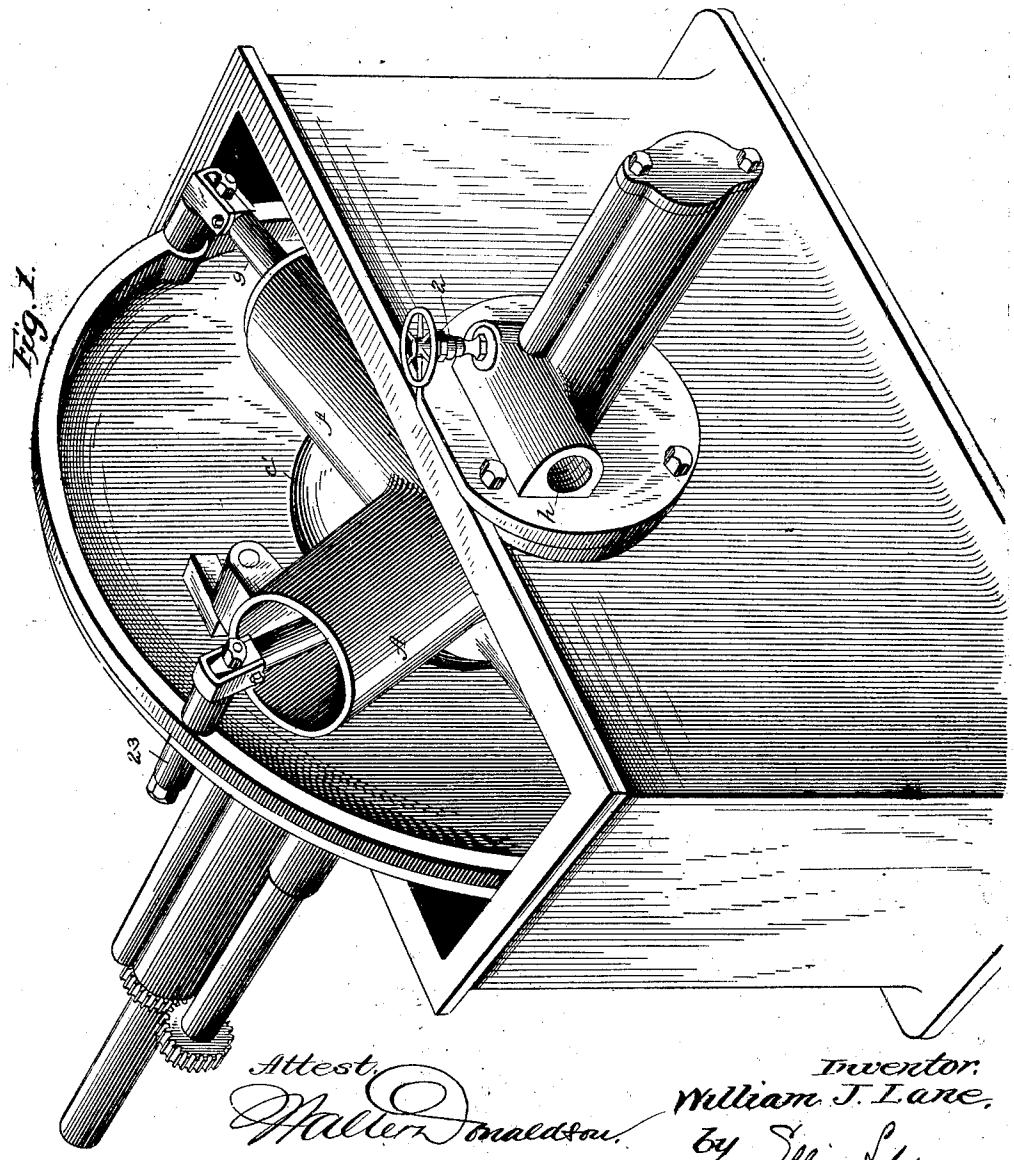
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# W. J. LANE.

## STEAM ENGINE.

No. 392,039. Patented Oct. 30, 1888.

Fig. 1.




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## STEAM ENGINE.

