C. G. ADSIT.

STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JUNE 2, 1911.

1,034,559.

Patented Aug. 6, 1912.

2 SHEETS—SHEET 1.

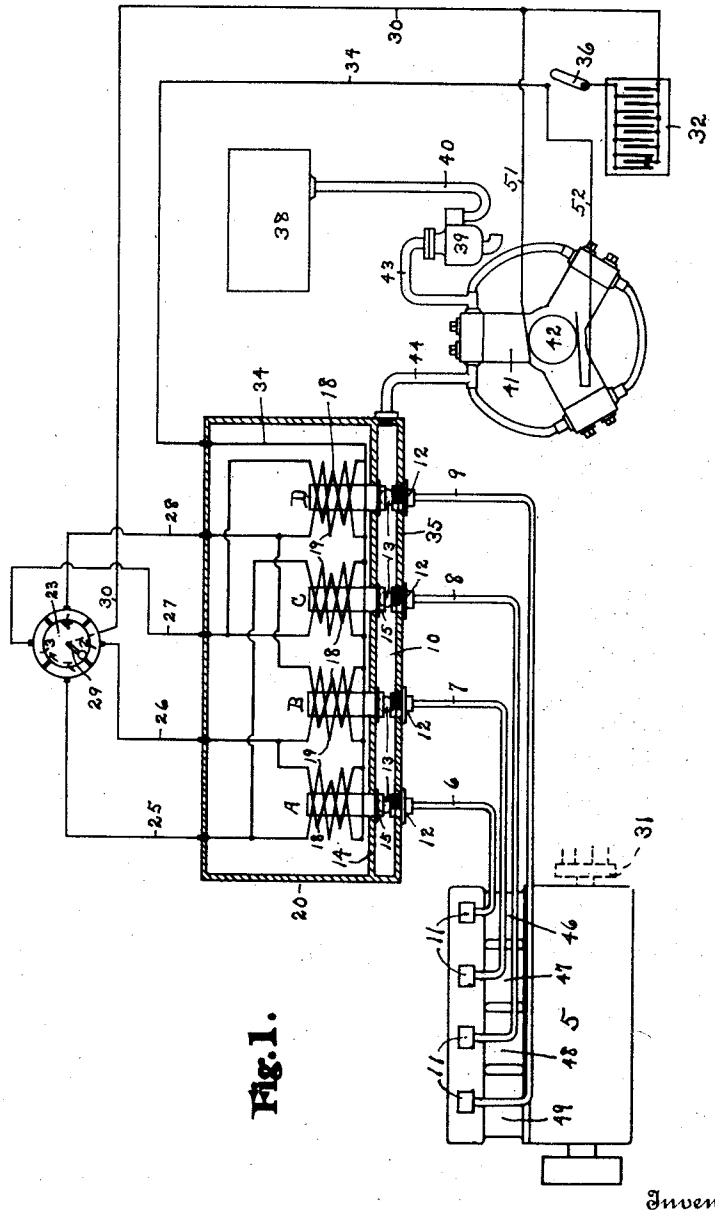

Fig. 1.

Inventor

Witnesses

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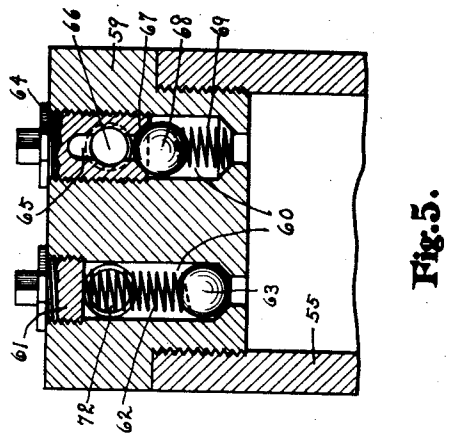

Fig.5.

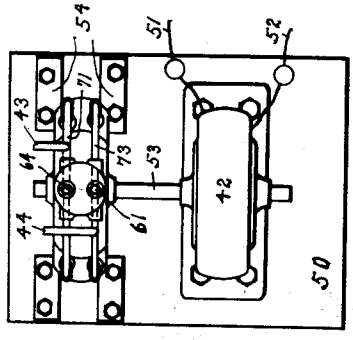

Fig.3.

