No. 850,295. PATENTED APR. 16, 1907.

G. H. CHAPPELL.

MOTOR.

APPLICATION FILED DEC. 15, 1906.

2 SHEETS—SHEET 1.

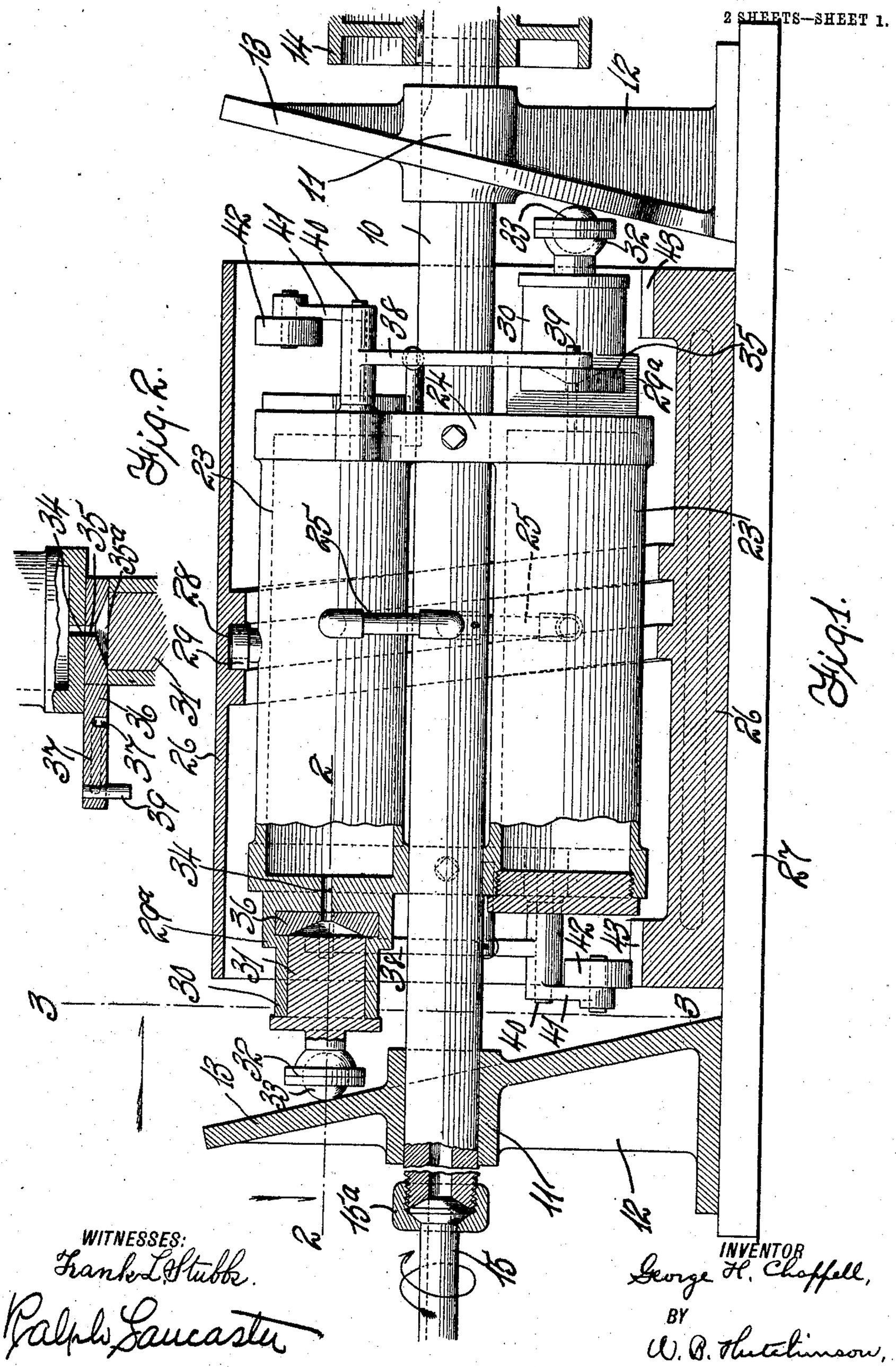

Fig. 1.

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2 SHEETS—SHEET 2.

