No. 708,518. Patented Sept. 9, 1902.

A. T. BOSSETT.

EXPLOSIVE ENGINE.

(Application filed Aug. 26, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 3.

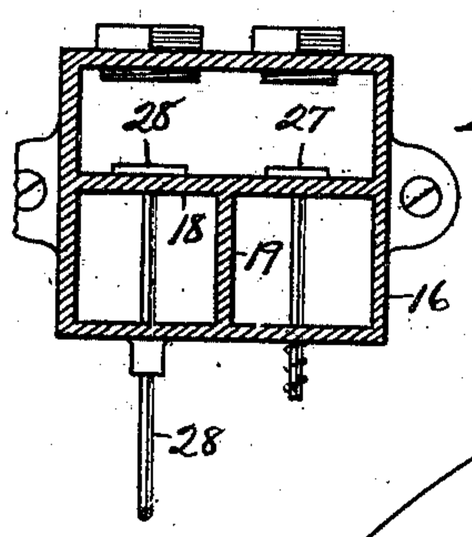

Fig. 4.

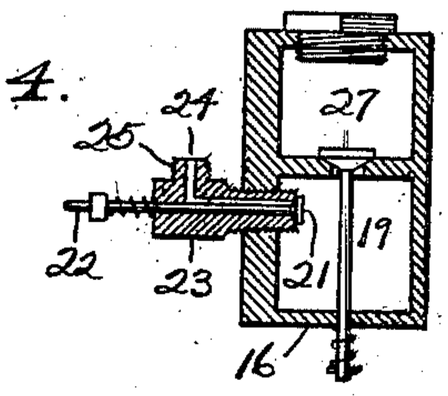

Fig. 1.

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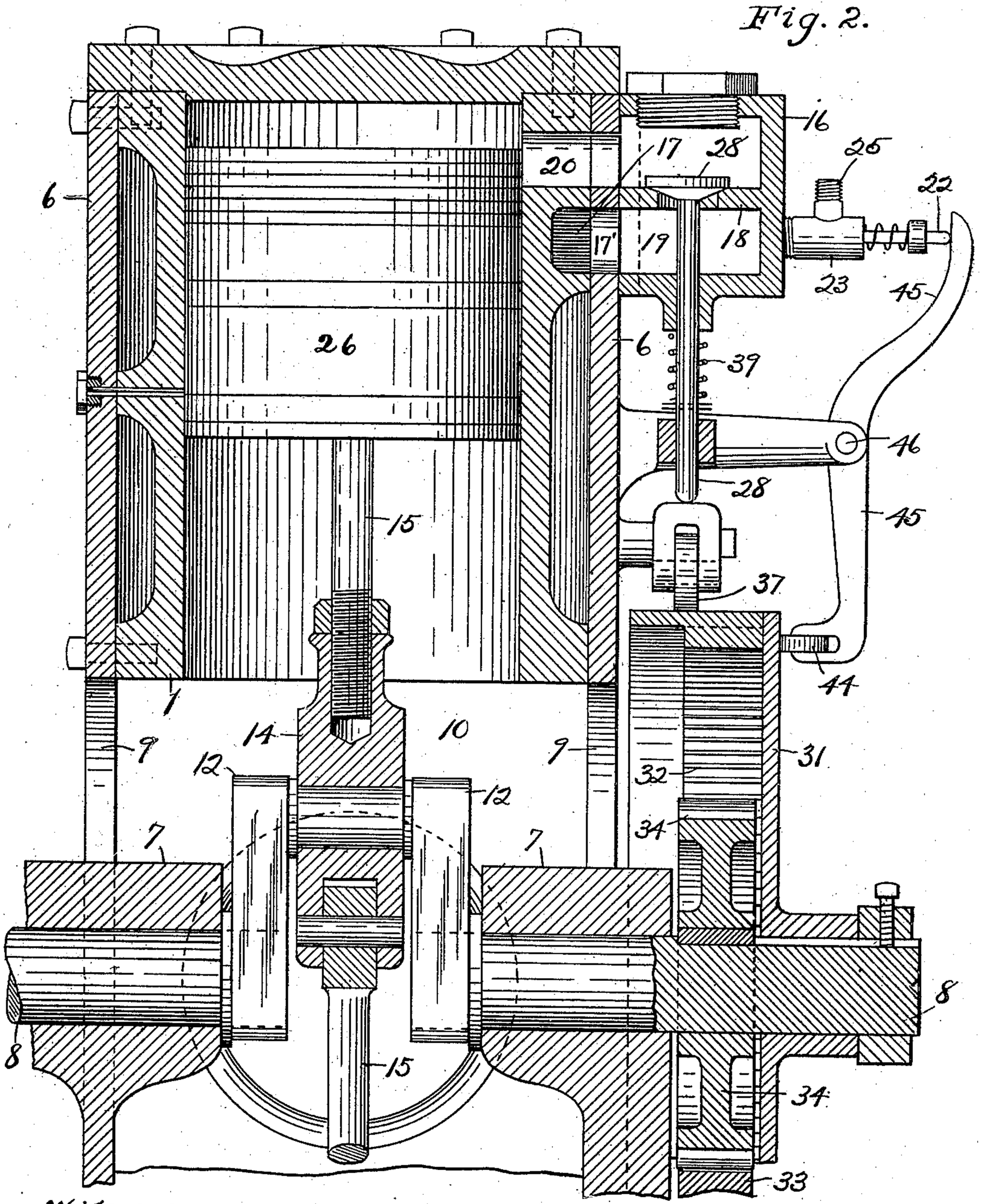
Fig. 2.



