(No Model.) 3 Sheets—Sheet 1.

P. E. SINGER.

INTERNAL COMBUSTION OR DETONATING ENGINE.

No. 600,971. Patented Mar. 22, 1898.

Fig. 1

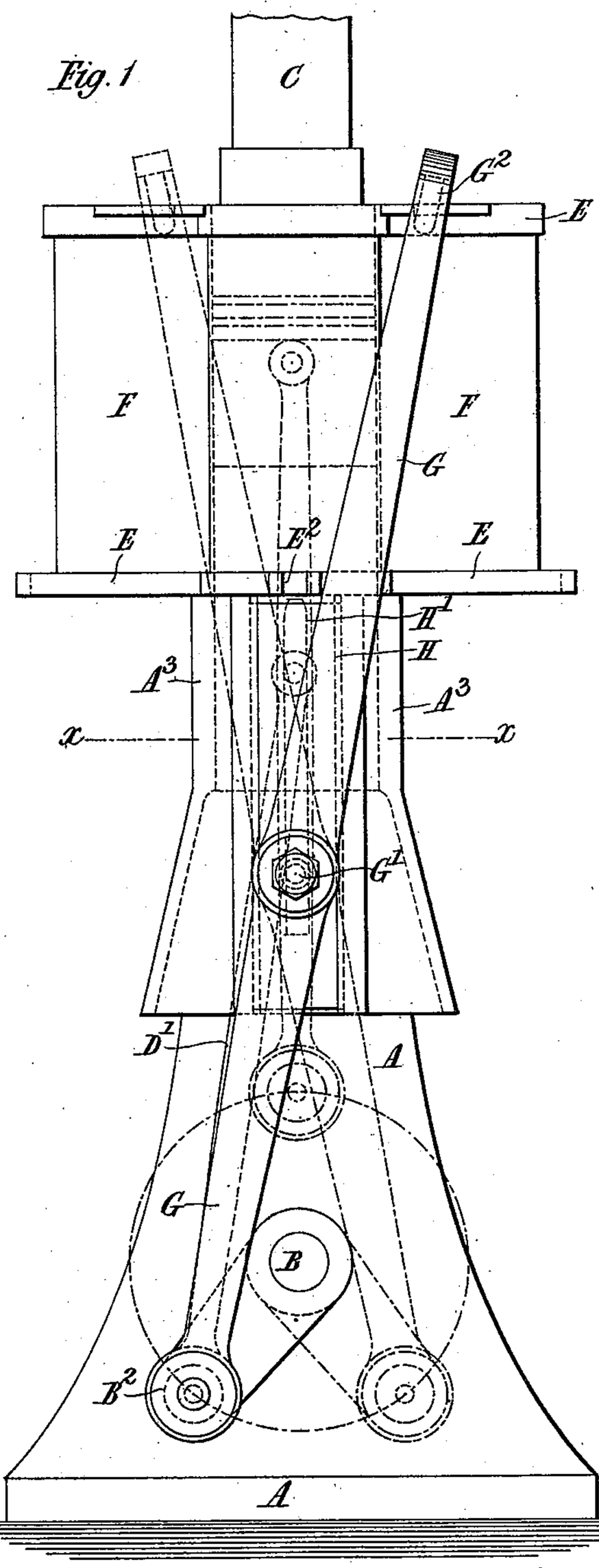

