(No Model.) 3 Sheets—Sheet 1.

E. A. EDWARDS.

STEAM MOTOR.

No. 505,350. Patented Sept. 19, 1893.

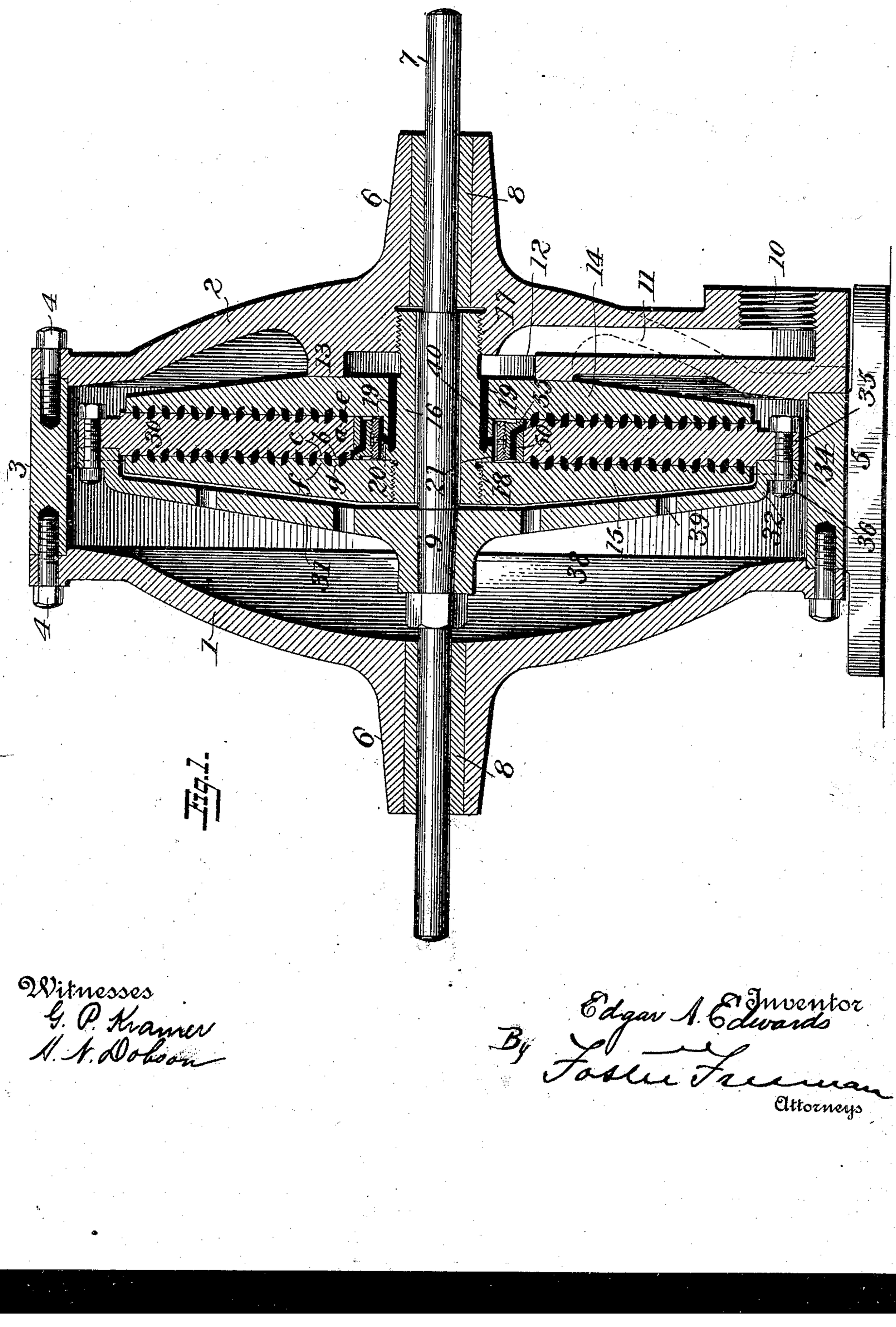

Fig. 1.

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(No Model.)

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Fig. 2.

