(No Model.) 2 Sheets—Sheet 1.

M. T. DAVIDSON.

VALVE FOR DIRECT ACTING ENGINES.

No. 497,442. Patented May 16, 1893.

Fig. 1.

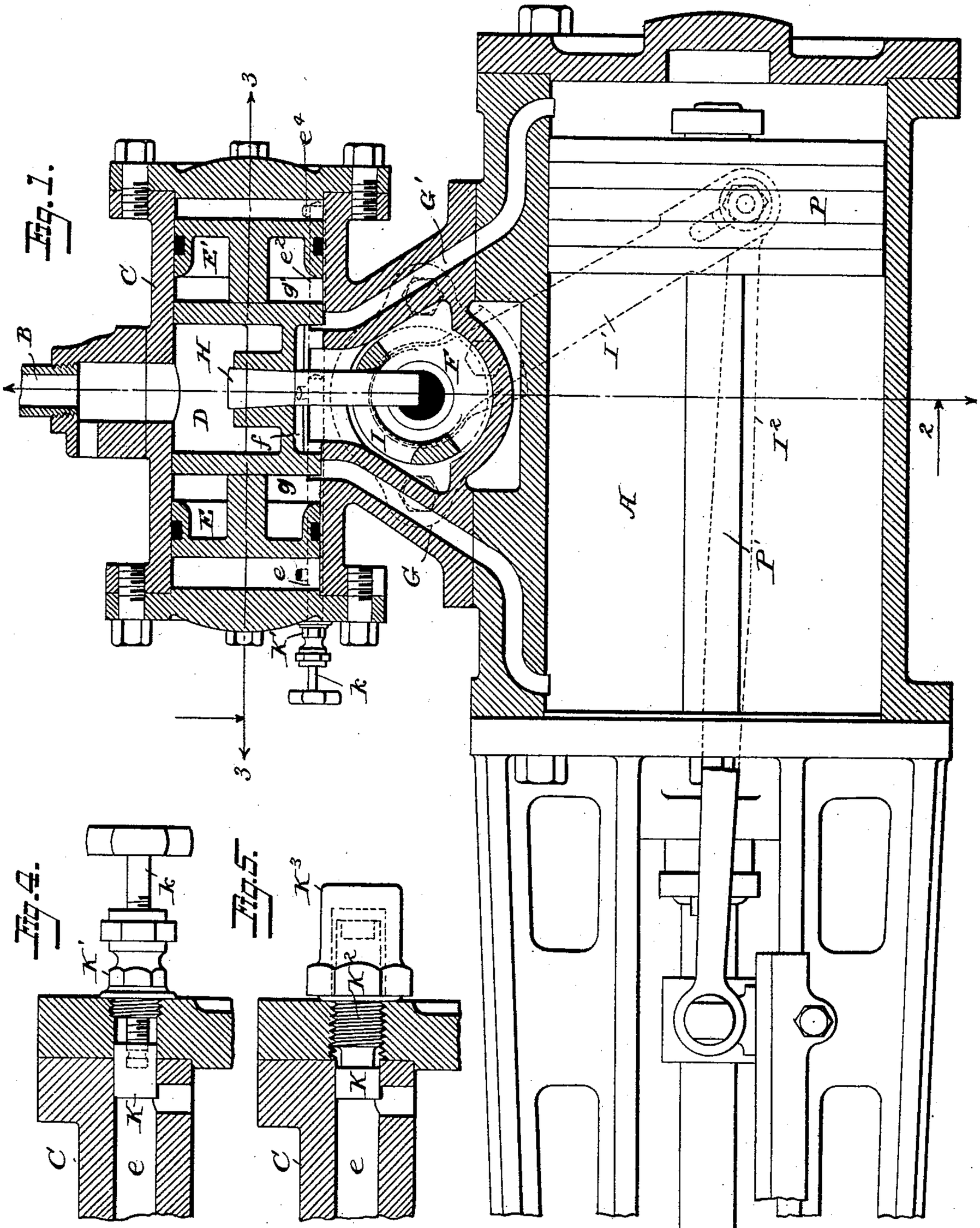

Fig. 4.

