No. 704,280. Patented July 8, 1902.

A. T. STIMSON.

ROTARY ENGINE.

(Application filed Aug. 24, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

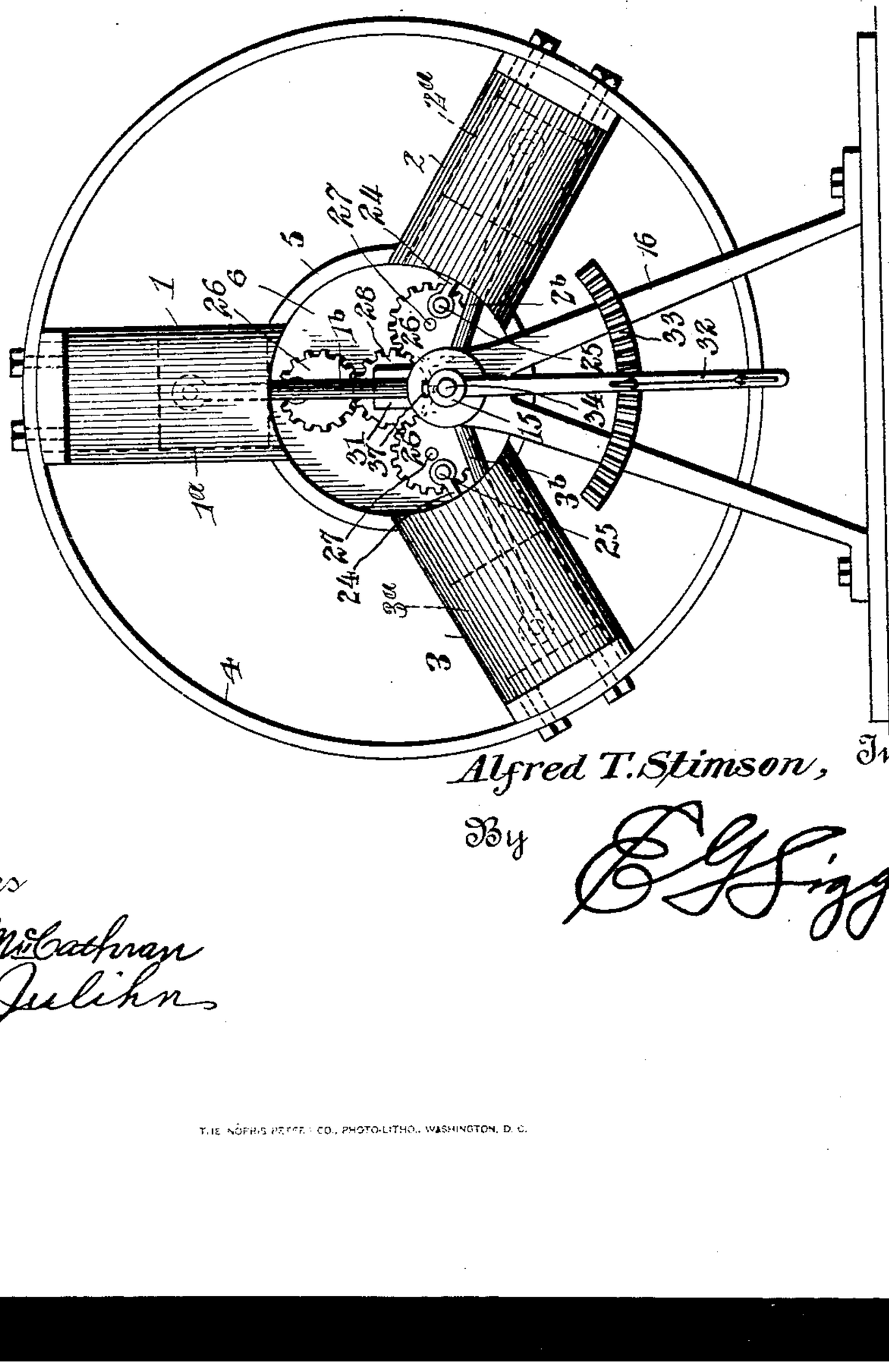
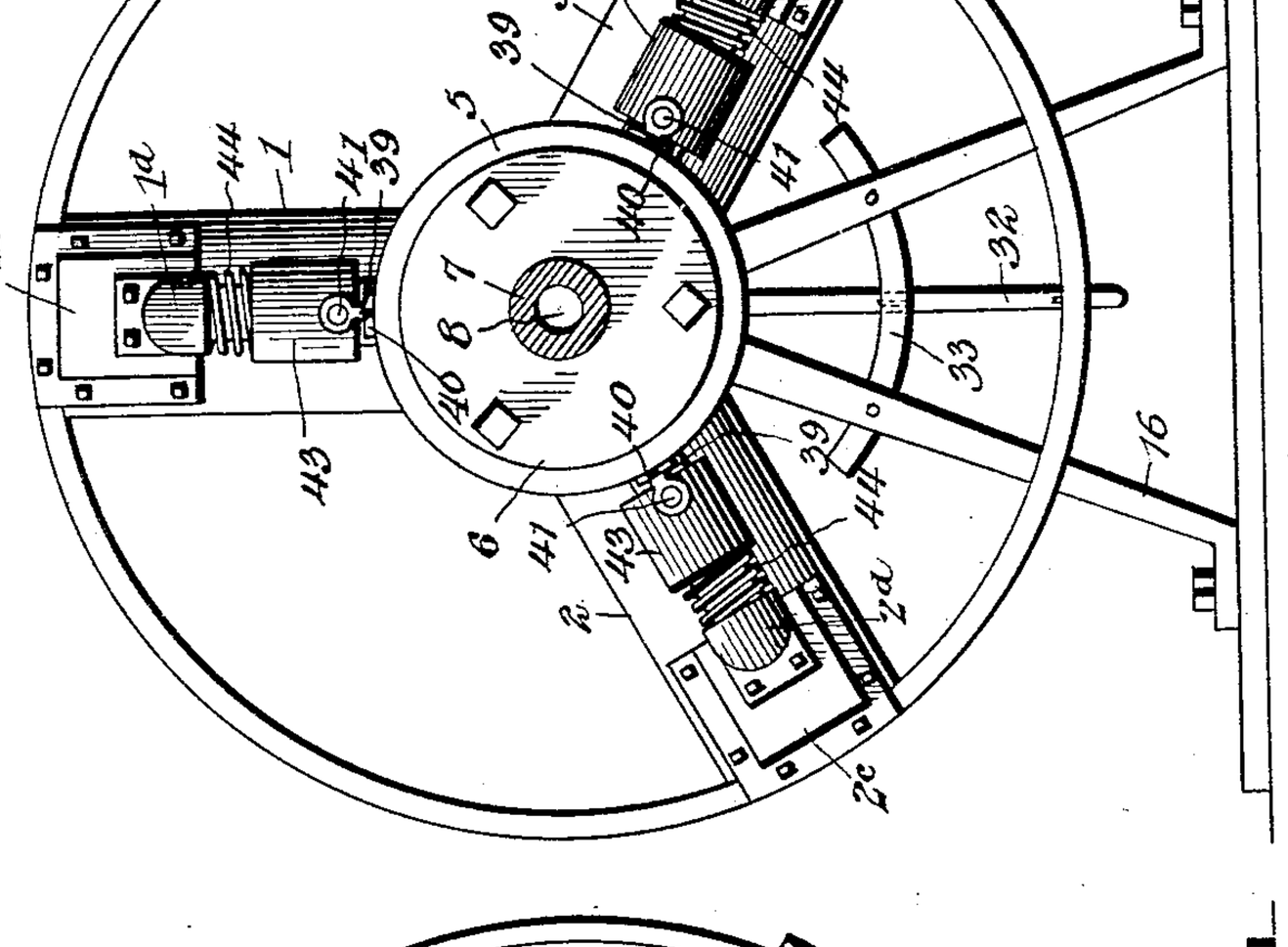


Fig. 2.



