

E. F. ENGEL & L. ANDERSON.

CALORIC ENGINE.

APPLICATION FILED MAY 8, 1914.

Patented Feb. 16, 1915.

3 SHEETS—SHEET 1.

1,128,860.

Fig. 3

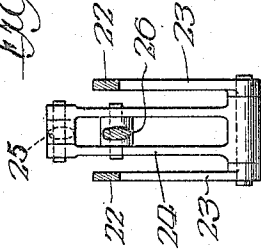


Fig. 2

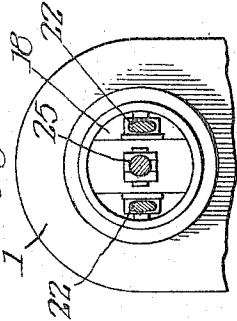
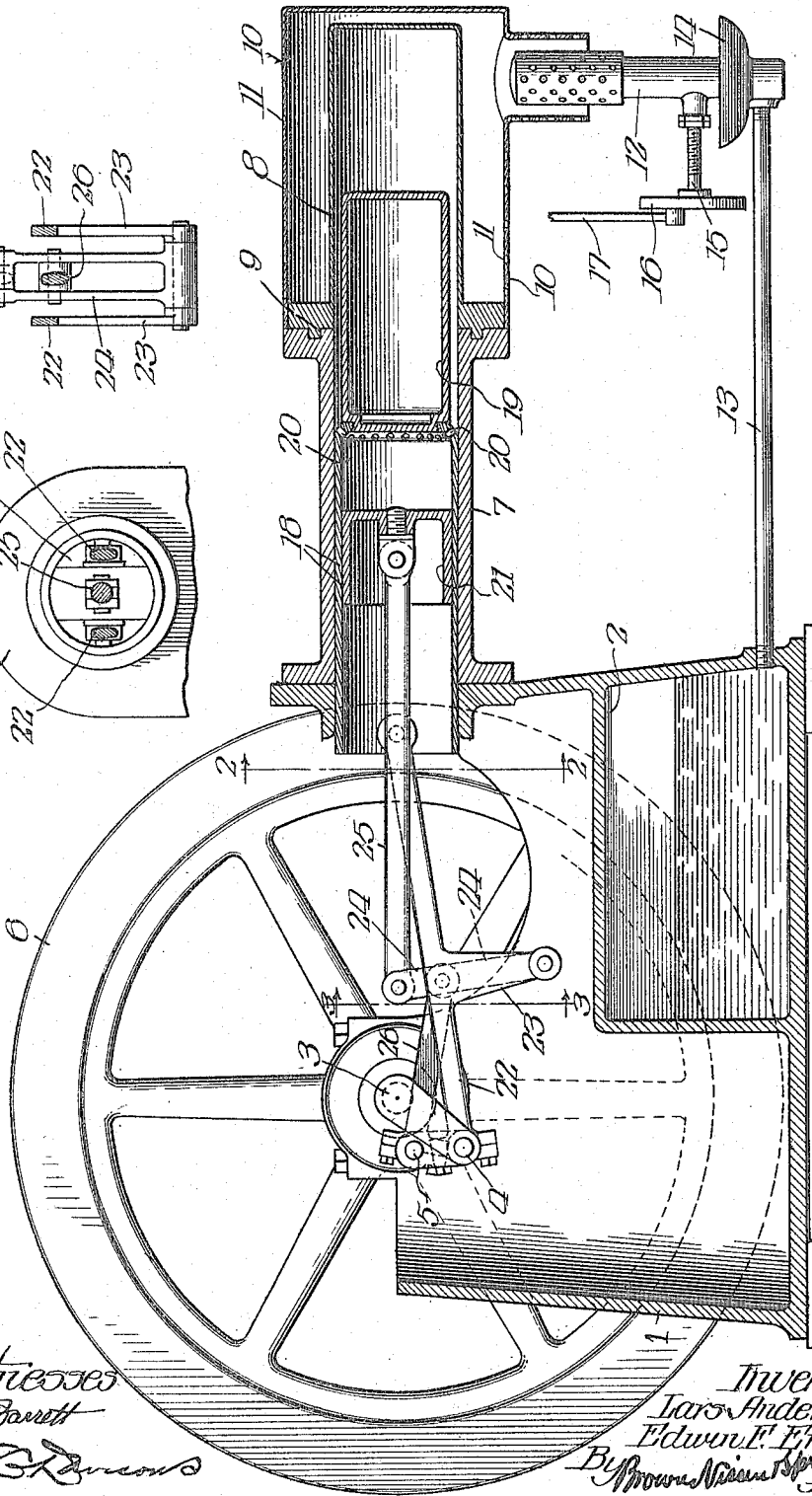