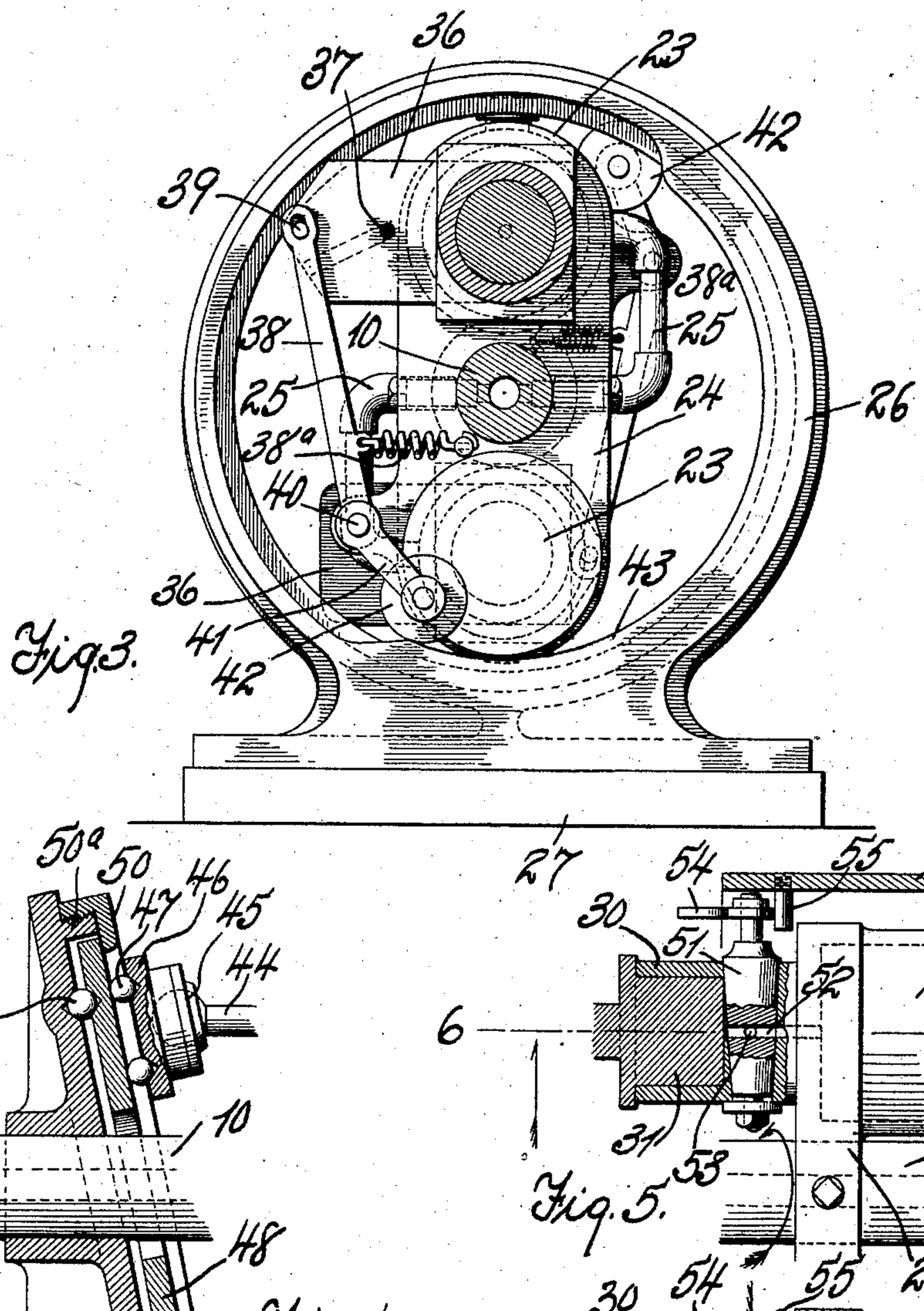


Fig. 3.

