

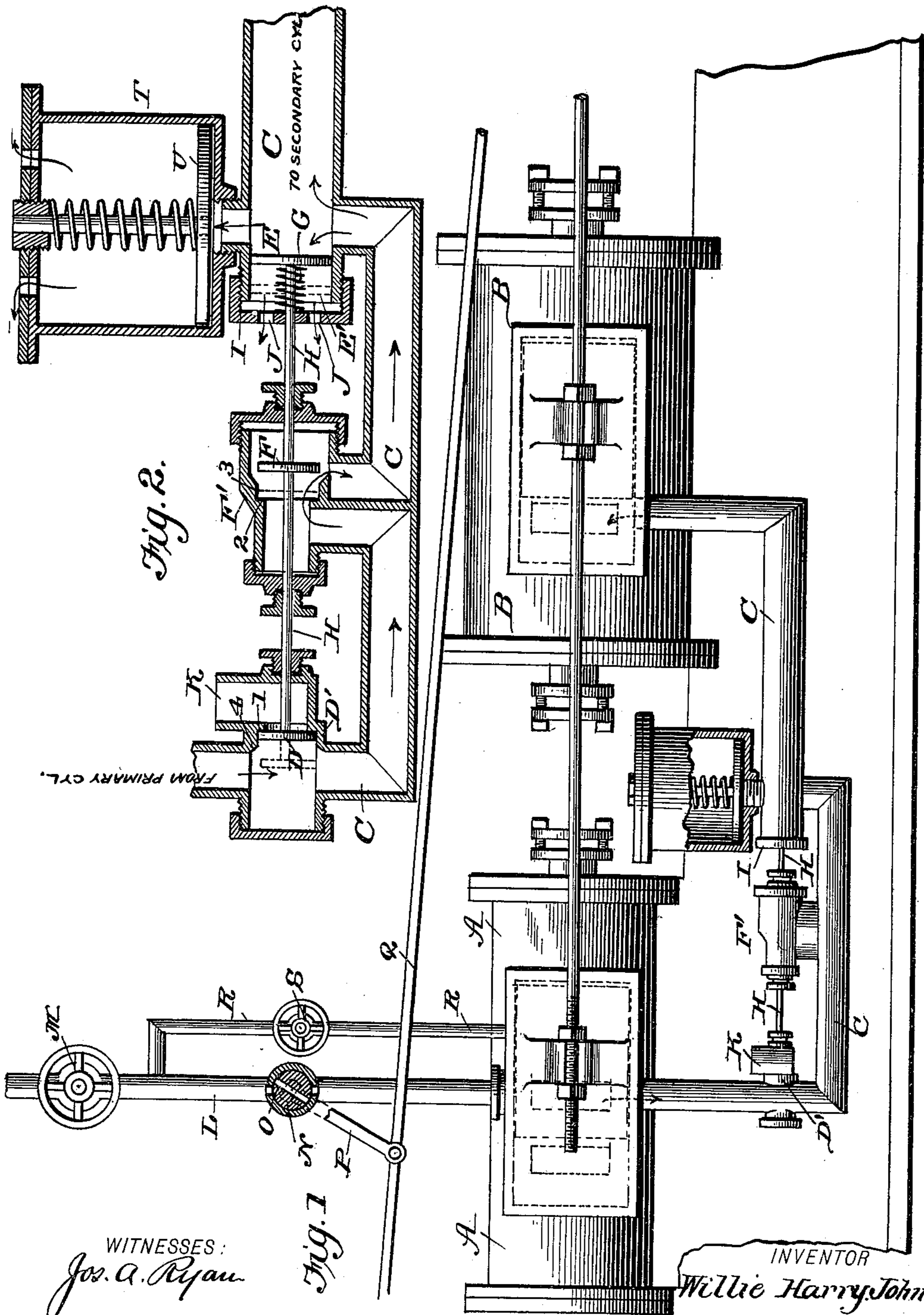
No. 627,425.

Patented June 20, 1899.

W. H. JOHNSON.
COMPOUND ENGINE.

(Application filed Mar. 31, 1898.)

(No Model.)



WITNESSES :

WITNESSES:
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WILLIE H. JOHNSON, OF NAVASOTA, TEXAS.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 627,425, dated June 20, 1899.

