G. M. PERLEWITZ.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED OCT. 16, 1909.

975,275. Patented Nov. 8, 1910.

5 SHEETS—SHEET 1.

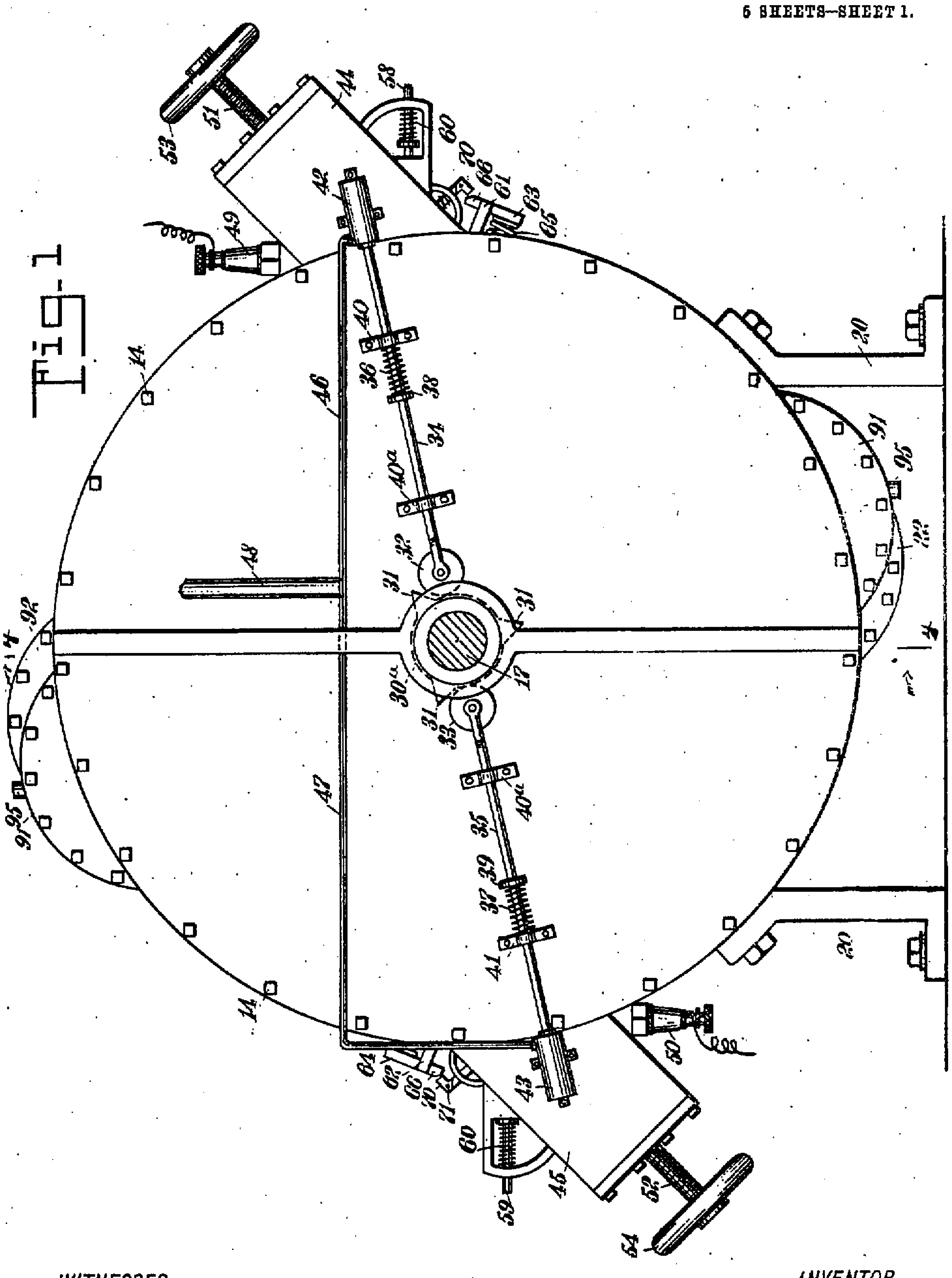

Fig-1

WITNESSES

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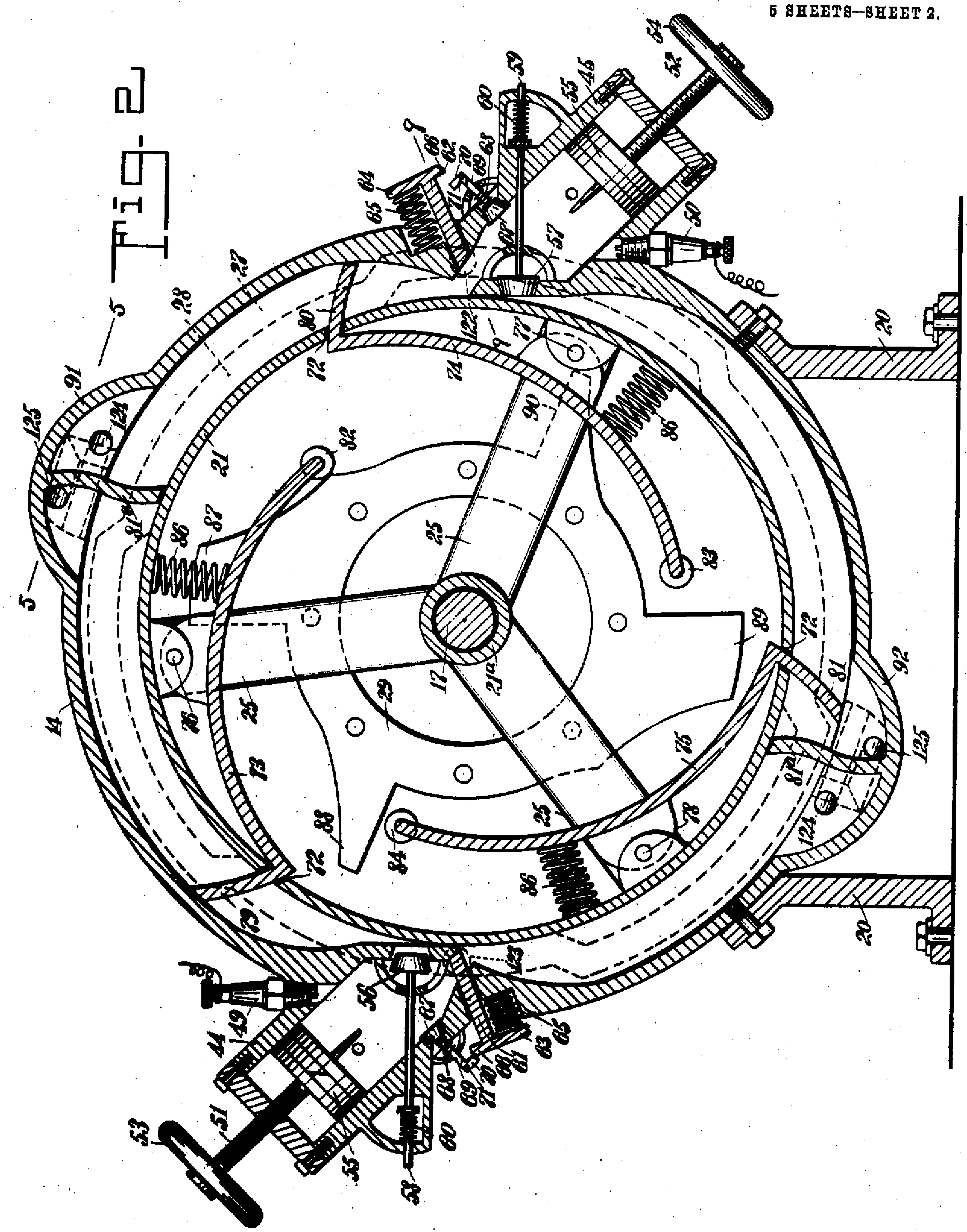
5 SHEETS—SHEET 2.

