

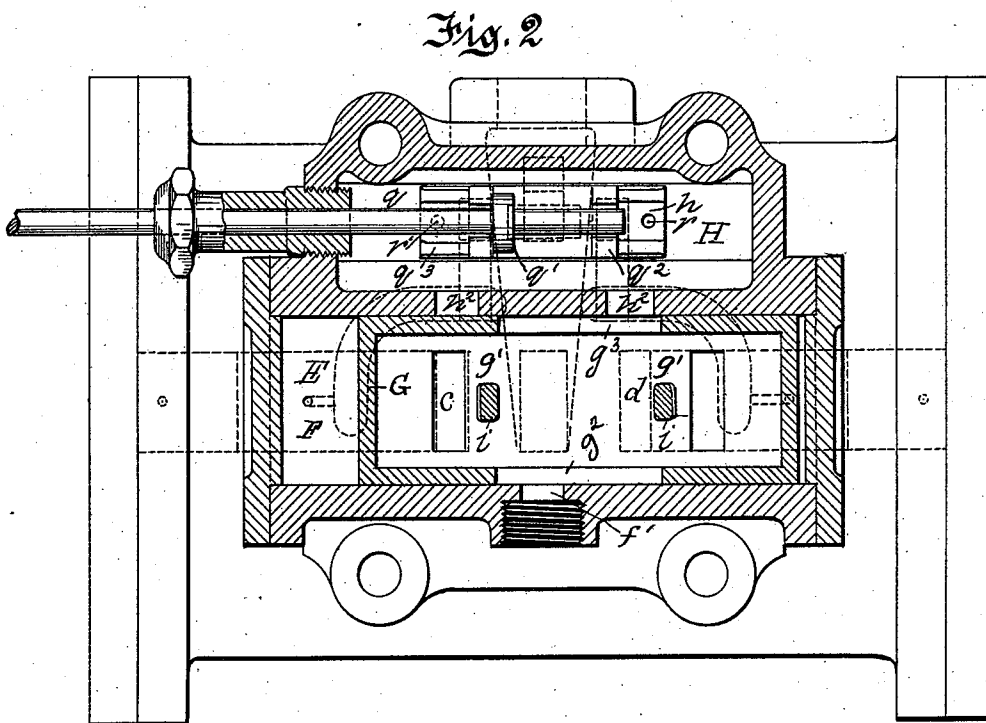
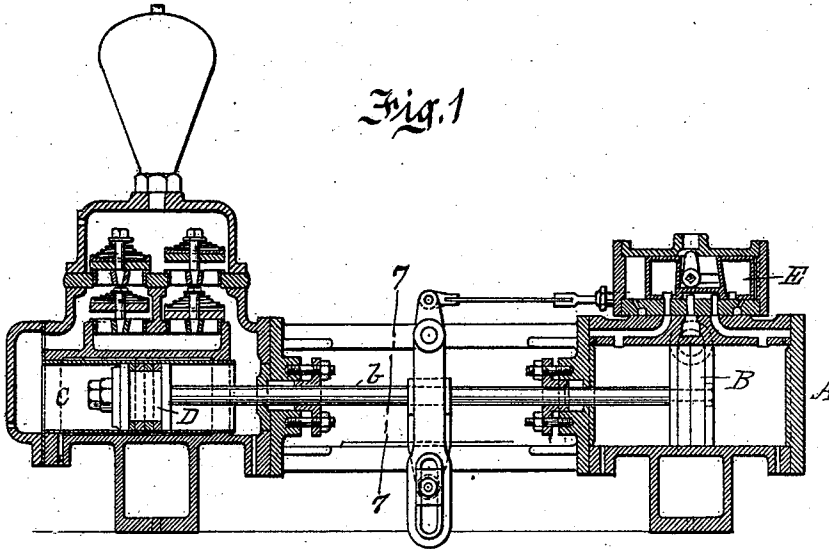
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3 Sheets—Sheet 1.

J. L. McGIFFIN.
VALVE MECHANISM FOR STEAM PUMPS.

No. 570,042.

Patented Oct. 27, 1896.



