(No Model.) 2 Sheets—Sheet 1.

M. T. DAVIDSON.

DUPLEX VALVE FOR PUMPING ENGINES.

No. 431,180. Patented July 1, 1890.

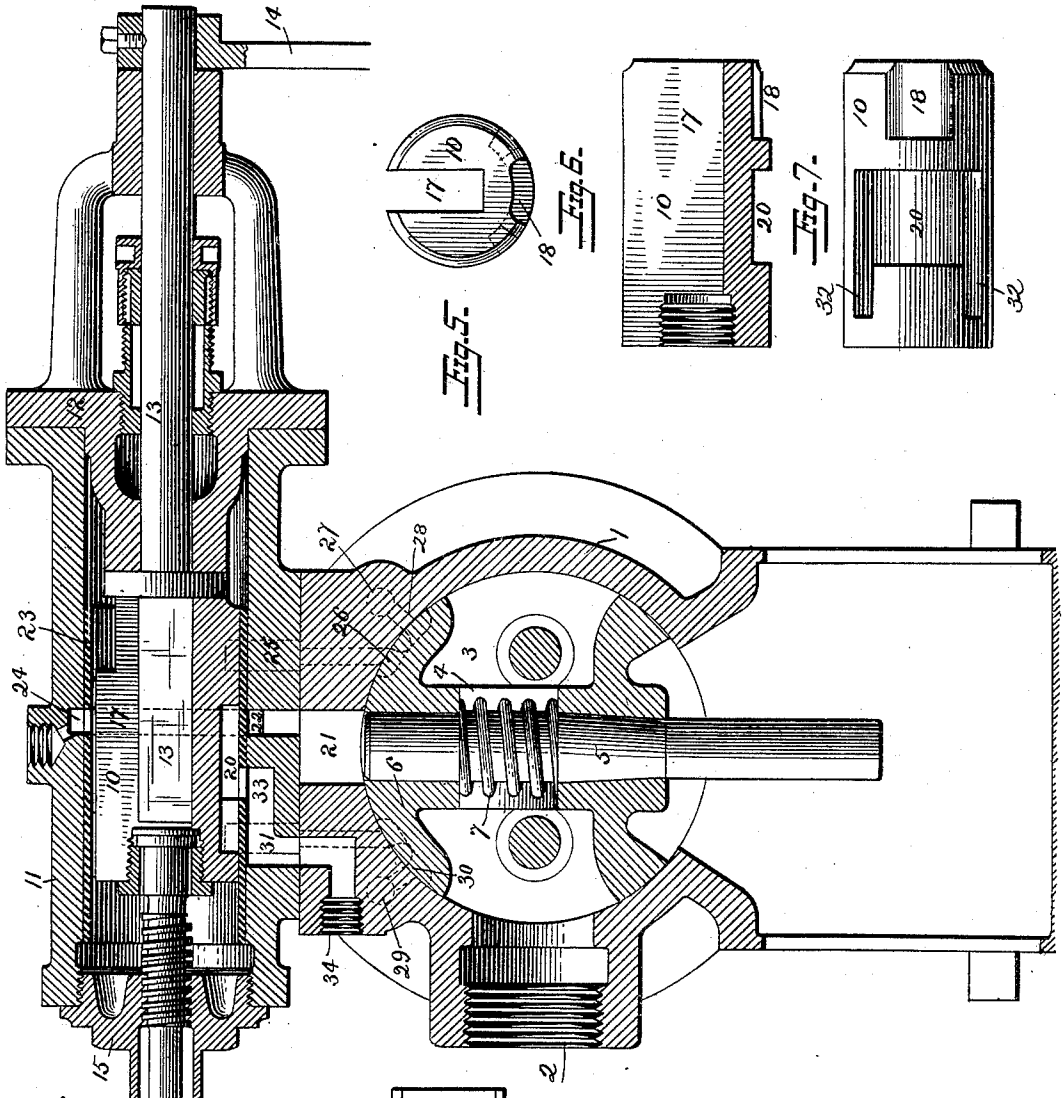

Fig. 1.

