No. 782,085. PATENTED FEB. 7, 1905.

C. R. TWITCHELL.

ROTARY ENGINE.

APPLICATION FILED MAR. 28, 1904.

5 SHEETS—SHEET 1.

Fig. 1.

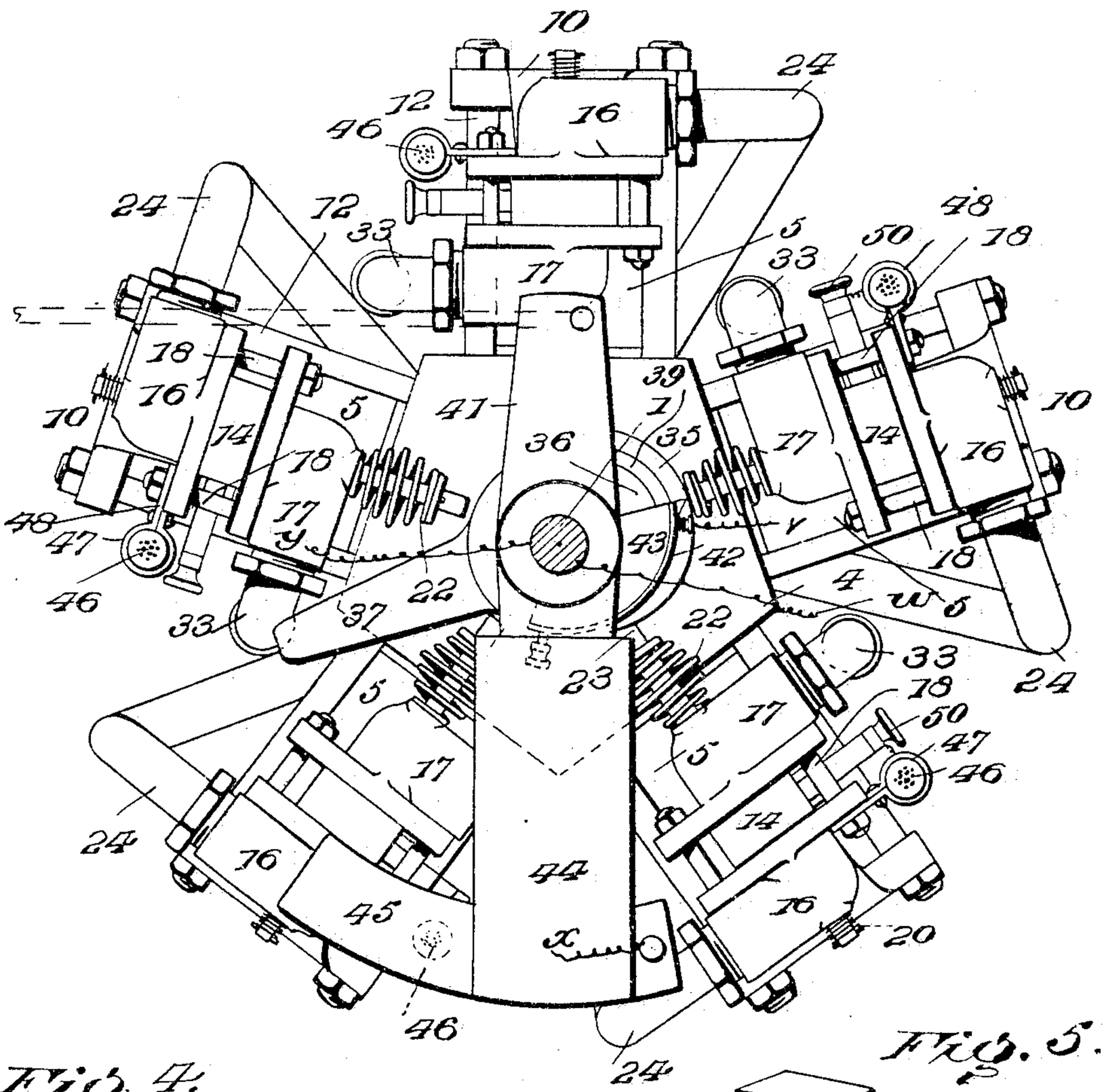

Fig. 4.

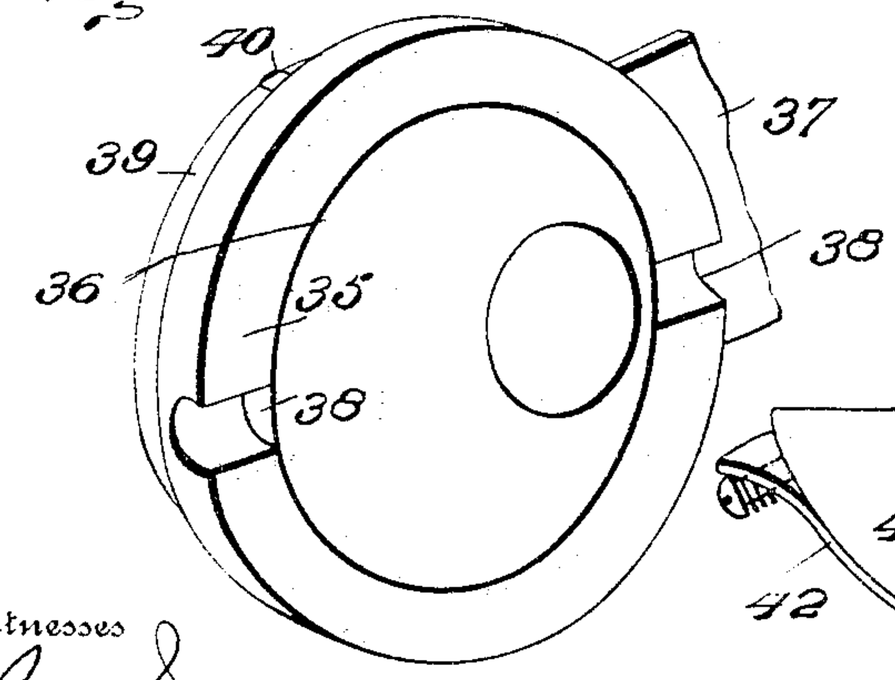

Fig. 5.

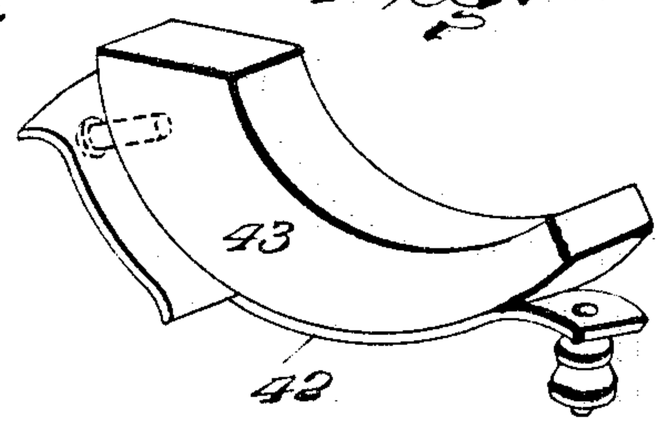

Fig. 5a

Witnesses

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5 SHEETS—SHEET 2.

Fig. 2.

