(No Model.) 2 Sheets—Sheet 1.

M. GREENWOOD.

VALVE GEAR.

No. 446,406. Patented Feb. 10, 1891.

FIG. 2.

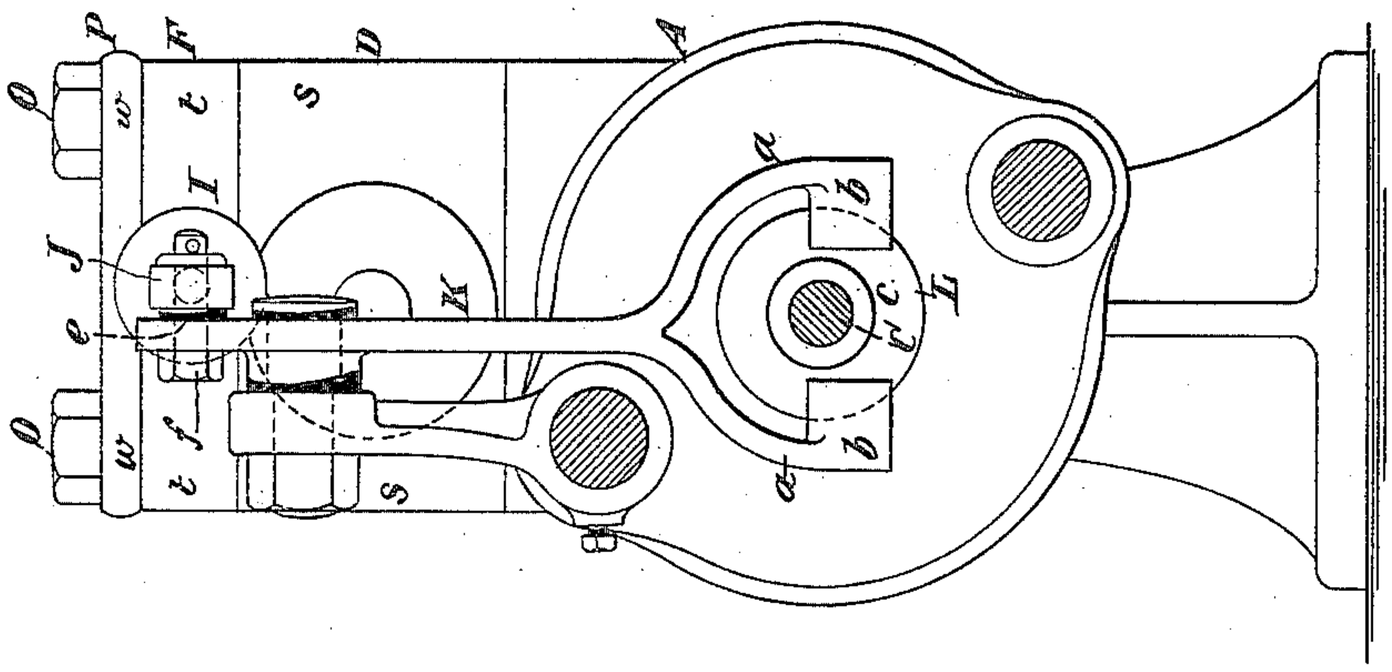
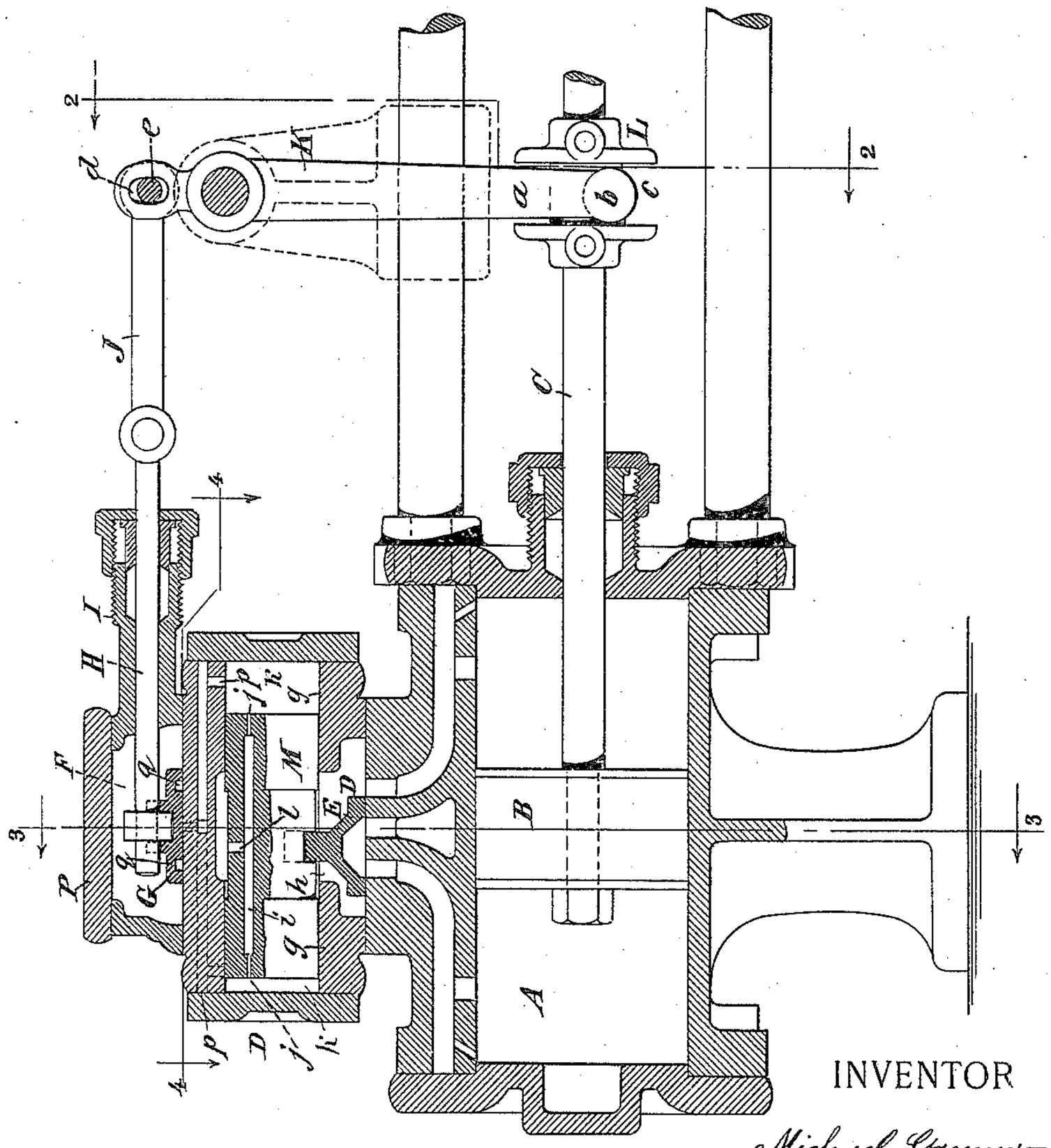


