

D. D. ROCK.
VALVE OPERATING MECHANISM.
APPLICATION FILED JUNE 27, 1913.

1,096,955.

Patented May 19, 1914.

2 SHEETS—SHEET 1.

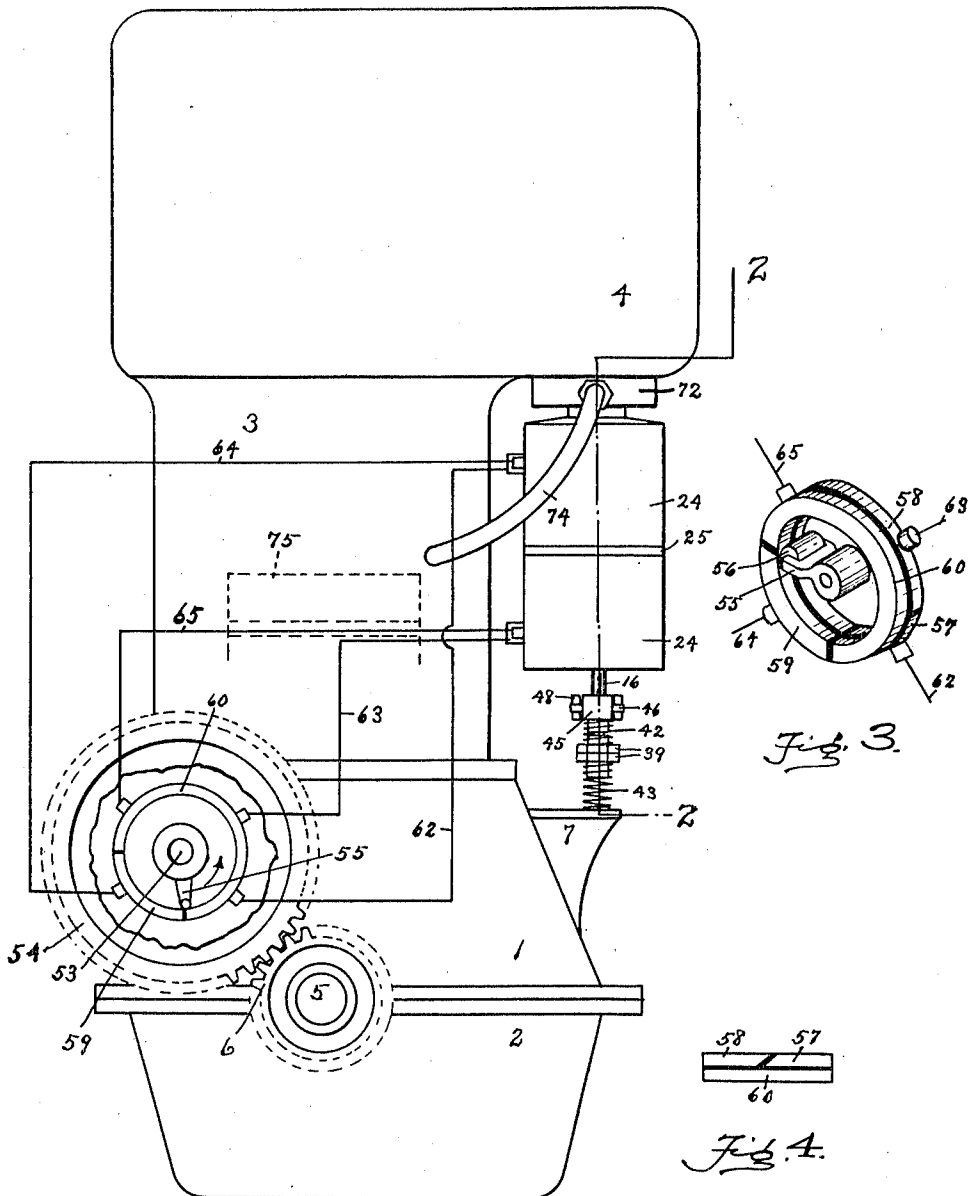


Fig. 1.