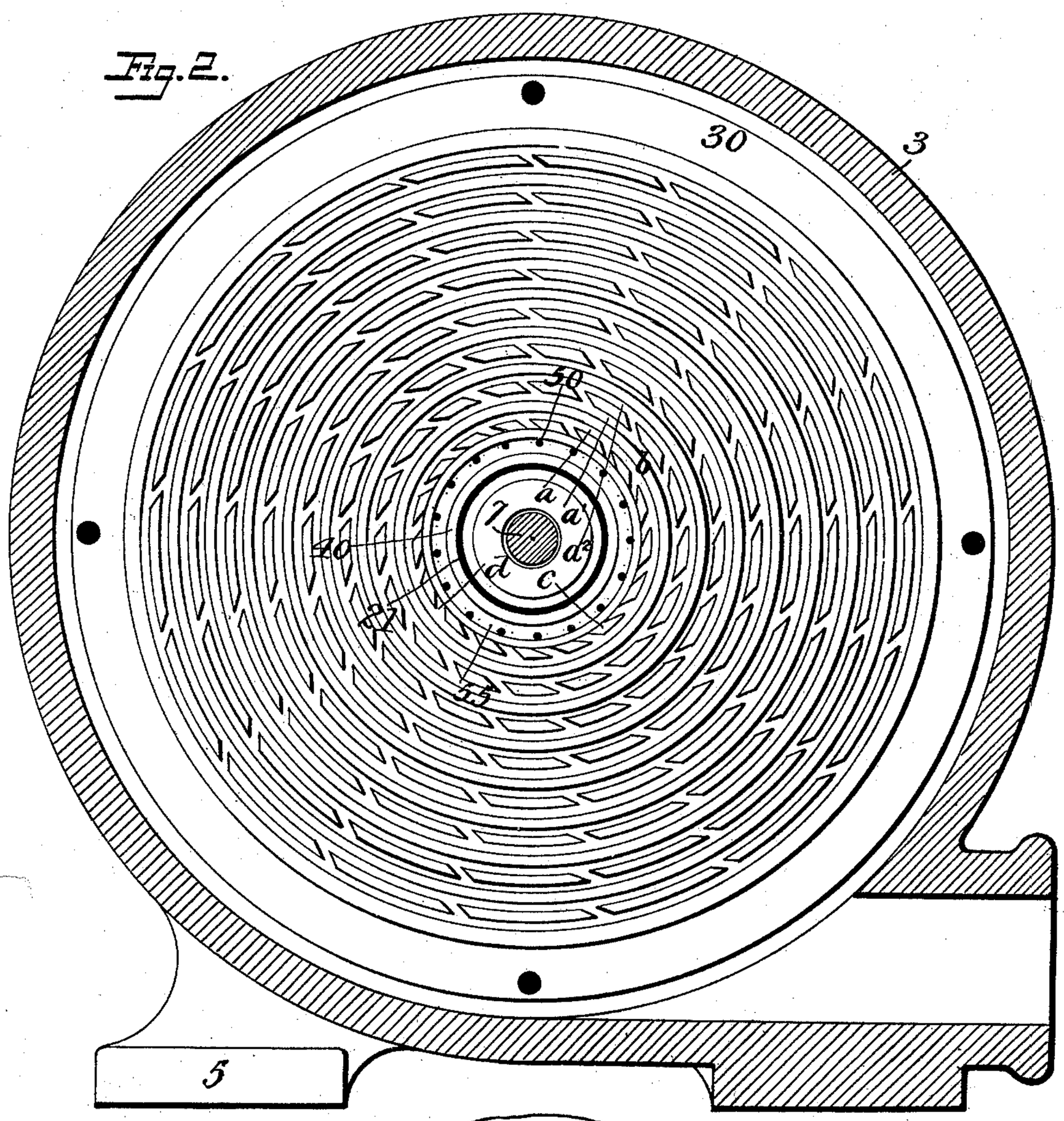
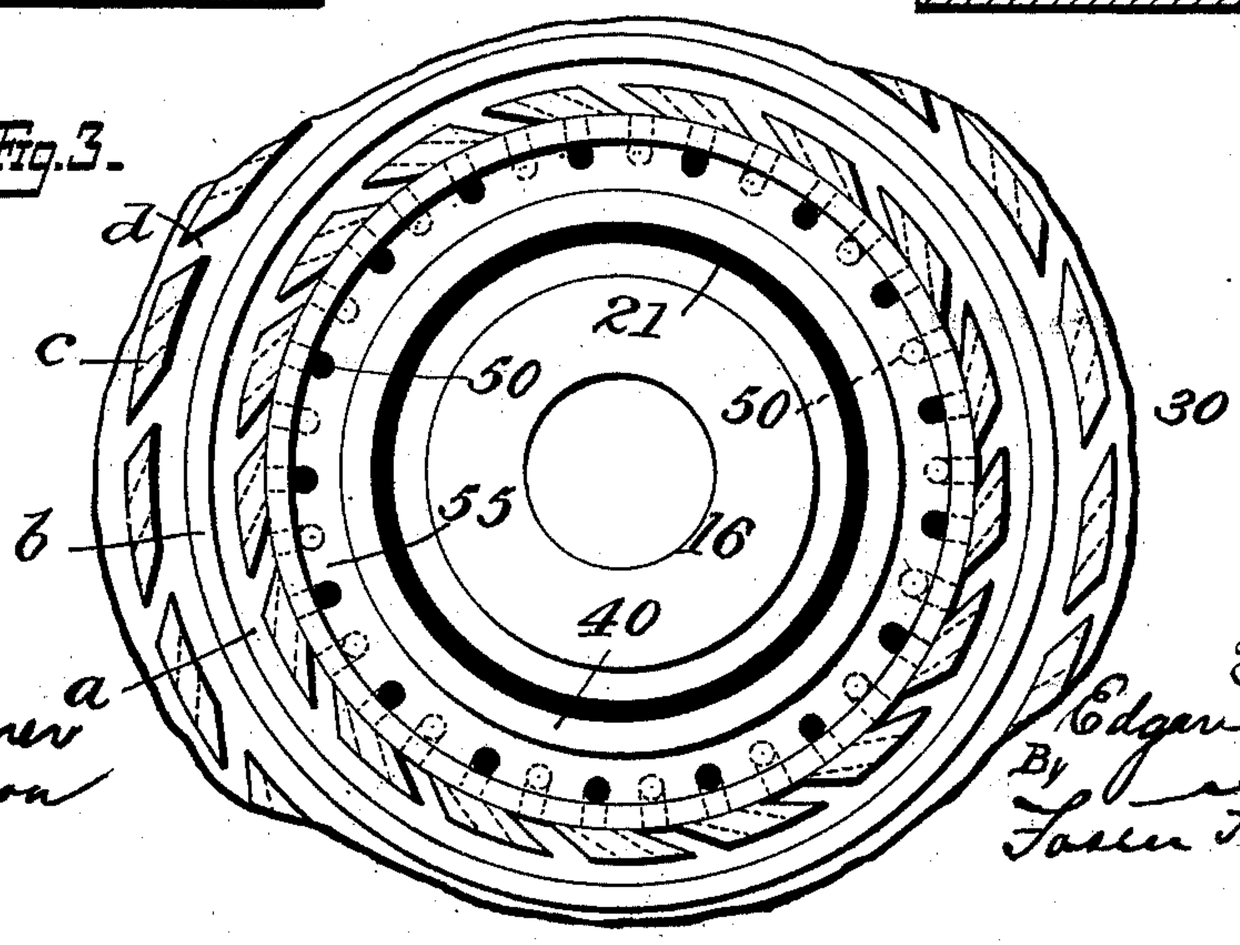