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No. 708,518. Patented Sept. 9, 1902.

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EXPLOSIVE ENGINE.

(Application filed Aug. 28, 1901.)

(No Model.) 4 Sheets—Sheet 3.

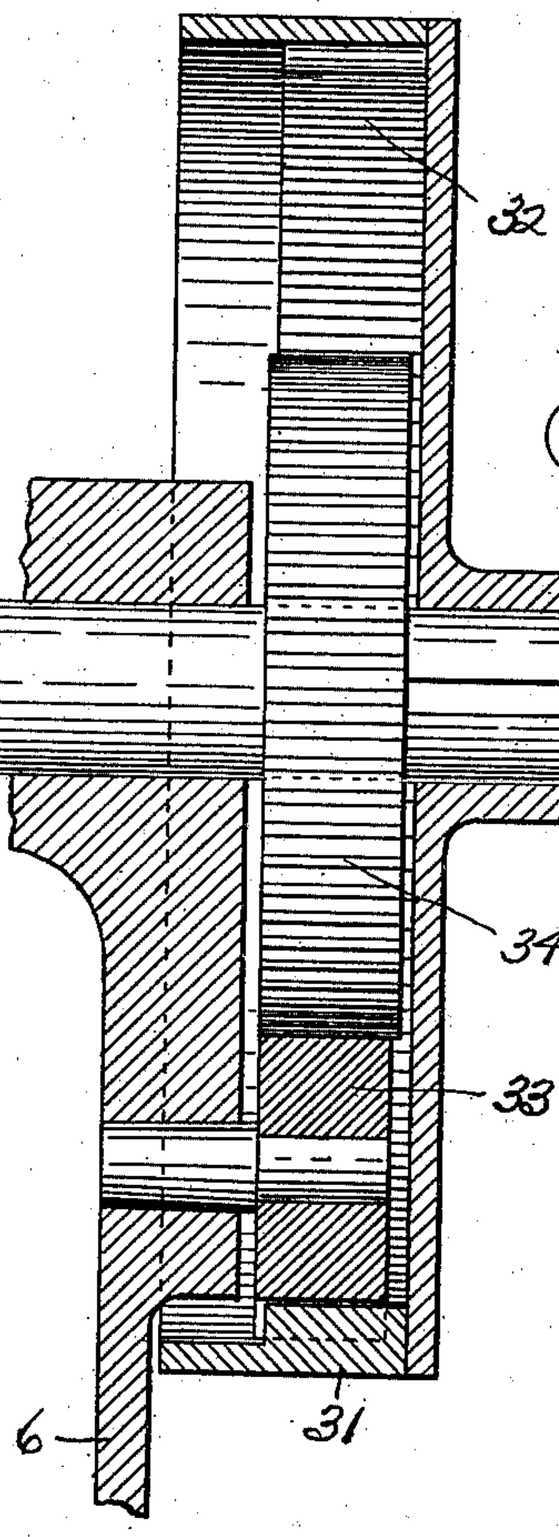

Fig. 5.

