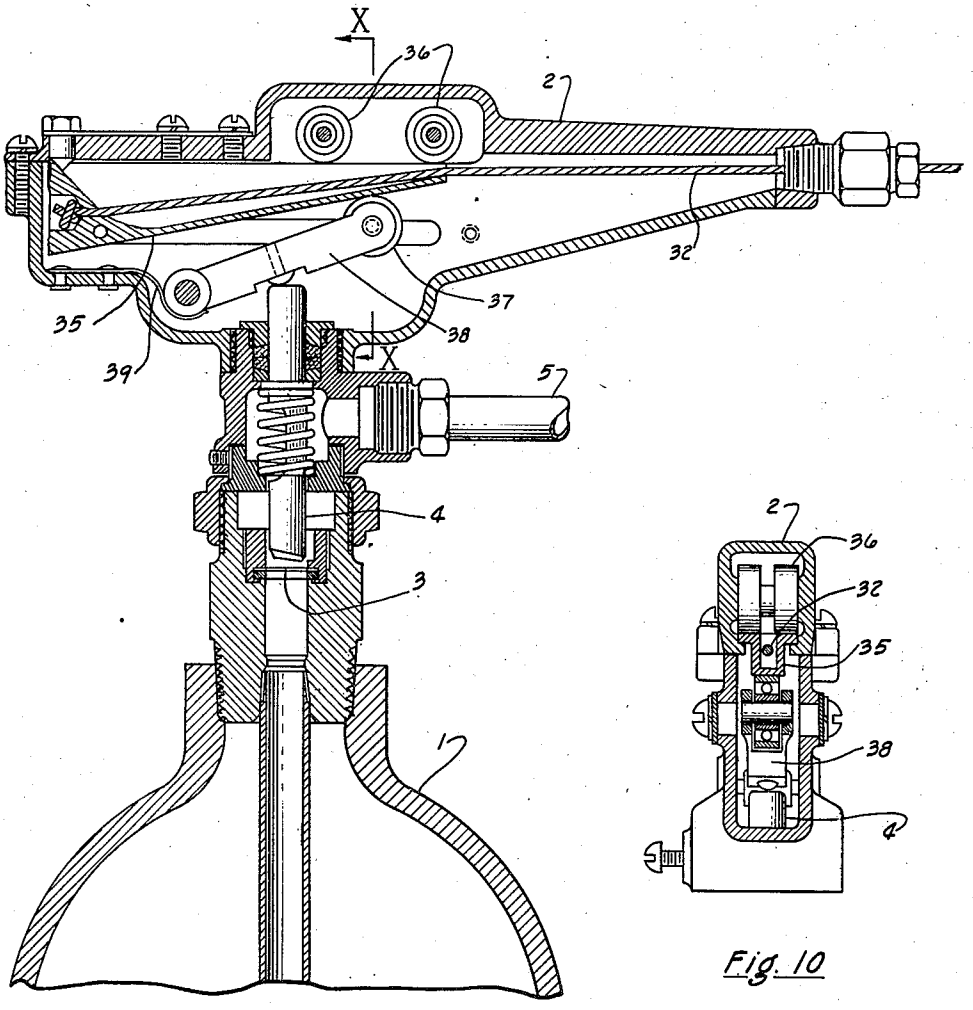


Fig. 9

Fig. 10

Charles H. Lindsay INVENTOR.

BY

Jeffrey, Kimbrough & Taylor
ATTORNEYS.

