

No. 772,299.

PATENTED OCT. 11, 1904.

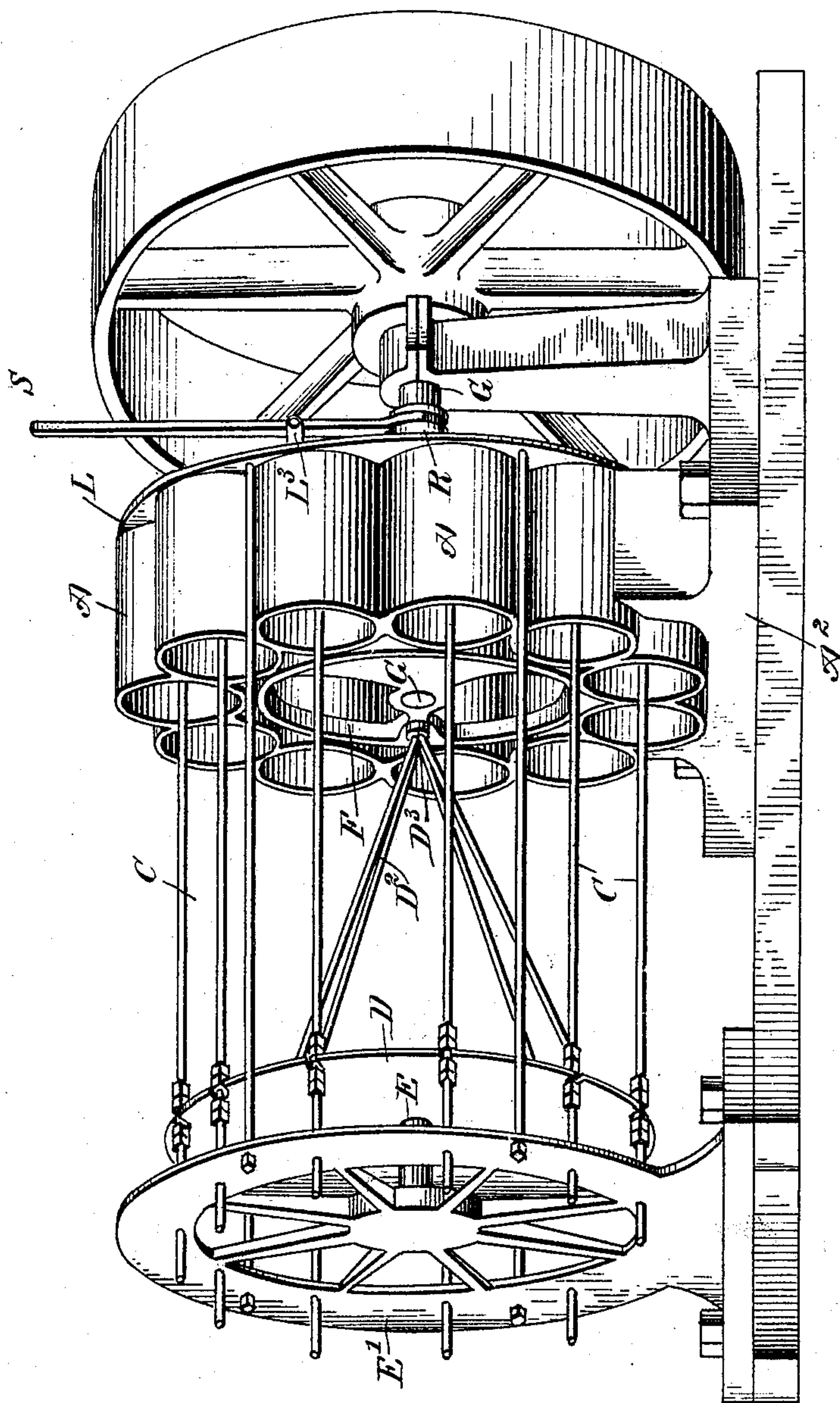
O. P. UNDERWOOD.
ENGINE.

APPLICATION FILED APR. 4, 1903.

NO MODEL.

