No. 728,232. PATENTED MAY 19, 1903.

M. J. HEWLETT.

ROTARY ENGINE.

APPLICATION FILED APR. 2, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

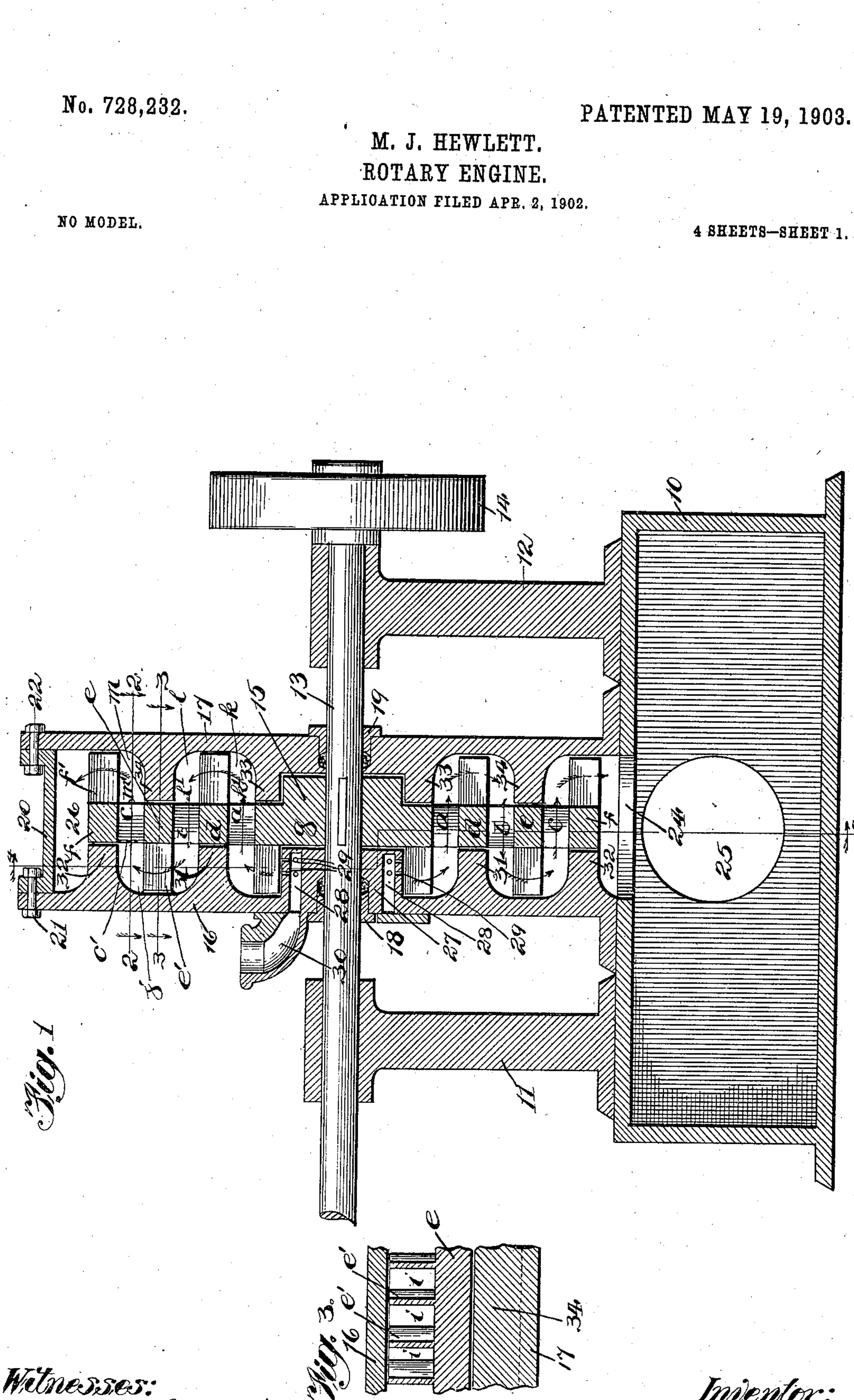


Fig. 1

Witnesses:
C. W. Smith
J. B. Allen

Inventor:
Maddra J. Hewlett,
by Bond Adams Pierce & Jackson
his Attys.

No. 728,232. PATENTED MAY 19, 1903.

M. J. HEWLETT.

ROTARY ENGINE.

APPLICATION FILED APR. 2, 1902.

NO MODEL. 4 SHEETS—SHEET 2.

Fig. 1.

