No. 729,602. PATENTED JUNE 2, 1903.

O. W. KELLY.

STEAM ENGINE.

APPLICATION FILED MAY 31, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1

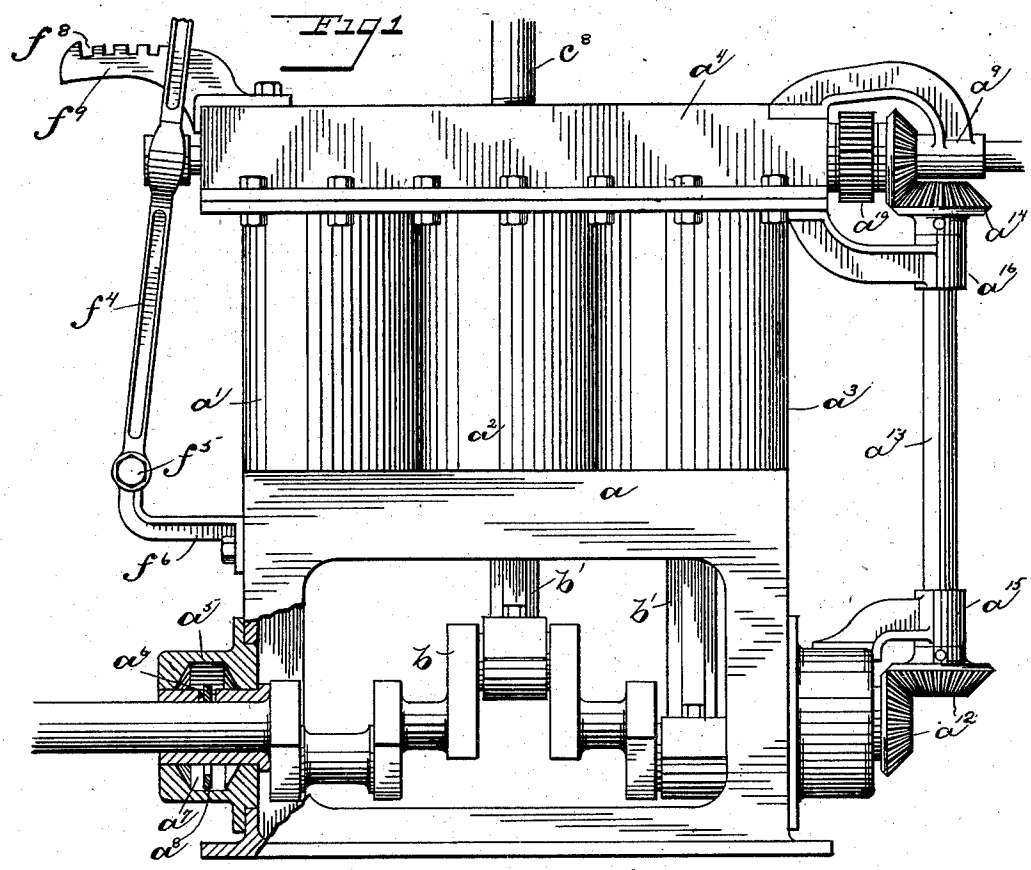


Fig. 2

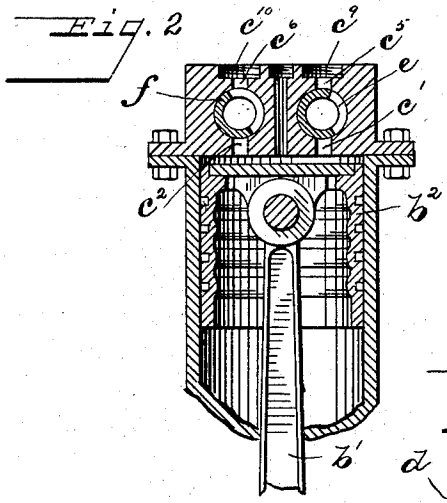


Fig. 3

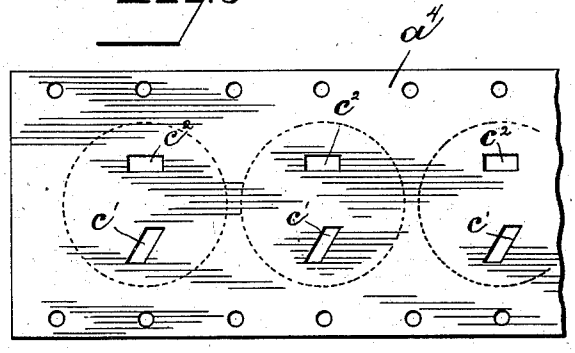
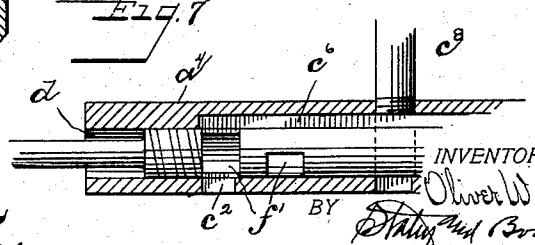


Fig. 7



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INVENTOR.