3 SHEETS—SHEET 1.

Fig 1



WITNESSES:

H. Walker
Geo. H. Foster

INVENTOR

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BY *Mumma*

ATTORNEYS.

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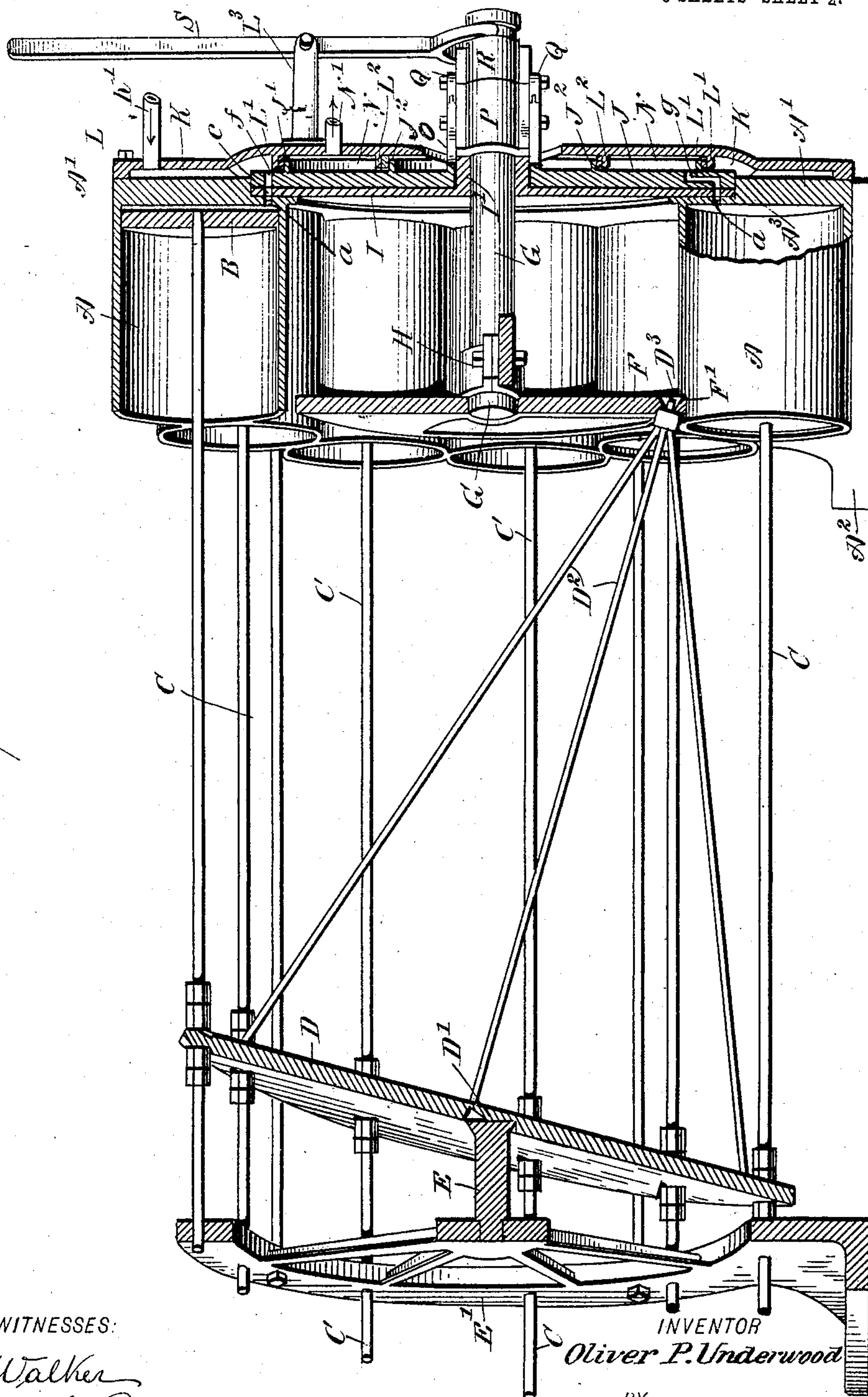
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NO MODEL.

