

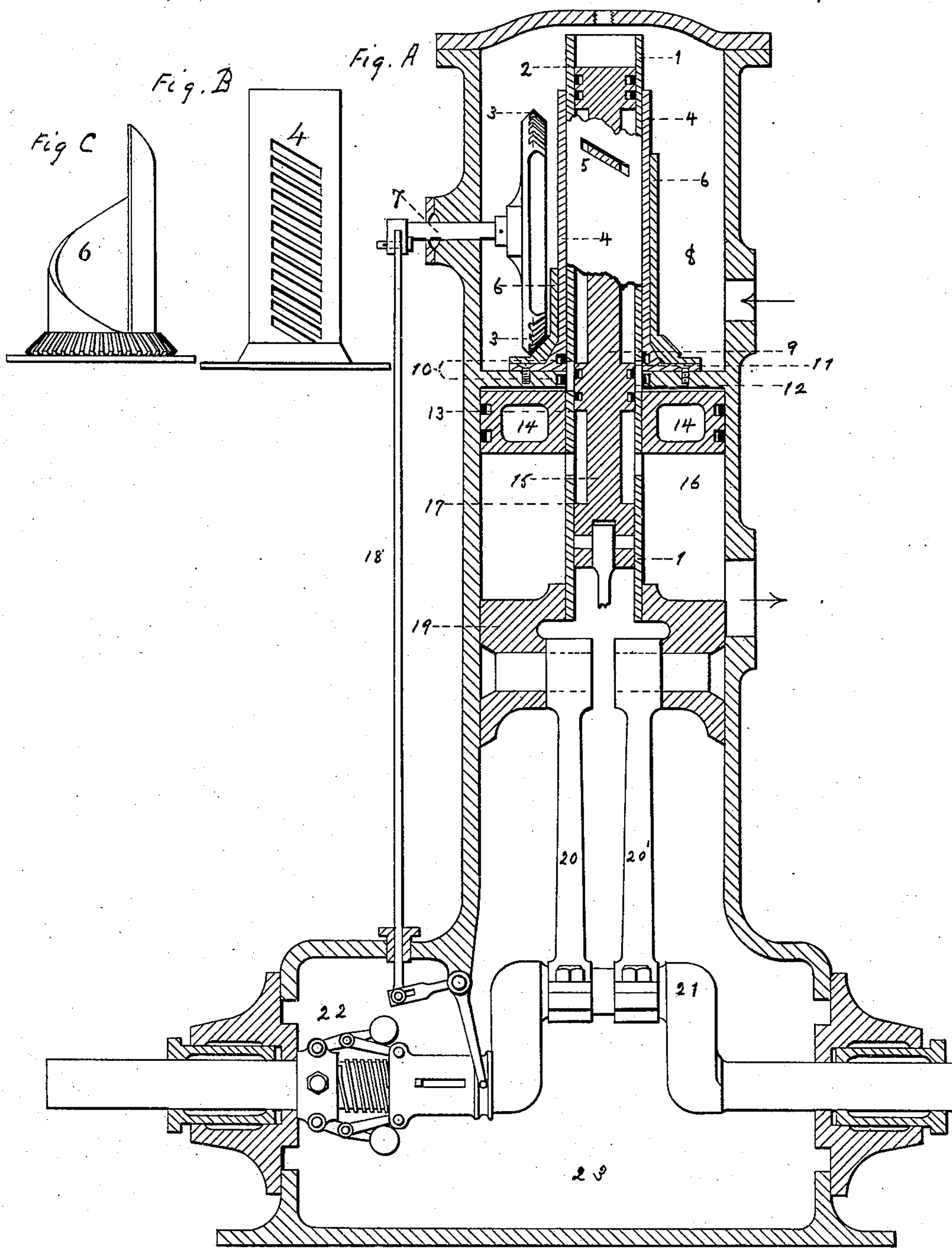
(No Model.)

C. H. BENTON.

STEAM ENGINE.

No. 370,919.

Patented Oct. 4, 1887.



WITNESSES:

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STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 370,919, dated October 4, 1887.

Application filed February 10, 1887. Serial No. 227,101. (No model.)

To all whom it may concern:

Be it known that I, CHARLES HORACE BENTON, a citizen of the United States, residing at Cleveland, county of Cuyahoga, State of Ohio, have invented or discovered certain new and useful Improvements in Steam-Engines; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification.

