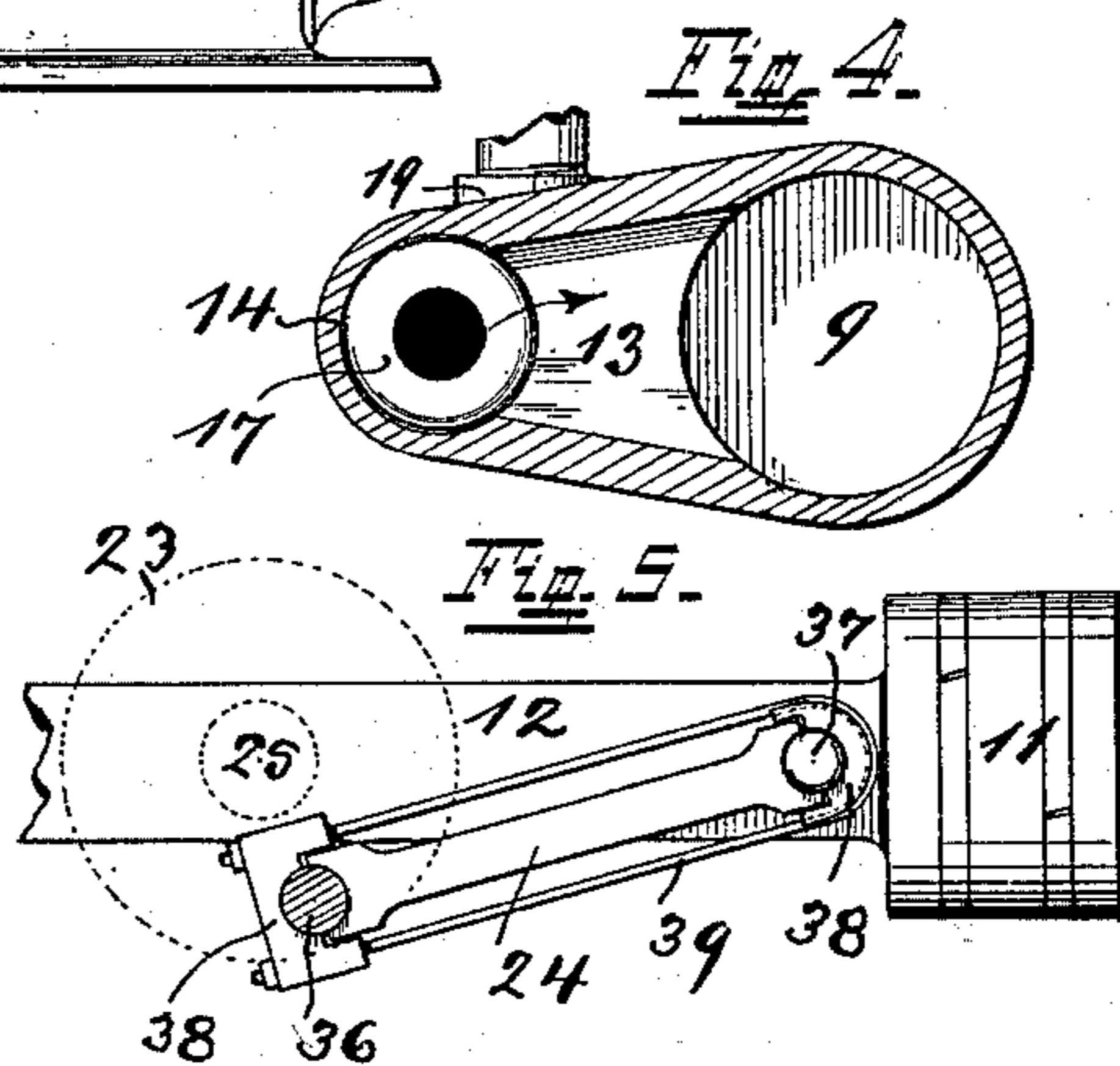