3 SHEETS—SHEET 2.

Fig 2



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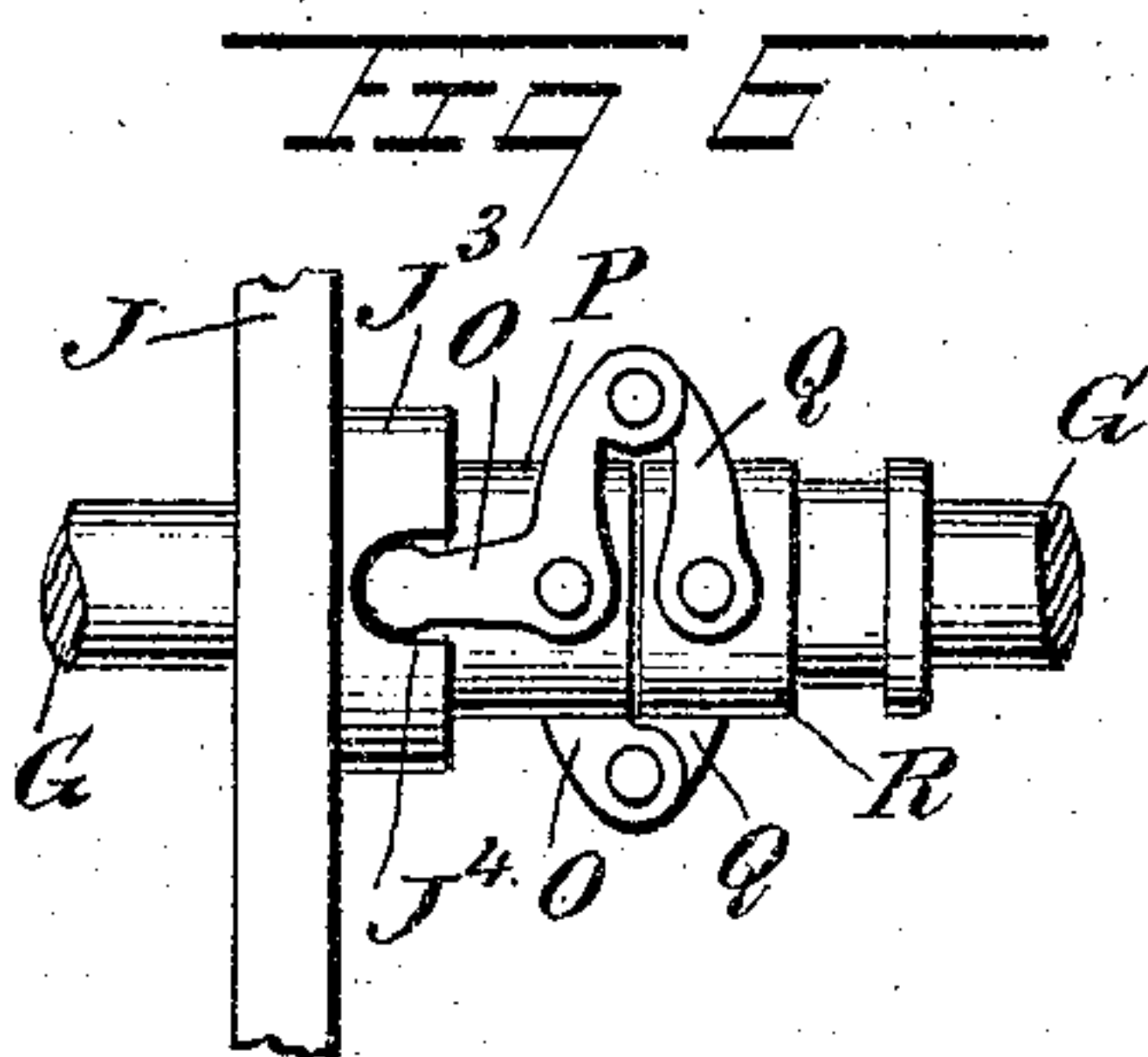
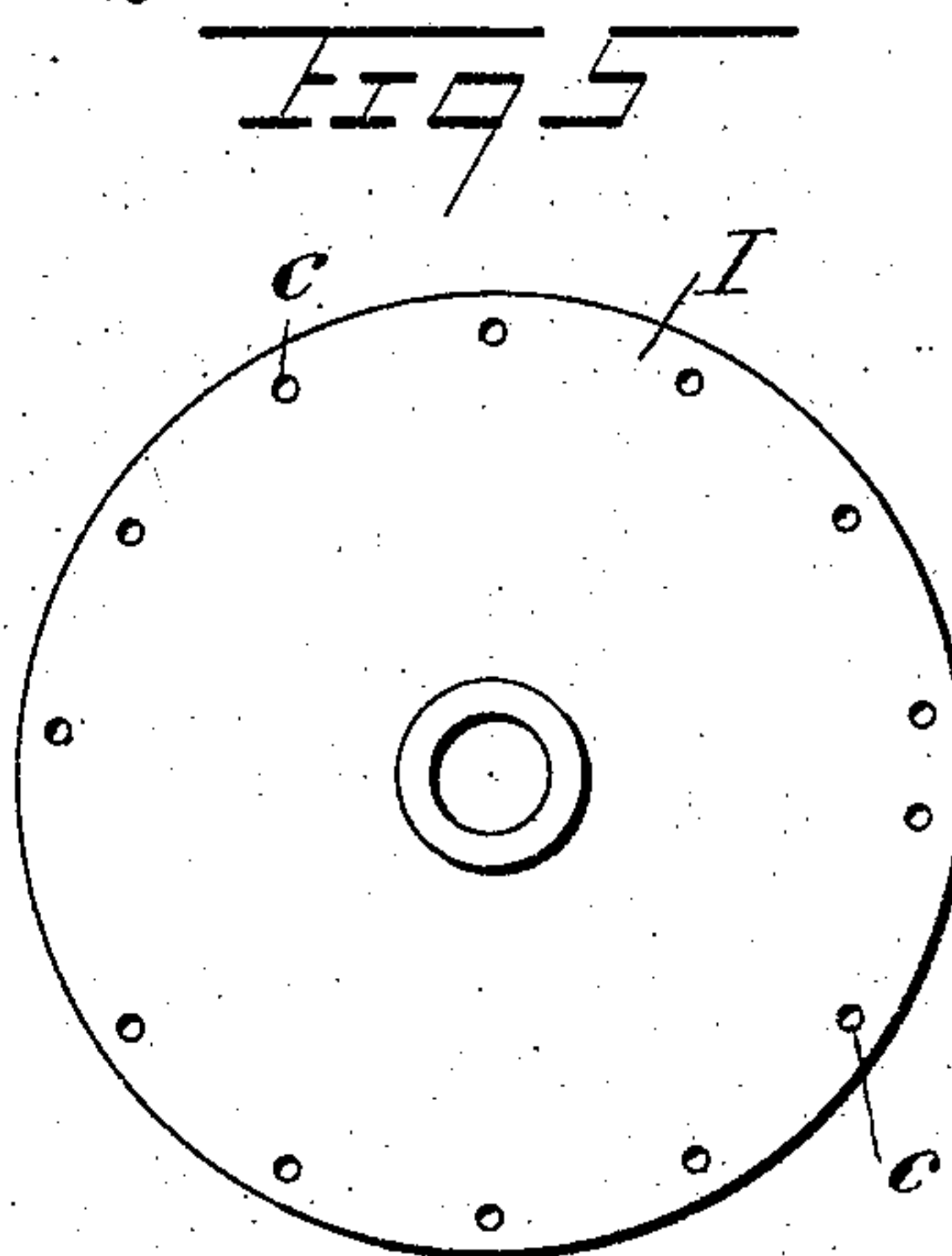
