Jan. 4, 1955 F. M. EVANS 2,698,580

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Filed Jan. 23, 1951 2 Sheets-Sheet 1

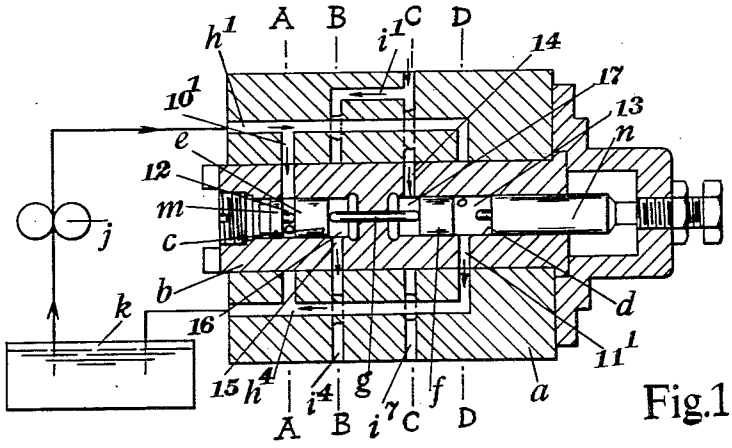


Fig.1

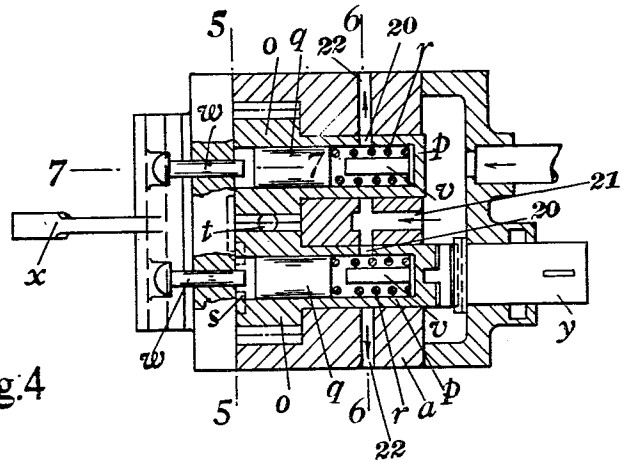


Fig.4

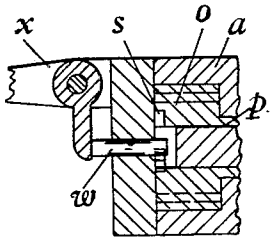


Fig.7

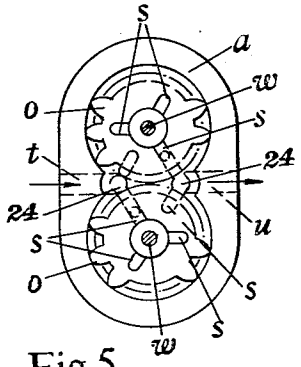


Fig.5

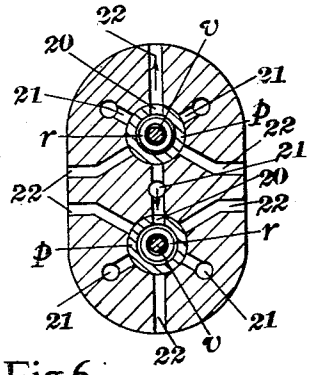


Fig.6

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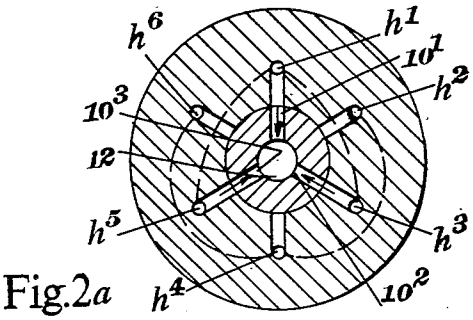


