United States Patent

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[54] **FLIGHT-REFUELING RECEPTACLE HAVING PRESSURE-INERTIA RELEASE VALVE**
7 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **141/346,** 141/349, 141/383, 244/135, 285/1
[51] **Int. Cl.** **B64d 39/00**
[50] **Field of Search** ..... 92/181, 256; 137/614.06; 141/269, 270, 311, 312, 346—350, 353—355, 372, 383, 385; 244/135 (A); 251/149, 149.9; 285/1, 33, 35, 304

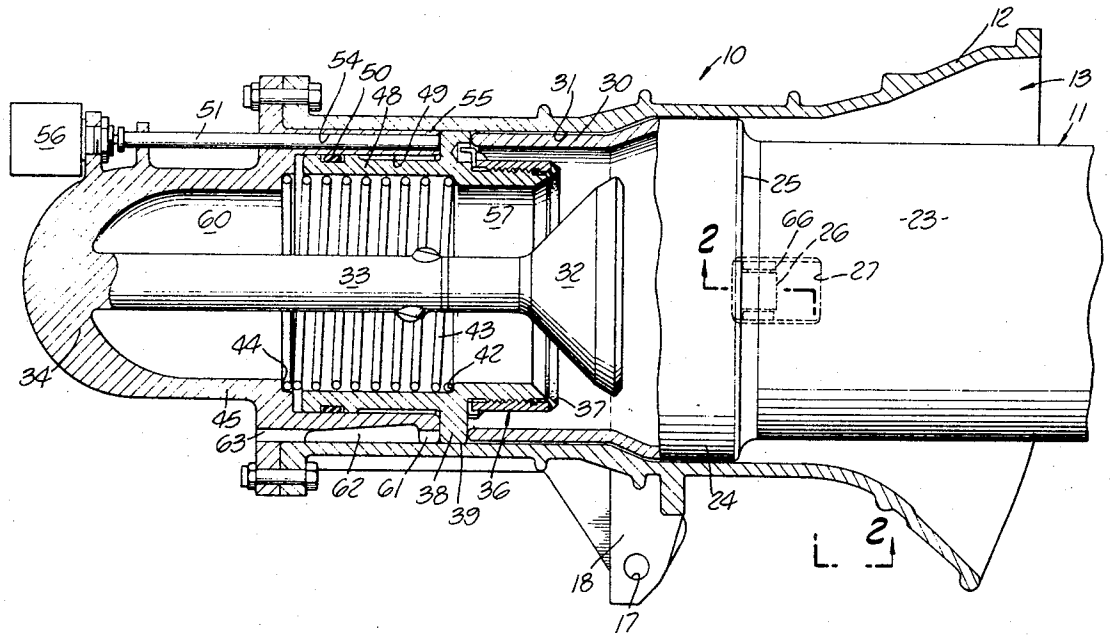
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2,938,688	5/1960	Trump	141/346X

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ABSTRACT: In a receptacle for the nozzle of an inflight refueling supply line, a pressure actuator, the pressure actuator having relief valve means to permit rapid emergency disconnection of the nozzle from the receptacle by the release of a lock by a lesser but highly accelerated external force on the lock than by a gradually increased applied external force on the lock required for unlocking and disconnection.



