March 2, 1926. 1,575,476

C. L. COOK

ENGINE

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Fig. 1

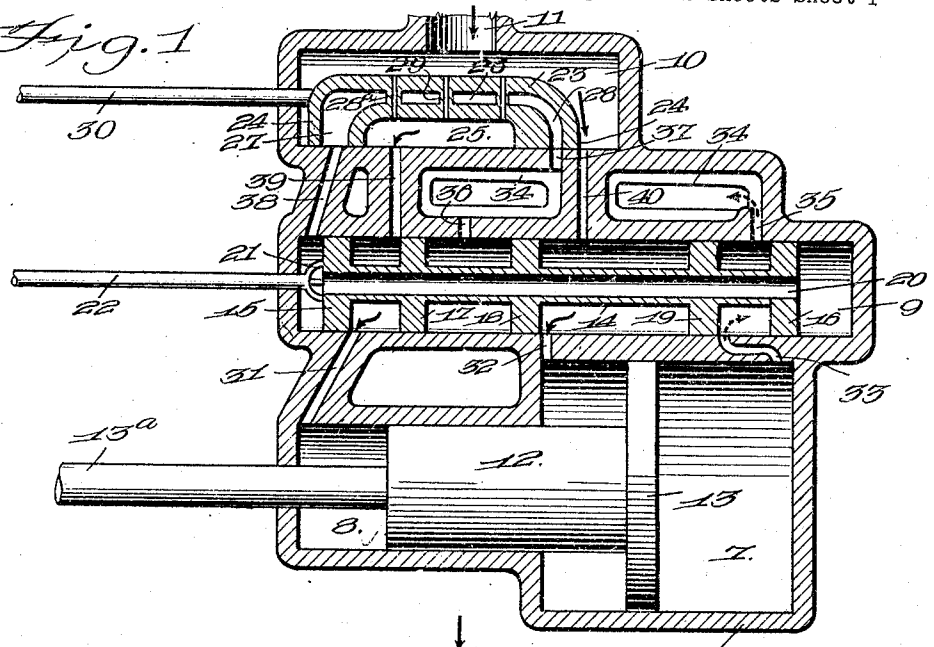
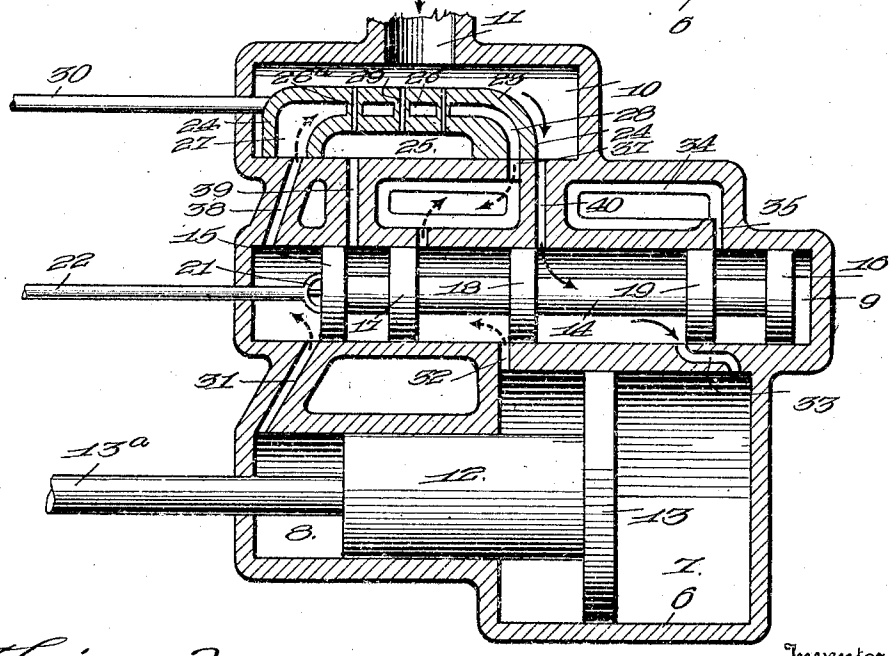


Fig. 2.



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Fig. 3.