Witnesses

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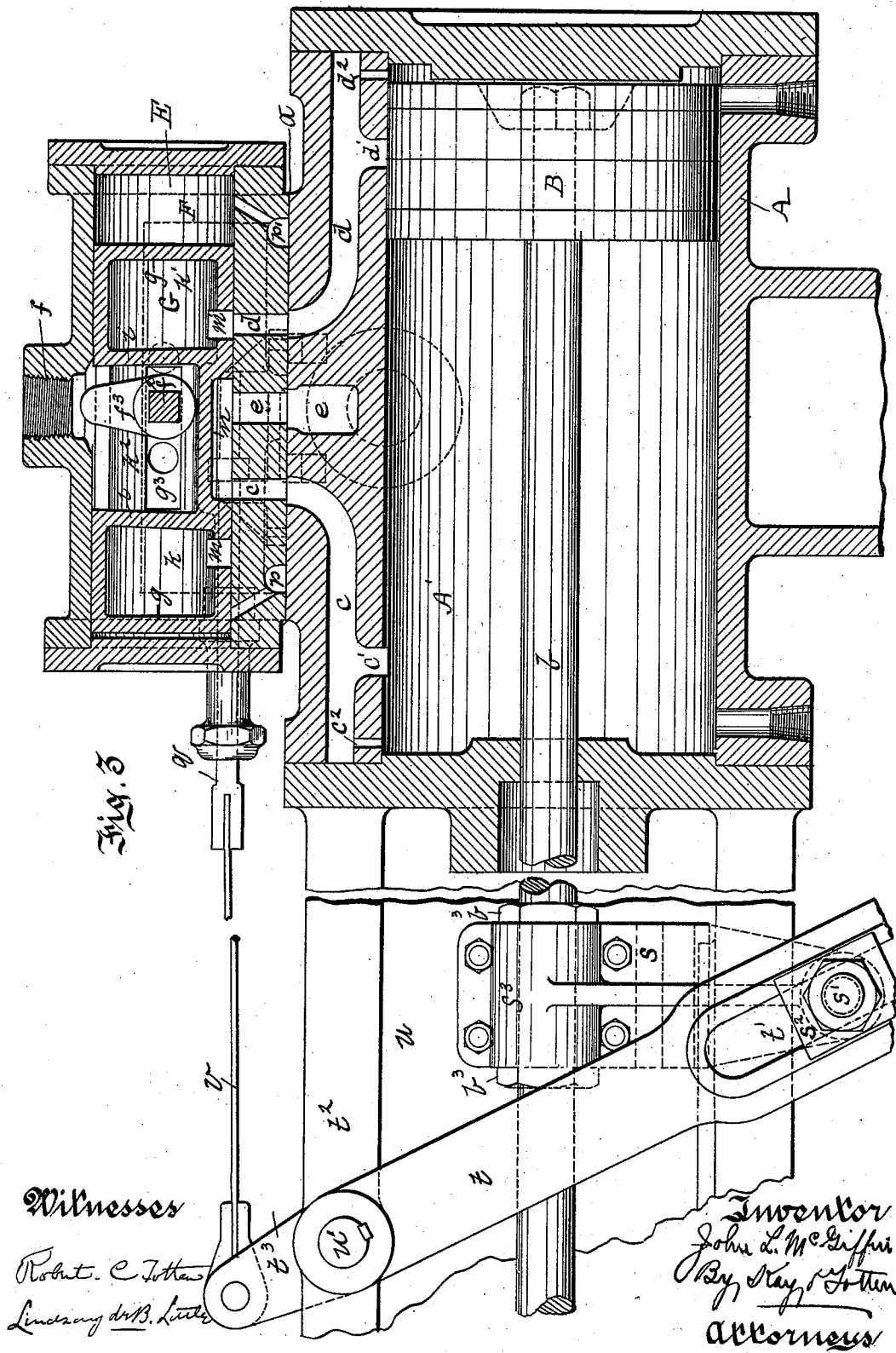
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