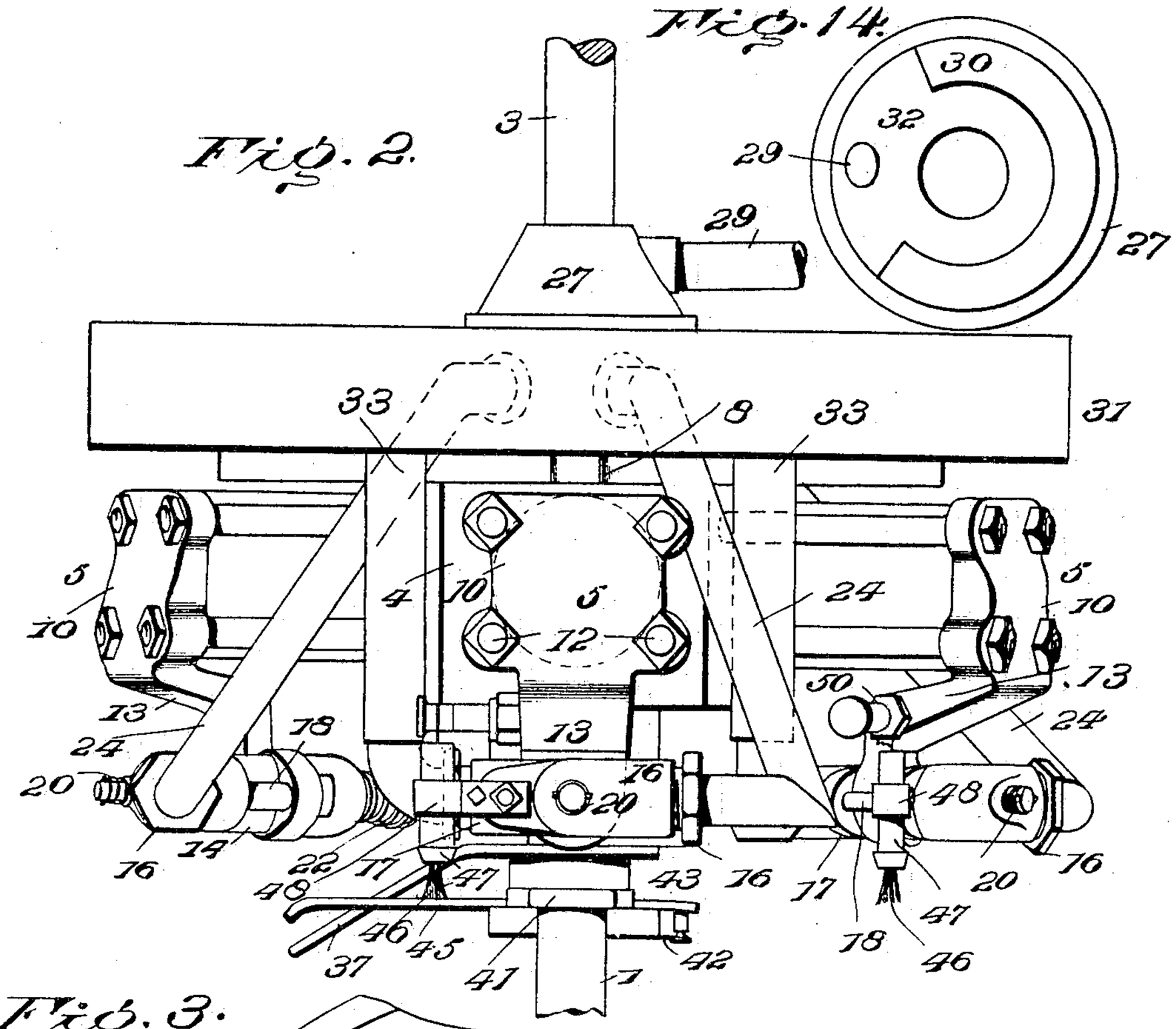
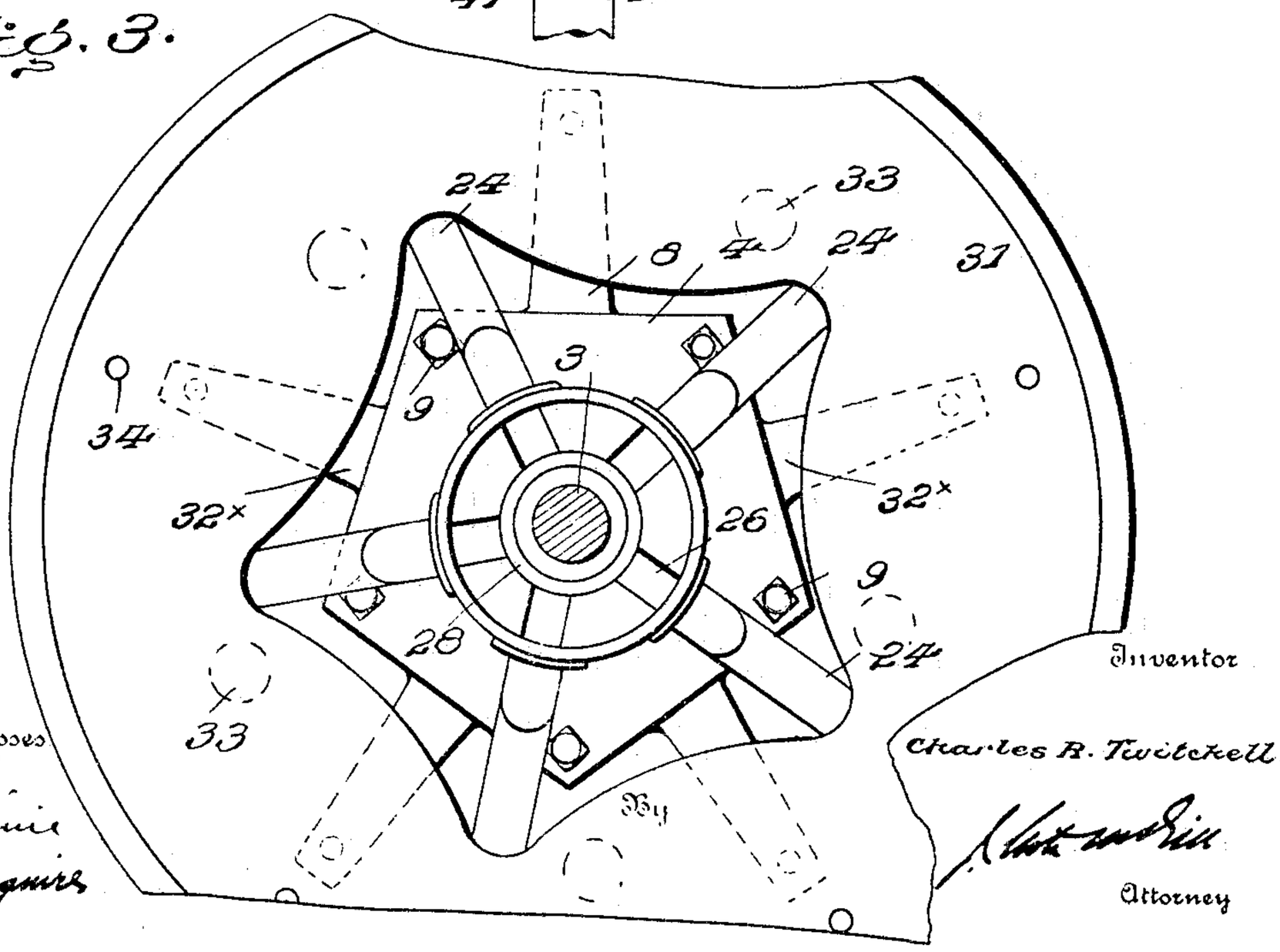


Fig. 1.