FIG. 1.



INVENTOR

Michael Greenwood,

By his Attorneys,

Arthur G. Fraser & Co.

WITNESSES:

John Becker

C. K. Fraser.

(No Model.) 2 Sheets—Sheet 2.

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FIG. 4.

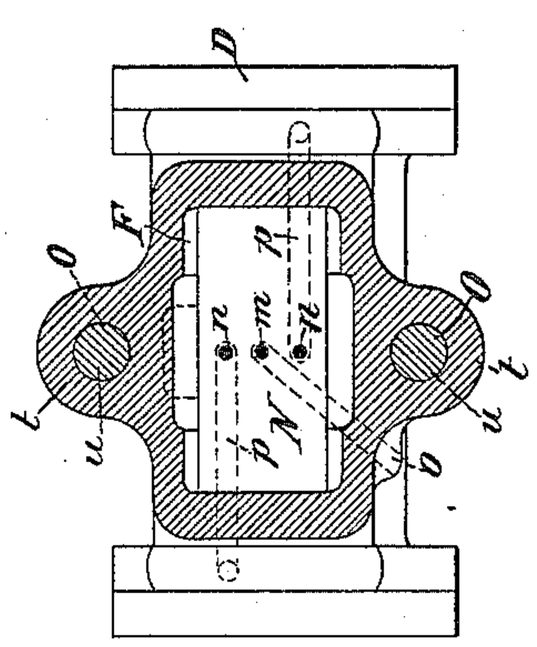


FIG. 5.