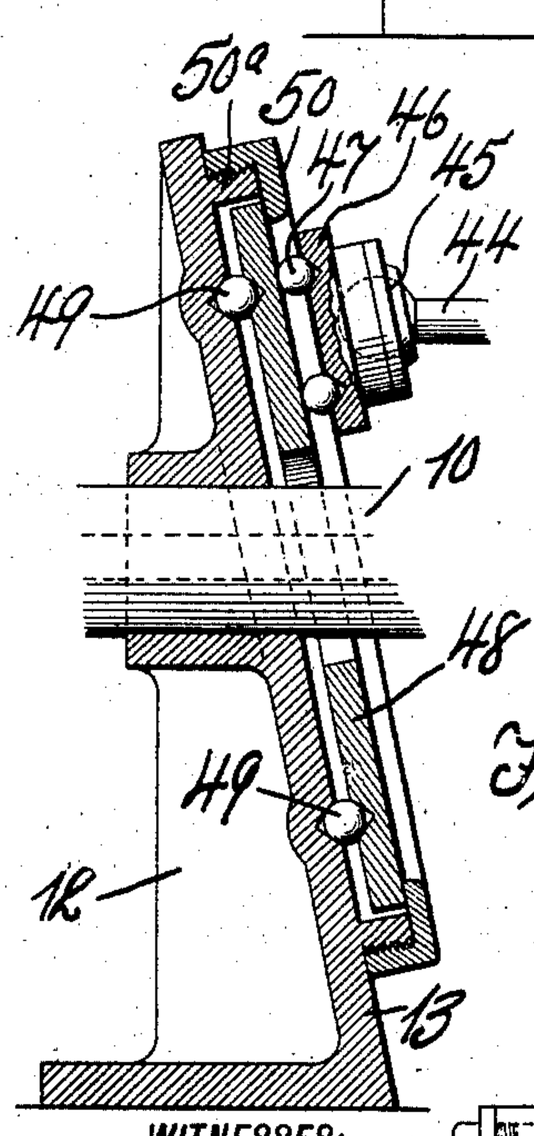


Fig. 4.

