May 16, 1950 R. L. HOLDRIDGE 2,507,597

AIRPORT FUELING SYSTEM

Filed Jan. 22, 1945 4 Sheets-Sheet 1

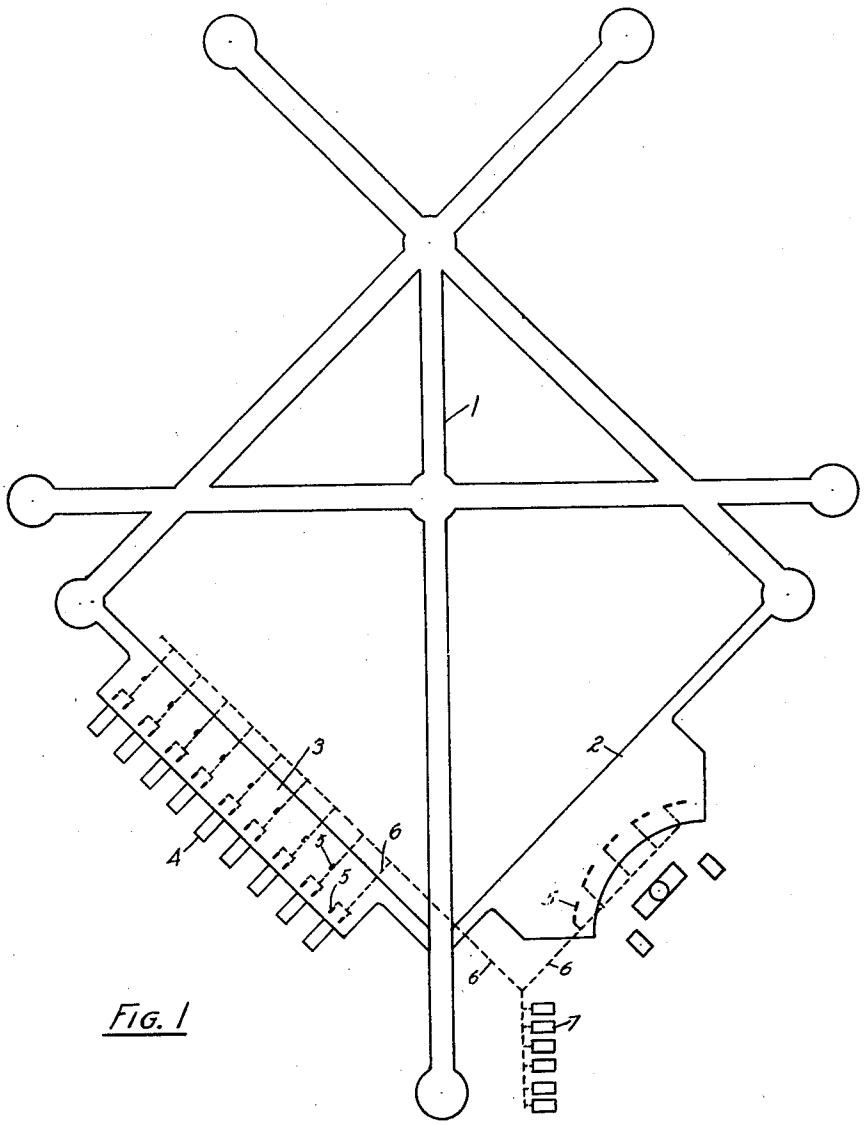

FIG. 1

INVENTOR.
Randall L Holdridge
BY
Ralph Hammar
attorney

May 16, 1950 R. L. HOLDRIDGE 2,507,597

AIRPORT FUELING SYSTEM

Filed Jan. 22, 1945 4 Sheets-Sheet 2