Fig. 1



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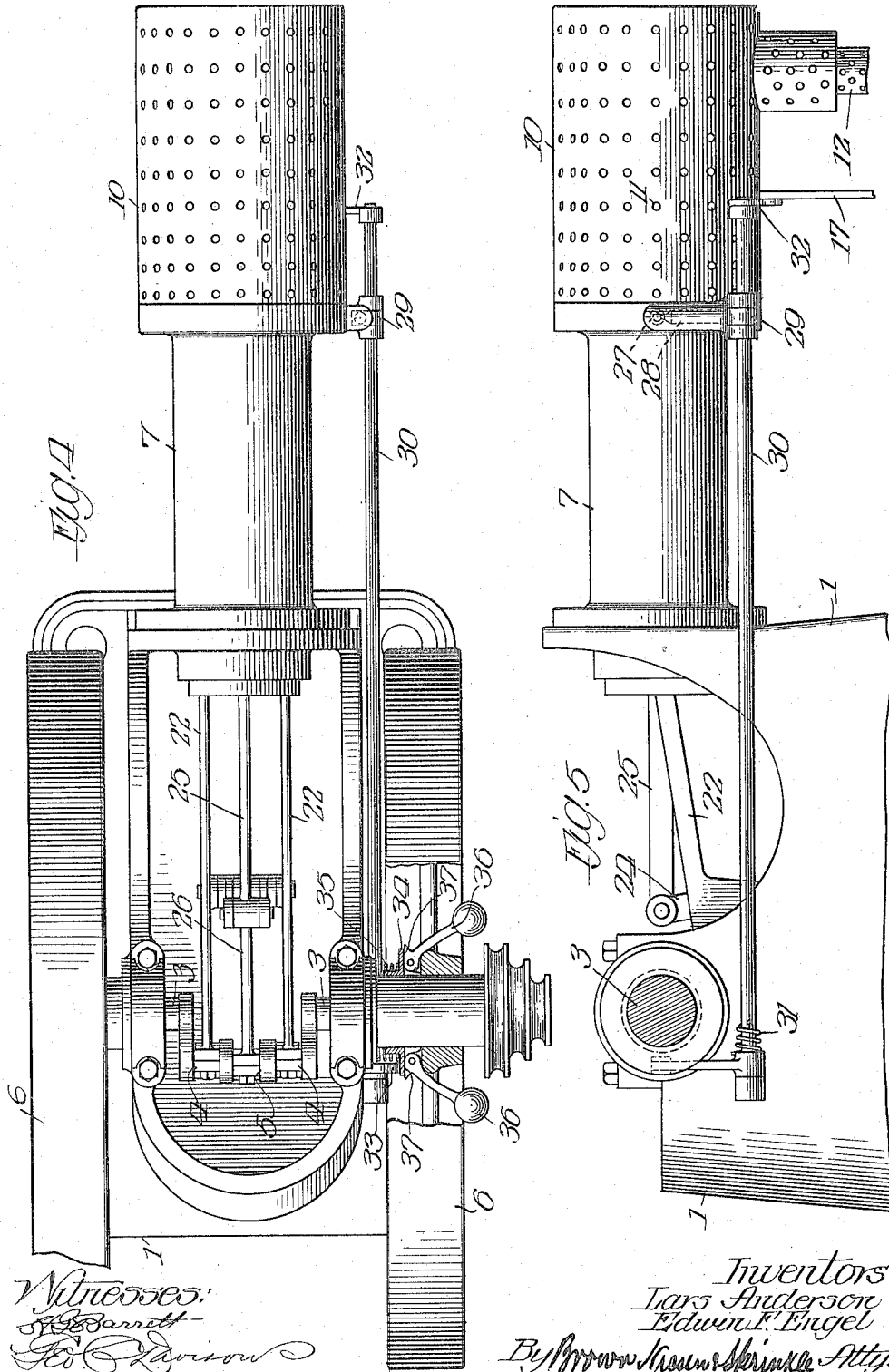
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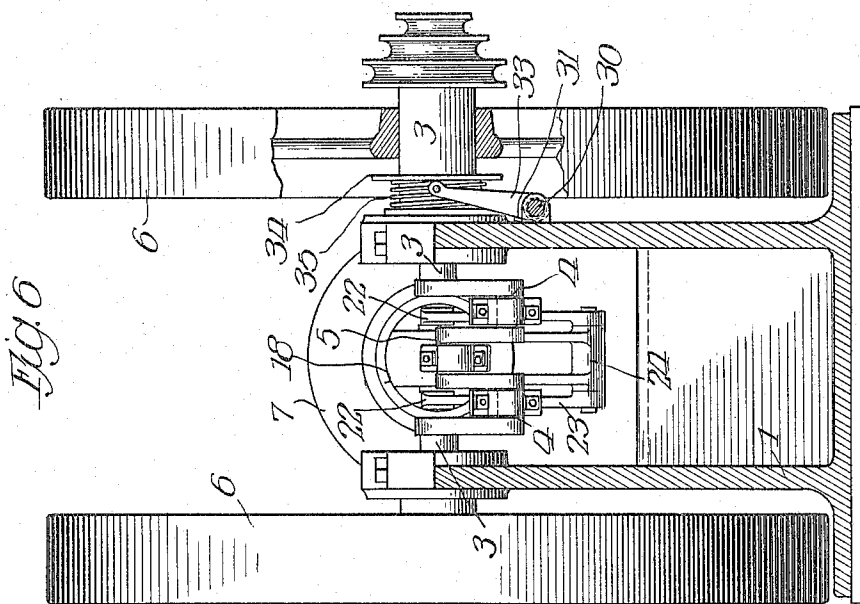
3 SHEETS-SHEET 2.



