No. 703,557. Patented July 1, 1902.

G. DE CAMP & C. A. HAAS.

ENGINE.

(Application filed Mar. 25, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig.1.

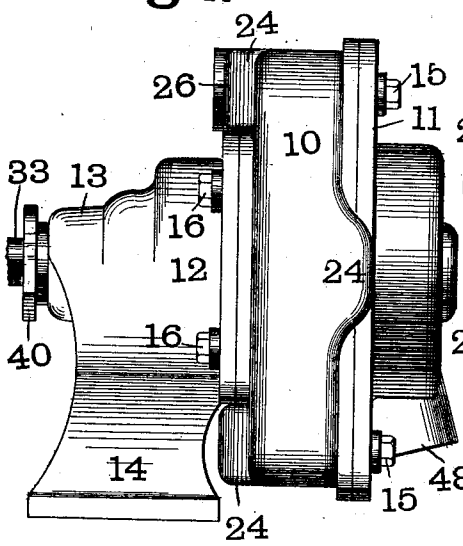

Fig.2.

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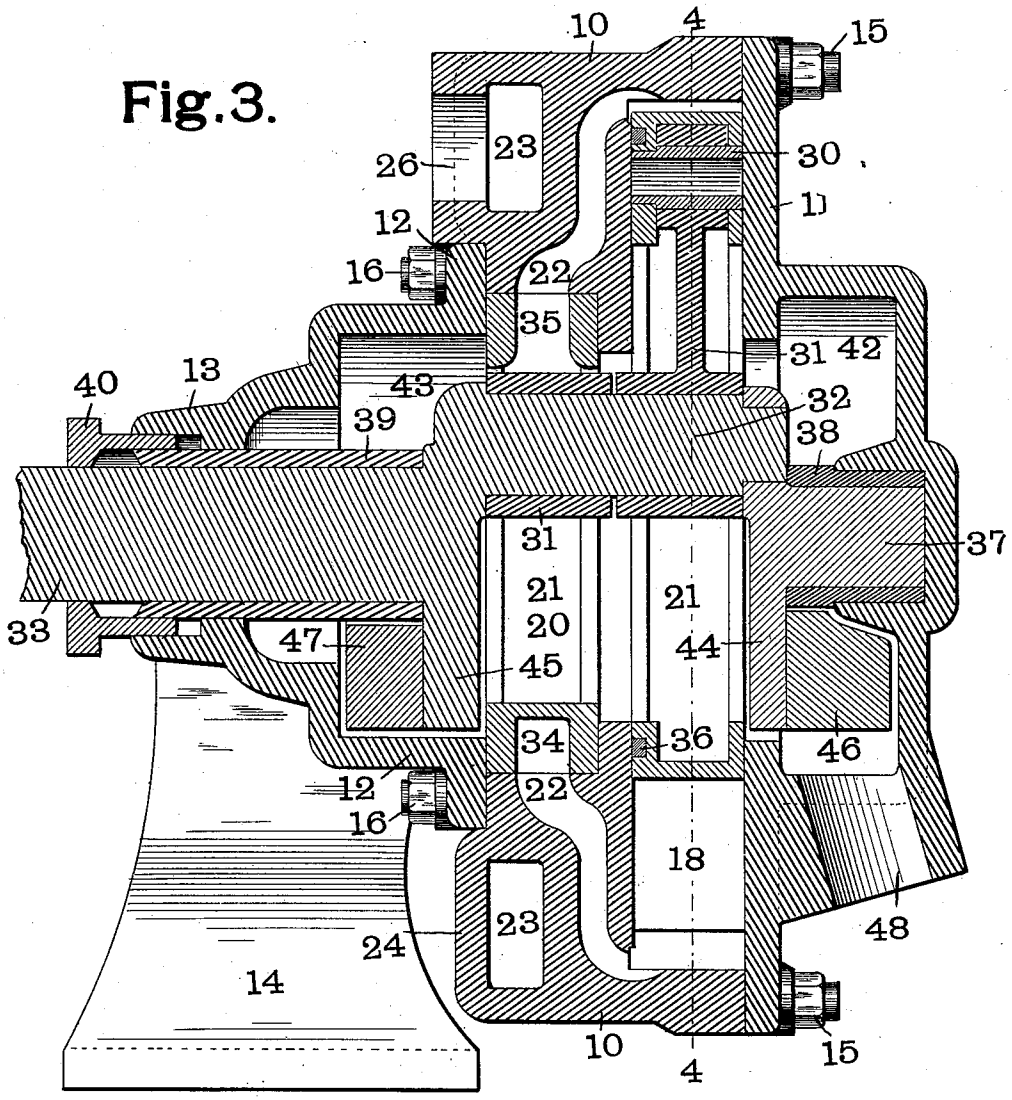
Fig.3.