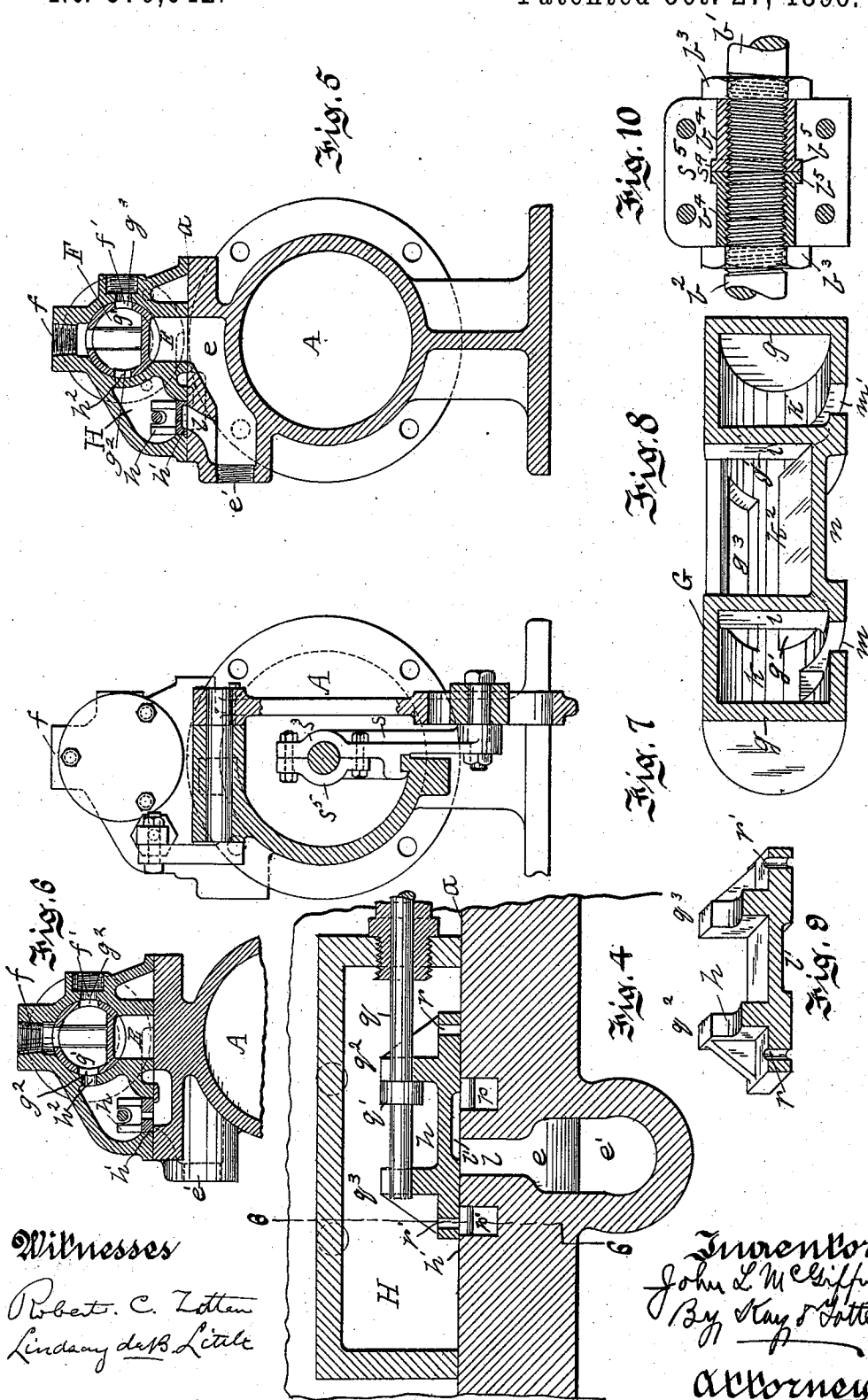
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UNITED STATES PATENT OFFICE.