Witnesses
Jas. K. McCathran
Louis L. Julihn

Alfred T. Stimson, Inventor

By E. G. Siggers

Attorney

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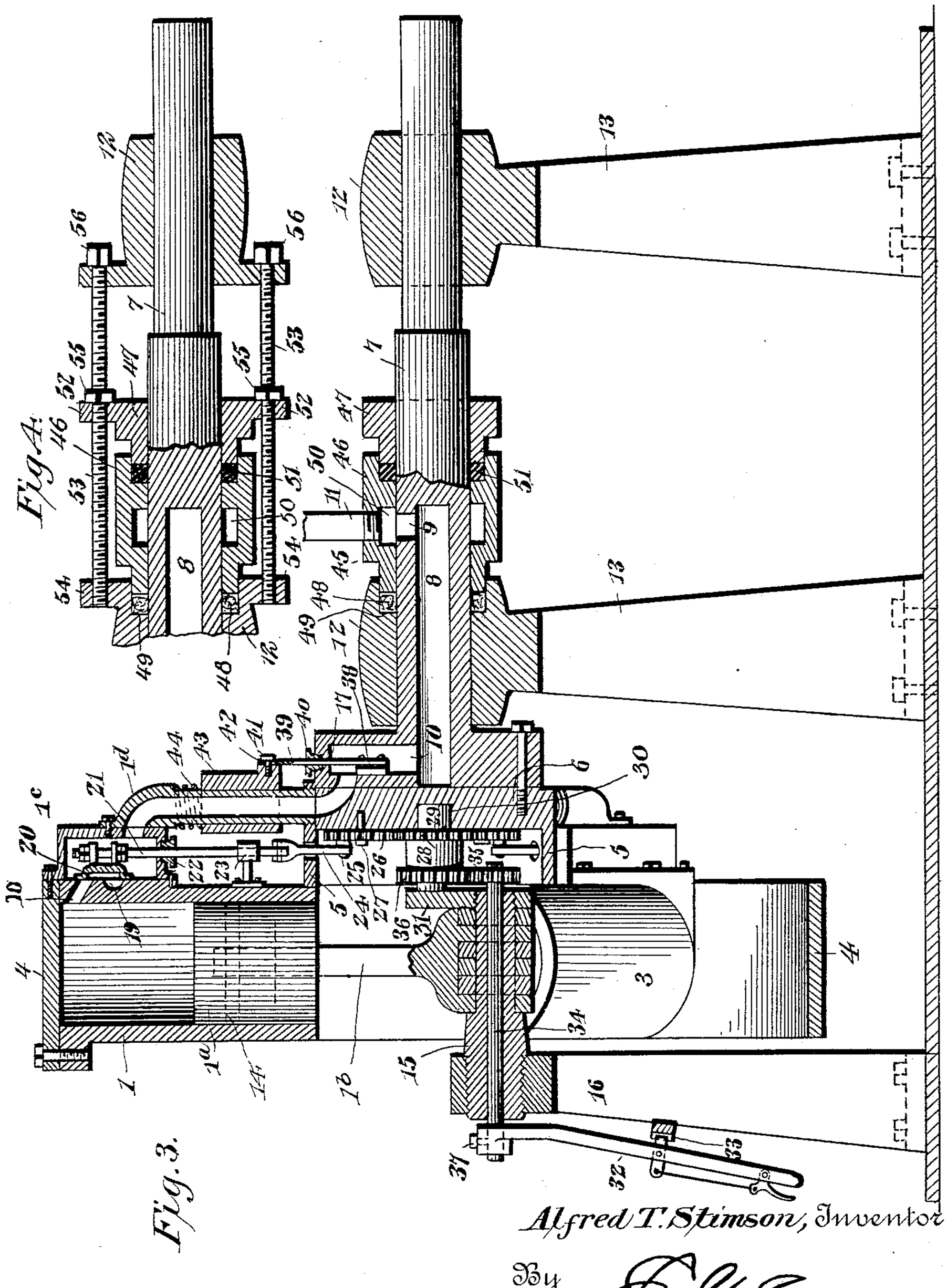

Fig. 4.

