

Feb. 6, 1973

L. L. MATTSON

3,714,987

HELICOPTER SUPPORTED AERIAL FIRE SUPPRESSANT APPLICATOR

Filed May 17, 1971

Fig. 1.

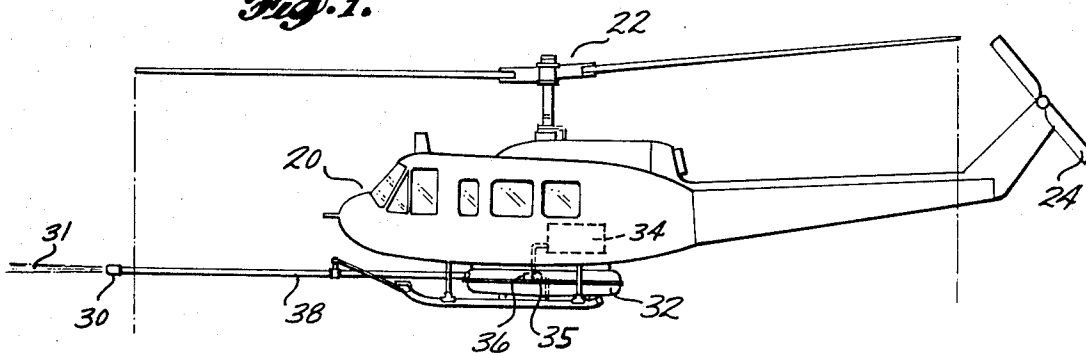


Fig. 2.

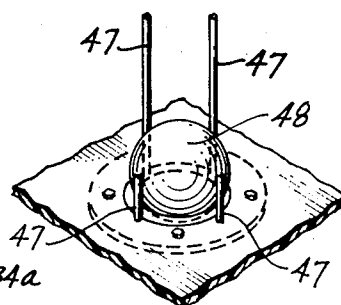
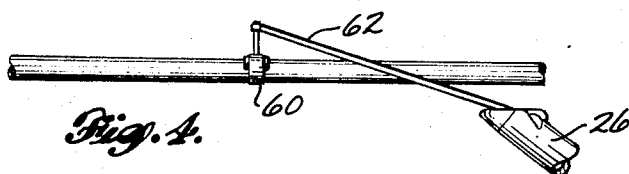
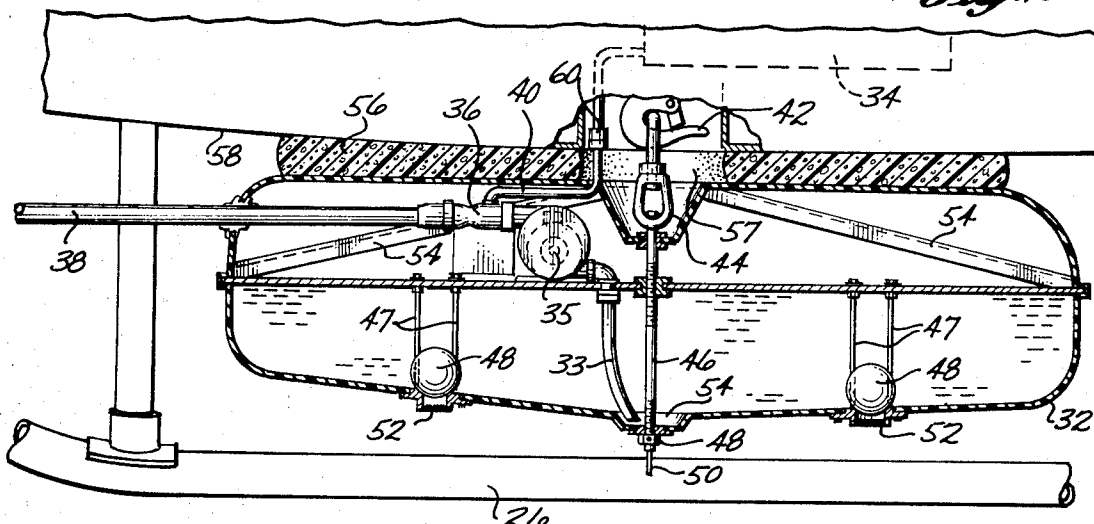


Fig. 3.

