J. E. SMITH.

DRUM CYLINDER MOTOR.

APPLICATION FILED MAR. 19, 1907.

**899,341.** Patented Sept. 22, 1908.

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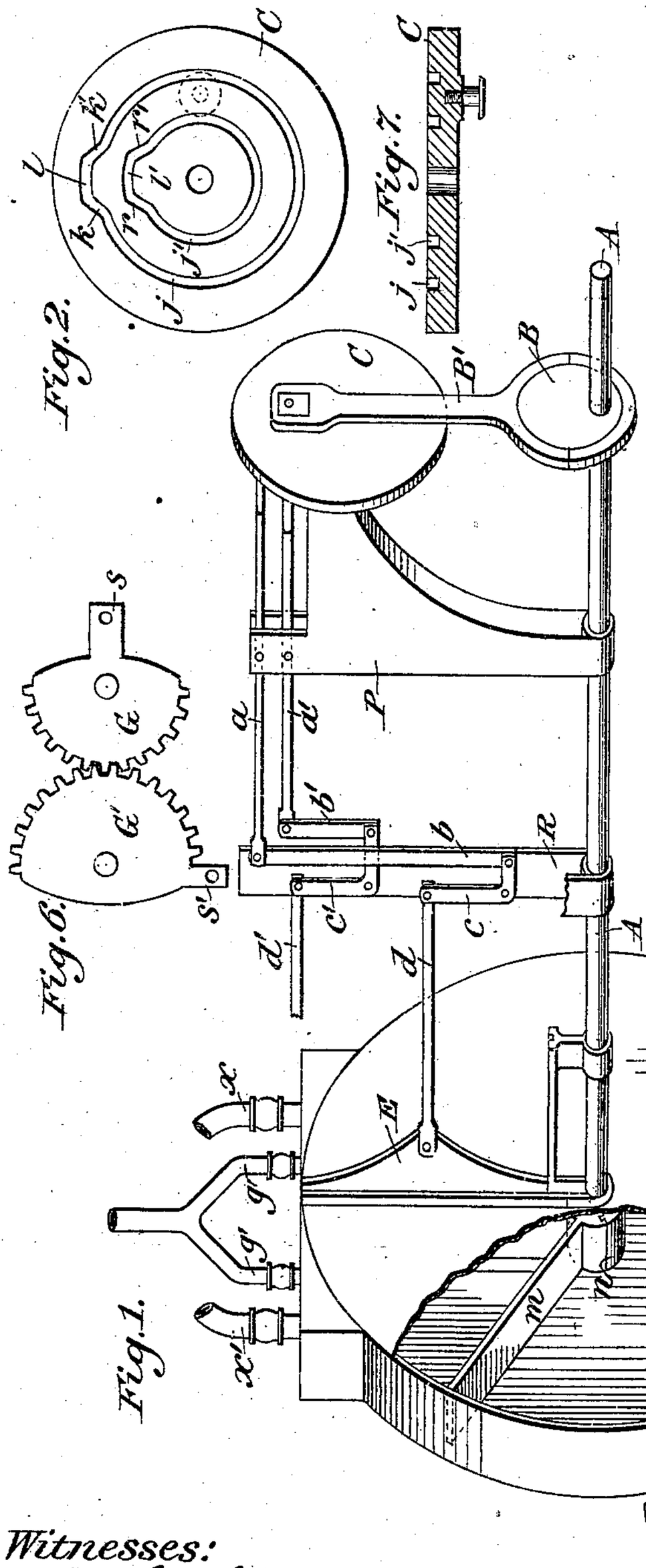











