F. T. WILEY.

STARTING DEVICE FOR INTERNAL COMBUSTION MOTORS.

APPLICATION FILED AUG. 3, 1909.

1,002,949. Patented Sept. 12, 1911.

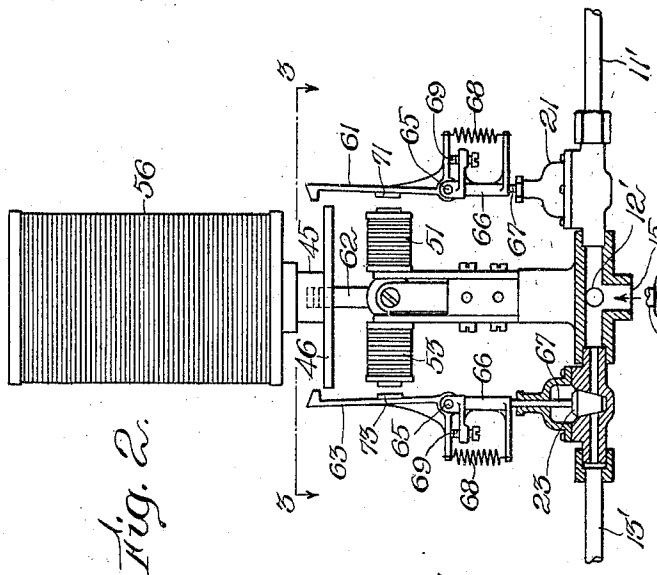

Fig. 2.

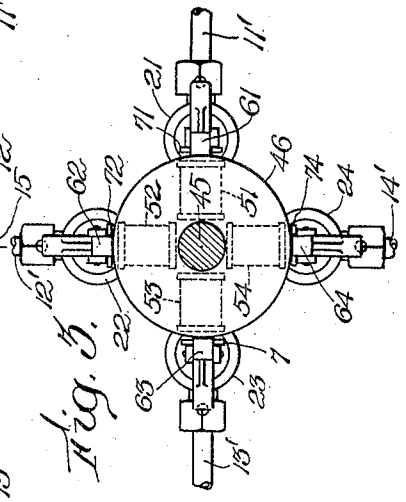

Fig. 3.