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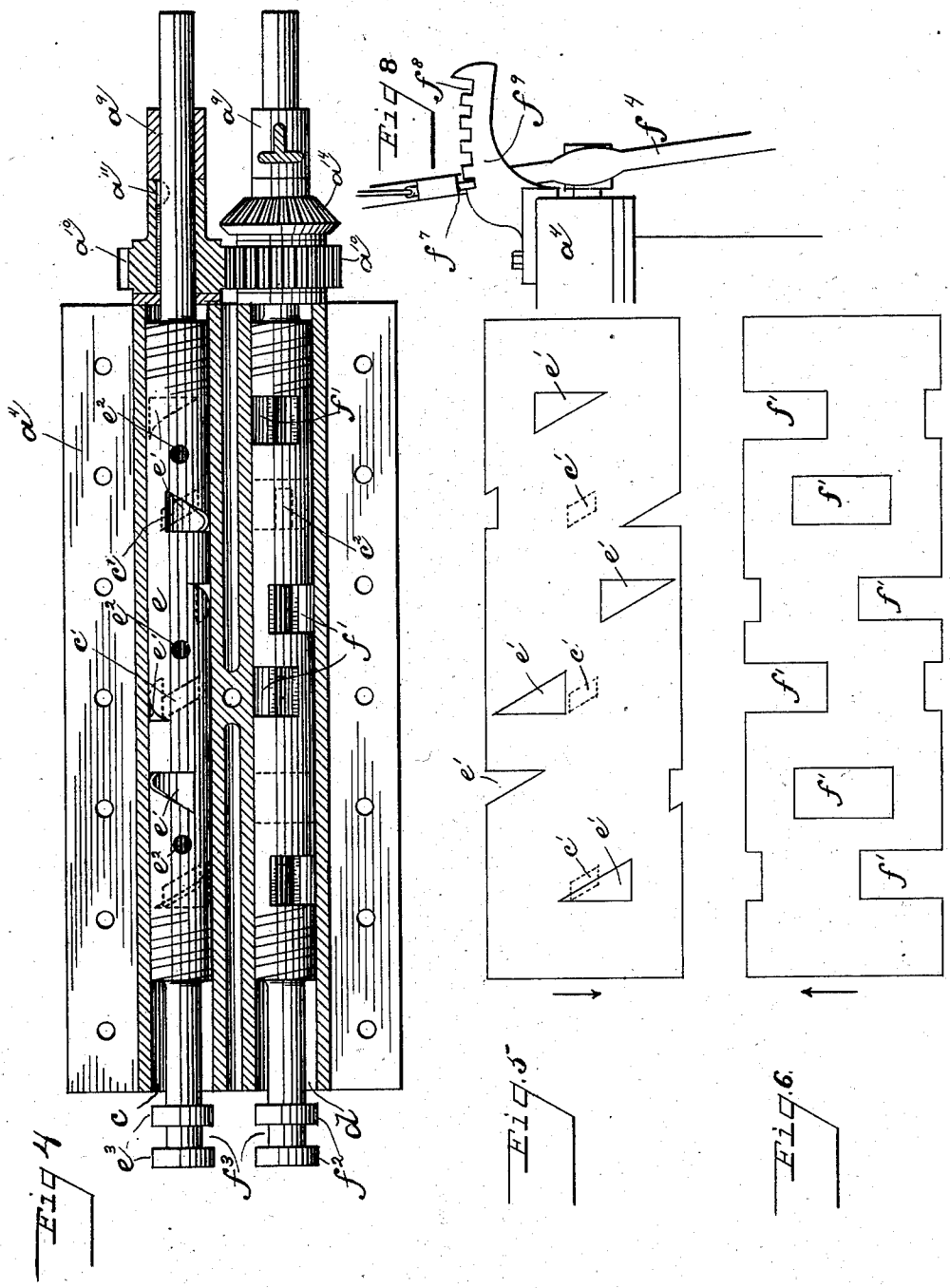


Fig. 4

Fig. 8

Fig. 5

Fig. 6

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 729,602. Patented June 2, 1903.

UNITED STATES PATENT OFFICE.

OLIVER W. KELLY, OF SPRINGFIELD, OHIO.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 729,602, dated June 2, 1903.

Application filed May 31, 1902. Serial No. 109,674. (No model.)

To all whom it may concern:

Be it known that I, OLIVER W. KELLY, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification.

My invention relates to steam-engines, and more especially to engines having a variable cut-off.

