

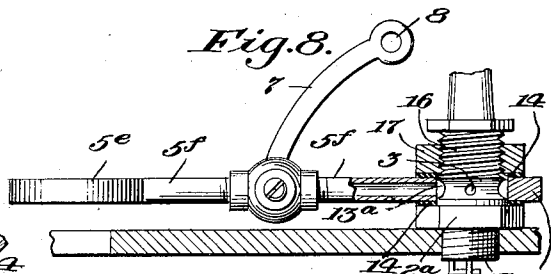
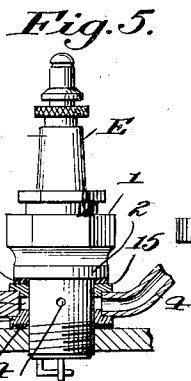
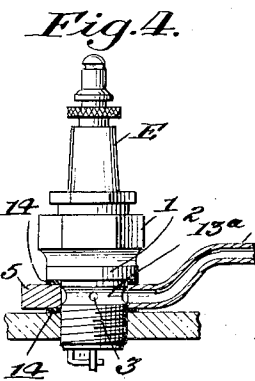
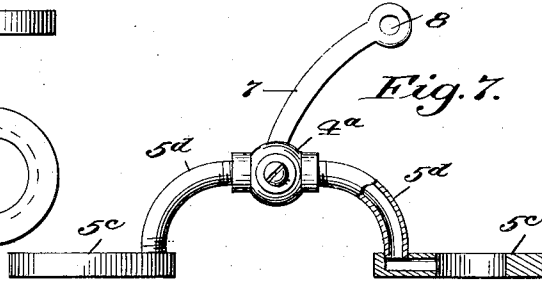
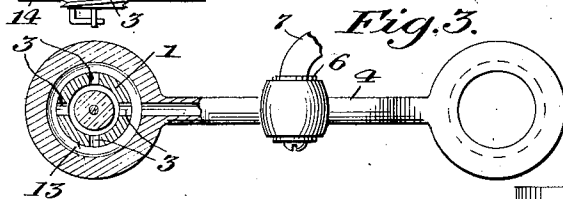
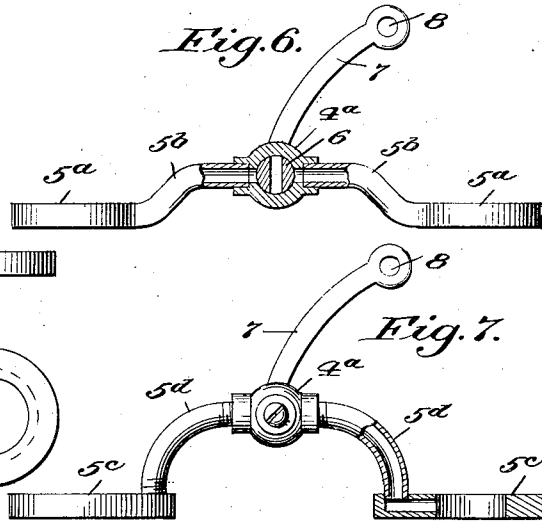
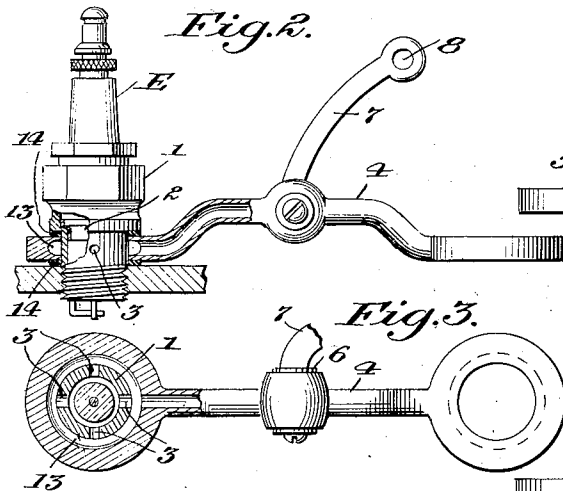
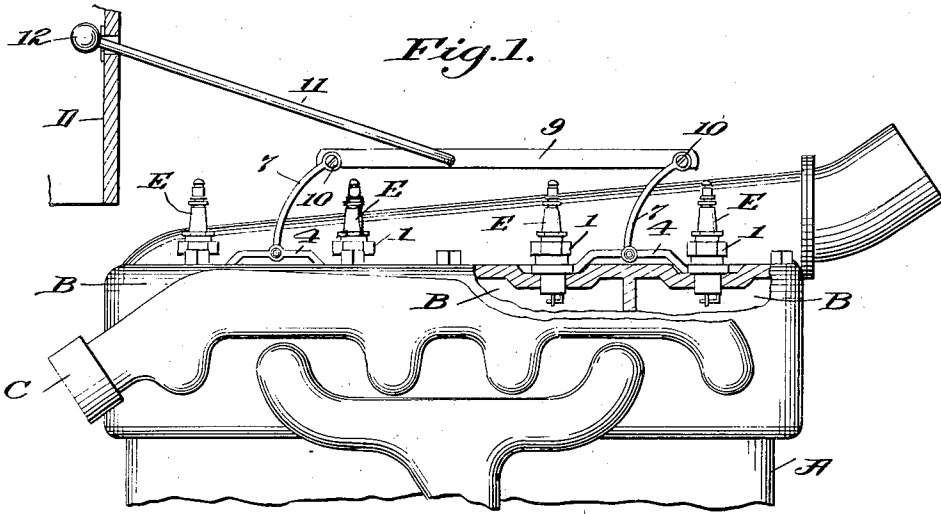
June 23, 1925.