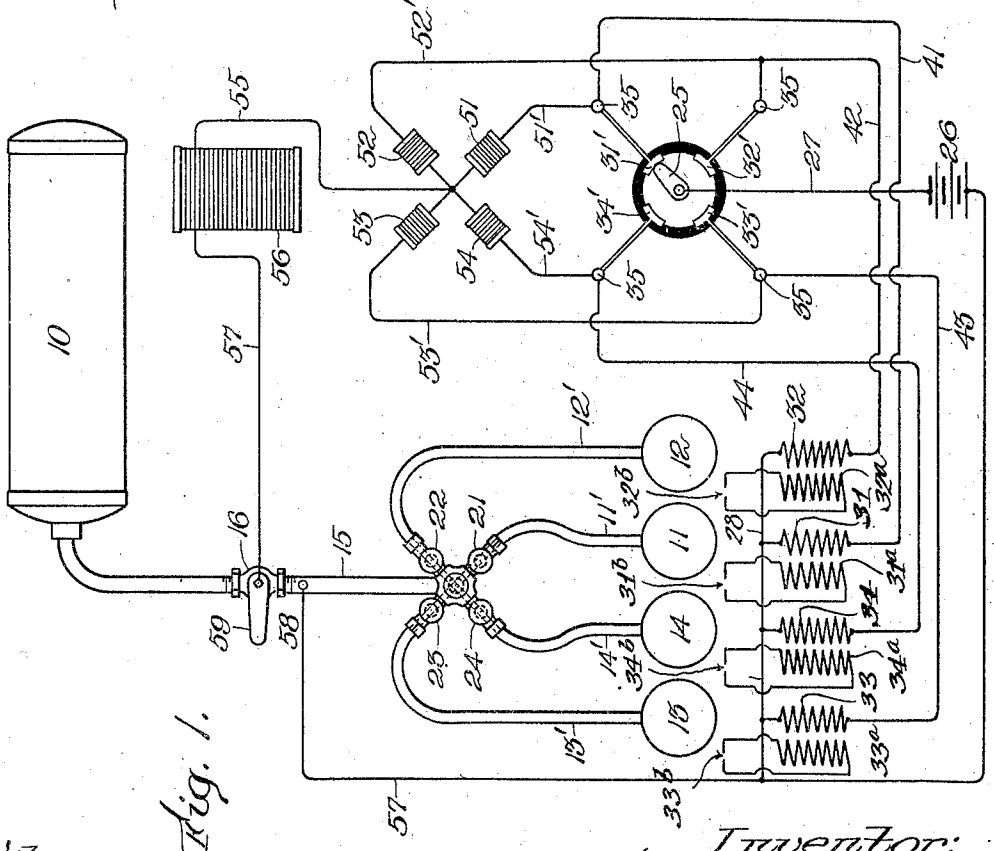

Fig. 1.

Witnesses:
P. A. Plezzetti
Caroline Abbott

Inventor:
Fred T. Wiley,
by Wright Brown Quinby & May
Attorneys.

UNITED STATES PATENT OFFICE.

FRED T. WILEY, OF BOSTON, MASSACHUSETTS.

STARTING DEVICE FOR INTERNAL-COMBUSTION MOTORS.

1,002,949. Specification of Letters Patent. Patented Sept. 12, 1911.

Application filed August 3, 1909. Serial No. 510,978.

To all whom it may concern:

Be it known that I, FRED T. WILEY, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Starting Devices for Internal-Combustion Motors, of which the following is a specification.

This invention relates to devices for starting internal combustion motors in which the starting force is exerted upon a piston of the motor by a fluid under pressure.

One object of the invention is to provide means of simple and inexpensive construction whereby the pressure may be directed selectively and successively to the several cylinders of an internal combustion motor comprising a plurality of cylinders.

Another object of the invention is to utilize the timer or distributer, as the case may be, of an ignition system for directing the pressure of the fluid to the cylinders in succession.

The invention is embodied in a plurality of conduits, one connected to each cylinder of the motor, and supplied with fluid under pressure, an independent valve in each conduit, an actuator, and means for coupling the valves successively to the actuator, said means and actuator including electromagnets under the control of the ignition system. The invention is adapted to be applied to an internal combustion motor having any number of cylinders, and having an ignition system which may be either a high tension system including a distributer, or a low tension system including a timer in the primary circuit.

For the purpose of illustration, the invention is herewith shown in connection with an internal combustion motor comprising four cylinders and an ignition system of the low tension type, including a timer.

Of the accompanying drawings, which illustrate one form in which the invention may be embodied,—Figure 1 represents a diagram including a four-cylinder motor, a source of fluid under pressure, an electric-spark-producing system, and electrically operated means controlled by the primary circuit for controlling and directing the pressure of fluid to the motor cylinders. Fig. 2 represents an elevation, partly in section, of the valve mechanism and electrically operated means for actuating the valves. Fig. 3 represents a section on line 3—3 of Fig. 2.

The same reference characters indicate the same parts wherever they occur.

On the drawings,—10 represents a tank or reservoir in which may be stored a suitable fluid under pressure, preferably compressed air.

11, 12, 13, and 14 indicate the cylinders of an internal combustion motor. Each cylinder is connected with the reservoir 10 so as to receive therefrom fluid under pressure, whereby the pistons in the cylinders may be successively driven.

Conduits are indicated at 11′, 12′, 13′, and 14′, and may extend separately to the reservoir 10, or may be joined as illustrated to a common supply pipe 15. The supply pipe may be provided with a valve 16 whereby the supply to all of the cylinders may be closed. Each branch or conduit 11′, 12′, 13′, and 14′ is provided with an independently operative valve, said valves being indicated respectively at 21, 22, 23, and 24. For the sake of convenience in operation, the four valves are arranged at equal distances from a common center.

Fig. 1 includes the primary circuit of an ignition system which is controlled by a timer 25. The primary circuit includes a source 26 of current of which one side is connected to the timer by a conductor 27.