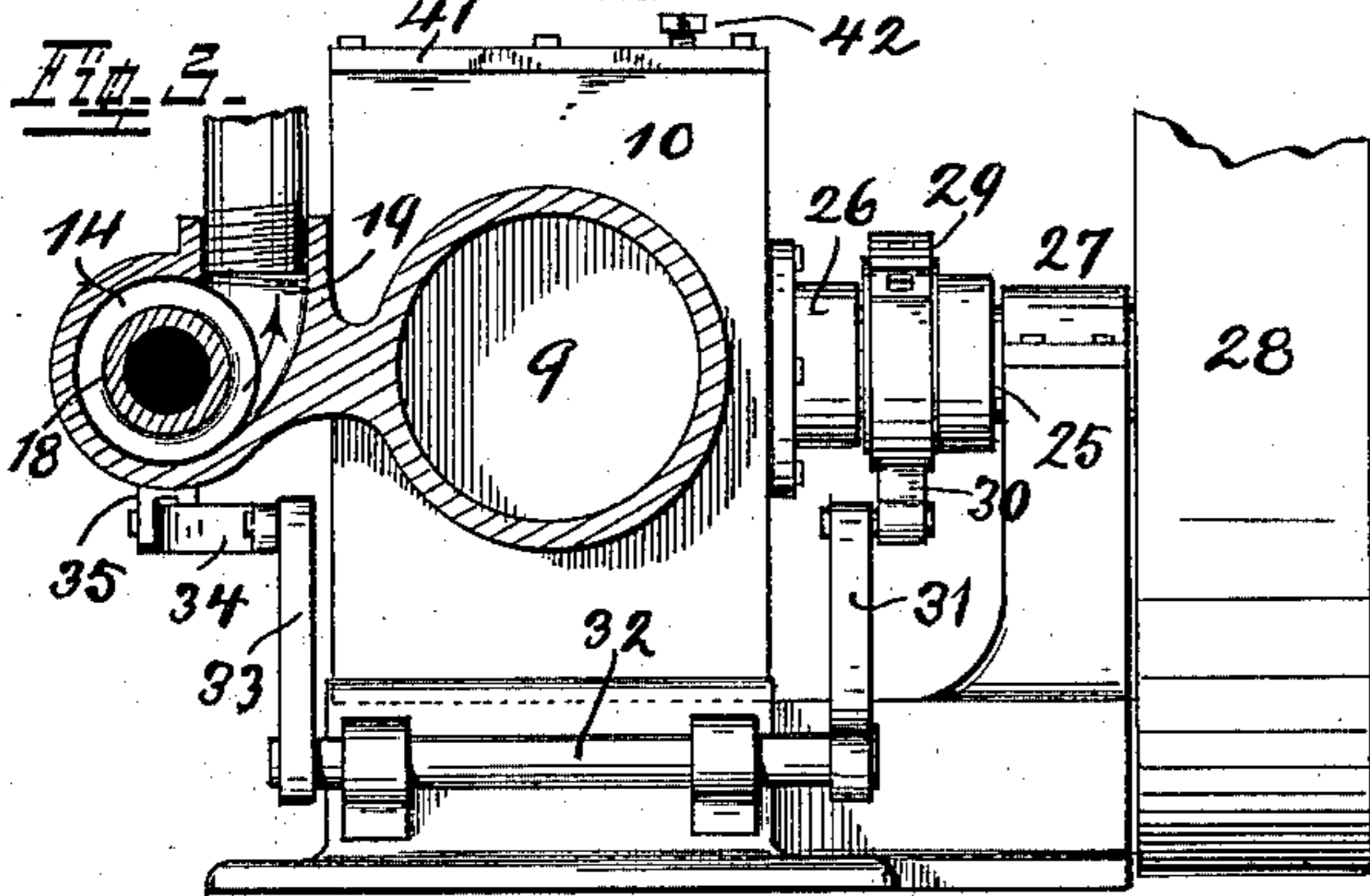
