No. 847,092. PATENTED MAR. 12, 1907.

E. A. MENKING.

STEAM ACTUATED VALVE.

APPLICATION FILED JULY 25, 1906.

4 SHEETS—SHEET 1.

Fig. 1

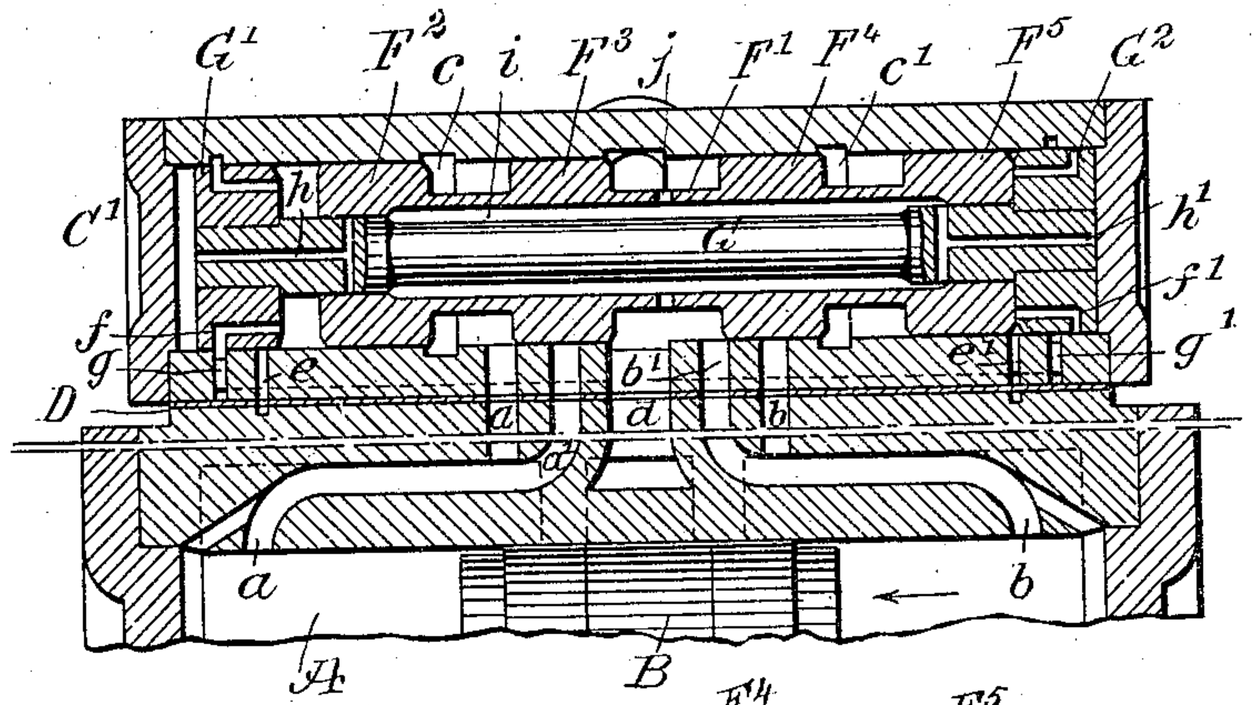


Fig. 2

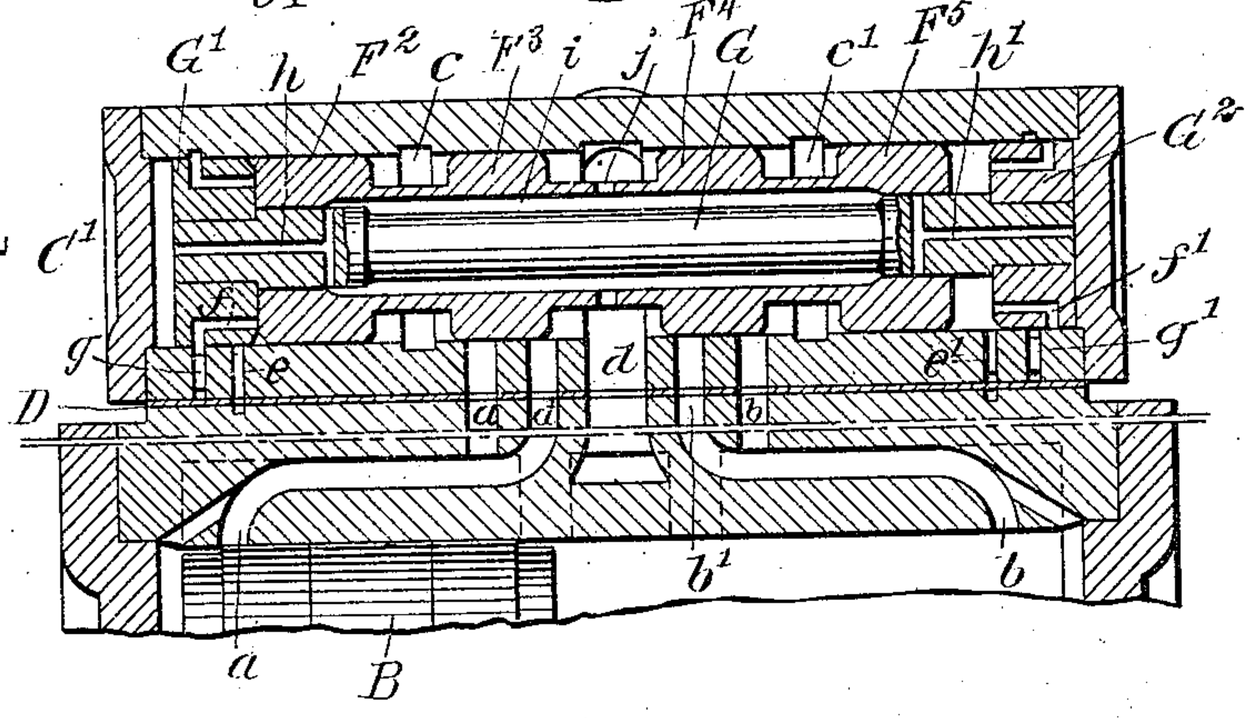
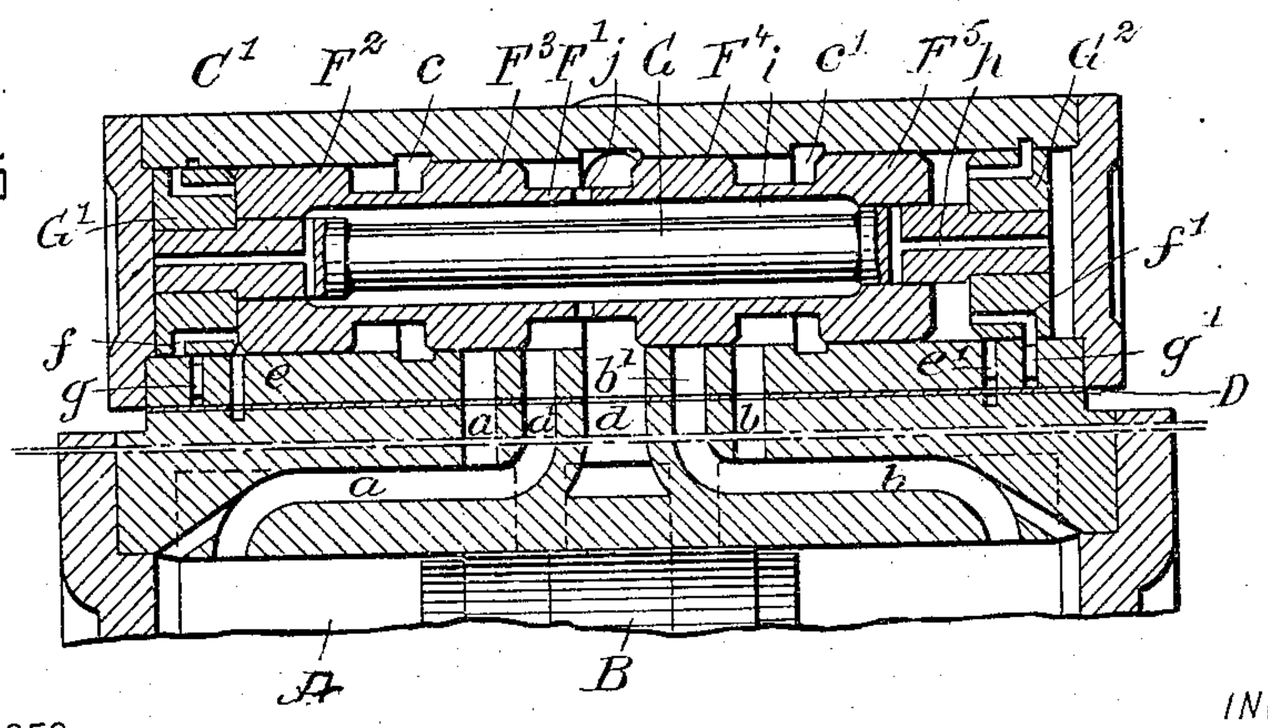


Fig. 3



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4 SHEETS—SHEET 2.