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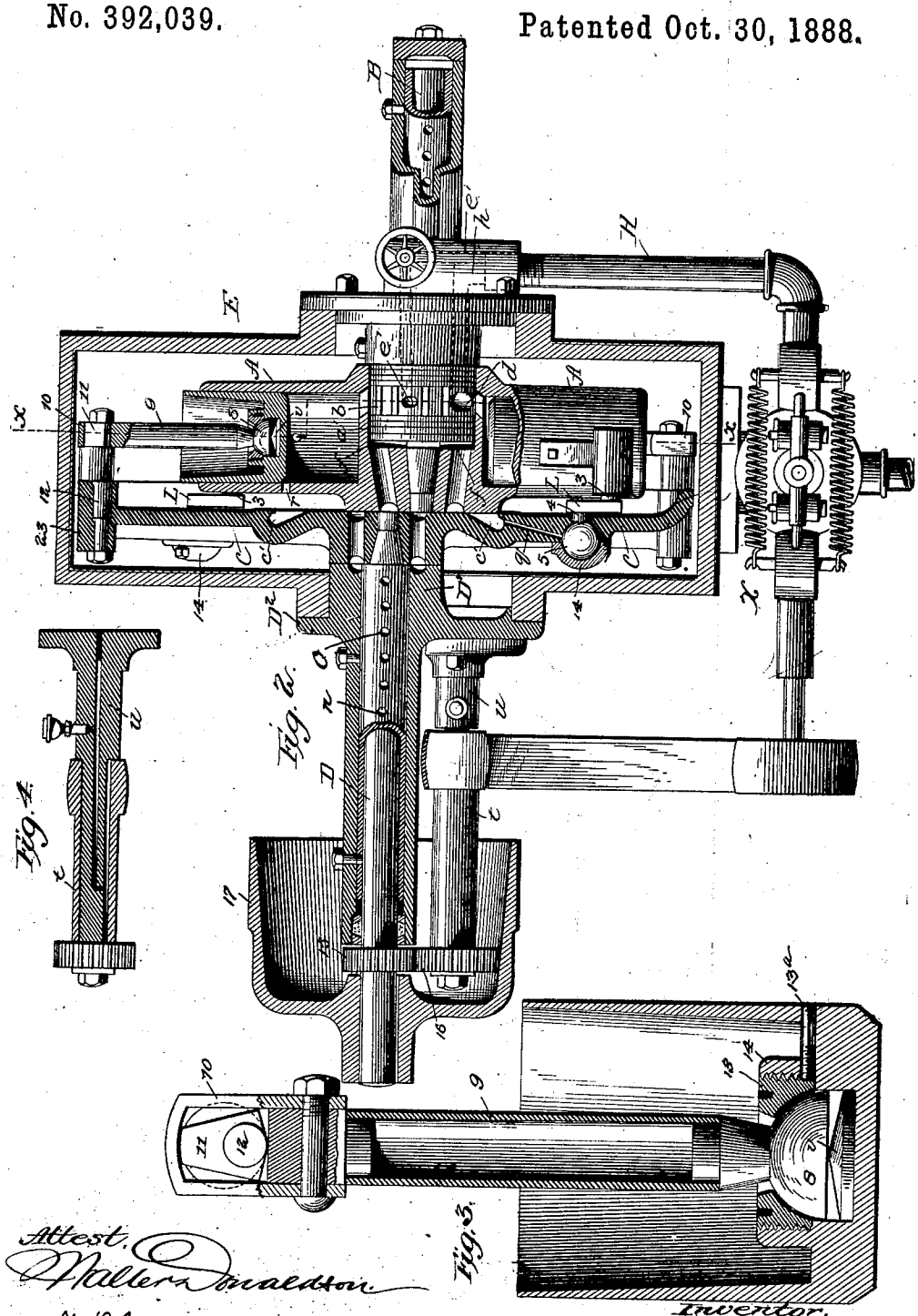


Fig. 2.

Fig. 4.

Fig. 3.

