

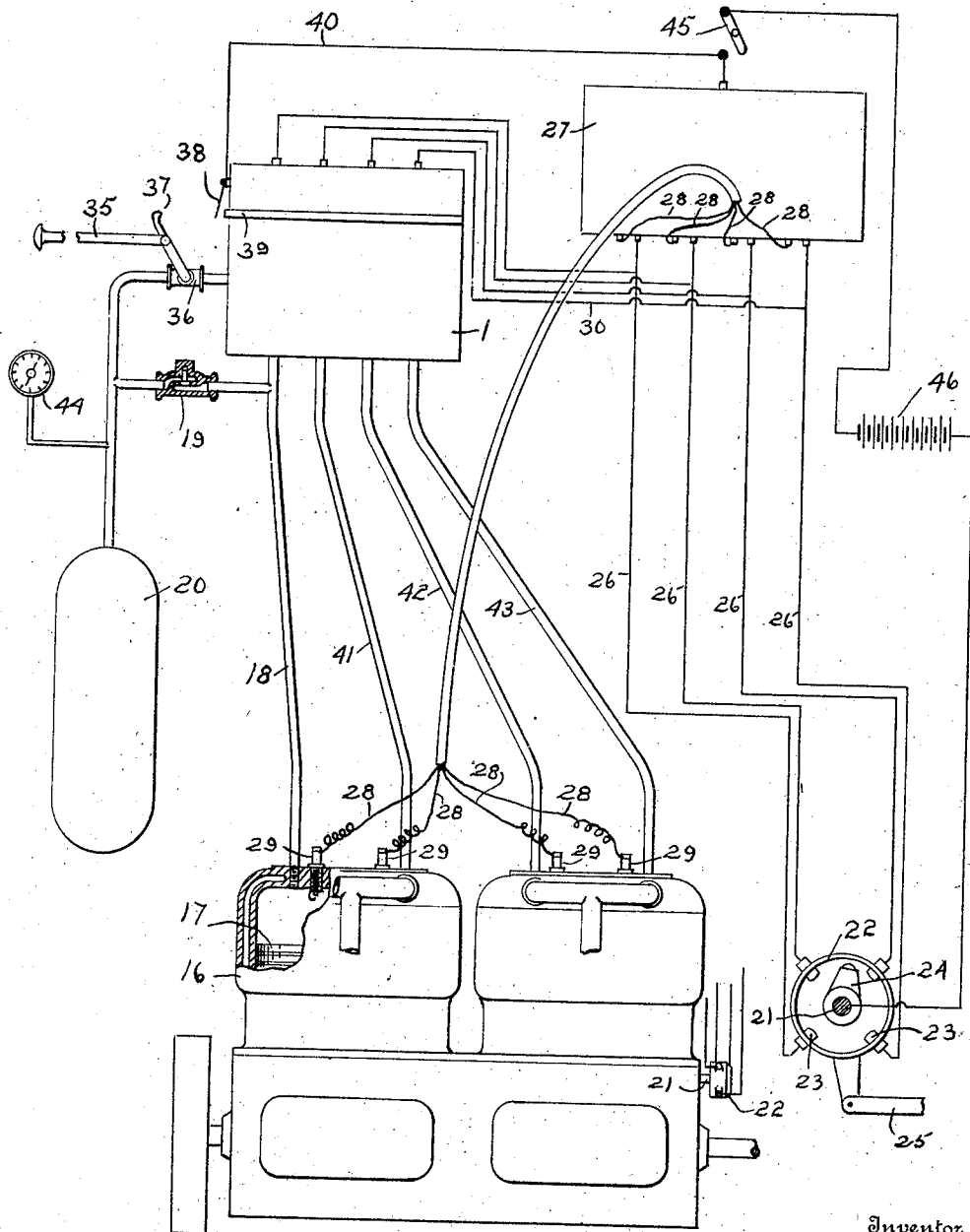
F. N. HOWARD.
 STARTING DEVICE FOR EXPLOSIVE ENGINES.
 APPLICATION FILED OCT. 23, 1907.

983,284.

Patented Feb. 7, 1911.

2 SHEETS-SHEET 1.

Fig. 1



Witnesses

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334

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2 SHEETS-SHEET 2.