Fig. 4

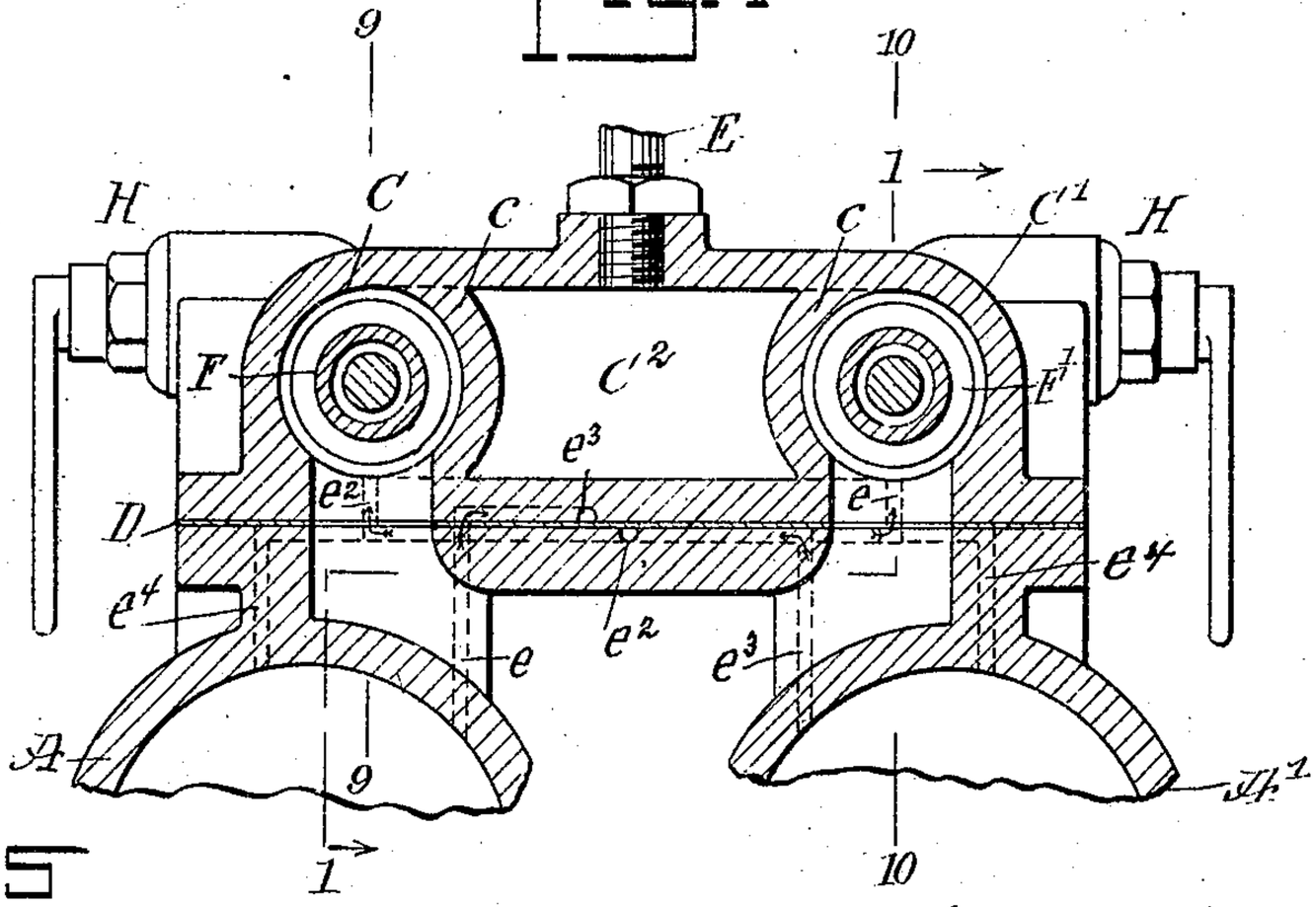


Fig. 5

