

March 10, 1931.

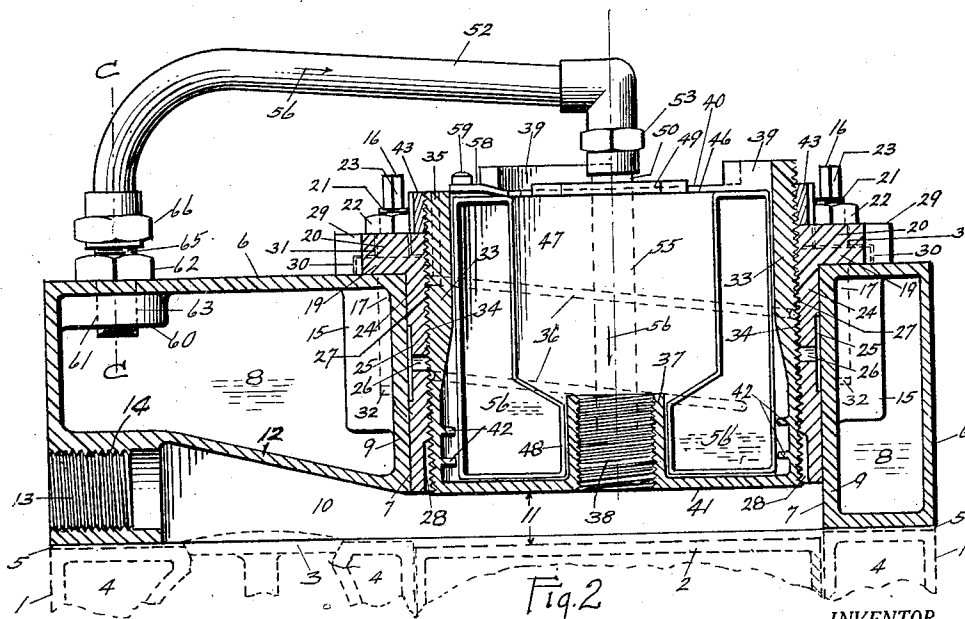
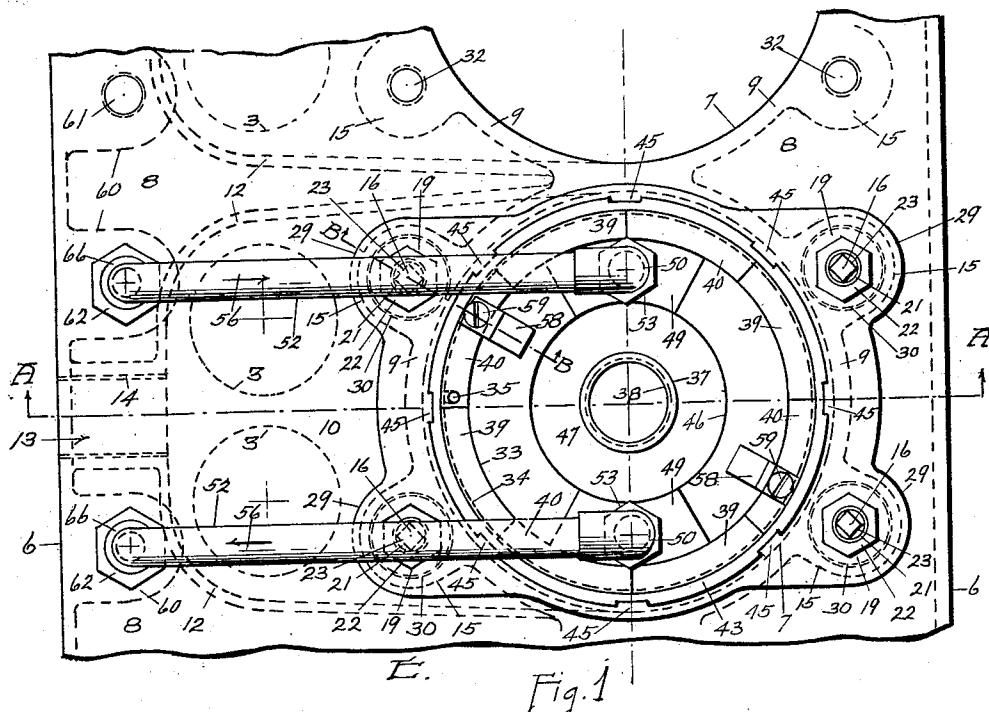
D. L. MARSHALL

1,795,309.

