G. F. LEIGER.

ROTARY ENGINE.

APPLICATION FILED JUNE 3, 1911.

1,023,322.

Patented Apr. 16, 1912.

4 SHEETS—SHEET 1.

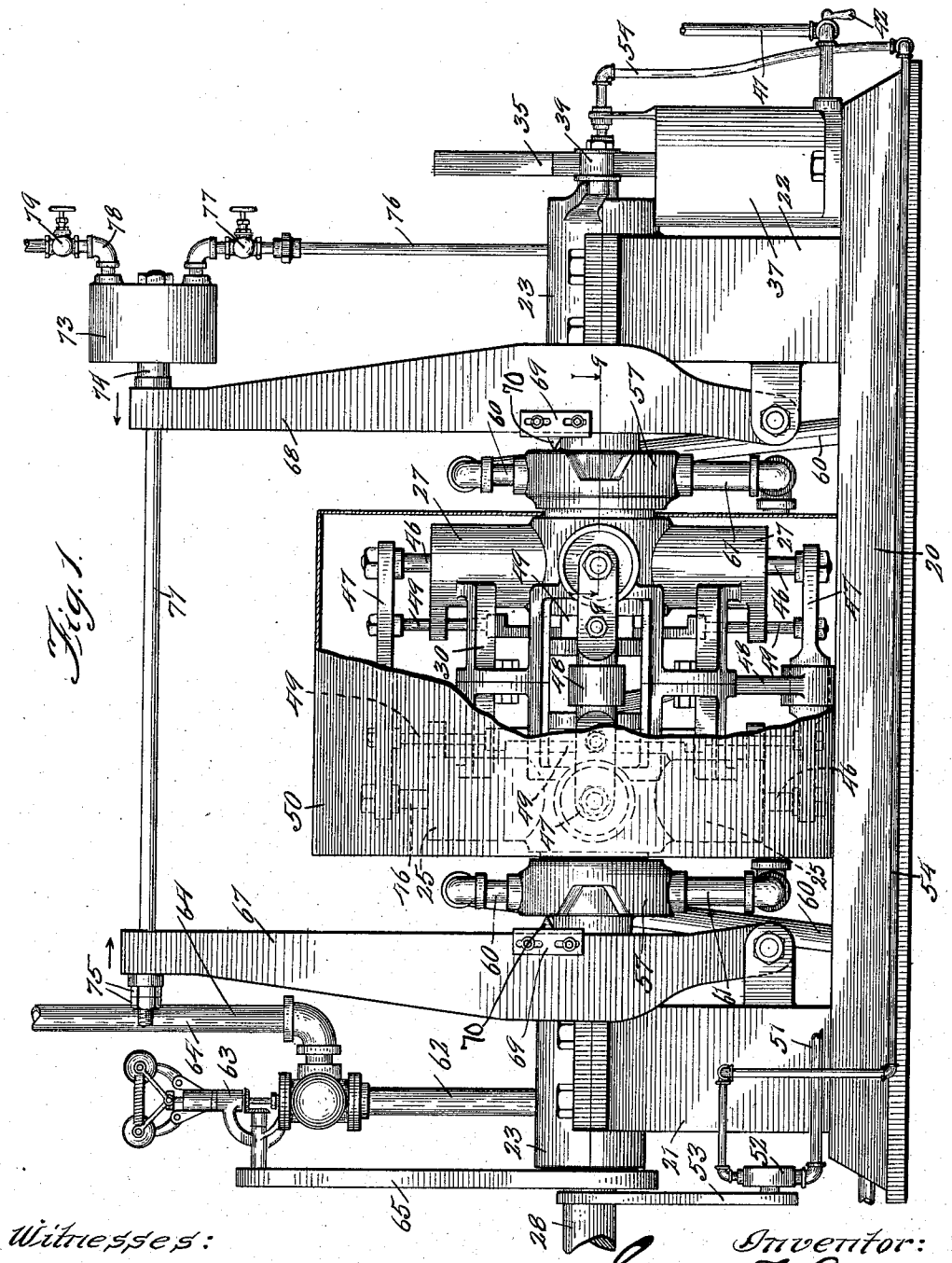

Fig. 1.

