May 18, 1937. L. J. McKONE 2,080,495

SPARK PLUG COOLING DEVICE

Filed June 22, 1935 2 Sheets-Sheet 1

Fig. 1

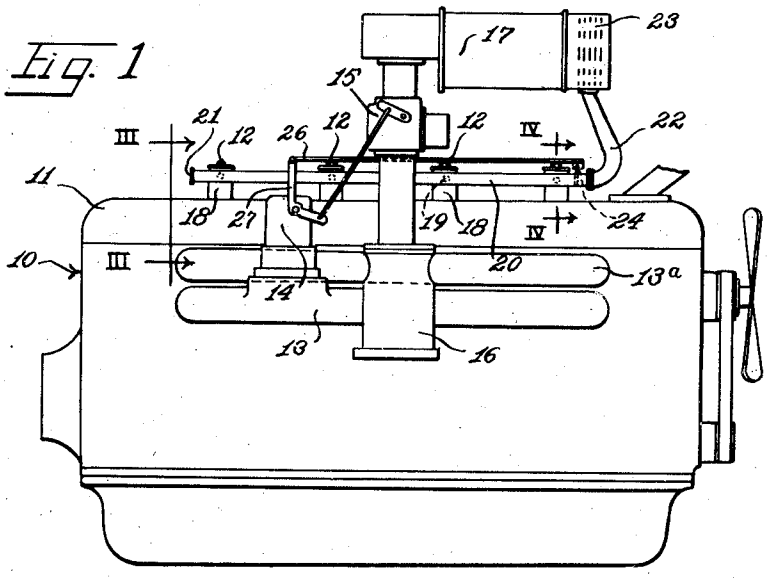


Fig. 2

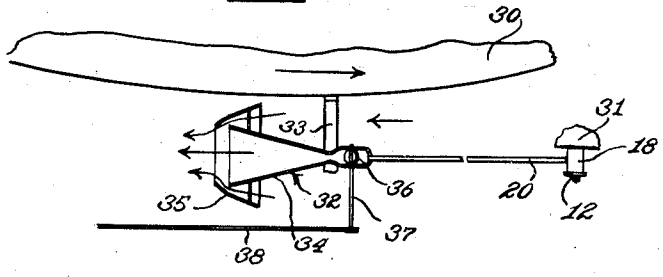


Fig. 6

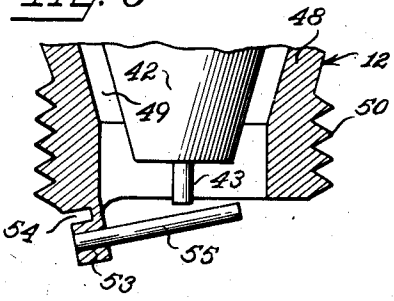


Fig. 7

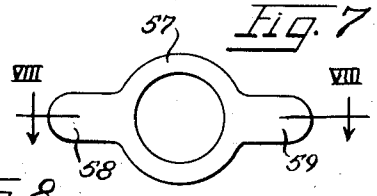
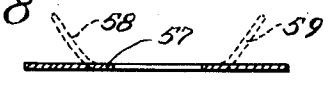