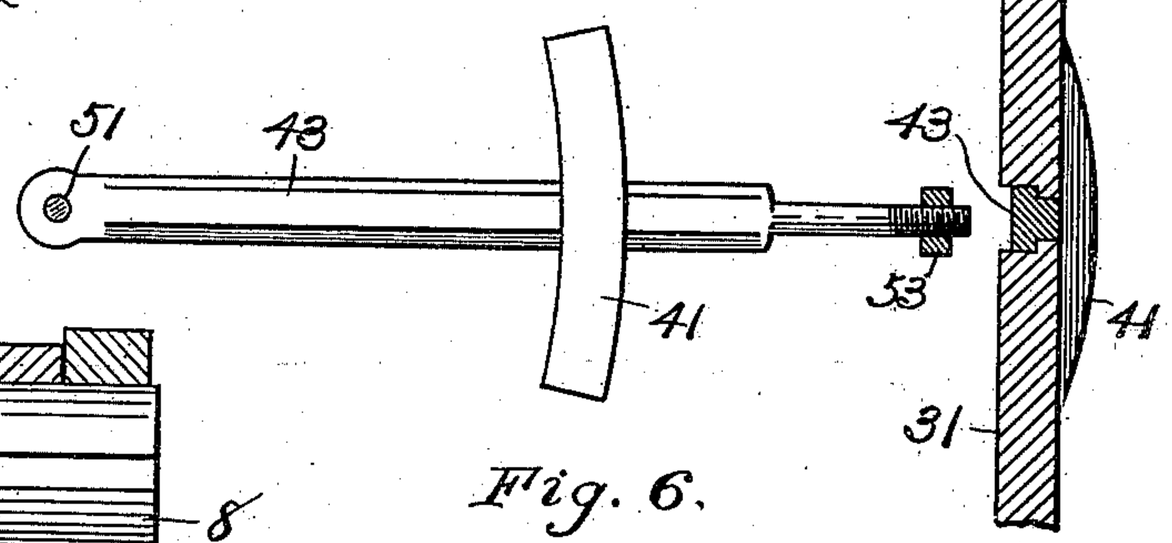

Fig. 6.

Fig. 7.

