E. A. HALBLEIB.

ENGINE STARTING APPARATUS.

APPLICATION FILED APR. 12, 1911.

1,017,538. Patented Feb. 13, 1912.

Fig. 1.

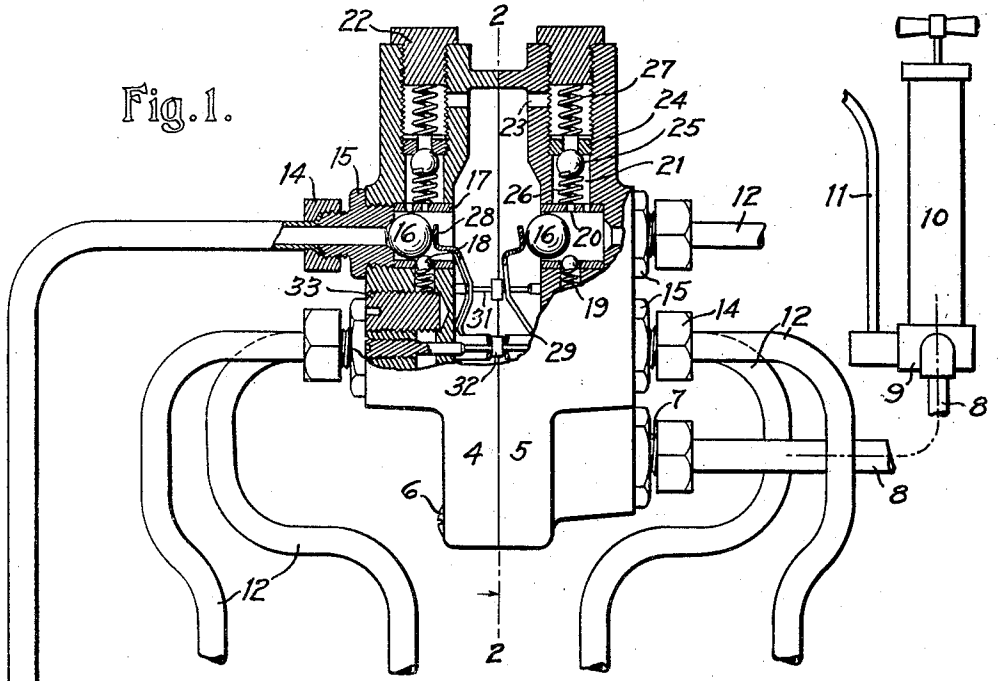
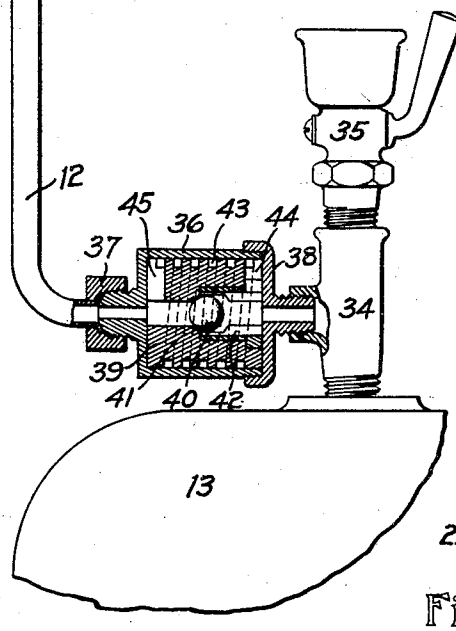


Fig. 2.



