(No Model.) 2 Sheets—Sheet 1.

C. A. GOYNE.

DUPLEX STEAM PUMP.

No. 509,659. Patented Nov. 28, 1893.

FIG. 6.

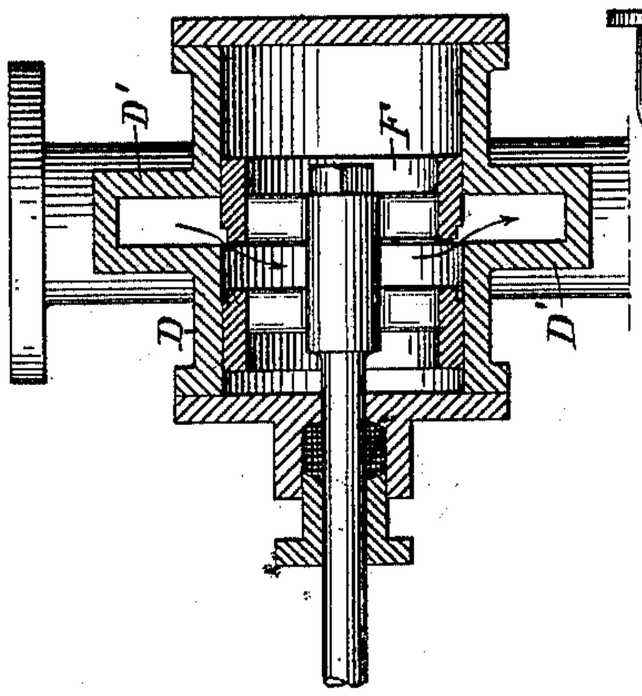


FIG. 5.

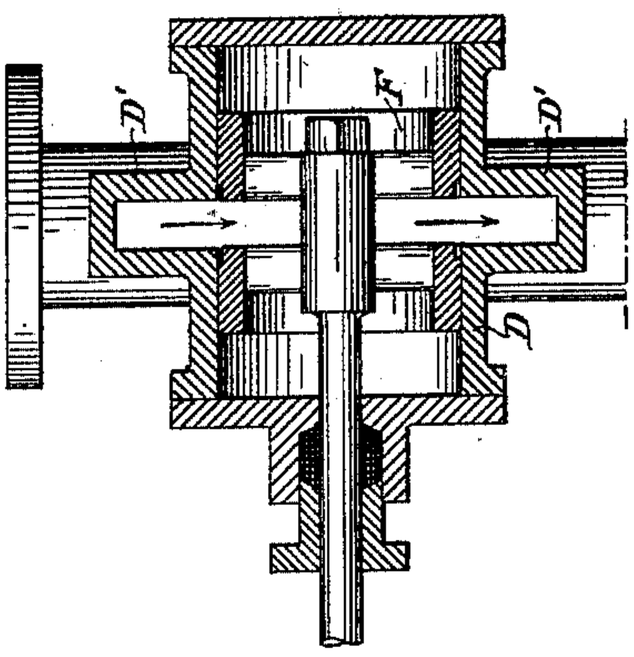


FIG. 4.

