Starting devices.

Combustible mixture supply.

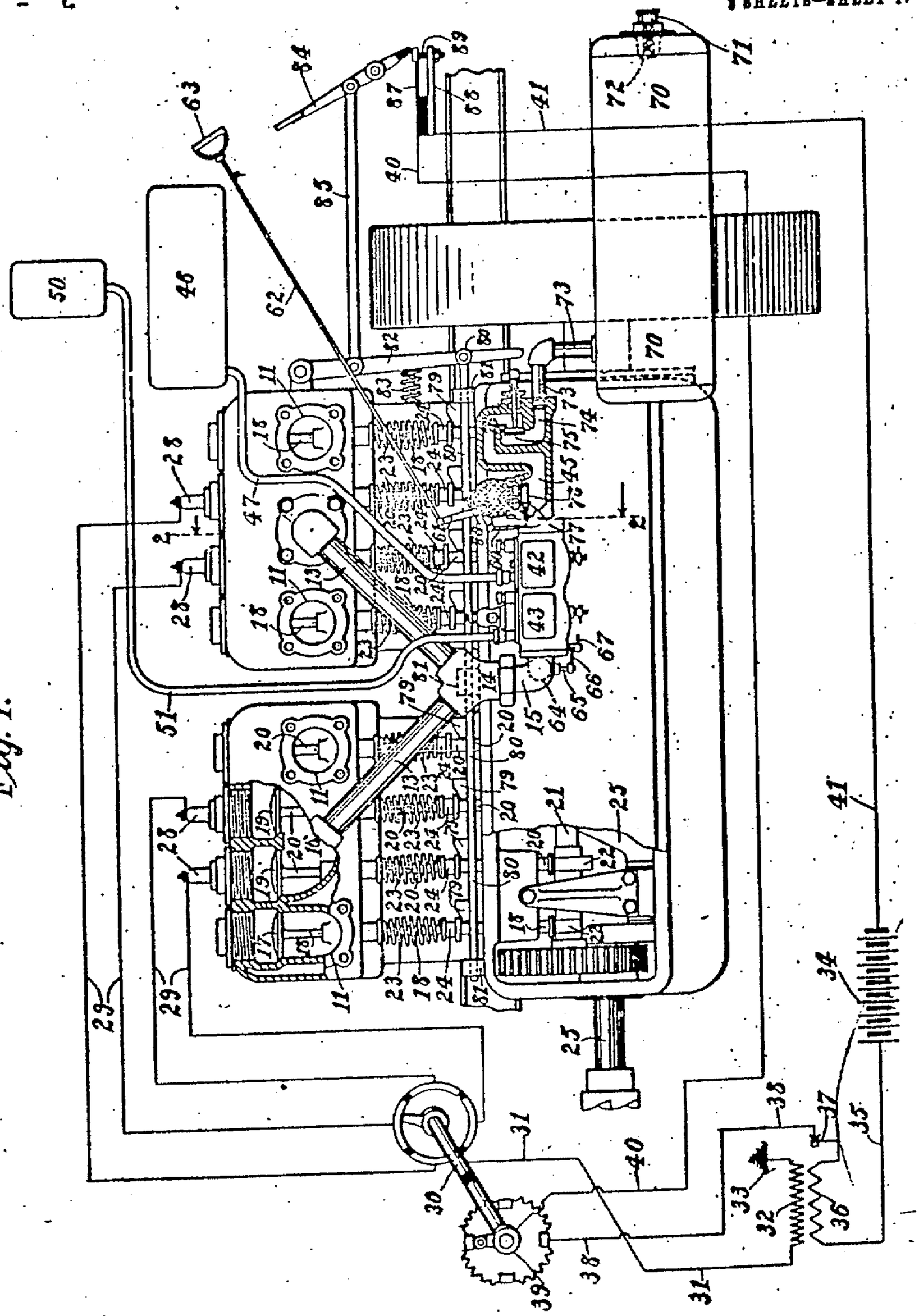
No. 867,797. PATENTED OCT. 8, 1907.

323
Box - 2

C. J. COLEMAN.
ENGINE STARTER.
APPLICATION FILED MAR. 12, 1907.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Wm. Ashley Kelly
Margaret Best

Inventor:
Clyde J. Coleman
by Henry D. Williams
Atty.

Starting device.

Combustible mixture supply.

No. 867,797. PATENTED OCT. 8, 1907

C. J. COLEMAN.

ENGINE STARTER.

APPLICATION FILED MAR. 13, 1907.

3 SHEETS—SHEET 2.

Fig. 2.