Fig. 2

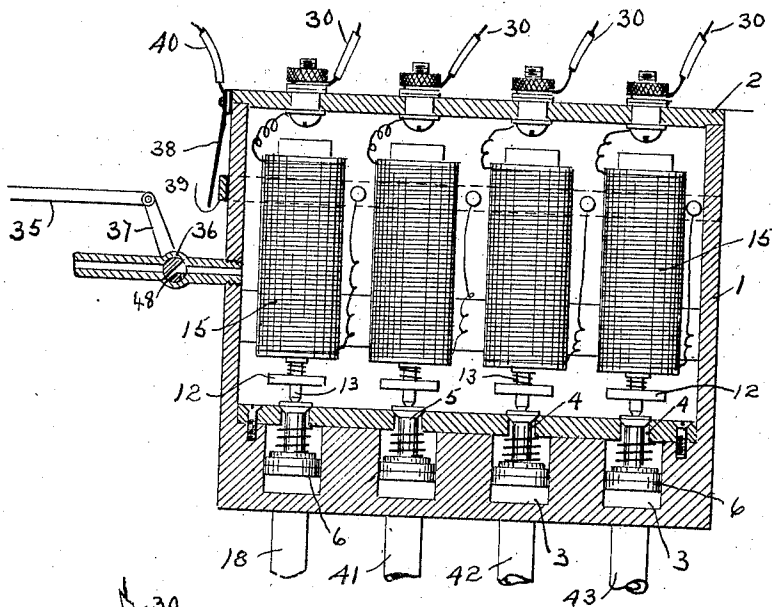


Fig. 3

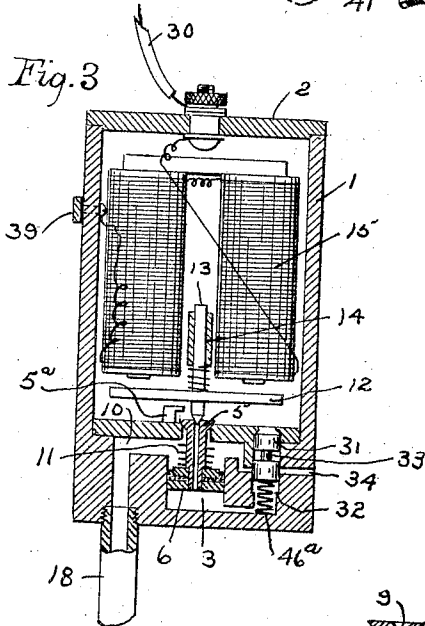


Fig. 4

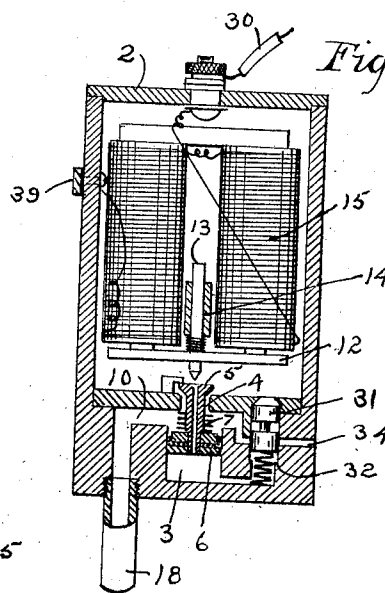
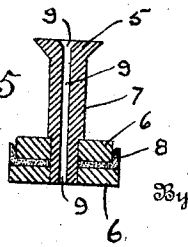


Fig. 5



Witnesses

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STARTING DEVICE FOR EXPLOSIVE-ENGINES.

983,284.

Specification of Letters Patent.

Patented Feb. 7, 1911.

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To all whom it may concern:

Be it known that I, FREDERIC N. HOWARD, a citizen of the United States, residing at Harris, in the county of Kent and State of Rhode Island, have invented certain new and useful Improvements in Starting Devices for Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

10 This invention relates to automatic starting devices for hydrocarbon engines, and has for its object to provide a simple, practical and efficient apparatus whereby a pressure of air or gas may be stored and automatically controlled to be admitted to the cylinder at the proper time to act upon the piston and start the engine.

A further object of the invention is to provide a storage tank and means for producing a pressure of gases in said tank by the operation of the engine, which pressure is subsequently utilized for putting said engine in motion.

15 In carrying out my invention I employ a set of magnetically controlled auxiliary valves for admitting the auxiliary pressure to the cylinders, the magnetic means being controlled in their action by a timing device whereby the admission of the pressure to the proper cylinder at the proper time is insured; this timer may also be arranged to operate the ignition, if desired.