EQUALIZING COMBUSTION UNIT

Filed Oct. 5, 1928

4 Sheets-Sheet 1



Witnesses
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4 Sheets-Sheet 2

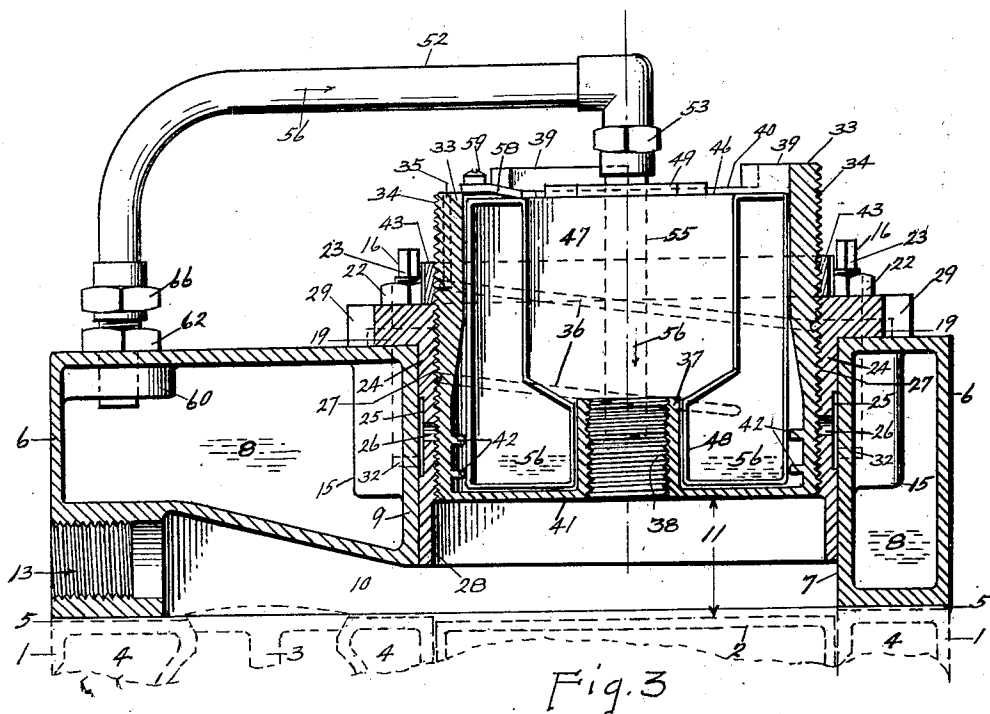


Fig. 3

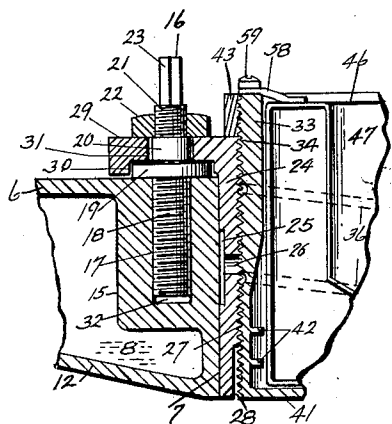


Fig. 4

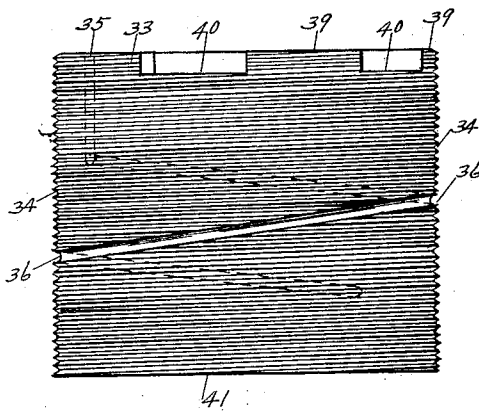


Fig. 5.