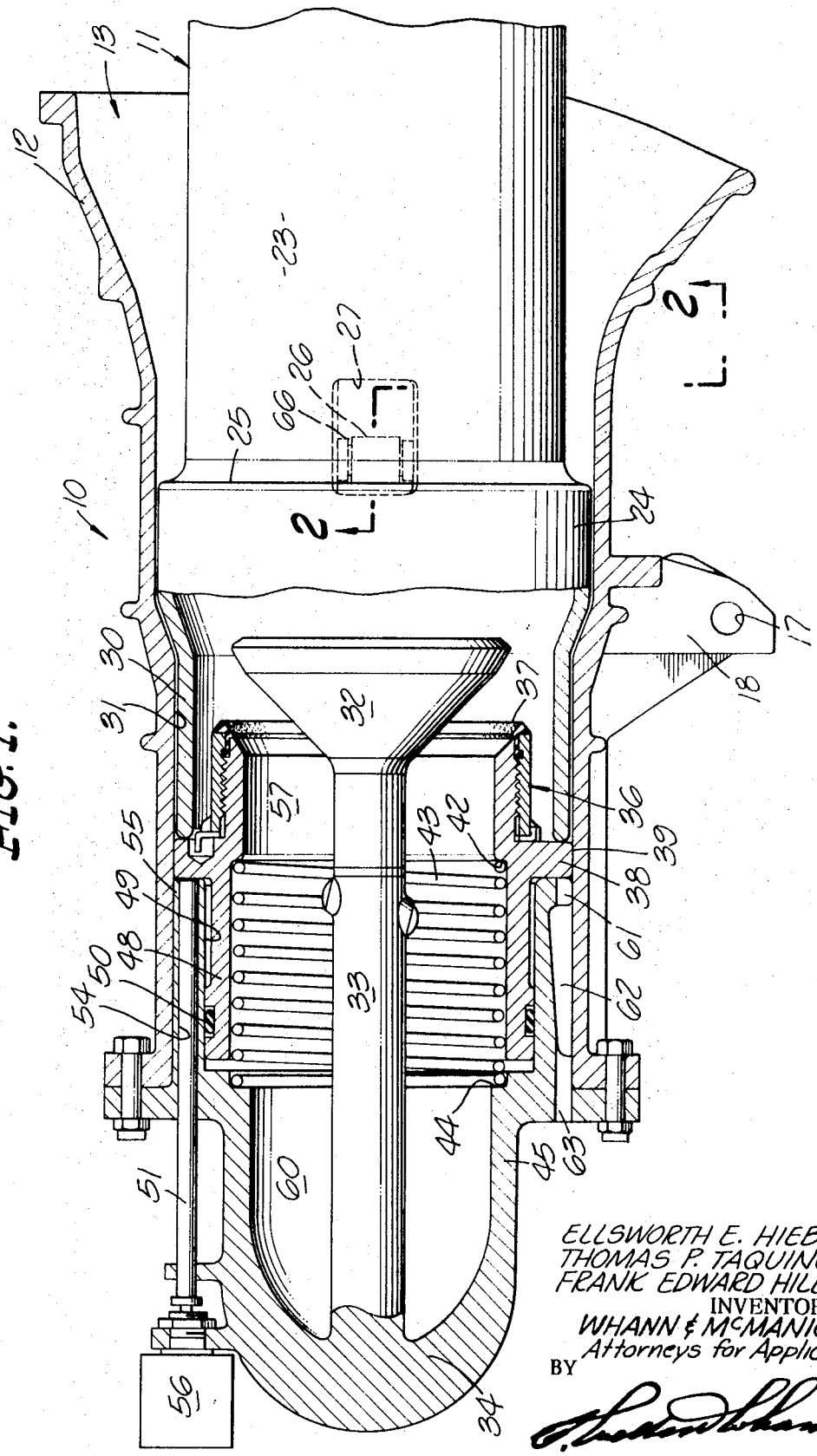


FIG. 1.

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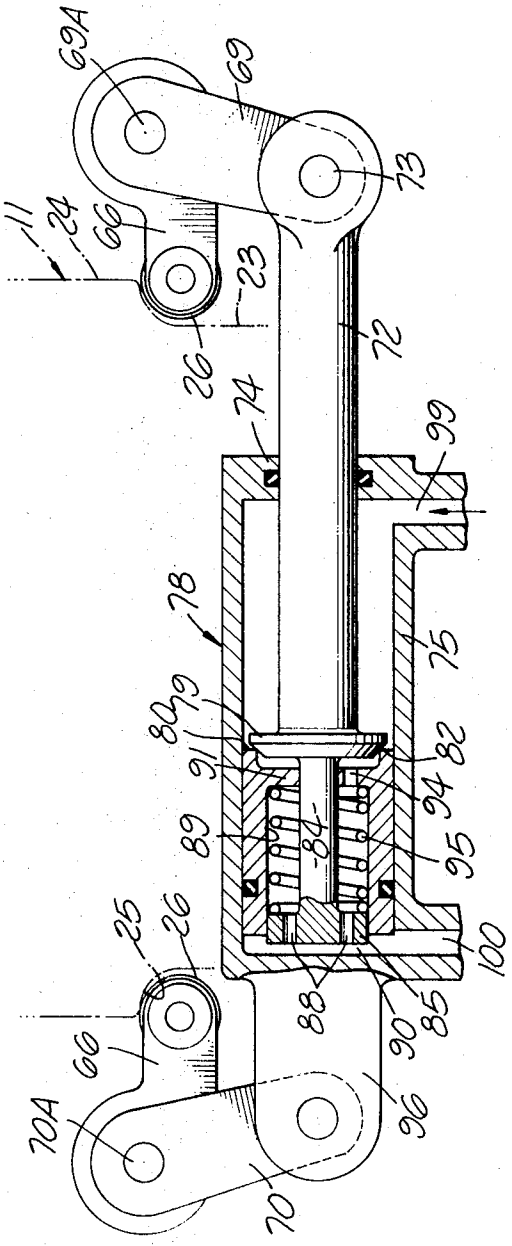


FIG. 2.

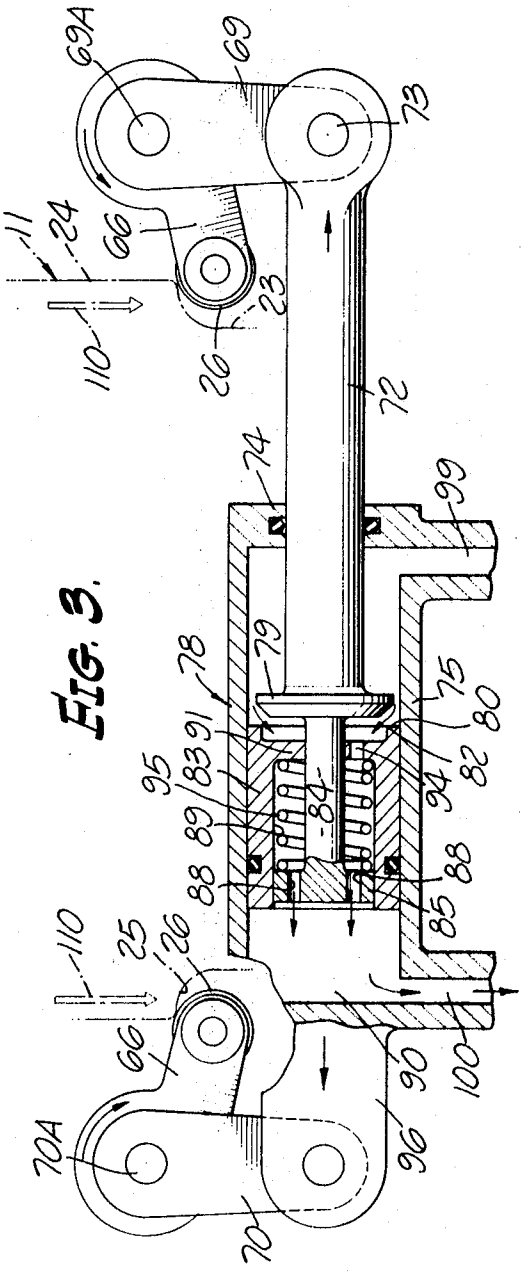


FIG. 3.

