(No Model.) 2 Sheets—Sheet 1.

J. S. KLEIN.

STEAM VALVE GEAR FOR DUPLEX STEAM PUMPS.

No. 336,924. Patented Mar. 2, 1886.

Fig. 1.

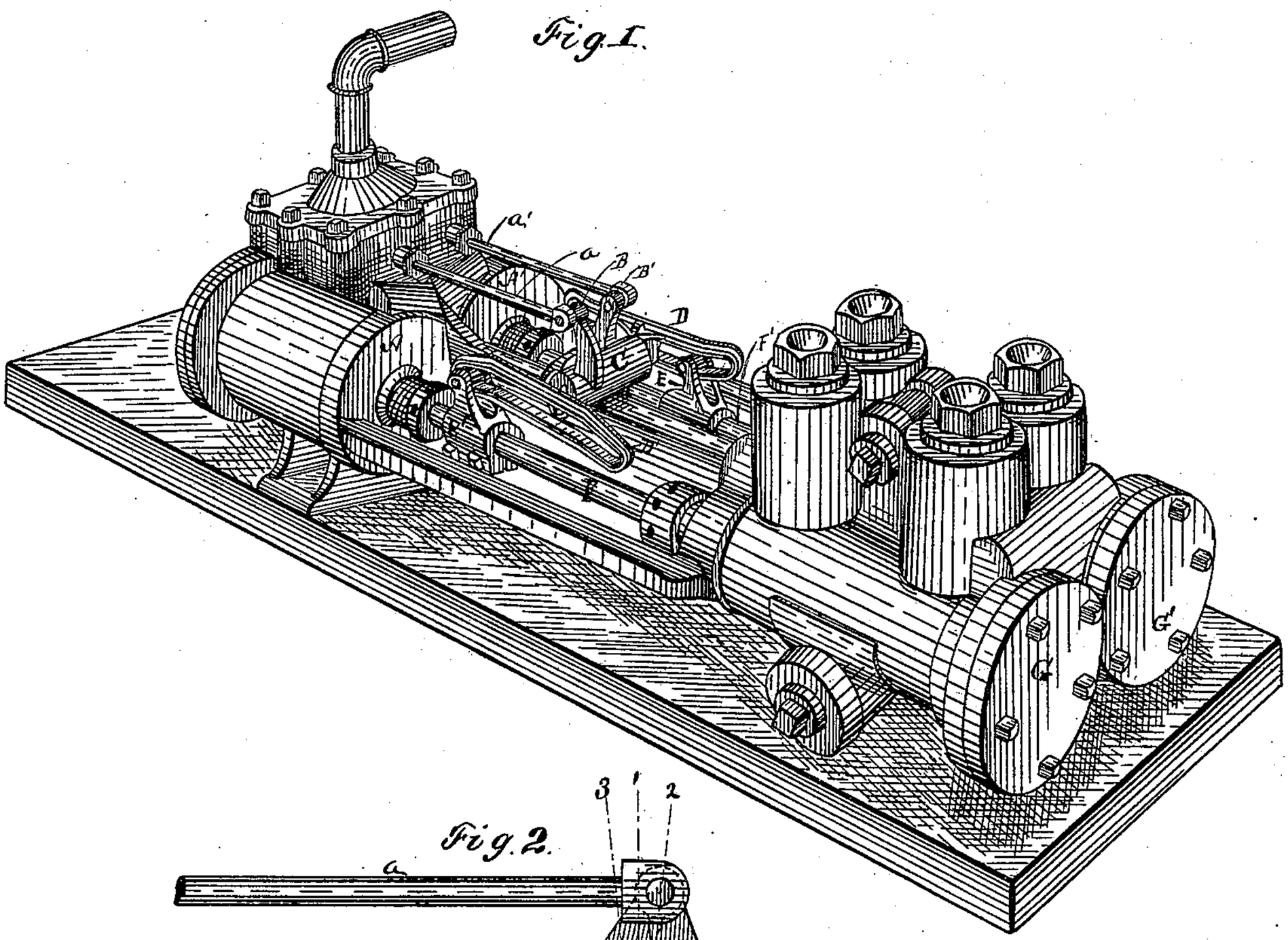


Fig. 2.