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5 SHEETS—SHEET 3.

Fig. 6.

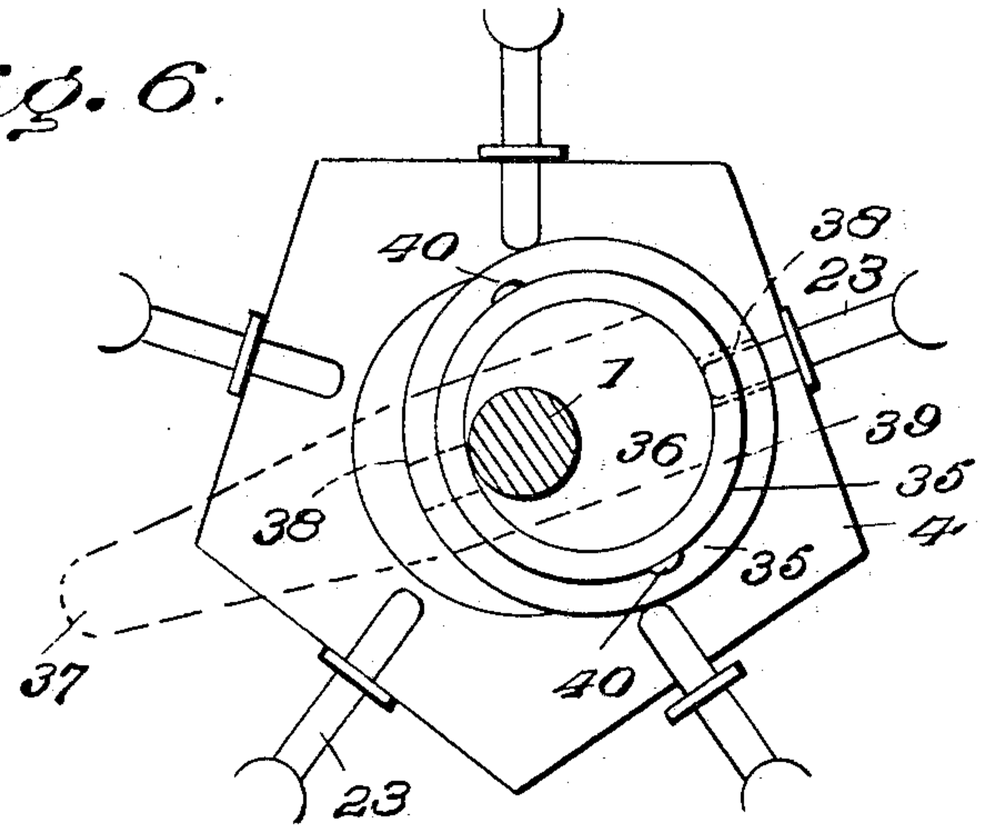


Fig. 8.

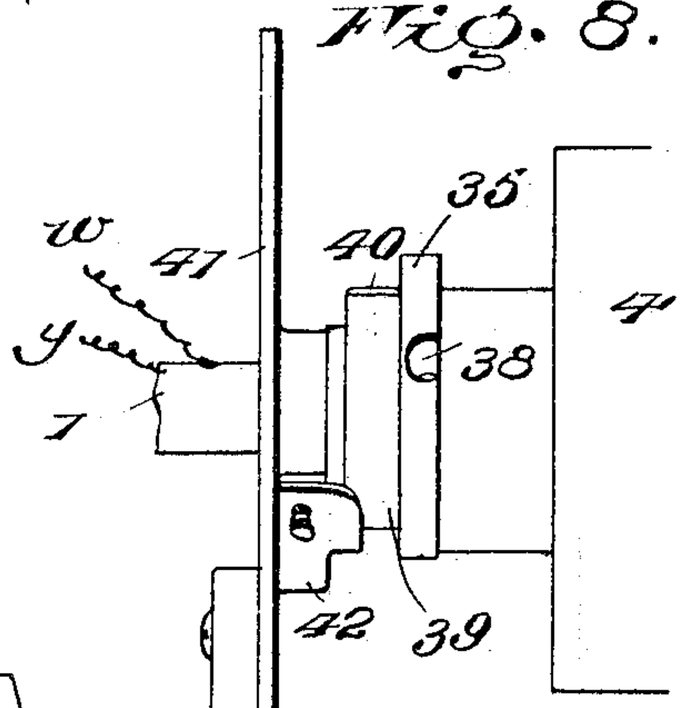


Fig. 7.

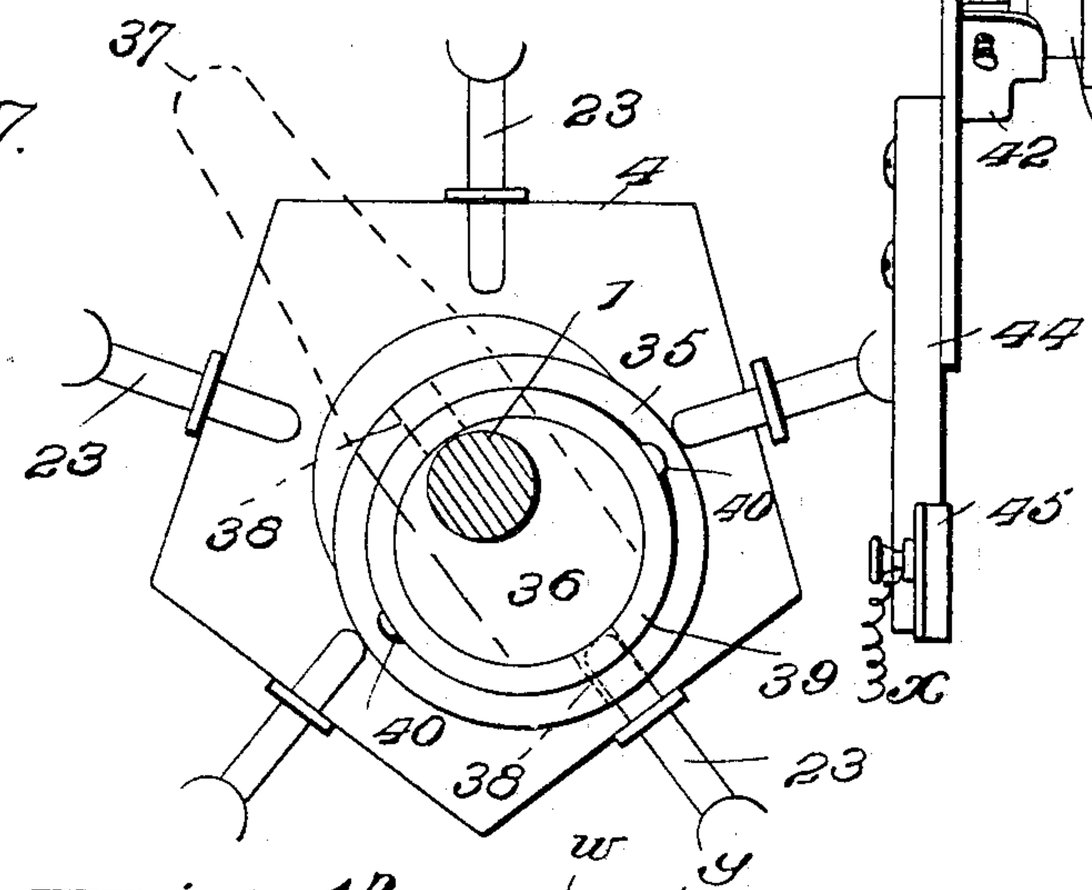
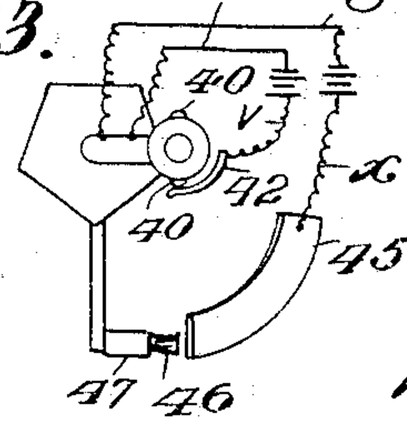