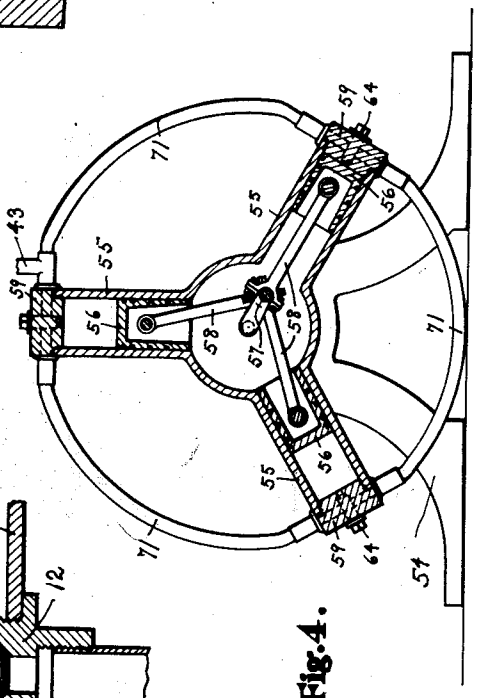

Fig.4.

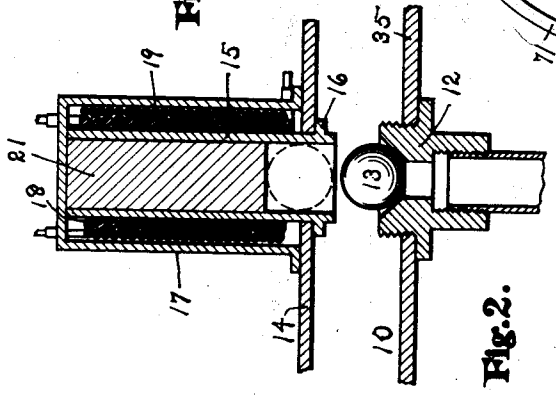

Fig.2.

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UNITED STATES PATENT OFFICE.

CHARLES G. ADSIT, OF DETROIT, MICHIGAN, ASSIGNOR OF ONE-FIFTH TO SIDNEY B. WINN, ONE-FIFTH TO GEORGE H. BROWN, ONE-FIFTH TO CHARLES H. LAND, JR., AND ONE-FIFTH TO NATHAN H. JEWETT, ALL OF DETROIT, MICHIGAN.

STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,034,559. Specification of Letters Patent. Patented Aug. 6, 1912.

Application filed June 2, 1911. Serial No. 630,863.

To all whom it may concern:

Be it known that I, CHARLES G. ADSIT, 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 useful Starting Device for Internal-Combustion Engines, of which the following is a specification.

This invention relates to means for forcing a charge of fuel into the proper cylinders of multi-cylinder internal-combustion engines, and the object of my improvements is to provide an automatically operated device whereby an explosive charge will be introduced into the cylinder whose piston is in such position with reference to the crank shaft, that the usual explosion will first occur in such cylinder, when properly charged; and whereby a similar charge will be introduced into the cylinder wherein the explosion will next occur, so it may be compressed by the power developed by the first explosion.

My invention consists in combination with a multi-cylinder internal-combustion engine, of a source of fuel supply, a pump for forcing the fuel to a group of valves, pipes connecting the valves to the engine cylinders, an engine driven controller for electric circuits to the operating devices for said valves, which controller and circuits are so constructed that two proper valves will be opened when the circuit to said controller is closed manually, one of the valves thus selected opening the passage for the fuel to the cylinder in which will next occur the usual electric sparks which cause the explosion, and the other valve opening a passage to the cylinder which is next in the order of explosions.

In the accompanying drawings, Figure 1 is a diagrammatic view of the complete construction of this improved starting device. Fig. 2 is a vertical section of a valve operating device. Fig. 3 is a plan of a motor and pump. Fig. 4 is a vertical cross section of a pump. Fig. 5 is a section showing the valves of one of the pump cylinders.

