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LIQUID FUEL INJECTION MEANS FOR PRIME MOVERS

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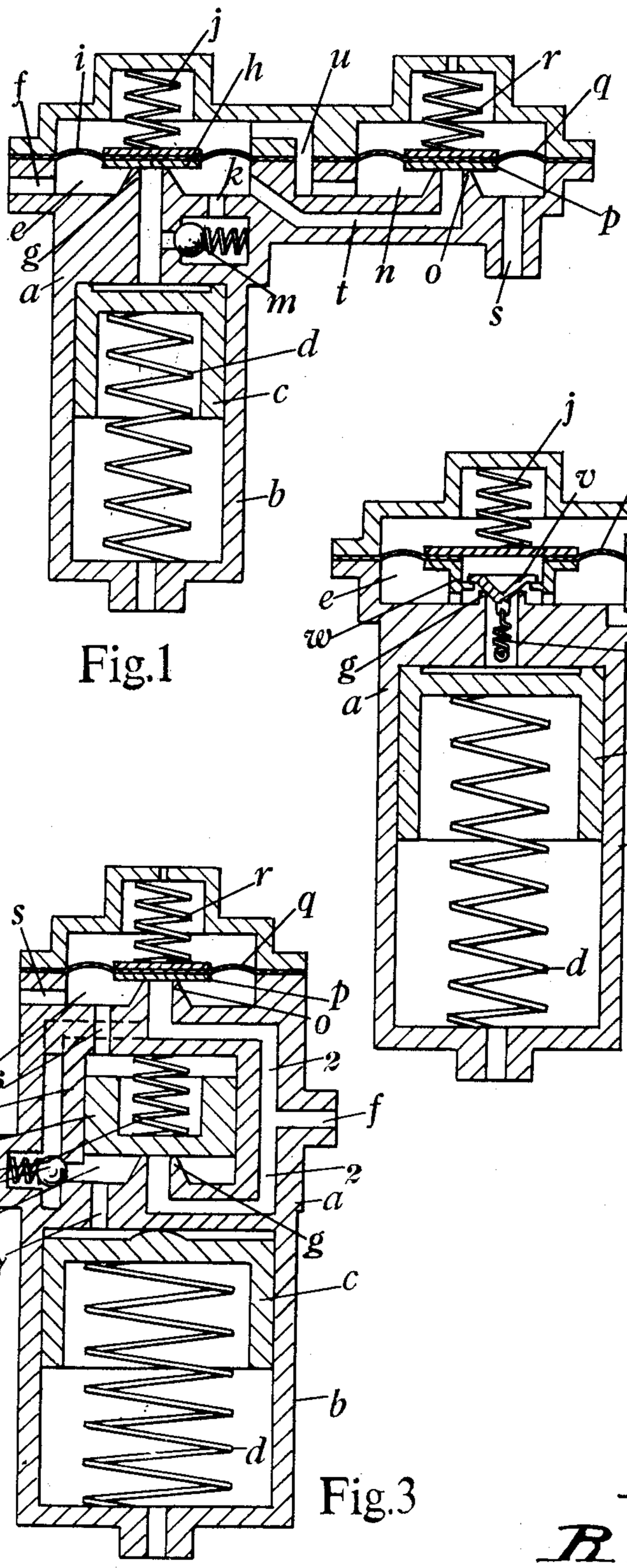

