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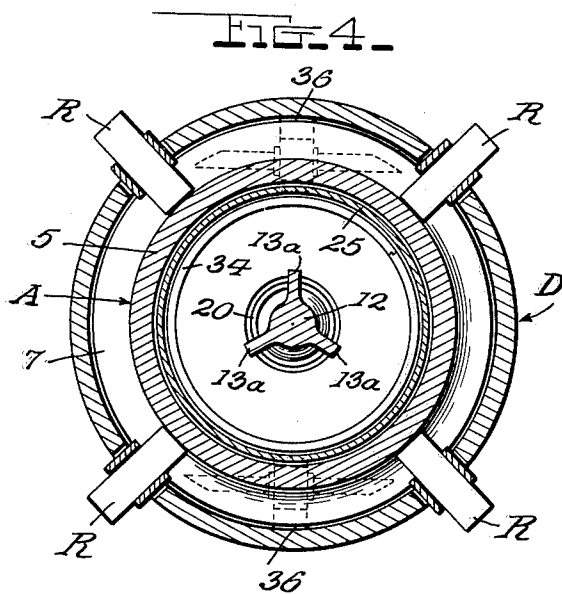
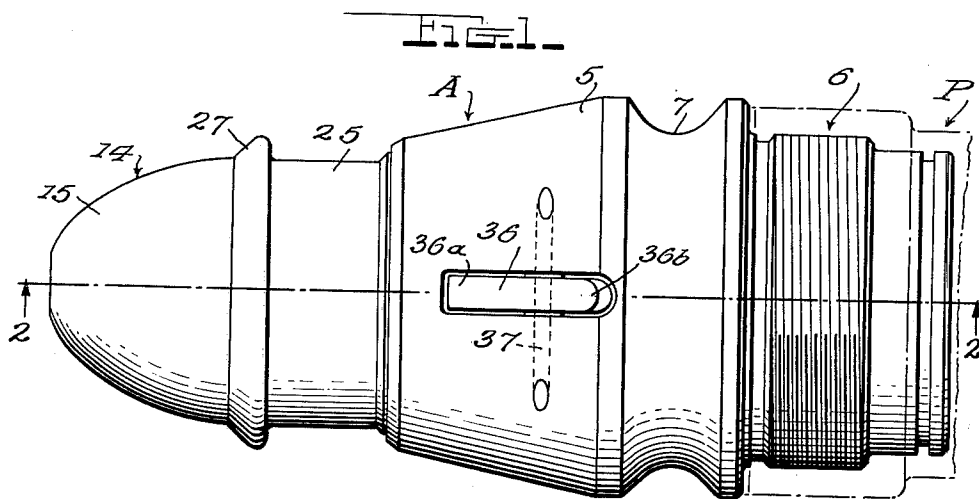
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3,059,895