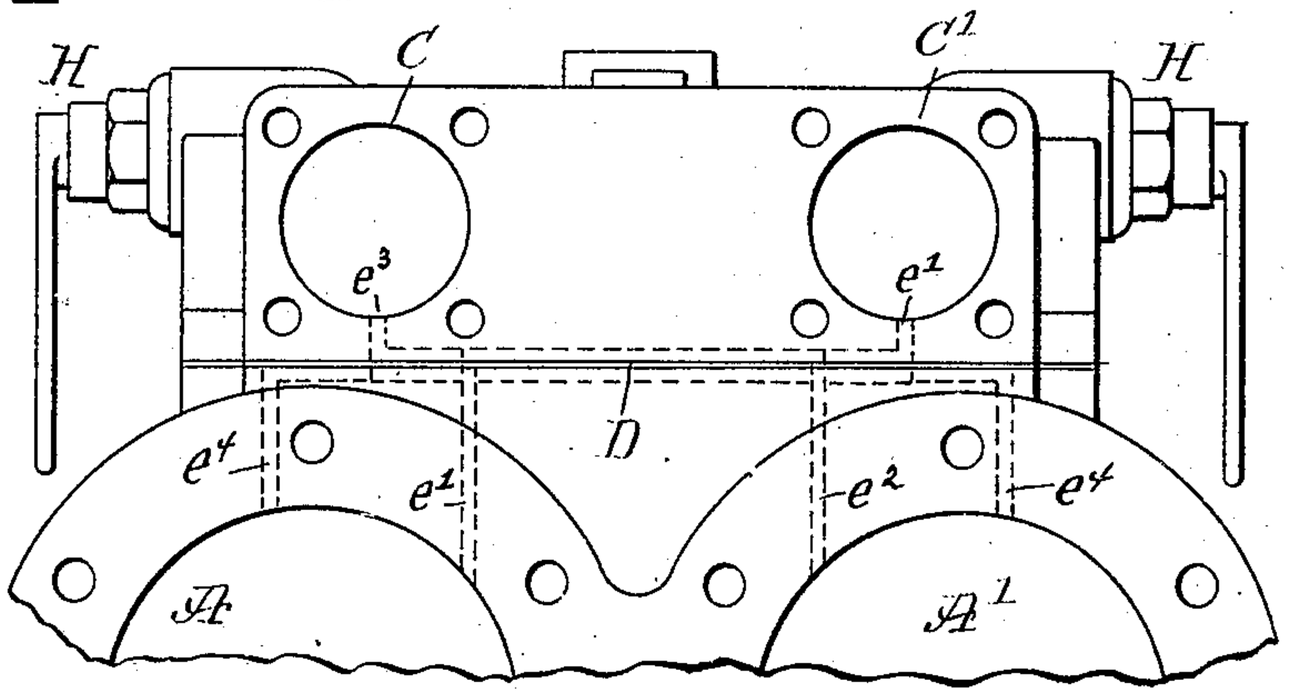
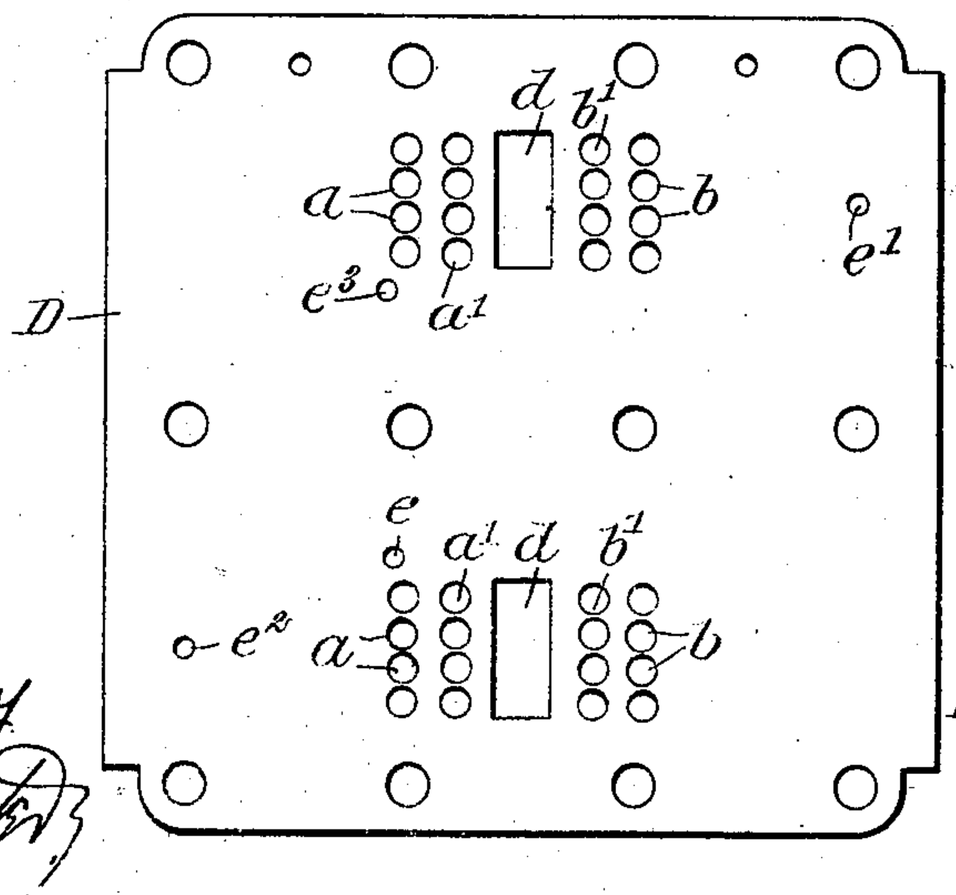