Fig. 2



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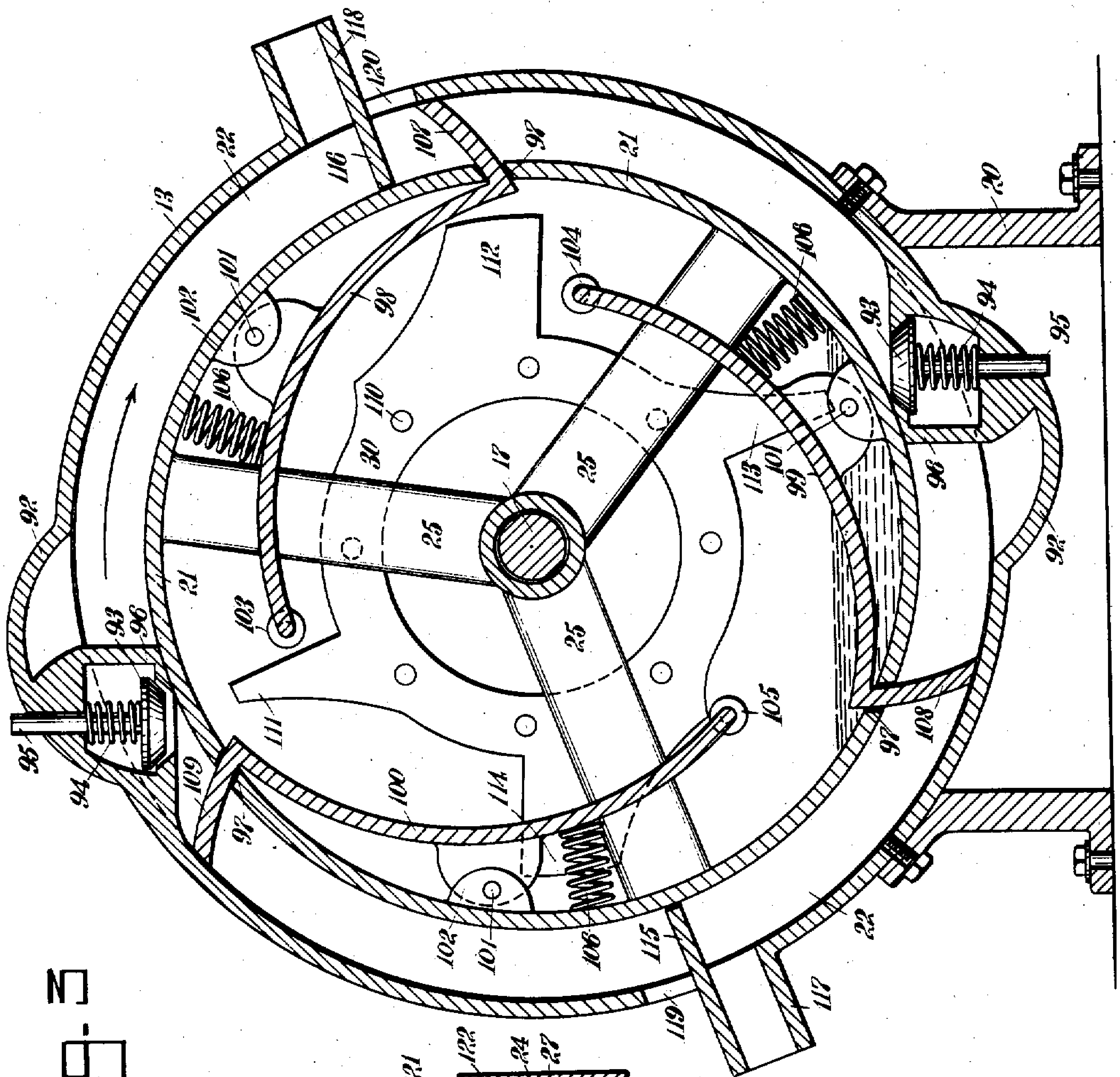