Fig. 5.

Fig. 6.

Fig. 7.

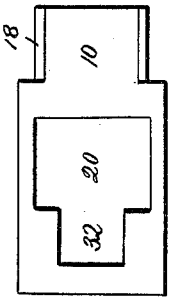

Fig. 4.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

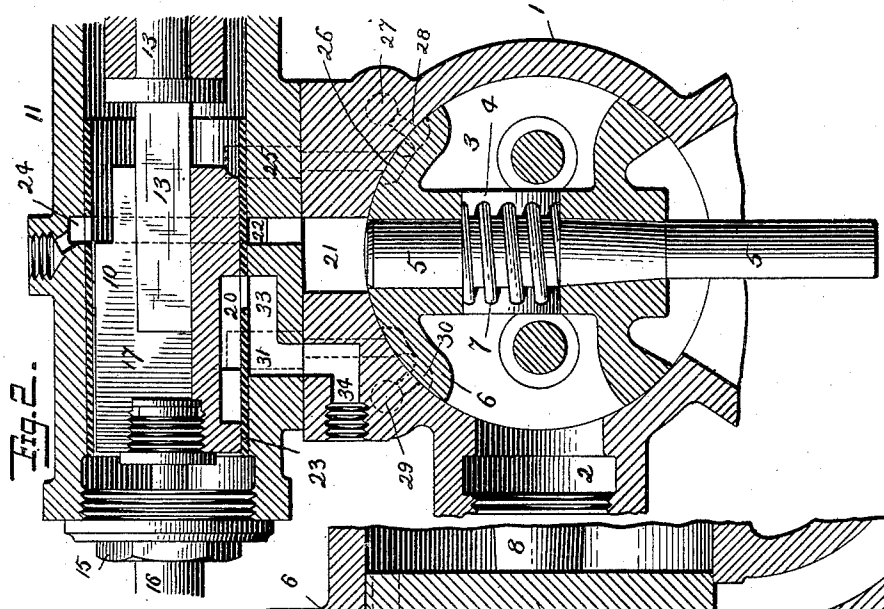
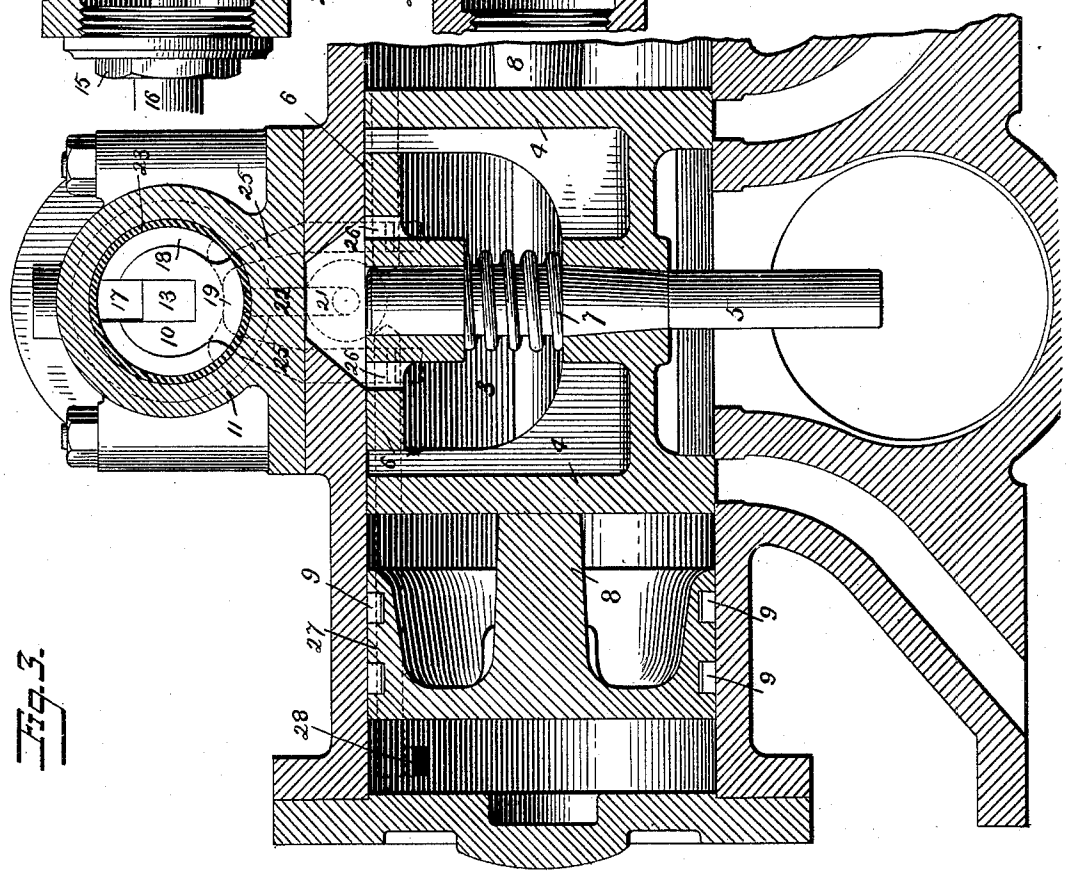