31, 32, 33, and 34 indicate respectively the primary windings of induction coils associated respectively with the cylinders 11, 12, 13, and 14. The primary windings are all connected to a common conductor 28 leading to the other side of the source 26 of current. The timer 25 may be rotated as usual by mechanism driven by the motor shaft so as to cause it to successively engage the stationary contacts 31′, 32′, 33′ and 34′. These contacts are here shown as connected to binding posts 35 which are connected respectively to the primary windings by conductors, 41, 42, 43, and 44. The windings in the secondary circuits are indicated at 31^a, 32^a, 33^a and 34^a, and the respective spark gaps are indicated at 31^b, 32^b, 33^b and 34^b. To those familiar with the operation of internal combustion motors, it is well known that the circuits by which sparks are produced in the cylinders are closed when the respective pistons are at the compression ends of their strokes. The closing of each spark producing circuit by the timer 25 produces a spark at the end of the compression stroke and before the beginning of the driv-

ing stroke. By the coöperation of the timer with the contacts 31′, 32′, 33′ and 34′, sparks are produced successively in the several cylinders. The order of sparking may be determined according to any preferred arrangement.

The means by which the spark-producing current is caused to direct pressure of fluid successively to the several cylinders includes controlling electromagnets 51, 52, 53, and 54, one for each of the valves 21, 22, 23, and 24. The electromagnets may be connected to the binding posts 35 by conductors 51′, 52′, 53′ and 54′. They are also connected to a common conductor 55, leading to a relatively large actuating electromagnet 56, hereinafter described. A conductor 57 connects the magnet 56 with the return conductor 28 and may include a switch 58. The switch here shown includes the handle 59 of the valve 16, and is arranged to close the circuit through the magnet 56 when the valve is open, and to open the circuit when the valve is closed.

It will be observed that the magnet 56 is relatively large, whereas the magnets 51, 52, 53, and 54 are relatively small. In consequence of the difference in size, the smaller magnets are adapted to be more sensitive and to operate more readily than the larger magnet, and they are so arranged with relation to the valves 21, 22, 23, and 24 that the larger magnet 56 may actuate said valves, and the magnets 51, 52, 53, and 54 may effect connection of either of the valves with the actuating magnet 56. As shown by Figs. 2 and 3, the magnet 56 is of the solenoid type, and is provided with a core or armature 45. The outer end of the core carries a disk or plate 46 which is adapted to be engaged by latches 61, 62, 63, and 64 connected respectively to the valves 21, 22, 23, and 24. The latches are pivoted at 65 to members 66 affixed to the valve stems 67, and they are connected to springs 68 by which they are normally retracted against adjustable stops 69.

71, 72, 73, and 74 indicate respectively armatures in coöperative relation with the magnets 51, 52, 53, and 54. When either armature is attracted by its magnet, the latch carrying the attracted armature is moved against the tension of its spring into coöperative relation with the disk 46, and when the disk is moved by the action of its magnet, the valve connected to the latch so moved is opened, thus admitting the pressure of fluid to the appropriate cylinder.

The operation of the device is as follows:—Assuming that the motor in coming to a state of rest stops at a point which causes the timer 25 to engage one of the stationary contacts, the circuit is closed at that point through one of the primary branches, and also through one of the controlling magnets. When it is desired to start the motor, the handle 59 of the valve 16 may be turned to open the valve, and to also close the switch 58. The pressure of fluid in the reservoir 10 is thereupon admitted to the valves 21, 22, 23, and 24, and the circuit is closed through the appropriate controlling magnet, and also through the actuating magnet 56. The controlling magnet being smaller and having a relatively light load, attracts its armature before the armature of the magnet 56 is moved. As the magnet 56 builds up, it finally becomes sufficiently powerful to actuate its armature which thereupon opens the valve which by that time is coupled with the plate 46. Pressure of fluid is thereupon admitted to the cylinder which is the cylinder for otherwise driving the motor by an ignited charge of combustible gas. As the motor advances under the pressure of the fluid so delivered, the timer 25 is advanced to the next succeeding contact, whereupon the next succeeding controlling valve is first coupled with and then actuated by the magnet 56 which is deënergized as often as the circuit is broken. A succession of driving impulses of the fluid from the reservoir 10 may be permitted to drive the motor until the motor is regularly driven by the combustion of the gas otherwise supplied to it. When the fluid from the reservoir 10 is no longer required, the valve handle 59 is moved to close the valve and open the switch 58, whereupon the motor may continue without receiving pressure from the reservoir.

