

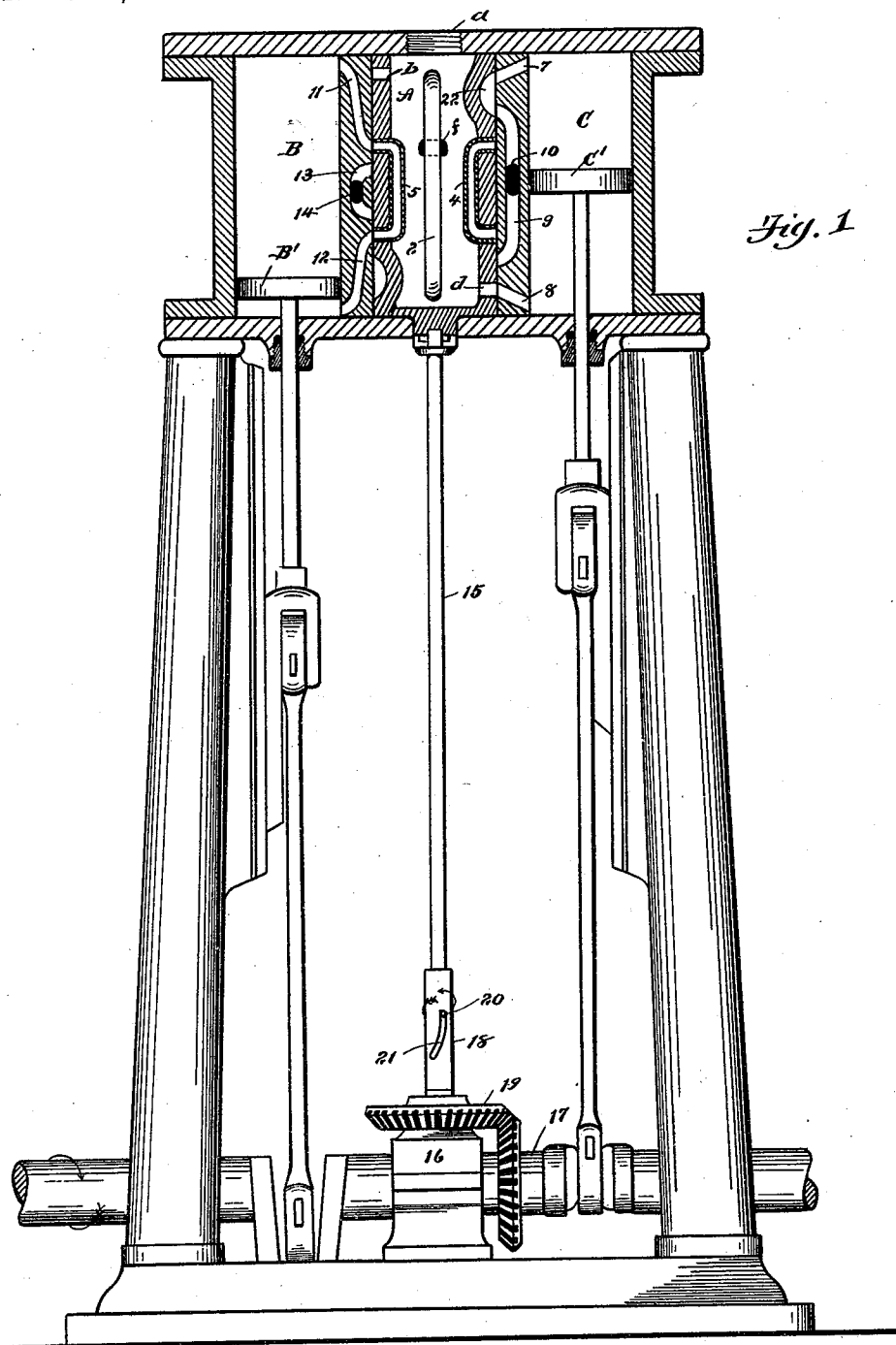
(No Model.)

2 Sheets—Sheet 1.

D. T. BURR.
STEAM ENGINE.

No. 544,477.

Patented Aug. 13, 1895.



WITNESSES

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INVENTOR

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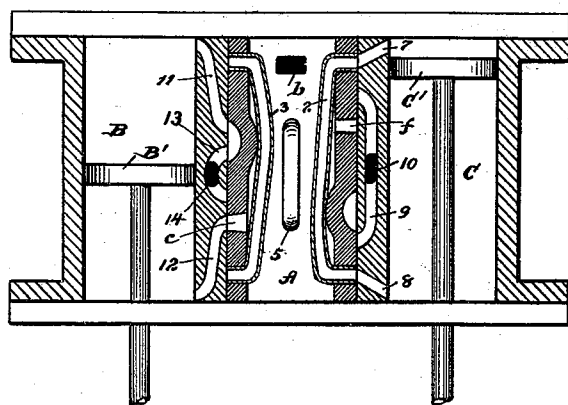


Fig. 2.