JOHN L. MCGIFFIN, OF SCOTTTDALE, PENNSYLVANIA.

VALVE MECHANISM FOR STEAM-PUMPS.

SPECIFICATION forming part of Letters Patent No. 570,042, dated October 27, 1896.

Application filed February 14, 1895. Serial No. 538,324. (No model.)

To all whom it may concern:

Be it known that I, JOHN L. MCGIFFIN, a resident of Scottdale, in the county of Westmoreland and State of Pennsylvania, have invented a new and useful Improvement in Valve-Mechanism for Steam-Pumps; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to reciprocating pumps and to the valve mechanism employed therewith, its object being to simplify the valve mechanism and provide a fluid-operated main piston-valve of peculiar construction, as will be hereinafter more particularly set forth.

It comprises, generally stated, in the combination with a main cylinder and piston, a fluid-operated main piston-valve controlling the cylinder-ports, said valve being of cylindrical form and hollow, and having supply-ports extending through its walls and forming communication directly with the cylinder-ports, and an auxiliary slide-valve at the side of the main valve and controlling the ports operating the piston-valve, and tappet connections from the piston-rod to the auxiliary valve.

It also comprises other improvements which will be hereinafter set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a longitudinal central section of the pump. Fig. 2 is an enlarged central horizontal section of the steam-chest. Fig. 3 is an enlarged longitudinal vertical section of the steam-cylinder and steam-chest. Fig. 4 is a longitudinal vertical section of the auxiliary valve-chamber. Fig. 5 is a central cross-section through the steam-cylinder and steam-chest. Fig. 6 is a detail cross-section on the line 6 6, Fig. 4. Fig. 7 is a cross-section on the line 7 7, Fig. 1. Fig. 8 is a perspective sectional view of a main slide-valve. Fig. 9 is a perspective sectional view of the auxiliary valve, and Fig. 10 is a detail section showing the joint between the piston-rod sections.

Like letters of reference indicate like parts in each.

The steam-pump in its general construction

has the steam-cylinder A, the piston B, the pumping-cylinder C, and the piston-rod *b*, connecting the pistons B and D. The pump is illustrated with the ordinary valve construction for the inflow and outflow of the water or other fluid to be pumped, and as the invention does not relate to this part it will require no further description.

The engine portion of the pump is formed of two main castings, the cylinder-casting A, having the flat upper face *a*, and the steam-chest casting E, having a flat under face which rests on the steam-chest casting, the two castings being bolted together. The cylinder-casting A has the main ports *c d* leading from the cylinder-chamber A', and these ports also extend through the steam-chest casting E, opening into the base of the cylindrical main-valve chamber F, in which the cylindrical main valve G slides. The steam-chest casting E has the auxiliary-valve chamber H at the side of the main-valve chamber F, the base of which is formed by the flat top face *a* of the cylinder-casting, and said flat top face also forms the valve-seat *h'* for the auxiliary valve *h*, such general construction simplifying and cheapening the engine.

The engine-port *c* has the main port *c'*, which is placed some distance from the end of the cylinder-chamber A', and the cushioning-port *c²* close to the end of the cylinder-chamber, and the port *d* has like ports *d' d²*. The usual central main exhaust-port *e* is employed, which leads from the cylindrical valve-chamber F, through the steam-chest E and cylindrical casting A, to the escape-port *e'*.

I will first describe the general construction of the main-valve chamber F and its valve G. The main-valve chamber is preferably a cylindrical chamber and of the same diameter throughout, and it has the inlet-port *f*, leading centrally into the top of the chamber, and the ports *c d e*, above referred to, leading therefrom through the body of the valve-chest and communicating with like ports, similarly lettered, in the main cylinder, as above stated. It has also one or more ports *h*, forming direct communication with the auxiliary-valve chamber H, and on the opposite side thereof is formed the bearing

f' , through which the shaft f^2 , carrying the starting-lever f^3 , passes, said starting-lever being employed as a precaution, though not generally necessary, as the pump is found to
 5 operate positively and to start, no matter what the position of its valves or pistons, even at a very low pressure. The main slide-valve G, the construction of which is illustrated in the different views and is more
 10 clearly shown in the perspective view of Fig. 7, corresponds in shape to the valve-chamber f , being preferably cylindrical, as above stated, and of the same diameter throughout, and it may have suitable packing-rings fitting around the same to pack it within the
 15 valve-chamber. The valve G is made hollow, having the solid end walls g , and in the central portion thereof having the passage or opening g' to permit the entrance of steam
 20 from the inlet-port f , having the side passage g^2 on the side through which the shaft f^2 passes and having the side passage g^3 on the other side, which provides for the passage of steam to the auxiliary chamber H through
 25 the port or ports h^2 . It also has the pillars or posts i , against which the starting-lever f^3 operates. As so constructed it has the hollow chambers k k' , one at each end, and a central hollow portion k^2 , steam passing from
 30 the same around the pillars i into the hollow chambers k k' . The valve has also the supply-ports m m' , leading from the chambers k k' through the walls of the valve, which form direct communication between the interior of
 35 the valve and the engine-ports c d , respectively, so that no separate slide-valve controlling said ports is required, and on account of the cylindrical body of the valve-chest and the cylindrical slide-valve working therein
 40 close and perfect joints which are not liable to wear are formed between the supply-ports and the cylinder-ports. Formed in the bottom face of the valve G is the groove or recess n , which forms the exhaust-passage
 45 between the cylinder-ports c d and the exhaust-port e . As so constructed a very simple form of valve is obtained, which can be cheaply made and is not liable to wear and which serves both the purpose of the main slide-valve controlling the main ports and the piston-valve to operate the same.

