

No. 631,206.

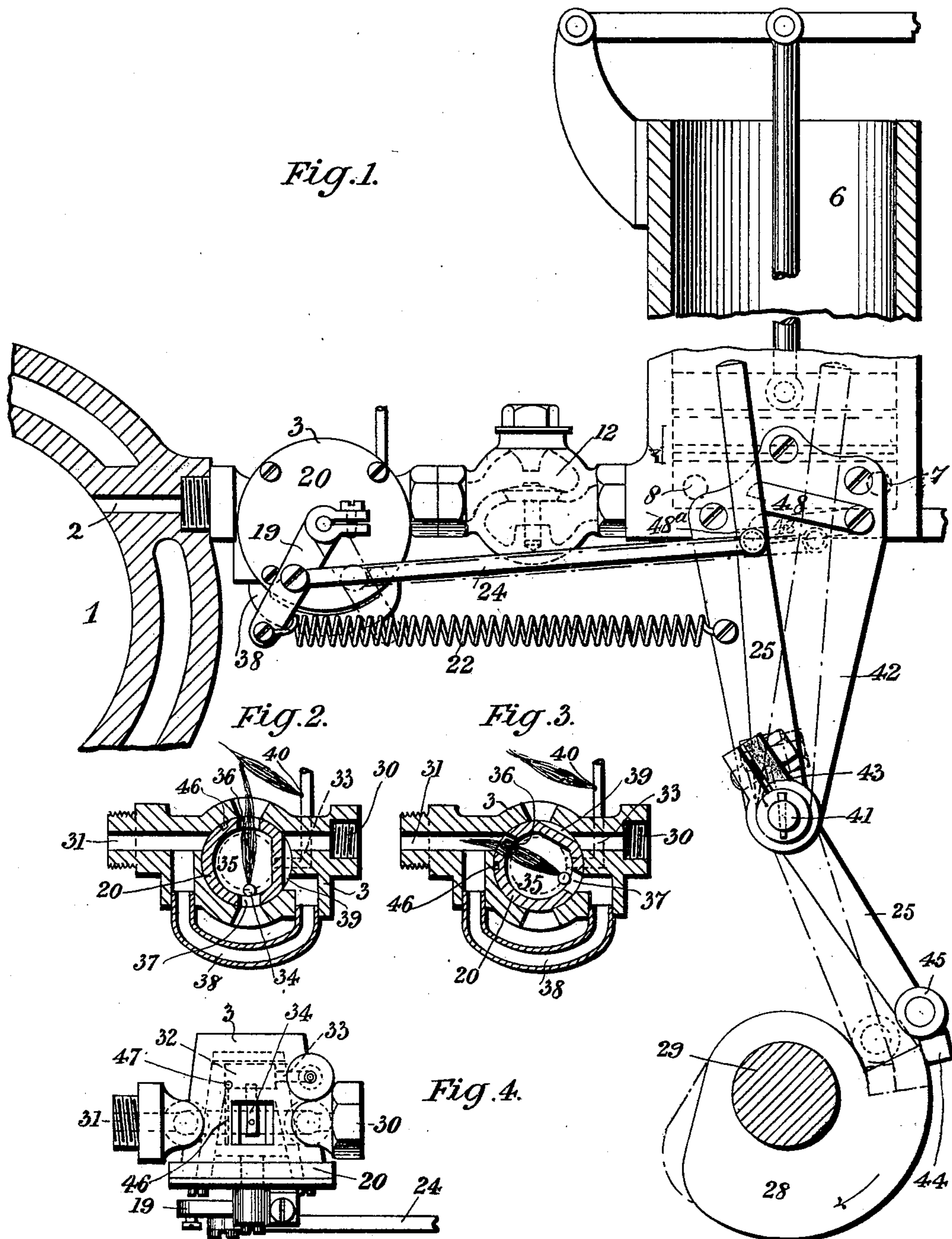
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J. EDMONDSON & J. W. DAWSON.

APPARATUS FOR STARTING INTERNAL COMBUSTION ENGINES.

(Application filed Apr. 4, 1898.)

(No Model.)



WITNESSES.

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# UNITED STATES PATENT OFFICE.

JOSEPH EDMONDSON AND JOHN WILLIAM DAWSON, OF BRADFORD,  
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## APPARATUS FOR STARTING INTERNAL-COMBUSTION ENGINES.

