M. J. HELMES.

ROTARY EXPLOSIVE MOTOR.

APPLICATION FILED APR. 9, 1908.

1,042,675.

Patented Oct. 29, 1912.

6 SHEETS—SHEET 1.

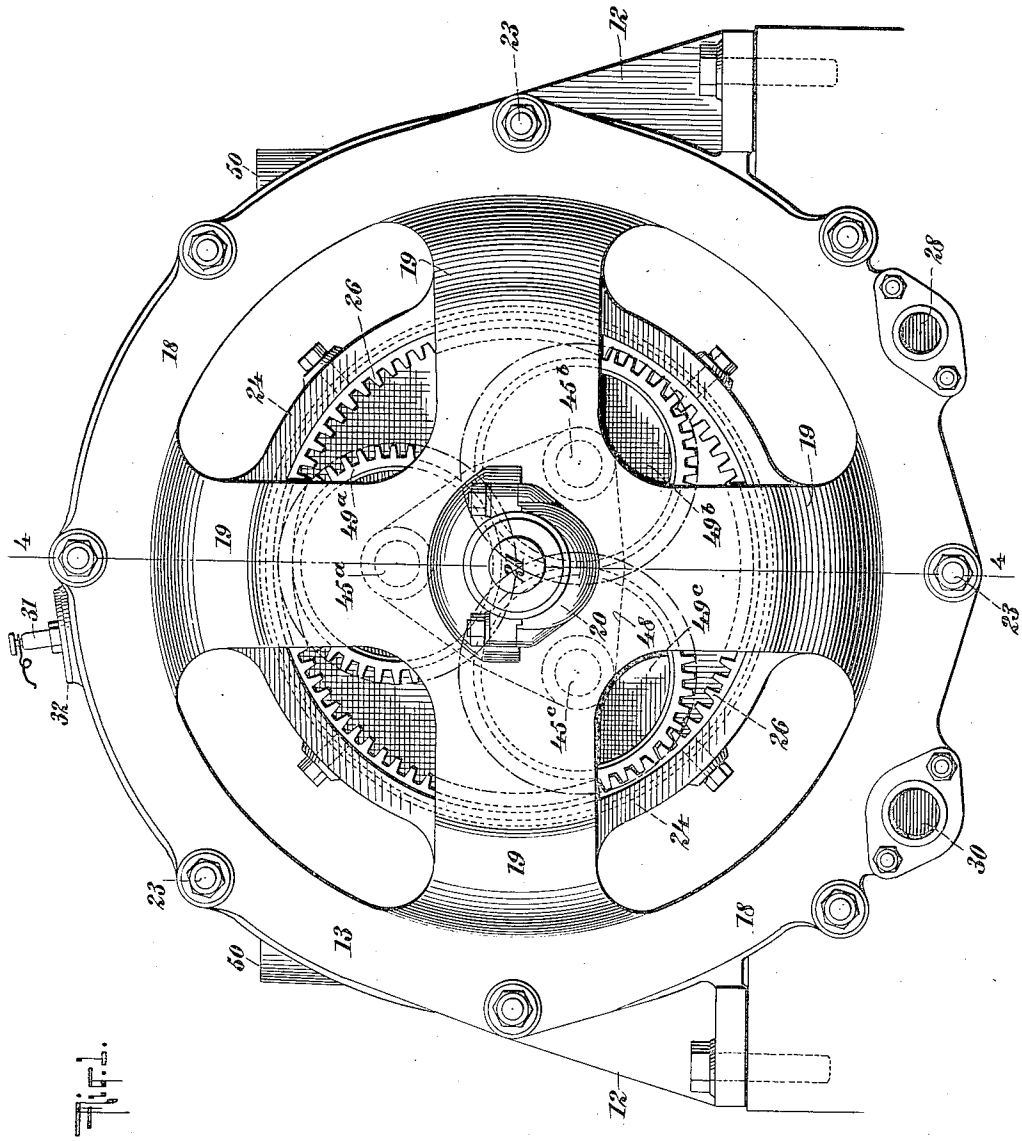

Fig. 1.

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6 SHEETS—SHEET 2.

