(No Model.) 4 Sheets—Sheet 1.

E. A. EDWARDS.

STEAM MOTOR.

No. 485,536. Patented Nov. 1, 1892.

Fig. 1.

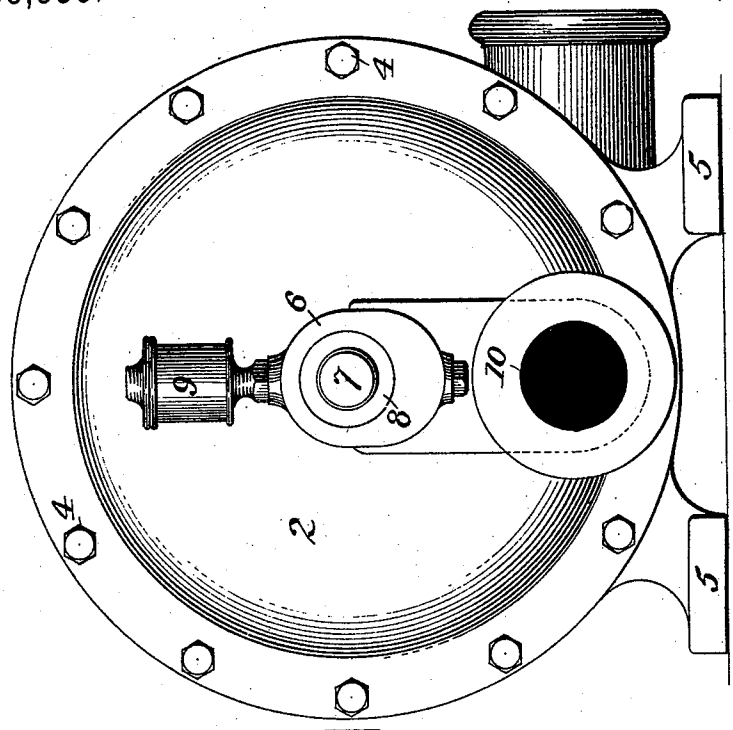

Fig. 2.

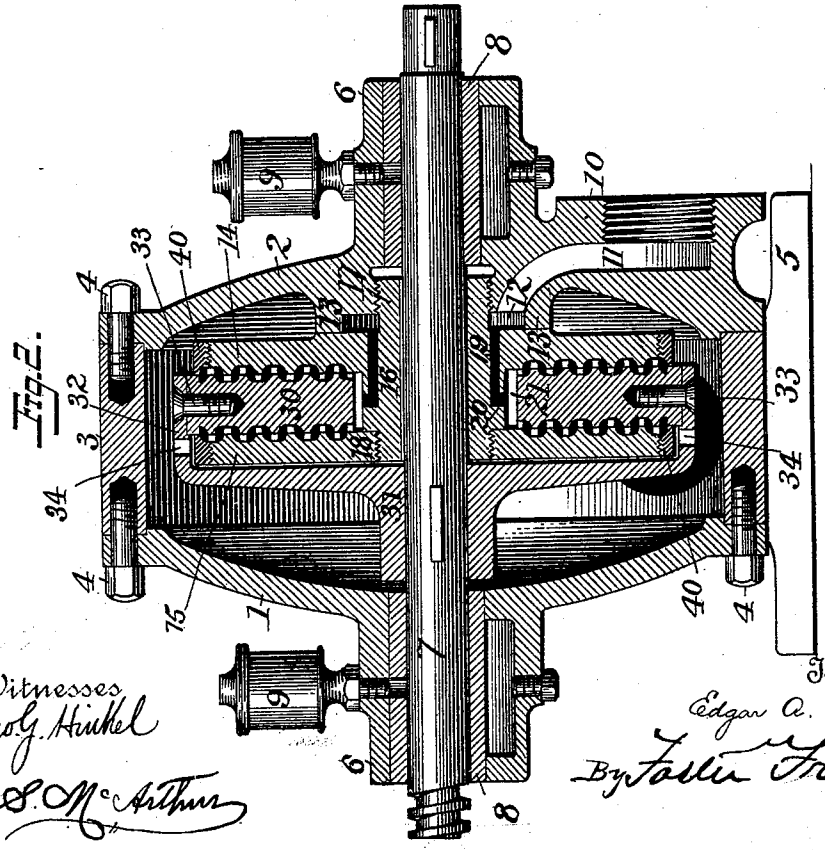

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Fig. 3.