Fig.1

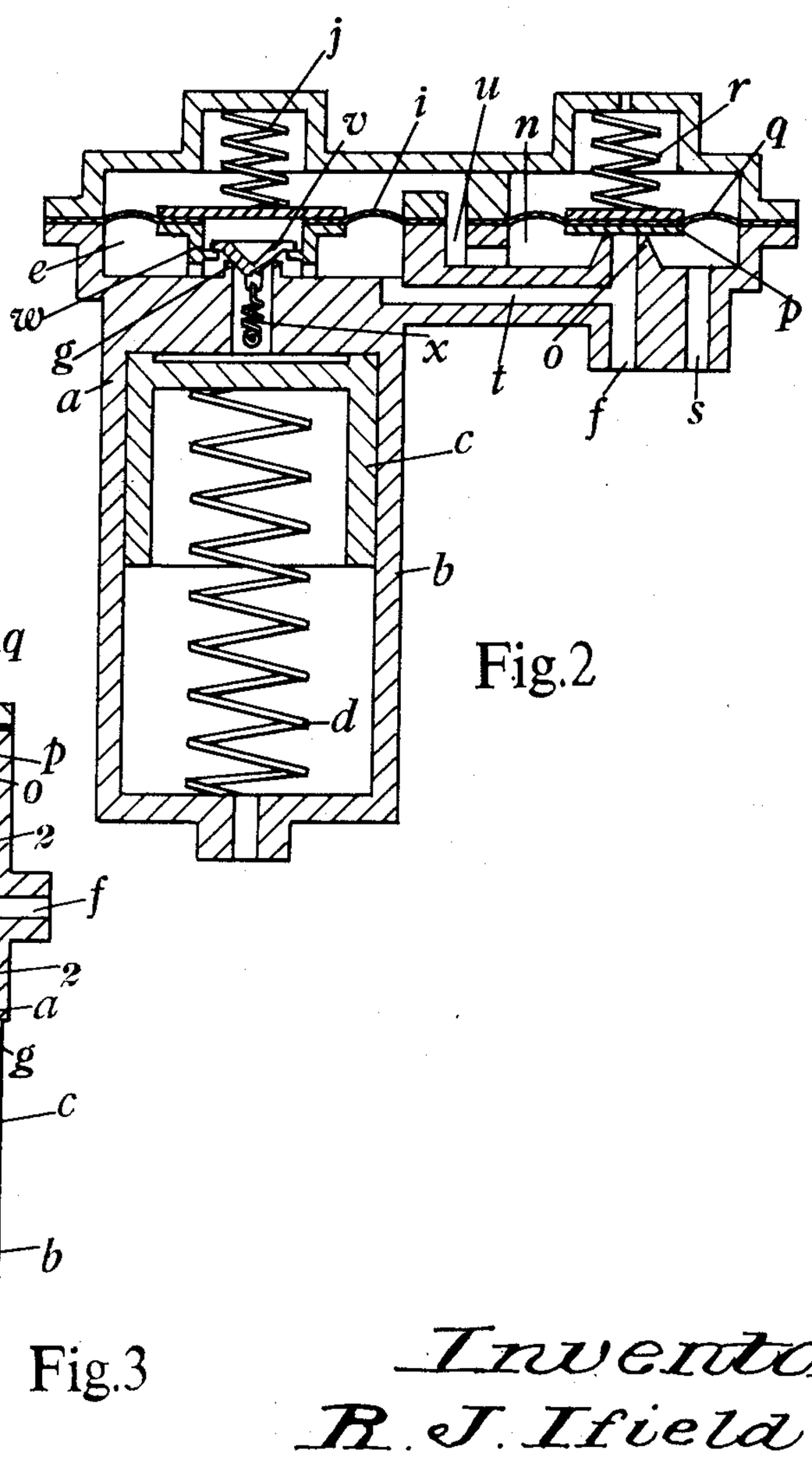

Fig.2

Fig.3

Inventor
R. J. Ifield
By Glascock Downing Seebold
Attys.