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Fig. 2

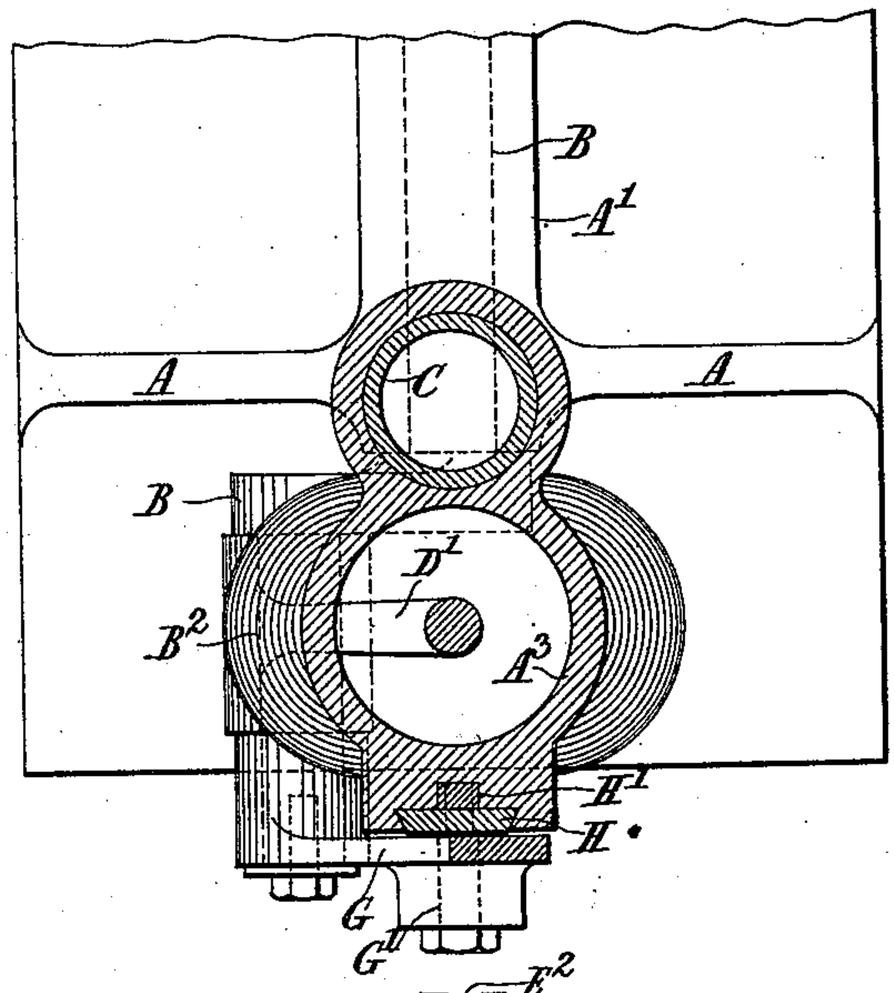


Fig. 4

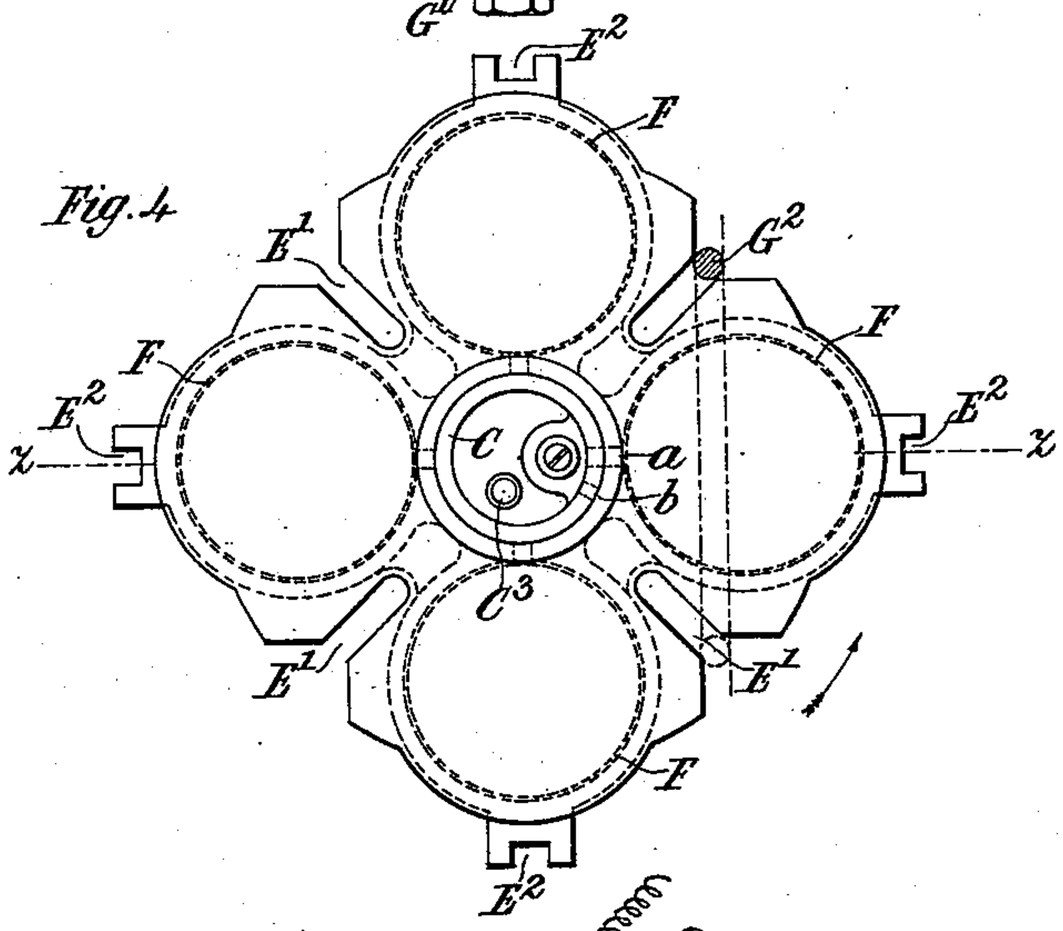