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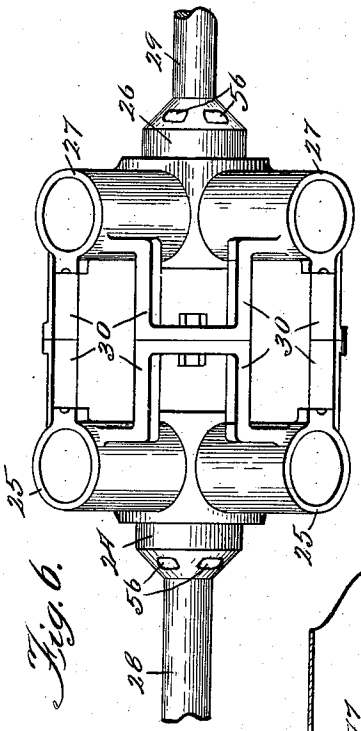

Fig. 6.

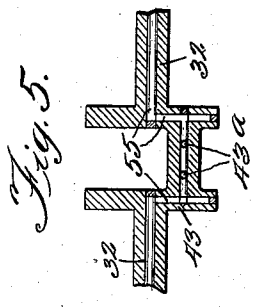

Fig. 5.

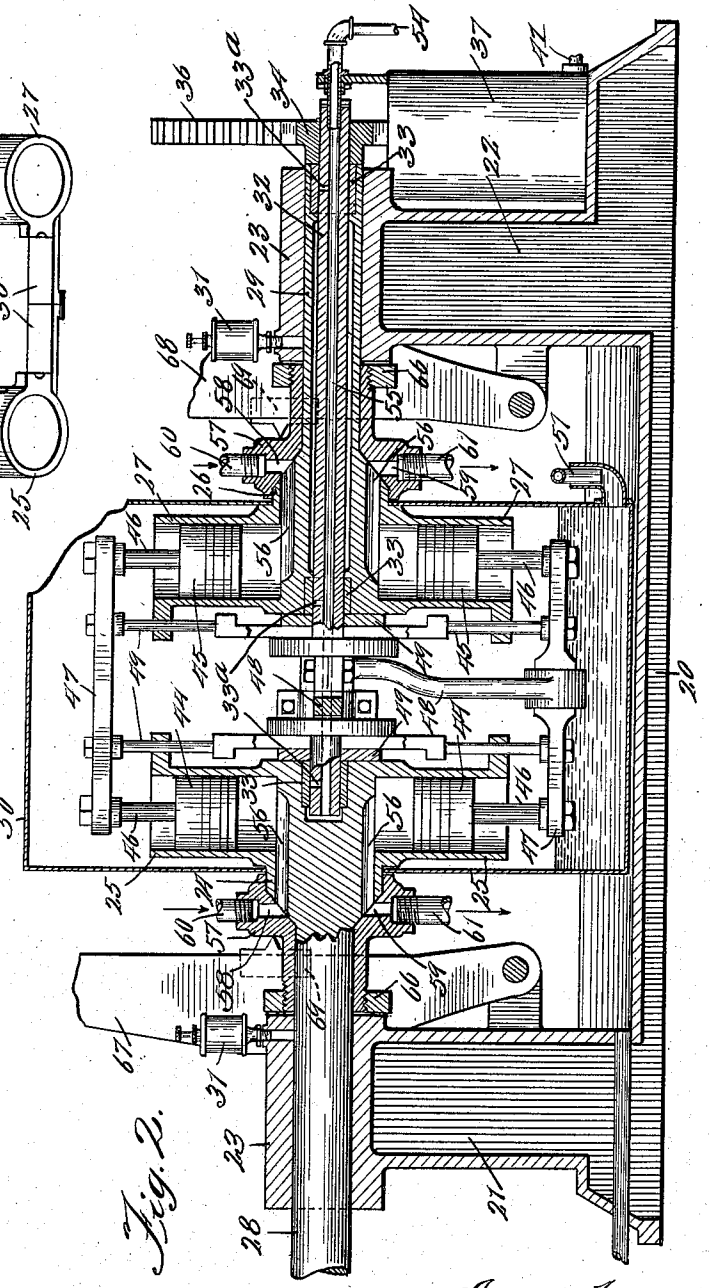

Fig. 2.

