

April 21, 1925.

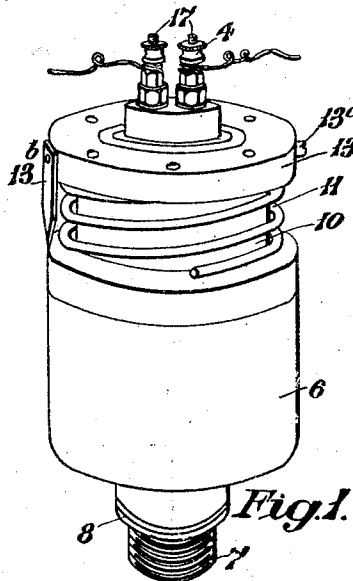
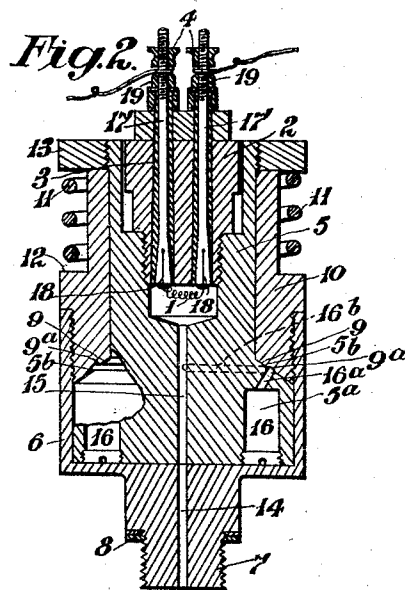
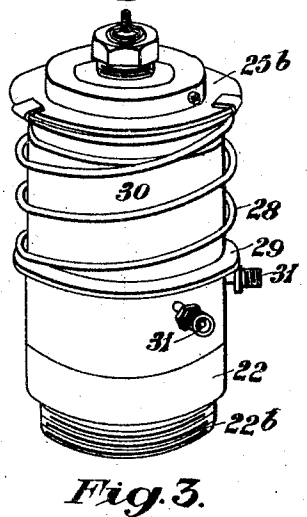
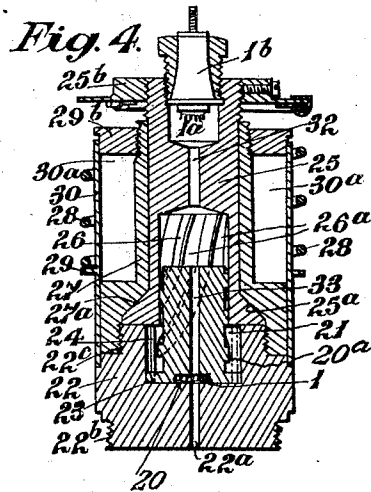
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1,534,368

IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES

Filed July 10, 1923

4 Sheets-Sheet 1



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April 21, 1925.