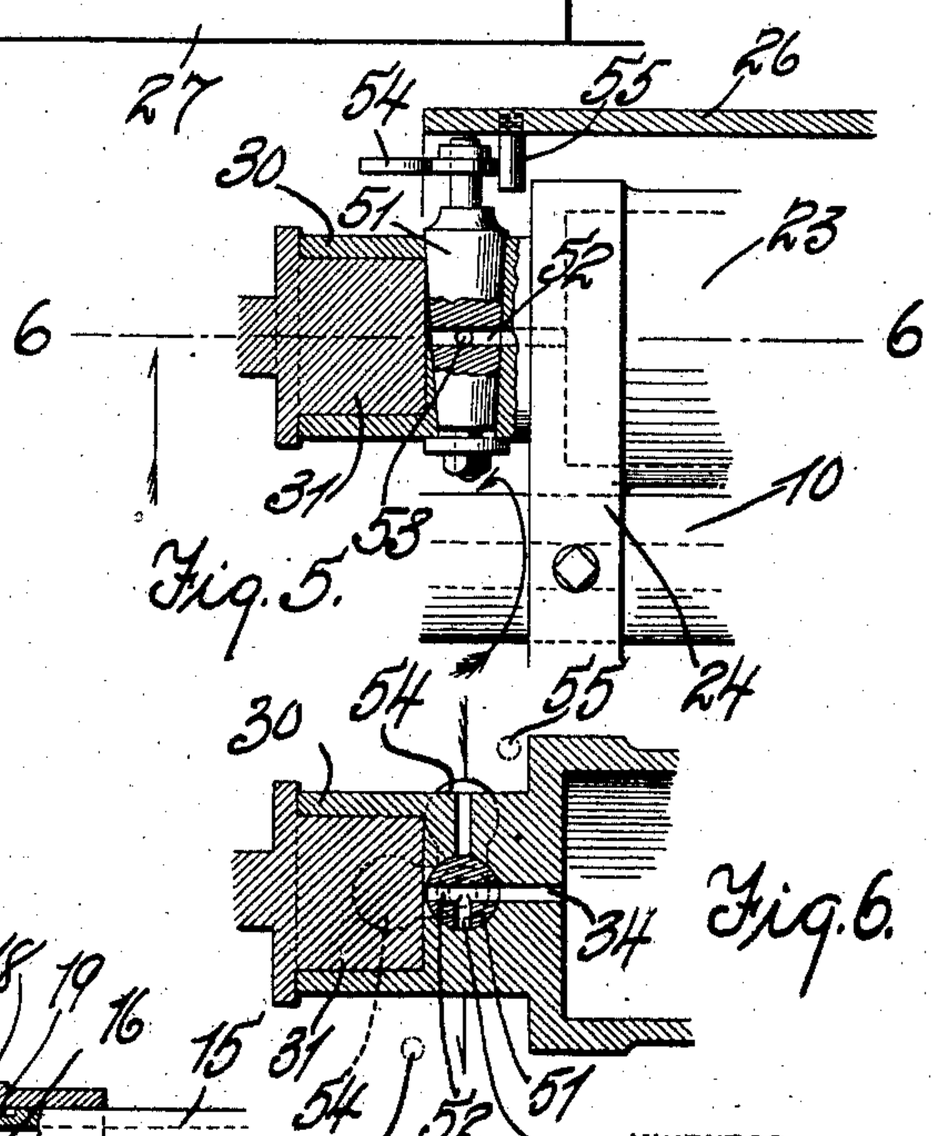


Fig. 5.




Fig. 6.

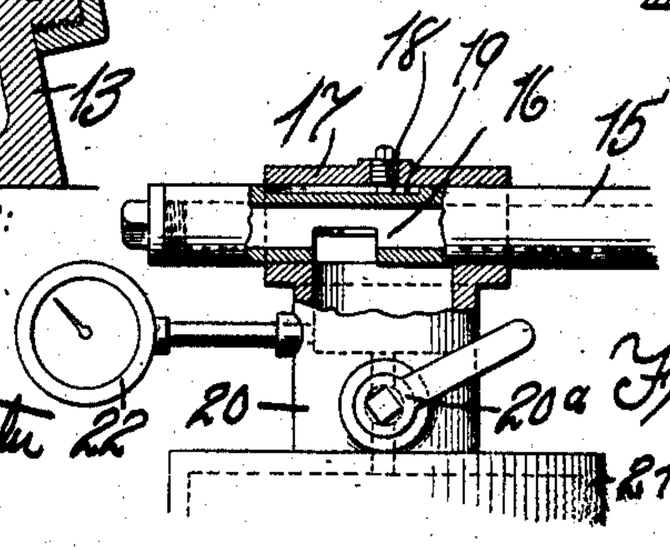


Fig. 7.

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# UNITED STATES PATENT OFFICE.

GEORGE H. CHAPPELL, OF WESTWOOD, NEW JERSEY, ASSIGNOR TO PROGRESSIVE $CO_2$ POWER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF SOUTH DAKOTA.

## MOTOR.

No. 850,295. Specification of Letters Patent. Patented April 16, 1907.

Application filed December 15, 1906. Serial No. 346,423.

*To all whom it may concern:*

Be it known that I, GEORGE H. CHAPPELL, of Westwood, Bergen county, New Jersey, have invented a new and Improved Motor, of which the following is a full, clear, and exact description.

My invention relates to improvements in motors; and the object of my invention is to produce a motor which will effect a great economy of power and which will utilize any pressure-gas, preferably carbonic-acid gas, to impart to a system of cylinders and the connecting-shaft a reciprocating and a rotary motion, and I do this in such a way that power may be conveniently taken from the shaft.

In carrying out my invention the cylinders are given a bodily reciprocating motion; but they are connected with a stationary cam in a manner to cause them to rotate at the same time and impart this rotary motion to the driving-shaft, which for convenience is made hollow and serves to supply the pressure-gas to the cylinders.

To this end my invention consists of certain features of construction and combinations of parts, which will be hereinafter described and claimed.

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

Figure 1 is a vertical longitudinal section, partly in elevation, of the motor embodying my invention. Fig. 2 is a detail section on the line 2 2 of Fig. 1. Fig. 3 is a cross-section on the line 3 3 of Fig. 1. Fig. 4 is a vertical section of a modified form of the inclined abutment and its connections. Fig. 5 is a detail sectional view, partly in elevation, of a modified form of exhaust-valve. Fig. 6 is a section on the line 6 6 of Fig. 5, and Fig. 7 is a detail of the means for supplying gas to the motor.