SPECIFICATION forming part of Letters Patent No. 631,206, dated August 15, 1899.

Application filed April 4, 1898. Serial No. 676,377. (No model.)

*To all whom it may concern:*

Be it known that we, JOSEPH EDMONDSON and JOHN WILLIAM DAWSON, both subjects of the Queen of Great Britain, residing at Bradford, in the county of York, England, have invented an Improved Apparatus for Starting Internal-Combustion Engines, of which the following is a specification.

This invention relates to improved apparatus for starting internal-combustion engines by the firing of initial and successive explosive charges, the object of same being to provide an arrangement of parts which is certain and efficient in action.

Our apparatus is illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of the apparatus, partly in section. Fig. 2 is a cross-section through the center of the starting-valve and casing, showing the valve in one position. Fig. 3 is a similar view showing the valve in another position. Fig. 4 is a plan of the valve-casing.

The main cylinder of the engine is indicated at 1. The passage 2 is the entrance for the explosive gas entering the compression-chamber of the cylinder. This passage connects with a hand-pump 6, having gas and air inlets 7 and 8, respectively, which are provided with suitable non-return valves. The outlet from the pumps connects with a valve-chamber 12, having a suitable non-return valve, and on the other side the chamber 12 communicates with the chamber of the igniting-valve 3, the exit 31 of which communicates with the passage 2 of the cylinder.

20 is the plug of the valve, having a chamber 32 communicating with the gas-supply by the pipe or passage 33 and with the internal burner 34, placed in a second chamber 35, having apertures 36 and 37 communicating with the open air, as in Fig. 2, or with the passages 31 and 38, as in Fig. 3, according to the position of the valve. A gap 39 in the plug portion of the valve forms a communication between the mixture-inlet passage 30 and the passage 38, as in Fig. 2, or

between the passage 30 and the open air, as in Fig. 3. A "pilot-burner" 40 is formed on the gas-supply pipe 33. On the valve-spindle is the arm 19, carrying a stud to which is attached the connecting-rod 24, having its other end working on a stud fixed in the lever 25, which is pivoted at 41 on the bracket 42 and carries a sleeve 43, on which is clamped the lower part of the lever 25, having on its end a squared piece 44 and also a roller 45. A cam 28 is placed on the cam-shaft 29 of the engine in any convenient position, the operation of the parts being hereinafter described.

In the ignition-valve a channel 46 is cut, opening into the chamber 32 at 47. This opens communication between the said chamber and the passage 31 while the valve is passing from the position shown in Fig. 2 to that shown in Fig. 3 previous to the opening of communication between the passage 31 and the passage 38 through the chamber 35.

To the end of the arm 19 of the ignition-valve is attached one end of a spring 22, the other end of which is fixed to the bracket 42. A catch 48, pivoted on the bracket 42, is adapted to drop and catch a square projection or block 48<sup>a</sup>, carried by the lever 25, when the lever 25 is moved to the left, the position of the catch being shown in dotted lines. The roller 45 is thus held clear of the cam 29, and the apparatus is at rest notwithstanding the running of the engine and cam.

The operation of the apparatus is as follows: The engine is placed a little before the middle of the explosion-stroke with the cam 28 in the position shown in Fig. 1, with the square piece 44 resting on it, as shown. The catch 48 is raised into the position shown in full lines. The levers 25, rod 24, and arm 19 are then in the position shown by the full lines, the square piece 44 resting on the cam, and the ignition-valve in the position shown in Fig. 2. The "pilot-jet" from burner 40 being lighted, it ignites the internal jet coming from burner 34. The gas-valves of the engine being open, as usual, from starting, the exhaust-valve of the engine (or a special ori-



