No. 692,668.

Patented Feb. 4, 1902.

D. HURST.

MOTOR.

(Application filed July 19, 1900.)

(No Model.)

2 Sheets—Sheet 1.

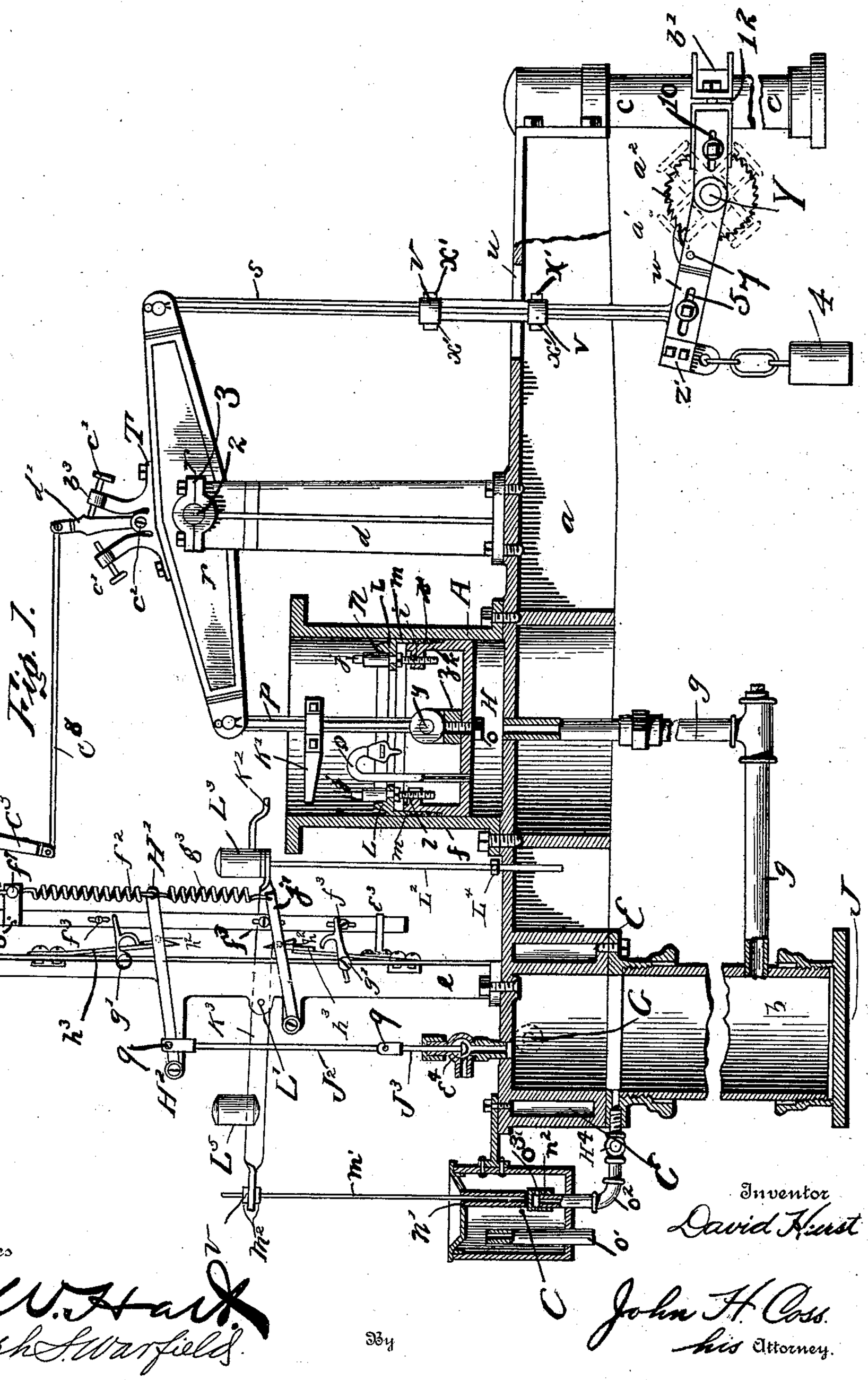

Fig. 1.