PROBE TERMINAL ASSEMBLY FOR IN-FLIGHT RE-FUELING

Filed May 31, 1957

3 Sheets-Sheet 1



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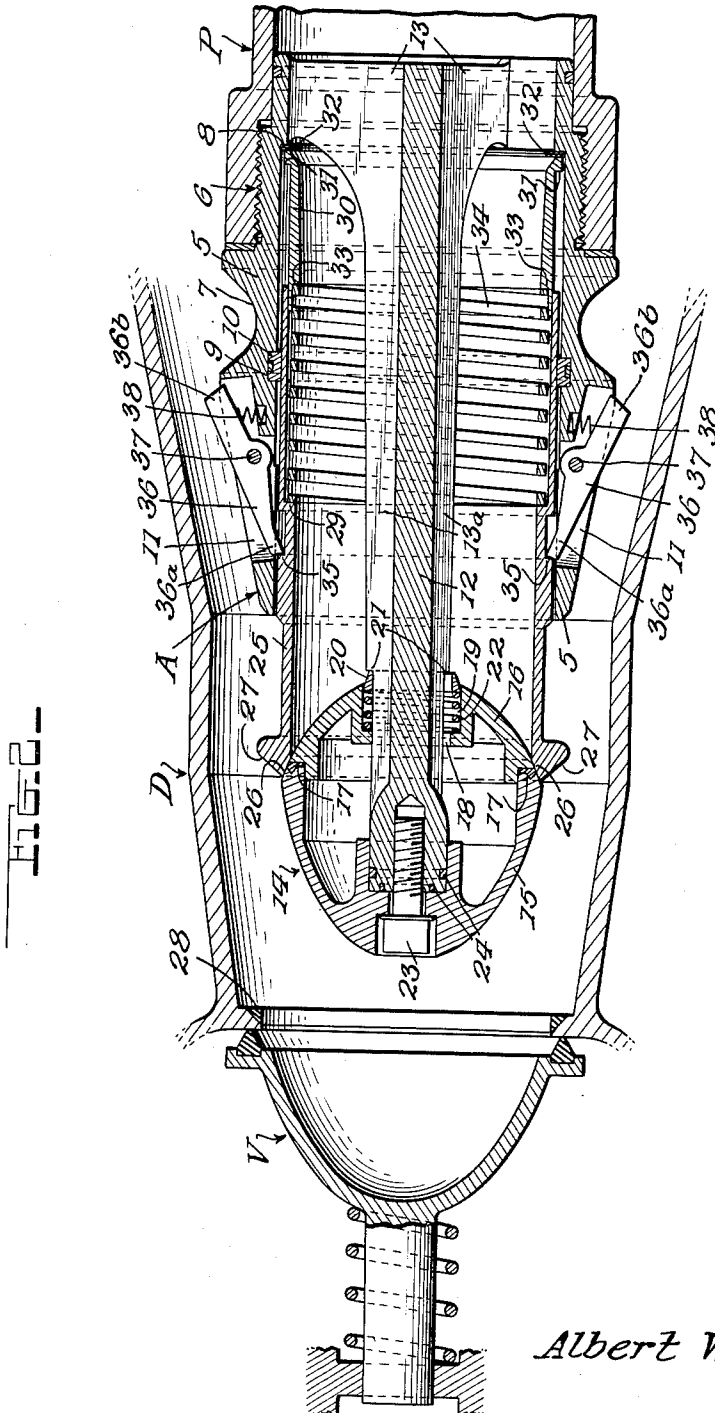
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PROBE TERMINAL ASSEMBLY FOR IN-FLIGHT RE-FUELING

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3 Sheets-Sheet 2



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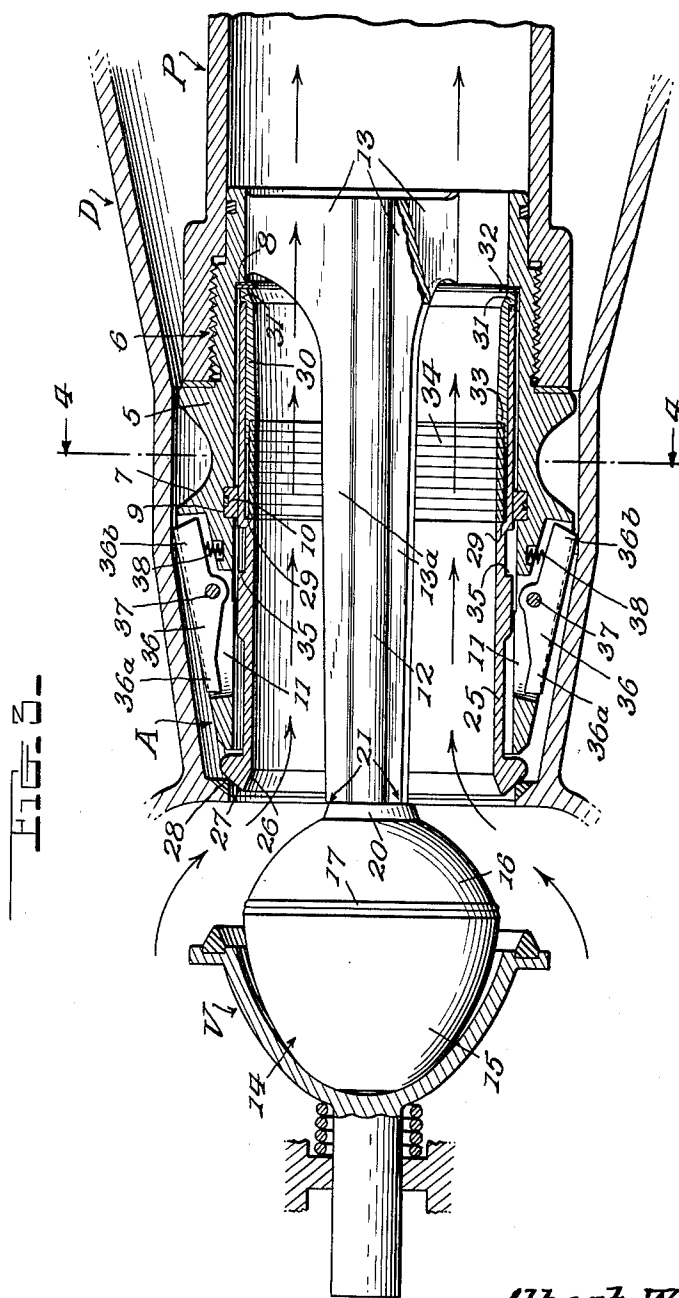
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PROBE TERMINAL ASSEMBLY FOR IN-FLIGHT RE-FUELING