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 4.

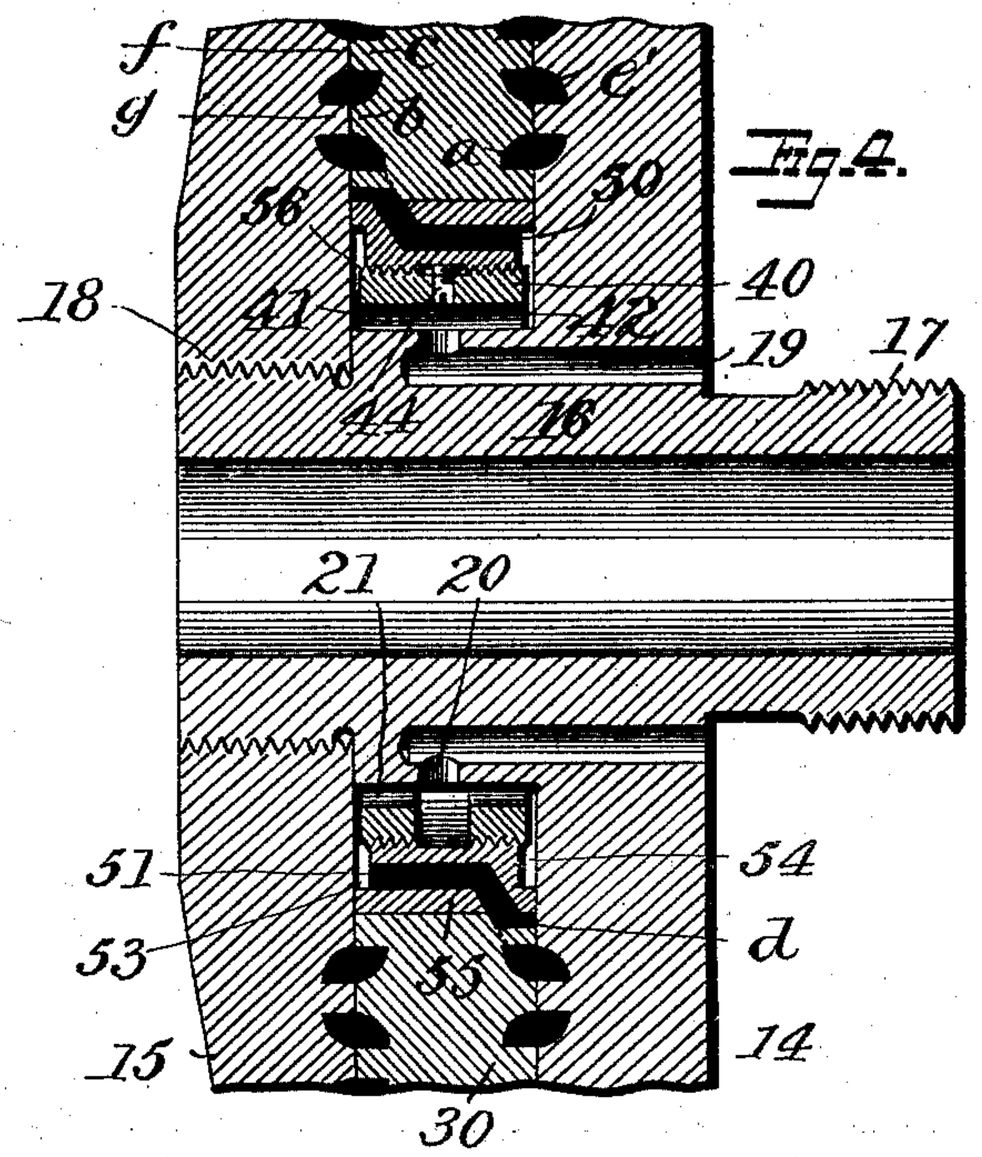