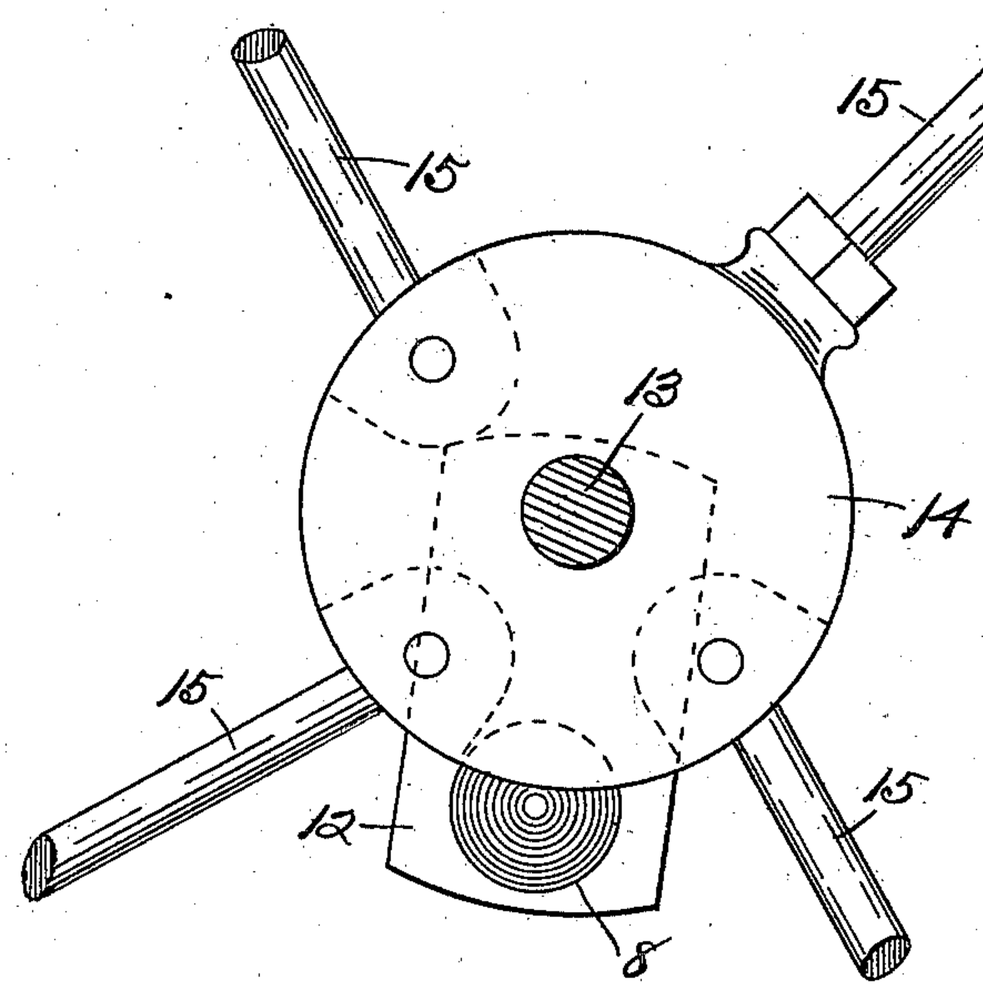

Fig. 8.

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EXPLOSIVE ENGINE.

(Application filed Aug. 26, 1901.)

(No Model.) 4 Sheets—Sheet 4.