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Walter Dwaddon
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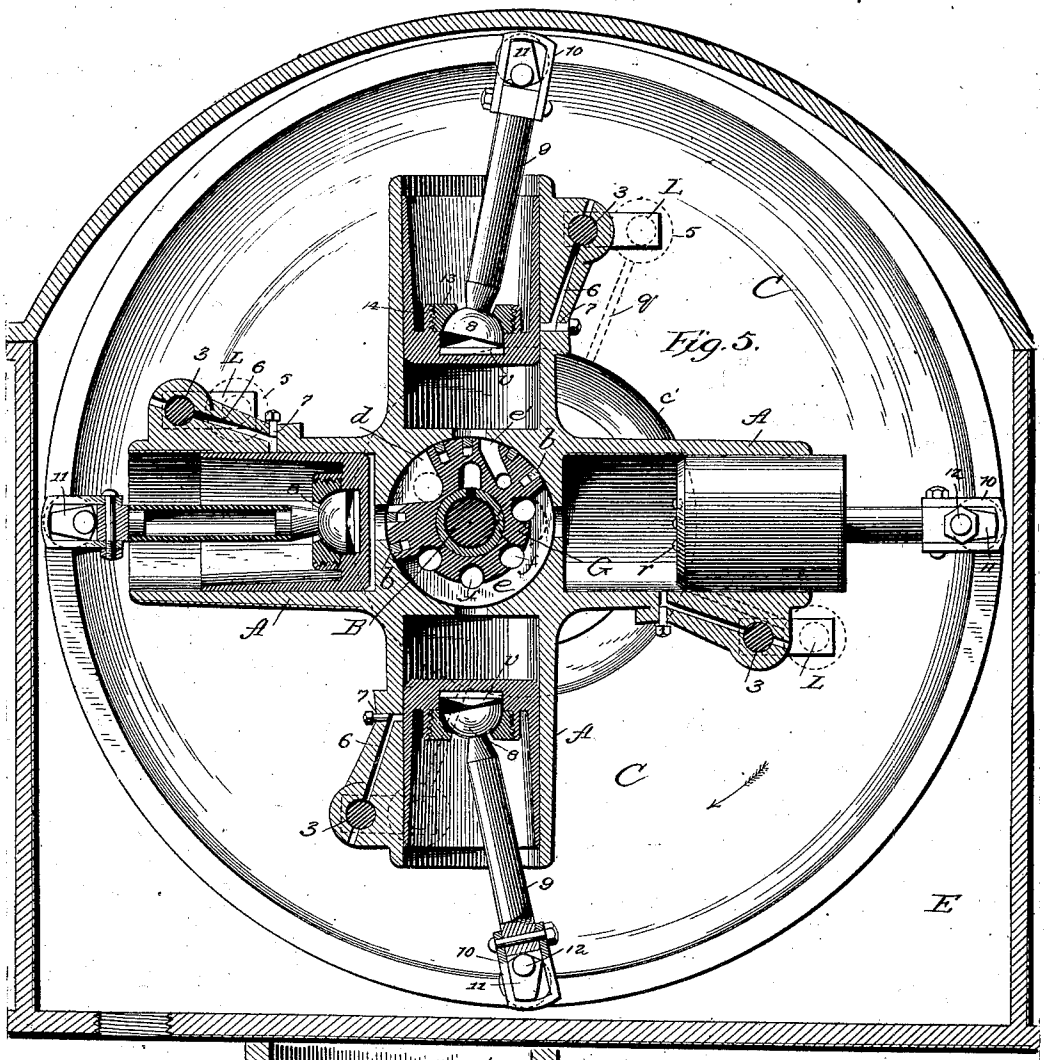
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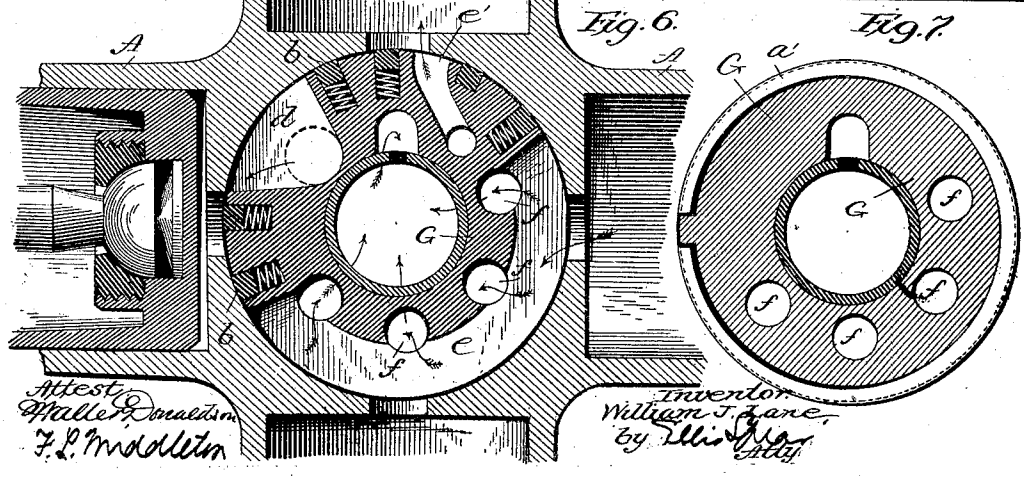
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## STEAM ENGINE.

No. 392,039. Patented Oct. 30, 1888.