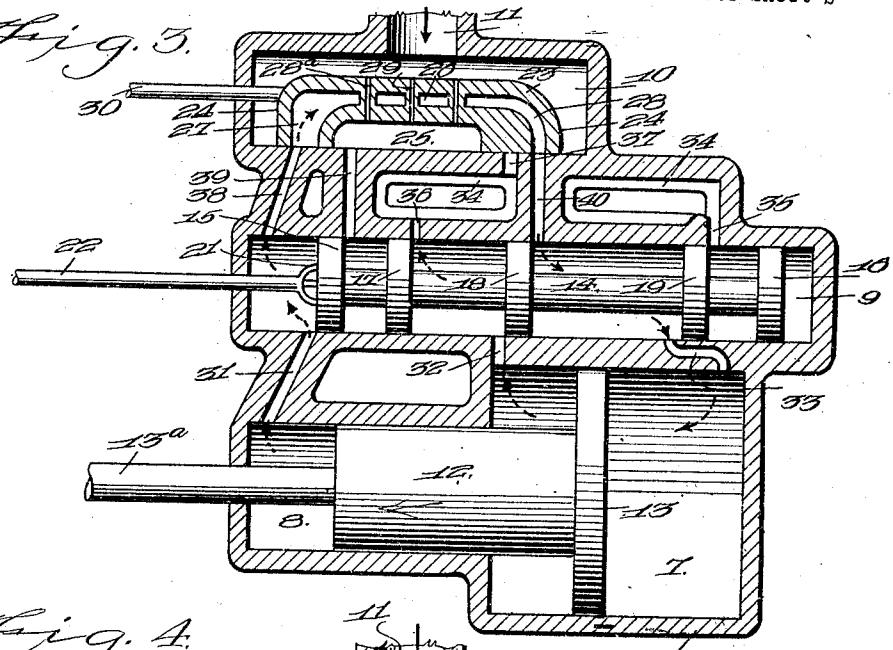


Fig. 4.

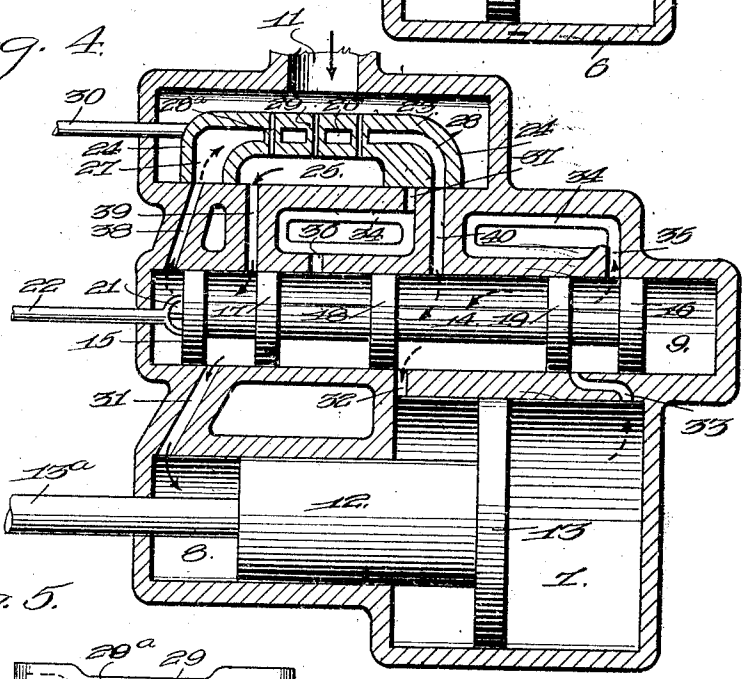
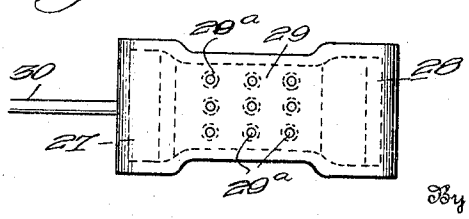


Fig. 5.



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Patented Mar. 2, 1926. 1,575,476

UNITED STATES PATENT OFFICE.

CHARLES LEE COOK, OF LOUISVILLE, KENTUCKY.

ENGINE.

Application filed June 10, 1921. Serial No. 476,506.

