No. 700,508. Patented May 20, 1902.

I. KLING.

COMPOUND OR MULTIPLE CYLINDER ENGINE.

(Application filed May 22, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

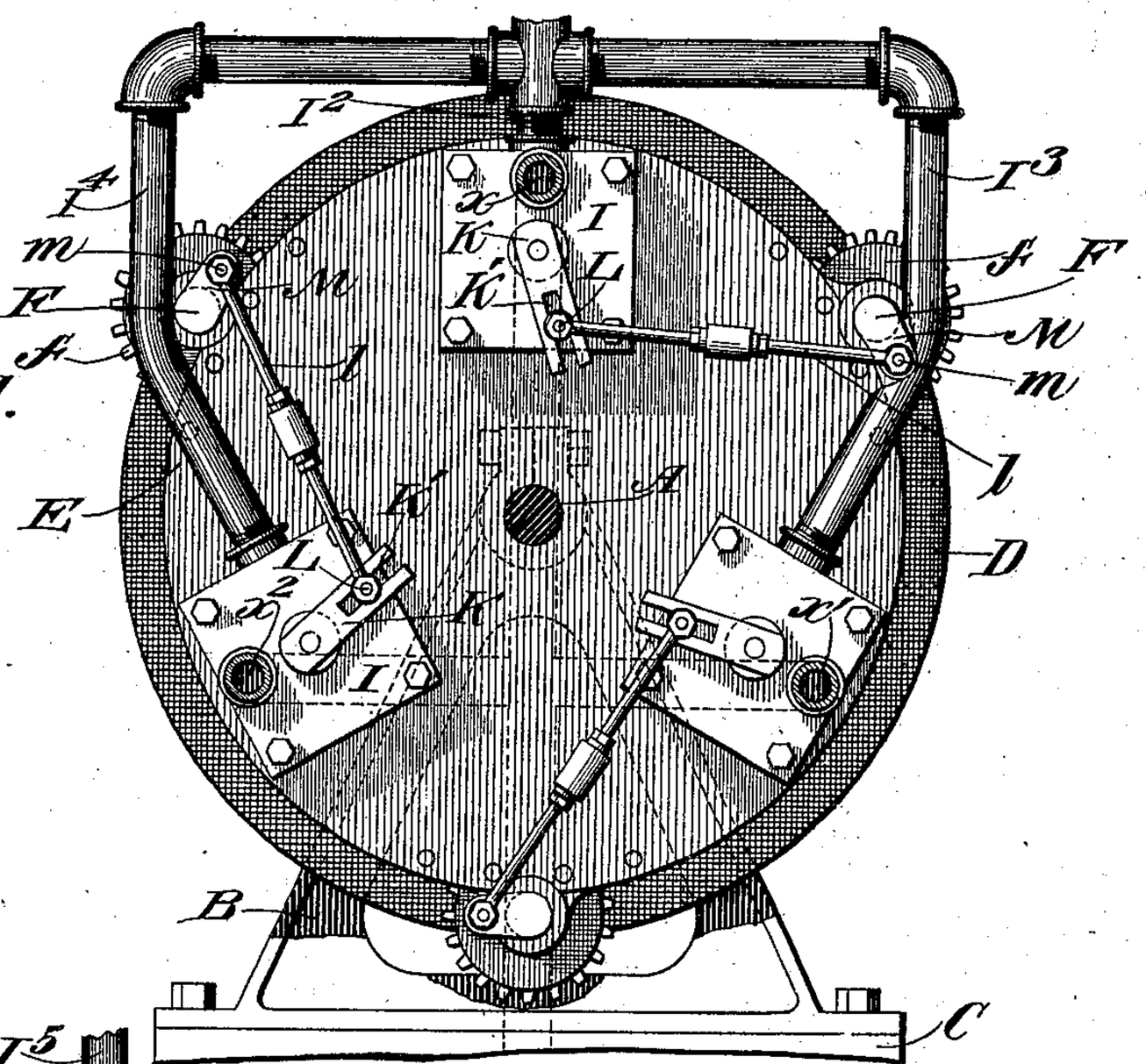
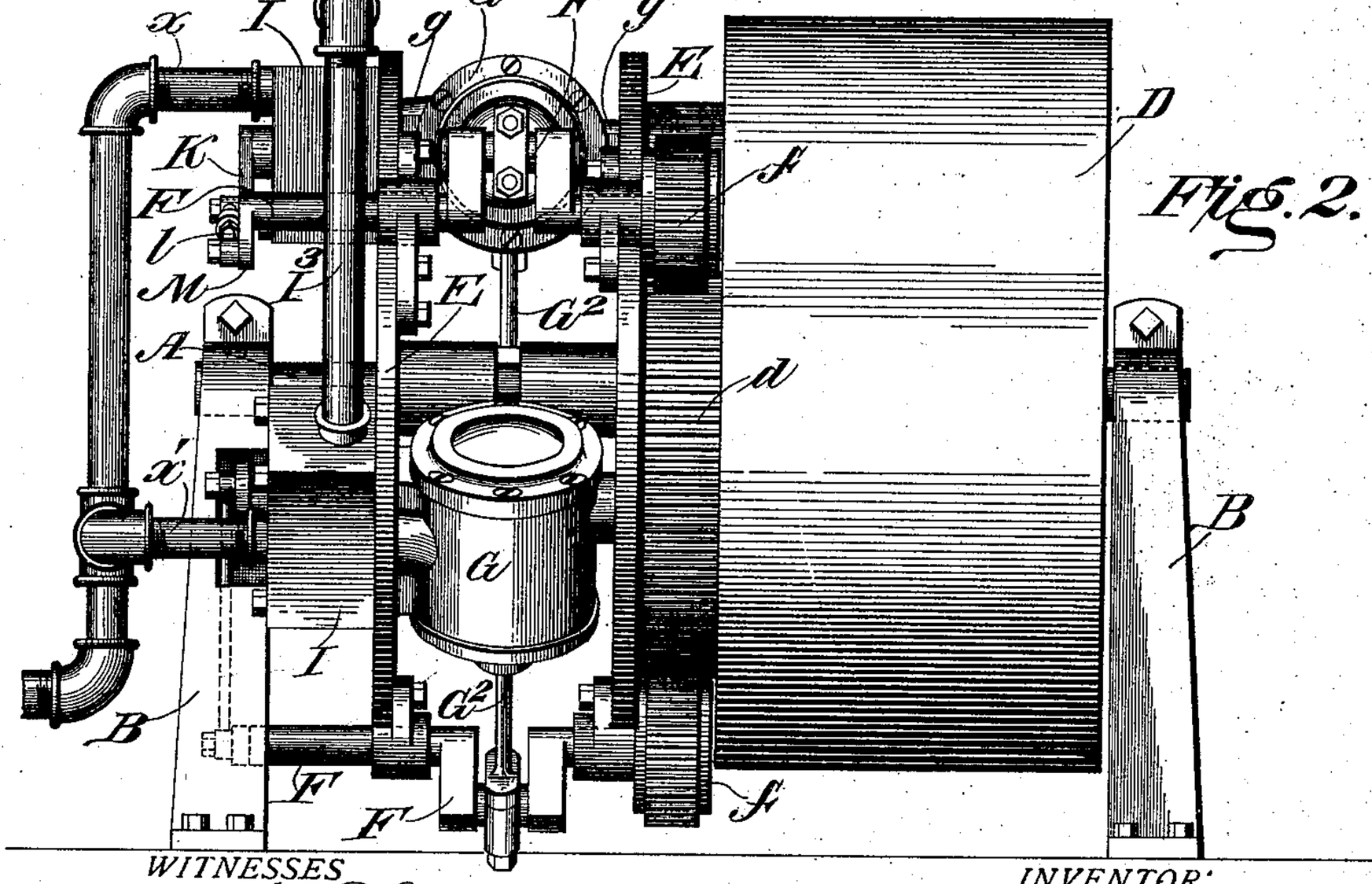