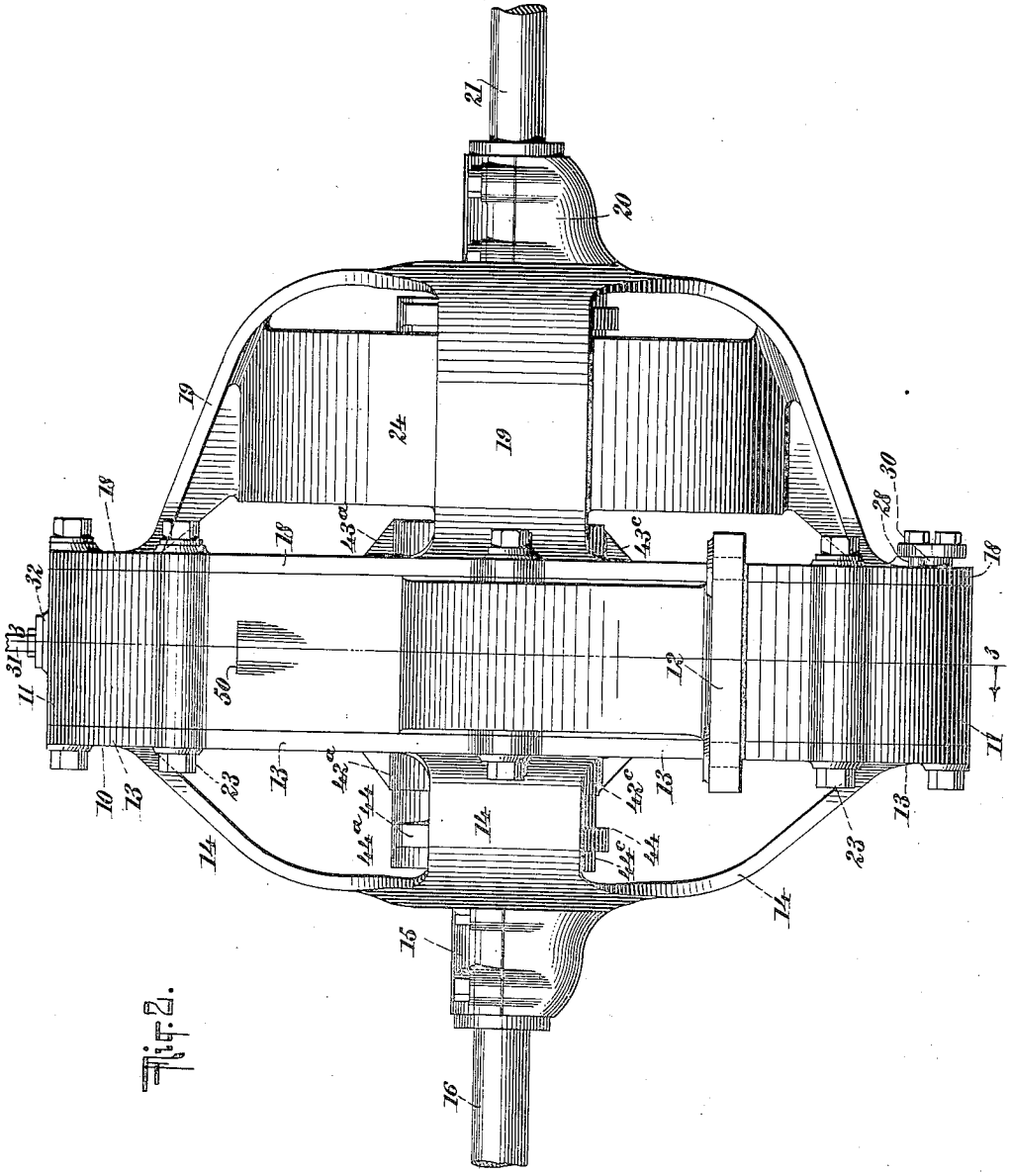

Fig. 2.

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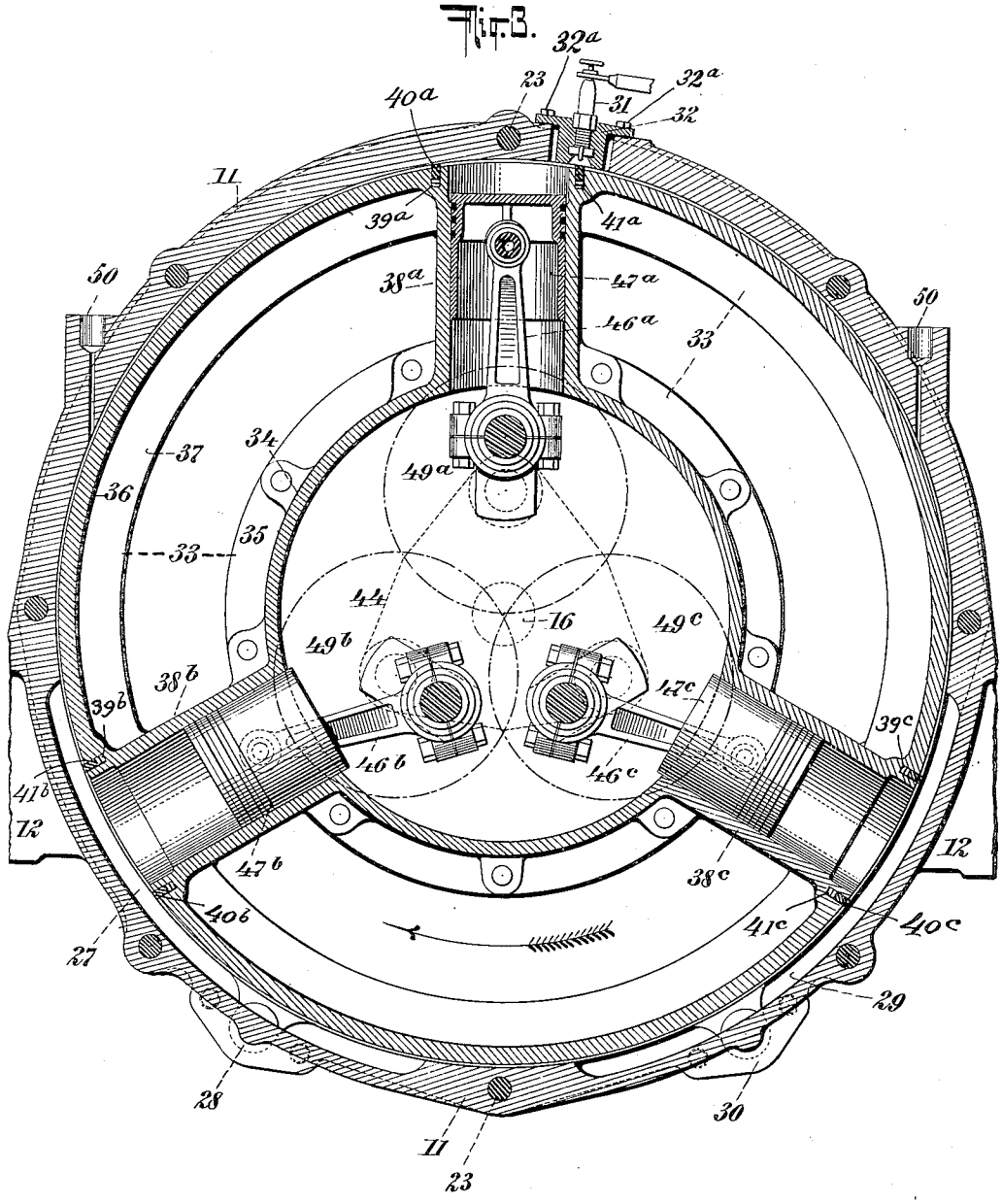
6 SHEETS—SHEET 3.