Fig. 3.

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UNITED STATES PATENT OFFICE.

ALFRED THOMAS STIMSON, OF EUREKA, CALIFORNIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 704,280, dated July 8, 1902.

Application filed August 24, 1901. Serial No. 73,192. (No model.)

To all whom it may concern:

Be it known that I, ALFRED THOMAS STIMSON, a citizen of the United States, residing at Eureka, in the county of Humboldt and State of California, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to engines of the multiple-cylinder type, and has for its object to simplify the construction, decrease the weight, and render more efficient the operation of the engine as a whole and of the valve-gear and governor mechanism thereof.

A further object of the invention is to improve the arrangement of steam connections in order that the driving or engine shaft may be utilized as a steam-conduit and to equip the engine with novel mechanism for controlling the operation of the valve-gear to reverse the motor.

To the accomplishment of these objects and others subordinate thereto, the invention contemplates the provision of a plurality of cylinders movable in unison with the rotating engine-shaft and revolving around an eccentrically-related fixed shaft with which the piston-rods of the several pistons are connected, said stationary or eccentric shaft serving as an abutment against which the thrust of the pistons is delivered to effect the rotation of the engine as an entirety.

The invention also consists in controlling the supply of steam to the several cylinders by means of slide-valves operated by gear-wheels mounted to revolve around a central gear-wheel coaxial with and in operative relation to controlling meaus which serves to hold the center gear stationary for the purpose of effecting the rotative movement of the several valve-gears upon their own axes or to have individual rotative movement which will change the relation of the valve-gears, and thereby control the operation of the several valves to stop, start, or reverse the engine in a manner well understood in the art.

The invention further consists in the provision of governor-valves independent of the controlling-valves, centrifugally-operated weights constituting governor members for operating the valves, and in various other details of construction and arrangement, all as will hereinafter more fully appear during the course of the succeeding description of that preferred form of my invention which I have illustrated in the accompanying drawings.

In said drawings, Figure 1 is a front elevation of the engine complete. Fig. 2 is a rear elevation thereof. Fig. 3 is a longitudinal sectional view of the engine, and Fig. 4 is a detail horizontal sectional view showing the arrangement of stuffing-boxes for effecting a steam-tight connection at the point of steam-induction to the hollow shaft.

Like numerals of reference are employed to designate corresponding parts throughout the several views.

1, 2, and 3 indicate the cylinders of my engine, disposed in radial relation with respect to a comparatively heavy circular rim 4 and an inner rim or hub flange 5, between which the cylinders are interposed and secured in any suitable manner. The inner rim 5 constitutes an annular flange extended from what may be termed a "hub" 6 concentric with the inner and outer engine-rims, but located in a different vertical plane to present the hub at a sufficient distance in rear of the engine proper to accommodate the location of the valve mechanism, to be described, in rear of the several cylinders.

The hub 6 is keyed or otherwise secured to the engine-shaft 7, having a longitudinal bore 8 extended from the front end of the shaft which is let into the rear face of the hub, and adjacent to the opposite ends of the bore the shaft 7 is pierced by induction-ports 9 and eduction-ports 10. The induction-ports 9 are constantly in communication with a source of steam-supply—as, for instance, a boiler—(not shown) through the medium of a steam-pipe 11, the steam-tight connection of which with the shaft is effected by a novel arrangement of stuffing-boxes, to be hereinafter more fully described. The shaft 7 is rotatably supported in suitable bearings 12 at the upper ends of standards 13, and as the engine is fixed to and supported by said shaft it is evident that these elements will rotate in unison and that the several engine-cylinders will revolve around the axis of the shaft.