1,543,646

H. C. SHAMBLIN  
CLEANING AND WARMING SYSTEM FOR THE SPARK PLUGS OF MULTICYLINDER  
INTERNAL COMBUSTION ENGINES AND PARTS THEREOF

Filed Feb. 2, 1925

2 Sheets-Sheet 1



Inventor:  
Harvey C. Shamblin,  
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Att'ys.

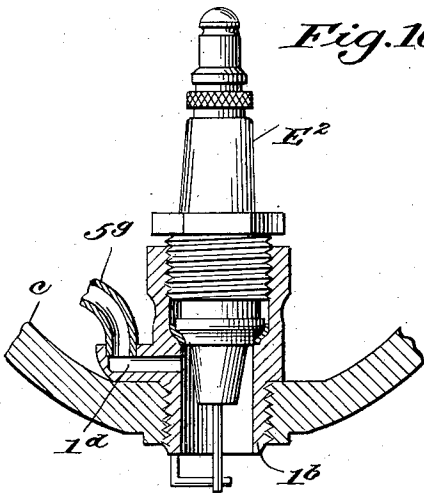
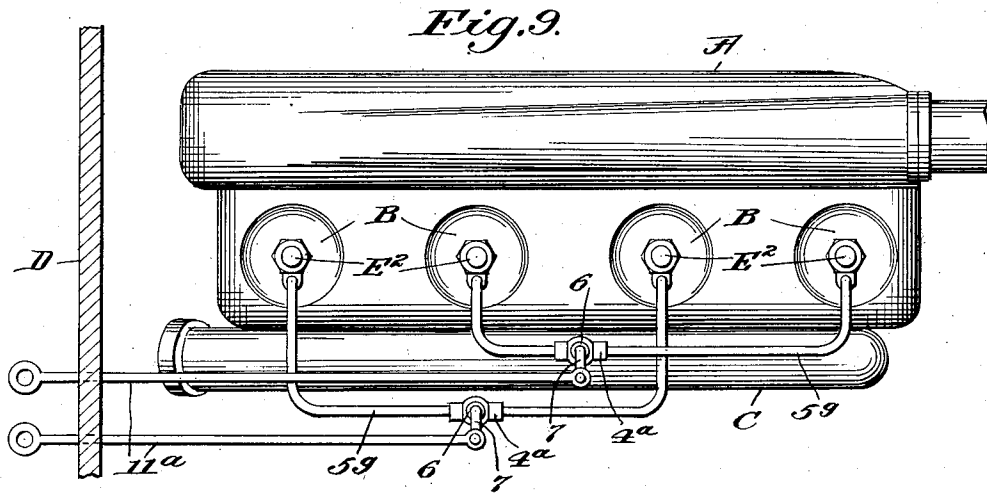
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2 Sheets-Sheet 2



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*Harvey C. Shamblin,*  
*By Wm. H. Babcock & Son*  
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Patented June 23, 1925.