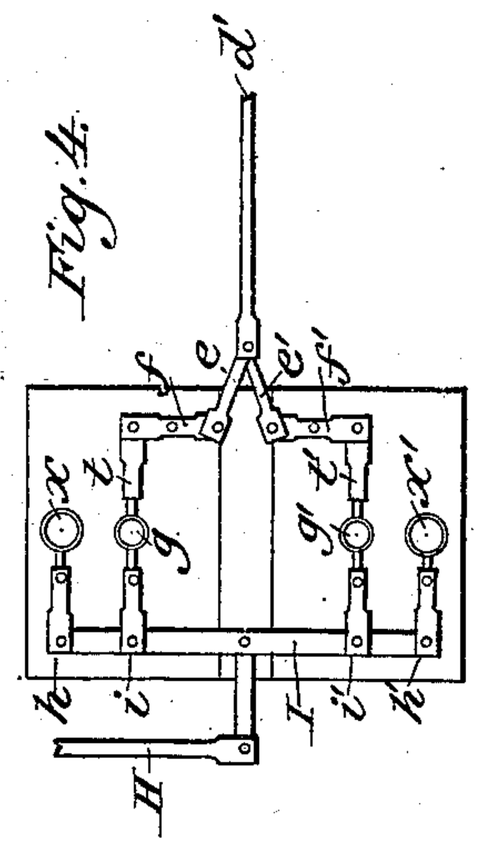


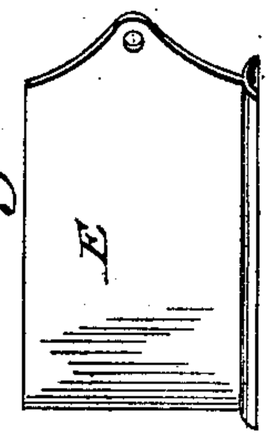


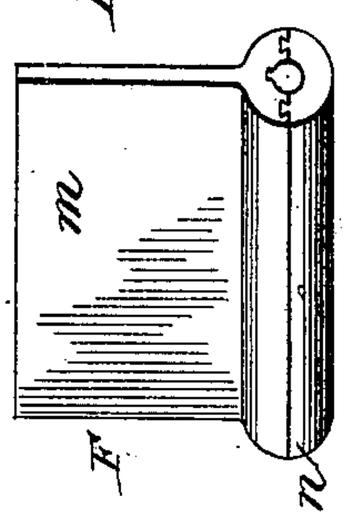


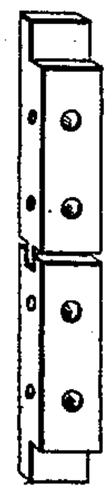


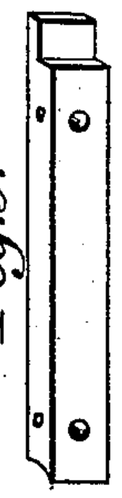


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2 SHEETS—SHEET 2.

Fig. 11.

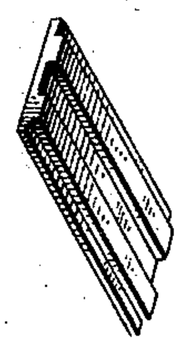


Fig. 12.

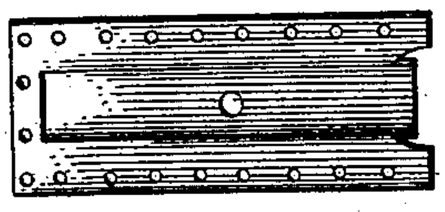


Fig. 13.

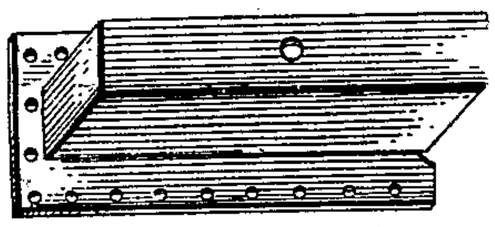


Fig. 14.

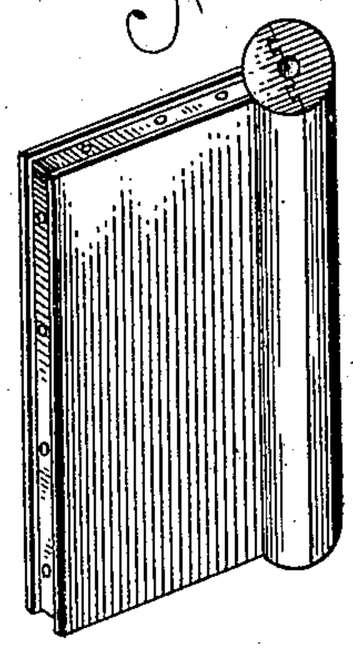


Fig. 15.