Fig. 5.

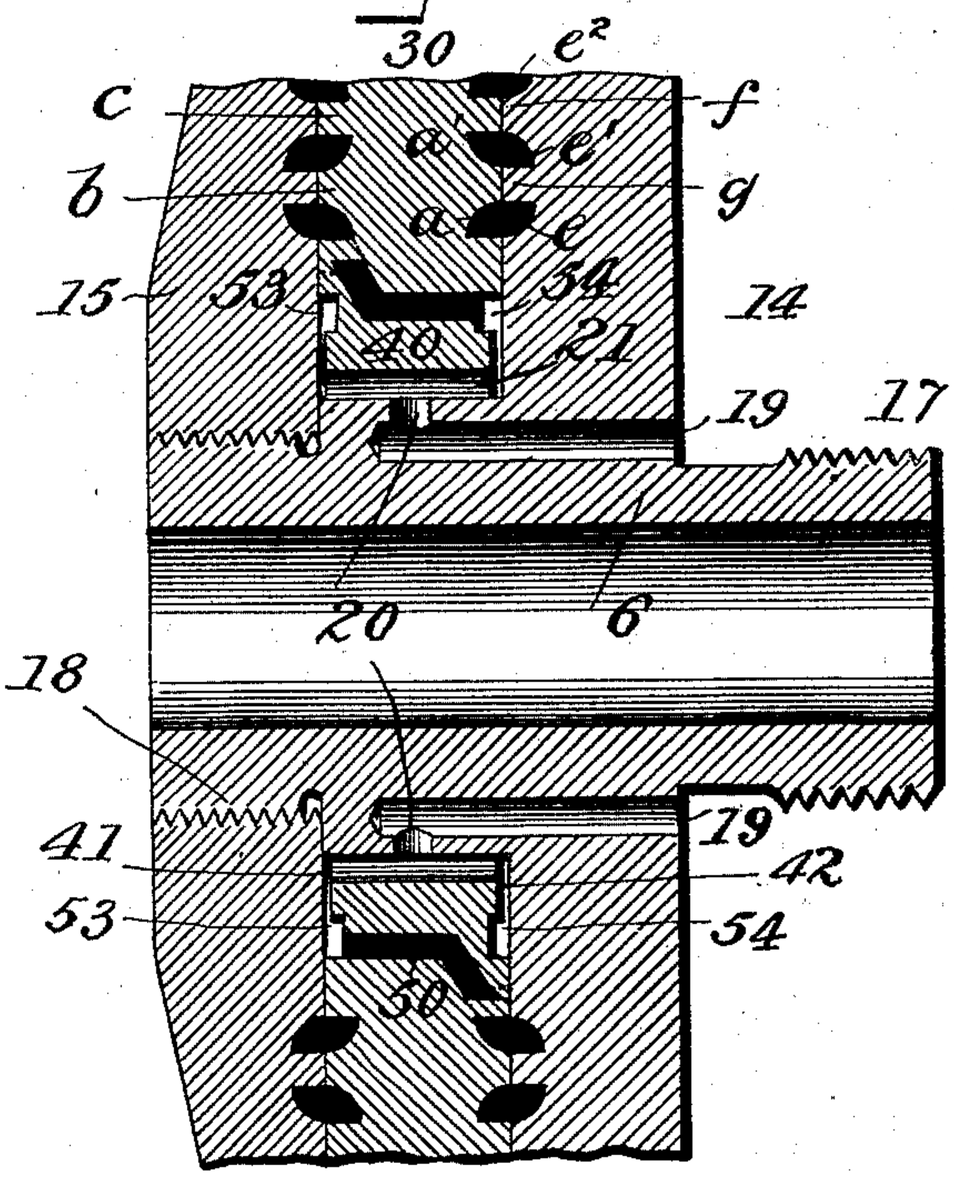
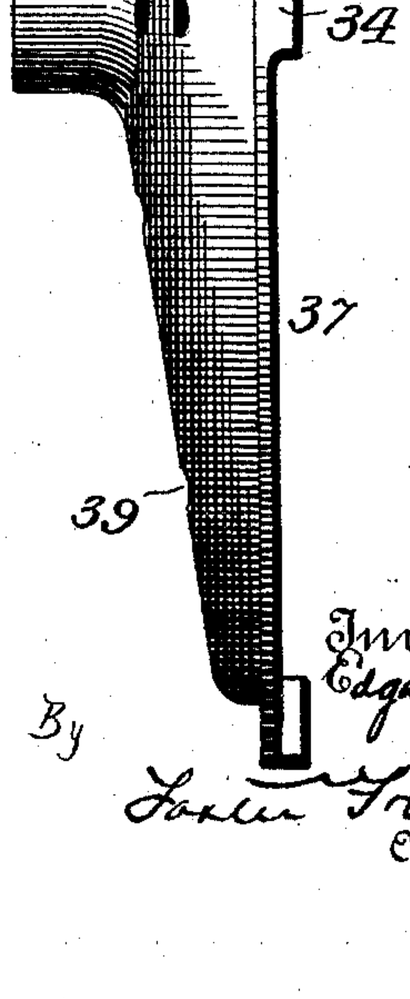