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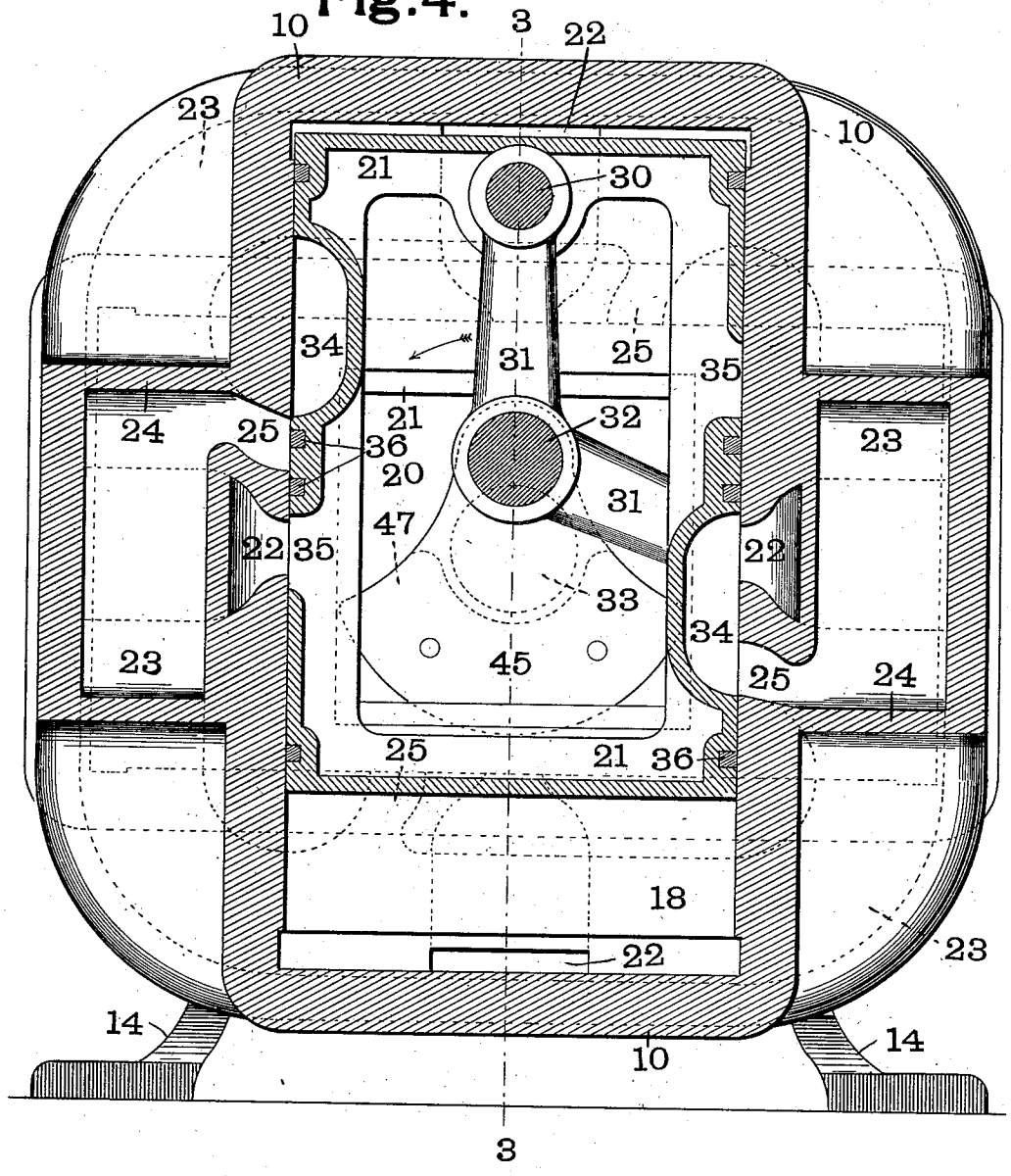
(No Model.) 4 Sheets—Sheet 3.

