No. 719,084. PATENTED JAN. 27, 1903.

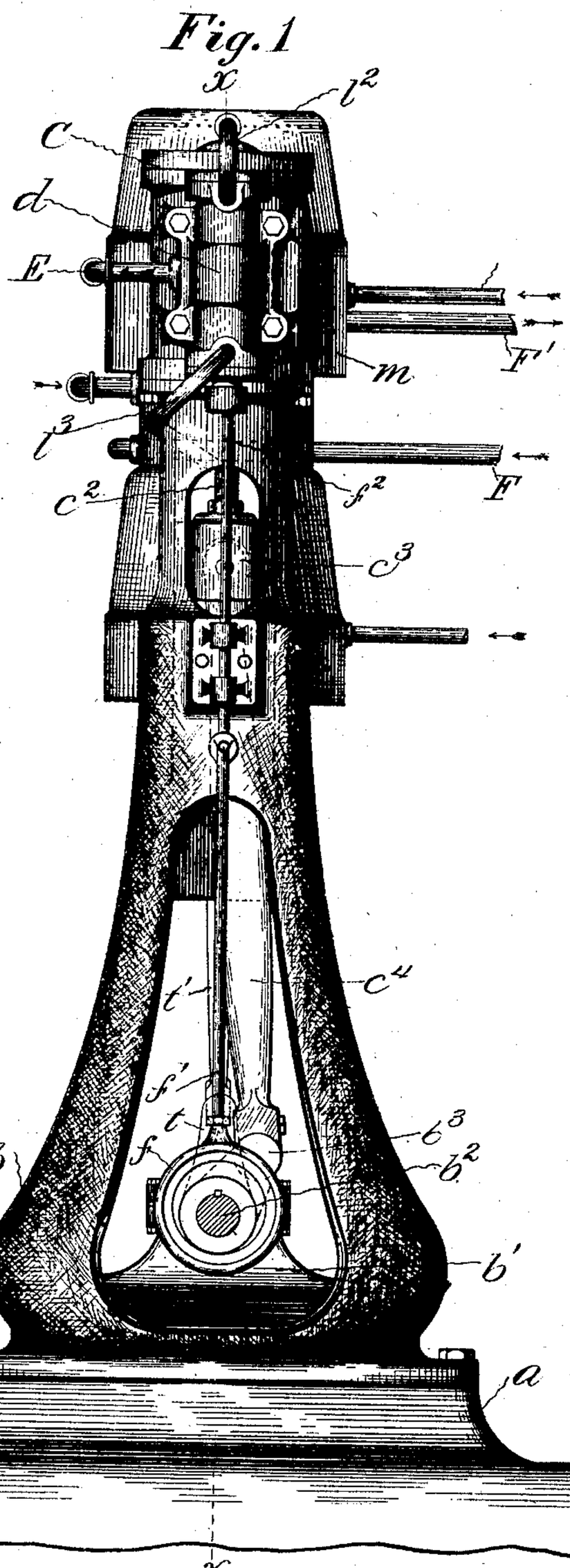
A. W. CASE.

HEAT ENGINE.

APPLICATION FILED MAY 3, 1898.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1



Witnesses:
William H. Barker
Arthur B. Jenkins.

