No. 781,607. PATENTED JAN. 31, 1905.

J. W. KALES.

ROTARY EXPLOSIVE ENGINE.

APPLICATION FILED SEPT. 30, 1902.

6 SHEETS—SHEET 1.

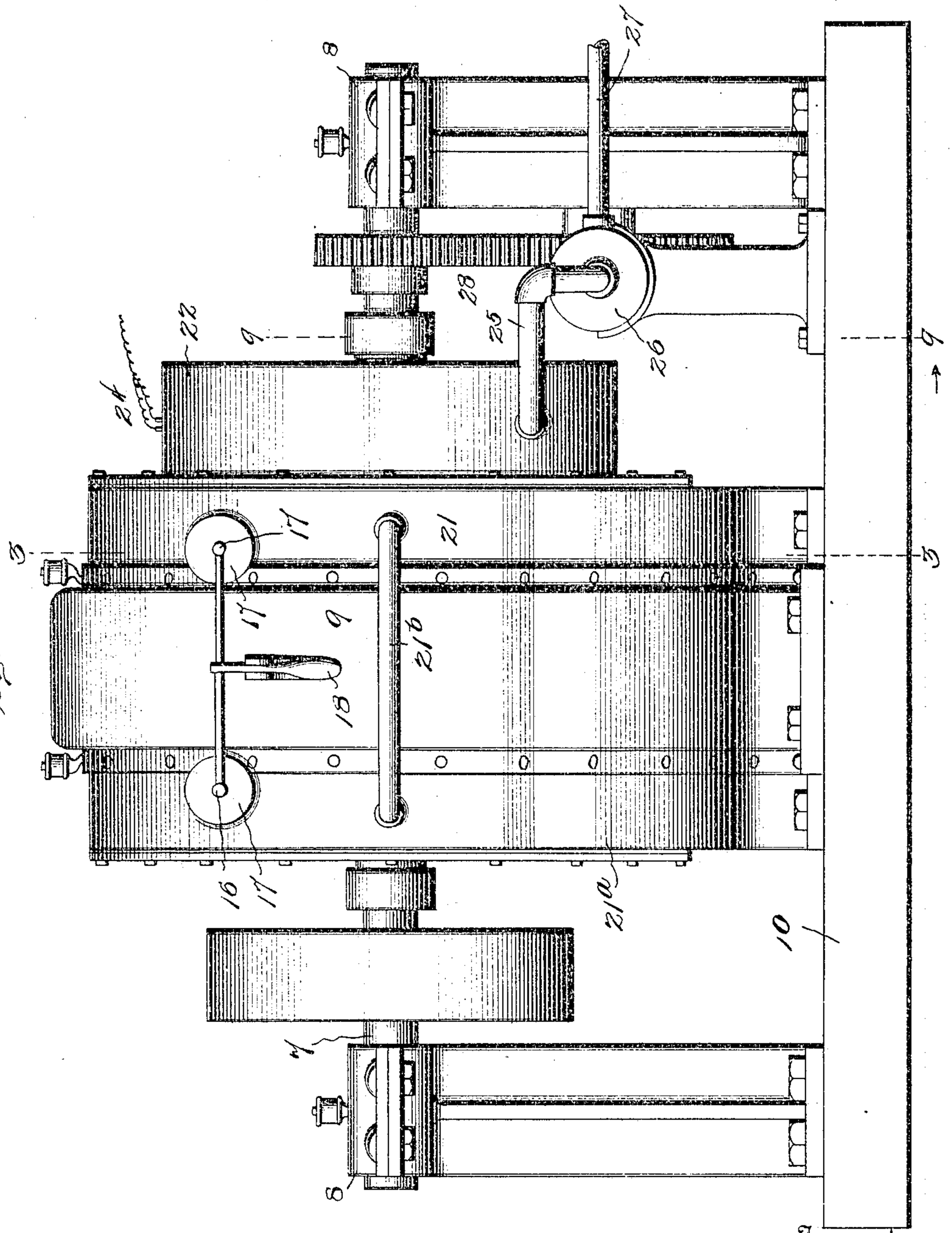

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PHOTO LITHOGRAPHED BY SACKETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

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6 SHEETS—SHEET 2.