Witnesses

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MOTOR.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

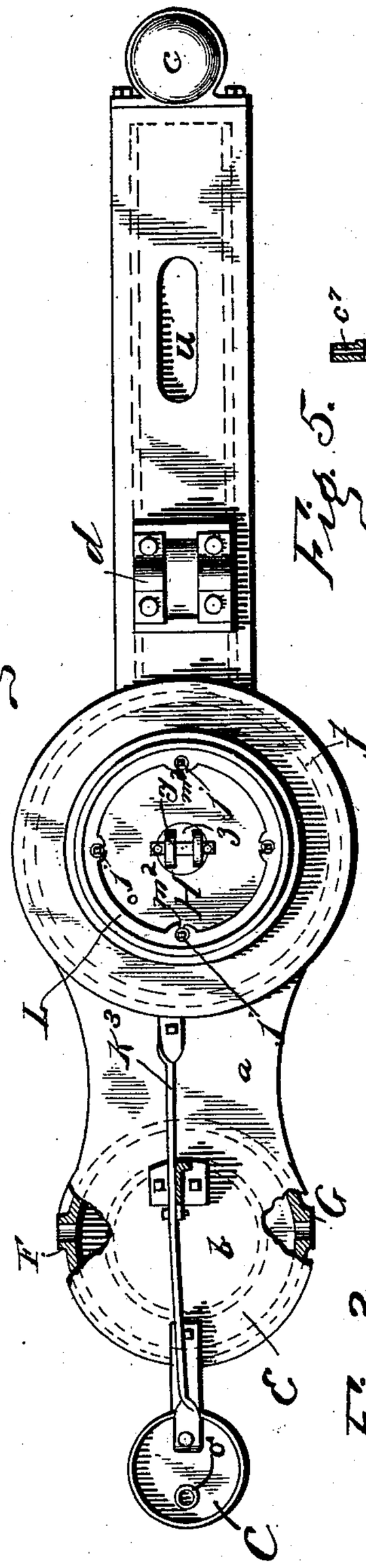


Fig. 5.

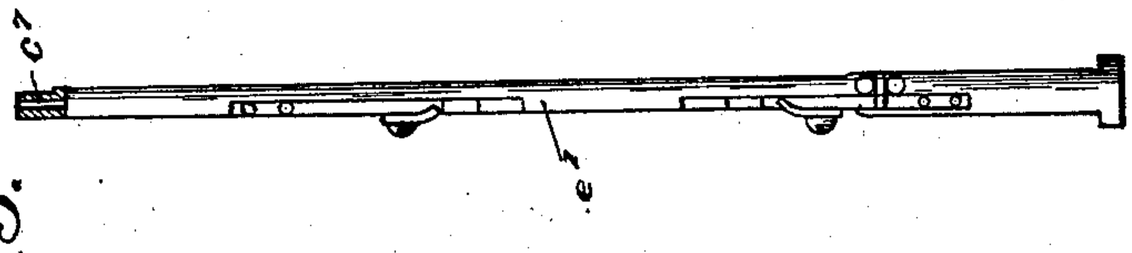


Fig. 4.

Fig. 3.

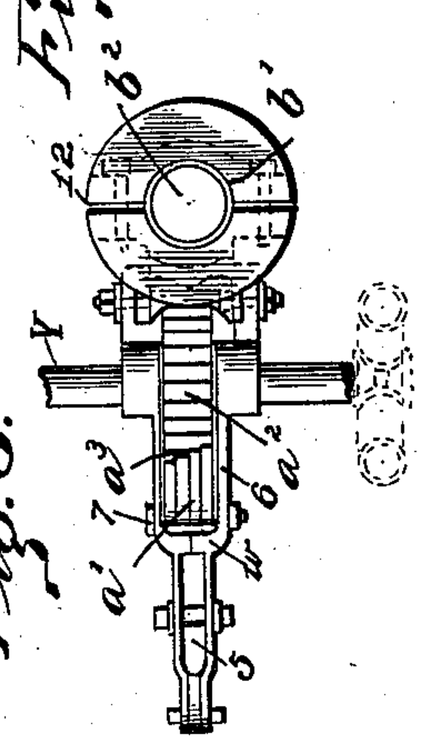
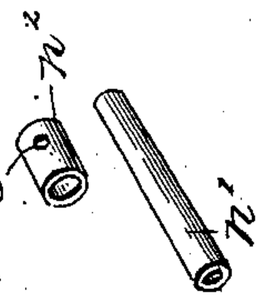


Fig. 6.



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UNITED STATES PATENT OFFICE.

DAVID HURST, OF MANSFIELD, OHIO.

MOTOR.

SPECIFICATION forming part of Letters Patent No. 692,668, dated February 4, 1902.

Application filed July 19, 1900. Serial No. 24,197. (No model.)

To all whom it may concern:

Be it known that I, DAVID HURST, a citizen of the United States of America, and a resident of Mansfield, county of Richland, State of Ohio, have invented certain new and useful Improvements in Motors, of which the following is a specification.

My invention relates to improvements in motors, and is more particularly applicable to those operated by the power of steam and atmospheric pressure.

The objects of my invention are, first, to furnish a motor that is reliable, efficient, and practical in its operation, as well as economical in the saving power; secondly, to afford improved facilities for the proper adjustment of parts of the device which regulate the admission of steam and prevent the admission of air, as well as to provide means whereby to effectually close the overflow-pipe at any point of the upward stroke of the piston, and, thirdly, to provide a means for adjusting the rotation of the shaft connected thereto.

