M. WHITE.

ROTARY ENGINE.

APPLICATION FILED AUG. 9, 1907.

917,390.

Patented Apr. 6, 1909.

5 SHEETS—SHEET 1.

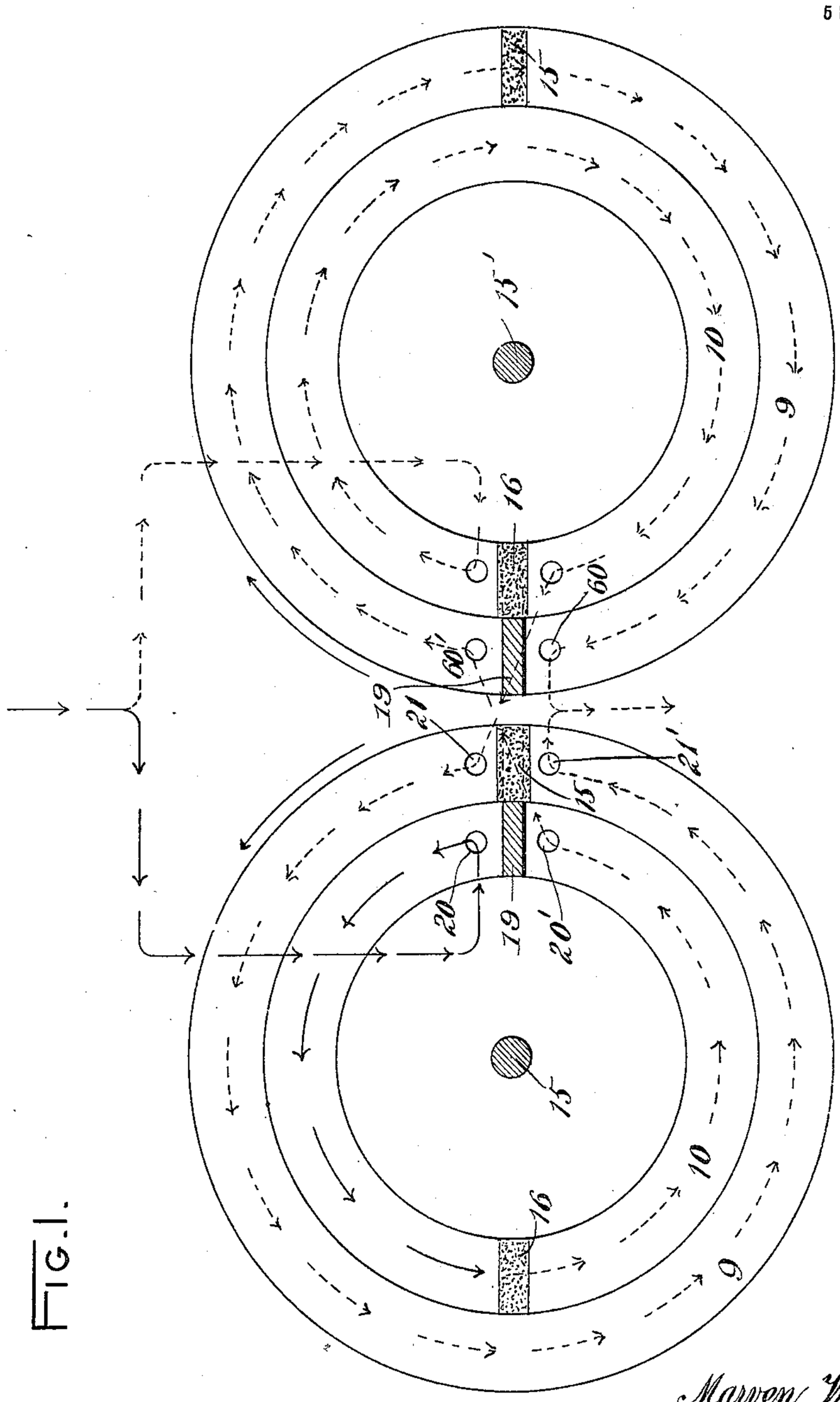

FIG. 1.

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5 SHEETS—SHEET 2.

FIG. 2.