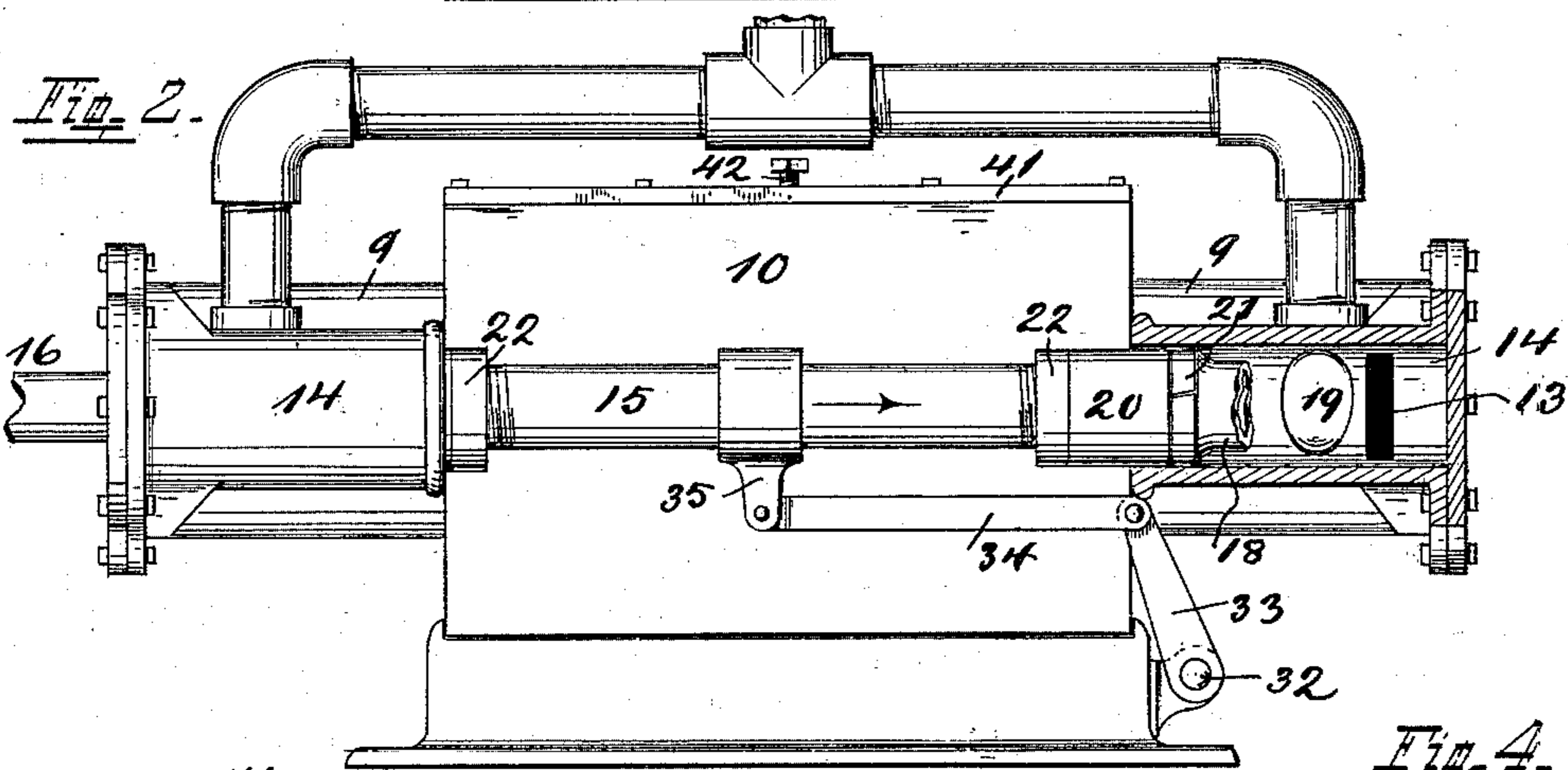