Within the cylinders 1, 2, and 3 are mounted for reciprocation the pistons 1^a, 2^a, and 3^a, provided with oscillatory piston-rods 1^b, 2^b,

and 3^b, having pivotal connection at their outer ends with the pistons, as indicated at 14 in Fig. 3, and having a common bearing at their inner ends upon a stud-shaft 15, fixedly secured to a suitable standard 16 and made hollow for a purpose to be hereinafter made plain. The stud-shaft 15 is disposed eccentric with respect to the engine and constitutes an abutment sustaining the thrust of the pistons, so that when the cylinders and the piston-rods are in angular relation and steam is admitted to the cylinders the reciprocation of the pistons will be necessarily accompanied by a rotary movement of the engine. It will therefore appear that by properly regulating the supply of steam to the cylinders to reciprocate the pistons under pressure when the parts are in predetermined relative positions the engine is caused to rotate under the impulse of successive pistons, the eccentric relation of the stud-shaft serving to present the several pistons in different relative positions at all times, so that they may be caused to operate under pressure successively in a continuous cycle.

We now come to consider the manner in which the steam or other motive agent is automatically supplied to and exhausted from the several cylinders at the proper time. In rear of each of the engine-cylinders, and at or adjacent to the outer ends thereof, are secured steam-chests 1^c, 2^c, and 3^c, communicating, by means of steam-pipes 1^d, 2^d, and 3^d, extending radially from the hub 6, with angular hub-ports 17, in communication with the eduction-ports 10 of the engine-shaft. This relation of the parts is clearly shown in Fig. 3 of the drawings, and while it has not been deemed necessary to illustrate each of the series of hub-ports 17 it will be understood, of course, that one of these angular ports is provided for leading steam from the interior of the shaft to each of the several steam-pipes leading to the steam-chests. In fact, the valve equipment of each cylinder, both as respects the controlling-valves and the governor mechanism, is precisely the same, and it will therefore be understood that the construction and arrangement of the valve mechanism to be described in connection with the cylinder 1 (illustrated in Fig. 3) is duplicated for each of the other cylinders of the engine. Referring, therefore, more particularly to Fig. 3 of the drawings, it will be seen that the steam-chest 1^c communicates with the interior of the cylinder 1, at the upper end thereof, through an induction-port 18, closely adjacent to which the wall of the cylinder is provided with an eduction or exhaust port 19, said ports being controlled by an ordinary slide or controlling valve 20, to which is connected the upper end of a valve-rod 21, passing through a suitable stuffing-box 22 at the inner end of the valve-chest and guided in its reciprocatory movement by a suitable bearing-bracket 23, bolted to and extending rearwardly from the cylinder. At its inner end the valve-rod 21 is pivotally connected to the outer end of a pitman 24, one end of which engages a wrist-pin 25, projecting from the front face of a valve-operating gear-wheel 26, rotatably mounted upon a stud-shaft 27, projecting eccentrically from the front face of the hub 6. The gears 26, of which three are employed, as heretofore premised, are disposed to actuate the valves of the several cylinders and are located equidistant from the axis of the hub-shaft and are spaced therefrom a sufficient distance to permit the interposition of a center or master gear 28, loosely mounted upon a stud-shaft 29 coaxial with the engine-shaft. At its inner end the stud-shaft 29 is extended into a socket 30, formed for its reception in the front face of the hub 6, and its outer end is fixed to and supported by an arm 31, upstanding from the rear end of the stud-shaft 15. The stud-shaft 29 therefore assists in the support of the engine and constitutes a journal therefor, as well as the journal for the master gear-wheel 28, which, as has been stated, is loosely mounted thereon and in mesh with the valve-gears 26. It will now be apparent that if the master gear-wheel 28 is held stationary the rotation of the engine will cause the valve-gears 26 to revolve around the master-gear and to rotate upon their own axes to reciprocate the controlling-valves for the purpose of admitting and exhausting the steam to or from the several cylinders at the proper time. It is therefore evident that provision must be made for holding the master gear-wheel stationary to cause the proper operation of the controlling-valves, and I therefore provide what may be termed a "valve-gear-controlling" device, designed to hold the master gear-wheel stationary for the purpose stated and arranged to rotate the master gear-wheel when it is desired to change the positions of the valve-gears for the purpose of reversing the operation of the controlling-valves, and thereby reversing the engine. This valve-gear-controlling mechanism comprises a controlling-lever 32, connected at its upper end to the front extremity of a rod 34, passed through the hollow stud-shaft 15, and provided upon its rear end with a fixed pinion 35, designed to mesh with a toothed rim 36, rigidly fixed to or integral with the hub of the master gear-wheel 28.