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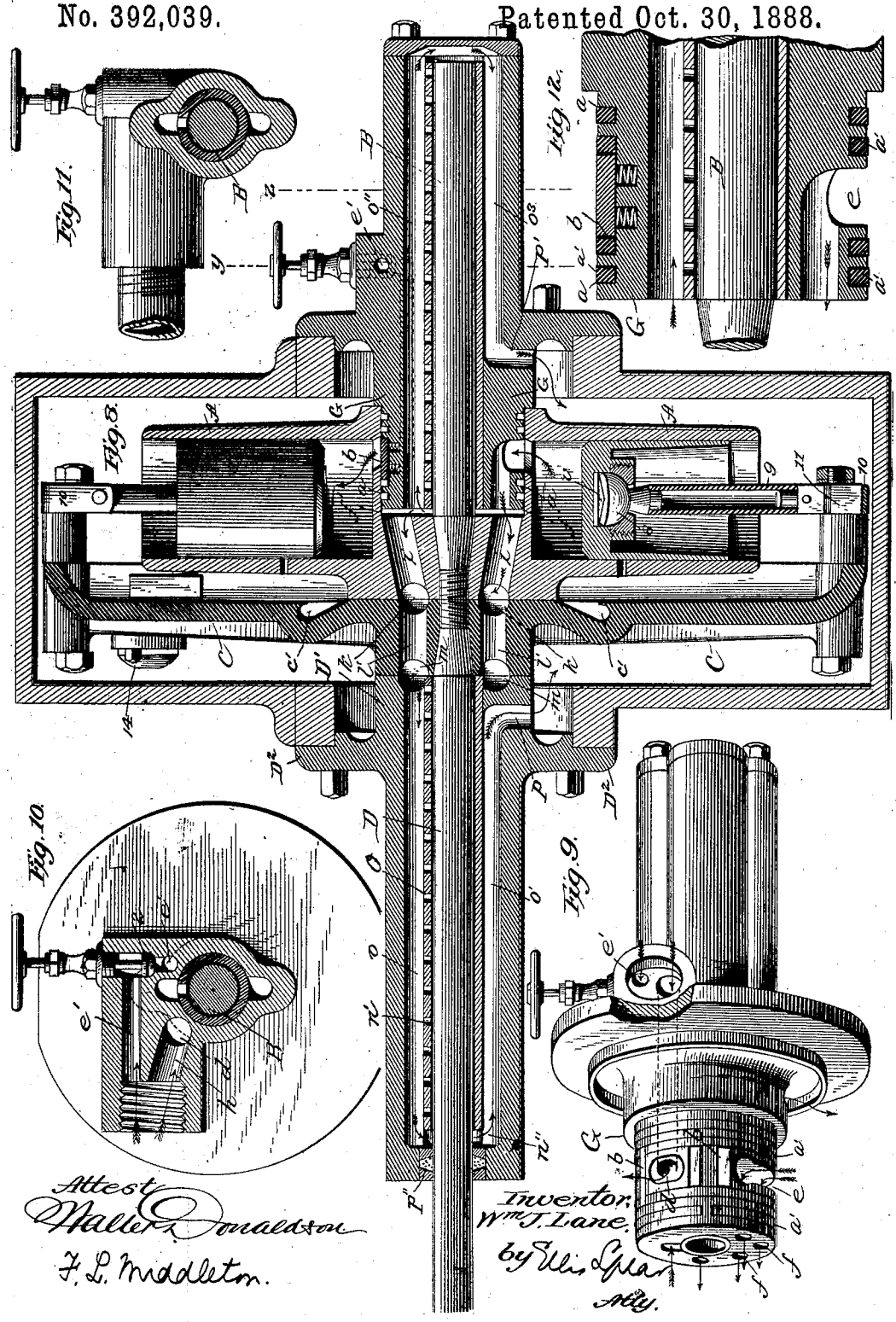
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## STEAM ENGINE.

No. 392,039. Patented Oct. 30, 1888.



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## STEAM ENGINE.

No. 392,039. Patented Oct. 30, 1888.

Fig. 14.