Fig. 3.



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UNITED STATES PATENT OFFICE.

MARSHALL T. DAVIDSON, OF BROOKLYN, NEW YORK.

DUPLEX VALVE FOR PUMPING-ENGINES.

SPECIFICATION forming part of Letters Patent No. 431,180, dated July 1, 1890.

Application filed September 17, 1889. Serial No. 324,182. (No model.)

To all whom it may concern:

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

My invention relates to that class of direct-acting duplex pumping-engines which can be instantly converted into two independent pumping-engines without requiring any change in the mechanical constructions of the valve-gears; and it relates more especially to that class of pumping-engines which are constructed substantially as shown and described in Patent No. 293,243, granted to R. W. Hamilton February 12, 1884.

My improvement consists mainly in providing each engine with a supplemental valve operated by the other engine for governing the supply of live steam to the induction-valve of the main-valve pistons of its own engine and the discharge of the exhaust-steam from the same, said supplemental valve being so constructed and arranged that it will give at the will of the operator either a continuous supply to both steam-cavities of the induction-valve and a continuous discharge from the exhaust-ports of the valve, or an intermittent supply and exhaust alternately to one induction-cavity and exhaust-port and to the other induction-cavity and the exhaust-port thereof.

My invention further consists of certain details of construction and arrangement of parts, which will be pointed out more particularly hereinafter.

In order that my invention may be clearly understood, I have illustrated in the annexed drawings so much of a direct-acting duplex pumping-engine as is necessary for a clear understanding of my invention, it being understood that the valve device shown is in the present instance intended to be applied to what are known as "Davidson's pumping-engines," which are provided with valves and connections substantially as shown in the patent to Hamilton above referred to.

In the said drawings, Figure 1 is a vertical section through the main valve and the supplemental valve mounted thereon. Fig. 2 is a similar view showing the supplemental valve in a different position. Fig. 3 is a similar vertical section at right angles to the first. Fig. 4 is a plan view of the supplemental valve shown in section in Fig. 1 and in end view in Fig. 2; and Figs. 5, 6, and 7 are respectively end, sectional, and plan views of a positive valve, which may be used in place of the negative valve shown in the supplemental valve-chamber.

In the pumping-engines shown in the patent to Hamilton, before referred to, the supplemental valve is arranged to control only the admission of steam to the steam cavities or ports of the main valve, the exhaust-steam being in no wise controlled by the supplemental valve. I have found in practice that under certain circumstances—as, for instance, when the packing of the pistons of the main valve becomes worn—some steam is liable to leak past the pistons into the ends of the valve-chest, one end of the chest being closed and the other open to the exhaust. The balance of the valve is destroyed, and the main valve is thus liable to move before the suplemental valves open the ports to control the steam. This is particularly disadvantageous when the pumps are acting as duplex pumping-engines and the supplemental valve of one engine is controlled by the movement of the piston of the other engine, as it is evident that the exact time of operation of the pumps is liable to be disarranged. I overcome this difficulty by providing a supplemental valve that will control both the supply of live steam and the exhaust-steam to and from the main valve.