Fig. 4.



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(No Model.) 4 Sheets—Sheet 4.

Fig.5.

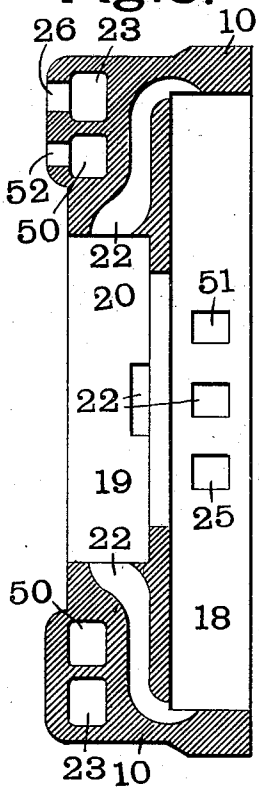


Fig.6.

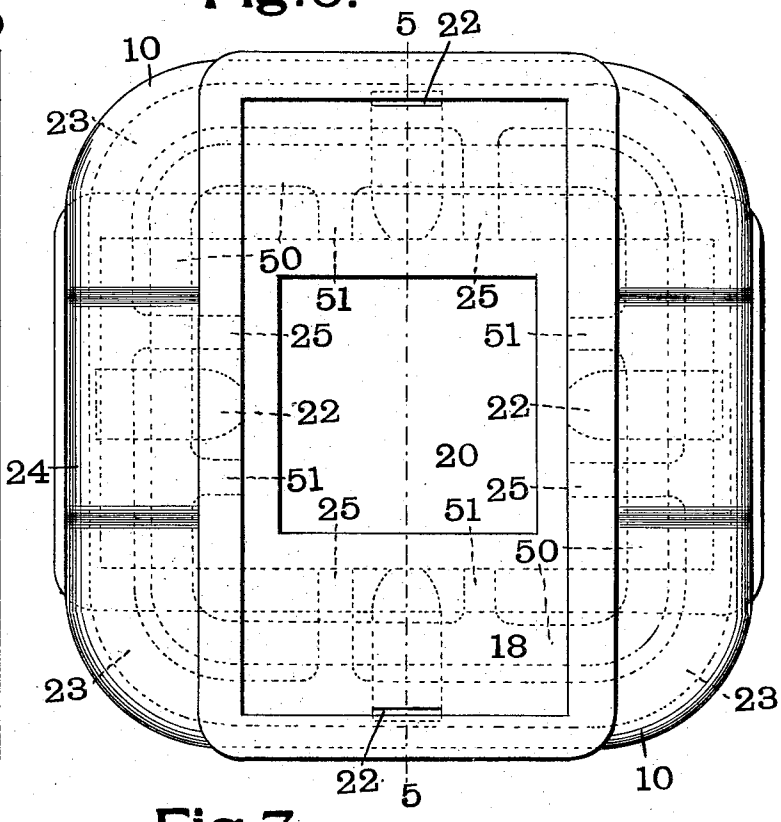
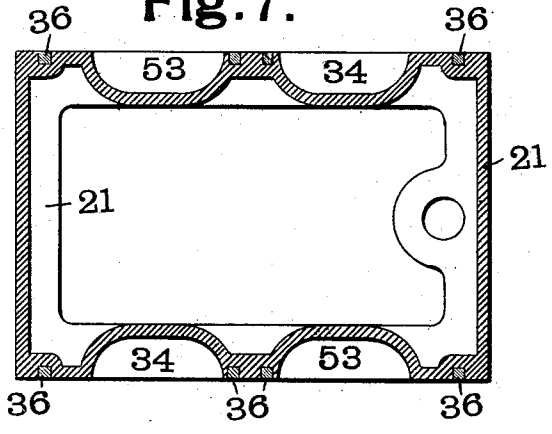