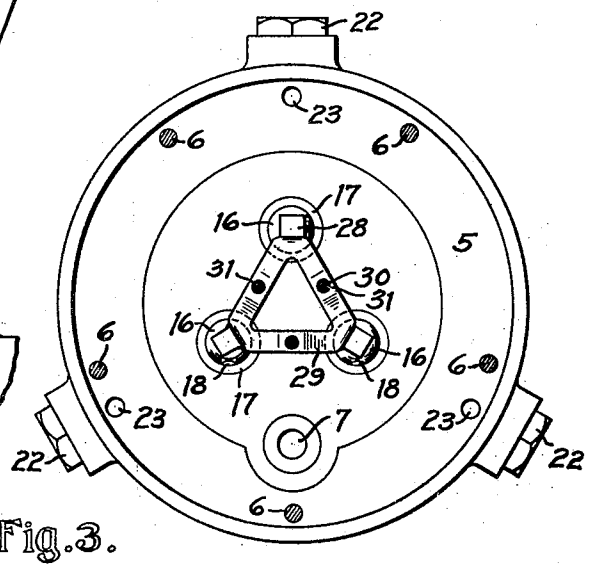
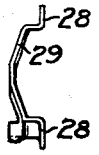


Fig. 3.



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ENGINE-STARTING APPARATUS.

1,017,538. Specification of Letters Patent. Patented Feb. 13, 1912.

Application filed April 12, 1911. Serial No. 620,683.

To all whom it may concern:

Be it known that I, EDWARD A. HALBLEIB, a citizen of the United States, and a resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Engine-Starting Apparatus, of which the following is a specification.

This invention relates to apparatus for starting internal-combustion engines, of the type in which combustible mixture is forced into one or more of the cylinders and ignited, to provide the primary impulse for the engine. In such apparatus it has been heretofore proposed, as, for example, in my copending application filed September 6, 1910, Serial No. 580,785, to provide a selector operated automatically by pressure from the engine-cylinders, for directing the combustible mixture to the cylinder or cylinders in which the piston is in the right position to produce a working stroke.

The present invention relates particularly to a selector of this type.

One object of the invention is to produce a simple and reliable selector which is adapted to control the inlet-passages of a plurality of cylinders, particularly where the cylinders in question are either three or six in number. To this end I employ a device having selector-valves which are mechanically interconnected in such manner that when one valve opens, in response to pressure from the cylinder controlled thereby, a plurality of other valves are automatically moved to and held in closed position by the opening of the first valve. This arrangement is particularly applicable to a group of three cylinders, as I have devised a lever of triangular form by which the three corresponding valves may be effectively interconnected in the required manner.

Another object of the invention is to provide a device of the kind in question with automatic means by which the transmission of pressure from the engine-cylinders shall be prevented or diminished during normal running of the engine, so as to minimize or avoid idle movements in the parts of the selector. To this end I interpose in the connections between the selector and the engine-cylinder, a device which permits gas to pass freely from the selector to the cylinder, but opposes the flow in the reverse direction to such a degree as to substantially prevent such flow in the short periods of time occupied by the normal compression and expansion-strokes of the engine.

A third object of the invention is to prevent the transmission of excessive heat to the selector, and to this object the automatic arrangement just described contributes, while I employ, as further provision to this end, an arrangement in which the gas from the engine must flow through a long and narrow passage in which it is effectually cooled before reaching the selector.

In the accompanying drawings: Figure 1 is a side-elevation, partly in section, of an automatic selector embodying the present invention, the figure indicating also, diagrammatically, a source of supply of combustible mixture with which the selector is connected; Fig. 2 is a vertical section through the selector on the line 2—2 in Fig. 1; and Fig. 3 is a detail view, in side-elevation, showing one of the triangular levers.

The illustrated embodiment of the invention is a selector adapted for use in connection with a six-cylinder internal-combustion engine, such as is commonly employed in automobiles. The moving parts of the selector are inclosed within a casing comprising two members 4 and 5, generally similar in form, these members being secured together by screws 6. Combustible mixture is introduced into the casing through an inlet 7, the casing being connected, for this purpose, by means of a pipe 8, with any suitable source of supply. In Fig. 1 I have indicated such a source diagrammatically as comprising a mixing-chamber 9, supplied with air by an air-pump 10, and with liquid fuel through a pipe 11. The air and fuel are mixed by any ordinary or suitable device in the mixing chamber 9, and are forced, by the operation of the air-pump, through the pipe 8 to the distributer, and thence to the cylinders of the engine.