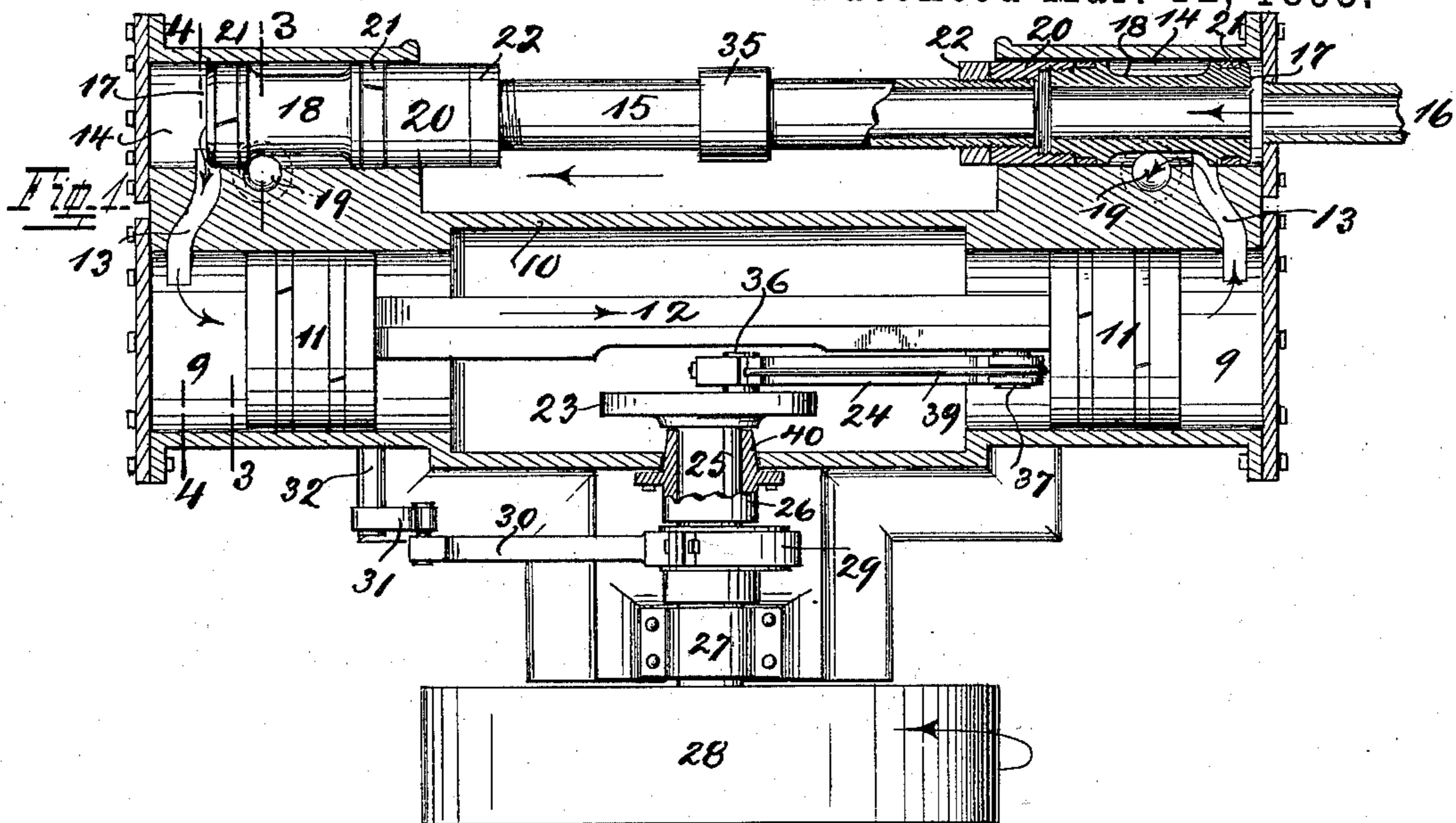