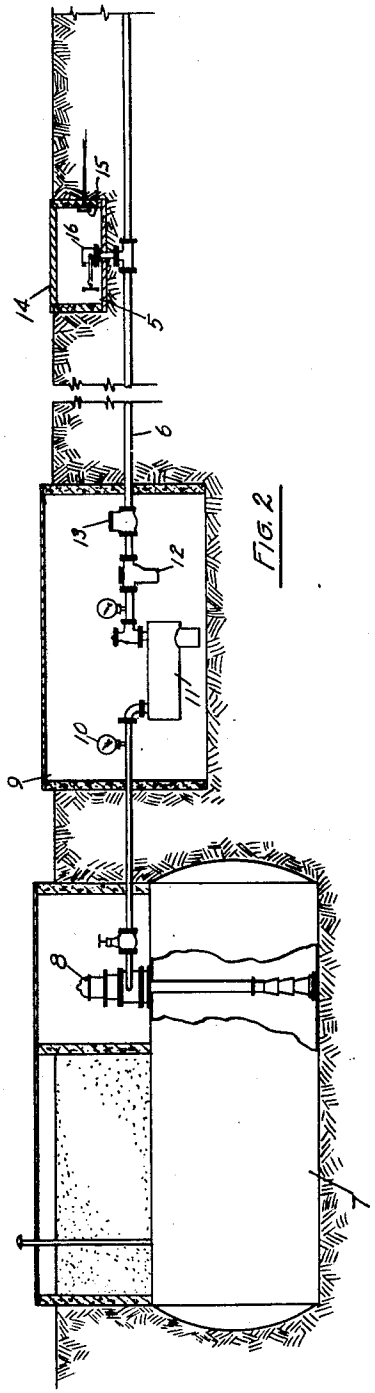

FIG. 2

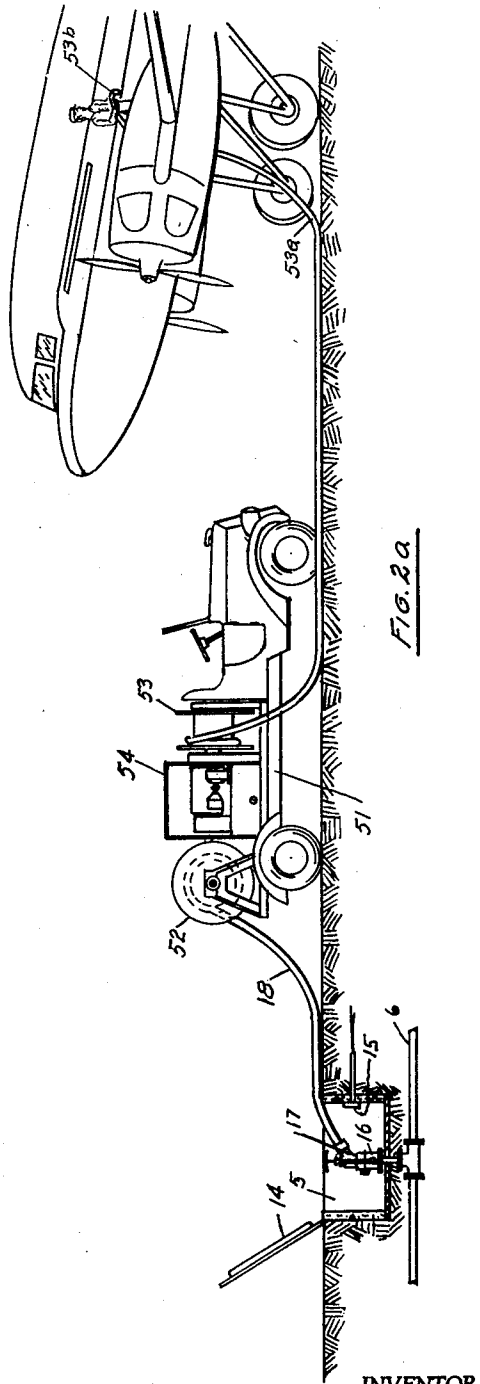

FIG. 2a

INVENTOR.
Randall L. Holdridge
BY
Ralph Hamman
attorney

May 16, 1950 R. L. HOLDRIDGE 2,507,597

AIRPORT FUELING SYSTEM

Filed Jan. 22, 1945 4 Sheets-Sheet 3

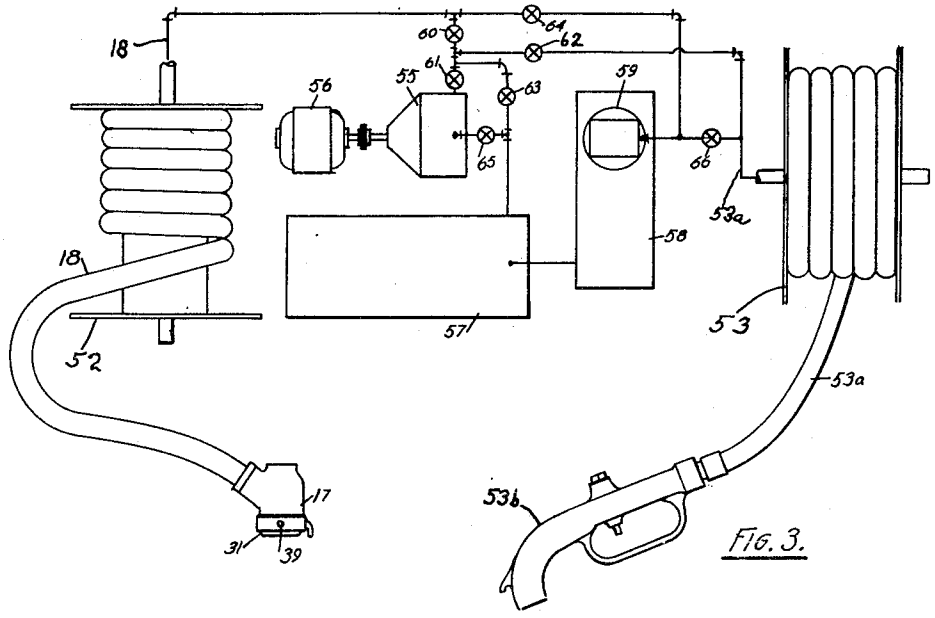

FIG. 3.

INVENTOR.
Randall L. Holdridge
