(No Model.)

5 Sheets—Sheet 1.

J. A. HOUSE.

ROTARY ENGINE.

No. 593,219. Patented Nov. 9, 1897.

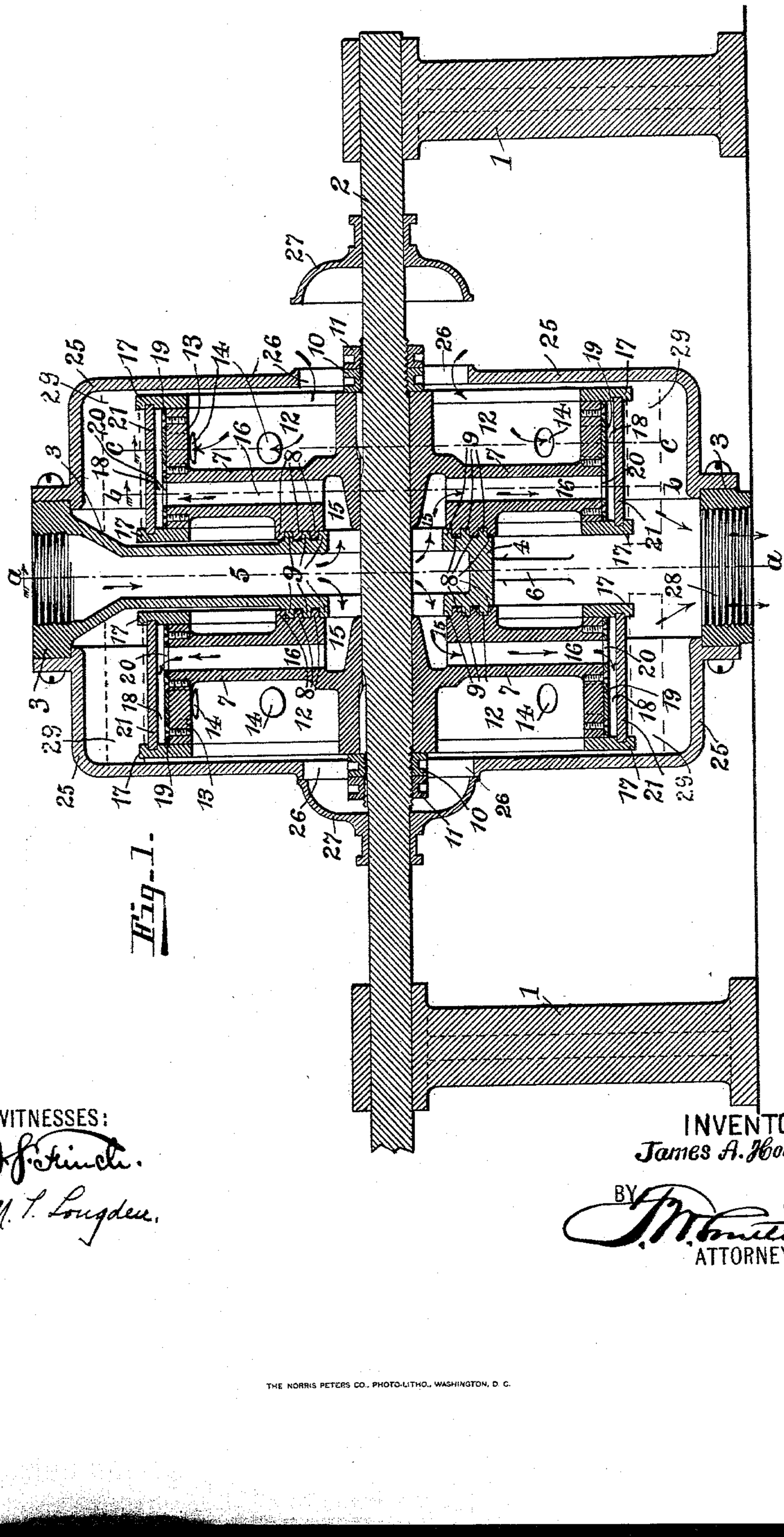

Fig. 1.

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(No Model.)

5 Sheets—Sheet 2.

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ROTARY ENGINE.

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Fig. 3.