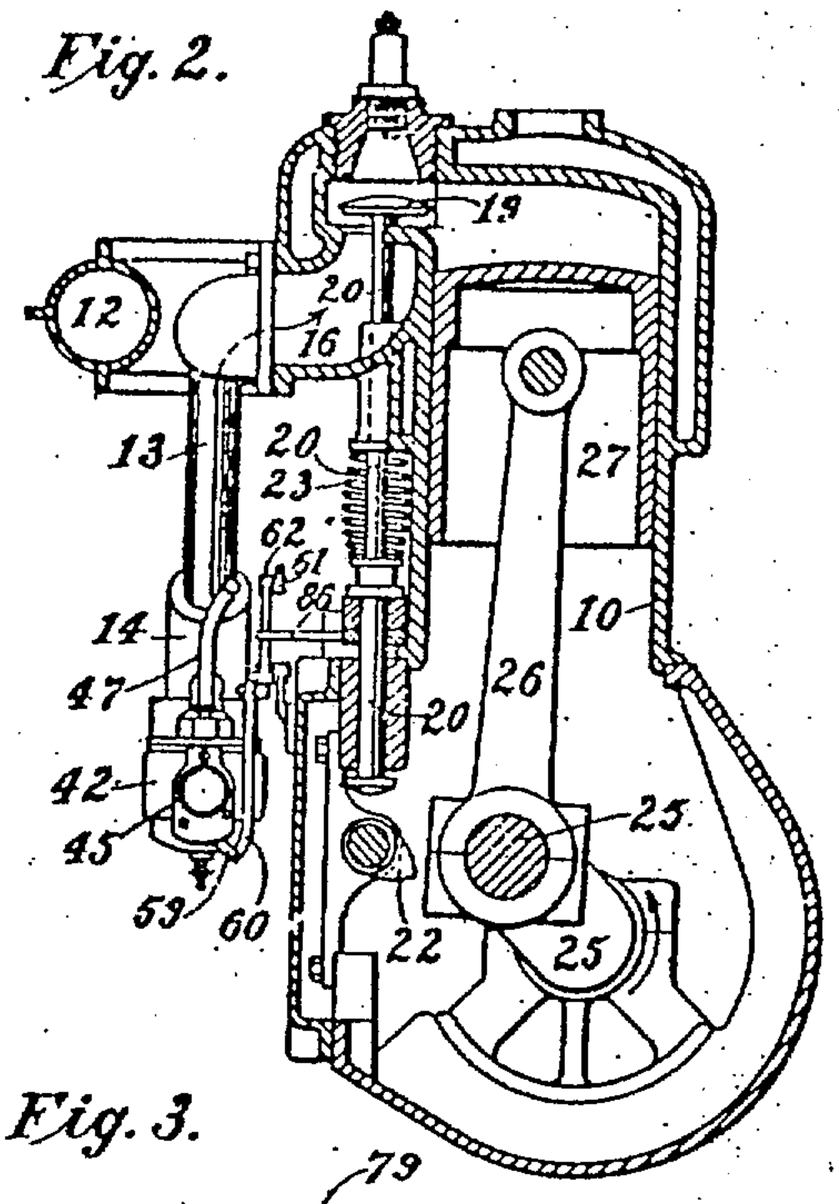


Fig. 3.

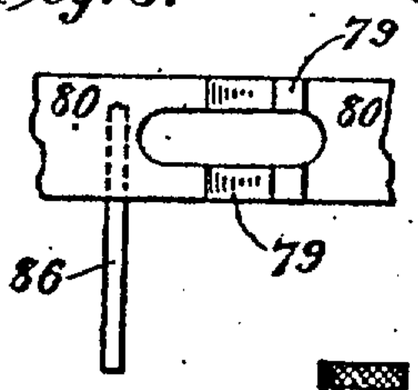


Fig. 4.

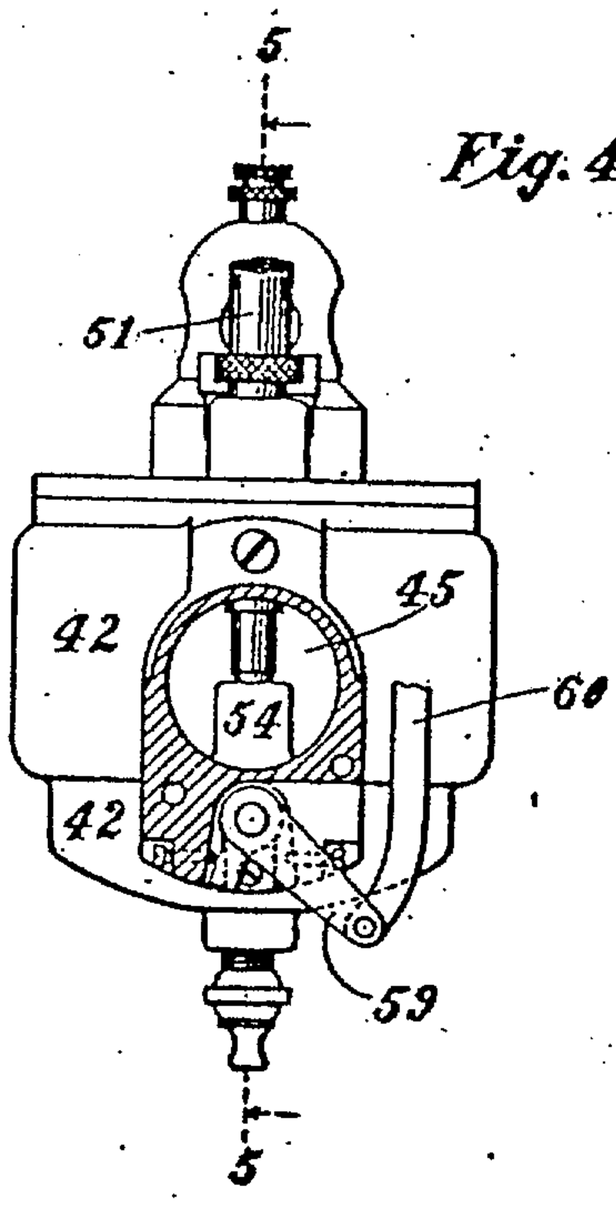


Fig. 5.