Fig. 3.



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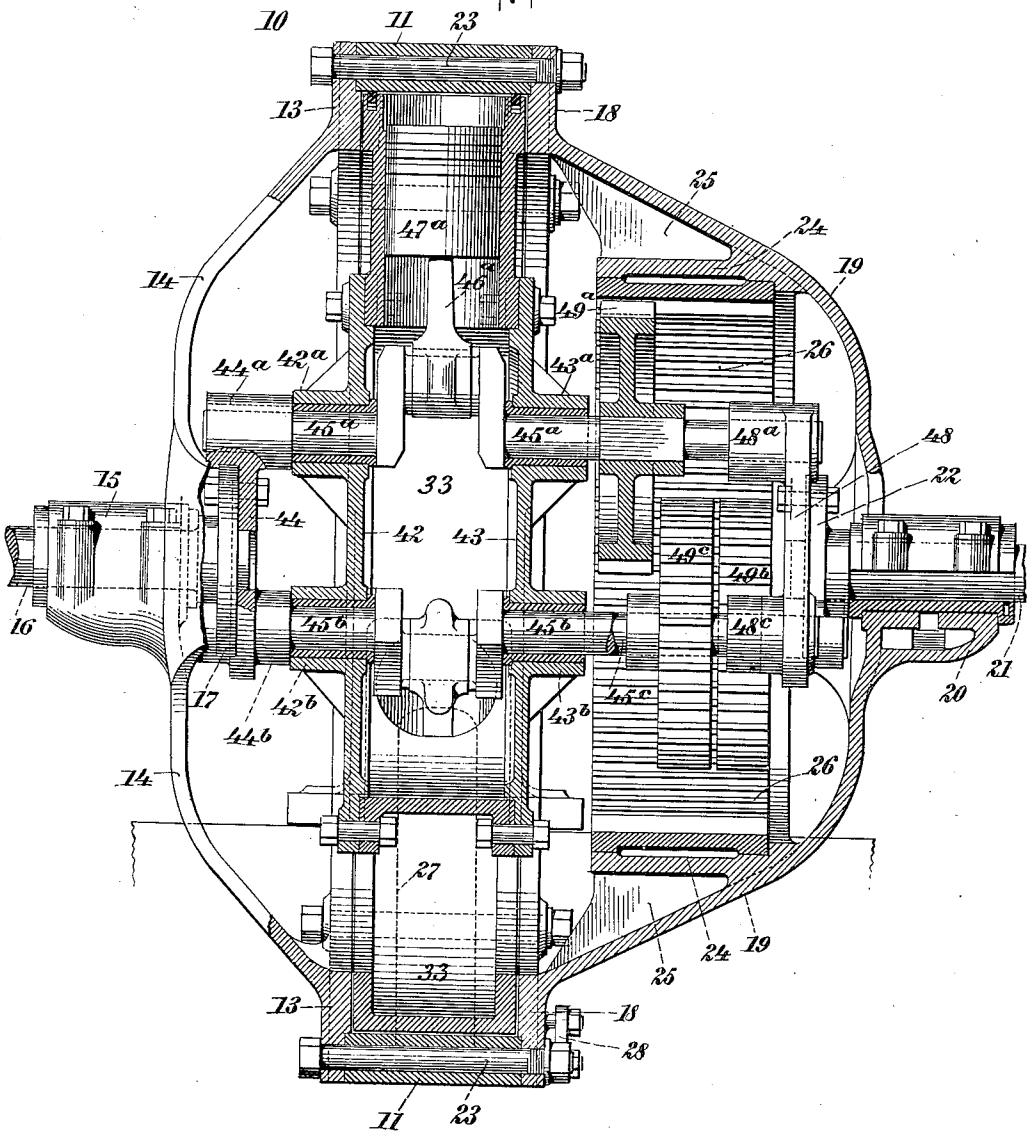
6 SHEETS—SHEET 4.