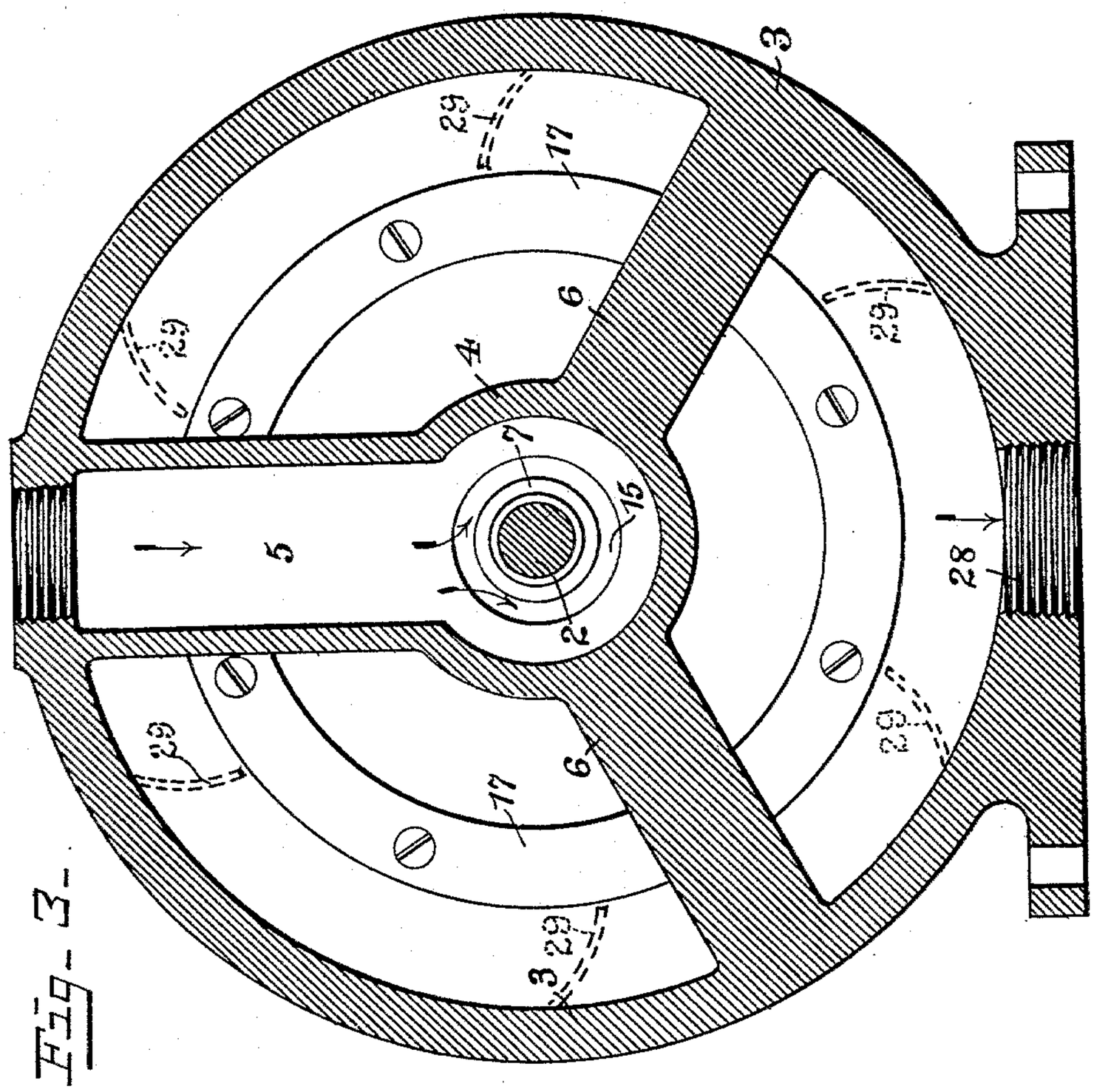
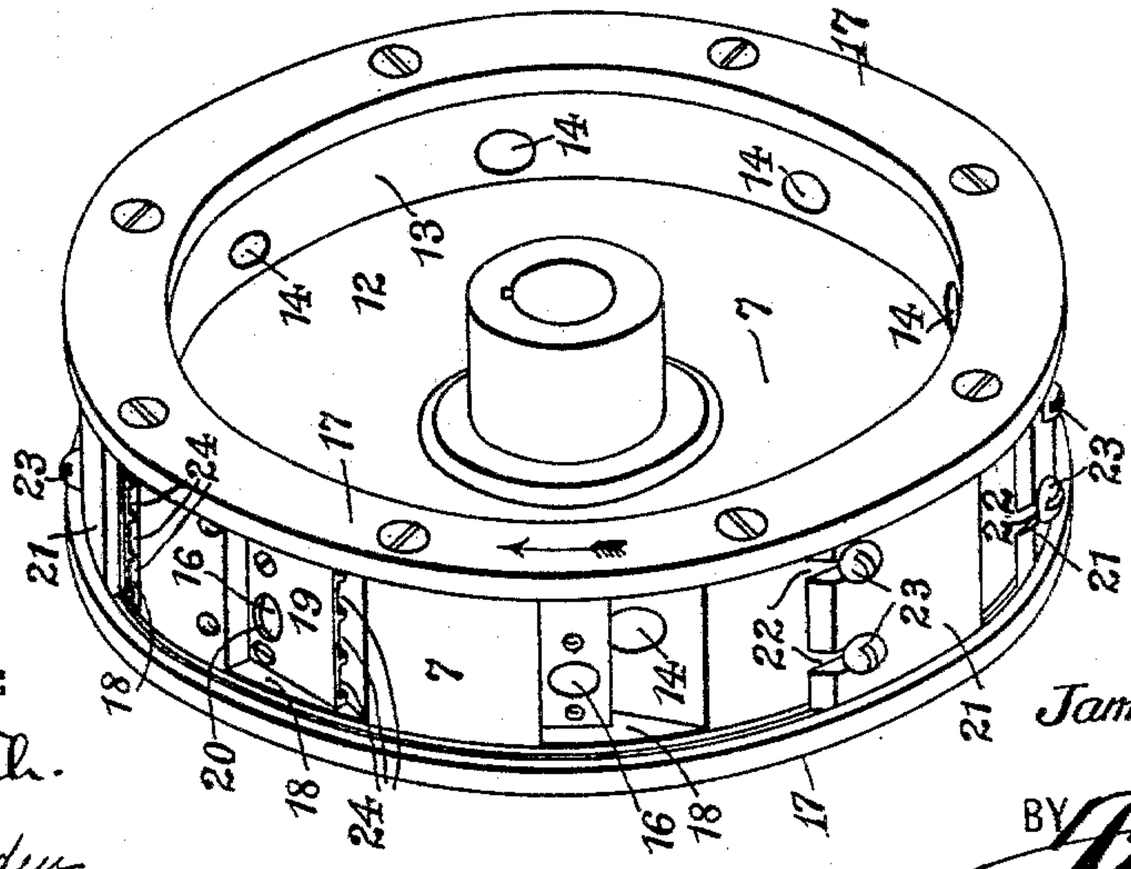


Fig. 2.



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(No Model.) 5 Sheets—Sheet 3.

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ROTARY ENGINE.

No. 593,219. Patented Nov. 9, 1897.

FIG. 5.