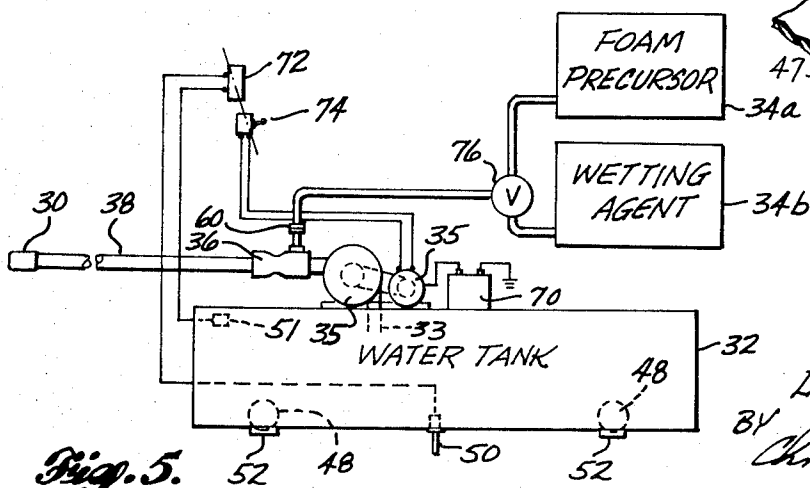


Fig. 5.

INVENTOR
LARRY L. MATTSON
BY
Christensen & Sanborn
ATTORNEYS

1

3,714,987

HELICOPTER SUPPORTED AERIAL FIRE SUPPRESSANT APPLICATOR

Larry L. Mattson, 3624 164th Place SE.,
Bellevue, Wash. 98008

Filed May 17, 1971, Ser. No. 143,995

Int. Cl. A62c 3/02; B64d 1/16; B05b 17/02

U.S. Cl. 169—2 A

6 Claims

ABSTRACT OF THE DISCLOSURE

A helicopter-transported fire suppression system and method is described wherein a fire suppression medium such as water, aqueous foam, slurries and the like are accurately directed to the precise location of a fire or to a portion of a fire to be treated by projecting a coherent stream of the fire suppression medium outwardly from the fire suppression system by locating a nozzle means beyond the effective area of helicopter rotor downwash to avoid interference with the stream by the downwash. The helicopter pilot controls the location and direction of application of the fire suppression medium by controlling the altitude, attitude and location of the helicopter and controls the quantity and composition of fire suppression medium by actuating pumping means therefore from the pilots control station.

BACKGROUND OF THE INVENTION

This invention relates to apparatus and a method for preparing and applying fire suppressant and retardant materials to fires from an aerial platform. This invention further relates to an apparatus for and a method of preparing and applying fire retardant materials accurately upon a desired specific location from a helicopter hovering adjacent the fire. This invention specifically relates to apparatus for a technique of aerial fire fighting of forest fires in remote areas by means of direct application of a stream of fire suppressant or retardant materials to the precise area of the fire chosen by the pilot of a helicopter carrying the fire fighting apparatus.

Suppression of fires in wilderness areas heretofore has been largely conducted by ground crews dispatched for that purpose from a central fire control station to travel by foot, by aircraft or by helicopter to the site of the fire in the event that the fire is not immediately adjacent an access road. In remote areas, fire fighting crews are limited to the tools which they have carried with them or which are subsequently dropped to the scene from aircraft. Combating fires in this manner is a time consuming, laborious and extremely inefficient procedure. Such fire fighting techniques have been augmented and enhanced by the use of aerial bombardment techniques in which a fire retardant material such as water or slurries of retardant materials in water are dropped upon the fire site from low-flying aircraft. Such activities tend to both cool the fire and retard its progress through low vegetation and trees treated by the aerial drop.

