

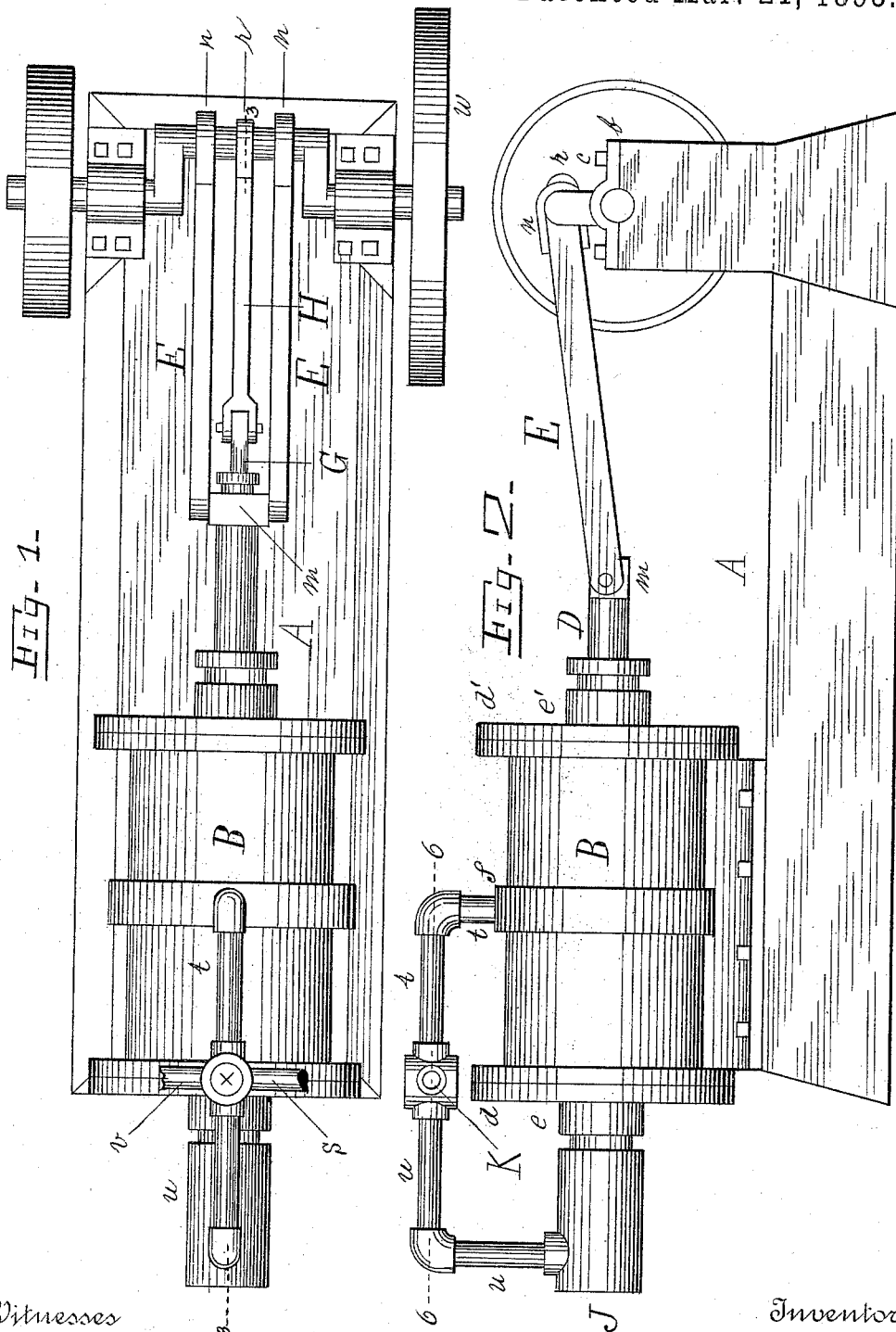
(No Model.)