BY Ralph Hammar
Attorney

May 16, 1950 R. L. HOLDRIDGE 2,507,597

AIRPORT FUELING SYSTEM

Filed Jan. 22, 1945 4 Sheets-Sheet 4

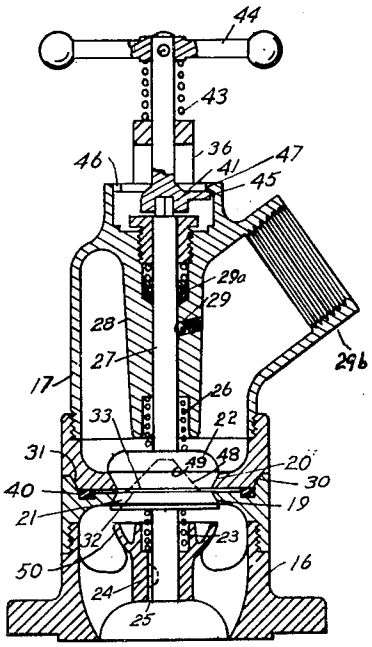

FIG. 4.

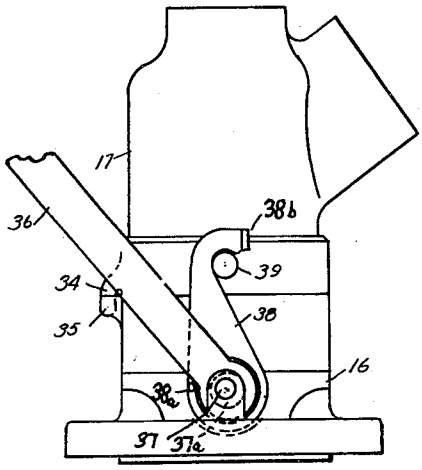

FIG. 5.

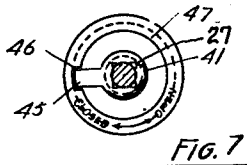

FIG. 7.

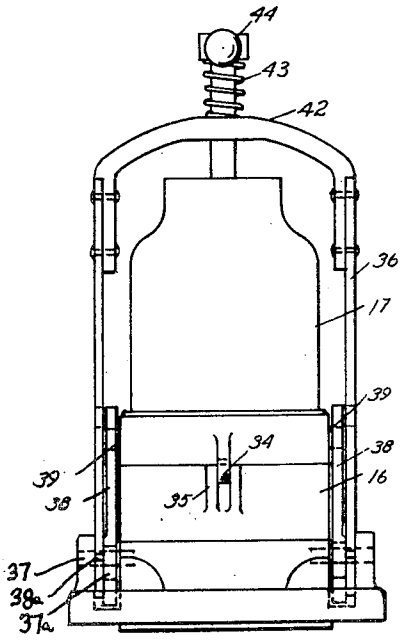

FIG. 6.