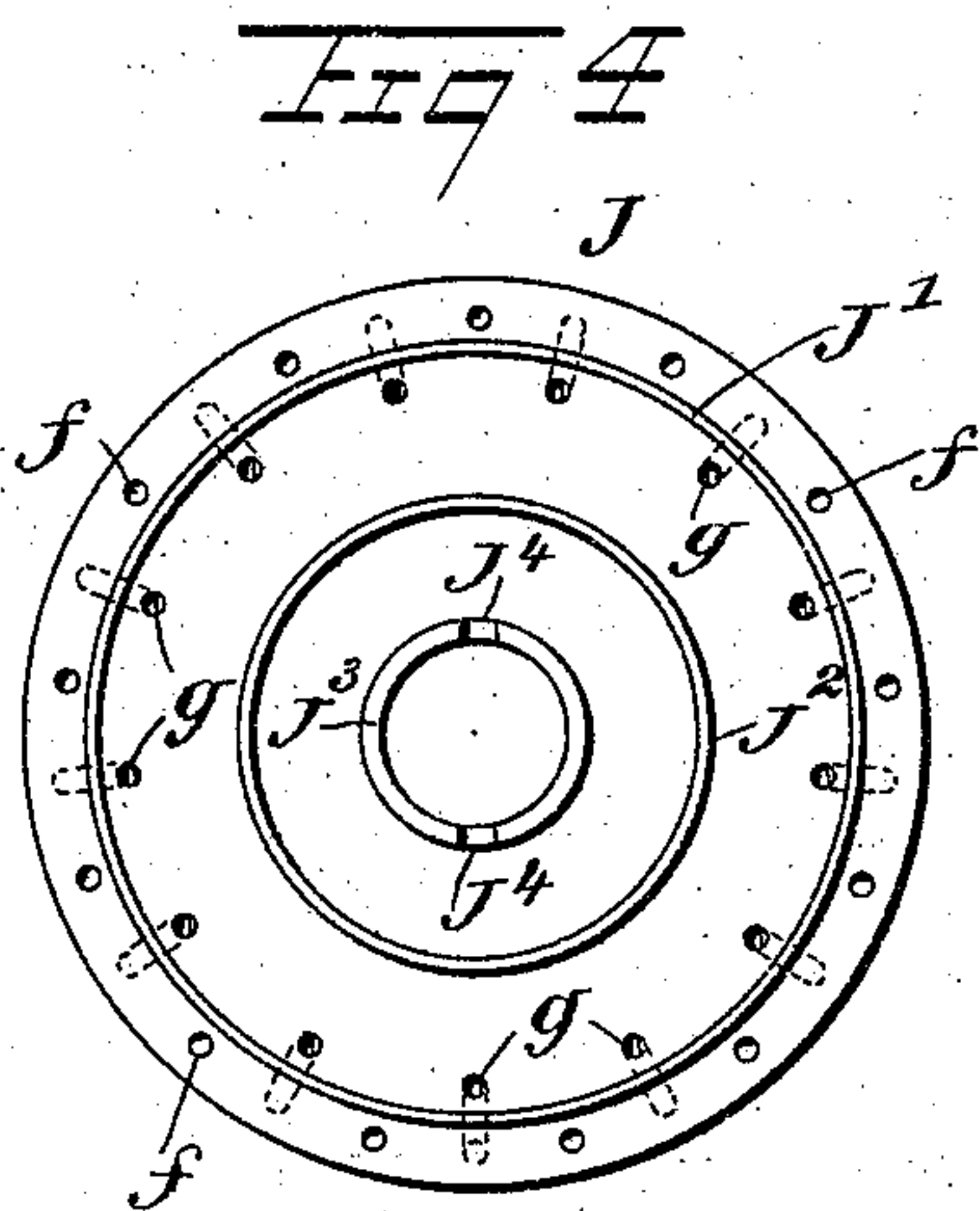
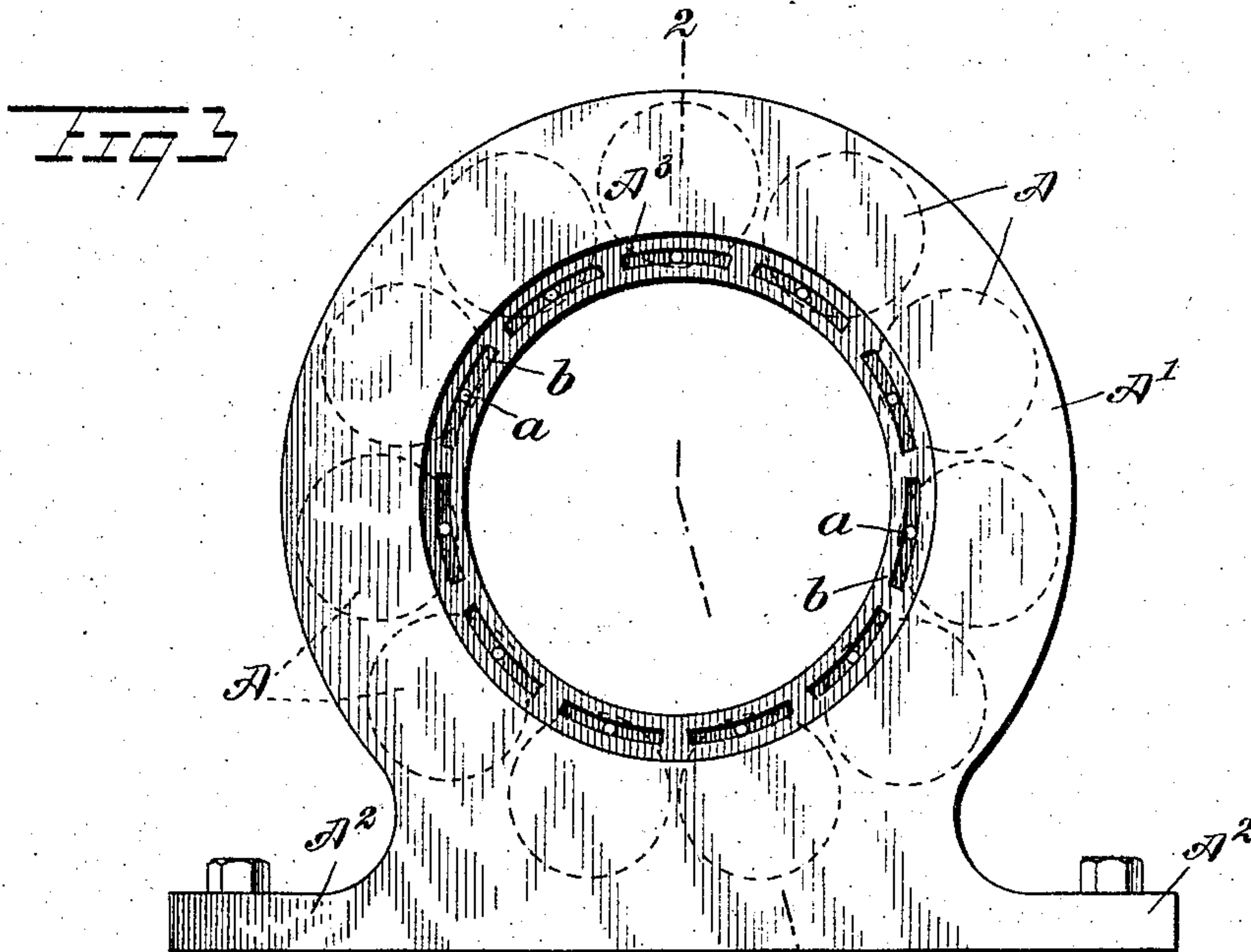
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NO MODEL.