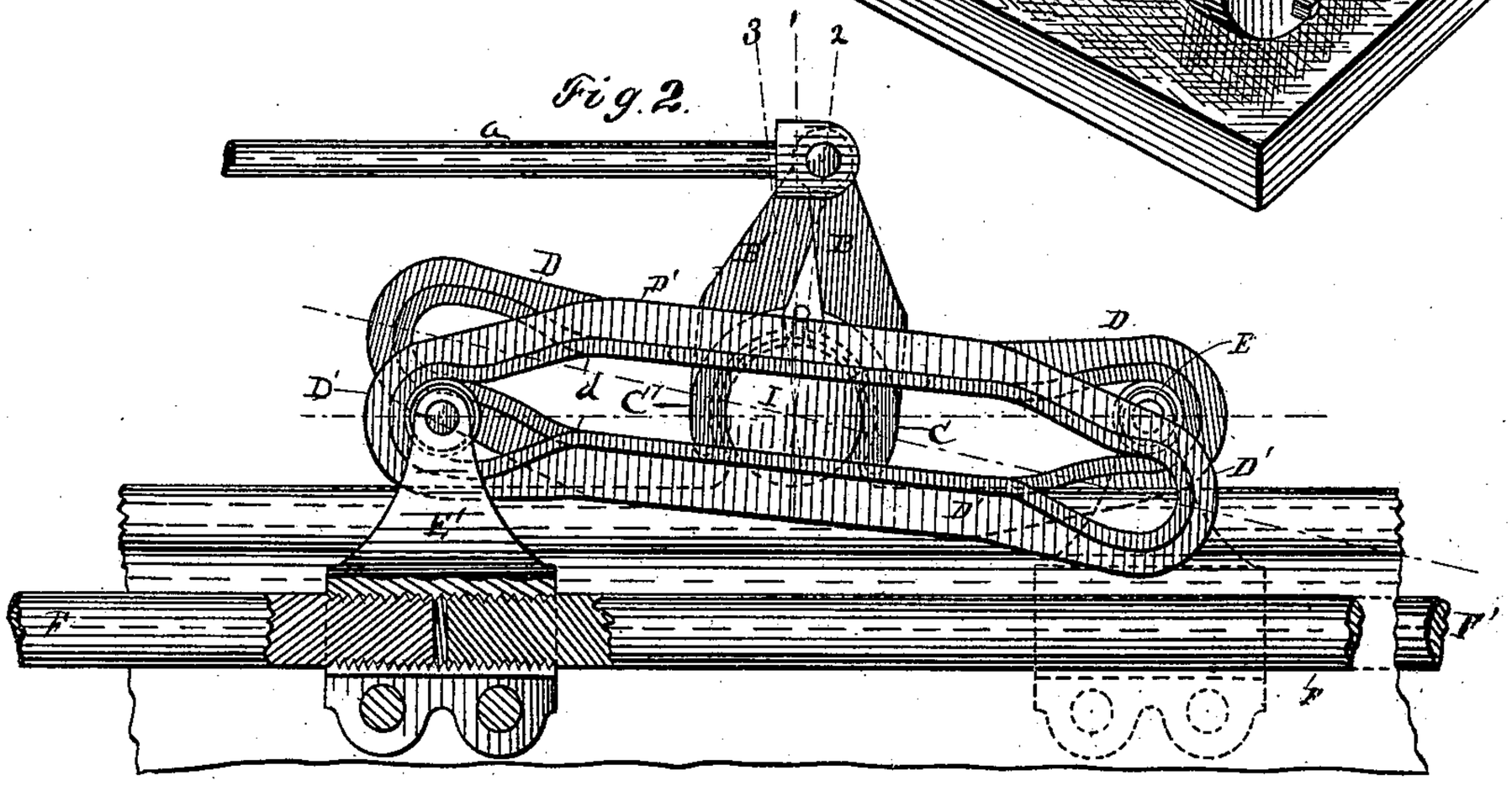
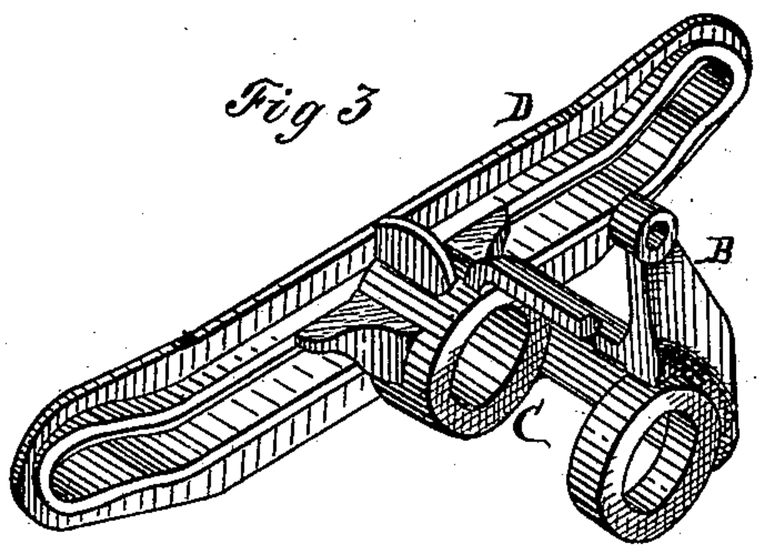