Fig. 6



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4 SHEETS—SHEET 3.

Fig. 7

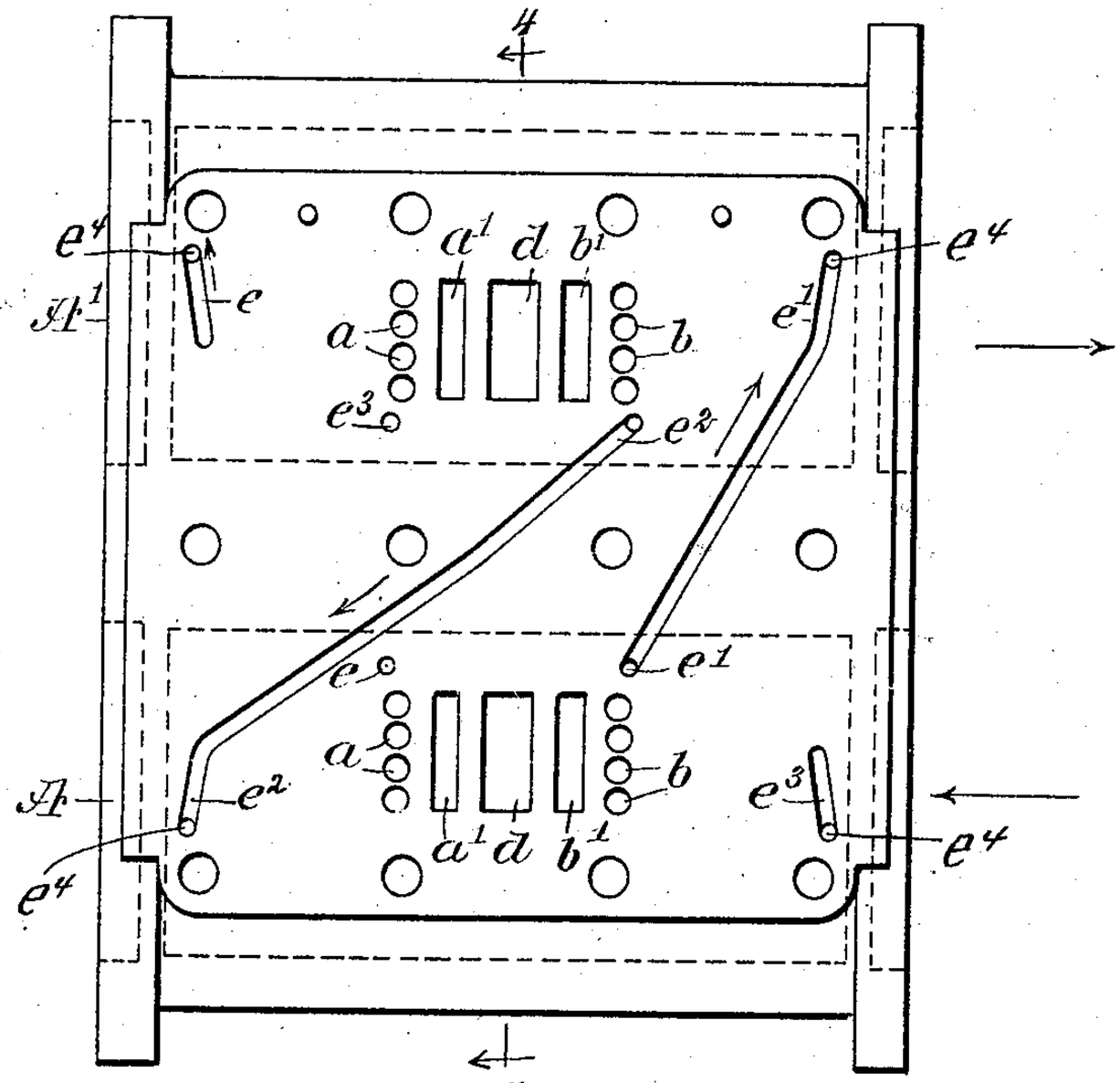
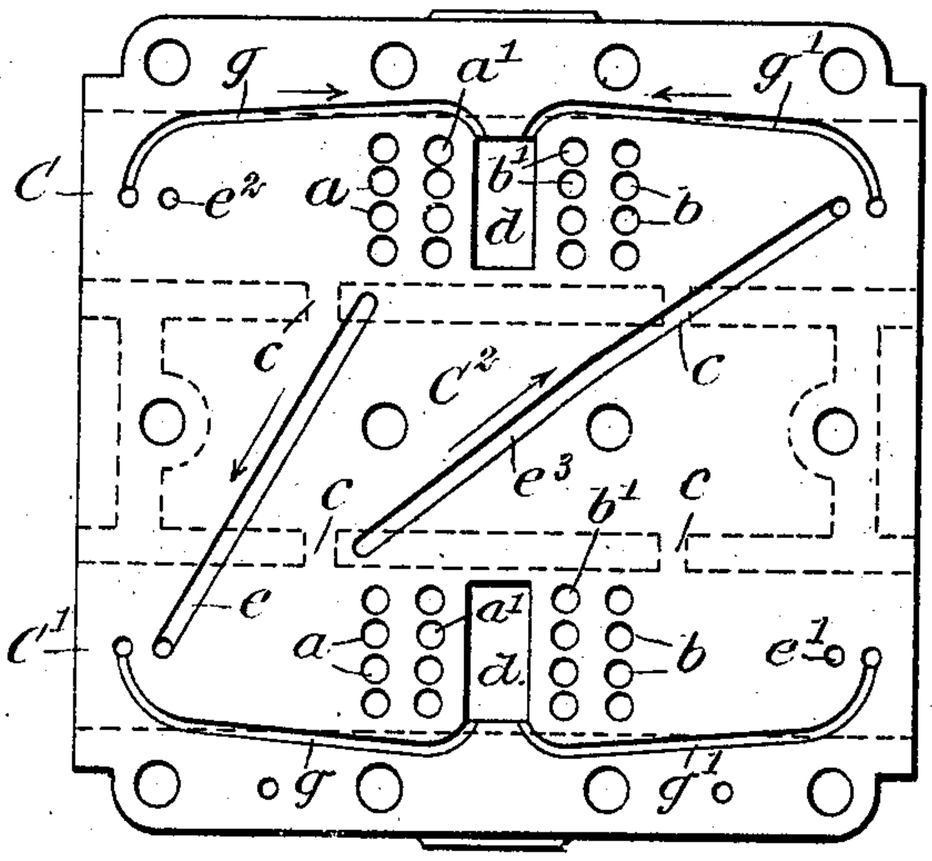