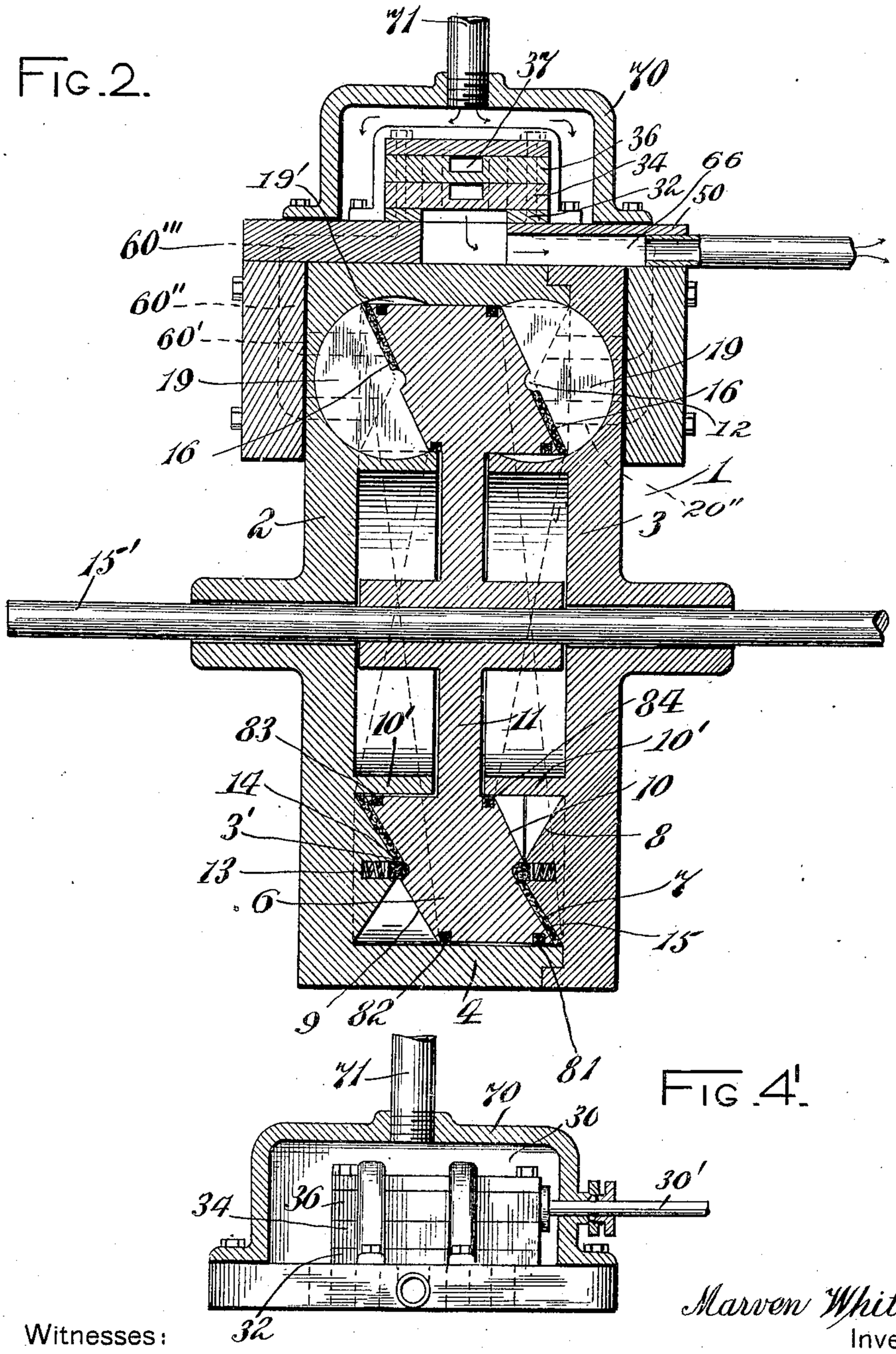

FIG. 4.

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5 SHEETS—SHEET 3.