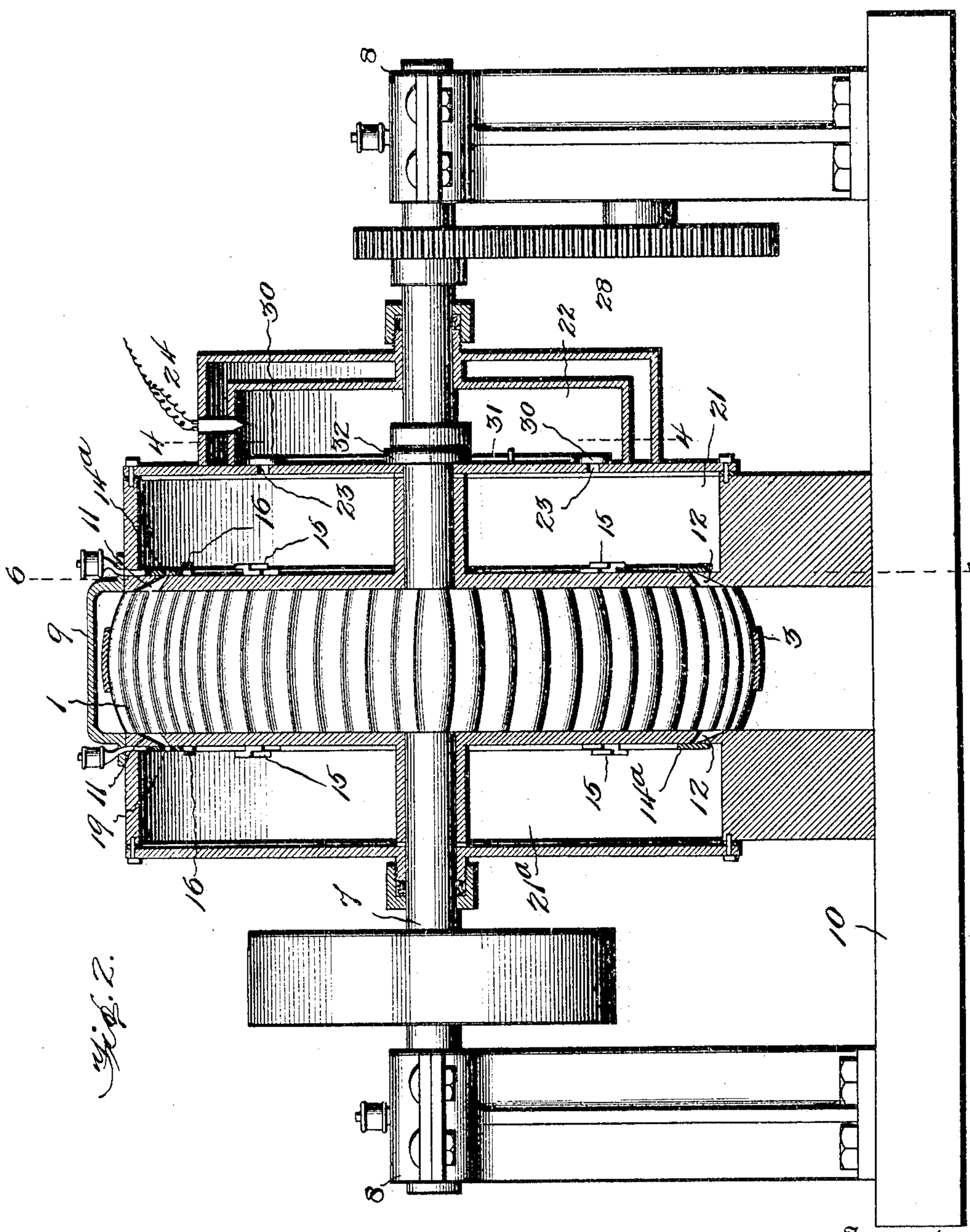

Fig. 2.

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6 SHEETS—SHEET 3.

Fig. 3.

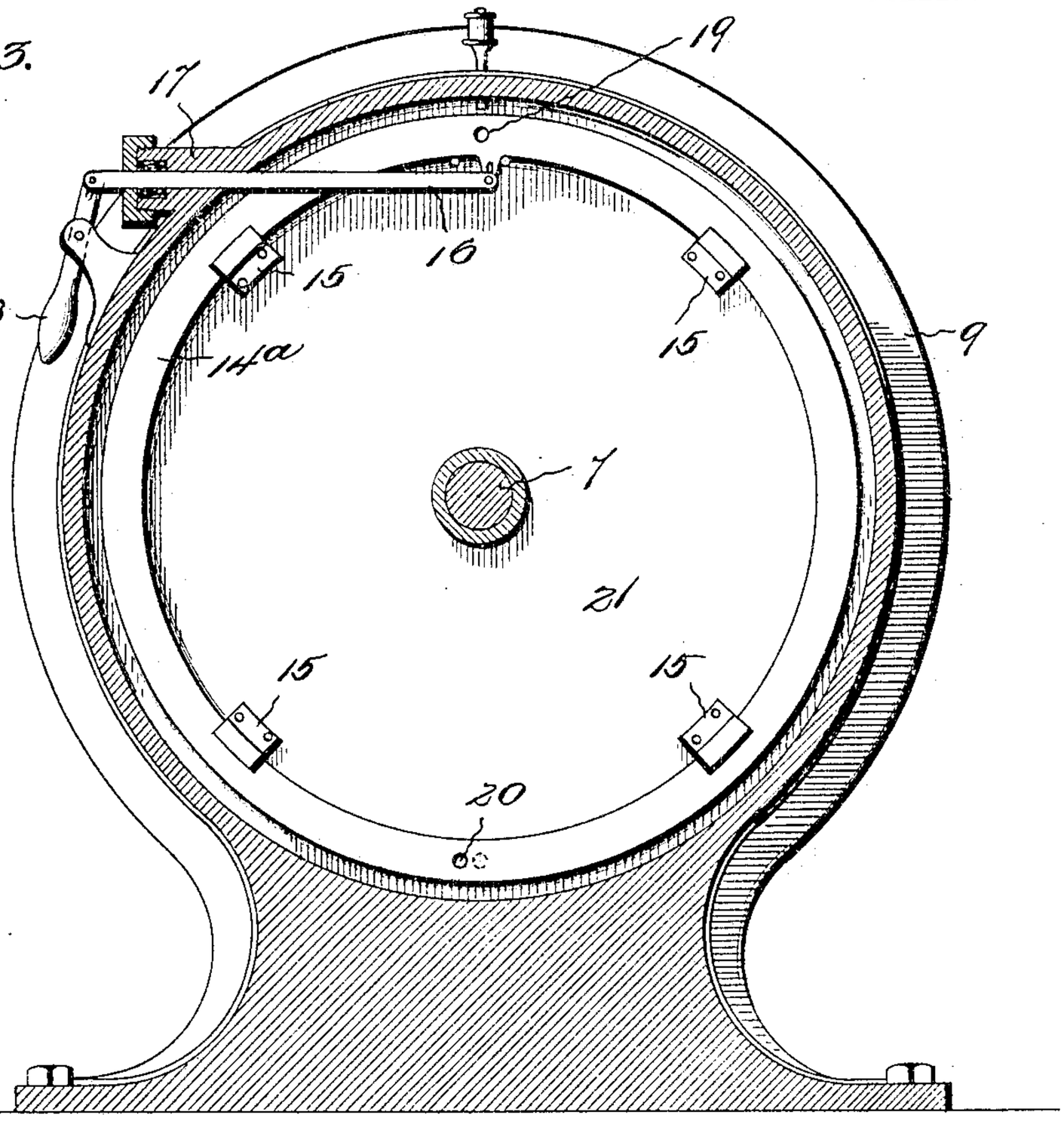
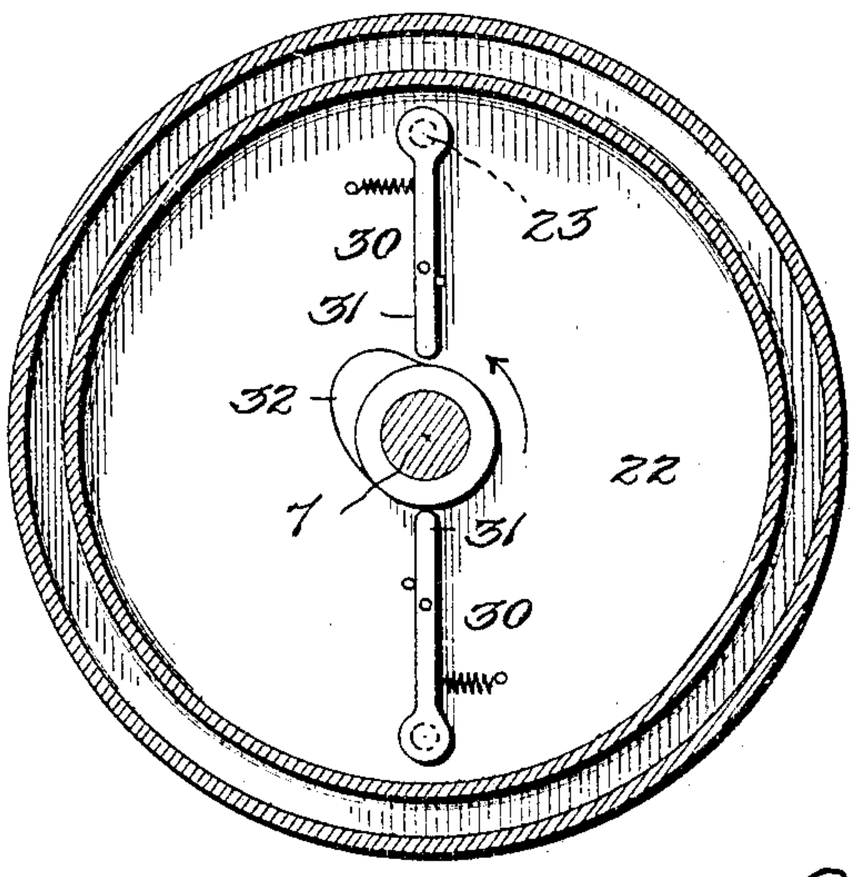