1,543,646

# UNITED STATES PATENT OFFICE.

HARVEY C. SHAMBLIN, OF MIAMI, OKLAHOMA, ASSIGNOR OF TWO-FIFTHS TO HIMSELF, TWO-FIFTHS TO PAUL E. BRADLEY, OF JOPLIN, MISSOURI, ONE-TENTH TO RICHARD E. BARCOCK AND ONE-TENTH TO WILLIAM S. BARCOCK, BOTH OF WASHINGTON, DISTRICT OF COLUMBIA.

CLEANING AND WARMING SYSTEM FOR THE SPARK-PLUGS OF MULTICYLINDER INTERNAL-COMBUSTION ENGINES AND PARTS THEREOF.

Application filed February 2, 1925. Serial No. 6,416.

*To all whom it may concern:*

Be it known that I, HARVEY C. SHAMBLIN, a citizen of the United States, residing at Miami, in the county of Ottawa and State of Oklahoma, have invented certain new and useful Improvements in Cleaning and Warming Systems for the Spark-Plugs of Multicylinder Internal-Combustion Engines and Parts Thereof, of which the following is a specification.

This application is a continuation in part of my application filed September 21, 1923 for spark plug cleaning system, Serial No. 664,133, Series of 1915.

This invention relates to spark-plug cleaning and warming systems for multiple cylinder internal combustion engines, and comprises the spark-plugs of the respective cylinders in combination with suitable connections and other elements for the purposes of, without removing said spark-plugs, cleaning them, warming them, and avoiding the fire hazard heretofore constituting a serious objection to cleaning the spark-plugs without removing them as heretofore several times attempted. The invention further relates to sub-combinations of the system, and to various details or elements thereof.

The invention is especially of value for use in starting a cold engine by preserving the compression, cleaning all carbon and other foreign matter, oil and moisture from the spark-plugs, including the points thereof, and warming the spark-plugs, particularly the points thereof, and is intended also for use for a brief interval, of a few seconds or less, from time to time, as may seem desirable, to clear the plugs of carbon, gummy oil deposit and the like such as is formed or accumulates with undesirable rapidity and with resulting loss of efficiency in engines that, for any one of a number of reasons throw oil, or pump oil, or where the oil level has been raised, inadvertently or otherwise, to flooding stage.

In the use of spark-plugs in internal combustion engines it has long been known that with use they become coated and clogged with carbon so that after a time they become so coated and clogged that the carbon bridges the insulation and they will not spark, the rate of formation of such carbon

deposit depending largely on the type and condition of the particular engine and the type and quality of fuel used. However, even though such extreme condition be not present, the coating and clogging by carbon, even though not bridging the insulation, handicaps the functioning of the spark-plug in degree according to the degree of coating or clogging, and this is true also if there be any oily moisture upon the spark-plug electrode points. To cure the carbon condition it is necessary in some manner to clean the spark-plugs periodically, and this is done, practically universally, at present by removing the spark-plugs and scraping them, but such cleaning as thus performed is usually only done at long intervals and is an unpleasant job that requires real time. It has been proposed to, in various ways, direct the products of combustion outwardly through the spark-plugs, thus blowing them out, but such method has been found unsatisfactory for a number of reasons, among others, the following:

First, the greatest difficulty with fouled spark-plugs is encountered in starting up the engine when it is cold as the charge of fuel will not be warmed and vaporized properly by the warmth from the engine and the points of the spark-plugs will be cold and, further, the engine in cooling off will have condensed cold moisture, carrying oil and water, on the inner walls of the engine; second, such blowing outward through the spark-plugs at such time will result in driving this chilling oil and water into the spark-plugs and around the points thereof; third, such blowing outwardly into the atmosphere allows the full charge to escape on the compression stroke and so prevent the obtaining of the proper compression of the fuel charge as well as wasting much of the fuel; and, fourth, such blowing out when the charge does ignite results in a jet of flame and incandescent particles of carbon shooting out into the hood of the automobile, if used on an automobile engine, and dropping in the grease pan with consequent great danger of igniting gaseous vapors under the hood and oil and gasoline collected in the grease pan.