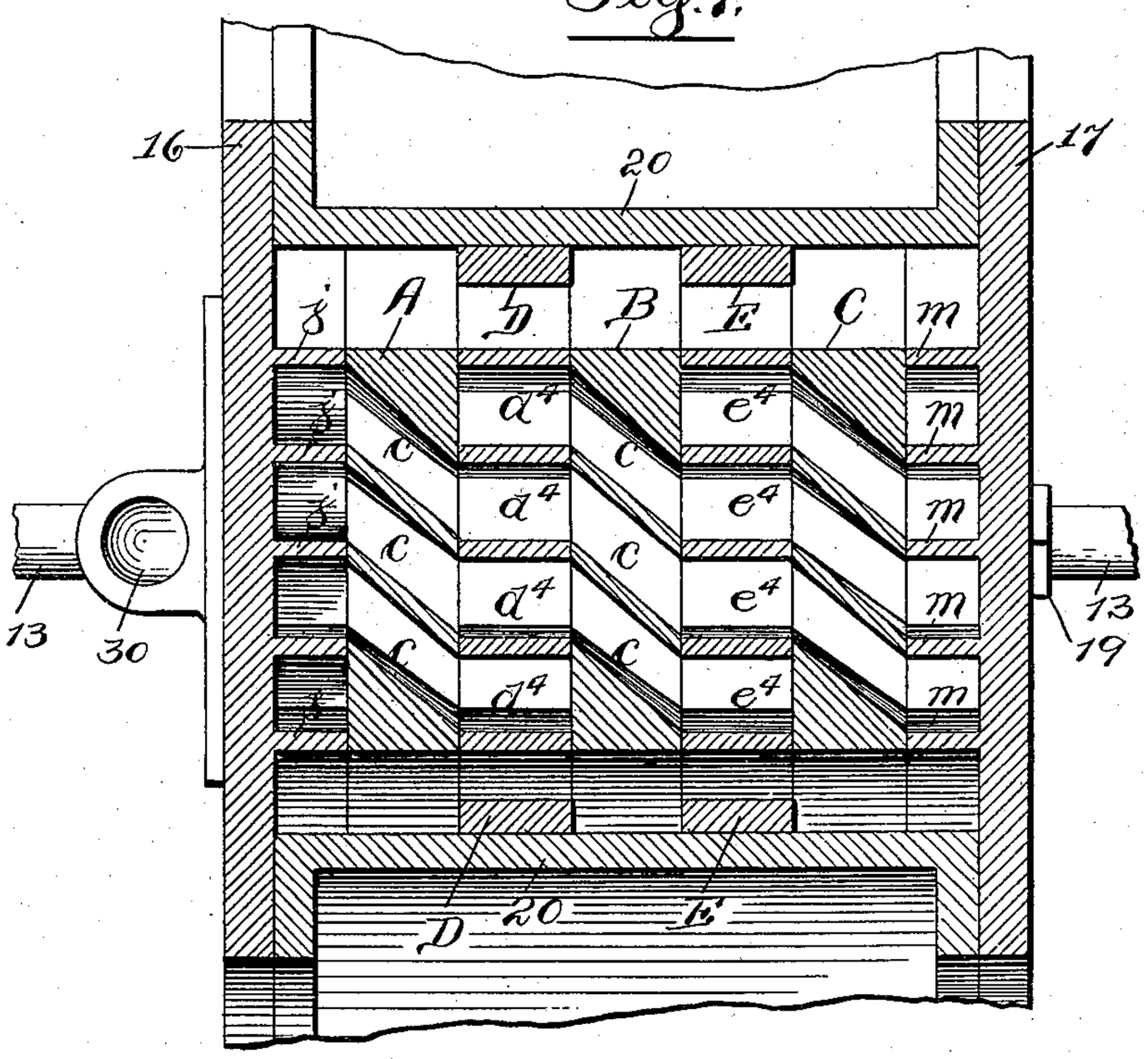
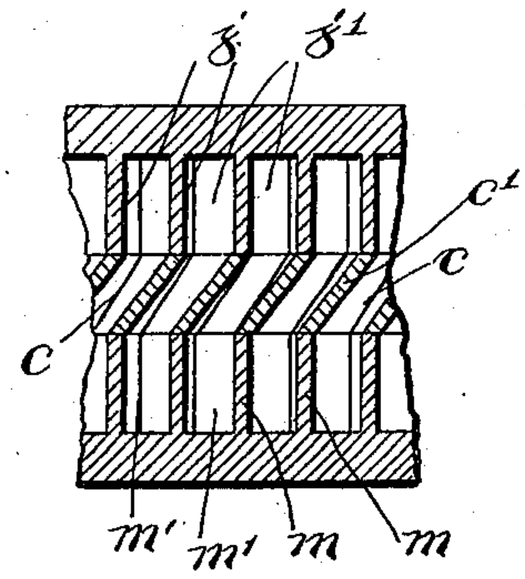


Fig. 2.