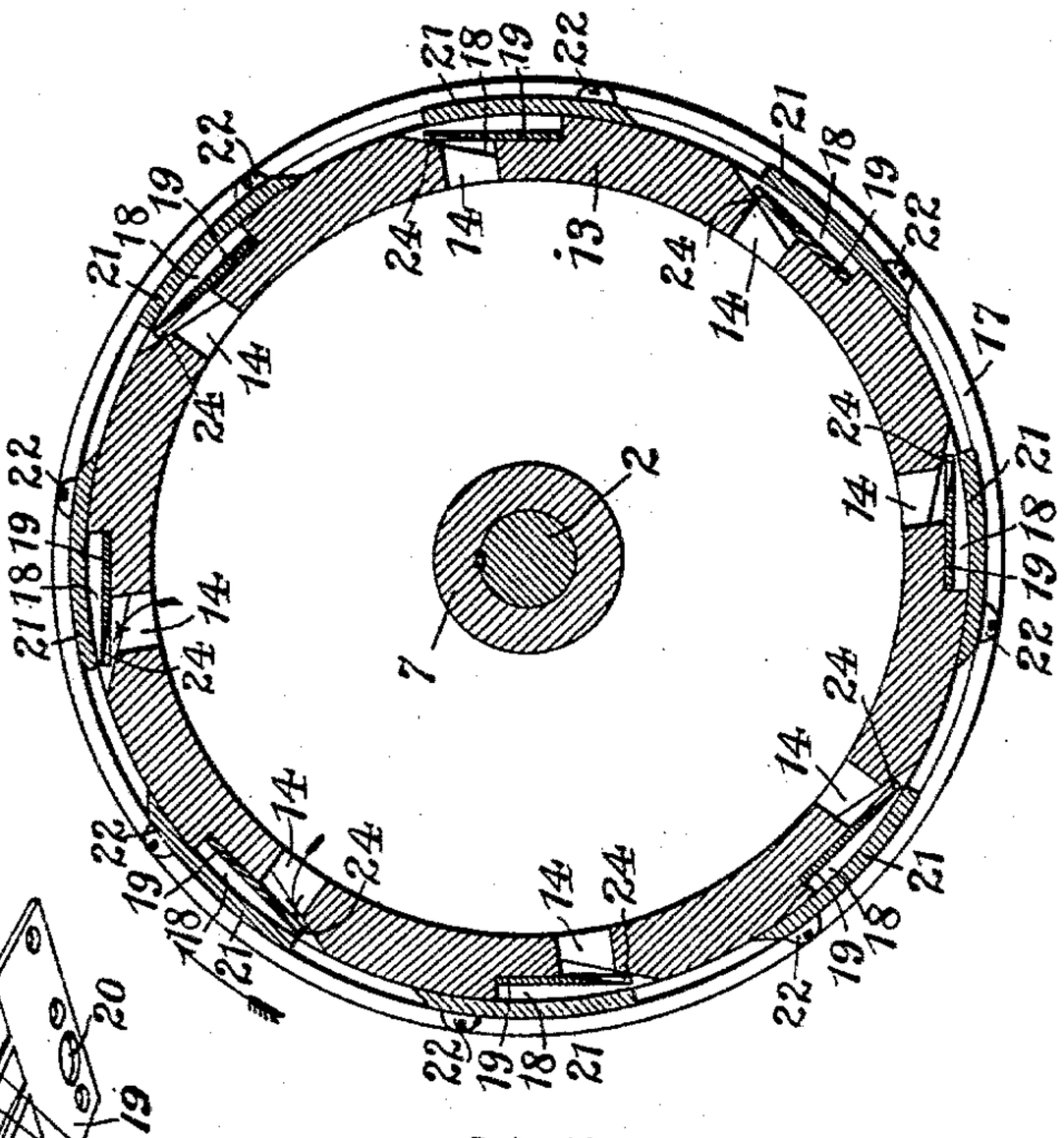


FIG. 6.

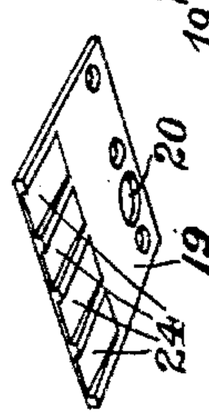
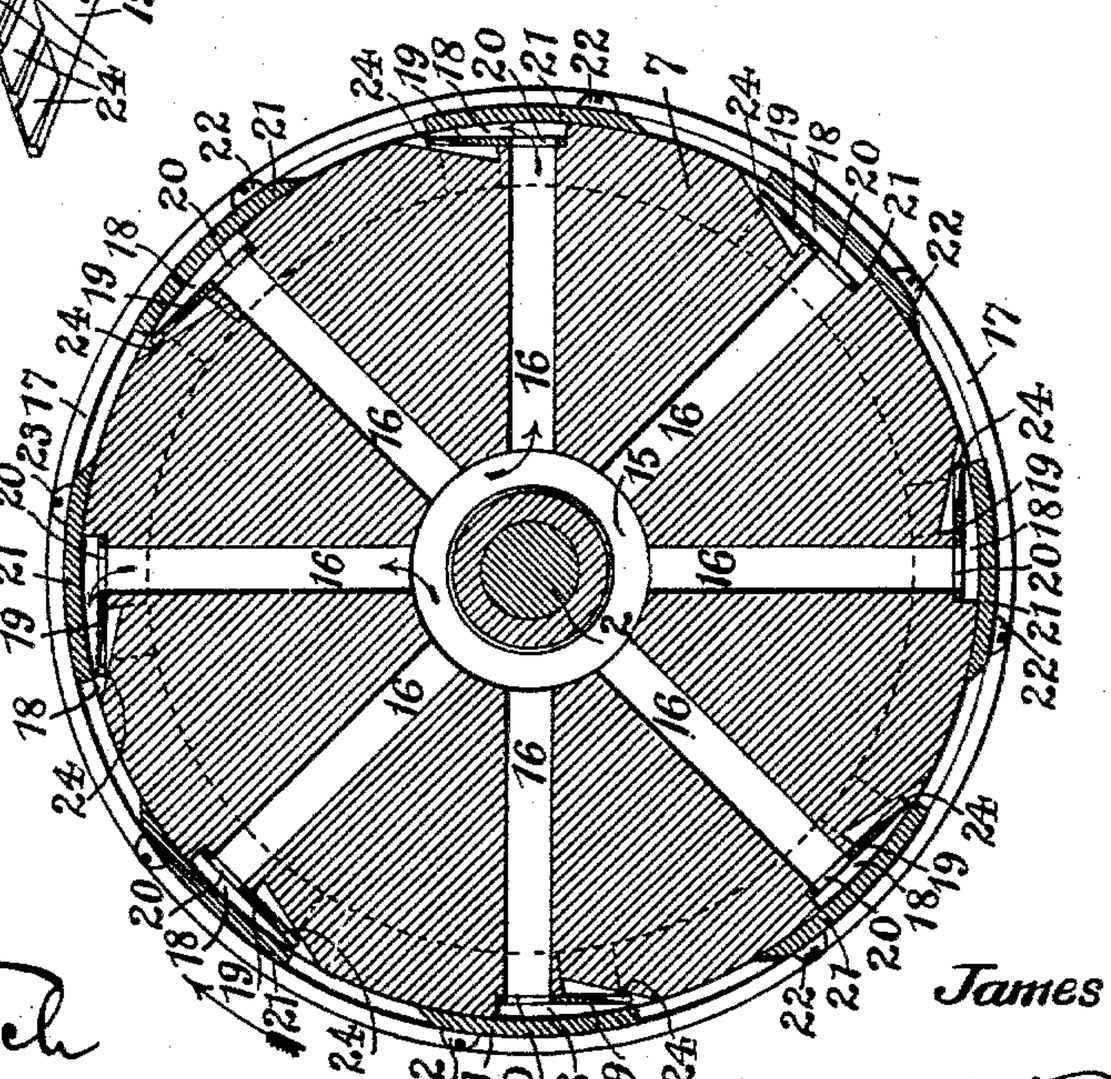