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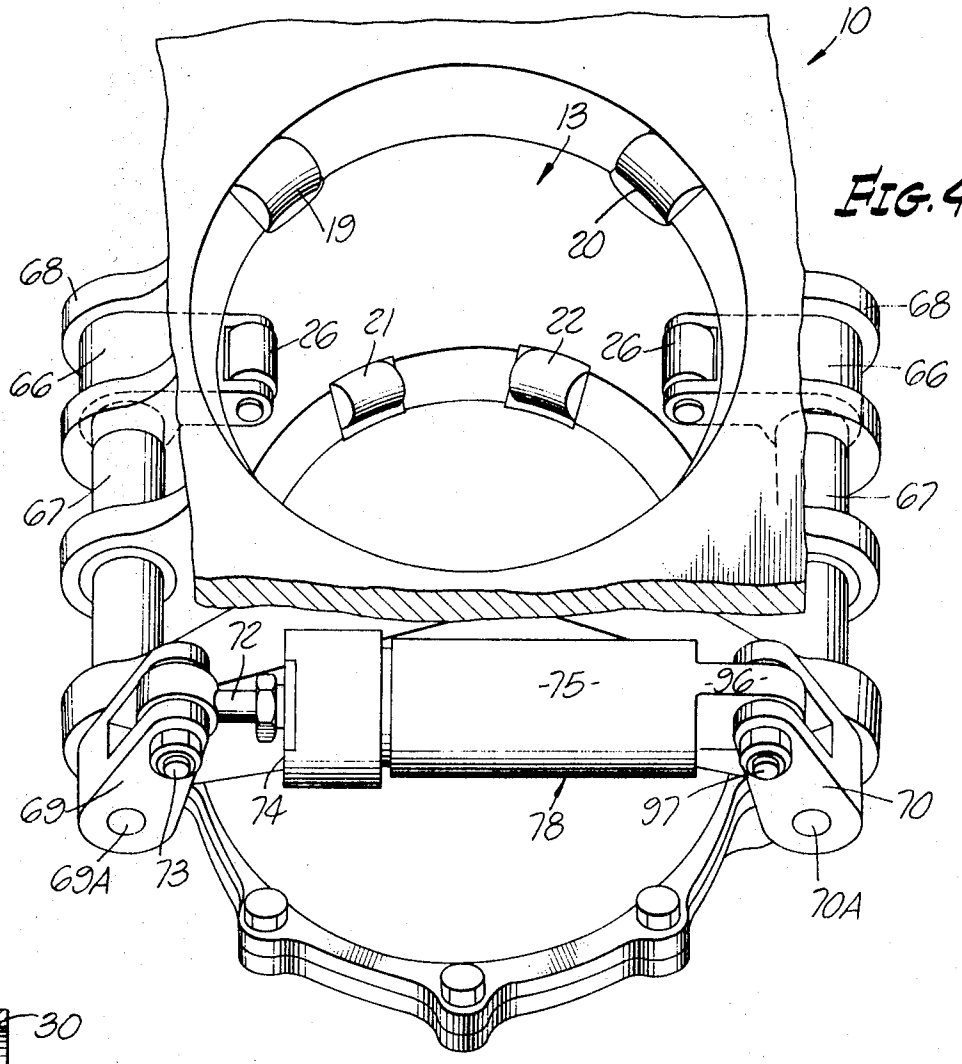


FIG. 4.

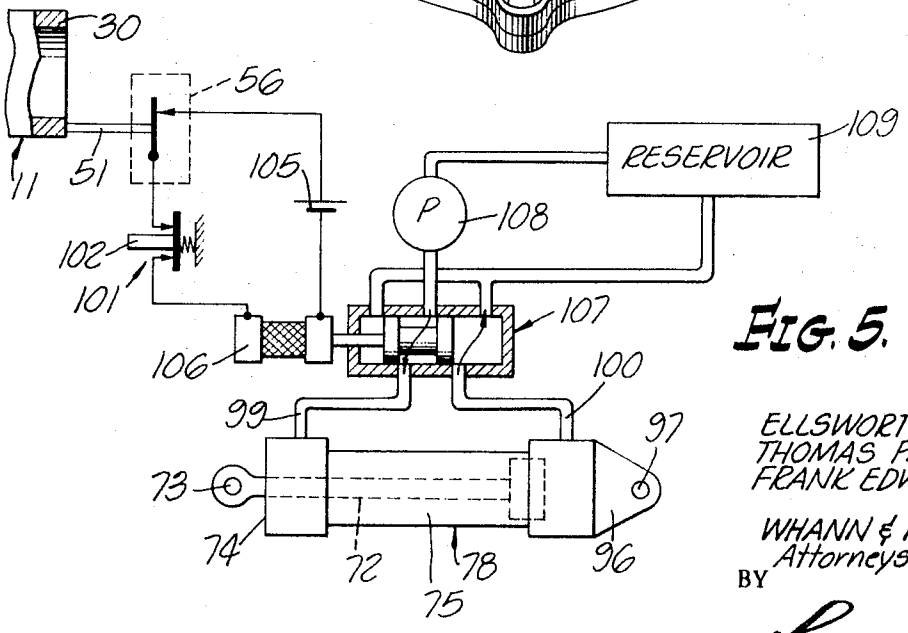


FIG. 5.

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FLIGHT-REFUELING RECEPTACLE HAVING PRESSURE-INERTIA RELEASE VALVE

In a hydraulic actuator, a piston head slidably engaged within a hydraulic cylinder, means externally of said cylinder associated with the cylinder and piston head for translating movable means associated with the cylinder and piston from a retracted holding position to an extended released position, the means externally of the cylinder being cooperative with the piston to position the movable means in accordance with the position of the piston within the cylinder and in accordance with fluid pressure applied to the piston, the movable means being adapted to apply a holding force in the retracted holding position related to the fluid pressure on the piston, and a relief valve on the piston head being adapted to open and release the fluid pressure at a predetermined force applied externally to tend to release said movable means from its holding position when said latter force is gradually applied and increased, said relief valve being adapted to permit a rapid emergency release of the movable means from its holding position and dissipation of its holding force by a lower but highly accelerated external force on the movable means than that required by the increased gradually applied external force, whereby when the highly accelerating force is applied the inertia forces of the piston head, the relief valve spring and column of fluid within the cylinder tend to remain substantially at rest to permit the relief valve to open and release the fluid at said lower external force.

