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REGULATING MEANS FOR LIQUID FUEL SUPPLY SYSTEMS OF PRIME MOVERS OR OTHER APPARATUS

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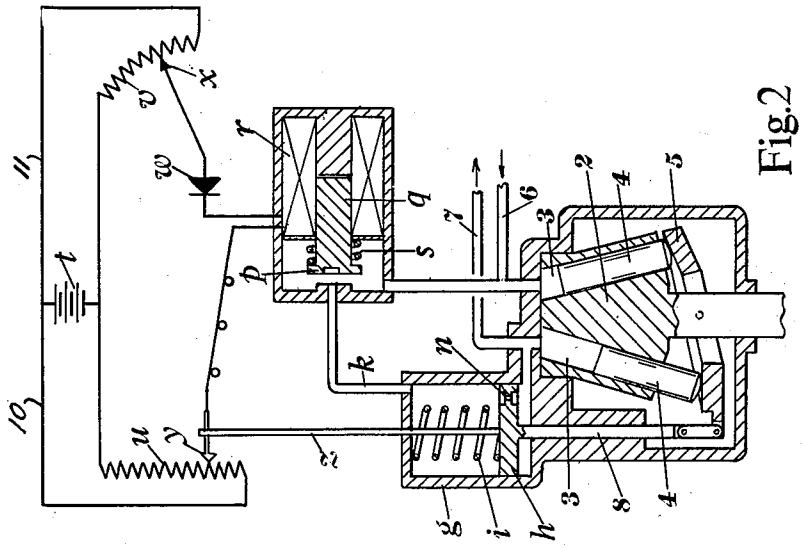


Fig.2

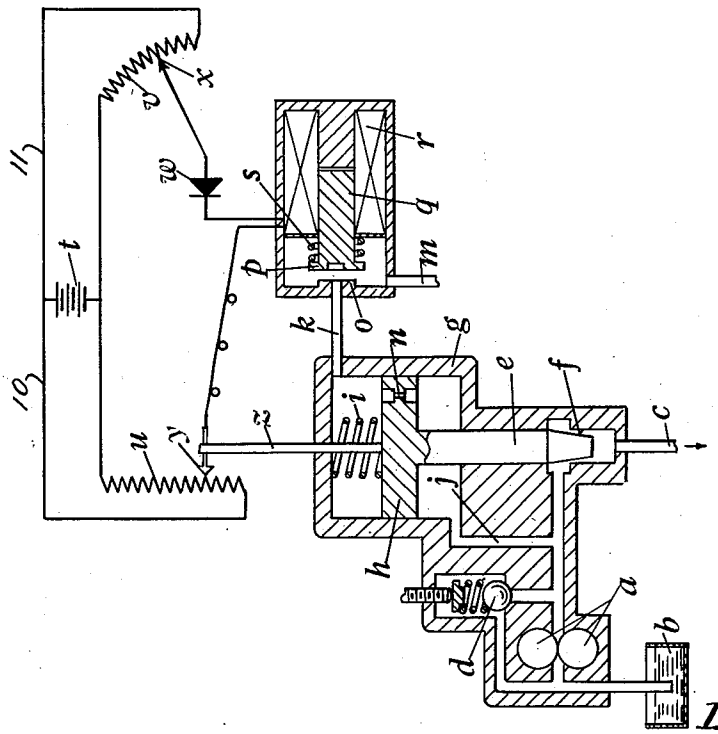


Fig.1

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REGULATING MEANS FOR LIQUID FUEL SUPPLY SYSTEMS OF PRIME MOVERS OR OTHER APPARATUS

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1 Claim. (Cl. 121—41)

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This invention relates to systems for supplying liquid fuel to prime movers or other apparatus, and of the kind which include a pump, and a fluid operated servo-mechanism for regulating the rate of supply of fuel. Hitherto the regulating means has been adapted for manual control through a suitable intermediate mechanical connection, but for some purposes it is more convenient to effect the control through electrical means, and the object of the present invention is to enable this requirement to be met in a simple and satisfactory manner.

The invention comprises the combination of an electromagnet and potentiometers having a rectifier associated therewith.

In the accompanying drawings:

Figures 1 and 2 illustrate diagrammatically two embodiments of the invention.