Witnesses:
Wm. Ashley Kelly
Margaret Burt

Inventor:
Clyde J. Coleman
by Henry D. Williams
Atty.

No. 867,797. PATENTED OCT. 8, 1907.

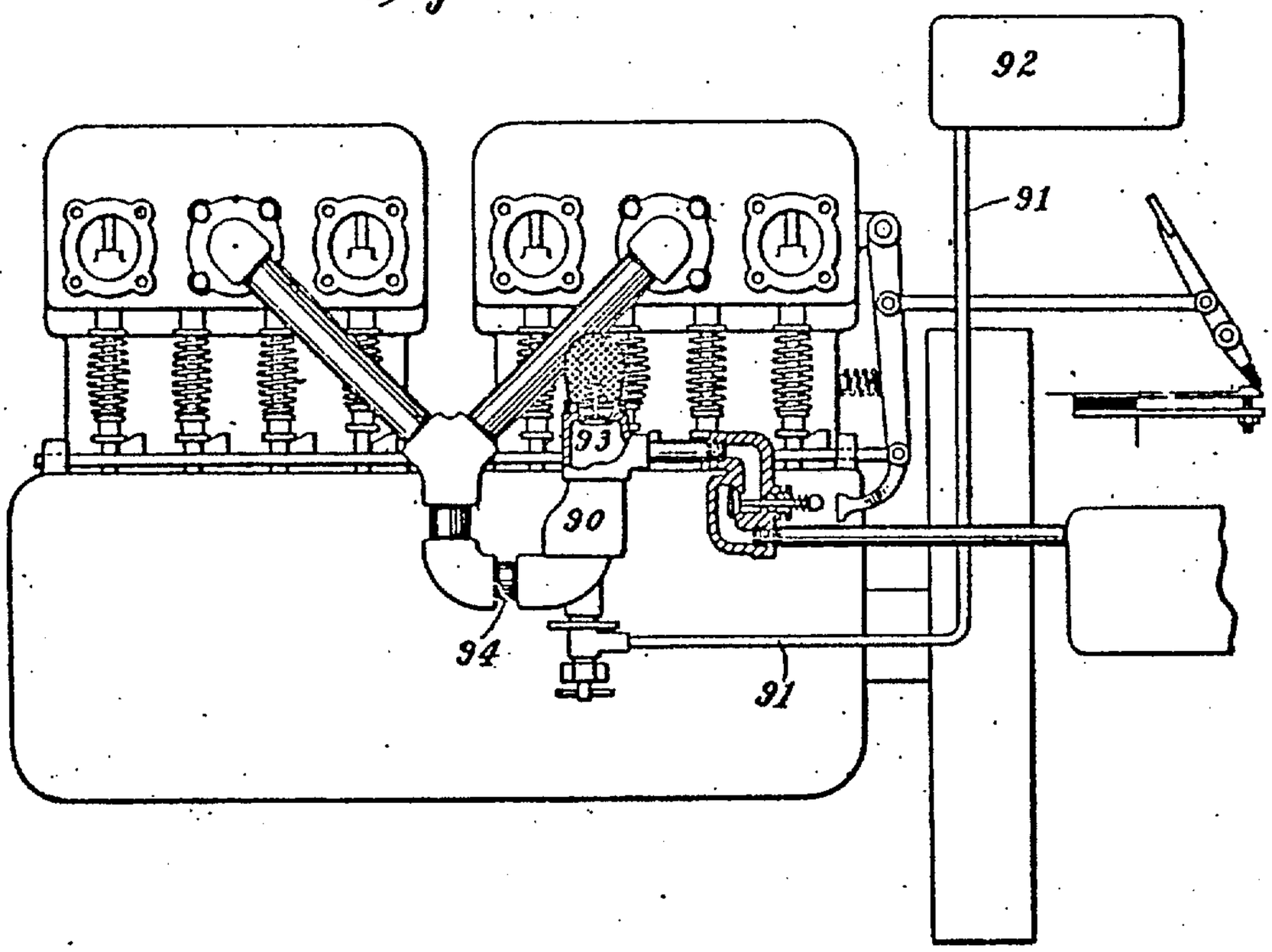
C. J. COLEMAN.

ENGINE STARTER.

APPLICATION FILED MAR. 13, 1907.

3 SHEETS—SHEET 3.

Fig. 6.



Witnesses:
Wm. Ashley Kelly
Margaret Butt

Inventor:
Clyde J. Coleman
by Henry D. Williams
Atty.