The auxiliary-valve chamber H is located at the side of the main-valve chamber directly above the outlet-port e' , where it passes
 55 through the main-cylinder casting, and the top face of the cylinder-casting A forms the base of the chamber and the seat n for the valve. It has the central exhaust-port l , leading through the cylinder-casting A to the
 60 outlet-port e' . It has also the ports p p' , leading down into the cylinder-casting to one side of the valve-seat and thence up to the under face of the valve-chest and, as shown in dotted lines in Fig. 7, to the main-valve cylinder F, said ports p p' opening by small
 65 passages, as indicated in Fig. 3, into the ends of said cylinder, and opening a sufficient dis-

tance from the ends of the cylinder to provide for the cushioning of the main slide-valve therein. The auxiliary valve h has
 70 the central recess l' , forming the exhaust-passage between the ports p p' and the exhaust-port l . It is to be noticed that the auxiliary valve is of such length that it always covers the ports p p' , and to form communication
 75 therewith near the ends thereof the ports r r' pass directly through the body of the valve for the passage of steam to the ports p p' , respectively. The valve h is operated by the
 80 tappet-rod q , which has the tappet q' thereon, the valve h having the lugs q^2 q^3 extending up therefrom and recessed to receive the tappet-rod q and the tappet q' , moving between such lugs q^2 q^3 and near the ends of
 85 the stroke of said rod striking against the standards, so causing the movement of the valve over the ports l , p , and p' . Any suitable mechanism for operating the tappet-rod
 90 q may be employed, that illustrated in the drawings, and which is preferred by me, being the arm s , carried by the piston-rod b and depending below the same and having a
 95 pin s' and carrying a sliding block s^2 , working in a slide t' in the lower end of the lever t . This lever is secured to a shaft t^2 , mounted
 100 in a bearing u' on the horizontal brace or bar u , extending between the steam-cylinder A and the pump-cylinder C, and extending upwardly from the other end of the shaft t^2 is the lever t^3 , which forms an extension of the
 105 lever t and is connected to the rod or strap v , the other end of which connects to the tappet-rod q . The strap v is preferably made of a flexible bar to provide for the necessary deflection of the end thereof connected to the

lever t^3 in the swinging of the lever.
 In order to simplify the repair of the pump, the piston-rod b is formed in two sections b' b^2 , so that either piston or cylinder may be removed without disturbing the other. I
 110 employ any suitable joint for connecting the sections and have illustrated it as made by the clamp s^3 , securing the arm s to the piston-rod. The adjoining ends of the rod-sections
 115 b' b^2 are threaded and nut-locks b^3 are first screwed thereon, after which the collars b^4 , having flanges b^5 , are screwed onto the rods. The clamp s^3 has a recess s^4 to receive the
 120 flanges b^5 , and the cap s^5 of the clamp has a like recess and fits over the collars b^4 and is bolted to the body of the clamp, after which the nut-locks may be screwed up against the
 125 clamp, the collars b^4 and nuts b^3 providing for accurate adjustment of the rod-sections. To remove or repair either cylinder or piston, it is only necessary to open the clamp, so dividing the piston-rod into two sections and providing for easy handling.