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3 Sheets-Sheet 3



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**PROBE TERMINAL ASSEMBLY FOR
IN-FLIGHT RE-FUELING**

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4 Claims. (Cl. 251-149.7)

In a known means for conducting fuel from a tanker plane to a receiving plane, while both planes are in flight, the tanker plane is provided with a hose-carried drogue to receive the terminal assembly of a probe carried by the receiver plane, both the drogue and probe terminal assembly being provided with normally closed valve means which are opened automatically upon entrance of said probe terminal assembly into said drogue. An example of such re-fueling means is found in U.S. Patent 2,728,590, issued December 27, 1955 to P. S. MacGregor.

In such known re-fueling means, the probe terminal assembly embodies an outer sleeve connected with the front end of the probe, a valve head spaced from the front end of said outer sleeve, means within said outer sleeve and connecting said valve head and outer sleeve for unitary movement, a valve sleeve slidable in said outer sleeve and projecting forwardly therefrom, said valve sleeve having a forwardly facing seat at its front end normally abutting said valve head and also having a forwardly presented valve surface to abut a seat of the drogue, and spring means acting forwardly on said valve sleeve and reacting rearwardly on said outer sleeve. When the probe terminal assembly enters the drogue, the forwardly presented valve surface of the valve sleeve abuts the coacting drogue seat and arrests movement of said valve sleeve. The outer sleeve and the valve head unitarily connected therewith continue movement into the drogue. The valve head thus moves away from the valve sleeve and in so doing thrusts against and opens the drogue valve to permit fuel flow from the drogue through the probe. By the time the drogue valve has been fully opened, the outer sleeve and the drogue are locked together by a spring-pressed locking means which is later releasable by pulling of the probe terminal assembly from the drogue.

While the present invention relates to a re-fueling means of the above described general type, it is concerned only with a new and improved terminal assembly for the probe. For this reason and to avoid unnecessary complexity, only such portions of the drogue have been disclosed as to permit clear explanation of the invention.

One object of the invention is to provide an improved and simplified construction in which the valve head which cooperates with the valve sleeve is carried by the front end of a longitudinal stem having its rear end connected with the rear end of the outer sleeve by means of webs radiating from said rear end of said stem to said rear end of said outer sleeve, said webs being rigidly secured to said stem and sleeve.

Another object is to provide a novel construction in which the aforesaid webs are integral with the rear ends of the stem and outer sleeve.

A further object is to provide a novel construction in which the spring for projecting the valve sleeve is confined within the rear end portion of this sleeve, the sleeve being provided with a rearwardly facing shoulder against which the spring thrusts forwardly, and the outer sleeve being provided with a forwardly facing shoulder which receives the rearward thrust exerted by said spring.

A still further object is to interpose a thrust sleeve between the aforesaid spring and the forwardly facing shoulder of the outer sleeve, the front end of said thrust

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sleeve being slidably telescoped into the rear end of the valve sleeve.

Yet another object is to provide the aforesaid thrust sleeve with an external forwardly facing stop shoulder to limit the sliding of the outer sleeve with respect to the valve sleeve when the movement of the latter is arrested upon engagement with the drogue.

Another object is to provide simple and effective latch means for normally holding the valve sleeve seat in contact with the aforesaid valve head, said latch means having a releasing portion projecting beyond the periphery of the outer sleeve for actuation by a portion of the drogue.

A further object is to embody the above mentioned latch means in the form of a simple lever, one end of said lever abutting a shoulder of the valve sleeve, and the other end of said lever constituting the aforesaid latch releasing portion.

Yet another object is to provide a novel construction for the valve head with which the valve sleeve coacts.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a side elevation of the probe terminal assembly.

FIGURE 2 is a longitudinal sectional view on line 2-2 of FIGURE 1, the probe terminal assembly being shown attached to the probe and entering the drogue.

FIGURE 3 is a view similar to FIGURE 2 but showing the probe terminal assembly fully engaged with the drogue.