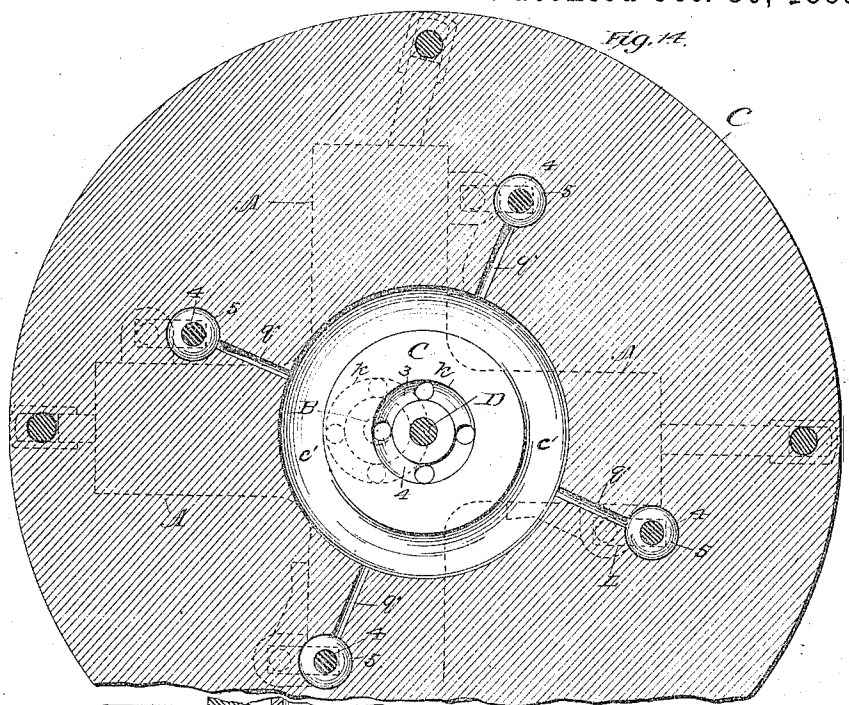
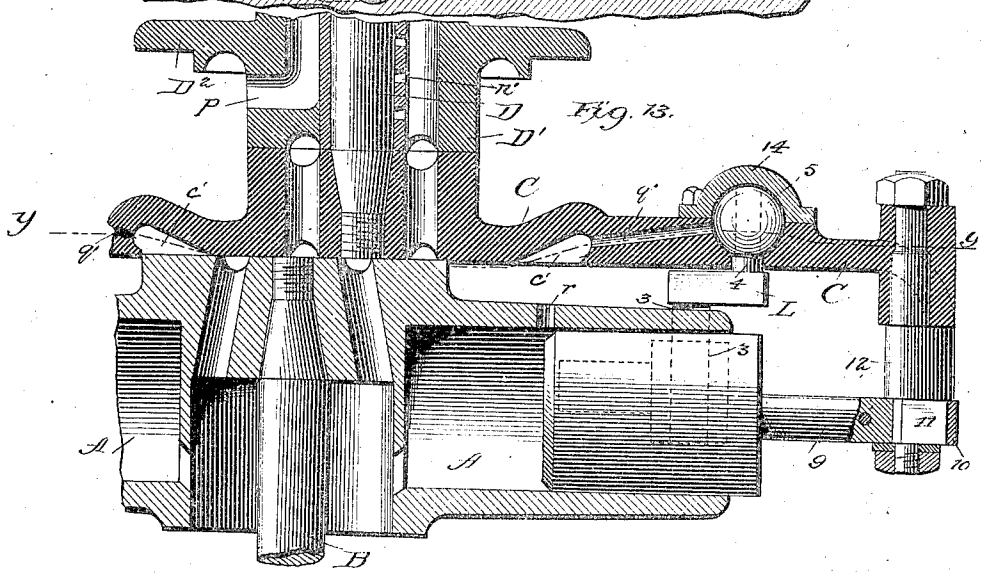



Fig. 13.




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# UNITED STATES PATENT OFFICE.

WILLIAM J. LANE, OF POUGHKEEPSIE, NEW YORK.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 392,039, dated October 30, 1888.

Application filed June 5, 1888. Serial No. 276,142. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM J. LANE, of Poughkeepsie, in the county of Dutchess and State of New York, have invented a new and useful Improvement in Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the same.

Letters Patent of the United States were granted to me November 2, 1886, for an improvement in revolving-cylinder engines.

My present invention is a further improvement in the same class of engines, but includes the leading features shown in my said patent. These features, in which my invention consists, are details of construction, whereby the better operation of the engine is secured, all as hereinafter explained, and as shown in the accompanying drawings.

In the drawings, Figure 1 represents in perspective my improved engine with the upper part of the casing removed. Fig. 2 represents the machine in plan view and with parts in horizontal section. Figs. 3 and 4 show details enlarged and in section. Fig. 5 represents the machine in section on a line *x x* of Fig. 2. Figs. 6 and 7 are enlarged views of sections, showing the positions of the parts, the packing, and other details. Fig. 8 is a central vertical section taken longitudinally of the axis, but showing the journals and one piston in side elevation, the section on one side being taken centrally of one shaft and the section on the opposite side centrally of the other shaft. Figs. 9, 10, 11, and 12 show on a larger scale, and more clearly, details of the parts shown in Fig. 8, Fig. 9 being a perspective view of the cylinder-bearing and the projection extending into the cylinder-hub, and Fig. 10 being a section on line *y y* of Fig. 8, and Fig. 11 a section on line *z z* of Fig. 8. Fig. 13 represents a central longitudinal section of the hubs, both of the cylinders, and the piston-carrying wheel with parts of the cylinder and wheel. Fig. 14 is a section on line *y y* of Fig. 13.

The cylinders A—preferably four in number—are set radially on a hub which turns with a shaft, B. A disk, C, is mounted on another shaft, D, set out of line with the first, and to this disk are attached the connections with the pistons, whereby the relative movement of pistons and cylinders imparts a rotary movement to both the cylinder-hubs and to the disk which carries the pistons, these being connected.