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4 Sheets-Sheet 3

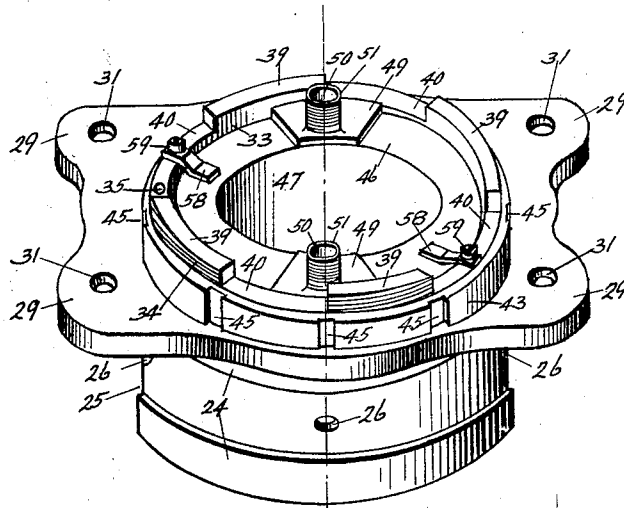


Fig. 6.

Fig. 7^a.

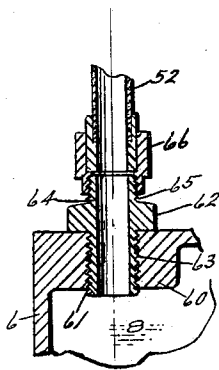
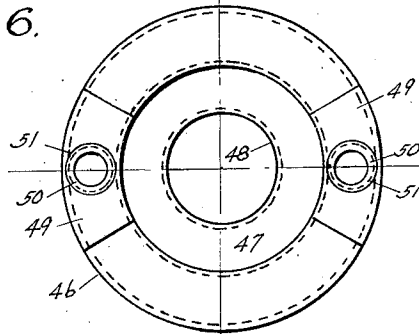
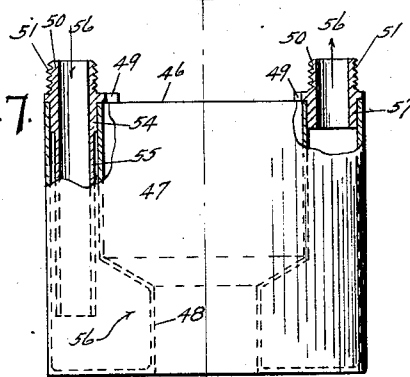


Fig. 8.

Fig. 7.



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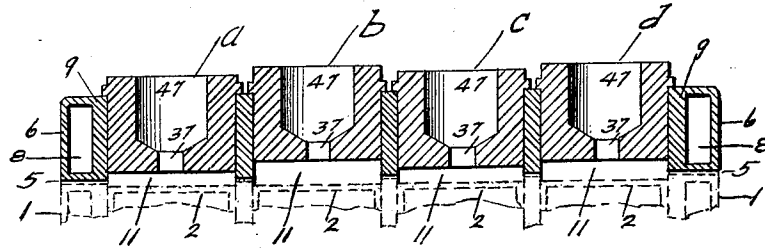


Fig 10.

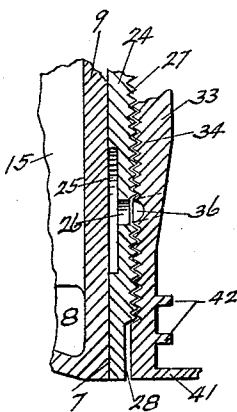


Fig. 9.

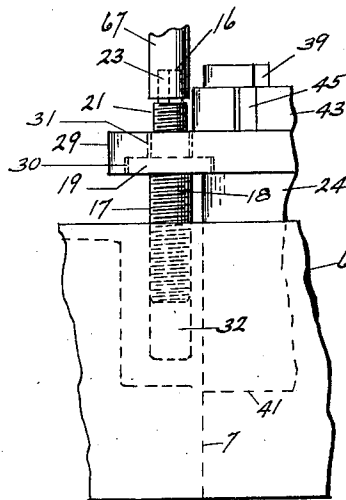


Fig. 11.