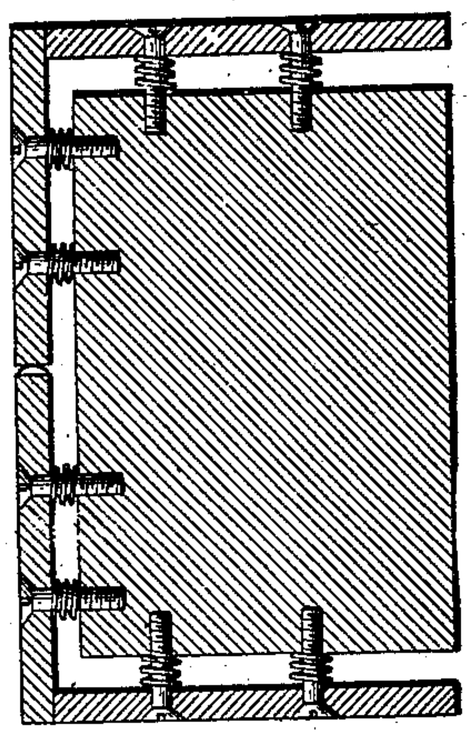
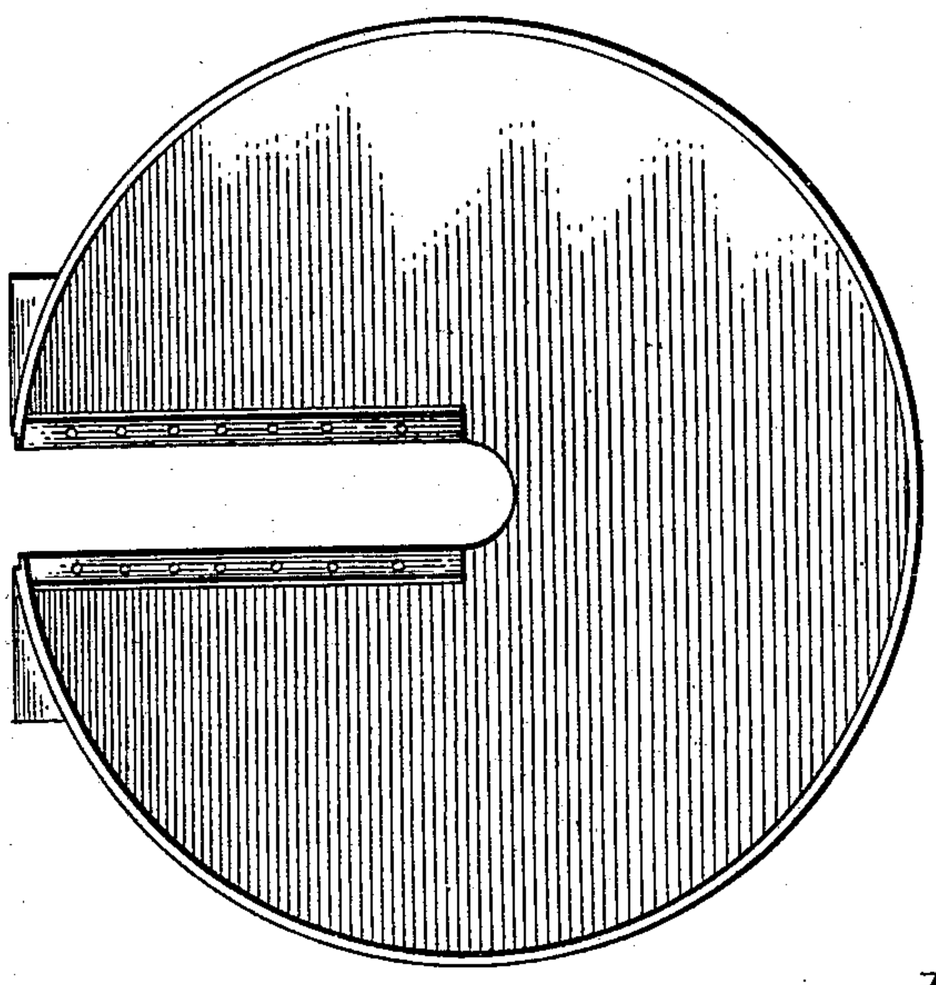


Fig. 10.



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# UNITED STATES PATENT OFFICE.

JOHN ELLSWORTH SMITH, OF KANSAS CITY, KANSAS.

## DRUM-CYLINDER MOTOR.

No. 899,341. Specification of Letters Patent. Patented Sept. 22, 1908.

Application filed March 19, 1907. Serial No. 363,294.