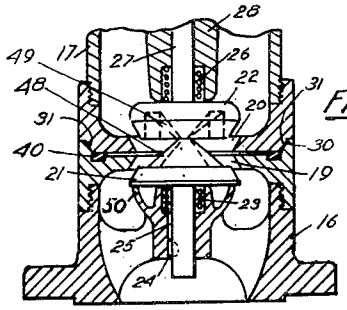

FIG. 8.

INVENTOR.
Randall L. Holdridge
BY Ralph Hammar
Attorney

Patented May 16, 1950 2,507,597

UNITED STATES PATENT OFFICE

2,507,597

AIRPORT FUELING SYSTEM

Randall L. Holdridge, Erie, Pa., assignor to Erie Meter Systems, Inc., Erie, Pa., a corporation of Pennsylvania

Application January 22, 1945, Serial No. 574,022

8 Claims. (Cl. 222—128)

1

In airports fueling is desirable at widely separated points. There are disadvantages in permanent fueling installations and in fuel trucks. This invention is designed to provide the desired fueling points by utilizing mobile dispensing units carrying the necessary fuel delivery equipment and delivering fuel from fuel supply outlets. This gives the possibility of using the units with any one of a number of outlets thereby making more effective use of the fuel delivery equipment. The mobile units can be lighter and more maneuverable than fuel trucks requiring less precise spotting of the aircraft at the fueling points and presenting less of a traffic problem. Further objects and advantages appear in the specification and claims.

In the accompanying drawing, Fig. 1 is a diagrammatic view of an airport illustrating the layout of the fueling system; Figs. 2 and 2a are fragmentary elevations of the fueling system which, taken together, illustrate the use; Fig. 3 is a diagrammatic view of the fuel dispensing equipment; Fig. 4 is a sectional elevation of one of the couplings and valves connecting the fuel outlets with the intake hose of the dispensing unit; Fig. 5 is a side elevation of the coupling; Fig. 6 is a front elevation of the coupling; Fig. 7 is a detail of the top of the intake hose coupling member; and Fig. 8 is a fragmentary elevation showing the valves in the open position.

In Fig. 1 there is shown an air-port having runways 1, a loading apron 2, a parking apron 3, and service hangars 4. At convenient locations, for example on the loading and parking aprons and at the service hangars, are fuel outlet pits 5 fed by fuel lines 6 connected with gasoline storage tanks 7.

As indicated in Fig. 2, each of the gasoline storage tanks may be provided with a pump 8 discharging to the fuel lines 6 through a pit 9 containing a pump pressure control 10, a water separator 11, a strainer 12, a pipe line meter 13, and any other equipment necessary for the control of the delivery of the fuel to the fuel line 6. The pump pressure control 10 may maintain a pressure in the fuel line sufficient to deliver the fuel to the airplane tanks or it may only maintain a pressure sufficient to keep the fuel line filled. The fuel line is laid beneath the surface of the airport and at various points along its length is connected to fuel outlet pits 5 normally closed by covers 14 flush with the surface of the ground. In the pit the fuel line is connected to a coupling member 16 adapted to be connected to a coupling member 17 on the intake hose 18 of a fuel dispensing unit. The pit may contain an electrical outlet 15.

2

As shown more in detail in Figs. 4 to 8 inclusive, the coupling members 16 and 17 have ports 19 and 20 normally closed by poppet valves 21 and 22 so that the flow of fuel through the coupling members is prevented when the coupling connection is disconnected. The poppet valve 21 for the coupling member 16 is biased against its seat by a coil spring 23 and is prevented from turning by a key 24 slidable in a key-way 25. The poppet valve 22 is biased against its seat by a coil spring 26 surrounding a valve stem 27 rotatable in a boss 28 and yieldably held against rotation by a ball detent 29. Suitable packing for the valve stem is indicated at 29a. A nipple 29b is provided for connection with the intake hose 18. The coupling member 16 is provided with a beveled seat 30 for receiving a mating projection 31 on the coupling member 17. The sides of the beveled seat 30 extend above the closely spaced surfaces 32 and 33 of the poppet valves 21 and 22. When the valves are closed, the small amount of fuel between the surfaces 32 and 33 is held in the well provided by the beveled seat 30. The structure is such that this amount of fuel can be kept to a negligible quantity.