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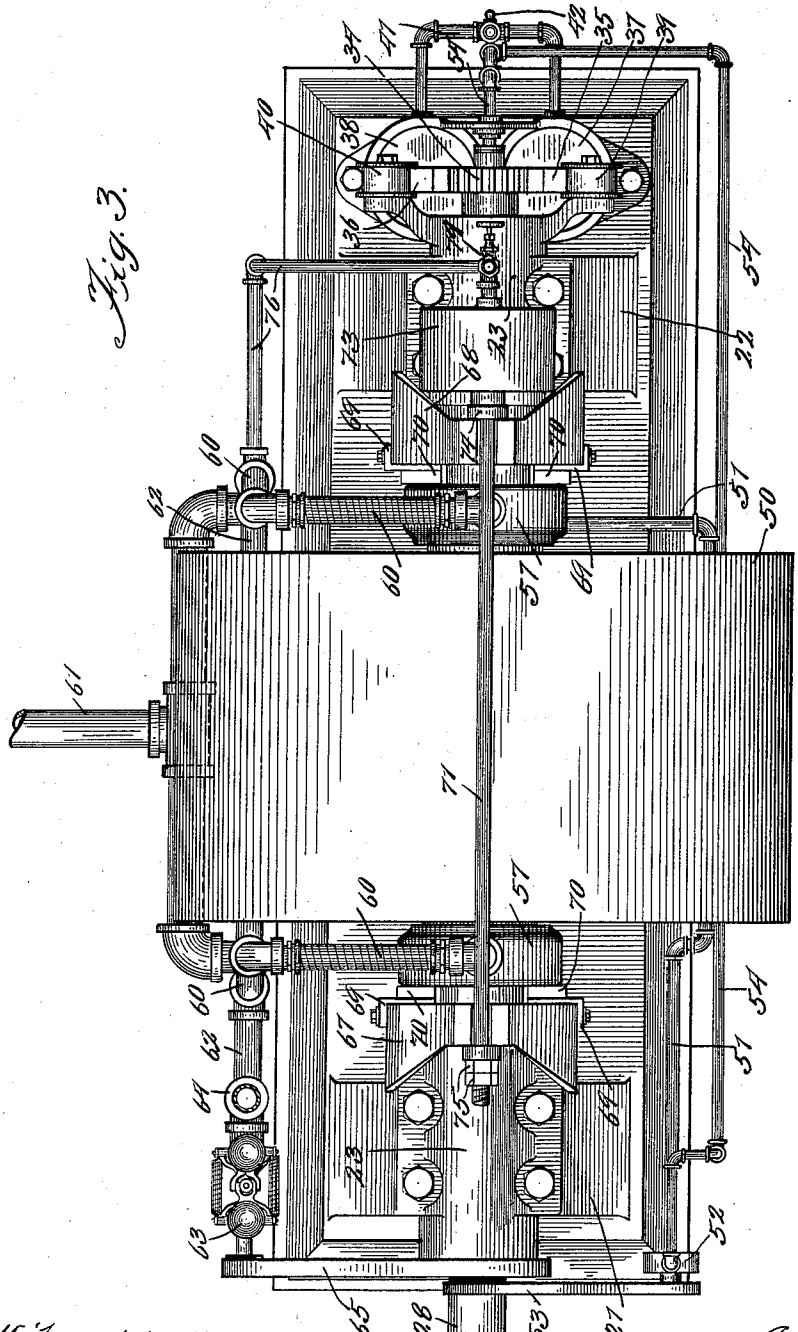
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