UNITED STATES PATENT OFFICE.

CLYDE J. COLEMAN, OF NEW YORK, N. Y., ASSIGNOR TO CONRAD HUBERT, OF NEW YORK, N. Y.

ENGINE-STARTER.

No. 867,797. Specification of Letters Patent. Patented Oct. 8, 1907.

Application filed March 13, 1907. Serial No. 362,102.

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at the borough of Manhattan, city of New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Engine-Starters, of which the following is a specification, reference being had therein to the accompanying drawings, forming a part thereof.

My invention relates generally to starting devices for internal combustion engines, more particularly engines such as are used on automobiles or motor boats, and has for its objects simplicity of construction, and convenience, simplicity and efficiency of operation.

I provide a manually controllable valve for admitting compressed air from a reservoir to the air intake conduit of the carbureter, the communication of the air intake of the carbureter with the outer air being closed at this time by a valve provided for the purpose, so that the air under pressure from the reservoir passes through the carbureter, vaporizing the sufficiently volatile liquid fuel supplied to the carbureter. The combustible mixture thence passes to the working cylinders of the engine and into and through all of the cylinders until the former and more or less incombustible contents of the cylinders are driven out and replaced by the combustible mixture or priming, inlets to and outlets from the cylinders being opened for this purpose by manually controllable means. Means are provided for preventing the operation of the sparking devices or ignition devices during the time that the cylinders are receiving their priming. In the preferred form of my invention, for ordinary running, a fuel is used which is less volatile than could be efficiently used for starting or for running while the carbureter is yet cold. In this preferred construction means are provided for supplying the carbureter with a more volatile fuel for starting and for running until the less volatile fuel can be vaporized by the carbureter, such as is the subject of my prior application, Serial Number 349,277, filed December 24, 1906. A single unidirectional movement of a manually operable part or lever prevents the operation of the sparking devices, forces open the inlet and exhaust valves, connects the more volatile fuel to be used for vaporization and cuts off the supply of less volatile or ordinary running fuel, opens the compressed air supply valve, and causes the closing of or continues the closed condition of the atmospheric air intake of the carbureter. A reverse movement of such part or lever performs the reverse function of restoring all parts to their first or original positions, excepting that the connections for the use of the more volatile fuel are not disturbed by such reverse movement. The change to ordinary running fuel is subsequently effected by an independent operation. The engine then starts by the ignition of the priming charge and continues to run by drawing atmospheric air through the carbureter in the usual manner.

My invention includes means for introducing priming of combustible mixture into all of the engine cylinders concurrently and for passing such priming through the cylinders until the cylinders have become filled with the priming and the previous contents of the cylinders have been substantially displaced.

My invention also includes means for effecting such priming from a selected one of a plurality of sources of volatile fuel, whereby the cylinders may be primed for the starting operation with a high grade fuel and may be run until the carbureter is sufficiently heated on such high grade fuel and may be thereafter run on ordinary or low grade fuel.

My invention also includes means for preventing the operation of the ignition devices of the engine during the time that the engine is receiving its priming.

My invention also includes various improvements in the construction and combination of parts, and has other objects and advantageous features, which will appear from the following description of the means embodying my invention which is illustrated in the accompanying drawings. I will now describe the mechanisms shown in the drawings and will thereafter point out my invention in claims.

Figure 1 is a side elevation, partly in section, of an internal combustion engine including means embodying my invention, with a diagrammatic illustration of the sparking circuits. Fig. 2 is a transverse vertical section taken centrally through one of the cylinders, on a plane indicated by the line 2—2, Fig. 1. Fig. 3 is an enlarged detail plan of a portion of the longitudinally slidable bar with a valve-opening cam-block thereon. Fig. 4 is an enlarged vertical transverse section of the carbureter on a plane indicated by the line 4—4, Fig. 5. Fig. 5 is an enlarged vertical longitudinal section of the carbureter, taken on a central plane, as indicated by the line 5—5, Fig. 4. Fig. 6 is a side elevation, partly in section, of an internal combustion engine including an embodiment of my invention in modified form.

The engine shown is a four-cycle four cylinder engine of usual construction, the cylinders 10, as ordinarily, being arranged in pairs, the exhaust outlets for the respective cylinders appearing at 11 in Fig. 1, the exhaust manifold piping 12 (see Fig. 2) being removed for clearness. The cylinders receive their supply of combustible mixture through inlet manifold pipes 13 connected by a Y-connector 14 with a common supply pipe 15 and each opening into an inlet chamber 16 common to a pair of cylinders (Figs. 1 and 2). Each cylinder has an exhaust valve 17 carried by a stem or