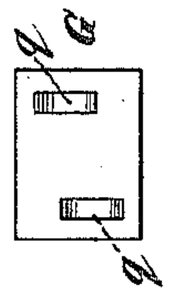
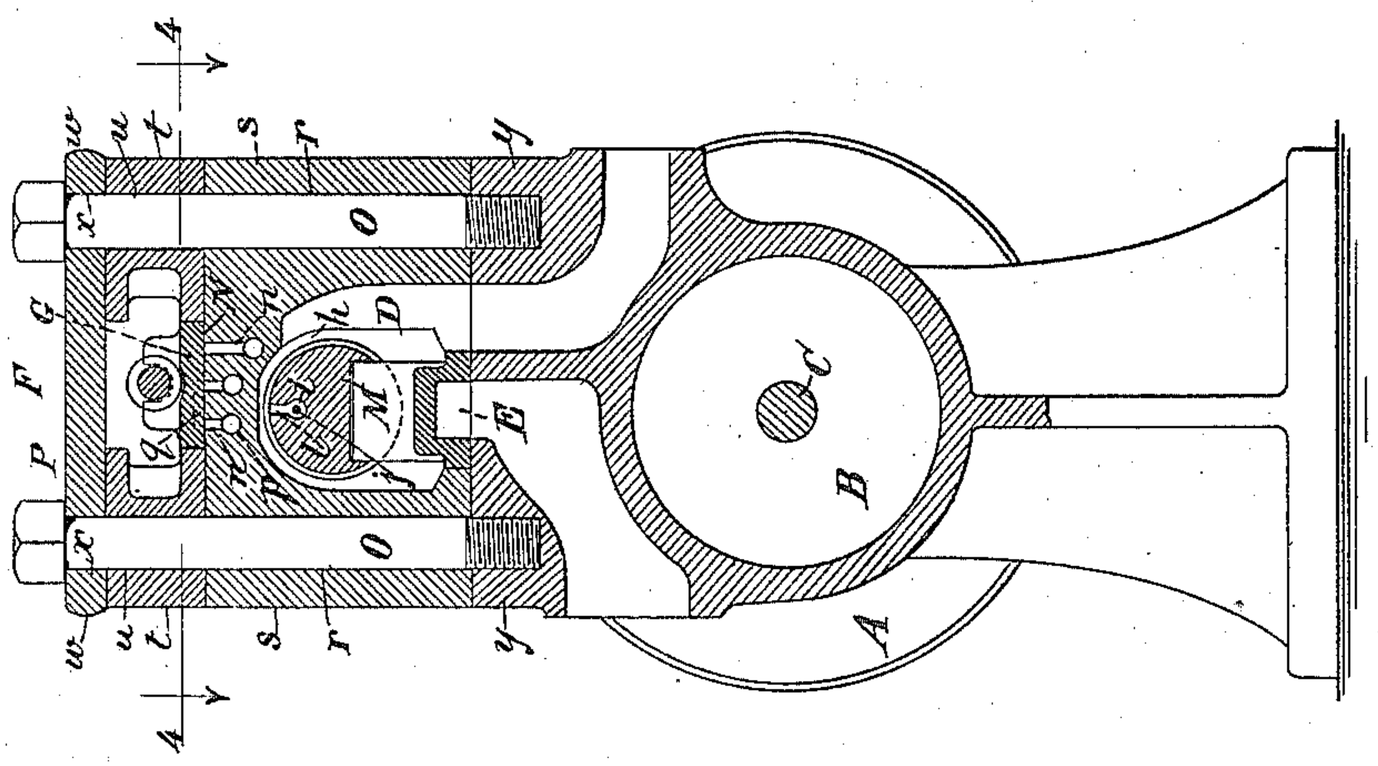


FIG. 3.



WITNESSES:
John Becker
C. K. Fraser.

INVENTOR:
Michael Greenwood,
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Arthur G. Fraser & Co.

UNITED STATES PATENT OFFICE.

MICHAEL GREENWOOD, OF BELLEVUE, DELAWARE, ASSIGNOR TO THE HALL STEAM PUMP COMPANY, OF PLAINFIELD, NEW JERSEY.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 446,406, dated February 10, 1891.

Application filed December 20, 1889. Renewed January 20, 1891. Serial No. 378,456. (No model.)

To all whom it may concern:

Be it known that I, MICHAEL GREENWOOD, a citizen of the United States, residing at Bellevue, in the county of New Castle and State of Delaware, have invented certain new and useful Improvements in Valve-Gear, of which the following is a specification.