Fig. 4.



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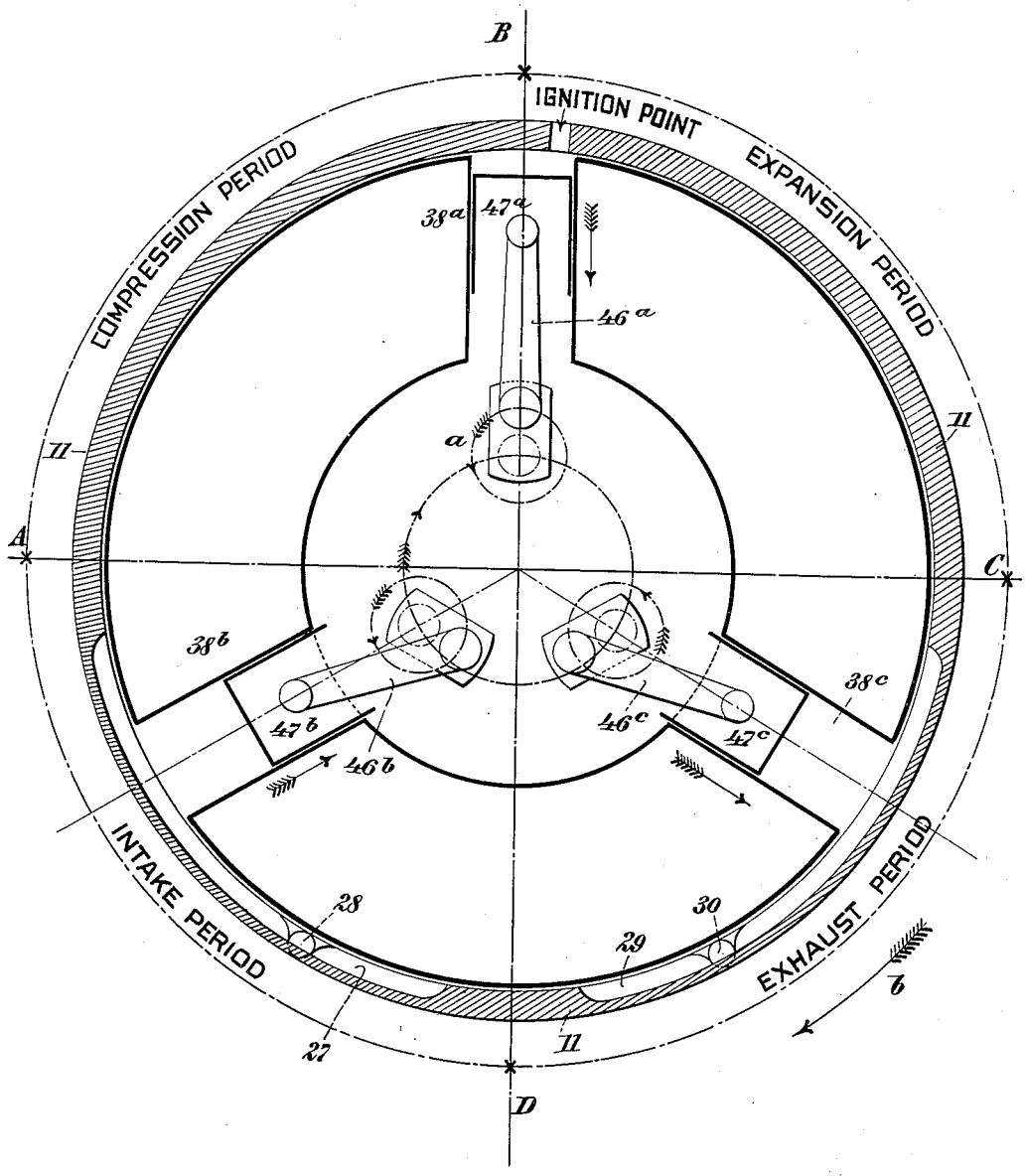
6 SHEETS—SHEET 5.

Fig. 5.



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1,042,675.

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6 SHEETS—SHEET 6.

Fig. 6.

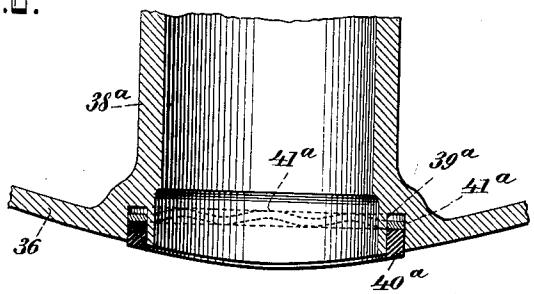


Fig. 7.