Fig. 5.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

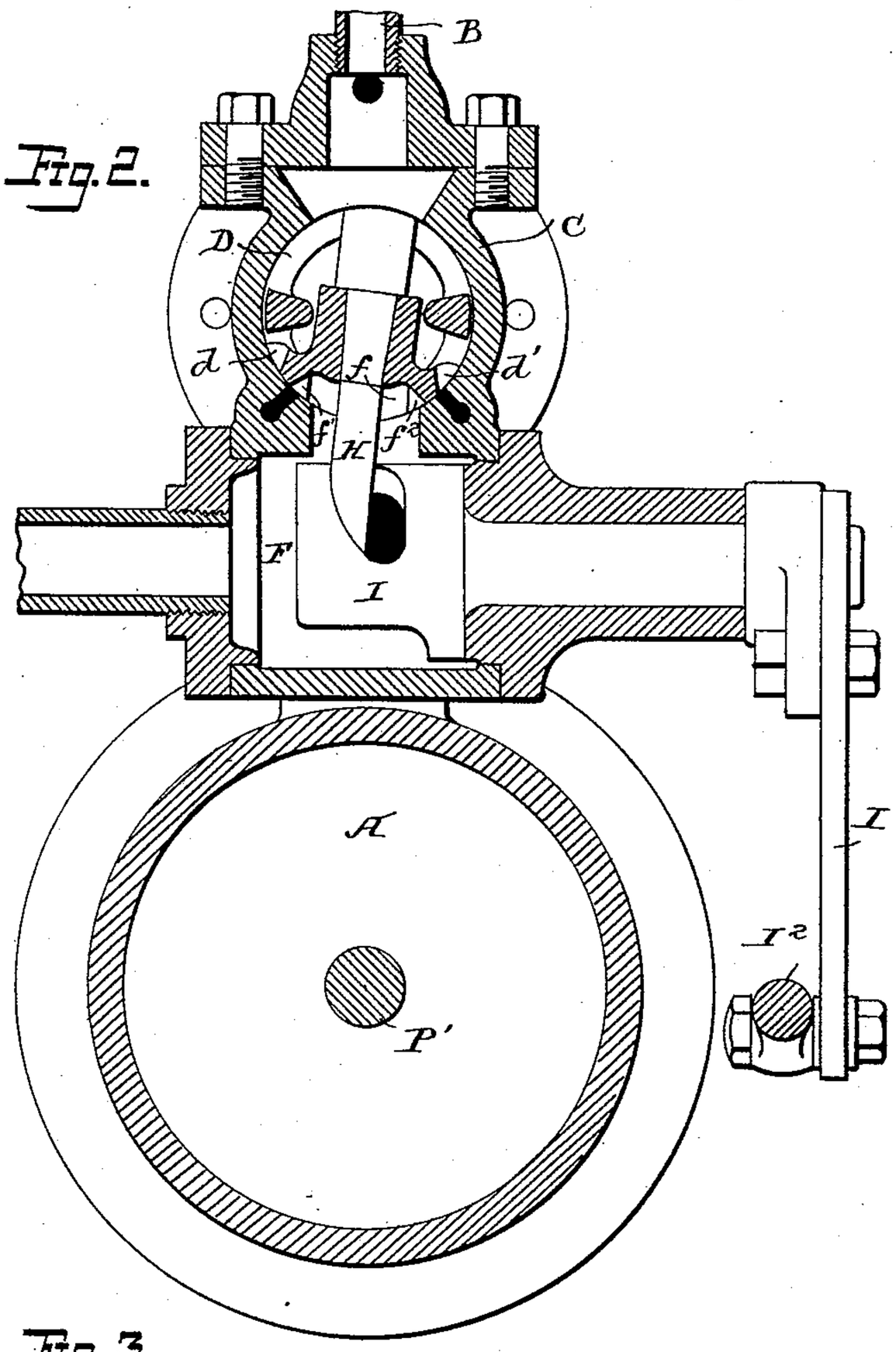
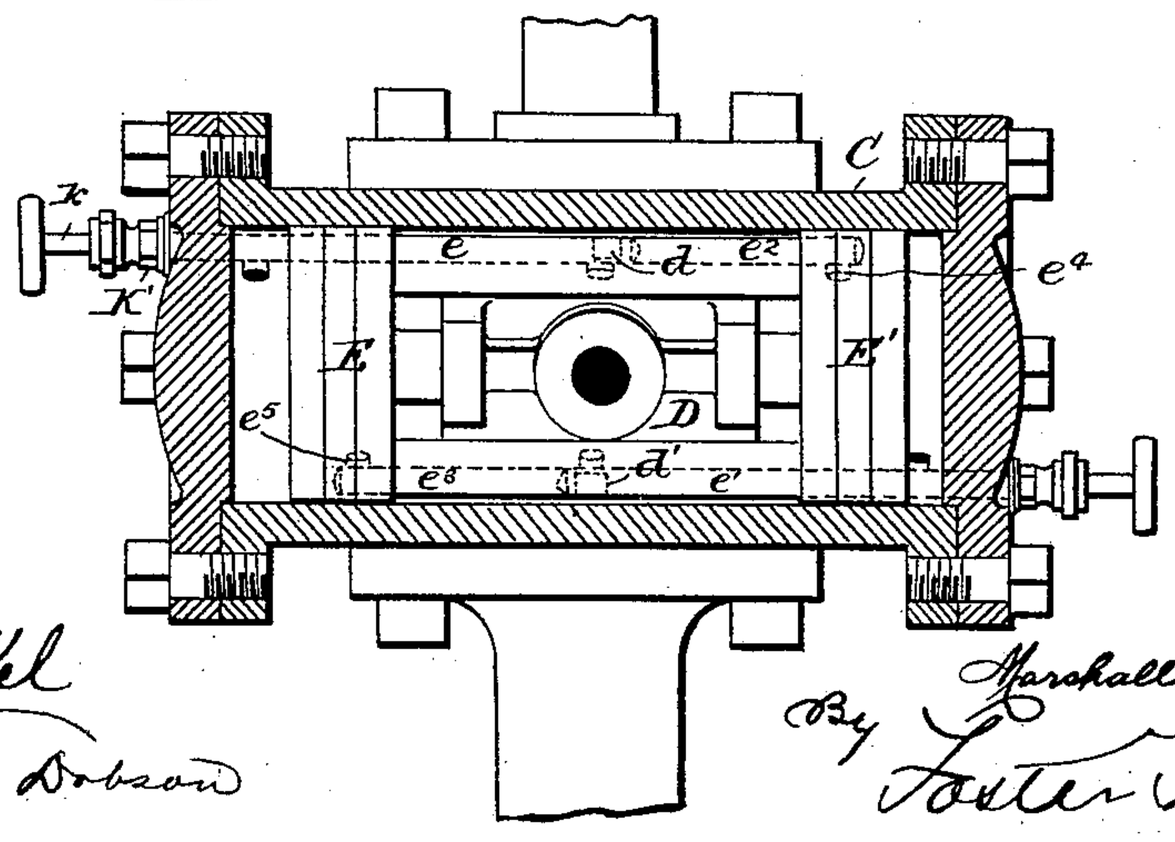