When it is desired to operate the motor, steam is admitted into a chamber filled to a given point with water by means of suitable pipe connections. The water is brought in contact with the bottom of a piston, and the pressure of the steam against this body of water forces the piston upward and completes the upward stroke of the piston, operating the mechanism provided for regulating the motor, together with the connecting mechanism, more particularly described hereinafter and fully pointed out in the claims. The admission of the steam into the chamber forces the air and excess of water from condensation out through a check-valve located in an auxiliary chamber. This check-valve automatically closes on or before the completion of the upward stroke of the piston. When the steam is cut off from the water-chamber, condensation takes place therein, because the water in said chamber has been heated by the steam and is subsequently cooled by a water-jacket which surrounds the water-chamber, and thereby produces a vacuum. The valve-gear may be adjusted to cut off the steam at any point during the upward stroke of the piston by means of a trip. The piston is then forced downward by means of atmospheric pressure, the weight of the piston and its connections being counterbalanced.

In the drawings I have shown my motor attached to the driving or feeding shaft of a "mechanical stoker," to the operation of which it has been found to be particularly adapted. I do not, however, confine myself to this, as it is obvious to one skilled in the art that it can be adapted to operate other machinery as well which does not require a high pressure of steam without deviating from the principle of my device.

Having fully described the objects and the mode of operation of my invention, I will point out how I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of the motor, showing the valve-gear, check-valve mechanism, stoker connections, and pipe connections used to regulate the motor. The water-chamber *b*, chamber C, the cylinder *f*, the water-jacket E, and bed-plate *a* are shown in cross-section. Fig. 2 is a plan view of the bed-plate, chamber C, piston H, and trunnion support or standard *d*, other parts being removed. Fig. 3 is a top view of a device used to connect the motor to the driving-shaft of any device which it is desired to operate. Fig. 4 is a side view of a flat bar E^2, to which are attached the bell-crank lever c^3, spiral springs f^2 g^3, and pins for operating the trips. Fig. 5 is a side view of the bracket or frame to which are attached the parts of the valve-gear mechanism, and Fig. 6 is a plan view in perspective of my peculiar check-valve and pipe which is attached to the head of the chamber C.

Similar characters refer to similar parts throughout the several views.

The reference-letter *a* designates the bed-plate, to which are attached the water-chamber *b*, post *c*, trunnion-support *d*, valve-gear bracket *e*, and cylinder *f*, the whole constituting the framework of my motor. Steam is admitted into the chamber *b* through the angle globe-valve e^4. The water in the chamber *b* is forced downward therein and out through the pipe connections *g g*, producing a pressure against the bottom of piston H and causing the piston to make its upward

stroke. The piston has four lugs *i i* made integral therewith and projecting inwardly from the interior of the piston. These lugs are disposed diametrically opposite each other. A hole is drilled and tapped in the lugs, and collar-bolts *j j*, having square heads cut thereon, are screwed therein. The lower portion of the piston is turned to fit the cylinder, while its upper portion *k* is turned smaller in diameter than the inside diameter of the cylinder, thus leaving an area between the upper portion of the piston and the inside diameter of the cylinder for the purpose of inserting packing *x* therein. A piston-ring L, having a flange *m* extending downward and fitted to the inside of the cylinder, is attached to the piston by means of the collar-bolts *j j*, said bolts being inserted in slots cut in a circumferential flange m^2, made integral with the piston-ring L, said slots coinciding and corresponding with the lugs *i i* on the piston H. The piston-ring has a tapered rib or ring *n* made integral and extending upward, the purpose of which is to provide means whereby lubricant may be contained between the rib *n* and the side of the cylinder *f*. In the center of the piston a hole is drilled and a bolt *o* is inserted. A stud *z*, provided with upstanding lugs, is screwed on the bolt *o*, the lugs having apertures formed therein. A piston-rod *p* is then placed between the lugs of the stud *z* and is attached thereto by means of a bolt *y*, passing through each side of the slot and the boss or end of the piston-rod. The air-vent Q is inserted in the top of the piston. This air-vent is for the purpose of permitting the escape of any air or gas in the cylinder *f* when the piston is making its downward or inward stroke in order that such air or gas may not operate as a cushion to retard and prevent the descent of the piston into the cylinder *f*. The air-vent Q consists of a tube secured to and extending through piston H and formed with a bend or downward curve at its highest point, the free end terminating in a valve of any approved construction, which permits the air to escape from beneath the piston. The upper end of the piston-rod *p* is connected to one end of the walking-beam *r*, this beam having a slot cut in each end thereof for the purpose of receiving the upper ends of the piston-rod *p* and connecting-rod *s*. The beam *r* has a trunnion Z made integral therewith and projecting transversely from the center of the beam. This trunnion is fitted to and supported in bearings 3 in the trunnion-support *d*. The connecting-rod *s* is secured to the beam by means of a bolt passing through the aperture in the end thereof and through the end of the beam similarly to the piston-rod. The connecting-rod passes through and swings or reciprocates in a slot *u* cut in the bed-plate.

