

No. 747,926.

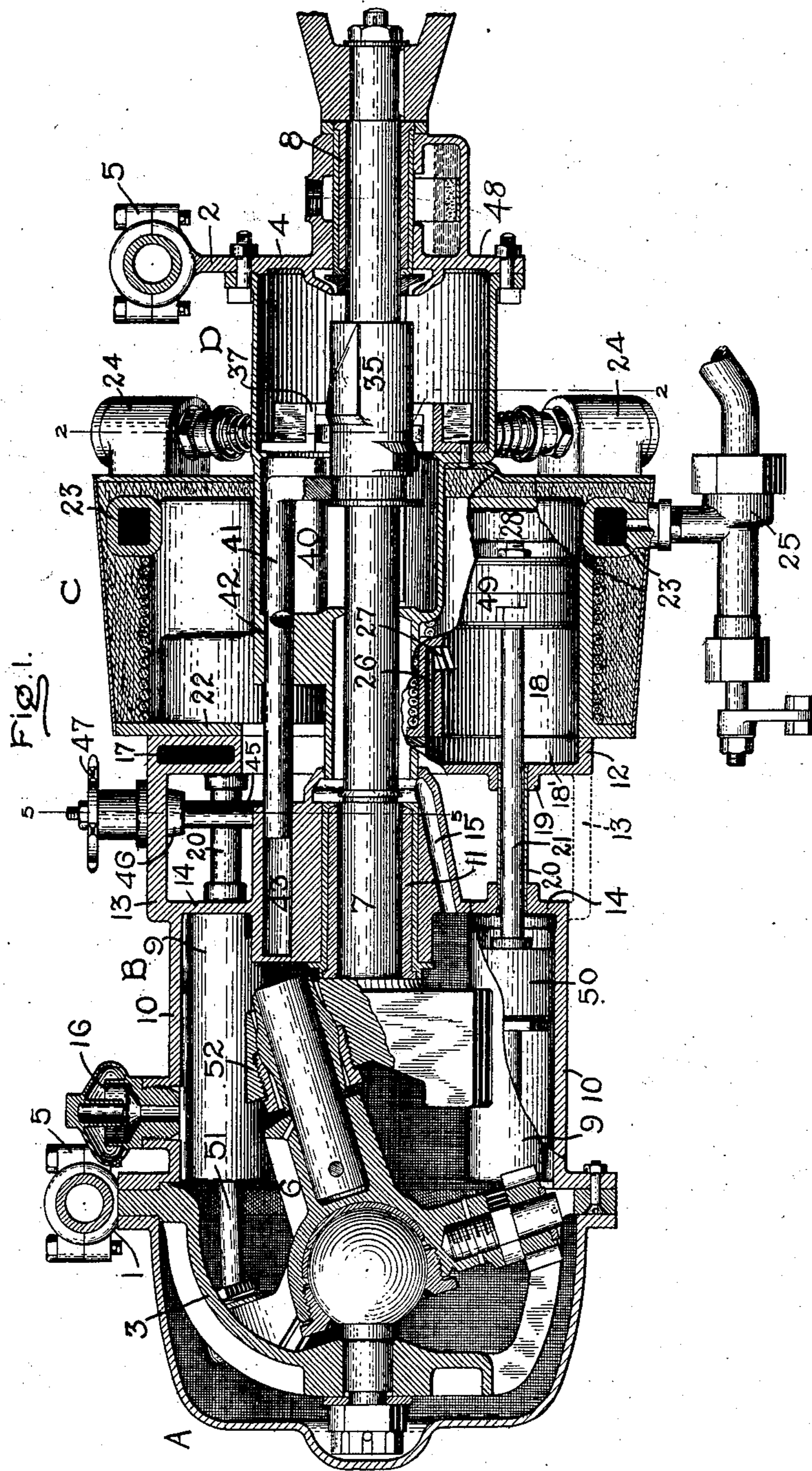
PATENTED DEC. 29, 1903.