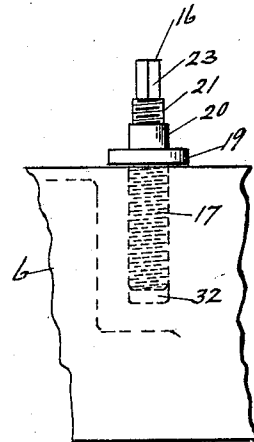


Fig. 12

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UNITED STATES PATENT OFFICE

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EQUALIZING-COMBUSTION UNIT

Application filed October 5, 1928. Serial No. 310,619.

My invention relates broadly to a cylinder head unit, adaptable to combustion engines. Its full intent being to provide a variable control device, built in the cylinder head, adjacent to the reciprocating piston in order to equalize the compression areas for single or multiple cylinder engines, in such a way that the regulation of each unit is independent of each other, for the purpose of producing increased power, balance, flexibility and rhythmic smoothness.

The unit being self-contained, its adjustable compression head can be re-set to any desired area from an external position while the motor is running or idle. Provides single or dual ignition, separate water circulation for the control of the heat, and can be removed as a unit by the removal of four release studs, for quick inspection or cleaning when the engine is idle. When removed it leaves an opening in the cylinder head of the same diameter as the complete unit, providing ease of cleaning piston and valves without removing the cylinder head or any of its connections. Replacements can be made without changing its original setting.

The special feature of this device, being the flexible degree in which the combined units can be adjusted to operate under any desired combustion ratio for various load conditions. As its operation is independent of the general design or mechanical features incorporated into any standard internal combustion engine.

In order to describe the various parts, I will now refer to the accompanying drawings which illustrate a unit, embodying the features of my invention, with the same characters representing the same part on various sheets, and in which—

Figure 1 is a plan view showing a part section of a cylinder head illustrating a unit assembled for operation, and the opening left in the cylinder head when the unit is removed.

Figure 2 is a vertical section of Fig. 1 on line A—A showing the relative parts of the unit, when the adjustable combustion head is in its lowest position.

Figure 3 same as Fig. 2 showing the relative parts of the unit when the adjustable

combustion head is in its elevated position to change the combustion chamber's volume.

Figure 4 is a vertical section on line B—B, Fig. 1, showing the detail construction of the cylinder head bosses supporting the release studs which securely fastens the unit to the cylinder head and remove it when desired.

Figure 5 is an elevation of the adjustable combustion head only, showing the thread and oil groove around its periphery, and the oblong teeth on the top rim of same by which adjustments are made.

Figure 6 is a perspective from the top showing the assembled unit, as it appears after being drawn from, or ready to be returned to the cylinder head opening so as not to change the setting.

Figure 7 is an elevation of the circulating water container, with part section of the inlet and outlet sides of the water bosses to illustrate the flow of the water in absorbing the heat, as the water passes through the container, to and from the cylinder head connections.

Figure 7—A is a plan view of Fig. 7 showing position of water connections at the top, also cylindrical openings for spark plug, and spark plug boss.

Figure 8 is a vertical section of a portion of the cylinder head showing a nipple connection for one end of the flexible water tube, which connects the water space in the cylinder head with the connections on the water container, so as to provide means in carrying the circulating water to and from the container.

Figure 9 is a part vertical section showing the wall of the cylinder head opening, the wall of the housing member with its shallow angular groove to collect oil and carbon as a secondary method in sealing the combustion gases, a thread on its inner surface with which the corresponding thread on the wall of the adjustable head operates in making adjustments for the combustion areas.

Figure 10 is a vertical longitudinal section of a four unit cylinder head, illustrating the variation of adjustments for the combustion areas, and the lip around the side of the top

flange for sealing the combustion gases at the top of the cylinder head.

Figure 11 is a part elevation at E, Fig. 1, showing the unit being drawn out of the cylinder head by the action of the release studs without changing its adjustments.

