No. 706,425. Patented Aug. 5, 1902.

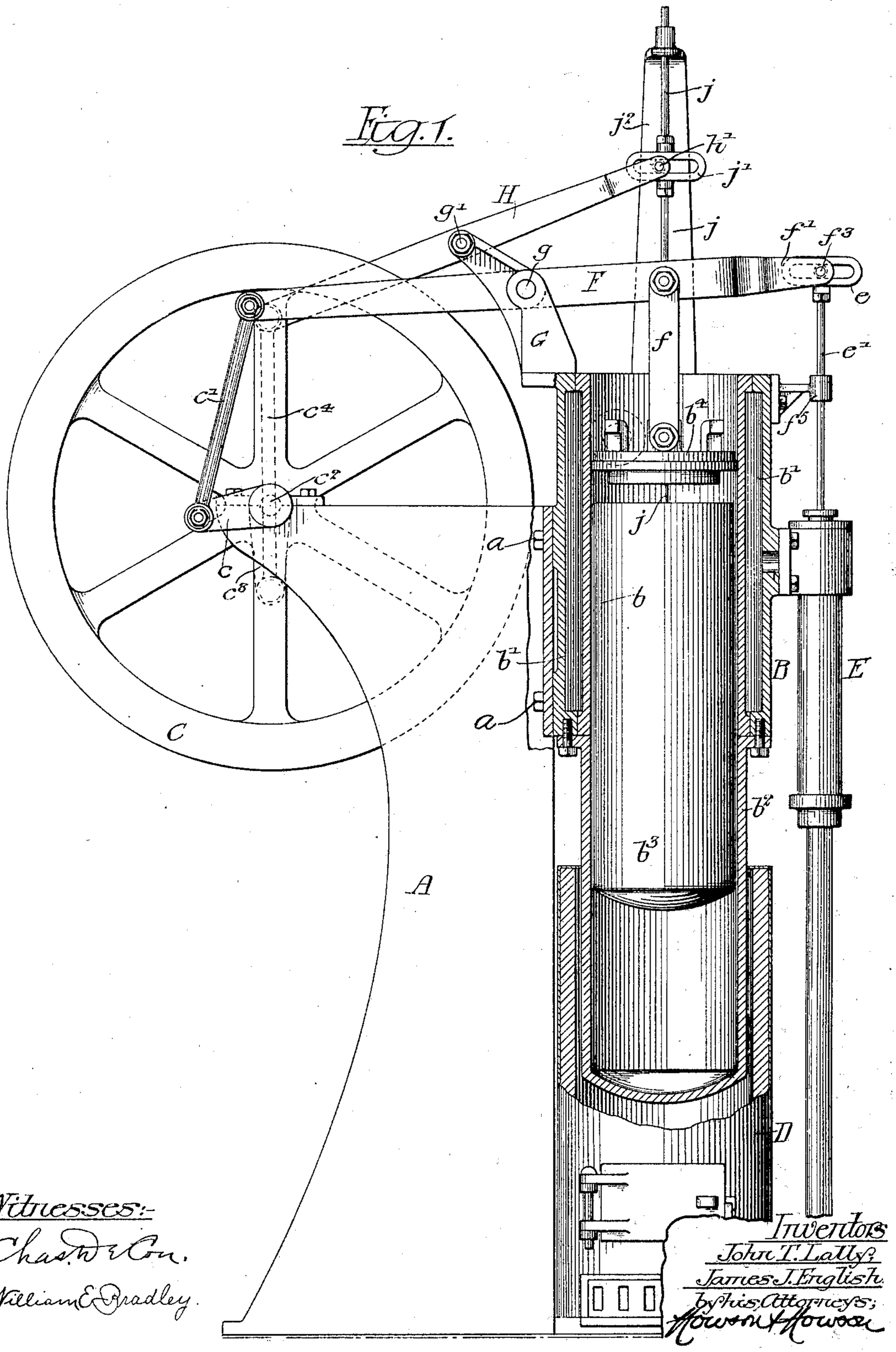
J. T. LALLY & J. J. ENGLISH.

HOT AIR PUMPING ENGINE.

(Application filed Jan. 28, 1902.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses:-
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William E. Bradley.

Inventors
John T. Lally;
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Fig. 2.