Fig. 4.



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6 SHEETS—SHEET 4.

Fig. 13.

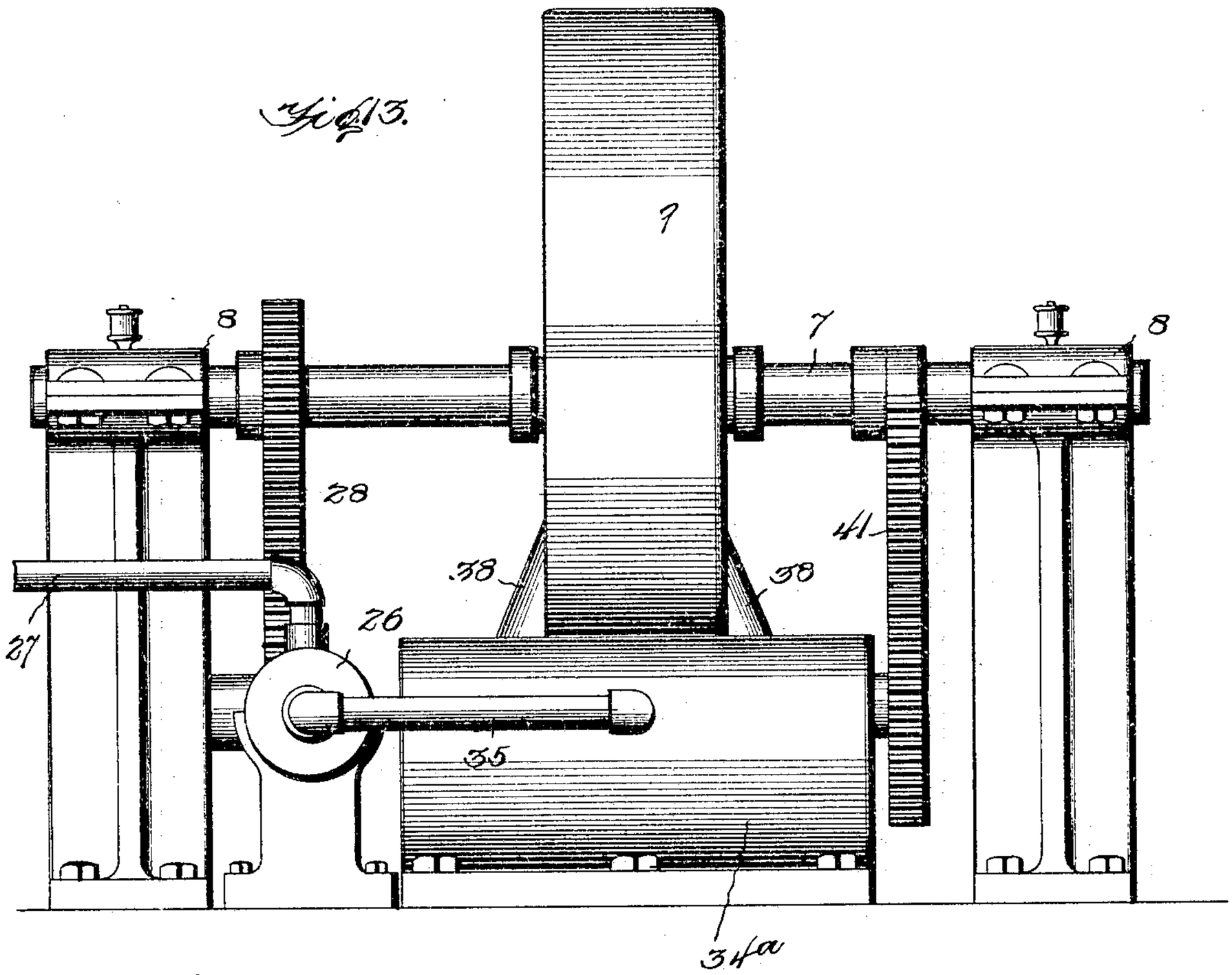


Fig. 5.

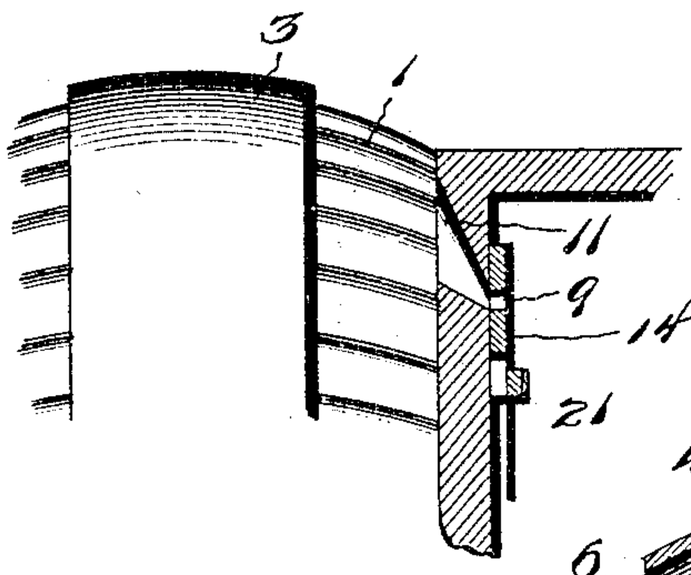


Fig. 7.