Fig. 8



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Fig. 3

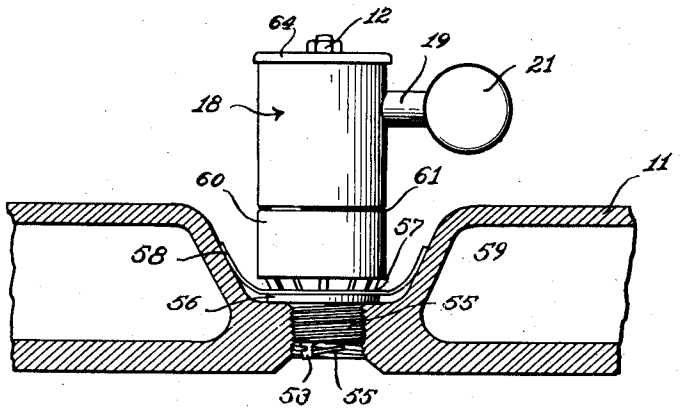


Fig. 4

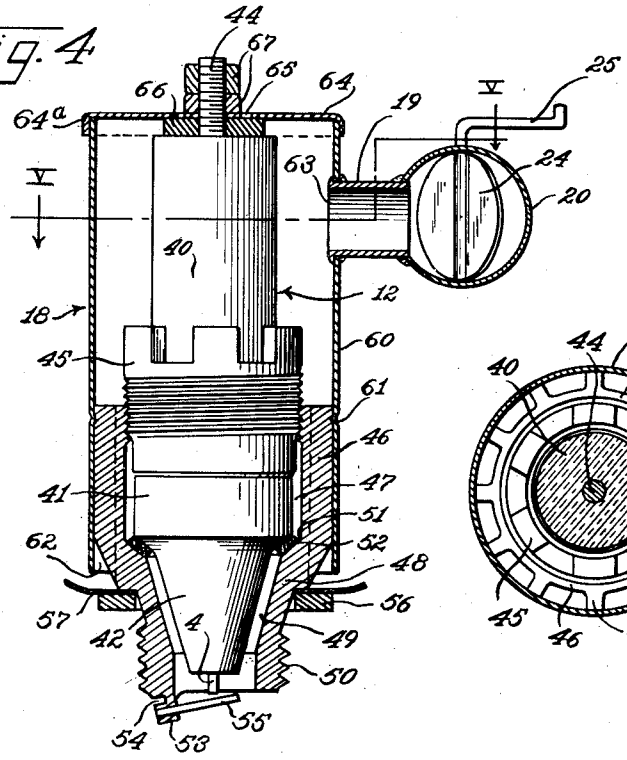
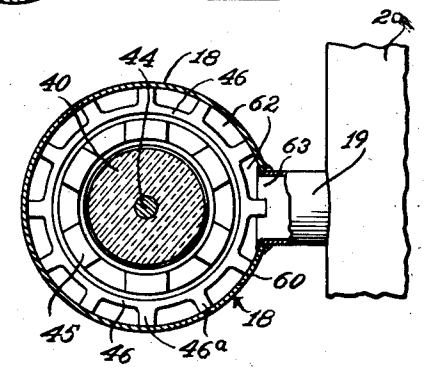


Fig. 5



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Patented May 18, 1937 2,080,495

UNITED STATES PATENT OFFICE

2,080,495

SPARK PLUG COOLING DEVICE

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Application June 22, 1935, Serial No. 27,998

15 Claims. (Cl. 123—169)

This invention relates to a device for cooling spark plugs in use on internal combustion engines and includes a method of cooling said plugs.

More specifically this inventory relates to a device for enclosing the exposed portions of spark plugs together with means for flowing air through the device by induced draft caused by the operation of the motor.

In my copending application entitled: "Spark plug", Serial No. 5192 filed February 6, 1935, I have described and claimed a spark plug provided with spaced radiating fins for dissipating heat from the plug. I have now found that a superior cooling of spark plugs can be effected by surrounding these fins with a container to enclose the exposed part of the spark plug and drawing air through the container to absorb heat from the plug. The hot air can then be used for combustion purposes within the motor. While my cooling device is particularly adapted for use with spark plugs having radiating fins formed thereon it should be understood that it can also be used with ordinary types of spark plugs.

In accordance with my invention I provide a small metallic container around each spark plug. The container is open at the bottom and is provided with an opening near the top thereof connected to a header duct. The header duct is connected with the air intake of the motor or with other means for drawing air therethrough. In this manner a draft of air is created around each of the spark plugs and they are maintained in a cool condition. Means may be provided in the header duct to control the amount of air flowing therethrough in the event that it is desired to allow the spark plug to become heated to a desired temperature before the cooling draft is created. This regulating means may conveniently be controlled by the automatic choke device commonly used in automotive vehicles.