APPLICATION FILED MAY 8, 1914.

3 SHEETS--SHEET 3.

Fig. 7 is a perspective view of a component with a circular opening and a flange. Fig. 8 is a side view of the component showing its profile and a bolt. Figs. 9, 10, and 11 are cross-sectional views of a mechanical assembly showing various components and their interactions, including a lever and a frame.



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UNITED STATES PATENT OFFICE.

EDWIN F. ENGEL AND LARS ANDERSON, OF CHICAGO, ILLINOIS, ASSIGNORS OF ONE-HALF TO GEORGE W. STAHL, OF CHICAGO, ILLINOIS.

CALORIC ENGINE.

1,128,860.

Specification of Letters Patent.

Patented Feb. 16, 1915.

Application filed May 8, 1914. Serial No. 837,154.

To all whom it may concern:

Be it known that we, EDWIN F. ENGEL and LARS ANDERSON, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Caloric Engines, of which the following is a specification.

This invention relates to engines commonly known as hot air engines which are impelled by the expansion and contraction of a fluid contained in a closed cylinder, and the principal object of the invention is to provide an improved construction, combination and arrangement of the several parts for producing a simple, economical and efficient engine of this class.

A further object of the invention is to provide means for automatically governing the speed of the engine.

A still further object is to provide improved means for effecting the movement of the plunger and piston thereof in the cylinder.

For the attainment of these ends and the accomplishment of other new and useful objects as will appear, the invention consists in the features of novelty in the construction, combination and arrangement of the several parts generally shown in the accompanying drawings and described in the specification, but more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a side elevation, partly in section, of an engine constructed in accordance with the principles of our invention; Fig. 2 is a detail sectional view on the line 2—2 of Fig. 1; Fig. 3 is a detail sectional view on the line 3—3 of Fig. 1; Fig. 4 is a plan view; Fig. 5 is a side elevation of a portion of the engine; Fig. 6 is an end elevation; Fig. 7 is a detail sectional view showing the governor valve, and Figs. 8, 9, 10 and 11 are diagrammatic views showing the relative positions of the plunger and piston within the cylinder for different positions of the crank shaft.

Referring now more particularly to the drawings, an engine bed 1 is formed with a fluid fuel receptacle 2 and provides bearings for a crank shaft 3 having offset crank portions 4 and 5, one in advance of the other. Mounted on the crank shaft are fly wheels 6, one at each side of the base. Secured to the engine base is a cylindrical cas-

ing 7 to which is connected a heating cylinder 8 forming a continuation of the cylindrical surface thereof substantially in line with the center of the crank shaft and secured to the casing by means of a fluid-tight joint 9. Surrounding the heating cylinder 8 is a heating jacket 10 with perforations 11 therein, and with an opening for a burner 12 which receives its fuel from the fluid fuel receptacle 2 by means of a pipe 13. A generating cup 14 is provided in connection with the burner, and the burner is controlled by means of a needle valve having a stem 15 rotated by means of a disk 16 to which a control rod 17 is attached.

Mounted for free reciprocation in the casing 7 and the cylinder 8 is a plunger 18 open at one end and with a closed portion 19 at the end adjacent the heating cylinder, which is less in diameter than the plunger proper so that an air space is formed between the closed portion 19 and the cylinder 8. Adjacent the point where the closed portion 19 is connected to the plunger proper, the plunger is provided with perforations 20 which form a communication between the plunger portion 18 and the space within the cylinder 8 and cylindrical member 7. Fitting closely within the plunger 18 and freely movable therein is a piston 21.