Fig. 8



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4 SHEETS—SHEET 4.

Fig. 9

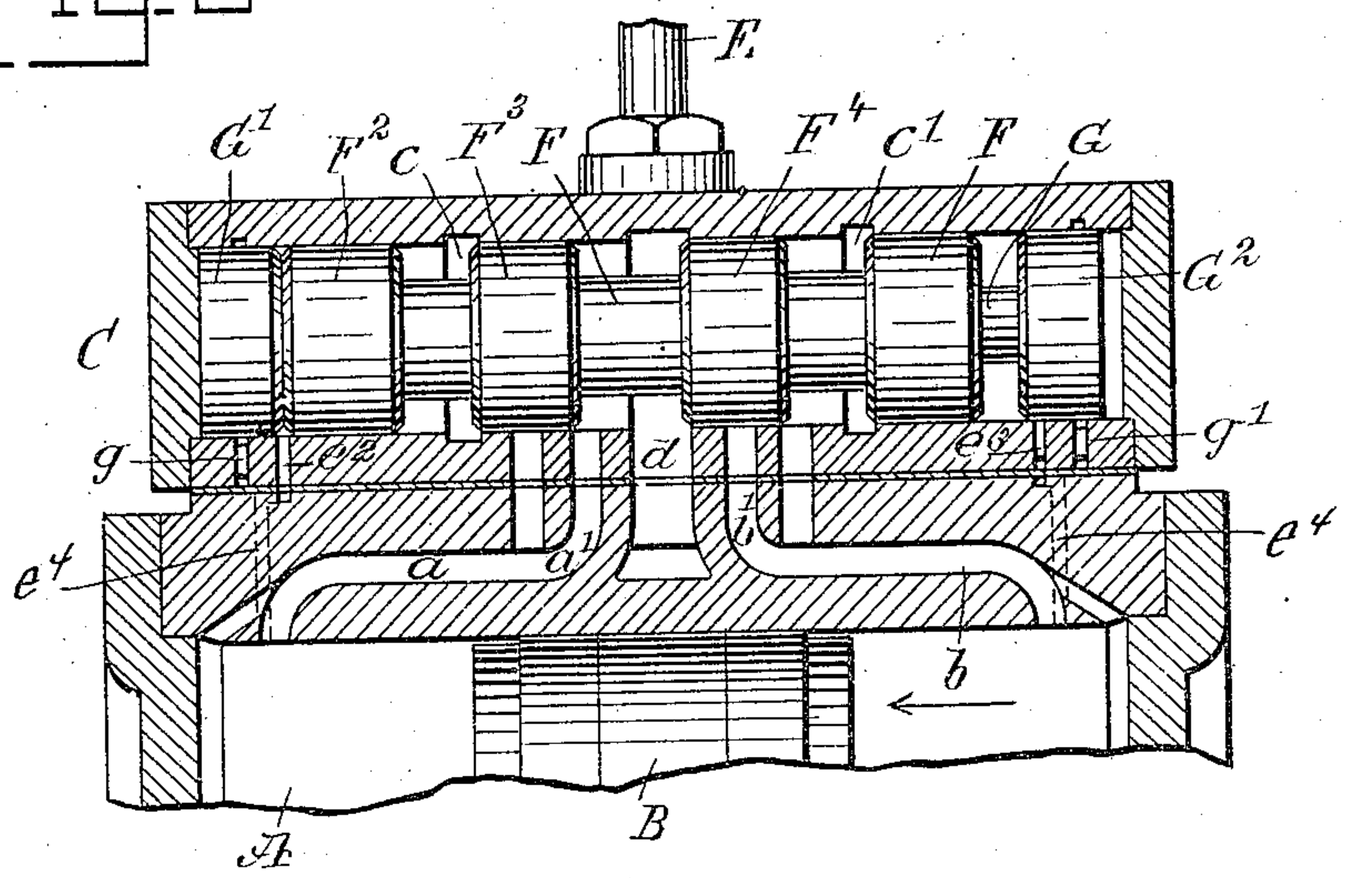
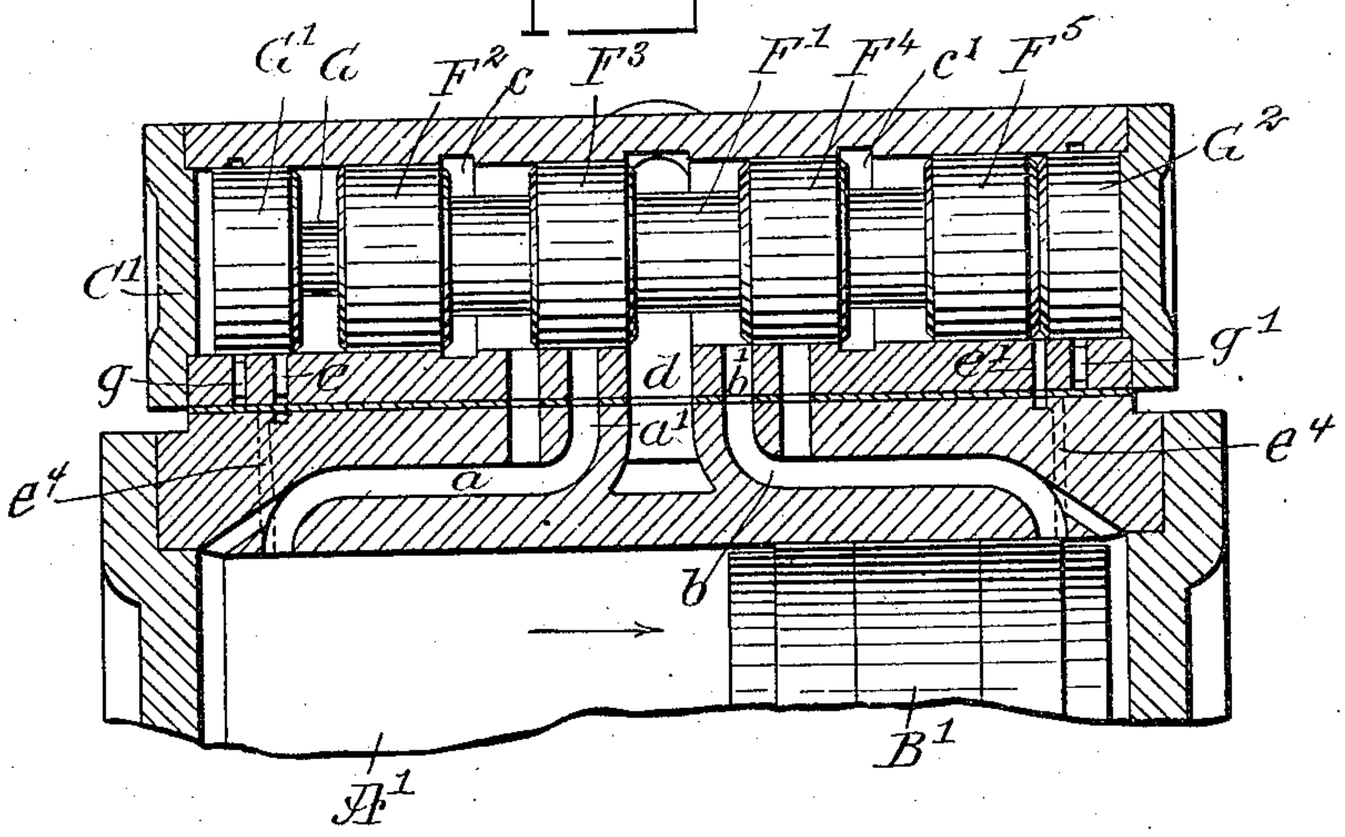


