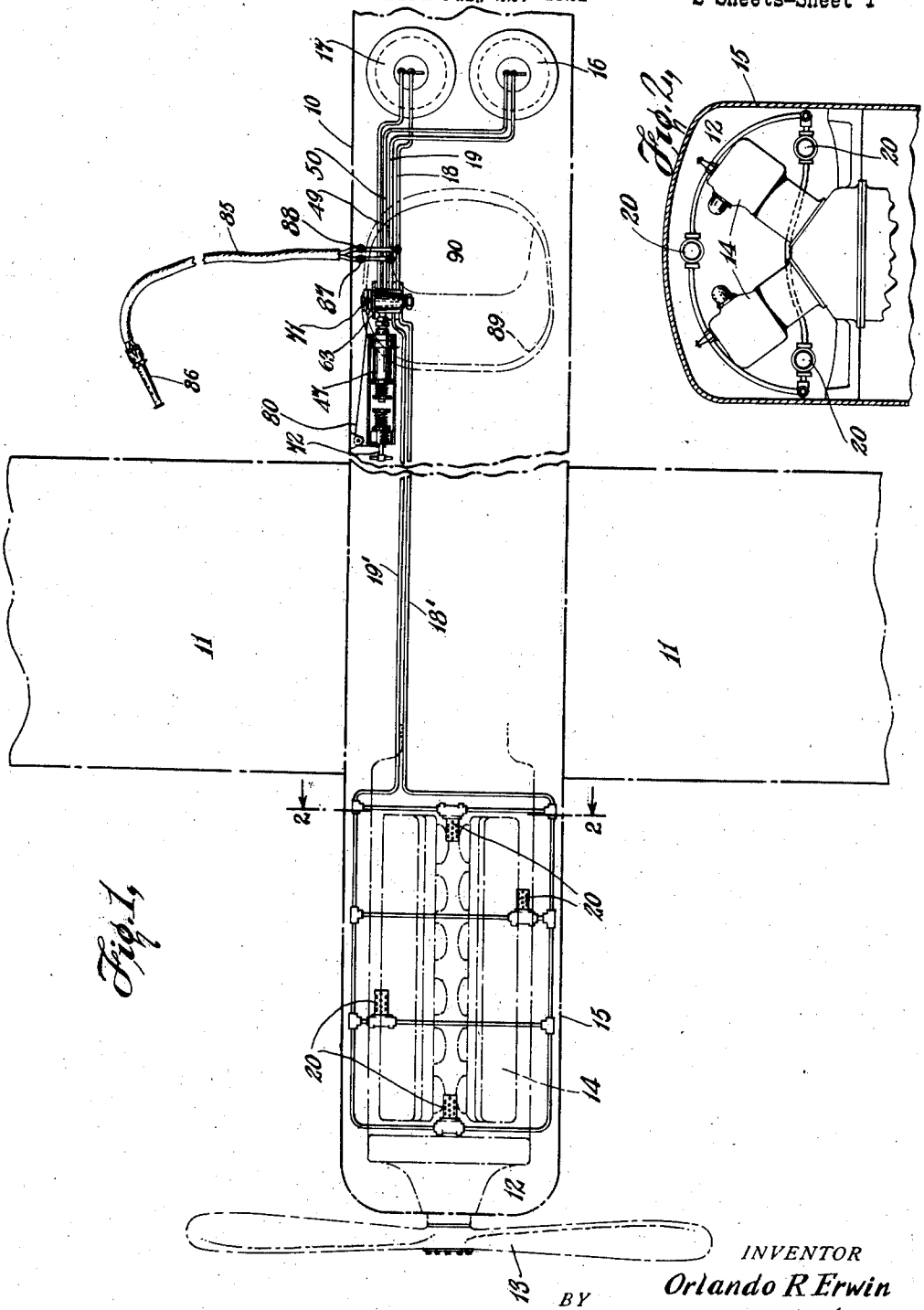
Feb. 28, 1928. 1,660,992

O. R. ERWIN

FIRE EXTINGUISHING APPARATUS

Filed July 22, 1921 2 Sheets-Sheet 1



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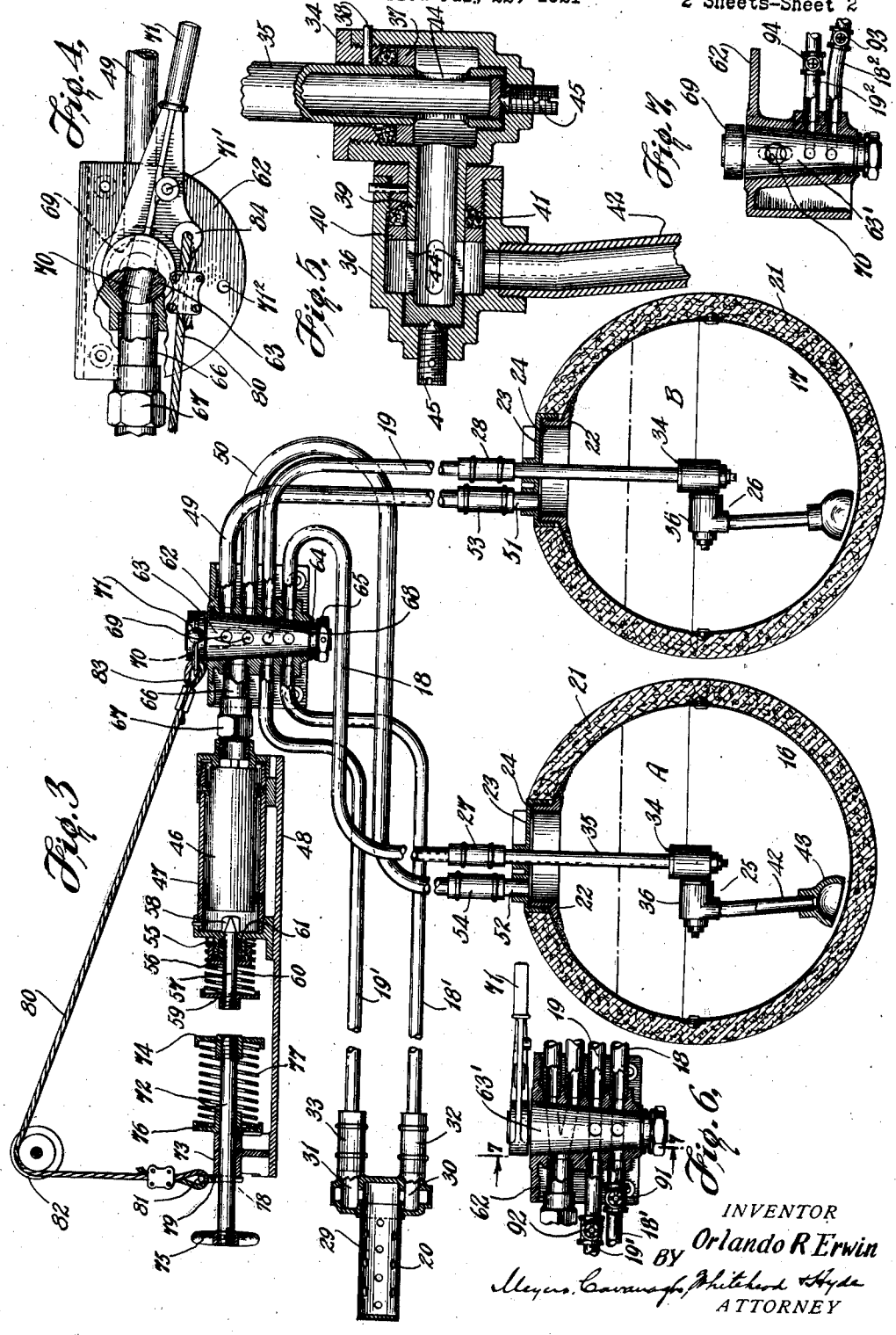
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UNITED STATES PATENT OFFICE.

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FIRE-EXTINGUISHING APPARATUS.

Application filed July 22, 1921. Serial No. 486,700.

This invention relates to fire extinguishing apparatus and more particularly to a fire extinguishing system suitable for incorporation in aircraft.

The peculiar conditions under which apparatus of this kind is required to function call for an apparatus which is essentially light and compact, and moreover an apparatus which can be rendered fully operative in any of the positions assumed during flight by the machine to which it is attached.

To satisfy the conditions of lightness and compactness, it is proposed to employ a fire extinguishing system, using foam as the fire extinguishing medium but in view of the inherent lightness of the foam and the high wind conditions likely to be encountered when the apparatus is called into play, it is necessary that the apparatus be protected by supplemental means, such as would not be required were the apparatus employed on the ground.

In order that the invention may be readily understood, reference is made to the accompanying drawings, in which Fig. 1 is a fragmentary plan view of an aeroplane, showing my fire extinguishing system installed therein.