The fluid is expanded in the cylinder 8 and contracted in the casing 7 and the action is produced exclusively by the movement of the piston 21 in the plunger 18 and by the movement of them both in the casing 7. The proper movement is effected by means of a rod 22 formed with a lateral extension 23 which connects one of the crank portions 4 with the plunger 18. Provided at one end in the lateral projection 23 is a lever 24, the other end of which is connected by means of a rod 25 with a piston 21. Intermediate the ends of the lever one end of another rod 26 is connected, the other end of which is connected to the crank portion 5 which is angularly in advance of the crank portion 4. Preferably there are two rods 22 connected, one at each side of the plunger 18, as shown more clearly in Fig. 2, with the rod 25 extending between them and the lever to which the rod 25 is pivotally connected being mounted on a rod connecting the extremities of the lateral extensions 23, as shown more clearly in Fig. 3. The result of this arrangement of parts is

that the movement of the piston 21 is in advance of the movement of the plunger, and the lever connection with the piston causes it to have a quicker movement and a longer throw than the plunger.

The cylindrical casing 7 is provided at the end adjacent the cylinder 8 with an opening 27 controlled by a valve 28. This valve falls of its own weight to admit air through the opening 27 and is maintained in closed position by means of a cam 29 mounted on a governor rod 30. The governor rod extends below the crank shaft of the base and is provided with a coil spring 31 which tends to press it in the direction to hold the valve 28 closed. The rod is also provided with a crank arm 32 to which the rod 17, for controlling the needle valve of the burner 12, is connected, so that when the valve 28 opens, the valve stem 15 is rotated in a direction to shut off the fuel supply. In order to control the movement of the governor rod an arm 33 (see Figs. 4 and 6) is connected thereto adjacent the crank shaft 3, the outer end of which bears against a collar 34 pressed outwardly by a spring 35. Pivotaly mounted in the fly wheel at this side of the engine are weighted levers 36 each having a cam surface 37 bearing against the collar 34. When the fly wheel is rotated the weighted levers fly outwardly causing the cam surface to press the collar 34 inwardly against the tension of the spring 35 and causes the governor rod 30 to be rotated by reason of the engagement of the arm 33 with the collar 34, thus controlling the operation of the air valve 28 and the fuel burner 12, as previously set forth.

It should be understood, of course, that the admission of air through the opening 27 decreases the efficiency of the engine by destroying the partial vacuum within the expansion chamber and thereby cutting down the power produced by the expansion and contraction of the fluid within the normally closed chamber. This action is also assisted at the same time by the control of the fluid supply to the burner 12.

In operation the heating of the air within the cylinder 8 causes it to expand thereby forcing the piston outwardly as shown in Fig. 8 and moving with it the plunger 18. The piston at first travels more rapidly than the plunger and this action draws the heated fluid through the openings 20 into a space within the plunger 18 and within the space covered by the cylinder casing 7. Drawing the heated air through the restricted openings 20 into the space in the plunger assists in cooling the air or fluid, and the contact of the air with the plunger which in turn is in contact with the cooling casing 7 further cools and contracts the air or fluid and causes a partial vacuum which sets up a counter-movement of the air through the

openings 20 into the larger space in the heating cylinder thereby acting upon the piston and assisting the return movement of both the piston and the plunger. If we assume in Fig. 8 that the air is expanding the piston will be impelled in the direction of the arrow and at first will move more rapidly than the plunger increasing the space within the plunger and drawing the heated air through the restricted openings 20. Because of the fact that the piston is at a constant angular distance in advance of the plunger it will reach the end of its stroke before the plunger and will be started on the return movement (as shown by Fig. 10) in advance of the plunger. Before starting on the return movement however the air within the plunger has been sufficiently cooled by its contact with the plunger casing 18 which contacts with the cooling cylinder 7, to contract the air and the contraction assists in moving the piston within the plunger and the plunger within the casings 7 and 8. It will be seen therefore that the piston acts at a constant angular distance in advance of the plunger at all times. The cycle of operation diagrammatically shown by Figs. 8 to 11, is repeated for each revolution and if the speed of the engine is constant the amount of air within the cylinders will remain constant. The speed is automatically governed by the admission or exhaust of air to or from the heating chamber.

