(No Model.) 2 Sheets—Sheet 1.

T. HARDING.

ROTARY ENGINE.

No. 513,232. Patented Jan. 23, 1894.

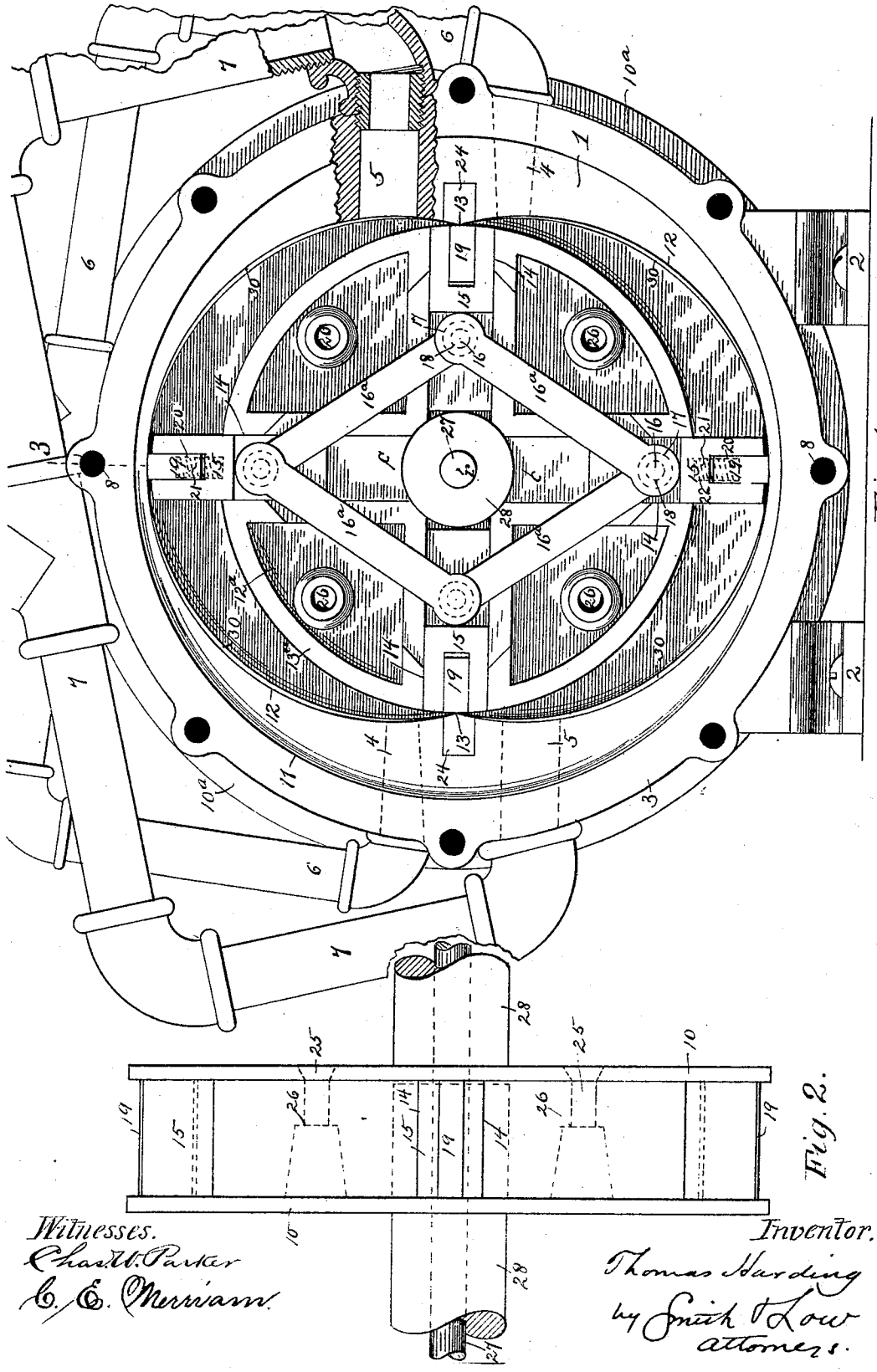

Fig. 1.