Fig. 3

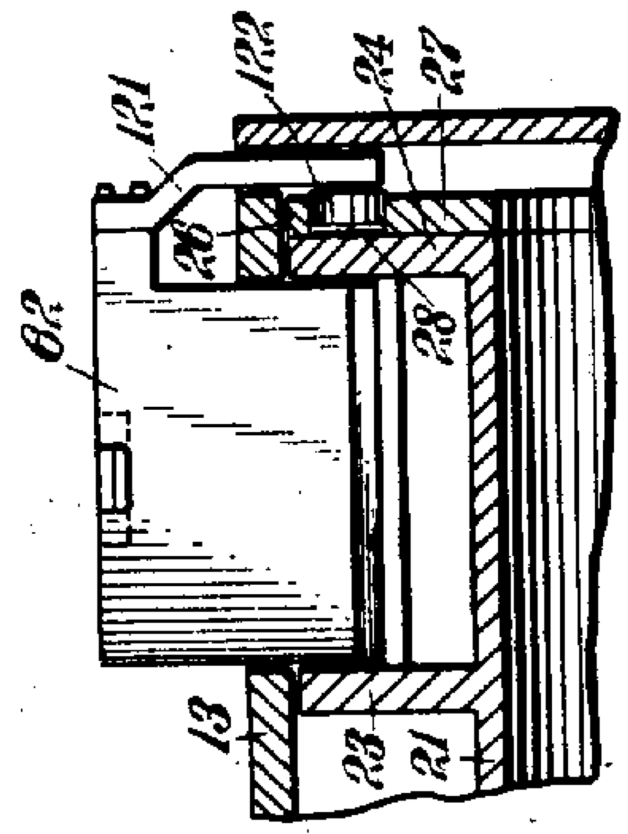

Fig. 9

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5 SHEETS—SHEET 4.

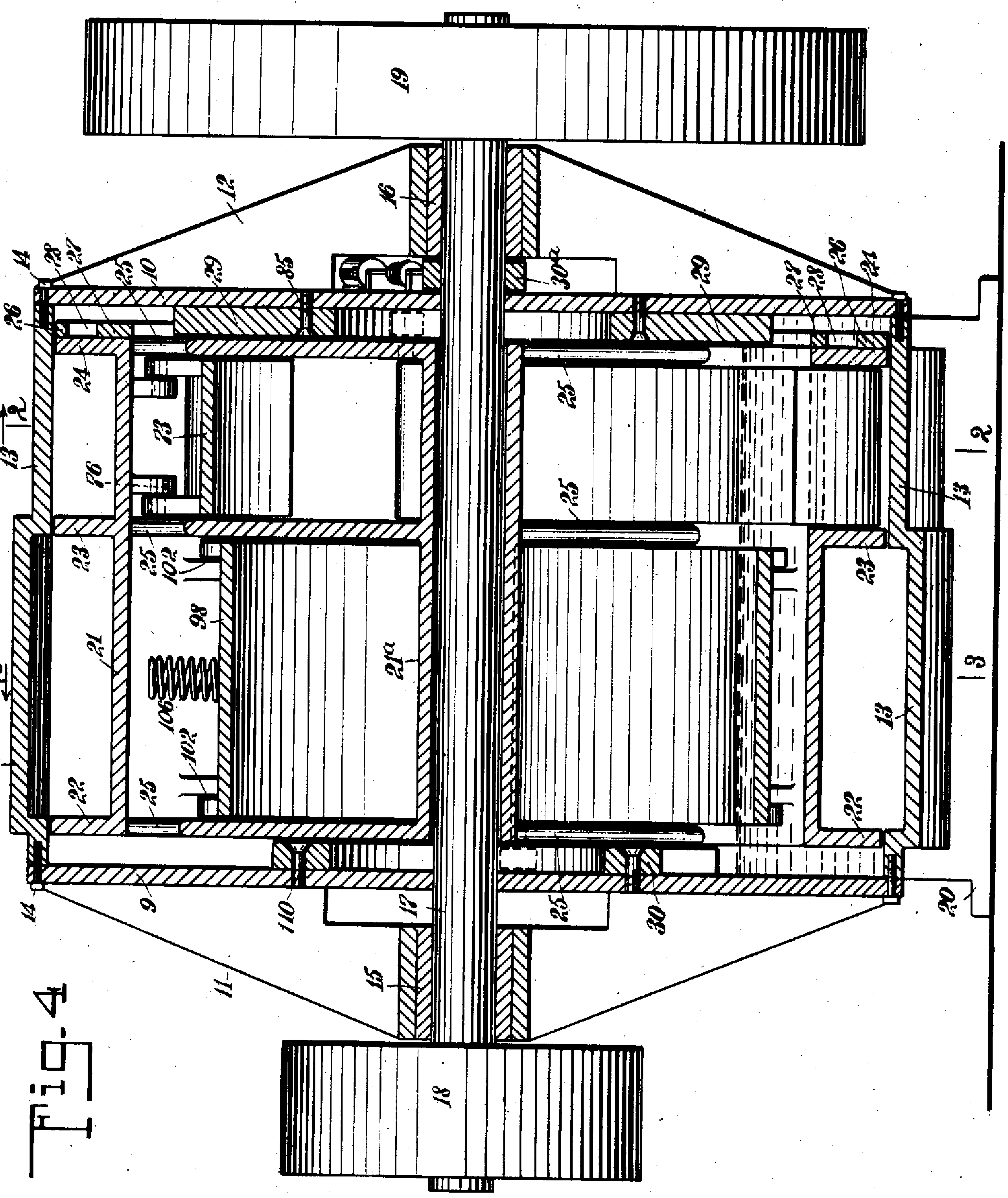

Fig. 4

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5 SHEETS—SHEET 5.