Application filed March 31, 1898. Serial No. 675,928. (No model.)

To all whom it may concern:

Be it known that I, WILLIE HARRY JOHNSON, a citizen of the United States, residing at Navasota, in the county of Grimes and State of Texas, have invented certain new and useful Improvements in Compound Engines, of which the following is a full, clear, and exact specification.

My invention is an improvement in compound engines, seeking to furnish means whereby the full force of the exhaust from the primary cylinder may be utilized in the secondary cylinder and the back pressure of such exhaust on the piston of the primary cylinder may be relieved; and the invention consists in certain novel constructions and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the drawings, Figure 1 is an elevation, partly in diagrammatic form, illustrating an engine embodying my improvements, parts being removed and others shown in section. Fig. 2 is a detail sectional view illustrating the exhaust-releasing valve, the cut-off valve, and the operating-head, together with their seats and connecting devices.

In the use of compound expansion-engines a difficulty is experienced from the back pressure of the exhaust from the primary cylinder acting on the piston of such cylinder, and my invention seeks to avoid this difficulty. This I accomplish by furnishing means between the primary and secondary cylinders whereby the exhaust after it has passed into the secondary cylinder will be cut off and held in the said cylinder and at the same time an exhaust-port will be opened to release the exhaust from the piston of the primary cylinder, so the exhaust can act expansively in the secondary cylinder and will be freed from the back of the piston in the primary cylinder.

In carrying out my invention I provide the cut-off and releasing devices and the means for operating the same in the steam-passage between the primary and secondary cylinders, as will more fully appear hereinafter.

The primary or high-pressure cylinder A and the secondary or low-pressure cylinder B, together with their steam-chests and valves, may be of the ordinary or any desired construction, and the exhaust-port of the primary cylinder is connected with the feed-port

of the secondary cylinder by the steam-passage C in the usual manner. In the steam-passage C, I provide the exhaust-releasing valve D and a device E for operating said exhaust-releasing valve by the pressure of the exhaust-steam fed to the secondary cylinder. In connection with these devices I also prefer to provide the cut-off valve F, which is arranged between the exhaust-releasing valve D and the secondary cylinder B, for the purpose of holding the exhaust-steam in the secondary cylinder when it is released by the valve D from the primary cylinder, so the steam may act expansively in the secondary cylinder, but will be relieved from the primary cylinder by the valve D, as will be readily understood from the drawings.

It will be noticed that I arrange the exhaust-releasing valve comparatively near to the primary cylinder, the purpose of which is to leave as much of the exhaust-steam as possible in connection with the secondary cylinder to act expansively therein in the operation of the engine.

In connection with and forming a part of the steam-passage C, I provide the valve-casings D' and F' for the valves D and F and the cylinder E', in which operates the head E, which actuates the valves D and F, as shown in Fig. 2. The casings D' and F' have seats 1 and 2 for their respective valves and are provided with guards encircling and projecting from said seats, the guard 3 of the seat 2 being so related to the guard 4 of the seat 1 and the valves D and F to each other that the cut-off valve F will close before the valve D opens in the opening movement of such valve D in order to prevent the escape of any exhaust-steam from the secondary cylinder in the operation of releasing the back pressure on the primary cylinder by the releasing-valve D, as before described. It should be understood that the guards 3 and 4 encircle their respective valves and conform thereto, thus forming, practically, cylinders in which the valves D and F operate.

The head E is in the nature of a piston operating in the cylinder E' and is of a greater area than the releasing-valve D, so it may be operated by the exhaust-steam to open the releasing-valve in the desired manner. This head E is actuated by a spring G, which tends

to hold the releasing-valve closed, the head E and valves F and D being connected by a rod H, as shown. To secure the spring G, I provide a cap I, threaded on the cylinder E', so it can be adjusted to vary the tension of the spring G and having at J openings to the atmosphere. Suitable stuffing-boxes are provided for the passage of the rod H, and all necessary joints may be packed in any suitable manner.

In the operation of the described construction the exhaust-steam will pass through the passage C to the secondary cylinder. When it has so passed to establish a pressure of equal pounds on the head E to that on the releasing-valve D, the greater area of the head E will cause the same to be operated by the pressure to open the valve D and permit the exhaust to escape at K. Before, however, the valve D opens the cut-off valve F will be closed to prevent the escape of the exhaust which is acting expansively in the secondary cylinder. The exhaust-discharge at K, as well as that from the secondary cylinder, may be into the air or to a suitable condenser, as may be desired.