Fig. 2.



WITNESSES

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Fig. 3.

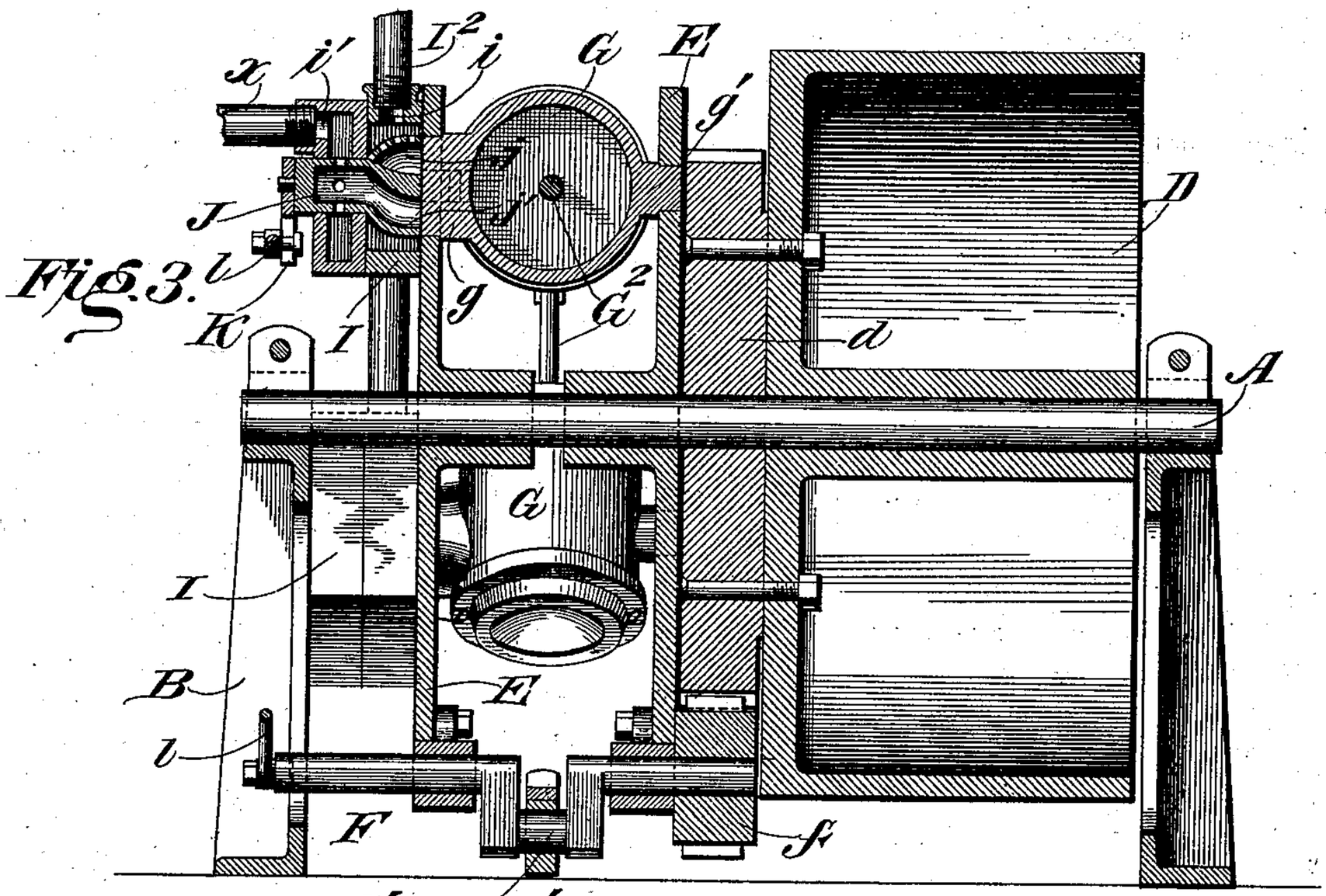


Fig. 4.