A split sleeve *v*, having projections *x' x'*, is bolted on the rod *s* where it passes through slot *u*, the projections on the sleeve being so arranged with reference to the slot that they will act as stops for the upward and downward stroke of the piston and beam by coming in contact with the sides of the slot. This split sleeve can be adjusted to correspond with the adjustment of the valve-gear mechanism presently to be described. The opposite end of the connecting-rod *s* is secured to a swinging lever *w*, which lever is provided with a slot 5. The connecting-rod is secured to the lever *w* by means of a bolt passing through the slot in the lever and an aperture in the end of the connecting-rod. The swinging lever *w* is slotted longitudinally at 5 and 10 to permit of the adjustment of the connecting-rod and increase the feed or rotation of the drive-shaft Y, supported in bearings in the swinging lever. An ear *z'* is formed at the free end of the lever, having a hole cut therein to permit a weight 4 of any suitable kind or size to be hung thereon to counterbalance the weight of the mechanism secured on the end of the piston-rod *p*. One or more pawls *a'* are inserted in a slot 6 formed in and longitudinally of the swinging lever *w* at a point in said lever that will bring the ends of the pawls in contact with the teeth of ratchet-wheel a^2, and a bolt 7 is passed through the opposite ends of the pawls to retain them in place on the swinging lever and form a pivot therefor.

The ends of the pawls that operate the ratchet-wheel a^2, which is keyed solidly on the driving-shaft Y, are made of different lengths, the purpose of which is to afford a means of regulating the rotation of the drive-shaft. By placing one pawl in contact with the ratchet-wheel the drive-shaft is rotated more or less, according to the pitch of the teeth. By placing two pawls in contact the rotation of the shaft is increased, each pawl increasing the rotation of the drive-shaft as it is thrown in contact with the ratchet-wheel.

The swinging lever *w* is attached to post *c* by means of a split sleeve *b'*. A slot 12, cut in said sleeve at right angles with the hole b^2 in said sleeve, affords a means for securing and retaining the swinging lever *w* in position on the post *c*. The sleeve *b'* can be adjusted on the post *c* to coincide with the adjustment of the mechanism of the valve-gear and piston. A bracket b^3, having two arms curved slightly in opposite directions and made integral therewith, is attached to the top and in the center of the walking-beam, these arms having adjusting-screws *c'* placed in the end thereof. Between the arms of said bracket a flange or upwardly-projecting lug c^2 is formed, having a slot formed therein longitudinally of the beam. A lever *d'* is secured to this flange by a bolt and is pivotally held in an upright position therein. The throw of this lever *d'* is regulated by the adjusting-screws *c'*. A connecting-rod c^8 is attached to the end of the lever *d'* and connects with the bell-crank lever c^3. This bell-crank lever is pivotally attached to the bracket *e*, at the end of the loop in the bracket, by means of a

bolt which passes through the angle of the bell-crank lever. The opposite end of the bell-crank lever c^3 is attached to the flat bar E^2, which is inserted in a slot c^7 formed in the top of the loop on the bracket e, the slot made to fit said bar, which latter passes through a similar opening in a guide e^3, secured on bracket e. To the flat bar E^2 a lug 8 is riveted. This lug extends away from the bar e^2 and has attached at its outer or free end the straight portion f' of a spiral spring f^2, the straight portion being inserted under a set-screw f^7 in the lug 8. This screw is used to adjust the tension of the spiral spring. Pins f^3 are inserted in slots cut in the flat bar E^2, which pins extend from the sides of the bar to operate the trips g', by means of which the admission of steam into the water-chamber b is regulated. The pins come in contact with the trips g' as the flat bar E^2 is reciprocated and operate the trips to close or open the angle globe-valve E^4 alternately by means of the spring-catch regulators h^3.

One end of the spiral spring f^2 is turned to form a hook and is inserted in a hole in the spring-catch lever H'. The opposite end of the lever H' is fulcrumed in the projecting arm H^2 of the bracket e. A second spiral spring g^3, having both ends turned to form hooks, is connected to the end of the lever H' and the end of the lever j', respectively, thereby providing a tension to sustain the levers H' and j' in position to automatically close and open the angle globe-valve E^4. Two square pins h^2 are placed in the levers H' and j', and as the valve-gear mechanism is operated by the motor these pins interlock with catch-springs h^3. These catch-springs are attached to the bracket e with the catch portion of each pointing in opposite directions and in direct alinement with each other.