20 The invention consists of other novel features and parts and combinations of the same as will be fully described hereinafter and then pointed out in the appended claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

25 In the drawings: Figure 1— is a diagrammatic view illustrating the general arrangement of my improved apparatus. Fig. 2— is a side elevation of the valve chest, in section, showing the arrangement of the magnetically actuated valves, also showing the valve connection from the storage tank and the lever for controlling the admission of the pressure to said valve chest, which lever at the same time causes an electrical connection to be made to said magnets. Fig. 3— is a sectional end elevation of the valve chest showing one of the admission valves in its closed position, also showing a compression

controlling valve. Fig. 4— is an end elevation of said valve chest in section, showing the magnets as energized and the armature raised, and one of the admission valves in its open or operating position. Fig. 5— is an enlarged view of one of the admission valves.

30 In the practical use of explosive engines, particularly for marine or automobile work, it is very desirable and important to stop and start the engine at will without being obliged to crank the same. In order to accomplish this purpose I have provided a simple and practical device whereby the operation of a single switch or lever will cause the engine to automatically start and continue to run.

35 Referring to the drawings, at 1 is a valve chest having a plate or cover 2 at its upper end, which is bolted or fixed thereto in any suitable manner. The lower portion of this chest is provided with valve chambers 10 which communicate with the main pressure chamber through the passageways 4—4, the opening through each passageway being controlled by means of a valve 5. In order to cause this valve to operate more easily when acted upon by the necessarily heavy pressure, the same is balanced by means of a piston 6, which works in the cylinder 3, which piston is of a greater area than the head of the valve and is secured to the lower end of the stem 7 of said valve. This larger piston is provided with a suitable packing 8 which will allow the proper amount of pressure to escape past it when it is desired to close the valve or depress the piston into its cylinder. A very small passageway or port 9 is formed through this valve whereby pressure may be admitted therethrough into the cylinder 3 in order to act upon the larger piston and raise the valve 5 from its seat up against the stop 5* to admit the pressure to the valve chamber 10 from where it is conducted to the engine cylinder as hereinafter described. A small spiral spring 11 is arranged to act upon this valve to normally hold the same to its seat. In order to control the opening through this port and so control the opening and closing of this valve an armature 12 is provided on the lower side of which is a pointed extension pin 13 adapted to enter the end of port 9 to close the same. The upper end of this pin 13 passes through the bearing 14 to serve as a vertical guide for said armature. When it

is desired to operate this valve 5 the electro-magnet 15 is energized in the manner hereinafter described.

At 31 is a compression relief valve in each valve chamber, which is adapted to be pressed downward onto its stop seat 32 as soon as the pressure is admitted to the pressure chamber, thereby causing the recess 33 in the same to register with the outlet port 34, allowing the compression in all of the cylinders to escape.

At 16 I have shown an explosive engine of the usual four cylinder type, but any number of cylinders may be used ordinarily not less than 2. One of these cylinders is illustrated as being partly broken away, showing the piston 17 and the spark plug in the cylinder. Each of these cylinders is connected to its individual valve chamber through the pipes 18, 41, 42 and 43. This cylinder, which is broken away is also shown as being connected through the pipe 18 and check valve 19 to the storage tank 20, whereby at each explosion a small amount of gas is forced from this cylinder into said tank until the pressure in said tank is raised to that caused by the explosion in the cylinder.

The usual sparking timer is mounted on the shaft 21, the same being provided with a shell 22 in which are the contact points 23—23, the connection to said contacts being made through the finger 24 which is rotated by said shaft 21. To better illustrate the manner of operating said timing device an enlarged front view of the same is shown as being disconnected from the engine, illustrating the wire connections thereto. The shell 22 is adapted to be rotated or oscillated both forward and backward by means of the connection 25 so as to insure the bringing of one of the contacts 23 in connection with the finger 24 to complete the circuit and start the engine, also for the purpose of advancing or retarding the time of sparking.

The connecting wires 26 pass up through the spark coil 27 whence the current is transmitted through the corresponding wires 28 to the spark plugs 29 in their respective cylinders. Connected to each of these wires 26 is another set of wires 30 which lead to the magnets 15 each of which magnets is arranged to operate its individual valve and control the admission of starting pressure to its corresponding cylinder, each cylinder being controlled by its own individual magnet operated valve, which magnet is energized at substantially the same time that the engine sparking device is operated.