My present invention relates to steam-engines of the class in which the steam is supplied to the cylinder through a hollow trunk or tube upon which the piston is fixed, which hollow trunk works through a stuffing-box or gland into the steam-chest.

It is the object of my invention to provide a simple, durable, and effective method of cutting off the steam-supply at any part of the stroke of the piston, embodying, in connection with the general features of construction above mentioned, novel and improved means for effecting regulation of speed and power by variation in degree of expansion and in maintaining the distribution-valve constantly in a state of thrust.

The improvements claimed are hereinafter fully set forth.

Figure A is a longitudinal elevation, partly in section, of a vertical engine embodying my improvements. Figs. B and C are elevations of the details of the cut-off mechanism.

In the practice of my invention I make a cylinder, 16, which contains a single-acting piston, 14, which is fixed upon a hollow trunk, 1. The piston is coupled by means of cross-head 19 and connecting-rod 20 and 20' to a crank, 21, in a closed crank-chamber, 23. The distribution-valve 15 is contained within the hollow trunk 1, and, in addition to its own movement to open and close the steam-ports, accompanies the piston in its reciprocating motion. This valve may be worked by means of a valve-gear such as described in Letters Patent of the United States, No. 344,027, granted and issued to me under date of 22d of June, 1886. Such gear would then work between the two halves of the double connecting-rod 20 and 20'. The hollow trunk 1 works through the gland 10 into the steam-chest 8. The top of the hollow trunk 1 contains a port, 5, through

which steam is admitted from the steam-chest to the hollow trunk. A second port, 12, admits steam from the hollow trunk to the cylinder.

A cut-off sleeve, 6, (shown in section,) is arranged in the steam-chest to close the port 5 in the side of the hollow trunk. When the port 5 is above this cut-off sleeve, steam is admitted to the hollow trunk; but whenever the port 5 is closed by the said cut-off sleeve the steam is no longer admitted to the hollow trunk. The steam is distributed between the hollow trunk and the cylinder by the distribution-valve 15.

Fig. A represents the piston at the top of its stroke and with the distribution-valve 15 about to open to admit steam to the cylinder from the hollow trunk by moving downward. As soon as the valve is opened, the steam flows from the hollow trunk 1 through the cylinder-port 12 into the cylinder, and into the trunk 1 from the steam-chest 8 through the port 5. The steam will continue thus to flow until the piston, continuing on its stroke, causes the port 5 to pass the edge of the sleeve 6, where the steam will be cut off and the piston will move to the end of its stroke by means of the expansion alone of the steam contained in the cylinder at the moment of cut-off. As the point of cut-off is regulated solely by the edge of the sleeve 6, by making this sleeve adjustable a cut-off is provided which shall maintain the engine at any desired speed. The cut-off sleeve may be fixed by a set-screw or regulated by hand.

The general construction of engines, as above described, is not claimed by me as a part of my present invention. The specific features of improvement of which as applied to an engine of such character will now be severally described.

The cut-off sleeve 6 is made adjustable, preferably circumferentially, and is shown in Fig. C, and has its cut-off edge spiral. The port 5 must then be made to correspond in angle to this edge, in order to give a sharp cut-off. This cut-off sleeve has gear-teeth affixed to its circumference, as shown. The movements of a governor are transferred to this cut-off sleeve by means of corresponding gear-teeth affixed to a shaft which represents the governor movements. This is done preferably by means of

a wheel, 3, mounted on a shaft, 7, so that the governor movement shall be transferred through the steam-chest cover by means of a rotatory and not a sliding movement. By arranging the teeth in the pair of gears thus formed the cut-off sleeve 6 may be made to take up any desired position for any desired movement in the governor, and may have a long range of movement without friction, to correspond with only a short range in the governor movement.

The shaft 7 passes through the steam-chest cylinder and is joined to a governor-rod, 18. This governor-rod is worked by means of a centrifugal governor, 22, mounted upon the crank-shaft 21 itself of the engine. The governor is preferably within the crank-chamber 23. The engine as thus arranged can be made compact, and is not subject to accidents to governor-gearing, as when the engine works at a high speed and a centrifugal governor is driven by the usual gearing.