The distributer is provided with six outlets connected, by pipes 12, with the respective cylinders 13 of the engine. The pipes 12 are connected, by glands 14, with bushings 15 screwed into the casing, these bushings being provided with valve-seats controlled by movable valve-members in the form of balls 16. Each valve-ball fits closely but freely in a cylindrical sleeve or valve-

casing 17. Coöperating with each valve-ball is a detent-ball 18 which is pressed upward by a spring 19, so as to engage the valve and retain it in either open or closed position, as shown, respectively, at the left and the right in Fig. 1.

Each valve-casing is provided with inlet-openings 20 communicating with a passage 21 in the casing. This passage is closed, at its outer end, by a screw-threaded plug 22 affording access to the interior, and communicates, through an opening 23, with the central open space in the casing. The combustible mixture flows from said space through the opening 23, the passage 21, and the openings 20 into the valve-casing, and, in case the valve is open, it passes thence through the outlet and the pipe 12 to the engine-cylinder. On the other hand, when the engine has been running and is brought to rest, from those cylinders in which the pistons are on the expansion-stroke or the compression-stroke gas is forced backwardly through each corresponding pipe 12 and the outlet, thereby moving the valve from its seat to the position at the right of Fig. 1. To prevent this gas from entering the body of the casing the passage 21 is controlled by a ball check-valve 25, coöperating with a valve-seat 24 which is screwed into the casing in the passage 21. A spring 27, between this valve-seat and the plug 22, prevents accidental displacement of the valve-seat, while a spring 26 presses the check-valve normally against its seat, but permits it to yield to the flow of combustible mixture through the passage.

A novel feature of the invention resides in a lever of generally-triangular form, shown particularly in Figs. 2 and 3. This lever has at each apex an outwardly-offset finger 28, which engages one of the valve-balls 16, and these fingers are connected by bars 29 coinciding with the sides of the triangle. Each bar is provided with a central perforation 30, and the lever is mounted upon three fulcrum-pins 31, which are screwed at their ends into the casing, and which pass loosely through the holes 30 in the lever. At the middle of each fulcrum-pin is a collar 32, constituting a fulcrum for the lever.

The arrangement just described is such that in case either valve-ball is moved to open position, the ball presses against the corresponding finger on the lever, and thereby rocks the lever upon the two fulcrums engaging the two adjacent sides of the triangle. Accordingly the other two fingers or apices of the lever are moved through an equal distance in the opposite direction, thereby moving the corresponding valve-balls to closed position against their seats. Accordingly, in the group of three cylinders, one selector-valve is always open, affording communication with one cylinder, while the other two valves are closed. To apply this arrangement to a six-cylinder engine it is necessary only to duplicate the arrangement of valves and levers as illustrated, the cylinders being controlled in two independent groups of three. Thus, in a six-cylinder engine there are always two cylinders which are in communication with the source of supply of combustible mixture, the pistons in these cylinders being also in the proper position to receive a starting impulse. To afford convenient access to the detent-devices, each portion of the valve-casing is provided with a threaded central perforation, which is normally closed by a screw-plug 33.

The device for restricting back-flow of gas from the engine-cylinder while the engine is in normal operation is shown in vertical section in Fig. 1. The pipe 12 is connected with the engine-cylinder 13 through a T 34 which serves conveniently also as means for connecting the usual priming-cock 35 with the cylinder. Between the pipe and the T is a cylindrical casing 36 which is connected at one end with the pipe by means of a gland 37. The other end of the casing is closed by a screw-cap 38 which has a nipple screwed into the T. Closely fitting within the casing 36 is a generally-cylindrical member 39 which is centrally perforated and provided with a valve-seat coöperating with a valve-ball 40. The valve-ball moves in a cage 42 having ribs by which the ball is guided and its movement limited.