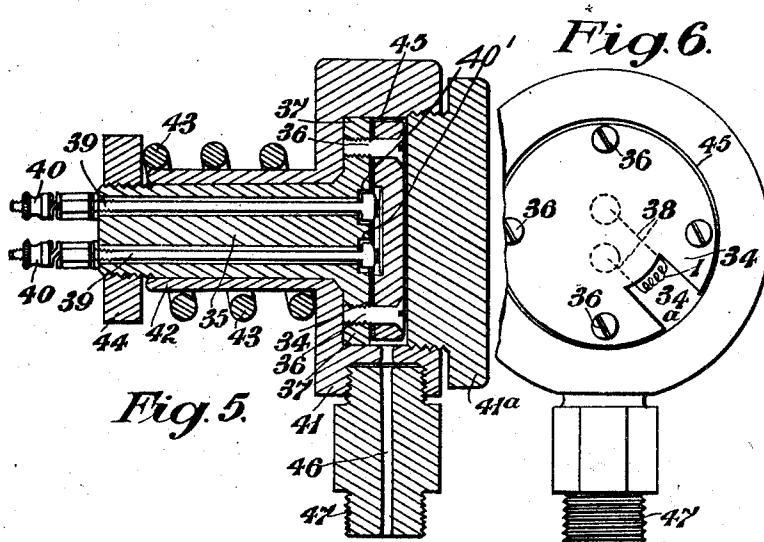
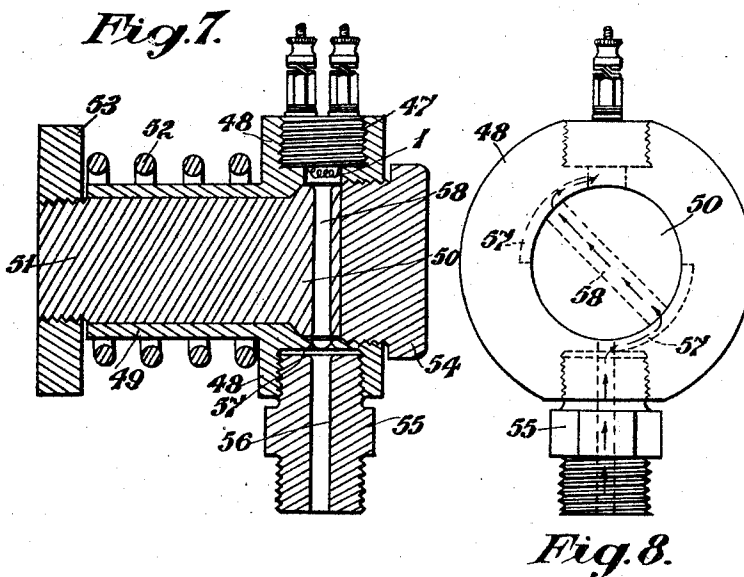
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IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES

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4 Sheets-Sheet 2



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IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES

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4 Sheets-Sheet 3

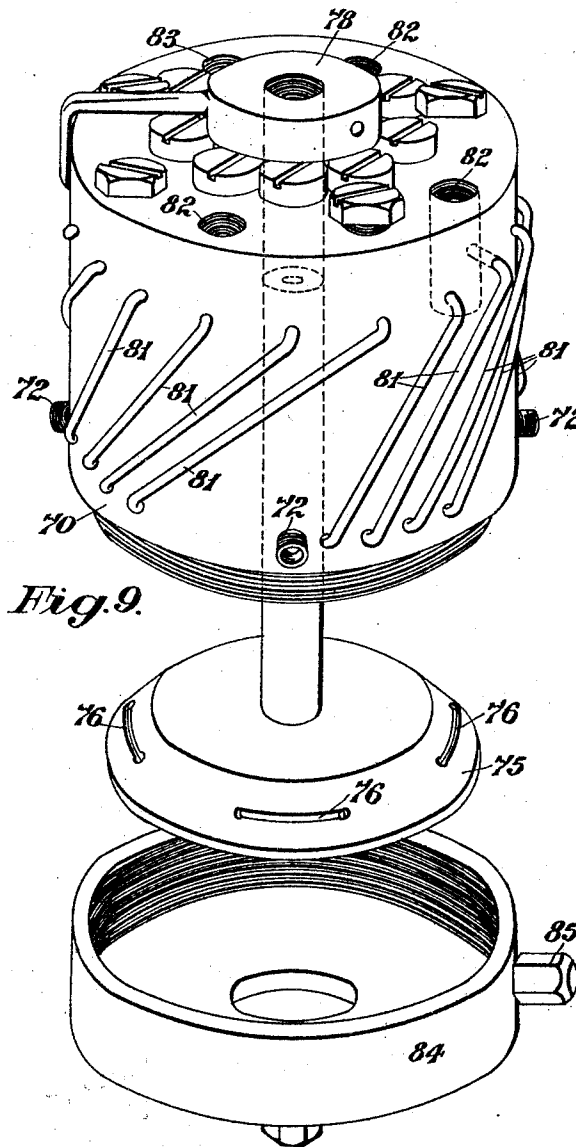


Fig. 9.