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

The usual multi-cylinder internal-combustion engine must be "cranked" in order to draw an explosive charge into one of the cylinders, a proceeding which requires considerable effort and often results in accidents. While the invention is herein shown and described as applied to a four cylinder engine, it will be readily understood that it may be applied to engines having any number of cylinders. The present invention is embodied in mechanism by means of which the proper cylinders are filled with an explosive charge automatically upon the closing of an electric circuit. The engine indicated in Fig. 1 has cylinders mounted on the base 5, and pipes 6, 7, 8 and 9 connect these cylinders to the valve chamber 10 wherein are valves which control the flow of the fuel. In each pipe may be mounted a check valve 11 of any desired construction. In the bottom 35 of the valve chamber 10 are screwed a series of valve seats 12, one for each pipe, and a ball 13 normally rests in each seat and closes the passage. The upper side 14 of the chamber is formed with holes in which are fitted the metal tubes 15, preferably provided with collars 16 which can be soldered to this plate 14. In the case 20 above this passage, and around the tubes 15, are coils 18 and 19 of insulated wire, and around the coils are shells 17 of any desired material. It should be understood that the number of these coils for each valve will vary according to the number of cylinders which are to be included in each group and for a six cylinder engine may be two or three, and for an eight cylinder engine the coils may be in two different cases and still be cross-connected. Cores 21 of soft iron are within the coils. The balls 13 are of steel or iron, and preferably, copper plated. Mounted on the engine bed, where it can be driven by the cam shaft, or in any other desired manner or location, is a circuit closer, consisting of a dial 23 on which are mounted the insulated segments 1, 2, 3 and 4, to which are connected the wires 25, 26, 27 and 28. In the center of the dial is a hand 29 which revolves at the same speed as the cam shaft of the engine, and which rubs or rolls over these segments. A wire 30 connects the hand to the current source. One location of this circuit closer is indicated at 31 by dotted lines.

The current may be obtained from any desired source, a storage battery 32 being indicated. The different coils 18 and 19 of

the valve operating devices A, B, C and D all connect to the line wire 34, and that, in turn, connects to the current source. One of the wires 30 or 34 may be omitted in part when a proper "ground" is employed. A switch 36 is connected into one of these circuits.

The liquid fuel may be obtained from any desired source 38, whence it may flow to the carbureter 39 through the pipe 40. The explosive vapor may be drawn from the carbureter in any desired manner. A pump 41 of any desired construction is shown in the drawings and is driven by a motor 42, and has a suction pipe 43 connecting to the carbureter and a discharge pipe 44 connecting to the valve casing 10. In the construction shown, it is assumed that the explosions in the cylinders 46, 47, 48 and 49 will be in the order of 47, 46, 48, 49 47, etc.

The operation of this mechanism is as follows: So long as the switch 36 is open, no current passes to the circuit closer or to the pump-motor. But when the circuit is closed the current will flow over the wire 30 to the hand 29, then to the segment 2 and over wire 26 to the winding 19 of the solenoid B and to the winding 18 of the solenoid A, causing the opening of the valves 13 of the pipes 7 and 6, leading to the cylinders 47 and 46. At the same time, the motor is energized and immediately afterward drives the pump 41, causing a flow of fuel to the valve chamber 10, through the pipes 7 and 6 and into the cylinders 47 and 46. When the proper explosive charge has entered, the switch 36 is opened and the ignition circuit closed and its current permitted to flow to the spark-plug of the cylinder 47. This will cause the charge in cylinder 47 to explode and turn the shaft of the engine, thereby compressing the charge in cylinder 46 which next receives the ignition spark. These two explosions are generally sufficient to start the engine. When the hand 29 engages the segment 1, the solenoids A and C will be energized and the cylinders 46 and 48 receive the charges. Segment 3 connects to the solenoids C and D and segment 4 to the solenoids D and B. It will be evident that by simply making the proper connections, the succession of explosions and any desired charging of combinations of cylinders of any engine may be accomplished by this device.

In Figs. 3, 4 and 5 a few details of construction of a pump adapted for this use are shown. On a bed-plate 50 is mounted a motor 42 which has line wires 51 and 52 connecting to the current source. Its shaft 53 is also the crank shaft of the pump which has frames 54 supporting the three cylinders 55, in each of which is a piston 56 connecting to the common crank pin 57 by a pitman 58. The cylinder heads 59 are fitted to the ends of the cylinders in any desired manner and have bores 60. A plug 61 is fitted in the upper end of one bore and a spring 62 beneath this plug normally holds the discharge valve 63 on its seat. A plug 64 has a bore 65 connecting to the intake passage 66, and also has a seat 67 for the intake valve 68, held in place by the spring 69. The difference in construction of the intake and discharge valves lies only in the plugs 64 and 61, the springs and valves being the same in both cases. Pipes 71 connect all the intake passages 66 in the heads to the suction pipe 43, while the discharge passages 72 in the heads are connected by the pipes 73. These passages 66 and 72 extend entirely through the heads and connect to the pipes 71 and 73 on both sides of the heads.