Witnesses

J. B. Weir

Edward G. Caufield

Inventor

Maddra J. Hewlett,

by Bond Adams Pickard & Jamison.

his Attys.

No. 728,232. PATENTED MAY 19, 1903.

M. J. HEWLETT.

ROTARY ENGINE.

APPLICATION FILED APR. 2, 1902.

NO MODEL. 4 SHEETS—SHEET 3.

Fig. 4

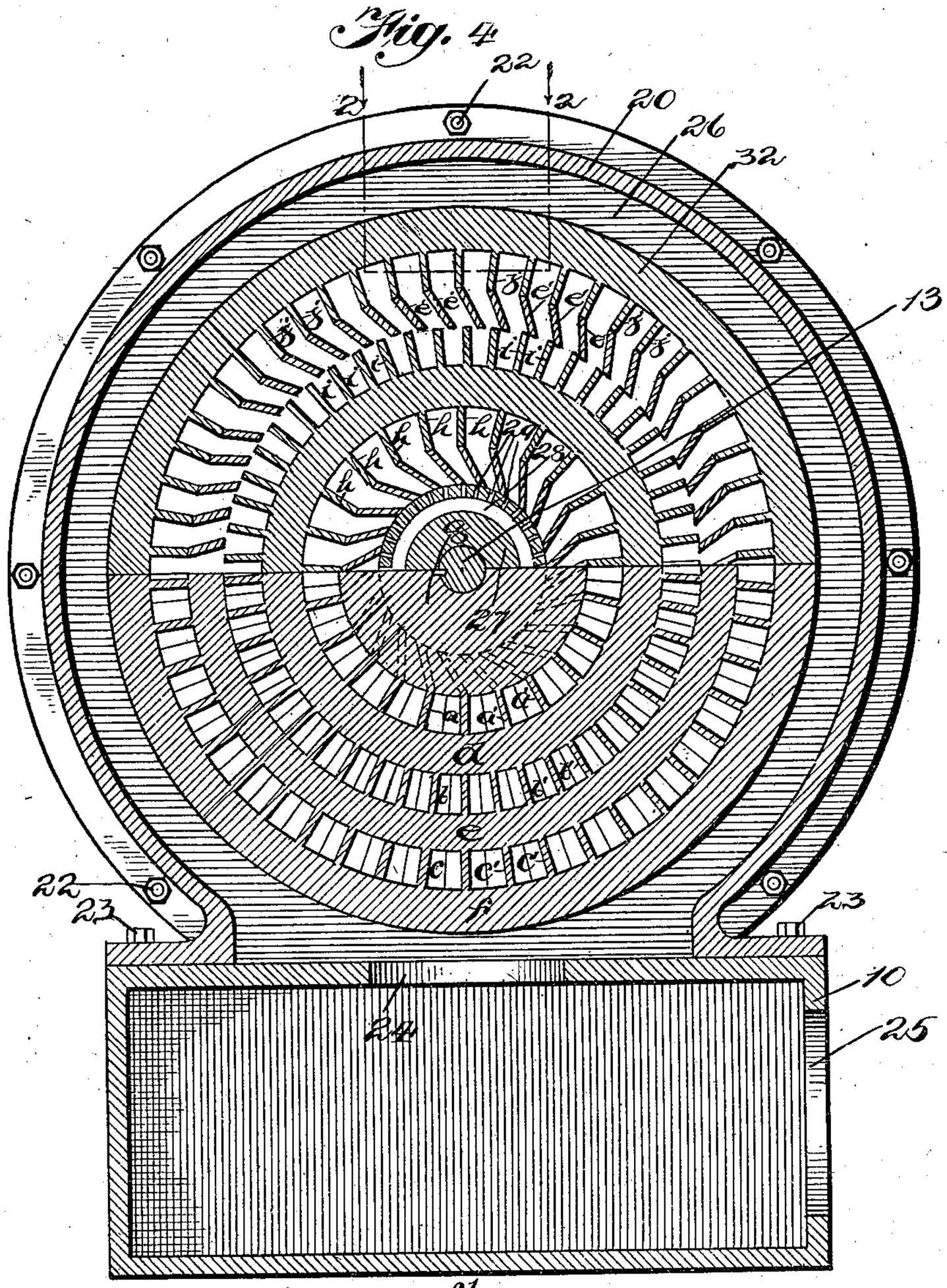
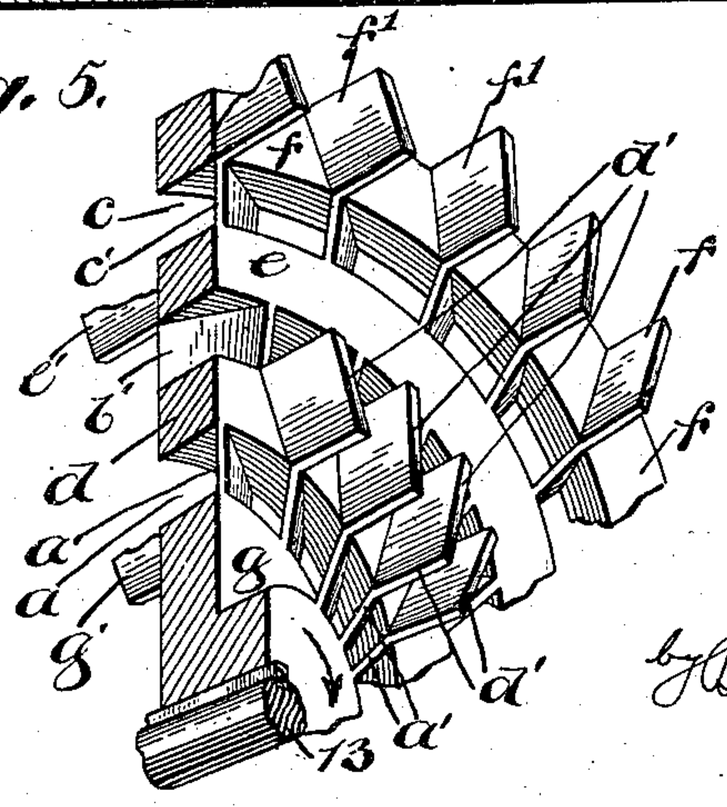