FIG. 3.

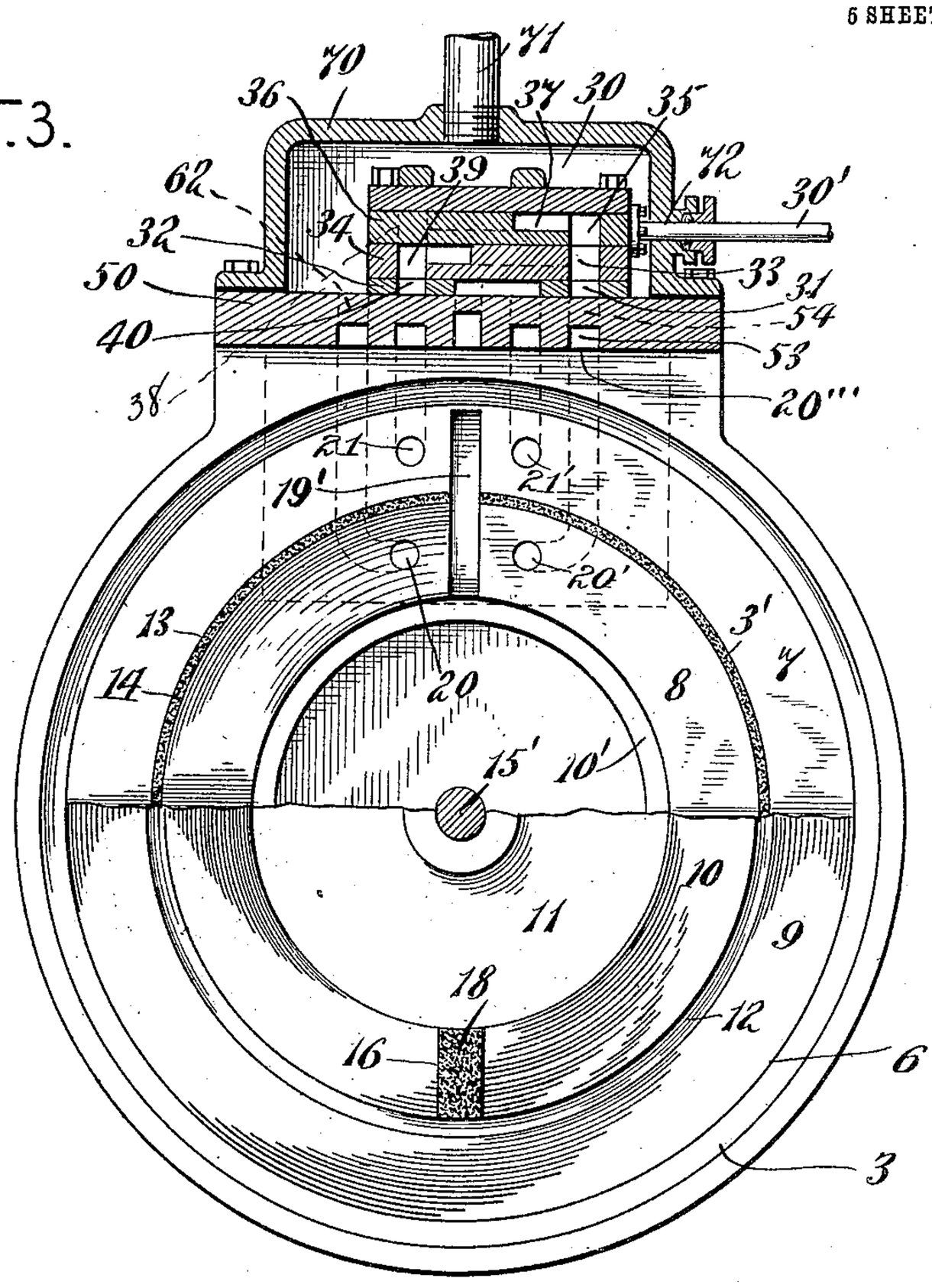
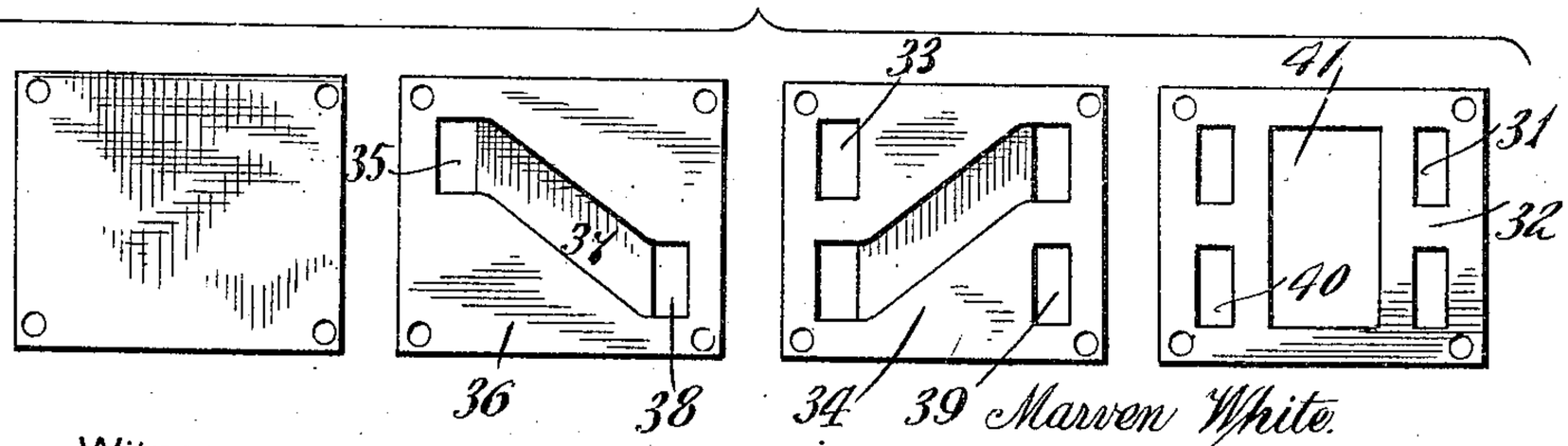