H. S. BALDWIN.
MULTIPLE CYLINDER STEAM ENGINE.

APPLICATION FILED JUNE 1, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses

Ewing R. Kurney
Alex. F. Macdonald

Inventor

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By *Albert S. Davis*
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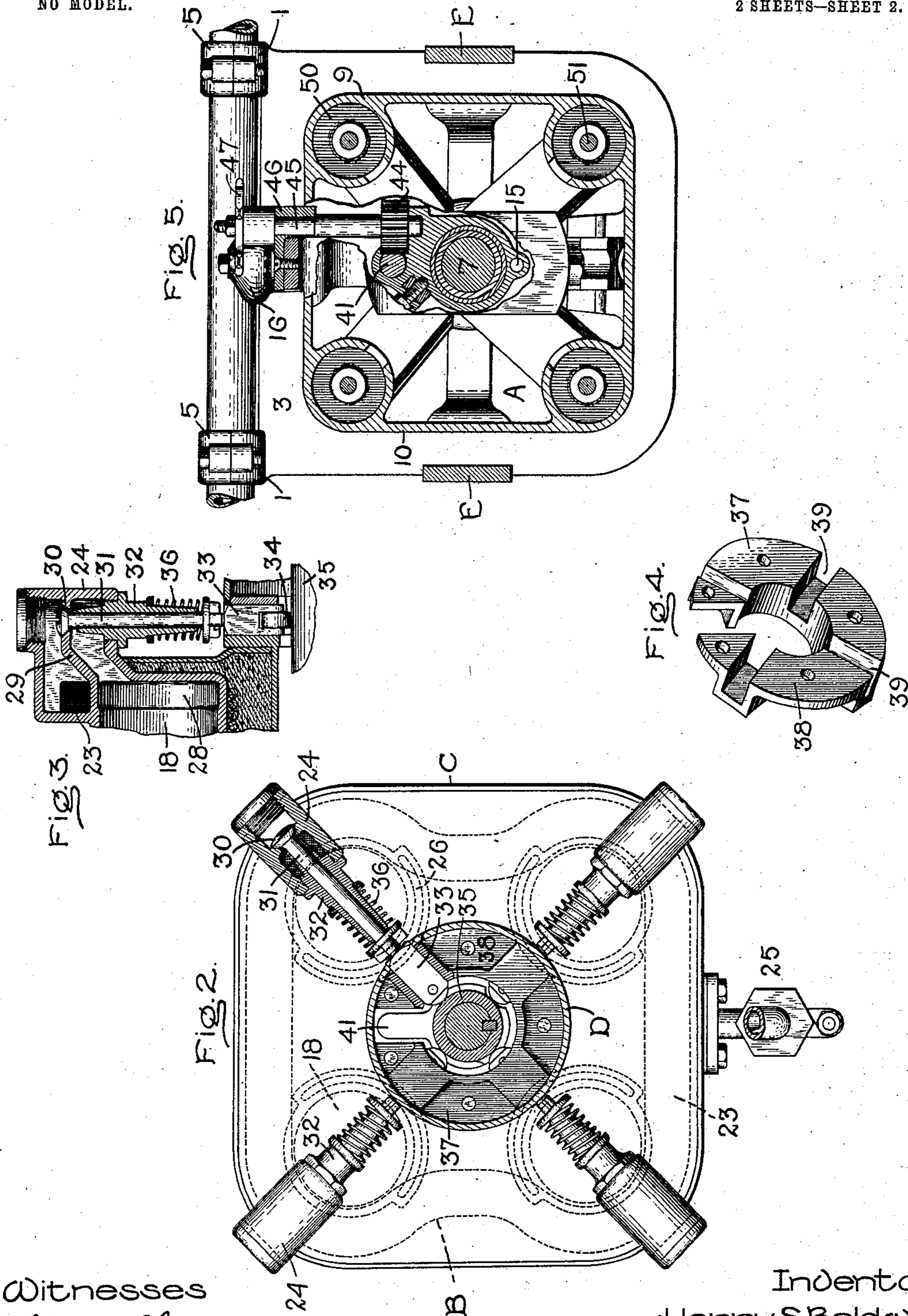
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UNITED STATES PATENT OFFICE.

HENRY S. BALDWIN, OF LYNN, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MULTIPLE-CYLINDER STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 747,926, dated December 29, 1903.

Application filed June 1, 1903. Serial No. 159,483. (No model.)

To all whom it may concern:

Be it known that I, HENRY S. BALDWIN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have
5 invented certain new and useful Improvements in Multiple-Cylinder Steam-Engines, of which the following is a specification.

The present invention relates to a multiple-cylinder steam-engine of that type disclosed
10 in the joint application of Hermann Lemp and Otto F. Persson, Serial No. 138,616, filed January 12, 1903, whereby parallel reciprocating motion of the several pistons is converted by means of a wabblor into rotary mo-
15 tion of the central crank-shaft disposed parallel to the direction of motion of the pistons.