Fig.2a

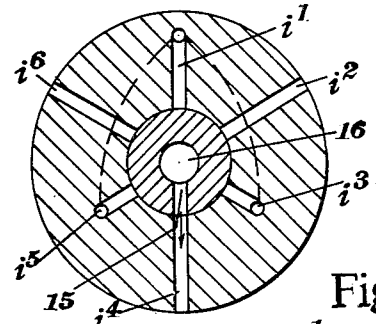


Fig.2b

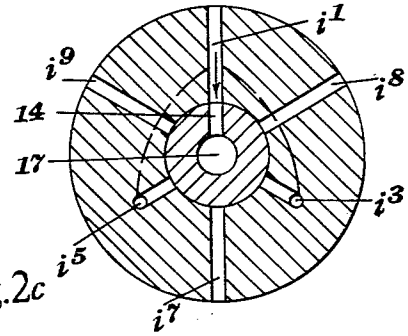


Fig.2c

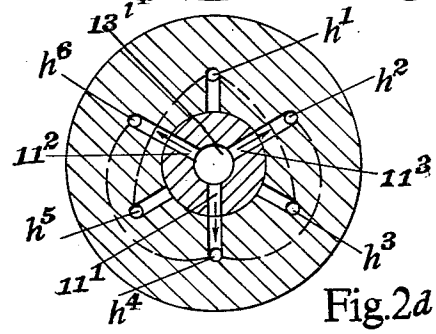


Fig.2d

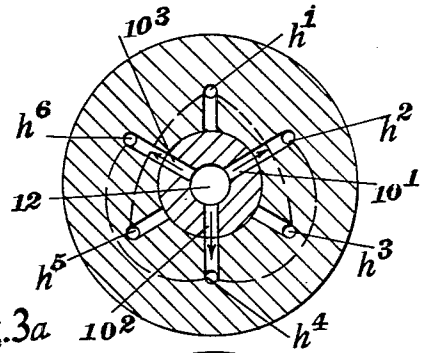


Fig.3a

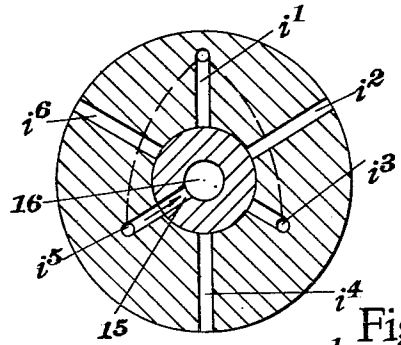


Fig.3b

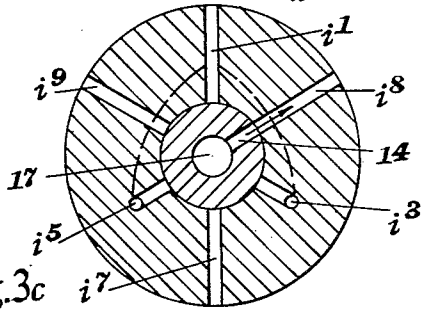


Fig.3c

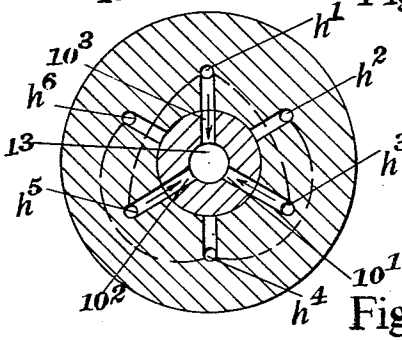


Fig.3d

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Claims priority, application Great Britain January 26, 1950

3 Claims. (Cl. 103—44)

This invention relates to pumps, and particularly pumps for supplying petrol or like liquid fuel to engines under high pressure, the pumps being of the kind in which measured quantities of the liquid are discharged from a measuring chamber by a freely movable (or shuttle) piston under the action of fluid pressure.

When the liquid dealt with by such a pump is of the kind used, for example, as a fuel for a diesel or compression ignition engine, that is to say a so-called heavy fuel, no difficulty is experienced in discharging the liquid to the engine at high pressure. But when the liquid is petrol or other like light and highly mobile fuel, a shuttle-type pump of conventional construction is found to be unsatisfactory when the pressure at which delivery is required is of the order of, for example, 100 lbs./sq. inch., this being attributable at least in part to unavoidable internal leakages.

The object of the present invention is to enable a pump of the kind above specified to be successfully employed for supplying light liquid fuels or highly mobile liquids under considerable pressure, and the invention comprises a pump of the said kind adapted for the actuation of the shuttle-piston or pistons by liquid other, and of a greater viscosity, than the liquid to be delivered.

In the accompanying drawings:

Figure 1 is a sectional side elevation of a pump embodying the invention.

Figures 2*a*, 2*b*, 2*c* and 2*d* are cross sections taken respectively on the lines A—A, B—B, C—C and D—D of Figure 1.

Figures 3*a*, 3*b*, 3*c* and 3*d* are respectively similar views to Figures 2*a* to 2*d* showing the rotatable part in a different position.

Figure 4 is a sectional side elevation of another pump embodying the invention.

Figures 5 and 6 are cross sections on the lines 5—5 and 6—6 (Figure 4) respectively.

Figure 7 is a fragmentary sectional plan on the line 7—7 (Figure 4).