Figure 12 is a part elevation at E, Fig. 1, showing one of the release studs in position for receiving the assembled unit.

Fig. 1 shows such a unit in plan view, assembled for its operation and can better be described in connection with—

Fig. 2 which is a vertical cross section of Fig. 1, on line A—A, dotted lines showing a typical cylinder block 1, a reciprocating piston in its top center position for firing 2, intake and exhaust valves 3, cylinder block water jacket 4, cylinder head gasket 5. These parts and their function being unchanged and well known it is not necessary for them to be described here as they are shown only to help illustrate my invention. Cylinder head casting 6, being cast in one piece in the regular way, (all unnecessary parts not shown) provides a cylinder opening 7, for each unit separated from the water jacket 8, by the wall 9, extending upward through the cylinder head 6, of the same diameter as the piston 2, or any diameter as may be required. Space 10, being the gas passage between the intake and exhaust valves 3, and the compression area 11, is separated from the water space 8, by the wall 12. Opening 13, is provided with a thread 14, for a compression gauge or ignition on the valve side of the cylinder head 6, and opens into the gas passage 10.

Four separate bosses 15, are cast integral with the cylinder head 6, and the wall 9, extending down into the water space 8, from the top with a threaded hole 32, to receive and form a support for the lower part of the four release studs 16, which hold the assembled unit in place. Operation for all four studs 16, being the same, description covers Fig. 4, which is a vertical section on line B—B, Fig. 1, in which release stud 16, has an extension 17, at the bottom with a thread 18, for threading into the holes 32, in bosses 15. Above the lower extension 17, a round collar 19, and a bearing surface 20, both being a part of the stud 16, and having a finished surface to revolve in the corresponding recesses of the lugs 29, of the compression head housing 24. Above the bearing surface 20, is a short thread 21, for the lock nut 22, for holding housing 24 of the unit stationary. The upper end of the stud 16 having a square shank 23, for a socket wrench 67 Fig. 11, is used in turning the studs 16, when jacking the assembled unit out of the cylinder head 6, for removal of the complete unit. Grouping of the figures will better describe some of the relative parts of the assembled unit, and they will follow in the manner of their assembly.

Figs. 2-4, being sectional views together

with Fig. 6 a perspective view of the unit from the top, shows the compression head housing as the supporting member for the complete unit, its lower portion having a vertical cylindrical wall 24, forming a horizontal surface at the top into the four lugs 29. Wall 24, around its outside periphery conforms to the cylinder opening 7, assembles with it and has a finished surface for a sliding fit, with a wide, shallow angular groove 25, around its outer surface to act as a sealing space for the gases and a reservoir to collect oil from the lubricating oil groove 36 Fig. 9. The inner surface of 24, having a female thread 27 Figs. 4-9, extending from the top down to the recess 28, for supporting its adjacent member 33. Recess 28, at the bottom of the inner wall surface reduces its metal thickness and provides a smooth surface for the action of the gases at this point when the adjustable compression head 33, is lifted from its low position as shown in Fig. 3. The four top surface lugs 29 Figs. 4-6 each have a recess 30, opening on the under side to receive the round collar 19, and an opening 31, bored central with it, directly above for receiving bearing surface 20, on release stud 16.

Adjustable compression head 33, Fig. 4 is supported by wall 24. Its outside periphery has a male thread 34 Fig. 5, running down its entire length which engages the thread 27 Fig. 9. An oil feed 35, from its top exposed surface or rim runs down a suitable distance Fig. 3 in a vertical manner, until it intersects the oil groove 36, which in turn runs around its periphery on a spiral for a suitable distance to lubricate the threads 27 and 34.

Wall 33, being closed at the bottom by the horizontal wall 41, except at the center where it forms the vertical internal boss 37, which has a female thread 38, provides for the insertion of the main ignition spark plug which travels with the head so that the compressed gases are always fired from a top central position, regardless of the variation of the area 11, by any change of its position as shown by Fig. 3. The top or rim of the wall 33 Fig. 6, has four projecting surfaces 39, and four recesses 40, each alternating with each other every forty-five degrees of its circumference, forming oblong teeth for the use of a spanner wrench in raising or lowering same. It is heaviest at the top, tapering toward its lower wall 41, to reduce the metal thickness and has two internal ribs 42, for strength and a bearing surface to prevent separate water container 46, from vibrating.