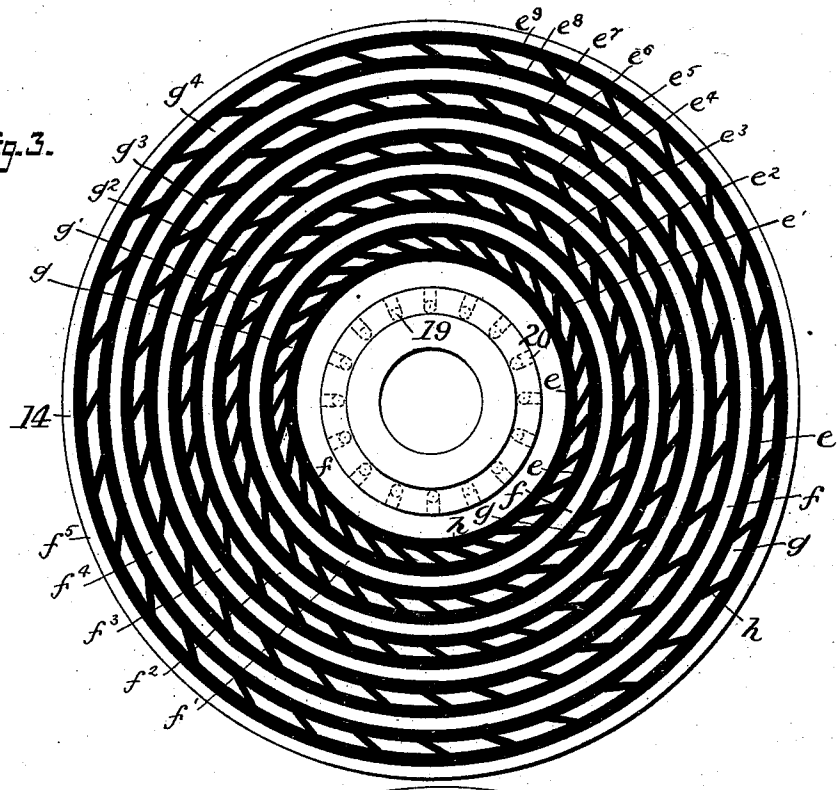

Fig. 4.