BACKGROUND OF THE INVENTION

The present invention is an improvement on that in U.S. Pat. to Trump, No. 2,938,688 for Retractable Receptacle for Flight Refueling. The present invention provides a receptacle or receiver, including means by which it is normally closed and sealed against the passage or leakage of fuel therethrough. It is designed to open and permit the passage of fuel when a nozzle from a tanker plane is operatively inserted and engaged in locking connection in the receptacle on the airplane being refueled. When operatively connected to the receptacle the nozzle cannot be readily withdrawn while fuel is being transferred to the airplane.

If and when the locking connection is released and the nozzle disengaged, the receptacle automatically closes and seals itself against passage or leakage of fuel.

The receptacle may be fixed within the airplane in a wing or in the fuselage of the airplane and having a cover which is removable in flight for refueling or the receptacle may be mounted so that it may be moved to an extended position for refueling and retracted when the refueling has been completed.

In normal operation, the nozzle, which is on a trailing end of a fueling boom extending from the tanker, is locked into the receptacle automatically when engagement is complete by means of an electrically operated circuit which causes hydraulic fluid to be supplied to a pressure actuator through an electrically operated hydraulic valve. Normal release of the latching device or lock is accomplished upon completion of the refueling operation by deenergizing the circuit through an operator-controlled switch, either on the tanker aircraft, receiver aircraft or both, at which time the refueling boom may be withdrawn from the receptacle and retracted to its stowed position.

In actual operations of such systems it has been found that inadvertent separation of the nozzle from the receptacle in the receiver aircraft sometimes occurs due to turbulent air or other contingencies arising from close formation flying, and that frequently the separation is of such a violent character that damage to the receiver or tanker aircraft occurs due to the inability of the hydromechanical latching device to effect a rapid release. The present invention provides a means for releasing the latching device in an effective manner for any combination of separation velocities likely to be encountered in service.

In the early in-flight fueling systems, no type of release valve was used and displaced fluid from the hydraulic cylinder of the pressure actuator was displaced into the hydraulic supply line upon emergency disconnect. In a later state of the art, a relief valve was placed in the cylinder supply line to relieve at a preset pressure, and in a more sophisticated design a relief valve was incorporated into the piston head in the hydraulic cylinder. In all of these prior art devices, a rapid disconnect, in the range of 10 feet per second, resulted in dangerously high hydraulic pressures and disconnect forces, especially at extreme temperatures, such as minus 65° F. when the fluid viscosity of the hydraulic fluid is such as to resist free flow.

SUMMARY OF THE INVENTION

The latching device, according to the invention, is such that tension (retraction) of a hydraulic cylinder of a pressure actuator urges a lock to the latched position. The piston within the cylinder is constructed of two halves, the rod half incorporating a normally closed relief valve poppet, and the other half consisting of a piston head with a relief valve seat and a spring within the piston head to hold the poppet closed and to provide a preset release pressure. External forces tending to release the lock are applied to the piston rod and through the spring to the poppet head. Such forces occur when the nozzle is being pulled away from the receptacle in which it is locked or when the receptacle is under the same circumstances being pulled away from the nozzle.

If the external force is of a gradually applied nature, the pressure on the latching side of the cylinder will gradually increase until its predetermined cracking pressure is reached, to unlock the receptacle from the inserted nozzle. However, if the load applied is in the nature of a highly accelerating force, the inertia forces of the piston head, the spring and the supporting column of fluid tend to remain at rest, thus permitting the piston head and poppet to separate at a lower external force or hydraulic pressure than the preset cracking pressure for the poppet. The opening through the piston head presented when the poppet is unseated is of a relatively large area offering little flow resistance of the hydraulic fluid from the latching side of the cylinder to the other side of the piston head and from which the fluid is permitted to flow out of the cylinder. However, actual flow out of the cylinder need not occur because the volume displaced by the poppet or rod end is less than that displaced by the piston head without the rod.

Therefore, it is possible to effect rapid emergency disconnects at a lesser force than that required for a slow breakaway when the external force is gradually increased causing the hydraulic pressure to increase to that necessary pressure to lift the poppet off the seat. To prevent rapid emergency disconnects at too small an external force, it is only necessary to provide orificing of the hydraulic fluid in the piston head downstream of the seat and of the piston rod poppet.

An object of the invention is to provide an improved receptacle and fueling valve for inflight fueling and having a pressure-actuated lock which will permit emergency disconnects without damaging the tanker aircraft or the receiving aircraft.

Another object of the invention is to provide a locking device for an inflight fueling receptacle for a receiving aircraft that will permit an emergency release of a nozzle from a tanker aircraft due to a highly accelerating force at a lesser force than that required when the external force tending to cause such a release is gradually increased until a predetermined release force is applied.

Still another object of the invention is to provide a hydraulic pressure actuator for locking a nozzle into a receptacle, as described in the preceding paragraphs, in which in a cylinder of the pressure actuator, the inertia forces of the piston head, of a piston relief poppet spring, and of the supporting column of hydraulic fluid tend to remain at rest when a highly accelerating external force tends to separate the nozzle and receptacle, the latter type of force being permitted to separate the piston head and the relief poppet at a lower external force or hydraulic pressure than the preset cracking pressure.