Generally stated, the present invention consists in certain novel features of construction whereby the engine is rendered more
20 simple, durable, and cheap to construct.

For a consideration of what I believe to be novel and my invention attention is called to the description and claims appended thereto.

In the accompanying drawings, which represent one embodiment of my invention, Figure 1 is a longitudinal section of a multiple-cylinder type of steam-engine with portions of the cylinder and cross-head sections broken away. Fig. 2 is a vertical transverse section
30 taken on line 2 2 of Fig. 1, showing the steam-admission valves and guide-ring for the valve-tappets. Fig. 3 is a detail section of a portion of a cylinder, the steam-chest, and valve mechanism. Fig. 4 is a perspective view of the valve-tappet guide-ring; and Fig. 5 is a
35 vertical transverse section of the engine, taken on line 5 5 of Fig. 1 and showing the interior of the cross-head section.

Similar reference characters indicate corresponding parts.
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As I have selected to illustrate the distinctive features of my invention as applied to the engine set forth in the application hereinbefore named of Hermann Lemp and Otto F. Persson, Serial No. 138,616, the description
45 of the details of construction of the engine in this case will pertain more especially to those parts to which my invention is particularly related.

The engine-frame comprises four main sections—namely, the wabblor-section A, the cross-head and steam-exhaust section B, the cylinder or piston section C, and the cam-inclosing section D—the several sections being
50 separably secured together by longitudinal side bars E, which latter are shown in section in Fig. 5.

While it is desirable to suspend the engine on transverse bars between supporting-beams, as referred to in the above-mentioned application, I have found it preferable for the purpose of facilitating the removal of the engine from its supporting cross-bars to furnish the hangers with removable caps. Thus the hangers 1 and 2, respectively, of the wabblor-
55 cage 3 and the plate 4 of the head portion of the cam-inclosing section are provided with caps 5, that are secured to the hangers by through-bolts in a common manner.

The section A, containing the wabblor 6, its bearing and guiding devices, the crank-shaft 7, extending longitudinally and centrally through the several sections, and the crank-pin connection with the wabblor, the cam-inclosing section D, and the front bearing 8 of the crank-shaft are features all of familiar construction and the same involve
60 no elements of my invention. The cross-head section B embodies in a single casting, preferably of iron, cross-head guides 9, circumferential connecting-webs 10 between said guides, a main shaft-bearing 11, an exhaust-chamber plate 12, and bridge-pieces 13, connecting said webs and plate. This casting is
65 of a mechanical construction that can be easily produced and particularly obviates the necessity of machined parts and joints due to separate sections, which impair the strength of the engine-frame and also dispense with the tie-bolts extending from the wabblor-section to the middle section, as hitherto. The cylindrical guides 9 for the cross-heads are four in number, as shown, and are disposed
70 symmetrically around the central shaft 7, with their axes parallel with that of the shaft. The circumferential webs 10 connect the cross-head guides tangentially at their outermost points, so as to form, in connection with
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the end plate 14 of the cross-head section and the main shaft-bearing 11, carried thereby, a hollow interior, that combines with the wab-
 5 bler-section to form a closed-in oil-contain-
 ing chamber for the crank and the wab-
 10 The main shaft-bearing is provided with an
 annular oil-duct 15, communicating with the
 closed-in chamber, and thus by the splashing
 of the oil therein the shaft and other parts
 are properly lubricated.

In order to maintain atmospheric pressure and free circulation of air within the closed-in chamber, an oil-entrapping ventilator 16 is provided in the top connecting-web of the
 15 cross-head section, the same being of com-
 mon construction.

The exhaust-chamber is substantially an annular plate having circular recesses 18', Fig. 1, that register with the open ends of
 20 the piston-cylinders 18, and between and connecting these recesses are cored-out passages 17, so that by means of these passages and recesses the open ends of the piston-cylinders are all in constant communication, or,
 25 in other words, the exhaust-chamber is a common exhaust for the cylinders. The plates 12 and 14 are provided with bosses 19 on their exterior surfaces, which aline with the axes of the piston-cylinders and cross-head
 30 guides and in which are tightly fitted sleeves 20 for protecting the piston-rods 21. The cylinder-section C comprises a plurality of cylinders arranged in a manner similar to the cross-head guides relatively to the central
 35 shaft 7. These cylinders are connected at their open ends by a plate portion 22 and at their closed ends or heads by a steam-carrying conduit 23, which latter extends circumferentially of the group of cylinders and carries forwardly-extending steam-chests 24. At
 40 a suitable point, preferably at the bottom, the steam-conduit 23 is provided with a throttle-valve 25, connected directly thereto. The exhaust or open ends of the cylinders are provided with approximately semi-annular ex-
 45 haust-passages 26, as shown in Figs. 1 and 2, that open into the recesses 18', said passages 26 having communication with the steam-space of the cylinders through ports 27, which
 50 are uncovered at the end of the outward stroke of the pistons.