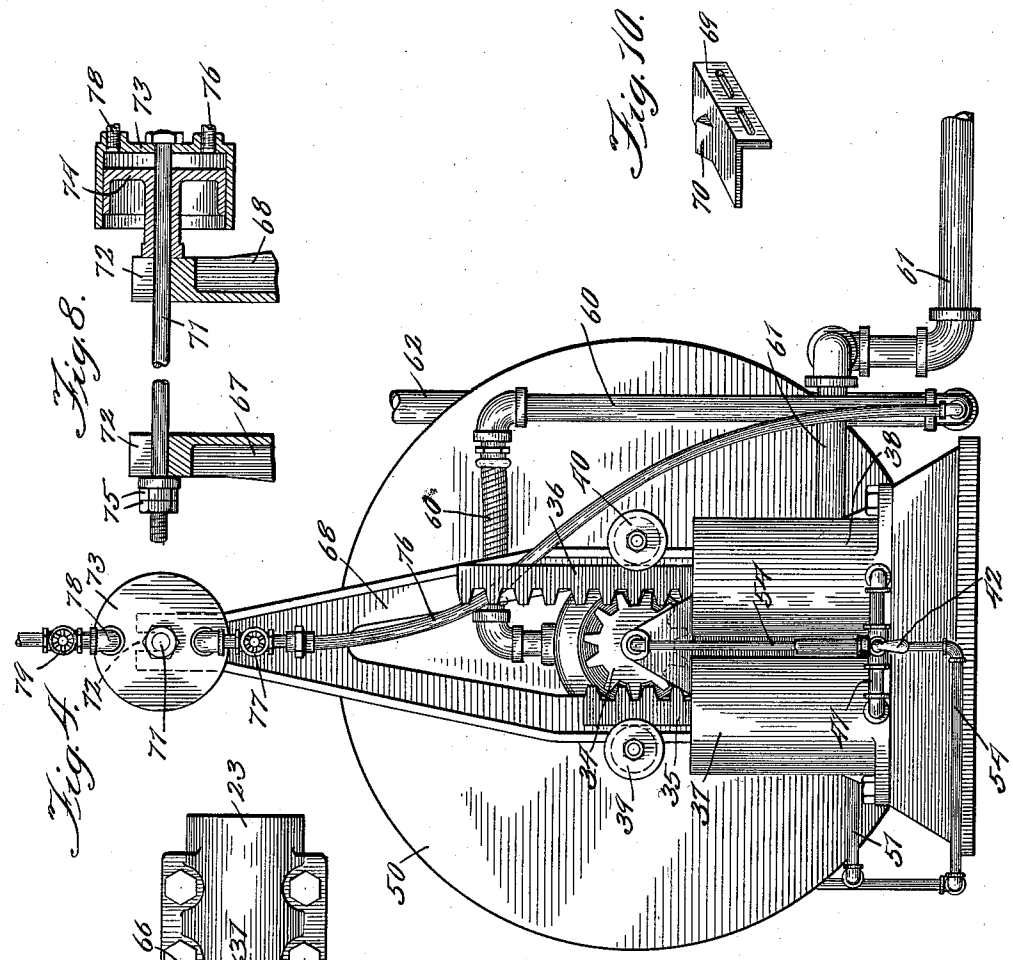

Fig. 8.

Fig. 4.

Fig. 10.

Fig. 7.

Fig. 9.

Witnesses:

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UNITED STATES PATENT OFFICE.

GEORGE F. LEIGER, OF CHICAGO, ILLINOIS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO CHICAGO OCTAGON ROTARY ENGINE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ROTARY ENGINE.

1,023,322. Specification of Letters Patent. Patented Apr. 16, 1912.

Application filed June 3, 1911. Serial No. 631,015.