(No Model.)

T. F. CRARY.
STEAM ENGINE.

No. 535,356.

Patented Mar. 12, 1895.



Attest
C. F. Finn.
S. S. Spier.

Inventor
Thomas F. Crary
by C. Spengel Atty.

UNITED STATES PATENT OFFICE.

THOMAS F. CRARY, OF MIDDLEPORT, OHIO.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 535,356, dated March 12, 1895.

Application filed October 1, 1894. Serial No. 524,546. (No model.)

To all whom it may concern:

Be it known that I, THOMAS F. CRARY, a citizen of the United States, and a resident of Middleport, Meigs county, State of Ohio, have
5 invented a certain new and useful Duplex Steam-Engine; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and
10 use the same, attention being called to the accompanying drawings, with the reference-numerals marked thereon, which form a part of this specification.

This invention relates to improvements in
15 steam engines which have two cylinders disposed centrally in line with each other, each occupied by a piston, receiving steam on one side only, such pistons being rigidly connected to each other and reciprocating together, each
20 in its cylinder. In connection with such an engine, I use a perfectly balanced piston slide valve, that is to say, one valve for each cylinder, each also reciprocating in steam-chests centrally in line with each other and connected together and operating substantially
25 like the pistons in the steam-cylinders. The details of construction of these valves, their connection and operation in combination with suitably constructed valve-chests forms
30 the subject of my invention.

In the following specification and particularly pointed out in the claims at the end thereof, is found a full description of my invention, its operation, parts and construction, which latter is also illustrated in the accompanying drawings, in which—

Figure 1, is a horizontal sectional top-view, of my steam-engine, the line of section passing through at a level in line with the centers of the cylinders. Fig. 2, is a rear-elevation of the same looking at it from the side of the steam- or valve-chests. Fig. 3, is a sectional end elevation, on a line indicated by 3—3 and passing substantially through the
40 exhaust-port. Fig. 4, is a similar view, the section being taken on line 4—4, and passing substantially through the steam-port. Fig. 5, is a detail view of the connecting rod, whereby the reciprocating piston rod is connected to the crank which rotates the main-
50 shaft.

9 are the steam-cylinders, being disposed

centrally in line with each other and carried by a frame 10, of which they either form an integral part, or are connected to it. 55

11, are the pistons, one in each cylinder, which latter, as steam is admitted on one side of the pistons only, are open on their inner ends. This obviates the use of stuffing boxes with resulting friction at the points where the
60 piston-rods pass through cylinders, completely closed.

The pistons are connected to each other by a piston-rod 12, which passes from one piston in one cylinder to the one in the other cylinder, being rigidly affixed to each. 65

Steam is alternately admitted to each steam-cylinder, near their outer ends, by ports 13, coming from steam- or valve-chests 14, also centrally in line with each other and parallel
70 with the steam-cylinders. Such admission is controlled by two piston slide-valves, rigidly connected to each other by a rod 15, and reciprocating together within said valve-chests. Live steam enters at one of the latter, at 16, 75 and passes into the other valve-chest through the nearest valve, through connection 15 and through the other valve, all of which are hollow. As will now be seen, live steam occupies the interior of the valves and their connection, 80 lying also constantly before the outer ends 17, of the valves, from whence, as the latter alternately uncover steam-ports 13, it enters first one and then the other steam-cylinder.

Part of the valves, inwardly from their outer
85 ends 17, are reduced in thickness at 18, to afford a clearance, which permits the steam on the dead return stroke of each piston to escape through, entering reversely from port 13, and passing into and out through exhaust
90 ports 19. This is shown in Fig. 1, right side, in which figure the pistons are passing to the right and nearing the end of their stroke in that direction. The piston on the left is acting under live steam-pressure, while the cylinder on the right is exhausting. The valves
95 have about started on their return stroke in the other direction whereby, by the time the pistons have completed their stroke, the one on the right will have uncovered port 13, to admit live steam to, the corresponding cylinder,—said port now communicating with the exhaust port, while on the left side the valve
100 will cover and close port 13, to the admission

of live steam and permit the contents of the cylinder to escape through the exhaust port. All the parts act in the same manner, only in reverse order, when the pistons are traveling in the other direction. As the valves are traveling now, the valve on the right (which also counts for the other valve, when moving to the other side) never passes beyond the space between the live-steam and the exhaust-port, which latter is never uncovered on either side, so that part 17 of the valves remains always between said port and the live steam.