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LIQUID FUEL INJECTION MEANS FOR PRIME MOVERS

Richard Joseph Ifield, Dural, New South Wales, Australia, assignor to Joseph Lucas Limited, Birmingham, England

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6 Claims. (Cl. 137—110)

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The invention relates to liquid-fuel injection systems for prime movers, and of the kind comprising a pump driven by the prime mover, and a delivery nozzle or nozzles through which the fuel is supplied to a combustion chamber from the pump. When the prime mover is initially set in motion by an electric motor or other external source of power, the speed of rotation may be insufficient to enable an adequate delivery to be obtained from the pump to ensure prompt and effective starting of the prime mover under its own power. To meet this condition I have employed an accumulator (as described in the specification of British Letters Patent No. 552,725) which is charged by the pump during the starting operation, and a release valve adapted to control the supply of liquid fuel from the pump and accumulator to the nozzle or nozzles, the valve being adapted to be opened automatically when a predetermined quantity of fuel has been stored, or when a predetermined fuel pressure is reached in the accumulator.

For some purposes it has been found desirable to obviate or minimise the possibility of recharging of the accumulator during normal working of the prime mover, as, for example, when the speed of the latter is being accelerated, and the object of the present invention is to enable this requirement to be met in a simple and satisfactory manner.

In the accompanying drawings:

Figures 1, 2 and 3 are sectional views respectively illustrating in a diagrammatic form three embodiments of the invention.

Referring to Figure 1, I employ a body part *a* having therein a cylindrical accumulator chamber *b* containing a piston *c* loaded by a spring *d*. At one end the body part includes an inlet chamber *e* communicating with the fuel inlet *f* and in this chamber is provided a valve seating *g* leading to the accumulator chamber *b*. Also in the inlet chamber is provided a closure member *h* co-operating with the seating and carried by a diaphragm *i* loaded by a spring *j*. Moreover this chamber communicates with the accumulator chamber by way of passages *k* containing a non-return valve *m*.

Adjacent to the inlet chamber is provided an outlet chamber *n* containing a release valve which comprises a seating *o* and a closure member *p* carried by a diaphragm *q* loaded by a spring *r*. The outlet chamber communicates with a delivery outlet *s* and is provided with passages *t u* communicating with both sides of the diaphragm *i* carrying the closure member *h* in the inlet chamber *e*.

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The mode of action is as follows:

When the prime mover is set in motion by an external source of power, the first effect of the fuel discharged by the pump is to lift off its seating the closure member *h* in the inlet chamber (by the pressure exerted on one side of the associated diaphragm *i*) and so allow fuel to flow into and charge the accumulator *b*. When the fuel pressure is sufficient to open the release valve *p* in the outlet chamber *n* (by pressure on the associated diaphragm *q* the accumulator can then discharge (under the action of its spring loaded piston and through the above mentioned non-return valve *m*) and liquid fuel is then supplied to the nozzle or nozzles by the joint action of the pump and the accumulator in sufficient volume to ensure prompt starting of the prime mover. At the same time the closure member *h* in the inlet chamber *e* is closed by the action of its spring (the fluid pressure now acting on both sides of its associated diaphragm), and the accumulator chamber is thereby isolated, so that re-charging cannot occur until the next starting operation is performed.

In the modification shown in Figure 2, I dispense with the separate non-return valve *m* between the accumulator chamber *b* and the inlet chamber *e*, and instead employ the following device. On the seating *g* which leads from the inlet chamber *e* to the accumulator chamber *b* I provide a conical or other suitable closure member *v* loaded by a spring *x* and having a lost motion connection with a controlling member *w* carried by a spring loaded diaphragm *i*. Otherwise the arrangement is essentially the same as that above described, excepting that in this example the inlet and outlet passages are situated adjacent to each other. When fuel enters the inlet chamber *e* it lifts the controlling member *w* and the latter lifts the closure member *v* off its seating *g*, allowing fuel to enter the accumulator chamber. When the fuel pressure is sufficient to open the release valve *p* fuel is supplied to the nozzle or nozzles by the discharge from the pump and the accumulator chamber. At the same time fuel pressure can then act on both sides of the diaphragm *i* carrying the control member *w* allowing the latter to resume its initial condition and enabling the associated part *v* to re-close for isolating the accumulator chamber.