FIG. 4.



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(No Model.) 5 Sheets—Sheet 4.

J. A. HOUSE.

ROTARY ENGINE.

No. 593,219. Patented Nov. 9, 1897.

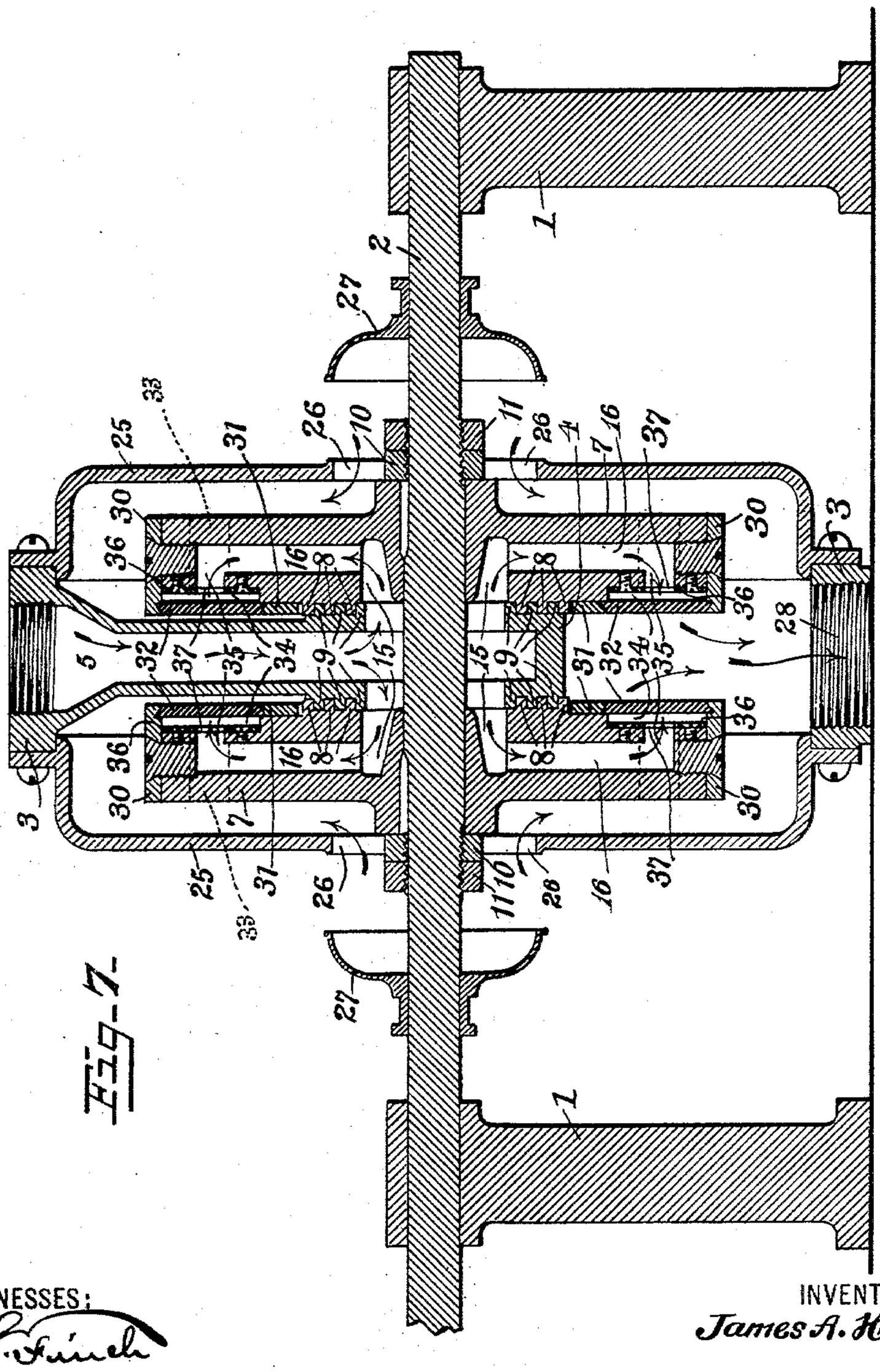

Fig. 7.

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(No Model.)

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ROTARY ENGINE.

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Fig. 8.