Fig. 5.



Witnesses:
C. W. Smith
J. B. Weir

Inventor:
Maddra J. Hewlett,
by Bond Adams Pickard Jackson
his Attys.

No. 728,232. PATENTED MAY 19, 1903.

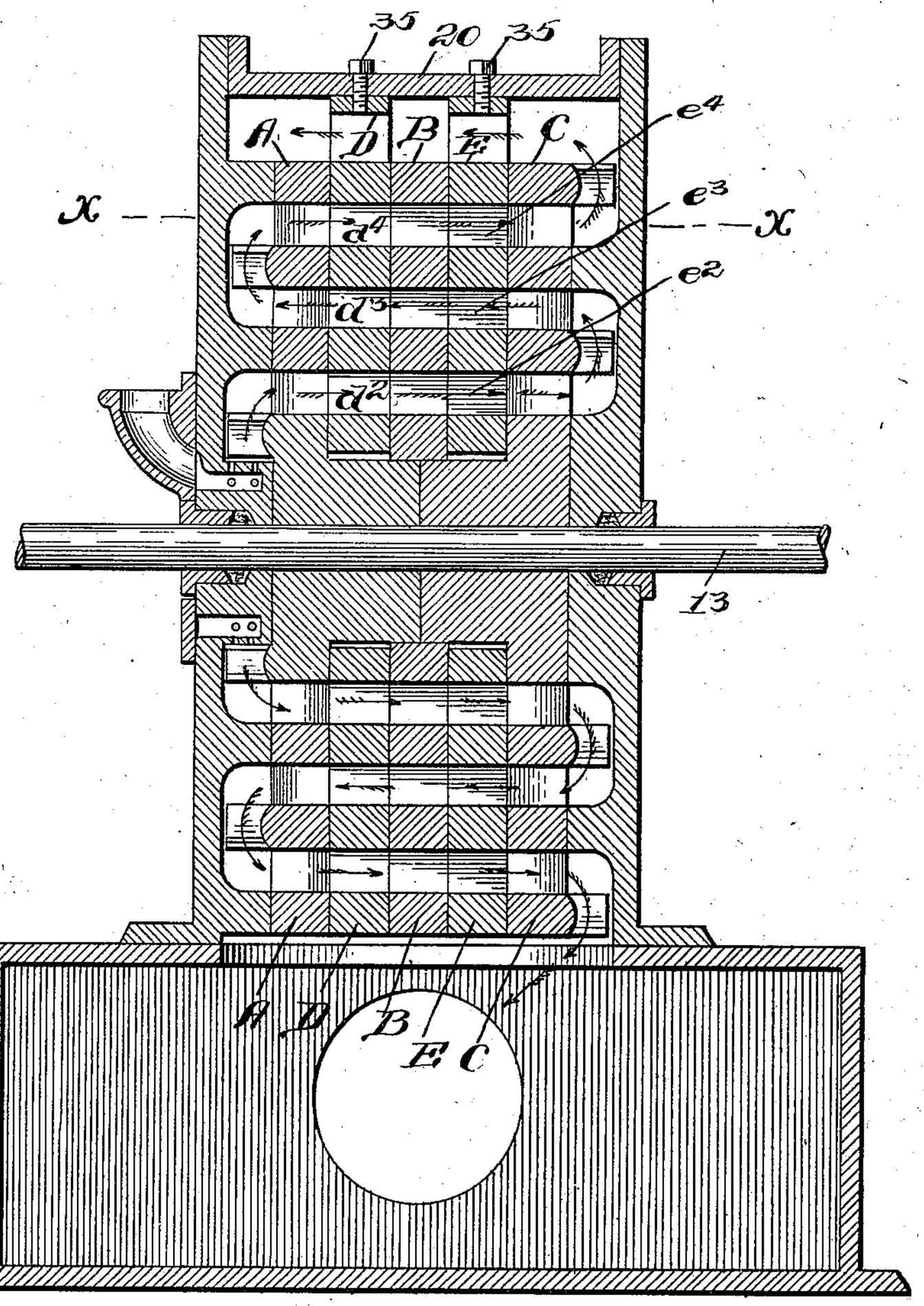
M. J. HEWLETT.