Inventor:
Alfred Wells Case.
by Chas. L. Burdett,
Attorney

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Fig. 3

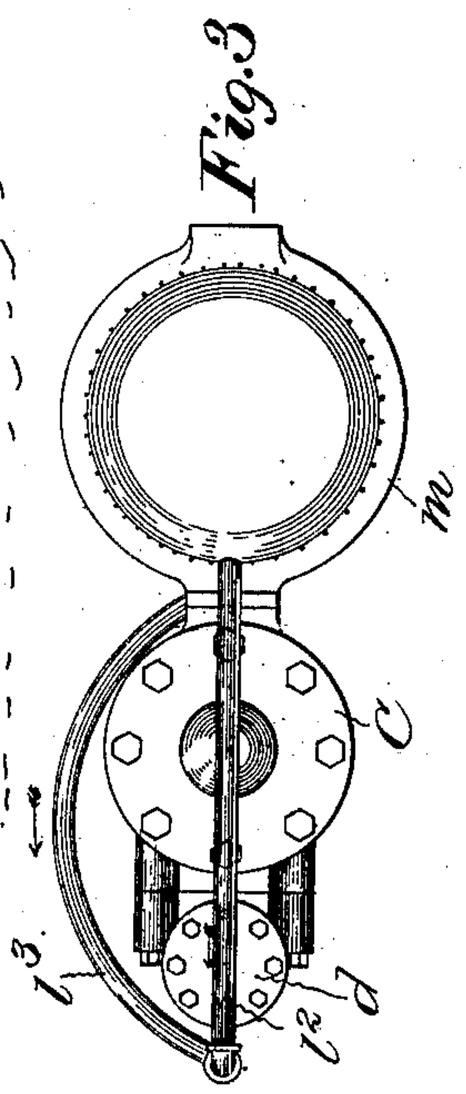
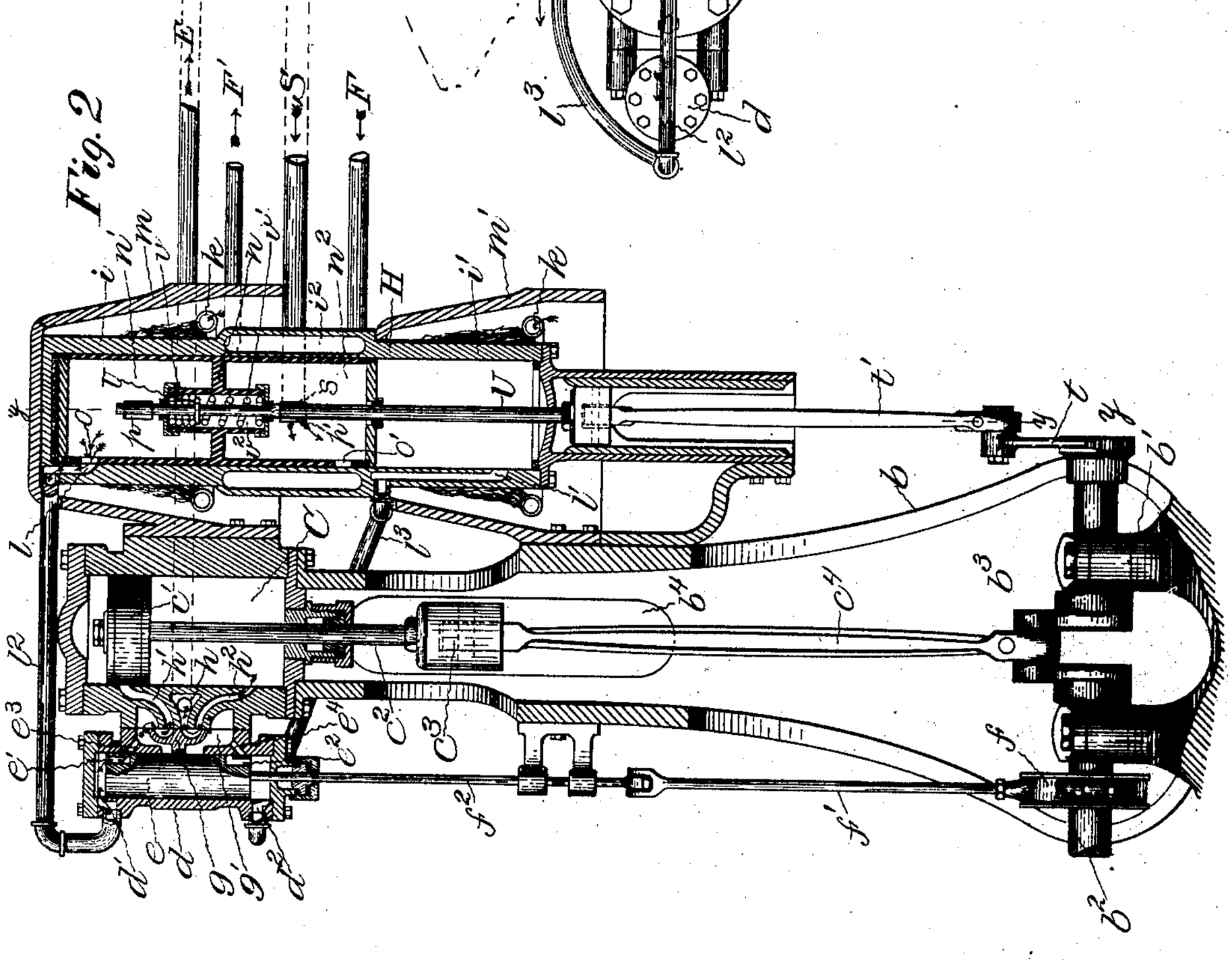