2 Sheets—Sheet 1.

J. W. POWERS.
STEAM OR PNEUMATIC ENGINE.

No. 493,840.

Patented Mar. 21, 1893.



Witnesses
Walter Farnham
L. S. Thompson

Inventor
Jay W. Powers

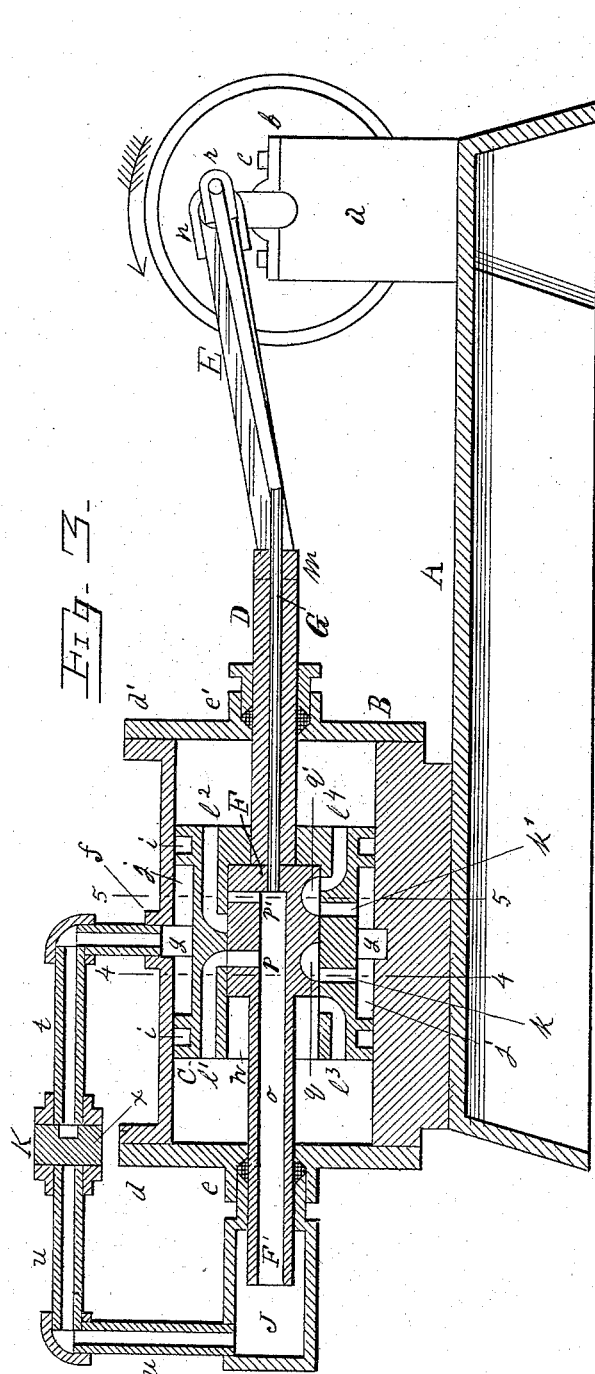
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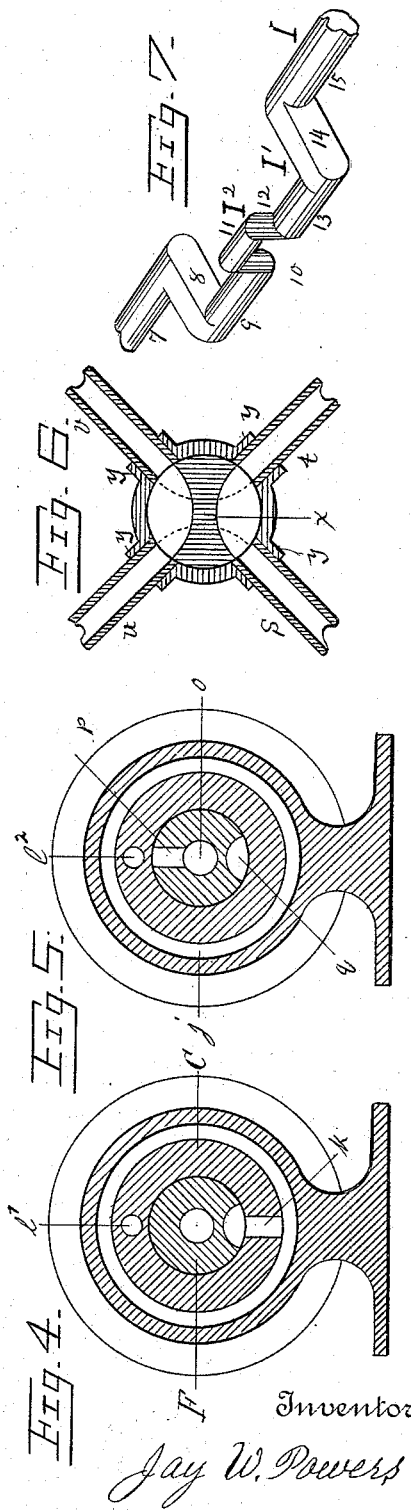
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Witnesses
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UNITED STATES PATENT OFFICE.