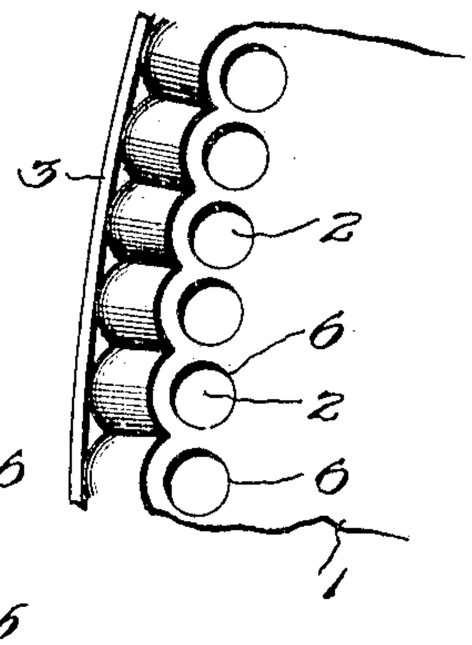
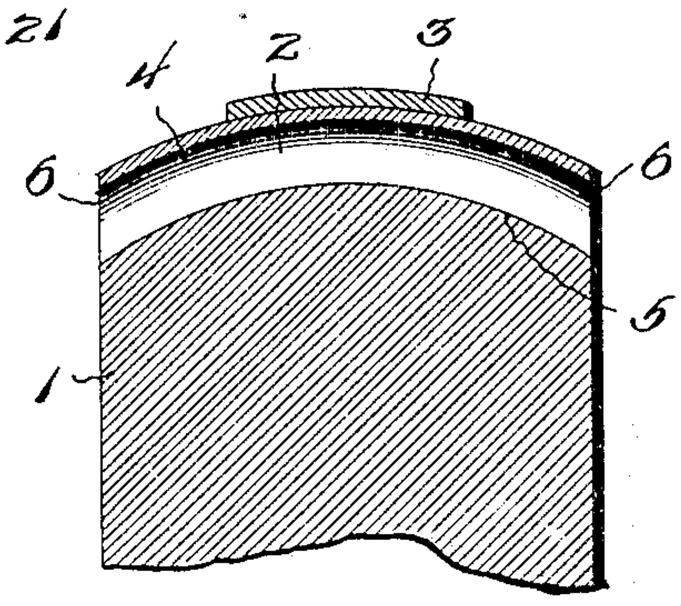


Fig. 8.



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ROTARY EXPLOSIVE ENGINE.

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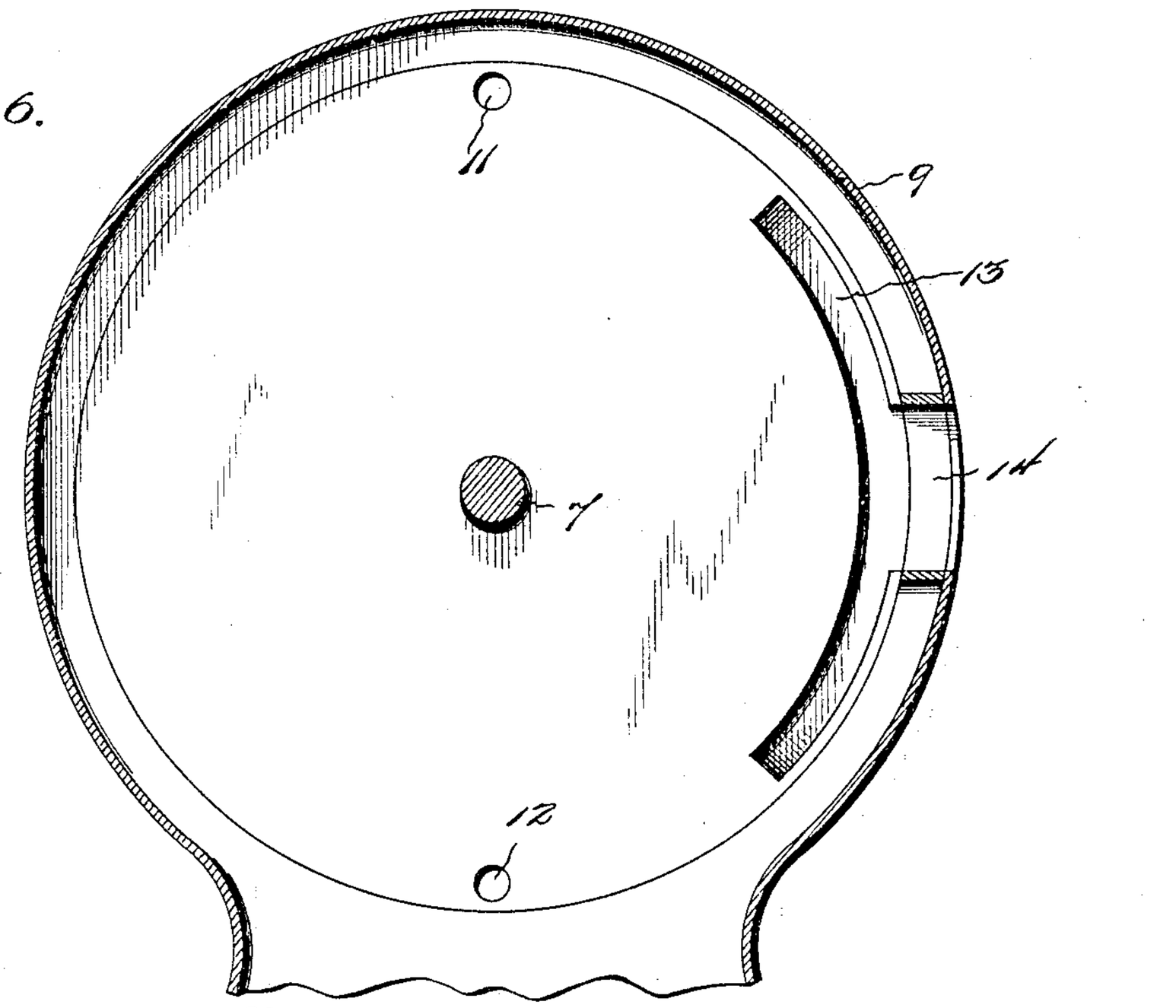
6 SHEETS—SHEET 5.

Fig. 6.