Fig. 2 is a view in cross section taken on the line II—II of Fig. 1.

Fig. 3 is a detail view of the fire extinguishing system;

Figs. 4 and 5 are views of details.

Figs. 6 and 7 are views of slightly modified forms of parts of the apparatus.

Referring to Fig. 1 of the drawings, it will be seen that the aeroplane to which my system is shown as applied, includes the usual fuselage 10, wings 11, power plant 12, and propeller 13, the power plant shown comprising a 12-cylinder Liberty engine 14.

Surrounding the engine 14, I provide a casing 15 into which the fire extinguishing medium is to be injected in time of fire, the purpose of the casing 15 being to prevent the foam from being dispersed and blown away from the engine as soon as it emerges from the distributing means.

For the storage of the foam-making solutions, I provide a plurality of tanks or compartments 16 and 17, the solutions being conducted in time of fire through solution lines 18 and 19 connected to the compartments 16 and 17 respectively and through additional lines 18′ and 19′ to a plurality of mixing chambers arranged in parallel across the solution lines.

As shown, the mixing chambers 20 are distributed about the engine compartment so that it may readily be flooded in the event of fire, the provision of the casing 15 permitting the generation of the foam to take place within a completely closed system.

Referring to Fig. 3, it will be seen that the solution compartments 16 and 17 are shown in the form of spherical tanks, and for the purpose of insulating the tanks against freezing, each may be surrounded by a blanket of hair or felt insulation 21. Each of the tanks is provided with a filling opening defined by the threaded neck 22, which receives a cap 23, an efficient closure between these elements resulting from the insertion there-between of a gasket 24. Each of the solution tanks is also provided with intake means 25—26 supported by the caps 23 to which means the solution lines 18 and 19 are connected as by couplings 27 and 28.

To insure the operation of the apparatus in any position which the aeroplane may assume during flight, I provide each of the solution tanks with a universally movable intake structure which, as shown in Fig. 5, comprises a head 34, mounted for rotation about the pipe section 35 connected to the solution line and a second head 36 mounted for rotation about the head 34 and about an axis normal to the axis of rotation of the latter. The head 34 is supported by the pipe section 34 as by means of the collar 37, packing 38 being provided between the collar and the head for securing a leak-proof connection between the pipe section 35 and the head 34. The head 34 is provided with the tubular stem 39, also carrying a collar 40, leak-proof packing 41 also being provided in this head. Attached to the head 36 is the pipe section 42 extending to the bottom of the tank and terminating in a bell-mouth inlet 43.

For the purpose of providing intercommunication between the pipe section 35 and the pipe section 42, the stem 39 and the pipe section 35 are provided with a plurality of spaced apertures 44 opening into the pipe section 42 and tubular stem 39 respectively. Adjusting screws 45 may be provided in both heads 34 and 36 if desired. With this

construction the bell mouth inlets are universally movable with respect to the solution lines to which they are respectively connected, these inlets gravitating to the bottoms of the respective tanks in any and all positions of the plane, the solutions in the tanks being by this means capable of drainage to capacity in the event of fire.

In time of fire the solutions in the tanks are driven under pressure through the solution lines and to the mixer 20 which is shown as having the central mixing chamber 29 and the solution ducts 30 and 31, the latter being connected to the lines 18', 19' by couplings 32 and 33 respectively. To provide the necessary pressure to force the solutions through the pipe lines I preferably provide a gas capsule or cartridge 46, which may take the form of the gas cartridge shown in Patent No. 1,568,795, dated January 5, 1926, the said cartridge 46 being shown in a cartridge casing 47 mounted on a base 48, the casing 47 providing a gas chamber; the said chamber being adapted for communicating connection to a plurality of pressure or gas lines 49 and 50, the gas lines 49 and 50 being, in turn, connected for communication with pipe sections 51 and 52 fitted to the closure caps 23, coupling elements 53 and 54 being provided for this purpose. The gas casing 47 is provided at one end with a threaded neck 55 threadedly receiving a collar 56, a spring pressed plunger or firing pin 57 having a head 58 being arranged for sliding motion in the neck 55 and collar 56, the plunger 57 being provided with the disc 59 functioning as a seat for the compression spring 60, the neck piece 55 serving as an opposed seat for the said compression 60. Action of the spring 60 normally holds the plunger head 58 out of contact with the cartridge 46, the spring 60 permitting motion of the plunger 57 in a direction towards the cartridge 46, as will appear further hereinafter when gas producing activity is desired to be started. For the purpose of providing the desired anti-gas leak connection between the neck 55 and collar 56, suitable packing between these elements such as 61 may be provided.