FIGURE 4 is a transverse sectional view on line 4-4 of FIGURE 3.

In the drawings, a portion of a probe is shown at P, the probe terminal assembly at A, the drogue body at D and the spring-closed drogue valve at V. Rollers R forming portions of the drogue-carried locking means for locking the assembly A in the drogue are shown at R in FIGURE 4, and may be mounted as shown in the patent above referred to, for example.

The assembly A includes an outer body-forming sleeve 5 shown as having a threaded connection 6 with the probe P, said sleeve being provided with an external circumferential groove 7 for coaction with the rollers R. Near its rear end, the outer sleeve 5 is formed with an internal forwardly facing shoulder 8: and between its ends, said sleeve 5 has an internal circumferential groove 9 in which a seal assembly 10 is seated. In the front portion of the sleeve, longitudinal slots 11 are formed for a purpose to appear.

An elongated stem 12 extends longitudinally within the sleeve 5 and is coaxial therewith. The rear end of this stem is unitarily connected with the rear end of the sleeve 5 by means of webs 13 formed integrally with said rear ends of said stem and sleeve. The webs 13 preferably have narrowed portions 13a extending forwardly along the stem 12 and forming integral portions of said stem.

The front end of the stem 12 carries a substantially ovate valve head 14 and spaces this head forwardly from the front end of the outer sleeve 5. This valve head 14 is composed of a front section 15, a rear section 16 and a yieldable seal ring 17 clamped between said sections 15 and 16 and exposed at the peripheries thereof. The rear section 16 has an opening 18 through which the front portion of the stem 12 extends, and said rear section 16 has a recess 19 from its rear end to said opening 18. Within the rear end of this recess 19 a thrust ring 20 surrounds the stem 12 and its web portions 13a and

abuts shoulders 21 of the latter. A coiled compression spring 22 abuts the thrust ring 20 within the recess and exerts a forward pressure on the rear section 16 of the valve head 14. The front section 15 of this valve head is suitably secured to the stem 12, for example by a screw 23; and suitable seals 24 are provided to prevent any fuel leakage between said section 15 and said stem 12. As the section 15 is secured to the stem, the forward thrust of the spring 22 on the rear section 16 causes fluid tight clamping of the seal ring 17 between the two sections 15 and 16.

A valve sleeve 25 is slidable in the outer sleeve 5 and projects forwardly therefrom, said valve sleeve being fluid-tightly engaged with the seal ring assembly 10 and having its rear end spaced forwardly from the shoulder 8 of said outer sleeve 5. The front end of the valve sleeve 25 has a forwardly facing seat 26 for fluid-tight contact with the seal ring 17 and contiguous portions of the valve head 14; and said sleeve end is also provided with a forwardly facing valve surface 27 to abut a seat 28 in the drogue body D when the probe terminal assembly A is received in the drogue.

Between its ends, the valve sleeve 25 is formed with a rearwardly facing internal shoulder 29 behind which said sleeve is preferably of somewhat enlarged internal diameter. The front end of a thrust sleeve 30 is slidably telescoped into the rear end of the valve sleeve 25 and is held against rearward movement by the shoulder 8 of the outer sleeve 5. The thrust sleeve 30 has an external forwardly facing stop shoulder 31 to strike the valve sleeve 25 and limit the continued forward movement of the outer sleeve 5, stem 12 and valve head 14 when the forward movement of said valve sleeve 25 is arrested by contact of the valve surface 27 with the drogue seat 28. By placing one or more washers 32 between the rear end of the thrust sleeve 30 and the shoulder 8, the stop shoulder 31 of said sleeve 30 may be located with precision.

Near its front end, the thrust sleeve 30 has a forwardly facing internal shoulder 33; and a coiled compression spring 34 is confined between this shoulder 33 and the shoulder 29 of the valve sleeve 25, said spring being within the rear end portion of said valve sleeve. The spring 34 thrusts forwardly on the valve sleeve 25 and thrusts rearwardly on the thrust sleeve 30 and as rearward movement of this thrust sleeve is prohibited by the shoulder 8, said spring normally acts to forwardly hold the valve sleeve 25 with its seat 26 engaging the valve head 14.