It is a further object of the invention to provide a receptacle and hydraulic actuator for locking the receptacle onto a fueling nozzle, as described in the preceding paragraphs, that will permit rapid emergency disconnects of the nozzle and receptacle at a lesser external force than that required for a slow breakaway of the nozzle from the receptacle.

It is a still further object of the invention to provide a hydraulic actuator, as described in the preceding paragraphs, which will permit rapid emergency release of the actuator from its holding or operating position at a lesser external force than that required by a gradually increased applied external force for releasing of the actuator from its holding or operating position.

Further objects and advantages of the invention may be brought out in the following part of the specification, wherein small details have been described for the competence of disclosure, without intending to limit the scope of the invention which is set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the accompanying drawings, which are for illustrative purposes:

FIG. 1 is a cross-sectional view illustrating a refueling receptacle within a receiving aircraft, the valves of the receptacle being shown as having been opened by means of a fueling nozzle from a tanker aircraft, the nozzle having been inserted into the receptacle and locked in position for fueling;

FIG. 2 is a schematic view of a hydraulic actuator associated with the receiving receptacle, the actuator having been operated so as to lock the fueling nozzle within the receptacle, taken substantially as indicated along the line of 2–2 of FIG. 1;

FIG. 3 is a schematic view of the aforesaid hydraulic actuator, illustrating the operation of the actuator and lock as external forces are being applied through the nozzle to cause the lock to release the nozzle to permit disconnection of the nozzle and receptacle;

FIG. 4 is a perspective end view illustrating the receptacle, the hydraulic actuator and the locking means operated by it in the locking position; and

FIG. 5 is schematic view of the hydraulic and electrical circuitry for locking and unlocking the latching device for holding the fueling nozzle in the receiving receptacle during fueling.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring again to the drawings, there are shown in FIGS. 1 and 4, a fueling receptacle generally designated as **10** adapted to be secured within the wing or fuselage of an aircraft to be refueled while in flight, and a nozzle **11** locked within the receptacle in FIG. 1 and which is adapted to be extended from and trail rearwardly of a tanker aircraft during a fueling operation. The receptacle has an enlarged conical-shaped open end **12** having an opening **13** to receive the nozzle **11** by maneuvering of one or both of the aircraft during flight. The receptacle may be affixed within the aircraft and have a removable cover or may be positioned in a wing or the fuselage in which it may be pivoted upwardly by means not shown at a hole **17** in a hinge-supporting member **18**. In FIG. 4 there are shown rollers **19**, **20**, **21** and **22**, not shown in FIG. 1, to guide the nozzle and to make its entry into the receptacle relatively frictionless.

The nozzle **11** has a small diameter portion **23** from which extends an enlarged diameter portion **24** and on which is formed a shoulder **25** adapted to be engaged by lock rollers **26**, which when moved radially inwardly into the receptacle through diametrically opposed openings **27** lock the nozzle within the receptacle. In FIGS. 1 and 4 the locking rollers are shown in the locking position. In FIG. 1 inwardly of the portion **24** of the nozzle is a leading end, small diameter portion **30** which is complementary to an interior cylindrical and reduced diameter portion **31** of the receptacle.

Within the receptacle portion **31** is a fixed conical-shaped valve member **32**, supported on a stem **33** which is secured to an inner end **34** of the receptacle. Slidably engaged within the cylindrical portion **31** is a sleeve, generally designated as **36**. At its outer end the sleeve has a sealing member **37** which is adapted to normally seat on the valve **32** to close the valve and to seal the receptacle.

Extending radially outwardly on the sleeve is an annular flange **38** which has a circumferential surface **39** slidably engaged with the interior surface **31**. Internally of the flange **38** on the sleeve is a radially directed shoulder **42** on which an outer end of a coil spring **43** abuts to hold the seal **37** of the sleeve in its normally closed, valve position. The other end of the spring is in abutment with a radially directed shoulder **44** internally in the receptacle on a wall portion **45**. An outer portion of the sleeve **48** is slidably engaged with an internal cylindrical surface **49** of the receptacle and an O-ring **50** provides the seal between the sleeve and the receptacle.

As may be seen in FIG. 1, the inward movement of the nozzle portion **30** has moved the sleeve off of the valve **32** to open it as the nozzle was inserted into the receptacle when the end portion **30** of the nozzle contacted the annular flange **38** of the sleeve. A switch rod **51** is slidably engaged in a bore **54** in a wall portion **55** of the receptacle. When the valve **32** is closed the rod normally extends upwardly beyond the wall portion **55** so that as the nozzle portion **30** moves the flange **38** inwardly it contacts the rod **51** to close a switch **56** which causes the locking members **26** to be moved to locking engagement with the shoulder **25** of the nozzle. At this time the receiving aircraft is then in condition to receive the fuel through the nozzle and which flows into the open portion **57** of the sleeve and into the receptacle portion **60**. From the receptacle portion **60** the fuel flows into the fueling system of the aircraft through an opening in the receptacle, not shown, extending at an angle to the surface of the drawing outwardly of the receptacle portion **60**. In the wall portion **55** of the receptacle diametrically opposite the switch rod is a bore comprised of three parts **61**, **62** and **63** and which provides a passage to permit flow of any fluid externally of the seals **50** and **37** to be discharged to prevent the buildup of any pressure that might otherwise prevent the inward movement of the flange **38** by the nozzle portion **30**.

In FIGS. **2**, **3** and **4** the latching mechanism is illustrated. The locking rollers **26** are mounted on levers **66** which are fixed to rotate with shafts **67**, mounted for rotation in ears **68** which support the locking mechanism on the receptacle. The shafts **67** at their other ends are fixed to be rotated by means of levers **69** and **70**. The lever **69** is pivotally secured to a piston rod **72** so that movement of the rod causes the lever **69** to be pivoted at the point **73**. The rod **72** is slidably and sealingly engaged in one end **74** of a cylinder **75** of a hydraulic pressure actuator generally designated as **78**. The pressure actuator is drawn schematically in FIGS. **2** and **3** for convenience whereas its actual appearance is shown FIG. **4**.