operating-rod 18, and also has an inlet valve 19 carried by a stem or operating-rod 20. The exhaust and inlet valves are mechanically operated in proper sequence by a usual cam-shaft 21 carrying valve-operating cams 22 to engage with the lower ends of the valve stems to lift the valves against the tension of usual strong valve-seating thrust-springs 23 coiled about the valve-stems and abutting against usual collars 24 thereon. The engine has a main-shaft or crank-shaft 25 to which are connected pitmen or piston-rods 26 carrying pistons 27 working in the cylinders 10. Firing or ignition takes place from usual spark plugs 28 from which spark-circuit conductors 29 lead to respective segments of a distributer whose common contact terminal 30 is connected by a common conductor 31 to one terminal of the secondary winding 32 of a spark-coil, the other terminal of the spark-coil secondary being shown as grounded at 33, thus completing the circuit. Current for the spark-coil is supplied by a battery 34, the circuit from which may be traced by way of conductor 35 through the primary 36 of the spark-coil, interrupter or buzzer 37, conductor 38, timer 39, conductor 40, an interposed cut-out or circuit-breaker, and conductor 41 back to the battery. The timer, distributer, spark-coil, battery and all circuits are shown diagrammatically; and the distributer and timer are shown as operatively connected together and electrically insulated from each other as usual. Everything above particularly described, excepting alone the circuit-breaker or cut-out mentioned, is usual and ordinary construction, but should be noted so as to properly understand my invention in its relation to the parts described.

The combustible mixture for the engine is supplied by a carbureter of the construction shown, described and claimed in my above mentioned prior application. This carbureter has duplicate fuel-reservoirs or float-chambers 42 and 43, through which passes a common air-conduit 44 which is continuous at its delivery end with the delivery or engine supply pipe 15 and is continuous at its intake end with an intake conduit 45. In operation greater pressure at the intake end causes a current of air to pass through the air-conduit in the direction indicated by arrows, such pressure being caused, when the engine is running, by the suction or low pressure produced by the engine. The two independent float-chambers are provided for containing volatile liquid fuels of different grades or kinds. For example, the chamber 42 may contain a grade or kind of fuel suitable for ordinary running conditions such as exist after the carbureter has become warmed by a short period of the running of the engine. This volatile liquid may be low grade gasolene, of 66 to 76 Baumé, or kerosene, or alcohol. The chamber 43 may contain a grade or kind of fuel suitable for starting the engine, such as high grade gasolene, preferably of about 88 Baumé, or benzin. The chamber 42 receives its supply of ordinary or running fuel from a fuel-tank 46 through a fuel-conduit 47 and an inlet valve 52 controlled by a float 53. The chamber 43 receives its supply of high grade or starting fuel from a fuel-tank 50 through a fuel-conduit 51 and an inlet valve 48 controlled by a float 49. The chamber 42 is provided with a fuel-nozzle 54 and the chamber 43 is provided with a fuel-nozzle 55, each fuel-nozzle leading from its chamber and opening into the common air-conduit 44. The two nozzles are conjointly controlled by a valve common to both and in such manner that when one nozzle has communication with its fuel-chamber the other nozzle is shut off from communication with its fuel-chamber. This valve is shown as a taper-valve 56 provided with grooves 57 and 58 out of circumferential alinement with each other and each of the proper length and longitudinal location to establish communication with one of the chambers and the corresponding nozzle, either the one or the other of the fuel-chambers being in communication with its nozzle according to the rotative position of the valve 56. To effect a reversal of nozzle connections the valve 56 is rotated by an operating arm 59. A link 60 forms a connection between the arm 59 and a bell-crank lever 61 pivotally supported on the engine frame and to which is connected an actuating rod 62 extending to a convenient location for manual operation and provided with a handle 63. A throttle-valve 64, shown as of usual "butterfly" type, is located in the delivery conduit 15, in control of the draft passing through the carbureter, and is carried by a rotatable stem 65 carrying an actuating arm 66 to which is connected an operating rod 67 which may extend to any convenient location. The carbureter is provided with an inwardly opening auxiliary air-inlet valve 68 normally retained upon its seat by a spring 69.

According to my invention, preparatory to starting the engine, all of the cylinders are to be filled with combustible mixture. To this end means are provided for blowing the combustible mixture through all of the cylinders concurrently, such means including a source of compressed air shown as an air receiver or air storage reservoir 70. So far as the present invention is concerned, the supply of air held under compression in the reservoir 70 may be replenished in any convenient manner. For use in thus replenishing the air the reservoir is provided with a plug or coupling part 71 having therein an inwardly opening check valve 72. To produce a combustible mixture for starting the engine, the compressed air from the reservoir is passed through the carbureter, and to assure that a combustible mixture will be then produced means are provided for assuring that the higher grade of fuel will at that time be supplied to the carbureter. For passing air through the carbureter an air-conduit 73 leads from the reservoir 70 and opens into a passage 74 which communicates, through a manually operable air controlling valve 75, with a passage 76 which opens into the air-intake pipe 45 of the carbureter. The air-controlling valve 75 could be of any preferred construction but is shown as of the puppet type and as opening towards the air reservoir. This valve has an actuating stem extending rearwardly to the atmosphere through an ordinary packing gland as shown, the stem terminating in a head by which the valve may be actuated. This valve is held upon its seat by the pressure of the air in the air reservoir, and is additionally retained upon its seat and made to quickly close by a valve-closing thrust spring shown as coiled about the valve-stem and acting upon the head of the valve-stem.