Referring to Figures 1–3, there is provided in a bore in a body part *a*, a rotary cylindrical distributing valve *b* having a pair of coaxial bores *c*, *d*, one of them containing a shuttle-piston *e*, and the other a shuttle-piston *f*, a thrust piece *g* situated between and in contact with the pistons being slidable through a partition separating the adjacent ends of the bores.

In the body part *a* are provided two sets of passages, one set being indicated by h^1 to h^6, and the other set by i^1 to i^9. The passages h^1 to h^6 serve, in conjunction with radial ports 10^1 to 10^3 and 11^1 to 11^3 in the piston valve *b*, to conduct the piston-actuating liquid (which may be engine lubricating oil) to and from the chambers **12**, **13** formed by the parts of the bores *c*, *d* at the remote ends of the pistons *e*, *f*. Any convenient pump *j* may be used for supplying the piston-actuating liquid from a sump *k* to the passages h^1, h^3 and h^5, and for returning this liquid from the passages h^2, h^4 and h^6 to the sump. For this purpose the passages h^1, h^3 and h^5 are interconnected in any convenient manner, and the passages h^2, h^4 and h^6 are likewise interconnected, the interconnections being indicated diagrammatically by dotted lines in Figures 2*a*, 2*d*, 3*a* and 3*d*. The other passages i^1 to i^9 serve, in conjunction with additional radial ports **14**, **15** in the piston valve *b*, to conduct petrol or other light liquid fuel to and from the chambers **16**, **17** formed by the parts of the bores *c*, *d* at the adjacent ends of the pistons *e*, *f*. The light liquid fuel is supplied from

any convenient source (not shown) to the passage i^1 which is connected to the passages i^3 and i^9 in any convenient manner as indicated diagrammatically by dotted lines in Figures 2*b*, 2*c*, 3*b* and 3*c*. The passages i^4, i^6, i^7, i^8 and i^9 are intended to be connected to engine cylinders (not shown) required to be supplied with liquid fuel.

Starting with the various parts of the pump occupying the positions shown in Figures 1, 2*a*, 2*b*, 2*c* and 2*d*, it will be seen that piston-actuating liquid enters the chamber **12** via the passages h^1, h^3 and h^5 and ports 10^1, 10^2 and 10^3. The accompanying movement of the piston *e* (towards the right in Figure 1) causes liquid fuel to be discharged from the chamber **16** via the port **15** and the passage i^4. This movement of the piston *e* is transmitted by the thrust piece *g* to the other piston *f*, and liquid fuel enters the chamber **17** via the passage i^1 and the port **14**. Meanwhile piston-actuating liquid escapes from the chamber **13**, via the ports 11^1, 11^2 and 11^3 and passages h^2, h^4 and h^6.

On rotation of the valve *b* to its next position as shown in Figures 3*a* to 3*d*, piston-actuating liquid is supplied to chamber **13** via passages h^1, h^3 and h^5 and ports 10^1, 10^2 and 10^3. The accompanying movement of the piston *f* (towards the left in Figure 1) causes liquid fuel to be discharged from the chamber **17** via port **14** and passage i^8. This movement of the piston *f* is transmitted by the thrust piece *g* to the other piston *e*, and liquid fuel enters the chamber **16** via passage i^5 and port **15**. Meanwhile piston-actuating liquid escapes from the chamber **12** via ports 10^1, 10^2 and 10^3 and passages h^2, h^4 and h^6. Continued rotation of the valve is accompanied by joint reciprocatory movements of the pistons. The extent of movement of the pistons, and hence the quantity of petrol discharged in each stroke is determined by stops *m*, *n* in the outer ends of the bores, one of which (*n*) is adjustable.

By the use of ordinary engine lubricating oil, or other liquid having a suitably higher viscosity than the petrol, both pistons are effectively sealed against leakage of the petrol past the pistons and consequently the petrol can be discharged at high pressures. Further, the shuttle-pump can be supplied with fuel-liquid from a low pressure source.

Referring to Figures 4–7 there is provided in a body part *a* a gear pump comprising at least one pair of interengaging gear wheels *o*. Each gear wheel has extending coaxially from one of its sides a hollow spindle *p* which forms the rotary barrel of a shuttle-type pump, and which is rotatably supported in a bore in the body part *a*. In the bore of the barrel is contained an axially slidable shuttle piston *q* loaded by a spring *r*. Also in each barrel is formed a radial port **20** which cooperates with inlet passages **21** and outlet passages **22** in the body part.