Fig. 13.



Witnesses

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5 SHEETS—SHEET 4.

Fig. 9.

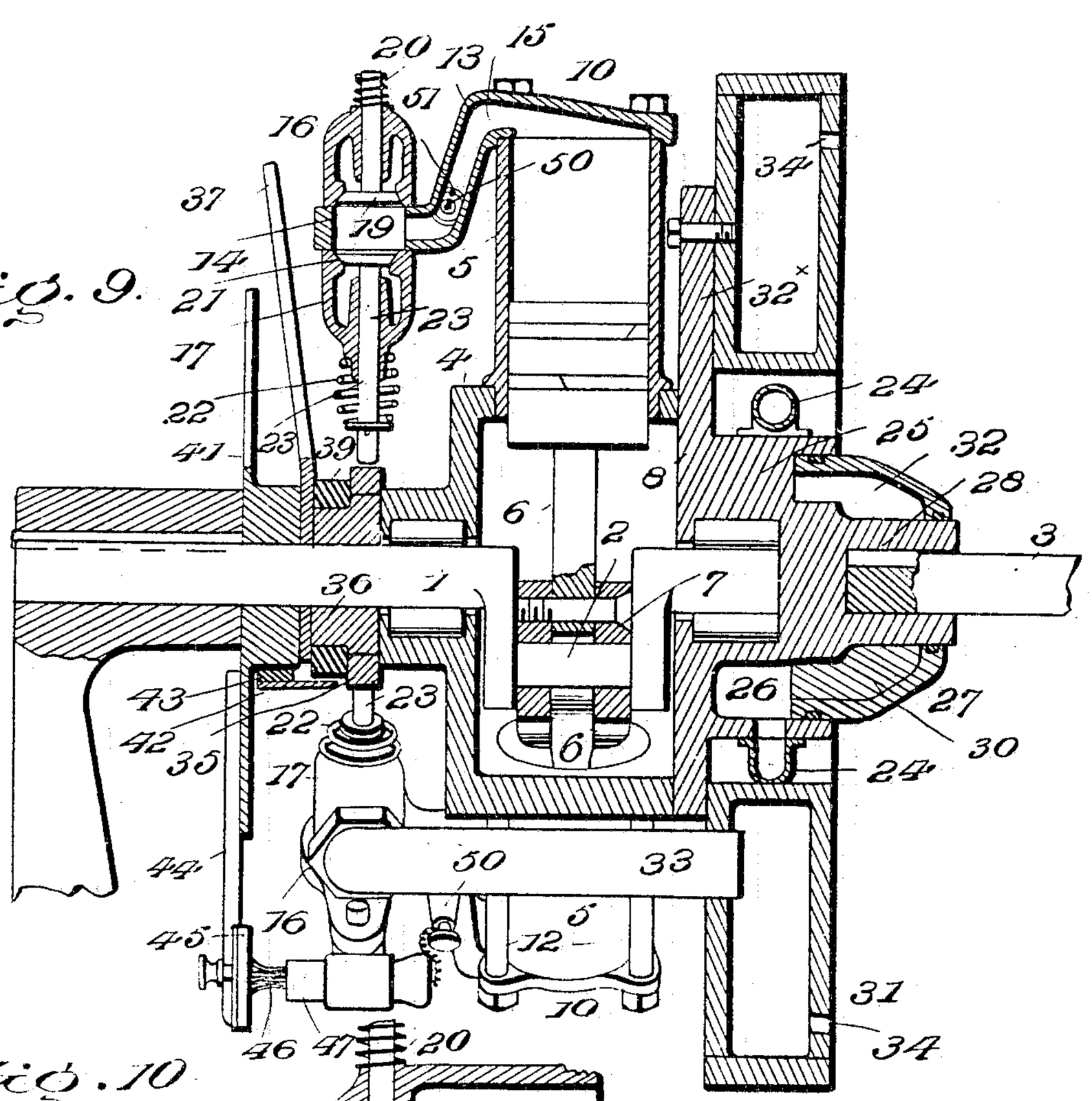
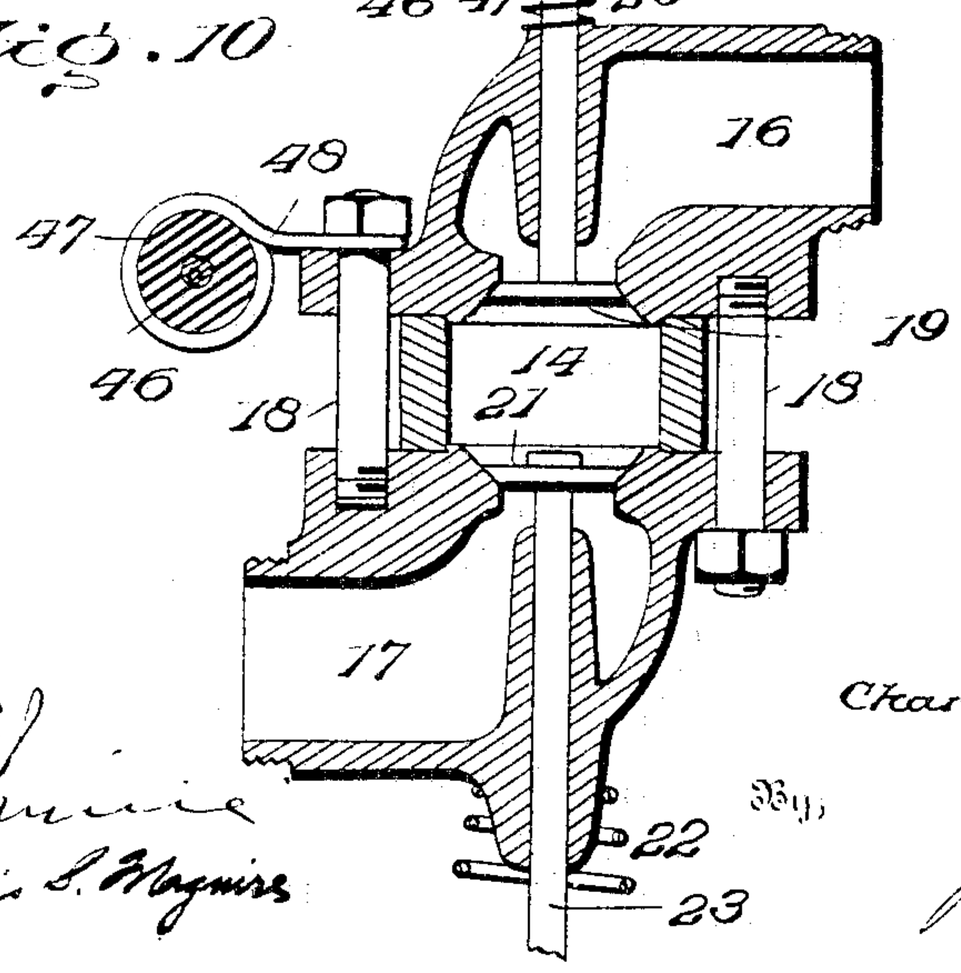


Fig. 10.