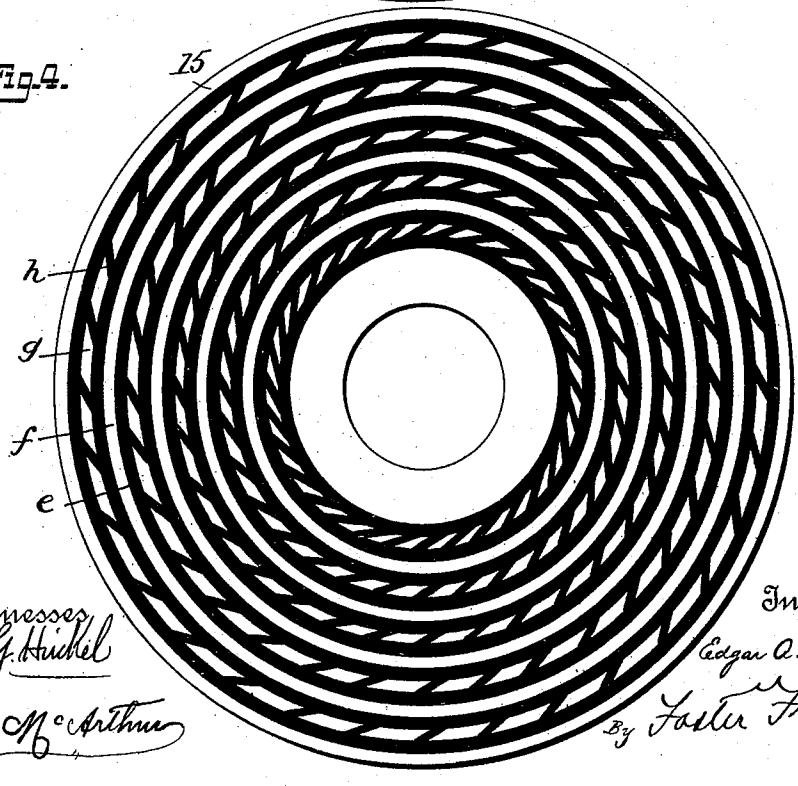

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Fig. 5.

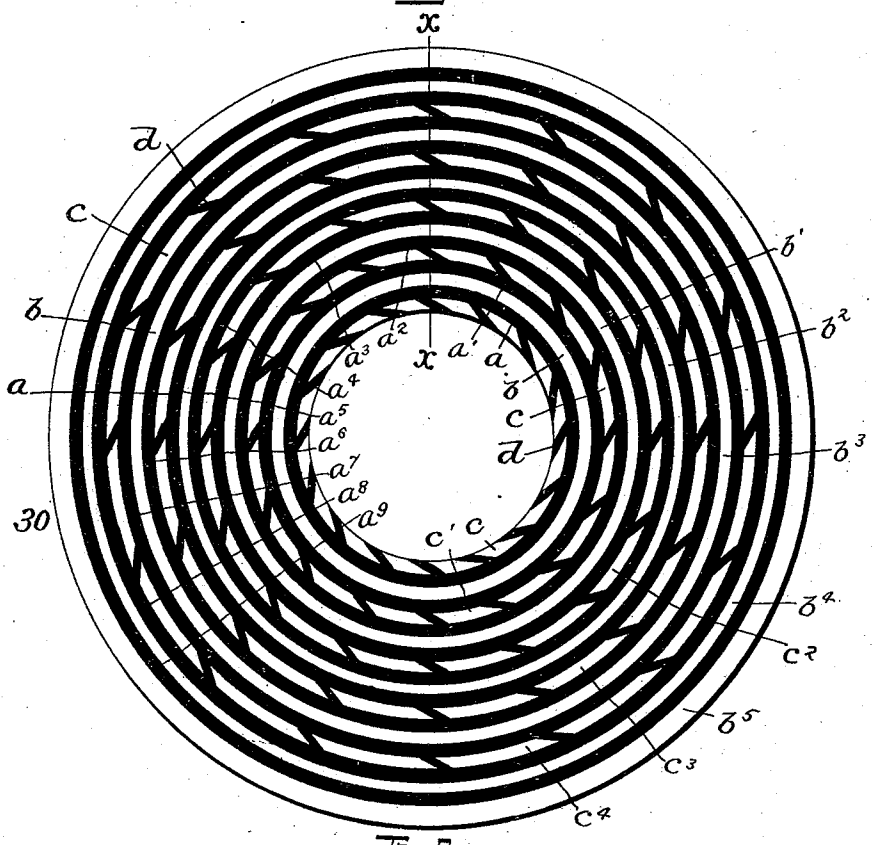

Fig. 6.