Adjustable compression head lock ring, 43 Fig. 3, being a sectional view, showing the adjustable compression head 33, in an elevated position. Lock ring 43, maintains the same relative position for locking as shown by Fig. 2. Its function being to hold the adjustable compression head 33, from turning

after adjustments are made. It is cylindrical, having a female thread on its inner surface corresponding to the male thread 34, on the adjustable compression head 33, assembles over its upper portion Fig. 6, above the top surface of the compression head housing 24, and bears against it when locked in place. Around its periphery are a series of suitable angular notches 45, for holding the jaws of a spanner wrench in releasing or locking same for adjustments.

Circulating water container 46 Fig. 6, being a perspective view from the top, Fig. 7 being a plan and elevation with water connections in part section for better illustration. This container being a closed vessel of copper or other suitable metal to provide rapid transmission of the heat from the unit to the circulating water 56, is cylindrical in shape and conforms largely to the inside surface and supported by the adjustable compression head 33.

Water container has large recess 47, at its center extending from the top downward, tapering at its base toward the center to encircle the spark plug boss 37, by the recess 48, and resting Fig. 3, on the inside of the lower wall 41, of the compression head 33. Its outside vertical surface is straight forming a bearing against the heavy portion of the upper wall, and the two ribs 42, on the lower part of the adjustable compression head 33. The top surface Fig. 7, has two connections for the circulating water of which flange 49, conforms to the circular lines of the top of 46, with an external boss 50, having a male thread 51, for water connections of the flexible tubes, and the fittings 53. An internal boss 54, from the under side of the flange 49, has a tube 55 attached to it, extending down a suitable distance from the bottom, to carry the cooling circulating water to the lowest part as shown by the arrow 56, so that it will circulate around the recess 48, absorbing the heat and rise to the return boss 57, and back through the return flexible tube 52, to the cylinder head 6. Return boss 57, being the same as the inlet side except tube 55, is not required. The water container is held in place by the weight of both flexible tubes 52, water 56, and the two spring clamps 58, which are secured to the top rim of the adjustable compression head 33, by the screws 59.

Fig. 8 being a vertical section on line C—C, Fig. 2, in which a portion of the cylinder head 6, has internal bosses 60, each with a threaded opening 61, for the attachment of the nipples 62, which in turn has a threaded boss 63, for threading into the openings 61. Its upper portion forming the boss 64, with a thread 65, for connection 66, on the flexible metal tubes 52. Both feed and return tubes 52 and connections for attachments of the cylinder head 6, and container 46, are of any

suitable type, and shown here for completing the water circulation between the cylinder head and the unit, and are not claimed as a part of this invention.

Fig. 9 being a part enlarged section of the vertical walls of the unit to illustrate the oiling of the cylinder opening 7, shows cylinder wall 9, compression head housing wall 24, and adjustable compression head wall 33. As oil feeds down the spiral grooves 36, around the periphery of 33, it will come in contact with and feed through one or more of the four ports 26, into the angular groove 25, of the wall 24, distributing oil on the face of cylinder opening 7, and form an oil seal at the same time.

Fig. 10 being a vertical longitudinal section of a four unit cylinder head, parts are blocked in merely to illustrate how a series of units, *a—b—c—d*, would vary in the different settings to provide an even pressure for the areas 11, this is shown by placing all the pistons at a top center position for illustration.

Fig. 11, part elevation of a unit at E, Fig. 1, showing the release stud 16, jacking the unit out of the cylinder head 6, herein later described. When brought to sufficient height the unit can be lifted from the top of the studs 16, by hand, leaving studs 16, in hole 32.

Fig. 12, part elevation at E, Fig. 1, showing one of the release studs 16, re-placed in position to receive the unit upon being re-placed in cylinder opening for re-assembly.