Fig. 10



WITNESSES

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UNITED STATES PATENT OFFICE.

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STEAM-ACTUATED VALVE.

No. 847,092. Specification of Letters Patent. Patented March 12, 1907.

Application filed July 25, 1906. Serial No. 327,656.

To all whom it may concern:

Be it known that I, ERNEST A. MENKING, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and Improved Steam-Actuated Valve, of which the following is a full, clear, and exact description.

The invention relates to steam-actuated valves, such as shown and described in Letters Patent of the United States No. 500,407, granted to me on June 27, 1893.

The object of the invention is to provide a new and improved steam-actuated valve, more especially designed for steam-pumps and like machines and arranged to insure an easy and automatic shifting of the valve for controlling the admission and exhaust of steam to and from the cylinder.

The invention consists of novel features and parts and combination of the same, which will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional side elevation of the improvement as applied to a duplex steam-pump, the section being on the line 1 1 of Fig. 4. Figs. 2 and 3 are like views of the same, showing the parts in different positions. Fig. 4 is a transverse section of the same. Fig. 5 is an end view of the same, parts being omitted. Fig. 6 is a plan view of the gasket interposed between the cylinder-top and the steam-chest bottom. Fig. 7 is a plan view of the cylinder. Fig. 8 is an inverted plan view of the steam-chest. Fig. 9 is a sectional side elevation on the line 9 9 of Fig. 4, and Fig. 10 is a similar view of the same on the line 10 10 of Fig. 4.

In the steam-cylinders A and A′ of a duplex steam-pump reciprocate the pistons B B′ in half-stroke position relative one to the other—that is, when the piston B is at the half-stroke position, going from the right to the left, (see Fig. 9,) then the other piston B′ has completed its stroke in the opposite direction, as illustrated in Fig. 10.

On the steam-cylinders A and A′ are secured the steam-chests C C′, with a gasket D, of sheet metal, interposed between the contacting surfaces of the said cylinders and the steam-chests. An entrance-chamber C^2, common to both steam-chetss C C′, is connected by a pipe E (see Fig. 4) with a boiler or other steam-supply, and said steam-chests C C′ are preferably made cylindrical and contain the main piston-valves F and F′, respectively, both alike in construction and operation, and each is formed with a plurality of spaced pistons F^2 F^3 and F^4 F^5 in frictional contact with the interior surface of the corresponding steam-chest C or C′, the spaced pistons mentioned being arranged to form annular spaces on the main piston-valve, as plainly shown in Figs. 1, 2, and 3.