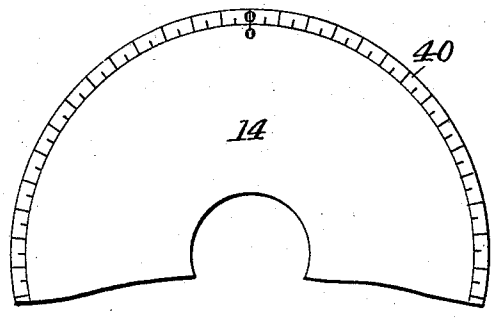

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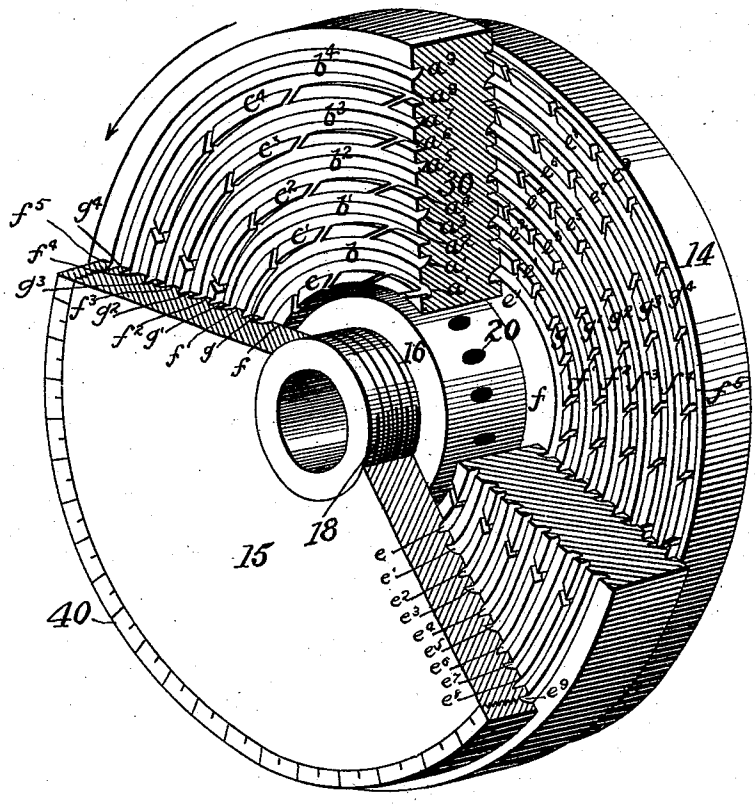
Fig. 7.



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UNITED STATES PATENT OFFICE.

EDGAR A. EDWARDS, OF CINCINNATI, OHIO.

STEAM-MOTOR.

SPECIFICATION forming part of Letters Patent No. 485,536, dated November 1, 1892.

Application filed November 21, 1891. Serial No. 412,650. (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 it relates more particularly to that class of steam-motors which involve what is commonly understood as the "turbine" system of impact and reaction.

It has for its object to provide a simple, cheap, and effective construction and arrangement of parts whereby the steam or other fluid admitted to the motor may act and react upon the parts and be gradually expanded as it passes through the motor, causing a fall of pressure and increase of volume of the steam.

To these ends my invention consists in a motor having the various features of construction, arrangement, and mode of operation substantially such as is hereinafter more particularly pointed out.

Referring to the accompanying drawings, wherein I have illustrated one embodiment of the general principles of my invention sufficient to enable me to describe the same, Figure 1 is an end view of the engine. Fig. 2 is a longitudinal vertical section of the same. Fig. 3 is a plan view on a somewhat enlarged scale of one of the stationary plates. Fig. 4 is a similar view of the other stationary plate. Fig. 5 is a similar view showing one face of the propeller-wheel, and Fig. 6 is a detail view showing means for adjusting the rings upon the stationary plates. Fig. 7 is a sectional perspective view of the plates and wheel.

One of the objects of the invention is to provide a motor having a comparatively-great efficiency which shall be small, compact, simple, cheap, and not liable to get out of order, while at the same time it may be capable of running at a very high rate of speed. The uses for such a motor are many and need not be recited; but it may be stated that primarily the object of my construction is to provide means for operating a dynamo-electric generator through direct connections in order to secure the greatest efficiency from a generator of comparatively-small dimensions and cheap construction.