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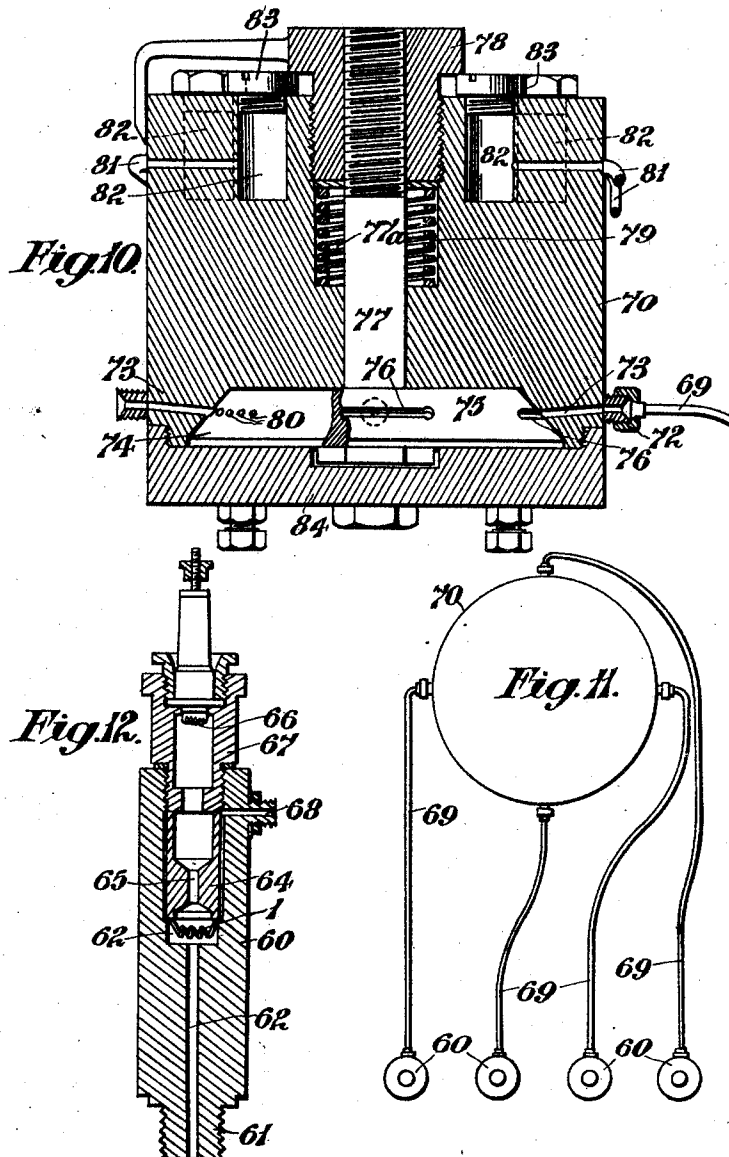
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IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE.

HOWARD E. FELLOWS, OF HAMMERSMITH, LONDON, ENGLAND.

IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

Application filed July 10, 1923. Serial No. 650,662.

To all whom it may concern:

Be it known that I, HOWARD EDWARD FELLOWS, subject of the King of Great Britain, residing at Hammersmith, W. 6, London, England, have invented new and useful Improvements in Ignition Systems for Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improved and novel system of ignition for internal combustion engines. The ignition systems at present in use employing sparking plugs which derive current from either a magneto or coil and accumulator systems are as is well known practically standardized in principle, and apart from the crude hot point ignition which was proposed in the pioneer stage of internal combustion engines and which in a modified form is now used for stationary heavy oil engines, for instance such as the Diesel crude oil engines, no serious attempt has been made to substitute the sparking plug ignition with a more reliable system which during the running of the engine does not rely upon the source of electric current to insure working. Chiefly, experiments and inventions relating to ignition systems have had for their object to improve the electrical systems which have been common practice for a long period, and these improvements generally add to the complexity of the system. The object of this invention is to introduce a system of ignition which will entirely dispense with the existing complicated electrical systems, which once an engine has been started will require no current whatever to ensure a correct working and even running of the engine, will be practically impossible under ordinary treatment to get out of order, will require no mechanical transmission from the engine, as in the case of a magneto, and which will be of a simple and extremely durable character.