The primary objects of the invention, in

its broader aspects, are to provide a system or combination whereby a blast of gas under high compression may be directed through the spark-plug of one cylinder, through a connecting means or by-pass, through the outer end portion of the shell of a connected spark-plug of another cylinder into the central bore or chamber around the insulation of the central electrode of the latter spark-plug and will pass from there out of said latter spark-plug into the interior of the cylinder in which it is mounted, wiping off the inner face of the latter spark-plug, the insulation of its central electrode, and its electrodes, including their points, said blast carrying with it all carbon, grease and moisture that may have collected in said latter spark-plug or on the points thereof, and warming said latter spark-plug, and particularly the points thereof, which will usually be exposed on all sides to the action of said blast which may be warm by reason of its high compression, or may be products of combustion; to avoid appreciable loss of compression in the cylinders having the interiors of their spark-plugs temporarily in communication while being cleaned and warmed; and to avoid risk of fire by guarding against any flames or sparks being exposed to the atmosphere about the engine by jacketing or enclosing such products of combustion as may pass out of the respective cylinders through their respective spark-plugs.

Further objects are to provide for operation and control of the cleaning and warming system from the driver's seat of an automobile, or from a distance; to provide a construction which does not involve any modification of engine construction; to provide a construction which may be easily coupled up without any need for having any particular part of any spark-plug in any special relation to a similar part of any of the other spark-plugs of said engine; to provide a construction in which the spark-plugs may be removed and replaced as is now usual in engines not equipped with such cleaning and warming system with no parts of said system requiring therefore to be uncoupled or thereafter to be coupled to said spark-plugs; to provide a simple means or by-pass for, at will, providing communication between the interiors of two connected spark-plugs; to provide in the latter means a chamber having at least a portion laterally disposed with relation to its respective spark-plug and having communication with the chamber or bore thereof by means of an opening through the outer end portion of the wall thereof; to provide in said connecting means a portion loosely surrounding its respective spark-plug and adapted to be held in position by the latter and the top of the engine and together with said spark-plug and the adjacent portion of the engine defining a chamber or passage-way for the gases in passing from said spark-plug; to provide a spark-plug cleaning and warming system requiring only a very slight modification of any one of a variety of the usual known spark-plugs now on the market; to avoid all constructions requiring any radical departure in the construction of the spark-plugs employed from the spark-plugs now in common use for internal combustion engines, or in the manufacture or assembly of such spark-plugs; and to provide a combination of elements accomplishing the above objects and which shall be economical of manufacture and capable of application by even a novice simply by the removal of the original spark-plugs, the placing in position of the connecting means or by-passes, and then the insertion of the new plugs in the connector rings and screwing tight of said new spark plugs in the engine head, as usual.

In the accompanying drawings, illustrating but several of many possible embodiments of my invention by way of examples: Figure 1 represents a side elevation, broken away and partly in section, of a Ford automobile engine equipped with a spark-plug cleaning and warming system embodying my invention, the dash or instrument board being indicated in a very general way in section; Figure 2, a detail enlarged view, partly in section and partly in side elevation, of one by-pass made according to my invention, as applied in operation, one of the spark-plugs being shown in side elevation as mounted in the cylinder head in the sectioned part of the view, and being omitted in the other end of the connector or by-pass; Figure 3, a top plan view, partly in section, of the parts shown in Figure 2; Figure 4, a fragmentary detail sectional view of a modified form showing the spark-plugs as annularly grooved; Figure 5, a similar fragmentary detail sectional view of a modified form showing both the spark-plug and its ring or collar having opposed substantially plane surfaces in a vertical direction, but arranged at an interval from each other to form a chamber or passage between them; Figure 6, a side elevation, partly in section, of a slightly modified form of connector or by-pass; Figure 7, a side elevation, partly in section, of a still further slightly modified form of connector or by-pass; Figure 8, a side elevation, partly in section, of a still further modified form of connector or by-pass used in connection with a modified spark-plug construction; Figure 9, a top-plan view of a Ford automobile engine provided with a modified

form of a spark-plug cleaning and warming system embodying my invention, the dash or instrument board being indicated rather generally in section; and