The connection between the rod and the lever 32 is effected by a set-screw 37, and the lever 32 is retained by a toothed rack 33. The pinion 35 therefore constitutes a locking-pinion which, engaging with the toothed rim 36 of the master gear-wheel, holds the latter stationary; but when it is desired to reverse the valve mechanism the rod 34 may be rocked, by means of the lever 32, to partially rotate the locking-pinion 35, and thereby impart sufficient individual rotary movement to the sun or master gear 28 to reverse the positions of the several valve-gears. Thus it will be seen that the valve motion comprehends sun-

and-planet gearing, the planet-gears 26 serving to operate the controlling-valves and the sun or master gear 28 being held stationary or partially rotated for the purpose of effecting the operation of the valve mechanism or of reversing such operation, as desired.

Obviously the cylinders must take steam successively; but as the proper timing of the operation of the several valves is a mere matter of the relative locations of the wrist-pins 25 upon the valve-gears 26 it is unnecessary to enter into a detailed description of this phase of the engine construction.

We have now seen the manner in which the engine is operated and the arrangement of the controlling-valve mechanism for effecting the supply and exhaust of the motive fluid to and from the cylinders. It therefore remains to describe the governor mechanism by means of which the supply of the motive agent to the valve-chests is regulated automatically by the speed of the engine. Within each of the hub-ports 17 is arranged a slidably-mounted governor-valve 38, movable radially with respect to the axis of the engine-shaft and designed when drawn outward to constrict the steam-passage through the port. Each of the governor-valves is provided with a valve-stem 39, extending upwardly through a stuffing-box 40, screwed into the periphery of the hub 6, and is adjustably connected at its outer end, as by a screw 41, extending through a slot 42 in the rod, to a governor-weight 43, slidably mounted upon a steam-pipe 1^d, 2^d, or 3^d, as the case may be, and constantly urged inwardly by means of a stout spring 44, encircling the pipe and bearing at its opposite ends against the adjacent steam-chest and the governor block or weight 43.

It will be observed that the several steam-pipes 1^d, 2^d, and 3^d, except at the point of their connection with the steam-chests, are disposed parallel with the cylinders and radial with respect to the engine. Therefore when the engine is rotated beyond a predetermined speed the outward movement of the governor members 43 under the impulse of centrifugal force and against the resistance of the springs 44 will cause the governor-valves to be drawn outwardly and the supply of steam to be correspondingly decreased until the speed of the engine is again normal.

By reference to Figs. 3 and 4 it will be seen that the connection of the steam-supply pipe 11 with the hollow engine-shaft is effected by means of a double stuffing-box 45, comprising two glands 46 and 47. The gland 46 is forced at one end against an annular packing ring or gasket 48, located in a cavity 49, formed around the shaft in one of the bearings 12. The gland 46 is formed in its inner face with an annular cavity 50, disposed opposite the induction-ports 9 and in communication with the steam-supply pipe 11, which is screwed into a suitable threaded opening in the wall of the gland opposite the cavity 50. At its end opposite the gasket 48 the gland 46 is provided with an annular cavity for the reception of a gasket 51, against which bears the second gland 47, provided with bearing-lugs 52, through which pass elongated adjusting-screws 53, engaging threaded openings in similar bearing-ears 54, formed on the bearings 12. Opposed to the rear faces of the bearing-lugs 52 are nuts 55, engaging the screws, so that when the latter are turned by means of square heads 56 provided thereon the nuts will be caused to force the gland 47 against the gasket 51, which in turn effects the clamping of the gland 46 against the gasket 48 to insure an absolutely steam-tight connection between the steam-supply pipe and the rotating engine-shaft.