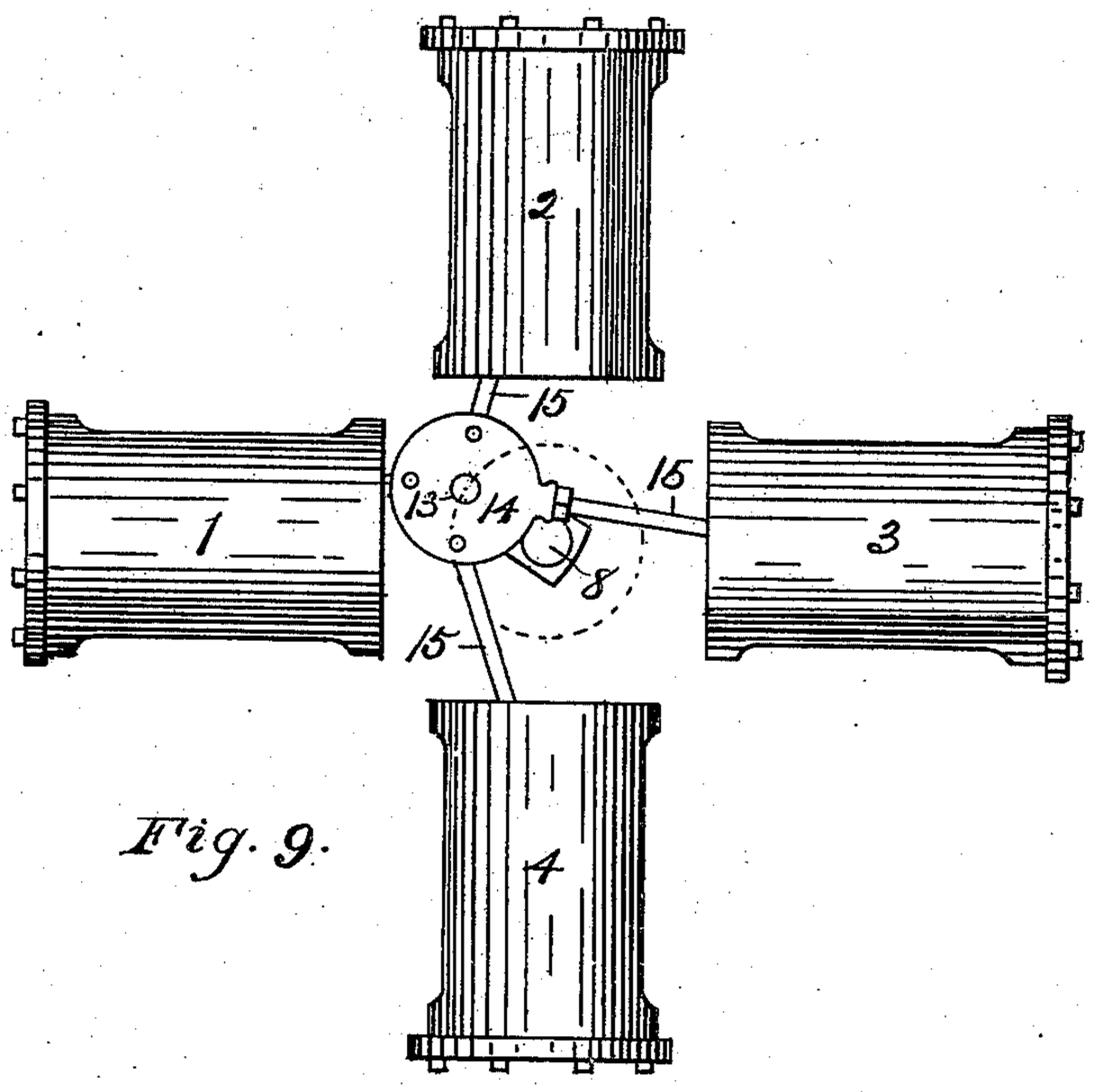

Fig. 9.

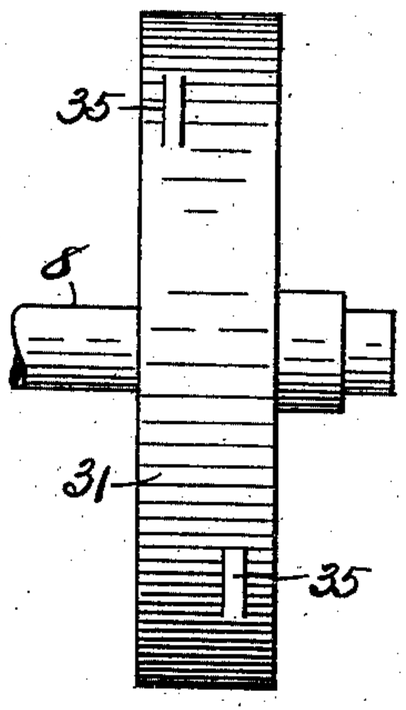

Fig. 11.

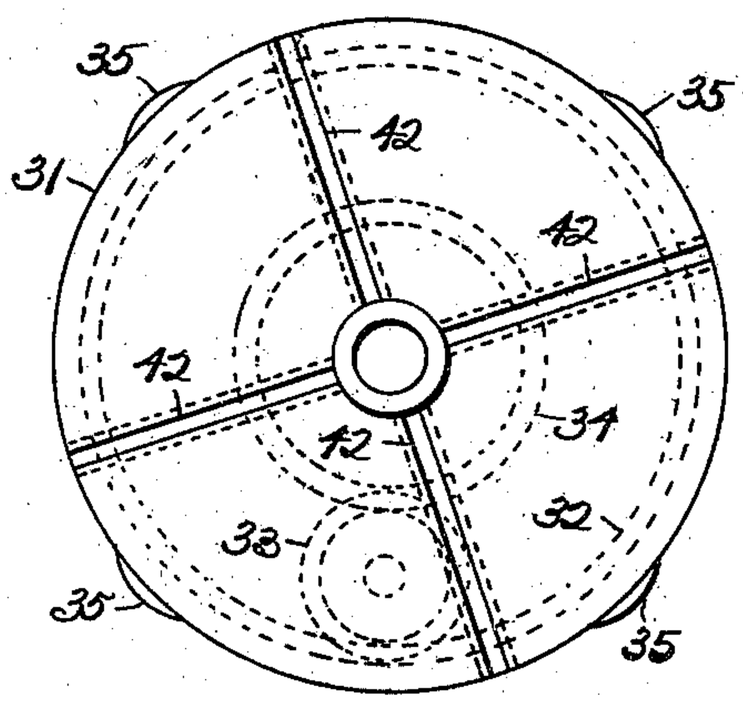

Fig. 10.