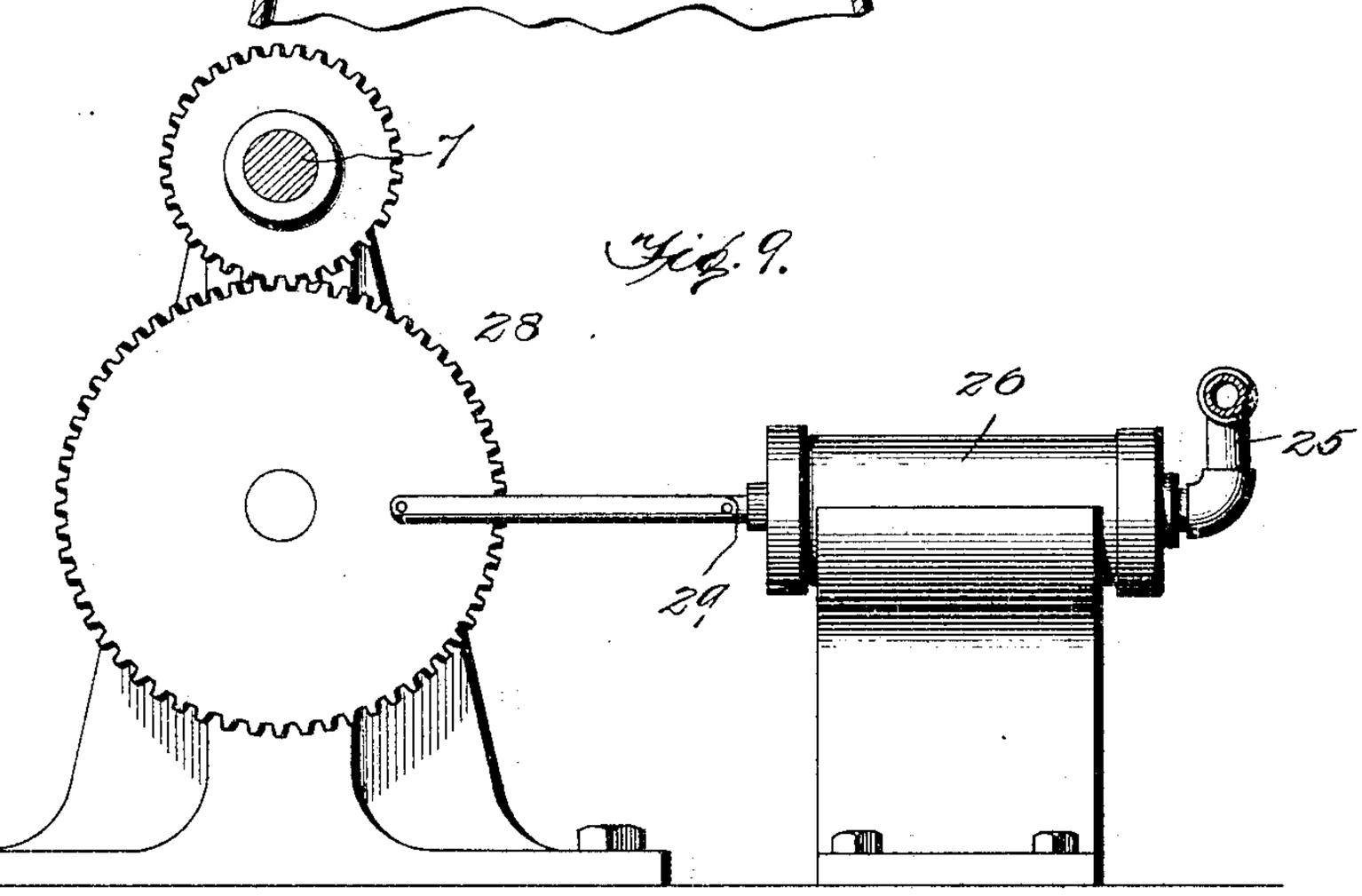


Fig. 9.

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APPLICATION FILED SEPT. 30, 1902.

6 SHEETS—SHEET 6.

Fig. 10.