The object of my invention is to provide a simple and efficient valve that will vary the cut-off at full steam and adapted to be further moved to throttle and close the steam-port and when employed in multiple-cylinder engines by the use of double ports in the valve for each cylinder-port to further reverse the engine and in like manner vary the cut-off at full steam and throttle and close the steam-ports, and I provide an exhaust-valve to work in harmony with said steam-valve, both of said valves being controlled by a single lever or equivalent device.

My invention consists of the constructions and combinations hereinafter described, and set forth in the claims.

In the accompanying drawings, Figure 1 represents a three-cylinder engine taking steam upon one side of its pistons in which my invention is employed. Fig. 2 is a vertical section of a portion of one of the cylinders, showing the steam supply and exhaust valves. Fig. 3 is a view of the bottom of the valve-chest, showing the inlet and exhaust ports leading to the cylinder. Fig. 4 is a sectional view of the valve-chest, showing the steam and exhaust valves in position. Fig. 5 is a view of the surface or periphery of the supply-valve opened out flat, showing the shape and relative positions of the supply-ports. Fig. 6 is a like view of the exhaust-valve, showing the exhaust-ports. Fig. 7 is a sectional view of a portion of the exhaust bore and recess with valve in place, the arrangement being the same for the supply; and Fig. 8 shows hand-lever and latch with notched segment.

Like parts are represented by similar letters of reference in the several views.

My invention is preferably employed in a multiple-cylinder engine, and in the drawings I have shown a three-cylinder engine having the body a, the cylinders a', a^2, and a^3 secured to same, and the valve-chest a^4 is bolted to the head of the cylinders, as shown. A crank-shaft b is journaled in self-oiling bearings a^5 of the body, said bearings being slotted at a^6 and having the outer hollow portion a^7 to carry oil, which is lifted from the bottom of the hollow portion into the bearing by the ring a^8, hung on the shaft in the slot a^6. I have shown the cylinders formed open at the bottom and connecting-rods b' pivoted to the piston-heads b^2 and to the crank-shaft in the usual manner. The connecting-rod for the cylinder a' is omitted from Fig. 1. A valve-chest a^4 is provided with the longitudinal parallel bores c and d, c being for the supply-valve and d for the exhaust-valve, said bores or valve-seats having the ports c' and c^2 opening into the cylinder and the longitudinal recesses c^5 and c^6, c^5 furnishing the supply and c^6 being the exhaust, which is connected to an exhaust-pipe c^8. Fig. 2 shows the screw-threaded openings c^9 and c^{10} to said recesses for connecting the supply and exhaust pipes. A supply-valve e is formed hollow and has the triangular-shaped ports e', there being two of said ports for each of the ports c', leading to the cylinder, for the purpose to be hereinafter mentioned, and said valve e is further provided with perforations e^2 to receive steam from the recess c^5. The exhaust-valve f is formed hollow and has the ports f', there being two of said ports for each of the ports c^2, leading from the cylinder, said supply and exhaust valves having solid shaft extensions at each end, the extensions at one end being journaled in the projecting bearings a^9, secured to the valve-chest. Between these bearings and the chest I mount on the shafts spur-gears a^{10}, adapted to mesh with each other, said gears being splined to said shafts by the keys a^{11}, so the shafts may be moved longitudinally through them. Rotary motion is given the shafts and their valves from the crank-shaft, preferably by means of two pairs of bevel-gears, the pair a^{12} being attached to the crank-shaft and the upright shaft a^{13} and the pair a^{14} being attached to said upright shaft and one of the valve-shafts, it being shown attached to the exhaust-valve shaft. Said upright shaft is carried by the bearings a^{15} and a^{16}. The

shaft extensions on the other ends of the valves have the collars or projections e^3 and f^2 thereon, forming the recess f^3, in which a yoke engages, the hand-lever f^4, pivoted at f^5 to the brace f^6, engaging with said yoke, so that by the movement of the lever the supply and exhaust valves may be moved longitudinally in unison, and I further provide a latch f^7 on the lever f^4 to engage notches f^8 in the segment f^9, said notches being so placed that each set of supply and exhaust ports may be held to rotate in different fixed relations to the inlet and exhaust ports of the cylinders.

In Figs. 4 and 5 I have shown the supply and exhaust valves in their position to the extreme right, so that in their rotations the supply and exhaust ports at the extreme left and each alternate supply and exhaust port to the right will register with the respective inlet and exhaust ports to the cylinder, said inlet-ports being shown by the dotted lines in Fig. 5, the valve-supply ports being triangular in form and the side lines being coincident, respectively, with longitudinal and transverse lines to the shaft, as shown in Fig. 5, and the inlet-valves to the cylinder being preferably in the shape of a parallelogram inclined so that its side lines will in passing coincide with the hypotenuse of the triangular supply-ports, and the side of the triangle coincident with the longitudinal line of the valve being of greater width than the inlet-valve to the cylinder, and the valve being rotated in the direction shown by the arrow in Fig. 5 when in its extreme position, as shown in Fig. 4, will pass and register with the cylinder inlet-port, so as to give the greatest supply to the engine.