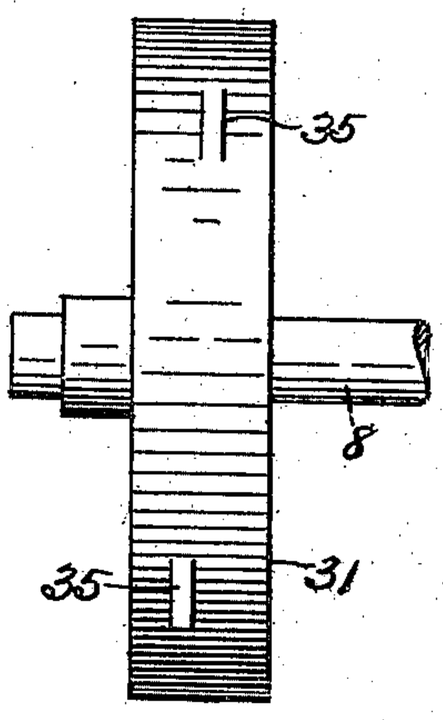

Fig. 12.

Witnesses,
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W. L. Lange

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By Higdon & Higdon,
Atty's.

UNITED STATES PATENT OFFICE.

ALBERT T. BOSSETT, OF KANSAS CITY, MISSOURI.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 708,518, dated September 9, 1902.

Application filed August 26, 1901. Serial No. 73,400. (No model.)

To all whom it may concern:

Be it known that I, ALBERT T. BOSSETT, a citizen of the United States, and a resident of Kansas City, in the county of Jackson and State of Missouri, have invented new and useful Improvements in Explosive-Engines, of which the following is a specification.

My invention relates to that class of explosive-engines in which a plurality of reciprocating pistons act upon a crank-shaft; and the objects of my invention are, first, to obtain two explosions or impulses during every rotation of the crank-shaft; second, to secure the maximum power in the smallest space and with the least weight of metal.

Reference is had to the accompanying drawings, in which—

Figure 1 is an elevation of a four-cylinder engine constructed in accordance with my invention, showing the governors and the valve-operating mechanism. Fig. 2 is an enlarged sectional view of the upper cylinder, its exhaust-valve, and a portion of the valve-operating cam-wheel, showing also the crank and connecting-rod. Fig. 3 is a sectional view of one of the valve-chambers, showing the exhaust-valve. Fig. 4 is a sectional view at right angles to Fig. 3, showing the admission-valve. Fig. 5 is an enlarged sectional detail showing the gearing actuating the cam-wheel. Fig. 6 represents one of the admission-valve cams detached. Fig. 7 shows the same cam in position against the face of the cam-wheel, which is broken away and in section. Fig. 8 is a side view of the head by which the piston-rods are connected to the crank, the crank-pin being in section and the rods broken off. Fig. 9 is a diagram showing the cylinders and the connecting-rods as connected to the crank-pin. Fig. 10 is an outside face view of the cam-wheel detached from the crank-shaft, omitting the admission-valve cams, the gearing being indicated by dotted lines. Figs. 11 and 12 are views of opposite sides of the cam-wheel, showing the exhaust-valve cams.

1, 2, 3, and 4 designate, respectively, the four piston-cylinders, which are cast in a single frame, having a base or feet 5. Two side plates 6 are bolted directly to the cylinders, Fig. 2, and have bearings 7 for the crank-shaft 8. Above each bearing 7 is an opening 9 for admission of air to the crank-chamber 10. Two cranks 12 on shaft 8 are connected by a crank-pin 13, on which is mounted a head 14, to which three of the piston or connecting rods 15 are connected pivotally, as shown in Fig. 8, while one of said rods is rigidly secured thereto in the same manner as an eccentric-rod to its eccentric.