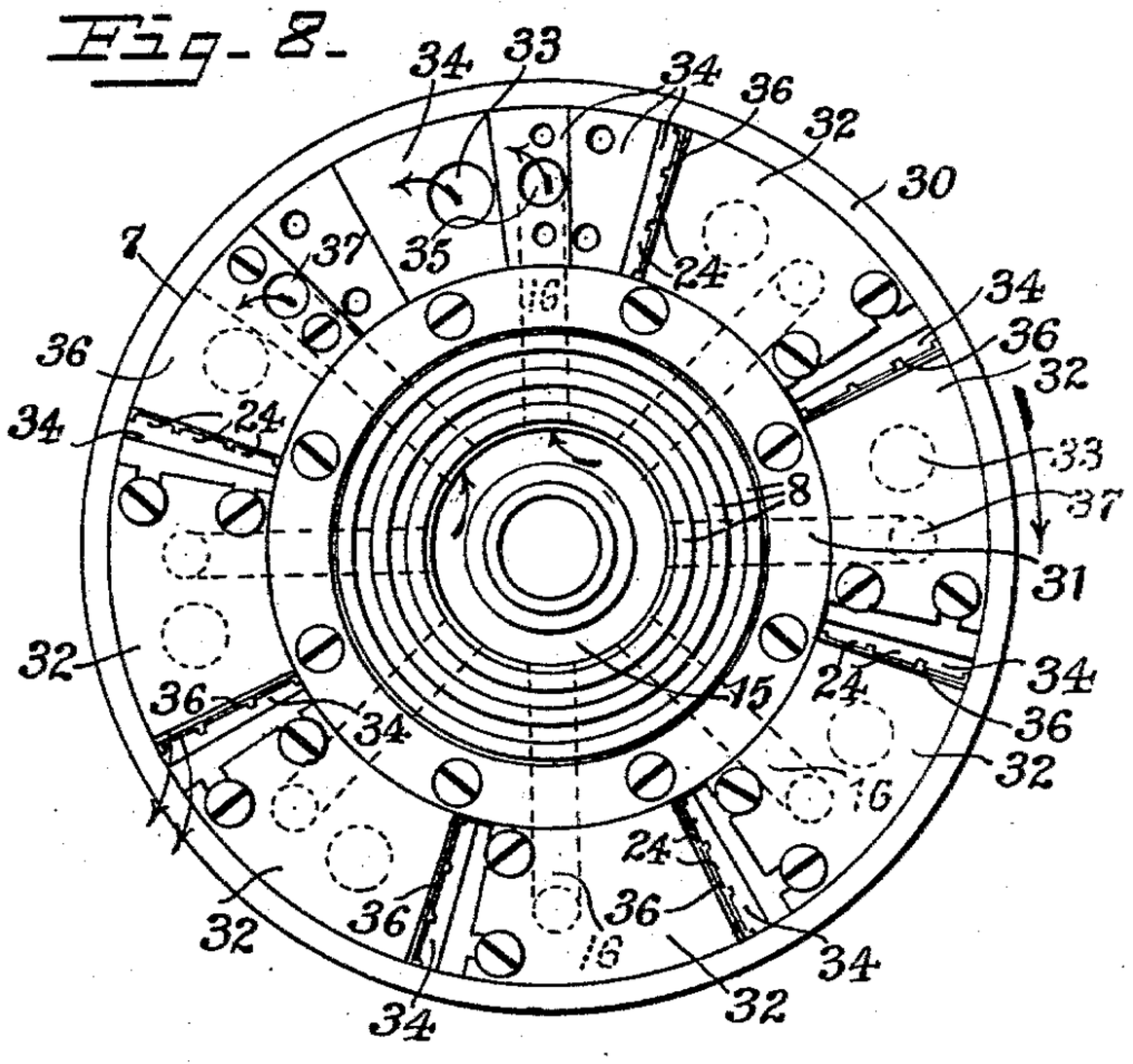
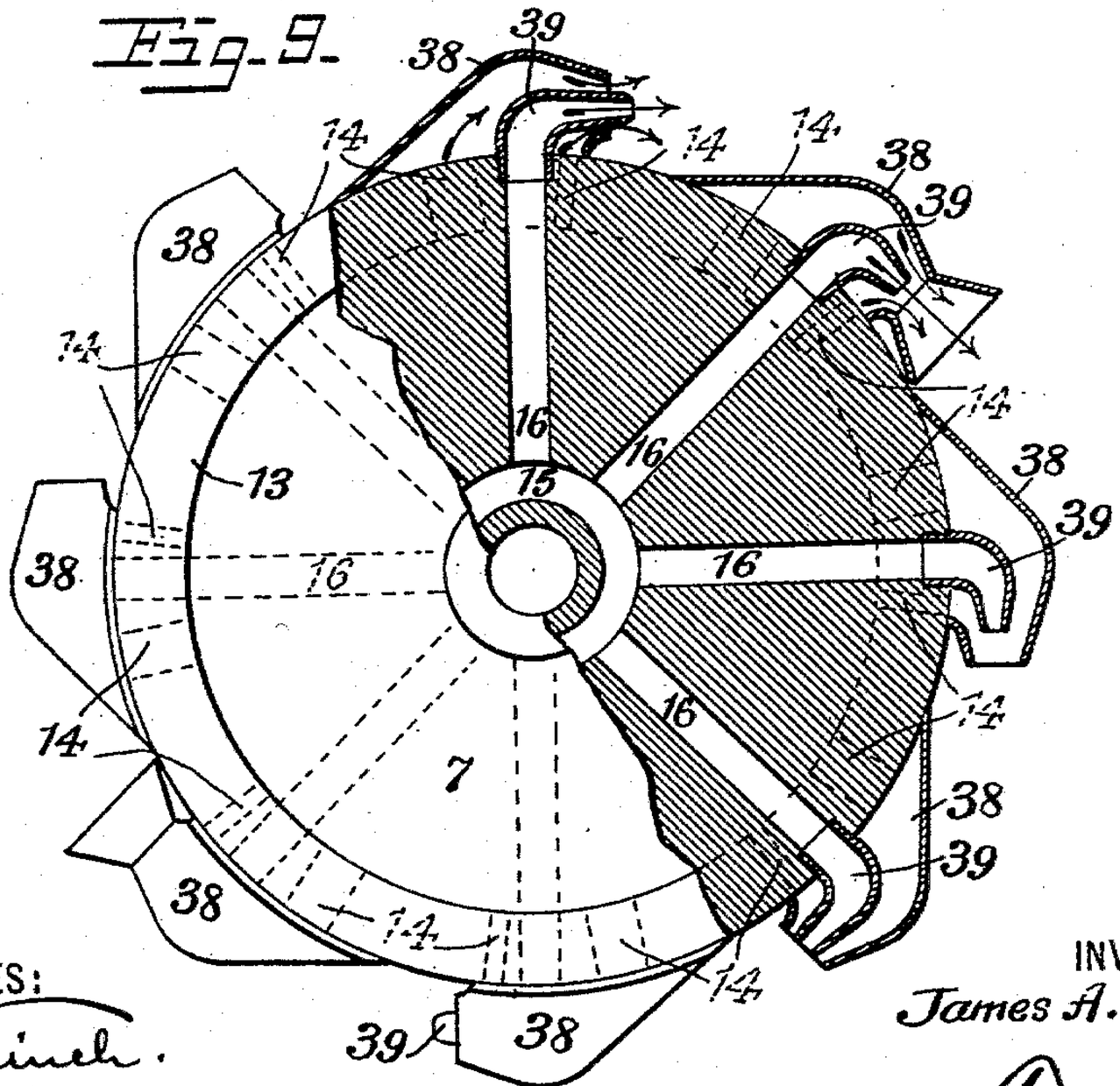


Fig. 9.