Helicopters have also been used for fire suppression activities by spraying the retardant material into the downwash from the rotors of the helicopter, causing a distribution of liquid droplets and particles of fire suppressant or retardant materials upon an area limited to the ground surface impinged upon by the downwash from

2

the helicopter rotor. This type of application of fire suppressant materials is extremely inefficient in that sufficient density and volume of fire suppressant media is lacking to adequately cover and suppress a fire, and such materials are not specifically applied to the area at which the fire suppressant material is most urgently needed. Rather, a general distribution of the fire suppressant material occurs over a broad area beneath the helicopter. Such a wide distribution is helpful in certain types of fires in which a large area is affected by the fires, however, in the event that fires have broadened into a long line of fire front, such as is found in the general nature of forest fires, there is a great need for the ability to apply the fire suppressant or retardant materials to a specific area with a great deal of control and accuracy.

OBJECTS OF THE INVENTION

It is accordingly an object of this invention to provide a means of delivery and a method by which fire suppressant material may be delivered to a specified and closely confined area from an aerial platform.

It is a further object of this invention to provide a helicopter-supported fire suppression means and method of use thereof useful in applying a stream of fire retardant or suppressant materials directly upon a point remote from the helicopter.

It is a still further object of this invention to provide apparatus for fire fighting purposes which is supportable and transportable by a helicopter and which may be easily jettisoned upon pilot command in the event of a helicopter power failure.

One specific object of this invention is to provide a method for combating forest fires in remote areas and the apparatus necessary for such operations which may be transported by a helicopter and may be refilled at any location in which there is water accessible to a hovering helicopter.

It is a further specific object of this invention to provide tank filler means suitable for use with a helicopter-mounted fire fighting apparatus constructed and arranged so that the tank may be rapidly filled from any source of water accessible to a hovering helicopter without the requirement of landing the helicopter during the tank filling operation.

An additional specific object of this invention is to provide helicopter-mounted fire fighting apparatus in which the jet nozzle for applying the fire suppressant or retardant material extends beyond the downwash of the helicopter rotor so that no interference with the continuity and integrity of the stream projected from the nozzle is encountered from the downwash to ensure the maximum density and controllability of the stream of fire suppressant medium, making it less susceptible to the high winds encountered during certain fire situations.

SUMMARY OF THE INVENTION

In accordance with the present invention, a refillable tank is mounted on the fuselage of a helicopter by means of the widely used cargo hook or other suitable types of connection. The tank is provided with an efficient lightweight pumping system which will provide a positive high pressure flow of water through an in-line inductor system for mixing a foam precursor material or wetting agent

therein to a suitable nozzle at the end of a length of pipe extending beyond the area affected by the downwash from the rotor blades. The nozzle of the pipe extending beyond the downwash from the rotors is adapted to project a coherent stream of fire retardant or suppressant materials, unaffected by the rotor downwash, outwardly from the helicopter-mounted tank system to a point within the range of observation of the pilot of the helicopter. The externally mounted tank is of a readily refillable nature, permitting the helicopter pilot to refill the tank from any body of water having a sufficient depth to substantially receive the depth of the tank. The tank is fitted with at least one large ball-seat type valve assembly which will unseat as the hydrostatic pressure is increased upon the lower side as a result of the tanks being lowered into the water while the helicopter is hovering immediately above the water's surface. The ball valves are adapted to close immediately upon removal of the tank from the water due to the forces applied thereto by hydrostatic pressure to seat the balls upon their respective valve seats.

This means of employing fire suppressant or retardant materials to a fire utilizes to its full extent the maneuverability and adaptability of the helicopter to fire fighting situations in that when airborne the pilot controls the stream of fire suppressant or retardant materials by maneuvering the altitude, attitude and direction of the helicopter to point the nozzle of the fire suppression apparatus in the desired direction to inundate the base of the fire with suppressant or retardant materials. The pilot controls the direction at which the fire suppressant or retardant materials is projected from his vehicle by changing the location of the entire helicopter and through actuation of a simple on-off switch controlling the flow of fire suppressant or retardant materials.