JAY W. POWERS, OF CHICAGO, ILLINOIS.

STEAM OR PNEUMATIC ENGINE.

SPECIFICATION forming part of Letters Patent No. 493,840, dated March 21, 1893.

Application filed June 23, 1892. Serial No. 437,783. (No model.)

To all whom it may concern:

Be it known that I, JAY W. POWERS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Steam or Pneumatic Engines, of which the following is a specification.

This invention relates to engines of the character known as reciprocating piston, and it has for its object the production of an engine wherein, first, many of the parts heretofore deemed essential to the practical operation of all piston engines are dispensed with, thereby simplifying construction; second, both the piston and valve will receive the force of the steam or compressed air, and both will transmit it to the crank shaft, thereby utilizing the power at present expended in operating the valve or valves, and third, the engine may be started, stopped, or reversed by means of a throttle valve, thereby further simplifying construction.

To these ends the invention consists in a peculiar construction and arrangement of its several parts, substantially as hereinafter described, and particularly pointed out in the subjoined claims.

In the accompanying drawings Figure 1 is a top view of the entire engine. Fig. 2 is a side elevation with the balance wheel removed. Fig. 3 is a longitudinal vertical section on the line 3 3 of Fig. 1. Fig. 4 is a vertical cross section on the line 4 4. of Fig. 3: Fig. 5 the same on the line 5 5. of Fig. 3. Fig. 6 is a horizontal section of the throttle and its connecting pipes on the line 6 6. of Fig. 2: and Fig. 7 is a detail of a portion of the crank.

Like letters and numerals refer to like parts in all of the figures, A being the bed or frame: B the cylinder: C the piston: D the piston rod: E E the connecting rods: F the valve: G the valve stem: H the valve rod: I the crank shaft: I' the piston crank: I² the valve crank: J the steam or air chamber: and K the throttle valve.

The bed or frame A should be of sufficient weight to break the vibrations of the working parts and give the engine stability. It is provided with the pillow blocks *a a* furnished with the caps *b b* held in place by the bolts *c*, thus forming bearings for the crank shaft I.

The cylinder B is securely bolted to the

bed A, its center being in line with the center of the crank shaft I. It is provided with the heads *d* and *d'* which are furnished with the stuffing boxes *e* and *e'*. It is provided midway between its opposite ends with the annulus *f* the purpose of which is to provide for the interior annular recess *g*, and yet preserve uniform thickness of its wall. This annular recess *g* is an important feature of my invention, as its position at the point not traversed by the packing of the piston, prevents the formation at this point of ridges which would otherwise result from the wear of the piston packing up to this point.