To the lever H', at a point 9 close to the fulcrum, a rod J^2 is attached. The lower end of this rod is secured to the stem J^3 of the angle globe-valve E^4. The rod is apertured on both ends, and is secured to the lever H' and the valve-stem J^3, respectively, by means of bolts passing through the end of the rod and lever and the opposite end of the rod and valve-stem, respectively. An open cylinder f, having flanges cast on the top and bottom thereof, is bolted to the bed-plate a over the orifice of the pipe g. To the piston-rod p an arm or dog k' is attached. The dog when the piston is making its upward stroke comes in contact with the projecting lug k^2, attached to a swinging bar k^3, pivoted to an arm L' on the bracket e. Both ends of the bar k^3 are turned at right angles with the body portion of the bar. On one end of the bar a hole is drilled, into which a rod L^2 is inserted, the upper end of which rod is threaded and a weight L^3 secured thereon. The lower end of the rod passes through the bed-plate a and is adjusted by the collar L^4. A second weight L^5, having a slot cut in the bottom thereof, is placed on the bar or lever k^3 and slides thereon.

A rod m' is received in and projects through the opposite end of the bar K^3, which rod is provided with adjusting-nuts m^2, fitting on either side of the end of the bar k^3. The bar m' passes down through the sleeve n' and comes in contact with the top of the check-valve n^2. This rod m' is adapted to close and open the check-valve in the chamber C when the motor is in operation. An overflow-pipe o' projects upward from the bottom of the chamber C and keeps the water in said chamber at its proper level. The check-valve n^2 is constructed to fit the circumference of the relief-pipe o^2 and is placed on the top thereof. A hole o^3 is drilled through said check-valve transversely with the sides thereof and immediately under the cap. When the piston is making its downward stroke, the valve n^2 is forced upon and in contact with the lower end of the sleeve n' against the pressure of rod m'. The excess of water in chamber b flows through pipe o^2 and out through the holes o^3 in the valve n^2 into the chamber C and out through the overflow-pipe o'. When the piston is making its upward stroke, the rod p brings the dog k' in contact with lug k^2 on the lever k^3, causing the rod m' to press down on the top of the check-valve and close it.

The reference-letters E E represent a water-jacket through which water passes around the upper portion of the water-chamber b, the purpose of which is to rapidly condense the steam admitted by the valve E^4. Inlet and outlet pipes F and G, respectively, are provided for the entrance of the water into and from the jacket in pipe o^2. H^4 is an ordinary check-valve in pipe o^2. The water-chamber b is screwed and leaded to the bed-plate a and cap J.

The operation of my device is as follows: Steam is admitted to the chamber b through angle globe-valve E^4, the chamber b having previously been filled to the required height with water from any suitable source. The steam acting upon the water forces the latter out into pipes g and up against piston H. The relief-pipe o^2 is of course open, and a small percentage of the steam may at first escape into the chamber C. However, as the piston is forced upward by the pressure of water thereagainst the dog k' on the piston-rod p is brought into contact with the lug k^2, located on the swinging bar k^3. This contact operates to swing the bar k^3 on its pivot L' and force the rod m', carrying valve n^2, down upon the relief-pipe o^2. It will be seen that a very slight descent of the valve n^2 will suffice to close the apertures o^3. Furthermore, the adjustable weight L^5 is located to balance the lever k^3, so that the moment the dog k' raises the lever k^3 above the pivot L' the weight L^5 assists in closing valve n^2 and retaining it in closed position. Also the adjustment of rod m' may be so regulated that the valve will be closed almost immediately, if need be. The rod L^2 by means of the adjusting-nut L^4 operates to retain the lug k^2 in

