Nov. 10, 1953 T. A. HARRIS 2,658,483

FLUID OPERATED SERVO MECHANISM

Filed Oct. 5, 1949

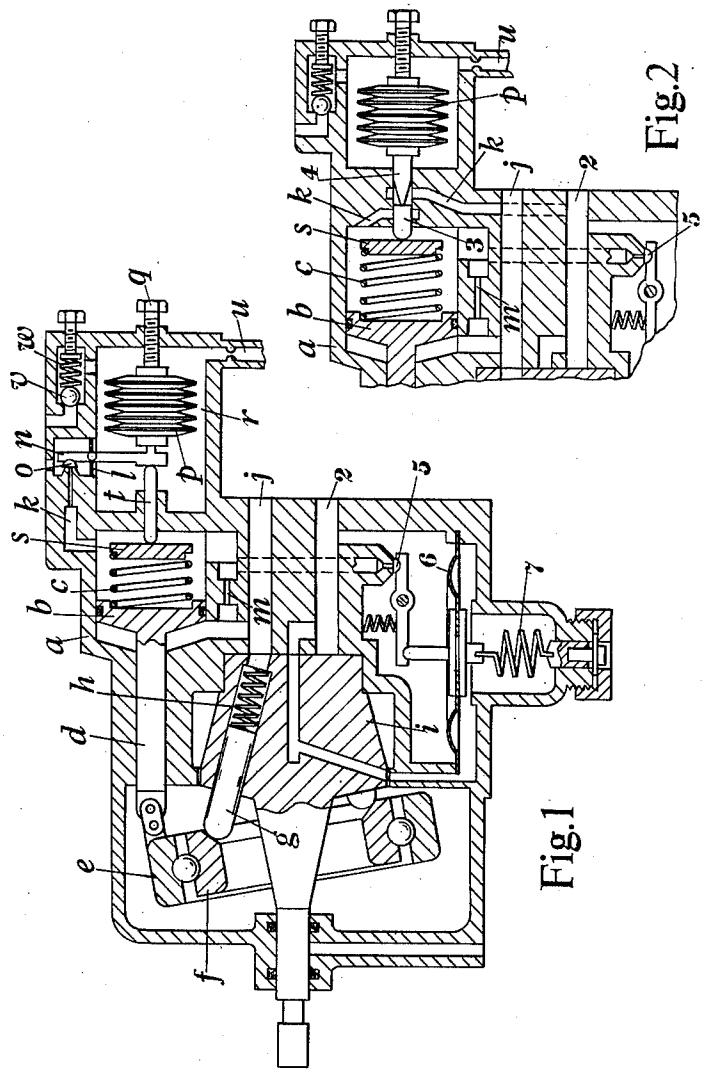

Fig.2

Fig.1

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Patented Nov. 10, 1953 2,658,483

UNITED STATES PATENT OFFICE

2,658,483

FLUID OPERATED SERVO MECHANISM

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Application October 5, 1949, Serial No. 119,701

Claims priority, application Great Britain October 15, 1948

1 Claim. (Cl. 121—41)

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This invention relates to variable-delivery liquid fuel pumps of the kind used with internal combustion prime movers (for example jet-propulsion engines) and particularly those used on aircraft. The object of the invention is to provide improved means for controlling the output of such a pump in response to the pressure of the atmosphere and of the air supplied to the prime mover by a blower.

The invention comprises the combination with a fluid-operated servo mechanism for controlling the pump output, of a valve for controlling the servo mechanism, a member responsive to atmospheric and blower air pressure for actuating the valve, a chamber enclosing the said member, and a spring-loaded valve for admitting air to the chamber from a blower, the chamber being provided with a restricted orifice in communication with the atmosphere.

In the accompanying drawings:

Figure 1 is a sectional elevation illustrating one embodiment of the invention, and

Figure 2 is a fragmentary sectional elevation illustrating a modification.

Referring to Figure 1, there is employed a known form of fluid-operated servo mechanism. This comprises a cylinder *a* containing a piston *b* loaded by a spring *c*, a rod *d* extending from the piston through one end of the cylinder serving to actuate the output-controlling means of the pump, which means in this example consists of an angularly adjustable ring *e* carrying the swash ring *f*. The latter actuates pump plungers as *g*, each being loaded by a spring *h* and carried in a rotary pump body part *i*. The end of the cylinder *a* remote from the spring *c* receives operative fluid from any convenient source, which (in the example illustrated) is the pump outlet passage *j*. The other end of the cylinder *a* communicates with an outlet passage *k* leading to a sump (or the suction side of the pump) and controlled by a valve. Both ends of the cylinder are in communication with each other through a restricted passage *m* in either the piston or (as shown) in the cylinder wall.