Method of operation

Engine cylinder heads are designed with a fixed area or a pre-determined pressure, which acts direct on the reciprocating piston, the variation of the piston fit provides a leakage in the various cylinders, thus varying the power balance of each. To overcome this I have provided the cylinder head construction with a series of adjustable units assembled in suitable openings that will equalize this condition from an outside adjustment, so that the ultimate working areas give an absolute balance to the exploding gases for each, Fig. 10, regardless of the variation of the clearance above the piston.

Referring to Fig. 2, cylinder head casting being of standard one piece design, with the exception that additional provision is made in the cylinder head for the four bosses 15, and the wall 9, which forms the cylindrical opening 7, for the installation of the assembled unit of which the major parts are the compression head housing 24, adjustable compression head 33, adjustable compression head lock ring 43, and the circulating water container 46, all being supported by each other in turn as before described.

Drawings illustrate a standard side pocket type of head, in which the gases are passed through the valves 3, and space 10, to area

11 in the regular manner for firing. The volume of this area is controlled by the distance between the top of the piston 2, and the under side of the wall 41, which can be of any desired shape.

For describing its operation: Let it be assumed the area 11 Fig. 2, is at variance or working at a higher pressure per square inch than its adjoining cylinders. For resetting to bring it to the same pressure, remove the two screws and spring clips 58 and 59, so that the circulating water container 46, being smooth and of sufficient clearance around its outside walls and base, will be free to remain stationary in the adjustment head 33, as it is held against turning by the two flexible water tubes 52, which are left connected to 46, and 6.

With a spanner wrench inserted into the angular grooves 45, loosen and back up lock ring 43, two or three turns, to free the adjustable compression head 33. The area 11, is controlled only and entirely by the movement of the adjustable compression head 33, and is adjusted by placing a spanner wrench in the external oblong extensions 39, and recesses 40. Turning same to the left or right will move the adjustable compression head 33, up or down to any fraction of an inch by the action of the stationary thread 27 on 24, and the adjusting thread 34, on 33, bringing 33, to any desired position Fig. 3, carrying container 46, and the spark plug in boss 37, with it, maintaining both in the same relative position as before.

Adjustments can be made with the engine in operation, as the length and fit of the threads 27 and 34, are sufficient to control the force of the exploding gases. With adjustments made, re-set the lock ring 43, replace spring clips 58 and screws 59, and the unit has been re-set and again locked in place. A small variation in increasing or decreasing the volume makes a marked difference, the large increase of area shown between Fig. 2 and 3, being for illustration only.

Method of adjustments for all units being the same, any number can be operated at one time until the proper operation is attained.

An alternate method of adjustment for closer results can be obtained with the engine idle, by placing a pressure gauge in opening 13, in place of the spark plug, and proceeding as above described, turning the engine over by hand and reading the pressure on the gauge, thus setting each unit to a perfect and exact pressure per square inch as desired, varying each as required Fig. 10, to obtain a proper balance.

The complete water circulation comes up from the cylinder block 1, through the standard system of ports, enters the space 8, passes through the nipple 65, Fig. 8, as indicated by the arrow 56, into the flexible tube 52, and

travels in a transverse direction Figs. 1 and 2, to the unit connection 53, through the boss 50, Fig. 7, and tube 55, to a point close to the bottom of 46, circulating around opening 48, then up to the outlet boss 57, on the return side to connection 53, through flexible tube 52, and emptying back into the space 8, of the cylinder head 6.

To remove the assembled unit, without changing or interfering with its adjustments, as for inspection or cleaning: After draining off a portion of the water in the cooling system to bring it below the unit level, remove connections 53, on both feed and return side of the unit water container 46, remove the lock nut 22, on each of the four release studs 16, Figs. 4 and 11.

