No. 731,929. PATENTED JUNE 23, 1903.

W. MAY.

DIRECT ACTING PUMPING ENGINE.

APPLICATION FILED DEC. 1, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

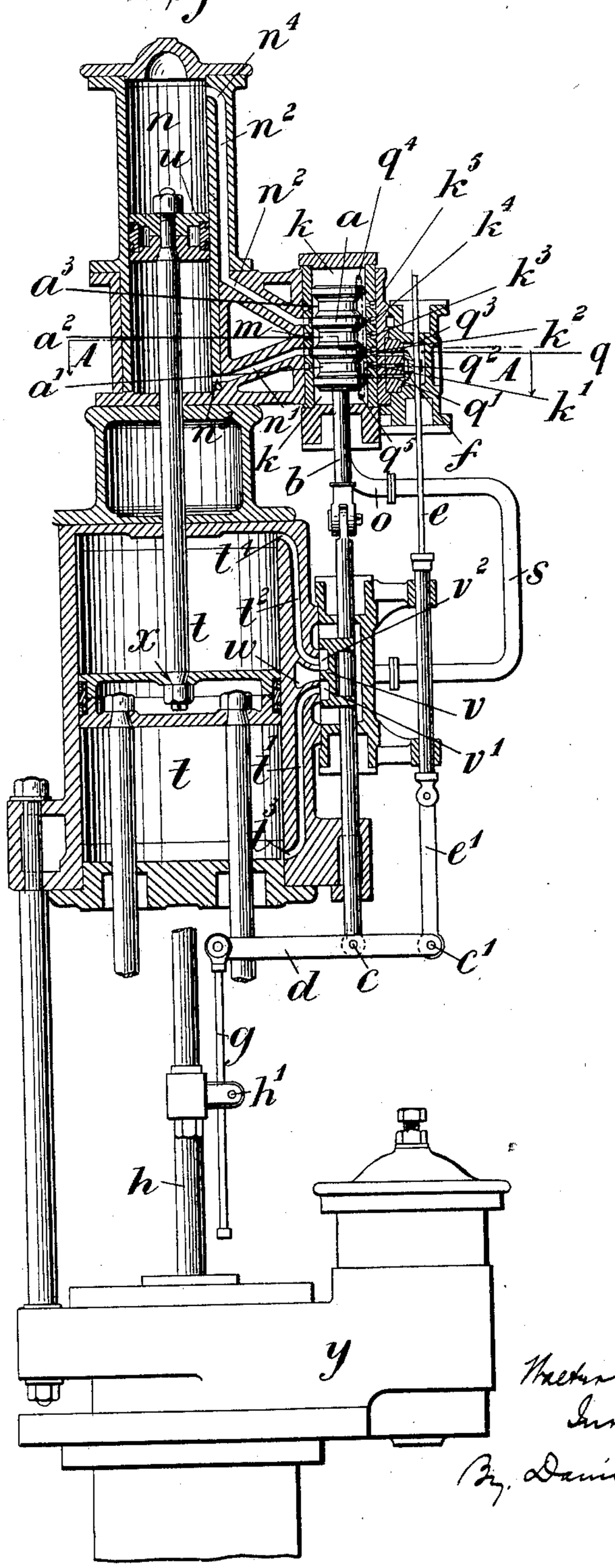

Fig. 3.