Secured to one of the side plates 6 are four valve-chambers 16, each of which contains an inlet and an exhaust valve for the adjacent cylinder. Three interior views of one of the valve-chambers are shown. (See Figs. 2, 3, and 4.) An annular exhaust-port 17 is cast in the cylinder-casting, its course being shown by the dotted circles in Fig. 1. This annular port communicates with each valve-chamber 16 by a lateral port 17′, which passes through the side plate 6, as shown in Fig. 2. The valve-chamber is divided by a horizontal partition 18, and below said partition by a vertical partition 19, as shown in Figs. 2, 3, and 4, thus forming a large chamber above partition 18 and two smaller ones below it. The inlet-port 20 connects the cylinder 1 to the upper compartment of the valve-chamber, and the flow of gas into said port is controlled by the admission-valve 21, the detail construction of which is shown in Fig. 4. The valve-stem 22 is mounted slidably in a bushing 23, in which is a passage 24 for the oil or gas, terminating in the valve-seat, so that when the valve is unseated the fluid may enter the valve-chamber.

25 designates the nipple for connection to the supply-pipe. (Not shown.) The inward movement of the piston 26 creates a partial vacuum which permits the atmospheric pressure to unseat an automatic valve 27, which thus permits the fluid to enter the admission-port 20.

The exhaust-valve 28 is seated upon the plate 18, and thus controls communication between the piston-cylinder and the exhaust-port 17.

The construction of the valves in each of the valve-chambers 16 is identical with that described above. All of the valves are operated by the mechanism next described.

Mounted rotatably on the crank-shaft 8 is a cam-wheel 31, having an internal gear 32. A stationary pinion 33 meshes with said gear 32, Fig. 5, and is driven by a gear-wheel 34,

keyed on the crank-shaft 8. The gears 32 and 34 are so proportioned that two rotations of gear 34 impart exactly one rotation to gear 32, and therefore to the cam-wheel 31. Rigidly secured on the periphery of the cam-wheel 31, ninety degrees apart, are four valve-operating cams 35, which are staggered, as shown in Figs. 11 and 12, so that no two cams revolve in the same path. Four arms 36 are pivotally secured at 38 38 38 38 to the side plate 6 and carry rollers 37 at their opposite ends, which rollers bear against the cam-wheel 31, being pressed thereon by the respective stems 28′ of the exhaust-valves 28 by springs 39. The rollers 37 are arranged in different vertical planes, so that only one roller can be engaged by any one of cams 35. Thus during one rotation of the cam-wheel 31 (or two of the main shaft 8) each exhaust-valve 28 is opened once by the action of cams 35 upon the arms 36 and the valve-stems 28′. The admission-valves 21 are operated by other cams 41 on the face of the cam-wheel 31, as follows: Four radial slots 42, set ninety degrees apart, are cut in the face of the cam-wheel, as shown in Fig. 10. Each of said slots is undercut, as shown in Fig. 7, in which the outer face of the cam-wheel is at the right. In each slot is mounted slidably a bar 43, to which is rigidly secured a cam 41, shaped as shown in Figs. 6 and 7. Said cams 41 are thus held against the outer face of the cam-wheel 31 and are movable thereon radially. The normal position of the cams 41 is shown in Fig. 1, from which it will be seen that they are all at different distances from the center of the cam-wheel 31. Arranged in the respective paths of said cams are four rollers 44, mounted upon the inner ends of four levers 45, one of which is shown in side elevation in Fig. 2. These levers are fulcrumed at 46 46 46 46 on brackets projecting from the side plate 6. The upper end of each lever 45 is pressed outwardly by one of the admission-valve stems 22, thereby holding the roller 44 against the cam-wheel 31. When said roller is moved outwardly by its cam 41, the upper end of the lever 45 presses in the valve-stem 22, and thereby opens the admission-valve 21. Two curved governor-levers 47 are pivotally secured to the cam-wheel 31 at 48 48, Fig. 1, and upon each of said arms is adjustably secured a weight 49. Thus during rotation of the cam-wheel the centrifugal force acting on said weights tends to hold the longer arms of the governor-lever 47 out and their shorter arms in toward the center of revolution. Pins 51, projecting from two adjacent cam-bars 43, project through slots in one of the governor-levers 47, as shown, for converting oscillations of the governor-lever into reciprocating movements of said cam-bars. Similarly the two opposite cam-bars 43 are connected by pin-and-slot joints to the respective arms of the opposite governor-lever 47. To oppose the action of the governor-weights 49, two expansion-springs 52 are provided for pressing outwardly the two cam-bars 43, which are connected to the shorter arms of the governor-levers 47, said springs being confined between the periphery of the cam-wheel 31 and nuts 53, mounted on threaded extensions of said two cam-bars 43, Fig. 6. The other two cam-bars connected to the weighted arms of the governor-levers 47 have no such extensions, and their outer ends do not reach the periphery of the cam-wheel 31. The purpose of this shortening is to provide space for two expansion-springs 54, which press inwardly against the outer ends of said cam-bars and are retained in the slots 42 by caps, pins, or plugs inserted in or over the ends of said slots. Thus all four of the springs 52 54 oppose the centrifugal force of the weights 49. The cams 41 being movable radially, as described heretofore, and being connected to the governor-levers 47, it follows that when the speed of the crank-shaft 8 becomes too high the weights 49 will cause said cams to be shifted out of their normal positions, and when the cams are shifted far enough they will not engage the rollers 44, and therefore the admission-valves 21 will not be opened. As soon as the speed of the engine falls to or below normal the centripetal movements of the governor-weights 49 will move the cams 41 back to their normal positions for operating the admission-valves. The cams 41 and the rollers 44 are so arranged that the charges in the cylinders 1 2 3 4 are exploded in the following order: 1 3 4 2.