The piston C is formed with a central longitudinal chamber *h* closed at one end. It is a little more than half as long as the interior of the cylinder B, to the end, that neither of its packing rings *i i* will have to pass (in their reciprocating movements) the interior annular recess *g*. It is provided between its packing rings *i i* with a circumferential groove *j*. Two parts *k* and *k'* connect the central longitudinal chamber *h* and the circumferential groove *j*, and four ducts *l'*, *l*, *l'*, and *l*, extend longitudinally inward from its opposite ends, (two from either end) their approaching inner ends curving inward and terminating in the central longitudinal chamber *h*.

The piston rod D is rigidly attached to the closed end of the piston C passes out through the stuffing box *e'* of the cylinder head *d'*, extends to, and is connected with the cross head *m*. It is pierced longitudinally to provide a passage for the valve stem G.

The connecting rods E E are pivoted to the cross head *m*, and extend to the piston crank I' to which they are connected by means of the strap joints *n n*.

The valve F is provided with a head fashioned to fit within the central longitudinal chamber *h* of the piston C closely, and yet be movable longitudinally therein, while the remaining portion F' extends out through the stuffing box *e* into the steam or air chamber J. It is provided with a longitudinal duct *o* entering its rear end, and extending nearly its entire length. Two parts *p* and *p'* pierce its side wall tapping the longitudinal duct *o*. They are located so as to alternately register with the ducts *l* and *l'* of the piston C. It is further provided upon its exterior with two

recesses q and q' adapted to alternately register with the parts k and k' and with the ducts l^3 and l^4 of the piston C.

The valve stem G is rigidly attached to the forward or closed end of the valve F passes out through the pierced piston rod D and is pivoted to the valve rod H, which extends to the valve crank I^2 to which it is connected by means of the strap joint r .

The crank shaft I revolves in the pillow blocks aa of the bed A. It consists of a horizontal bar 7 bent horizontally at an angle of ninety degrees thus forming the second horizontal bar 8, thence at an angle of ninety degrees forming the third horizontal bar 9, thence upward at an angle of ninety degrees forming the first vertical bar 10, thence horizontally at an angle of ninety degrees forming the fourth horizontal bar 11 thence downward at an angle of ninety degrees forming the second vertical bar 12 parallel with bar 10 thence horizontally at an angle of ninety degrees forming the fifth horizontal bar 13, thence at an angle of ninety degrees forming the sixth horizontal bar 14 parallel with bar 8, thence at an angle of ninety degrees forming the seventh and last horizontal bar 15 in line with bar 7, the whole forming a double or compound crank, in which the outer arm of the larger crank I' will be divided, and the ends connected by the side arms of the smaller crank I^2 . It will be observed that bars 8 and 14 are parallel and that they, together with bars 9 and 13, form the piston crank I' and that bars 10 and 12 also are parallel and that they, together with bar 11, form the valve crank I^2 and that the former stands at right angles to, and has a much greater throw than the latter. The steam or air chamber J is attached to the stuffing box e of the cylinder head d . The four way cock K has its body part fashioned in the form of a cross thus providing four bosses y into which the four pipes s t u and v are tapped. The pipe s extends to the boiler or compressing chamber, and serves to conduct the steam or compressed air to the cylinder B. The pipe t extends to, and is tapped into the cylinder B on a line with the center of the annulus f , and serves either as a supply or as an exhaust pipe as will hereinafter be understood. The pipe u extends to, and is tapped into the steam or air chamber J, and, like the pipe t serves either as a supply or as an exhaust as will hereinafter appear. The pipe v communicates with the outer air or with a condensing chamber, and serves as an escape pipe for the cylinder B.