a predetermined position to contact with dog k'. The piston may continue to ascend to the full limit of its stroke, the lug k^2 describing the arc of a circle about L′ as a center and being long enough to always remain in contact with the dog k' until on the instroke or downstroke the nut L^4 prevents the swinging bar k^3 from descending farther. Of course as the piston rises it actuates the walking-beam, forcing rods s downward until the lugs x' x' engage the bed a of the device. The split sleeve v, carrying lugs x' x', is adjusted on the rod s so that the lugs will contact with bed-plate a at the completion of the downward stroke of the walking-beam. The rod s of course forces the swinging lever w down on the arc of a circle on y as a center, and the pawls a' drop back on the teeth of ratchets a^2 to obtain a new hold. Simultaneously with the movement of the walking-beam the lever d', located between the adjusting-arms and screws b^3 b^3 and c' c', respectively, is oscillated until it comes in contact with one of the set-screws c', whereupon a longitudinal movement is communicated to rod c^8, drawing the lower arm of bell-crank lever c^3 outward and forcing the flat reciprocating rod E^2, which is connected to the other arm of bell-crank lever c^3, downward in its bearings c^7 E^3. It will be remembered that the levers H′ and j' are provided with square pins h^2, adapted to come in contact and be locked with catch-springs h^3. The drawing Fig. 1 shows the pin h^2 on lever H′ in contact with the catch-spring. Now as the flat bar E^2 descends the upper one of the adjustable pins f^3 is brought into contact with the upper catch-hook g'. This hook is forced down against the upper catch-spring h^3 and presses the said spring-catch backward to release the pin h^2 on lever H′. At the same time the pin h^2 on lever j' is engaging and becoming locked by the lower catch-spring h^3. This last is caused by the central pin f^3, which is in contact with lever j' and forces it down, the pin h^2 sliding on the inclined surface of lower catch-spring h^3 and finally becoming locked therewith. As soon as the pin h^2 on lever H′ is released from contact with the upper catch-spring h^3 the tension of spring g^3 is permitted to exert itself on lever H′ to rock it downward on its pivot H^2. This action closes the angle globe-valve E^4 through rod J^2, which is pivoted to lever H^2. As soon as the steam is cut off, a reversal of the above operations, the water in water-jacket E operates to cool the steam and condense the moisture thereof. This creates a vacuum in chamber b, and the water column in pipes g and piston-cylinder A, which has commenced to return, having been forced above its level by the steam, is quickly returned to chamber b and piston H descends by reason of the atmospheric pressure thereon. Any air caught beneath the piston is allowed to escape through air-vent q. In order that there may be no air-cushion when the piston descends, the walking-beam is actuated to raise rod s until the lower studs x' x' contact with the lower side of the bed-plate a. This movement of the rod s raises the swinging lever W, and the pawls engaging the ratchet-teeth revolve the shaft y. At the same time lever d' has come in contact with the opposite one of said adjusting-screws c' the rod c^8 is operated to give the bell-crank lever an inward and upward movement which carries with it the flat bar E^2. When this flat bar moves upward, the lower catch-hook g' is brought against lower catch-spring h^3 by means of lower pin f^3 to compress the spring and release pin h^2 on lever j', the tension of spring g^3 is released and tends to draw up lever j', and as the flat bar is moving upward tension is brought to bear on lever H′ by spring f^2, thereby raising the lever, which in turn raises rod J^2 and opens the angle globe-valve E^4. As the piston H descends or makes its instroke, the water meanwhile refilling chamber b, any excess of water will be forced out through pipe o^2 and, raising valve n^2 until the apertures o^3 are above the level of pipe o^2, will discharge therethrough into the chamber C, which is provided with an overflow-pipe to permit the water to escape. It will be understood, therefore, that the dog k' by supporting lug k^2 tends to retain the valve n^2 in closed position against the pressure of the steam on the upstroke and only admits of the valve being opened by the pressure of the water in chamber b when the dog k', owing to the descent of the piston, has reached a point parallel with pivot L′ of lever K^3 and allows the water to commence to raise the valve n^2. The opening of the valve and the length of the stroke thereof are regulated both by set-screw L^4 on rod L^2 and also by lock-nuts m^2 on rod m'.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an automatic motor, the combination with a fluid-chamber, and a cylinder, of pipes connecting the chamber and cylinder, a piston in the cylinder, means for intermittently causing the fluid to actuate the piston, mechanism actuated by the piston for controlling the fluid-pressure, and an escape-valve for the excess of fluid.

2. In an automatic motor, the combination with a cylinder and piston operating therein, of a fluid-chamber, communications between the cylinder and chamber, means for causing the fluid in the chamber to force the piston in one direction, means surrounding the cylinder for causing a vacuum therein whereby the piston makes its return stroke by atmospheric pressure and means operated by the piston for intermittently permitting the admission of pressure to the fluid in the fluid-chamber.

3. In a motor, the combination with a cylinder, a piston operating therein, and a fluid-chamber in communication with the cylinder, of a cooling means surrounding the chamber, positive means for actuating the piston in one

direction, the positive means being intermittently cut off from the fluid-chamber, the cooling means acting upon the positive means whereby a vacuum is created in the fluid-chamber thereby allowing the piston to be returned to its original position by atmospheric pressure.

4. An automatic motor comprising a bed-plate, a cylinder and a fluid-chamber attached thereto, connections between the chamber and cylinder, a piston in the cylinder, positive means for intermittently actuating the piston in one direction, means operated by the piston for controlling the positive means and means acting on the positive means for causing a vacuum in the fluid-chamber whereby the piston is moved in the opposite direction by atmospheric pressure alone.

5. An automatic motor consisting of a bed-plate, a removable fluid-chamber suitably packed, secured thereto, a removable cylinder, a piston therein, connections between the chamber and cylinder, means for positively actuating the fluid in the chamber whereby to drive the piston in one direction, means operated by the piston to control the admission of the first-named means into the fluid-chamber, and a cooling means operating on said first-named means whereby to create a vacuum in the fluid-chamber and permit atmospheric pressure to return the piston to its original position.