The air-intake pipe 45 is provided as usual with an air inlet opening 77, but in addition thereto a valve is provided for controlling this air inlet opening, this valve being shown as an inwardly opening check-valve

78. This check-valve has its weight counterbalanced and is pressed lightly towards its seat by a thin spring as shown, thus presenting no appreciable obstacle to the ingress of air in the operation of the engine, but closing under pressure of the air from the reservoir to prevent the escape of this air to the atmosphere and to compel this air to pass through the carbureter. As the air from the air reservoir passes through the carbureter it readily vaporizes the high grade fuel which is provided for starting and forms a combustible mixture which is passed into the engine cylinders and made to displace their former contents until the cylinders become filled with the combustible mixture.

To allow the cylinders to fill with combustible mixture, means are provided for forcing open and holding open all of the cylinder inlet valves 19 and also at the same time all of the exhaust valves 17 until the cylinders are thus filled. Thus when the cylinder inlet and exhaust valves are open and the air controlling valve 75 is open, compressed air will be blown from the air reservoir through the carbureter wherein it will be carbureted to an explosive mixture, which will be blown through the cylinders, displacing their former contents and filling the cylinders with combustible mixture. When the cylinders have become filled with combustible mixture the inlet and exhaust valves and the air controlling valve are allowed to close, after which the engine is made to start by igniting the mixture in the cylinders in the proper order or sequence.

The means shown for holding open the inlet and exhaust valves comprise valve-opening cam-blocks 79 carried by a longitudinally slidable bar 80 guided in bearings 81 on the engine frame. These cam-blocks have as shown a sloping or wedge-shaped portion for engaging beneath the valve-stem collars 24 to raise the valves. The bar 80 has elongated openings or slots to permit the valve stems 18 and 20 to pass through the bar without interfering with the sliding movement of the bar, and a valve-lifting cam-block 79 is located at each side laterally of each of such slots (see Fig. 3). The cams or wedges 79 are shown as normally located in rear of the valve stems, necessitating that the sliding bar 80 be moved forward to effect an opening of the engine valves. The bar 80 is shown as having pivotal connection at its rear end with an intermediate lever 82 which is pivotally supported by a stationary part of the engine as shown. The bar 80 is normally held at its rearward position by a thrust-spring 83 acting between the intermediate lever 82 and the engine frame. The bar 80 may be actuated at will, to cause the cams 79 to open the engine-valves, by a pedal or foot-lever 84 connected to the intermediate lever 82 by a link or connecting rod 85. When the pedal 84 is pressed the cams 79 will be actuated against the tension of the cam-bar-restoring spring 83 to force open all of the closed inlet and exhaust valves 17 and 19 against the tension of the valve-closing springs 23, and when the pedal is released all of the inlet and exhaust valves not held open by the valve-operating cams 22 will be closed by their valve-closing springs.

The intermediate lever 82 extends downward beyond its connection with the cam-operating bar 80 to engage with the head or outer end of the valve-stem of the air-controlling valve 75 to hold this valve open while the inlet and exhaust valves of the engine are held open. When the pedal is released the air-controlling valve will be closed by its spring and by the pressure of air in the reservoir.

To form a proper combustible mixture for starting the engine, means are provided for automatically supplying the higher grade fuel or starting fuel and for cutting off the lower grade fuel or ordinary running fuel. Such means comprise a valve-actuating pin 86 carried by the slidable bar 80 at the rear of and in alinement with the upper arm of the bell-crank lever 61. When the bar 80 is moved forwardly to open the engine-valves the pin 86 engages with the bell-crank lever to push the upper arm thereof forward, thereby, through connections already described, rotating the nozzle-controlling valve 56 to the position where it opens communication between the fuel-chamber 43, containing high grade or starting fuel, and its nozzle, while at the same time closing communication between the fuel-chamber 42, containing low grade or ordinary running full, and its nozzle, as seen in Figs. 2, 4 and 5. It is usually desirable that the engine shall not only be given its initial or starting movement with high grade fuel, but that it shall continue to use the high grade fuel until the carbureter shall have become sufficiently warmed to satisfactorily vaporize the ordinary running fuel. Therefore, the nozzle-controlling valve 56 is not arranged to be operated in its opposite direction of rotation by the return movement of the bar 80, the pin 86 then merely moving away from the bell-crank 61, as shown in Fig. 1, leaving the nozzle-controlling valve in the position seen in Fig. 5. After a short period of running of the engine the nozzle-controlling valve may be independently restored to its former position, to supply the ordinary running fuel, by drawing backward the handle 63.

Means are provided for preventing ignition while the cylinders are being filled with combustible mixture. Such means as shown comprises a cut-out or circuit-breaker for automatically opening the battery circuit. The battery circuit conductor 40 is connected to a contact spring or movable terminal 87 shown as carried by but electrically insulated from a base-plate 88 to which is connected the battery circuit conductor 41. The plate 88 carries an adjustable stationary contact terminal 89 for coöperating with the movable terminal 87. The foot-lever is shown as extended below its fulcrum pivot and provided with an insulating tip which normally engages the spring contact terminal 87 to hold it in contact with the stationary contact terminal 89 and thus to preserve the continuity of the battery circuit. However, when the pedal is pressed forward to actuate the above described devices for blowing a combustible mixture through the cylinders, the contact spring 87 is released and opens the battery circuit, deënergizing the spark-coil and preventing ignition taking place until the battery circuit is reëstablished by the release of the pedal.