Fig 3



Witnesses
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

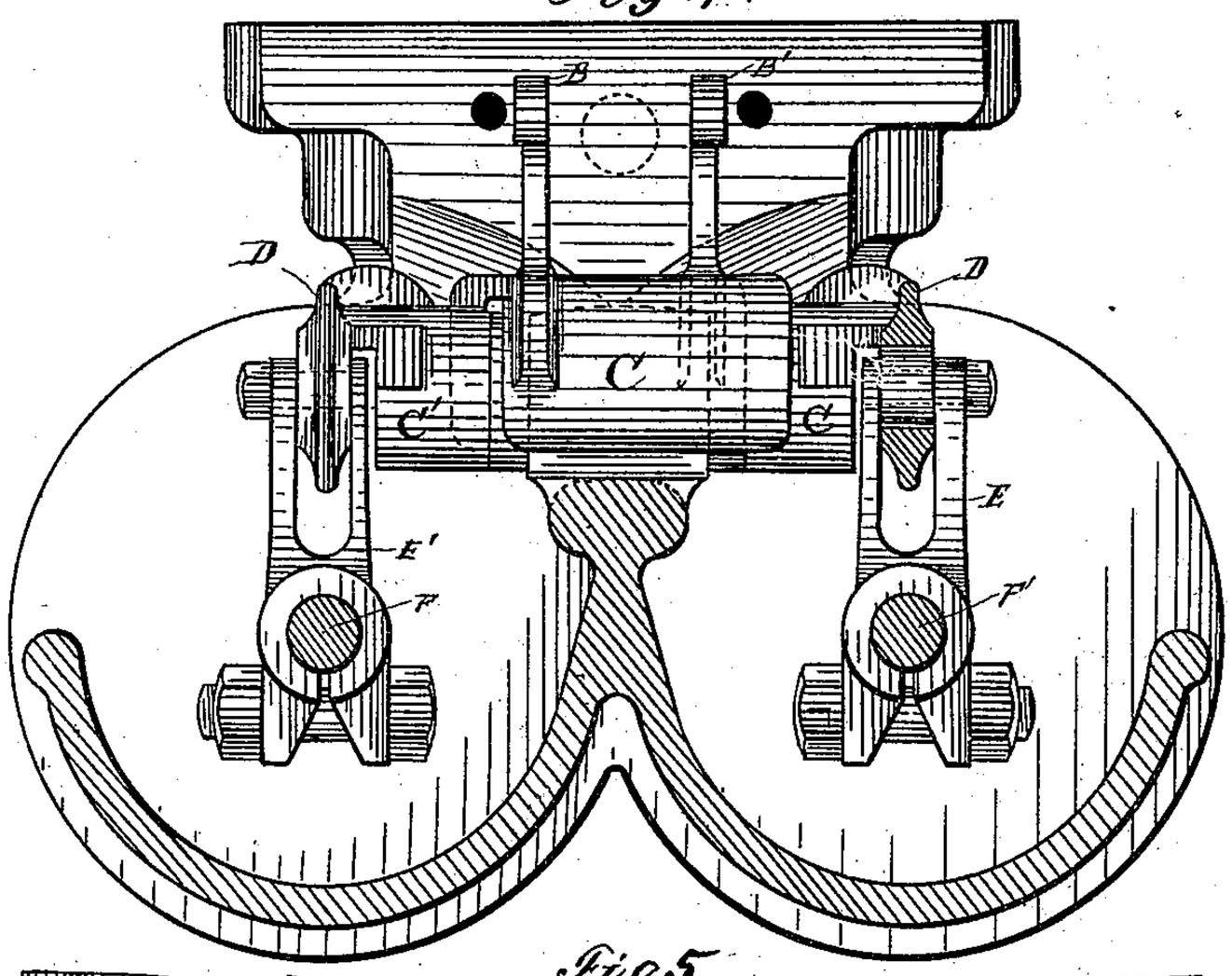
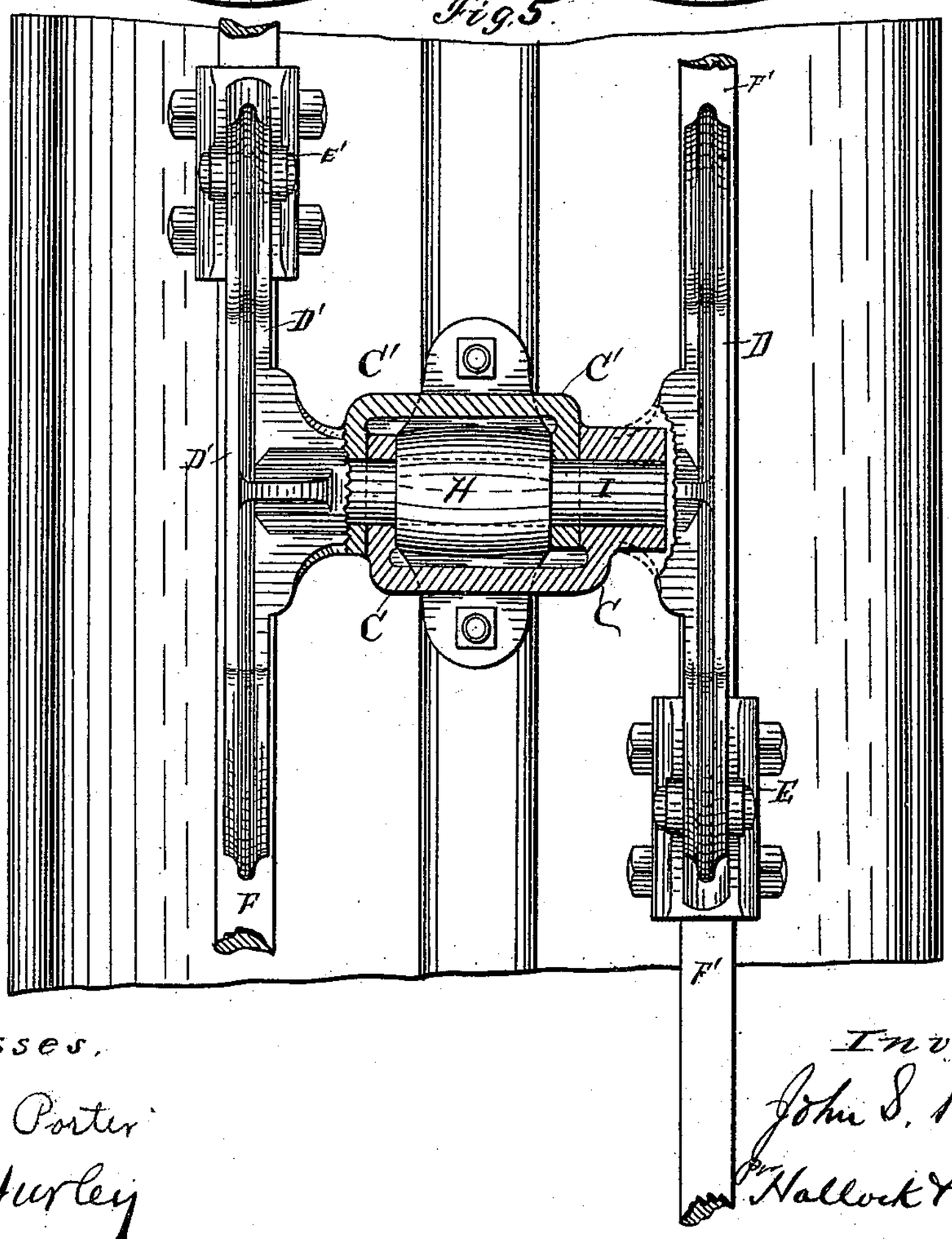


Fig. 5.