FIG. 4.



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5 SHEETS—SHEET 4.

FIG. 7.

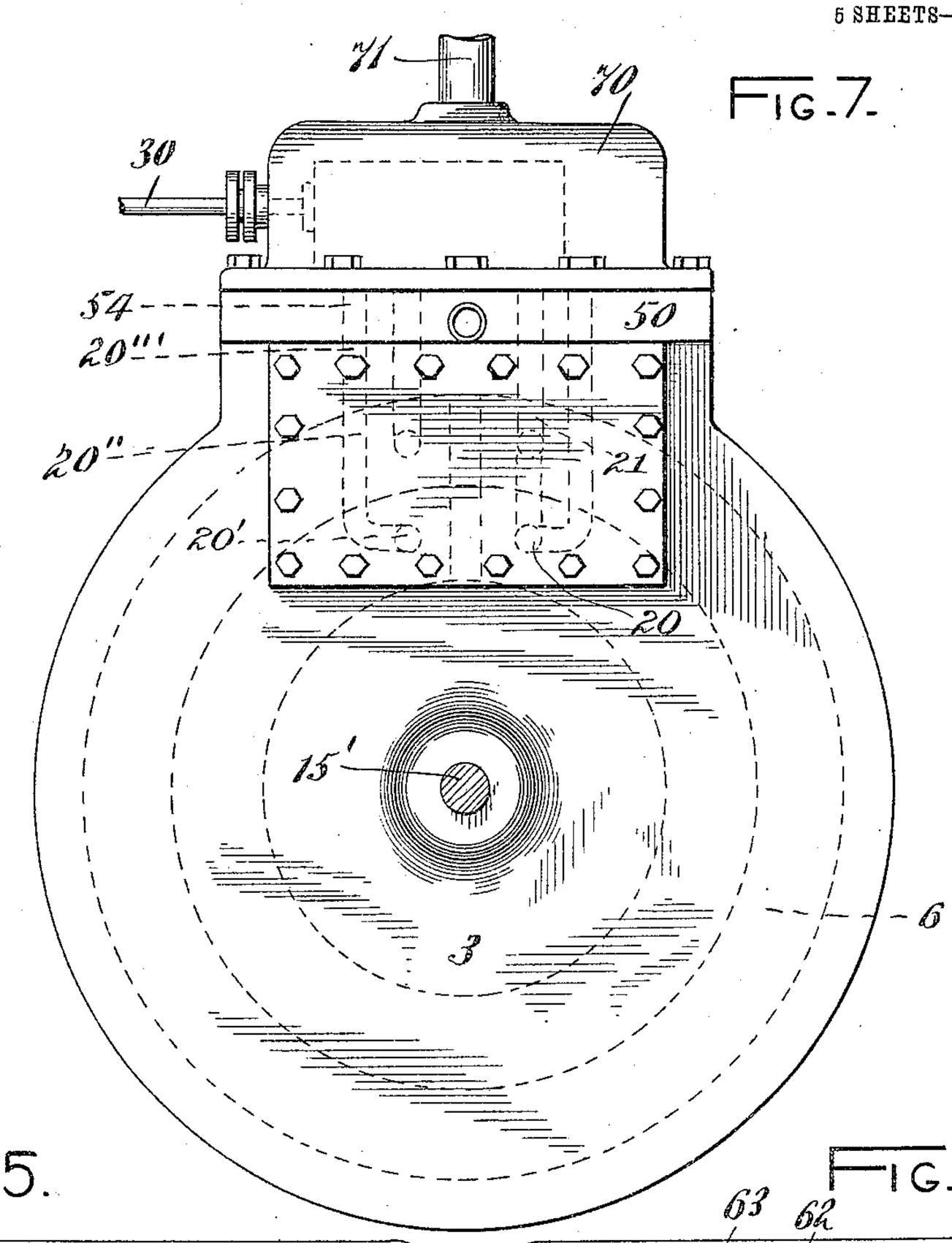


FIG. 5.

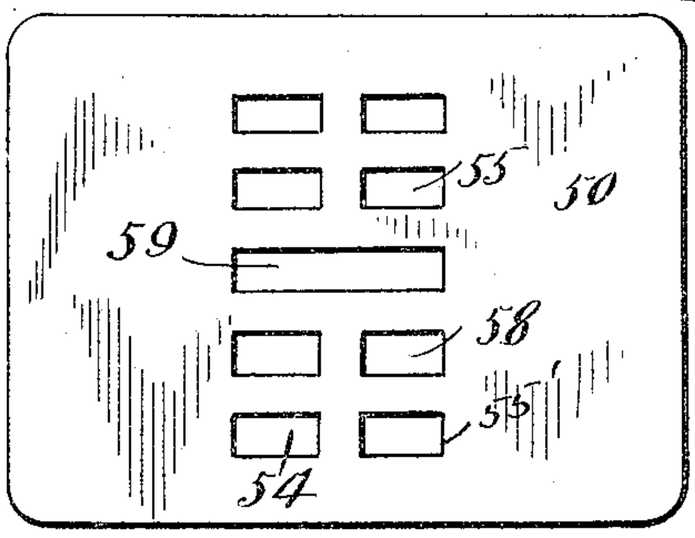
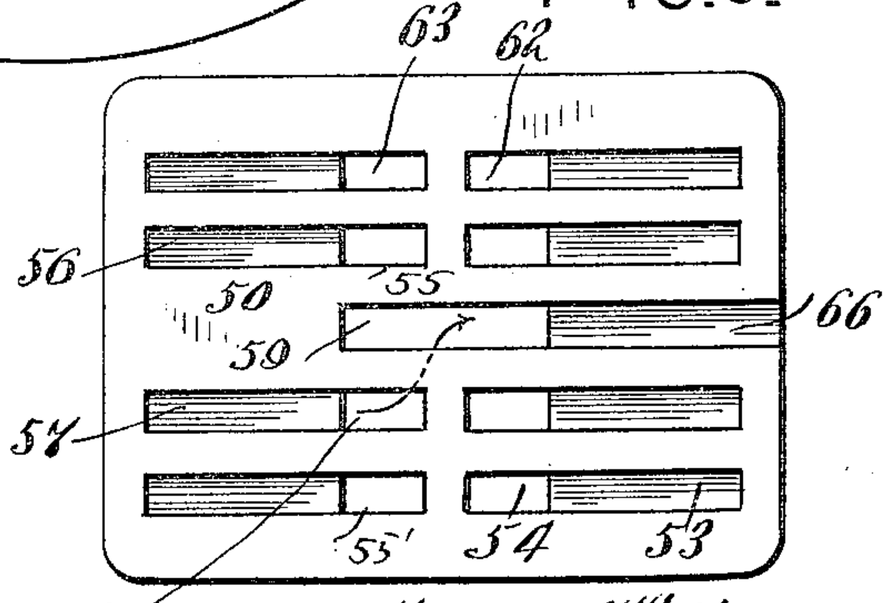


FIG. 6.



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5 SHEETS—SHEET 5.

FIG. 9.