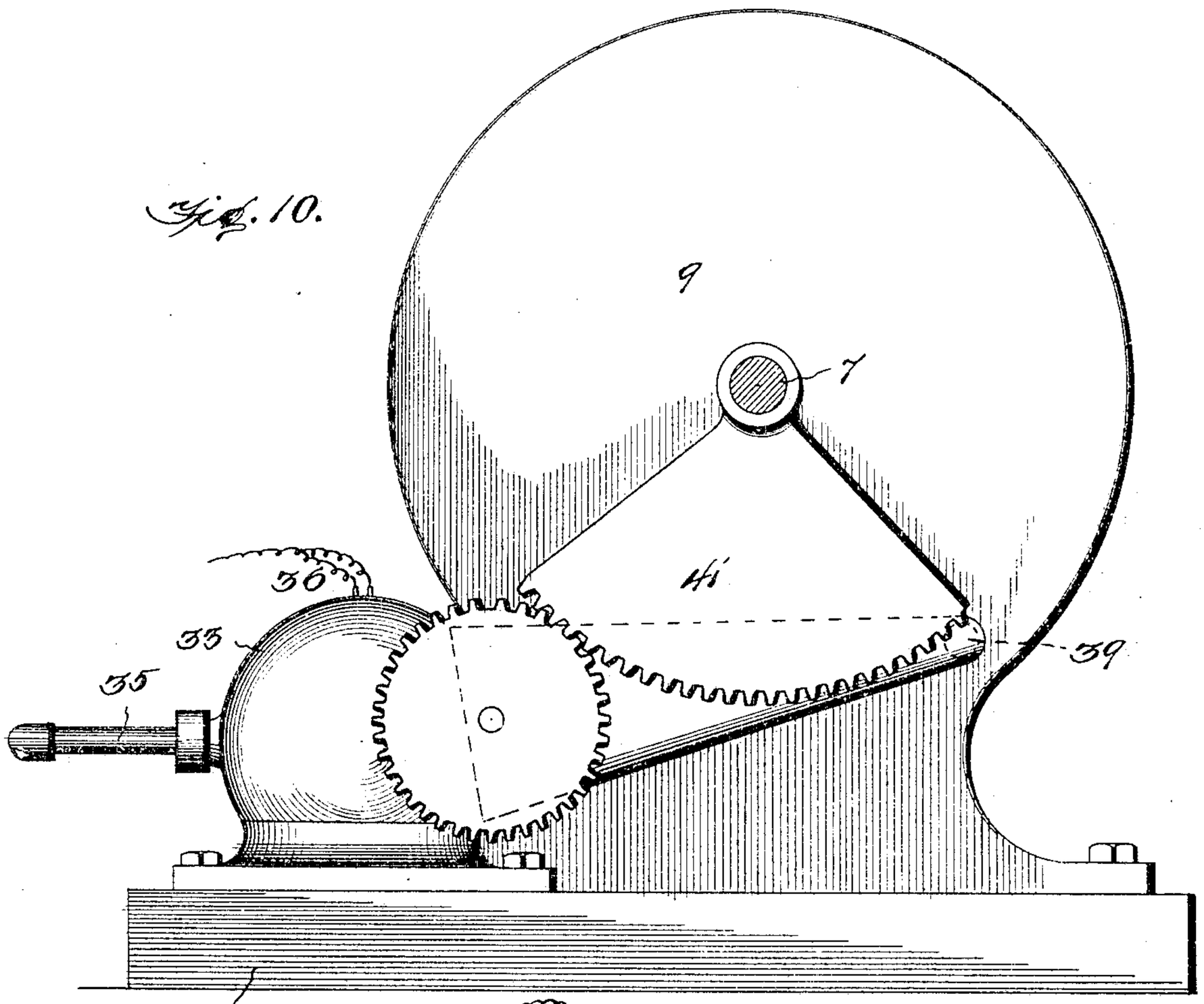


Fig. 12.

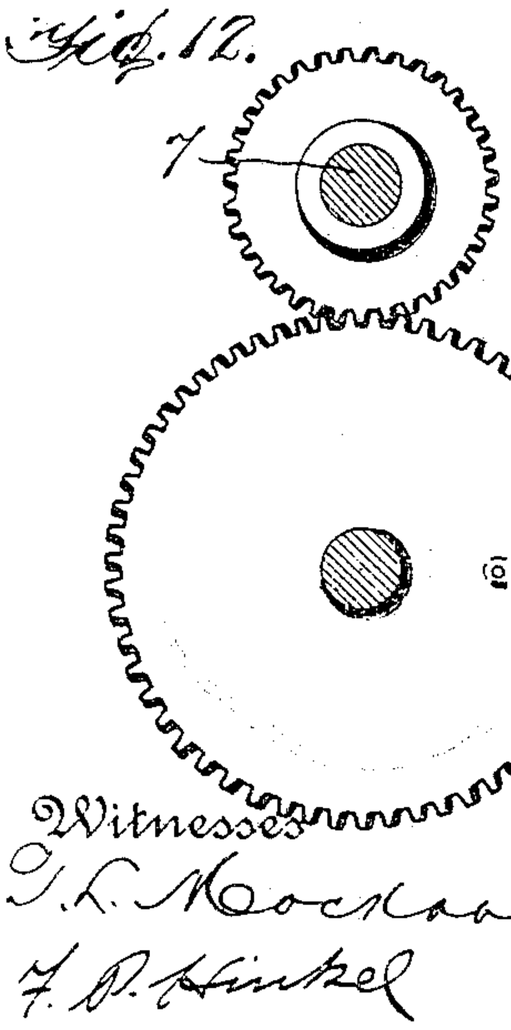
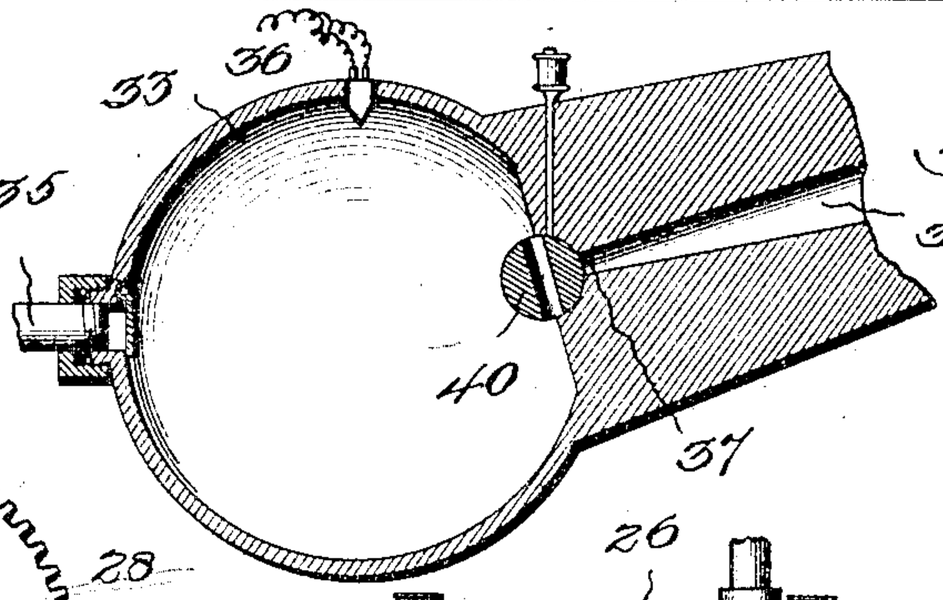
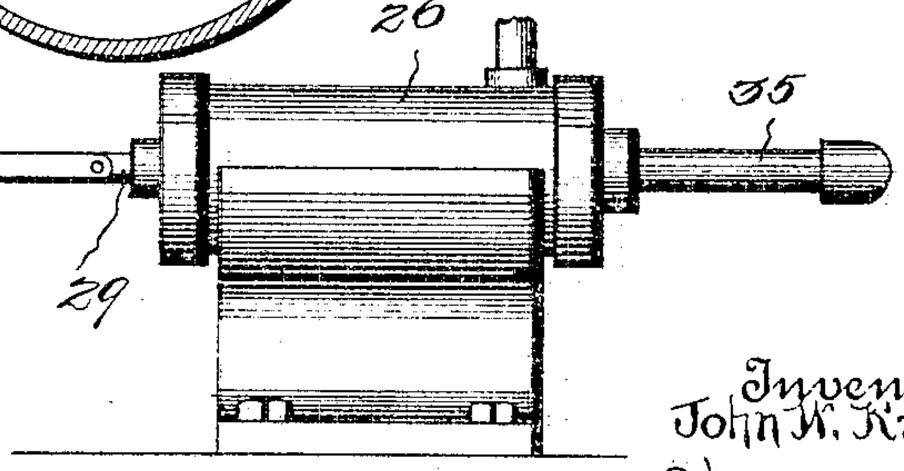


Fig. 11.





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No. 781,607. Patented January 31, 1905.

UNITED STATES PATENT OFFICE.