For the purpose of preventing the solutions from reaching the open mixing chambers 20 and the gas chamber 47 during normal flight of the aeroplane, means is provided in the solution lines 18 and 19 and the gas lines 49 and 50 for normally closing communication between the solution compartments and the mixing chamber and gas casing respectively, such means preferably taking the form of a manually operable unitary valve structure. Referring to Figures 1 and 3 of the drawings, this valve structure may comprise a valve casing 62 and a rotatable preferably conical shaped valve plug 63 rotatable in the casing, the valve plug being resiliently retained in the casing, as by means of a compression spring 64 seated at one end against the casing structure and at the other end against the nut 65 attached to the valve plug 63. The casing 62 is provided with registering ducts, as shown clearly in Figure 4, for connecting the gas lines 49 and 50 with the pipe section 66 which, in turn, is connected as by means of a union 67 to gas casing 47 and for connecting the solution lines 18 and 19 extending from the solution compartments to the sections 18' and 19' leading to the mixing chambers. The valve plug 63 is in turn provided with spaced bores 68 constituting ports adapted in one position of the valve plug for registration with the solution lines 18 and 18' and 19 and 19' as shown in Figure 3 of the drawings, for closing communication between the solution lines 18 and 18' and 19 and 19' respectively. The valve plug 63 is further provided with bores 69 leading into an enlarged bore 70, shown particularly in Figure 4 of the drawings, these bores forming ports connecting the single pipe section 66 to the gas lines 49 and 50. For the purpose of operating the valve and positioning the plug in either of its positions the plug 63 is provided with the valve handle 71. For locking the valve, the handle may be supplied with a locking pin 71' cooperating with a positioning aperture 71^2. It will be apparent that with the position of the valve handle and valve plug as shown in Figure 3 of the drawings, solution lines 18 and 19 and gas lines 49 and 50 are closed, preventing movement of the component solutions through these lines during normal use of the plane. It will be further apparent that rotation of the valve handle 71 to a position as shown in Figure 4 of the drawings will open the solution lines and the gas lines to the foam mixing chambers and to the gas casing respectively. To set the cartridge 46 into gas producing activity I provide a spring actuated plunger or hammer 72 slidably mounted in a bearing 73 attached to the base 48, the hammer 72 being provided at one end with a hammer disc 74 and being provided at its other end with a hand piece 75. Seated between the disc 74 and a stationary flanged disc 76 and surrounding the hammer 72 is the compression spring 77 normally under compression and adapted when the hammer 72 is free for sliding motion for impelling the hammer disc or head 74 forwardly, as will appear presently. The hammer 72 is provided with a bore 78 adapted for the reception of a pin 79, the bore being in pin-receiving position when the plunger is in retracted position, as shown in Figure 3 of the drawings. It will be apparent that with the provision of this structure when the pin 79 is given an upward pull and is removed from the bore 78 that the compressed spring 77 will impel the hammer 72 forward-

ly driving the firing pin 57 into the cartridge 46, thereby setting the same into gas generating activity.

For the purpose of releasing the hammer 72 by removal of the pin 79 I preferably provide the cable 80 having one of its ends looped for the reception of an integral hook portion 81 of the pin 79, the cable 80 being preferably trained over a pulley or sheave 82, the other end of the cable being looped as at 83 and being received by an apertured lug 84 preferably formed integral with the valve handle 71. By the provision of this means for removing the pin 79 it will be apparent that rotation of the valve handle 71 to a position as shown in Figure 4 of the drawings will simultaneously set the cartridge 46 into gas producing activity and open the gas lines 49 and 50 to the gas casing 47 and also open communication between the mixing chambers 20 and the solution tanks. By this means, therefore, a single motion of a valve handle will start the gas producing activity, will open communication to the gas lines so that the gases generated will exert their operating pressure on the solutions in the tanks and will simultaneously open the solution lines from the tanks to the mixing chambers.

For the purpose of extinguishing any local fires that may occur outside of the engine casing 15, I may provide hose lines in the form of twin or duplex hose sections 85, comprising a plurality of hose lines connected at one end to the solution lines 18 and 19, as shown in Figure 1 of the drawings, and being provided at its other end with a mixing nozzle 86. For the purpose of normally closing the twin hose lines 85 these lines may be provided with the valve elements 87 and 88.