*To all whom it may concern:*

Be it known that I, JOHN ELLSWORTH SMITH, a citizen of the United States, residing at No. 65 South Valley street, Kansas City, in the county of Wyandotte and State of Kansas, have invented a new and useful Improvement in Motors.

My invention relates to a rotary motor, designed to be propelled by pressure expansion of any elastic medium in a drum cylinder, the general objects of my invention are to secure a continuous rotary motion for the propeller; dispense with piston rods and their cumbrous weight and the heavy combinations and connections necessary to utilize such piston power.

Figure 1,— represents a general plan view of the motor with the drum D partly in section. Fig. 2,— is an enlarged representation of the reverse side of the wheel C. Fig. 3,— represents an enlarged outline of the propeller F. Fig. 4,— shows somewhat in detail the rectangular area at the top of the drum D. Fig. 5,— gives an outline of the slide E. Fig. 6,— shows the geared rockers G G′. Fig. 7,— is a rim view of the wheel C in section. Fig. 8 shows an illustration of the strip to be fitted into the groove in the top of the blade *m*. Fig. 9, gives an outline of the strips to be fitted into the grooves in the edges of the blade *m*. Fig. 10, gives an end view of the drum, D, without the removable sections. Fig. 11, shows the inner surface of the top portion of the removable section. The groove is designed to receive the top of the slide E. Fig. 12, is intended to show the inner surface of the section of the reverse head of the drum D. It is recessed to receive the end of the slide E. Fig. 13, shows the combined section and hooded guide for the presenting head of the drum D. It has an opening for the stem of the slide E. The reverse side of this figure is practically as shown in Fig. 13, except the recess is changed to an opening into the hooded guide. Fig. 14 gives an outline of the blade, F, and its hub, showing the linear grooves provided to receive the spring actuated strips. Fig. 15, is an enlarged representation of a section of the blade F, showing the spring actuated strips in position.

In the drawings A A represents the motor shaft from which power may be taken in any manner desired.

B is an eccentric attached to the motor shaft and connected to the wheel C by the bar B′. On the reverse side of C as shown in Fig. 2, concentric grooves of suitable width and depth are provided. The grooved segments *l* and *l′* are concentric but have a greater radii than the grooves *j* and *j′*. The segment *l* is joined to *j* by inclined plane grooves *k* and *k′*, converging towards the segment *l*, and the segment *l′* is joined to *j′* by the inclined plane grooves *r* and *r′* converging towards the segment *l′*. The segments *l* and *l′* are approximately the same length. By this arrangement two separate and complete grooved paths, of suitable width and depth, are provided on the reverse side of C, with special reference to its center, when it is revolved on its shaft by the eccentric B and the connecting rod B′. Into the grooves *j* and *j′* the heads of the bars *a* and *a′* are slidably fitted.

The bars are supported in P as indicated. The rod *b* connects the reciprocating end of the bar *a* to the lower arm of the bell crank *c*. The crank *c* is supported in R by a pin as shown. The upper arm of the bell crank *c* is connected to the slide E by the rod *d*. The rod *d* is given a side adjustment on the lower arm of the bell crank *c* to avoid interfering with the upper arm of the crank *c* and the end of the rod *d*. While the head of the bar *a* is traversing the groove *j*, the slide E will remain stationary in the drum D; but when the head of the bar *a* is engaged by the inclined plane groove *k* a reciprocating motion is secured and communicated to the bell crank *c*, which changes the vertical motion to a horizontal motion and the slide E is withdrawn for the passage of the blade *m* of the propeller F. The slide E remains stationary while the head of the bar *a* traverses the grooved segment *l*, but is again returned to its position in the drum D when the head of the bar *a* passes through the inclined plane groove *k* or vice versa. The action of the bars *a* and *a′* are identical except that the head of the bar *a′* passes into the grooved segment *l′* before the head of the bar *a* is engaged by the inclined plane groove *k;* the segments *l* and *l′* being approximately equal, the head of the bar *a* will pass into the groove *j* before the head of the bar *a′* will engage the inclined plane groove *r′* or vice versa. It is designed to have the reciprocating motion of *a′* not so great as the bar *a*. The bar *a′* is given a side adjustment to prevent interfering with the bar *a*. By the connections indicated the reciprocating motion of the bar