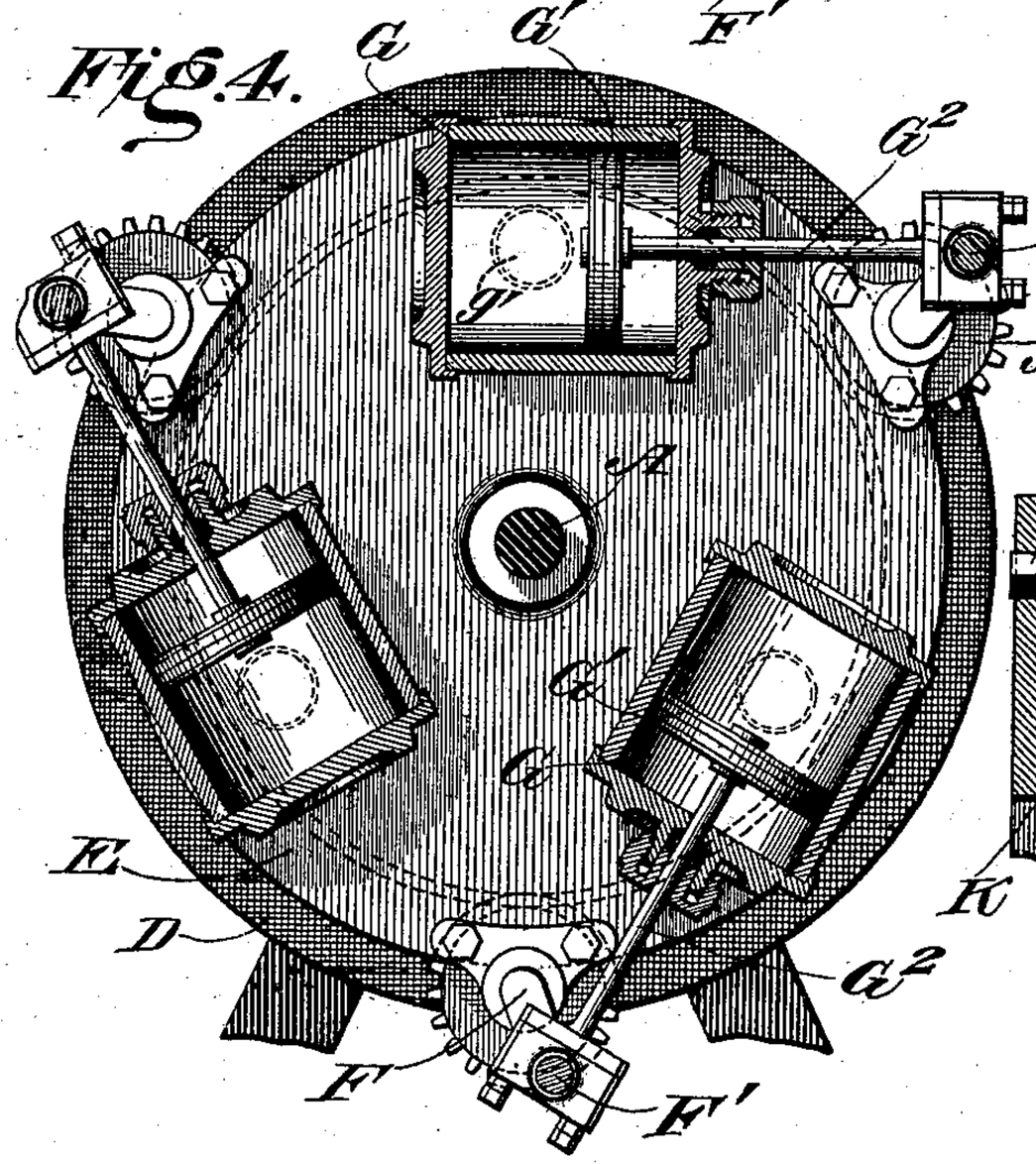
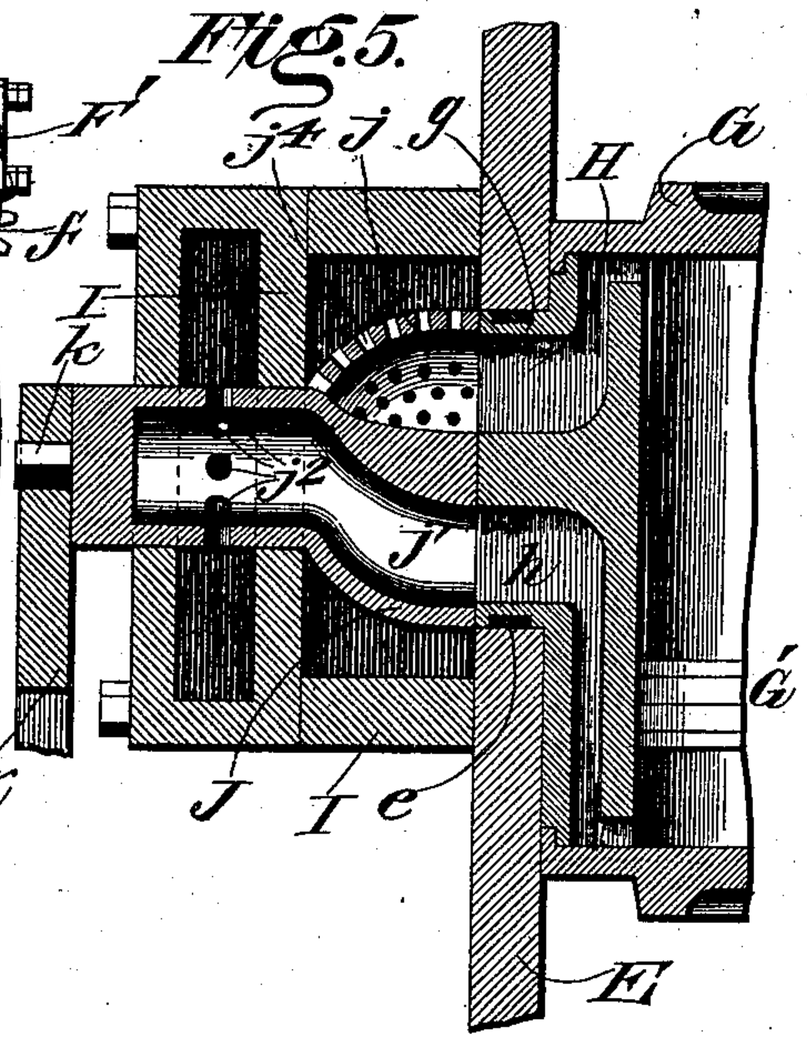