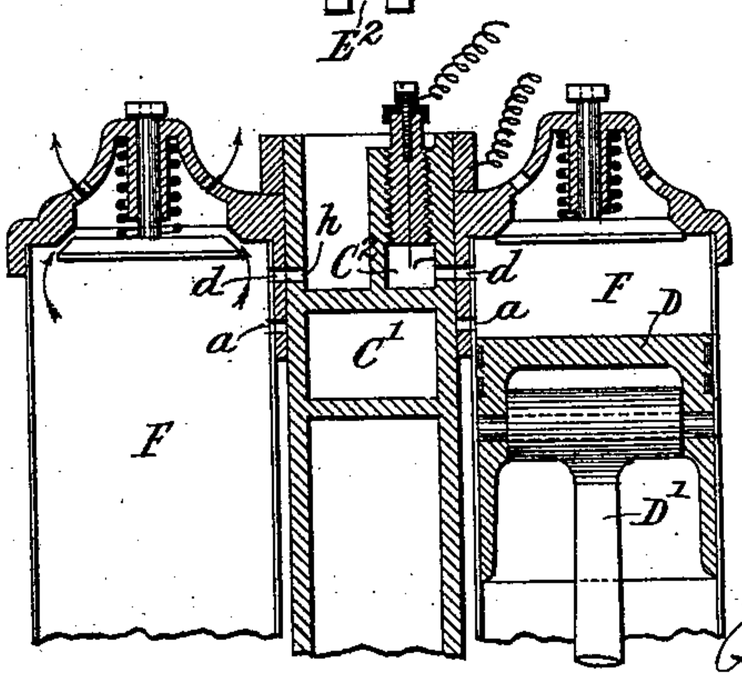


Fig. 5



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INTERNAL COMBUSTION OR DETONATING ENGINE.