Fig. 3.



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UNITED STATES PATENT OFFICE.

MARSHALL T. DAVIDSON, OF BROOKLYN, NEW YORK.

VALVE FOR DIRECT-ACTING ENGINES.

SPECIFICATION forming part of Letters Patent No. 497,442, dated May 16, 1893.

Application filed October 11, 1892. Serial No. 448,486. (No model.)

To all whom it may concern:

Be it known that I, MARSHALL T. DAVIDSON, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Valves for Direct-Acting Steam-Engines, of which the following is a specification.

My invention relates to direct acting steam engines, adapted more especially for operating pumps, and it has for its object to provide means whereby the valves of such engines may be more readily controlled to operate under varying pressures of steam.

To these ends my invention consists in the various features of construction and arrangement substantially as hereinafter more particularly specified.

Referring to the accompanying drawings, Figure 1, is a longitudinal vertical section through the steam cylinder and valve mechanism connected thereto. Fig. 2, is a vertical transverse section on the lines 2—2, Fig. 1. Fig. 3, is a horizontal section through the valve mechanism on the lines 3—3, Fig. 1. Fig. 4, is an enlarged detail view showing a throttling device for the ports of the valve; and Fig. 5, is a similar view of a modified form of throttling device.

My invention relates to what is generally known in the trade as the Davidson direct acting steam engine, and in the accompanying drawings I have illustrated sufficient of this engine to enable those skilled in the art to understand its construction and operation, and have shown my present improvement as applied thereto.

The steam cylinder A, which is shown only partially, is provided with the piston P, the piston rod P′, which may be connected with the pumping apparatus not shown herein. Mounted on the steam cylinder is the steam chest C, receiving steam from the pipe B, and containing a valve D. This valve is shown as a D-shaped valve having pistons E, E′, which may be formed integral with the valve or connected thereto in any desired manner. The under side of the valve is recessed as at *f*, to form an exhaust port communicating with the main exhaust passage F, formed in the casing of the steam chest, and the spaces *g*, *g′*, between the ends of the valve and the pistons operate as ports to communicate with the main piston port G, G′, of the steam cylinder. The steam chest is also provided with valve piston ports *e*, *e′*, which extend longitudinally of the steam chest from a point about the center thereof to near the opposite ends, and these valve piston ports are arranged on opposite sides of the lower portion of the steam chest as seen in Figs. 2 and 3, and have openings communicating with the chest at each end. The arrangement of these ports is best indicated in dotted lines in Fig. 3, and it will be seen that the valve D, is provided with exhaust notches *f′*, *f²*, and steam notches or recesses *d*, *d′*, in its sides which can be brought in coincidence with the openings of the valve piston ports.

In the Davidson engine the valve D, is provided with a pin H, which extends into the exhaust port F, and also mounted in the exhaust port is a cam I, to which is connected the arm I′, and this in turn is connected by suitable mechanism, as a link I², to the piston rod, so that as the piston moves, the valve D, is mechanically oscillated to open and close the valve piston ports, and is partly thrown longitudinally so as to produce a closure of the main piston ports, and the further longitudinal movement of the valve in the steam chest is accomplished by the steam passing through the ports *e*, *e′*, and acting on the pistons. Thus it will be seen that the valve has first an oscillating movement produced mechanically, then a longitudinal or reciprocating movement also produced mechanically, and finally a further longitudinal movement produced by steam pressure. This operation will be readily understood by referring to Fig. 1, wherein the parts are shown with the main piston port G, as partially open to the passage of steam to the steam cylinder, while the port G′, is partially open to exhaust from the cylinder, and the piston is shown in the position near to the end of its stroke, and the cam I, oscillated the valve and moved it longitudinally, so as to nearly close the steam

passages, and, as the piston advances farther, these passages will be completely closed by the mechanical action of the cam. The oscillation of the valve has in the meantime opened the valve piston port *e'*, so that the steam will pass behind the valve piston E', and at the same time the valve piston port *e*, has been opened, so as to exhaust from the steam chest in front of the valve piston E, and it will be readily understood that under these conditions the valve will be thrown over to its fullest extent by the direct pressure of the steam, and the main piston port G', will be opened for steam, and the port G, to exhaust.