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

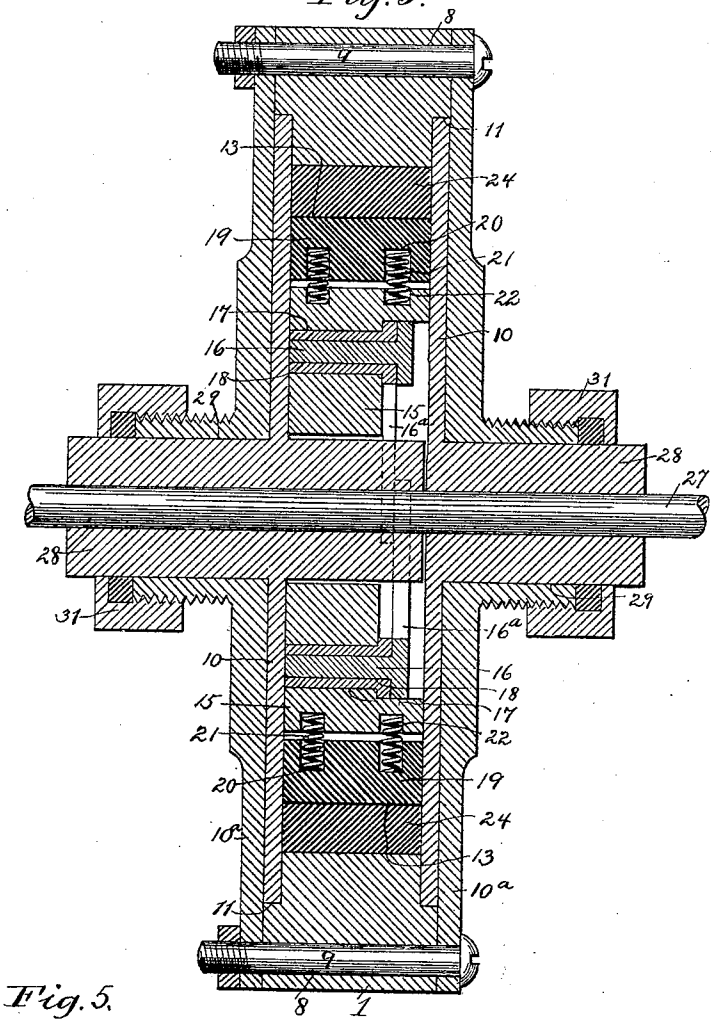


Fig. 4. Fig. 5.

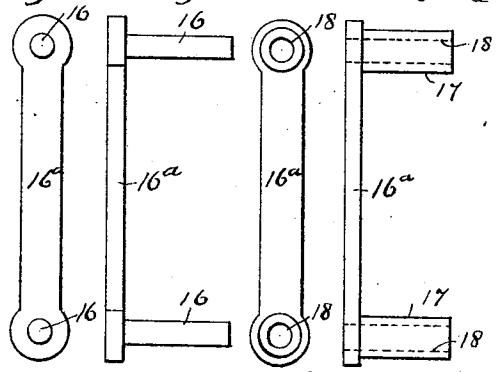
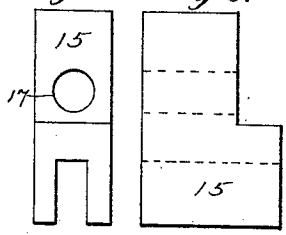


Fig. 6. Fig. 7.

Fig. 8. Fig. 9.



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UNITED STATES PATENT OFFICE.

THOMAS HARDING, OF SAN JOSÉ, CALIFORNIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 513,232, dated January 23, 1894.

Application filed May 5, 1893. Serial No. 473,059. (No model.)

To all whom it may concern:

Be it known that I, THOMAS HARDING, a citizen of the United States, residing at San José, in the county of Santa Clara and State of California, have invented certain new and useful Improvements in Rotary Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

By the word engine as used in this specification I intend a mechanical contrivance, employing the word in its broad sense. My improvement therefore is not to be confined to those devices which are termed specifically rotary engines, in which a rotary motion of the piston is produced by the direct pressure of steam.

I wish it to be understood that my improvements, hereinafter set forth, may be availed of in the construction and use not only of rotary engines specifically but also of water motors, in which the rotary motion of the piston is produced by hydraulic pressure; of pumps in which the rotary movement of the piston produces a flow of water; and of water meters in which the flow of water produces an indicating or measuring movement of the piston.

It is the object of my invention to much simplify this species of mechanical contrivance, and to make it accurate and economical in use.

