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MEANS FOR AUTOMATICALLY CONTROLLING THE SUPPLY
OF LIQUID FUEL TO PRIME MOVERS
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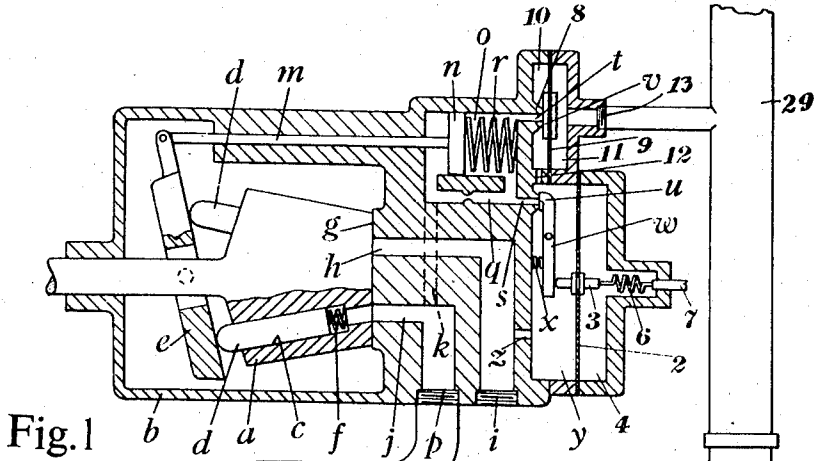


Fig. 1

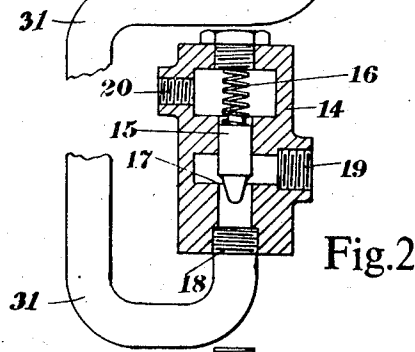


Fig. 2

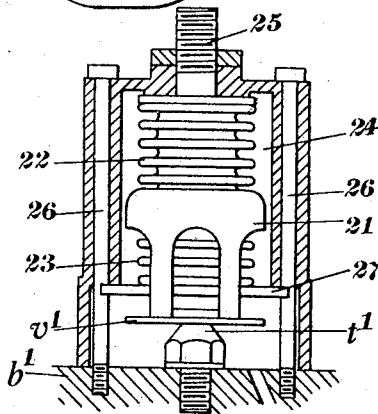


Fig. 3

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MEANS FOR AUTOMATICALLY CONTROLLING THE SUPPLY OF LIQUID FUEL TO PRIME MOVERS

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This invention relates to prime movers of the kind to which liquid fuel is supplied by a variable-delivery pump and the air by a blower. The object of the invention is to provide simple and convenient means for automatically maintaining the required proportionality (or approximate proportionality) or other ratio of the liquid fuel and air under varying conditions.

The invention comprises the combination of pump controlling means which (when in action) are subject to the opposed pump and blower delivery pressures.

In the accompanying sheet of explanatory drawings:

Figure 1 is a diagrammatic sectional side elevation of a variable-delivery liquid fuel pump embodying one feature of the invention, and Figure 2 is a similar view illustrating another feature of the invention.

Figure 3 is a sectional side view illustrating to a larger scale a modified form of the feature shown in Figure 1.

The pump shown in Figure 1 comprises a rotary body part *a* arranged in a casing *b* and having formed around its axis a plurality of bores as *c* in each of which is arranged a reciprocatory plunger as *d*. The body part *a* is adapted to be driven in any convenient manner by the prime mover (not shown) to be supplied with liquid fuel by the pump. During rotation of the body part *a* the plungers *d* are moved in one direction by an angularly adjustable swash plate *e* and in the opposite direction by springs as *f*, the latter being situated within the bores *c*, and serving to hold an end face of the body part in contact with a flat seating *g* in the casing *b*. The seating *g* is formed with a port *h* communicating with a liquid fuel inlet *i* in the casing *b*, and with another port *j* communicating with a liquid fuel outlet *k* in the casing. Adjustment of the swash plate *e* for varying the pump output in response to varying conditions associated with the prime mover is effected by a rod *m* connecting the swash plate to a piston *n*, the latter being slidable in a cylindrical chamber *o* formed in the casing *b*. One end of the chamber *o* is connected to the outlet *p* of the pump by a passage *k*, and to the other end of the chamber by a restricted passage *q*. The latter end of the chamber *o* contains a spring *r* for urging the piston *n* in the direction of maximum pump output, and is provided with a pair of vents *s*, *t* having closure members *u*, *v* at their outer ends. When the vents *s*, *t* are closed the liquid pressures at the two sides of the piston *n* are balanced, and the spring *r*

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causes the piston to move the swash plate *e* to the position of maximum delivery. But when either of the vents *s*, *t* is opened the liquid pressure acting on the same side of the piston *n* as the spring *r* is relieved, and the liquid pressure on the other side of the piston causes the latter to move the swash plate *e* in the direction for reducing the pump output, the extent of this movement depending on the extent of opening of the vent. The closure member *u* of the vent *s* is provided on one end of a lever *w*, the latter being pivoted at a position between its ends to the casing *b*, and being loaded by a spring *x* which tends to hold the closure member in its closed position. The lever *w* is contained in a chamber *y* formed on or secured to the adjacent end of the casing *b*, and this chamber communicates with the pump inlet passage *i* through a port *z*. The outer side of the chamber *y* is bounded by a controlling diaphragm 2 having at its centre an abutment 3 which is adapted to bear on the end of the lever *w* remote from the closure member *u*. At the outer side of and separated by the diaphragm 2 from, the chamber *y* is another chamber 4 to which fluid is supplied in any convenient and known manner at a pressure which varies with the speed of the pump. Also the diaphragm 2 is loaded by a spring 6 connected to an adjusting member 7, the latter being operable in any convenient manner to vary the effect of the spring.