So far the construction is the usual construction of the Davidson pump, and it has been found that under proper conditions this construction is fully operative in a satisfactory manner. It happens, however, in practice that pumps so constructed are used under varying conditions of steam pressure, and while the pump will operate satisfactorily under a given pressure, if the same pump is subjected to a greatly increased pressure, the action of the steam on the valve pistons will move the valve too rapidly, causing a thumping or pounding of the valves of the engine and pump which is open to well known objections. In order to overcome these objections, and to provide a pumping engine which is adapted to be used under extreme varying pressures without the necessity of rearranging or changing the parts, is the main object of my present invention, and to accomplish this object I provide means whereby the valve piston ports may be throttled, so that the passage of steam to the ends of the steam chest and its action upon the valve pistons can be quickly and readily regulated and adjusted to meet the requirements of any particular case. I accomplish this by providing a throttling plug K, which is arranged in the present instance in the end of the steam chest C, and is provided with a screw stem *k*, passing through the bearing K', and extending into the valve piston port *e*, or *e'*, and controlling the passage of the steam into the steam chest behind the pistons. Thus it will be seen, that, if the engine is operating under too high pressure of steam, which would produce pounding or too rapid movement of the valve, by properly adjusting the plug K, the passage of the steam into the chest behind the piston can be regulated by the plug, so that the valve will be moved in the proper and desired manner by the steam pressure on the piston thereof.

In Fig. 5, I have shown another arrangement of the plug K, in which the plug is fitted on the end of the screw K^2, turning in bearings in the head of the steam chest, and a cap K^3, is shown which fits over the screw to protect it after being properly adjusted.

I have further found that when the valve is operated by the cam, owing to the steam remaining in the steam chest at the end of the valve piston where it has just exerted its pressure to complete the movement of the valve, considerable force is required to move the valve in the opposite direction against this steam, it acting somewhat as a cushion not having time to condense, and consequently opposes the return movement of the valve. More than this, as the valve progresses in its movement under the action of the cam before the exhaust port is opened behind it, the resistance increases owing to the increased compression of the steam, by the space it occupies being reduced, and as a consequence there is more or less wear upon the cam, and wasting of steam power to produce the first movement of the cam by mechanical means, and it is the further object of my invention to overcome and obviate this objection. In order to accomplish this result I provide the steam chest with a valve piston exhaust, and arrange it to be controlled by the valve piston, so that at or about the moment the valve piston reaches the end of its reciprocation in either direction it shall open the exhaust in the rear of the piston, and allow the steam to escape and prevent its acting as a cushion, or exerting back pressure against the movements of the valve. This is readily accomplished in the construction shown by extending the valve piston ports *e*, *e'*, as shown at e^2, e^3, respectively, and having the corresponding openings e^4, e^5, into the steam chest arranged so that as soon as the valve piston is completely thrown, the port will be opened to exhaust, and this is clearly indicated in Fig. 3, of the drawings and need not be particularly described, as those skilled in the art will readily understand its operation in connection with the above description. It will thus be seen that I avoid moving the valve against the pressure of the steam in the end of the steam chest which has been used to move the valve in the opposite direction, and thereby the friction of the parts and resistance to be overcome by the cam are greatly reduced, enabling the valve to operate freely and quickly.

What I claim is—

1. In a direct acting engine, the combination with a valve having an oscillating and longitudinal movement by mechanical means, and a further longitudinal movement by steam pressure, of means for throttling the steam producing said longitudinal movement, substantially as described.

2. In a direct acting engine, the combination with a steam chest having steam ports extending from the center to the ends of the chest and being further provided with exhaust ports extending from the center of the chest to the rear of the valve; of a valve arranged to be oscillated and moved mechanically a portion of its distance and to open

the steam ports to allow it to be moved a farther distance, and to further open the exhaust ports when the valve has moved to the end of its reciprocation; substantially as described.

3. In a pumping engine, the combination with a steam chest having steam ports *e*, *e'* and exhaust ports e^2 e^3 extending from the steam ports; of a valve having pistons mounted in the chest and arranged to control the steam and exhaust ports; substantially as described.

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

MARSHALL T. DAVIDSON.

Witnesses:
WALTER E. CLARKE,
WM. A. DREWETT.