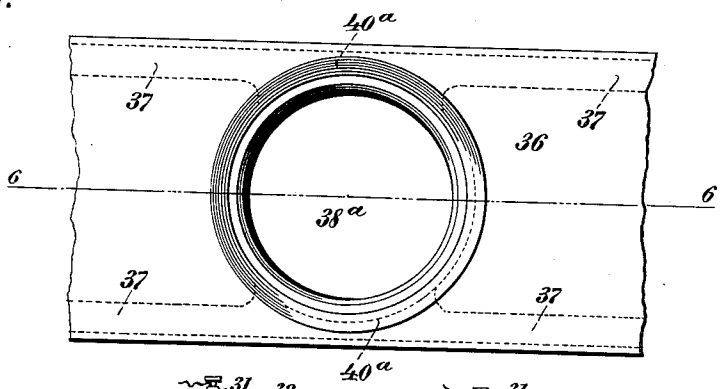
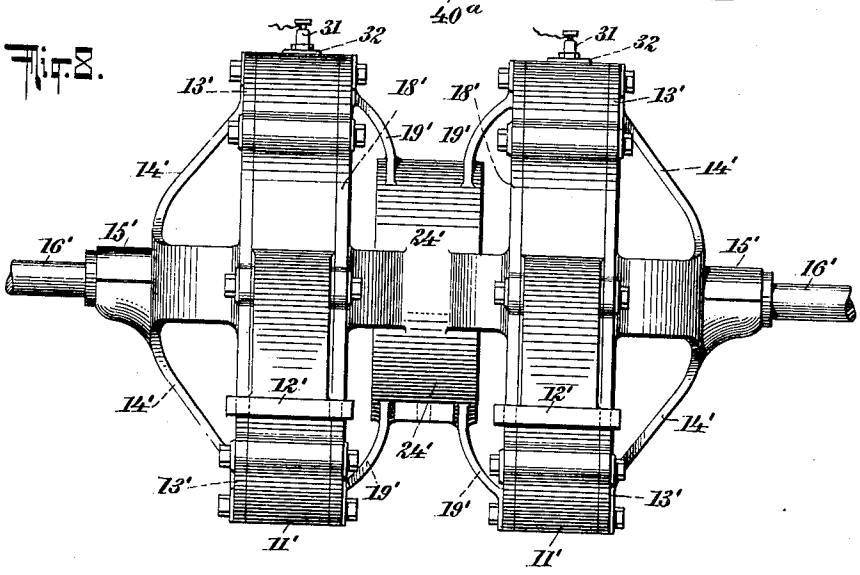


Fig. 8.



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UNITED STATES PATENT OFFICE.

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ROTARY EXPLOSIVE-MOTOR.

1,042,675. Specification of Letters Patent. Patented Oct. 29, 1912.

Application filed April 9, 1908. Serial No. 425,999.

To all whom it may concern:

Be it known that I, MAXIMILIAN J. HELMES, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Rotary Explosive-Motors, of which the following is a full, clear, and exact specification.

My invention relates to improvements in gas and analogous engines, and the same has for its object more particularly to provide a simple, efficient and reliable four-cycle rotary engine so constructed and arranged that it shall occupy the smallest space possible and be capable of use either as a stationary motor, or for use in motor vehicles, boats and other purposes requiring a small, light compact motor of high efficiency.

A further object of said invention is to provide a motor capable of producing a greater power in proportion to the space occupied than has heretofore been possible and to provide a motor in which the vibration is reduced to a minimum, and a smooth continuous operation insured.

To the attainment of the aforesaid objects and ends my invention consists in the novel details of construction, and in the combination, connection and arrangement of parts hereinafter more fully described, and then pointed out in the claims.

In the accompanying drawings forming part of this specification wherein like numerals indicate like parts,

Figure 1 is a rear or end view showing one form of rotary explosive motor constructed according to and embodying my said invention; Fig. 2 is a side view thereof; Fig. 3 is an enlarged sectional view taken on the line 3—3 of Fig. 2; Fig. 4 is a section taken on the line 4—4 of Fig. 1; Fig. 5 is a diagrammatic view indicating the arrangement and operation of the motor; Fig. 6 is a partial detail view taken on the line 6—6 of Fig. 7 showing the end of a cylinder with a compression ring located in the periphery of the revolving cylinder disk and surrounding the end of said cylinder; Fig. 7 is a face view thereof, and Fig. 8 is a multiple motor showing two units connected together.

In said drawings 10 designates the motor comprising an annular plate or ring 11 provided upon its opposite outer sides with brackets or lugs 12, 12 for supporting the motor in position upon a suitable support or bed.

13 denotes an annular cover plate having a plurality of arms or webs 14 14 extending inwardly from its inner edge, and uniting at their inner ends with a central bearing 15 in which is revolubly mounted a main driving shaft section 16 having a head 17 at its inner end. Upon the rear surface of the annular plate 11 is arranged an annular cover plate 18 also provided with a plurality of inwardly extending arms or webs 19, 19 which unite at their inner ends with a central bearing 20 arranged in alinement with the bearing 15 on the front cover plate 13, which bearing 20 is adapted to support a shaft section 21 provided at its inner end with a head 22. The front cover plate 13 and rear cover plate 18 are secured to the annular plate 11 by bolts 23, 23 extending through said cover plates 13, 18 and the annular plate 11.