The top of the hollow trunk, instead of sliding directly against the adjustable cut-off sleeve, interferes less with the ease of motion of said cut-off sleeve, and consequently with the facility of adjustment of the cut-off sleeve by the governor, if a fixed sleeve, 4, surrounds the hollow trunk and the cut-off sleeve 6 works upon the fixed sleeve and not directly upon the moving trunk. This fixed sleeve is shown at Fig. B. Steam-passages are cut, as shown, through this fixed sleeve to allow passage of steam to the hollow trunk. These passages must be so made as to correspond to the port in the hollow trunk. The steam is admitted to the cylinder from the hollow trunk by the distribution-valve moving downward until the edge 11 of the valve is below the cylinder-port 12.

To insure the cut-off of steam to the hollow trunk the end in the steam-chest of the trunk 1 must be closed, so that when the steam can no longer enter through the port 5 it cannot enter through the open end of the trunk. If the end of the hollow trunk be permanently closed and the distribution-valve 15 extend only to 11, (the highest point necessary in the valve for use in the distribution of steam,) the steam would be cut off properly, but would be suddenly admitted to the top of the valve on the return-stroke of the piston when the port 5 emerged from the edge of the adjustable cut-off. Lubrication of the valve is also difficult when the top of the hollow trunk is permanently closed. The communicating passage of the distribution-valve from 13 to 17 might be made longer and the valve movement be arranged to make this passage put the ports 5 and 12 into communication at the beginning of the stroke, the edge 13 then rising above the port 5 to admit steam to the cylinder, and thus closing the hollow trunk above the port 5. In this case, however, the point of stroke at which expansion begins is limited by the closing of

the port 5 by the distribution-valve. Moreover, unless the admission-edge of the valve be made of a complex form to correspond with the shape of the port-opening 5, steam will be too gradually admitted by the movement of said valve at the beginning of the stroke. All these difficulties are avoided by making the admission of steam to the cylinder by the uncovering of the cylinder-port 12 by the distribution-valve and by adding to this valve the additional part from 9 to 2. The end 2 of this piece is always under pressure of the steam and keeps the valve constantly in thrust, and oil can be dropped from an ordinary cylinder-cup lubricator through the steam-chest cover onto this end.

I also make compound engines and engines with more than one cylinder embodying my improvements, but which do not otherwise differ in construction from the engine hereinbefore described.

I claim herein as my invention—

1. The combination of a cylinder, a piston coupled to a crank-shaft working in a closed crank-chamber, which piston is fixed upon a hollow trunk sliding into the steam-chest and conveying steam to the cylinder, a distribution-valve reciprocating with the piston, a cut-off valve, having gear-teeth affixed thereto, which closes a port in the hollow trunk and controls admission of steam to the same, and a shaft, having gear-teeth affixed thereto, which transfers to the plate the movements of a governor, substantially as and for the purpose set forth.

2. The combination of a cylinder, a piston coupled to a crank-shaft working in a closed crank-chamber, which piston is fixed upon a hollow trunk sliding into the steam-chest and conveying steam to the cylinder, a distribution-valve reciprocating with the piston, and a cut-off valve which closes a port in the hollow trunk and controls admission of steam to the same, and is adjusted by a shaft joined to the governor-rod of a centrifugal governor mounted upon the crank-shaft, substantially as and for the purpose set forth.

3. The combination of a cylinder, a piston coupled to a crank-shaft working in a closed crank-chamber, which piston is fixed upon a hollow trunk sliding into the steam-chest and conveying steam to the cylinder, a distribution-valve reciprocating with the piston, and a sleeve fixed in the steam-chest surrounding the hollow trunk and having steam-passages through it, which passages are opened or closed by a cut-off sleeve whose position is adjusted by a shaft transferring the movements of a governor, substantially as and for the purpose set forth.

4. The combination of a cylinder, a piston coupled to a crank-shaft working in a closed crank-chamber, which piston is fixed upon a hollow trunk sliding into the steam-chest and conveying steam to the cylinder, a cylindrical distribution-valve, 15, working in the hol-

low trunk and admitting steam to the cylinder by uncovering the cylinder-port 12, and having a part, 9 and 2, added to the valve to close the end of the hollow trunk and to keep
5 the valve constantly under steam-pressure, and an adjustable cut-off sleeve in the steam-chest, which closes a port in the hollow trunk

and controls admission of steam to the same, substantially as and for the purpose set forth.

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Witnesses:

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OTIS B. BENTON.