$a'$ is changed to a horizontal motion by the bell crank $c'$ and communicated to the rod $d'$. As shown in Fig. 4 the rod $d'$ is provided with diverging adjustable arms, $e$ and $e'$, connected at convenient angles, right and left, to the horizontal reciprocating bars $f$ and $f'$, which are supported by pins as indicated, and their reciprocating ends suitably connected to sliding valves for the steam ports $g$ and $g'$. When the head of the bar $a'$ passes through the inclined plane groove $r$ the ports will be closed and remain closed through the segment $l'$ and reopened when the head of the bar $a'$ passes through the inclined plane groove $r'$ and remain open through the groove $j'$. Another feature of the steam supply by which it can be changed from $g$ to $g'$, or the reverse, at will, is also shown in Fig. 4.

H represents a section of a rod connecting a reverse lever conveniently located and joined to the reciprocating horizontal bar I as indicated. The bar I is supported by a pin and conveniently elevated above the other structures shown. A suitable connection at $h$ is provided with a sliding valve in the pipe carrying the exhaust from the opening at X and a similar connection is made at $i$ with a sliding valve in the pipe carrying steam to the port $g$, the same connections are arranged and indicated at $h'$ and $i'$ for the exhaust X′ and the port $g'$. When the $h$ end of the bar I is swung towards X this movement will close the valve in the pipe carrying the exhaust from X and open the valve in the pipe carrying steam to the port $g$, the same motion opening the valve in the pipe carrying the exhaust from X′ and closing the valve in the pipe carrying steam to the port $g'$. These steam pipes and exhaust pipes are represented in their approximate positions at the top of the drum cylinder D in Fig. 1. By this arrangement the movement of the propeller F can be reversed at will.

The propeller F, Fig. 3, comprises a blade $m$ and a section of the hub $n$ made in one piece, the other section of the hub being joined thereto by a grooved-tenon device. The hub is supplied with one or more grooves to engage feathers on the supporting shaft. The body of the hub $n$ being made in two equal parts as indicated provides a means of ready adjustment on such shaft. It may prove desirable to have each end of the hub $n$ projected beyond the sweep of the blade $m$ and it may be so arranged instead of as represented in Fig. 3.

To simplify construction and add to the adaptability of the blade $m$ to the drum D a linear groove of suitable width and depth on the top and on each edge including the hub section may be provided on the blade $m$. Into each of these grooves spring actuated strips will be fitted and the resiliency of the springs limited by the heads of set screws countersunk into the strips.

The slide E, Fig. 5, when it is in its proper position in the drum cylinder D, forms a closed space for pressure purposes behind the blade $m$ of the propeller F. It is provided with a concave dependent border, which conforms exactly with the contour of the hub $n$. Suitable guides are arranged for the motion of the slide E.

To minimize the friction of the packing arrangements for the slide E, it may be made with a stem to connect with the bar, $d$, and a closed or hooked guide provided to receive the slide, E. This closed guide will have an opening suitably adapted to the action of such a stem for E.

The drum cylinder D is designed to meet all the working requirements of the ordinary cylinder. Both heads will be made detachable, if convenience of construction should warrant. To facilitate ready adjustment of the drum on its supporting shaft a sufficient portion between the ports $g$ and $g'$ and an equal section on each head to the shaft openings will be made removable. On the head presenting the slide E and its packing arrangements will occupy the space of the removable section. At the top, on the inside of the drum D, a groove and on the reverse head a shallow recess are provided for the action of the slide E within the drum, thus supporting the free end and top for pressure purposes. The drum D will be so arranged in the plane of the described slide opening, recess and groove, by increasing the head to head diameter and the radius, so that the spring actuated strips set in the grooves of the blade $m$ will freely pass. At the top four vertical openings are provided, two on each side of the removable section already described. These openings are in the same plane, having reference to the circumference of the drum D. Externally in Fig. 4 they are identified by the letters $g$ and $g'$, X and X′. A limited representation of the steam and exhaust pipes is also shown at the top of the drum D Fig. 1. There will be a main pipe, with a throttle valve, to a convenient point above the drum, where a communicating pipe is provided for each steam port. Each port pipe is provided with two independent sliding valves conveniently arranged one above the other, the lower valves are suitably connected to the right to reciprocating bars $f$ and $f'$ as indicated in Fig. 4 by the jointed rods $t$ and $t'$ the upper valves have a similar connection to the left to the bar I Fig. 4, by the rods $i$ and $i'$. Each exhaust is provided with an independent pipe to a convenient point above the drum D, Fig. 1, where the independent pipes will communicate with a main pipe. Each exhaust pipe is supplied with a sliding valve and suitably connected to the left to the bar I by the rods

$h$ and $h'$, Fig. 4. Each main steam pipe and each main exhaust pipe will be made adjustable if the mechanical situation requires it. An opening not shown is also provided at the bottom of the drum D and supplied with a suitable valve conveniently connected to drain the drum of any condensed medium.