Fig. 5.



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UNITED STATES PATENT OFFICE.

ISAAC KLING, OF LOUISVILLE, KENTUCKY.

COMPOUND OR MULTIPLE-CYLINDER ENGINE.

SPECIFICATION forming part of Letters Patent No. 700,508, dated May 20, 1902.

Application filed May 22, 1901. Serial No. 61,453. (No model.)

To all whom it may concern:

Be it known that I, ISAAC KLING, of Louisville, in the county of Jefferson and State of Kentucky, have invented certain new and useful Improvements in Compound or Multicylinder Engines; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

This invention is an improved compound or multicylinder engine; and its object is to produce a non-dead-centering engine, one wherein the parts are assembled in compact space, wherein the cylinders exert their power through direct gearing upon a common shaft or fly-wheel, and which will economize steam and may be readily reversed.

The invention therefore consists in the novel construction of the engine as hereinafter described and claimed, and it has especial reference, first, to the employment of a series of oscillating direct-connected cylinders; second, to the novel construction of the valve mechanism, and, third, to the general construction and arrangement of parts.

In the drawings, Figure 1 is a front elevation of the complete engine, partly broken away. Fig. 2 is a side elevation of the complete engine. Fig. 3 is a longitudinal section therethrough; Fig. 4, a transverse vertical section; Fig. 5, an enlarged vertical section through one of the valve-chambers and connected parts.

Referring to the drawings, A designates the main shaft, supported in bearings in standard B, attached to the base C. Upon this shaft is loosely mounted a large fly-wheel or drum D, to the inner face of which is secured a gear *d*, and on this shaft are also mounted two plates E E, in which are journaled equidistant crank-shafts F F, (three being shown,) which lie parallel with shaft A, and on their inner ends have pinions *f*, meshing with the gear *d*, as shown. Between the plates E E are cylinders G, which are supported on the plates E, so as to oscillate therebetween by trunnions *g g'*, which are preferably placed near the inner end of the cylinder to lessen the oscillation of that end thereof. The trunnion *g* is larger than trunnion *g'*, and through it opens the exterior ends of the cylinder-ports H *h*, which respectively lead to opposite ends of the cylinder, as shown. (See Fig. 5.)

The cylinder-pistons G' are directly connected by rods G^2 to cranks F' on shafts F, respectively, as shown.