Fig.7.



Witnesses

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UNITED STATES PATENT OFFICE.

GEORGE DE CAMP AND CYRUS A. HAAS, OF ST. LOUIS, MISSOURI, ASSIGNORS TO DE CAMP ENGINE COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 703,557, dated July 1, 1902.

Application filed March 25, 1901. Serial No. 52,705. (No model.)

To all whom it may concern:

Be it known that we, GEORGE DE CAMP and CYRUS A. HAAS, citizens of the United States, residing at the city of St. Louis, in the State of Missouri, have invented a certain new and useful Engine, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

Our invention relates more particularly to that class of engines in which two or more pistons working at right angles to each other operate upon a common crank-shaft to produce rotary motion.

The object of our invention is to simplify the construction and reduce the number of parts in engines of the above-named class, thus not only lessening the cost of the engine, but also increasing its reliability and efficiency and decreasing its liability to get out of repair.

Our invention consists in various novel features and details of construction, all of which are described in the following specification and pointed out in the claims affixed hereto.

In the accompanying drawings, which illustrate an engine made in accordance with our invention, Figure 1 is a side elevation on a considerably-reduced scale of our complete engine. Fig. 2 is an isometric projection, partly in section, of the body of the casing. Fig. 3 is a vertical longitudinal section of the complete engine, taken on the line 3 3 of Fig. 4. Fig. 4 is a vertical cross-section of the complete engine, taken on the line 4 4 of Fig. 3. Fig. 5 is a vertical section of the body of the casing, taken on the line 5 5 of Fig. 6. Fig. 6 is a front elevation of the body of the casing, showing a slight modification; and Fig. 7 is a vertical longitudinal section of one of the pistons used in connection with the form of engine shown in Figs. 5 and 6.

Like marks of reference refer to similar parts in the several views of the drawings.

The casing of the engine consists of three parts—a central or body portion 10, a front plate 11, and a rear plate 12. The rear plate 12 is extended to form a bearing 13 for the shaft of the engine. Carried by the rear plate 12 and preferably formed integral therewith are two feet or standards 14, by which the casing of the engine is supported. The front plate 11 is secured to the body of the casing 10 by bolts 15, and the rear plate 12 is secured to said body by bolts 16. Formed in the body portion 10 of the casing are two rectangular chambers 18 and 19, which serve as the cylinders of the engine. The chambers 18 and 19 are connected by an opening 20 through which the crank-shaft passes. In each of the chambers 18 and 19 is a rectangular piston 21, which will be hereinafter described. Formed in the body portion 10 of the casing are four ports 22, each of which leads from the center of one of the sides of one of the chambers 18 or 19 to the center of the adjacent end of the opposite chamber. Formed in the body portion 10 is also an annular passage 23, which passes around the ports 22 through enlargements or projections 24 without communicating with said ports 22. Leading from the passage 23 are four ports 25, which terminate in the sides of the chambers 18 and 19 adjacent to the inner ends of the ports 22. Steam or other motive fluid is supplied to the passage 23 through a supply-opening 26, Figs. 1, 2, and 5, preferably at the rear of the body 10 and above the rear plate 11. Each of the pistons 21 consists of a rectangular frame, open in the center for the passage of the crank-shaft. Secured in one end of each of the pistons 21 is a pin 30, Figs. 3 and 4, which is surrounded by one end of a link 31, the opposite end of which surrounds the crank 32 of the engine-shaft 33. Each of the pistons is provided near one end of each side with a port 34, which is adapted to place the inner end of one of the ports 22 in communication with the adjacent port 25 and thus with the supply of steam or other motive fluid. At the opposite side of the center of each side of the piston is formed an exhaust-port 35. The exhaust-ports place the inner ends of the ports 22 in communication with the interior of the pistons and casing and thence with the exhaust-opening, as will be hereinafter described. In order to secure steam-tight joints between the pistons 21 and the sides of the chambers 18 and 19, the said pistons are provided with packing-strips 36.