ROTARY ENGINE.

APPLICATION FILED APR. 2, 1902.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 6.



Witnesses:
C. W. Smith
J. B. Weir.

Inventor:
Maddra J. Hewlett,
by Bond Adams Pickard & Jackson
His Attys.

No. 728,232. Patented May 19, 1903.

UNITED STATES PATENT OFFICE.

MADDRA J. HEWLETT, OF KEWANEE, ILLINOIS, ASSIGNOR OF ONE-HALF TO ALFRED M. HEWLETT, OF KEWANEE, ILLINOIS.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 728,232, dated May 19, 1903.

Application filed April 2, 1902. Serial No. 101,014. (No model.)

To all whom it may concern:

Be it known that I, MADDRA J. HEWLETT, a citizen of the United States, residing at Kewanee, in the county of Henry and State of Illinois, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to rotary engines involving the turbine principle, and has for its object to provide certain improvements by which the greatest efficiency of the steam may be obtained; also, to provide an improved reversible steam-turbine engine. I accomplish these objects as hereinafter described and as illustrated in the drawings.

What I regard as new is set forth in the claims.

In steam-turbine engines as heretofore constructed it has been customary to employ a rotary disk or wheel mounted upon a suitable shaft and inclosed in a housing formed of two heads or sides, one at each side of the rotary disk. The steam, being admitted around the axis of the rotary disk, has passed radially in suitable channels provided in the heads and transversely through inclined passages provided in the rotary disk, the power of the steam being applied to the rotation of the disk by its impingement against the inclined blades or flights forming the transverse passages. The rotary disk is provided with a series of concentric inclined passages at different distances from the center, the passages being successively reversely arranged, so that the steam passing in one direction through one series of passages and in the opposite direction through the next series of passages would operate, nevertheless, to rotate the disk in the same direction. While this construction is to a certain extent efficient, it is deficient in that the radial movement of the steam is not utilized to rotate the disk, its power being applied to the rotary disk only as it moves transversely through it. I have discovered, however, that by providing the rotary disk with suitable laterally-projecting inclined flights or blades the radial movement of the steam may be utilized and efficiently applied to the rotation of the disk, so that practically the entire expansive power of the steam is effectively employed. This, broadly considered, is the principal feature of my invention.

A second improvement consists in providing a plurality of rotary disks or wheels in connection with one or more intervening stationary disks or partitions, the whole being arranged so that the steam in its passage from the center to the circumference of the engine acts upon a plurality of rotary disks. By this means the expansive power of the steam may be employed to the fullest extent.

In addition to the more general improvements above described my invention also includes certain improvements in the construction of engines of this character, as will be hereinafter pointed out.

Referring to the drawings, Figure 1 is a transverse vertical section of my improved engine in its simplest form. Fig. 2 is a horizontal section on line 2 2 of Figs. 1 and 4. Fig. 3 is a horizontal section on line 3 3 of Fig. 1. Fig. 4 is a vertical section on line 4 4 of Fig. 1. Fig. 5 is a perspective view illustrating a segment of the rotary disk shown in Fig. 1, and Fig. 6 is a vertical cross-section of an engine employing a plurality of disks. Fig. 7 is a sectional elevation on the line $x\,x$ of Fig. 6.