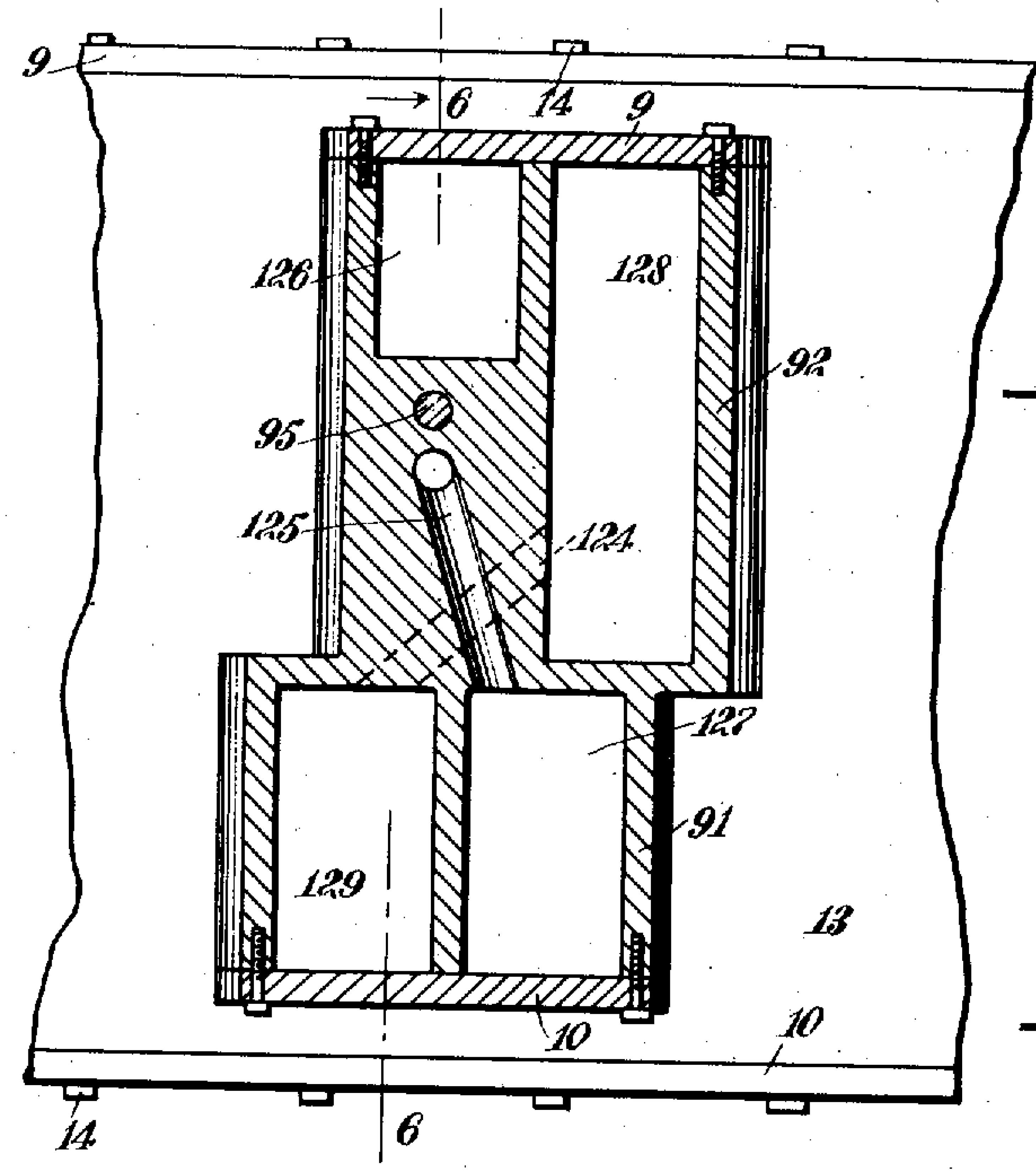


Fig. 5

Fig. 7

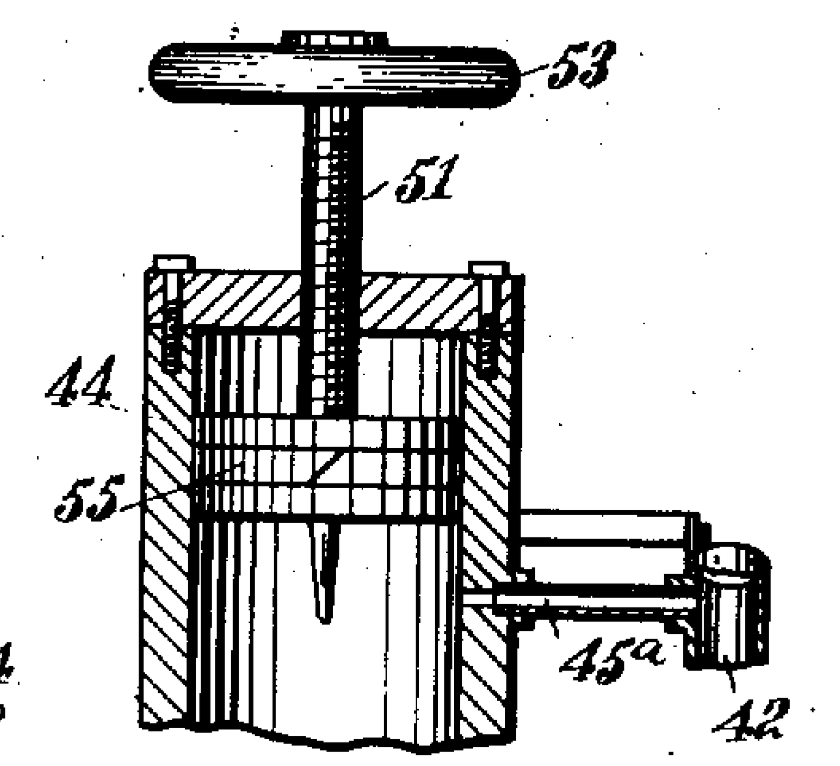


Fig. 6

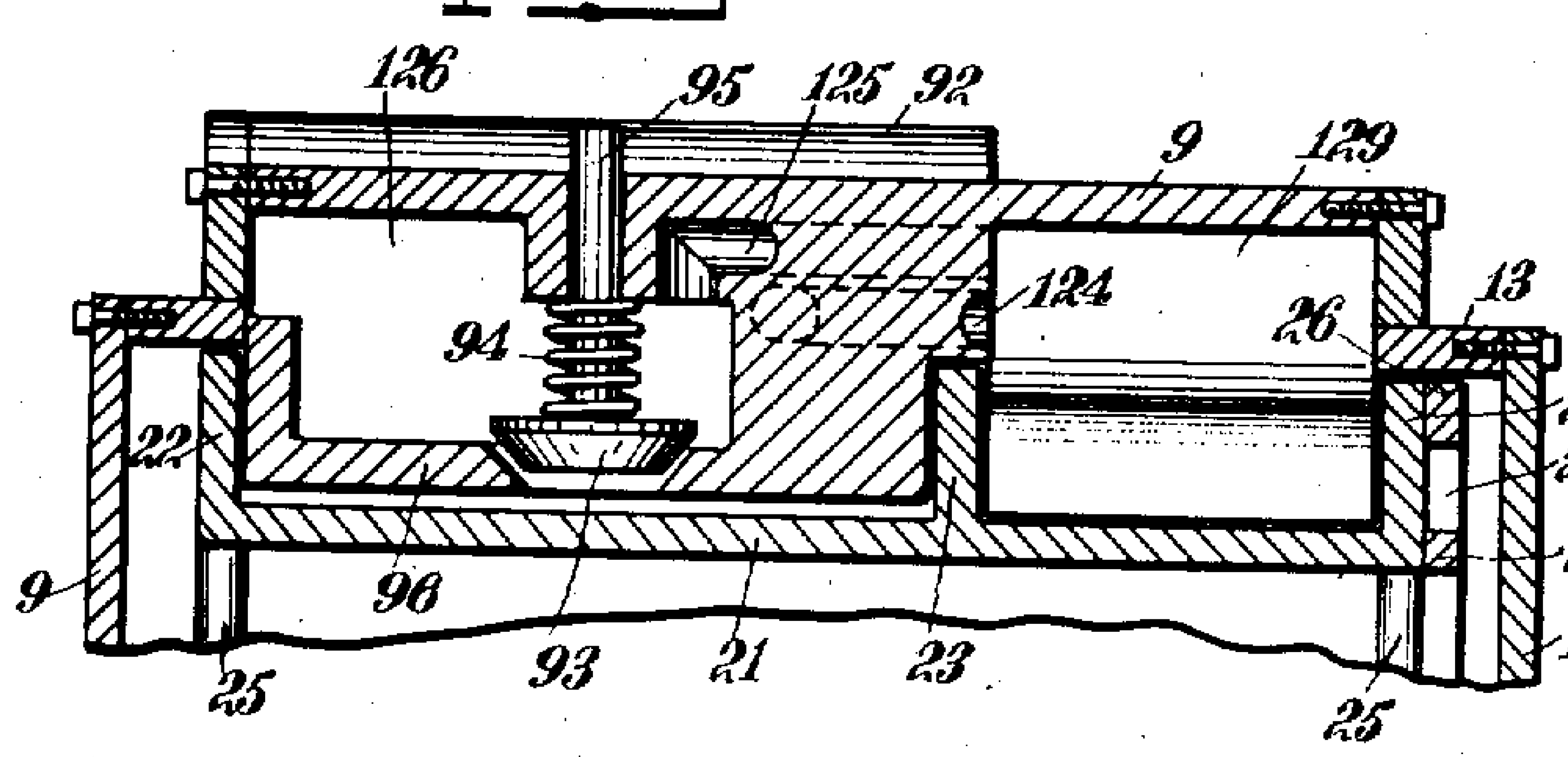
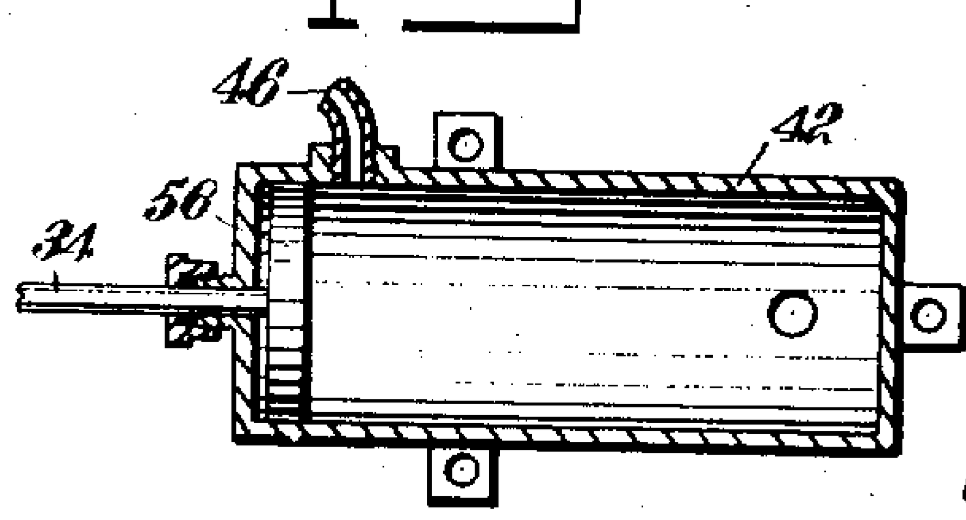


Fig. 8



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

975,275. Specification of Letters Patent. Patented Nov. 8, 1910.

Application filed October 16, 1909. Serial No. 522,935.

To all whom it may concern:

Be it known that I, GEORGE M. PERLEWITZ, a citizen of the United States of America, and a resident of Chihuahua, Mexico, have invented a new and Improved Internal-Combustion Engine, of which the following is a full, clear, and exact description.

My invention relates to internal combustion engines, my more particular purpose being to provide simple and efficient mechanism for conserving the power of the fuel.

More particularly stated, I seek to distribute certain forces of compression, so as to avoid undue strains upon different parts of the apparatus and at the same time render the compression more reliable and uniform.

In carrying out these general objects I provide a type of rotary engine having two distinct portions which I designate respectively as the "low pressure" side of the engine and the "high pressure" side. The low pressure side I use for two purposes: first, to receive gases of combustion already exploded in the high pressure side, and by allowing the gases to make a second expansion at low pressure, to conserve the power contained within the gases; and second, to make the preliminary compression of a volume of air and to pass this air over into the high pressure side in order to cause it to mingle with an explosive charge and thus to take part in the explosion. The high pressure side I employ for the purpose of exploding the charges and passing the burnt gases, while still under compression but at medium pressure, over into the low pressure side of the engine. The high pressure side is also used to give the charges of air received from the low pressure side (and thus already partially compressed) a further or final compression, whereby they are forced into the explosion chambers and there mingled with the explosive charges.