In one known system for supplying liquid fuel to a burner associated with a jet-propulsion engine, gas turbine, air heater or other analogous apparatus, a fluid operated servo-mechanism is employed for varying the rate of supply of fuel to the burner. In the example shown in Figure 1, the pump comprises a pair of interengaging toothed rotors *a* adapted to draw liquid fuel from a supply tank as *b* and discharge it to a delivery pipe *c* leading to the burner. In this example a relief valve *d* is provided by which fuel can be returned to the inlet side of the pump in the event of excessive pressure being developed at the delivery side of the pump. The rate of flow to the pipe *c* is controlled automatically by a slidable throttle *e* having a conical or otherwise shaped end for varying the effective area of an annular passage *f* leading to the pipe *c*. The throttle is movable by a fluid-operated servo-mechanism, which comprises a cylinder *g* and a piston *h* loaded by a spring *i*, the piston being formed on or secured to one end of the throttle *e*. Liquid fuel from the pump can enter one end of the cylinder *g* by way of a passage *j*, and can be returned to a sump or the inlet side of the pump by way of passages *k*, *m*. Also the ends of the cylinder are in communication by way of a restricted orifice *n* which may be formed in the piston as shown, or may be provided in a branch passage interconnecting the ends of the cylinder. The discharge end of the passage *k* opens into a seating *o* with which co-operates a valve *p*. The arrangement is such that when the valve *p* is closed on to the seating *o* no fluid can flow through the cylinder *g*. The fluid pressures acting on the opposite sides of the piston *h* are then equal, and the spring *i* can move the piston

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in the direction for restricting the area of the passage *f*. When the valve *p* is moved off its seating allowing fluid to flow through the passages *k*, *m*, the preponderating fluid pressure acting on one side of the piston *h* moves the latter against the spring *i* in the direction for increasing the area of the passage *f*. So far the apparatus above described is of known form.

In one manner of applying the present invention to the above described apparatus, the valve *p* is carried by the plunger *q* of an electromagnet having an exciting winding *r*, the plunger being loaded by a spring *s*. The electromagnet winding is energised by current derived from a battery *t*, or other convenient source of direct current, and this current is supplied through a bridge circuit having a pair of parallel branches 10, 11 formed in part by a pair of potentiometers *u*, *v*, provided with adjustable contacts *y*, *x*, the latter being connected to opposite ends of the electro-magnet winding, and the connection between one end of the solenoid winding and the potentiometer *v* being effected through a rectifier *w* permitting current to flow in one direction only. The movable contact *x* of the potentiometer *v* is movable by hand or otherwise under the control of an attendant. The movable contact *y* of the potentiometer *u* is movable by the piston *h* through a rod *z*.

The arrangement is such that when the piston *h* is in equilibrium, that is to say, when the forces acting on opposite sides of the piston are equal, the bridge circuit above mentioned is slightly out of balance, and sufficient current flows through the electromagnet winding *r* to retain the valve *p* slightly open. When the attendant actuates the contact *x* of the potentiometer *v* in one direction, current can flow to the winding *r* for opening the valve *p* to a greater extent. The servo-mechanism is thereby set in motion, and the contact *y* of the other potentiometer *u* is thereby moved until the original state of the bridge circuit is restored. When the attendant operates the movable contact *x* of the potentiometer *v* in the opposite direction no current will flow to the solenoid as it is intercepted by the rectifier *w*. Consequently the valve *p* will be closed by the spring *s*, and the servo-mechanism will be moved in the opposite direction until the original state of the bridge circuit is restored.

Figure 2 illustrates an application of the invention to a system in which the liquid fuel is supplied by a variable delivery pump of the swash-plate type. The pump comprises a rotor 2 having bores 3 containing reciprocatory

plungers 4 which co-operate with an angularly adjustable swash plate 5 in known manner. Fluid enters the pump along a passage 6 and is delivered by the pump along a passage 7. The swash-plate 5 is adjustable by a rod 8 connected to the piston *h* of the servo-mechanism. In other respects the system illustrated by Figure 2 is similar to that illustrated by Figure 1, and the above description of Figure 1 is applicable also to Figure 2. When the valve *p* is closed on to its seating, the piston *h* moves the swash plate 5 in the direction for increasing the pump output, and when the valve *p* is opened the piston *h* moves in the direction for reducing the pump output.

In either of the systems above described it is not essential that the contact *x* shall be operable by or under the control of the attendant, as it may be actuated automatically in response to any predetermined variable condition. Thus it may be operable by a thermostatic device so that the fuel supply is restricted when a predetermined temperature is exceeded. Further, instead of supplying current to the solenoid from a battery or other substantially constant source it may be supplied from a thermo-couple responsive to temperature changes, the contact *x* being then adjusted to determine the temperature at which it is desired to effect reduction of fuel supply.

By this invention the electrical control of the servo-mechanism for regulating the rate of fuel supply can be effected in a very simple and convenient manner.

Having thus described my invention what I

claim as new and desire to secure by Letters Patent is:

Fuel supply regulating means comprising in combination a valve, an electromagnet having an exciting winding and a movable member responsive to excitation of the winding for moving the valve in one direction, a spring opposing movement of the valve by the movable member of the electromagnet, an electric current supply circuit having a pair of parallel branches, a pair of potentiometers forming parts of the circuit branches and having adjustable contacts connected to opposite ends of the electromagnet winding, a rectifier connected between one of the potentiometer contacts and the corresponding end of the electromagnet winding, a fuel regulating member, and a fluid-operated servo-mechanism operable under the control of the valve for actuating the fuel regulating member and imparting adjusting movement to one of the potentiometer contacts.

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