To all whom it may concern:

Be it known that I, GEORGE F. LEIGER, a citizen of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to rotary engines of the general type shown in Letters Patent of the United States No. 977,888, granted to me on December 6, 1910, in which a beveled valve is held in contact with a correspondingly beveled part provided with ports leading to the cylinders, and one of the objects of the invention is to provide new and improved means for holding the valve with the required degree of power in position so that the steam shall not escape between the valve and the hub whatever the pressure of the steam may be, and so that at the same time the valve shall not bind upon the hub when the parts are expanded by the heat of the steam and the friction.

Another object of this invention is to provide a suitable oiling system for the engine.

Another object is to improve the construction of engines of this class in sundry details hereinafter pointed out.

The means by which I have accomplished these objects are illustrated in the accompanying drawings and hereinafter specifically described.

That which I believe to be new is set forth in the claims.

In the drawings,—Figure 1 is a side elevation of my improved engine. Fig. 2 is a longitudinal central sectional view, with the means omitted by which the cylinder members are secured together. Fig. 3 is a plan view of my engine. Fig. 4 is an end view as seen from the right in Fig. 1. Fig. 5 is a central cross-sectional view through the crank portion of the crank-shaft. Fig. 6 is a perspective view of the cylinder members. Fig. 7 is a fragmentary top view showing one of the valves and adjacent parts. Fig. 8 is a vertical central sectional view, partly broken away, of the upper ends of the arms by which the valves are held in position, and connected parts. Fig. 9 is a cross section on line 9—9 of Fig. 1. Fig. 10 is a perspective view of one of the bearing-plates by which the valves are held in position through the medium of the pivoted arms.

Referring to the several figures of the drawings, in which corresponding parts are indicated by like reference characters, 20 indicates a base, rising from which are standards 21—22 provided with bearings formed in their upper ends and in caps 23 suitably secured thereto.

24 indicates a hub on which are mounted four cylinders 25, and 26 indicates a second hub on which are mounted four additional cylinders 27. As best shown in Fig. 6, the hubs 24—26 have formed with them shafts 28—29, respectively, and also arms 30 by which one set of cylinders is secured to the other set. As shown in Fig. 2, the shafts 28—29 are rotatable in the bearings at the upper ends of the standards 21—22, oil cups 31 of any suitable type being provided for lubricating such bearings. As also best shown in Fig. 2, the shaft 29 and hub 26 are provided with a longitudinal bore through which the crank shaft 32 extends, said crank shaft extending also into a bearing in the hub 24. Bushings 33 are fixed in any suitable manner in the hubs 24 and 26 and in the end of the shaft 29, forming the bearings for the crank shaft 32 therein.

34 indicates a gear keyed or otherwise fixed on the crank shaft 32 between rack-bars 35—36 formed upon the piston rods of the reversing cylinders 37—38.

39—40 indicate rollers revolubly mounted on the frame-work of the engine to hold the piston-rods in proper alinement.

41 indicates a feed-pipe adapted to be connected to any suitable source of fluid under pressure, and 42 indicates a suitable controlling valve therein, whereby steam or other suitable fluid under pressure may be admitted to one or the other of the two cylinders and the crank-shaft 32 turned so that the crank 43 therein shall stand substantially horizontally on the opposite side of the crank shaft, all as is fully explained in another application heretofore filed by me, Ser. No. 604,991.

44 indicates a piston in each of the cylinders 25, and 45 indicates a piston in each of the cylinders 26. 46 indicates the piston-

rods carried by said pistons, and 47 indicates the cross-heads secured to the outer ends of said piston-rods.

48 indicates the links pivotally mounted on two of the cross-heads 47 at their outer ends and at their inner ends upon the crank 43.

49 indicates the bars which straddle the crank shaft 32 and rigidly connect the opposite cross-heads 47 so as to cause them to move together.