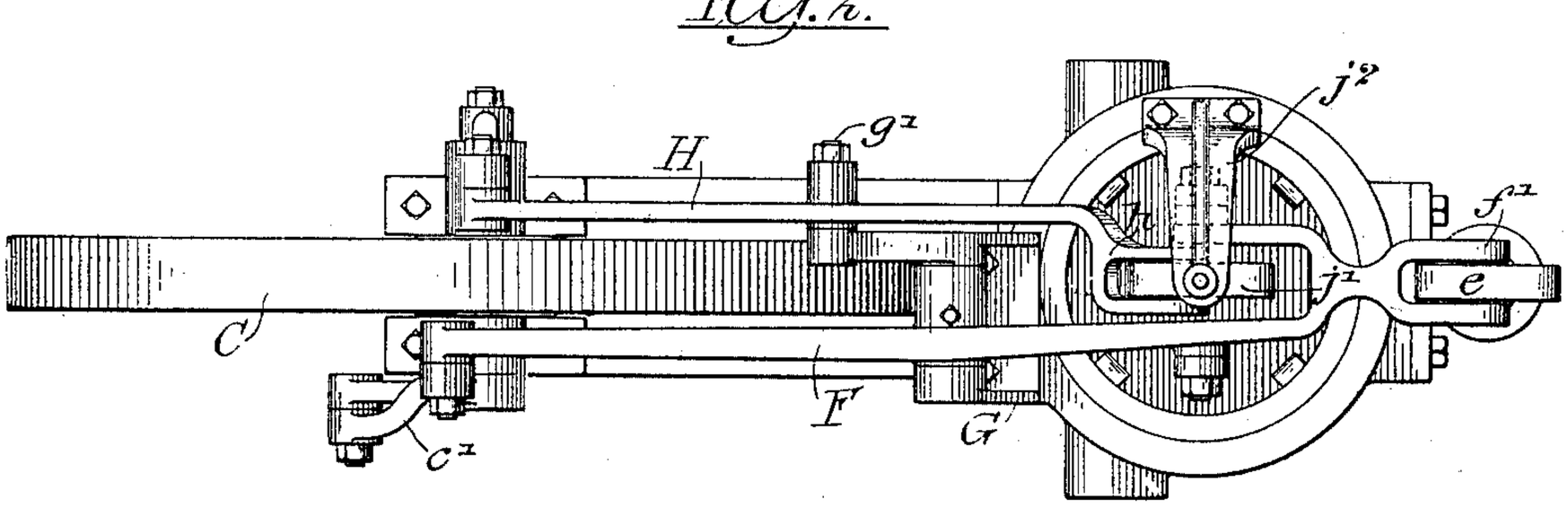
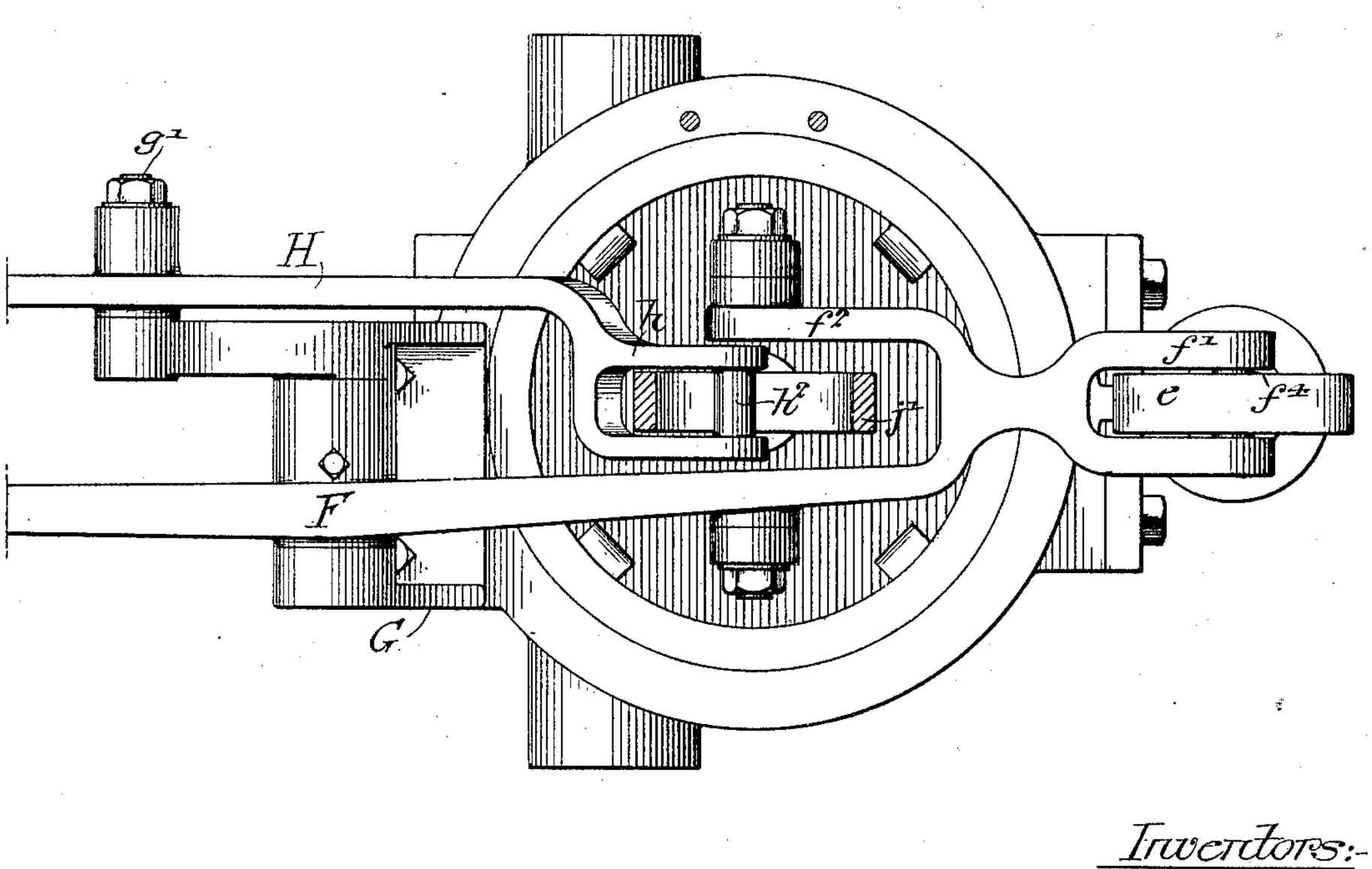