In the modification shown in Figure 3, the inlet and outlet chambers *e*, *n* and accumulator *b* are super-imposed. From the inlet *f*, a branched passage 2 has one part leading to the seating *g* and the other leading to the seating *o*. The seating *g* is controlled by a valve in the form of a

piston 3 loaded by a spring *j* and slidable in a cylinder 5 which is open to the chamber *n* through a passage 6. The cylinder is in communication with the accumulator *b* through a passage 7. Also a non-return valve *m* is provided as shown or in any convenient position between the accumulator and the outlet *s*.

The fluid entering at *f* raises the piston 3 allowing the accumulator to be charged. When sufficient pressure is reached the part *p* is raised off its seating *o* allowing fluid to flow through the outlet *s*. The piston 3 then returns for closing the seating *g* and isolating the accumulator under the action of the spring *j* and the pressure of the fluid entering the cylinder 5 by way of the passage 6. The accumulator is discharged through the valve *m* under the action of the spring *d*.

The invention is not, however, restricted to the examples above described, as subordinate details of construction or arrangement may be varied to suit different requirements.

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

1. For use in a liquid fuel injection system of the kind specified, means comprising in combination a cylindrical accumulator chamber, a spring loaded piston slidable in said chamber, a fuel inlet chamber, a first passage between said fuel inlet chamber and said accumulator chamber, a first spring loaded pressure responsive member in said fuel inlet chamber, an accumulator isolating valve in operative connection with said pressure responsive member and arranged to control said first passage, a fuel outlet chamber, a second passage between said fuel inlet chamber and said fuel outlet chamber, a second spring loaded pressure responsive member in said fuel outlet chamber, a release valve in operative connection with said second pressure responsive member and arranged to control said second passage, and a passageway through which the region of said outlet chamber containing said release valve is connected to the region of said inlet chamber at the side of said first pressure responsive member remote from said isolating valve.

2. Means as claimed in claim 1 and having an additional passage between the inlet and accumulator chambers, and a non-return valve controlling the said additional passage.

3. Means as claimed in claim 1, in which the isolating valve has a lost-motion connection with the associated pressure responsive member.

4. For use in a liquid fuel injection system of the kind specified, means comprising in combination a cylindrical accumulator chamber, a fuel inlet, a spring loaded piston slidable in said

chamber, a second cylindrical chamber in communication at one end with said accumulator chamber, a first passage leading from said fuel inlet to said end of said second chamber, a fuel outlet chamber, a second passage leading from said fuel inlet to said fuel outlet chamber, valving means in the form of a second spring loaded piston arranged in said second chamber to isolate said first passage therefrom during fuel flow from said inlet through said second passage to said outlet chamber, a spring loaded pressure responsive member in said outlet chamber, a release valve in operative connection with said pressure responsive member for controlling communication between said second passage and said outlet chamber, and a passageway through which fuel pressure in said outlet chamber can act on said valving means in opposition to the fuel pressure at said inlet, said valving means being arranged to be opened in response to pressure of fuel supplied to said inlet when said release valve is closed, and to be closed when said release valve is open.

5. Means as claimed in claim 4 and having a third passage between the accumulator chamber and the fuel outlet chamber, and a non-return valve in the third passage.

6. For use in a liquid fuel injection system, of the kind specified, means comprising in combination a cylindrical accumulator chamber, a spring loaded piston slidable in said chamber, an inlet through which said chamber can be charged with fuel against the action of said spring loaded piston, an outlet which has associated therewith a spring loaded release valve and through which fuel from both said chamber and said inlet can flow under the control of said release valve, spring loaded valving means for isolating said chamber from said inlet during the flow of fuel from said inlet to said outlet, and a passageway through which fuel pressure at said outlet can act on said valving means in opposition to the fuel pressure at said inlet, said valving means being arranged to be opened in response to pressure of fuel supplied to said inlet when said release valve is closed, and to be closed when said release valve is open.

RICHARD JOSEPH IFIELD.

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