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5 SHEETS—SHEET 5.

Fig. 11.

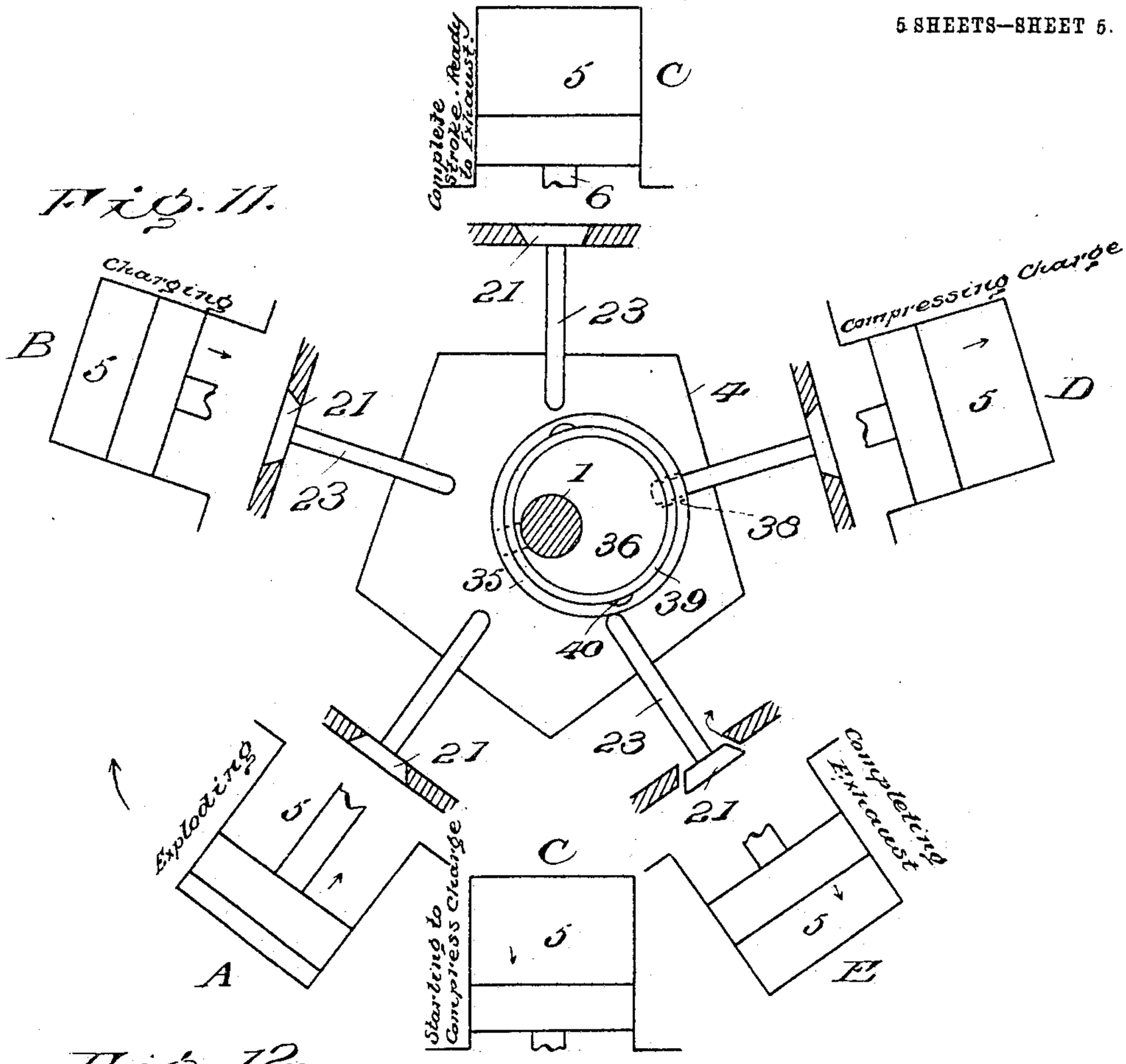
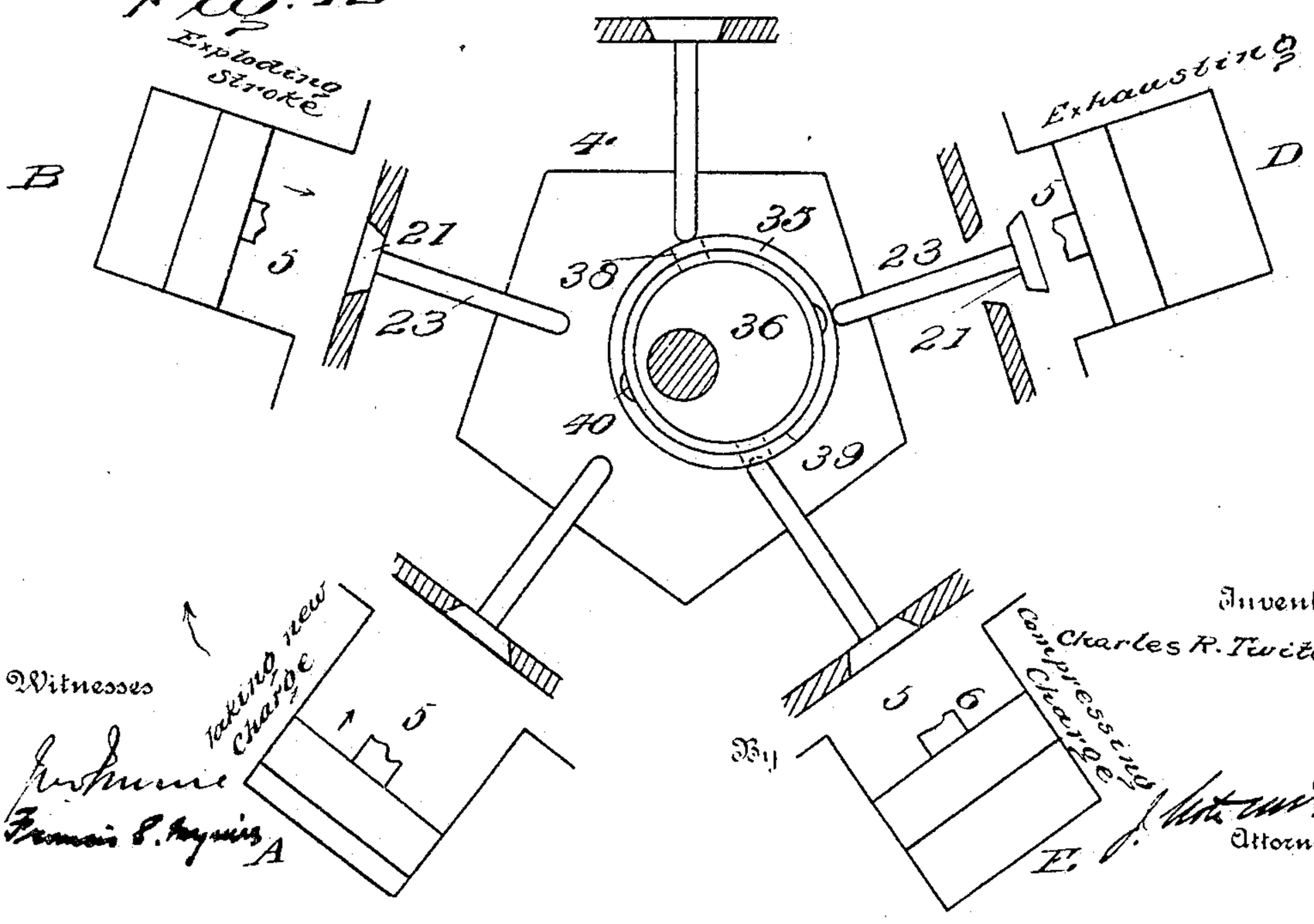