According to my invention the piston or rotary part is provided with two or more radially movable slides which are acted upon by the inner surface of the part which constitutes the cylinder and which are connected together in such manner that they alternately control each other in their movements.

With such objects in view my invention consists in the parts and combinations thereof hereinafter particularly set forth and claimed.

In order to make my invention more clearly understood I have shown in the accompanying drawings means for carrying the same into practical effect, without however limiting the improvement, in its useful applications, to the particular construction which for the sake of illustration, I have delineated.

In the said drawings:—Figure 1 is a front or face view of a rotary engine embodying my improvements, one of the sides of the casing or cylinder being removed to give a full view of the interior and of the piston therein. Fig. 2 is a side or edge view of the piston removed from the cylinder. Fig. 3 is a sectional view on line 3—3 of Fig. 1. Figs. 4, 5, 6, and 7 illustrate by face and edge views the links for connecting the sliding piston plates. Figs. 8 and 9 illustrate by an edge and a face view one of the said plates.

Referring to the drawings 1 indicates a casing or part which is stationary and serves the purpose of the cylinder of the engine. It is preferably provided with one or more base portions, flanges, or feet 2 by which it may be attached to a foundation or other stationary support. It is provided with a peripheral flange 3 through which enter into the interior of the cylinder the steam or water admission ports 4, 4, and the exhaust ports 5, 5. A live steam pipe 6, and an exhaust steam pipe 7 are connected with these ports in any suitable manner, a convenient arrangement for which I have shown in Fig. 1.

The casing 1 is provided on one side of its head, or on both sides if neither of its heads is formed integral with the casing, with bolt holes 8 into which enter bolts 9 by which the head, or heads, 10^a is or are secured in place. In the construction shown the said casing is made with both of its heads 10^a separable. On each side of the casing is formed a rabbet or recess 11 bounded by a shoulder, which recess is of a diameter nearly as large as the exterior dimension of the casing, which is concentric with the center of rotation of the piston hereinafter described, and which is of a greater diameter and surrounds the interior working opening of the casing or cylinder.

The boundary or working surface of the cylinder is indicated at 12. In its general shape it is oblong, being formed of two circular or substantially circular portions which are so situated relative to each other as that their boundaries intersect at the points 13, Fig. 1. The positions of the centers of the two cylinder portions are indicated at *c*, *c* in Fig. 1, and the center of rotation at *r*. I find the proportion between the distance apart of the points *c* and *r* to the distance between

the point *c* and the working face of the cylinder, as shown in said Fig. 1 to be suitable for practical purposes. The desired result in determining said proportion is that two or more sliding piston plates when mutually controlled as hereinafter described shall follow without much variation the contour of the interior or working face of the cylinder. The main body of the rotary part or piston is indicated at 12^a. Its particular shape is not of importance. I prefer to make it round and concentric with the center of rotation *r*. For the sake of lightness, and in order to save metal, the piston is preferably made hollow, or partly hollow, bounded by a flange 13^a which is of a width equal to the depth of the cavity of the cylinder 1. At two or more points in its periphery, preferably at four points as illustrated, the flange 13^a is provided with or formed with guide ways 14 in which fit radially sliding piston plates 15 of a width equal to that of the flange 13 and to the depth of the cavity of the cylinder. These piston plates 15 are connected with each other so as mutually to control each other by means of links 16^a arranged so as to form a parallelogram as seen in Fig. 1. The links (Figs. 4, 5, 6 and 7) run obliquely from one plate to the neighboring plate which is at an angle to the first mentioned plate, and are connected with the said plates by means of pins 16 formed preferably on two of the links, and engaging sleeves 18 formed on the other two links, and said sleeves fit in bearings 17 in the piston plates.

The foregoing being the construction and arrangement of the parts it will be seen that as the live steam enters the port or ports 4 it will act upon the piston plate or plates 15 in advance of the said opening or openings and cause a rotation of said plates together with the piston 12^a, around the center of rotation *r*. As this takes place the plates 15 which are opposite to or which are approaching the points 13 will be forced inward by the contour or wall 12 of the cylinder and caused to so act upon the links which are pivoted to them as to force the other plate or plates 15, which are at or near the major axis of the oblong cylinder cavity, outward into contact with or nearly into contact with the walls of the ends of said cavity. Inasmuch as the contours of the two portions of the cavity may not be of exactly the correct shape or have exactly the proper relation to each other, I prefer to provide the plates 15 with spring-actuated plunger plates 19 which are provided with cavities 20 in which fit spiral springs 21. These springs rest upon the bottom of recesses 22 in the plates 15 and tend to constantly press said plunger plates outward into steam tight contact with the walls of the cylinder. As the piston revolves there will be a slight inward and outward play of these plunger plates, in which movement they will be guided by the walls of the said recesses.