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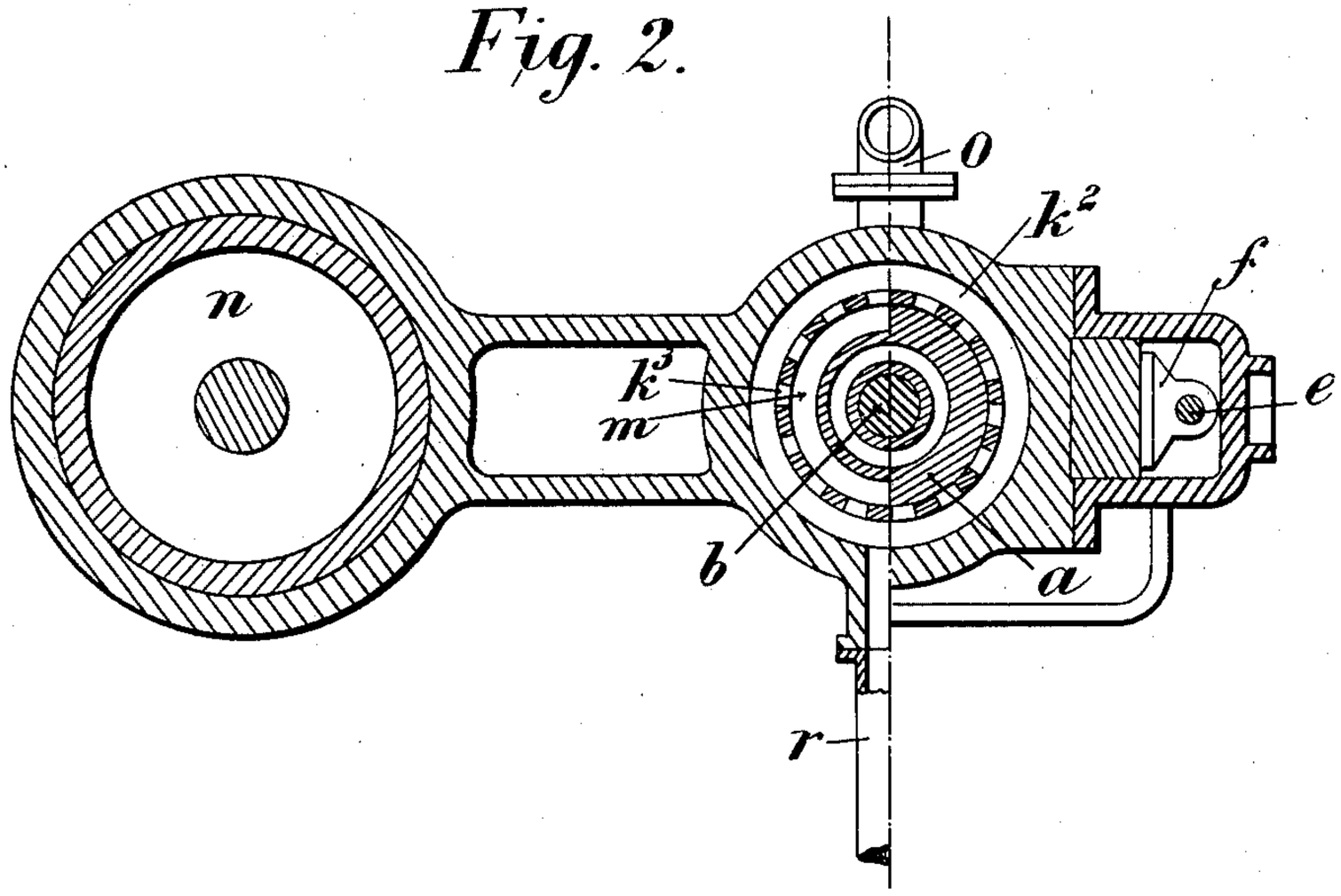
Fig. 2.



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No. 731,929. Patented June 23, 1903.

UNITED STATES PATENT OFFICE.

WALTER MAY, OF READING, ENGLAND, ASSIGNOR TO THE PULSOMETER ENGINEERING COMPANY, LIMITED, OF READING, ENGLAND.

DIRECT-ACTING PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 731,929, dated June 23, 1903.

Application filed December 1, 1902. Serial No. 133,339. (No model.)

To all whom it may concern:

Be it known that I, WALTER MAY, a subject of the King of Great Britain and Ireland, residing at Reading, in the county of Berks, England, have invented Improvements in Direct-Acting Pumping-Engines, of which the following is a specification.

This invention has reference to direct-acting pumping-engines wherein the supply of steam to the engine-cylinder or to the high-pressure cylinder in the case of a compound or multiple-expansion engine is directly effected by a main valve of piston type arranged within a cylindrical valve-chest and caused to move to and fro by means of steam that is admitted to and exhausted from the respective ends of the valve-chest by the action of an auxiliary or pilot valve actuated at the required times from a moving part of the engine. In a pumping-engine of this kind according to the present invention the movements of the valve-gear are cushioned by causing the main valve at each endwise movement thereof to close the admission-port to the corresponding end of the valve-chest toward which it is moving before it reaches the end of its stroke and the initial movement of the said valve in the opposite direction is effected positively from a moving part of the engine until such valve uncovers the said admission-port, whereupon it will be actuated by steam admitted to the said end of the valve-chest by the operation of the pilot-valve, this valve afterward acting to open the said end of the main-valve chest to exhaust and admit steam to the opposite end of the main-valve chest.

In the accompanying illustrative drawings, Figure 1 is a vertical section of so much of a direct-acting compound pumping-engine as is necessary to illustrate the nature of the present invention. Fig. 2 is a horizontal section on the line A A of Fig. 1. Fig. 3 is a detail view of a pilot-valve and part of the valve-face upon which it works.