5 Figure 10, a detail sectional view, broken away, of the head of one of the cylinders of said engine with a special spark-plug applied thereto and adapted to be connected by a tube, as illustrated, with a similar  
10 spark-plug.

Referring now in detail to the drawings, A designates the engine, B the cylinders thereof, C the exhaust pipe thereof, D the usual dash or instrument board, and E the  
15 spark-plugs for the cylinders respectively.

Each of the spark-plugs E screwed into the respective cylinders B has its shell 1 preferably provided with the usual annular shoulder 2 and immediately thereunder is  
20 provided with perforations 3, preferably four in number and preferably equidistantly spaced, as shown in Fig. 3, extending through the wall or skirt of said shell 1 immediately below the point where the tapered  
25 face of the insulation of the central electrode makes sealing engagement with the shell 1, thus being in communication with the interior of the cylinder B to which the spark plug is applied through the chamber or bore of said spark-plug E and permitting  
30 the egress or ingress of gases from or to the chamber or bore of the spark-plug E and its cylinder B through the said perforations 3.

The by-pass or connector 4, as shown in Figures 1 to 5 inclusive, is preferably one integral piece which may be formed up from sheet metal, or cast or stamped and bored, or cast and bored, or otherwise formed by  
40 any usual and known or developed mode of production. It comprises two end collar portions 5, and an intervening tubular portion having a conduit or passage extending through the inner faces of said collar portions 5 respectively, and a valve or  
45 turn-plug 6 is interposed in said tubular portion to open or close communication therethrough as desired, said turn-plug 6 being provided with an operating lever 7 formed with an eye 8, the levers 7 of all of  
50 the connectors or by-passes 4 of a system as applied on any particular engine being adapted to be connected together, as illustrated in Fig. 1, by a rod or bar 9 and co-  
55 operating screws or bolts 10 and their co-operating nuts respectively, and an operating rod 11 connected to the bar 9 extends rearwardly and upwardly through the dash D where it is preferably provided with a  
60 knob or equivalent 12 preferably within the convenient reach of the driver so that by a single pull on the knob 12 the driver may simultaneously temporarily turn all the valves or turn plugs 6 to open communication through each of the by-passes or con-

nectors 4 and, by thereafter pushing the knob 12 back to initial position, may simultaneously turn all the valves or turn-plugs 6 to close communication through each of the by-passes or connectors 4, the normal or usual position of the turn-plugs or  
70 valves 6.

Each collar portion 5 is adapted to receive its respective spark-plug E and to surround the same about the perforations 3,  
75 which will preferably be in a single plane as illustrated in Figure 3, and each collar may have an annular groove 13 formed in its inner face, as is well illustrated in Figures 2 and 3, to form a chamber or space  
80 between the opposed faces of the respective spark-plugs E and collar 5, the conduit of the by-pass 4 being in communication with the chambers so formed between each of its collar portions 5 and their respective spark-  
85 plugs E and forming, when its turn-plug or valve 6 is in open position, direct enclosed communication between the chambers or bores of said spark-plugs E and the interiors of their respective cylinders.

In assembling or applying on an engine, a suitable compressible, preferably soft metallic gasket 14 will preferably be interposed between each collar portion 5 and the top of engine A, and a similar gasket  
95 14 will preferably be interposed between the shoulder 2 of each spark-plug and the opposed face of its cooperating collar portion 5, so that when the respective spark-plugs E are screwed tightly into the top  
100 of engine A, as usual, gas-tight joints will be formed between the engine head and the respective collar portions 5 and between the collar portions 5 and the respective spark-plugs E. However, such gaskets or washers 14 are not essential. It is desirable that such joints should be gas-tight and this of course may be accomplished by employing suitable metallic or other material in the manufacture of the by-passes or connectors 4, or by smoothing the faces of the collar portions 5, or by any one of a number of other methods, or means.