Place a socket wrench 67, on the square shank 23, on the upper end of the stud 16. Turning each one in turn, a half turn will cause the part 17, to lift out of the threaded hole 32, by action of the thread 18, pressing the round collar 19, up against the lugs 29 in the recess 30, and opening 31. Thereby jacking the complete unit from its place in the cylinder opening 7, leaving an opening the full size of the unit for cleaning the valves and piston as shown in Fig. 1. To re-set the unit, replace the studs 16, in the threaded holes 32, Fig. 12. Placing the assembled unit in the opening 7, pressing it down into place with the four studs 16, passing through the opening 31, and over collar 19, re-set lock nut 22. Replace connections 53, and the unit is reassembled.

Having thus described the nature of this invention from practical working test, and the best descriptive means I know of—I claim:

1. An equalizing combustion unit placed in a suitable opening of the cylinder head for an internal combustion engine as herein described, said opening supporting an adjustable combustion unit having a stationary housing member combining a top flange surface anchored substantially to the cylinder head by release studs, providing a tight joint against the leakage of combustion gases, a cylindrical wall extending down from the top flange, the outside surface of which has a shallow angular groove of suitable dimensions interposed between the top flange and the bottom edge, to provide a space for the accumulation of oil and carbon to act as a secondary means of sealing the cylinder head wall against the combustion gases, the inner surface on the cylindrical wall having a thread extending from its top flange surface downward a suitable distance which supports the adjustable combustion head and permits adjustments thereto, thus constituting a main supporting member of the unit, which does not move when adjustments are made to vary the combustion area, but does permit the assembled unit's removal and replacement in

the cylinder head opening without changing the area.

2. An equalizing combustion unit placed in a suitable opening of the cylinder head for an internal combustion engine as herein described, said opening supporting a housing member, controlled by suitable release studs, embodying an adjustable combustion head for equalizing the compression volume, having a cylindrical wall open at the top, a thread and an oil groove around its periphery, actuated with its adjacent thread from an external position by a series of oblong teeth, a wall across its base of any suitable shape, having an internal boss at its center for ignition plug support.

3. An equalizing combustion unit placed in a suitable opening of the cylinder head for an internal combustion engine as herein described, said opening supporting a housing member, an adjustable combustion head embodying an adjustable locking ring having a thread on its inner surface which acts on the thread around the periphery of the adjustable combustion head, being above the top flange surface of the housing member and bears against it when locked in place, and having a number of grooves around its outside surface providing means for the use of a suitable tool to loosen and lock same in making adjustments to the adjustable combustion head for equalizing the compression area.

4. In an equalizing combustion unit placed in a suitable opening of the cylinder head for an internal combustion engine as herein described, said opening supporting an adjustable combustion unit having as its major parts, a housing member, an adjustable combustion head, and a circulating water container arranged in the form of a closed vessel providing a means for the rapid transmission of the heat to the water for cooling the unit, the outside and bottom surfaces conforming largely to the interior walls of, and supported by the adjustable combustion head, a central exposed surface forming a recess at the center providing a space for an ignition plug to the unit, a top surface having two circulation water connections each with an external boss as a means of connecting the flexible water tubes, one running from a suitable connection on the cylinder head to the inlet side of the circulating water container, one from the return outlet side of the circulating water container back to a suitable connection on the cylinder head, thus completing the water circulation by means of the flexible tubes between the water space in the cylinder head and the circulating water container of the unit, means for holding the circulating water container in position by two or more spring clamps which are securely fastened at suitable points at one end on the top rim or surface of the adjacent member by screws,

the free end resting firmly on the top surface of the water container forcing this member down on the inner wall of the adjustable combustion head to absorb the heat.

5. An equalizing combustion unit placed in a suitable opening of the cylinder head for internal combustion engine as herein described, said opening supporting an adjustable combustion unit having as one of its members a circulating water container for absorbing the heat of the unit, arranged in such manner as to provide a means for holding same in a non-turning position by two flexible water tubes during changes to the position of the adjustable combustion head, one end of each being connected to the circulating water container, the other anchored at a suitable point on the cylinder head independent of the unit, and by being released from the holding action of the spring clamps attached to the top surface of its adjacent member, thus permitting the smooth surface of the adjustable compression head to rotate around the smooth surface of the circulation water container without turning or interfering with the flow of the circulating water operating the unit for adjustments.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature.

DAVID LEWES MARSHALL.