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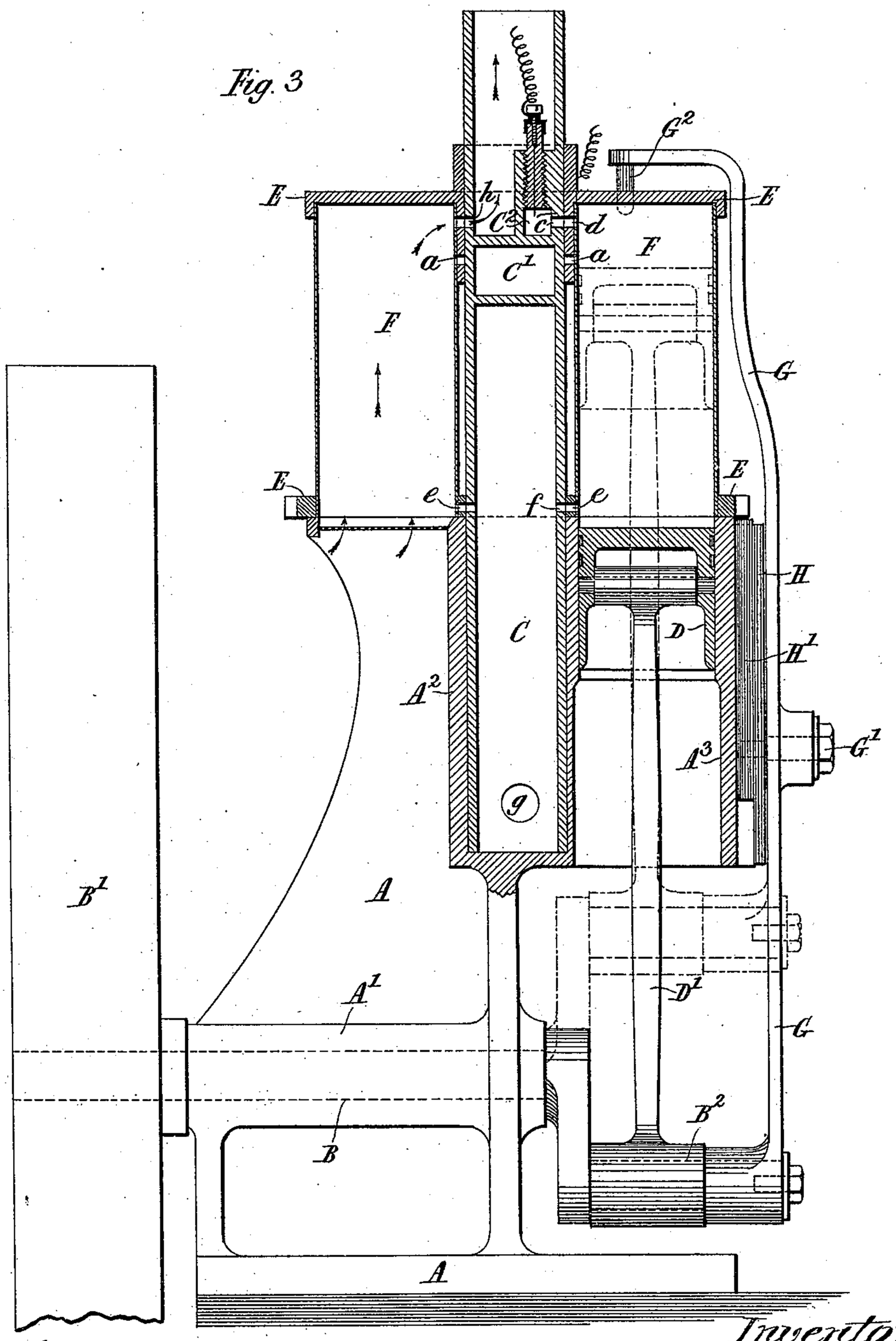
Fig. 3



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UNITED STATES PATENT OFFICE.

PARIS E. SINGER, OF LONDON, ENGLAND.

INTERNAL-COMBUSTION OR DETONATING ENGINE.

SPECIFICATION forming part of Letters Patent No. 600,971, dated March 22, 1898.

Application filed June 24, 1897. Serial No. 642,074. (No model.)