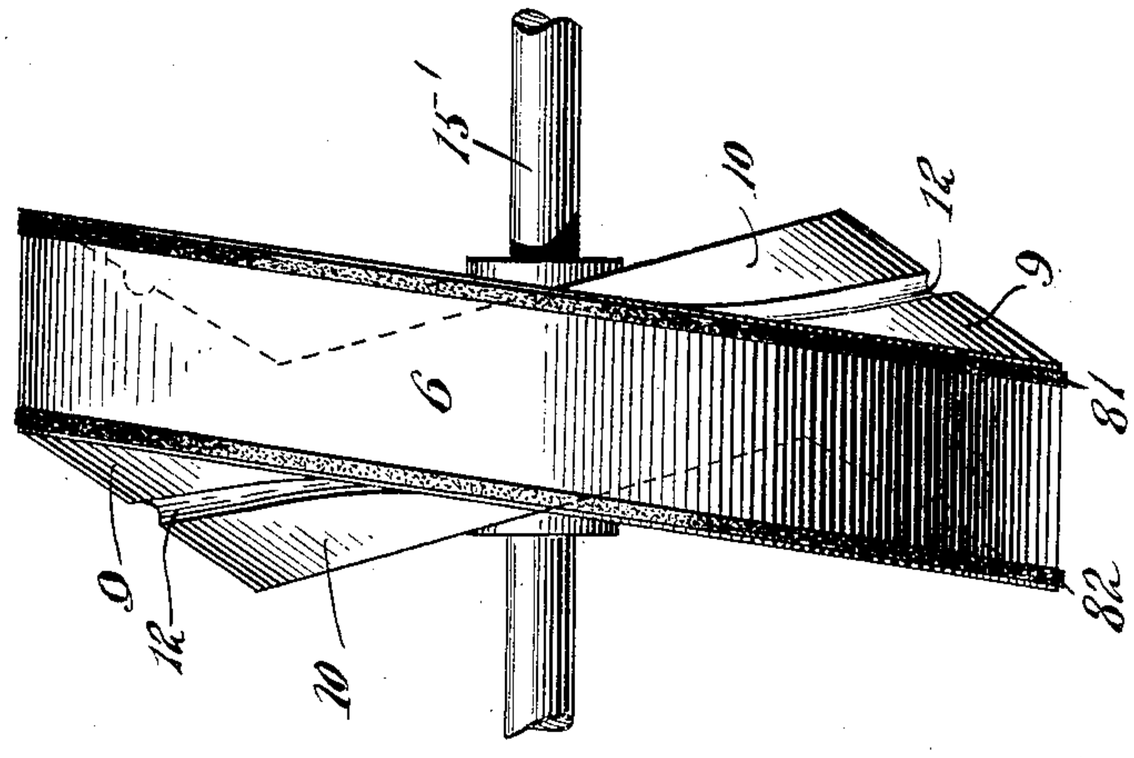
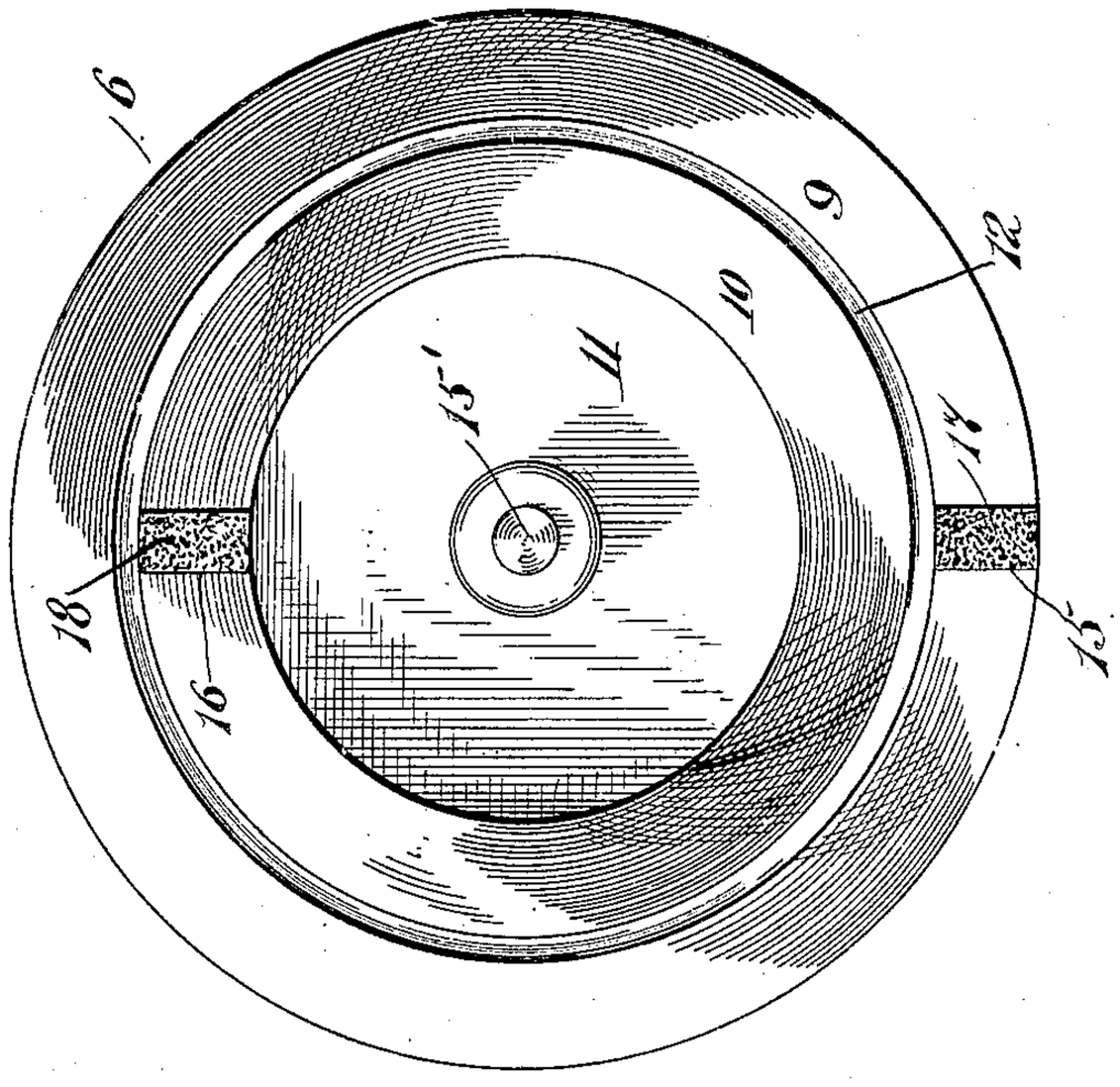


FIG. 8.



Witnesses:

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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

No. 917,390. Specification of Letters Patent. Patented April 6, 1909.

Application filed August 9, 1907. Serial No. 387,759.

To all whom it may concern:

Be it known that I, MARVEN WHITE, a subject of the King of Great Britain, residing at Wheatley, county of Essex, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare that the following is 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.

The present improvement is an invention in compound, continuous drive rotary steam engines of the sliding abutment type, wherein steam is admitted first to a high power compression chamber, then led from the high power chamber to a low power chamber, and after spending its energy in the low power chamber, finally exhausted from the engine to the outside air.