Fig. 6.



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UNITED STATES PATENT OFFICE.

EDGAR A. EDWARDS, OF CINCINNATI, OHIO.

STEAM-MOTOR.

SPECIFICATION forming part of Letters Patent No. 505,350, dated September 19, 1893.

Application filed June 9, 1893. Serial No. 477,076. (No model.)

To all whom it may concern:

Be it known that I, EDGAR A. EDWARDS, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Steam-Motors, of which the following is a specification.

My invention relates to what are broadly known as "steam motors," and more particularly to that class of steam motors which involve what is commonly understood as the "turbine" system of impact and reaction, such for instance, as is shown, described and claimed in my prior patent, No. 485,536, dated November 1, 1892.

The object of my invention is to improve the construction, arrangement and working of this class of devices, as more particularly hereinafter set forth, and my invention consists in the various features of construction and arrangement of parts, having the mode of operation substantially as hereinafter described.

Referring to the accompanying drawings, Figure 1, is a longitudinal, vertical section of a motor embodying my invention. Fig. 2, is an elevation of the wheel, with the heads of the case, carrier and one of the stationary disks, removed. Fig. 3, is an enlarged view of a portion of the same. Figs. 4, and 5, are enlarged detail sectional views, showing the balancing devices; and Fig. 6, is a side view of the carrier.

One of the main objects of the invention of a motor of this character, is to produce a motor which shall be relatively exceedingly small, compact, simple and cheap, and which shall have comparatively great efficiency, and in order to do this, it is necessary that the motor operate at an exceedingly high rate of speed. It is well known that any body rotating at a high rate of speed, in order to operate effectively, without injury or excessive wear, requires to be exceedingly well balanced, and the more nearly a perfect balance of the rotating parts is attained, the more satisfactory are the results. In constructing a motor of the class described, I first provide a practically perfect mechanical balance to the rotating portion, so that the tendency to get out of balance, or to vibration, or other disarrangement, is reduced to the smallest extent possible. It is found, however, that even with a practically perfect balance, while rotating at a high rate of speed, under the pressure of the motor fluid, there is a tendency under some conditions to disturb the balance.