The rod **72** within the cylinder has a poppet valve **79** which is adapted to seat at **82** as shown in FIG. **3** on a piston head **83**, inwardly of an annular surface **80**, and which with the poppet valve **79**, when closed, form the complete piston structure, and which is slidably and sealingly engaged within the cylindrical wall of the cylinder **75**. Extending from the poppet **79** is a stem **84** having on its end a circumferentially extending flange **85**. The flange **85** has a plurality of passages **88**. The flange **85** is slidably engaged in a cylindrical well **89** in the piston head **83**. One end of the well is open to the cylinder end portion **90**. The other end of the well is formed of a wall **91** extending transversely within the piston head and which has an orifice **94** in communication with the well **89** and the poppet **79**. Surrounding the stem **84** and abutting the flange **85** at one end and the wall **91** at the other is a coil spring **95** adapted to hold the poppet **79** in its normally closed position as shown in FIG. **2**.

Outwardly of the end **90** of the cylinder is a link **96**, pivotally connected to the link **70** at **97**. Adjacent the end **74** of the cylinder is a hydraulic fluid conduit **99** and adjacent the other end of the cylinder **90** is a hydraulic fluid conduit **100**.

As shown in FIG. 2, when the locking rollers are in licking position on the shoulder 25 of the nozzle the hydraulic actuator 78 is in its retracted position with the piston being adjacent the end 96 of the cylinder. Thus, as indicated in FIG. 3, when the piston and rod 72 moves toward the right in the drawing, the link 96 on the cylinder moves to the left so as to pivot the links 69 and 70 at 73 and 97, respectively. Since the other ends of the links 69 and 70 are fixed to rotate at 69A and 70A respectively, the pivoting movement resulting from the linear movement of the pressure actuator parts causes the lever 66 to be rotated so that the rollers 26 are also rotated outwardly toward the open end of the receptacle so as to be moved off of the shoulder 25 on the nozzle. Similarly, when hydraulic fluid pressure is applied through the conduit 99 the piston is moved toward the end 90 of the cylinder and the levers 66 are moved into the locking position with their inner ends having the rollers 26 in contact with the shoulder 25 of the nozzle.

Now referring to FIG. 5, which schematically illustrates a representative type of electrical circuitry and the hydraulic fluid circuitry, there is shown the leading end 30 of the nozzle 11 having closed the switch 56 by movement of the rod 51, as shown in FIG. 1, so as to close the circuit. The circuit also has a normally closed spring-held switch 101 which can be opened from the cockpit of the receiving aircraft by means of the rod 102. When the circuit is closed by the normally opened switch 56, a power source 105 actuates a solenoid 106 so as to operate the slide valve 107 to move it from its normal position which permits the flow of hydraulic fluid through the circuit 100 so that if pressure is applied, the piston will be moved to the right in FIGS. 2 and 3 and to the left in FIG. 5 to extend the actuator and to open or hold open the locking rollers 26. The flow of hydraulic fluid into the cylinder through conduit 99 causes the piston to be moved to the left in FIGS. 2 and 3 and to the right in FIG. 5 to retract the actuator and to close or hold closed the locking rollers 26.

In the hydraulic circuit there is a pump 108 and a hydraulic fluid reservoir 109 as shown in FIG. 5. When the pump 108 is connected to the conduit 100 the conduit 99 from the cylinder is connected to the reservoir. Thus, if pressure was applied by the pump so as to cause the piston to move from a locking position to an unlocking position fluid would flow into the conduit 100 and cylinder end 90 and out of the cylinder end 74 and into the conduit 99 and back to the reservoir. The pump 108 is energized by a separate circuit, not shown, although it could be energized by the sliding valve circuit shown for purposes of locking the nozzle within the receptacle. The switch 101 may be opened for emergency purposes and if pressure is maintained, as it normally would be, by means of the pump 108, the opening of the switch 101 would reverse the flow of movement of the slide valve to its normal position by deenergizing the solenoid 106 so as to cause the pressure to be applied through the conduit 100 to effectively extend the pressure actuator and move the rollers out of the path of the nozzle by rotation of the lever 66.

However, the invention here relates to the release of the locking mechanism by external forces acting on nozzle and receptacle as indicated by the arrows 110 in FIG. 3. These arrows 110 indicate direction of external forces which would tend to move the nozzle outwardly of the receptacle and thus also tend to rotate the levers 66 and thereby extend the actuator from its contracted position to its open extended position. During such applied forces the pressure would increase causing the spring 95 to compress and causing the poppet 79 to be moved off of the seat to permit the discharge of pressurized fluid entering the cylinder through the conduit 99. Thus when the poppet 79 is open this pressure is dissipated through the orifices 94, the well 89 and the orifices 88.

The spring 95 has a force of 260 pounds to maintain the poppet 79 on its seat 82. During normal operation, the hydraulic pressure applied to the poppet 79 and to the area 80 of the piston head outwardly of the poppet is 3,000 pounds per square inch. Because of the area 80 on the piston head, and the 260 pounds on the spring, the preset cracking pressure for the poppet 79 is 3,400 pounds per square inch. Thus, when a force is applied in a direction of the arrow 110 and gradually increased, the hydraulic actuator will be extended in the direction shown in FIG. 3 and the piston head will lift off of the poppet when the internal pressure within the cylinder reaches 3,400 per square inch. This 3,400 pounds per square inch corresponds to a gradually increased external force on the nozzle in the direction of the arrows 110 of a maximum of 4,500 pounds; that is, the gradually increased external force of 4,500 pounds corresponds to the 3,400 pounds per square inch of the preset cracking pressure internally in the cylinder. However, according to the invention, if the load applied externally in the direction of the arrows 110 is in the nature of a highly accelerating force, the inertia forces of the piston head 83, the spring 95, and the supporting column of fluid acting upon the piston head tend to cause the items to remain at rest to permit the piston head and the poppet to separate at a lower internal hydraulic pressure than the 3,400 pounds preset cracking pressure. Correspondingly, the highly accelerated force in the direction of the arrows 110 on the rollers and levers 66 is lower than the 4,500 pounds gradually applied external force. Any highly accelerating force in contrast to a gradually increasing force will cause the poppet end and piston head to be separated at a lower internal pressure than the 3,400 pounds and a lower external force than the 4,500 pounds but the greater amount of acceleration will cause a greater differential; that is, lower, in the force that will cause the disconnection.