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN T. LALLY AND JAMES J. ENGLISH, OF WILMINGTON, DELAWARE.

HOT-AIR PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 706,425, dated August 5, 1902.

Application filed January 28, 1902. Serial No. 91,590. (No model.)

To all whom it may concern:

Be it known that we, JOHN T. LALLY and JAMES J. ENGLISH, citizens of the United States, residing in Wilmington, Delaware, have invented certain Improvements in Hot-Air Pumping-Engines, of which the following is a specification.

Our invention relates to certain improvements in hot-air engines, and more particularly to certain improvements in the detailed construction of the same, having for its object the simplification and reduction in number of the operating parts of an engine of the above-mentioned type.

A further object of the invention is to provide an engine which while not being of a costly construction shall at the same time be reliable in its action and not likely to get out of order.

These objects we attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of our improved hot-air engine, partly in section, and showing particularly the detail construction of the water-jacketed cylinder. Fig. 2 is a plan view of the engine; and Fig. 3 is an enlarged plan view, partly in section, of the cylinder and the transfer and working levers, the same showing certain details of the construction of the latter.

In the above drawings, A is a supporting-casting upon which is carried a cylinder B and a fly-wheel C. By the side of this casting is a furnace D of any of the well-known forms commonly used in connection with hot-air engines of the Erricson type. The cylinder-casting B is held to the main casting A by bolts *a*, as shown in Fig. 1, and in the present instance is provided with an interior shell *b*, between which and the main casting B is a water-space *b'*. This shell *b* has portions of its surface turned and is made to form what is known as a "pressed" fit with the correspondingly-finished openings in the end of the cylinder-casting B, the joints so formed being water-tight. The interior space *b'* in operation is connected to the discharge of the pipe of a pump E, suitably supported alongside of the cylinder-casting. An extension b^2 of the shell *b* is bolted to the said cylinder-casting B and extends into the fire-pot of the furnace D in the well-known manner.

Within the interior of the cylindrical space formed by the sections *b* and b^2 is a transfer-piston b^3 and a working piston b^4, arranged in the manner well known in engines of the class to which ours belongs. The working piston is connected, by means of links *f*, to the working lever F, the shape of which is best seen from Figs. 2 and 3. From these it will be observed that the lever is pivotally supported by a pin *g* on a casting G, bolted to the top of the cylinder-casting B, the lever extending over the pump E and having its end forked, as indicated at *f'*. Where said lever passes over the working piston there is an arm or projection f^2 from it, the same being turned so as to extend parallel with the body of the lever. One of the links *f* of the working piston is pivotally bolted to the end of this arm, while the other link is bolted directly to the body of the lever. The ends of the forked portion *f'* are connected by means of a pin or bolt f^3, upon which is a roller f^4, in engagement with a slotted block *e*, fixed to the end of the pump piston-rod *e'*. This rod is provided with a guide f^5, bolted to the upper portion of the cylinder-casting, whereby it is compelled to move in a strictly vertical line. The other end of the lever F is attached, by means of a connecting-rod *c'*, to a crank *c*, fixed to one end of the fly-wheel shaft c^2, the other end of the said shaft having a crank c^3, (shown in dotted lines in Fig. 1,) there being a connecting-rod c^4 operatively attached to the same. The upper end of this second connecting-rod is attached to one end of a second lever H, which, similarly to the lever F, is pivoted to the casting G by a bolt *g'*. The other end of this lever is forked, being provided with a pin *h'*, carrying a roller h^2, acting within a slotted block *j'*, fixed to the transfer-piston rod *j*. This latter passes through the working piston b^4 and is suitably fastened to the transfer-piston b^3, being continued above the block *j'*, passing through an opening in a guide-arm j^2, bolted to the top of the cylinder-casting B.