In the drawings, 1 is the steam-chest, and 2 is the inlet admitting steam to the chest. The main valve 3 is shown in the present instance as a slide-valve, consisting of two plates 4, connected together and provided with a stem or pin 5, which is adapted to be connected to some operating part of the engine to be controlled thereby, and mounted upon the upper end of the stem or pin 5 is a plate 6, which is held in place by a spring 7, surrounding the pin and pressing the two portions of the valve closely to their seats. To each plate 4 of the valve is attached a piston 8, each provided with proper packing 9, and serving to complete the movement of the main

valve in a manner well understood in this class of valves.

Mounted upon the valve-chest 1 is the valve-chest 11 of the supplemental valve 10, and passing through and connected to the head 12 of the chest is a stem or rod 13, provided with a lever or connection 14, by which the valve 10 is operated by the other engine of the pair in a manner substantially as shown in the patent to Hamilton. Passing through the other head 15 of the valve-chest is a hand-screw 16, which is connected to the valve 10 and by which it may be moved longitudinally in the chest, so as to bring the ports of the valve in operative connection with the ports of the chest or to bring them in such a position that the ports shall always remain open, as before described—that is to say, when the engines are operating singly or independent of each other the valve 10 is moved so that the induction and eduction ports are always open, notwithstanding the fact that it may be oscillated by the adjacent engine; but when the two engines are operating as duplex engines the valve 10 is moved, so that both the induction and eduction ports are controlled by the oscillating movement imparted to the valve by the complementary engine. The valve 10 may be either what is known as a "positive" or as a "negative" valve, the negative form of the valve being shown in Figs. 1, 2, 3, and 4, and the positive form in Figs. 5, 6, and 7.

The valve 10 is shown as having a recess or slot 17 in the top portion thereof, and one end is cut away at 18 to allow a free passage of the steam through the channel and around the end, except where the extension 19 acts as the cut-off proper of the valve controlling the admission of steam to the opposite side of the main valve. A recess 20, substantially of the form shown in Figs. 4 and 7, as the case may be, serves to control the passage of the exhaust-steam from the exhaust-ports of the main valve. The steam is admitted to the supplemental chest through the main-valve chest—the port 21—and goes through a passage 22, formed in the chest and protected by a cylinder 23 between the valve and chest, so that the steam enters the recess 17 of the valve from an opening 24 in the cylinder, and thence passes to both ends of the valve 10, and when either one of the ports 25 is opened by the valve-face 19 being oscillated one way or the other the steam passes from the cavity 26 in the main valve to the passage 27, extending to one end or the other of the valve-chest, so that the steam will enter the chest at a point 28 between the head and piston and move the main valve as required.

The exhaust-steam from the main valve passes from the end of the chest through a port corresponding to the port 28, opening into a passage 29, thence through the cavity 30 to the port 31, which, when the exhaust is open, corresponds to the portion 32 of the opening or recess 20 in the valve 10, whence it passes through the port 33 to the exhaust-pipe or discharge 34. It will of course be understood that there is an induction and eduction passage connected to the ports in each end of the main-valve chest, and one or the other is opened or closed as the valve 6 is oscillated.

In Fig. 2 I have shown the supplemental valve as being moved by the hand-wheel or otherwise, so that although it may be operated by the adjacent engine it will not in any way affect the admission or emission of steam to the main valve, as the ports are always open. In this way the two engines may be operated as independent engines, the main valve alone controlling the passage of steam. When, however, it is desired to have the engines operate as duplex engines, it is only necessary to again move the valve 10 to the position shown in Fig. 1, when the ports both controlling the admission and emission of steam to the main-valve pistons will be controlled by the supplemental valve. It will be seen that in both positions of the supplemental valve the cylinder or lining 23 remains in the same position relative to the ports in the valve-chest, and the steam is delivered above the valve as before.