In the drawings, 10 indicates the base of the engine, and 11 12 standards or supports in which is journaled the shaft 13 of the engine. The form of the base and supporting devices for the shaft may of course be of any approved design.

14 indicates a pulley mounted on the shaft 13 for transmitting power therefrom.

15 indicates the rotary disk, which is mounted upon and keyed to the shaft 13, as shown in Fig. 1. This rotary disk 15 is provided with several series of inclined transverse passages, the different series of passages being at different distances from the center, as shown in Figs. 1 and 5 and in the lower portion of Fig. 4. The first or innermost series of passages is indicated by the letter a, the next by b, and the third by the letter c.

a' indicates the inclined blades by which the passages a are formed, b' the blades by

which the passages *b* are formed, and *c'* the blades by which the passages *c* are formed. It will be observed by an inspection of Fig. 5 that the blades *a'* and *c'* are inclined in the same direction, while the blades *b'* are oppositely arranged, being substantially at right angles to the blades *a'* and *c'*. By providing the passages *a b c*, as shown and described, a series of concentric rings *d e f* is provided, the ring *d* lying between the passages *a* and *b*, the ring *e* between the passages *b* and *c*, and the ring *f* being outside of the passages *c*, forming the rim of the wheel. Between the passages *a* and the shaft 13 is the hub *g* of the disk, as shown in Fig. 5.

d' f' indicate two series of laterally-projecting blades or flights carried by the rings *d f*, respectively, as shown in Fig. 5. The flights *d' f'* are similarly inclined, their inclination being such that radial movement of the steam from the center toward the circumference strikes such blades and causes the disk to rotate in the same direction as it is rotated by the passage of the steam through the passages *a b c*. Similarly laterally-projecting inclined blades *g' e'* are carried by the hub *g* and ring *e*, respectively, the blades *g'* and *e'* being at the opposite sides of the disk from the blades *d'* and *f'*. The blades *g'* and *e'* are inclined in the same direction as the blades *d'* and *f'*.

16 17 indicate the heads of the engine, which are in the form of disks fitted upon the shaft 13 at opposite sides of the disk 15 and provided with stuffing-boxes 18 19, respectively, to prevent the escape of steam from the engine. The heads 16 17 are mounted upon the base 10 and are connected at their peripheries by a band 20, which extends around said heads and is secured thereto by bolts 21 22, as shown. The band 20 is also secured to the base 10 by bolts 23, as shown in Fig. 4. In order to provide an exhaust-outlet, the band 20 does not extend entirely under the heads 16 17, as shown in Fig. 4, a central exhaust-passage 24 being provided immediately below the disk 15 for the escape of exhaust-steam into the base, which is hollow and is provided with an outlet-passage 25, as shown in Figs. 1 and 4. As shown in Fig. 1, the heads 16 17 are of somewhat greater diameter than the disk 15, so that an annular exhaust-chamber 26 is provided outside of the disk 15, which exhaust-chamber communicates with the interior of the base 10 through the passage 24, above described. The head 16 is provided with a central hub 27, which fits upon the shaft 13, as shown in Fig. 1, said hub being provided with an annular passage 28, having ports 29, by which steam is admitted from the passage 28 to the engine.

30 indicates an inlet-duct which communicates with the passage 28, as shown in Fig. 1. Steam may be supplied to the duct 30 in any suitable manner. 31 32 indicate annular flanges, which are concentrically arranged and project inwardly from the head 16. Said flanges lie opposite the rings *d f*, respectively, of the rotary disk 15, as shown in Fig. 1. Similarly the head 17 is provided with inwardly-projecting annular flanges 33 34, which lie opposite the outer portion of the hub *g* and the ring *e*, respectively. The inner and outer faces of the flange 31—that is to say, the faces which lie nearer and farther from the center of the head 16—are provided with radial blades *h i*, as best shown in Fig. 4, thereby forming a series of inner and outer passages *h' i'*, which are adapted to register with the passages *a b*, respectively. The flange 32 has on its inner face a similar series of blades *j*, forming a series of passages *j'*, adapted to register with the passages *c*. In a similar manner the flange 33 of the head 17 is provided on its outer face with a series of blades *k*, forming passages *k'*, adapted to register with the passages *a*, and the flange 34 is provided with inner and outer blades *l m*, forming passages *l' m'*, respectively, adapted to register, respectively, with passages *b* and *c*.