Fig. 12.



Witnesses

Inventor

Charles R. Twitchell

Attorney

No. 782,085. Patented February 7, 1905.

UNITED STATES PATENT OFFICE.

CHARLES R. TWITCHELL, OF DAYTON HEIGHTS, CALIFORNIA, ASSIGNOR TO BROWN-WINSTANLEY MANUFACTURING COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 782,085, dated February 7, 1905.

Application filed March 28, 1904. Serial No. 200,416.

To all whom it may concern:

Be it known that I, CHARLES R. TWITCHELL, of Dayton Heights, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare the following to be 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 primary object of this invention is to provide in a multicylinder rotary engine improved means for actuating the controlling-valves, as well as timing such actuation so as to control the speed of the engine.

A further object is to provide a single element for effecting the unseating of the valve of each alternate cylinder in each revolution, such element preventing the unseating in any one revolution of such cylinder-controlling valves as were actuated on the last previous revolution; and a further object is to effect by such element the closing of an electric circuit as a cylinder whose valve has not been unseated is primed for an explosion.

A further object is to provide improved means for supplying the explosive medium to the engine and controlling the discharge of the exhaust.

In the drawings, Figure 1 is an elevation. Fig. 2 is a plan view. Fig. 3 is an end view with the cap of the gas-supply chamber removed. Fig. 4 is a view of the valve-actuating ring and its support. Figs. 5 and 5ª are views of portions of the sparker-lever. Figs. 6 and 7 show the valve-actuating ring in different positions. Fig. 8 is an edge view of the sparker-lever and the valve-actuating ring. Fig. 9 is a vertical longitudinal sectional view. Fig. 10 is an enlarged sectional view through the inlet and outlet casings. Fig. 11 is a diagrammatic view showing the positions of the exhaust-controlling valves at one stage of revolution. Fig. 12 is a similar view at a different stage of movement. Fig. 13 is a diagrammatic view showing the electric circuit. Fig. 14 is an inner face view of the supply-chamber cap.

Referring to the drawings, 1 designates a stationary shaft having a cranked portion 2, and 3 a driven shaft in axial line with shaft 1. Revoluble on shaft 1 is a hollow casing 4, having a central chamber inclosing the crank. To this casing are secured five cylinders 5, the rods 6 of the pistons whereof are secured at their inner ends to a block 7, revoluble on crank 2. The removable side 8 of the casing is held in place by screws 9, and to it the shaft 3 is rigidly secured. Into a sleeve fixed centrally in side 8 projects the inner end of shaft 1, surrounded by ball-bearings. The outer heads 10 of the several cylinders are removable, being preferably secured by nutted rods 12, extended outwardly from the side of casing 4. Each of these heads has formed therewith a hollow branch 13, extended inwardly approximately parallel with the cylinder and terminating in a ring 14. This branch forms the duct or channel 15, through which the gases are admitted to and exhausted from the cylinder. The admission branch or elbow 16 and the outlet branch or elbow 17 are of corresponding formation and held firm against the opposite sides of the rings 14 by nutted bolts 18. Over the inner end of the inlet branch 16 is seated a valve 19, which is automatically unseated as against the tension of its holding-spring 20 by the inward or suction movement of the piston. This valve is directly in line with the circular opening of the ring 14. Also in line with this opening, but mounted in the outlet branch 17, is an exhaust-controlling valve 21, normally held to its seat by a spring 22, surrounding its stem 23. The stems of the several valves 21 all point toward the axial center of the casing 4. The gas-supply pipes 24 are coupled to the inlet branches 16 and thence carried transversely of the several cylinders to the opposite side of the revolving casing 4, being secured at their other ends to the cylindrical housing 25 of a gas-supply chamber, said housing being formed with corresponding ports opening from a series of interior channels 26. The outer end of this housing is closed by a stationary cap 27, having a gas-tight fit within the chamber and on

the central boss 28, extending from the housing. In this cap opens the gas-supply pipe 29. This cap on its inner face is built up at 30, so as to form a chamber 32, from which gas may pass into only certain channels in line therewith.

31 is a muffler-chamber in the form of a hollow wheel having a central star-shaped opening, through the several points of which the gas-supply pipes 24 are extended, such wheel surrounding the housing 25, to which such pipes are secured. This muffler-wheel is bolted to spider-arms $32^{\times}$, extending from casing 4, and is composed of two corresponding side disks connected at their peripheries. The inner disk is formed with openings wherein fit pipes 33, leading from the exhaust branches or outlets 17. In the outer disk, preferably near its periphery, are formed small escape-openings 34. Thus I am enabled to employ a very simple form of muffler common to all the cylinders and which tends to greatly lessen, if not entirely obviate, the noise usually attendant upon the exhaust-blasts.

35 is a ring eccentric to but movable with the several cylinders for unseating in each alternate revolution the exhaust-valves of certain of the cylinders, the valves of the remaining cylinders being undisturbed until the next following revolution. In a series of five cylinders, as shown, in each revolution the exhaust-valve of each alternate cylinder is unseated, the valves of the intermediate cylinders remaining closed. This ring has a central circular opening wherein fits a cam 36, mounted on shaft 1 and to which is secured a controlling-lever 37. In the periphery of the ring, and preferably intersecting the inner face thereof, are diametrically opposite holes or cut-outs 38, extending inward to the central opening. Into these holes or cut-outs fit the stems of the exhaust-controlling valves that are not at the time to be actuated. It is by the engagement of these stems with the ring that the latter is revolved with the cylinders. Those valves whose stems are not in alinement with these holes are unseated when brought into contact with the periphery of the ring. To postpone the time of such contact, and hence the unseating of the several exhaust-controlling valves, the lever 37 may be shifted so that through cam 36 the ring 35 will be so turned eccentrically to the shaft 1 that it will not be engaged at as early a stage in the revolutions of the cylinders subsequent to an explosion as when the ring is in its normal position. This will be understood by reference to Figs. 6 and 7. In the former the ring is set to advance the time of exhaust, while according to the latter the exhaust will be postponed—that is, the eccentricity of the ring relatively to the axis of the revolving cylinders is so shifted that the time of contact of the valves to be unseated will be delayed. From this it will be understood that the speed of the engine may be regulated by the movement of lever 37. The ring 35 has a concentric reduced portion which is covered by a band of insulation 39. On this band extending from the face of the disk are two contact-points or circuit-closers 40 at diametrically opposite points. These contacts are included within the primary connection of the sparker.