This type of lower force separation is of considerable benefit in that, where it does not exist in the prior art when the external separation forces are of a violent and accelerating nature damage to the receiver or tanker aircraft occurs due to the inability of the prior art latching devices to effect a rapid release. Thus, it is of considerable benefit to obtain a very rapid release when the external forces are rapidly accelerated. Consistent with this, when the external forces are applied gradually, in many cases they subsequently are reduced before the preset pressure is obtained to prevent the actual separation of the nozzle and receptacle. That is, if the external forces are applied gradually, frequently they never rise to a high enough point to actually cause separation and this, of course, is desirable so that the fueling can continue. According to the invention, separation pressure for a gradually applied force is selected to be a maximum safe pressure for separation of the nozzle and receptacle and because the more damaging type of separations, those caused by accelerating forces and permitting separation, occur at a lower pressure than the latter invention permits the higher maximum separation pressure for gradually applied forces which without the benefits of the invention would have to be substantially decreased so that there would not be damage done by the accelerating forces that would cause separation. In other words, the present invention permits a higher separation force for gradually applied external forces than would be possible without the invention.

The invention and its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of the parts of the invention without departing from the spirit and scope thereof or sacrificing its material advantages, the arrangements hereinbefore described being merely by way of example. We do not wish to be restricted to the specific form shown or uses mentioned except as defined in the accompanying claims, wherein various portions have been separated for clarity of reading and not for emphasis.

We claim:

1. In a receptacle for the nozzle of a fuel supply line including a fuel inlet conduit:

a. a valve assembly disposed in said conduit to normally close and seal it;

b. said valve assembly including slidable means mounted thereon and matingly complemental to said nozzle to receive and engage the nozzle upon its insertion whereby the valve assembly is opened;

c. a lock carried by the receptacle and operative to engage and secure the nozzle within the conduit;
d. a contact actuator for the operation of said lock disposed in the path of movement of said slidable means to cause said lock to lock said nozzle in sad receptacle when said slidable means contacts said contact actuator;
e. a pressure actuator connected to said receptacle to move and hold said lock in its locking position when said contact is made with said contact actuator; and
f. means within and associated with said pressure actuator to move said lock into a locking position when internal pressure is applied in one direction in the actuator and to open said lock when internal pressure is applied in the actuator in the direction opposite said one direction to normally permit disconnection of the nozzle from the receptacle;
g. the improvement comprising:
h. said last means within said pressure actuator including a cylinder and a piston slidably and sealingly engaged in the cylinder;
i. said pressure actuator being operated to when predetermined internal pressure in said one direction is applied to one side of said piston through a conduit to said cylinder and to unlock when said internal pressure in said other direction is applied to the other side of said piston through a second conduit to applied said cylinder;
j. said piston having passage means extending therethrough from said one side to said other side;
k. means to seal said piston passage means on said one side to prevent said internal pressure from entering said piston passage means; and
l. means associated with said piston to hold said means to seal in a sealing position;
m. said internal pressure on said one side being an additional means to hold said means to seal in said sealing position;
n. said means to seal being adapted to move off said piston passage means when a predetermined gradually increased external force is applied to said lock against the force of said internal pressure on said one side and against said means associated with said piston to hold said means to seal on said passage means whereby said internal pressure will dissipate through said piston and out of said cylinder through said second conduit to release said lock; and
o. the inertia forces on said piston and said external pressure on said one side being adapted to remain substantially at rest when an external highly accelerating force is applied to said lock in the direction to release it so as to permit the piston and means to seal to separate at a lower external force than said predetermined force and thereby release said lock.

2. In a receptacle for the nozzle of a fuel supply line including a fuel inlet conduit:
a. a valve assembly disposed in said conduit to normally close and seal it;
b. said valve assembly including slidable means mounted thereon and matingly complemental to said nozzle to receive and engage the nozzle upon its insertion whereby the valve assembly is opened;
c. a lock carried by the receptacle and operative to engage and secure the nozzle within the conduit;
d. a contact actuator for the operation of said lock disposed in the path of movement of said slidable means to cause said lock to lock said nozzle in said receptacle when said slidable means contacts said contact actuator;
e. a pressure actuator connected to said receptacle to move and hold said lock in its locking position when said contact is made with said contact actuator; and
f. means within and associated with said pressure actuator to move said lock into a locking position when internal pressure is applied in one direction in the actuator and to open said lock when internal pressure is applied in the actuator in the direction opposite said one direction to normally permit disconnection of the nozzle from the receptacle;
g. the improvement wherein:
h. said means within and associated with said pressure actuator includes additional inertia-external force reactive means operable to permit rapid emergency disconnection of the nozzle and the receptacle by the release of said lock by a lesser but highly accelerated external force on said lock than by a gradually increased applied external force on said lock required for unlocking and disconnection, and comprises:
i. a piston within a hydraulic cylinder adapted to have a supporting column of hydraulic fluid to hold said lock in the locked position;
j. a relief valve on said piston being adapted to open and release said fluid at a predetermined force applied externally to tend to release said lock when said latter force is gradually applied and increased; and
k. and when said highly accelerating force is applied externally to tend to release said lock, the inertia forces of the piston of said additional means and of the supporting column of fluid tend to remain substantially at rest to permit the relief valve to open and release said fluid at an external force lower than said predetermined external force.