The motor has a main driving-shaft 10, which is hollow and is journaled in suitable stationary bearings 11, these being formed in the posts or pedestals 12, which have inclined faces 13, these being oppositely inclined and serving as abutment-plates for the cylinder-pistons, as hereinafter described. The driving-shaft 10 reciprocates and also rotates, and it has, therefore, a pulley 14, from which power can be taken and which is keyed to the shaft so as to permit of the longitudinal movement of the shaft; but the pulley will turn with the shaft. The shaft is supplied with its pressure-gas from a supply-pipe 15, which connects with the shaft 10 by means of a suitable box $15^a$, (see Fig. 1,) and while the pipe 15 can be supplied in any convenient manner the arrangement shown in Fig. 7 is suitable. Here the pipe has a port 16, sliding in the cross-head 17, and the pipe is guided so that the port 16 will always register with its supply source by means of the pin 18 in the cross-head 17, which pin enters the groove 19 in the pipe 15.

The port 16 communicates with the extension 20 of the tank 21, and the supply is controlled by a valve $20^a$, and the part 20 can be connected with a pressure-gage 22. On diametrically opposite sides of the shaft 10 are the power-cylinders 23, which are made strong enough to stand a heavy pressure and connected together by yokes 24, so that they shall always have a fixed relation with each other and with the shaft 10. The yokes 24 are firmly secured to the shaft 10, so that the cylinders 23 and the shaft 10 are movable in unison. Each cylinder 23 connects with the shaft 10 by a supply-pipe 25, so that the pressure-gas can readily and constantly enter both cylinders.

The cylinders 23 rotate in a stationary cylindrical casing 26, which rests on a bed-plate 27, and the latter can afford a support for the posts 12, already referred to. One of the cylinders 23 carries a roller 29, which fits in a spiral cam-groove 28, extending around the cylinder or shell 26, and as the impulse given to the cylinders 23 is at first reciprocal it will cause the roller 29 to follow the cam-groove 28, and thus a rotary movement as well is imparted to the cylinders and their shaft. The groove 28 should be given a sufficiently sharp pitch so that when the cylinders are moved endwise the pressure of the roller 29 on the walls of the groove will, from the screw nature of the groove, impart a rotary motion to the cylinders and their shaft, and, further, by having the grooves arranged as shown, with the rollers fitting it, a steady action results.

Each cylinder 23 has an extension $29^a$ and

30, the former serving as a valve-box and the latter to receive the piston 31, which fits gas-tight in the extension 30 and carries at its outer end a ball-box 32, having an antifriction-ball 33 therein, and this follows the inclined abutment-plate 13.

Referring to Fig. 1, it will be seen that this arrangement is common to both cylinders; but it occurs at opposite ends of the cylinder. Each cylinder has a port 34 registering with a port 35 on the sliding valve 36, which slides in the box 29[a] between the piston 31 and the cylinder 23, and the valve is chambered on the side next the piston, as shown at 35[a]. The valve is also provided with the exhaust-port 37, so that when pushed inward by the spring 38[a], presently referred to, the gas on the side next the piston may exhaust. Each slide-valve 36 has at its outer end a pin 39, which fits loosely in the end of the tilting lever 38, and the latter is pulled by the spring 38[a], (see Fig. 3,) so as to normally push the valve 36 into position to exhaust the gas from the side next the piston 31, as just described. The lever 38 is fulcrumed, as shown at 40, and has a short arm 41, carrying a roller 42, which engages the cam-track 43, extending practically half around the shell 26. This arrangement is similar on opposite ends of the shell; but the tracks 43 are opposed, so that when one slide-valve 36 is open to exhaust the other is in the position shown in Fig. 2 to admit pressure-gas against the piston 31.

When the pressure is open to the piston, the tendency is to move the cylinders 23 endwise, and this causes the cylinders to push the roller 29 against the wall of the cam-groove 28, and so a rotary movement is imparted to the shaft 10, while the abutment-plates 13 serve to keep the pistons always pressing against them; but one ball 33 is against the lower part of an inclined abutment 13 when the opposed end is against the upper part of the opposed abutment.