Patented Feb. 23, 1943

2,311,844

UNITED STATES PATENT OFFICE

2,311,844

FIRE EXTINGUISHING SYSTEM

Charles H. Lindsay, Elmira, N. Y., assignor to American-La France-Foamite Corporation, Elmira, N. Y., a corporation of New York

Application December 11, 1937, Serial No. 179,325

27 Claims. (Cl. 169—2)

The invention relates to gas systems specially suited for fire extinguishing use in aeronautic vehicles but capable of other uses as circumstances permit. The object is to combine maximum simplicity and reliability of operation with minimum weight and complication, and such object is accomplished by an organization of parts according to the principles herein explained and which are illustrated in the drawings wherein:

Figs. 1 and 2 are respectively plan and elevation of a portion of an aeroplane having the invention installed;

Fig. 3, an elevation of the selector valve, parts broken away;

Fig. 4, a side view of Fig. 3;

Fig. 5, an axial section of Fig. 3 on line V—V;

Fig. 6, a section on line VI—VI of Fig. 5;

Fig. 7, an elevation or side view of the selector valve after operation;

Fig. 8, a detail of the safety vent and tell-tale;

Fig. 9, a longitudinal section of the flask operating head;

Fig. 10, a section thereof on line X—X, and

Fig. 11, a detail of the index-escutcheon plate.

In the illustrated embodiment, the system is applied to a twin-motored aeroplane of conventional type and comprises a flask 1 of liquid CO_2 gas, or equivalent fire extinguishing medium under pressure, shown as stored in a convenient location under the deck flooring of the fuselage. This flask, or each of them if more than one is required, is provided with an operating head 2 (Figs. 9–10) which, as customary, includes a puncturable sealing disk 3 and a device or cutter 4 for puncturing it, together with suitable means later described whereby an external force applied to the head will puncture the disk and allow the gas to escape into a pipe system through which it reaches its intended destination.

Such destination is determined by a single operating device, at the operator's station, which is the handle of a selector valve included in the system and serves the dual purpose (1) of directing the discharged gas to a selected outlet, by which is meant causing a path to be established through which the gas may flow from the flask to the fire, and (2) of opening the flask to cause the flow through the path thus selected. The pipe system comprises a main discharge pipe 5 leading from the flask head to the selector valve 6 from which radiate the several continuation pipes of which those marked 7 and 8 lead respectively to the interior of the cowlings of the engine nacelles herein referred to as the fire hazards, understanding that the invention is indifferent to the particular character of such hazards and that there may be one or more of them.

The continuation pipe 9 leads from the selector valve to an outlet fixture 10 opening to atmosphere. In the normal or off position of the operating handle this pipe is connected by the valve to the gas supply pipe 5 so that, if gas leakage should occur or a sealing disk burst, the discharge will be to atmosphere and not to a fire hazard which, in the case of an airplane engine, would stop it.

The vent fixture 10, as shown in Fig. 8 is secured in a hole in the skin 11 of the fuselage, on the underside of the forward part thereof as shown in Fig. 2. Its orifice is normally closed by a membrane 12 so fragile as to be easily ruptured by gas pressure behind it. Either this membrane, or a similar supplementary membrane 13 located behind it and also arranged to obstruct gas flow, is made of a distinctive color so as to serve as a tell-tale by which when the plane is grounded, the servicing attendants can readily observe the condition of the system. If there has been leakage or a disk rupture, one or both of these membranes will indicate the fact by their absence and the absence of the distinctive color. This fixture connection thus performs two safety functions.

The body 6 of the selector valve has a cover 14, tightly closed to it by a ring of peripheral bolts 15 with an intervening gasket 16. The several pipes are connected to the body 6 and terminate in corresponding valve ports formed in the flat valve-seat surface thereof in the interior of the valve casing. The valve body and its valve seat are metal but the movable valve element which coacts therewith is constituted of a non-metallic flat disk 17. It may be Bakelite or the equivalent. It is carried non-rotatably on the squared end of a rotary hollow spindle 18 journalled in the cover part 14 of the valve casing and therein sealed by a gland 19. A threaded nipple 20 screwed into the end of the spindle clamps the valve disk in place and a spring washer 21 between the valve cover and disk normally urges the disk against its metallic seat. When the system is functioning, the disk is additionally pressed to its seat by the pressure of the gas itself. Under such condition, it would be difficult if not impossible to turn the valve element since the gas pressure is normally in the order of more than 800 pounds per square inch, but by making the valve element non-metallic

it is readily turned as desired, while the gas is flowing.