fice for this purpose) being also open, explosive mixture is pumped into the cylinder by the pump 6 until it is filled with an explosive charge. The exhaust-valve is then closed, and pumping being continued the piston is slowly propelled by the increasing internal pressure and carries the cam 28 in the direction of the arrow until the square piece 44 drops off the cam end. The levers 24 25 are then drawn quickly into the position indicated by the dotted lines in Fig. 1, and the ignition-valve takes the position shown in Fig. 3, and igniting the explosive mixture in the channel 38 and exit 31 the flame travels to the cylinder, the charge is fired, and the piston is propelled. The pumping being still continued, the cam 28 operates the ignition-valve as required, the passage 38, exit 31, and the tube connecting with the cylinder are kept filled with explosive mixture, and a succession of impulses are given to the piston. This is continued until the firing of the charge is taken up by the ordinary ignition apparatus of the engine. The operator then ceases pumping, moves the top lever 25 well over to the left, the catch 48 drops into its dotted position, so that the piece 44 is clear of the cam, and the starting apparatus rests till again required. It is only necessary thus to pump the cylinder full of explosive mixture in cases in which the cylinder was previously filled with a spent charge. If it be already "scavenged" and filled with air, the exhaust-valve is left closed, and a charge of gas sufficient to make an explosive mixture with the contained air is pumped in. This is followed up by pumping explosive mixture, as before described and with the same results.

It will be seen that any efficient mode of ignition may be used in place of the one herein described.

Having thus described our invention, what we claim, and desire to secure by Letters Patent of the United States, is—

1. In starting apparatus of internal-combustion engines an ignition-valve having an inner flame-chamber, a passage partially surrounding said chamber, ports opening from said chamber and said passage and so arranged that during charging the explosive mixture passes through said passage and that when firing said charge the flame-chamber is open to such passage which is closed toward the passage leading to the charge-supply pipe.

2. In starting apparatus for internal-combustion engines, and in combination, a pump; a check-valve; an ignition-valve; an arm controlling the spindle of the ignition-valve; a pivoted lever; a rod connecting one arm of said pivoted lever and said arm controlling the spindle of the ignition-valve; a spring exerting a constant pull on the arm of said spindle; a cam-shaft on the engine; a cam thereon adapted to contact with one arm of said piv-

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3. In starting apparatus of internal-combustion engines and in combination, a pump, a check-valve, an ignition-valve, an arm controlling the spindle of the latter, a pivoted lever 25, a bracket 42 on which same is pivoted, a rod 24 connecting the lever 25, an arm 19, a spring connecting the arm to the bracket, a cam-shaft of the engine, a cam adapted to operate the lever and through it the ignition-valve, and a catch for holding the lever out of engagement with the cam.

4. In apparatus for starting internal-combustion engines, the combination with a valve-casing having a hollow valve-chamber and passages communicating with said chamber, one of said passages partially surrounding said chamber and communicating with another of said passages leading to the cylinder of the engine, of a valve-plug in said casing having a hollow flame-chamber, and having an exterior passage arranged to connect the inlet-passage with said partially-surrounding passage when the valve-plug is turned for charging, and to disconnect said passages when igniting the charge, substantially as described.

5. In apparatus for starting internal-combustion engines, the combination with a valve-casing having a hollow valve-chamber, with passages communicating with said chamber, and open-air apertures in said chamber, one of said passages partially surrounding said chamber and communicating with another of said passages leading to the cylinder of the engine; of a hollow turning-plug in chamber having circumferential openings therein arranged to register either with said air-aperture or the openings to two of the said passages, as turned and having an exterior passage arranged to connect the inlet-passage with said partially-surrounding passage, when the plug is turned for charging, and to disconnect said passages when igniting the charge, substantially as described.

6. In an apparatus for charging internal-combustion engines, the combination with a valve-casing having a hollow valve-chamber, passages communicating with said chamber and circumferential open-air apertures therein; one of said passages partially surrounding chamber and communicating with another of said passages; of a valve-plug in said casing having a hollow flame-chamber, and circumferential openings therein, and having an exterior passage arranged to connect one of said passages with said partially-surrounding passage when the valve-plug is turned for charging and to disconnect said passages when igniting the charge; a burner within said flame-chamber of the plug and a pilot-



burner arranged to project a flame across one of said open-air apertures in the casing, substantially as described.

7. In starting apparatus for internal-com-  
5 bustion engines, and in combination, a pump,  
a check-valve and a mechanically-operated  
igniter all in addition to the usual igniting  
apparatus of the engine, such igniter being  
supplied with explosive mixture directly from  
10 the pump and giving successive explosions

independently of the ordinary firing apparatus.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

JOSEPH EDMONDSON.

JOHN WILLIAM DAWSON.

Witnesses:

J. B. HOWARD,

WALTER BRIERLEY.