The admission ends of the cylinders are provided with the usual clearance-spaces 28, that communicate with the conduit 23 through
 55 the steam-chests 24. The steam-chests are arranged at the heads of the cylinders and are divided into two compartments by partitions 29, which latter are provided with valve-seats for the steam-admission valves, preferably puppet-valves 30, as shown in Figs. 2
 60 and 3. The valves are arranged to open outwardly, so as to relieve any undue compression in the cylinder due to any cause.

The stems 31 of the valves pass through
 65 elongated bushings or sleeves 32, which are screwed into the steam-chests in such a po-

sition as to be arranged radially with respect to a point coincident with the axis of the central shaft. At the inner ends of the stems 31 are tappets 33, having rectangular guide-
 70 surfaces, and antifriction-rollers 34, that engage with a revolving cam-sleeve 35 on the central shaft. The usual valve-springs 36, surrounding the stem and bushing, are provided. Situated in line with the outer end of
 75 each valve-stem is an opening which is closed by a detachable screw-threaded plug. By removing the plug and the key or nut which is attached to the inner end of the stem the valve as a whole can be removed without tak-
 80 ing down the engine or disturbing its antifriction roller or guide. Manifestly such an arrangement is desirable, since it permits of repairs being quickly made.

The cam-inclosing section D forms a hous-
 85 ing for the cam-sleeve and valve-tappets. These last-mentioned members extend through openings in the wall of the cam-inclosing section, and they are guided by means of a stationary guide ring or plate 37, Figs. 90
 1 and 4. This ring consists of a casting of suitable bearing material having a flat portion 38 and diametrically opposite grooves 39, extending from the circumference to the opening at the center of the ring, as shown
 95 in Fig. 4.

The guide-ring 37 is assembled in the cam-inclosing section D, which latter is cast with a reduced portion 40, Fig. 1, that encircles the central shaft and projects into the cylin-
 100 der-section C between the cylinders. The guide-ring surrounds the cam-sleeve 35 on the central shaft and is secured to the reduced portion, as by riveting, the upper part of the ring being recessed to provide for the
 105 movement of the cam-actuating device or shipper 41. The valve-tappets are confined in the flat-sided grooves 39 of the guide-ring, which afford large bearings to insure perfect
 110 alinement of the valve-stems on their bearing-sleeves. Another object, however, attained by the guide-ring is that of obviating the use of separate guide-bushings in the wall of the cam-inclosing section D for the
 115 valve-stems, as in the construction hitherto.

The reduced portion 40 of the cam-inclosing section is provided with a guide 42, which registers with a similar guide 43 on the main shaft-bearing 11. The cam-shipper is mov-
 120 ably supported in these guides, and its movement is accomplished by a rack carried on its rear end, that meshes with a pinion 44, Fig. 5, secured adjacent the lower end of a shaft
 125 45, which extends vertically from a step-bearing in the main shaft-bearing 11 through a removable bearing 46, attached to the top one of the bridge-pieces 13 and having a
 130 sprocket-wheel 47 keyed to its upper end. The cam-sleeve carries suitable cam-surfaces, which while revolving with the crank-shaft 7 engage successively the valve-tappets that actuate the valves, and in order to control

the action of the engine the cam-shipper is operated so as to present the desired working surface of the cams or non-working surface of the sleeve to the tappets for regulating the point of cut-off of the steam-admission or for throwing the valves out of service in a manner well known.

The front of the cam-inclosing section D is closed by the upper plate 4, carrying the hanger 2, as hereinbefore mentioned, and a lower plate 48, which together form the head of this section, and these also support the front bearing 8 for the crank-shaft.

The motive parts of the engine are of familiar construction, consisting of a plurality of pistons 49 and cross-heads 50, adapted to reciprocate, respectively, in the steam-cylinders and cross-head guides, piston-rods 21, connecting-rods 51, the wabblers 6, and the crank 52 of the central shaft 7.