At the points 13 on the minor axis of the oblong cavity of the cylinder I prefer to fit into the walls of the latter in suitably formed recesses, bronze or other suitable metal pieces 24 which are adapted to be adjusted outward by suitable packings so that a steam tight joint will always be maintained on the minor axis of the cylinder where there will be considerable wear.

25 indicates bolts which pass through the head plates 10 of the piston and are adapted to engage with screw-threaded holes 26 in the body of the latter or in the opposite head plate. The head plates 10 fit closely against the sides of the piston plates 15 and rotate in the recesses 11 already described, which are formed in the sides or ends of the cylinder casing.

27 is a shaft concentric with the center of rotation *r* upon which shaft are mounted the rotary piston and the two piston heads 10. The latter are preferably provided with central bosses or bearings 28 which extend outward through openings 29 formed in the end plates of the casing or cylinder.

When the device is used as a rotary engine specifically, power may be derived from a suitable wheel or pulley mounted upon the central shaft or upon the boss or hub of one or both of the plates 10. When the device is employed as a pump rotary movement may be imparted to the piston by means of a belt or other suitable power device connected with the said pulley and running from any suitable prime motor or engine.

The inclosing side or end plates of the casing are provided with suitable stuffing boxes 31 through which the hubs of the piston heads 10, or the ends of the central shaft, pass out by steam tight joints.

It will be observed that the live steam ports are so situated that steam is admitted simultaneously at both sides of the piston head, in both portions of the cylinder cavity, so as to effect a complete balance of pressure upon the piston. These ports may be readily so arranged that there will be no dead center upon which the piston can stop.

In engines of large diameter it will be preferable or necessary to fit the interior walls of the cylinder cavity with pieces 30 substantially in the shape of lunes, which will modify the contour of the cylinder cavity from that of a true circle, or portion of a circle, and enable the radially movable plates 15 to travel more closely to the interior walls or surfaces with which they form a steam tight joint, thus requiring less movement of the plunger plates in the piston plates.

Having thus described my invention, what I claim is—

1. In a rotary engine, comprising a motor, pump or meter, the combination with the cylinder or casing of a rotary piston head mounted therein and provided with two or more radially movable piston plates, and links extending obliquely from one plate to the next and directly connecting with each other

the two contiguous plates which are situated at an angle to each other whereby their movements are mutually controlled, substantially as set forth.

2. In a rotary engine the combination of a cylinder or casing having a cavity formed of two portions each of which is substantially circular and which portions intersect each other as set forth, a rotary piston head therein, radially movable piston plates mounted in said head, and a pivoted or hinged connection between said plates whereby they mutually control each other in their movement by their contact with the interior walls of said cavity, substantially as set forth.

3. The combination with a casing having an oblong cavity, of a rotary head therein provided with radially movable slides, and a link or links connecting said slides, and provided with pins 16 and sleeves 18, substantially as set forth.

4. In a rotary engine the combination of a casing having an oblong cavity, a rotary head therein provided with four oppositely situated radially movable plates, and four links arranged in the form of a parallelogram connecting said plates for mutually controlling their movements, substantially as set forth.

5. In a rotary engine the combination of a cylinder or casing having an oblong cavity as described, a rotary piston head mounted therein, radially movable piston plates mounted in said head, spring-actuated plungers carried by the latter, and oblique links connecting directly with each other the neighboring plates which are at an angle to each other for mutually controlling their movements, substantially as set forth.

6. In a rotary engine the herein described casing having a cavity consisting of two substantially circular portions intersecting each other as described, the walls of said cavity being lined at the four quarters contiguous to the points of intersection by the lunes 30, substantially as set forth.

In testimony whereof I affix my signature in the presence of two witnesses.

THOMAS HARDING.

Witnesses:
JAS. S. MCGINNIS,
J. R. KERSHNER.