It is thought that from the foregoing the construction, operation, and many advantages of my invention will be clearly apparent; but while the construction illustrated and described is believed at this time to be preferable I wish to be distinctly understood as reserving to myself the right to effect such changes, modifications, and variations thereof as may be properly embraced within the scope of the protection prayed.

What I claim is—

1. In a rotary engine, the combination with a hollow engine-shaft, means for supplying the motive fluid thereto, and a series of cylinders mounted to revolve in unison with the shaft and having communication therewith, of a stationary eccentric shaft, pistons within the cylinders, oscillatory piston-rods connected to the cylinders and to the stationary shaft, controlling-valves controlling the supply and exhaust of motive fluid to and from the cylinders, and governor mechanism independent of the controlling-valves, for independently regulating the supply of motive fluid to each of the cylinders.

2. In a rotary engine, the combination with a hollow engine-shaft, and means for supplying steam thereto, of a plurality of cylinders mounted to revolve in unison with the engine-shaft, steam-chests mounted upon the cylinders, steam-passages leading from the engine-shaft to the steam-chests and from the steam-chests to the interior of the cylinders, controlling-valves within the steam-chests, means for operating said valves, a governor-valve within each of the steam-passages leading to the steam-chests, means for operating the governor-valves, pistons within the cylinders, a stationary eccentric shaft, and oscillatory piston-rods connected to said shaft and to the several pistons.

3. In a rotary engine, the combination with a hollow engine-shaft, and means for supplying steam thereto, of a plurality of cylinders mounted to revolve in unison with the shaft, pistons within the cylinders, a stationary eccentric shaft, oscillatory piston-rods connected to said shaft and to the several pistons, steam-chests mounted on the cylinders, controlling-valves therein, means for operating said valves, steam-passages leading from the

engine-shaft to the steam-chests, independent governor-valves located in said passages and centrifugally-operated governor members arranged to operate the governor-valves.

4. The combination with a hollow engine-shaft, and means for supplying steam thereto, of a plurality of cylinders mounted to revolve in unison with the shaft, pistons within the cylinders, a stationary eccentric shaft, oscillatory piston-rods connected to said shaft and to the several pistons, steam-chests mounted on the cylinders, controlling-valves therein, radial steam-pipes connected to the steam-chests and communicating with the engine-shaft, governor-valves disposed to regulate the supply of steam through said steam-pipes, and centrifugally-operated governor-weights slidably mounted on said steam-pipes and operatively connected to the governor-valves.

5. In a rotary engine, the combination with a plurality of cylinders mounted for rotation in unison around a common center, of steam-chests mounted upon the cylinders, controlling-valves in the steam-chests to control the supply and exhaust of steam to and from the cylinders, sun-and-planet gearing operatively connected with said valves to operate the same, and means for holding the sun or master gear stationary or for effecting its movement, as desired.

6. In a rotary engine, the combination with a plurality of cylinders mounted to rotate in unison around a common center, of steam-chests mounted on said cylinders, controlling-valves in the steam-chests, sun-and-planet gearing operatively related to said valves, and a shiftable controlling device arranged to reverse the operation of the gearing.

7. In a rotary engine, the combination with a plurality of cylinders mounted to revolve around a common center, of steam-chests mounted on the cylinders, controlling-valves therein, sun-and-planet gearing operatively connected to the controlling-valves, the sun or master gear of said gearing being loosely mounted for free rotation and provided with a toothed rim, a locking-pinion arranged to engage the toothed rim of the master-gear, and means for holding the locking-pinion stationary, or for effecting the partial rotation thereof.