It is noted that while the spindle requires a packing gland where it passes through the valve cover no such gland is needed where it extends through or into the valve body. Leakage is prevented at this point by the engagement of the valve itself on its valve seat. Thus, only a single gland is required.

The gas enters the valve chamber by the port 5 which is provided with an extension nipple 22 projecting from the valve seat where it is within a slot or notch 23 in the valve disk 17 and so related to the disk as to limit its rotation in each direction of rotation, indicated by the dotted lines in Fig. 6.

From the valve chamber the gas passes by way of the hole 24 in the valve disk and through whichever one of the three outlet ports 7, 8 and 9, with which such hole is turned into registry, by the rotation of the disk. In its normal position, being that indicated in Fig. 6, the gas outlet is to the vent pipe; when turned to the left it is to the distribution pipe 7, and when turned to the right it is to the other of the fire hazards.

The valve is attached to the dash panel, deck floor or any other supporting wall 25, by its cover part 14 which, for this purpose, is tapped with four screw holes 26 symmetrically spaced about the valve axis and adapted to take the adjustment screws 27 which appear in Figs. 3 and 7 but before these screws are inserted the face or index plate 28 is first placed on the outer side of the wall so that the screws serve to clamp the valve to the back side of the supporting wall and the index plate 28 to the exposed side. In this way, the index plate serves also as an escutcheon for the hole cut in the supporting wall to receive the valve spindle. While there are four tapped holes 26 in the valve cover, only two of them are shown in use; the other two are present to be used in installations where the index plate requires to be set at a different angle, four angular positions of such plate being provided for. The index plate carries the names of the stations corresponding to the discharge connection established by the adjustment of the valve element.

The outer end of the valve spindle, being squared or angular in section is provided with two handles by means of either of which the valve disk may be rotated. The inner handle marked 29 is fixed to the spindle by a set screw as indicated and is provided with a pointer adapted to register with the station markings on the index plate 28.

The other handle 30 is the operating device above referred to being a pull handle axially movable on the valve spindle so that it can be pulled outward and preferably off of the spindle. By its interior anchor piece 31, this handle is secured to a cable 32 which runs through the hollow spindle and valve casing to the operating head 2 of the gas flask, so that by pulling the handle the sealing disk in the latter can be punctured and the gas flow started. When thus operated the cable 32 pulls through the spindle to such extent that the handle, then disconnected from the latter, hangs from the end of the spindle as indicated in Fig. 4.

The cable is ordinarily housed in a pipe conduit 33 with sheaves 34 at the angles. The ends of this conduit are threaded directly into valve casing and flask head respectively, and the cable end is attached to a pull wedge 35 in latter shown in Figs. 11 and 12. This wedge bears on its top side upon a set of rollers 36 and on its lower side on a roller 37 on the end of the lever 38 which bears directly on the cutter member 4 above referred to. Spring 39 acting on the lever tends to force the wedge to the retracted position indicated in the drawings, where it is releasably retained by a spring detent as indicated. It will be apparent that an easy pull on the cable will wedge the cutter lever 38 downwardly or inwardly and thereby bring about the opening of the disk and discharge of the gas.

However the pull handle can be pulled out for thus opening the flask only when it has first been turned to a station mark on the index plate where the selector valve opens one of the gas ports leading to a fire hazard. This restriction is imposed by an interlock formation between the pull handle and some fixed part associated with the valve structure. Such interlocking formation can be variously contrived but as herein shown is formed by providing a hook or projection 40 on the pull handle (Fig. 5) adapted to engage under or inside of the edge of the face plate 28 and by cutting one or more notches in such edge as shown at 41 in Fig. 11, one of these notches corresponding with each of the fire hazard ports. Only when the pull handle has been turned so that this projection registers with one or the other of these notches, can it be pulled out. When the handle is set to any position other than a fire hazard station, the interlock projection 40 is not in registry with a notch and therefore the handle can not be pulled to release the gas. When set to the "normal" station the pipe system is connected by pipe 9 to the atmospheric vent as above explained, thus guarding against interference with engine functions as well as providing indicator means for the condition of the system.