Heretofore it has been common in duplex engines to make the supplemental valves of each engine precisely alike, and this being so it was necessary to arrange the mechanical connections between the valves and the operating portion of the other engine reversely to each other. To avoid this arrangement, I prefer to construct the supplemental valves of the two engines differently, or, in other words, to make one a positive valve and the other a negative valve, so that they can both be operated by the same direct movement from the adjacent engine. This construction is clearly indicated in the drawings, which show the arrangement of parts, so that while both valves oscillate in the same direction they will open opposite ports leading to opposite ends of the main valves, so that they will be moved in a direction opposite to each other to cause the engines to operate in accordance therewith.

It is not absolutely necessary to provide each engine with a supplemental valve for governing the supply of steam to the induction-valve of its chest-cylinder, since where only one of the engines is provided with such a valve the two engines may still be worked either duplex or independently; but I prefer the described use of a supplemental valve for each engine for various reasons, among which I may cite that the engines are then both under positive control when working duplex, and that the capability of the engines of working duplex is still preserved in case one of the supplemental valves or its gear gets out of repair.

From the above it will be seen that while I do not claim to be the first to use, in connection with a pair of direct-acting engines, sup-

plemental valves for governing the induction of steam to one of the engines, I do believe myself to be the first to automatically control the induction and eduction of the steam in a valve arrangement of this character; and I therefore do not confine myself to the exact details of construction and arrangement herein set forth, as it is evident that this may be varied by those skilled in the art without departing from the spirit of my invention.

Having thus described my invention, what I claim is—

1. In a duplex engine, the combination, with the main valve of one engine, of a single supplemental valve for governing the supply of steam to the induction-port and the exhaust-steam from the eduction-port, and the valve-piston of the main chest-cylinder, said supplemental valve being controlled by the other engine, substantially as described.

2. In a duplex engine, the combination, with the main valve of one engine, of a supplemental valve for governing the supply and exhaust steam to the chest-cylinder in accordance with the movements of the other engine, the said valve being shiftable, so that the induction and eduction ports will be opened and closed alternately or will be open continuously, substantially as described.

3. The combination, with the valve-chest, of the valve moving therein and the cylinder arranged between the valve and chest, substantially as described.

4. The combination, with the valve-chest having induction and eduction ports, of a valve having a channel in its upper part and induction and eduction ports on its lower part, and a cylinder interposed between the valve and chest and arranged to deliver the steam to the channel in the valve, substantially as described.

5. In a duplex pumping-engine, the combination, with the valve-chamber, of a valve having one end cut away to form a passage for the live steam, a channel in the upper portion of the valve communicating with the steam-passage, and a recess in its lower portion for the passage of the live steam, substantially as described.

6. The combination, with the steam-chest, of a supplementary valve having induction and eduction ports for the live and exhaust steam, of a shiftable valve having one end cut away for the passage of the live steam and having a recess in its under side for the exhaust-steam, the arrangement being such that the ports may be continuously open or alternately opened and closed, according to the position of the valve, substantially as described.

7. The combination, with a main valve-chest, having ports in its upper portion for the live and exhaust steam, of a supplementary valve-chest having corresponding ports, and a shiftable valve in the supplementary valve-chest, arranged to maintain all the ports open in one position and to alternately open and close the live and exhaust steam ports in another position, substantially as described.

8. The combination, with the steam-chest having passages and ports in the upper portions thereof for the live and exhaust steam, of a valve having cavities in its upper portion corresponding to the said passages and ports, substantially as described.

9. In a duplex engine, the combination, with each main valve, of a supplemental valve arranged to be operated by the other engine, the said supplementary valves being positive and negative with respect to each other, 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:

CHARLES T. VARNEY,

D. F. MORGAN.