The operation of my engine is as follows. Steam generated in a suitable boiler, or air from a compressing chamber, is conducted to the cylinder B through the feed pipe s and, passing through the cock K and pipe t fills the circumferential groove j , passes through the port k' of the piston C, the recess q' of the valve F, and the duct l^4 of the piston, filling the outer end of the cylinder B, driving the piston C and valve F inward: the exhausted

steam or air in the inner end of the cylinder B escaping, meanwhile, through the duct l' of the piston C port p and duct o of the valve F, the chamber J, pipe u cock K and pipe v . Now through this inward stroke of the piston and valve, the piston crank I' has been carried to its inward, and the valve crank I^2 to its upward throw. At this position the ducts l' l^2 l^3 and l^4 are all closed, as the valve F is at half stroke, and the momentum of the balance wheel w , must now carry the piston and valve, past their dead point, when, through the valve crank I^2 being in lead of the piston crank I' , the valve F moves outward a short distance within the piston C thereby opening communication between the circumferential groove j and the inner end of the cylinder B, when the steam or air will pass through the port k of the piston C the recess q of the valve F, and the duct l^3 of the piston, filling the inner end of the cylinder B, driving the piston and valve outward, the exhausted steam or air in the outer end of the cylinder B escaping, meanwhile, through the duct l^2 of the piston C port p and duct o of the valve F the chamber J pipe u cock K and pipe v . Thus operated the crank shaft, I, will rotate in the direction indicated by the arrow, but it is apparent, that if I substitute the supply for the exhaust pipe, by turning the key x of the cock K in such manner as to let the steam or compressed air into the cylinder B through the pipe u the steam or air chamber J duct o and ports p and p' of the valve F and the ducts l' and l^3 of the piston C and allow the exhausted steam or air to escape through the ducts l^2 and l^4 of the piston C recesses q and q' of the valve F the circumferential groove j of the piston C and the pipe t the engine will run equally as well, but the crank shaft I will then rotate in an opposite direction to that indicated. Hence the engine can be reversed simply by opening the cock K to the right or to the left without other reversing mechanism, an advantage which will be appreciated by those familiar with this class of devices.

It will be noted that by having the valve chambered within, and forming a part of the piston, both receiving and both transmitting the power of the steam or other motive fluid to the crank shaft I utilize to drive the latter, the power at present expended in actuating the valve or valves.

I do not claim broadly in the present application a movable piston head having a valve operating within a chamber therein and with but in advance of the same, and both said piston head and valve receiving and both transmitting the power of the steam or other motive fluid to the shaft of the engine, since such construction is broadly claimed in my pending application, Serial No. 428,503, filed April 9, 1892.

Changes in the details of construction may suggest themselves to those skilled in the art to which my invention appertains and therefore I do not wish to be understood as con-

fining myself to the exact mechanism herein shown and described but reserve to myself the liberty of changing the details without departing from the spirit and intent of my invention.

Having thus described my invention, what I believe to be new, and desire to secure by Letters Patent, is—

1. In a steam or pneumatic engine, the combination with the cylinder, and a steam or air pipe entering the side thereof, of a chambered piston head having suitable ports and passages, and a valve having an enlarged portion operating within the chamber of said piston head and formed with suitable ports and passages, and its remaining portion extending through the end of the cylinder and formed with a longitudinal duct extending from end to end of it said duct communicating at its inner end with said ports in the enlarged portion, substantially as specified.

2. In a steam or pneumatic engine, the combination with the cylinder, a chambered piston therein having suitable ports and passages, and a valve having an enlarged portion operating within the chamber of said piston and formed with suitable ports and passages, and its remaining portion extending through the end of the cylinder and formed with a longitudinal duct extending from end to end of it, said duct communicating at its inner end with said ports in the enlarged portion, of a four way cock connected with said cylinder and serving to start, stop or reverse the engine substantially as described.

3. In a steam or pneumatic engine, the combination with the cylinder, a steam or air pipe entering the side thereof, a steam or air chamber at the end of said cylinder, and a steam or air pipe entering the steam or air chamber, of a chambered piston in said cylinder, having suitable ports and passages, and a valve having an enlarged portion operating within the chamber in said piston and its remaining portion extending through the end of the cylinder into said steam or air chamber, said enlarged portion of the valve having ports and passages, and said remaining portion having a longitudinal duct communicating with said ports, substantially as described and for the purposes specified.