Witnesses.
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UNITED STATES PATENT OFFICE.

JOHN S. KLEIN, OF OIL CITY, PENNSYLVANIA.

STEAM-VALVE GEAR FOR DUPLEX STEAM-PUMPS.

SPECIFICATION forming part of Letters Patent No. 336,924, dated March 2, 1886.

Application filed September 11, 1885. Serial No. 176,805. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. KLEIN, a citizen of the United States, residing at Oil City, in the county of Venango and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Valve Gear for Duplex Steam-Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to steam-pumps; and it consists in improvements on the valve-gear for duplex steam-pumps.

My invention is shown in the accompanying drawings, as follows: Figure 1 is a perspective view of a duplex steam-pump having thereon my improved valve-gear. Fig. 2 is a side elevation of the valve-gear. Fig. 3 is a perspective view of one of the rocker-arms and the cam by which it is operated. Fig. 4 is a transverse vertical section through the bed or frame and piston-stems, and shows the valve-gear in end elevation. Fig. 5 is a top or plan view of the valve-gear with the rocker-arm sleeves in horizontal section.

A A′ are the steam-cylinders. G G′ are the pump-cylinders. F F′ are the piston-rods. *a a′* are the steam-valve stems. B B′ are the rocker-arms, which move the steam-valve stems *a* and *a′*, respectively. C C′ are the journal-sleeves of the rocker-arms B and B′, respectively. D D′ are the cams which move the rocker-arms B and B′, respectively. E E′ are cam-followers, which are attached to the piston-rods F′ and F, respectively, and serve to move the cams D and D′, respectively. I is the journal-pin of the rocker-arms, and H is a hub connected with the bed, which holds the journal-pin I.

The construction and operation of my invention are as follows:

The two pumps are operated alternately, and the steam-valve of one is operated from the piston-stem of the other—that is to say, one pump makes a full stroke one way, while the other stands still, and as it completes said stroke it opens the steam-valve of the other pump, and it makes a full stroke the other way while the first pump stands still. Connected with the journal-sleeve of each rocker-arm is a cam, which lies above the piston-stem of the opposite pump. Thus the rocker-arm B, which moves the steam-valve stem *a* of the pump A G, is connected with a cam, D, which lies over the piston-stem F′ of the pump A′ G′, and the rocker-arm B′, which moves the valve-stem *a′* of the pump A′ G′, is connected with a cam, D′, which lies over the piston-stem F of the pump A G.

Fig. 3 shows the construction of the rocker-arm B, its journal-sleeve C, and the cam D, and it will there be seen that these parts are all formed of one piece of metal; but this is not essential. The other rocker-arm and cam are constructed in the same manner, and are counterparts of those seen in Fig. 3, except that the cam is reversed. The journal-sleeves of both are notched or cut away, so that the two parts can each span the hub H, one reaching around the hub on one side and the other on the other side. This is clearly seen in Fig. 5. By this construction each rocker-arm has a bearing on the pin I on each side of the hub H. This is simply for the purpose of giving a long firm bearing, and it gives a bearing opposite the connection of the rocker-arm with the valve-stem; but of course this is not essential. The two cams stand, when in place, reversed—that is, the slot in the cam D curves up at the ends, and that of D′ curves down. The cams are rocked by the reciprocal action of the cam-followers E E′, which are connected with the piston-stems F′ and F, respectively. The said cam-followers consist of a head or block connected with the piston-stems and bearing friction-rollers which lie in the slots of the cams.