Fig. 2



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NO MODEL.

3 SHEETS—SHEET 3.

Fig. 4

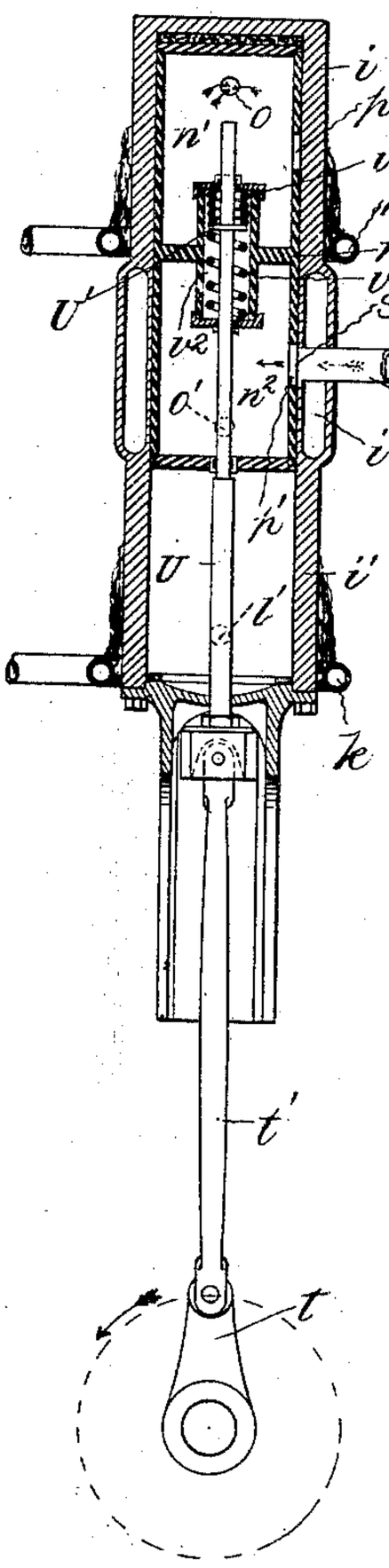


Fig. 5

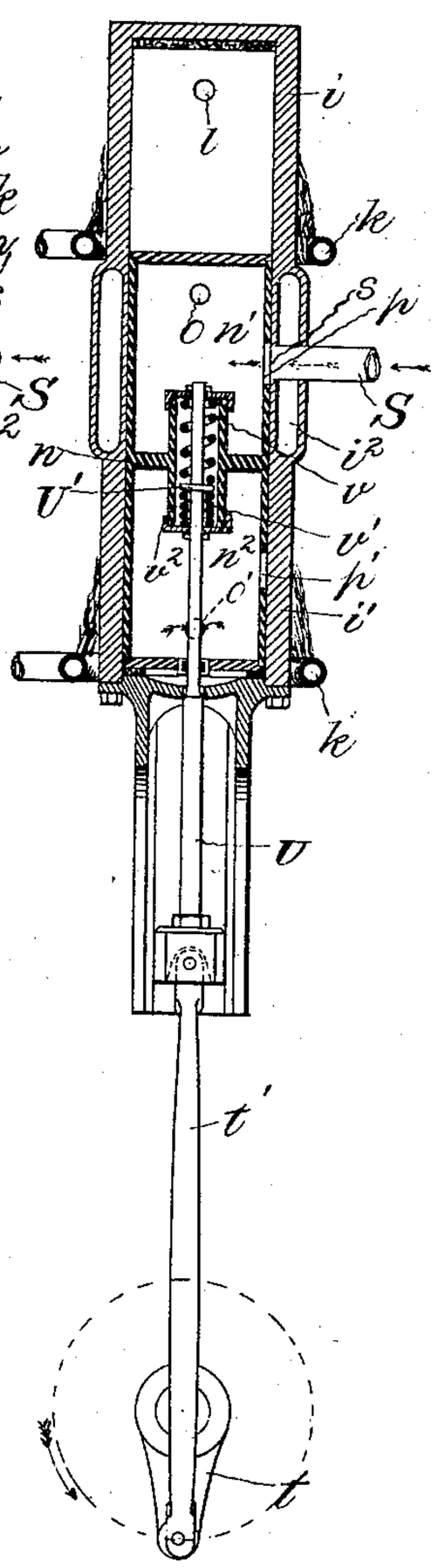
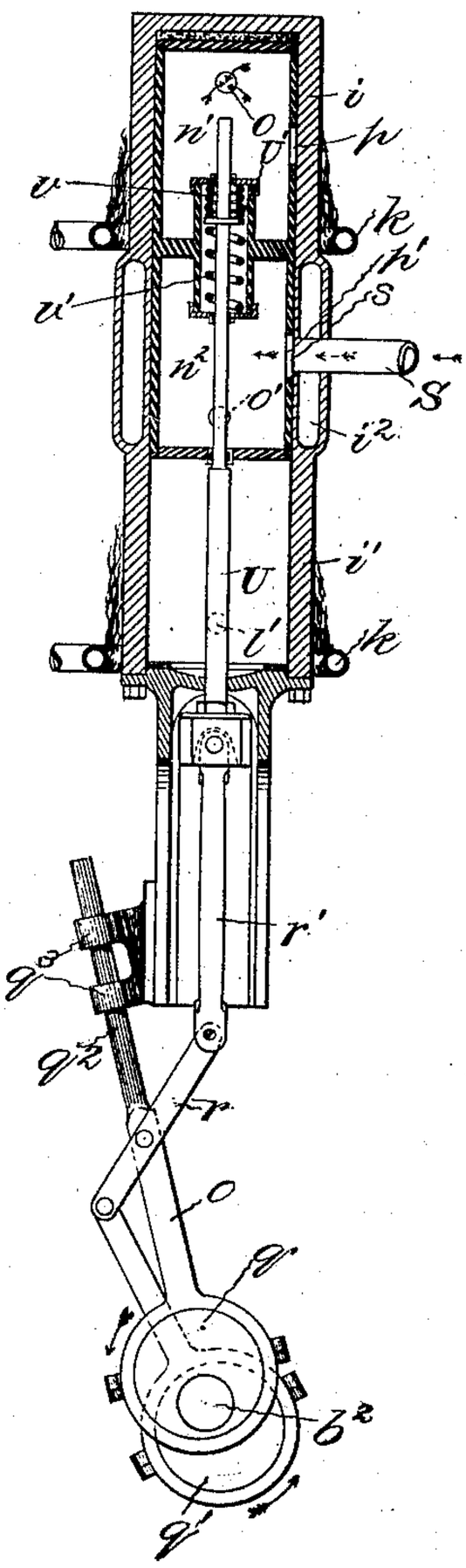


Fig. 6



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Attorney

UNITED STATES PATENT OFFICE.

ALFRED WELLS CASE, OF HIGHLAND PARK, CONNECTICUT.

HEAT-ENGINE.

SPECIFICATION forming part of Letters Patent No. 719,084, dated January 27, 1903.

Application filed May 3, 1898. Serial No. 679,572. (No model.)

To all whom it may concern:

Be it known that I, ALFRED WELLS CASE, a citizen of the United States, and a resident of Highland Park, in the town of Manchester, county of Hartford, and State of Connecticut, have invented certain new and useful Improvements in Heat-Engines, of which the following is a full, clear, and exact description, whereby any one skilled in the art can make and use the same.

My invention relates to the class of devices commonly called "steam-engines," but more properly "heat-engines"—that is, a device in which water, steam, or vapor is used as a medium through which kinetic energy is made to perform mechanical operations; and the object of my invention is to produce such a device or system for energizing and controlling the medium as will secure the maximum amount of work from a given initial heat, saving a great percentage of the heat which is allowed to go to waste in the ordinary steam-engine as commonly used.