3 SHEETS—SHEET 3.



WITNESSES:

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Geo. J. Hoster

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UNITED STATES PATENT OFFICE.

OLIVER P. UNDERWOOD, OF CENTRAL CITY, NEBRASKA.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 772,299, dated October 11, 1904.

Application filed April 4, 1903. Serial No. 151,049. (No model.)

To all whom it may concern:

Be it known that I, OLIVER P. UNDERWOOD, a citizen of the United States, and a resident of Central City, in the county of Merrick and State of Nebraska, have invented a new and Improved Engine, of which the following is a full, clear, and exact description.

The invention relates to multicylinder-engines; and its object is to provide a new and improved engine which is simple and durable in construction, very effective in operation, and arranged to utilize the motive agent to the fullest advantage to insure a uniform and constant transmission of the power developed to the main shaft at all points of the latter's rotation and completely avoid dead-center positions.

The invention consists of novel features and parts and combinations of the same, as will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a perspective view of the improvement. Fig. 2 is an enlarged longitudinal sectional perspective view of the same on the line 2 2 of Fig. 3. Fig. 3 is a reduced end view of the cylinders. Fig. 4 is a face view of the cut-off valve. Fig. 5 is a similar view of the rotary valve, and Fig. 6 is a plan view of the mechanism for turning and shifting the cut-off valve.

A plurality of cylinders A, arranged in a circle, are open at one end and closed at the other by an integral head A', common to all cylinders, the said head being provided with a base A² for supporting the cylinders, as plainly shown in the drawings. In the cylinders A are mounted to reciprocate pistons B, connected by their piston-rods C with a rocking cross-head D, having a central conical bearing D' engaging a pivot E, projecting from a guide E', in which the piston-rods C are guided and free to slide. The cross-head D is provided with a number of rods D², terminating in a wrist-pin D³, lying in the axis of the cross-head and engaging a wrist-

pin bearing F', formed in a crank-disk F, secured to a shaft G, journaled in suitable bearings H and H' and arranged in alinement with the pivot E, having its axis coinciding with the center of the circle in which the cylinders A are arranged. The pistons B are forced successively outward by the pressure of the motive agent admitted to the inner closed end of the cylinders, as hereinafter more fully described, and the outwardly-moving pistons B impart a rocking motion to the cross-head D, so that the rods D² thereof act on the crank-arm F and impart a continuous rotary motion to the main shaft G.

The admission and exhaust of the motive agent to and from the cylinders A successively is arranged as follows: In the cylinder-head A' are formed ports *a*, one for each cylinder, opening into elongated channels *b*, formed in the head A', as plainly shown in Fig. 3. The channels *b* are adapted to register with admission-ports *c*, formed alternately in a valve I, secured to the main shaft G and fitting into a seat A³, arranged on the head A', as plainly indicated in Figs. 2 and 3. The ports *c* are adapted to register with the inner ends of ports *f* and *g*, formed on a cut-off valve J, fitted against the outer face of the valve I and mounted to rotate loosely on the hub I' of the rotary valve I, and the entrance or outer ends of the said ports *f* and *g* are disposed on opposite sides of an annular ridge or ring J', formed integrally on the outer face of the cut-off valve J. The ports *f* are the admission-ports and open into an annular live-steam chamber K, formed on the outer face of the head A' by a cover L, bolted or otherwise fastened to the said head A'. A pipe K' opens into the chamber K and connects with a boiler or other suitable source of steam-supply, so that live steam can pass into the chamber K and from the latter, by way of the ports *f*, channels *b*, and ports *a*, successively into the cylinders A. The Z-shaped ports *g* are the exhaust-ports and open into an annular chamber N, formed between the outer face of the valve J and the cover L, as plainly shown in Fig. 2, the said cover being for this purpose provided with annular rings or ridges L' and L², fitting against packings on the ridges J

and J^2 , concentric on the cut-off valve J. Thus by the arrangement described the chambers K and N are separated from each other, and the exhaust-chamber N is provided with an exhaust-pipe N' for carrying off the exhaust motive agent.

In order to impart a turning motion to the cut-off and reversing valve J, the following device is provided. On the hub J^3 of the cut-off valve J are formed oppositely-disposed notches J^4 , engaged by bell-crank levers O, (see Figs. 2 and 6,) fulcrumed on a sleeve P, secured on the shaft G, so that when the latter turns the valve J rotates with it. A link Q is pivotally connected with each bell-crank lever O and is fulcrumed on a shifting collar R, mounted to turn with and to slide lengthwise on the shaft G and engaged by a shifting-lever S, fulcrumed on a bracket L^3 , projecting from the cover L, the said lever S being under the control of the operator for imparting a longitudinal sliding motion to the collar R to force the links Q to impart a swinging motion to the bell-crank lever O to shift the cut-off and reversing valve J on the hub I' of the rotary valve I either to the right or left for running the engine forward or in a reverse direction.