I claim:

1. The combination with an internal combustion motor, of a conduit connected to the cylinder of the motor, a valve in the conduit, an electrically operated actuator initially disconnected from the valve, and electrically operated means for connecting the valve to the actuator whereby the actuator may operate the valve.

2. The combination with an internal combustion motor, of a source of fluid under pressure, a conduit from said source to the motor, a valve in the conduit, two electromagnets in series, and disconnectible means whereby the valve and one of said magnets may be operatively connected, the other of said magnets being adapted to render said means operative for connecting said valve and the first magnet.

3. The combination with an internal combustion motor, of a source of fluid under pressure, a conduit from said source to the motor, a valve in the conduit, and valve operating means consisting of two electromagnets in series and connections whereby the action of one magnet connects the valve to the other magnet, said other magnet being adapted to actuate the valve.

4. The combination with an internal com-

bustion motor, of a source of fluid under pressure, a conduit from said source to the motor, a valve in the conduit, a relatively slow electromagnet and armature, a relatively fast electromagnet and armature, said magnets being connected in series, and means actuated by the relatively fast armature for connecting the valve to the relatively slow armature whereby the valve may be operated.

5. The combination with an internal combustion motor having a plurality of cylinders, of a source of fluid under pressure, a conduit including branches from said source to the cylinders, a valve in each branch, a common actuator initially disconnected from said valves, and means for connecting any one of said valves with the actuator whereby the connected valve may be operated.

6. The combination with an internal combustion motor having a plurality of cylinders, of conduits connected to the cylinders, a source of fluid under pressure for said conduits, a valve in each conduit, a single actuator, and means for connecting any one of said valves with said actuator.

7. The combination with an internal combustion motor having a plurality of cylinders, of conduits connected to the cylinders, a source of fluid under pressure for said conduits, a valve in each conduit, a magnetically actuated member, and electro-magnetic means for effecting successive connection between each of said valves and said member.

8. The combination with an internal combustion motor having a plurality of cylinders, of conduits connected to the cylinders, a source of fluid under pressure for said conduits, a valve in each conduit, an electromagnetic actuator, and means including electromagnets each in series with the winding of said actuator for coupling the valves with their actuator.

9. The combination with an internal combustion motor having a plurality of cylinders, of conduits connected to the cylinders, a source of fluid under pressure for said conduits, a valve in each conduit, an actuator controlled by the motor, and means controlled by the motor for effecting successive coupling of the valves with the actuator whereby the valves are operated successively.

10. The combination with an internal combustion motor having a plurality of cylinders, and electric spark producing means; of conduits connected to the cylinders, a source of fluid under pressure for said conduits, valves in said conduits, an electrically operated actuator controlled by the sparking means, and electrically operated means controlled by the sparking means for effecting successive connection of said valves with said actuator whereby the valves may be operated.

11. The combination with an internal combustion motor having a plurality of cylinders, and electric spark producing means, of conduits connected to the cylinders, valves in the conduits, electro-magnetic valve operating means controlled by the spark producing means, and means controlled by the sparking means for connecting the valves successively to said valve operating means.

12. The combination with an internal combustion motor having a plurality of cylinders, and electric spark producing means, of conduits connected to the cylinders, valves in the conduits, a plurality of electromagnets arranged to be controlled by the timer of said spark producing means so as to operate successively, a valve operating electromagnet arranged to be operated when each of the successive magnets is operated, and means adapted to be operated by said successive magnets for connecting the valves successively with said valve-operating magnet.

13. The combination with an internal combustion motor having a plurality of cylinders, and electrical spark producing means including a stationary contact for each cylinder and a movable coöperative contact; of a plurality of conduits, one connected to each cylinder, a valve for each conduit, an individual electromagnet for each valve, said magnets being connected respectively to said stationary contacts and to a common return conductor, a valve operating electromagnet in series with said return conductor, and means operated by said magnets for connecting their respective valves with said operating magnet whereby said operating magnet may operate the valves.

In testimony whereof I have affixed my signature, in presence of two witnesses.

FRED T. WILEY.

Witnesses:
ALBERT E. RUST,
P. W. PEZZETTI.