The valve-balls 13 are preferably copper-plated to prevent adhesion between the balls and cores 21. The height of the cores 21 should be such that the balls will be entirely out of the path of the vapor. The tubes 15 are preferably of brass or other non-magnetic metal, and when soldered to the plate 14, the coils will be in a separate chamber into which the explosive gas cannot penetrate.

The motor attached to the pump will preferably have a high speed so that a sufficient charge will be pumped into the cylinders in a comparatively short time. After the first explosion, the charge in the second cylinder will be compressed by the engine, and its explosion will usually be sufficient to start the engine.

As this mechanism is adapted to be operated by a current of low voltage, one of six volts potential being sufficient, the selector may be mounted within the crank case and be submerged in oil with little or no leakage of current.

The details of this construction may be modified by engineers and designers to meet the varying requirements without departing from the spirit of my invention.

Having now explained my construction, what I claim as my invention and desire to secure by Letters Patent is:—

1. In a starting device for multi-cylinder internal-combustion engines, the combination of a carbureter, a pump, an electric motor to drive the same, a series of valves, one for each cylinder, pipes extending from the valves to the cylinders, electrically energized devices for lifting the valves, means controlled by the engine for selecting the valve-actuating devices, and supply pipes connecting the carbureter, pump and the series of valves.

2. In a starting device for multi-cylinder internal combustion engines, the combination of a valve casing, a series of pipes con-

nected thereto and each leading to a separate cylinder, a series of valves mounted in the casing and controlling the flow of fluids through the pipes, a source of explosive vapor, means for conveying it to the valve casing, an electrically operated device for lifting each valve, means controlled by the engine for selecting the valve actuating devices in pairs, and a source to supply the electricity.

3. In a starting device for multi-cylinder explosion engines, the combination of a source of explosive vapor, a series of valves, one for each cylinder, means actuated by said engine to cause the opening of said valves in pairs, pipes for conducting the vapor to the valves and from each valve to its respective cylinder, and an electrically energized device to open each valve.

4. In a starting device for multi-cylinder internal-combustion engines, the combination of a valve-casing having a series of openings in its bottom, a valve seat secured in each opening, one for each cylinder, a pipe connecting each seat to its cylinder, a valve on each seat, a solenoid mounted in the top of the casing above each valve and having double windings, a selector connected to the engine and comprising a rotating hand and a ring of insulated segments, one for each cylinder, a current source, and wires connecting the hand of the selector to the current source, other wires connecting each segment to the windings of a plurality of solenoids and a third wire connecting all the windings of the solenoids to the current source, each winding connecting to only one segment.

5. In a starting device for multi-cylinder internal combustion engines, in combination with a series of cylinders, of a pipe leading to each cylinder, a valve casing, a valve seat in said casing for each pipe, a ball valve for each seat, a solenoid for each valve adapted when energized to lift its valve from its seat, a rotary selector, electric connections between the selector and with the solenoids in pairs, and means to supply explosive vapor to said valve casing.

6. In a starting device for multi-cylinder internal-combustion engines, in combination with a series of cylinders, of a pipe leading to each cylinder, a valve casing, a valve seat in said casing for each pipe, a ball valve for each seat, a solenoid for each valve adapted when energized to lift its valve from its seat, means controlled by the engine for selecting the solenoids in pairs, a current source, electric circuits between the current source, the selector and the solenoids, and means to supply explosive vapor to the valve casing.

7. In a starting device for internal combustion engines, the combination with an engine cylinder, a pipe connected thereto, a valve-seat and valve-casing at the opposite end of the pipe, a ball-valve for said seat, a carbureter, an electric-motor and pump to draw explosive vapor from the carbureter and force it into the valve-casing, a solenoid to lift the valve from its seat, a current source, and electric circuits comprising a switch between the current source and the solenoid and the motor.

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

CHARLES G. ADSIT.

Witnesses:
EDWARD N. PAGELSEN,
ELIZABETH M. BROWN.