The pump E may be of any desired construction and is provided with the necessary valves, stuffing-box, and connections required in pumps of this class.

It will be seen that by supporting the levers F and H above the cylinder of the engine and from a single casting G we have

greatly simplified the construction of this part of the mechanism of a hot-air engine, thereby not only reducing the number of working parts, but also materially simplifying the same. By constructing the two levers with forked or U-shaped ends and the working lever with the peculiarly-shaped arm, as illustrated, we are enabled to make the necessary connections between said levers and the two pistons of the engine with but little intervening mechanism and that of the simplest nature and of few parts. Similarly the connection to the piston-rod of the pump is made in a substantial manner and with the idea of reducing the wear upon the various parts of the same to the greatest possible extent. It will further be noted that we have done away with the necessity for gaskets and packed joints in constructing the upper portion of our water-jacketed cylinder. It has been found by actual experience that the pressed-joint connection between the internal shell *b* and the external casting B can be made of sufficient tightness and at a much less cost than is ordinarily required for this portion of the engine.

We claim as our invention—

1. In a hot-air engine, the combination of a frame, a cylinder supported thereon, having working and transfer pistons, means for heating the cylinder, a fly-wheel and a shaft therefor, with two levers connected to said shaft both pivotally supported above the top of the engine-cylinder and connected respectively to the working and to the transfer pistons, substantially as described.

2. In a hot-air engine, the combination of a frame, a cylinder supported thereon having working and transfer pistons, means for heating the cylinder, a fly-wheel and a shaft therefor, two cranks on the shaft, two levers supported over the cylinder each having a connecting-rod operatively attaching it to one of the cranks, one of the levers being connected to the transfer-piston and the other being connected to the working piston and to mechanism operated by the engine, substantially as described.

3. In a hot-air engine, the combination of a cylinder, means for heating the same, working and transfer pistons in the cylinder, a fly-wheel, a shaft therefor, two levers each connected to the fly-wheel shaft, one of the levers having a projecting portion or arm turned parallel to the body thereof and with said body connected to one of the pistons, the other lever extending between the said two parts of the first lever and being connected to the other piston, substantially as described.

4. In a hot-air engine, the combination of a cylinder, means for heating the same, working and transfer pistons in the cylinder, a fly-wheel, a shaft therefor, two levers each connected to the fly-wheel shaft, one of the levers having a projecting portion or arm turned parallel to the body thereof, and with said body connected to one of the pistons, the other lever being also forked and having a pin extending between the arms of its forked end with a rod connected to the second piston having a slotted block in engagement with said pin, substantially as described.

5. In a hot-air engine, the combination of a cylinder means for heating the same, working and transfer pistons in the cylinder, a fly-wheel, a shaft therefor, two levers each connected to the fly-wheel shaft, means for connecting one of the levers to one of the pistons, a piston-rod attached to the other piston and provided with a slotted block, a guide supported from the cylinder-casting and in engagement with said rod, the second lever being provided with means whereby it is attached to the rod through said slotted block, substantially as described.

6. In a hot-air engine, the combination of a cylinder, means for heating the same, working and transfer pistons in the cylinder, a fly-wheel, a shaft therefor, two levers supported above the cylinder, one of the same carrying a roller, a rod attached to one of the pistons carrying a slotted block engaged by said roller, the second lever provided with a projecting arm bent parallel with the body thereof, links connecting the second piston with the said arm and body of the second lever and an extension to said lever having means whereby it may be connected to mechanism to be operated, substantially as described.

7. In a hot-air engine, the combination of a cylinder, means for heating the same, working and transfer pistons in the cylinder, a fly-wheel, a shaft therefor, two levers each connected to the fly-wheel shaft, one of the levers having means for connecting it to the transfer-piston, the other lever being connected to the working piston and provided with an extension beyond the point of said connection, a pump having a piston-rod with a slotted block operatively connected to said extension, with means for guiding said rod supported from the cylinder-casting, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JOHN T. LALLY.
JAMES J. ENGLISH.

Witnesses:
NORRIS C. MORGAN,
ALFRED R. HART.