The method by which this invention is used comprises initially filling the chemical retardant and suppressant material supply tank or tanks with appropriate foam precursors, wetting agents and the like and filling the large tank positioned beneath the helicopter. The helicopter pilot, upon receiving notification of a fire would then proceed to the scene of a fire and upon arrival commence application of the appropriate fire suppression or retardant medium. Frequently the following procedure would be utilized. First a foam material, formed by educting foam precursor into the eductor would be projected outwardly through the nozzle onto the fire area to substantially blanket the fire and deprive the fire of the oxygen necessary for combustion. The foam would also act to cool the situs of the fire. With this important first step achieved, the helicopter pilot may then switch to a water application mode, with or without wetting agents.

The system and method provided in this invention isolates the fire combating system completely from the helicopter's operating and maneuvering system. Each fire suppression unit is self-contained in that a complete tank, pumping apparatus, battery, extension pipe and nozzle are provided independently of the helicopter and are connected only by cargo hooks widely utilized in helicopter operations and light control wire and hydraulic connections to chemical tanks contained within the helicopter cargo space. The pilot will thus be able to jettison the great majority of his load of fire suppression equipment in the event of helicopter engine failure, giving him the added control that a light helicopter has during hovering situations. In addition, external connection of the fire fighting unit permits the load to be classified as an external load which under existing Federal Aviation Administration regulations permits a larger load to be carried.

These and other objects, advantages and attributes of this invention will become more readily apparent through a detailed examination and evaluation of the following description of the preferred embodiments taken in conjunction with the appended drawings.

IN THE DRAWINGS

FIG. 1 shows a helicopter equipped with the fire fighting apparatus discussed herein shown dispensing fire suppressant or retardant material upon a fire site.

FIG. 2 shows a cross sectional view of the tank mechanism and associated mounting apparatus for the fire suppression unit of this invention.

FIG. 3 shows a schematic representation of the fluid flow system used in carrying out the method of this invention and showing schematically the control system utilized.

FIG. 4 shows the details of a releasable boom fastening means.

FIG. 5 shows a schematic representation of the fire suppression system of this invention.

Referring more particularly to the drawings wherein like numerals indicate like parts, there is seen in FIG. 1 a side elevation of a helicopter carrying the fire fighting apparatus of this invention. The helicopter shown generally at 20 having a rotor 22 and a stabilizer propeller 24. The helicopter 20 is shown as one of the high capacity styles of helicopter presently manufactured which is adapted to carry substantial weight loads. The helicopter 20 is shown with the fire suppressant applicator system of this invention strapped beneath the craft with the nozzle 30 extending beyond the downwash area from rotors 22. The fire suppressant applicator system shown in FIG. 1 includes a water tank 32, a pump 35 and an eductor-type mixer 36. Conduit 38 extends outwardly from the tank 32 and is adapted to carry the water or water and chemicals mixture to nozzle 30 which may then be projected outwardly from the nozzle 30 to the fire. The nozzle is positioned beyond the rotor downwash and is so located that the pilot of the helicopter 20 may observe the stream 31 of the fire suppressant or retardant material being projected outwardly from nozzle 30.

In FIG. 2 the details of the tank construction and the mounting means utilized in strapping the tank to the bottom of the helicopter is shown in the cross-sectional view. The tank system is connected to the helicopter by means of cargo hook 42, which engages the swivel 44 positioned directly above the center of the tank 32. The swivel 44 in turn engages a bolt member 46, which projects downwardly through the tank and is threadingly engaged by nut 48 to attach the tank 32 to the helicopter cargo hook 42. The upstanding portion of swivel 44 is hooked by the cargo hook and the bolt 46 is run up tight by the rotation of nut 48 so that the tank fits snugly against the bottom side of the helicopter. A foam rubber pad 56 is positioned in the tank 32 and the bottom 58 of the helicopter 20 such that a firm yet resilient engagement results between the tank 32 and the helicopter 20. The foam rubber pad 56 contains an interior aperture 57 through which passes the cargo hook engaging swivel 44 and the chemical line 40. The chemical tank 34 is positioned inside the fuselage of the helicopter 20 and is connected to the suction side of the eductor 36 by means of conduit 40. A quick detaching connector 60 is utilized to permit rapid jettison of the tank in the event of helicopter motor failure. The in-line eductor mixer 36 is shown positioned out the outlet of the pump-motor unit 35 and serves to thoroughly mix chemicals such as foam precursors, wetting agents and the like with water to form the desired fire suppression or retardant substance.