Each cylinder A and A′ is connected at its ends by the main ports *a* and *b* with the interior of the corresponding steam-chest C or C′, and the said ports are adapted to register alternately with the annular spaces between the pistons F^2 F^3 and F^4 F^5, respectively. The annular spaces between the pistons F^2 F^3 and F^4 F^5 are at all times in transverse register with the ports *c c′*, leading to the entrance-chamber C^2, so that live steam fills the said annular spaces between the pistons F^2 F^3 and F^4 F^5. The annular space between the pistons F^3 and F^4 is in register at all times with the exhaust *d* and is adapted to register alternately with branch ports *a′ b′* of the main ports *a* and *b* on shifting the main piston-valve F or F′ in the direction of its length, as hereinafter more fully described.

Each of the main piston-valves F and F′ is provided with a central bore extending longitudinally and through which passes loosely the stem G of two auxiliary piston-valves G′ and G^2, secured on the ends of the said stem G and located in the outer ends of the corresponding steam-chest C or C′, adjacent to the outer faces of the pistons F^2 F^5. The main piston-valve F in the steam-chest C and the corresponding auxiliary pistons G′ G^2, contained therein, are controlled by live steam from the cylinder A′, and the main piston-valve F′ in the steam-chest C′ and the corresponding pistons G′ G^2, contained therein, are controlled by live steam from the cylinder A. For this purpose the crossover-ports *e*, *e′*, e^2, and e^3 are provided, of which the port *e* extends at the left-hand side and near the middle of the cylinder A upward through the gasket D, along the under side of the steam-chests C C′, to then open into the left-hand side of the steam-chest C′, and the port *e′* extends from the right-hand end and near the middle of the cylinder *a* in an upward direction, passes along the top of the cylinders, (see Fig.

7,) then up through the gasket D and the bottom of steam-chest C' into the right-hand end thereof. The port e^2 extends from the right-hand end of the cylinder A', near the middle thereof, up and across the top of the cylinders A A' (see Fig. 7) to then pass through the gasket D and the bottom of the steam-chest C into the left-hand end thereof. The port e^3 extends from the cylinder A' to the left-hand side and near the middle thereof upward and through the gasket D, then across the under side of the steam-chests C' C and through the bottom of the steam-chest C into the right-hand end thereof.

The ports e and e^2 are adapted to conduct the steam between the opposite faces of the pistons F^2 and G' in the corresponding steam-chests C and C', and the ports e' and e^3 are adapted to pass between the opposite faces of the pistons F^5 G^2 in the steam-chests C and C'. In order to exhaust the steam from the spaces between the said pistons F^2 G' and F^5 G^2 the following arrangement is made: Each piston G' is provided with a port f, leading from the inner face of the said piston to connect with a port g, formed in the bottom of the steam-chests and connecting with the corresponding exhaust-port d, as plainly indicated in Fig. 8. A similar port f' is formed in each piston G^2 and is adapted to connect with a port g', leading to the corresponding exhaust-port d. (See Fig. 8.)

The ends of the stem G, carrying the auxiliary pistons G' G^2, are provided with ports h and h', leading from the extreme ends of the said stem inwardly, to connect at their inner ends with an annular space i, formed within the corresponding main piston-valve F or F', and the said space i is connected at all times by ports j with the exhaust-port d, so as to relieve the ends of the steam-chests C and C' of any pressure to allow the proper seating or outward movement of the auxiliary pistons G and G^2, as hereinafter more fully explained.

When the engine is in operation and the piston B in the cylinder A travels from the right to the left, and the piston B' in the cylinder A' travels from the left to the right, (see Figs. 9 and 10,) and the piston B has reached an approximately midway position, then the main piston-valve F in the steam-chest G admits steam by way of the port B into the right-hand end of the cylinder A, and the main piston-valve F' in the steam-chest C' admits steam into the left-hand end of the cylinder A' by way of the port a. Thus the piston B travels from the right to the left and the piston B' travels from the left to the right. The piston B when reaching a middle position uncovers the port e', so that live steam can pass through this port into the right-hand end of the steam-chest C', between the opposite faces of the pistons F^5 and G^2, (see Figs. 1 and 10,) to force the main piston-valve F' from the right to the left, thus closing the port a, leading to the cylinder A', and opening the port b, at the same time closing the branch port b' and connecting the branch port a' with the exhaust-port d.

When the main piston-valve F' travels from the right to the left, it finally reaches the position shown in Fig. 2, so that the port h connects the left-hand end of the steam-chest C' with the space i to permit the piston-valve F' to shift farther to the left and to carry the auxiliary piston G' along and, consequently the stem G and the auxiliary piston G^2 until the parts reach the position shown in Fig. 3. When this takes place, the port f in the piston G' is disconnected from the port g, and the port f' connects with the port g', so that the steam contained between the pistons F^5 and G^2 can pass to the exhaust-port d.

When the piston-valve F' is shifted from the right to the left, as described and shown in Fig. 2, then the ports c' and b are connected with each other to admit steam to the right-hand end of the cylinder A' to cause the piston B to start on the return stroke, and when the piston-valve F' has shifted to its extreme left-hand-end position, as shown in Fig. 3, then the ports c' and b are fully connected with each other, as indicated in Fig. 3. Now when the piston B reaches the end of its stroke from the right to the left the piston B' reaches a middle position from the right to the left, and then this piston B' uncovers the port e^2, so that steam passes from the cylinder A' through the port e^2 into the steam-chest C to shift the main piston-valve F from the left to the right into a position similar to the one occupied by the valve F', (shown in Fig. 1)—that is, the port a is connected with the live-steam port c to cause a return movement of the piston B.