In the operation of the pump the steam-piston B reciprocates in the cylinder A, and
 130 thus the piston-rod b moves the piston D on the cylinder C, so operating the pumping mechanism. The steam entering the steam-chest and entering the valve-chamber F

through the port f flows into the valve-chamber H through the port or ports h^2 . In the reciprocating stroke of the piston-rod b , through the arm s and its sliding block s^2 , working in the guideway t' in the tappet-lever t , the tappet-rod q is caused to reciprocate, and in its movement the tappet or block q' on said rod contacts with the lugs q^2 and q^3 on the auxiliary valve h when the tappet approaches the end of the stroke, and so draws the ports r r' into and out of communication with the ports p p' and forms communication between the exhaust-port l and said ports p p' through the recess or groove l' . It will be noticed that the ports r r' in the valve h pass directly through the same and are small in area, the purpose of such construction being to admit a small inflow of steam from the chamber H to the ports p p' and to provide for the quick cutting off of the same. These ports are so located in the valve h as to give the desired lead or stroke to the main-piston valve G, so as to enable it to properly control the ports leading to the main cylinder. The steam passes through the ports or passages p p' to the respective ends of the valve-cylinder F, entering the same at the points more clearly shown in Figs. 2 and 3. Supposing that the main piston B occupies the position shown in Fig. 3, the engine-cylinder receiving steam through the port m' of the valve G and through the port or passage d , the steam will first pass through the port d^2 to that end of the main cylinder A which will cause the movement of the piston until it uncovers the larger supply-port d' , and the piston will then travel toward the other end of the cylinder, carrying with it the arm s on the piston-rod and causing the swinging of the tappet-lever t and at the same time the movement of the tappet q' , which, before the end of the stroke, strikes against the lug q^2 of the valve h and slides the valve from the position shown in full lines to the position shown in dotted lines in Fig. 4, closing communication between the ports r' and p' and opening communication between the ports r and p and between the port p' and the exhaust-port l . Steam will then pass through the port p to the forward end of the valve-cylinder F and be exhausted from the rear end thereof through the port p' , which causes the movement of the valve G, closing communication between the port m' , leading through that valve and the main-cylinder port d , and moving the valve so that the valve-port m is brought into communication with the main-cylinder port c , while the groove or recess n is moved so as to close communication between the ports c and e and open communication between the ports d and e . The steam then passes from the interior of the main-piston valve G and through its port m into the cylinder port or passage c , and is exhausted from the other end of the cylinder through the ports or passages d e , causing the moving of the piston B in the

opposite direction, the main-piston valve remaining in the position shown in Fig. 1. As the tappet-lever t is swung in the opposite direction by the arm s on the piston-rod it moves the tappet q' , which toward the end of its stroke strikes the lug q^3 on the valve h , moving it to the position shown in Fig. 4, so that steam passes through the port p' to the outer end of the valve-cylinder F and is exhausted through the port p from the opposite end thereof, which causes the return movement of the cylinder-valve G, bringing it to the position shown in Fig. 3, and bringing the port m' in line with the cylinder-port d and forming communication between the cylinder-port c and the exhaust-port e . In these operations the valve mechanism is arranged to give the necessary lead to the different valves, so as to control the movement of the main piston and prevent its striking the cylinder-head, and it will be noticed that the main valve G closes the cylinder-ports as the main piston approaches the ends of the main cylinder, so providing for the cushioning of the same. It will also be noticed that a like means for cushioning the cylinder-valve G is provided, as the ports p p' enter the valve-cylinder some little distance from the ends thereof. The main-cylinder valve G thus acts itself to control the main-cylinder ports without the interposing of any separate slide-valve, and this is accomplished by the employment of the hollow valve having ports therein adapted to coincide with the cylinder-ports and having the peculiar construction shown, with the top opening in the central part thereof to permit the steam to enter the hollow valve. As a matter of fact the engine consists of the main cylinder A, formed in one casting, and the steam-chest formed in another casting. In this way the valve-chest need not be larger than the size of the single main valve and the auxiliary valve at the side thereof, which requires very little increase in the size of the casting. The top face of the main-cylinder casting is utilized to close the auxiliary-valve chamber and form a seat therefor, while the exhaust-port controlled by the auxiliary valve opens directly into the main exhaust-port and can be formed by a simple core in the casting. The different ports can also be formed at but small expense and be formed in the exposed parts of the castings, to form communication between the tappet-valve and the main-cylinder valve.