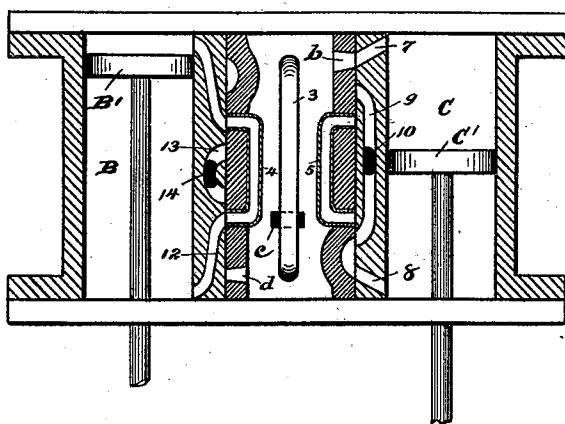


Fig. 3.

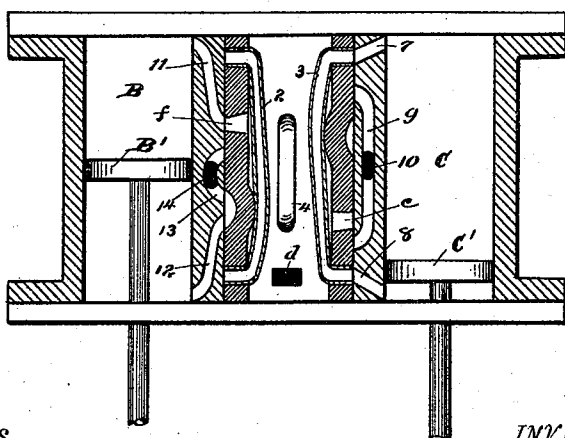


Fig. 4.

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UNITED STATES PATENT OFFICE.

DOCTOR THEODORE BURR, OF DETROIT, MICHIGAN.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 544,477, dated August 13, 1895.

Application filed November 30, 1894. Serial No. 530,369. (No model.)

To all whom it may concern:

Be it known that I, DOCTOR THEODORE BURR, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Steam-Engines; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to steam-engines, and has for its object an improvement in engines by which, through the instrumentality of a single rotating valve, the steam is admitted to two cylinders and drives two pistons, so constructed with respect to each other that each assists the operation of the other.

The special feature of improvement consists in the provision which is made, whereby the steam which has been employed to actuate the piston, driving it in one direction, is in part transmitted to the opposite end of the same piston which it has been driving and acts to drive the piston in the opposite direction.

The action of the two engines is identical, except that they are arranged to act alternately, and the various passage-ways and ports in the one engine are exactly similar to the passage-ways and ports in the other engine, although they may differ somewhat in location.

In operation, the steam which has been admitted into one piston at one end first drives that piston toward the opposite end until, by the rotation of the valve, passage-ways are opened to permit the free transmission of steam from this end of the cylinder to the opposite end of the cylinder and in front of the opposite face of the piston. This would result in balancing the piston, were it not that as soon as a sufficient action of the piston has taken place the free passage-way is interrupted, and an exhaust is opened behind the piston, allowing that portion of the steam which has been transmitted and is now in front of the piston to act expansively and throw the piston backward to the position it occupied before live steam was admitted behind it. This forward and return motion of

the piston alternates with an exactly corresponding to-and-fro motion of the piston of the second cylinder, the two engines being so constructed that the cranks with which the piston-rods are connected are at an angle of ninety degrees, and the valve being so set with respect to the pistons that the live steam is let in behind each piston at the period of time when its own crank is about at right angles to the line of motion of its piston-rod. The steam is used most effectively for the action of the crank-shaft.

In the drawings, Figure 1 shows the frame and crank-shaft and valve-stem in elevation and the cylinders and rotary valve in section. Fig. 2 shows cylinders and rotary valve in section at one-quarter in advance from the position shown in Fig. 1. Fig. 3 shows the same cylinders and valve in section at one-half advance from the position shown in Fig. 1. Fig. 4 shows cylinders and valve in section at three-quarters advance from the position shown in Fig. 1.

The four positions shown will enable one to arrive at an understanding of the action of the various parts.