In applying my present invention as shown in Figures 1 and 2 to the pump above described, I make the closure member *v* of the vent *t* in the form of a disc, ball, conical plug or the like, and I arrange it to co-operate with an annular seating 8 at the outlet end of the vent. Also I mount the closure member *v* on a diaphragm 9 which serves to divide another chamber on the casing *b* into two compartments 10, 11. The compartment 10 communicates with the chamber *y* through a port 12, and the compartment 11 is provided with a pipe connection 13 whereby this compartment can communicate with the passage 29 which conducts air from the blower 30 to the combustion chamber of the prime mover.

The closure member *v* is thus subject to the opposed actions of the blower delivery pressure (which acts on the diaphragm 9) and the pump delivery pressure or a pressure proportional thereto (which acts on the closure member through the vent *t*), and the amount of opening of the vent (and consequently the rate of delivery of liquid fuel by the pump) depends on the difference between these two pressures.

In a hollow body 14 (Figure 2) forming part of a passage 31 by which liquid fuel is conducted from the pump outlet 8 to the combustion chamber of the prime mover, is arranged a valve 15 loaded by a spring 16. This valve 15 is conveniently in the form of a cylindrical plug which is slidable in the body 14 and has a truncated conical or otherwise suitably shaped end adapted to co-operate with an annular seating 17 in the body, the latter being provided with inlet and outlet pipe connections 18, 19 between which the liquid fuel can flow under the control of the valve. The body 14 is also provided with an outlet 20 for liquid fuel leaking past the valve 15. The extent of opening of the valve 15 depends on the pump delivery pressure, and the configuration of the shaped end of the valve is made such that the area of the orifice between it and the seating 17 varies in a manner suitably correlated with the liquid pressure acting on the valve.

Instead of mounting the vent closure member v on a diaphragm as above described I may employ the modification shown in Figure 3 in which parts similar or analogous to those above described are indicated by the same reference characters suffixed by 1. As shown in Figure 3 the closure member v^1 has the form of a disc on one end of a hollow mounting 21 which at its other end is secured between the adjacent ends of a pair of coaxially arranged corrugated metal capsules 22, 23, the latter being arranged in a chamber 24 secured to the casing b^1 . The other end of capsule 22 is secured to the outer end of the chamber 24, and is provided with a pipe connection 25 through which it can communicate with the passage for conducting air from the blower to the combustion chamber of the prime mover. The other capsule 23 is evacuated and its end remote from the capsule 22 is closed by a fixed plate 27 the periphery of the latter being notched to effect engagement with long screws 26 which serve to secure the chamber 24 to the casing b^1 . It will be seen that the closure member v^1 is subject to the opposed actions of the blower delivery pressure (which acts through the capsule 22) and the pump delivery pressure or a pressure proportional thereto (which acts on the closure member through the vent t^1), and the amount of opening of the vent (and consequently the rate of delivery of liquid fuel by the pump) depends on the difference between these two pressures.

By the use of a valve as above described in the pump delivery passage, and a pump controlling means subject to the opposed actions of blower and pump delivery pressures, I am able very

simply and conveniently to maintain the required proportionality or approximate proportionality of the liquid fuel and air supplied to the combustion chamber, over a wide range of variation of blower output.

The invention is not, however, restricted to the examples above described, as the mode of varying the pump output in response to the opposed actions of pump and blower delivery pressures may be varied. Also the form of the valve in the pump delivery passage may be varied. But in all cases the two devices are such that when in operation they provide the desired relation between the air and liquid fuel supplied to the combustion chamber.

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

1. A system for supplying liquid fuel and air to a prime mover, comprising in combination a variable-delivery liquid fuel supply pump having a movable member for varying its output, an air blower, a cylindrical chamber which at one end communicates with the delivery side of the pump, a liquid vent at the other end of the chamber, a spring loaded piston slidable in the chamber under fluid pressure and connected to the said movable member, a restricted passage interconnecting the ends of the chamber, and closure means responsive to fluid pressure for controlling the vent, the closure means being exposed to the delivery pressures of the pump and blower at positions where the said delivery pressures have opposed effects on the closure means.

2. A system as claimed in claim 1 and having in combination with the pump, a delivery passage through which flows the liquid fuel to be supplied by the pump to the prime mover, and a spring loaded valve arranged in the said passage and adapted to be opened to a variable extent by the pump delivery pressure for varying the fuel flow through the passage.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
Re. 21,758	Folsy	Apr. 1, 1941
2,177,098	Doe et al.	Oct. 24, 1939
2,273,670	Udale	Feb. 17, 1942
2,292,125	Ifield	Aug. 4, 1942