The cylinders take steam and exhaust through their hub and the whole is inclosed in a case, E, whereby all the working parts are lubricated. So far the general form and combinations described are the same as those shown in my aforesaid patent; but in the said patent the ports which admit steam to the cylinders are in the face of the hub, which is ground to fit against a corresponding face in the casing, and a collar and spring are provided to maintain the connection between the two faces and overcome the tendency to separate by reason of the steam-pressure. While this construction is effective, some inconvenience arises in the running of the engine by reason of the care required to adjust the pressure of the springs, and these, if not of sufficient power, would allow leakage, and, if too great, would work tight, and cause loss of power by friction. To avoid this inconvenience and at the same time to provide a permanent connection perfectly steam-tight, with a minimum of friction and self-adjusting, I recess the hub on the induction side, and fit it to receive a cylindrical projection, G, from the casing through lateral ports in which steam is admitted and exhausted directly into and from the bottoms of the cylinders. As the cylindrical surface of the projection fits the cavity in the hub, the inconvenience, referred to, of the separation of the parts or their liability to bind, is wholly avoided. On each side of the circumferential line of ports, in the cylindrical surface of the projection G, are peripheral grooves *a*, in which are segmental spring packing-rings *a'*, bearing upon the periphery of the cavity.

The diameter of the projection G is slightly less than the interior diameter of the recess in which it is fitted, and the spring packing-rings, by reason of their elasticity, project slightly beyond the periphery of the projection, bearing against the walls of the recess, so that the rings are the only points in frictional contact. These rings being of spring metal are continually forced outward against the walls of the recess, thus being self-adjusting to take up the wear, and while presenting a minimum amount of friction-surface and

make a connection practically steam-tight. Two or more of these rings are arranged on each side of the circumferential line of the ports, so as to break joints at their divided ends. Between the grooves on each side of the ports and between the exhaust and induction ports are set transversely to the rings *a'* packing-strips *b*, fitted into suitable cavities over springs, by means of which they are constantly pressed outwardly, and are also self-adjusting to take up the wear, the rings and strips thus forming packing on all sides of the ports.

Figs. 5 and 6 show plainly the main induction-port *d* and the exhaust *e*. They also show the supplemental induction-port *e'*, hereinafter explained, and in these figures the packing-pieces *b* are represented in pairs interposed between the ports.

Steam is taken through the pipe H and passage *h* in the projection G, as shown in dotted lines in Fig. 2, to the inlet-port *d*. The exhaust *e* is through the half-circumference of the extension and by-passages *f* in the extension shown in Figs. 6, 7, and 8, into a space, *f'*, between the extension and interior of the recess of the hub, and thence through by-passages *i*, through the hub, and thence into a passage, *k*, formed by annular grooves in each of the opposing faces of the cylinder-hub and the hub of the disk C. These annular grooves are shown at *k*, Fig. 8. It will be observed that these annular grooves do not coincide throughout their whole extent, for the reason that they are not concentric. They appear in their proper position in Figs. 13 and 14, the latter figure showing that they cross each other, forming at this point a cylindrical passage in cross-section, so that they are always in connection at two points, 3 and 4, during the revolution of the disk and cylinders. From the passage formed by these grooves *a* passages *l'* extend through the hub of the disk to a second set of annular grooves, *m*, one in the hub of the disk and the other in the opposing face of an extension, D', forming a bearing for the shaft of the disk C. These grooves being concentric form an annular chamber, as shown in Fig. 8. The shaft of the disk C is supported in bearings formed in an extension, D', provided with a disk, D², by which it may be secured to the casing, the said disk also closing the opening in said casing at this point.

The extension D', as shown in Fig. 8, is provided with longitudinal channels *o o'*, formed above and below the shaft, and to form a bearing for the shaft a sleeve, O, is inserted in the extension with a series of perforations, *n'*, in the upper part of the sleeve to allow for the proper lubrication of the shaft by the steam passing through the channel *o*. The channels *o o'* are connected at the end, as shown at *n''*, the sleeve O being less than the whole length of the extension for this purpose. A bearing provided with suitable packing is made in the end of the extension, as shown at *p'*. The passage *o* is in uninterrupted communication with the annular grooves *m* in the disk-hub. The steam after passing through the passages *o o'* escapes into the casing through port *p*, Fig. 8.

Lubrication of the shaft of the cylinder is effected in a similar manner. Steam from the space between the projection G and the bottom of the recesss in which it is located passes into the passage *o²*, and thence around the end of the shaft into passage *o³*, and thence through port *p'* into the casing. It lubricates the shaft of the cylinders through holes in the bearing, as before explained in connection with the shaft D.

In order to provide for carrying steam when required, as in doing heavy work or in starting the engine, I arrange a supplemental steam-induction port in connection with a passage, *h*, and this is shown at *e'* in position for operation. It is located a little in front of the main induction-port, at such distance that it will be in communication with the port leading to one of the cylinders when the main induction-port is between the port of that cylinder and the one next following. The passage *e'* is in communication with the main steam-supply pipe through the stop-cock 2, so that when at work steam may be cut off at the most economical point or be allowed to follow later at will. After the engine has been started this valve should under ordinary conditions be kept closed.