Broadly according to the present invention ignition is effected by the location of means susceptible to heat in such manner as to be accessible by the combustible mixture delivered into the combustion chamber

or chambers of an internal combustion engine, such means deriving sufficient heat from the explosion of the combustible mixture to constitute a constant ignition point during the running of the engine, the moment of explosion being predeterminable by the adjustment of the volume of space within which the combustible mixture is compressed before ignition, whereby the moment at which the requisite compression of the combustible mixture for explosion may be advanced or retarded.

In the preferred embodiment of my invention means are provided whereby the firing of the engine may be selected to occur at predetermined moments so that ignition may be advanced or retarded. This may be effected by moving the actual firing point towards or away from the combustion chamber, or by leading the combustible mixture into variable accommodating means, so that the requisite pressure for ignition can be delayed or advanced according to the location of the ignition point or the amount of variable accommodating means employed; it being appreciated that a certain amount of pressure on the combustible mixture is essential before ignition will occur.

The initial explosion of each combustion chamber of the engine may be effected by an ordinary sparking plug; low tension current supplied to a resistance element so that a glow is generated, or current may be supplied directly to the point of ignition itself which will be of such a nature as to offer sufficient resistance to generate the requisite heat. Immediately subsequent to each such initial explosion the current may be, and preferably is, entirely cut off, the heat acquired by each ignition point from the explosion being sufficient to ensure a constant point of ignition.

The ignition element is preferably accommodated in a chamber which is detachable from the cylinder of an engine for instance by threading into the ordinary sparking plug or other threaded hole, whereby in existing engines the sparking plugs may be readily substituted.

Alternatively however the chamber may be cast integrally with its cylinder.

Figs. 1 and 2 are perspective and bi-sec-

tional elevational views respectively of a device adapted to be attached to a cylinder of an internal combustion engine.

Figs. 3 and 4 are similar views of a modification.

Fig. 5 is a bi-sectional elevational view of a further modification.

Fig. 6 is an end view partly broken away of the device shown in Fig. 5 but with an end cap removed.

Fig. 7 is a bi-sectional elevational view of a further modification.

Fig. 8 is an end view of Fig. 7 with an end cap removed.

Fig. 9 is a perspective view of a device adapted to operate as a common controlling member for a plurality of cylinders of an engine, such view showing parts detached for clearness.

Fig. 10 is a bi-sectional elevational view of the device illustrated in Fig. 9 and having the parts assembled.

Fig. 11 is a diagrammatic plan view illustrating the application of the modification illustrated in Figs. 9 and 10 and.

Fig. 12 is a bi-sectional elevational view of a suitable form of igniter for use with the device shown in Figs. 9 and 10.

Referring to Figs. 1 and 2 of the drawings a device is shown one of each of which is intended to be applied to each cylinder of an internal combustion engine. The point of ignition is shown as constituted by a small coil 1 of metal or alloy of good wearing and resistance properties, one very suitable material being that known in the trade as "Bright Ray Nichrome." This coil 1 is carried at the base of a metal member 2 which is threaded into a cylindrical central member 5 rotatably accommodated at its base in an outer cupped base 6 having an internal diameter which accommodates as a close fit the enlarged base 5^a of the rotatable member 5, a sloping or shallow truncated conical portion 5^b constituting the junction of the parts 5 and 5^a. The cupped base 6 is formed with a central downwardly depending threaded portion 7 adapted to be threaded into the ordinary sparking plug hole of a cylinder, packing rings or washers 8 being provided to ensure a gas tight fit.