The end of the shaft which enters the front plate 11 is preferably made of a separate piece 37, as shown in Fig. 3, secured to the crank 32 and in line with the main part 33 of the shaft. The end 37 of the shaft rotates in a bushing 38, carried by the front plate 11, while the main part 33 of the shaft rotates in a bushing 39, carried by the extension 13 of the rear plate 12. The main part 33 of the shaft is preferably provided with a packing-gland 40 to prevent the escape of steam around said shaft. In the front plate 11 is formed a cylindrical chamber 42 and in the rear plate 12 a similar chamber 43. The end 37 of the shaft is provided at the side opposite the crank 32 with a segment 44, and the main part 33 is provided with a similar segment 45. Secured to the segments 44 and 45 are weights 46 and 47, respectively, which revolve in the chambers 42 and 43 and counterbalance the crank 32 and attached parts. Leading from the chamber 42 is an exhaust-opening 48, Figs. 1 and 3, through which the exhaust-steam escapes from the interior of the casing.

The operation of our engine is as follows: Steam is admitted to the passage 23 through the supply-opening 26. The parts now being in the position shown in Fig. 4, it will be seen that the port 34 at the right-hand side of the front piston 21 places the port 22 in communication with the port 25, thus admitting steam to the right-hand end of the rear chamber 19. At the same time the port 35 at the opposite side of the front piston opens communication between the adjacent port 22 and the interior of the casing and outlet-opening 38, thus exhausting the left-hand end of the rear chamber 19. This will cause the rear piston 21 to move toward the left. As soon as a slight movement is made the rear piston will in a like manner place the port 22, opening into the upper end of the chamber 18, into communication with the steam-supply and that opening into the lower end of said chamber into communication with the exhaust. This will cause the front piston 21 to move downward. The combined force of the two pistons will be communicated by the links 31 to the crank 32, thus revolving it in the direction of the arrow in Fig. 4, and consequently rotating the shaft 33 in the same direction. As soon as the crank 32 has completed a quarter of a revolution the front piston 21 will be in its central position, closing both the ports 22 of the rear chamber 19, the piston of which is now in its extreme position to the left. A slight further movement will cause the port 34 at the left-hand side of the front piston to connect the ports 22 and 25 at that side of the chamber, and thus supply steam to the left-hand end of the rear chamber 19. At the same time the port 35 at the right-hand side of the said front piston will come into register with the port 22 at that side of its chamber, thus exhausting the right-hand end of the rear chamber 19. The rear piston will now be driven toward the right. At the end of the next quarter-revolution the rear piston will in like manner reverse the supply and exhaust of the front chamber 18, thus driving the front piston upward. The succeeding movements of the engine are simply repetitions of the above and need not be further described.

It will be seen that each piston acts as a cut-off valve, controlling the supply and exhaust to the opposite chamber and also acts as its own cross-head, so that the only moving parts are the pistons, crank-shaft, and the connecting-links. In case it is desired to reverse the engine the steam may be admitted through the opening 48 and exhausted through the opening 26, in which case the engine will run in the opposite direction. We prefer, however, for a reversing-engine to use a slightly-modified form, which will now be described.