In the embodiment of the invention illustrated herein, the rotating portion of the motor is arranged with relation to the fixed portions so that there is an exceedingly small clearance or space between the parts, in actual practice amounting, in some instances, to only one and one-half thousandths of an inch, and the necessity of not only a perfect mechanical balance, but a perfect fluid pressure balance to the rotating portion, will be apparent, and it is one of the principal objects of my present invention to provide means whereby the motor fluid pressure shall operate to automatically maintain a practically perfect steam balance of the rotating parts, so that under all conditions of operation, the rotating parts will not come in frictional contact with the stationary parts, and the greatest efficiency and least wear are attained.

In the present application, I have illustrated and will now proceed to describe the construction and arrangement of parts of what I consider to be a practically perfect embodiment of my invention, but it will be understood that the details of construction and arrangement can be varied by those skilled in the art, to suit the various purposes to which my invention is applied, without departing from the general principles thereof, and I do not, therefore, limit my invention to the construction and arrangement illustrated, or the use specifically set forth.

The motor shown in the drawings is provided with a suitable casing, forming an internal chamber, in which the operative parts of the motor or engine are inclosed, and I have shown this casing as consisting of the heads 1, 2, united by a ring or short cylinder portion 3, the parts being secured in any suitable way, as by bolts 4. In order to support the motor, the ring or cylindrical portion of the case is provided with a suitable base 5, by which the motor may be supported in any proper position. The heads 1, 2, are extended laterally in opposite directions to form bearings 6, 6, through which passes a shaft 7, suitable bearing sleeves 8, being interposed be-

tween the shaft and bearings in the heads. The head 2, is provided with a suitable inlet 10, for the steam or other motor fluid, and from this inlet there is a passage 11, extending to an annular recess 12, for distributing steam or motor fluid, in the manner hereinafter set forth. This head is also provided in the present instance with an extension or ring 13, against which one of the stationary plates bears, forming a steam-tight joint.

The operative parts of the engine consist, substantially as indicated in the patent before referred to, of two plates which are fixedly mounted within the chamber of the case, the adjacent faces of which are provided with a series of annular recesses or grooves, and a propelling wheel or wheels suitably mounted to rotate within the space between the stationary plates, and having its two faces similarly grooved or recessed to correspond with the grooves in the fixed plates.

The fixed plates 14 and 15, may be mounted in various ways, and I have shown a convenient, simple and effective means of mounting them, in which the plate 14, is provided with a hub 16, having lateral extensions one of which is screw-threaded at 17, and secured in the head 2, while the other end is screw-threaded at 18, and receives and forms a support for the fixed plate 15. In this way, both plates are securely held in their proper position within the chamber, the hub 16, supporting the plate 14, which is preferably integral with the hub, and the plate 15, which is mounted thereon. The hub is provided with a series of passages 19, extending from the annular chamber 12, parallel to the shaft, where they meet radial passages 20, opening into what may be termed the "steam chest" 21. While more or less passage-ways may be made, in the present instance I have shown a large number to furnish a free conduit for the steam from the annular chamber to the steam-chest.

Suitably mounted on the shaft 7, is a support or carrier 31, for the propeller wheel 30, and I have shown it as consisting of a plate having a hub provided with a tapering opening adapted to fit closely upon the tapering portion 9, of the shaft 7, it being preferably held in place by a suitable nut or other equivalent means. This carrier is provided with a laterally extending flange 32, having a radially extending rim or flange 33, to which the propeller wheel 30, is secured in any suitable way. In the present instance, I have shown the rim or flange 33, as having lugs or plates 34, fitting an extension 35, on the wheel 30, being secured thereto by suitable bolts 36, while the flange is cut away between the lugs or plates, as at 37, furnishing a free passage for the exhaust steam into the exhaust chamber 38. Suitable openings 39 are formed in the carrier to preserve the steam balance.