41 is a sparker-lever loosely fulcrumed on shaft 1. To its hub is secured an electrode 42, insulated from the lever by a block 43 of suitable material. This electrode is curved so as to conform to the periphery of band 39, and to it is secured a wire *v* of the primary circuit, the other wire, *w*, thereof being grounded on the machine. To a plate 44, of insulating material, secured to the lower end of lever 41, is attached a second electrode 45 in the form of an elongated plate. To this plate is secured a wire *x* of a secondary circuit, the other wire, *y*, being also grounded on the machine. With this electrode 45 are designed to engage brushes 46 of the several cylinders. These brushes are shown as composed of a series of fine wires projecting beyond the ends of tubes 47, of insulating material, mounted in brackets 48, carried by the cylinders. The wires of each brush at their inner ends are secured to the outer end of a plug of a sparker 50, extended into the duct or channel 15 of each cylinder, which plugs are insulated from the casing, while the other member, 51, of the sparker is uninsulated therefrom. The result is that when the primary circuit is closed through the engagement of one of the contacts 40 with the electrode 42 the brushes of the cylinder primed for an explosion will upon engaging electrode 45 close the secondary circuit, and thereby create the spark just as such cylinder has passed the dead-center. The arrangement of contacts 40 relatively to the holes or cut-outs in the valve-actuating ring is such that as the exhaust-controlling valve of a fully-charged cylinder is protected from being unseated one of the contacts 40 is in close relation to the electrode of the primary circuit, the circuit not being closed, however, until the brushes of such cylinder engage the electrode of the secondary circuit. On the next operation the exhaust-controlling valve of such cylinder whose charge was exploded on the previous operation is unseated by engagement with ring 35. In this revolution when its brushes engage the secondary electrode the primary circuit is open. The cycles of operation will be described in connection with the diagrammatic showings of Figs. 11 and 12. In the former the charge of the cylinder at A has just exploded, and the piston is starting on its outward stroke, the exhaust-controlling valve remaining seated as it was while its stem was in one of the holes of ring 35 on the downward travel of the cylinder. The cylinder at B is taking in its charge, its

controlling-valve being likewise seated, and in the further travel its stem will enter that hole of ring 35 vacated by the valve-stem of the cylinder at A. The piston of the next forward cylinder at C has completed its stroke under an explosion, with the stem of its exhaust-valve about to engage the unseating-ring. The piston of the cylinder at D has just completed its intake preparatory to making its compression-stroke, while the stem of its valve is coinciding with a hole or cut-out of the ring so as not to be unseated, and the cylinder at E is completing its exhaust-stroke and its valve-stem is about leaving the unseating-ring. Now the next cycle is outlined in the other diagrammatic view. The cylinder at A (which in Fig. 11 may be regarded as at E) is beginning to take in its charge, its exhaust-valve being seated. The piston of the cylinder at B is on its explosion-stroke, and its valve is seated. The cylinder at C has its full charge, which is about to be compressed, the valve-stem being nearly in coincidence with the cut-out of the ring, so that in the further revolution it will not be unseated. The cylinder at D is exhausting, its valve being open, while the piston of the cylinder at E is completing its compression-stroke, with the valve-stem in a cut-out of the ring. As the cylinders at C and E pass at the bottom across a line perpendicular to the axis of the several cylinders the circuit is closed and sparks generated through the engagements of the contacts 40 with the primary electrode simultaneous with the contacts of the brushes with the secondary electrode.

It will be noted that the valve-unseating ring has a different axis from that of the several cylinders and in consequence the exhaust-valve of each cylinder will be unseated only after a charge has been exploded, but not until the piston starts on its return stroke, while by the same element the exhaust-valves of the charged cylinders will not be unseated. It will also be noted that the contacts or circuit-closers are carried by this exhaust-controlling ring and that they have such relation to the means for preventing the unseating of valves that they effect the closing of the circuits as to any one cylinder only in every other revolution thereof. By shifting the position of this valve-unseating ring, so as to postpone the time of exhaust, the speed of the engine may be lessened. Likewise, by shifting the sparker-lever the time of explosion may be advanced or postponed, since the double contact must exist to close the circuits.

The construction of the revolving supply-chamber and the cap fitted therein is such that gas is supplied to the several cylinders only in every other revolution, and then only when the piston is on the intake-stroke. In Fig. 11 the pipes of the cylinder at B and D are alone in open communication with the gas-chamber, admission to the intermediate cylinder at C being prevented because the piston has not completed its explosion-stroke and its exhaust is still closed.

Although I have only shown and described my invention as applicable to the unseating of the valves controlling the exhaust of the several cylinders, it is manifest that the same means could be employed for controlling valves governing the inlet or induction.

I claim as my invention—

1. A rotary explosive-engine having a plurality of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, controlling-valves carried by said cylinders, and a single element common to all the cylinders movable with the latter for acting on the valves of all the cylinders in two revolutions, but not in sequence.

2. A rotary explosive-engine having a plurality of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, controlling-valves carried by said cylinders, and a single element common to all the cylinders movable with the latter, but on a plane eccentric thereto, for acting on the valves of all the cylinders in two revolutions, but not in sequence.

3. A rotary explosive-engine having a plurality of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for controlling the exhaust of each cylinder, and a single revoluble element movable with the cylinders but mounted eccentrically to the axis thereof for unseating the exhaust-valve of each cylinder but not in sequence, and means for shifting the position of such element, for changing the points of unseating.

4. A rotary explosive-engine having a plurality of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for controlling the exhaust of each cylinder, and a single revoluble element movable with the cylinders but on a different axis thereto for unseating the exhaust-valves of each cylinder, but not in sequence, and having means for preventing the unseating in any one revolution of such of said valves as were unseated on the last previous revolution.

5. A rotary explosive-engine having an uneven number of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for said cylinders, and a single revoluble element movable with the cylinders for unseating the valve of each alternate cylinder, and having means for preventing the unseating of the valves of the intermediate cylinders.

6. A rotary explosive-engine having an uneven number of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for controlling the exhaust of each cylinder, and a ring revoluble with the cylinders but on a different

axis thereto for unseating the exhaust-valve of each cylinder, but not in sequence, said ring being provided with means for preventing the unseating of the valve of each alternate cylinder in each revolution.

7. A rotary explosive-engine having an uneven number of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for controlling the exhaust of each cylinder, and a ring revoluble with the cylinders but on a different axis thereto for unseating the exhaust-valve of each cylinder, but not in sequence and having means for preventing the unseating in any one revolution of such of said valves as were unseated on the last previous revolution.

8. A rotary explosive-engine having an uneven number of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for controlling the exhaust of each cylinder, and a ring revoluble with the cylinders but on a different axis thereto for unseating the exhaust-valve of each alternate cylinder in each revolution and having means for preventing the unseating of the valves of the intermediate cylinders.