To all whom it may concern:

Be it known that I, CHARLES LEE COOK, a citizen of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented certain new and useful Improvements in Engines, of which the following is a specification.

The object of the present invention is to provide an engine having a very high degree of efficiency, and which may be utilized either as a direct acting engine, or as a compound engine. A further and very important object is to so relate the parts that when acting as a compound engine the superheat of the live steam is utilized for heating the exhaust steam used in the expansion cylinder, and thereby the efficiency of the latter is materially decreased, while any excessively high temperature of the live steam with its consequent deleterious influences is eliminated.

An embodiment of the invention somewhat diagrammatic in its character is illustrated in the accompanying drawings, wherein:—

Figure 1 is a sectional view showing the parts with the piston being driven in one direction entirely under the action of live steam,

Figure 2 is a view similar to Figure 1, but showing the piston moving in the opposite direction,

Figure 3 is a sectional view with the mechanism operating as a compound engine,

Figure 4 is a view similar to Figure 3, but showing the piston being moved in an opposite direction,

Figure 5 is a plan view of the converting valve.

In the embodiment disclosed, a cylinder member 6 is employed, having communicating piston chambers 7 and 8 of different diameters, the chamber 7 preferably being twice the diameter of the chamber 8. The cylinder member is furthermore provided with valve chambers 9 and 10, and expansive motive fluid, as for example steam, is introduced into the chamber 10 from any suitable source through a supply port 11.

Located in the cylinder member is a piston comprising a drum element 12 that operates in the chamber 8 and a head or disk element 13 connected to one end of the drum element and operating in the chamber 7. A piston rod 13ª extends from the drum element to any driven part desired. Operating in the chamber 9 is a piston valve, comprising a tubular rod 14 having terminal heads 15 and 16 and intermediate heads designated respectively 17, 18 and 19. The bore 20 of the rod 14 is open-ended. The valve is connected by a spider 21 to a valve rod 22 that may be engaged with and operated by any suitable valve gear. In the chamber 10 is located a process controlling valve 23 having downturned terminal portions 24 forming a pocket 25. This valve is furthermore provided with a passageway 26 having terminal ports 27 and 28 in the downturned ends 24. Transverse relief ports 28ª, preferably pass through the valve and through reenforcing webs 29 that bridge the passageway 26. The converting valve 23 is actuated through the medium of a rod 30 connected thereto and to any suitable actuating means.

A port or passageway 31, opening into the inner end of the piston chamber 8, also opens into one end portion of the valve chamber 9. An intermediate port 32 opens from the inner end of the piston chamber 7 into the central portion of the valve chamber 9 and a third port or passageway 33 constitutes means of communication between the outer end of the piston chamber 7 and the outer end portion of the valve chamber 9. Exhaust ports 34—34 open to atmosphere are formed in the cylinder member between the piston chambers 9 and 10. One of these ports is in communication with the piston chamber 9 through a passageway 35 preferably opposite to the port 33. Communication between the intermediate portion of the chamber 9 and the other exhaust port is established by a passageway 36. Another port 37 opens from the central exhaust chamber into the bottom of the valve chamber 10. Direct communication between the chambers 9 and 10 is established by an end port 38, by an intermediate port 39 and by an opposite end port 40.

The operation of the structure may be outlined as follows, and in this connection the solid line arrows are employed on the drawings to indicate live steam or other expansive motive fluid under pressure, while the dotted arrows are utilized to show exhaust. Assuming the engine is to be driven under full pressure by live steam alone, the converting valve 23 is moved to the position illustrated in Figures 1 and 2, while the intermediate valve is reciprocated in a man-

ner well understood by those skilled in the art. With the parts as shown in Figure 1, it will be evident that live steam entering the chamber 10 through the intake 11 will pass freely through the ports 40 and 32 into the inner end of the large piston chamber 7 and act against the rear face of the disk 13. Live steam will also flow freely through the ports 39 and 31 into the rear end of the piston chamber 8. Thus this live steam operates against two coactive faces of the piston member equaling the entire diameter of the piston, with the exception of the rod 13a. The exhaust in advance of the piston member will take place through the ports 33 and 35 to atmosphere. The piston is thus driven to the right. When the distributing valve is reversed the parts will assume the relation illustrated in Figure 2. Motive fluid under pressure will then flow from the chamber 10 through the ports 40 and 33 into the right hand end of the chamber 7, and operating against the full area of the disk 13 will drive the piston member to the left. The exhaust in this instance from behind the disk 13 will take place through the ports 32 and 36 to atmosphere and from behind the drum piston 12 through ports 31, 38, and 27; thence by the passageway 26 through ports 28 and 37 to atmosphere. It will be understood that with this arrangement the full power of the engine can be secured.