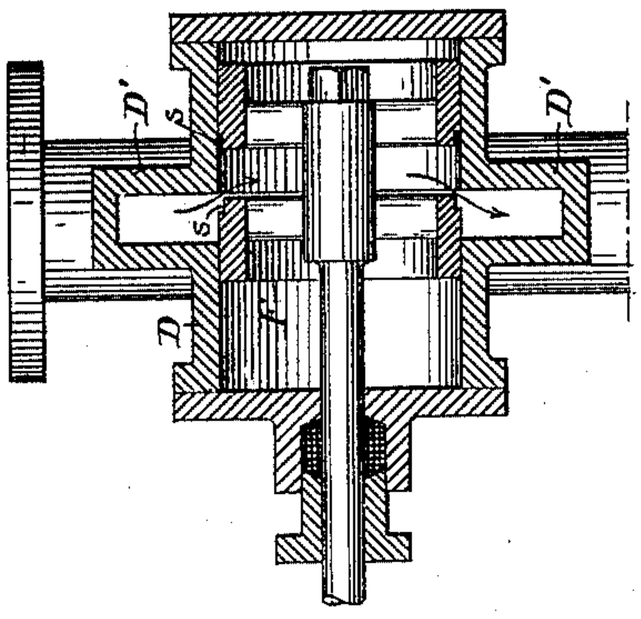
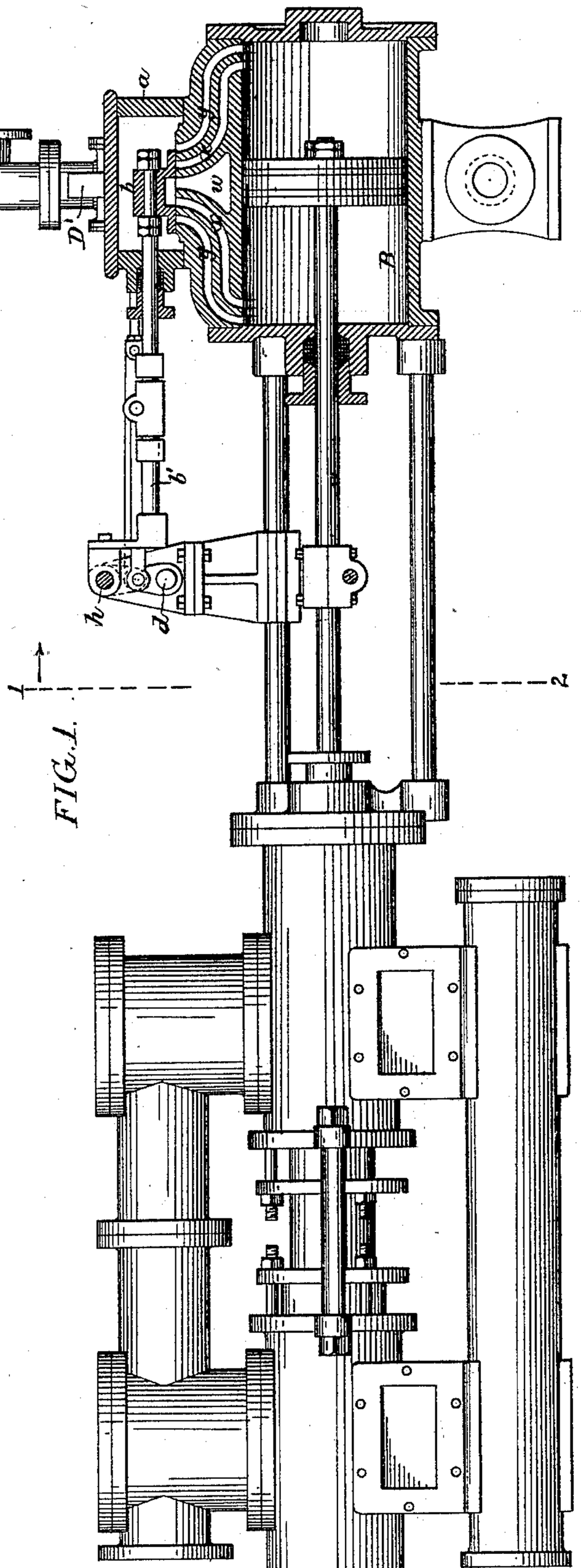


FIG. 1.



Witnesses:
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A. V. Groupe

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by his Attorneys
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THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

C. A. GOYNE.

DUPLEX STEAM PUMP.

No. 509,659. Patented Nov. 28, 1893.

FIG. 2.