The ported trunnions *g* project through openings *e* in the outermost plate E and are inclosed by a valve-chamber I, (one for each trunnion *g*,) to which steam is admitted through an inlet-port *i*, communicating by suitable pipes I^2 I^3 I^4 with a main steam-pipe I^5, connected to a suitable steam-boiler. The admission of steam from pipe I^5 may be controlled by a suitable governor, (not shown,) actuated from one of the rotating parts, preferably from one of the shafts F.

Within each valve-chamber I and fitted closely against the dressed outer face of the trunnion *g* therein is a valve J, which is of peculiar construction. The valve has two chambers *j j'*, the latter being closed on all sides and extending from the inner face of the valve through the stem or trunnion of the valve, as shown, communicating at the outer end of the trunnion through lateral perforations j^2 with a chamber I' in the end of the valve-chamber, which communicates with the exhaust-pipe *x x'* or x^2 through outlet *i'*, as shown. The chamber *j* communicates at all times with the chamber I through perforations j^4 in the wall of chamber *j*, as shown. It will be observed that the chamber I is larger in diameter than valve J, so that chamber *j* can always receive steam, but chamber *j'* cannot receive steam direct from chamber I. These chambers *j j'* are adapted to alternately communicate with ports H *h* of the cylinder, and thus alternately admit and exhaust steam from opposite ends of the cylinder, so as to produce a reciprocation of the piston therein and consequent rotation of the connected shaft F, as in ordinary engines.

The trunnion of valve J is connected to an arm K by a screw-bolt *k* or other suitable means, and this arm K is preferably slotted, as at K', and in the slot is secured an adjustable pin L, which is connected by a rod *l* to a pin *m* on an eccentric or crank arm M, attached to the end of the shaft F, actuated by

the cylinder controlled by the valve. This rod *l* can be adjusted so as to regulate the extent and throw of the valve, and thus the time and extent of admission of steam to the cylinder. The valve oscillates oppositely to the trunnion, thus obtaining a quick and easy shifting of the ports. The employment of an oscillating valve working in connection with and oppositely to the oscillating ported trunnion of an oscillating-cylinder engine I consider very valuable in practice.

Further, I can operate my engine on the expansion principle by connecting the exhaust of the upper steam-chest to the inlet of the next steam-chest, and the exhaust of the latter to the inlet of the third, and so on, as is obvious. When this is done, the cylinders should be of successively greater diameter, as required in all compound expansion-engines.

Operation: As shown, shaft A is fixed and plates E are fixed thereon, while drum D and gear *d* are free to revolve. Consequently when steam is admitted to the cylinders they rotate shafts F, and the latter through pinions *f* rotate gear *d* and drum D. From the latter power may be transmitted by belts or in other desired manner. The relative power and speed imparted to drum D depends upon the relative sizes of gears *f* and *d* and of course also upon the size of the cylinders and the number employed. It is not essential that shaft A be stationary, as the action would be the same if plates E were loose on shaft and drum D keyed thereon. In the latter case power could be transmitted from either end of shaft A.

Preferably the plates and cylinders may be covered with a housing (not shown) to prevent accidental interference with the action of the cylinders.

While I have illustrated three cylinders in the drawings, a greater or less number may be used, according to power and size of engine wanted.

The engine may be caused to run either forward or backward by providing an ordinary reversing-lever and link connections with valves, so that the latter can be shifted before starting the engine, so as to admit steam to the desired ends of cylinders. I do not consider it necessary to illustrate such feature herein, as it is not claimed and can be readily applied by an engineer.

Having thus described my invention, what I therefore claim as new, and desire to secure by Letters Patent thereon, is—

1. The combination of an oscillating cylinder having a ported trunnion, with an oscillating steam-valve controlling the ports in said trunnion and means for oscillating said valve simultaneously with but oppositely to the cylinder.

2. The combination with an oscillating cylinder having its inlet and outlet ports leading through one of its trunnions; with an oscillating main valve fitted against the trunnion and controlling the ports therein and means for oscillating said valve simultaneously with but oppositely to the cylinder, substantially as described.

3. The combination of an oscillating cylinder having a trunnion and ports leading through said trunnion, with a main-valve casing over the trunnion, a rocking valve in said casing controlling the ports in the trunnion, and means for oscillating said valve simultaneously with but oppositely to the trunnion, substantially as described.