Also, it is not essential that the inner faces of the collar portions 5 be grooved,  
115 but, as shown in the slight modification illustrated by Figure 4, the outer faces of the spark-plugs E may be annularly grooved as at 13<sup>a</sup> instead.

Or, as in the slight modification illustrated in Figure 5, the opening in each collar portion 5 may be made large enough so that as assembled in operative relation it will be at a slight distance from the opposed face of its corresponding spark-plug E to  
120 provide space or chamber 13<sup>b</sup> for the passage of gases from or to the perforations 3 in the shell or skirt 1 of the spark-plug E. Also, shouldered centering or spacing washers-15 may be provided in such case, though  
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such washers 15 are not essential, and they may be used in addition to the washers 14, or by way of substitution therefor, or may be omitted, or both washers 14 and washers 15 may be omitted, according as desired.

In the modification shown in Figure 6, instead of the structurally integral one-piece by-pass or connector 4, I provide a connector or by-pass comprised of a valve-casing, hub or coupling 4<sup>a</sup> provided with the valve or turn-plug 6 and receiving the adjacent ends of the tubular extensions 5<sup>b</sup> preferably integral with and leading off from the collar portions 5<sup>a</sup> respectively, the adjacent ends of the tubular extensions 5<sup>b</sup> preferably being welded in the part 4<sup>a</sup>, so that as a finished product it will be, operatively viewed, a single part provided with a rotatable valve or turn-plug 6. Otherwise, the construction and operation of this modified form are in all respects the same as above set forth.

In Figure 7 I illustrate a modification very similar to that shown in Figure 6 and differing therefrom in construction and operation only by having the collar portions 5<sup>c</sup> connected to the valve-casing or hub 4<sup>a</sup> by means of short curved tubular sections 5<sup>d</sup> which may have their ends externally screw-threaded and screwed into the ends of said hub 4<sup>a</sup> respectively and into their respective collar portions 5<sup>c</sup>, or may be welded in said hub 4<sup>a</sup> and their respective collar portions 5<sup>c</sup>, or otherwise suitably connected in known manner to their respective collar portions 5<sup>c</sup> and said valve-casing or hub 4<sup>a</sup>.

In all of the forms shown in Figures 1 to 7 inclusive the conduit portion of the connector or by-pass between the two end collar portions is off-set or struck up so that the collar portions may fit down into the depressions about the spark-plugs as found in the Ford engine and in a number of other makes of automobile engines now in use and well known.

In the modification shown in Figure 8 the collar portions 5<sup>e</sup> have short tubular portions 5<sup>f</sup> having their adjacent end portions externally screw-threaded and screwed into, or welded in, the adjacent ends, respectively, of the hub or housing 4<sup>a</sup>, the collar portions 5<sup>e</sup> and tubular portions 5<sup>f</sup> all being substantially in the same plane as illustrated, and a modified form of spark-plug E' is used, having its usual annular shoulder 2<sup>a</sup> of angular shape transversely of the spark-plug, having its shell or skirt 1<sup>a</sup> provided with a groove 13<sup>a</sup> immediately above said shoulder 2<sup>a</sup> and having perforations 3 at this point, and the upper part of the shell 1<sup>a</sup> is externally screw-threaded as at 16 to be engaged by a nut 17. In assembling, the spark-plug E' is screwed into the top of its cylinder of the engine A, a gasket 14 is preferably then slipped down around the spark-plug E', lying on top of shoulder 2<sup>a</sup>

thereof, the corresponding collar portion 5<sup>e</sup> is then slipped down on spark-plug E', preferably another gasket 14 is then positioned about the spark-plug E' on the upper face of said collar portion 5<sup>e</sup>, and then the nut 17 is applied and turned up tight. Otherwise, the construction and operation of this modified form are in all respects the same as in the form illustrated in Figures 1, 2 and 3.