3. In a receptacle for the nozzle of a fuel supply line including a fuel inlet conduit:
a. a valve assembly disposed in said conduit to normally close and seal it;
b. said valve assembly including slidable means mounted thereon and matingly complemental to said nozzle to receive and engage the nozzle upon its insertion whereby the valve assembly is opened;
c. a lock carried by the receptacle and operative to engage and secure the nozzle within the conduit;
d. a contact actuator for the operation of said lock disposed in the path of movement of said slidable means to cause said lock to lock said nozzle in said receptacle when said slidable means contacts said contact actuator;
e. a pressure actuator connected to said receptacle to move and hold said lock in its locking position when said contact is made with said contact actuator; and
f. means within and associated with said pressure actuator to move said lock into a locking position when internal pressure is applied in one direction in the actuator and to open said lock when internal pressure is applied in the actuator in the direction opposite said one direction to normally permit disconnection of the nozzle from the receptacle;
g. the improvement wherein:
h. said means within and associated with said pressure actuator includes additional inertia-external force reactive means operable to permit rapid emergency disconnection of the nozzle and the receptacle by the release of said lock by a lesser but highly accelerated external force on said lock than by a gradually increased applied external force on said lock required for unlocking and disconnection, and comprises:
i. a piston within a hydraulic cylinder adapted to have a supporting column of hydraulic fluid to hold said lock in the locked position;
j. a relief valve on said piston being adapted to open and release said fluid at a predetermined internal force corresponding to a predetermined external force applied externally to tend to release said lock when said latter force is gradually applied and increased to that amount required for release;
k. said additional means being associated with said relief valve and piston and which when said highly accelerating force is applied externally to tend to release said lock, the inertia forces of the piston of said additional means and of the supporting column of fluid tend to remain substantially at rest to permit the relief valve to open and release

said fluid at an external force lower than said predetermined external force; and

l. and said lower highly accelerating external force corresponding to a lower highly accelerating internal force.

4. In a receptacle for the nozzle of a fuel supply line including a fuel inlet conduit:

a. a valve assembly disposed in said conduit to normally close and seal it;

b. said valve assembly including slidable means mounted thereon and matingly complemental to said nozzle to receive and engage the nozzle upon its insertion whereby the valve assembly is opened;

c. a lock carried by the receptacle and operative to engage and secure the nozzle within the conduit;

d. a contact actuator for the operation of said lock disposed in the path of movement of said slidable means to cause said lock to lock said nozzle in said receptacle when said slidable means contacts said contact actuator;

e. a pressure actuator connected to said receptacle to move and hold said lock in its locking position when said contact is made with said contact actuator; and

f. means within and associated with said pressure actuator to move said lock into a locking position when internal pressure is applied in one direction in the actuator and to open said lock when internal pressure is applied in the actuator in the direction opposite said one direction to normally permit disconnection of the nozzle from the receptacle;

g. the improvement wherein:

h. said means within and associated with said pressure actuator includes additional inertia-external force reactive means operable to permit rapid emergency disconnection of the nozzle and the receptacle by the release of said lock by a lesser but highly accelerated external force on said lock than by a gradually increased applied external force on said lock required for unlocking and disconnection, and comprises:

i. a piston within a hydraulic cylinder;

j. said piston being formed of a piston head and a relief valve when it is closed;

k. passage means extending through said piston head and providing communication from one side of said piston head and cylinder to the other when said relief valve is open;

l. and means within said piston head to hold said relief valve closed with an internal predetermined force;

m. said cylinder being adapted to have a supporting column of hydraulic fluid on said one side applying said internal pressure in said one direction to hold said lock in the locking position;

n. said internal force within said piston head and said fluid force on said one side providing a total internal predetermined force effectively equivalent to correspond to said required gradually increased external force for said unlocking and disconnection;

o. said cylinder having a fluid conduit to each side of said piston; and

p. whereby when said highly accelerated external force is applied to tend to release said lock, the inertia forces of the piston head and the supporting column of fluid tend to remain substantially at rest to permit the relief valve to open and release said fluid through said piston head passage means and fluid conduit to the cylinder at said other side at said lesser force.

5. The invention according to claim **4**, in which:

a. said relief valve is a poppet seated on said piston head when closed;

b. said poppet being connected to an inner end of a piston rod;

c. said rod extending through a first end of said cylinder and being slidably and sealingly engaged in said first end;

d. said outer end of said rod being externally of said cylinder; and

e. said outer end of said rod being connected to said lock so that said external forces tending to open said lock are applied to said rod and to said poppet so as to tend to open said poppet.

6. The invention according to claim **5**, in which:

a. a second end of said cylinder opposite said first end is connected to a second lock;

b. said piston being relatively adjacent said second end and said rod being in the farthermost inwardly position in the cylinder when in the locking position; and

c. said rod and said second end having been moved away from each other in the unlocked position.

7. The invention according to claim **4**, in which:

a. said means within said piston head to hold said relief valve closed is a spring within said piston head biasing a poppet element of said relief valve to a normally closed position on a seat on said piston head;

b. said piston head having an annular portion extending radially outwardly from said seat;

c. said annular portion having a radially directed face on said one side upon which said internal pressure in said one direction is applied;

d. said poppet having a radially directed annular surface upon which said internal pressure in said one direction is applied; and

e. said annular face on said piston head having a predetermined area to predetermine the cracking pressure at which the poppet will open relative to the force of said spring and said internal pressure and to the external forces applied to tend to open said lock.