The conical portion 5^b of the central member 5 seats upon a correspondingly shaped seating 9 formed on the lower edge of a collar 10 threaded into the base 6, a close engagement of such seating being effected by a coiled spring 11 interposed between an annular ledge 12 formed on the outside of the collar 10, and an annular ring 13 threaded on to the upper end of the central member 5 and secured by a set screw 13^a.

During the running of the engine the coil 1 receives sufficient heat from the explosions of the combustible mixture to constitute a constant ignition point, the gases reaching

the coil 1 through a narrow central passage 14 in the base 6 and a narrow passage 15 in the rotatable central member 5, a certain amount of pressure by the piston upon the gas being required to force the gas through such passages 14 and 15 so as to be somewhat compressed about the coil 1 before an explosion takes place, this pressure of course taking place during the compression stage of the cycle of the engine. Should it be required to retard the firing of the engine the moment at which the requisite pressure of explosion takes place will be delayed, and this is effected by leading the gas into other channels from the passages 14 and 15. This is carried out by providing in the central rotatable member 5 a plurality of chambers 16, which have small inlet holes 16^a but which are otherwise sealed. These holes 16^a lead in from the conical portion 5^b and are covered by a groove or channel 9^a cut into the seating 9 of the collar 10. In addition to the holes 16^a a hole 16^b is provided which passes straight through the member 5 bringing the interior 15 of such member 5 into communication with the channel 9^a. It will be apparent from the foregoing that any gas forced into the interior of the rotatable member 5 will now pass through the hole 16^b into the channel 9^a and can be led into a selected number of chambers 16, the selection of the number of chambers being effected by rotating the member 5; or if desired the chambers 16 can be entirely cut off by sufficiently rotating the member 5. To enable adjustments to be effected the ring 13 may carry a pointer 13^b, and the collar 10 be provided with suitable indications.

For the initial explosion in each cylinder the coil 1 is connected to a source of current, one suitable method of connection being that illustrated in Fig. 2 wherein the ends of the coil are connected in series to a pair of terminals or electrodes 17 the upper ends of which are connected in any suitable manner to the source of current. These electrodes 17 in the preferred embodiment each comprises a metal post tapered outwardly at the lower end and split as at 18 for a short distance to receive one end of the coil 1.

Threaded upon the upper end of the electrode is a nut 19 which when tightened will result in wedging the lower end of the electrode into the body 2. Each electrode is surrounded by insulation 3 and may be provided with a terminal nut 4.

Instead of leading the combustible mixture into chambers for varying the time of explosion as described with reference to Figs. 1 and 2, the coil 1 may be adjustably carried within a chamber which communicates with the combustion chamber of the engine so that by moving the coil 1 towards or away from the gas inlet of its chamber the time at which the requisite pressure for

explosion is required may be advanced or retarded. One method of carrying this into effect is illustrated by Figs. 3 and 4 in which the coil 1 is carried by a small cylinder 20 axially movable within a chamber 21 provided within a body 22 adapted to be threaded into a cylinder head. The base of the small cylinder 20 is flanged as at 23 to provide a close sliding fit against the walls of the chamber 21, and rotation of the cylinder 21 is prevented by one or more feathers or keys 24 engaging corresponding grooves in the flanged portion 23.

The cylinder 20 is moved axially in the chamber 21 by the rotation of a column 25 hollowed as at 26 for the accommodation of the cylinder 20, such hollowed portion being formed with a quick pitch thread 26^a which receives a correspondingly threaded portion 20^a formed on the outer surface of the cylinder 20, from which it will be apparent that rotation of the column 25 will result in axial movement of the cylinder 20 with resultant variation of the space beneath the flanged portion 23 for the reception of the combustible mixture.