A further object of my invention is to provide a structure having the characteristics before mentioned which at the same time shall be capable of using steam in the most economical way—that is, by taking advantage of the gradual fall of pressure and increase of volume of the steam as it passes through the engine, and again in utilizing in connection therewith the forces of impact and reaction. It is to meet these requirements and others which need not be stated that the present invention is made.

While I have illustrated and will now proceed to describe the details of the construction and arrangement of parts of what I consider the preferred embodiment of my invention, it will be understood that these details can be varied by those skilled in the art to suit various purposes without departing from the general principles of my invention, and I do not therefore limit my invention to the construction and arrangement illustrated and described.

The motor in the first place is provided with a suitable casing forming the internal chamber, in which the operative parts of the engine are inclosed, and I have shown this casing as consisting of the heads 1 2, united together 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 cylinder portion of the case is provided with suitable feet 5, by which the engine may be secured in any proper position. The heads 1 and 2 are extended laterally in opposite directions to form bearings 6, through which passes the shaft 7, suitable bearing-sleeves 8 being interposed between the shaft and the bearings in the heads. These bearings may be provided with the usual means for lubricating, as the cups 9. The head 2 is provided with a suitable inlet 10 for the steam, and from this inlet there is a passage 11, extending to an annular recess 12 for distributing the steam in a manner hereinafter set forth. This head is also provided with an extension or ring 13, against which one of the stationary plates bear, forming a steam-tight joint.

The operative parts of the engine consist, essentially, 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 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, as seen in Fig. 3, 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 suitable hub fitting the shaft, to which it may be keyed or otherwise secured, and provided with a laterally-extending flange 32, fitting the exterior periphery of the propeller-wheel 30 and secured thereto by suitable means, as the screws 33. This flange 32 is provided with a series of openings 34 for the free passage of the steam into the exhaust-chamber after it has performed its work. It will thus be seen that the propeller-wheel is rigidly connected to the shaft in a manner to rotate freely between the stationary plates.

As before intimated, the faces of the propeller-wheel are provided with suitable grooves and the adjacent faces of the stationary plates are provided with similar grooves, and I have illustrated for the sake of clearness these grooves on an enlarged scale in Figs. 5, 3, and 4, respectively. Referring more particularly to Fig. 5, which shows one face of the propeller-wheel, (the other being the exact counterpart,) it will be seen that there are ten concentric grooves a to a^9, respectively, and while this is a desirable number in a structure like that shown of course it will be understood that the number will vary, being greater or less as circumstances may dictate. These grooves naturally produce upon the face of the wheel a series of concentric rings b c, &c., and it will be seen that 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. These grooves d are shown at an angle to the radial lines of the wheel, and while this angle may vary within certain limits I have shown the grooves at an angle of substantially sixty degrees to the radial lines passing through the grooves. The width of these grooves may also vary, depending upon their number, the pressure of steam to be used, the speed required, and other contingencies. The adjacent faces of the stationary plate are provided with similar grooves e, separated by the complete rings f and segmental rings g, and these segments are in turn separated by angular grooves h. It will be seen on comparing these grooves and rings, and perhaps more clearly in Fig. 2, that where there is a complete annular ring b—for instance, in the propelling-wheel—at the same distance from the center in the stationary plate there is a segmental ring g, and vice versa, and where there is a complete annular ring f in the stationary plate at the same distance from the center in the propelling-wheel there is a segmental ring c. Thus it will be seen that the grooves in the wheel and plates correspond in position and are at the same radial distance from their axis, while the complete rings in the wheel correspond with a segmental ring in the plates, and the complete rings in the plates correspond with the segmental rings in the wheel. It will further be seen on reference to Fig. 2 that one side of each of the grooves, both in the plates and the wheel, are curved on the side of the groove adjacent the complete rings, and while I prefer this construction, as it furnishes a better path for the steam, in a manner hereinafter set forth, I do not limit my invention to this feature. From this arrangement of the rings and grooves on the propeller-wheel and fixed plates it will be seen that when they are in position shown in Fig. 2 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. Thus, for instance, in tracing the steam from the steam-chamber in one position it will first pass through the first series of angular grooves d to the first circular groove a in the wheel, impinging upon the curved sides of complete ring b and being deflected into the first circular groove e of the plate, which grooves correspond with each other in their radial distance, then impinging upon the curved side of this groove, and, being deflected, passes through the first series of angular grooves g in the plates, and these angular grooves are formed at an angle opposite to the angle of the grooves d of the wheel, from which it passes to the circular groove e' of the plate,