By the construction described it will be seen that steam entering through ports 29 from the passage 28 will be free to expand radially. The first effect of the steam is directed against the laterally-projecting inclined blades *g'*, causing the rotary disk 15 to rotate in the direction indicated by the arrow in Fig. 5. As soon as the steam has acted upon the blades *g'* it enters the passages *h'*, formed by the stationary blades *h*. It will be observed that, as shown in Fig. 1, the inner portions of the passages *h'* are curved, the object being to more readily direct the steam laterally, as indicated by the arrow in Fig. 1. The steam moving laterally from passages *h'* strikes the inclined blades *a'*, imparting a further impulse to the disk. The steam then passes on through the passages *a* in the direction indicated by the arrows in Fig. 1, entering passages *k'*, whence it is directed radially, striking the laterally-projecting blades *d'*, thence passing into passages *l'*, whence it is again directed laterally in the opposite direction from that taken by it in moving through the passages *a*. The steam then returns through passages *b*, striking the inclined blades *b'*, thence on into passages *i'*, thence again radially against inclined blades *e'* into passages *j'*, thence back laterally through passages *c* to passages *m'*, thence again radially against blades *f'*, where it escapes to the exhaust-chamber 26. The laterally-projecting blades carried by the rotary disk being all inclined in the same direction, the radial movement of the steam acts constantly to rotate the disk in the same direction, while the inclination of the blades *b'* being opposite to that of the blades *a'* and *c'* the lateral or transverse movement of the steam also acts to rotate the disk constantly in the same direction.

By the construction described it will be seen that the entire expansive force of the steam from the time it enters the engine

until it is discharged into the exhaust-chamber is utilized. So far as I am aware this has never before been accomplished.

The simplest form of apparatus embodying my improvements is shown in Fig. 1.

In Figs. 6 and 7 I have illustrated some further improvements involving the use of a plurality of rotary disks A B C, respectively, said disks being separated by stationary intermediate disks D E, respectively. As shown, the rotary disks A, B, and C are provided with inclined passages through which the steam passes in its transverse movement in the manner already described, the principal difference between the construction shown in Fig. 6 and that previously described being that the stationary intermediate disks D and E are provided with a series of passages d^2 d^3 d^4 and e^2 e^3 e^4, respectively, which are straight—*i. e.*, not inclined—and serve to "straighten up" or restore the steam to its transverse direction before it passes on from such passages to the adjacent inclined passages of the rotary disks. By this construction a more extended lateral movement of the steam is provided for without destroying its effect, as would be the case were long continuous lateral passages provided. The stationary disks D E are held properly in place by means of bolts 35, which secure them to the band 20, as shown in Fig. 6.

The apparatus shown and described illustrates my invention in the best form at present known to me; but I wish it to be understood that my invention, broadly considered, is not restricted to the specific construction illustrated and described, as it may be embodied in other constructions and forms of apparatus. Except, therefore, in so far as the specific features of construction are particularly claimed, they are not to be regarded as essential to the invention generically set forth in the broader claims.

While my improved engine is designed to be operated by steam, any equivalent fluid may be employed to operate it.

The term "rotary disk" as employed in the broader claims is used in a generic sense to indicate the rotary support for the laterally-projecting blades and through which the transverse passages extend whether such disk be single or consist of a plurality of members between which the stationary disks or partitions extend.

That which I claim as my invention, and desire to secure by Letters Patent, is—

1. A rotary engine comprising a rotary disk having laterally-projecting inclined blades, transverse passages through said disk, means inclosing said disk, means for admitting steam to said disk near the center thereof, and means for directing the steam through said transverse passages, substantially as described.

2. A rotary engine comprising a rotary disk having laterally-projecting inclined blades, inclined transverse passages through said disk, means inclosing said disk, means for admitting steam to said disk near the center thereof, and means for directing the steam through said transverse passages, substantially as described.

3. A rotary engine comprising a rotary disk having a series of laterally-projecting blades arranged in the form of a circle, inclined transverse passages through said disk, and means for directing steam against said inclined blades and through said passages, substantially as described.

4. A rotary engine comprising a rotary disk having a series of laterally-projecting inclined blades arranged in circular form, inclined transverse passages, and radial blades carried by a stationary support and arranged between said laterally-projecting blades and said transverse passages, for directing the steam in its passage, substantially as described.

5. A rotary engine, comprising a rotary disk, a housing therefor, operating means actuated by radial movement of the steam for rotating said disk, operating means actuated by transverse movement of the steam for rotating said disk in the same direction, and means for conducting the steam from one to another of said operating means, substantially as described.