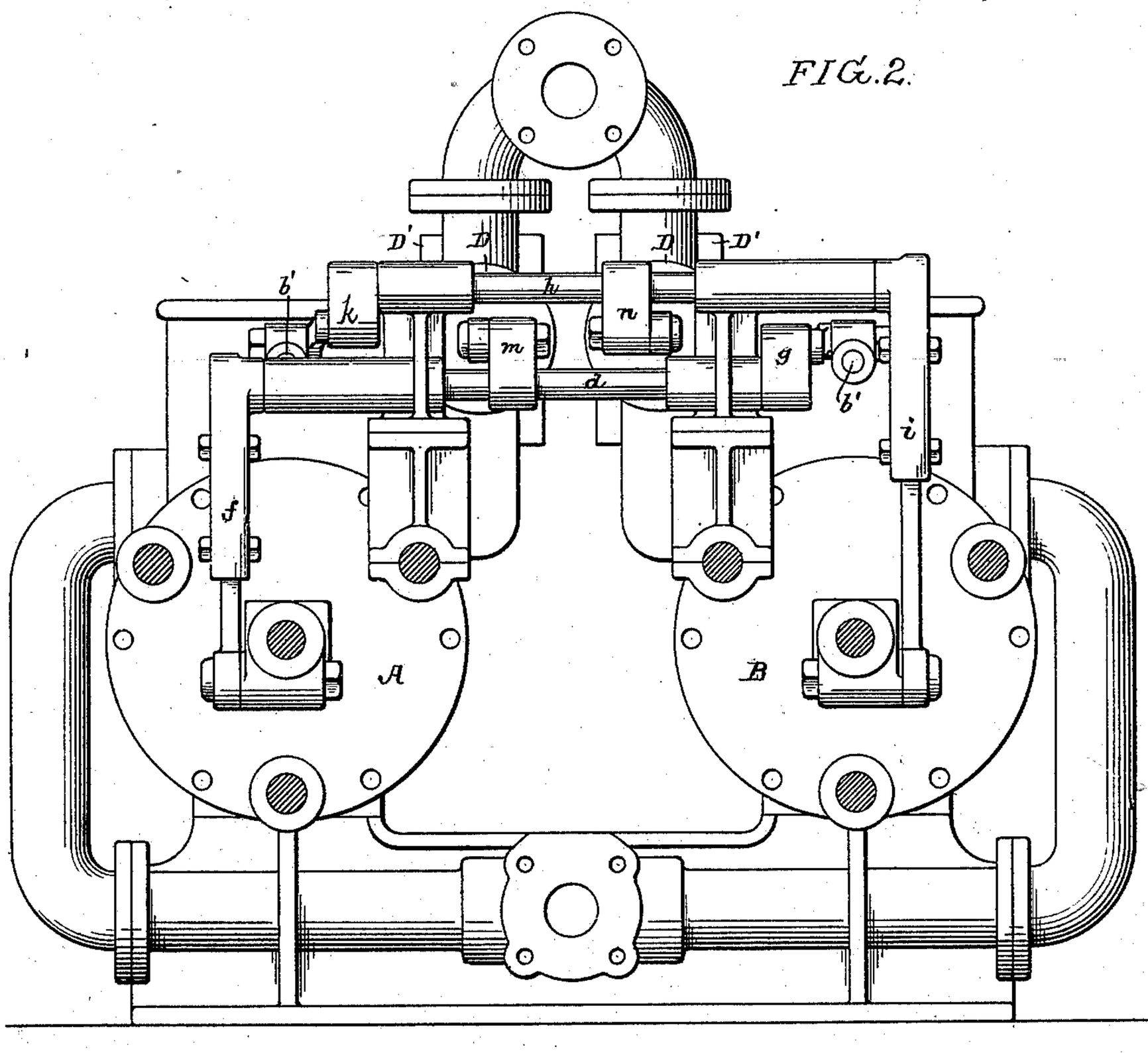


FIG. 7.

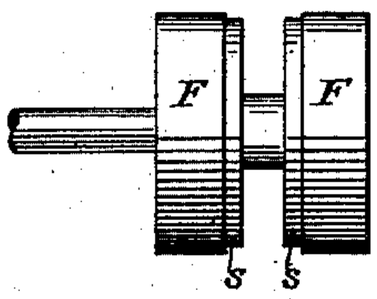
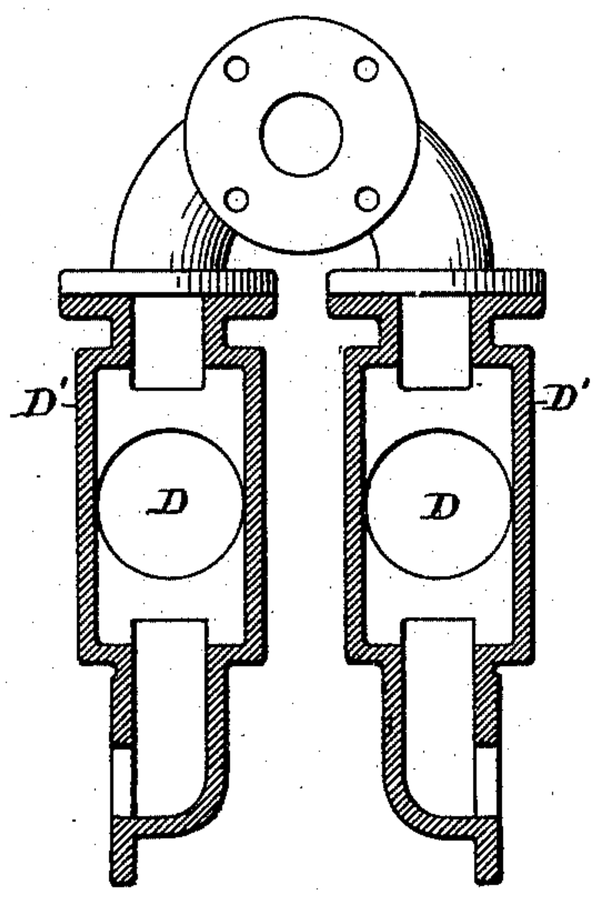


FIG. 3.