JOHN W. KALES, OF FRANKLINVILLE, NEW YORK.

ROTARY EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 781,607, dated January 31, 1905.

Application filed September 30, 1902. Serial No. 125,424.

To all whom it may concern:

Be it known that I, JOHN W. KALES, a citizen of the United States, residing at Franklinville, in the county of Cattaraugus and State of New York, have invented certain new and useful Improvements in Rotary Explosive-Engines, of which the following is a specification.

This invention relates to an improved explosive-engine of the rotary type and embodying a rotary element or piston which receives the direct impact and expansive force of the motive agent, and hence provides for directly imparting motion to the drive-shaft, thus insuring a steady, speedy, and powerful motion with a minimum amount of friction and with greater economy of fuel than is possible with the ordinary types of reciprocating engines.

To this end the invention primarily contemplates the utilization of the turbine principle in an explosive or gas engine to derive a maximum amount of speed and power with a minimum expenditure of fuel, preferably of the hydrocarbon form. In carrying out this essential object the invention has in view the provision of simple and practical means for delivering the exploded products of combustion to the turbine piston-wheel in such a manner as to utilize the full expansive force of such products, and thus secure a maximum effect from the compression and expansion thereof, resulting in the greatly increased speed and power from the piston or piston-wheel.

A further object in this connection is to provide novel means for automatically discharging the exploded products of combustion from a combustion-chamber into a chamber or space permitting of the expansive action of the gases in passing to the impact pockets or cups of the wheel.

Another object of the invention is to provide simple and effective means whereby an immediate reversal of the engine may be effected without injury to any part of the mechanism thereof.

With these and many other objects in view, which will more readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts, which will be hereinafter more fully described, illustrated, and claimed.

The essential features of the invention involved in the novel means provided for utilizing the pressure and expansive force of exploded products for imparting motion to a turbine piston-wheel are necessarily susceptible to a wide range of modification without departing from the spirit of the invention, but for illustrative purposes there are shown in the drawings a few of the preferred embodiments of the invention.

In the drawings, Figure 1 is a general elevation of an explosive, rotary, or turbine engine embodying the present invention and illustrating a form in which the compression-chambers are compounded and arranged, respectively, upon opposite sides of the wheel or turbine casing. Fig. 2 is a vertical sectional view including a section of the engine and illustrating more plainly the operative relation of the wheel-casing, the compression-chamber, and the combustion-chamber in that form of engine wherein a well-defined compression-chamber is employed in addition to the ports for directing the products into the impact-pocket of the wheel. Fig. 3 is a sectional view on the line 3 3 of Fig. 1, showing one form of reversing-valve that may be employed for reversing the direction of rotation of the engine. Fig. 4 is a sectional view on the line 4 4 of Fig. 2, showing a form of feed-valve mechanism that may be employed in controlling the passage of exploded products from one chamber to the other. Fig. 5 is an enlarged detail sectional view showing more plainly the operative relation of the flared feeding-ports to the impact-pockets of the turbine-wheel, whereby the exploded products of each charge are delivered at each time into a group of the pockets, which group of pockets are subsequently emptied or relieved through the exhaust port or ports. Fig. 6 is a sectional view on the line 6 6 of Fig. 2, showing more plainly one of the provisions which may be employed for exhausting the pockets of the wheel. Figs. 7 and 8 are fragmentary views of a form of turbine piston-wheel that may be employed. Fig. 9 is a sectional elevation on the line 9 9 of Fig. 1. Fig. 10 is an

elevation of the modification in which the combustion-chamber and feeding-port are combined in an expansion-nozzle in lateral communication with the pocketed turbine. Fig. 11 is an enlarged sectional view of the flared expansive nozzle and the globular form of combustion-chamber illustrated in Fig. 10. Fig. 12 is a detail elevation showing the form of construction that may be employed in operating the compression-pump for the modified form of engine illustrated in Fig. 10. Fig. 13 is an elevation of another modification in which the expansive nozzles may be compounded or duplicated upon opposite sides of the casing.

Like reference-numerals designate corresponding parts throughout the several figures of the drawings.

In carrying out the invention any approved type of turbine-wheel may be employed as the rotary piston element of the engine. It is, however, preferable in order to secure a maximum effect that the turbine piston-wheel be of a closed-periphery type and receive and exhaust the motive agent laterally—that is, at the sides thereof. A form of turbine piston-wheel embodying these characteristics is shown in the drawings and designated in its entirety by the numeral 1. This illustrative form of turbine piston-wheel essentially consists of a disk-like body provided at the periphery thereof with a continuous circular series of impact pockets or cups 2. These impact pockets or cups 2 may be provided in any suitable way upon the body of the wheel and may be either integrally formed or separately fitted thereto and held in position by an encircling retaining-band 3 or equivalent fastening means. Irrespective of the manner in which the wheel is provided with the peripheral impact pockets or cups 2 the latter are provided with closed outer and inner walls 4 and 5, respectively, and are further provided with open ends 6, whose orifices are preferably disposed in the plane of the sides of the wheel-body. Also in order to secure a maximum motive effect the impact pockets or cups 2 are of a segmental or curved form and extend transversely across the periphery on a curved line, so that the motive agent under pressure and under expanding force enters either open end 6 of the individual pockets and impacts against the closed outer sides 4 thereof, thus exerting a propulsive influence upon the wheel. Various ways of mounting the wheel in feeding the impact-pockets thereof with the motive agent may be resorted to; but in a preferred construction the said turbine piston-wheel is illustrated as being mounted on a main drive-shaft 7, journaled in suitably-arranged bearings 8, and is also incased within a wheel-casing 9 of circular form and mounted upon a suitable base 10. The wheel-casing 9 is constructed in any suitable manner to provide for properly housing the turbine piston-wheel, and assuming the latter to be supplied with motive agent from one side it is to be observed that the side wall of the wheel-casing is provided with the flared feeding-ports 11 and 12, arranged in diametrically opposite relation and respectively disposed in different directions with reference to the direction of rotation of the piston-wheel, whereby simple and practical provision may be made for reversing the engine, as will be presently explained.

The individual feeding-ports 11 and 12 are flared toward the adjacent side of the turbine piston-wheel and are located and arranged in the same circular plane as the open ends 6 of the impact-pockets 2. Also the said feeding-ports are disposed at an angle to the vertical plane of the wheel in order to deliver the motive agent at an angle into the impact-pockets, whereby the same will impact itself against the outer closed sides 4 thereof. It is to be further observed in this connection that the inner portions of the flared feeding-ports 11 and 12 are sufficiently wide to embrace and feed a group of impact-pockets at a time, thus utilizing the expansive force of the agent to the greatest possible extent.