I have also in the present invention improved the connection between the cylinders and the disk which carries the pistons, whereby I secure a long and firmer bearing, better adapted to maintain the parts in their proper relative position, and at the same time provide for the perfect and automatic lubrication of the connections. This connection, instead of being arranged between the cylinder and the piston-disk, in which position but a short bearing could be secured, is in the present case arranged centrally upon one side of the cylinders. It consists of a crank, I, provided with a pin, 3, which works in bearings formed in a boss on the side of the cylinders, and a pin, 4, in the other end, projecting in an opposite direction, carries a ball, 5, on its end, which works in a socket formed in the disk C, and by a cap, 14, covering the same. In order to lubricate the pin 3, a passage, 6, is bored down diagonally through the bearing in the boss to intersect with another passage, 7, bored directly from the outside to the interior of the cylinder and within the outer limit of the piston movement. The hole 7 is plugged on the outside, and this leaves a passage from the interior of the cylinder to the bearing of the pin 3, so that every time the piston rises in the cylinder by reason of the introduction of steam the steam is admitted to the bearing of the pin before the exhaust begins. The ball and socket are lubricated by means of a passage, *q*, which opens into an annular groove, *c'*, in the disk C, formed as in Fig. 8, and adapted to catch the water of condensa-

tion and oil, and by the centrifugal force cause the same to pass to the ball-bearings. The cylinders, while they are passing the position shown on the right of Fig. 5, are exhausting the steam contained by them, and at this time the exhaust-ports *r* are uncovered, and a portion of the exhaust-steam is directed into the groove *c'* and thence into the channels *q*. I have also improved the connections between the pistons and the disk on which they are carried with a view of reducing the centrifugal force by lightening the parts, and also to make the connections at the point of contact practically frictionless. For this purpose I make the connection between the piston and the wrist-pin on the disk of tubular form, as shown more clearly in Fig. 3 at 9. The direct connection to the piston is formed by a hemispherical head, 8, secured by an extension to the tubular part 9.

The under surface of the head 8 is plain and bears at its center upon the apex of a steel plate, *v*, fitted to a recess in the head of the piston, its upper face being cone-shaped, as shown, and this construction is such as to support the head 8, but at the same time to offer the best contact-surface. While running at ordinary speeds, the centrifugal force of the piston is at all times sufficient to keep the head 8 and plate *v* in contact and the piston in proper position in relation to the piston-connection; but when stopping or starting or when running slowly that is not the case. I therefore arrange within an internally-screw-threaded cup, 14, in the piston-head the concave bearing 13, conforming to the shape of the head 8, securing said bearing by a screw, $13^a$. Under ordinary circumstances or when the engine is running rapidly there is no contact at this point, as the steam-pressure and centrifugal force keep the pistons out. The neck of the head 8 is made inclined to allow space between it and the bearing, so as to permit free movement and to permit of the entrance of steam for the purposes of lubrication. To the other end of the tube 9 is bolted a loop, 10. This loop embraces a block, 11, formed as a part of the stud 12, and secured to the disk by a nut. This bolt passes through sleeves 23, as shown more clearly in Fig. 1, to form a firm support for the pistons to work against. The sides of the block 11 are inclined, and the outer end is formed on a curve struck from the lower edge where it bears upon the plug, and this upper curved end moves under the curved end of the loop. The inclined surface of the bottom and sides of the block are sufficient to allow the necessary lateral swing to the link as the disk and cylinders revolve. The upper curved surface is not in contact except under the conditions mentioned in connection with the head 8 and bearing 13. On the shaft is fixed a gear, 15, meshing into another gear-wheel, 16, on the counter-shaft, the latter having a pulley, 17, which, through a belt connected to another pulley which operates the governing apparatus, is shown at X, Fig. 2.

The counter-shaft is shown in Fig. 4, and is of special construction. It is tubular in form, marked *t*, and it fits over a stem, *u*, provided with a steam-passage opening into the interior of the tubular shaft. This passage leads into the chamber which contains the working parts of the engine, whence exhaust-steam may be derived to lubricate the bearing of the hollow shaft. The described arrangement for lubricating the shaft it is obvious may be applied to compound engines with equally as good results.

It will be understood that a lubricator-cup is attached to the engine at any convenient point, in connection with the steam-space, and the lubricant is thus carried by the steam to the different parts to be lubricated, as above described.

I claim as my invention—

1. In combination, the cylinder-hub provided with a recess, a projection, G, supported from the inclosing-case fitting said recess, a main-supply passage through said projection adapted to supply steam successively to the ports in the cylinders, and an exhaust-passage leading into the casing, substantially as described.

2. The combination, with the cylinder-hub and piston-disk supported on shafts, of perforated bearings for said shafts, and of steam induction and exhaust passages, in connection with the cylinders and passages for directing the exhaust over the perforated bearings of the shafts, whereby steam is admitted thereto and the shafts lubricated, substantially as desribed.