While I have shown my invention in connection with only two cylinders, it is manifest it may be embodied in engines compounded to any degree.

In connection with my improvements, as before described, I find it desirable to provide means for automatically cutting off the feed-steam from the primary cylinder after a suitable amount has been supplied to effect the desired operation. This I accomplish by providing in the feed-pipe L, between the main throttle M and the cylinder A, a rocking valve N, whose port O may be adjusted into and out of register with the passage through pipe L and provide on said valve N a crank-arm P, which is connected with a rod Q, which in turn may be connected with the valve-gearing or eccentrics in the usual manner. As the rod Q is reciprocated by the action of the eccentrics in the usual manner, the valve N will be rocked to open and close the feed-pipe L, as desired. A supplemental feed-pipe R, having a throttle S, connects at one end with the cylinder A and at its other end with the feed-pipe L between the valves M and N and may be used in starting the engine or otherwise when an excessive power may be desired.

In practice I prefer to provide in the steam-passage between the primary and secondary cylinders an exhaust receiver and discharger comprising a chamber T, having a spring-actuated piston U, whose tension can be adjusted and which is forced back by the pressure of the exhaust as the same passes to the secondary cylinder and then by its actuating-spring gives additional force to the exhaust in its action on the piston of the secondary cylinder. This receiver and discharger, it will be noticed, is arranged between the release-valve and the secondary cylinder.

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

1. An improvement in compound engines comprising the primary cylinder, the low-pressure cylinder, the connection for the passage of exhaust-steam thence to the secondary cylinder, the cut-off valve in said connection whereby to prevent the reaction of said exhaust against the piston in the primary cylinder and means whereby the pressure of the exhaust automatically closes said cut-off valve, substantially as set forth.

2. A compound engine comprising the primary cylinder, the secondary cylinder, the connection between the same for the passage of steam from the primary to the secondary cylinder and release and cut-off valves in said connection both such valves being automatically operated by the pressure of the exhaust whereby to relieve the exhaust from the primary cylinder after the exhaust has passed to the secondary cylinder without releasing the said exhaust from the latter cylinder whereby to prevent the reaction of said exhaust against the piston in the primary cylinder substantially as set forth.

3. In a compound engine having the exhaust-releasing valve in the steam-passage between the primary and secondary cylinders adapted to be normally closed, the combination with said exhaust-releasing valve of a head connected therewith and of greater area than said valve and arranged in such steam-passage between the exhaust-releasing valve and the secondary cylinder and to receive pressure on one side only whereby to be operated by the pressure acting on said excess of area to open the exhaust-releasing valve substantially as shown and described.

4. In a compound engine having the exhaust-releasing valve in the steam-passage between the primary and secondary cylinders and adapted to be normally closed, the combination with such valve, of the cut-off valve between said release-valve and the secondary cylinder, whereby to prevent the reaction of said exhaust against the piston in the primary cylinder and means whereby the release-valve is automatically operated by the pressure of the exhaust substantially as set forth.

5. In a compound engine having the exhaust-releasing valve in the steam-passage between the primary and secondary cylinders, the combination with said releasing-valve of the head arranged to be operated by the pressure in the secondary cylinder to open said release-valve, such head being arranged between the release-valve and the secondary cylinder, and a cut-off valve in the steam-passage between the release-valve and the operating-head and arranged to be actuated by the latter whereby to prevent the reaction of said exhaust against the piston in the primary cylinder substantially as set forth.

6. In a compound engine having in the

steam-passage between the primary and secondary cylinders an exhaust-releasing valve, the combination with such valve, of devices connected therewith and arranged to operate the said valve by the pressure after the same has passed to the secondary cylinder substantially as set forth.

7. In a compound engine having in the steam-passage between the primary and secondary cylinders valve-seats for the exhaust-releasing and the cut-off valves whereby to prevent the reaction of said exhaust against the piston in the primary cylinder, the combination with said seats and the valves fitted thereto and connected for joint operation, of the head of greater area than the exhaust-releasing valve and connected therewith substantially as set forth.