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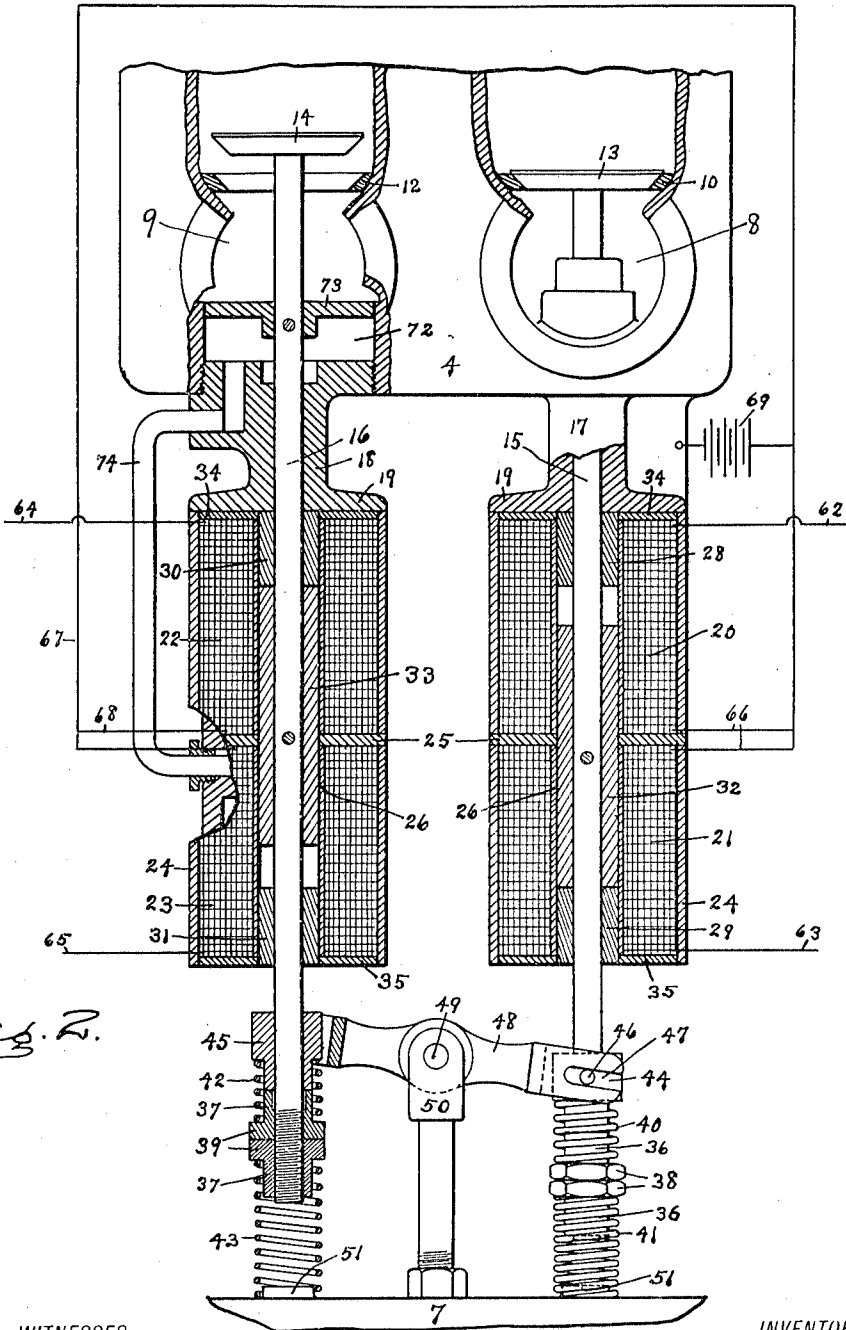


Fig. 2.

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VALVE-OPERATING MECHANISM.

1,096,955.

Specification of Letters Patent.

Patented May 19, 1914.

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To all whom it may concern:

Be it known that I, DARREL D. ROCK, a citizen of the United States, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented a new and Improved Valve-Operating Mechanism, of which the following is a specification.

This invention relates to means for noiselessly reciprocating valve-rods of engines at high rates, and especially for actuating the valve-rods of high speed internal combustion automobile engines, and its object is to provide combined mechanical and electric means whereby a rod may be moved back and forth at predetermined intervals.