For the purpose of placing the system under ready manual control the valve means 63 and the valve handle 71 may be located in the cockpit 89 of the aeroplane with the valve handle 71 adjacent the pilot's seat 90. The valves 87 and 88 in the twin hose lines 85 may be also conveniently located adjacent the pilot seat to be under ready manual control.

For the purpose of simultaneously controlling foam production at a plurality of stations such as is desired for extinguishing fires in other regions of the plane, as well as in the motor plant, I may employ the modified form of valve mechanism shown in Figures 6 and 7 of the drawings. In this form of valve mechanism the valve plug 63′ is provided with means for simultaneously opening communication between the solution lines 18 and 19 and a plurality of sets of solution lines 18′, 19′ and 18^2, 19^2 respectively, lines 18′ and 19′ being intended for connection to the mixing chambers 20 of the motor plant, the lines 18^2 and 19^2 being intended for connection to a twin hose section such as 85, Figure 1. To effect the desired intercommunication, the valve plug 63′ is provided with a plurality of bores each having an inverted T configuration, the arms of the T's being intended for alinement with lines 18′ and 19′, as shown in Figure 6 of the drawings, the legs of the T's being in turn intended for alinement with lines 18^2 and 19^2, as shown in Figure 7 of the drawings; Figures 6 and 7 showing the valve in open position. To close the valve the valve handle 71 is rotated substantially 90 degrees towards the observer, as viewed in Figure 6, the operation being similar to the operation of the valve shown in Figure 3 of the drawings. With this construction foam may be generated at a plurality of stations by a single throw of the valve handle into the position shown in Figures 6 and 7, the extinguishing of motor fires and secondary fires being controlled in this manner. If desired, lines 18′ and 19′ and lines 18^2 and 19^2 may be supplied with manually operable valves 91 to 94 respectively, these valves being used to cut off solution flow to either the mixing chambers 20 or the twin hose lines 85 in the event that only one of these delivery means is desired to be availed of.

The operation of my fire extinguishing system will be apparent from the above description but it is to be understood that the arrangement of parts described and illustrated is merely exemplary of the invention and therefore subject to modification without departing from the scope of the following claims.

1. In an aeroplane fire extinguishing system, apparatus including tanks for storing chemical solutions, mixing devices for mixing the solutions to produce a fire extinguishing medium, means to separately conduct the solutions to the mixing devices, a source of latent pressure for driving the solutions from the tanks to the mixing devices, mechanical means to convert the latent pressure into active pressure, a common means for controlling the means for conducting the solutions to the mixing devices, for preventing communication between the tanks and consequent intermixture of the solutions when the apparatus is inverted and for controlling the connections between the source of pressure and the tanks, the operation of said common means being effective to render active the said mechanical means.

2. In a fire extinguishing system, solution compartments for normally storing chemical component solutions which, upon intermixture, produce a fire extinguishing medium, a mixing chamber, solution lines connecting the compartments with the mixing chamber, valve means in said solution lines normally closing communication between the mixing

chamber and the compartments, normally inoperative instrumentalities for exerting operating pressure on the component solutions in time of fire to drive the same through the solution lines, provisions for setting the instrumentalities into activity and unitary means for simultaneously controlling the operation of said provisions and the opening of said valve means.

3. In a fire extinguishing system, a plurality of solution compartments, a mixing chamber, solution lines connecting the compartments with the chamber, a gas pressure generator, gas lines connecting the generator with the compartments, normally closed unitary valve means in said solution and gas lines, provisions for setting the generator into gas producing activity in time of fire and means for simultaneously controlling operation of said provisions and the opening of said valve means.

4. In a fire extinguishing system, fire extinguishing apparatus including solution compartments for normally storing component chemical solutions, mixing chambers, a hose station, solution lines connecting the solution compartments with the mixing chambers and the hose station, unitary valve means in said lines normally closing communication between the compartments and the hose station and mixing chambers, instrumentalities for setting the apparatus into activity in time of fire and unitary means for controlling operation of said instrumentalities and the opening of said unitary valve means.

5. In a fire extinguishing system the combination with a source of pressure of a plurality of containers for component foam-making solutions each connected with the source of pressure, a mixing chamber for the solutions connected with each of said containers and a common means controlling the connections between the pressure source and each container and the connections between each container and the mixing chamber whereby intermixture of the solutions without the operation of said means is prevented.

Signed at New York in the county of New York and State of New York this 21st day of July, A. D. 1921.

ORLANDO R. ERWIN.