It is to be noted that all of the above-named incidents of operation should take place in their proper sequence. For example, it is obvious that sparking should be discontinued prior to the opening of the air-controlling valve, and it is also obvious that the sparking should not be resumed until after such air-controlling valve has closed, nor until after the inlet and exhaust valves have been released by cams 79. Also it is preferable that the air-controlling valve should not be

opened until after the inlet and exhaust valves have been opened at least sufficiently to provide a clear and unobstructed way through the cylinders so that the air may pass freely through the carbureter to produce an efficient vaporization. As shown in the drawings (Fig. 1), when the foot-lever is depressed the contact-spring 87 will be released and will open the battery circuit along with the initial valve-opening movement of the bar 80 and previously to the engagement of the lever 82 with the stem of the air-controlling valve 75 to open such valve. As shown in the drawings, the inlet and exhaust valves will have substantially completed their opening movement prior to the actuation of the air-controlling valve 75. The nozzle-controlling valve 56 will be actuated, to supply starting fuel to the carbureter, along with the valve-opening movement of the bar 80. When the pedal is released the spring 83 acts upon the lever 82, first, incidentally, to release and permit the closure of the air-controlling valve 75, and last, just after the inlet and exhaust valves have been released by the cams 79, to depress the contact spring 87 and restore the battery circuit.

To start the engine the pedal is simply pressed down and held for a few moments and then released. Ignition will then take place in whichever cylinder sparking occurs, according to the operative position of the distributer or spark-controller 39. Should the operative position be such that sparking does not occur, then sparking may be caused to occur by manipulation of the spark-controller in the usual manner of spark adjustment. After the first ignition has occurred, and an initial starting movement thereby given, the charges in the other cylinders will be fired successively in their proper order, the engine then continuing to run in the ordinary manner by drawing air through the carbureter and atmospheric air-inlet 77. After a short period of running and consequent warming of the carbureter, ordinary running fuel may be substituted for the starting fuel by operating the nozzle-controlling handle 63 as above described.

In the modification illustrated in Fig. 6, the invention is shown in its simplest form. The construction and operation of corresponding parts through ut are substantially identical with those just described. The sparking devices are omitted because identical with what is shown in Fig. 1. The only substantial difference in the modified construction from that just described is that in place of the duplex carbureter an ordinary carbureter 90 is employed. This also of course eliminates the mechanism for effecting a change from one grade or kind of fuel used to another grade or kind. The carbureter 90 receives its supply of fuel through a fuel-conduit 91 leading from a fuel-tank 92. In this construction, in which provision is made for one grade or kind of fuel only, it is of course necessary that the fuel used for ordinary running must be of a sufficiently high grade to effect the starting operation. The carbureter 90 is connected with an intake chamber or intake passage 93, corresponding to the intake conduit 45 of the first described construction, and is connected with a delivery pipe 94, corresponding to the delivery pipe 15. No further description of what is shown in Fig. 6 is thought to be necessary.

It is obvious that various modifications may be made in the constructions shown and above particularly described within the principle and scope of my invention.

I claim:

1. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, manually actuatable means for concurrently opening an outlet from each cylinder, an atmospheric air inlet for the carbureter, means for closing the atmospheric air inlet, a source of compressed air communicating with the carbureter, and a manually actuatable valve in control of such communication.

2. In an engine starter for multiple cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, the cylinders having outlets, a source of compressed air communicating with the carbureter, manually actuatable means for concurrently opening the cylinder outlets and such communication, an atmospheric air inlet for the carbureter, and means for sealing such inlet when the above named communication is open.

3. In an engine starter for multiple cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, outlet-valves for the cylinders, a source of compressed air communicating with the carbureter, an air-controlling valve in control of such communication, manually actuatable means for concurrently opening all of the cylinder outlet valves and the air-controlling valve, an atmospheric air inlet for the carbureter, and means for preventing the escape of compressed air through such inlet.

4. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, manually actuatable means for concurrently opening an outlet from each cylinder, an atmospheric air inlet for the carbereter, means for closing the atmospheric air inlet, a source of compressed air communicating with the carbureter, a manually actuatable valve in control of such communication, an ignition circuit for the engine, and means for preventing the operation of such circuit when the air-controlling valve is open and restoring such circuit to operative condition after such valve has closed.

5. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, the cylinders having outlets, a source of compressed air communicating with the carbureter, manually actuatable means for concurrently opening the cylinder outlets and such communication, an atmospheric air inlet for the carbureter, means for sealing such inlet when the above named communication is open, an ignition circuit for the engine, and means for preventing the operation of such circuit when all of the cylinder outlets and the above named communication are open.

6. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, outlet-valves for the cylinders, a source of compressed air communicating with the carbureter, an air-controlling valve in control of such communication, manually actuatable means for concurrently opening all of the cylinder outlet valves and the air-controlling valve, an atmospheric air inlet for the carbureter, means for preventing the escape of compressed air through such inlet, an ignition circuit for the engine, and means for preventing the operation of such circuit when the air-controlling valve and the cylinder outlet valves are open.

7. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, a source of compressed air communicating with the carbureter, an air-

controlling valve in control of such communication, manually controllable means for concurrently opening the air-controlling valve and also all of the inlet and exhaust valves of the engine cylinders, an atmospheric air inlet for the carbureter, and means for preventing the escape of compressed air through such inlet.

8. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, a source of compressed air communicating with the carbureter, an air-controlling valve in control of such communication, manually controllable means for concurrently opening and holding open the air-controlling valve and also all of the inlet and exhaust valves of the engine cylinders, an atmospheric air inlet for the carbureter, means for preventing the escape of compressed air through such inlet, an ignition circuit for the engine, and means preventing the operation of such circuit when the air-controlling valve and the inlet and exhaust valves are held open.

9. In an engine starter for multiple-cylinder internal combustion engines, the combination of a source of liquid fuel, vaporizing means for the fuel communicating with the inlets of the respective cylinders, a source of compressed air communicating with the vaporizing means, an air-controlling valve and also all of the inlet and exhaust manually controllable means for concurrently opening the air-controlling valve and also all of the inlet and exhaust valves of the engine cylinders, means preventing the escape of the compressed air to the atmosphere before it has passed through the vaporizing means, another source of liquid fuel, vaporizing means for this last named source also communicating with the inlets of the respective cylinders, and manually controllable means for conjointly controlling the vaporizing means so that when one such means is in use the other is not in use.

10. In an engine starter for multiple-cylinder internal combustion engines, the combination of a source of liquid fuel, vaporizing means for the fuel communicating with the inlets of the respective cylinders, a source of compressed air communicating with the vaporizing means, an air-controlling valve in control of such communication, manually controllable means for concurrently opening the air-controlling valve and also all of the inlet and exhaust valves of the engine cylinders, an atmospheric air inlet for the vaporizing means, means for preventing the escape of compressed air through such inlet, another source of liquid fuel, vaporizing means for this last named source also communicating with the inlets of the respective cylinders, and manually controllable means for conjointly controlling the vaporizing means so that when one such means is in use the other is not in use.

11. In an engine starter for multiple-cylinder internal combustion engines, the combination of a source of liquid fuel, vaporizing means for the fuel communicating with the inlets of the respective cylinders, outlet valves for the cylinders, a source of compressed air communicating with the vaporizing means, an air-controlling valve in control of such communication, manually actuatable means for opening all of the cylinder outlet valves and the air-controlling valve concurrently, an atmospheric air inlet for the vaporizing means, means for preventing the escape of compressed air through such inlet, another source of liquid fuel, vaporizing means for this last named source also communicating with the inlets of the respective cylinders, and manually controllable means for conjointly controlling the vaporizing means so that when one such means is in use the other is not in use.

12. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, a source of compressed air communicating with the carbureter, an air-controlling valve in control of such communication, manually controllable means for concurrently opening the air-controlling valve and also all of the inlet and exhaust valves of the engine cylinders, an atmospheric air inlet for the carbureter, means for preventing the escape of compressed air through such inlet, a plurality of sources of liquid fuel, and manually controllable means for connecting different sources of fuel with the carbureter.

13. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, a source of compressed air communicating with the carbureter, an air-controlling valve in control of such communication, manually controllable means for concurrently opening the air-controlling valve and also all of the inlet and exhaust valves of the engine cylinders, an atmospheric air inlet for the carbureter, means for preventing the escape of compressed air through such inlet, a plurality of sources of liquid fuel each having communication with the carbureter, and a manually actuatable fuel-valve in control of such communications and adapted to connect different sources of fuel with the carbureter when in different positions.

14. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, a plurality of sources of liquid fuel each having communication with the carbureter, a fuel-valve in control of such communications and adapted to connect different sources of fuel with the carbureter when in different positions, a source of compressed air communicating with the carbureter, an air-controlling valve in control of such communication, manually controllable means for concurrently opening the air-controlling valve and all of the inlet and exhaust valves and also adapted to shift the fuel-valve to a certain position should such valve not already occupy that position, an atmospheric air inlet for the carbureter, and means for preventing the escape of compressed air through such inlet.

15. In an engine starter for multiple-cylinder internal combustion engines, the combination of a carbureter, fluid-carrying connections from the outlet of the carbureter to the inlets of the respective cylinders, two sources of liquid fuel each having communication with the carbureter, a fuel-valve common to both communications and adapted when moved to one of its positions to open one of such communications and close the other and when moved to another position to open the other communication and close the first named, a source of compressed air communicating with the carbureter, an air-controlling valve in control of such communication, and manually controllable means for concurrently opening the air-controlling valve and all of the inlet and exhaust valves and also adapted to move the fuel-valve to a certain one of its positions and to prevent the return of the fuel-valve to its original position until the restoring of the manually controllable means to its original position also.

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

CLYDE J. COLEMAN.

Witnesses:
WM. ASHLEY KELLY,
BERNARD COWEN.