To vary the cut-off, the valves by the lever are drawn to the left, so that the supply-port, by reason of its triangular shape, will in passing give an earlier cut-off. By drawing the valve still farther to the left the supply-valve will fail to fully register with the cylinder-inlet, and the continued movement to the left will completely throttle the steam and bring the engine to rest. A further movement in the same direction will bring the other supply and exhaust ports of each set in line with the cylinder inlet and exhaust ports, which will reverse the engine. The arrangement of the gearing is such that the supply and exhaust valves turn in opposite directions, and when the engine is reversed the valves are also reversed, so that they turn in the opposite direction to the arrows shown in Figs. 5 and 6. The arrangement of the supply-valve and inlet ports is such that they operate successively. In Figs. 4 and 5 the supply-valve at the extreme left is about to close, the next alternate one is about to open and the next alternate one is closed, and when this set of valves is used they will continue to operate successively in this manner. Now if when the valves are in the position I have stated, as shown in Fig. 5, the next series of supply-ports are drawn over the inlet-port at the right, which has been closed, and the piston of its cylinder about midway of its upward stroke will be opened and its exhaust closed, which will reverse the operation of the engine, and the inlet-ports to the left will successively take steam and continue to do so from right to left until the engine is again reversed by bringing the other set of ports in the supply and exhaust valves into operative position. The exhaust-ports in the exhaust-valve are so adjusted in their relation to the exhaust-ports from the cylinder that they will properly receive the exhaust from the cylinder when the engine is operated in either direction. The relative size of the supply-ports in the supply-valve and the inlet-ports to the cylinder may be made so as to give an earlier or later cut-off, as may be desired.

It is not essential that the inlet-port opening be in the shape of a parallelogram; but that form is preferred. Furthermore, while I have shown the supply-port of the supply-valve triangular in shape the essential features are that one side travels at an inclination to its line of rotation and another side parallel to the axis of the supply-valve and of greater width than the inlet-port to the cylinder, and my invention covers any form of supply-port involving these features.

Having thus described my invention, I claim—

1. The combination with a cylinder having inlet and exhaust ports, of a hollow rotating supply-valve having a port therein to register with said inlet-port, and a hollow rotating exhaust-valve having a port therein to register with said exhaust-port, and means to move said valves longitudinally in unison to vary the cut-off, substantially as specified.

2. The combination with a cylinder having inlet and exhaust ports, of a hollow rotating supply-valve having a port therein to register with said inlet-port, and a hollow rotating exhaust-valve parallel with said supply-valve having a port therein to register with said exhaust-port, means to move said valves longitudinally in unison and means to rotate said valves, substantially as specified.

3. In a multiple-cylinder single-acting engine, the combination with inlet and exhaust ports to each of said cylinders, of a hollow rotating supply-valve having two ports for each cylinder-inlet, a hollow rotating exhaust-valve parallel with said supply having two ports for each cylinder-exhaust, means driven from the crank-shaft of the engine to rotate said valves and means to move said valves longitudinally in unison, whereby the cylinder-ports may be made to register with either one of the two ports for each cylinder-port in said valves, substantially as specified.

4. The combination with a cylinder and its inlet-port, of a hollow rotating valve having a supply-port therein, one side of which travels at an inclination to its line of rotation and another side parallel to the axis of said valve,

said valve-port being of greater width at its last-named side than said inlet-port, and means to longitudinally move said valve, for the purpose specified.

5. The combination with a cylinder having inlet and exhaust ports, of a hollow rotating supply-valve having a port therein, one side of which travels at an inclination to its line of rotation and another side parallel to the axis of said valve, said valve-port being of greater width at its last-named side than said inlet-port, a hollow rotating valve having a port therein adapted to register with said exhaust-port, and means to move said valves in unison, for the purpose specified.

6. In a multiple-cylinder single-acting engine, the combination with inlet and exhaust ports to each of said cylinders, of a hollow rotating supply-valve having two ports for each cylinder-inlet, one side of which travels at an inclination to the line of rotation and another side parallel to the axis of said valve, said valve-ports being of greater width at the last-named side than said inlet-ports, a hollow rotating exhaust-valve parallel with said supply-valve having two ports for each cylinder-exhaust, means driven from the crank-shaft of the engine to rotate said valves, and means to longitudinally move said valves in unison, substantially as and for the purpose specified.

In testimony whereof I have hereunto set my hand this 22d day of May, A. D. 1902.

OLIVER W. KELLY.

Witnesses:

PERCY NORTON,

CHAS. I. WELCH.