3. In combination with the cylinder-hub, a projection, G, fitted thereto, provided with an induction-passage, the supporting-shaft for the cylinders, a perforated bearing for said shaft, and a steam-passage, $o^2$ $o^3$, extending longitudinally of the shaft, substantially as described.

4. In combination with the recessed hub, the projection fitting the hub, a main steam-supply passage, an exhaust-passage, and a supplemental steam-supply passage in said projection having controlling means whereby the engine may be started off the dead-center, substantially as described.

5. In combination with the recessed hub of the cylinders, a projection fitting said recess and having induction and exhaust passages working in connection with ports in the cylinders, passages over the bearing of the shaft of the cylinders for the exhaust steam, and a steam-space between the end of the projection and the bottom of the recess, said space communicating with the exhaust-passage, substantially as described.

6. In combination with the recessed hub of the cylinders, a projection fitting said recess and having induction and exhaust passages working in connection with ports in the cylinders, with exhaust-steam passages over the bearing of the shaft of the cylinders, the projection being arranged in the recess to leave a steam-space between the end thereof and the bottom of the recess, said space communicating with

the exhaust-passage by a series of openings, *f*, leading to the elongated exhaust-passage in the periphery of the extension, substantially as described.

7. In combination with the recessed hub of the cylinders, and the projection having the induction-passages therein, with a space between the end of the projection and the bottom of the recess, and passages, as *i* and *l' k*, from the interior of the recess through the cylinder and disk to the periphery of the shaft, substantially as described.

8. In combination with the exhaust-passages in the projection G, an annular groove in the cylinder-hub, communicating with said passages, an annular groove in the opposing faces of the disk-hub, passages through the disk-hub from said groove to an annular groove in the other end of the said hub, and a passage, *o*, in connection therewith, leading through passage *o'* to the casing, substantially as described.

9. In combination with the recessed hub and with the supply and exhaust ports therein, the projection G, having similar supply and exhaust passages, the packing-rings on each side of the circumferential line of passages of the port, and the packing-pieces between the passages, substantially as described.

10. In combination with the recessed cylinder-hub having ports in connection with the cylinders, a projection, G, fitted to said recess and provided with induction and eduction passages, segmental spring packing-rings arranged circumferentially upon each side of the line of passages in the projection, and spring packing-blocks between said passages, substantially as described.

11. In combination with the cylinders mounted, as described, on a hub, pistons in the cylinders mounted on a disk, said disk being supported out of line with the hub of the cylinders, and a connecting-crank between the cylinders and disk, having a pin working in bearings in the shell of the cylinder, with a steam-passage leading from the bearing to the interior of the cylinder, substantially as described.

12. In combination with the cylinders mounted on a hub supported on a shaft, pistons in said cylinders connected with a disk supported on a shaft out of line with the cylinder-shaft, and a connecting-crank between the cylinders and disk having an elongated pin fitted to a lug on the side of the cylinder, substantially as described.

13. In combination with the cylinders mounted on a hub supported on a shaft, pistons in said cylinders connected with a disk supported in a shaft out of line with the cylinder-shaft, and a connecting-crank between the cylinders and disk having a ball fitting a socket in the disk, and an opening from said socket to the interior of the casing, substantially as described.

14. In combination with the cylinders mounted on a hub supported on a shaft, pistons in said cylinders connected with a disk supported on a shaft out of line with the cylinder-shaft, and a connecting-crank between the cylinders and disk, having at one end an elongated pin fitted to a boss on the side of the cylinder, and a ball on the other end fitting a socket in the disk with lubricating-passages to the pin and socket, substantially as described.

15. In combination with the cylinders mounted on a hub supported on a shaft, pistons in said cylinders connected with a disk supported on a shaft out of line with the cylinder-shaft, a connecting-crank between the cylinders and disk having a ball fitting a socket in the disk, a passage from said socket to the steam-space, and an annular recess in the inner face of the disk, in connection with the passages leading to the sockets containing the balls, said recess serving as a reservoir, substantially as described.

16. In combination with the cylinders mounted, as described, on a hub, and a disk mounted on a shaft out of line with that of the cylinders, pistons in the cylinders, and a connecting-crank between the cylinders and disk having a ball fitting a socket in the disk, an annular recess in the face of the disk, a passage from said socket to said recess, and an opening in the cylinder for the passage of steam in line with the recess, substantially as described.

17. In combination with the revolving cylinders and with a disk revolving eccentrically thereto, pistons working in said cylinders, the connections with the pistons being by means of a hemispherical head having a plain face bearing upon the point of a cone in the bottom of the piston, and means for holding the hemispherical head to the piston, substantially as described.

18. In combination with the revolving cylinder, the piston, the connection 9 between the piston and the revolving disk, a block, 11, having beveled faces with a lower point bearing against the upper end of the part 9, and the loop fixed to the part 9 and encircling the block 11, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM J. LANE.

Witnesses:
GEO. H. SHERMAN,
J. W. RUST.