The body 22 is axially apertured at 22^a to provide a passage for the combustible mixture from the engine cylinder into the chamber 21, and it may be cast integrally with the cylinder or threaded as at 22^b for threading into the cylinder, such threaded portion being of any suitable dimensions. The upper portion of the body 22 is threaded at 22^c to receive a sleeve 27 which constitutes the support for the rotatable column 25, the lower portion of such sleeve being coned on its inner surface as at 27^a to provide an abutment for a correspondingly coned portion 25^a formed on the column 25, a close engagement of such coned parts being assured by means of a coiled spring 28 interposed between a collar 25^b carried by the column 25 and a fixed rim 29 provided on the outer face of a jacket 30 surrounding the sleeve 27 to provide a water jacket for cooling, the space 30^a for the reception of water being closed at the top by a collar or annular ring 27^b secured on the upper end of the sleeve 27. Nipples 31 may be provided for the circulation of the water, such nipples receiving pipes leading to a convenient part of the engine containing cooling water.

If desired, for the initial explosion, the coil 1 may be connected to a suitable source of current, but preferably in this case the coil 1 glows solely as a result of the explosion of the combustible mixture, the initial ignition being effected by a separate coil 1^a carried by a body 1^b threaded into the upper end of the column 25, a passage 32 being provided in the column 25 for the passage of the combustible mixture from the engine combustion chamber, the small

cylinder 20 being also apertured as at 33 for the same purpose. The coil 1^a is connected to a source of current in any suitable manner, for instance similarly to the coil 1 as shown in Fig. 2.

A further modification in which the ignition point is movable for varying the time of ignition, is illustrated by Figs. 5 and 6. In this modification the igniter 1 is carried by a disc 34 secured to a rotatable column 35 by means of screws 36 or other suitable means, such column 35 being flanged as at 37 to provide a face against which the disc 34 is held. The coil 1 is accommodated in a small bay 34^a cut in the periphery of the disc 34, and it is connected in series by leads 38 to a pair of terminal posts or electrodes 39 passing through the column 35 and provided with terminal nuts 40 at their outer ends whereby they may be connected to a source of current. One or both of the opposing faces of the disc 34 and the base of the column 35 are recessed as at 40 to provide accommodation for the base heads of the electrodes 39 and the leads 38.

The flanged portion 37 of the column 35 has a close fit in a housing 41 which is formed with a sleeve 42 for the support of the rotatable column 35, a coiled spring 43 being interposed between a collar 44 carried by the column 35 and the housing 41 to ensure a close fit of the flanged portion 37 within the housing. The disc 34 is of a slightly smaller diameter than the flanged portion 37 so that an annular passage 45 is provided between the inner face of the housing 41 and the periphery of the disc 34, such passage communicating with an inlet aperture 46, such inlet aperture being formed in the wall of the housing 41 and a plug portion 47 threaded into said housing or cast integrally therewith and adapted to be threaded into the engine cylinder instead of the usual sparking plug.

The housing 41 is closed by a threaded cap 41^a.

It will be apparent that gases compressed in the combustion chamber of the engine will pass through the aperture 46 into the annular passage 45 and so reach the coil 1 with consequent ignition, variation in the timing of ignition being effected by rotation of the disc 34 to move the coil 1 away from or towards the inlet aperture 46. In this arrangement the body of the device is shown disposed in a horizontal plane, but it will be apparent that a slight modification would enable it to be disposed vertically if desired.

A somewhat similar arrangement to that illustrated in Figs. 5 and 6 is illustrated by Figs. 7 and 8, but in the latter arrangement the coil 1 is stationary and the combustible mixture is conveyed through a movable

passage. The coil 1 is carried by a body 47 and is connected in series to a pair of terminals or electrodes adapted to be connected to a source of electric current, in a manner similar to that represented in Fig. 2. The body 47 is threaded into an enlarged head 48 of a sleeve 49, such enlarged head accommodating as a close fit a valve 50 constituting one end of a column 51 rotatable within the sleeve 49, the valve 50 being securely held in its seating in the head 48 by the action of a coiled spring 52 interposed between a collar 53 threaded on to the column 51. The chamber in the head 48 within which the valve 50 is accommodated is closed by a cap 54 threaded therein.