The cylindrical member 7 may be regarded as a cooling cylinder and the cylinder 8 as the heating cylinder, the cylinders being connected by a fluid tight joint preferably consisting of a coöperating ridge and groove joint.

It is obvious that others skilled in the arts to which this invention appertains may make various changes in the construction, combination and arrangement of the several parts without departing from the spirit and scope of the invention.

What we claim is:

1. In a caloric engine, the combination with a cylinder, of a plunger movable therein, and a piston movable a constant angular amount in advance of the plunger to vary the expansive space in the cylinder.

2. In a caloric engine, the combination with a cylinder, of a plunger movable therein, and a piston movable a predetermined angular amount at a constant angular distance from the plunger to vary the expansive space in the cylinder.

3. In a caloric engine, the combination with a cylinder, of a plunger movable therein, and a piston movable in the plunger at a constant angular distance from and at a different speed than the plunger.

4. In a caloric engine, the combination with a cylinder, of a hollow plunger movable therein having perforations in the sides,

and a piston movable in the plunger in the same direction and at a constant angular distance from the plunger to vary the expansive space in the plunger.

5 5. In a caloric engine, the combination with a cylinder, of a plunger movable therein, a piston movable in the plunger, a crank shaft with offset crank portions, one in advance of the other, a rod connecting the
10 plunger with one of the crank portions, and means for connecting the piston with the offset crank portion which is at a constant angular distance from the other crank portion.

15 6. In a caloric engine, the combination with a cylinder, of a plunger movable therein, a piston movable in the plunger, a crank shaft with offset crank portions, one in advance of the other, a rod connecting the
20 plunger with one of the crank portions, and means pivoted on the rod connecting the piston with the offset crank portion which is at a constant angular distance from the other offset crank portion.

25 7. In a caloric engine, the combination with a cylinder, of a plunger movable therein, a piston movable in the plunger, a crank shaft with offset crank portions, one a predetermined amount in advance of the other,
30 and means connecting the plunger and the piston to the crank, the piston being connected to that portion at a constant angular distance from the portion to which the plunger is connected.

35 8. In a caloric engine, the combination with a cylinder, of a plunger movable therein, a piston movable in the plunger, a crank shaft with crank portions, one angularly in advance of the other, a rod connecting the
40 plunger and one of the crank portions, a lever pivoted to the rod, and other rods connected to the lever one of which is connected to the offset portion of the crank shaft and the other of which is connected
45 to the piston for causing a greater throw and a quicker action of piston than of the plunger.

9. In a caloric engine, the combination with a cylinder, of a plunger movable therein, a piston movable in the plunger, a crank shaft having offset crank portions, one in advance of the other, a rod connecting one of the crank portions with the plunger, said rod having a lateral projection, a lever pivoted at one end in the extension, a rod connecting the outer end of the lever with the piston, and another rod connecting the lever intermediate its ends with the crank portion
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which is angular in advance of the other, whereby the piston is moved in advance of a greater length of stroke than the plunger. 60

10. In a caloric engine the combination with the cylinder of a hollow plunger movable therein having perforations in the sides, a piston movable in the plunger in the same direction and at a constant angular distance from the plunger to vary the expansive space in the plunger, and a speed governor comprising an air inlet for the cylinder. 65

11. In a caloric engine the combination with the cylinder of a hollow plunger movable therein having perforations in the sides, a piston movable in the plunger in the same direction and at a constant angular distance from the plunger to vary the expansive space in the plunger, and a governor dependent for operation upon the speed of the engine comprising a valve to admit atmospheric air to the cylinder, and means to operate the valve. 70 80

12. In a caloric engine the combination with the cylinder of a hollow plunger movable therein having perforations in the sides, a piston movable in the plunger in the same direction and at a constant angular distance from the plunger to vary the expansive space in the plunger, and a weighted valve to admit air to the cylinder and a governor dependent for operation upon the speed of the engine to permit the weight of the valve to open it when the speed of the engine is too high. 85 90

13. In a caloric engine, the combination with a closed cylinder, of means to vary the expansive space therein, a heater for the cylinder comprising a burner and a valve for the burner, a valve to control the supply of air in the cylinder, and means dependent upon the speed of the engine for operating both valves. 100

14. In a caloric engine, a cooling cylinder, a heating cylinder having its inner surface practically continuous with the cooling cylinder, a fluid-tight ridge and groove connection for the cylinders, and means to vary the expansion space in the cylinders comprising a plunger movable in the said cylinders. 105

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, on this 1st day of May, A. D. 1914. 110

EDWIN F. ENGEL.
LARS ANDERSON.

Witnesses:

KENT W. WONNELL,
CHARLES H. SEEM.