To this end my invention consists in the device as a whole and in the combination of the parts and in the details of such parts and their combination, as hereinafter described, and more particularly set out in the claims.

Referring to the drawings, Figure 1 is a view in end elevation of the device. Fig. 2 is a view in central vertical section on a plane denoted by the dotted line $x\ x$ of Fig. 1 with the base and lower portion of the pedestal broken away. Fig. 3 is a top or plan view of the cylinders. Fig. 4 is a sectional view of the transferrer and heater-case on a plane denoted by the dotted line $y\ y$ of Fig. 2. In this view the transferrer is shown at the upper end of its stroke. Fig. 5 is a view of the parts shown in Fig. 4, the transferrer being at the opposite end of its stroke from that shown in Fig. 4. Fig. 6 shows a modified form of transferrer.

For the purpose of illustration I have shown what is commonly known as a "vertical" or upright engine, although it is readily understood that the improvements may be applied in any of the many forms of engines in common use.

The letter a denotes the base, cast to proper size and form and which has mounted upon it the pedestal b. A pillow-block b' is secured within an enlarged recess at the base of the pedestal and forms suitable bearings for the driving-shaft b^2. The main steam-cylinder c is secured to the top of the pedestal and is provided, as in the case of any ordinary steam-engine, with a piston c' and a piston-rod c^2, the latter passing through a suitable stuffing-box attached to the lower cylinder-head. Secured to the outer end of the piston-rod is the cross-head c^3, provided with slide-surfaces adapted to engage and be moved along the slideways b^4, located within the upper portion of the pedestal. The reciprocating rectilinear motion of this cross-head is transformed to rotary motion of the driving-shaft through the connecting-rod c^4 and crank-arm b^3.

The letter d denotes what may well be called a "valve-cylinder," provided near either end with inlets d' and d^2. A cylindrical valve-piston e, located within the valve-cylinder, receives a reciprocating movement from the eccentric f, mounted on the shaft b^2, through the eccentric-rod f' and piston-rod f^2. This piston e is provided with ports or openings e' and e^2, which by the movement of the piston are alternately brought into registering positions with the chest-ports e^3 and e^4, these ports being normally closed by the surface of the cylindrical piston e.

The letter g denotes a slide-valve attached to and moving with the piston e. This valve g, moving within the chest g', is of the ordinary B pattern and its function is to control the ports $h\ h'\ h^2$ of the main cylinder c.

The letter H denotes a heater-case. The walls of the upper and lower sections $i\ i'$ of this case are with the exception of the port-spaces $l\ l'$ solid and of a considerable thickness, that they may acquire and retain a proper degree of heat, which may be applied by any suitable heating means. In the drawings, $k\ k'$ represent a form of heat-supply—namely, ring gas-burners surrounding the cylinder. The flames from these burners are drawn upward and evenly diffused about the heater-case by air-currents entering at the bottom of the cone-like hoods $m\ m'$, suitable perforations being provided at the upper portion of the hoods to give a proper draft. The central section of the heater-case or the portion between the heating-sections $i\ i'$ is cored out, a chamber being formed, as at i^2. It has been found desirable in the operation of the