At a point in advance of the feeding-ports 11 and 12 the inner side wall of the wheel-casing is formed with an exhaust-channel 13 in communication with a common exhaust-port 14, opening into the outer air or exhaust-pipe, as preferred. By reason of this arrangement of the exhaust-channel 13 it will be observed that with the motive agent passing through either of the ports 11 and 12 the same is delivered into a group of the impact-pockets and that this group of impact-pockets passes beyond the plane of the said feeding-port before coming into communication with the exhaust-channel 13, so that the full effect of the impact may be secured before the exhausting of the pockets takes place. In connection with the exhausting it is to be noted that the exhaust-channel 13 is disposed in the circular plane of the open ends of the impact-pockets, so as to communicate with the latter through such open ends.

A simple expedient for reversing the engine is shown in Figs. 2, 3, and 5 of the drawings and may consist in the employment of an oscillatory circular valve-ring 14^a, held to a working position upon one side of the wall having the ports 11 and 12 through the medium of suitable keepers 15 or equivalent retaining devices. The said ring may be operated by an operating-pitman 16, extending through a stuffing-box 17 and having its outer end suitably connected with a controlling-lever 18, mounted upon the exterior of the engine-body. Other means could be resorted to for adjusting the position of the valve-ring 14; but irrespective of this the said ring is provided with oppositely-located cut-off ports 19

and 20, which respectively coöperate with the separate feeding-ports 11 and 12. When the valve-ring is adjusted to bring the port 19 in register with the port 11, the turbine piston-wheel will obviously be caused to rotate in one direction; but when said port is thrown out of action the port 20 is brought into communication with the port 12 and the direction of rotation will necessarily be reversed.

In the form of engine just described it is preferable to feed the supply-port 11 or 12 from a compression-chamber 21, suitably provided upon one side of the wheel-casing 9 and in communication with a combustion-chamber 22 through the discharge-ports 23, formed in the intervening wall between the said two chambers. In the preferable construction both the combustion and compression chambers encircle the drive-shaft, and the combustion-chamber is supplied with a continuous sparker or sparking device 24 of any approved construction. The explosive charge is supplied to the combustion-chamber 22 from the mixture-supply pipe 25, leading from a compression-pump 26, whose intake connects with a main supply-pipe 27, leading to a carbureter or other source of supply for the explosive mixture. The pump may be operated in any suitable manner, preferably through the medium of operating connections 28 between the piston-rod 29 thereof and the main drive-shaft 7, upon which the turbine piston-wheel is mounted. The explosive charge which is exploded within the chamber 22 is automatically discharged through the ports 23 into the compression-chamber 21, and this communication between the said two chambers is preferably automatically controlled through the medium of the automatic discharge-valves 30. These automatic discharge-valves 30 are illustrated as being of a spring-retracted type, pivotally mounted upon one wall of the combustion-chamber and having the tappet-arms 31, lying in the path of an actuating-cam 32, carried by the shaft 7. The springs normally hold the valves closed over the ports 23, and the cam 32 in its rotation successively opens each of the valves, which are preferably arranged in opposite relation.

The description has referred particularly to the engine as of a single form—that is, feeding the turbine-wheel from one side; but the said feeding of the wheel may be effected simultaneously from both sides by compounding the compression-chambers. As shown in Fig. 1, this simply involves the addition of an extra compression-chamber 21^a upon the side of the wheel-casing 9 opposite the chamber 21 and connecting the said two chambers with a coupling-pipe 21^b.

Another form of the invention is shown in Figs. 10 and 11 of the drawings, in which there is associated with the wheel-casing a globular combustion-chamber 33, having a supply-pipe connection 35 with the compression-pump for the gaseous mixture and equipped with a suitable sparking device 36. The said globular or other shaped combustion-chamber 34 has a discharge-port 37 in communication with the flared expansion-nozzle 38, whose small end is in direct communication with the main feeding-port 39, which delivers into the main casing in the same way as the ports 11 and 12, previously referred to in connection with the other forms. The discharge-port 37 has fitted therein an intermittently-operated ported valve-plug 40, having an intermittent connection 41 with the main drive-shaft of the wheel-piston, whereby the valve will be alternately opened and closed by an intermittent motion.

Another modification embodying the construction just described is shown in Fig. 13 of the drawings, in which a pair of the flared expansion-nozzles 38 are employed, respectively, upon opposite sides of the wheel-casing and both of which are in communication with a common combustion-chamber 34^a.

In all forms of the invention as described the same action takes place, and it will therefore be understood that various changes in the form, proportion, and minor details of construction may be resorted to without departing from the spirit of the invention or sacrificing any of the advantages thereof.

Having thus described the invention, what is claimed, and desired to be secured by Letters Patent, is—

1. In an explosive-engine, a turbine-wheel having open-ended and otherwise closed pockets bowed transversely outward across the wheel, and a casing inclosing the wheel and closing the ends of the pockets, and also provided with a feeding-port disposed to discharge longitudinally into the pockets.

2. In an explosive-motor, the combination with a shaft, of a rotary turbine secured thereto and having transversely-disposed pockets, a chamber surrounding the shaft and having an end wall located adjacent to one side of the turbine, said wall having ports therethrough that coact with the pockets, an explosion-chamber surrounding the shaft in rear of the first-mentioned chamber and having communication therewith through the adjacent wall, valve mechanism for controlling said communication located within one of the chambers, and means carried by the shaft and arranged in one of the chambers for periodically operating said valve mechanism.

3. In an explosive-engine, a turbine-wheel having open-ended transverse pockets, a casing inclosing the wheel and closing the ends of the pockets, an annular expansion-chamber provided with reversing feed-ports communicating with the interior of the casing in the path of the open ends of the pockets, an oscillatory valve-ring within the expansion-chamber working across the ports and pro-

vided with perforations for alternate alinement with the ports, and means piercing the expansion-chamber to oscillate the valve-ring.

4. In an explosive-engine, a turbine-wheel having open-ended transversely-disposed pockets, a casing embracing the wheel and closing the open ends of the pockets, annular expansion-chambers at opposite sides of the casing, each being provided with reversing-ports in communication with the casing in the paths of the open ends of the pockets, oscillating valve-rings working past the ports in the chambers and provided with perforations for alternate alinement with the ports, links pivotally connected to the rings and piercing the peripheries of the chambers, a cross-bar connecting the links externally of the chambers, and means connected to the cross-bar for oscillating the valve-rings.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN W. KALES.

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