Between its ends, the valve sleeve 25 is provided with a rearwardly facing external shoulder 35 which is normally disposed at the front ends of the slots 11 as seen in FIGURE 2. Latch levers 36 are mounted in these slots, respectively, and coact with the shoulder 35. Each latch lever 36 is disposed longitudinally of the outer sleeve 5 and is fulcrumed between its ends at 37 for movement in a plane radial to said outer sleeve. A spring 38 is engaged with each latch lever 36 and normally holds it in the position shown in FIGURE 2, the front end 36a of the lever being then in engagement with the valve sleeve shoulder 35 while the rear end 36b of the lever then projects obliquely beyond the periphery of the outer sleeve 5. In this position, the levers 36 lock the valve sleeve 25 in fluid-tight engagement with the valve head 14 of the stem 12. All parts of the probe terminal assembly A then occupy the positions shown in FIGURE 2 and remain in these positions until said assembly is telescoped with the drogue body D to perform a re-fueling operation.

When re-fueling, although the hose-carried drogue of the tanker plane is actually pulled rearwardly onto the assembly A of the receiving plane, the effect is the same as if said assembly A were forwardly moved into said drogue and will be so described. When the assembly A is received in the drogue (FIGURE 3) the valve surface 27 of the valve sleeve 25 abuts the seat 28 of the drogue and at the same time the latch levers 36 are released by

contact of their rear ends 36b with the drogue. The outer sleeve 5, stem 12 and valve head 14 then continue forwardly as a unit, the result being that said valve head 14 is separated from the valve sleeve 25 and pushes the drogue valve V open, the assembly A being then locked in the drogue by means of the rollers R entering the groove 7 of the outer sleeve 5. Fuel may then flow from the drogue through the assembly A and probe P to the tanks of the receiving plane, as indicated by the arrows in FIGURE 3. When re-fueling has been completed, relative movement of the two planes away from each other, pulls the assembly A from the drogue and all parts return to their normal positions.

From the foregoing it will be seen that a novel and advantageous assembly has been provided for attaining the desired ends but it is to be understood that variations may well be made within the scope of the invention.

I claim:

1. In a probe terminal structure, a longitudinal stem having a forwardly facing external shoulder near its front end, a substantially ovate valve head mounted on said stem in advance of said shoulder, said valve head being hollow and comprising a front section, a rear section and a yieldable sealing ring clamped between said front and rear sections and exposed at the peripheries thereof, means securing said front section to said stem, and spring means on said stem acting forwardly on said rear section and reacting rearwardly on the aforesaid shoulder to hold said sealing ring in its clamped condition.

2. A structure as specified in claim 1; said spring means comprising a coiled spring surrounding said stem, and an abutment ring interposed between said spring and said shoulder, said rear section having a rearwardly open recess in which said spring and said abutment ring are confined.

3. In a probe terminal structure, a longitudinal stem having a forwardly facing shoulder near its front end, a substantially ovate valve head mounted on said stem in advance of said shoulder, said valve head being hollow and comprising a front section receiving said stem front end in sealed relation and being otherwise imperforate, a rear section slidable on said stem, and a yieldable sealing ring disposed between said front and rear sections, and spring means on said stem acting forwardly on said rear section and rearwardly on said shoulder to clamp said sealing ring between said front and rear sections to form a seal therebetween and with said sealing ring projecting outwardly from said front and rear sections for engagement with a valve seat.

4. A probe terminal assembly for insertion into a drogue, said probe terminal assembly comprising an outer sleeve having an outer surface for direct engagement within and for connection with a drogue, an ovate valve head fixedly carried by said sleeve co-axial therewith and projecting forwardly out of said sleeve, said valve head being hollow and having front and rear sections, a sealing ring clamped between and sealing said front and rear sections, said sealing ring being exposed at the peripheries of said valve head sections, a valve sleeve slidable in said outer sleeve and projecting forwardly therefrom, said valve sleeve having a front end defining an inner seat abutting said valve head in overlying relation to the connection between said valve head front and rear sections and being in engagement with the exposed portion of said sealing ring to normally form a seal with said valve head, and spring means acting forwardly on said valve sleeve and reacting on said outer sleeve to hold said valve sleeve against said valve head in sealed relation, and said valve sleeve having an outer valve seat to abut an inner seat of the drogue whereby when said probe terminal assembly is inserted into the drogue, said valve sleeve outer seat will first abut the drogue inner seat to form a seal with said drogue after which further movement of the probe terminal assembly into said drogue will result in the relative rearward move-

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ment of said valve sleeve with respect to said valve head to unseat said valve sleeve from said valve head and permit flow therebetween, said valve sleeve inner seat being also normally in metal-to-metal engagement with said valve head forwardly of said sealing ring to positively limit the forward position of said valve sleeve inner seat on said valve head.

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