The rear cover plate 18 is provided with a concentric cylindrical casing 24 which is supported by integral webs 25, 25 extending from the inner sides of the webs 19, 19, and within said casing 24 is rigidly secured an internal gear 26.

In the inner side of the annular plate 11 is provided a gas inlet channel 27 which occupies the lower left hand quarter of said plate and communicates with a suitable gas supply through an inlet port 28, and in the lower right hand quarter of said plate 11 is provided a similar, but slightly deeper channel 29 which communicates with an exhaust outlet 30.

31 denotes a spark plug or igniting device mounted in a bushing 32 and provided with flanges having slots therein adapted to receive screws 32^a—32^a whereby said adjusting device 32 may be secured to its adjusted position in a circumferential recess provided in the upper portion of the annular plate 11 intermediate the intake and exhaust ports of the motor, in order to control the proper firing of the explosive charges in the rotating cylinder.

Within the annular plate 11 between the annular cover plates 13, 18 is revolubly disposed a hollow annular cylinder disk 33, comprising an inner annular member 34 pro-

vided along its opposite edges with inwardly projecting flanges 35, 35 and an outer annular member 36 provided along its opposite edges with outwardly projecting flanges 37 37. Intermediate the annular members 34, 36 are provided cylinders 38^a, 38^b, 38^c, which are spaced equally apart from each other and made integral with said members and connected at their outer ends with the member 36 and at their inner ends with the member 34, and in the outer surfaces of the member 36 of said hollow disk 33 are provided circular recesses 39^a, 39^b, 39^c which surround the outer ends of the cylinders 38^a, 38^b, 38^c respectively and adapted to receive metal packings 40^a, 40^b, 40^c, the outer surfaces of which are maintained in contact with the interior surface of the plate 11 by means of springs 41^a, 41^b, 41^c in order to form a fluid tight closure for the open outer ends of said cylinders 38^a, 38^b, 38^c.

42 denotes a circular plate which is secured by bolts to the outer surface of the hollow cylinder disk 33 over the central opening therein, and said plate 42 is provided at its front with three journal bearings 42^a, 42^b, 42^c and 43 denotes a similar plate secured by bolts to the inner or rear surface of the cylinder disk 33, and the same is also provided with three journal bearings 43^a, 43^b, 43^c arranged in alinement with the journal bearings 42^a, 42^b, 42^c in the front plate 42.

44 denotes a circular plate rigidly secured by bolts to the circular plate 17 at the inner end of the shaft section 16, and is provided with three journal bearings 44^a, 44^b, 44^c which register with the bearing on the plate 42 carried upon the outer surface of the cylinder disk 33.

45^a, 45^b, 45^c denote crank shafts arranged in the central portion of the hollow cylinder disk 33, said crank shafts having their front ends disposed in the bearings 42^a, 42^b, 42^c of the plate 42 and the bearings 44^a, 44^b, 44^c of the circular plate 44 bolted to the shaft section 16, and the inner or rear ends of said shafts supported in and projecting beyond the bearings 43^a, 43^b, 43^c of the cover plate 43.

To the off-set portions of the crank shafts 45^a, 45^b, 45^c within the hollow cylinder disk 33 are pivotally secured the outer ends of rods 46^a, 46^b, 46^c, respectively, which have their outer ends pivotally secured to pistons 47^a, 47^b, 47^c working in the cylinders 38^a, 38^b, 38^c respectively.

The extreme inner or rear ends of the crank shafts 45^a, 45^b, 45^c are supported in bearings 48^a, 48^b, 48^c arranged upon a circular plate 48 bolted to the inner side of the circular plate 22 of the shaft section 21. The portions of the crank shafts 45^a, 45^b, 45^c intermediate the bearings 43^a, 43^b, 43^c, and said bearings 48^a, 48^b (not seen), 48^c are provided with squared portions arranged in staggered formation upon which are fixed gears 49^a, 49^b, 49^c respectively meshing with the internal gear 26 arranged within the casing 24. Each of said gears 49^a, 49^b, 49^c having one half of the diameter of the internal gear 26 in order that each of said gears shall describe two complete revolutions during one revolution of the cylinder disk 33.

50, 50 denote oil holes provided in the opposite sides of the annular plate 11 through which the lubricant for the rotating cylinder disk 33 may be introduced.