The valve comprises a lever *n* which is carried by a diaphragm or partition *l*, and at one end carries a closure member *o* co-operating with a seating on the said outlet passage *k*. For controlling the valve I employ an evacuated elastic capsule *p* which is supported at one end by an adjustable stop *q* extending through an end wall of an enclosing chamber *r*, the free end of the capsule being arranged to bear on one side of the lever. Also the lever is loaded at its other

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side by the spring *c* in the servo cylinder, this spring being supported at one end by a movable abutment *s* between which and the lever *n* is arranged a thrust rod *t*.

The chamber *r* is open to the atmosphere through a restricted orifice *u*. Also it is adapted to be connected in communication with the air blower through a non-return valve *v* which is loaded by a spring *w*, the latter being preferably adjustable to suit different working conditions of the prime mover.

The mode of action is as follows: With a given atmospheric pressure acting on the capsule *p*, the valve lever *n* controlling the servo mechanism is caused to take up a position in which the valve is slightly open, thereby enabling the said mechanism to move the fuel pump controlling means to the position at which the pump gives a predetermined output. With diminution of the atmospheric pressure on the capsule the latter expands, causing the valve to be correspondingly moved in the direction for increasing the valve opening and enabling the servo mechanism to move in the direction for restricting the pump output. Also (under any condition of atmospheric pressure) when the blower air pressure is sufficient to open the valve *v* leading from the blower to the capsule chamber *r*, the additional pressure exerted thereby on the capsule *p* causes the capsule to be contracted, thereby causing the valve of the servo mechanism to be moved towards its closed position for increasing the pump output.

As already stated, the servo mechanism illustrated in the drawing is of known form. When the associated valve is closed, liquid pressure acting on both sides of the piston *b* is balanced by flow through the restricted orifice *m*, and the spring *c* then moves the piston *b* in the direction for increasing the pump output. On opening the said valve, liquid can pass out of the cylinder *a* and the preponderating liquid pressure acting on the inlet side of the piston *b* moves the latter against the action of the spring *c* for reducing the pump output.

In the modified construction shown in Figure 2, one end of the cylinder *a* communicates with the pump inlet **2** by way of a passage *k*. This passage is controlled by a slidable piston valve **3** which passes through the adjacent end of the cylinder *a* and which at one end bears against the abutment *s* of the spring *c*. A stem **4** extending from one end of the capsule *p* bears against the other end of the valve **3**. The mode of action of this modification is essentially the same as that of the arrangement shown in Figure 1.

The servo mechanism shown in both of the above described examples is also under the control of a valve **5** which is operable by a diaphragm **6** loaded by a spring **7**, the diaphragm **6** being responsive to fluid pressure which varies with the speed of the pump, but this feature is known and forms no part of the present invention.

Whilst in the foregoing a capsule *p* has been described for actuating the valve lever *n*, an equivalent piston slidable in an evacuated cylindrical chamber, or a flexible diaphragm forming one end of an evacuated chamber, may be used, but an evacuated elastic capsule is usually more convenient and preferable.

By this invention I am able in a very simple manner to correlate in a desired manner the fuel pump output and atmospheric and blower air pressures, the latter becoming operative only when a predetermined blower air pressure has been attained.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

Fluid-operated servo mechanism, comprising in combination a cylindrical chamber provided at opposite ends respectively with an inlet and an outlet for fluid under pressure, a piston slidable in said chamber under the pressure of fluid admitted thereto through said inlet, means forming a restricted passageway interconnecting the ends of said chamber, a spring arranged in said chamber and acting at one end on the side of said piston remote from said inlet, a first valve controlling said outlet, a member responsive to fluid pressure for actuating said first valve, a second chamber enclosing said member and having a restricted orifice through which said member is exposed to atmospheric air pressure, a spring-loaded second valve for admitting air under pressure to said second chamber to supplement the atmospheric air pressure therein, said member being arranged to effect opening movement of said first valve in response to diminution of the air pressure in said second chamber, a movable abutment arranged in said first chamber and supporting the end of said spring remote from said piston, and a thrust piece movable through the medium of said abutment by said piston and spring to effect closing movement of said first valve.

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