The faces of the propeller wheel are provided with suitable grooves, and the adjacent faces of the stationary plates are provided with similar grooves, as fully set forth in my prior patent above referred to, and I do not deem it necessary to describe the exact relations of these grooves, with the same detail as they are described in said patent, but it is sufficient to say that the propeller wheel 30 is provided with a number of grooves a, a', a^2, &c., on each face, producing a series of concentric rings, b, c, &c., and these rings are alternately complete rings and segmental rings, the rings b, being complete, while the rings c, are made up of sections or segments having grooves d, between the segments, the grooves being shown at an angle to the radial lines of the wheel. The adjacent faces of the stationary plates are provided with similar grooves e, e', &c., separated by complete rings, f, f', and segmental rings g g', the segments being separated in turn by angular grooves corresponding to the grooves in the propeller wheel. The grooves in the wheel and plates correspond in position and are at the same regular distance from their axles, while the complete rings on the wheel correspond with the segmental rings in the plates, and the complete rings in the plates correspond with the segmental rings in the wheel. From this arrangement of the rings and grooves on the propeller wheel and fixed plates, it will be seen that the steam from the steam chest 21, finds a series of passages to the exhaust chamber, and these passages are formed by the complementary grooves and rings. The steam first acts upon the inclined faces of a series of segments in the wheel, exerting a tendency of rotation by the impact of the steam, and then similarly on the inclined faces of a series of segments in the plates, tending to rotate the wheel by reaction, so that the wheel is under a tendency to rotate both from the impact of the steam upon the segments of the wheel, and the reaction of the steam upon the segments on the stationary plates.

As intimated in my prior patent, the wheel and fixed plates are so formed and adjusted that there is a certain amount of clearance between their adjacent faces, which in practice varies within certain limits, preferably being about one and one-half thousandths of an inch on each face of the wheel, when in operative condition, due allowance being made in setting up the engine, for the expansion of the metal.

One of the main features of my present invention is to provide means to maintain this clearance and to so arrange the devices that it shall be automatically maintained by the pressure of the steam, and thus provide a perfect fluid pressure balance to the rotating portion of the motor, as hereinbefore pointed out. In the present case, I have shown a means which I have found exceedingly effective in accomplishing these results, and I provide what I term broadly a "valve" 40, which is arranged to control the passage of the steam from the steam-chest 21, to the grooves and passages in the faces of the pro-

peller wheel and stationary plates. This valve 40, is shown in the form of a ring, being of a width a little less than the width of the space between the stationary plates, and I have shown it connected to the propeller wheel and rotating therewith, and having steam passages or ports 41, 42, on each side of the valve between the edges of the ring and the walls of the stationary plates.

In order to produce the proper balancing effect, it is necessary that the steam which passes through one of the ports or passages, as 41 for instance, should pass through the grooves in the opposite plate and the face of the wheel adjacent thereto. Thus, for instance, the steam passing through the passage or port 41, should act on the grooves in the plate 14, and the adjacent face of the wheel, and the steam passing through the port or passage 42, should act on the grooves and segments of the plate 15 and the adjacent face of the propeller wheel, and in order to permit this, it is necessary to provide suitable passages through the propeller wheel from side to side. These transverse passages 50, 51, are shown as being formed in opposite sides of the propeller wheel, extending partially therethrough, in axial lines, with their ends curved upward, opening into the spaces *d*, of the wheel, and in order to have a free and even distribution of the steam, I preferably form grooves 53, 54, in opposite sides of the wheel with which these passages connect.

In Fig. 4, I have shown these transverse passages as being formed in the separate and independent steam passage ring 55, mounted on the propeller wheel, between the inner periphery thereof and the valve 40, and while under some circumstances, this is a preferable construction, it is evident that the passages can be formed integral in the ring, as shown in Fig. 5, and it is further evident that the valve itself may also be formed integral with the wheel, as shown in said Fig. 5. When, however, the parts are made separate, as shown in Fig. 4, the steam passage ring 55, may be secured to the wheel in any suitable way, as by forcing it in tightly, where it is held by friction, or by using set screws, or other means, and the inner periphery thereof is preferably screw-threaded, as shown at 56, and the outer periphery of the valve 40 is similarly screw-threaded, so that the valve ring can be accurately and delicately adjusted in proper position, and be secured by any suitable device, as the screws 44, and in this way, an exceedingly accurate adjustment may be readily attained. When, however, the valve ring and transverse steam passage ring are formed integral with the wheel, it is only necessary that they be accurately turned and adjusted, so as to not only maintain the mechanical balance of the wheel, but to permit a perfect steam balance, allowing the passage of the steam through both ports in absolutely equal quantities, so that the steam balance will be maintained under all conditions. As above intimated, the steam passage ring 55, may be formed integral with the wheel, and the valve ring may be independent and adjustable thereon in the manner shown in Fig. 4, it being immaterial as far as its adjustment is concerned, whether the steam passage ring is integral with the wheel or not. The valve, instead of being a single ring, may be made in two portions, each adjustable, as shown in the lower portion of Fig. 4.