The intake hose coupling member 17 is provided with a lug 34 received between ears 35 on the outlet coupling member 16 and angularly locating the coupling members so that the coupling connection can be made only when the members are in one position. After the hose coupling member is located, it is locked against the mating coupling member by a bail 36 fixed to shafts 37 journaled in the outlet coupling member. On the shafts are eccentrics 37a rotatably carrying hooks 38 which hook over projections 39 on the hose coupling member and secure the coupling members together. Pins 38a and lugs 38b provide a limited turning of the hooks with respect to the bail. Upon rotation of the bail to the upright position from that illustrated in Fig. 5, the eccentrics cam the hooks downward forcing the hose coupling member tightly against the outlet coupling member and compressing a gasket 40 sealing the space around the valves. In the upright or locked position of the bail, a key or socket 41 is opposite the squared upper end of the stem 27. The key is slidable in the bail and is normally held against the underside of top 42 of the bail by a coil spring 43 arranged between the top of the bail and a handle 44.

When the handle is in the position correspond-

ing to the closure of the valves (Fig. 7), a projection 45 on the key 41 is directly above and registering with a notch 46 in a flange 47 surrounding and slightly above the upper end of the valve stem 27. When the handle is depressed to bring the key into engagement with the upper end of the valve stem, the projection 45 passes through the notch 46 so that upon turning the handle to open the valves, the projection is received beneath the flange 47 and holds the key in engagement with the valve stem. The key cannot be disengaged from the valve stem until the handle is turned to the closed position.

The valve 21, which is held against rotation by the key 24, is provided with inclined cam surfaces 48 which engage complementary cam surfaces 49 on the rotatable valve 22. Upon turning the handle 44, the valves are cammed apart, the valve 21 being stopped by a flange 50 and the valve 22 being stopped by engagement with the lower end of the boss 28. Upon turning of the handle to the closed position, the springs 23 and 26 close the valves. During closure the fuel between the valves is squeezed out through the space between the valves and the ports 19 and 20.

The delivery of fuel to the planes is effected by mobile dispensing units 51 carrying the reels 52 and 53 for the intake hose 18 and the delivery hose 53*a* and metering and control equipment indicated at 54. This equipment, being relatively light, may be mounted on skids or on wheels. It is illustrated as mounted on a light truck. Typical equipment for the dispensing unit as diagrammatically illustrated in Fig. 3 comprises a fuel delivery pump 55, a gasoline or electric pump motor 56, a water separator 57, a strainer 58, and a meter 59. The intake hose 18 is connected through valves 60 and 61 to the pump inlet, through a valve 62 to the delivery hose 53*a*, through a valve 63 to the water separator 57 and through a valve 64 to the meter outfit. The pump discharge is connected through a valve 65 to the water separator 57. The water separator, the strainer, and the meter have permanent connections. Between the meter outlet and the fuel delivery hose is a shut-off valve 66.

When the dispensing unit is used for fueling a plane under conditions in which the fuel pressure in the pipe line 6 is insufficient to deliver the fuel, the valves 62, 63 and 64 are closed and the valves 60, 61, 65 and 66 are open. Fuel is then drawn through the intake hose 18 by the pump and forced through the water separator, strainer and meter to the delivery hose 53*a*, the fuel delivery being controlled at the delivery nozzle 53*b*. If the fuel pressure in the pipe line 6 is high enough so that the additional pressure provided by the pump 55 is not necessary, the valves 61 and 65 will be closed and the valve 63 will be opened so that the fuel from the intake hose 18 by-passes the pump but otherwise flows through the same fluid circuit to the airplane.

Under some circumstances it is desirable that fuel be removed from the airplane fueling tanks. This de-fueling can be carried out with the dispensing unit by opening the valves 61, 62, 64 and 65 and closing the valves 60, 63 and 66. Under these conditions the delivery nozzle 53*b* of the delivery hose 53*a* is opened and dropped into the airplane fuel tank, and fuel is drawn back through the valves 62 and 61 to the pump inlet and is discharged through the valve 65, the water separator, the strainer and meter, and from the meter through the valve 64 to the intake hose 18.