and, being deflected by the curved side thereof, passes to its complementary groove a' in the wheel, where it is again deflected and passes through the next series of angular grooves d', and so on, passing alternately through the angular grooves in the wheel and plates, and being deflected from the curved sides of the complementary circular grooves in wheel and plates, and thus imparting a rotary motion to the wheel. It will be seen that the steam first acts upon the incline 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 incline 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 segment on the wheel and the reaction of the steam upon the segments on the stationary plates. It may be further remarked that the wheel and fixed plates are so formed and adjusted that there is a certain amount of clearance between their adjacent faces, and I have found in practice that this should be from two to three thousandths of an inch.

In order to insure a clearance in the manner hereinafter described and prevent the faces of the wheel coming in contact with the face of either plate, I provide the wheels with an adjusting device, and I have shown the rings 40 mounted upon the periphery of the plates 14 and 15. These are screw-threaded to accurately fit the plates, and, further, for the purpose of adjustment. Thus it will be seen on referring more particularly to Fig. 6 that by turning the rings to a slight degree one way or the other in their screw-threads a very accurate adjustment can be obtained. Assuming, for instance, that the screw-threads are twenty to the inch and that the ring is divided into one hundred divisions, as indicated in Fig. 6, it will readily be seen that a turning of the ring on the plate a distance equal to one division will give a lateral adjustment of the face of the ring of one two-thousandth of an inch.

The clearance of the parts is automatically maintained in this construction in the following manner: Assuming, for instance, that the rings are properly adjusted with relation to the plates and the wheel, and assuming, for some reasons, that the wheel is caused to approach one of the plates, as 14, more closely than its normal condition, the clearance between the face of the wheel adjacent the plate 14 will be decreased and the passage of steam into the exhaust-chamber between the ring and wheel will be throttled, resulting in an increase of pressure between the wheel and the face of the plate 14, while, on the other hand, the clearance between the ring on the plate 15 and the adjacent side of the wheel 30 will be increased, resulting in a more rapid expansion of the steam and consequent reduction of pressure on that side of the wheel. The result is that the wheel will be automatically restored to its normal position between the adjacent plates and all friction and unevenness of operation avoided and the steam utilized in the most effective manner.

It is evident that the adjusting-rings might be arranged upon the wheel instead of the plates, as shown, and the same results attained, or both the wheel and plates might be supplied with the adjusting-rings.

What I claim is—

1. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates having grooves in their adjacent faces, substantially as described.

2. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates having grooves on their adjacent faces, which grooves correspond in radial distance from the center of the wheel and plates, substantially as described.

3. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates having rings in their adjacent faces, the rings in the wheel and plates corresponding in radial distance from the centers of the wheel and plates, substantially as described.

4. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates having alternate rings and grooves in their adjacent faces, substantially as described.

5. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates having on their adjacent faces two series of rings, one series being complete rings and the other series being composed of segments, substantially as described.

6. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates having alternate grooves and rings on their adjacent faces, each alternate ring on each face being composed of segments, substantially as described.

7. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with

or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates each having two series of rings on their adjacent faces, one series of complete rings and the other series made up of segments, the rings on the wheel and plates being arranged so that the segmental rings on the wheel correspond with the complete rings on the plates, substantially as described.

8. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates each having segmental rings on their adjacent faces, the segments of one having inclined ends arranged in a direction reverse to the inclined ends of the segments on the other, substantially as described.

9. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates being provided on their adjacent faces with annular grooves and rings, and inclined grooves connecting two adjacent annular grooves, substantially as described.

10. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates each having a series of annular grooves corresponding to each other and each having two series of rings, one series of complete annular rings and a second series of rings composed of segments, the arrangement being such that the segments on the wheel correspond with the complete rings on the plates, and vice versa, substantially as described.

11. A motor comprising plates, one of which plates is supported upon the outer or free end of the hub, which hub is formed integral with or rigidly secured to the engine-case, and a wheel rotating between the plates, the wheel and plates being each provided with two series of rings on their adjacent faces, one series of complete rings and an intermediate series of rings composed of segments, the ends of the segments being inclined, the arrangement being such that the segmental rings on the wheel correspond to the complete rings on the plates and the end of the segments on the wheel are inclined in an opposite direction to the ends of the segments on the plates, substantially as described.

12. In a motor, a case, plates supported in said case, one of which plates is supported upon the outer or free end of a hub, which hub is formed integral with or rigidly secured to the engine-case, a rotating shaft, and a wheel carried by said shaft and rotating between the plates, substantially as described.

13. In a motor, a case, plates supported in said case, one of which plates is supported upon the outer or free end of a hub, which hub is formed integral with or rigidly secured to the engine-case, a shaft supported in said case, and a wheel connected to said shaft and rotating between the plates, the plates and wheel being provided with grooves on their adjacent faces, substantially as described.

14. A motor comprising plates, a shaft, a carrier having radially-extending portions mounted on the shaft, and a wheel connected to the carrier and rotating between the plates, substantially as described.

15. In a motor, a case, plates supported in said case, a shaft, a carrier mounted on said shaft and having a laterally-extending flange, and a wheel connected to said flange and rotating between the plates, substantially as described.

16. A motor comprising plates, a wheel rotating betwen the plates, and supports for the wheel at or near the periphery thereof, substantially as described.

17. A motor comprising plates, a wheel rotating between the plates, and rings mounted on the plates and laterally adjustable thereon and arranged to control the clearance between the rotating wheel and plates, substantially as described.

18. In a motor comprising stationary and rotating parts, means for accurately adjusting the clearance between the parts, comprising a ring or rings screw-threaded and having division-marks, whereby a practical micrometer adjustment between the parts and ring or rings may be obtained, substantially as described.

19. In a motor, a case having heads, a hub connected to one of the heads, plates mounted on the hub, a shaft passing through the hub, and a wheel supported on said shaft and rotating between the plates, substantially as described.

20. In a motor, a case having heads, a hub connected to one of the heads, a steam-inlet passage in the head, a steam-passage through the hub, plates carried by the hub, a shaft and wheel carried thereby and rotating between the plates, and steam-passages arranged in the adjacent faces of the wheel and plates, substantially as described.

21. In a motor, a case having heads provided with bearings for the shaft, a hub connected to one of the heads, a plate formed integral with the hub, a second plate mounted on the hub, steam-passages through the hub, connected with an inlet-passage to the case, a wheel mounted on the shafts and rotating between the plates, and steam-passages arranged in the adjacent faces of the wheel and plates, and adjusting devices for controlling the clearance between the wheel and plates, substantially as described.

22. In a motor, the fixed plates having steam-passages in their faces, a wheel rotating between the plates and having steam-passages in its faces adjacent the plates, a carrier for the wheel, and adjustable clearance

devices on the plates, the arrangement being such that the rotating wheel will automatically adjust itself in accordance with the difference in pressure of the steam on its opposite sides to compensate for lateral displacement, 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,
W. S. MCARTHUR.