

1,056,115.

FIG. 1.

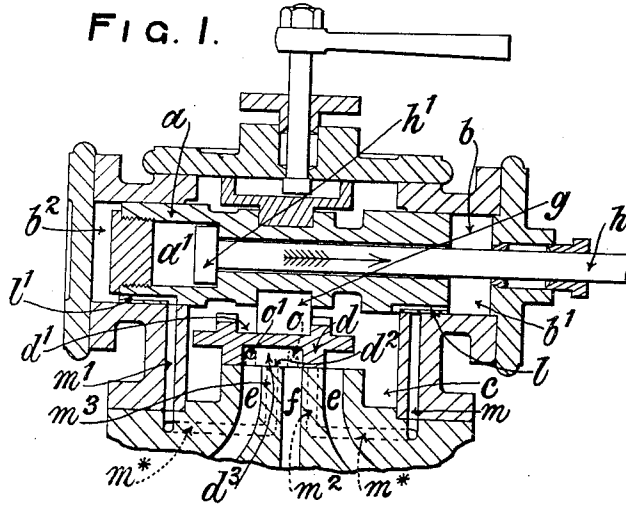


Fig. 2.

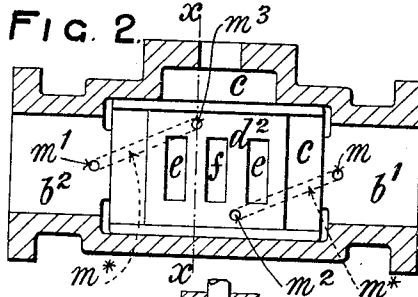
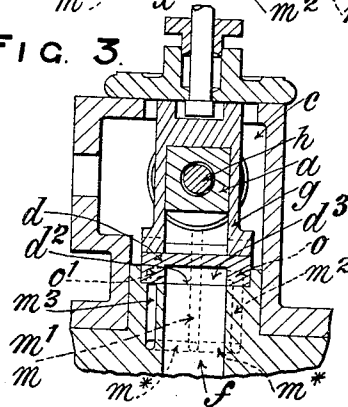


Fig. 3.



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ARTHUR G. MUMFORD AND ALFRED ANTHONY, OF COLCHESTER, ENGLAND.

VALVE-GEAR FOR FLUID-PRESSURE ENGINES.

1,056,115.

Specification of Letters Patent.

Patented Mar. 18, 1913.

Application filed April 29, 1912. Serial No. 693,856.

To all whom it may concern:

Be it known that we, ARTHUR GEORGE MUMFORD and ALFRED ANTHONY, subjects of the King of Great Britain and Ireland, and
5 respectively residing at The Culver Street Engineering Works, Colchester, in the county of Essex, England, and Beaconsfield avenue, Colchester, in the county of Essex, England, have invented certain new and useful
10 Improvements in Valve-Gear for Steam and other Fluid Pressure Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

15 This invention relates to the valve gear of fluid pressure engines of the direct-action type, *i. e.* the type in which the reciprocating action of the piston is imparted direct to the purpose for which the power
20 is required without the intervention of a crank or its equivalent, and it relates particularly to that type of direct-action engine in which the main distributing slide valve is operated by a shuttle piston valve
25 which receives its motion partly from the piston rod of the engine and partly from the pressure of the fluid employed to drive the engine.

In valve gears of the type specified the
30 exhaust ports which put the ends of the shuttle valve cylinder into communication with the main exhaust are controlled by the shuttle valve, and consequently during a large portion of that part of the travel of
35 said valve, which is effected by the piston rod of the engine, said valve is moving against the full pressure of the steam.

The object of the present invention is to balance this pressure so as to minimize the
40 force required to move the shuttle valve during that portion of its travel when it is receiving motion from the piston rod of the engine, whereby greater smoothness of working is attained and the durability of
45 the working parts is materially enhanced. We attain this end by controlling the exhaust ports of the shuttle valve cylinder both by the shuttle valve and by the slide valve, so that communication between the
50 ends of said valve cylinder and the main exhaust is only established at that end toward which the shuttle valve is traveling, that is to say, when it is required to effect the reversal of the valve by fluid pressure.

55 In the accompanying drawing which illustrates this invention:—Figure 1 is a

broken view in longitudinal section of the improved valve gear adapted for a steam engine, Fig. 2 is a view in plan, and Fig. 3 is a view in transverse section on lines
60 *x x* Fig. 2.

Throughout the views similar parts are marked with like letters of reference.

The shuttle valve *a*, which is of the usual construction, is mounted in a cylinder *b*
65 which is preferably made in one with the steam chest *c*. The slide valve *d*, which controls the main admission ports *e e* and the main exhaust port *f*, is operated by the shuttle valve *a* by means of a strap piece
70 *g* carried by said shuttle valve which alternately engages first one end and then the other end of a recess *d*¹ in the back face of the slide valve so as to permit of a certain amount of lost motion between the
75 valves. The shuttle valve *a* is operated by a rod *h* which receives a positive motion from the piston rod or other reciprocating part of the engine through any suitable mechanism. This valve rod *h* is not fixed
80 to the valve *a* but passes freely into it and carries a collar *h*¹ at its back end which works in a recess *a*¹ at the back end of the valve so that the valve has a limited amount of free movement relative to the rod.
85

In the ends of the shuttle valve *a* are small L-shaped ports *l* and *l*¹ which put the ends *b*¹ and *b*² of the valve cylinder alternately into communication with the steam chest *c* and with the exhaust ports *m* and *m*¹. These
90 exhaust ports instead of communicating directly with the main exhaust port *f* are connected by passages *m*² with ports *m*² and *m*³ located in the face of the seating *d*² of the slide valve *d* on either side of the ports *e*
95 *e* and *f*. In the slide valve *d* are two ports *o* and *o*¹ which run between the face of the slide valve *d* and the exhaust cavity *d*³ thereof. These ports are so arranged that at predetermined periods during the travel
100 of the slide valve in either direction they place the ports *m*² and *m*³ in communication with the main exhaust port *f* through the exhaust cavity *d*³ of the valve.