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WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES A. GOYNE, OF ASHLAND, PENNSYLVANIA, ASSIGNOR TO HIMSELF, FRANCIS H. GOYNE, THOMAS R. GOYNE, AND ARTHUR H. GOYNE, OF SAME PLACE.

DUPLEX STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 509,659, dated November 28, 1893.

Application filed January 3, 1893. Serial No. 457,048. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. GOYNE, a citizen of the United States, and a resident of Ashland, Schuylkill county, Pennsylvania, have invented certain Improvements in Duplex Steam-Pumps, of which the following is a specification.

My invention consists of certain improvements in duplex steam pumps in which the piston rod of one pump controls the steam valve of the other pump, the object of my invention being to overcome certain defects, hereinafter referred to, which have been found, in practice, to detract from the otherwise efficient operation of pumps of this class.

In the accompanying drawings:—Figure 1, is a side view, partly in section, of a pump of the class referred to, but having my attachment applied thereto. Fig. 2, is an enlarged transverse section of said pump, taken on the line 1—2, and looking in the direction of the arrow. Fig. 3, is a transverse section of the valve chest attachment constituting one of the features of my invention. Figs. 4, 5 and 6, are enlarged longitudinal sections of said valve chest and its valve showing the latter in different positions; and Fig. 7, is a side view of the valve.

A valve movement for duplex pumps of the character before referred to has merits which are universally recognized, and this movement has been largely adopted by pump builders generally, but while the movement is in many respects a very desirable one, practice has demonstrated that for certain work it is defective in some particulars, for instance, the slide valve is moved wide open and the piston attains its full speed almost from the beginning of the stroke, thus causing a sudden lift of the water valve, and the slide valve remains open until the piston reaches the end of its stroke, the stoppage of the piston being effected not by a gradual cutting off of steam, but by the piston passing the exhaust port and cushioning the steam ahead of the same. The sudden stop of the piston rod at each end of the stroke causes the valves of the pump to drop onto their seats with a sudden shock and this not only causes the valves to wear very rapidly, but, in connection with the sudden stopping of the piston, causes a jarring of every part of the pump and column pipe, thus causing joints to leak and blow out, besides causing a very objectionable thump in the working of the pump. Of course these imperfections are only developed when the pump is running at a considerable speed or is doing heavy duty, such as is required from mining pumps, but in these cases the imperfections are, in many cases, very seriously objectionable. I have therefore devised means whereby, in pumps of this class, the steam can be admitted to the valve chest of the steam cylinder gradually as the piston begins its stroke, the volume of steam increasing as the piston approaches the center of its stroke and being then gradually diminished until the end of the stroke, the result being that the piston begins its stroke slowly, attains its highest speed about mid-stroke, and ends the stroke slowly as it began. Hence the water valves are lifted and permitted to drop by a gradual and easy movement and the objections heretofore noted are effectually overcome.

In carrying out my invention I use, in connection with each steam cylinder, a cut off or throttle valve which is operated from the piston rod of said cylinder so that the flow of steam to each cylinder is regulated by the movement of its own piston and not by the movement of a slide valve under control of the piston rod of the other pump, said slide valve only serving as an admission valve to direct the steam to the proper end of the cylinder.

In the drawings, A and B represent respectively the two steam cylinders of a duplex pumping engine of the type referred to, the piston rod of each cylinder being connected to the plunger of its respective pump in the ordinary manner. The pump structures are similar to those of ordinary construction and hence require no specific description in this specification, as they form no part of my present invention. Each cylinder has a steam chest *a* with slide valve *b* controlling a set of five ports, namely, the central or exhaust port *w*, the eduction ports *x*, and the induction ports *y*, and as the valve is moved to uncover