In the arrangement of valve-gear shown, a is the main valve, connected through its rod b to an intermediate portion c of a floating lever d, one end of which is connected, as through a link e', to the rod e of the pilot-valve f and the other end of which is connected to a tappet-rod g, adapted to be operated at the required times by a moving part of the pumping-engine—for example, by a projection h' on the pump-rod h. The main valve a is formed with three annular grooves a' a^2 a^3 and is arranged to work in a cylindrical valve-chest k, formed with five annular sets of ports k' k^2 k^3 k^4 k^5. The central set of ports k^3 constantly communicate with a live-steam inlet m and with the central annular groove a^2 in the valve a. The two sets of ports k^2 k^4 that are next the central set and are at opposite sides thereof, communicate with the respective ends of the main cylinder n by the passages n' n^2, respectively, and over them the central groove a^2 of the main valve a is alternately brought, and the two extreme sets of ports k' k^5 are in communication with an exhaust-pipe o, each of these sets of ports being placed in communication with the set of ports k^2 or k^4, leading to the corresponding end of the main cylinder n through the corresponding outer annular groove a' or a^3 in the main valve a when this valve is moved in a direction from the set of exhaust-ports k' or k^5 to the cylinder-ports k^2 or k^4.

The pilot-valve f, shown as a circular slide-valve, is arranged to work in a valve-chest q, that is in communication with the steam-supply—as, for example, through a pipe r—and is formed with three ports q' q^2 q^3. The lower port q' communicates with the upper end portion of the main-valve chest k through a port q^4, arranged at a little distance from the extreme upper end of such chest. The upper port q^3 communicates with the lower end portion of the main-valve chest k through another port q^5, arranged at a little distance from the extreme lower end of such valve-chest, and the intermediate port q^2 communicates with the exhaust pipe or passage o of the main cylinder n, or with the steam-receiver s between the high and low pressure cylinders n and t in the case of a compound engine, as in the example shown, where the port q^2 is in communication with the steam-receiver s through the exhaust pipe or passage o.

As will be seen, the arrangement is such that, assuming the main valve a to be in its lower position, in which it admits steam to

the lower end of the main cylinder n through the passage n', it will be held in that position by steam admitted to the upper end of the main-valve chest k through the top admission-port q^4 and the passage q', controlledby the pilot-valve f. Upon the main piston u in the engine-cylinder n nearing the end of its upward stroke the tappet-rod g will be struck by the moving part h' on the pump-rod h and will operate the floating lever d and cause it to turn about its point of connection c with the rod b of the main valve a and operate the pilot-valve f, so as to cause the same to descend and place the upper end portion of the main-valve chest k in communication with the exhaust-passage o through the ports and passages q' and q^2 and the cavity f' in the pilot-valve and at the same time place the passage q^3, leading to the lower end of the main-valve chests k, in communication with the steam-supply. The floating lever d will then turn about its point of connection c' with the link e' of the rod e of the pilot-valve f and positively raise the main valve a through its rod b until it uncovers the lower steam-admission port q^5 to the main-valve chest k, whereupon steam will be admitted to the said chest through that port and cause the main valve a to complete its upward stroke and place the upper end of the cylinder n in communication with the steam-supply passage m through the passage n^2, the passage a^2 in the valve a, and the set of ports k^3, the main valve acting to close the top steam-admission port q^4 to the upper end of the main-valve chest before completing its stroke, so that the steam thereby confined between the said main valve and the top of the valve-chest will act to cushion the valve and attached parts. The main piston u will now make its downstroke, and upon nearing the lower end thereof the floating lever d will be operated in the reverse direction by the tappet-rod g and moving part h', so as to first turn about its point of connection c with the rod b of the main valve a and move the pilot-valve f upward, so as to place the lower end of the main-valve chest k in communication with the exhaust-passage o through the passages q^3 q^2 and the valve-cavity f' and at the same time place the passage q', leading to the upper end of the main-valve chest, in communication with the steam-inlet passage m through the valve-chamber q, after which the said lever d will turn about its point of connection c' with the link e' of the pilot-valve rod e and positively depress the main valve a until it uncovers the admission-port q^4 to the top of the main-valve chamber k, whereupon steam will be admitted to the upper end of this chamber and cause the said main valve to complete its downward stroke and again place the lower end of the main cylinder n in communication with the steam-supply passage m through the passages n' and a^2 and ports k^3, the main valve a acting to close the lower steam-admission port q^5 before reaching the end of its downstroke, so that the steam confined between it and the lower end of the valve-chamber will act, as before, to cushion the valve and attached parts.

In the case of a compound engine, as shown, the slide-valve v of the low-pressure cylinder t is or may be a flat slide-valve, as shown, fixed to the main-valve rod b and formed with two cavities v' v^2 in its face, each for placing one end of the low-pressure cylinder in communication with a central exhaust-passage w, steam being admitted over the ends of the valve to the steam-ports t' t^2, leading to the lower and upper ends, respectively, of the low-pressure cylinder t.