This invention consists in combination of electro-magnets in line with each other and a slidably mounted rod, of an armature mounted on the rod between the cores of the magnets, and a pair of springs engaging the rod and tending to carry the armature to a position intermediate the cores.

It further consists in grouping two valve-rods and their actuating magnets and springs, together with means whereby the springs on one rod may influence the movement of the other rod.

In the accompanying drawings, Figure 1 is an end elevation of an internal combustion engine equipped with a valve operating device embodying the present invention. Fig. 2 is a vertical section of the valve operating device on the line 2—2 of Fig. 1, on a larger scale, a portion of the valve-chamber being broken away to show the valves. Fig. 3 is a perspective of a circuit closing device. Fig. 4 is a detail of the same.

Similar reference characters refer to like parts throughout the several views.

This invention is embodied in the valve operating mechanism of an engine having a crank-case composed of an upper portion 1 and lower portion 2, a cylinder 3 having a valve-chamber 4, and a crank-shaft 5 carrying a pinion 6. A bracket 7 supports the lower springs of the valve-operating device. The valve-chamber has an intake passage 8 and an exhaust passage 9 which are shown to be side by side, but this invention is not limited to engines of such construction. The valve-chamber is shown provided with valve-seats 10 and 12 for the valves 13

and 14 on the upper ends or the valve-stems 15 and 16.

Extending down from the valve-chamber 4 are the sleeves 17 and 18, having flanges 19 at their lower ends. Below these flanges are the magnet spools 20, 21, 22 and 23 of proper wire, incased in the magnetic shells 24, and separated by the disks 25 also of magnetic material. Sleeves 26 of non-magnetic material separate the spools from the cores 28, 29, 30 and 31, and from the armatures 32 and 33 on the valve-stems 15 and 16, respectively. These valve-stems may be of non-magnetic material, as are also the valve-seats 12, although when the valves are non-magnetic, the seats may be of steel or iron. The disks 34 and 35 magnetically connect the shells 24 to the cores. Shoulders or collars may be formed on the lower ends of these valve-stems in any desired manner. In the drawings, nuts 36 and 37 on the lower ends of the valve-stems 15 and 16, hold each other in position by jamming, and have collars 38 and 39 between the springs 40 and 41, and 42 and 43, respectively. The springs are preferably of equal tension, the upper springs being preferably one half the length of the lower and engaging the collars 44 and 45, slidable on the valve-stems. These collars have pins 46 extending into slots 47 in the bifurcated ends of the lever 48, pivoted at 49 on the standard 50. Bosses 51 may be used to center the lower springs. The relative positions of the collars 38 and 39 and of the valves 13 and 14 are such that when the magnets are deenergized, and the heads are held in balanced position between the springs, the valves will be off their seats a distance equal to one half of their total movement, that is, midway between the positions of the valves 13 and 14 in Fig. 2. If the total movement of a valve is three-eighths of an inch, the normal position will be about three-sixteenths of an inch from its seat. At this time, the hubs on the collars 45 will be three-thirty-seconds of an inch from the nuts 36 and 37.

Any desired system of current control may be employed, that indicated conventionally in Figs. 1 and 3 being merely one of many that are well known. Rings of metal are cut into segments, substantially

one-fourth and three-fourths of the circumference in length, and these are mounted concentric with a revoluble shaft 53 which carries a gear 54 meshing with the pinion 6 and twice its size, and an arm 55 which carries a contact roller 56. The parts 57, 58, 59 and 60 of these rings may have posts to which the wires 62, 63, 64 and 65 respectively, connect. The arm 55 may be grounded. The wires 66, 67 and 68 connect to the current source 69, and that in turn may be grounded on the engine, which furnishes the connection to the contact roller 56.