A small coil spring 42 housed inside of the outer end of the valve spindle, around the cable, and normally compressed by the cable anchorage 31, when the pull handle is interlocked with the face plate, urges the handle outwardly so that it snaps automatically into registry with a notch when turned to a fire hazard station, thus enabling the operator to feel the correct setting without observing the pointer, this being a particular aid when there are several hazards protected.

As indicated in Fig. 1, the selector valve is located in a well in the floor of the operator's cabin between the seats where it may be easily reached. The operator simply turns the pull handle until the pointer registers with the location of the fire and then pulls it, which discharges gas to the hazard. If however a mistake has been made or if there is need to direct some of the discharge to another station, that may then be done by the use of the inner or auxiliary valve handle 29 still remaining on the spindle, and which can be turned by the fingers notwithstanding the pressure as above pointed out.

I claim:

1. A system comprising a flask of compressed gas, a pipe system connecting it to a plurality of outlets, a rotary selector valve element in said system having different stations for respectively directing discharged gas to a selected one of said outlets, a gas release element movable in an axial direction with respect to said rotary element to open said flask, and an operating handle adapted for rotatably operating said valve element and axially operating said gas-release element.

2. A system comprising a flask of compressed gas, a pipe system connecting it to a plurality of

outlets, a rotary selector valve element in said system having different stations respectively corresponding to said outlets, a gas release element movable in an axial direction with respect to said rotary element for opening said flask, an operating handle adapted for rotatably operating said valve element and axially operating said release element, and interlock means for said handle blocking its axial operation in certain rotary positions thereof.

3. A system as in claim 2 further characterized by said operating handle being rotatable to two different stations, one of which is normal and vents the interior of the pipe system to atmosphere, and another of which connects the flask to a place of use, and being axially movable only in the latter station for opening said flask.

4. A system as in claim 2 wherein said operating handle is axially and rotatably mounted and adapted to turn said valve element to either of two stations, operating connections between said handle and the flask for opening the latter by the axial movement of the handle and means to prevent such axial movement between said stations.

5. A fire extinguishing system comprising a gas-flask, disk-sealed and provided with a disk-puncturing device, a pipe system leading therefrom to outlets one or more of said outlets being fire hazards, a pull handle having connections whereby pulling thereon actuates said puncturing device, said handle being rotary, a valve element operated by the rotation thereof for directing gas to one of said outlets to the exclusion of others and an interlock between said handle and a fixed part organized to block the pulling of said handle when not set to direct the gas to a fire hazard.

6. A system as in claim 5 in which the valve element is mounted on a hollow spindle and the puncturing means includes a cable extending through said spindle.

7. A system as in claim 5 wherein the valve element is carried by a hollow spindle, the pull handle is mounted on the end of such spindle and the puncturing means includes a cable extending through the spindle attached to the handle.

8. A system as in claim 1 wherein the valve element is a non-metallic disk carried on a tubular spindle and coacting with a metallic seating surface and pressed against said surface by the fluid pressure in the valve casing, and the gas release element extends through said spindle.

9. A system as in claim 2 wherein the casing for the valve element is provided with an index plate, and the operating handle is a pull handle having its interlocking engagement with said index plate.

10. A system as in claim 2 wherein the casing for the valve element is provided with an index plate attachable thereto in different angular relations and the handle has interlocking engagement with said index plate.

11. A system as in claim 1 wherein the valve element is a disk coacting with a seating surface on the valve body, and the inlet and outlet ports are formed in said surface, the inlet port being provided with a nipple projecting into a recess in said disk and in such relation thereto as to serve as a limiting stop for the rotation thereof.