device, as hereinafter described, to have a constant temperature at this central section and preferably a temperature not exceeding that of the source of supply or boiler. In case steam is used as the active medium this very desirable result may be obtained by using the chamber i^2 as a water-jacket. In this instance the feed-water, coming from the feed-water heater at a temperature very nearly equal to that of the boiler A, is allowed to enter the chamber through a pipe F, a return-pipe F′ being provided near the top of the chamber to carry the heated water on to the boiler A. By this means the temperature of the central portion of the heater-case may be kept nearly constant irrespective of the temperatures of the sections $i\ i'$, which in practice are very much higher. Fitting snugly within this heater-case and having a reciprocating motion therein is a transferrer n. This transferrer has two compartments $n'\ n^2$, duplicates in size and operation. Each compartment is provided with two openings or ports, outlets $o\ o'$ and inlets $p\ p'$, arranged to be opened and closed by the movement of the transferrer within the heater-case. The arrangement is such that the inlet-port of one compartment is always in position to receive steam or vapor from a supply-port, as s, at the instant the outlet-port of its duplicate registers with one of the ports $l\ l'$ of the heater-case. (See Figs. 4 and 5.) Suitable conductors $l^2\ l^3$ connect these ports $l\ l'$ of the heater-case with the inlets $d'\ d^2$ of the valve-cylinder. The transferrer n receives its movement from the crank t through the connecting rod t' and piston-rod U and carries a quantity of the steam bodily from the place where the transferrer receives its charge to the point where it discharges the steam, and by the term "bodily" I mean that the quantity or charge of fluid is moved by power other than that exercised by itself, or, in other words, that the charge does not flow while being superheated. The piston-rod instead of being secured directly to the transferrer, imparting to it a motion equal in length to the entire throw of the crank, moves the piston by contact with the intermediate cushioning-springs $v\ v'$. These springs are arranged within a spring-chamber v^2, one on either side of the piston-rod collar U′. The spring in the upper portion of the box is of sufficient size and strength to support the transferrer and normally hold it in a central position with relation to the collar U′. The throw of the crank and consequent movement of the piston-rod exceeds the total movement required to carry the transferrer the entire length of the heater-chamber cylinder. This lost motion between the parts allows the transferrer to come to rest at both ends of the stroke, thus securing sufficient time to insure a proper working of the ports or valves of the transferrer and heater-case.

In Fig. 6 is shown a modification of the piston-actuating mechanism. In this form a pair of eccentrics is used in place of the crank to give a motion of proper length to the piston-rod. These eccentrics $q\ q'$ are so set upon the shaft b^2 as to work in opposition to each other—that is, one is always rising while the other is falling. The eccentric q' is provided with an extension or guide q^2, moving in suitable journals q^3. A lever-arm r is connected to the rods of these eccentrics by suitable pins, the outer end of the lever having proper connection with the connecting-rod r'. It will be readily seen from this construction that with a lever-arm of proper proportions eccentrics of small throw may be used to give a motion of the required length to the piston.

While I have shown and described herein a means of accomplishing the desired result, I do not intend to limit myself to any particular means for accomplishing this end, as any device for increasing the force of an active medium in its transmission from the source of supply to the point of action will come within the scope of my invention.

The operation of the device is as follows: Steam or vapor under pressure generated in any suitable source of supply, as a boiler A, is led to the port s of the heater-case through a conducting-pipe S. This port s, however, is closed to the passage of steam by the outer surface of the transferrer except when one of the inlet-ports $p\ p'$ is brought into registering position with it—that is, when the transferrer is at either end of its stroke. In either of these positions one of the compartments $n'\ n^2$ is free to receive its charge of steam or vapor from the supply source. (See Figs. 4 and 5.) Suppose the transferrer, Fig. 2, to be at the lower end of its stroke, (the upper and lower sections of the heater-case being already brought to a high degree of temperature by flames from the burners $k\ k'$.) Steam may now enter and fill the compartment n', temperature of the parts (owing to the nearly constant temperature of the central section of the heater-case at this point) being such that the steam or vapor neither expands nor condenses. Suppose the pressure of the fluid entering the compartment to be one hundred pounds per square inch. Now if the main shaft be turned a half-revolution the transferrer will move upward to the position shown in Fig. 2, the compartment n' with its charge of steam being subjected to the heating influence of the upper section i of the heater-case, both the inlet and outlet ports of the compartment being closed during its upward movement. This increase in temperature will of course increase to a great degree the pressure of the steam confined within the compartment—say to two hundred and ten pounds per square inch. As the piston reaches the upper end of its stroke the outlet-port o is brought opposite the opening l, allowing the steam, now at a high pressure, to enter the main cylinder C, the ports e', e^3, and h' being open. The steam or vapor now acting upon the piston c' drives it downward, causing the shaft b^2 to