This invention relates to that class of valve-gearing for steam-engines wherein the main slide-valve controlling the ingress and egress of steam to the power-cylinder is steam-actuated, and wherein the steam for actuating the main slide-valve is controlled by an auxiliary slide-valve operated by mechanical connection with a moving part of the engine. The present improvements on this character of valve-gear are especially applicable to steam pumping-engines, and are designed to meet the requirements of this class of engines.

The present improvements consist in the special construction of the main valve, the arrangement of the ports between the main valve and the auxiliary controlling-valve, the means for connecting the two valve-chests to the steam or power cylinder, and in the mechanical connection between the auxiliary valve and the moving part of the steam-engine, which in this case is the piston-rod.

The improvements are illustrated in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of the steam-cylinder of a pumping-engine. Fig. 2 is a vertical cross-section in a plane indicated by the line 2 2 in Fig. 1. Fig. 3 is a partial vertical cross-section in a plane indicated by the line 3 3 in Fig. 1. Fig. 4 is a plan view of the valve-seat for the auxiliary valve. Fig. 5 is a bottom view of the auxiliary valve.

A is the steam or power cylinder. B is the piston thereof.

C is the piston-rod.

D is the steam-chest of the main valve.

F is the valve-chest of the auxiliary valve, and G is the sliding auxiliary valve.

The auxiliary valve G is connected rigidly to its reciprocating valve-rod H, which extends outwardly through an elongated stuffing-box I, and is connected by a link J to the short arm of an oscillating lever K. The long lower arm of this lever is forked, and the two forks *a* are each provided with an inwardly-projecting rounded stud *b*. The two rounded studs enter on opposite sides and fit into the annular groove *c* of the collar L, which is rigidly secured to the piston-rod C. Owing to this construction the lower end of the lever will be moved back and forth with the piston-rod, while the grooved collar and the therein entering studs permit the vertical movement of the lower end of the lever and at the same time insure a constant close fit between the piston-rod and lever. The connection between the upper short end of the lever K and the link J is an adjustable one, so as to allow a variable extent of travel to the auxiliary valve G. The upper end of the lever K is provided with a longitudinally-extending elongated slot *d*, in any desired portion of which a transverse bolt *e* is held by a locking-nut *f*. On a part of this bolt the link J is pivotally hung.

The main slide steam-actuated valve E is connected to an actuating balanced piston M, which fits and slides in cylindrical portions *g g* at opposite ends of the steam-chest D. The central portion of this piston is recessed around its entire periphery, and this central annular recess *h* is in constant communication with that portion of the steam-chest into which the live steam enters. The main-valve-actuating piston is formed with a steam duct or passage *i* extending longitudinally through it, said duct or passage having contracted openings or ports *j j* at opposite ends of the piston, through which contracted openings or ports the said duct or passage communicates with balancing spaces or chambers *k k* in the steam-chest beyond the respective ends of the piston. The duct or passage *i* is at its central portion in constant free communication with the live steam by means of a transverse duct *l*, which opens into the annular space *h*. The live steam can thus freely enter the duct *i*, but is retarded and hindered in passing therefrom into the balancing spaces or chambers *k k* at opposite ends of the valve-actuating piston by reason of the reduced size of the contracted ports *j j*. Both ends of the piston being in constant communication with the live steam it is consequently normally a balanced piston.

The valve-seat N of the auxiliary slide-valve G is provided with a central exhaust-port *m* and two live-steam ports *n n* on opposite sides of the exhaust-port. An exhaust-passage *o* leads from the exhaust-port to the air or a condenser, and oppositely-extending passages or ducts *p p* lead from the live ports *n n*, respectively, to the two spaces or chambers *k k* at opposite ends of the main-valve-actuating piston. To provide for cushioning the piston the ducts *p p* open into the spaces or chambers *k k* a short distance from the extreme ends of the chest D. The ports *m n n* are approximately the same in length as in width, being preferably circular, and in cross-section each should have an area approximately equal to that of the duct *i* in the main-valve-actuating piston.