In the modification illustrated in Figures 9 and 10 a spark-plug E<sup>2</sup> having its shell 1<sup>b</sup> provided with a nipple 1<sup>c</sup> having, extending from its outer face laterally through the wall of said shell, a passage or conduit 1<sup>d</sup>, which communicates with the upper portion of the central bore or chamber of said shell 1<sup>b</sup> approximately just immediately below the point where the tapered face of the insulation of the central electrode makes sealing engagement with the shell 1<sup>b</sup>, thus forming communication between the interior of its engine cylinder B and said passage or conduit 1<sup>d</sup>, is screwed into the top of each of the cylinders B of the engine A.

The wall of the outer portion of the passage 1<sup>d</sup> may be internally provided with screw-threads or otherwise suitably connected to the tubes 5<sup>g</sup>, which then have their other ends connected up in pairs by a valve-casing 4<sup>a</sup> in which is mounted a valve or turn-plug 6 having a lever 7 connected directly to an operating rod 11<sup>a</sup> extending through the dash D, the alternate spark-plugs being illustrated as connected in pairs, and there being an operating rod 11<sup>a</sup> for each pair.

Of course, any known suitable or desired valve construction or means or method of operation may be employed, for instance, a check-valve construction may be used in substitution for the simple turn-plug construction I have illustrated, and it may be such as to permit the passage of gas through the respective valves in one direction in one position of the valve or control means while preventing such passage in the reverse direction while the valve or control means is in such position.

Also, of course, the by-passes and the chambers or spaces about the spark-plugs might be formed in the cylinder heads, but this would be rather expensive and also would not be applicable to a large proportion of the great number of engines now in use, and even where applicable to engines now in use would involve the expense of a new engine head and the waste incident to the discarding of the old engine head.

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

1. In a cleaning and warming system for the spark-plugs of a multi-cylinder internal combustion engine, the combination of

spark-plugs respectively mounted in the respective cylinders, each said spark-plug having a perforation through the wall of its shell, with a conduit for forming communication between the interiors of a pair of said spark-plugs to alternately direct blasts of gas under high compression from one of said spark-plugs inwardly through the other spark-plug of such pair.

2. In a cleaning and warming system for the spark-plugs of a multi-cylinder internal combustion engine, the combination of spark-plugs respectively mounted in the respective cylinders, each said spark-plug having a perforation extending through its shell, with a conduit for temporarily forming communication between the interiors of a pair of said spark-plugs to alternately direct blasts of gas under high compression from one of said spark-plugs inwardly through the other spark-plug of such pair, and means for opening or closing such communication through said conduit at will.

3. The combination of a multi-cylinder internal combustion engine and spark-plugs respectively mounted in the respective cylinders thereof, each said spark-plug having a perforation extending through the wall of its shell, with means for connecting two of such spark-plugs together to form enclosed communication between the interiors of their respective cylinders to direct some of the products of combustion from one of said cylinders inwardly through the spark-plug of the other cylinder and into the latter.

4. The combination of a multi-cylinder internal combustion engine and spark-plugs respectively mounted in the respective cylinders thereof, each of said spark-plugs having a perforation through the wall of its shell, with means for connecting two of such spark-plugs together to form enclosed communication between the interiors of their respective cylinders to direct some of the products of combustion from one of said cylinders inwardly through the spark-plug of the other of said connected cylinders and into the latter, and valve means interposed in said means for opening or closing such communication at will.

5. In a cleaning and warming system for the spark-plugs of a multi-cylinder internal combustion engine, the combination of spark-plugs respectively mounted in the respective cylinders, each said spark plug having a perforation extending through its shell, with parts, in operative position, fixed with relation to the respective spark-plugs and having chambers respectively communicating with the bores of their respective spark-plugs through the perforations in the walls of the latter respectively, a by-pass for forming communication between two of said chambers to permit the passage of

blasts of gas under high compression from the interior of each of said spark-plugs to the interior of the other thereof, and a valve for opening or closing communication through said by-pass at will.