As above indicated, there is a certain amount of clearance between the propeller wheel and the stationary plates, and this permits a certain proportion of the steam to pass directly between the wheel and plates, so as to form what may be termed a "steam cushion," and as the steam, for instance, passes through one of the ports, as 42, a portion of it will pass directly up between the wheel and the stationary disk 14, while the bulk will pass through the transverse passages 50, into the grooves in the opposite side of the wheel, and in the stationary disk 15. Thus it will be seen that there is always more or less steam passing directly from the ports to the clearance space on the same side of the propeller wheel, sufficient to maintain a practical steam cushion. From this construction it will be understood how the steam balance is maintained automatically, and it is only necessary to state that the steam from the steam-chest 21, passes through the ports 41, 42, on either side of the valve, a portion going directly to the clearance space, forming the steam cushion, while the bulk passes through the corresponding passages 50, 51, to the grooves in the stationary disks and the adjacent surfaces of the wheel, and it will be seen that if an equal amount of steam passes through both ports, the wheel will be maintained in proper balance. If, however, from any cause, less steam passes through one of the ports, as for instance, port 41, an excess of steam will pass through the opposite port, as 42, and thence passing through the passages 50, will exert an increased pressure between the stationary plate 15 and the adjacent side of the wheel, and tend to force it toward the port 42, thereby closing or tending to close said port, and to open the port 41, until a point of equilibrium is reached, when the steam shall pass in equal quantities through both ports, and act with equal force on both sides of the propeller wheel and the respective stationary disk. It will be observed that these conditions are controlled automatically, and the tendency of the wheel is always to maintain itself in perfect balance with relation to the stationary disk, and any disturbance of that balance, from any cause, increases this tendency, and aids in restoring the balance.

While I have thus explained the principle of my present invention, and have illustrated various ways of embodying it in practice, it will be evident that the details of construction and arrangement of parts may be varied

to satisfy the various conditions of operation, without departing from the principles set forth, and my invention is not limited in its broad sense, to any one of the constructions shown.

What I claim is—

1. A motor, comprising stationary plates and a rotating wheel between the plates, the wheel and plates having grooves in their adjacent faces, a steam chest supplying steam to said grooves, and a valve on the wheel arranged to change its position in the steam chest to automatically vary the relative dimensions of the ports, in accordance with the relations of the stationary plates and rotating wheel, substantially as described.

2. A motor, comprising stationary plates, and a rotating wheel between the plates, the wheel and plates having grooves in their adjacent faces, the wheel having transversely crossing steam passages, a steam chest supplying steam to said grooves, and a valve on the wheel arranged to change its position to automatically vary the relative dimensions of the ports, in accordance with the relations of the stationary plates and rotating wheel, substantially as described.

3. A motor, comprising stationary plates and a rotating wheel between the plates, the wheel and plates having grooves in their adjacent faces, and the wheel having transverse steam passages arranged to conduct the steam across the wheel to the grooves, substantially as described.

4. A motor, comprising stationary plates and a rotating wheel between the plates, the wheel and plates having grooves in their adjacent faces and arranged to have a clearance between the wheel and plates, a steam chest supplying steam to said grooves, transversely crossing steam passages, and a valve in the steam chest, the arrangement being such that a portion of the steam passes directly to the clearance space from the ports, while the bulk of the steam passes through the transversely crossing steam passages to the opposite side of the wheel, substantially as described.

5. A motor, comprising stationary plates and a rotating wheel between the plates, the wheel and plates having grooves in their adjacent faces, and a ring connected to the wheel having transversely crossing steam passages, substantially as described.

6. A motor, comprising stationary plates and a rotating wheel between the plates, the wheel and plates having grooves in their adjacent faces, transversely crossing steam passages, and a valve adjustably connected to the wheel, arranged to change its position in the steam chest, to automatically vary the dimensions of the ports in accordance with the relations of the stationary plates and rotating wheel, substantially as described.

7. A motor, comprising stationary plates and a rotating wheel between the plates, the wheel and plates having grooves in their adjacent faces, a ring provided with transversely crossing steam passages connected to the wheel, and a valve ring connected to said steam passage ring, substantially as described.

8. A motor, comprising stationary plates and a rotating wheel between the plates, the wheel and plates having grooves in their adjacent faces, a carrier having a projecting flange provided with lugs to which the wheel is connected, and having cut-away portions between the lugs for the passage of the exhaust steam, substantially as described.

9. A motor, comprising stationary plates and a rotating wheel between the plates, the wheel and plates having grooves in their adjacent faces, a carrier having projecting lugs, (the said wheel having a radial extension,) and means for connecting the lugs of the carrier and the radial extension of the wheel, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDGAR A. EDWARDS.

Witnesses:
F. L. FREEMAN,
ALLE W. DOBSON.