In Fig. 4 I have shown a modified means of connecting the pistons with the abutment-plate. As here illustrated, a rod 44 is adapted to extend outward from the piston 31, and at its end it connects by a bearing 45 with the plate 46, which in turn connects, by means of balls 47, with a loose plate 48 on the shaft 10 and opposite the abutment 13, and the plate 48 is backed by the balls 49, forming a ball-bearing between it and the abutment-plate 13. The plate 48 is held in place by the angle-ring 50, which is screwed to the flange 50[a] on the plate 13.

In Figs. 5 and 6 I have shown a modified form of exhaust, in which case a two-way cock 51 turns opposite the piston 31 and between it and the cylinder 23. The cock has one port 52 extending diametrically across the cock, so as to register with the port 34 and permit pressure to be exercised against the piston 31, and another branch port 53 opening to the exhaust. The cock is turned, as in the previous case, by the rotation of the cylinder, and to provide for this the cock has short arms 54 arranged at an angle of ninety degrees to each other, and these arms are struck alternately by the abutment-pins 55, which can be secured to the shell 26 to turn the cock 51 so as to open or close the exhaust.

It will be seen that I have provided a very simple motor which can use gas under very heavy pressure and which causes it to impart in an easy manner a rotary motion to the driving-shaft.

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

1. A motor having a driving-shaft, opposed cylinders turning and sliding with the driving-shaft, inclined abutment-plates opposite the cylinder ends, a sliding piston opposite each cylinder, having a sliding connection with one of the abutment-plates, and a valve controlling the inlet of pressure-gas to the cylinders.

2. A motor comprising a rotating and reciprocating driving-shaft, cylinders arranged parallel with and moving with the shaft, oppositely-inclined abutments at the ends of the cylinders, pistons working from the cylinders and against the abutments, means for admitting pressure to the cylinders, and means for transforming the sliding movement of the cylinders and shaft into rotary motion.

3. A motor comprising a driving-shaft, opposed cylinders arranged parallel with the shaft and sliding and turning therewith, means for admitting pressure to the cylinders, oppositely-inclined abutments at the cylinder ends, pistons operated from the cylinders and working against the abutments, and means as the cam-groove and roller for converting the sliding movement of the cylinders and shaft into rotary motion.

4. In a motor, the combination of the opposed cylinders and their shaft, and means for driving the cylinders and shaft endwise, of a shell inclosing the cylinders, and a cam-groove on the shell receiving an abutment on one of the cylinders.

5. A motor comprising a hollow driving-shaft, means for admitting pressure into the shaft, cylinders arranged parallel with and turning with the shaft, means for admitting gas from the shaft to the cylinders, oppositely inclined abutments near the cylinder ends, pistons worked by the cylinders and engaging the abutments, and means for converting the sliding movement of the cylinders into a rotary movement.

6. In a motor, the combination of the sliding and rotatable cylinders and their shaft, of a stationary shell inclosing the cylinders,

the said shell having a cam-groove therein, and a roller on one of the cylinders to enter the cam-groove.

7. The combination with the sliding and rotating cylinders and shaft, of the inclined abutments, pistons operated from the cylinders and engaging the abutments, valves controlling the pressure-supply to the cylinders, and automatic means for alternately operating the valves.

8. The combination with the rotating cylinders, and the slide-valves controlling the inlets to the cylinders, of tilting levers connected with the slide-valves, and cam-tracks in the path of the outer ends of the levers to operate them.

9. In a motor, the combination with rotating cylinders and their shaft, of the opposed and oppositely-inclined abutment-plates at the cylinder ends, pistons working from the cylinders and against the plates, a cam-track held opposite the cylinders, and an abutment on one of the cylinders to engage the cam-track.

10. The combination with the sliding and rotating cylinders, of the oppositely-arranged inclined abutments rigidly supported in a stationary position at the cylinder ends, pistons operated from the cylinders, and a ball-joint connection between the pistons and the abutments.

11. The combination with the sliding and rotating cylinders, of the inclined and oppositely-arranged abutments near the cylinder ends, a stationary shell inclosing the cylinders, a ball-joint connection between the cylinders and the abutments, a cam-track on the shell, and an abutment on one cylinder to engage the cam-track.

12. The combination with the sliding and rotating cylinders, of the inclined and oppositely-arranged abutments near the cylinder ends, the inclined plates turning on the abutments, pistons operated from the cylinders, and a free connection between the piston and the revolving plate.

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