The geared rockers G and G', Fig. 6 are designed to be used in the place of the bell crank $c$ when the space is too limited for a certain horizontal motion.

I have described all parts practically as they are intended to be utilized, convenience in actual usage may require some minor changes.

I claim and desire to protect by Letters Patent:—

1. A rotary motor having a supporting shaft, an eccentric conveniently attached thereto, the bar of said eccentric being vertically adapted to a rotating wheel bearings for the same; the said wheel having on its reverse face, concentric, with reference to the axis of its revolution, independent annular grooves, said grooves being incomplete in the same segment, concentrically arranged segments of grooves having a greater radii, being independently joined to the said incomplete annular grooves by equilinear diverging inclined plane grooves; the greater of the said grooved tracks, slidably engaging the head of a reciprocating bar, a pin and support for the same, a bar vertically connecting by simple hinge joint attachments, the lower arm of a bell crank, a pin and post for the same, to the free end of said reciprocating bar, the upright arm of said crank being suitably connected by a horizontally arranged bar to a slide, having an inclosed guide with suitable openings, adapted to the movements of the slide, the said slide having a concave bottom, the edges thereof having a limited flare conforming to the contour of a propeller hub.

2. A rotary motor having a supporting shaft, an eccentric conveniently attached thereto, the bar of said eccentric being vertically adapted to a rotating wheel, bearings for the same, the said wheel having on its reverse face, concentric, with reference to the axis of its revolution, independent annular grooves, the said grooves being incomplete in the same segment, concentrically arranged segments of grooves, having a greater radii being independently joined to the said incomplete annular grooves, by equilinear diverging inclined plane grooves, the smaller of the said grooved tracks slidably engaging the head of a reciprocating bar, a pin and post for the same, a bar vertically connecting by hinge joint attachments the lower arm of a bell crank, a pin and support for the same, to the free end of said reciprocating bar, the upright arm of said crank having a suitable hinge joint attachment to a horizontally arranged bar, the other end of the said bar having diverging adjustable arms of equal length separately and suitably connected at convenient angles, right and left, to the ends of horizontal reciprocating bars, pins supporting the same, the remote ends of said bars being suitably connected to the sliding valves of steam ports.

3. In a rotary motor a supporting shaft having one or more feathers at the motor site, a rotary propeller comprising a hub divided on its axis into two equal segments, said segments being held firmly together by a mortise-tenon device, the eye of said hub having one or more grooves engaging the feathers on the supporting shaft a blade projected from one of the said segments at right angles to the faces thereof, the edges of the said blade having linear grooves, spring actuated strips set therein, the said blade and hub being adapted to revolve in a drum cylinder.

4. In a rotary motor a drum cylinder, supports for the same, a shaft carrying a propeller the heads of said drum being adapted for the shaft to rotate therein, the said cylinder having a vertical section with reference to the said shaft, designed to facilitate changing of cylinders, a rectangular area at the top of the said cylinder, vertical openings arranged as shown in the rectangular area said openings communicating internally with the cylinder and externally with pipes having valves suitably arranged, an opening in the bottom of the said cylinder, a valve adapted to the same, a groove at the top on the inner circumference in the plane of the axis of the shaft, a recess in the same plane on the inner surface of the reverse head, a vertical opening in the plane of the radius on the presenting head adapted to the movements of a slide.

5. In a rotary motor a bar one end of which is controlled by a convenient lever, the other end suitably connected to a stem centrally projected at right angles from a horizontal bar, a central pin supporting the same, a suitable connection at each end of the said horizontal bar to sliding valves adapted to exhaust pipes, on the body of the said horizontal bar near each end rods suitably connected to sliding valves fitted in pipes adapted to carry a pressure medium.

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Witnesses:
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