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UNITED STATES PATENT OFFICE.

JAMES ALFORD HOUSE, OF BRIDGEPORT, CONNECTICUT.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 593,219, dated November 9, 1897.

Application filed February 8, 1897. Serial No. 622,572. (No model.)

To all whom it may concern:

Be it known that I, JAMES ALFORD HOUSE, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Rotary Engines; and I do hereby 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.

My invention relates to certain improvements in that class of steam-engines known as "rotary" engines; and its principal objects are to render the rotary motion of the engine stronger, steadier, and more powerful than has heretofore been the case in machines of this description.

Further objects of my invention, which, however, contribute to the main objects in view as above specified, are the prevention of the formation of vacuums at the periphery of the rotary wheel where the steam-jets are directed, the adaptation of the engine to steam, hot air, gas, compressed air, &c., and the provision of means for cooling the wheel when steam, hot air, and the like are used as the running agent.

With these ends in view my invention consists in certain details of construction and arrangement of parts, such as will be hereinafter fully set forth, and then specifically be designated by the claims.

In the accompanying drawings, which form a part of this application, Figure 1 is a longitudinal sectional elevation of my improvement; Fig. 2, a detail perspective of the wheel; Fig. 3, a section at the line *a a* of Fig. 1; Fig 4, a section at the line *b b* of Fig. 1; Fig. 5, a section at the line *c c* of Fig. 1; Fig. 6, a detail perspective of one of the partition-plates which divides the pockets on the periphery of the wheel into air and steam spaces; Fig. 7, a view similar to Fig. 1, but showing the arrangement of steam and air passages for discharging the steam and air through the sides of the wheels; Fig. 8, a detailed side elevation of the wheel shown at Fig. 7 and illustrating particularly the location of the discharge-nozzles for the steam and air, and Fig. 9 a detailed broken sectional elevation of a wheel and showing particularly modified forms of discharge-nozzles for the steam and air.

Similar numbers of reference denote like parts in the several figures of the drawings.

1 are any suitable supports within which is journaled the shaft 2.

3 is a frame through which said shaft passes freely, said frame being bolted to any suitable standard or platform. (Not shown.) This frame is open and of circular shape and has a hollow hub 4, from which a tubular passage-way 5 leads radially out through the rim of said frame.

6 are ordinary strengthening-spokes which extend from said hub to the rim of said frame.

7 are wheels splined on the shaft 2 on opposite sides of the frame 3, and 8 9 are a series of raised annular ribs projecting toward each other from the contiguous sides of said wheels and frame, respectively, said ribs being concentric with each other and with the axis of the shaft 2.

10 11 are respectively jam and lock nuts on the shaft 2 and driven against the outer faces of the hubs of the wheels 7, whereby the latter are forced inwardly, so that the ribs 8 9 will interlock, as shown in Fig. 1; but although said ribs interlock there is no actual contact between them, since their construction is such that there will be a very small space between all the interlocking surfaces of these ribs, so that there can be no undue friction to oppose the revolution of the wheels. This construction of interlocking ribs is quite ordinary and is commonly called a "slip-joint" to prevent the leakage of steam, air, and the like, especially when the wheels are capable of a slight play lengthwise on the shaft, owing to centrifugal tendencies during rotation, and therefore it is not deemed necessary to enter into any further or detailed description of this joint, especially since any ordinary and suitable steam-joint may be used in this connection. The outer faces of these wheels are cored out, as seen at 12, thus leaving rims 13 at the outer circumferences of the wheels 7, and through these rims extend perforations 14. Annular recesses 15 are formed at the centers of the wheels, which recesses lead into the hollow hub 4 and are therefore in direct communication with the passage-way 5. 16 are ports which extend ra-

dially from these recesses out through the peripheries of the wheels. It will thus be clear that there is a continuous closed duct leading down through the passage-way 5 into the hollow hub 4, thence laterally into the recesses 15, and thence upwardly through the ports 16 to the peripheries of the wheels.

In carrying out my invention the steam, compressed air, or other agent is introduced down through the passage-way 5 and is discharged through angularly-directed nozzles at the peripheries of the wheels, so that the impact of such steam or other agent against the atmosphere will produce a reaction and cause the rotation of the wheels, and I will now describe the manner in which I provide for this discharge of the steam.

Secured to opposite sides of each wheel are rings 17, whose peripheries project beyond the peripheries of the wheels. Pockets 18 are formed across the peripheries of the wheels, the area of such pockets being such that a perforation 14 and port 16 open into the same pocket.

19 are partition-plates which are each provided with perforations 20, which register with the ports 16, said plates being screwed or otherwise secured to the peripheries of said wheels in such manner as to provide a separate inner chamber in each pocket, with which chambers the perforations 14 communicate.

21 are cover-plates which are secured within suitable ways between the rings 17, said plates being provided with elongated slots 22, through which screws 23 are driven into the peripheries of the wheels in order to secure these plates in position immediately above the pockets and partition-plates. This will practically divide these pockets into two compartments, into one of which lead the steam-ports, while the perforations 14 lead into the other compartment, and there is a slight space between the cover-plates and the partitions and between the floor of the pockets and the partitions, so that outlets are afforded through the rims of the wheels.

In order that the pressure of the steam in the outer compartment may not deflect the partition-plates down against the floor of the lower compartment, so as to cut off all communication between the latter and the outside air, I channel out the inner faces of these plates, as shown at 24 and in detail at Fig. 6, so that should said plates be deflected there will still be adequate space for the discharge of air or any other agent out through the inner compartment. Of course should it be ascertained that the normal outlet for the steam was too great or too little this may easily be remedied by loosening the screws 23 and sliding the cover-plates 21 to a proper adjustment, whereby a greater or less space may be left for the discharge of the steam.