To all whom it may concern:

Be it known that I, PARIS EUGENE SINGER, of 19 Kensington Court, London, Middlesex county, England, have invented certain new and useful Improvements in Internal-Combustion or Detonating Engines, of which the following is a specification.

This invention relates to motive-power engines in which a cool working cylinder is always ready for the compression and expansion of an explosive mixture at each revolution of the crank-shaft, the object of the invention being to improve the construction of such engines.

In carrying out this invention I employ, as before, a crank-shaft connected with one or more pistons and a series of working cylinders which are brought into use in succession. Near the end of the working stroke the piston leaves the cylinder and rests in a holder, and while in this position the cylinder from which the piston has been withdrawn is replaced by a cool one containing air, into which, at a desired moment, the gas or other material to be ignited is forced. The return of the piston compresses the mixture and the ignition is done electrically in the usual way. The working cylinders are grouped two, three, or more together and mounted on a central hollow axle, around which they are caused to revolve by suitable gearing after each explosion, so as to bring a cool cylinder into line with the working piston or pistons. The cylinders must be then locked in position to allow of the piston or pistons compressing a fresh charge of mixed gases. It is through the hollow axle that the gas or other medium of combustion is conveniently supplied to the cylinders and through which also the exhaustion of the spent gases is obtained, the axle being for this purpose divided into two passages, which connect, respectively, with the supply and exhaust.

The cylinders I propose to employ will consist of thin steel tubes open at one end to receive the piston and closed at the other end to provide for the compression of the inclosed gases. The closed end will be fitted with a valve for the outlet of the burned gases and the cleansing-air, which valve will be closed during the compression of the mixed gases, and ports will be provided in the cylinders to meet the supply and exhaust ports of the hollow axle. After the explosion the valve will be opened and allow a draft of air to rush through and cool the cylinder. Thus an undue amount of heat will never accumulate in my improved engine.

In order that my invention may be clearly understood, I will now proceed to fully describe it, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of my improved engine. Fig. 2 is a sectional plan taken on the line *x x* of Fig. 1. Fig. 3 is a vertical section taken on the line *z z* of Fig. 4, which is a top plan; and Fig. 5 is a vertical section of a slight modification in the arrangement of the working cylinders.

A is a standard of any convenient form mounted on a suitable base and provided with a sleeve A′ for the crank-shaft B, which carries at its outer end the fly-wheel B′. In the standard A is provided a cylindrical chamber A^2 to receive the end of a hollow axle C, and also a second cylindrical chamber A^3 to form a holder for the piston D during a portion of its stroke, as will be hereinafter described.

D′ is the piston-rod, which is connected to the crank-pin B^2, and this pin is prolonged beyond the attachment of the rod, for a purpose to be presently explained.

E is a frame which is mounted upon the upper part of the hollow axle C and carries two, three, or more cylinders F. These cylinders form the explosion or working cylinders and are consecutively brought into position to register with the holder A^3, so that the piston D may freely enter during its stroke.

The frame E is rotated on the axle C by the means which will be now described.

Upon the prolonged portion of the crank-pin is mounted the boss of a propelling rock-lever G, which has its fulcrum at G′ on a slide H, working in a groove in the face of the holder A^3. The upper end of this lever is cranked and carries a pin G^2, which drops into conveniently-shaped notches E′ in the frame E. As the crank-pin revolves the propelling-lever G is rocked from one side to the other side for the purpose of rotating the frame E, with its cylinders F, as indicated by the dotted position in Fig. 1, and it is also

raised and lowered to disengage the pin G^2 from one notch of the frame E and cause it to enter another notch preparatory to moving the frame the necessary distance to bring another explosion or working cylinder into position, as indicated by the dotted lines in Figs. 3 and 4. At the back of the slide H and attached thereto and working therewith is a bolt H′, which enters conveniently-placed notches or catches E^2 on the edge of the frame E, and so locks the particular explosion or working cylinder F in position to receive the piston D.