Threaded into or cast integrally with the head 48 is a plug portion 55 adapted to be threaded into the engine cylinder, and an inlet passage 56 through said plug portion establishes communication between the interior of the head 48 and the combustion chamber of the engine, the interior of the head 48 being provided in its wall with a pair of diagonally opposite channels 57 extending partially around its inner circumference. Connecting these two channels 57 is a passage 58 extending diametrically through the valve 50. One of the channels 57 leads opposite the inlet passage 56, and the other channel leads into a chamber 59 within which is located the coil 1, whereby it will be apparent that combustible mixture passes to the ignition point via the inlet passage 58 in the valve 50 and finally through the remaining channel 57 to the ignition point. To advance or retard the moment of ignition the valve 50 is rotated by means of the column 51 thereby varying the effective length of the passage for the flow of combustible mixture. If desired the valve 50 may be provided with a pair of radial extensions which fit into the channels 57 to provide baffles to ensure the gas taking the shortest path to the ignition point. However it is preferred to dispense with these baffles so that the passage 58 may be moved out of alignment with the channels 57 to entirely cut off the coil 1 from communication with the combustion chamber of the engine.

It will be obvious from the foregoing that when any of the modifications described are employed with a multi-cylinder engine they will be connected by a suitable connecting rod or other convenient means for movement in unison, all being adjusted to produce the same effect upon each combustion or cylinder unit, i. e. the moment of explosion in each cylinder will take place at a common position of each piston. However if desired instead of employing an advancing

and retarding device for each cylinder, a device common to the whole of the cylinders may be employed, and one such embodiment is illustrated by Figs. 9, 10 and 11, a suitable ignition member for use in conjunction with this modification being illustrated in vertical section by Fig. 12.

This further embodiment is based upon the principle of the device shown in Figs. 1 and 2, but a device operating in a similar manner could quite easily be based upon the principle of operation of the Figs. 3 and 4, or 5 and 6 and be within the scope of this invention.

Dealing first with Fig. 12 the ignition member is constituted by a metal plug body 60 which may be cylindrical or polygonal, and is provided with a threaded base 61 adapted to be threaded into the ordinary sparking plug hole in a cylinder. A central aperture 62 is provided to establish communication between the combustion chamber and the ignition coil 1, located in a chamber 63. The ignition coil 1 is carried by a small metal cylinder 64 which rests upon a ledge constituting the junction of the chamber accommodating it and the chamber 63, such metal cylinder being bored axially as at 65 to provide a passage for the combustible mixture to an initial ignition coil 66 carried by a hollow body 67 threaded into the upper end of the plug body 60, such coil 66 being connected to a source of current which when the circuit is closed will produce the necessary glow in the coil 66 for the initial explosion, the circuit being broken after the initial explosion and the heat acquired from the explosion by the coil 1 being relied upon to provide the ignition point for subsequent explosions. In cases where two such ignition coils are used the initial explosion coil, i. e. the one connected to a source of current is preferably so located as not to be materially affected by the heat of the explosions.

Communicating with the hollow interior of the small metal cylinder 64 is a lateral by-passage 68 to which is adapted to be connected one end of a metal tube 69, the other end of such tube being connected to the metal body 70 of a controlling device 71 adapted to receive a similar tube 69 from each metal body 60 as illustrated diagrammatically in Fig. 11 which shows the device as applied to a four cylinder engine. The method of connection of the ends of the tubes can be as illustrated at 72 in Fig. 10 showing an ordinary gas nipple union. Each tube 69 communicates with an inlet aperture 73 bored in the body 70, such aperture leading into a shallow truncated conical chamber 74 which accommodates a correspondingly shaped valve 75 provided around its periphery with channels 76 and

held tightly on its seating by the action of a coiled spring 77^a disposed about a spindle 77 locked to said valve, and interposed between a collar or sleeve 78 threaded and locked on such spindle and the base of a chamber 79 formed axially in the body 70.

The peripheral channels 76 are adapted to establish communication between each inlet aperture 73 and a plurality of apertures 80 extending radially to the outer surface of the cylindrical body 70, and connected by means of tubes 81 to chambers 82 in the upper part of the body 70, such chambers being sealed by short studs 83.