In a compound direct-acting pumping-engine according to this invention the steam-ports n^3 n^4 at the lower and upper ends, respectively, of the high-pressure cylinder n are arranged at a short distance from such cylinder ends, so as to be closed in turn by the high-pressure piston u before the same reaches the end of its stroke in one or other direction, and the steam-ports t^3 t^4 at the lower and upper ends, respectively, of the low-pressure cylinder t are arranged at the extreme ends of such cylinder, as shown, so as not to be closed by the low-pressure piston x when the same reaches the end of the stroke in either direction, so that the cushioning of the pistons u x and attached parts is wholly effected in the high-pressure cylinder n by the steam confined between the high-pressure piston u and each of the closed ends of the high-pressure cylinder in turn, and the pressure of steam on the low-pressure piston x is entirely depended upon for causing the initial movement of the high and low pressure pistons u x in an upward or downward direction, while the steam-port n^3 or n^4 to one or other end of the high-pressure cylinder n is closed by the high-pressure piston u.

The pump y may be of any desired construction adapted to be directly driven through the pump-rod h from the pistons of the compound engine hereinbefore described.

What I claim is—

1. In a direct-acting pumping-engine, the combination with the engine cylinder and piston, and a moving part of the engine, of a main-valve chest, a piston-valve fitted to slide therein and control the passage of steam to and from each end of said cylinder, said main-valve chest having at a short distance from each end thereof a steam-admission port arranged to be closed by said piston when moving toward the corresponding end of the cylinder, a pilot-valve chest, a pilot-valve arranged to work in said last-mentioned chest and control the passage of steam to and from each end of said main-valve chamber through its corresponding admission-port, and means arranged to be positively operated from said moving part of the engine at each stroke of the pump and to move said pilot-valve in a direction to admit steam to one admission-port and place the other in communication

with the exhaust and to afterward positively move the main valve in a direction and to a sufficient extent to uncover the admission-port to which steam has been admitted.

2. In a direct-acting pumping-engine, the combination with the engine cylinder and piston, and a moving part of the engine, of a main-valve chest, a main valve of piston type fitted to slide in said valve-chest and control the passage of steam to and from the respective ends of said cylinder, a pilot-valve chest having steam and exhaust ports and passages and a pilot-valve controlling said ports and passages, the steam-passages extending to the respective ends of the main-valve chest and communicating therewith through admission-ports each arranged to be closed by said engine-piston before the same reaches the corresponding end of its stroke, and means arranged to be positively operated from said moving part of the engine and to move said pilot-valve and place one of said steam-passages in communication with the interior of said pilot-valve chest and the other in communication with the exhaust-passage, and to afterward move said main valve in the opposite direction past the corresponding steam-admission port.

3. In a direct-acting pumping-engine, the combination with the engine cylinder and piston, and a moving part of the engine, of a main-valve chest, a piston-valve fitted to slide therein and control the passage of steam to and from each end of said cylinder, said main-valve chest having at a short distance from each end thereof a steam-admission port arranged to be closed by said piston when moving toward the corresponding end of the valve-chest, a pilot-valve chest, a pilot-valve arranged to work in said last-mentioned chest and control the passage of steam to and from each end of said main-valve chest through its corresponding admission-port, a floating lever connected to said pilot-valve and to said main valve, and a tappet-rod connected to said lever and arranged to be operated alternately in opposite directions by said moving part of the engine as said piston nears the end of its stroke in each direction.

4. In a direct-acting pumping-engine, the combination with the engine cylinder and piston, of a cylindrical main-valve chest having a steam-admission port arranged at a short distance from each end thereof, a main piston-valve fitted to slide in said valve-chest and control the passage of steam to and from the respective ends of said cylinder and to close each of said steam-admission ports in turn before completing its stroke in the corresponding direction, a pilot-valve chest, a pilot-valve fitted to slide in said pilot-valve chest and control the passage of steam to and from each of said steam-admission ports in turn, a lever connected at one end to said pilot-valve and at an intermediate part to said main valve, a tappet-rod connected to the other end of said lever, and a reciprocating part of said engine arranged to move said tappet-rod and attached valves alternately in opposite directions.

5. In a direct-acting pumping-engine, the combination with an engine-cylinder having steam-passages n', n^2 and a piston u, of a cylindrical main-valve chest having five sets of ports k', k^2, k^3, k^4, k^5 at its central portion and steam-admission ports q^4, q^5 near its ends, a piston-valve fitted to slide in said main valve and formed with three annular grooves a' a^2, a^3, a pilot-valve chest q having two steam-ports q', q^2 communicating with said steam-admission ports q^4 and q^5 respectively by crossed passages, and an intermediate exhaust-port q^3, a circular pilot-valve arranged to slide in said pilot-valve chest and control said ports q', q^2, q^3, a floating lever d connected to the rods of said main and pilot valves, a tappet-rod g connected to the free end of said lever, and a projection h' carried by a reciprocating part of said engine, the several parts being arranged substantially as described and shown for the purpose specified.

Signed at 75, 76, and 77 Cornhill, London, E. G., this 7th day of November, 1902.

WALTER MAY.

Witnesses:
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WM. O. BROWN.