12. A fire extinguishing system comprising a gas-flask, disk-sealed and provided with a disk-puncturing device, a distribution pipe system leading therefrom to outlets at two or more fire hazards, a pull handle having connections whereby pulling thereon actuates said puncturing device, said handle being rotary, valve mechanism operated thereby for directing gas to one of said hazards to the exclusion of others, an interlock between said handle and a fixed part organized to block the pulling of said handle except when set to direct gas to one of said hazards and a vent pipe, said parts being organized to connect the vent pipe to said distribution system when the interlock blocks the pulling of the handle.

13. A system as in claim 12 wherein the vent pipe is provided with a gas-operated tell-tale.

14. In an airplane fire extinguishing system, a flask of compressed gas provided with a gas-releasing device, a distribution pipe system, including a directing valve element, leading to the engine space, a gas release element, a single handle for operating both said elements and a vent pipe from said valve having an atmospheric outlet provided with a gas-operated tell-tale located on the under-surface of the forward part of the fuselage.

15. In a gas distribution system for aeronautical vehicles, the combination with a flask constituting the source of compressed gas, and a discharge pipe connected thereto, of a control valve connected to such pipe having an operating handle adapted to work said valve and also having means connecting said handle to operate a means at said flask to release the gas into said discharge pipe, such valve having at least two settings for directing gas flow, a vent pipe in communication with said valve to receive gas therefrom in one of its said settings and leading to the exterior of the vehicle, another pipe connected to said valve to receive gas therefrom in another of its said settings and extended to a place of use, and interlocking means for said handle preventing gas-releasing use thereof when in the first of said mentioned settings.

16. In a CO_2 system for aeronautical vehicles, the combination with a flask constituting the source of CO_2, and a discharge pipe connected thereto, of a control valve connected to such pipe having an operating handle adapted to work said valve and also having means connecting said handle to operate means at said flask to release the gas into said discharge pipe, such valve having at least two settings for directing gas flow, a vent pipe provided with a gas-operated leak indicator in communication with said valve to receive gas therefrom in one of its said settings and leading to the exterior of the vehicle, another pipe connected to said valve to receive gas therefrom in another of its said settings and extended to an outlet within the vehicle, and interlocking means for said handle preventing gas-releasing use thereof when in the first of said mentioned settings.

17. In a gas fire extinguishing system, the combination of a disc-sealed source of CO_2 confined in liquid form, a pipe system and a selector valve therein for directing the gas to one or another point of discharge, said valve including a valve chamber subject to the gas pressure during discharge, and a rotary valve disc therein having a metallic seat and adapted to be pressed to said seat by the pressure in said chamber said valve disc being of non-metallic material whereby it may be turned during discharge, a handle for so turning it and another handle for first rupturing the sealing disc so as to cause the discharge.

18. In an aeronautical vehicle, a flask of carbon dioxide having a discharge head adapted

for operation to release the gas and subject to such operation from the pilot's station a discharge pipe leading from said head into the casing of a selector valve, such casing having at least three outlet ports and a valve member therein normally registered with one of said ports but adapted to be registered with any one of the others, a pipe line connecting the normally registered port to an overboard discharge fixture secured in an outer wall of the vehicle and a pipe line connecting each one of the other ports to points inside the vehicle and a handle at the pilot's station whereby said valve member may be shifted from its said normal position to either of the other positions.

19. In an aeronautic vehicle, the combination with a flask of carbon dioxide provided with a gas-confining discharge head, means at the operator's station for operating said head to discharge the gas to one or more hazards within the vehicle and a vent pipe for gas that leaks from the flask or flows therefrom on the spontaneous rupture of its confining means leading to and terminating in a fixture secured in the outer wall of the vehicle, said fixture being located on the lower side of the vehicle body in a position to be seen by ground attendants and including a visible leak indicator.