Internal support straps 54 are utilized to provide the necessary strength and rigidity to the tank. At the bottom of tank 32 are a pair of water inlet ports 52, which are utilized to fill the tank from a convenient source of water such as a lake or a stream. The valve mechanism is a ball and seat arrangement in which ball 48 is free to travel up and down confined by vertical restraining elements 47 in response to hydrostatic pressures, upward movement of the balls resulting in opening of the valve mechanism whenever the tank is partly or completely submerged and downward movement to close the valve mechanism when-

5

ever the tank is removed from the water thus preventing flow of water from the tank. The pump-motor unit 35, shown in FIG. 2, draws water from the lowermost portion 54 of tank 32 through inlet pipe 33, and discharges the water into an eductor-mixer 36. A water proximity sensor 50 is shown in position on the bottom end of threaded member 46 to aid the pilot in determining the location of the tank with respect to the location of the body of water from which the tank is to be filled.

In FIG. 3 the details of the ball and seat valve shown in FIG. 2 are presented in a perspective view. Ball 48 is permitted to travel up and down within the confines of vertical restraining elements 47 and is adapted to seat upon valve seat 47 and form a seal whenever the hydrostatic pressure is sufficient to force the ball down against seat 47. The spherical ball 48 is preferably a density equal to or slightly exceeding the density of water so that hydrostatic forces will cause the ball to unseat, whenever the tank is submerged, but will not cause the ball 48 to float in a partially or completely filled tank.

In FIG. 4 the details of one embodiment of a releasable boom fastening means are shown. Strut 62 extends outwardly from the fore portion of skid 26 and carries a boom-engaging clip member 60 which is adapted to be released easily in the event of tank jettison.

In FIG. 5 a schematic representation of the fire suppression system of this invention is shown. The chemical tanks 34a and 34b contain foam precursor, wetting agent or other suitable fire suppression or retardant agents suitable for use with an aqueous system. The water tank 32 contains a sufficient amount of water to extinguish a reasonably large sized blaze, yet is within the carrying capabilities of a helicopter. The water tank 32 contains therein the water pump and motor unit 35, as shown in position on the top side of tank 32, and is driven by electrical power supplied by battery 70. The pump-motor unit 35 is controlled by a switch mechanism 74 accessible to the helicopter pilot. Water under pressure is supplied by the motor-pump unit 35 to the eductor mixer 36 wherein chemicals from tank 34a or 34b are thoroughly mixed and projected outwardly from nozzle 30 at the tip of boom 38 as the fire suppressant or retardant material. In the alternative, water alone may be sprayed out through nozzle 30 to soak a fire area after the foam retardant has been used to suppress and partially cool the blaze. The proper chemical material for forming the fire suppressant or retardant material may be chosen from tank 34a or 34b, or chemical treatment may be omitted by proper setting of valve 76. The method of using the apparatus shown in detail in the attached drawings includes the following steps.

The chemical storage tanks 34a and 34b are filled with the proper material for use with water to form the desired fire suppressant or retardant medium. Water tank 32 is filled and the apparatus which has previously been attached to the helicopter 20 is then ready for use.

Upon receiving notification of a fire, the helicopter pilot would immediately proceed to the scene of the fire and commence suppression activities. Initially, the helicopter pilot would apply a foam material to the fire site to knock down the fire and deprive the fire of the oxygen necessary for combustion. In addition, the presence of aqueous foam material will substantially cool the fire and impede its progress.

The helicopter pilot would then switch his mode of operation into a water application phase in which water from tank 32 is utilized by itself or in conjunction with a wetting agent from tank 34b to thoroughly inundate and extinguish the fire.