The operation of the motor is as follows: Assuming that the hollow cylinder disk 33 is in position as shown and indicated at Fig. 3, and diagrammatically at Fig. 5, and the main driving shaft consisting of the sections 16, 21, together with the hollow cylinder disk 33 to have been rotated in order to set the motor in operation, the piston 47^b will be caused to move inward within its cylinder 38^b and take in a charge of explosive mixture or fuel during the time said cylinder 38^b is making a quarter revolution, to wit, the distance from D to A, during which time the open outer end of said cylinder 38^b is in constant communication with the intake channel 27. During the second quarter revolution of said hollow disk 33, to wit, the distance from A to B, said piston 47^b will be traveling outward and assume the position of the piston 47^a, during this period the explosive charge will be compressed until the point B is reached when said charge will be ignited and expanded, and the piston 47^b caused to travel inward again, and rotation imparted, in the direction of the arrow *a*, to the shaft 45^a, gear 49^a, which being in mesh with the fixed internal gear 26 will cause the cylinder disk 33 to rotate in the direction of the arrow *b*, until the cylinder 38^b has reached the end of the third quarter of its movement, to wit, the point C. Hereupon the said cylinder begins the fourth quarter of its revolution during which time the outer end thereof is in constant communication with the exhaust channel 29, and the piston 47^b moving outward in said cylinder 38^b drives the combusted fuel out through said channel 29 and exhaust port 30 until the fourth quarter of its revolution has been reached, thereby bringing said cylinder 38^b back to its initial position. The operation of the cylinder 38^b, and its piston 47^b and connected parts will thereupon be successively performed by each cylinder and piston as long as the motor remains in operation.

It will, of course, be understood that as the piston 47^b is about to begin its compression stroke the piston 47^a is about to begin its expansion or power stroke, and at the same time the piston 47^c is about to begin

its exhaust stroke in which several positions said pistons are shown at Fig. 3 and diagrammatically at Fig. 5.

In the construction illustrated at Fig. 8 the interior construction of each unit and its operation is as hereinbefore described. Each unit consists of an annular plate 11′ provided with brackets or lugs 12′ 12′ and front cover plate 13′ having arms or webs 14′ supporting a bearing 15′ for the shaft section 16′. The rear cover plates 18′, 18′ are both provided with inwardly projecting arms or webs 19′, 19′ to the ends of which is connected a cylindrical casing 24′ within which is secured the large internal gear heretofore described.

It will be quite obvious that the power and size of the motor may be readily increased or diminished by increasing or reducing the number of cylinders or pistons or increasing the diameter of said cylinder bores and that a number of said hollow cylinder disks may be arranged side by side and connected together forming a multiple disk motor as indicated at Fig. 8.

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

1. A rotary explosive motor comprising a stationary casing having inlet and outlet ports therein, a revoluble annular member mounted to rotate in said casing, a gear secured to said stationary casing, a main shaft comprising two sections secured to said revoluble member and supported at their ends in said casing, a plurality of radial cylinders in said revoluble member, pistons and rods adapted to work therein, a plurality of shafts mounted in said revoluble member intermediate said main shaft sections, gears fixed on said shafts and meshing with said stationary gear, and cranks on said shafts connected to the piston rods in said cylinders for rotating said revoluble member and causing said pistons to move inward and outward twice in their respective cylinders during one revolution of said revoluble member, substantially as specified.

2. A rotary explosive motor comprising a stationary casing having inlet and outlet ports therein, and circumferential channels communicating with said ports, bearings secured to said casing at its opposite sides, an annular member arranged in said casing and adapted to rotate therein, a plurality of radial cylinders in said annular member, pistons and rods arranged to work in said cylinders, a gear case secured to said stationary casing, an internal gear fixed within said gear case, a shaft mounted in one of said bearings, a disk secured to the inner end of said shaft, a plurality of shafts disposed in said gear case, having their outer ends mounted in said annular member, and their rear ends mounted in the disk fixed at the inner end of said last-mentioned shaft, gears fixed thereon in mesh with said internal gear, and cranks at the forward ends of said shafts pivotally connected to the inner ends of said piston rods, substantially as specified.

3. A motor comprising a stationary casing having a circular opening therein, circumferential channels in said casing around said opening, an annular disk revolubly mounted in said casing, a plurality of cylinders in said disk, pistons and rods adapted to work in said cylinders, a gear case secured to said casing, concentric with said annular disk, an internal gear fixed therein, bearings provided at the opposite ends of said casing, shaft sections mounted in said bearings, bearings provided upon the inner ends of said shaft sections, a plurality of shafts carried by said disk and mounted in said bearings, cranks on said shafts connected to said piston rods, and gears fixed upon said shafts meshing with said internal gear, substantially as specified.

4. A motor comprising a stationary casing having a circular opening therein, circumferential intake and exhaust channels in said circular casing, an annular disk revolubly mounted in said circular opening, a plurality of cylinders arranged radially in said annular disk, pistons and rods in said cylinders, bearings provided in said annular disk, a plurality of crank-shafts arranged in said bearings connected to said rods, and having their ends projecting out of said annular disk, a gear case secured to said casing and concentric with said annular disk, an internal gear fixed in said case, bearings provided at the opposite ends of said stationary casing, shaft sections mounted in said bearings, plates secured to the inner ends of said shaft sections, bearings on said plates adapted to support the ends of the crank shafts arranged in said annular disk, and gears fixed on said crank shafts meshing with said internal gear, substantially as specified.