The perforations 14 are preferably slightly in advance of the steam-ports 16, for the purpose presently to be explained.

25 are side casings which are secured to the sides of the frame 3 and are open at the center, as seen at 26, in order to afford ample communication between the outside atmosphere and the perforations 14, and 27 are caps which are capable of sliding freely along the shaft 2 and which are employed for the purpose of closing the openings 26 or for clogging the same should the occasion arise.

28 is the exhaust, which I locate, preferably, at the bottom of the casing.

The discharge-outlets for the air and steam in the rims of the wheels are in reality tangentially-directed nozzles, and while I have shown and described peripheral pockets in the wheels within which the steam and air ports lead, this construction, although preferable, is by no means absolutely necessary to the successful operation of my improvement, the gist of which in this respect rests in the broad idea of discharging the steam or other driving agent through nozzles which are so deflected or angularly disposed as to effect the rotation of the wheels, owing to the impact of such agent against the surrounding air. Also it will be clear that the discharging of the steam across the outlet for the air will induce current of the latter, so as to insure a steady rush of air out through the rims of the wheels to counteract the disadvantages of the natural vacuum formed by the revolution of the wheels, and while greater efficiency as to strength and steadiness of revolution of the wheels is obtained by locating the discharge-orifices for the air in front of the steam-discharging nozzles, in that it affords, as it were, a column against which the steam may have impact, nevertheless if the steam and air were commingled at the point of discharge, so that they would be expelled together, the revolution of the wheels would be materially stronger and steadier than would be the case if the air were entirely dispensed with. Moreover, it will be obvious that, although the air will prove a valuable auxiliary to the steam in revolving the wheels, provided that the discharge-nozzles for the air are substantially tangential to the rims of the wheels, nevertheless the disadvantages of the vacuum in close proximity to the wheels would be obviated if the air-ports discharged radially through the rims of the wheels, and therefore I do not wish to be limited in this respect.

The best results are undoubtedly obtained by directing the discharge-nozzles for the air and steam tangential to the rims of the wheels; but the latter will be revolved when said nozzles are merely angularly disposed—that is to say, when they are not directed in radial lines from the center of rotation—it being only necessary that these nozzles should point in a direction reverse to that in which the wheel revolves.

In rotary engines a water-jacket is almost indispensable to obtain good results in instances where hot air or gas is used as the

agent whereby to drive the wheels; but it is extremely difficult to provide for such a jacket without greatly increasing the weight and resistance to be overcome in revolving the wheels; but in my improvement my air-ports are arranged and disposed with the especial end in view to properly cool the rims of the wheels, and in this connection it will be clear that I can easily regulate the temperature of the air which is drawn in through the openings 26 in the side casings.

The construction which I have shown and described comprises two wheels which are each arranged on a common shaft of rotation, and the engine is therefore properly balanced and symmetrical; but of course the number of wheels is immaterial, and it would be very easy for an ordinary mechanic to construct an engine using a single, double, triple, or even quadruple arrangement of wheels, but always providing for the taking in and discharging of the steam or air or both, in substantially the manner hereinbefore described, without being called upon to exercise any inventive ability whatever, and I shall therefore make certain claims to my invention irrespective of the number of wheels employed.

From the foregoing description it will be clear that the proper supply of air and steam and their delivery out through the rims of the wheels constitute the chief and most valuable features of my invention; but right at this point I desire to call attention to the fact that the steam and air ports may lead out through the sides of the wheels instead of through the peripheries, the provisions for the proper angular discharge of the steam and air being substantially the same as in the instance where the nozzles are at the peripheries of the wheels, and in this respect I do not wish to be limited except as to the provision of discharge-nozzles which are angularly directed with respect to the radii of the wheels, or, in other words, which point in a direction opposite to that in which the wheels revolve. I have therefore illustrated in Figs. 7 and 8 the manner in which I would preferably provide for the discharge of the steam and air through nozzles opening into the side of the wheel, and in this connection I would state that I employ precisely the same construction and arrangement of pockets, partition-plates, and cover-plates as that heretofore described with respect to the discharge of the steam and air through the rim, the only difference being that the air-openings and steam-ports extend through the sides of the wheel into the pockets instead of through the rim of the wheel. In this construction I secure a tire 30 around the periphery of the wheel and also secure a ring 31 to the side of the wheel, and within suitable ways in this tire and ring I locate and fasten cover-plates 32, which tire, ring, and cover-plates perform the same functions as the rings 17 and cover-plates 21 heretofore described. Through the sides of the wheel are the air-openings 33, which lead into the pockets 34, located in this instance in the side of the wheel, while the steam-ports 16 are deflected, as seen at 35, so as to lead into said lateral pockets. Partition-plates 36, perforated, as seen at 37, to register with the outlets of said steam-ports, are secured to the side of the wheel, so as to separate the pockets 34 into two compartments, as heretofore described, and in connection with the cover-plates provide discharge-nozzles for the steam and air.

It will thus be obvious that the construction shown at Figs. 7 and 8 can hardly be called a modification of my invention, since it contemplates in reality a mere change in the direction of the air and steam ports, and the object of the illustrations is merely to show the great facility with which my improvement is adapted for discharging the air and steam through the sides of the wheel.

To those versed in steam-engineering it will be clear that the particular form and construction of discharge-nozzles for the steam and air are quite immaterial, although possibly some forms are to be preferred to others. Therefore, although I have shown and described the construction which embodies the pockets, the cover-plates, and partition-plates, which is an exceedingly efficient construction, there are many ways in which the proper discharge of the steam and air may be provided for, and I have therefore seen fit to illustrate in Fig. 9 several modified forms of nozzles, which I will now describe.

The construction and arrangement of steam-ports and air-openings are precisely the same as shown at Fig. 1. The pockets for the steam and air outlets as shown at Fig. 1 are within the circumference of the wheel, but in Fig. 9 these pockets, which in this instance might be more properly termed "hoods," are secured to the periphery of the wheel and extend therefrom, as shown at 38, and within these hoods the perforations 14 lead. The steam-ports terminate in nozzles 39, and the outlets to these hoods also form nozzles which extend in the same direction with the nozzles 39.