The valve-ball 40 constitutes a check-valve which permits gas to flow from the selector to the engine-cylinder, but prevents the return of gas from the cylinder through the passage controlled by the ball. To permit the return flow of gas when necessary, however, a long and slender passage is provided by forming a helical groove 43 in the outer surface of the member 39. This groove is connected with the space at the right of the check-valve by means of a radial passage 44, and its left-hand end is connected with the central passage leading to the pipe 12 by means of a radial passage 45. The resistance opposed to the flow of gas by this long and slender passage is so great that, during the normal running of the engine, there is not sufficient time for any substantial return flow of gas during the compression and expansion-strokes of the engine. Accordingly while the engine is running normally there is little or no motion in the valve-balls 16 and the levers by which they are controlled, and thus wear on the mechanism of the selector is minimized, while the slight loss of compression in the engine-cylinders which would otherwise occur is also avoided. When the engine comes to

rest, however, the compression in the cylinders gradually forces gas backward through the passages 43 so as to move the selector-mechanism into operative position for the next starting operation upon the engine.

In addition to checking the return flow of gas as just described the passages 43 cause gas returning through them to be effectually cooled, the heat and gas being transferred to the walls of the casing 36 and thence to the atmosphere, so that during the running of the engine such gas as finds its way through the passage 43 during the expansion-stroke of the engine is reduced substantially below the ignition temperature and the selector is protected against the injurious effect of high temperature.

My invention is not limited to the embodiment thereof hereinbefore described and illustrated in the accompanying drawings, but may be embodied in various forms, within the nature of the invention as it is defined in the following claims.

I claim:

1. An automatic selector for engine-starting apparatus having, in combination, valves for controlling the admission of air to the respective cylinders of an engine, said valves being movable into open position by pressure from the respective cylinders, and connections between the valves whereby movement of either valve to open position causes the movement of a plurality of the other valves to closed position.

2. An automatic selector for engine-starting apparatus having, in combination, three valves controlling the admission of air to as many cylinders of an engine, said valves being movable, respectively, into open position by pressure from the respective cylinders, and lever connections between the valves whereby movement of either valve to open position causes movement of the other two valves to closed position.

3. An automatic selector for engine-starting apparatus, having, in combination, three valves for controlling the admission of air to as many cylinders of an engine, said valves being movable, respectively, into open position by pressure from the respective cylinders, and a lever of generally-triangular form engaging the valves at the respective apices of the triangle and fulcrumed between said apices, so that the movement of either apex, by the operation of the valve engaging said apex, causes opposite movement of the other apices to close the other two valves.

4. An automatic selector for engine-starting apparatus having, in combination, a plurality of valves for controlling the admission of air to the respective cylinders of an engine, said valves being movable, respectively, into open position by pressure from the respective cylinders, and a polygonal lever engaging the valves at its apices and fulcrumed in the middle of its sides, so that movement of either apex by the opening of the corresponding valve causes opposite movement of the other apices to close the valves connected therewith.

5. Engine-starting apparatus having, in combination with an internal-combustion engine, a source of supply of combustible mixture, a casing provided with an inlet connected with said source of supply and a plurality of outlets connected, respectively, with three or more cylinders of the engine, a valve controlling each outlet and movable into open position by pressure from the corresponding cylinders, and mechanism connecting the valve whereby movement of either valve to open position closes a plurality of the other valves.

6. Engine-starting apparatus having, in combination, a selector adapted to be connected with an internal-combustion engine and operated by pressure from the engine, and connections between the selector and the engine including means for restricting the flow of gas from the engine to the selector, said means permitting free flow of gas from the selector to the engine.

7. In combination with an internal-combustion engine and a selector adapted to be connected with the engine and operated by pressure therefrom, connections between the engine and the selector comprising a comparatively unobstructed passage adapted to permit free flow of gas therethrough, a check-valve for preventing flow of gas through said passage from the engine to the selector, and a second passage around said check-valve to permit a restricted flow of gas from the engine to the selector.

8. In combination with an internal-combustion engine and a selector adapted to be connected with the engine and operated by pressure therefrom, connections between the engine and the selector comprising a comparatively unobstructed passage adapted to permit free flow of gas therethrough, a check-valve for preventing flow of gas through said passage from the engine to the selector, and a second elongated, narrow passage around said check-valve to permit a restricted flow of gas and to cool the gas passing therethrough.

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