The parts heretofore described are substantially like the constructions shown and described in my said Letters Patent No. 977,888, and in said application, Ser. No. 604,991, and it is therefore believed that it is not necessary herein to describe such parts in further detail.

Referring now to the oiling system, 50 indicates a housing of any suitable type for the cylinders 25—27 and their immediately connected parts. As shown in Fig. 2, the housing 50 contains a quantity of oil, together with a limited amount of water of condensation. Each of the cross-heads 47 dips into this oil as the cylinders rotate, thus keeping the bearings of the links 48 upon such cross-heads properly lubricated, and also serving to splash the oil upon such other parts within the housing as require oil. 51 indicates a pipe leading out of said housing at the bottom and extending toward the left-hand end of the engine as it is shown in the figures. 52 indicates a rotary pump connected to said pipe 51, adapted to be operated by a belt 53 from the shaft 28 of the engine. 54 indicates a pipe leading from said pump to the other end of the engine, where it is suitably connected to a passage 55 extending through the entire length of the crank-shaft 32. At each of the bearings 33, a suitable duct 33^a leads from the passage 55 to the inside of the bearing, and in the crank 43 suitable ducts 43^a are also provided. By these means, when the engine is running a supply of oil is pumped out of the receptacle 50 and kept circulating through the passage 55 in the crank-shaft, the greater portion of such oil dripping again from the bearings into the receptacle 50.

As best shown in Fig. 2, each of the cylinders 25—27 has leading into it at its inner end a port 56, the opposite ends of which ports open upon the beveled ends of the hubs 24—26.

57 indicates valves mounted upon the beveled ends of the hubs 24—26 covering the ends of the ports 56, these valves being held non-rotatably in position as hereinafter described. Each of the valves 57 is provided with two chambers 58—59, the upper one of which in the construction shown has connected with it a pipe 60 connected as hereinafter described with a suitable source of fluid under pressure, while the chamber 59 has connected with it an exhaust pipe 61. Each of the pipes 60 leads to one side by a section of flexible piping, and then slightly diagonally downward, where they are connected to a longitudinally-extending pipe 62, which at one end of the engine turns and rises to a governor 63 to which steam or other suitable fluid under pressure is fed by means of a pipe 64. The governor is run by a belt 65 from the shaft 28.

Coming now to the means for holding the valves 57 in position against the hubs 24—26, 66 indicates collars screw-threaded upon the outer ends of said valve-parts adapted to be tightened, if desired, against the standards 21—22, respectively, to hold said valves in position. I have discovered, however, that as steam is admitted to the cylinders the metal of the cylinders, hubs and valves expands to an extent that, if the collars 66 are properly tightened in position before the admission of steam, such collars after the expansion of the metal bind firmly against the standards 21—22 seriously interfering with the proper operation of the engine. For the purpose of properly securing the valves in position, I provide the following-described mechanism: 67—68 indicate heavy arms pivoted at their lower ends upon the standards 21—22 and extending upward therefrom at both sides of the shafts 28—29. 69 indicates bearing-plates slidably mounted on the arms 67—68 opposite the valves 57 and adjustable up and down relative to the ports 56. 70 indicates wedge-shaped projections on the faces of the plates 69 adapted to be adjusted to the proper point upon the valves 57 to receive the endwise thrust of the valve and to hold it in proper position without binding upon the hub. 71 indicates a rod mounted in slots 72 in the upper ends of the arms 67—68. 73 indicates a cylinder mounted on said rod next to its head, and 74 indicates a piston slidably mounted on the rod 71 within the cylinder 73 and bearing at its outer end upon the arm 72. 75 indicates nuts screw-threaded upon the opposite end of the rod 71 beyond the arm 67. 76 indicates a pipe leading from the pipe 62 to the cylinder 73, with a suitable valve 77 interposed between. 78 indicates a pipe leading from the cylinder 73, with a valve 79 therein.