The action of the valve gear is as follows:—Assuming the two valves *a* and *d* to be in the position shown in Fig. 1, the forward end *b*¹ of the valve cylinder is in communication with the steam chest *c* by the port *l* so that the pressure in said end of
110 cylinder is the same as that in the steam chest *c* and the other end *b*² of the valve

cylinder is closed to the main exhaust port *f* as although the port *l*¹ registers with the port *m*¹ the port *m*² does not register with the port *o*¹ and is therefore closed to the exhaust cavity *d*² of the slide valve *d*². The result of this is that steam leaking past the back end of the valve *a* into the back end *b*² or the valve cylinder causes a balance of pressure in both ends of said cylinder and consequently there is no pressure acting against the forward travel of the valve *a* in the direction of the arrow. When the valve *a*, and with it the valve *d*¹, has moved in the direction of the arrow—under the influence of the rod *h*—so far that the port *l* registers with the port *m*, the port *m*² registers with the passage *o*, and the port *l*¹ opens to the steam chest *c*, the steam pressure in the back end *b*² of the valve cylinder causes the shuttle valve *a* to continue its forward motion which is not opposed by the pressure of the steam in the front end of the valve cylinder as the front end *b*¹ of said cylinder is open to the main exhaust port *f* by the ports *l*, *m*, *m*² and *o*, and by the exhaust cavity *d*² of the valve *d*¹. Further movement of the two valves *a* and *d*¹ in the direction of the arrow takes the port *o* out of register with the port *m*², thereby shutting off the main exhaust port *f* from the front end *b*¹ of the valve cylinder, and so causes the valve to come to rest. The slide valve *d* having now opened the rear admission port *e*, the valve rod *h* commences to move in the opposite direction to the arrow and in due time its enlarged end *h*¹ contacts the other end of the recess *a*¹ and causes the shuttle valve *a* to move with it. As the port *l*¹ is open to the steam chest *c* the steam pressure in the back end *b*² of the valve cylinder is opposed to the movement of the shuttle valve, but as the front end *b*¹ of the valve cylinder is not open to the main exhaust *f*, by reason of the ports *m*² and *o* not registering, the pressure of the fluid in the back end *b*² of the valve cylinder is balanced by the pressure of the steam leaking past the forward end of the valve into the forward end *b*¹ of the valve cylinder. Further movement of the valve *a* on its return stroke—which brings the ports *m*³ and *o*¹ into register—takes the port *l* out of register with the passage *m* so that there is still no communication between the front end *b*¹ of the valve cylinder and the main exhaust port *f*.

What we claim as our invention, and desire to secure by Letters Patent is:—

1. In a valve gear for steam or other fluid pressure engines, the combination with a main slide valve controlling the admission and exhaust ports of the engine, of a cylinder in communication with the steam chest containing the slide valve, a piston valve of the shuttle type working in said cylinder, a coupling between said valves whereby the

shuttle valve operates the slide valve with a predetermined amount of lost motion, means for imparting motion to the shuttle valve with a predetermined amount of lost motion, ports in the ends of the piston shuttle valve cylinder leading to the slide valve face, ports in the ends of the piston shuttle valve for establishing communication between the ends of said cylinder and the steam chest and the ports leading from the ends of the piston shuttle valve cylinder to the slide valve face respectively, and ports in the slide valve for establishing communication between the ports in the slide valve face and the exhaust cavity of said valve, as set forth.

2. In a valve gear for steam or other fluid pressure engines, the combination with a main slide valve controlling the admission and exhaust ports of the engine, of a cylinder in communication with the steam chest containing the slide valve, a piston valve of the shuttle type working in said cylinder, a coupling between said valves whereby the shuttle valve operates the slide valve with a predetermined amount of lost motion, means for imparting motion to the shuttle valve with a predetermined amount of lost motion, an exhaust port in each end of the piston shuttle valve cylinder—said ports leading to the slide valve face and opening thereto on either side of the main admission and exhaust ports of the engine, ports in the ends of the piston shuttle valve for establishing communication between the ends of the piston shuttle valve cylinder and the steam chest and the exhaust ports of the shuttle valve cylinder respectively, and ports in the slide valve for establishing communication between the exhaust ports in the slide valve face and the exhaust cavity of said valve, as set forth.

3. In a device of the character described, the combination of a slide valve, a steam-chest containing said slide-valve, a piston-valve of the shuttle-type, a coupling between said valves, said coupling having a sliding connection with said slide-valve and a fixed connection with said piston-valve, and a piston rod having a sliding connection with said piston-valve, said piston valve and said slide-valve having ports alternately establishing communication through the steam chest ports with the respective ends of the piston-valve chamber, and the exhaust chamber of the slide-valve.

4. In a device of the character described, the combination of a slide-valve, a steam-chest containing said slide-valve, a piston valve of the shuttle-type, having a chambered end, a piston rod received by said piston-valve, and having a headed end received within said chambered end of the piston-valve, and a coupling between said slide-valve and said piston-valve said coupling having a fixed connection with said piston-

valve and a sliding connection with said
slide-valve and piston-valve and said slide-
valve, having ports alternately establishing
communication through the steam-chest
5 ports with the respective ends of the piston-
valve chamber and the exhaust chamber of
the slide-valve.

In testimony whereof we have signed our

names in the presence of subscribing wit-
nesses.

A. G. MUMFORD.
A. ANTHONY.

Witnesses:

A. H. WYATT,
F. NOBLE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."