Under many conditions, however, it is only necessary to utilize a part of the power, and under such circumstances the apparatus can be readily converted into a compound engine by simply shifting the converting valve 23 to the position shown in Figures 3 and 4. Considering first Figure 4, it will be noted that when the parts are in the positions illustrated therein, live steam or other motive fluid will pass from the supply chamber 10 through the ports 39, and 31 into the piston chamber 8, driving the piston to the right. The motive fluid in advance of the disk 13 will exhaust through the ports 33 and 35 to atmosphere. The inner end of the larger piston chamber 7 behind the disk 13 is now shut off from atmosphere and therefore all the steam or other motive fluid which has been trapped in the various ports and chambers will have access, as indicated by the dotted arrows, to the inner end of said chamber 7 and will act upon the disk 13 to assist the propulsion of the piston. When the valve is shifted to the position illustrated in Figure 3, live motive fluid from the chamber 10 is entirely cut off from the piston chambers 7 and 8 but the steam which is in the chamber 8 and which is under high compression, will pass through the ports 31 and 38, passageway 26, ports 40 and 33 into the right hand and outer end of the piston chamber 7 and expanding in said chamber will drive the piston to the left. In this passage, it will be observed that the exhaust steam as it traverses the passageway through 23 will be surrounded by the superheated live steam in the chamber 10. Its temperature will thus be increased and its energy thereby materially augmented. At the same time should the live steam as is often the case be abnormally superheated, its temperature will be reduced, thus securing a double benefit. The exhaust from the inner end of the piston chamber 7 behind the disk 13 during this operation is freely permitted through the ports 32 and 36 to the atmosphere.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

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

1. In an expansible fluid operated engine, the combination with a cylinder member having a pair of piston chambers of different diameters and valve chambers, of a piston member comprising a disk of large diameter in the larger piston chamber and a drum of smaller diameter connected to the disk and operating in the smaller piston chamber, a distributing valve in one of the valve chambers for directing motive fluid alternately against opposing faces of the piston, a converting valve in the other chamber, and ports connecting the different chambers and controlled by the converting and distributing valves for either directing live motive fluid simultaneously to correspondingly disposed faces of the drum and disk and to the opposite face of the disk alternately, or to the face of the drum and exhausting it therefrom to the opposite face of the disk.

2. In an expansible fluid operated engine, the combination with a cylinder member having a pair of piston chambers of different diameters and valve chambers, of a piston member comprising a disk of large diameter in the larger piston chamber and a drum of smaller diameter connected to the disk and located in the smaller piston chamber, a distributing valve in one of the valve chambers for directing motive fluid alternately against opposing faces of the piston, a converting valve in the other of the valve chambers, and ports connecting the different chambers and controlled by the converting and distributing valves for either directing live motive fluid alternately to opposing faces of the piston member, or directing live motive fluid to one of the

piston faces and exhausting it thence to the opposing face, and said converting valve including a passageway for the exhaust fluid so directed and being subjected to the heat of the live motive fluid.

3. In an expansible fluid operated engine, the combination with a cylinder member having a pair of piston chambers of different diameters and valve chambers, of a piston member comprising a disk of large diameter in the larger piston chamber and a drum of smaller diameter in the smaller piston chamber, a distributing valve in one of the valve chambers, a converting valve in the other valve chamber, and ports connecting the different chambers and controlled by the converting and distributing valves for either directing live steam simultaneously to correspondingly disposed faces of the drum and disk and alternately to the opposite face of the disk or to the face of the drum and exhausting it thence to the opposite face of the disk, means for passing the live steam through the converting valve chamber and said converting valve in said chamber having a passageway that directs the exhaust steam from the drum piston face to the opposing face of the disk, said exhaust being thereby heated by said live steam.

In testimony whereof, I affix my signature.

CHARLES LEE COOK.