It is understood that when the engine is running in one direction the half of the ports c preceding the part of the valves which are in line with the wrist-pin bearing F' register with the inlet-ports f and the remaining ports register with the exhaust-ports g , and when it is desired to reverse the engine the valve J is shifted, so as to bring the ports c , which register with the inlet-ports f , to register with the intermediate exhaust-ports g , which brings the opposite half of the ports c to register with the inlet-ports f instead of the outlet-ports g , thereby reversing the engine. Furthermore, to obtain the benefit of expansion begin at the port of valve J in line with the wrist-pin bearing F and plug ports f each way until the steam is cut off from entering the cylinders at the point desired in the stroke, causing the piston to make the rest of the stroke on expansion-steam. This may be done by leaving the holes unbored in construction or by the operator plugging.

It is understood that during the time one half of the cylinders take steam the remaining half of the cylinders exhaust, as one half of the pistons B move outward at a time, while the remaining half are on the return or backward stroke. Thus it will be seen that by the arrangement described a uniform and constant transmission of the power developed in the cylinders is transmitted to the main shaft at all points of the latter's rotation, thus completely avoiding dead-center positions.

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

1. An engine comprising a plurality of cylinders arranged in a circle, pistons mounted

to reciprocate therein, a guide, a rocking cross-head mounted on said guide and engaged by the piston-rods which slide freely in said guide, a main driving-shaft, having a crank-arm engaged by a wrist-pin supported from the said cross-head, and means, substantially as described, for controlling the admission and exhaust of the steam to and from the said cylinders, as set forth.

2. An engine, comprising a plurality of cylinders arranged in a circle, pistons mounted to reciprocate in the cylinders, a guide in which the piston-rods freely slide, a cross-head mounted to rock on the guide and with which the piston-rods are connected, a driving-shaft, a crank on the driving-shaft, rods connected with the cross-head and with the crank of the driving-shaft, and means for controlling the admission and exhaust of steam to and from the said cylinders, as set forth.

3. An engine, comprising a plurality of cylinders arranged in a circle, pistons in the cylinders, a guide in which the piston-rods slide, a cross-head mounted to rock on the guide and with which the piston-rods are connected, a driving-shaft, a crank-disk on the driving-shaft and provided with a bearing, rods secured to the cross-head and terminating in a wrist-pin engaging the bearing of the crank-disk, and means for controlling the admission and exhaust of steam to and from the cylinders, as set forth.

4. An engine, comprising a plurality of cylinders arranged in a circle, pistons in the cylinders, a circular guide provided with openings in which the piston-rods work and with a central pivot, a rocking cross-head having a central conical bearing engaged by the pivot of the said guide, said cross-head being engaged by the piston-rods, a driving-shaft in alignment with the pivot of the guide, a crank-disk on the driving-shaft and provided with a bearing, rods secured to the cross-head and terminating in a wrist-pin engaging the bearing of the crank-disk, and means for controlling the admission and exhaust of steam to and from the cylinders, as set forth.

5. An engine, comprising a plurality of cylinders arranged in a circle, pistons mounted to reciprocate in the cylinders, a rocking cross-head engaged by the piston-rods, a driving-shaft having a crank-arm, a plurality of rods secured to the cross-head and to the crank-arm of the driving-shaft, and means for controlling the admission and exhaust of steam to and from the cylinders, as set forth.

6. An engine, comprising a plurality of cylinders arranged in a circle, pistons mounted to reciprocate in the cylinders, a rocking cross-head engaged by the piston-rods, a driving-shaft having a crank-arm, a plurality of rods secured at one end to the cross-head and having their other ends secured together and connected with the crank-arm of the driving-shaft, and means for controlling the admission

and exhaust of steam to and from the cylinders, as set forth.

7. An engine, comprising a plurality of cylinders arranged in a circle upon a common head, said head having ports leading to the cylinders and provided with annular steam and exhaust chambers, pistons in the cylinders, a driving-shaft mounted within the circle of cylinders and having a crank, a rocking cross-head engaged by the piston-rods, rods
10 connecting the cross-head with the crank of

the driving-shaft, and a valve whereby the admission and exhaust of the steam to and from the cylinders may be controlled and the engine reversed, as set forth.

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

OLIVER P. UNDERWOOD.

Witnesses:

JOEL TOWNSEND,

BENJAMIN S. ABEL.