For fires in areas inaccessible to the usual firefighting equipment this invention can be utilized to a great advantage in knocking down the fire and building a barrier across which the fire cannot travel. This type of operation of this invention involves the construction of a fire line utilizing aqueous foam material. This is accomplished by positioning the helicopter at a location in which tube 38

6

is substantially perpendicular to the edge or front of the fire. Foam material is then directed upon the edge of the fire such that a strip of one or more feet in width is inundated with the foam material and the fire substantially extinguished at that location, by the presence of the foam. By utilizing a rather persistent foam, the progress of the fire will be impeded and other techniques including substantially completely soaking the fire area with water from the helicopter-supported firefighting system may be utilized to completely extinguish the fire.

While only preferred embodiments of the methods and apparatus of this invention, together with various modifications thereof have been described in detail herein and shown in the accompanying drawings, it will be evident that various further modifications are within the capability of those skilled in the art without departing from the scope of the invention.

I claim as my invention:

1. An airborne fire suppression system for depositing a fire suppressant or retardant material on a closely controllable location comprising:

a liquid storage tank having means thereon to releasably engage a support mechanism on the bottom side of a helicopter said tank to be positioned directly beneath said helicopter;

a boom means extending outwardly from the forward portion of said tank, said boom of sufficient length to position a nozzle beyond the downwash pattern of said helicopter so that liquids ejected from said nozzle are projected outwardly from said nozzle in a coherent stream;

means to supply liquid from said tank to said nozzle; and,

means positioned at the bottom of said tank for rapidly filling said tank from a body of water comprising valve means operable in response to hydrostatic pressure to fill said tank when said tank is submerged into said body of water and to prevent flow of water from said tank said fill mechanism upon removal from said tank from said body of water.

2. The apparatus of claim 1 wherein a substance is added to the liquid contained in said tank prior to supplying said liquid to said nozzle to enhance the fire suppression characteristics thereof.

3. The apparatus of claim 2 wherein said chemical material is added to said liquid by means of an eductor-mixer means operated by the flow of liquid to said nozzle.

4. The method of combatting a fire from an aircraft having a downward pattern and having the capability to hover adjacent the fire comprising the steps of:

extending a boom from the aircraft beyond the influence of said downward pattern, said boom having a nozzle at the tip thereof adapted to form a relatively coherent stream of liquid projecting outwardly therefrom;

supplying a fire retardant or suppressant liquid under sufficient pressure to said boom to force said liquid out of said nozzle in a coherent stream; and

directing said coherent stream upon said fire by controlling the position of said aircraft.

5. The method of claim 4 and the step of filling a water tank means used to supply said fire retardant or suppressant liquid to said nozzle by immersing of said tank means through filling means operable by immersion of said tank, said tank releasably positioned beneath said helicopter so that said filling step is accomplished while said helicopter hovers over a body of water with said tank at least partly immersed therein.

6. An airborne fire suppression system for depositing a fire suppressant or retardant material on a closely controllable location comprising:

a liquid storage tank having means thereon to releasably engage a support mechanism on the bottom side of a helicopter said tank to be positioned directly beneath said helicopter;

a boom means extending outwardly from the forward

7

portion of said tank, said boom of sufficient length to position a nozzle beyond the downwash pattern of said helicopter so that liquids ejected from said nozzle are projected outwardly from said nozzle in a coherent stream;
 means to supply liquid from said tank to said nozzle; and,
 water inlet means on said tank for rapidly filling said tank with water.

References Cited

UNITED STATES PATENTS

3,519,080 7/1970 Rochat ----- 169—2 R
 3,494,423 2/1970 Stansbury et al. ----- 169—2 R
 3,603,340 9/1971 Rousselet ----- 137—533.13 X

8

2,461,304 2/1949 Wilson ----- 137—533.13 X
 2,611,439 9/1952 Faulkner ----- 169—15
 2,934,149 4/1960 Bedford et al. ----- 169—15
 3,234,962 2/1966 Williamson ----- 169—13 X
 3,442,334 5/1969 Gousetis ----- 169—2 R
 3,485,302 12/1969 Thorpe ----- 169—2 R
 3,580,339 5/1971 Nance ----- 169—2 A

FOREIGN PATENTS

10 773,893 12/1967 Canada ----- 169—2 R

ROBERT S. WARD, JR., Primary Examiner

U.S. Cl. X.R.

15 169—15; 137—533.13