6. In a motor, a water-chamber, a steam-inlet a water-jacket surrounding the water-chamber, cylinder open at one end, a piston operating in the cylinder, pipe connections between the water-chamber and the cylinder, means for intermittently causing a jet of steam to enter the water-chamber, whereby the water therein is forced through the pipes and against the piston to give it a positive impulse in one direction, the water-jacket meanwhile condensing the steam to form a vacuum in the water-chamber in order that the piston may be returned to its former position by means of atmospheric pressure.

7. A motor consisting of a water-chamber and a cylinder, pipes connecting the two, a piston operating in the cylinder of means for giving the piston a positive impulse in one direction, means for creating a vacuum in the water-chamber to allow atmospheric pressure to return the piston to its original position and an outlet from the water-chamber, the outlet provided with an intermittently-actuated valve for permitting the escape of water therefrom.

8. A motor provided with an air-tight water-chamber, a cylinder and piston, pipe connections between the cylinder and the water-chamber, and means for causing the actuation of the piston of an auxiliary chamber connected to the water-chamber, an air-tight valve in the auxiliary chamber, governing the outflow of water from the water-chamber, and an overflow-pipe for conducting away the surplus water.

9. An automatic motor operated by steam and atmospheric pressure, a fluid-chamber, a cooling means surrounding the fluid-chamber, a cylinder, a piston therein, and means of communication between the chamber and cylinder whereby steam entering the chamber forces the fluid therein against the piston to impel it in one direction, the cooling means operating to create a vacuum in the chamber whereupon the piston is returned to its first position by atmospheric pressure.

10. In a motor, a bed-plate having a trunnion-support attached thereto, a walking-beam journaled in bearings on the trunnion-support, a bracket secured on the walking-beam, the bracket provided with arms slightly curved, adjusting-screws fitted in the arms, a flange between the arms of the bracket and a lever journaled in the flange, the throw of the lever being regulated by the adjusting-screws, a fluid-chamber, a cylinder, means of communication between the chamber and cylinder, a piston in the cylinder connected to the walking-beam, means for actuating the piston and mechanism connected to the lever whereby to control the actuating means.

11. In a motor, a piston having a slotted stud-bolt attached to the end thereof, means for actuating the piston, a piston-rod, a walking-beam to which the rod is secured a bracket attached to the beam, a lever d', connected with the bracket, a bell-crank lever, a rod connecting the first-named lever and the bell-crank lever, the latter secured to a bracket e, the bracket e, provided with guides, a bar E^2 inserted in the guide, the bar having slots cut therein adapted to receive adjustable pins, and trips operated by said pins whereby the actuating means is controlled.

12. An automatic motor provided with a cylinder and a piston therein, a bracket mounted on the motor, arms pivotally attached to the bracket, spring-catches on the bracket, a bar slidably connected to the bracket, pins on the bar and on the arms, the pins on the arms adapted to engage the spring-catches trips pivoted on the bracket adapted to engage the catch-springs, the pins on the bar adapted to engage the trips whereby to release the levers from engagement with the catch-springs, one of the pins on the bar adapted to engage one of the arms, springs connecting the arms and the bar, a valve for admitting operating means whereby to actuate the piston, means on one of the arms for controlling the valve, a walking-beam connected to the piston, and means of connection between the sliding bar and the walking-beam, whereby the piston controls the admission of actuating power to itself.

13. In a motor of the character described provided with a water-chamber, cylinder and piston a bracket, spring-catches secured to the bracket the ends of the catches pointing in opposite directions, trips secured to the bracket, levers pivotally attached to the bracket and pins on the levers for engaging

the spring-catches, a sliding bar connected to the bracket, means on the sliding bar to engage the trips and one of the levers, whereby to release the levers from engagement with the spring-catches, means connecting the levers with each other and the sliding bar, means secured to one of the levers to control the actuation of the piston, a rocking member, connections between the rocking member and the piston and between the rocking member and the sliding bar whereby the reciprocation of the piston controls the actuating mechanism therefor.

14. A motor of the character described provided with a water-chamber, an auxiliary chamber, a cylinder and piston, a bracket, levers attached to the bracket, a rod connected to one of the levers, the rod secured to a valve-stem and adapted to open and close the valve alternately, a rocking member connected to the piston, a sliding bar on the bracket connected to the rocking member, means on the sliding bar for operating the levers, whereby a jet of steam is injected into the water-chamber to positively actuate the piston.