When it is desired to admit the pressure from the storage tank 20 to the pressure chamber 1 the push rod 35 is pressed forward which opens the valve 36 allowing the pressure to pass in and when this valve is

closed again the pressure in said chamber passes out through the opening 48 in the casing. At the same time the upper end of the valve lever 37 engages the spring contact 38 which is insulated from the valve chest, causing the same to make a connection at the point 39 which is also insulated from said chest, to complete the circuit through the wires 30 and 40 so that the proper magnet controlled by the timer may be energized to admit the pressure to the cylinder whose piston is in the proper position to receive it.

I do not confine myself to producing a pressure in the storage tank by taking the same from the engine cylinder, as any other convenient means may be used for producing the pressure in this tank. Neither do I confine myself to the use of the same timer that controls the engine sparking apparatus, as a separate and independent timer may be used for controlling the operation of the valves which admit the auxiliary pressure to the cylinders.

The operation of the device may be more fully described as follows: When it is desired to start the engine, supposing the storage tank 20 were already under pressure, which is indicated by the gage 44, the switch 45 is first thrown, then the lever 35 is pressed to admit the pressure to the pressure chamber 1, at the same time completing the circuit to the electro-magnets 15 through the spring contact 38. As soon as the pressure is admitted to the chamber all of the relief valves 31 are forced down to allow the compression in all of the cylinders to escape. The spark timing device is then operated by the connection 25 whereby the current from the battery 46 is permitted to pass through the proper wire, energizing the proper magnet to raise its armature, the desired armature is thereby raised, allowing the pressure to pass through the port 9 down into the cylinder 3 whereby the pressure on both sides of said relief valve 31 is equalized allowing the spring 46^a to act and again raise the same, closing said outlet or relief port 34. The pressure admitted through the port 9 into the cylinder 3 also acts on the larger area of the piston 6 forcing the same up and opening the main valve 5 to admit the pressure into the valve chamber 10 whence it passes direct to the cylinder to rotate the engine shaft. The valves are then actuated one after the other at the proper time, controlled by the timing device, to allow the pressure to pass successively into the cylinders and keep the engine in operation until such time as a proper charge is drawn in to be ignited by the sparking device, which is arranged to work simultaneously with the letting in of the auxiliary pressure. After the engine has started to run by its own explosions the valve 36 is closed to the storage

tank, the turning of which allows the pressure to escape from the pressure chamber through its two way channel valve 36 and opening in the valve casing 48 and at the same time disconnects the spring contact 38 cutting out the operation of the magnets.

A feature of my device is that the same may be easily applied to any engine already in use in which case the wires controlling my auxiliary valves may be connected to the regular timer which controls the sparking of the engine.

My invention is not restricted to the precise construction and arrangement of parts herein shown and described nor to the various details thereof as the same may be modified or re-arranged in various particulars without departing from the spirit and scope of my invention the essential feature of which being that a timing device is arranged to electrically control an auxiliary pressure whereby the same is admitted into the cylinder at the proper time to start the engine, one practical embodiment of which arrangement has been herein illustrated and described without attempting to show all of the various forms and modifications in which my invention might be embodied.

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

1. A starting device for explosive engines comprising a distributing chamber arranged to contain pressure sufficient to start the engine, a plurality of valves in said chamber, each controlling the passage of the pressure from said chamber to one of the said cylinders, auxiliary valves also located in said chamber, means for operating said auxiliary valves to permit the first mentioned valves to be unseated by the pressure in said chamber, and selective means for controlling the operation of each auxiliary valve.

2. A starting device for explosion engines comprising a distributing chamber arranged to contain pressure sufficient to start the engine, valves controlling the passage of the pressure from said chamber to the engine cylinders, means whereby said valves may be unseated by the pressure in said chamber, a magnet for controlling the operation of each valve, and selective means for operating said magnets.

3. A starting device for explosive engines comprising a distributing chamber arranged to contain pressure sufficient to start the engine, a plurality of valves in said chamber, each controlling the passage of the pressure from said chamber to one of the said cylinders, auxiliary valves also located in said chamber, means for operating said auxiliary valves to permit the first mentioned valves to be unseated by the pressure in said chamber, and selective means for controlling the operation of each auxiliary

valve, said selective means including a timing device operated by the engine.