From the foregoing description the operation of the engine will be understood to be as follows: Steam is admitted to the cylinders in successive order, thereby imparting successive impulses to the pistons under the expansion of the steam. The motion of the pistons is communicated to the wabblers, causing a rotative movement of the crank-pin, which in turn imparts its movement to the crank-shaft. As the cam-sleeve rotates with the crank-shaft the cams are brought into active engagement with the valve-tappets one after another, opening the valves successively and admitting the steam to the piston-cylinders in the same order. Reversing the order of opening the valves obviously changes the direction of rotation of the crank-shaft.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now consider to be the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a multiple-cylinder engine, the combination with a central shaft, of a cylinder-section, and a cross-head section having an integral exhaust-plate.

2. In a multiple-cylinder engine, the combination with a central shaft, of a cylinder-section, a cross-head section, an exhaust-plate, and bridge-pieces integral with said cross-head section and exhaust-plate.

3. In a multiple-cylinder engine, the combination with a central shaft, of a supporting-frame, a cylinder-section, and a cross-head section carrying an exhaust-plate integral therewith.

4. In a multiple-cylinder engine, a cross-head section, comprising an integral casting having parallel guides, a crank-shaft bearing, an exhaust-plate, and bridge-pieces connecting the plate and guides.

5. In a multiple-cylinder engine, a cross-head section, comprising an integral casting of parallel cylindrical guides suitably spaced about a common axis, a forwardly-extending crank-shaft bearing, an exhaust-plate, and bridge-pieces connecting the plate and guides.

6. In a multiple-cylinder engine, the combination with a cylinder-section, of a cross-head section comprising a plate portion, cylindrical guides, circumferential webs connecting the guides, a crank-shaft bearing carried by the plate portion, an exhaust-plate, bridge-pieces connecting the plate and webs, and means securing the sections together.

7. In a multiple-cylinder engine, the combination of a crank, a wabblers-section, a wabblers mounted therein, a cross-head section having a hollow portion forming with the wabblers-section an inclosed oil-containing chamber for the wabblers and crank, and an oil-trap ventilator in the cross-head section.

8. In a multiple-cylinder engine, the combination with a central shaft, of a cylindrical section, a cross-head section comprising a casting having cylindrical guides, an exhaust-plate and bridge-pieces, and means supporting the sections in position around the central shaft.

9. In a multiple-cylinder engine, a cylinder-section comprising an integral casting having a plurality of cylinders, a plate connecting the cylinders at one end, a circumferential steam-conduit connecting the cylinders at the opposite end, and steam-chests extending longitudinally from the steam-conduit.

10. In a multiple-cylinder engine, the combination with a central shaft, of a plurality of parallel cylinders disposed symmetrically around the shaft, a circumferential steam-admission conduit arranged on the cylinders, steam-chests extending outwardly from the conduit and connecting the latter with the cylinders, and admission-valves arranged in the steam-chests.

11. In a multiple-cylinder engine, the combination with a central shaft, of a cylinder-section, pistons therefor, steam-chests therefor, admission-valves operating in the chests, bearing-sleeves for the stems of the valves, cam and tappet means for actuating the valves, and a guide-ring surrounding the central shaft for guiding the tappets of the valve-stems.

12. In a multiple-cylinder steam-engine, the combination of a central shaft, a cylinder-section, pistons therefor, a cam-sleeve on the shaft, a shipper for actuating the sleeve, a cam-inclosing section, steam-admission valves, a stationary guide-ring arranged in the cam-inclosing section, the said ring being slotted in the line of movement of the shipper, and valve-tappets extending into the cam-inclosing section and being guided by the ring.

13. The combination of a plurality of cyl-

inders, pistons therefor, steam-chests, admission-valves therefor, radially-disposed valve-stems, bearing-sleeves for the valve-stems, tappets at the outer ends of the stems, and
5 a plate having radial grooves forming guide-ways for the valve-stem tappets.

14. The combination of a plurality of cylinders, pistons therefor, a steam-chest radially disposed, spring-controller puppet-
10 valves therefor, cam-actuating means for the

valves, a guide-ring providing bearings for the outer ends of the valve-stems, and a crank for actuating the cams.

In witness whereof I have hereunto set my hand this 28th day of May, 1903.

HENRY S. BALDWIN.

Witnesses:

DUGALD MCK. MCKILLOP,
JOHN A. MCMANUS.