The operation of this device is as follows: When the parts are as shown in Figs. 2 and 3 of the drawings, current is passing from the roller 56 to the segments 58 and 59 and over the wires 63 and 64 to the spools 21 and 22, which are thereby energized, and magnetize the cores 29 and 30. The armature 32 will be held down and the armature 33 will be held up, resulting in the valve 13 being held on its seat and the valve 14 in elevated position during the scavenging stroke of the engine. At the end of the scavenging stroke the roller 49 passes from the segment 59 to the segment 60, and from the segment 58 to the segment 57, the poles 29 and 30 are deenergized and the poles 28 and 31 are energized. The first step results in the release of the armatures and in the movement down of the armature 33 by the spring 42 and the movement up of the armature 32 by the spring 41. As the springs are all of substantially the same stiffness, and the springs 40 and 42 preferably of half the length of the other two, the movement of the collars 38 and 39 by the tensioned springs will carry the armatures nearly across the space between them and the opposite poles 28 and 31, respectively, the inertia of the parts serving to nearly complete such movement. This movement is extremely fast, so that, by the time the poles 28 and 31 are magnetized, the armatures are almost in contact with them. Thus by using the balanced springs in connection with the valve-stems, three of which springs are under greatest tension at the instant the armature is released, a great increase in the speed of the valve movements is attained, and thereby a great increase in the number of revolutions of the engine is made possible. The width of the insulation between the segments of the control rings will regulate the time between the demagnetization of one pole and the magnetization of the other. If desired, the segments may overlap, as indicated in Fig. 4, so that one pole will be magnetized at substantially the same time that the other is demagnetized, the angularity of the adjacent ends depending on the speed of the engine. The intake valve of an engine is usually opened at the end of the scavenging stroke when the

pressures on its upper and lower sides are substantially the same as that of the atmosphere. But at the time the exhaust valve opens, there is usually a pressure in the valve-chamber greater than that below the valve. To counteract this excess of pressure a cylindrical chamber 72 may be formed in the bottom of the valve-chamber and a piston 73 secured to the valve-stem 16. A pipe 74 connects into this chamber 72 and into the cylinder 3 just above the lower limit of movement of the engine piston 75, so that when the piston reaches the bottom of its stroke, as indicated in dotted lines in Fig. 1, the pressure of the burnt gases will pass up the pipe 74 into the chamber 72 and tend to counterbalance the pressure of these gases above the valve 14.

Many changes in the details of construction, and proportions of the parts of this valve operating mechanism may be made by those skilled in the art without departing from the spirit of my invention.

I claim—

1. In a valve operating device, the combination of a valve-stem, an armature secured thereto, a pair of electro-magnets mounted end-to-end concentric with said stem, poles at the outer ends of the magnets between which the armature is movable, and a pair of opposed springs to hold the armature intermediate the poles when the magnets are deenergized.

2. In a valve operating device, the combination of a valve-stem, an armature secured thereto, a pair of electro-magnets having poles between which the armature is movable, and a pair of opposed springs to hold the armature intermediate the poles when the magnets are deenergized.

3. In a valve operating device, the combination of a valve-stem, an armature secured thereto, a pair of electro-magnets mounted end-to-end concentric with said stem, poles at the outer ends of the magnets between which the armature is movable, a pair of opposed springs to hold the armature intermediate the poles when the magnets are deenergized, and means for controlling the flow of current to said magnets.

4. In a valve operating device, the combination of a valve-stem, an armature secured thereto, a pair of electro-magnets having poles between which the armature is movable, a member adjustably mounted on the stem, a spring on each side of the member and pressing against it to hold the armature intermediate the poles when the magnets are deenergized.

5. In a valve operating device, the combination of a plurality of valve stems, an armature secured to each stem, two pairs of electro-magnets between which the armatures are respectively movable, a pair of op-

posed springs on each stem, a member secured to each stem between the springs, a stationary abutment for the lower spring of each stem, a collar slidable on each stem above the upper spring, and means connecting the collars to compel them to move in opposite directions at the same time.

6. In a valve operating device, the combination of a valve-stem, an armature secured thereto, a pair of electro-magnets mounted end-to-end concentric with the stem, poles at the outer ends of the magnets between which the armature is movable, a disk adjustably mounted on the stem, and a spring on each side of the disk and pressing against it to hold the armature intermediate the poles when the magnets are deenergized.