In the form of engine which we prefer to use for reversing all the parts are the same, except the body 10 of the casing and the pistons, which parts in their modified form are shown in Figs. 5, 6, and 7. In this modified form the annular passage 23 in the body 10 of the casing is made narrower, so as to leave room for a second and similar annular passage 50. Leading from this annular passage 50 are four ports 51, similar to the ports 25, and like them terminating in the side of the chambers 18 and 19, but at the opposite sides of the ports 22. Steam or other motive fluid is admitted to or exhausted from the passage 50 by an opening 52, similar to and preferably situated adjacent to the opening 26. The pistons are similar to those previously described, except that in place of the exhaust-ports 35 they are provided with two ports 53 like the ports 34. The operation of this form of engine will be readily understood from that previously described. When steam or other motive fluid is admitted through the opening 26 to the passage 23, the engine will be driven in the same direction as above described and the operation will be the same, except that the exhaust instead of passing through the ports 35 into the interior of the casing and thence through the opening 48 will be directed by the ports 53 and 51 into the annular passage 50 and thence out through the opening 52. To reverse the engine, the steam is admitted through the opening 52 to the annular passage 50 and exhausted through the opening 26. It will be obvious that in this form of engine the opening 48 may be dispensed with.

Having fully described our invention, what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an engine, a pair of independent double-acting pistons, separate chambers in which said pistons move, and suitable passages connecting said chambers, each of said pistons being provided with supply and exhaust ports and acting as a valve to control the supply of motive fluid to and exhaust it

from both ends of the chamber containing the other piston.

2. In an engine, a pair of chambers, a piston in each chamber, a passage leading from each side of each chamber to one end of the other chamber, a passage communicating with each side of both chambers, and supply and exhaust ports in said pistons controlling the supply and exhaust of the motive fluid from said passages.

3. In an engine, a pair of chambers arranged at right angles and adjacent to each other, a piston in each of said chambers, a passage leading from each side of each chamber to the adjacent end of the other chamber, a passage communicating with both sides of each chamber, and supply and exhaust ports in said pistons controlling the supply and exhaust of the motive fluid from said passages.

4. In an engine, a pair of chambers, a piston in each of said chambers, a passage leading from each side of each chamber to one end of the other chamber, a passage communicating with each side of both chambers, a port in each side of each piston adapted to place one of said first-named passages in communication with said second passage, and an exhaust-port in each side of said piston adapted to be put in communication with one of said first-named passages.

5. In an engine, a pair of chambers, a piston in each of said chambers, a passage leading from each side of each chamber to one end of the other chamber, two passages each in communication with each side of both chambers, and supply and exhaust ports in said piston controlling the supply and exhaust of the motive fluid through said passages.

6. In an engine, a casing, a pair of chambers formed in said casing, a passage leading from each side of each chamber to one end of the other chamber, said passages being formed in said casing, a passage formed in said casing and communicating with each side of both chambers, and a pair of pistons in said chambers provided with supply and exhaust ports controlling the said passages.

7. In an engine, a casing, a pair of chambers formed in said casing at right angles to each other, a passage leading from each side of each chamber to one end of the other chamber, an annular passage formed in said casing and communicating with each side of both chambers, and a pair of pistons working in said chambers and provided with ports controlling the supply and exhaust through said passages.

8. In an engine, a casing, a pair of chambers formed in said casing at right angles to each other, a passage leading from each end of each chamber to one side of the other chamber, two annular passages formed in said casing and each communicating with each side of both chambers, and a pair of pistons working in said chambers and provided with ports controlling the supply and exhaust through said passages.

In testimony whereof we have hereunto set our hands and affixed our seals in the presence of the two subscribing witnesses.

GEORGE DE CAMP. [L. S.]
C. A. HAAS. [L. S.]

Witnesses:
W. A. ALEXANDER,
JAMES H. BRYSON.