The cams D D′ constitute an essential part of my invention, as by them the admission of steam to and cutting of steam off from the cylinder of one pump is effected by the action of the other pump. It is common in duplex steam-pumps to move the steam-valve of one pump by the action of the other pump through the medium of a rocker-arm and a connecting-rod. With such a valve-gear there is no point in the stroke of the piston in which there is no movement of the steam-valve it actuates. One of the results of this construction is, that where the pump is working light, as in drawing air from a conduit as it is filling with fluid,

it will not make full strokes, but short, rapid ones. Another objection to such a valve-gear is, that after a piston has completed its stroke no cut-off of steam occurs until it is time for that piston to move back again. In other words, the valves are moved from one end of their stroke to the other at one movement, so that when they stand they are admitting steam to the cylinders at one end or the other. In some cases this is not a disadvantage, while in others it causes a great consumption of steam.

By the use of my rocking cams D D′, I overcome both the above objections, for, in the first place, they have a straight space in their slots, which allows the pistons to move without moving them, and they can only be moved as the pistons are beginning or ending a stroke, and, in the next place, when constructed as shown they move the valve twice to complete one stroke or traverse of the valve. Thus, for example, when the piston F starts to move, it will first move the cam D′, so as to close the valve of the pump A′ G′, and then, as it completes its stroke, it will again move the cam D′ in the same direction it did at first, and this will open the valve of the pump A′ G′. This latter feature where not wanted will be dispensed with by omitting the lower bar of the cam D′ and the upper one of the cam D, or the inclined faces on said bars. To a full understanding of the action of the valve-gear, I will describe its complete operation.

Beginning with the parts in the position shown in Fig. 1, the piston-stem F′ is just completing its stroke toward the right, and the cam-follower E is just impinging upon the lower inclined face at the angle of cam D. As this stroke is completed, the cam D is tilted down at its right end. This rocks the arm B to the right and opens the valve of pump A G, so as to admit steam to the left of the cylinder A. This action starts the piston-stem F on its stroke toward the right, and as it starts the cam-follower E′ will tilt the cam D′ down at its left end and rock the arm B′ toward the left, and thus close the valve of the pump A′ G′. When the piston-stem F is about completing its stroke toward the right, the cam-follower E′ will strike upon the upper inclined face at the right end of cam D′, and tilt the said cam again in the same direction as before, and move the valve of the pump A′ G′ still farther to the left, which will open the part at the right end of the cylinder A′, and start the piston-stem F′ on its return-stroke, and as it moves to the left it tilts up the right end of the cam D and closes the valve of cylinder A.

From the foregoing it will be seen that if, as above stated, the cams were so formed that there were no cam-faces on the upper side of cam D nor on the lower side of cam D′, the valves would only be moved once in either direction in making a full traverse, and hence they would have to be so formed that they would be admitting steam to the cylinders all the time, either at one end or the other, just as is common in the constructions heretofore in use. So it will be seen that I can so construct my cams as to either cut off the steam from the cylinders while their pistons are at rest or not, as desired. It will also be observed that in either case the cams will not be moved, and therefore the valves will not be moved except as the pistons are at the beginning or finish of their strokes, and therefore it will be impossible for the pumps to run with short quick strokes, for the pistons must make full strokes in order to effect a cut-off or admission of steam.

What I claim as new is—

1. In a duplex steam-pump, a valve-gear consisting of the combination of a rocking cam which consists of a bar pivoted at its middle and having a cam-slot formed, as shown, with upper and lower cam-faces at each end and a dwell between the ends, arranged adjacent to the piston-stem of each pump, a cam-follower on each piston-stem, by which said cams are rocked as the said piston-stems reciprocate, and rocker-arms connected with the pivot of each of said cams, and with the valve-stem of the opposite pump.

2. In a duplex steam-pump, a valve-gear which consists of the cams D D′, journal-sleeves C C′, rocker-arms B B′, and cam-followers E E′, combined and arranged to operate substantially as and for the purposes set forth.

3. In a duplex steam-pump valve-gear, the combination, substantially as shown, of the cam-followers E E′, connected with the pistons F′ F, respectively, and the two rocking gears formed, respectively, of the cam D, rocking sleeve C, and arm B, and the cam D′, journal-sleeve C′, and arm B′, and journaled on the common pivot I, and operated from the piston-stems F′ F, and connected with the valve-stems *a a′*, respectively.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN S. KLEIN.

Witnesses:
JNO. K. HALLOCK,
ROBT. H. PORTER.