4. A starting device for explosive engines comprising a distributing chamber arranged to contain pressure sufficient to start an engine, valves located within said chamber and operated by the pressure in the latter for controlling the passage to the cylinders of the engine, said valves being provided with central bores, auxiliary valves controlling said bores, and means for operating said auxiliary valves to permit the first mentioned valves to be unseated by the pressure passage through said bores, and selective means for controlling the operation of each auxiliary valve.

5. A starting device for explosion engines comprising a distributing chamber arranged to contain pressure sufficient to start the engine, means operated by the pressure in said chamber for controlling the passage to the engine cylinders, magnets for controlling said pressure operated means, and selective means for operating each magnet.

6. A starting device for explosion engines comprising a distributing chamber arranged to contain pressure sufficient to start the engine, discharge passages leading from said chamber to the cylinders of the engine, a valve for each passage provided with means whereby it may be unseated by pressure, and magnetic means controlling the admission of pressure to unseat each valve.

7. A starting device for explosion engines comprising a distributing chamber arranged to contain pressure sufficient to start the engine, valves controlling the passage of the pressure from said chamber to the engine cylinders, means whereby said valves may be unseated by pressure, magnetic means for controlling the admission of pressure to unseat each valve, and a timing device operated by the engine for controlling said magnetic means.

8. A starting device for explosion engines comprising a distributing chamber arranged to contain pressure sufficient to start the engine, a plurality of valves in said chamber each controlling the passage of pressure from said chamber to one of the engine cylinders, each of said valves being provided with an operating piston, auxiliary valves located within said chamber, means for operating said auxiliary valves to permit the first mentioned valves to be operated, and selective means for controlling the operation of said auxiliary valves.

9. A starting device for explosion engines comprising a distributing chamber arranged to contain pressure sufficient to start the engine, valves controlling the passage of pressure from said chamber to the engine cylinders, each of said valves being provided with an operating piston, supplemental valves controlling the admission of pressure

back of said pistons, and magnets controlling said supplemental valves.

10. A starting device for explosion engines comprising a distributing chamber arranged to contain pressure sufficient to start the engine, means operated by the pressure in said chamber for controlling the passage of pressure to the engine cylinders, selective means for controlling said valves, and means operated by the pressure in said chamber for effecting a reduction of pressure in the engine cylinders.

11. An explosive engine starting device comprising a pressure storage tank, a pressure chamber, a set of pressure admission valves in said chamber communicating with the engine cylinders, a set of magnets for controlling the operation of said valves, means for admitting pressure from said tank to said chamber, and means actuated by the pressure in said tank for allowing the compression in all of the engine cylinders to escape.

12. An explosive engine starting device comprising a pressure storage tank, a pressure chamber, a set of pressure admission valves in said chamber communicating with the engine cylinders, a set of magnets for controlling the operation of said valves, means for admitting pressure from said tank to said chamber, and a set of valves opened by the pressure in said tank to allow the compression in all of the engine cylinders to escape and means for subsequently closing said valves.

13. An explosive engine starting device comprising a pressure chamber, a set of pressure admission valves in said chamber communicating with the engine cylinders, a set of magnets for controlling the operation of

said valves, an armature for each magnet, and means whereby the raising of one of the armatures will allow the pressure from said chamber to pass beneath its valve and cause the same to open to admit pressure to its corresponding engine cylinder.

14. An explosive engine starting device comprising a pressure chamber, a set of pressure admission valves in said chamber communicating with the engine cylinders, a set of magnets for controlling the operation of said valves, an armature for each magnet, means whereby the raising of one of the armatures will allow the pressure from said chamber to pass beneath its valve and cause the same to open to admit pressure to its engine cylinder, a set of compression valves opened by the pressure in said chamber to allow the compression in all of the engine cylinders to escape, and means whereby the admission of the pressure to open the admission valve will close its corresponding compression valve.

15. The combination with an internal combustion motor and electric spark producing means, of a conduit connected to the motor cylinder, a manually operative valve in said conduit, a valve between the cylinder and the manual valve, electrically operated means controlled by the sparking means for operating the interposed valve, and a switch for said electrically operated means arranged to be operated by said manual valve.

In testimony whereof I affix my signature in presence of two witnesses.

FREDERIC N. HOWARD.

Witnesses:

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E. I. OGDEN.