In the use of my improved engine, whenever the work driven by the engine is increased, the governor automatically opens permitting an increased amount of steam or other fluid under pressure into the cylinder 73 and consequently increasing the pressure upon the outer faces of the valves 57 to compensate for the increased pressure upon the inner faces thereof and thus balancing the pressure. The valve 57 is thus held in such contact with the hub as to prevent any material leaking between the valve and the hub however great may be the force of the

steam pressure, the pressure on opposite sides being balanced.

The plate 69 is to be regulated up or down upon the lever 68 so that the wedge-shaped projection 70 bears upon the upper portion of the valve 57 where the greater part of the pressure of the steam exerts itself, the pressure in the lower chamber of the valve which contains the exhaust steam being comparatively very much smaller. The plate 69 is therefore to be adjusted up or down to a point where it centers the valve upon the taper of the hub so that the valve does not bind upon the hub and so that substantially no steam is permitted to escape.

By the use of the valves 77 and 79, the admission of the steam to the cylinder 73 and its exhaust therefrom can be regulated independently of the governor 63 to vary the pressure upon the outside of the valves 57 as desired.

While I have described the parts 24—26 as being hubs mounted upon and formed with the shafts 28—29, this is merely for convenience of description, and I do not wish to limit myself to a construction comprising hubs strictly speaking nor including parts similar in construction to the parts 24—26, the term "hub" being used in the specification and claims to denote the means by which the cylinders of each set are held in proper relation to each other. Moreover, it will be readily understood that the ports leading to the cylinders might be otherwise formed than as shown, the only essential as to the ports being that they shall lead from the cylinders to a properly inclosed valve.

What I claim as my invention and desire to secure by Letters Patent is,—

1. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading into said cylinder, and a valve located next to said hub and adapted to communicate with said port, of other fluid-operated means for holding said valve in position next to said hub.

2. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of other fluid-operated means for holding said valve in position next to said hub, and means for regulating the effective strength of said fluid-operated means in proportion to the amount of work being done by the engine.

3. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of other fluid-operated means for holding said valve in position next to said hub, and a governor adapted to regulate the admission of fluid under pressure to said fluid-operated means.

4. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of fluid-operated means for holding said valve in position next to said hub, and means for regulating the pressure upon said valve by permitting the escape of a limited amount of fluid under pressure.

5. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of fluid-operated means for holding said valve in position next to said hub, a governor adapted to regulate the admission of fluid under pressure to said fluid-operated means, and means for regulating the pressure upon said valve by permitting the escape of a limited amount of fluid under pressure.

6. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of other fluid-operated means for holding said valve in position against said hub, the point at which said fluid-operated means bears upon said valve being substantially in line with the position of the port in said hub at which fluid under pressure is admitted to said cylinder.

7. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of other fluid-operated means for holding said valve in position against said hub, the bearing of said fluid-operated means upon said valve being in a line substantially at right angles to the position of the cylinder when its port stands opposite the middle point of the inlet chamber of the valve.

8. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of other fluid-operated means for holding said valve in position against said hub, and means for varying the point at which said fluid-operated means bears upon said valve.

9. In a rotary engine, the combination

with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of an arm pivotally mounted relative to said valve and having a bearing on the same, and other fluid-operated means adapted to force said arm toward said valve to hold said valve in position against said hub.

10. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of an arm pivotally mounted relative to said valve, a bearing plate carried by said arm and adapted to bear upon said valve, means for adjusting said bearing plate along said arm, and other fluid-operated means adapted to force said arm toward said valve to hold said valve in position against said hub.

11. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of an arm pivotally mounted relative to said valve, a wedge-shaped bearing part carried by said arm and adapted to bear at its sharp edge upon said valve, means for adjusting said bearing part along said arm, and other fluid-operated means adapted to force said arm toward said valve to hold said valve in position against said hub.

12. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, said hub being provided with a port leading to said cylinder, and a valve located next to said hub and adapted to communicate with said port, of other fluid-operated means for holding said valve in position against said hub, and means for regulating the effective strength of the fluid under pressure admitted both to said piston and to said other fluid-operated means.

13. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, a second hub revolubly mounted opposite thereto, a cylinder mounted on said second hub, each hub being provided with a port leading into the cylinder mounted thereon, and a valve located against each hub and adapted to communicate with the port therein, of two arms each of which is pivotally mounted relative to one of said valves and has a bearing on the same, and other fluid-operated means tending to force said arms together to hold said valves in position.

14. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, a second hub revolubly mounted opposite thereto, a cylinder mounted on said second hub, each hub being provided with a port leading into the cylinder mounted thereon, and a valve located against each hub and adapted to communicate with the port therein, of two arms each of which is pivotally mounted relative to one of said valves and has a bearing on the same, a rod secured to one of said arms, a cylinder secured upon said rod, and a piston slidably mounted on said rod within said cylinder and bearing against the other of said arms.

15. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, a second hub revolubly mounted opposite thereto, a cylinder mounted on said second hub, each hub being provided with a port leading into the cylinder mounted thereon, and a valve located against each hub and adapted to communicate with the port therein, of two arms each of which is pivotally mounted relative to one of said valves and has a bearing on the same, a rod secured to one of said arms, a cylinder secured upon said rod, a piston slidably mounted on said rod within said cylinder and bearing against the other of said arms, and a valve connected with said cylinder adapted to permit and regulate the escape of fluid under pressure from said cylinder.

16. In a rotary engine, the combination with a revolubly-mounted hub, a cylinder mounted thereon, a second hub revolubly mounted opposite thereto, a cylinder mounted on said second hub, each hub being provided with a port leading into the cylinder mounted thereon, and a valve located against each hub and adapted to communicate with the port therein, of two arms each of which is pivotally mounted relative to one of said valves and has a bearing on the same, a rod secured to one of said arms, a cylinder secured upon said rod, a piston slidably mounted on said rod within said cylinder and bearing against the other of said arms, a valve connected with said cylinder adapted to permit and regulate the escape of fluid under pressure from said cylinder, and a valve connected with said cylinder adapted to regulate the admission of fluid under pressure to said cylinder.

17. In a rotary engine, the combination with a revolubly-mounted hub, four cylinders rotatably mounted thereon, a second hub revolubly mounted opposite thereto, four cylinders rotatably mounted on said second hub, each hub being provided with four ports leading into the four cylinders respectively, and a valve located against each hub and adapted to communicate with the ports therein in order, of two arms each of which is pivotally mounted relative to one of said valves, a bearing-plate carried by each arm and adapted to bear upon the corresponding valve, means for adjusting each

bearing-plate along its arm, a rod secured to one of said arms, a cylinder secured upon said rod, and a piston slidably mounted on said rod within said cylinder and bearing against the other of said arms.

18. In a rotary engine, the combination of a plurality of cylinders mounted on a hub, a shaft extending from one end of said hub, said cylinders and hub and shaft being formed integral, a plurality of cylinders mounted on a second hub, a shaft extending from one end of said second hub, said last-named cylinders and hub and shaft being formed integral, means for securing one set of said cylinders to the other set, and a crank spindle extending longitudinally through one of said shafts and hubs, and having a bearing in the other hub.

19. In a rotary engine, the combination of a revolubly-mounted hub, a cylinder mounted thereon, a crank-shaft extending axially through said hub, links pivotally mounted on said crank, said crank-shaft being provided with a longitudinally-extending passage communicating with the bearings of said links on said crank, and means operated by the rotation of the engine for forcing oil through said passage.

20. In a rotary engine, the combination of a revolubly-mounted hub, a cylinder mounted thereon, a crank-shaft extending axially through said hub, links pivotally mounted on said crank, said crank-shaft being provided with a longitudinally-extending passage communicating with the bearings of said links on said crank, a receptacle mounted under said crank-shaft, and a pump operated by the rotation of the engine adapted to take oil from said receptacle and to force it through said passage and through said bearings.

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