In my type of combustion engine there is, therefore, as between the high pressure side and the low pressure side, an interchanging of aeriform bodies; atmospheric air is taken in on the low pressure side and passed over to the high pressure side where it mingles with explosive charges and explodes, and the gases of combustion originating in the high pressure side are passed over into the low pressure side from which they make their escape into the atmosphere.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of my internal combustion engine complete—the high pressure side being next to the observer; the main shaft, however, being in section; Fig. 2 is a vertical cross section on the line 2—2 of Fig. 4, looking in the direction of the arrow, and showing the internal construction of the portion of the engine which I designate as the high pressure side; Fig. 3 is a vertical section on the line 3—3 of Fig. 4, looking in the direction of the arrow, and showing the internal construction of the portion of the engine which I designate as the low pressure side; Fig. 4 is a vertical section on the line 4—4 of Fig. 1, looking in the direction of the arrow, and showing how certain movable parts are connected with the shaft and rotated in connection therewith; Fig. 5 is a detail showing in section on the line 5—5 of Fig. 2, various passages whereby different compartments of the engine intercommunicate with each other; Fig. 6 is a section on the line 6—6 of Fig. 5, looking in the direction of the arrow, and showing one of the air valves used in transferring charges of air from the low pressure side into the high pressure side of the engine; Fig. 7 is a detail, showing in section one of the explosion chambers and a hand-operated piston for varying at will the capacity of same; Fig. 8 is a detail, showing in section one of the positive fuel jet pumps and connections; and Fig. 9 is a detail sectional view on the line 9—9 of Fig. 2.

Circular heads 9, 10 (Fig. 4) are provided with spiders 11, 12, cast integral therewith and are parallel with each other.

At 13 is the casing or cylindrical wall of the engine, and at 14 are bolts used for holding the heads 9, 10 and the casing 13 together.

Mounted upon the spiders 11, 12 are bearings 15, 16, and journaled in these bearings is a revoluble shaft 17. Pulleys 18, 19 are mounted rigidly upon opposite ends of this shaft.

A base 20 supports the engine as a whole.

At 21 is a power wheel which is provided with flanges 22, 23, 24 integral with it and parallel with each other. The power wheel is further provided with spokes 25 which engage a hub 21[a], the latter being mounted rigidly upon the shaft 17. The flange 24 carries a pair of rings 26, 27, these rings being so spaced relatively to each other as to leave a cam groove 28 therebetween. This groove has a general annular form, and as this form is followed around (see dotted lines in Fig. 2) it bends alternately inward and outward. At 29 is an annular guide which is secured to the inner side of the head 10. Another annular guide 30 is secured upon the inner side of the head 9, the guides 29, 30 serving to space the power wheel properly in relation to the heads 9, 10.

Mounted rigidly upon the shaft 17 is a cam 30ª having a general annular form and provided with radially projecting points 31. Because of the shape of this member I designate it as a "star cam." Disposed upon opposite sides of it are cam rollers 32, 33 carried respectively by power jet pump stems 34, 35. Encircling these power jet pump stems are spiral springs 36, 37 which respectively fit against collars 38, 39, the latter being mounted rigidly upon the jet pump stems.

At 40, 41 are cleats through which the jet pump stems extend and which serve the double purpose of bearings for the jet pump stems and stops for the springs 36, 37.

At 40ª are cleat bearings similar in construction to the members 40, 41, and which, like the members 40, 41, are slidably engaged by the jet pump stems.

At 42, 43 are small cylinders each performing essentially the office of a positive force fuel jet pump. These two fuel jet pumps are mounted upon two explosion chambers 44, 45, and are connected therewith by short pipes 45ª, which pipes are supplied with check valves (not shown)—(see Fig. 7). Connected with the fuel jet pumps 42, 43 are two tubes, 46, 47 which communicate with a supply pipe 48, and are used for supplying fuel for the fuel jet pumps figures 42, 43. Spark plugs 49, 50 are mounted upon the explosion chambers and are employed in the usual manner for detonating charges of explosive gases or vapor therein.

Fitting into the outer ends of the explosion chambers 44, 45 are threaded stems 51, 52 carrying hand wheels 53, 54 whereby they are turned and thus adjusted. The inner ends of the threaded stems 51, 52 are provided with pistons 55 fitted rigidly thereupon. By turning the hand wheels 53, 54, the pistons are moved to a greater or lesser distance within the explosion chambers, and the capacity of these chambers is thus regulated at will.

Mounted within the explosion chambers are check valves 56, 57, opening outwardly and normally closing communication between the explosion chambers and the high pressure compression duct or side of engine. These valves are mounted upon stems 58, 59 which are encircled by spiral springs 60 against the tension of which the valves may be opened. Two gate valves 61, 62 are mounted oppositely to each other, as indicated in Fig. 2. These gate valves 61, 62 are provided with projecting portions 63, 64, and these projecting portions are engaged by springs 65, the tension of which is outward from the center of the engine, as will be understood from Fig. 2. Each gate valve 61, 62 is further provided with a lug 66, and adjacent to the lugs 66 are two check valves 67 mounted upon the explosion chambers and opening inwardly in relation thereto. Each of these check valves is provided with a stem 69, and encircling the latter is a spiral spring 68 which normally keeps the valve seated.

Each valve stem 69 carries a lug 70 journaled thereupon by aid of a pivot pin 71 and adapted to swing outwardly when actuated by the adjacent lug 66. That is to say, when a gate 61 or 62 is opened, the lug 66 carried by this gate in passing the stem 69, trips the head 70, and as the latter turns upon a pivot (71), the lug 66 can easily pass. When, however, the gate closes, the lug 66 lodges against the head 70 which is now unable to yield, the result being that the valve 67 is now opened. The net result is that whenever a gate 61 or 62 opens, it has no effect upon the adjacent valve 67, but when either of the gates closes, the valve 67 adjacent to the gate is suddenly opened and then immediately afterward closes with a snap.

The power wheel is provided with three slots 72 disposed in the same plane. Adjacent to these slots are levers 73, 74, 75 mounted respectively upon pivots 76, 77, 78. Mounted upon the levers 73, 74, 75 are pistons 79, 80, 81, adapted to move inwardly or outwardly in accordance with movements of the levers 73, 74, 75. These levers carry rollers 82, 83, 84, by aid whereof they are actuated. The guide ring 29 is held in position by aid of bolts 85. The levers 73, 74, 75 are engaged by spiral springs 86 which tend to hold the levers in their respective normal positions—that is, each roller being inward relatively to the general position of the main shaft. The guide ring 29 is provided with cam spurs 87, 88, 89, 90 which are engaged by the rollers 82, 83, 84 and thus trip the levers carrying these rollers so as to periodically draw each of these pistons 79, 80, 81 inward.