The face of each gear wheel at the side remote from the associated barrel is recessed to form ports *s* which co-operate with ports passages **24** in the contiguous face of the body part, whereby the liquid impelled by the gear pump can be admitted to and released from the adjacent end of the associated shuttle. This liquid is admitted to the pump body part at *t* from a sump (not shown) and returned to the sump at *u* by way of a spring-loaded relief valve (not shown). The length of travel of each shuttle piston is controlled in part by a stop *v* in the associated barrel, and in part by an adjustable stop *w* in the body part, acting respectively on the opposite ends of the shuttle. The stops *w* are adjustable by a lever *x* pivotally mounted on the body part.

Motion is imparted to the gear pump by a driving spindle *y* connected to one of the barrels *p*.

When the pump is in action the liquid associated with the gear pump, which may be oil of considerably higher viscosity than the fuel or other light and mobile liquid to be delivered, and which is used as a motive liquid for moving the pistons *q* in one direction, is alternately admitted to and released from corresponding ends of the piston-containing bores under the control of the ports **2** and passages **24**, the admission of such liquid to either

of these bore ends being accompanied by release of liquid from the other, so that while either piston *q* is being moved by the motive liquid against the action of its loading spring *r*, the other is being moved in the opposite direction by its loading spring. Movement of each piston *q* by the motive liquid causes fuel or other light and mobile liquid to be discharged from the corresponding pump barrel *p* via the associated port **20** and the outlet passage **22** communicating therewith, whilst return movement of the piston by its spring loading causes the pump barrel to be recharged with fuel or other light and mobile liquid via the corresponding port **20** and the inlet passage **21** communicating therewith, the rotational movements of the barrels serving to bring the ports **20** into communication alternately with the associated inlet and outlet passages.

The invention is not, however, restricted to the examples above described, as the same underlying idea may be embodied in a variety of forms of pumps for dealing with light fuels or other liquids.

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

1. A liquid pump comprising in combination a stationary body having a bore therein, a rotary member mounted in said bore and having a second bore therein, a shuttle-piston slidably mounted in said second bore, passages and ports provided respectively in said body and member and arranged to co-operate with each other for permitting light and mobile liquid to be supplied to and subsequently discharged from said second bore at one side of said shuttle-piston, and additional passages and ports provided respectively in said body and member and arranged to co-operate with each other to permit a motive liquid of greater viscosity than the light and mobile liquid to flow into and out of said second bore at the other side of said shuttle-piston, the latter being movable by the motive liquid in the direction for discharging the light and mobile liquid previously supplied to said second bore, and means being arranged to act on said shuttle-piston for moving the latter in the opposite direction to permit recharging of said second bore with light and mobile liquid preparatory to the next movement of said shuttle-piston by the motive liquid.

2. A liquid pump comprising in combination a stationary body having a bore therein, a rotary cylindrical valve mounted in the bore of said body and having a pair of coaxial bores therein, a partition separating adjacent ends of said coaxial bores, a pair of shuttle-pistons slidably mounted respectively in said coaxial bores, passages and ports provided respectively in said body and valve and arranged to co-operate with each other for permitting light and mobile liquid to be supplied to and subsequently discharged from said coaxial bores at the sides of said pistons adjacent to each other, additional passages and ports also provided respectively in said body and valve and arranged to co-operate with each other to permit a motive liquid of greater viscosity than the light and mobile liquid to flow into and out of said coaxial bores at the remote sides of said pistons, and a movable thrust piece arranged between said pistons so that movement of either piston by the action thereon of the motive liquid is transmitted to the other piston by said thrust piece, each of said pistons being movable by the action thereon of the motive liquid in the direction for discharging light and mobile liquid previously supplied to the corresponding valve bore, and by the action thereon of said thrust piece in the opposite direction for permitting recharging of the corresponding valve bore with light and mobile liquid.

3. A liquid pump comprising in combination a stationary body having a pair of parallel bores therein, a pair of rotary cylindrical members respectively mounted in the bores of said body and each having a bore therein, a pair of interengaging gear wheels provided respectively on adjacent ends of said members and forming with said body a gear pump, a pair of shuttle-pistons slidably mounted respectively in the bores of said members, springs acting on said pistons, passages and ports provided respectively in said members and body and arranged to co-operate with each other for permitting light and mobile liquid to be supplied to and discharged from the bores of said members at the sides of said pistons remote from said pump, additional passages and ports provided respectively in said body and gear wheels and arranged to co-operate with each other to permit a motive liquid of greater viscosity than the light and mobile liquid to be supplied by the pump to and discharged from the bores of said members at the other sides of said pistons, the latter being movable by the action of the motive fluid thereon in one direction for discharging light and mobile liquid previously supplied to the bores of said members, and by said springs in the opposite direction for permitting recharging of the last mentioned bores with light and mobile liquid.

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