4. The combination of a valve-casing having a steam and an exhaust chamber, a cylinder, its ports, communicating with the valve-chamber, and a crank-shaft operated from the piston in said cylinder; with a valve within the valve-port having an inlet-chamber continually communicating with the steam-supply and an outlet-port passing through the steam-space of the valve-casing but not communicating therewith, said outlet-port communicating with the exhaust-chamber of the valve-casing, and means for oscillating said valve, substantially as described.

5. The combination of a cylinder, its ports extending through the cylinder-trunnion, a valve-chamber over said ports and a crank-shaft operated from the piston in said cylinder; with a valve within the valve-port covering the said ports and having an inlet-chamber continually communicating with the steam-supply and an outlet-port passing through the steam-space of the valve-casing but not communicating therewith, and an exhaust-chamber exterior to the steam-space with which said exhaust or outlet port of the valve communicates continually, and means for oscillating said valve from said crank-shaft, substantially as described.

6. The combination of the cylinder, its opposite ports, a steam-chamber surrounding the outlets of said ports, and an exhaust-chamber exterior to the steam-chamber; with an oscillating valve in said steam-chamber covering the mouths of said cylinder-ports, said valve having inlet and outlet ports adapted to register alternately and successively with the cylinder-ports, the inlet-port of the valve being continually in communication with the steam-space and the outlet-port of the valve extending through the steam-chamber to the exhaust-chamber, and means for operating said valve.

7. The combination of the cylinder, its opposite ports, a steam-chamber surrounding the outlets of said ports, and an exhaust-chamber exterior to the steam-chamber; with an oscillating valve in said steam-chamber, having inlet and outlet ports adapted to register successively and alternately with the cylinder-ports, said valve-inlet port continually in communication with the said steam-chamber, and said valve-outlet port extending through the steam-chamber and communicating only with the exhaust-chamber, and means for operating said valve.

8. The combination of the main shaft, the

gear thereon, the opposite fixed side plates, the oscillating cylinders journaled in and between said plates, the crank-shafts for the cylinders journaled in said plates, the pinions on said shafts meshing with said gear the cylinder-pistons, the piston-rods connecting the pistons directly to adjoining crank-shafts, and the steam-ports leading through the trunnions of the cylinders, and the combined steam supply and exhaust valve having inlet and exhaust ports adapted to register successively with the cylinder-ports, substantially as and for the purpose described.

9. The combination of an oscillating cylinder having steam inlet and exhaust ports leading through one of its trunnions, a valve-casing fitted over said trunnion, having a main steam-chamber and an exterior exhaust-chamber, a valve in said casing extending through the exhaust and steam chambers, said valve having one chamber always communicating with the steam-space, and another chamber extending through the steam-space and communicating with the exhaust-chamber only, said valve-chambers having ports in their inner ends adapted to alternately register with the cylinder-ports, and means for oscillating said valve, substantially as described.

10. The combination of the main shaft, the drum and gear loosely mounted thereon, the opposite side plates, the oscillating cylinders hung between said plates, the crank-shafts for the cylinders journaled in said plates, the pinions on said shafts meshing with said gear the cylinder-pistons, the piston-rods connecting the pistons directly to adjoining crank-shafts, and the steam inlet and outlet ports leading through one trunnion of each cylinder, and the steam supply and exhaust valve coöperating with the ported trunnion, substantially as and for the purpose described.

11. The herein-described engine comprising a main shaft, a gear and drum or fly-wheel loosely mounted thereon, a pair of plates fixed thereon, a series of crank-shafts journaled in said plates, pinions on said shafts meshing with said gear, an oscillating cylinder for each shaft journaled between said plates, the cylinder-pistons and piston-rods, and the cylinder-ports extending through the outermost trunnion of each cylinder; with the valve-casings attached to the outer plate over the cylinder-trunnions, the steam and exhaust chambers in said valve-casings, the valves in said chambers constructed substantially as described, and the valve-actuating devices connected to and operated by the respective crank-shafts, for the purpose and substantially as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

ISAAC KLING.

Witnesses:
M. J. FINNEGAN,
A. J. EARLEY.