6. A rotary engine comprising a rotary disk, a housing therefor, said disk having transverse passages, and means at opposite sides of said disk operated by radial movement of the steam for rotating said disk, substantially as described.

7. A rotary engine comprising a rotary disk, a housing therefor, said disk having inclined transverse passages, and means at opposite sides of said disk operated by radial movement of the steam for rotating said disk, substantially as described.

8. A rotary engine comprising a rotary disk, a housing therefor, said disk having transverse passages, and inclined blades at opposite sides of said disk operated by radial movement of the steam for rotating said disk, substantially as described.

9. A rotary engine comprising a rotary disk, a housing therefor, said disk having inclined transverse passages, and inclined blades at opposite sides of said disk operated by radial movement of the steam for rotating said disk, substantially as described.

10. A rotary engine comprising a rotary disk having a plurality of series of inclined laterally-projecting blades, transverse passages in said disk, a housing for said disk, and means for admitting steam to said disk near the center thereof, substantially as described.

11. A rotary engine comprising a rotary disk having a plurality of series of inclined laterally-projecting blades at each side thereof, transverse passages in said disk, a housing for said disk, and means for admitting steam to said disk near the center thereof, substantially as described.

12. A rotary engine comprising a rotary

disk having laterally-projecting inclined blades at opposite sides thereof, transverse passages in said disk between adjacent series of blades, and heads at opposite sides of said blades, said heads having inwardly-projecting annular flanges which engage said disk adjacent to said transverse passages, substantially as described.

13. A rotary engine comprising a rotary disk having laterally-projecting inclined blades at opposite sides thereof, inclined transverse passages in said disk between adjacent series of blades, and heads at opposite sides of said blades, said heads having inwardly-projecting annular flanges which engage said disk adjacent to said transverse passages, substantially as described.

14. A rotary engine comprising a rotary disk having a plurality of series of laterally-projecting inclined blades at each side thereof, transverse passages between consecutive series of lateral blades, and heads at opposite sides of said disk, said heads having inwardly-projecting flanges which engage said disk between adjacent transverse passages, substantially as described.

15. A rotary engine comprising a rotary disk having a plurality of series of laterally-projecting inclined blades at each side thereof, transverse passages between consecutive series of lateral blades, and heads at opposite sides of said disk, said heads having inwardly-projecting flanges which engage said disk between adjacent transverse passages, said transverse passages being alternately oppositely inclined, substantially as described.

16. A disk for rotary engines having laterally-projecting inclined blades and transverse passages, substantially as described.

17. A disk for rotary engines having a plurality of series of inclined laterally-projecting blades, and transverse passages between consecutive series of blades, substantially as described.

18. A disk for rotary engines having a plurality of series of inclined laterally-projecting blades, and inclined transverse passages between consecutive series of blades, substantially as described.

19. A rotary engine comprising a plurality of rotary disks having inclined transverse passages, a stationary device between said disks having transverse passages, and heads arranged opposite said rotary disks, said heads having inwardly-extending annular flanges adapted to engage said rotary disks adjacent to said transverse passages and laterally-projecting inclined blades carried by the disks adjacent to said heads, substantially as described.

20. A rotary engine comprising a plurality of rotary disks having laterally-projecting inclined blades, transverse passages in said rotary disks, a stationary disk between said rotary disks, said stationary disk having transverse passages adapted to register with the transverse passages of said rotary disks, means inclosing said disks, and means for admitting steam near the center of said engine, substantially as described.

21. A rotary engine comprising a plurality of rotary disks having transverse passages, means operated by radial movement of the steam for rotating said disks, and means operated by transverse movement of the steam for rotating said disks in the same direction, substantially as described.

22. A rotary engine comprising a plurality of rotary disks having inclined transverse passages, a stationary disk between said rotary disks, having transverse passages, and means operated by radial movement of the steam for rotating said rotary disks in the same direction as they are rotated by the passage of the steam through said transverse passages, substantially as described.

23. A rotary engine comprising a plurality of rotary disks having inclined transverse passages, a stationary device between said disks, said stationary device having transverse passages having their axes parallel with the axis of the disk, a housing for said disks, and means for directing steam through said passages, substantially as described.

24. A rotary engine comprising a plurality of rotary disks having a plurality of series of inclined transverse passages, said series of inclined passages being at different distances from the center, the passages of adjacent series being oppositely arranged, a stationary device between said disks, said stationary device having transverse passages having their axes parallel with the axis of the disks, a housing for said disks, means for admitting steam to said disks near the center thereof, and means for directing the steam through the passages of the different series in succession, substantially as described.

MADDRA J. HEWLETT.

Witnesses:
H. L. DAY,
W. T. PIERCE.