C′ represents a chamber in the hollow axle C for the gas or other fluid under pressure supplied by a pipe C^3, Fig. 4, and C^2 is the firing-chamber, the firing being effected by an electric spark in the usual way or by any other convenient means.

The operation of the engine will be as follows: Supposing the piston D to be in the drawn position, Fig. 3—that is to say, withdrawn into the holder A^3 clear of the cylinders F—the cylinder-frame E will be free to rotate (under the action of the propelling rock-lever) to bring a fresh cylinder opposite the holder. By reason of the cylinder being open at bottom it will be full of air as it comes into position. Just before it comes to rest a port *a* in the wall of the cylinder is brought opposite a port *b* in the wall of the gas-chamber C′ to permit of a charge of gas entering the cylinder. The piston D will now commence to rise, and the bolt H′ moving with it, by reason of its connection with the crank-pin through the rock-lever G, will lock the cylinder in positon before the piston enters, and will hold it firm during the compression and explosion of the gases and the return of the piston to its holder A^3. The piston rising to the dotted position will compress the mixture of air and gas and force a portion of it into the firing-chamber through the ports *c d*. At this moment the circuit will be closed and the electric spark will ignite the gases and cause the explosion which propels the piston forward. As the piston leaves the cylinder a portion of the gases of combustion will rush out by the port *e* and enter the hollow axle by the port *f*, from whence they will pass by the outlet *g* to the atmosphere or other convenient place. When the piston is clear of the cylinder, the crank-pin will be in the drawn position, Fig. 1, and as it passes to the dotted position the rock-lever G will rotate the frame E, with its cylinders F, to bring a fresh cylinder to register with the holder A^3, the bolt H′ having also been withdrawn from its notch. By the continued movement of the crank-pin the pin G^2 will be raised out of one notch, traversed across and dropped into another notch, ready to again move the frame E when required. It will thus be seen that the movements of the piston D, bolt H′, and the rock-lever G are simultaneous. As the cylinders leave the holder the gases will be free to escape at the open end, air taking their place, thus cleansing the cylinders. The cleansing operation may be hastened and completed by causing a current of air to pass through the cylinders by bringing the port *d* of the cylinder successively opposite ports *h* in the upper part of the hollow axle C, which, acting as a ventilating-shaft, causes a suction or draft through the cylinders, as indicated by the arrows, Fig. 3.

In the modification, Fig. 5, the closed end of each cylinder has a spring-operated valve, the normal position of which is open, the closing being effected during the act of compression by the pressure of the mixture.

I would here remark that I have described only one piston; but it will be obvious that I may have more, if desired. Neither do I wish to confine myself to four working or explosion cylinders, as shown, nor to the precise arrangement, as the cylinders may be placed below the crank-axle, as well as above, or may be horizontal instead of vertical.

What I claim is—

1. In an internal-combustion or detonating engine, the combination with a working piston, of a series of working or explosion cylinders closed at one end and open at the other and provided with suitable ports in their walls, and a hollow axle divided into separate chambers with suitable ports, each explosion-cylinder having a through-passage for a current of air for cleansing purposes, substantially as described.

2. In an internal-combustion or detonating engine, the combination with a working piston, of a series of revolving working or explosion cylinders mounted on a hollow axle about which the explosion-cylinders rotate, said axle being provided with compartments or chambers serving for the admission of the gas or other fluid for firing and for exhaust purposes, substantially as described.

3. The combination with a series of cylinders and a hollow axle on which the series of cylinders is mounted, of the means shown and described, for rotating the series of cylinders and locking them in their working position, such means consisting in a rock-lever G fulcrumed on a slide H, which carries a bolt for locking into notches in the cylinder-frame, such rock-lever G being connected to the crank-pin of the crank-shaft, and carrying at its extremity a driving-pin which engages with radial notches in the cylinder-frame, and, under the action of the crank-pin, imparts an intermittent rotary motion to the cylinder-frame.

PARIS E. SINGER.

Witnesses:
H. K. WHITE,
JOSEPH LAKE.