20. In an aeronautic vehicle, a carbon dioxide flask, a pipe system connecting it to a plurality of discharge points, a selector valve element for directing gas to any one of such points to the exclusion of the others, a gas release element, a handle having connections for respectively operating both said elements and a supplementary handle having connection only to the selector valve element.

21. In an aeronautic vehicle, a disc-sealed flask of carbon dioxide having an operating head with a cutter for the disc and connected with a pipe system to discharge the gas at one or more fire hazards, said system including a selector valve in said pipe system having a flat disc valve element adapted to direct the discharge to one hazard or the other according to its adjustment, a hollow spindle by which such disc is rotated, a handle removably carried on said spindle, a cable extending from said handle through the spindle to the disc cutter and a sheave for said cable carried on the valve body.

22. In an aeronautic vehicle, the combination with a flask of compressed gas provided with a discharge head normally confining the gas therein, a conduit connecting such head with a directing valve controlling two conduits, one of such conduits connecting such valve to a discharge point within the vehicle, and the other connecting such valve to a vent fixture, said fixture being secured in the outer wall of the vehicle and including a gas-operated element visible from outside the vehicle for indicating gas leakage as from the spontaneous opening of said discharge head and means at the operator's station for adjusting said valve and for actuating said discharge head for purposely releasing the gas into said conduit.

23. In a high pressure fluid medium distribution system comprising a high pressure fluid medium releasably confined in a container, a releasing mechanism adapted to be actuated by a cable, a discharge conduit for said container, and a plurality of distribution conduits for said fluid medium, the combination of cable actuating means, a cable secured to said cable actuating means leading to said releasing mechanism, and a distribution valve for controlling the passage of the fluid medium through the conduits comprising a valve body having an inlet adapted to receive said discharge conduit and a plurality of outlet passages adapted to be connected to said distribution conduits, a valve member rotatable in the valve body by said cable actuating means independently of the actuation of said cable and adapted upon rotation to change the respective outlet passage communicating with the inlet passage of the valve body, and cable guide means in said member adapted to receive the cable.

24. In a high pressure fluid medium distribution system comprising a high pressure fluid medium confined in a container, a fluid medium releasing mechanism for said container adapted to be actuated by an actuating member, a discharge conduit for said container, and a plurality of distribution conduits for said medium, the combination of a fluid medium distribution valve operatively disposed between said discharge and said distribution conduits, an actuating member secured to said releasing mechanism, means to actuate said actuating member and said valve secured to said member and operatively combined with said valve adapted for independent actuating movements for the member and the valve respectively, whereby the valve and the actuating member are actuatable by said actuating means, each independently of the other.

25. In a high pressure fluid medium distribution system comprising a high pressure fluid medium confined in a container, a fluid medium releasing mechanism for said container adapted to be actuated by an actuating member, a discharge conduit for said container, and a plurality of distribution conduits for said medium, the combination of a fluid medium distribution valve operatively disposed between said discharge and said distribution conduits, an actuating member secured to said releasing mechanism, means to actuate said actuating member and said valve secured to the member and operatively combined with said valve adapted for actuating movements independent of each other for the valve and the actuating member respectively, and interlocking means associated with said valve and said actuating means, whereby the actuating member is actuatable in accordance with the operative position of the valve.

26. In a high pressure gas distribution system comprising a gas flask, a gas releasing device and a distribution system including a rotary selector valve adapted to direct the discharge to one or another discharge outlet, means for operating said system comprising a single handle for rotating the valve and operating said device and an auxiliary handle for rotating said valve.

27. In a gas distribution system for airplanes, the combination with a flask of compressed gas, gas-releasing means normally confining the gas therein, a piping system normally subject only to atmospheric pressure leading from said flask to one or more discharge outlets within the airplane, and including a pipe line terminating at the skin of the airplane on the lower side thereof, at a point visible to attendants when the plane is grounded, and a tell-tale connected with the end of said line containing gas-operated means adapted to record the occurrence of a pressure increase in said pipe line incident to gas escape from said flask.

CHARLES H. LINDSAY.