15. In a motor of the character described provided with a water-chamber, an auxiliary chamber, a cylinder and piston, a piston-rod attached to the piston, a dog or arm projecting from the rod, a lever with which the arm contacts when the piston is on its upward stroke, weights on the lever, a rod m', attached to one end of the lever, a valve in the auxiliary chamber to which the rod m' is attached, a rod L^2, attached to the opposite end of the lever, the latter rod adapted to fit in a hole in the bed-plate, and an adjustable collar fitted thereon to limit the oscillation of the lever.

16. A motor, having a closed chamber C, attached to the bed-plate, a sleeve n', fitted in the head of the chamber, and projecting downward thereinto, a rod m', adapted to be received in the sleeve, a check-valve controlled by the rod, the valve provided with holes drilled immediately under the cap thereof a pipe o^2, over which the valve is fitted, a lever to which the rod is connected, a lug on the opposite end of the lever, a cylinder and a piston reciprocating therein, a piston-rod, a dog on the piston-rod adapted to engage the lug on the lever to close the valve, and adjustable means for controlling the movements of the lever.

17. An automatic motor provided with a bed-plate, supports for the bed-plate, a fluid-chamber, a cylinder, a piston reciprocating therein, means connecting the cylinder and chamber, means in connection with the chamber for operating the piston, a walking-beam operated by the piston, a swinging lever connected to the walking-beam a revoluble shaft, and means actuated by the swinging lever for rotating the shaft.

18. An automatic motor provided with a fluid-chamber, a cylinder communication between the cylinder and chamber, a piston in the cylinder, a walking-beam operated by the piston, an auxiliary chamber connected with the fluid-chamber, a valve operated by the piston for governing the connection between the auxiliary and fluid chambers, a valve for admitting steam into the water-chamber whereby to operate the piston, and means controlled by the piston for actuating the steam-valve.

19. An automatic steam-motor provided with a fluid-chamber adapted to receive steam therein, a cylinder open at one end, a piston therein adapted to be moved in one direction by the steam-impelled fluid, a cooling means surrounding the fluid-chamber adapted to cool the steam and create a vacuum in the fluid-chamber whereby the atmospheric pressure acting on the outer face of the piston returns the latter to its former position, the steam prevented from coming in contact with the lower face of the piston by means of the intervening fluid.

20. An automatic motor operated by steam and atmospheric pressure, a bed-plate, a fluid-chamber, connected thereto, a water-jacket surrounding the fluid-chamber, the jacket integral with the bed-plate, a cylinder, a piston therein, and means of communication between the chamber and cylinder whereby steam entering the chamber forces the fluid therein against the piston to impel it in one direction, the water-jacket operating to create a vacuum in the chamber whereupon the piston is returned to its first position by atmospheric pressure.

21. An automatic motor comprising a fluid-chamber, a cylinder connected therewith, a piston in the cylinder, means for actuating the piston, an overflow-chamber also connected with the fluid-chamber by means of piping, the overflow-chamber provided with a cover, a sleeve on the cover extending into the chamber, an overflow-pipe, an air-tight valve for the pipe connection, provided with side inlets, an adjustable rod operating the valve, the rod received in the sleeve, a lever secured on the motor to which the rod is attached, the opposite end of the valve adapted to be actuated by the reciprocations of the piston to open and close the valve.

22. In a motor the combination with a water-chamber, and cylinder, of pipes connecting the two, a piston in the cylinder, the diameter of the piston being smaller at its upper than at its lower end, packing between the piston and cylinder, a packing-ring, secured to the piston, an air-vent in the piston, a walking-beam to which the piston is connected, an impelling means by which the water in the water-chamber is forced against the piston to positively actuate it in one direction and operate the walking-beam and means actuated by the walking-beam for controlling the admission of the impelling force to the fluid-chamber.

23. The combination in a motor, provided with a bed-plate of a cylinder, a piston in the

cylinder, a water-chamber connected to the cylinder, means for forcing the water contained in the chamber against the piston, a walking-beam operated by the piston a connecting-rod secured to the other end of the walking-beam, and extending through a slot in the bed-plate, a swinging lever attached to the connecting-rod, means on the lever to counterbalance the weight of the piston and an adjustable split sleeve V, on the rod, the sleeve provided with stops which contact with the bed-plate whereby to limit the length of stroke of the connecting-rod and means actuated by the walking-beam to control the admission of the motive power into the fluid-chamber.

24. An automatic motor comprising a bed-plate, a fluid-chamber removably secured thereto, a cylinder and an overflow-chamber connected with the fluid-chamber by suitable pipes, a piston in the cylinder, a walking-beam supported on the bed-plate and operated by the piston, a revoluble shaft, a swinging lever pivoted on the shaft, a rod connection between the walking-beam and the swinging lever means on the lever for rotating the shaft, and means controlled by the piston for admitting motive power to the fluid-chamber.

Signed by me at Mansfield, Ohio, this 12th day of July, 1900.

DAVID HURST.

Witnesses:
N. T. HURST,
R. W. HARTMAN.