The principal aim of this invention is to construct an engine of the above general type, wherein a single rotary piston is provided with surfaces on its opposite sides so formed as to present approximately concentrically disposed steam chambers, each of which through the contour of its own surface in coöperation with a sliding abutment is divided into an exhaust and a working chamber, the chambers on one side of the piston alternating with those on the opposite side thereof in such manner as to present the high power chambers successively for admission of live steam from the steam chest, to present a high pressure exhaust chamber on one side of the piston, in position to exhaust into a low pressure working chamber on the opposite side of the piston, and to present a low pressure working chamber on the same side as the last named low pressure working chamber in position for exhaust to the outside air; the whole engine working automatically.

The valves are so constructed and arranged as to admit, exhaust, transfer and re-exhaust the steam, to and from the chambers as above generally stated, continuously and successively, the passages of the steam being so rapid as to exist practically simultaneously.

That one skilled in the art to which this invention relates may the more readily understand its construction and mode of operation, reference should be had to the accompanying drawings, wherein one general form of the engine is illustrated.

Figure 1 is a diagrammatic view, showing the path of steam from its successive admission to the high pressure chambers, its transfer from them successively to the low pressure chambers, and its exhaust from the low pressure chambers successively to the outside air. Fig. 2 is a vertical cross sectional view, taken centrally through the engine as a whole. Fig. 3 is a plan view of the interior face of the removable cylinder head, showing in section the arrangement of steam ports in the valve. Fig. 4 is a plan view of the several elements of the sliding valve. Fig. 4′ is a side view of the same assembled. Fig. 5 is a plan view of the valve-port-plate in the bottom of the steam chest. Fig. 6 is a plan view of the reverse side of the same. Fig. 7 is a front view of the engine as a whole, looking toward the removable cylinder head and showing the relative positions and connections of the several supply and exhaust ports on one side of the piston head. Fig. 8 is a plan view of one face of the piston showing the preferred form of driving surfaces of the steam chambers and their relative disposition; and, Fig. 9 is a side elevation of the piston as a separate element.

Referring to the drawings in detail: The piston cylinder 1 comprises the two heads 2 and 3, the head 3 being removable and the head 2 carrying, preferably, integrally formed therewith, the cylinder wall 4. The two heads and wall constitute between them, generally speaking, a cylinder. Each of the heads 2 and 3 carries a hollow cylindrical tang 10′, depending from the center of the inner face thereof toward the center of the cylinder proper, and consequently toward each other, in such relative position as to present between them a circular space in which the web 11 of the piston 6 travels as the piston rotates with its shaft 15′.

The interior surfaces of the cylinder heads 2 and 3 between their respective tangs 10′ and the cylinder wall 4, are similar in all respects, and therefore a description of one of them will be sufficient. The head 3 is provided on its inner face with an annular raised surface, angular in cross section, and presenting a circular apex 3′, which is concentric with the center of the piston shaft, and two oppositely inclined faces 7 and 8 which coöperate with faces on the piston 6 to form therewith steam chambers, the faces 8 coöperating with piston surfaces to form high power compression and exhaust chambers,

and the faces 7 coöperating with piston surfaces to form low power compression and exhaust chambers, all as will hereinafter appear.

The piston, designated as a whole by the numeral 6, comprises a block, provided on its opposite faces with two concentrically disposed and reversely directed helicoidal surfaces 9 and 10. These surfaces 9 and 10 are separated from each other throughout their extent by the circular groove 12.

The groove 12 is disposed concentrically with relation to the piston shaft 15′ and when the piston is in operative position, is coincident with the apex 3′ of the annular surface on the cylinder head 3.

The apex 3′ of the surface on the head 3 is grooved as at 13, and a spring-pressed packing ring 14 forms, fitting into the groove 13 under spring pressure, a steam tight joint between the two annular chambers on either side of the apex and lying between the piston face and the cylinder head. These two chambers are further each divided into two more chambers; one an exhaust and the other a working or drive chamber. This division into exhaust and working chambers is made by a high point 15 on the helicoidal surface 9, which travels in continuous though light contact with the face 7 and a similar high point 16 on the surface 10 traveling in light though continuous contact with the face 8. To present steam tight joints between 15 and 9, and 16 and 10, respectively, suitable packing pads 17 and 18 are attached to the points 15 and 16 respectively. A sliding abutment 19 is seated in a groove 19′ in the head 3. This abutment 19 is, preferably, semicircular in form and so mounted as to oscillate about the apex 3′ as a center. As the high point 15 reaches the abutment 19, the abutment is swung about the apex 3′ at right angles thereto until the portion of one side of the apex 3′ is forced below the surface 7. While the abutment is being forced below the face 7, it is likewise being forced above the face 8, as will be readily understood.

The pitch of the two surfaces 9 and 10 is so proportioned, and the surfaces themselves are so placed, that as the high point 15 of the surface 9 reaches abutment 19 the high point 16 of the surface 10 is diametrically opposite, and consequently the extreme low point of the surface 10 is over the abutment 19, and in contact therewith.

The surfaces 9 and 10 are so constructed as to travel in continuous sliding contact with the abutment 19 and (at points 15 and 16) with faces 7 and 8 respectively. It is clear from the above that the surfaces 15 and 16, together with the surfaces 9 and 10 and sliding abutment 19, form four separate steam chambers. These four chambers are adapted to constitute two high power and two low power chambers, two of which exhaust and two drive as the piston revolves.