7. In a valve operating device, the combination of a valve-stem, an armature secured thereto, a pair of electro-magnets mounted end-to-end concentric with the stem, poles at the outer ends of the magnets between which the armature is movable, a disk adjustably mounted on the stem, a spring on each side of the disk and pressing against it to hold the armature intermediate the poles when the magnets are deenergized, and means for controlling the flow of current to said magnets.

8. In a valve operating device, the combination of a valve-stem, a guide for the same, a valve at one end of the stem, an adjustable head at the other end of the stem, a pair of electro-magnets in line with each other and concentric with the stem, a pole mounted in the outer end of each magnet and provided with a passage through which the stem is slidable, a stationary support, a spring on said stem between the head and the adjacent pole and a second spring in line with the first between the head and the support, and a cylindrical armature on the stem within the electro-magnets and normally positioned equi-distant from the poles by said springs.

9. In a valve operating device, the combination of a valve-chamber having a cylindrical extension, a valve-seat between the chamber and the extension, a valve-stem extending through the chamber and the extension, a valve on the end of the stem, a piston on the stem within the extension, a pipe connecting said extension to a source of gas under pressure, a pair of electro-magnets, and an armature on the stem between the magnets.

10. In a valve operating device, the combination of a plurality of valve-stems, an armature secured to each, a pair of electro-magnets mounted end-to-end concentric with each stem, poles at the outer ends of the magnets between which the armatures are movable, a pair of opposed springs on each stem, a collar secured on each stem between

the springs, a stationary abutment for the lower spring on each stem, a collar slidable on each stem above the upper spring, and a centrally pivoted lever having its ends connected to said collars.

11. In a valve operating device, the combination of a plurality of valve-stems, an armature secured to each, a pair of electro-magnets mounted end-to-end concentric with each stem, poles at the outer ends of the magnets between which the armatures are movable, a pair of opposed springs on each stem, the lower spring being of twice the length of the upper, a collar secured on each stem between the springs, a stationary abutment for the lower spring on each stem, a collar slidable on each stem above the upper spring, and a centrally pivoted lever having its ends connected to said collars.

12. In a valve operating device, the combination of a plurality of valve-stems, an armature secured to each, a pair of electro-magnets mounted end-to-end concentric with each stem, poles at the outer ends of the magnets between which the armatures are movable, a pair of opposed springs on each stem, a collar secured on each stem between the springs, a stationary abutment for the lower spring on each stem, a collar slidable on each stem above the upper spring, a post between said valve-stems, and a lever centrally mounted on said post and having its ends engaging the slidable collars on the valve-stems.

13. In a valve operating device, the combination of a valve-chamber having an extension, a valve seat between the chamber and the extension, a valve adapted to rest on the seat, a stem for the valve, a pipe connecting said extension to a source of gas under pressure, an armature on the stem, and a pair of electro-magnets between which the armature is movable.

14. In a valve operating device, the combination with the engine cylinder and the piston therein, of a valve-chamber having an extension, a valve seat between the chamber and the extension, a valve stem extending through the chamber and the extension, a valve on the stem, a piston on the stem within the extension, and a passage extending from the extension to a point in the cylinder a short distance within the outer limit of movement of the piston, for the purpose of counterbalancing the pressure of the burnt gases on the valve, at the time the exhaust valve is to be opened, by the pressure of the exhaust gases on the piston.

15. In a valve operating device, the combination with the engine cylinder and the piston therein, of a valve-chamber having an extension, a valve seat between the chamber and the extension, a valve stem extending through the chamber and the extension, a

valve on the stem, a piston on the stem with-
in the extension, an armature on the piston,
a pair of electro-magnets between which the
armature is movable, a pair of opposed
5 springs to hold the armature intermediate
the poles when the magnets are deenergized,
and a passage extending from the extension
to a point in the cylinder a short distance
within the outer limit of movement of the
10 piston, for the purpose of counterbalancing
the pressure of the burnt gases on the valve,

at the time the exhaust valve is to be opened,
by the pressure of the exhaust gases on the
piston.

In testimony whereof I have signed this 15
specification in the presence of two subscrib-
ing witnesses.

DARREL D. ROCK.

Witnesses:

EDWARD N. PAGELSEN,
HUGO W. KREINBRING.