Mounted upon the casing 14 and integral therewith are arches 91, 92 for facilitating the distribution and passage of the aeriform bodies handled by the engine. At 93 (see Fig. 3) is an air valve for facilitating the travel of charges of air from the low pressure side of the engine to the high pressure side thereof. The valve 93 is engaged by a spring 94 which encircles the stem 95 carried by the valve. At 96 is a hollow wall or barrier extending from the casing 13 and neatly fitting against the power wheeel 21, so as to form, as nearly as practicable, an air tight fit. There are two of these air valves 93 with parts accompanying the same, as will be understood from Fig. 3, and located diametrically opposite each other on the low pressure side of the engine. The power wheel 21 is provided upon the low pressure side of the engine with three slots 97, all disposed in the same plane. Three levers 98, 99, 100 are mounted upon pivot pins 101 and thus journaled so as to rock relatively to the power wheel carried by lugs 102.

Rollers 103, 104, 105 are mounted upon the inner or free ends of the levers 98, 99, 100. These levers are engaged by spiral springs 106 which also engage the inner side of the power wheel. The levers are thus normally held in the positions indicated in Fig. 3. The levers 98, 99, 100 carry pistons 107, 108, 109 which move inwardly and outwardly in accordance with movements of the levers. The guide ring 30 is held in position by fastenings 110 and is provided with spur cams 111, 112, 113, 114, as indicated in Fig. 3. As the power wheel turns, the rollers 103, 104, 105 engage the cams and are one at a time thrown outwardly so as to draw the pistons 107, 108, 109 inwardly—that is, toward the general center of revolution.

At 115, 116 are stationary abutments, and at 117, 118 are outlets which are used in discharging burnt gases into the atmosphere after these gases have finished their work. At 119, 120 are air inlets, through which the air is taken from the atmosphere into the low pressure side of the engine in order to be given a preliminary compression, and then passed over to the high pressure side. Connected with the respective gates 61, 62 are arms 121 (see Fig. 9), these arms carrying rollers 122 (see right of Fig. 2), 123 (see left of Fig. 2) which travel in the cam groove 28 and thereby thrust the arms 121 inwardly and outwardly, so as to open and close the gate valves 61, 62. When, therefore, the power wheel is turned, the valve 61 is opened at the instant the valve 62 closes, and vice versa.

The various levers 73, 74, 75, 98, 99, 100 are so proportioned that when subjected to centrifugal force, they are balanced.

A passage 124 (see Fig. 5) leads obliquely across from the arch 91 to the arch 92. Another passage 125 also leads from the arch 91 to the arch 92. These arches are provided with various passages 126, 127, 128, 129, for facilitating the travel of the charges of air and the gases of combustion from one side of the engine to the other.

The operation of my device is as follows: Suppose that the various parts are in the positions indicated in Fig. 2, and that an explosion takes place in the explosion chamber 45. It will be noted that the gate valve 62 is now open, being held positively so by the cam roller in the cam groove 28. The valve 57 is held closed by the spring 60 and the valve 67 is held closed by the spring 68. The force of the explosion has, therefore, no effect upon any of these valves, except possibly to tighten the closure of the valve 57 and the valve 67. The gases of combustion make their escape under the gate valve 62 and press against the piston 80, so as to rotate the power wheel 21 in a contraclockwise direction according to Fig. 2.

Ahead of the piston 80, in the direction of its rotation, is a quantity of burned gases left from the previous explosion. The travel of the piston 80 forces these burned gases ahead and they pass through the straight passage 124 over to the low pressure side of the engine, as indicated in Fig. 3, following the general direction of the arrow shown in this figure. When the piston 80 reaches a point adjacent to a partition 81ᵃ, one of which is located in each arch 91, 92, the roller 83 trips upon the cam spur 90 and rocks the lever 74, so that the piston 80 is drawn inwardly, thus dodging the partition 81ᵃ. An instant later, however, the roller 83 disengages the cam spur 90 so as to release the lever 74, and this lever, under tension of its spring 86, snaps back into its normal position. During the interval while the power wheel is turned a distance sufficient to carry the piston 80 to the point adjacent to the partition 81ᵃ, the piston 109 (see Fig. 3) in the low pressure side of the engine, moves past the wall or barrier 96. This is because the roller 105 trips upon the cam spur 114 so as to rock the lever 100, and as soon as the piston 109 passes the barrier 96, pressure of the spring 106 causes the lever 100 to snap back into its normal position, the piston 109, however, having now been moved to a point to the right of the arch 92 according to Fig. 3. The burned gases, therefore, in passing through the straight passage from the high pressure side of the engine into the low pressure side thereof, now bear against the piston 109 and continue to expand. They thus expand twice in succession, once in the high pressure side of the engine and again in the low pressure side. They finally make their escape through the outlet 118 into the open air.

Let us now see what other effects are produced by the fragmentary movement of the power wheel above mentioned. The piston 81 (on the high pressure side—see Fig. 2) moves in a contraclockwise direction away from one of the partitions 81ᵃ immediately adjacent to it. The result is that a partial vacuum is produced immediately behind the piston 81, and in consequence of this partial vacuum, air flows into the high pressure side through the bent passage 125. This charge of air thus taken into the high pressure side of the engine has already undergone a preliminary compression in the low pressure side as hereinafter explained. Just ahead of the piston 81 in the direction of its travel is another charge of compressed air previously received from the low pressure side, as the piston 81 travels forward, it further compresses this charge and in so doing finally opens the valve 57 as hereinafter set forth and introduces said charge into explosion chamber 45. The tension of the spring 60 is so adjusted that the valve 57 does not lift until gate 62 has completely closed and in closing, trips the check valve 67, releasing to the atmosphere through check valve 67, the resultant residue trapped burned gases from chamber 45. The check valve 67 under tension of the spring 68 immediately snaps shut, the charge of air under its second or final compression is then forced into chamber 45, this compression being given it by one of the pistons 79, 80, 81, the particular instance under discussion being 81. The air under its final compression is thus forced into the explosion chamber 45. At the same time a charge of liquid or vaporized fuel is introduced into this chamber through the pipe 45[a] by means of the jet pump 43 and mixed with the air ready for another explosion. The gate 62 is closed by the action of the cam roller 122 just previous to the introduction of the fuel and compressed air into chamber 45.