5. A motor comprising a stationary casing having a circular opening therein, circumferential intake and exhaust channels in said circular casing, an annular disk revolubly mounted in said circular opening, a plurality of cylinders arranged radially in said annular disk, packing arranged about the outer ends of said cylinders intermediate the outer surface of said annular disk and the inner surface of said circular casing, pistons and rods in said cylinders, cover plates secured centrally to said annular disk at the opposite sides thereof, bearings in said cover plates, a plurality of crank shafts revolubly mounted in said bearings and connected to said rods, said crank shafts having their ends projecting out of said bearings, a gear case secured to said casing and concentric with said annular disk, an internal gear

fixed in said case, bearings provided at the opposite ends of said stationary casing, shaft sections mounted in said bearings, heads arranged upon the inner ends of said shaft sections, plates secured to said heads, a plurality of bearings arranged upon said plates registering with the bearings in the cover plates on said annular disk and receiving the ends of said crank shafts, and gears fixed upon said crank shafts meshing with said internal gear, substantially as specified.

6. A motor comprising a stationary casing having a circular opening therein, circumferential intake and exhaust channels in said circular casing, an annular disk revolubly mounted in said circular opening, a plurality of cylinders arranged radially in said annular disk, packing arranged about the outer ends of said cylinders intermediate the outer surface of said annular disk and the inner surface of said circular casing, pistons and rods in said cylinders, cover plates secured centrally to said annular disk at the opposite sides thereof, bearings in said cover plates, a plurality of crank shafts revolubly mounted in said bearings and connected to said rods, said crank shafts having their ends projecting out of said bearings, a gear case secured to said casing and concentric with said annular disk, an internal gear fixed in said case, bearings provided at the opposite ends of said stationary casing, shaft sections mounted in said bearings, heads arranged upon the inner ends of said shaft sections, plates secured to said heads, a plurality of bearings arranged upon said plates registering with the bearings in the cover plates on said annular disk and receiving the ends of said crank shafts, gears fixed upon said crank shafts meshing with said internal gear, and an igniting device mounted in said stationary casing intermediate the intake and exhaust channels therein, and adjustable in a path concentric with the axis of rotation of said annular disk, substantially as specified.

7. A motor comprising a stationary casing having a circular opening therein, circumferential intake and exhaust channels in said circular casing, an annular disk revolubly mounted in said circular casing, a plurality of cylinders arranged radially in said annular disk, packing arranged about the outer ends of said cylinders intermediate the outer surface of said annular disk and the inner surface of said circular casing, pistons and rods in said cylinders, cover plates secured centrally to said annular disk at the opposite sides thereof, bearings in said cover plates, a plurality of crank shafts revolubly mounted in said bearings and connected to said rods, said crank shafts having their ends projecting out of said bearings, a gear case secured to said casing and concentric with said annular disk, an internal gear fixed in said case, bearings provided at the opposite ends of said stationary casing, shaft sections mounted in said bearings, heads arranged upon the inner ends of said shaft sections, plates secured to said heads, a plurality of bearings arranged upon said plates registering with the bearings in the cover plates on said annular disk and receiving the ends of said crank shafts, gears fixed upon said crank shafts meshing with said internal gear, an igniting device, and means for supporting said igniting device arranged in said casing, and adjustable in a path concentric with the axis of rotation of said annular disk, substantially as specified.

8. A motor comprising a stationary casing having a circular opening therein, intake and exhaust channels arranged in opposite sides of said circular casing around said opening, an annular disk revolubly mounted in said circular opening, a plurality of cylinders arranged radially in said annular disk, packings arranged surrounding the outer ends of said cylinders intermediate the outer surface of said annular disk and the inner surface of said circular casing; pistons and rods in said cylinders, cover plates secured centrally to said annular disk at opposite sides thereof, bearings disposed in said cover plates, a plurality of crank shafts independently rotatable in said bearings and revoluble with said annular disk, said crank shafts being connected to said rods and having their ends projecting out of said bearings, annular cover plates secured to said stationary casing, arms projecting inwardly from said annular cover plates, bearings arranged concentrically with said annular disk and connected to the inner of said arms, a gear case fixed to one of said cover plates and concentric with said annular disk, shaft sections mounted in the bearings carried by said annular cover plates, heads arranged upon the inner ends of said shaft sections, plates secured to said heads, a plurality of bearings arranged upon said plates and registering with the bearings in the central cover plates on said disk and receiving the ends of said crank shafts, gears fixed upon said crank shafts meshing with said internal gear, an igniting device, and supporting means therefor arranged in said stationary casing intermediate the intake and exhaust channels therein, and adjustable in the path of travel of said annular disk, substantially as specified.

9. A motor comprising a stationary casing, having circular openings therein, circumferential intake and exhaust channels in said circular casing, a plurality of annular disks revolubly mounted in said circular openings, cylinders arranged radially in said annular disks, pistons and rods in said cylinders, bearings provided in said annular disks, a plurality of crank shafts ar-

ranged in said bearings connected to said rods and having their ends projecting out of said annular disks, a gear case supported intermediate said annular disks secured to said casing concentric with said annular disks, an internal gear fixed in said case, bearings provided at the opposite ends of said stationary casing, shaft sections mounted in said bearings, plates secured to the inner ends of said shaft sections, bearings on said plates adapted to support the ends of the crank shafts arranged in said annular disks, and gears fixed on said crank shafts meshing with said internal gear, substantially as specified.

Signed at the city of New York in the county and State of New York, this third day of April, nineteen hundred and eight.

MAXIMILIAN J. HELMES.

Witnesses:

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