rotate. During this discharge from the compartment n' the lower compartment n^2 has been in proper position to receive its charge of steam at the lower pressure, the slight pause of the transferrer during the compression of the springs v v' giving ample time both for a complete filling of the lower compartment and discharging of the upper. The shaft b^2, now rotated by the downward thrust of the piston and connecting-rods, causes the transferrer to move to the lower end of its stroke, suitable connection being provided for this purpose, as already described. This brings the compartment n^2 into the heater-section i', where, the pressure of its charge being raised, as in the case of the compartment n' just described, it discharges through the opening l' and conductor l^3 to the valve-cylinder d. During this downward movement of the transferrer the eccentric f has moved the valve-piston e and slide-valve g until the ports e^2 e^4 register, the upper port e^3 being now closed. This arrangement of the ports now gives the high-pressure steam free access to the under side of the piston c' through ports e^2 e^4 h^2, where it exerts its influence to drive the piston upward until the valve-piston e is moved to a position to admit another charge of high-pressure steam from the compartment n'. The port h', which in the discharge of the compartment n' acted as an inlet-port, now serves as an exhaust, being coupled with the port h by the slide-valve g. This exhaust h has a conductor E, which leads back to the boiler A or source of supply. From this it is seen that the steam at an initial pressure of one hundred pounds per square inch has been raised to two hundred and ten pounds per square inch by the heater-section and at this increased pressure has been admitted to the main cylinder to act upon the piston c'. The cylinder c and length of stroke of the piston are so proportioned that this high pressure of steam instead of losing nearly all its pressure in moving the piston decreases in pressure, say, one hundred pounds per square inch—that is, after moving the piston downward till the inlet-port is changed to exhaust there still remains an actual pressure of one hundred and ten pounds per square inch. The exhaust being now opened, this steam at one hundred and ten pounds pressure will force its way back into the boiler, where a pressure of only one hundred pounds exists, carrying with it a great amount of heat.

The above pressures are arbitrary and are taken merely as an illustration.

I claim as my invention—

1. In combination, a source of supply for generating fluid under pressure, the main driving mechanism of an engine, operative connections between the supply and main driving mechanism, means for separating and carrying a charge of the fluid bodily from the supply to the point of delivery to the driving mechanism, and means for increasing the pressure of said separated charge.

2. In combination, a source of supply for generating fluid under pressure, the main driving mechanism of an engine, a movable transferrer operatively connected with the source and with the driving mechanism and arranged to carry a charge of fluid bodily to the place of discharge, means for closing said connections, and means for increasing the pressure of the charge in the transferrer.

3. In combination, a source of supply for generating fluid under pressure, the main driving mechanism of an engine, a transferrer, having compartments, operatively connected with the source and with the main driving mechanism and arranged to carry a charge of fluid bodily to the place of discharge to the driving mechanism, and means for increasing the pressure of the charge while contained in said compartments.

4. In combination, a source of supply for generating fluid under pressure, the main driving mechanism of an engine, a transferrer having compartments, operatively connected with the source and with the driving mechanism of the engine and arranged to carry a charge of fluid bodily to the place of discharge to the driving mechanism, means for closing said connections and means for increasing the pressure of the fluid while contained in said compartments.

5. In combination, a source of supply for generating fluid under pressure, the main driving mechanism of an engine, a transferrer connected with the source and with said driving mechanism, means for moving said transferrer whereby said connections are opened or closed and a charge of fluid carried bodily to the place of discharge to the driving mechanism, and means for increasing the pressure of the fluid while contained in the transferrer.

6. In combination, a source of supply for generating fluid under pressure, the main driving mechanism of an engine, a movable transferrer operatively connected with the source and with the driving mechanism and arranged to carry a charge of fluid bodily to the place of discharge to the driving mechanism, and means for increasing the force of said charge delivered to the transferrer and after its departure from the source and for action on the driving mechanism.

7. In combination, a source of supply for generating fluid under pressure, the main driving mechanism of an engine, a movable transferrer arranged to receive and to carry a charge of the fluid bodily from the supply to the place of discharge to the driving mechanism, means for increasing the pressure of the fluid in the transferrer and for delivering it to the driving mechanism, and means for decreasing the pressure in the transferrer for the purpose of receiving another supply at the temperature and pressure of the source.

ALFRED WELLS CASE.

Witnesses:
CHAS. L. BURDETT,
ARTHUR B. JENKINS.