On opposite sides of the abutment 19 are disposed two steam ports 20, 20′ and 21, 21′. Port 20 is adapted to receive live steam at high pressure, as will later appear. As the steam from port 20 acts upon a portion of the surface 10 between the abutment 19 and the point 16, the piston is revolved, as indicated by the arrows Fig. 1. As the portion of the said surface lying between the opposite side of the abutment and the point 16 approaches the abutment, steam previously admitted thereto exhausts through the port 20′, through the passage 20″ and through the port 20‴ into the passage 53 of the valve-port-plate 50, through port 54 therein, through port 31 in the disk 32 of the slide valve 30, thence through the port 33 in the disk 34, thence through the port 35 in the disk 36, along diagonal passage 37 therein to the port 38 therein, through said port, thence through port 39 in the disk 34, thence through port 40 in disk 32, thence through port 55 in port-plate 50, through passage 56 therein into port 60‴, thence through passage 60″ and thence through port 60′ into the low pressure chamber on the opposite side of the piston. At the end of the succeeding revolution, the steam admitted through port 60′ exhausts through port 60. From port 60 the steam passes through passages similar to those connecting the exhaust port 20′ with passage 53. It then passes along the passage 57 in port-plate 50, through port 58 therein, through port 41 in disk 32, through port 59 in port-plate 50 and thence to the outside air by way of exhaust passage 66.

Packing rings 81, 82, 83 and 84 are placed between the piston surface and the cylinder wall 4 and between the piston surface and tags 10 to preserve absolutely steam tight joints and prevent any leakage of steam.

The remaining high power and low power chambers receive steam through the slide valve 30 and the ports and passages therein in a similar manner to that above described. The high pressure chamber on the side of the piston opposite to the one described begins to receive steam at the same moment its counterpart begins to exhaust, the transfer of its steam to the low pressure chamber on the opposite face of the piston beginning at the same time that the exhaust of the first low pressure chamber starts. In order to reverse the engine at any moment, it is only necessary to slide the valve 30 to cover the ports 62 and 63 by which steam was delivered to the port 20 and its counter port and to open up ports 54 and 55′, whereby steam will be admitted to the reverse high power chambers, as will be evident.

A steam chest 70 is mounted upon the cylinder 1 and is provided with an inlet 71 for

admission of steam thereto and a second opening 72 through which a suitable handle 30′ may be projected for operating the valve 30.

The valve-port-plate 50 may or may not be rigidly connected to the steam chest. It is essential, however, that this plate and its ports and passages bear a definite and unchangeable relation to the delivery and exhaust ports of the several chambers of the engine, and to that end it should be securely attached either to the cylinder 1 or to the steam chest.

As shown, the preferred form of slide valve is one comprising a plurality of disks, each disk being provided with a plurality of ports, and two of said disks each having therein a diagonal passage adapted to transfer steam from a high pressure chamber on one side of the piston to a low pressure chamber on the opposite side thereof. However, if desired, the valve may be made from a single piece of metal, and the passages and ports bored therein.

It is obvious that by using one set of chambers for inlet and driving the other set could be used for suction, and the engine thereby constituted a pump with very satisfactory results.

The motive fluid selected for purposes of illustration is steam. Clearly, any other agent exerting its energy through expansion is equally applicable, and the invention is meant to cover an improvement of the character described and adapted to use any one or all such power agents.

Many changes in the construction and arrangement of parts may be made without in any way departing from the scope and extent of the present invention.

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

1. In a compound rotary engine, a cylinder comprising removably connected heads, each provided with oppositely inclined concentrically disposed annular surfaces on its interior face, the inclination of one surface being toward the center of the cylinder and the inclination of the other surface being directed away from the center of the cylinder, the two surfaces meeting and forming an annular apex or ridge, a piston mounted to rotate between said heads and provided with surfaces adapted to coöperate with the surfaces on the cylinder heads, and an annular apex or ridge adapted to travel in close contact with the ridge on the cylinder heads, the cylinder head surfaces and piston surfaces forming between them a plurality of steam chambers, and means for admitting steam to and exhausting it from said chambers.

2. In a compound rotary engine, a cylinder comprising removably connected heads, each provided with oppositely inclined concentrically disposed annular surfaces on its interior face, the inclination of one surface being toward the center of the cylinder and the inclination of the other surface being directed away from the center of the cylinder, the two surfaces meeting and forming an annular apex or ridge, a piston mounted to rotate between said heads and provided with surfaces adapted to coöperate with the surfaces on the cylinder heads, and an annular apex or ridge adapted to travel in close contact with the ridge on the cylinder heads, the cylinder head surfaces and piston surfaces forming between them a plurality of steam chambers, and means for admitting steam to and exhausting it from said chambers successively.

3. In a compound rotary engine, a cylinder comprising removably connected heads, each provided with oppositely inclined concentrically disposed annular surfaces on its interior face, the inclination of one surface being toward the center of the cylinder and the inclination of the other surface being directed away from the center of the cylinder, the two surfaces meeting and forming an annular apex or ridge, a piston mounted to rotate between said heads and provided with a plurality of surfaces on its opposite sides adapted to coöperate with the surfaces on the cylinder heads, and an annular apex or ridge adapted to travel in close contact with the ridge on the cylinder heads, the cylinder head surfaces and piston surfaces forming between them a plurality of steam chambers, a sliding abutment in such cylinder and operated by the surfaces of the piston head and adapted to divide said chambers on the opposite sides of the piston head each into working and exhaust chambers, and means for admitting steam to and exhausting it from said chambers.

4. In a compound rotary engine, a cylinder, concentrically disposed and oppositely inclined annular surfaces on the interior face of each of the cylinder heads, the inclination of one surface being toward the center of the cylinder and the inclination of the other surface being directed away from the center of the cylinder, the two surfaces meeting and forming an annular apex or ridge, a piston mounted to rotate in said cylinder and provided on its opposite sides with concentrically disposed oppositely inclined surfaces, and an annular apex or ridge which travels in contact with the apex or ridge on the adjacent cylinder head surfaces, the surfaces on one side of the piston head cooperating with the surfaces on the adjacent cylinder head to form a plurality of steam chambers divided into series, one series constituting high power chambers and another low power chambers, an abutment operated by said piston and adapted to divide said

chambers each into working and exhaust chambers, and means for admitting steam to and exhausting steam from said chambers successively.