The cylinder is similar to any steam-cylinder—a round tube with the ends closed and having a headed piston fitted therein. The valve A is a rotary valve fitted in a tubular bearing that is located midway between the two cylinders B and C. It has a hollow valve, and provision is made for the admission of steam into its interior from the end *a*. It is provided with four live-steam ports, one of which, *b*, is seen in Fig. 2; another of which, *c*, is seen in Fig. 3; another, *d*, is seen in Fig. 4, and another, *f*, is seen in Fig. 1. Of these the ports *b d* communicate at proper times with the cylinder C, and the ports *c* and *f* communicate at proper times with the cylinder B. It is also provided with four by-pass tubes, two of which serve to transmit steam from the one end of the piston C' to the other, and the other two of which serve to transmit steam from the one end of the piston B' to the other. The two by-pass tubes which transmit steam around the piston C' are indicated at 2 and 3, and the two by-pass tubes which serve to transmit steam around the piston B' are indicated at 4 and 5. Through the walls which lie between the valve-case and cylin-

ders are passage-ways properly arranged to communicate with the inlet-ports and with the by-pass tubes. Thus through the wall between the valve-case and the cylinder C are two passage-ways 7 and 8, and vertically through the wall is a passage-way 9, the ends of which lead into the interior opening in which the valve is seated. At the middle of the passage-way 9 is an exhaust-port 10. Through the walls between the cylinder B and the valve are passages 11 and 12, and vertically along this wall is a passage-way 13 corresponding to the passage-way 9 in connection with the piston-cylinder. At the middle of this passage-way 13 is an exhaust-port 14. To the valve is connected a valve-stem 15 mounted on a suitable bearing 16 that straddles the main shaft 17. The shaft 15 is connected by a sleeve 18 with the spindle of the miter gear-wheel 19. A sleeve 18 is fixed from rotation with respect to either the stem 15 or the spindle of the gear 19 and loose with respect to the other, but is capable of moving endwise on both, so that its motion endwise, acting through the medium of the pin 20 and the diagonal slot 21, causes a partial rotation of the shaft 15 with respect to the gear 19, the arrangement being to produce a half of a revolution, which will result in reversing the action of the engines by giving to the valve a motion that is faster than that which is properly due to it from the action of the shaft 17 and the engine-pistons. This sleeved connection in itself is not considered novel, as it is found in several structures, although I am not aware that it has been used in connection with a rotary valve.

The operation of the engine will be best understood by beginning with Fig. 1 and tracing through the motion of the piston during a complete revolution of the valve. In the position shown in Fig. 1 live steam is being admitted through the port 8, which now registers with the port *d* of the valve and the piston C' in rising. After the valve has made a partial revolution, depending on the width of the ports *d* and the port 8 and usually arranged to be about one-sixteenth of a revolution, the port *d* passes out of register with the port 8, and for a short time the steam behind the piston C' acts expansively. During this time the passage-way 7 has registered with the pocket 22, and steam from that end of the cylinder had free exit through the exhaust-opening 10. After a short further revolution the by-pass pipe 2 comes into register with both the passage-ways 7 and 8, and there is a free communication through the pipe 2 from the space behind the piston to the space in front of it. Both exhaust-openings and inlet-openings are cut off. The steam equalizes itself in the two ends of the cylinder and against the two faces of the piston C'. The valve rotates still further until it assumes the position shown in Fig. 3. The passage-way to the exhaust from behind the piston is now

open, and live steam is admitted through the passage-way *b* in front of the piston. The piston begins to move backward and continues to move backward until the by-pass tube 3 comes into register with the passage-ways 7 and 8, when the steam again equalizes itself on the two faces of the piston until the exhaust from the passage-way 7 is open and the passage-way *d* comes into register with the passage-way 8, and again admits the live steam below the piston. The action of the steam on the piston B' is exactly similar, the only difference being in the time in which the steam is applied. These passage-ways are so arranged that after there has been an equalizing action which takes place always before the piston has reached the end of its stroke the steam that has been transferred is held in position, acting against the piston for a short time after the exhaust has been opened from the end from which the steam was transferred. This enables me to use the steam thus transferred, first, as a cushion, and, second, expansively to start the return stroke of the piston, and this return stroke of the piston is aided by the admission of new live steam at a time when the piston has made from a third to a half of its stroke, and just at the time when the admission of steam and the impulse will be most efficient in actuating the main shaft. I am thus enabled to employ the steam that has been once used to drive the shaft for the purpose of starting the return motion and thus saving the use of fresh live steam until the return stroke has been commenced and partially completed, thus in each case utilizing a part of the steam twice. It thus produces an equilibrium of pressure on the piston just at the time when the piston is on the center.

What I claim is—

1. In a steam engine provided with a rotary valve and with suitable ports and passage-ways for the admission and exhaust of steam, a by-pass passage-way adapted to transmit steam that has been used to actuate the piston in one direction to the opposite face of the piston, and utilize it at the commencement of the return stroke, substantially as described.

2. In a steam engine provided with a rotary valve and with suitable ports and passage-ways for the admission and exhaust of steam, a by-pass passage-way adapted to transmit steam that has been used to actuate the piston in one direction to the opposite face of the piston, and utilize it at the commencement of the return stroke, and equalize the force of the same on the two faces of the piston, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

DOCTOR THEODORE BURR.

Witnesses:

G. M. AUCHISON,
FRANCES CLOUGH.