9. A rotary explosive-engine having a plurality of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for controlling the exhaust of each cylinder, and a single revoluble element movable with the cylinders for unseating the exhaust-valves of all the cylinders in two revolutions, but not in sequence.

10. A rotary explosive-engine having a plurality of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for controlling the exhaust of each cylinder, and a single revoluble element movable with the cylinders but on a different axis thereto for unseating the exhaust-valves of all the cylinders in two revolutions, but not in sequence.

11. A rotary explosive-engine having an uneven number of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for controlling the exhaust of each cylinder having projecting stems, a ring revoluble with the cylinders but on a different axis thereto, said ring being engaged by the stem of each valve to unseat the latter, but not in sequence, and having holes or cut-outs to accommodate the stems of such of said valves as were unseated on the last previous revolution, the number of cylinders being prime to the number of holes or cut-outs in the ring.

12. A rotary explosive-engine having a series of five cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for controlling the exhausts of the cylinders having projecting stems, a ring revoluble with the cylinders but on a different axis thereto, said ring having two diametrically opposite holes or cut-outs in its periphery, each valve-stem being designed to engage said ring in each alternate revolution and in each intermediate revolution to enter one of said holes or cut-outs.

13. A rotary engine having a plurality of revolving cylinders, a stationary crank-shaft to which the several piston-rods are secured, valves for said cylinders, and a single revoluble element movable with the cylinders but on a different axis thereto for actuating the valves of all the cylinders in two revolutions, but not in sequence, and having means for preventing the actuation of such of said valves as were actuated on the last previous revolution and means for shifting said element so as to postpone or advance the time of actuation of such valves.

14. The combination with the stationary crank-shaft, the series of cylinders revoluble thereon having their piston-rods secured thereto, and controlling-valves for said cylinders, of an eccentric on said shaft, a ring on said eccentric having holes or cut-outs, and means for shifting said eccentric, said ring being designed to effect the unseating of some of said valves in each revolution and prevent the actuation of others of said valves, the stems of the latter fitting in said holes or cut-outs.

15. The combination with the stationary crank-shaft, the series of cylinders revoluble thereon having their piston-rods secured thereto, and controlling-valves for said cylinders, having projecting stems, of an eccentrically-mounted ring having diametrically opposite holes or cut-outs to accommodate each of said valve-stems in each alternate revolution, the stems not so accommodated in any one revolution being engaged by said ring to effect the unseating of their valves, as set forth.

16. A rotary explosive-engine having a series of revoluble cylinders, a stationary crank-shaft to which the piston-rods are secured, valves for controlling the exhausts of the cylinders, a single revoluble element movable with the cylinders but on a different axis thereto for unseating certain of said valves and preventing the unseating of others in each revolution, electrical sparking mechanism for each cylinder, and means carried by such element for closing a circuit, such circuit being closed only as to those cylinders whose valves in any one revolution have not been unseated.

17. A rotary explosive-engine having a series of revoluble cylinders, a stationary crank-shaft to which the piston-rods are secured, valves for controlling the exhausts of the cylinders, a ring revoluble with said cylinders, but on a different axis thereto for unseating certain of said valves and preventing the unseating of others in each revolution, electrical sparking mechanism for each cylinder, an electrode, and circuit-closers carried by said ring for closing the circuit through said electrode, such circuit-closers having fixed relations to

said ring so that the circuit will be closed only as to those cylinders whose valves in any one revolution have not been unseated.

18. A rotary explosive-engine having an uneven number of revoluble cylinders, a stationary crank-shaft to which the piston-rods are secured, valves for controlling the exhausts of the cylinders, a separate sparker for each cylinder having a contact, a ring movable with the cylinders but on a different axis thereto for unseating certain of said valves and having diametrically opposite means to prevent the unseating of the others of said valves in each revolution, diametrically opposite contacts carried by said ring, and two electrodes, one designed to be engaged by said latter contacts and the other by the sparker-contacts, the engagement of the latter closing the circuit only when one of the other contacts is at the time of engagement with its perspective electrode.

19. The combination with the stationary shaft, the series of cylinders revoluble thereon having their piston-rods secured thereto, and the exhaust-controlling valves for said cylinders, of a ring movable with said cylinders but on a different axis thereto, said ring having diametrically opposite holes or cut-outs to accommodate the stems of said valves, an insulating-band on said ring, opposite contacts carried by the latter, a lever on said shaft movable in parallelism to the rotation of said cylinders, an electrode on said lever hugging said band and designed to be engaged by said contacts, a second electrode on one end of such lever, sparkers carried by said cylinders, and contacts therefor designed to engage said second electrode.

20. In a rotary explosive-engine, in combination, a series of revoluble cylinders having exhaust-controlling valves, a ring movable with, but eccentric to, said cylinders for effecting in each revolution the unseating of only certain of such valves, sparkers carried by said cylinders having contacts, a lever having an electrode designed to be engaged by said contacts, a second electrode also carried by said lever, opposite contacts carried by said ring for engaging said second electrode, and means for shifting said ring for changing the time of actuation of said exhaust-valves, the time of closing the circuit through said contacts being controlled by the shifting of said lever.

21. A rotary explosive-engine having a plurality of revolving cylinders, valves for controlling the exhaust of each cylinder, a single revoluble element movable with the cylinders but on a different axis thereto for unseating the exhaust-valve of each cylinder in each alternate revolution, but not in sequence, and having means for preventing the unseating of such of said valves as were unseated on the last previous revolution, electric sparkers for said cylinders, and contacts carried by said element for closing the circuit as the cylinders whose valves were not so unseated in any one revolution are primed for an explosion.

22. A rotary explosive-engine having a plurality of revolving cylinders, valves for controlling the exhaust of each cylinder, a ring movable with the cylinder but on a different axis thereto for unseating the exhaust-valve of each cylinder in each alternate revolution, but not in sequence, said ring having holes to accommodate the stems of such of said valves as were unseated on the last previous revolution so as to prevent their being unseated, electric sparkers for said cylinders, and contacts carried by said ring for closing the circuit as the cylinders whose valve-stems were not so unseated in any one revolution are primed for an explosion.

23. The combination with the series of revoluble cylinders and means for controlling the admission and exhaust of gases, of a sparker for each cylinder, laterally-projecting brushes connected to such sparkers, contact-pieces or circuit-closers revoluble with said cylinders, and two electrodes, one designed to be engaged by said contact-pieces or circuit-closers and the other positioned at right angles to said brushes so as to be engaged thereby, the circuit being closed therethrough at the time the other electrode engages one of said contact-pieces or circuit-closers.

24. The combination with the series of revoluble cylinders and means for controlling the admission and exhaust of gases, of a sparker for each cylinder, laterally-projecting brushes connected to such sparkers, contact-pieces or circuit-closers revoluble with said cylinders, and a lever fulcrumed concentrically to said cylinders having two electrodes, one designed to be engaged by said contact-pieces or circuit-closers and the other by said brushes.

25. A rotary-explosive-engine comprising, in combination, a plurality of revolving cylinders, a crank-shaft with which the several piston-rods engage, controlling-valves carried by said cylinders, and a single element common to all the cylinders movable with the latter for acting on the valves of all the cylinders, but not in sequence, and having means for preventing the unseating in any one revolution of such of said valves as were unseated on the last previous revolution.

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

CHARLES R. TWITCHELL.

Witnesses:
W. E. Brown,
Chas. B. Warren.