The auxiliary valve G has on its under side two transverse ports *q q*, respectively, near the opposite ends of the valve, the longitudinal distance between the axes of these ports being substantially equal to the normal extent of travel of the valve. The width of each port *q* is substantially equal to the diameter of one of the ports *m n n*, and the length of each port *q* is equal to the distance between the exhaust-port *m* and one of the live ports *n* increased by the diameter of one of the ports. The two ports *q q* extend, respectively, in opposite directions from the longitudinal axis of the valve, so that when the valve reaches the limit of its travel in one direction it establishes communication between one live port *n* and the exhaust, and when it reaches its limit of movement in the opposite direction communication is established between the other live-steam port and the exhaust. It will be observed that during the intermediate portions of the travel of the auxiliary valve the ports *m n n* are all closed, and that it is only just at the ends of the travel of the valve that the ports are uncovered. When the auxiliary valve reaches its limit of motion in one direction, communication is established between the exhaust and one of the spaces or chambers *k k* at one end of the main-valve-actuating piston, thus relieving the pressure at that end. The piston is consequently moved in that direction by the excess of steam-pressure at its opposite end. The movement of the piston closes the opening leading from the spaces or chambers *k* into the duct *p*, and the pressure at opposite ends of the piston is equalized by the live steam passing through the contracted ports *j j* and equilibrium is restored, so that when the auxiliary valve reaches its limit of travel in the opposite direction (thus relieving the pressure at the other end of the piston) the first action is repeated.

Owing to the described construction the main valve shifts only at the proper intervals and at the same time the auxiliary valve is a constantly moving one, so that the movements of the valves are effected without employing tappets, springs, or other noisy or striking devices.

The various parts of the steam-chest D and the valve-chest F are constructed so that they can all be securely fastened to the power-cylinder A by the employment of two through-bolts O O.

The steam-chest D is formed of a solid casting having two vertical passages *r r* for the insertion of the bolts formed in lateral ribs *s s* on the casting. The valve-chest F is formed with its sides and ends in a single hollowed casting, and is formed with laterally-extending ears or ribs *t t*, having bolt-passages *u u* in line with the passages *r r*, and the top plate or cover P of the valve-chest is provided with laterally-extending ears or ribs *w w*, having bolt-holes *x x* in line with the passages *u u*, so that the same bolts secure the valve-chest and its top plate in position. The bolts screw into ears *y y* on the sides of the steam or power cylinder, so as to retain the casting in place. This construction renders the parts readily and economically attachable and detachable.

I claim as my invention—

1. A valve-seat having a central exhaust-port and two live-steam ports on each side of said exhaust-port, in combination with a slide-valve having two transverse ports near its opposite ends, said ports extending in opposite directions from the longitudinal axis of said valve, the longitudinal distance between said ports being substantially equal to the extent of the travel of the valve, and each port being long enough to reach from said exhaust-port to one of said live-steam ports, substantially as set forth.

2. The main valve of a steam-cylinder, a balanced actuating-piston therefor having a longitudinally-extending duct in constant communication with the live steam and communicating at opposite ends with balancing spaces or chambers at the respective ends of the piston, in combination with a valve-seat having a central exhaust-port and two live-steam ports on each side of said exhaust-port, said two live ports communicating with said balancing spaces or chambers, respectively, and an auxiliary slide-valve having two transverse ports near its opposite ends, said ports extending in opposite directions from the longitudinal axis of said auxiliary valve, the longitudinal distance between said ports being substantially equal to the extent of the travel of said auxiliary valve, and each port being long enough to reach from said exhaust-port to said live-steam port, substantially as set forth.

3. The main valve of a steam-cylinder and a balanced actuating-piston therefor having a longitudinally-extending duct in constant communication with the live steam, said duct having contracted ports at opposite ends of the piston communicating with spaces or chambers at the respective ends of the piston,

in combination with a valve-seat having a central exhaust-port and two live-steam ports on each side of said exhaust-port, said two live ports communicating with said balancing spaces or chambers, respectively, and a constantly-moving auxiliary slide-valve having two transverse ports near its opposite ends, said ports extending in opposite directions from the longitudinal axis of said auxiliary valve, the longitudinal distance between said ports being substantially equal to the extent of the travel of said auxiliary valve, and each port being long enough to reach from said exhaust-port to one of said live-steam ports, substantially as set forth.

4. The steam-actuated main valve of a steam-cylinder, the reciprocating piston, and the piston-rod, in combination with a constantly-moving auxiliary valve which controls the movement of said main valve, said constantly-moving valve being mechanically connected with said piston-rod so as to move in unison therewith, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

MICHAEL GREENWOOD.

Witnesses:

GEORGE H. FRASER,

JNO. E. GAVIN.