The action of the various parts at the left of Fig. 2, may be readily understood from the foregoing description; that is to say, every part at the left of Fig. 2 is a substantial duplicate of the corresponding part at the right of the said figure, and the same operations above described as taking place at the right of Fig. 2, necessarily take place at the left thereof.

Let us now look further at the action taking place in the low pressure side of the engine—represented more particularly by Fig. 3. Each time a piston (say 107) passes a barrier (115 or 116) the piston dodges the barrier, owing to the action of the roller (say 103) associated with it upon some one of the cam spurs (say 111). The pistons 107, 108, 109, similarly dodge the walls 96 and snap back into their respective normal positions after passing these walls. With the movable parts occupying the positions indicated in Fig. 3 (corresponding to the positions of the various parts shown in Fig. 2) the piston 107 has just passed the barrier 116 and snapped outwardly into normal position; the piston 108 is between the wall 96 and the barrier 115; the piston 109 is quite close to and is approaching the wall 96. Just ahead of the piston 107 in the direction of its travel is a volume of air which has been taken through the air inlet 120. This volume of air is now being compressed. An instant later and it will lift the valve 93 and will pass through the passage 125 into the high pressure side of the engine. The piston 108 is pressed upon from its rear by the expansion of gases arriving through the adjacent passage 125 from the high pressure side of the engine. Immediately ahead of the piston 108 the spent gases of combustion are escaping through the outlet 117 into the open air. The piston 109 being close to the valve 93, has caused the intervening volume of air to press upon this valve, so as to open it, the air thus compressed now passing over into the high pressure side of the engine. Immediately behind the piston 109 atmospheric air is flowing in through the air inlet 119. The action above described may therefore be thus summarized: The low pressure side of the engine takes in air at atmospheric pressure, gives it a preliminary or partial compression and passes it over to the high pressure side of the engine where it mingles with the explosive mixture, and with it receives a further or final compression, the mixture then being exploded. The gases of combustion thus originating in the high pressure side of the engine are partially expanded therein, thereby doing useful work, and after such partial expansion they are passed over into the low pressure side of the engine where they further expand and finally make their escape to the atmosphere. The beginning and the end of the entire cycle of operations, therefore, are in the low pressure side of the engine. That is to say, the low pressure side of the engine takes in air and ultimately discharges the gases of combustion.

The various levers, because each is pivoted in its proximate middle, are balanced upon their pivots so that when subjected to the action of centrifugal force they are easy to operate.

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

1. An internal combustion engine, comprising a casing, a power wheel mounted therein and provided with a high pressure side and a low pressure side, means for supplying air into said low pressure side, mechanism for compressing said air thus supplied into said low pressure side, an explosion chamber connected with said high pressure side, means for conducting said air after receiving a compression into said explosion chamber, means for supplying a fuel into said explosion chamber, an igniting device for exploding a mixture of said fuel and said air under compression and allowing the gases of combustion to explode in said high pressure side, and means for conducting said

gases after expansion in said high pressure side over to said low pressure side of said power wheel.

2. In an internal combustion engine, the combination of a casing, a power wheel mounted therein and revoluble relatively thereto, means controllable directly by said power wheel for taking a volume of air into said casing and giving the same a preliminary compression, other means controllable directly by said power wheel for receiving said charge of air and giving the same a further compression within said casing, an explosion chamber for receiving said charge of air after said further compression, means for admitting into said explosion chamber a fuel to be mixed with said charge of air, an exploding device for causing the mixture of compressed air and fuel to explode, thereby generating expansive gases of combustion, and means for directing the gases of combustion against said power wheel.

3. In an internal combustion engine, the combination of a casing, a power wheel revolubly mounted therein, mechanism carried by said power wheel and co-acting with said casing for compressing a charge of air, an explosion chamber for holding the charge of air thus compressed, means for admitting fuel into said explosion chamber, so as to mix the fuel with the air thus compressed, an igniting device for exploding the mixture within said explosion chamber, means for directing gases of combustion at high pressure against a portion of said power wheel in order to subject said portion to the expansive action of said gases, and mechanism for directing said gases when thus partially expanded against another portion of said power wheel so as to utilize a further expansion of said gases in turning said power wheel.

4. In an internal combustion engine, the combination of a casing provided with stationary abutments, a power wheel mounted within said casing and provided with pistons, said casing and said power wheel being together provided with a high pressure side and with a low pressure side, means for compressing charges of air in said low pressure side, connections from said low pressure side to said high pressure side for conveying into said high pressure side charges compressed in said low pressure side, and other connections from said high pressure side to said low pressure side for transferring gases of combustion partially expanded in said high pressure side into said low pressure side.

5. An internal combustion engine, comprising a casing, a power wheel mounted therein and provided with a high pressure side and a low pressure side, means for admitting air into said low pressure side, means co-acting with said power wheel for compressing said air within said low pressure side thereof, means for conveying said air to said high pressure side after compression in said low pressure side, mechanism for admitting fuel into said high pressure side and into contact with the compressed air therein, an igniting device for exploding the mixture of said fuel and compressed air, and means for directing the gases of combustion due to the explosion first against the portion of said power wheel in the high pressure side, and next against the portion of said power wheel in said low pressure side.

6. An internal combustion engine, comprising a casing provided with stationary abutments, a power wheel mounted within said casing and revoluble relatively to the same, levers carried by said power wheel and mounted to rock upon pivots, the location of said pivots being such as to balance said levers when under the action of centrifugal force, mechanism for periodically tripping said levers, and pistons carried by said levers and periodically moved thereby so as to avoid engaging said stationary abutments.

7. An internal combustion engine, comprising a casing provided with abutments, a revoluble member mounted within said casing, levers mounted upon said revoluble member and adapted to rock, each lever being balanced as regards the action of centrifugal force, pistons carried by said levers and periodically moved inward by movements thereof in order to avoid engagement with said abutments, and means for firing explosive charges in order to propel said pistons and said revoluble member carrying the same.

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

GEORGE MORTIMER PERLEWITZ.

Witnesses:

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L. J. KEENA.