5. In a compound rotary engine, a cylinder provided on the interior face of its respective cylinder heads with concentrically disposed oppositely inclined annular surfaces, the inclination of one surface being toward the center of the cylinder and the inclination of the other surface being directed away from the center of the cylinder, the two surfaces meeting and forming an annular apex or ridge, a piston mounted to rotate in said cylinder and provided on its opposite sides with concentrically disposed and oppositely inclined surfaces meeting to form an annular apex or ridge, which travels in contact with the apex or ridge on the cylinder head, the piston surfaces being so adapted that one of them on each side of the piston head coöperates with one of the surfaces on the adjacent cylinder head to form therewith a plurality of low power chambers, and the other of said surfaces on the same side of the piston head coöperates with the remaining surface on the adjacent cylinder head to form therewith a plurality of high power chambers, the high power and low power chambers alternating, with one another, an abutment operated by said piston and adapted to divide each of said chambers into a working and an exhaust chamber, and means for admitting steam to and exhausting steam from the high power and low power chambers successively.

6. In a compound rotary engine, a cylinder provided on the interior face of its respective heads with concentrically disposed and oppositely inclined annular surfaces, the inclination of one surface being toward the center of the cylinder and the inclination of the other surface being directed away from the center of the cylinder, the two surfaces meeting and forming an annular apex or ridge, a piston mounted to rotate in said cylinder and provided on its opposite sides with concentrically disposed and oppositely inclined surfaces meeting to form an annular ridge adapted to travel in contact with the ridge on the adjacent head, the surfaces on each face of the piston being adapted to form coöperatively with the surfaces on the adjacent cylinder head a plurality of concentrically disposed steam chambers, the steam chambers on each side of the piston being divided into series of high and low power chambers, the high power chambers and low power chambers on one side of the piston alternating one with the other, and the high power and low power chambers on the opposite sides of the piston alternating respectively with similar high and low power chambers on the opposite sides of the piston, an abutment operated by the piston and adapted to divide each of said chambers into a working and an exhaust chamber, means for admitting steam to the high power chambers, means for transferring steam from a high power chamber on one side of the piston to a low power chamber on the opposite side of the piston, and means for simultaneously exhausting steam from the low power chamber on the first side of the piston.

7. In a compound rotary engine, a cylinder provided on the interior faces of its cylinder heads with concentrically disposed oppositely inclined annular surfaces, the inclination of one surface being toward the center of the cylinder, and the inclination of the other surface being directed away from the center of the cylinder, the two surfaces meeting and forming an annular apex or ridge, a piston mounted to rotate in said cylinder and provided on its opposite sides with concentrically and coöperatively disposed surfaces meeting to form a ridge adapted to travel in contact with the ridge on the adjacent cylinder head, the surfaces on the piston head being adapted to form with the surfaces on the adjacent cylinder head a plurality of concentrically disposed steam chambers, the chambers being divided into high and low power series, the high power and low power chambers alternating one with another, a sliding abutment mounted to oscillate in the cylinder wall and adapted to be so oscillated by the surfaces on the piston head as said piston rotates and to divide each series of high and low power chambers respectively into receiving and exhaust chambers, and means for admitting steam to said steam chambers and for exhausting it therefrom.

8. In a compound rotary engine, a cylinder comprising removably connected heads, each having on the inner face thereof concentrically disposed and oppositely inclined annular surfaces, the inclination of one surface being toward the center of the cylinder, and the inclination of the other surface being directed away from the center of the cylinder, the two surfaces meeting in an annular apex or ridge, a piston mounted to rotate between said cylinder heads and in contact with said annular apex and provided with surfaces adapted to coöperate with the surfaces on the cylinder heads and to form therebetween a plurality of steam chambers, the surfaces on the piston head being disposed alternately on opposite sides of the aforesaid apex or ridge, and means for admitting steam to and exhausting it from said chambers.

9. In a compound rotary engine, a cylinder comprising removably connected heads, each having on the inner face thereof concentrically disposed and oppositely inclined annular surfaces, the inclination of one surface being toward the center of the cylinder and the inclination of the other surface be-

ing directed away from the center of the cylinder, the two surfaces meeting in an annular apex or ridge, a piston mounted to rotate between said cylinder heads and in contact with said annular apex or ridge and provided with concentrically disposed oppositely inclined annular surfaces, adapted to coöperate with the surfaces of the cylinder heads to form therebetween a plurality of steam chambers, the surfaces on the piston heads being disposed alternately on opposite sides of the aforesaid apex or ridge, and means for admitting steam to and exhausting steam from said cylinder.

10. In a compound rotary engine, a cylinder comprising removably connected heads, each having on the inner face thereof concentrically disposed and oppositely inclined annular surfaces, the inclination of one surface being toward the center of the cylinder and the inclination of the other surface being directed away from the center of the cylinder, the two surfaces meeting in an annular apex or ridge, a piston mounted to rotate between said cylinder heads and in contact with said apex and provided with concentrically disposed oppositely inclined annular surfaces adapted to coöperate with the surfaces of the cylinder heads to form therebetween a plurality of steam chambers, the inner set of surfaces on the piston head being arranged alternately with relation to the outer set thereon, said annular surfaces being disposed alternately on opposite sides of the aforesaid apex or ridge, and means for admitting steam to and exhausting steam from said cylinder.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

MARVEN WHITE.

Witnesses:
ARTHUR LA MARSH,
BURTON VRAKER.