4. In a steam or pneumatic engine, the combination with the cylinder having a steam or air chamber at one end, and a four way cock connected by separate pipes with the cylinder and with the steam or air chamber, said pipe serving for the supply and exhaust to, and from, the engine, said cock also having pipes for the feed and escape of steam or air to and from it, of a chambered piston in said cylinder having suitable ports and passages, and a valve having an enlarged portion operating within the chamber in said piston, and its remaining portion extending through the end of the cylinder into the said steam or air chamber, said enlarged portion of the valve having suitable ports and passages, and said

remaining portion having a longitudinal duct communicating with said ports, substantially as described and for the purposes specified.

5. In a steam or pneumatic engine, the combination with the cylinder having inlet and outlet ports, a chambered piston head movable longitudinally within said cylinder and having suitable ports and passages, a valve operating within the chamber in the piston head and having suitable ports and passages, and a shaft having a compound crank, to one of the crank portions of which said piston is connected and to the other of the crank portions of which said valve is connected, the crank operating the piston having a greater throw than the crank operating the valve, substantially as described, whereby both the piston head and valve will be acted upon by the motive fluid and both will transmit motion to said shaft, as specified.

6. In a steam or pneumatic engine, the combination of the cylinder, a steam or air pipe entering the side thereof, a chambered piston in said cylinder, having suitable ports and passages, and a valve having an enlarged portion operating within the chamber in said piston, and formed with suitable ports and passages, and its remaining portion extending through the end of the cylinder, and formed with a longitudinal duct communicating with the ports in said enlarged portion of a compound crank, to one of the crank portions of which said piston is connected, and to the other of the crank portions of which, said valve is connected, the crank operating the piston, having a greater throw than the crank operating the valve, as and for the purposes specified.

7. In a steam or pneumatic engine, the combination with the cylinder having a steam or air chamber at one end, a steam or air pipe entering the side of said cylinder, and a steam or air pipe entering the steam or air chamber, of a chambered piston in said cylinder, having suitable ports and passages, a valve having an enlarged portion operating within the chamber in said piston and its remaining portion extending through the end of the cylinder into said steam or air chamber, said enlarged portion of the valve having suitable ports and passages, and said remaining portion having a longitudinal duct communicating with said port in the enlarged portion, and a compound crank, to one of the crank portions of which, said piston is connected, and to the other of the crank portions of which said valve is connected, the crank operating the piston, having a greater throw than the crank operating valve, as and for the purposes specified.

8. In a steam or pneumatic engine, the combination with the cylinder having an air chamber at one end, a steam or air pipe entering the side of said cylinder, a steam or air pipe entering said steam or air chamber, and a four way cock connecting said pipes, said cock also being provided with pipes for the feed to it

or the escape from it of steam or air, of a chambered piston in said cylinder, having suitable ports and passages, a valve having an enlarged portion operating within the chamber in said piston and its remaining portion extending through the end of the cylinder into the said steam or air chamber, said enlarged portion of the valve having suitable ports and passages, and said remaining portion having a longitudinal duct communicating with said ports in the enlarged portion, and a compound crank, to one of the crank portions of which said piston is connected and to the other of the crank portions of which said valve is connected, the crank operating the piston having a greater throw than the crank operating the valve as set forth.

9. The combination with the cylinder of a steam or pneumatic engine, of a piston op-

erating therein, said piston having a longitudinal chamber *h* closed at one end, a circumferential groove *j*, ports *k* and *k'* connecting said chamber and groove, and ducts *l'* *l''* *l'''* and *l''''* extending inward from opposite ends of said piston to said chamber, and a valve operating in said chamber in the piston, said valve having a longitudinal duct *o* two ports *p* and *p'* with which said ducts communicate, and arranged so as to alternately register with said ducts *l'* and *l''* of the piston, and external recesses *q* and *q'* arranged to alternately register with said ports *k* and *k'* and ducts *l'''* and *l''''* of the piston, all substantially as shown and described.

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