8. A compound engine having in the steam-passage between the primary and secondary cylinder an exhaust-releasing valve arranged relatively near to the primary cylinder, and a pressure-operated head arranged in the said passage between the secondary cylinder and the exhaust-releasing valve and arranged and adapted to operate the latter substantially as set forth.

9. A compound engine having in the steam-passage between the primary and secondary cylinders an exhaust-releasing valve and a cut-off valve connected with the releasing-valve and arranged between the same and the secondary cylinder, and having seats for said releasing and cut-off valves and guard portions encircling and leading from said seats and conformed to the valves, the releasing and cut-off valves being so related that the cut-off valve will be closed before the releasing-valve is opened substantially as set forth.

10. A compound engine having in the steam-passage between the primary and secondary cylinders, an exhaust-releasing valve, a head connected therewith and arranged to operate therewith and arranged to operate said exhaust-releasing valve, a cylinder in which said head works, a spring actuating the head and a cap having openings leading to the air and threaded onto the head-cylinder and securing the actuating-spring substantially as set forth.

11. A compound engine having in the steam-passage between the primary and secondary cylinders, an exhaust-releasing valve and a cut-off valve connected together, seats for said valves and guards extending therefrom and conforming to their valves whereby the cut-off valve may close before the release-valve, and the head arranged in the passage between the cut-off valve and the secondary cylinder and connected with said valves, such head being of greater area than the exhaust-releasing device whereby it is operated to open the exhaust-valve by the pressure in the passage between the cylinders substantially as set forth.

12. In a compound engine the combination

with the feed-pipe and the valve-gear rod, of a valve in the said pipe connected with the valve-gear rod and arranged to be alternately opened and closed by the movements of said rod substantially as set forth.

13. In a compound engine the combination of the feed-pipe, the main throttle-valve, a rocking valve in the feed-pipe between the throttle-valve and the cylinder and having a crank-arm, the valve-gear rod connected with said crank-arm to open and close the rocking valve, a branch pipe having a controlling-valve and communicating at one end with the feed-pipe between the rocking and throttle valves and at its other end with the engine substantially as set forth.

14. In a compound engine, the combination with the primary cylinder, the secondary cylinder, and the connection for supplying the exhaust thereto, of the receiver and discharger whereby to store the pressure of the exhaust-steam and by its reaction aid the operation of such steam in the secondary cylinder, and the cut-off valve between said receiver and the primary cylinder, substantially as set forth.

15. A compound engine having in the steam-passage between its primary and exhaust cylinders means for releasing the pressure of the exhaust in the primary cylinder after the exhaust has been conducted to operate in the secondary cylinder, combined with the feed-pipe having a throttle-valve and a rocking valve in said feed-pipe provided with a crank-arm, the valve-gear rod connected with said crank-arm and the branch pipe having a controlling-valve and arranged and operating substantially as set forth.

16. In a compound engine having an automatically-operated release-valve in its steam-passage between the primary and secondary cylinders, the combination with such release-valve and cylinders of an exhaust receiver and discharger in connection with the steam-passage substantially as set forth.

17. In a compound engine, the combination with a valve-severing connection between high and low pressure cylinders, a back-pressure exhaust-valve D by which a part of the exhaust-steam from high-pressure cylinder can flow into a condenser or atmosphere, and intercepting valve F by which a part of exhaust-steam from high-pressure cylinder is divided and allowed to expand in low-pressure cylinder without pressing back of piston of high-pressure cylinder, of a piston-valve E which automatically closes valve F and opens valve D by means provided substantially as shown.

18. In a compound engine, the combination of connected reciprocating valves for providing and intercepting the passage of steam from high-pressure cylinder to the low, of a guard-recess 4 for the valve D for preventing escape of exhaust when valve F begins to close, a guard-recess 3 for the valve F to prevent escape of steam when valve D begins to

open, and a cylinder in which the piston E operates substantially as shown and described.

19. In a compound engine the combination of the reciprocating valves D, E, and F, the connecting-rod H to which said valves D, E, F, are secured in their respective places so as to secure concert of action, a spiral spring G operating the piston E in opposition to the action of the greater power of the exhaust-steam from high-pressure cylinder, the piston

E being of sufficient area to overcome the tension of the spiral spring G and open valve D when high-pressure exhaust-steam has become about an equal pressure in all parts of valve device substantially as shown and described.

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Witnesses:

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