Inwardly next to their reduced parts 18, the valves are increased again in thickness at 20, such increased parts, as well as increased parts 17, completely filling out the valve-chests and forming the traveling surfaces of the valves. These increased parts are further provided with packing rings 21, whereby leakage is prevented and heads on the inner ends of the valve-chests and stuffing boxes therein are made unnecessary.

The valves are preferably in sections, screwed together with spaces between the sections whereby grooves are formed for the convenient insertion of the packing rings. The inner end of each valve is also screw-threaded interiorly and receives one end of the hollow connecting-rod 15. 22 are lock-nuts on connecting-rod 15, which are screwed up against the inner ends of the valves after their adjustment, to prevent them from turning, or working loose.

The reciprocating motion of the pistons is converted into a rotary one for practical use by means of a crank, or crank-wheel 23, connected to piston-rod 12, by means of a link 24. Crank-wheel 23, rotates a shaft 25, supported in boxes 26 and 27, and carrying on its outer end a suitable pulley 28, or any other power-transmitter.

The reciprocation of the valves may be obtained from main-shaft 25, by any convenient movement. In this case a customary eccentric 29, is shown on shaft 25, connected by a rod 30, to an arm 31, on a rock-shaft 32. A similar arm 33, is at the other end of the latter and connects by means of a link 34, to an arm 35, rigidly secured to the valve-connecting rod 15.

The boxes holding crank-pin 36, and pin 37, on connecting rod 12, between which two connecting link or rod 24, passes, are constructed in this way that one half of each box is formed in the ends of rod 24, the other halves being formed by overlapping caps 38, which are held in position by a stirrup-strap 39, passing around one cap and with its ends through the other one, beyond which latter nuts are provided on said ends. By a tightening of these nuts, the wear in the two boxes may be taken up at once.

It is my intention to use the box-shaped frame 10, as a means to hold the lubricant

for the crank-pin. A sufficient quantity is poured in to enable the latter to dip into it while passing through the lower part of the path of its revolution. For this reason box 26 should be constructed in a manner to prevent the leakage of oil where shaft 25 passes out of frame 10. For such purpose I provide this box with a conical collar 40, which fits into a similarly shaped opening in frame 10, into which it may be tightly drawn until a close fit is obtained. Frame 10 is preferably covered by a top-plate 41, which is provided with a removable plug 42, for closing up an opening through which the lubricant is poured in.

Having described my invention, I claim as new—

1. In a steam-engine with two cylinders centrally in line with each other and with a piston for each cylinder, valve-chests also centrally in line with each other and one alongside of each cylinder, a steam-port 13 in each valve-chest, communicating with its cylinder, an exhaust-port 19, in each valve-chest connecting it with an external exhaust-pipe, a hollow valve in each steam-chest, reduced between its ends, which latter fit the steam-chest tightly and open at its outer end 17, over which the live steam issues and enters port 13, when the same is uncovered by the end of the valve, a hollow rod 15, connecting the valves between the steam chests and by their inner ends and means secured to rod 15, for reciprocating it with the valves.

2. In a steam-engine with two cylinders centrally in line with each other and with a piston for each cylinder, valve-chests also centrally in line with each other and one alongside of each cylinder, a steam-port 13 in each valve-chest, communicating with its cylinder, an exhaust-port 19, in each valve-chest connecting it with an external exhaust-pipe, a hollow valve in each steam-chest formed of sections screwed together with grooves between the sections, packing rings 21, contained in said grooves at each end of the valves, forming their guiding and traveling surfaces, the valves being reduced between said packing-rings and having their inner opposite ends screw-threaded, a hollow connecting rod 15, to each end of which one of the valves is adjustably connected by its screwthreaded end, lock-nuts 22, on the connecting rods bearing against the ends of the valves to hold them to their adjusted positions and means secured midway to the connecting rod 15, for reciprocating it with the valves thereon.

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

THOMAS F. CRARY.

Witnesses:

J. F. DOWNING,
ARTHUR CURTIS.