Since the fuel removed from the tanks is metered, a credit can be given.

When fueling or de-fueling is desired, the aircraft is moved to the desired fuel outlet (it need not be precisely spotted) and a dispensing unit is moved into position, the intake hose 18 coupled to the mating coupling member on the fuel outlet, the power lead for the motor 56 plugged into the outlet 15, and the valves 60—66 positioned for the desired fueling operation. Since the expense of providing fuel outlets is not great, the fuel outlets can be located so the fueling operation will not block the use of the airport. The dispensing units, being light and mobile, can be kept out of the way except when needed.

The coupling connection is broken at the end of the fueling operation by first closing the valves by turning the handle 44 to the position in which the projection 45 is opposite the slot 46, releasing the handle to permit movement of the key 41 to a position above the flange 47, swinging the bail 36 to the position of Fig. 5 in which the hooks 38 are lifted above the pins 39, and continuing the downward swinging of the bail to release the hooks due to engagement of the bail with the pins 38*a*.

It should be noted that a positive interlock is provided in the couplings requiring closure of the valves before the coupling connection can be broken. When the connection is broken, only a negligible amount of fuel is exposed and this is retained in a well so none is spilled.

What I claim as new is:

1. In combination with an airport having one or more locations at which fueling of aircraft is desired, a fuel supply line leading from a remote source to fuel outlets at said locations, couplings on said outlets each having a valve for shutting off the supply upon decoupling, a mobile dispensing unit having intake and discharge hoses and connecting fuel metering equipment, and a mating detachable coupling on the inlet hose connected to any one of the fuel outlet couplings, said mating coupling having a valve for shutting off the intake hose upon decoupling.

2. The combination of claim 1 and further including a pit housing the fuel outlets.

3. The combination of claim 1 in which the fuel outlet couplings have a well into which the intake hose coupling fits and the valves for shutting off the fuel outlet and intake hose have sealing surfaces below the top of the well whereby any fuel between the couplings remains in the well upon decoupling.

4. The combination of claim 1 and further including a pump for supplying the fuel supply line under pressure.

5. The combination of claim 1 and further including interlocking means between the valves and the couplings for closing the valves prior to breaking the coupling connection.

6. In combination with an airport having one or more locations at which fueling or defueling of aircraft is desired, a fuel supply line leading from a remote source to fuel outlets at said locations, said outlets having couplings each provided with a valve for shutting off the supply upon decoupling, a mobile dispensing unit having intake and delivery hoses, connecting fuel metering equipment, and a pump for alternatively pumping fuel from the intake hose to the discharge hose for fueling or in the reverse direction for defueling, a mating detachable coupling on the intake hose connected to any one of the fuel outlet couplings, said inlet hose coupling having a valve

for shutting off the inlet hose upon decoupling.

7. The combination of claim 6 and further including a pump supplying fuel to the fuel supply line under pressure, and a fuel pressure control for the pump responsive to the supply line pressure.

8. In combination with an airport having one or more locations at which aircraft fueling is desired, a fuel supply line leading to fuel outlets at said locations, a coupling on each of said outlets having a valve for shutting off the flow of fuel upon decoupling, a mobile dispensing unit having an intake hose, a discharge hose, and connecting fuel metering and pumping equipment, a mating coupling on the intake hose connected to any one of the fuel outlet couplings and having a valve for shutting off the flow of fuel from the intake hose upon decoupling, the hoses permitting movement of the dispensing unit to fuel aircraft variously located about the fuel outlets, and interlocking means between the couplings and

valves compelling making of the coupling connections prior to opening the valves and closing of the valves prior to breaking the coupling connections.

RANDALL L. HOLDRIDGE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
330,853	Rosenfield	Nov. 17, 1885
1,599,081	Douglas	Apr. 7, 1926
1,633,483	Graham	June 21, 1927
1,872,418	Davis	Aug. 16, 1932
2,017,345	Granberg	Oct. 15, 1935
2,203,922	Paisley	June 11, 1940
2,362,559	Jauch et al.	Nov. 14, 1944
2,393,489	Trautman	Jan. 22, 1946