8. In a rotary engine, the combination with a plurality of cylinders mounted to revolve around a common center, of steam-chests mounted on the cylinders and controlling-valves within the steam-chests, sun-and-planet gearing operatively connected to the valves, a stationary eccentric shaft, pistons within the cylinders, oscillatory piston-rods connected at their inner ends to the eccentric shaft and at their outer ends to the several pistons, and mechanism associated with said eccentric shaft for controlling the operation of the sun-and-planet gearing.

9. In a rotary engine, the combination with a plurality of cylinders mounted to revolve around a common center, steam-chests thereon and controlling-valves within the steam-chests, of sun-and-planet gearing operatively connected to the valves, pistons within the cylinders, a stationary eccentric shaft, oscillatory piston-rods connected to said shaft and to the several pistons, a controlling-lever located beyond one end of the eccentric shaft, a locking device located at the other end of the eccentric shaft for engagement with the sun or master gear of the sun-and-planet gearing, and means for operatively connecting the lever with the locking device.

10. In a rotary engine, the combination with a plurality of cylinders mounted to revolve around a common center, steam-chests thereon and controlling-valves in the steam-chests, of sun-and-planet gearing arranged to operate the valves, the sun or master gear of said gearing being provided with a toothed rim, a hollow stationary eccentric shaft, pistons within the cylinders, oscillatory piston-rods connected to the said eccentric shaft and to the several pistons, a rod extended through the hollow shaft and provided upon one end with a locking-pinion arranged to engage the toothed rim of the sun or master gear, and a controlling-lever connected to the opposite end of said rod to actuate the same.

11. In a rotary engine, the combination with inner and outer concentric rims, a series of interposed cylinders, and a hub supporting said rims and located in rear thereof, of sun-and-planet gearing mounted on the face of the hub, steam-chests mounted on the cylinders, controlling-valves located in the steam-chests and operatively connected to the sun-and-planet gearing, a stationary eccentric shaft, pistons within the cylinders, oscillatory piston-rods connected to the stationary eccentric shaft and to the pistons, respectively, and means for controlling the operation of the sun-and-planet gearing.

12. In a rotary engine, the combination with a hollow engine-shaft, and means for supplying motive fluid thereto, of a plurality of cylinders provided with pistons and disposed to rotate in unison, a hub connected to the engine-shaft and cylinders and provided with ports in communication with the interior of the shaft, said hub having a flat face located beyond the shaft, steam-chests mounted upon the cylinders and in communication with said ports, valves within said chests, and valve-operating mechanism connected to the several valves and located upon the flat face of the hub.

13. In a rotary engine, the combination with a hollow engine-shaft, and means for supplying motive fluid thereto, of a plurality of cylinders provided with pistons and disposed to rotate in unison, a hub connected to the engine-shaft and cylinders and provided with ports in communication with the interior of the shaft, steam-chests mounted upon the cylinders and in communication with said ports, valves within said chests, valve-operating

mechanism connected to the several valves and located upon the face of the hub, governor-valves located within the ports in the hub, and centrifugally-operated governor-weights operatively related to said governor-valves.

14. In a rotary engine, the combination with an engine-shaft, and means for supplying steam thereto, of a plurality of cylinders mounted to revolve in unison with the shaft, pistons within the cylinders, steam-chests mounted on the cylinders, controlling-valves therein, radial steam-pipes connected to the steam-chests and communicating with the engine-shaft, valve-operating mechanism located in advance of said pipes, governor-valves located in rear of said pipes and disposed to regulate the supply of steam therethrough, and centrifugally-operated governor-weights slidably mounted on the pipes and operatively connected to the governor-valves.

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

ALFRED THOMAS STIMSON.

Witnesses:
GEO. B. COLLOM,
MAUD M. BARRY.