I have found that various changes may be made in the shape of the hood and in the relative arrangement of the nozzles which are immaterial so long as the nozzles are so disposed with respect to each other that the steam will maintain an induced current of air while both nozzles shall point in a direction reverse to that in which the wheel revolves. For instance, referring to Fig. 9, it will be observed that the uppermost steam-nozzles project slightly beyond the nozzle of the air-hood, while the steam-nozzle to the right of this is entirely within the hood, the latter being provided with a flared mouth, and it will also be observed that the steam-nozzle to the extreme right is inclosed by the hood without the flared-mouth construction, while the nozzle immediately below this extends flush with the mouth of the hood.

It is not deemed material to enter into any discussion of the relative merits of these nozzles, since they are all serviceable and are, moreover, well known, and it will accordingly be apparent that the particular construction of nozzles for the discharge of the steam and air is immaterial so long as the relative arrangement of said nozzles be such that a current of air is induced by the jet of steam discharged.

As a motor my construction is more efficient than most rotary engines, even when I entirely dispense with the arrangement whereby the air is supplied and delivered. By this I do not mean to be understood as saying anything to lessen the vast superiority and importance of the construction which I have heretofore described and which is shown in the drawings; but I mean that I have demonstrated by actual use of my improvement that if the caps 27 are so adjusted and arranged as to completely close the openings 26 the exhaust-steam, after passing through the nozzles, will be drawn inwardly through the spaces between the rings 17 and side casings 25, and thence outwardly through the perforations 14, so as to effect substantially the same result in connection with the live steam as is effected by the air when these openings are not closed. When my improvement is used with a condenser as a condensing-engine, these openings necessarily are closed as against the inlet of air, and the live steam then induces a current of exhaust-steam up through the perforations 14, and it will therefore be clear that my improvement, without any structural change whatsoever, may be used with similar beneficial and purely characteristic results, both as a condensing-engine and as a non-condensing engine. I therefore do not wish to be limited to the induction by the live steam of air or any particular agent up through the perforations 14, nor do I wish to be limited to any special construction or provisions for the induction of such agent, except that such agent must be delivered in proximity to the steam-outlet nozzles, so that a current of such agent may actually be induced.

When raised, peripheral pockets or hoods are provided, as shown at Fig. 9. The spaces between these hoods or pockets are practically so supplied with the induced agent that the steam-jets will meet with sufficient resistance to effect a strong and speedy rotation of the wheel.

I have heretofore said nothing concerning the employment of buckets properly supported and arranged in close proximity to the nozzles to afford substantial impact surfaces for the steam or air; but these buckets may of course be employed without departing from the spirit of my invention, although, especially in the small-sized motors, it would probably never be deemed advisable ever to use these buckets. I have shown such buckets in dotted lines in Figs. 1 and 3 and have denoted the same by the numeral 29.

As before stated, in order to utilize the supply of air or exhaust-steam as an auxiliary in the revolution of the wheel the relative arrangement of the live-steam nozzles and the discharge-outlets for the air or exhaust-steam must be such that the discharge of the live steam will create and keep up an induced current of air or exhaust-steam, and the best results are obtained by locating the air or exhaust-steam outlets slightly in advance of the live-steam nozzles; but it is nevertheless true that a current will be induced by the live steam if the outlets for such air or exhaust-steam are substantially at the same point with the live-steam nozzles, or, in fact, even if such outlets are slightly in the rear of said nozzles, and therefore I desire to be understood in this particular as claiming such a relative arrangement of said outlets and nozzles as would cause the induction of the air or exhaust-steam current, for if such arrangement be new in a generic sense in devices of this description I am entitled to such a claim.

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

1. In a rotary engine, the combination of a rotary wheel provided with interior closed passages and revolving in a vertical plane, means for supplying live steam within said passages, angularly-directed outlets to such passages, and additional openings in said wheel having no communication with said passages but located in advance of said outlets and communicating with the exhaust-steam that has been discharged and has effected its function, whereby a current of exhaust-steam will be induced through said openings by the discharge of the live steam, substantially as set forth.

2. In a rotary engine, the combination of the rotary wheel provided with interior closed passages, means for supplying steam within said passages, nozzles angularly disposed with respect to radii of the wheel and into which said passages lead, air-ports communicating with the outside atmosphere and opening in proximity to the extremities of said nozzles whereby the steam from the latter will create and maintain an induced current of air through said openings, substantially as set forth.

3. In a rotary engine, the combination of the rotary wheel provided with interior closed passages into and through which steam is admitted and directed, said wheel being also provided with air-chamber communicating with the outside air and with openings leading from said chamber in close proximity to the outer ends of said passages, and angularly-disposed nozzles into which said passages lead and through which the steam is expelled in close proximity to said air-open-

ings whereby a current of air is induced, substantially as set forth.

4. In a rotary engine, the combination of the rotary wheel having an annular recess at its hub and provided with ports which extend radially from said recess out through the rim of the wheel, said wheel having an air-chamber and openings leading therefrom through the rim of the wheel, pockets formed in said rim and into which said ports and openings lead, the partition and cover plates carried by said wheel whereby said pockets are divided into two compartments into which said ports and openings respectively lead and whereby tangentially-disposed nozzles are formed, and means for supplying steam within said recess, substantially as set forth.

5. In a rotary engine, the combination of the rotary wheel provided with interior closed passages, means for supplying steam within said passages, nozzles angularly directed with respect to radii of the wheel and into which said passages lead, air-passages within the wheel communicating with the outside air and terminating in angularly-directed nozzles in close proximity to the steam-nozzles whereby the steam from the latter will induce a current through the former, substantially as set forth.

6. In a rotary engine, the combination of the rotary wheel provided with interior passages opening through the rim of the wheel, means for supplying steam within said passages, perforations extending through the rim of the wheel and having at their inner ends communication with the outside air, and tangentially-directed discharge-nozzles for said passages and perforations, the extremities of said nozzles being in close proximity to each other whereby the discharge of the steam will induce a current of air through said perforations, substantially as set forth.

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

JAMES ALFORD HOUSE.

Witnesses:

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J. D. CARR.