The ports e, e', e^2, and e^3 have extensions or branches at or near their ends for forming draining-ports e^4, of which the draining-ports e^4 for the ports e and e' lead down into the ends of the cylinder A' and the draining-ports e^4 for the ports e^2 and e^3 lead down into the ends of the cylinder A, as will be readily understood by reference to Figs. 7, 9, and 10. The object of the draining-ports e^4 is to lead away any leakage of steam or air-pressure past the piston-valves F F', and the ports e^4 are only active when the main pistons B B' have closed the corresponding ports e, e', e^2, or e^3. When the main piston B, for instance, has traveled from right to left and closed and completed half of its stroke (see Fig. 9) and opened the port e', then the steam-pressure does not reverse the main piston-valve F' for the cylinder A' until the main piston B' in the cylinder A' has closed the port e^2. The result of this is that each main piston B or B' has to make its full stroke before reversing of the corresponding main piston-valve takes place. Thus, for instance, if one side of the

duplex pump is packed tighter than the other, or a valve in one side of the pump does not seat properly, then one side of the duplex pump functions faster than the other, and the slow functioning side of the pump will be short in its stroke at one or both ends. By having the draining-ports e^4, however, open to the exhaust side of the main piston B or B′ this difficulty is avoided, as in the fast side of the duplex pump the corresponding main piston stops at the ends of its stroke until the other piston on the slow-moving side of the pump has closed the corresponding port e, e', e^2, or e^3.

Mechanisms H for shifting the main piston-valves F and F′ by hand whenever it is desired to do so are employed and are of the same construction as the ones shown and described in the Letters Patent above referred to, so that further description of the same is not deemed necessary.

Although I have shown my improvement applied to a duplex steam-pump, it is evident that the same arrangement can be used on a single steam-pump, the same as shown and described in the Letters Patent above referred to.

From the foregoing it will be seen that the main piston-valve F in the steam-chest C is controlled by live steam from the cylinder A′, and the main piston-valve F′ in the steam-chest C′ is controlled by live steam coming from the cylinder A, and the said main piston-valves F and F′ are gradually shifted to first cause a partial opening of the corresponding main piston-valve (see Fig. 2) and then a full opening of the valve, as indicated in Figs. 1 and 3.

It will be noticed that by the arrangement described the valve mechanism in one of the steam-chests for one cylinder is controlled by live steam from the other cylinder and at a time when the piston in the said other cylinder reaches an approximately midway or half-stroke position and the piston in the first cylinder is at the end of its stroke. Thus the pistons B and B′ are caused to travel in half-stroke positions relative one to the other.

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

1. A duplex steam-engine provided with cylinders, pistons reciprocating therein, steam-chests, main piston-valves in the said steam-chests, and auxiliary piston-valves, each having a stem extending through the corresponding main piston-valve and connecting the auxiliary piston-valves with each other, each cylinder having crossover ports leading from near the middle of the cylinder to the steam-chest for the other cylinder.

2. A duplex steam-engine provided with cylinders, pistons reciprocating therein, steam-chests, main piston-valves in the said steam-chests, and auxiliary piston-valves, each having a stem extending through the corresponding main piston-valve and connecting the auxiliary piston-valves with each other, each cylinder having crossover-ports leading from near the middle of the cylinder to the steam-chest for the other cylinder, and each auxiliary piston-valve having exhaust-ports for conducting the steam from the steam-chests to the main exhaust.

3. A duplex steam-engine provided with cylinders, pistons reciprocating therein, steam-chests, main piston-valves in the said steam-chests, and auxiliary piston-valves, each having a stem extending through the corresponding main piston-valve and connecting the auxiliary piston-valves with each other, each cylinder having crossover-ports leading from near the middle of the cylinder to the steam-chest for the other cylinder, the said valve-stem having relief-ports at its ends for connecting the ends of the steam-chests with annular spaces in the main piston-valves and which spaces are connected with the main exhausts.

4. The combination with a steam-chest having inlet and exhaust ports leading to the ends of the cylinder, said steam-chest having also live-steam ports, a main piston-valve, a stem slidable in the chest and having at each end auxiliary valves, the main valve being mounted on the stem for sliding movement between the auxiliary valves, said chest having inlet-ports for admitting steam to the space between the ends of the main valve and the auxiliary valves whereby to move said valve along the stem, and exhaust-ports leading therefrom, each of said auxiliary valves having a port therethrough for connecting the space between said valve and the adjacent end of the chest with the exhaust when the main valve abuts thereagainst, whereby to permit said stem to move to connect the space between the main valve and the auxiliary valve at the opposite end of the chest with the exhaust.

5. A duplex steam-engine provided with cylinders, pistons reciprocating therein, steam-chests, main piston-valves in the said steam-chests, and auxiliary piston-valves, each having a stem extending through the corresponding main piston-valve and connecting the auxiliary piston-valves with each other, each cylinder having crossover-ports leading from near the middle of the cylinder to the steam-chest for the other cylinder, the said crossover-ports being controlled by the said pistons on reaching an approximately midway position in their cylinders.

6. A duplex steam-engine provided with cylinders, pistons reciprocating therein, steam-chests, main piston-valves in the said steam-chests, and auxiliary piston-valves, each having a stem extending through the corresponding main piston-valve and con-

necting the auxiliary piston-valves with each other, each cylinder having crossover-ports leading from near the middle of the cylinder to the steam-chest for the other cylinder and draining into the latter.

7. A duplex steam-engine provided with cylinders, pistons reciprocating therein, steam-chests, main piston-valves in the said steam-chests, and auxiliary piston-valves, each having a stem extending through the corresponding main piston-valve and connecting the auxiliary piston-valves with each other, each cylinder having crossover-ports leading from near the middle of the cylinder to the steam-chest for the other cylinder, each crossover-port having a draining-port into the other cylinder.

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

ERNEST A. MENKING.

Witnesses:

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JOSEPH H. STENGER.