6. In a cleaning and warming system for the spark-plugs of a multi-cylinder internal combustion engine, the combination of spark-plugs respectively mounted in the respective cylinders, each said spark-plug having a perforation extending through the wall of its shell, with collars respectively surrounding the respective spark-plugs, each said collar having a portion of its face spaced from the opposed portion of the face of its spark-plug about the perforation in the latter to form a chamber communicating with the bore of said spark-plug, and material connecting said collars in pairs and forming a conduit providing for temporary direct enclosed communication between the said chambers.

7. In combination, two spark-plugs, each spark-plug having a perforation in the lateral wall of its shell, and means adapted to be associated with said spark-plugs to form enclosed direct communication between the interiors of said spark-plugs through the perforations in their lateral walls respectively.

8. In combination, two spark-plugs, each spark-plug having a perforation in the lateral wall of its shell, means adapted to be associated with said spark-plugs for temporarily at will forming enclosed communication between the interiors of said spark-plugs through the perforations in their lateral walls respectively, and controlling means for opening or closing such communication at will.

9. In combination, two spark-plugs, each spark-plug having a perforation in the lateral wall of its shell, and means adapted to be associated with said spark-plugs to form enclosed direct communication between the interior of said spark-plugs through the perforations in their lateral walls respectively, said means comprising two collar portions adapted respectively to surround said spark-plugs and having parts of their inner faces spaced respectively from the opposed portions of said spark-plugs about their perforations respectively, said means being formed to provide for enclosed communication between the interiors of said spark-plugs through the chambers formed by said spaced portions respectively and the perforations in the respective spark-plugs.

10. In combination, two spark-plugs, each spark-plug having a perforation in the lateral wall of its shell, and means adapted to be associated with said spark-plugs to form enclosed communication between the interiors of said spark-plugs through the perforations in their lateral walls respectively,

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said means comprising two collar portions adapted respectively to surround said spark-plugs and having their inner faces spaced respectively from opposed portions of said spark-plugs about their perforations respectively to provide a chamber between each collar and its spark-plug, each said chamber having communication with the interior of the respective spark-plug through the perforation in the wall of the latter, said means being formed to provide for temporary enclosed direct communication between said chambers to conduct a gas from one to the other, and a valve for opening or closing such communication at will.

11. For use in a cleaning and warming system for the spark-plugs of a multi-cylinder internal combustion engine, a by-pass having two collars adapted to respectively surround the respective spark-plugs and, in assembled relation, having portions of their inner faces spaced from the respective opposed faces of said spark-plugs, and being formed with a conduit extending from the inner face of such portion of one collar to the corresponding portion of the inner face of the other of said collars.

12. For use in a cleaning and warming system for the spark-plugs of a multi-cylinder internal combustion engine, a by-pass having two collars adapted to respectively surround the respective spark-plugs and, in assembled relation, having portions of their inner faces spaced from the respective opposed faces of said spark-plugs, formed with a conduit extending from the inner face of such portion of the one collar through the corresponding portion of the inner face of the other collar, and provided with a valve for opening or closing communication through said conduit at will.

13. The combination of two combustion

chambers of an internal combustion engine, and two spark-plugs mounted respectively in the walls of said chambers, each said spark-plug having a bore in communication with the interior of its combustion chamber, and each said spark-plug having a perforation in communication with its bore, with enclosed communication means for delivering gas from one spark-plug into the other.

14. The combination of two combustion chambers of an internal combustion engine, and two spark-plugs mounted respectively in the walls of said chambers, each said spark-plug having a bore in communication with the interior of its combustion chamber, and each said spark-plug having a perforation in communication with its bore, with means providing for enclosed communication between the perforations of said spark-plugs for delivering gas from one of said chambers to the other, and means for opening or closing such communication at will.

15. In a cleaning and warming system for a spark-plug of an internal combustion engine, the combination of a spark-plug mounted in its cylinder of the engine, and a tubular part mounted in a part of such engine and adapted to receive exhaust gases under compression therefrom, with a conduit extending from said tubular part to said spark-plug to form enclosed temporary communication between the interiors of said tubular part and said spark-plug, and a valve for controlling such communication.

In testimony whereof, I have signed my name to this specification at Miami, Ottawa County, Oklahoma this 28 day of January 1925.

HARVEY C. SHAMBLIN.