Practical use has shown that the pump can be operated at any desired speed, from an exceedingly slow to a very rapid stroke; that it can be stopped and started in any position and is positive in its action, starting on a very low pressure of steam at a slow stroke as easily as under high pressure.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination with a main cylinder

formed of a casting having a flat upper face, a steam-chest formed of a separate casting and having a main-valve chamber containing a steam-operated valve, main-cylinder ports being formed in both of said castings and controlled by ports in the steam-operated valve, said steam-chest having at the side of the main-valve chamber an auxiliary-valve chamber, containing a tappet-valve having its valve-seat formed on the top face of the main-cylinder casting and tappet connections from the piston-rod to said tappet-valve, substantially as set forth.

2. The combination with a main cylinder and steam-chest having a main-valve chamber, a steam-port communicating with the upper end of the valve-chamber, and a fluid-operated main-piston valve, said valve being formed hollow and having an opening in the upper part of the central portion thereof to permit of the entrance of steam and having supply-ports leading through the lower portion thereof forming communication with the cylinder-ports, substantially as set forth.

3. In steam-engine-valve apparatus, the combination with a steam-chest having a cylindrical valve-chamber with which the inlet-port *f* and with which the cylinder-ports *c*, *d*, *e*, communicate, and the fluid-operated hollow cylindrical valve *G* having the central opening *g'* communicating with the inlet-port *f*, the hollow chambers *k*, *k'* and supply-ports *m* *m'* passing through the same and forming direct communication with the cylinder-ports *c*, *d*, and the recess *n*, in the under face communicating with the main exhaust-port, the valve having also the central side opening *g*² and the pillars *i*, and the starting-lever *f*³ supported between said pillars on the shaft *f*² entering through the opening *g*², on the same horizontal plane as the valve *G*, substantially as set forth.

4. In the combination with a main cylinder formed of a casting having a flat face, a valve-chest having a main cylindrical valve-chamber with an inlet-port entering centrally through the top thereof, an auxiliary-valve chamber at the side of the main chamber, and having the auxiliary valve seated on the top face of the main-cylinder casting, one or more ports in the wall between the valve-chambers and a hollow cylindrical valve fitting in the main-valve chamber, and having a central opening communicating with the inlet-port and an opening in the side providing for communication with the auxiliary-

valve chamber, through said port or ports, substantially as set forth.

5. In combination with a main cylinder formed of a casting with a flat upper surface, a valve-chest formed of a separate casting resting thereon and containing a main-valve chamber and an auxiliary-valve chamber at the side thereof containing a slide-valve seated in the upper face of the main-cylinder casting, and ports leading from the seat of said auxiliary valve down into the main-cylinder casting and thence to the under face of the valve-chest casting and to the end of the main-valve chamber, substantially as set forth.

6. In steam-engine-valve apparatus, the combination of a valve-chest having the valve-chamber *H* with ports *p*, *p'* and *l* therein, a slide-valve *h* having the central exhaust-recess *l'* and supply-ports *r*, *r'* formed of holes passing directly through the body of the slide-valve, and having the lugs *q*² *q*³ and the tappet-rod having a tappet operating between said lugs, substantially as set forth.

7. The combination with a main cylinder having a piston sliding therein, of a valve-chest having the valve-chamber *H* and the tappet-valve *h* therein, the depending arm *s* having a sliding connection with the lever *t*, the tappet-rod *q* and connections between said lever and the tappet-rod *q*, and a tappet on the rod engaging with the valve, substantially as set forth.

8. The combination with a main cylinder having a piston sliding therein, of a valve-chest having the valve-chamber *H* and the tappet-valve *h* therein, the arm *s* having a sliding connection with the lever *t*, the tappet-rod *q* and a flexible strap connecting said lever and tappet-rod, and a tappet on the rod engaging with the valve, substantially as set forth.

9. The combination, in a steam-operated apparatus, of valves or pistons in line with each other and a rod connecting the valves or pistons, said rod being made in two sections and flanged collars secured at the ends of the rod-sections, and a clamp fitting around said flanged collars, substantially as set forth.

In testimony whereof I, the said JOHN L. MCGIFFIN, have hereunto set my hand.

JOHN L. MCGIFFIN.

Witnesses:

ROBERT C. TOTTEN,
LINDSAY DE B. LITTLE.