Any preferred igniting device may be employed, and for clearness no igniting devices are shown in the drawings.

The cam-wheel 31 rotates in the direction of the arrow in Fig. 1.

By the hereinbefore-described construction there will be four piston impulses at each revolution of the cam-wheel 31 or two impulses at each revolution of the crank-shaft 8.

The preferred embodiment of my invention has been described; but certain changes in details or arrangement of parts may be made without sacrificing any of the advantages of the invention.

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

1. In an explosive-engine, a plurality of piston-cylinders, a crank-shaft, a gear-wheel secured on said shaft, a stationary pinion driven by said gear-wheel, a cam-wheel mounted rotatably on said shaft, an internal gear in said cam-wheel, driven by said pinion, a plurality of cams, corresponding in number to the number of cylinders, mounted on the face of said cam-wheel so as to be movable radially, governor-levers pivotally secured to said cam-wheel and connected to said cams in such a manner that oscillation of said governor-levers will shift said cams radially, weights on said governor-levers, springs opposing the centrifugal pull of said weights, and admission-valves operated by

the revolution of said cams, substantially as described.

2. In an explosive-engine, four piston-cylinders arranged ninety degrees apart, a crank-shaft, a gear-wheel secured on said shaft, a stationary pinion driven by said gear-wheel, a cam-wheel mounted rotatably on said shaft, an internal gear in said cam-wheel, driven by said pinion, the pitch diameter of said internal gear being double that of said gear-wheel, four cams on the periphery of said cam-wheel, set ninety degrees apart, and four exhaust-valves operated respectively by said cams, substantially as described.

3. In an explosive-engine, four piston-cylinders arranged ninety degrees apart, a crank-shaft, a gear-wheel secured on said crank-shaft, a stationary pinion driven by said gear-wheel, a cam-wheel mounted rotatably on said shaft, an internal gear in said cam-wheel, driven by said pinion, the pitch diameter of said internal gear being double that of said gear-wheel, four cams mounted on the face of said cam-wheel so as to be movable radially, said cams being ninety degrees apart, two governor-levers pivotally secured to said cam-wheel and connected to said cams in such manner that oscillation of said governor-arms will move said cams radially, weights on said governor-levers, springs opposing the centrifugal pull of said weights, and four admission-valves operated by the revolution of said cams, substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

ALBERT T. BOSSETT.

Witnesses:

M. L. LANGE,

PRESTON F. POCOCK.