the induction port at one end of the cylinder, it closes the eduction port at the said end of the cylinder, opens the eduction port at the opposite end of the cylinder, and closes the induction port at said end, so that after the piston passes the eduction port at the exhaust end of the cylinder it cushions the steam in advance of it, the valve, it should be understood, opening the induction port fully at each end of the stroke and allowing it to remain open until the completion of the stroke. This is due to the fact that the valve of each steam cylinder is operated positively by the moving piston rod of the other pump, the usual means for transmitting the movement being a rock shaft having one arm connected to the piston rod of one pump and another arm connected to the valve stem of the other pump. For instance, in Fig. 2, *d* represents a rock shaft mounted in suitable bearings on the cylinders and having at one end an arm *f*, pivoted at its lower end to a block on the piston rod of the cylinder A, and having at its opposite end an arm *g*, which is connected by suitable means to the stem *b'* of the slide valve *b* of the cylinder B, while another rock shaft *h* has at one end an arm *i* pivoted to a block on the piston rod of the cylinder B and at the other end an arm *k* connected to the stem *b'* of the valve *b* of the cylinder A. The arms *f* and *i* are each composed of sections one sliding in the other so that the arm can lengthen and shorten as required by the horizontal movement of the lower end of each arm, or said arms may be constructed in any of the ways usually adopted for attaining this result.

In connection with each cylinder, I use a supplementary steam chest or box D, each of these steam chests being connected to the main steam pipe, and one chest communicating with the steam space of the valve chest of one cylinder, and the other with the steam space of the valve chest of the other cylinder and in each of these chests D is a valve F which, as shown, is a hollow cylindrical valve with central annular port, although it may be differently constructed as will be evident from the following description of its purpose and method of operation.

The stem of the valve F which operates in connection with the cylinder A is connected to and operated by an arm *m* on the rock shaft *d* which receives motion from the piston rod of said cylinder A, and, in like manner, the stem of the valve F which operates in conjunction with the cylinder B is connected to and operated by an arm *n* on the rock shaft *h* which receives motion from the piston rod of said cylinder B.

Each chest D has a port corresponding with the central port of the valve F and, as this port is preferably narrower than the diameter of the steam pipe, the central portion of each chest is expanded laterally as shown at D' so that the steam pipe will communicate with this expanded portion of the chest. Hence the central port of the latter may be of a length equal to the full diameter of the cylindrical portion of the chest in which the valve moves, and the capacity of the port will equal that of the pipe which delivers the steam to or takes it from the chest.

When the piston of either cylinder is at either end of its stroke the valve F which controls the flow of steam to that cylinder occupies a position which greatly limits the flow of steam. For instance, it may occupy the position shown in Fig. 4, on reference to which it will be observed that the ports of the valve and chest are opened to but a slight extent, so that when the slide valve *b* of the cylinder is opened the first flow of steam into the cylinder will be in very limited volume and the piston will consequently start to move slowly. As soon as the piston commences to move, however, this movement is transmitted from the piston rod through the devices described to the valve F, and the latter commences to open so as to increase the volume of steam admitted to the cylinder, such movement continuing until the piston reaches about mid stroke when the valve is fully opened, as shown in Fig. 5. As the piston continues to move, the valve also continues to move and gradually cuts off the flow of steam to the cylinder, until, by the time the piston reaches the end of its stroke, the valve has assumed the position shown in Fig. 6 and the flow is almost entirely cut off, the speed of the piston gradually diminishing toward the end of the stroke owing to this gradual cutting off of the flow of steam so that both the beginning and end of the stroke are gradual, thereby attaining the advantageous results in the operation of the pump as hereinbefore set forth.

The valve F has in its outer face an annular recess *s* on each side of the central port so that in case of any increase in the travel of the piston which might otherwise tend to completely close the central port of the valve, said recesses will serve as a means of conveying steam to the said port and will thus prevent the complete cutting off of the steam from the valve chest and the stoppage of the pump which would follow. It is manifest that the same result might be attained by forming the recesses in the chest on each side of the port, instead of in the valve.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. In a duplex pump, the combination of two steam cylinders each provided at each end with an outer steam admission port and an inner steam eduction port, a slide valve for governing the communication between the steam chest and the admission ports and between the exhaust port and the eduction ports, mechanism whereby the valve of each cylinder is operated by the piston rod of the other cylinder, a throttle valve for each cylinder whereby the admission of steam to its chest is governed without being cut off, and

means whereby said throttle valve is operated from the piston rod of the cylinder to which it appertains, substantially as specified.

2. In a duplex pump, the combination of the two steam cylinders each provided with a slide valve operated by the piston rod of the other cylinder, with throttle valves each operated by the piston rod of the cylinder to which it appertains, and each having ports with recesses adjacent thereto, whereby complete cutting off of steam is prevented even when the ports are moved out of line, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHAS. A. GOYNE.

Witnesses:
WM. PEDLOW,
JAMES PERRY.