From the foregoing it will be apparent that each combustion chamber of the engine may be brought into communication with one or more chambers 83 (four for each combustion chamber are shown in the drawings) by rotation of the valve 75 (by means of the collar 78) thereby enabling the moment at which the requisite pressure of the combustible mixture for explosion by the action of the heated coil 1 to be varied, as obviously the greater number of chambers 82 which are brought into communication with each combustion chamber the longer will the moment of explosion be delayed.

The apertures 80 and 73 and the channels 76 are so located in sets that the channels 76 each cover a corresponding number of apertures simultaneously thereby ensuring synchronous timing of the successive explosions.

The base of the body 70 is closed by a cap 84 threaded thereon, such cap if desired having a drain hole plug 85, should it be desired to pour a cleansing fluid into the device at any time.

The body 70 need not be a solid piece of metal as illustrated but may quite easily constitute a skeleton framework built up or cast, so as to avoid excessive weight and expense, and in practice it is preferred to adopt this practice.

To enable positions of the valve to be selected the collar may be provided with a pointer 86, the body 70 having indications thereon, each representing an aperture 80 and one for an entirely cut out position for fully advanced ignition.

In one modification (Figs. 3 and 4) a water jacket is shown, it will be apparent that such a provision can easily be applied to the other modifications, further it will be apparent that in all cases the means accommodating the ignition point may in the construction of engines be cast integrally with the cylinders. Instead of a water jacket air cooling ribs may be equally easily provided.

The modifications disclosed only illustrated by way of example some methods of carrying my invention into effect it being apparent that a great number of modifica-

tions may be effected without departing from the spirit and scope of my invention.

Although I have described my invention as applied to an ordinary type of internal combustion engine, it is obvious that it may be applied to any other type of internal combustion engine, for instance an internal combustion turbine.

The proportions shown in the drawings are substantially those which in practice I find give correct results.

What I claim is:—

1. Ignition means for explosive engines including a member provided with variable capacity explosive charge receiving means and with an inlet aperture to said means adapted to be connected with the explosion chamber of an engine, a heat retaining element effected by the amount of compression of an explosive charge contacting therewith to ignite the same, and means between said inlet aperture and said variable capacity explosive charge receiving means to vary the effective capacity of the latter.

2. Ignition means for explosive engines including a member provided with variable capacity explosive charge receiving means and with an inlet aperture to said means adapted to be connected with the explosion chamber of an engine, a heat retaining element affected by the amount of compression of an explosive charge contacting therewith to ignite the same, and valve means between said inlet aperture and said variable capacity explosive charge receiving means to vary the effective capacity of the latter.

3. Ignition means for explosive engines including a member provided with variable capacity explosive charge receiving means and with an inlet aperture to said means adapted to be connected with the explosion chamber of an engine, a heat retaining element affected by the amount of compression of an explosive charge contacting therewith to ignite the same, and rotatable means between said inlet aperture and said variable capacity explosive charge receiving means to vary the effective capacity of the latter.

4. Ignition means for explosive engines having plural explosion chambers, including a member provided with plural variable capacity explosive charge receiving means, one for each chamber, and with separate inlet apertures to each of said means, adapted to be connected with the explosion chambers of the engine, respectively, a heat retaining element associated with each explosive chamber and affected by the amount of compression of an explosive charge contacting therewith to ignite the same, and a single device common to the aforesaid plurality of variable capacity explosive charge receiving means effective to vary the capacity thereof.

5. Ignition means for explosive engines including a member provided with variable

capacity explosive charge receiving means and spring means holding said valve means
and with an inlet aperture to said means seated.
adapted to be connected with the explosion In witness whereof I have signed this
chamber of an engine, a heat retaining ele specification in the presence of two wit-
ment affected by the amount of compression nesses.
5 of an explosive charge contacting therewith
to ignite the same, rotatable valve means be-
tween said inlet aperture and said variable
capacity explosive charge receiving means
10 to vary the effective capacity of the latter,

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Witnesses:

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