It is therefore an object of this invention to provide a device for circulating air around the exposed parts of a spark plug to cool the plug.

A further object of this invention is to effect a cooling of spark plugs in use on internal combustion engines by creating a forced draft around each plug.

Another object of this invention is to shield the spark plugs individually in metallic containers to prevent short circuiting thereof and to create a draft of air through said containers for cooling the plug.

A specific object of this invention is to form individual metallic containers for spark plugs and to connect said containers with the air intake of an internal combustion engine for circulating air through the container to cool the plug and heat the air before feeding into the carburetor.

Other and further objects of this invention will be apparent from the following detailed description of the annexed sheets of drawings which disclose preferred embodiments of the invention.

On the drawings:

Figure 1 is a side elevational view of an automobile engine provided with a down-draft carburetor and an air cleaner illustrating the manner in which the spark plug cooling device of this invention may be mounted to supply heated air to the carburetor.

Figure 2 is a diagrammatic fragmentary view illustrating the manner in which the cooling device of this invention may be equipped with a Venturi apparatus located in the slip stream of an airplane for effecting circulation of air around the spark plugs of an airplane engine.

Figure 3 is an enlarged cross-sectional view, with parts in elevation, taken substantially along the line III—III of Figure 1.

Figure 4 is an enlarged cross-sectional view, with parts in elevation, taken substantially along the line IV—IV of Figure 1.

Figure 5 is a cross-sectional view taken substantially along the line V—V of Figure 4.

Figure 6 is an enlarged cross-sectional detail view showing a preferred manner of mounting the contact points in a spark plug used in this invention.

Figure 7 is a plan view of a metal washer adapted to effect contact between the spark plug and the automobile engine.

Figure 8 is a cross sectional view taken substantially along the line VIII—VIII of Figure 7 showing in dotted lines the manner in which the extending ears of the washer are bent upward when in use.

As shown on the drawings:

In Figure 1 the reference numeral 10 indicates generally an automobile engine having a head 11 with spark plugs 12 extending therefrom. The engine 10 is provided with the customary exhaust manifold 13. The manifold 13 carries a thermostat device 14 operatively connected to a down-draft carburetor 15 to automatically control the choking of the gasoline feed into the engine. The down-draft carburetor 15 is connected with an intake manifold 13a through a heat exchanger 16 of the customary type for heating the intake fuel and air mixture by the exhaust gases from the motor before delivering this charge to the intake manifold 13a. Air for the carburetor 15 passes

through an air cleaner 17 of the customary type mounted on top of the engine 10.

The device of this invention consists of open bottomed containers or shrouds 18 surrounding each spark plug 12. These containers 18 communicate through tubes 19 at the top thereof with a header duct 20 which is closed at one end 21 thereof and which is connected through a tube 22 to the inlet end 23 of the air cleaner 17. Thus when air is drawn through the air cleaner 17 on the intake strokes of the motor 10 the header duct 20 is subjected to suction thereby drawing air through the containers 18 and tubes 19. In this manner the spark plugs 12 are cooled by the circulation of air therearound and air fed to the carburetor is heated. The amount of air flowing through the header duct 20 may be automatically controlled by the thermostatic device 14 which controls the automatic choke in the carburetor 15 by providing a damper 24 (best shown in Figure 4) in the duct 20 near the front end thereof. An arm 25 extends through the duct 20 for controlling the damper 24. This arm 25 is connected through a rod 26 (Figure 1) to an arm 27 operated by the thermostatic device 14 which arm 27 also controls the automatic choke of the carburetor 15.

In Figure 2 I have illustrated diagrammatically the manner in which the cooling device of this invention may be applied to airplanes. In Figure 2 the reference numeral 30 indicates diagrammatically the fuselage of an airplane and the reference numeral 31 indicates the airplane engine having a spark plug 12 extending therefrom covered by a container 18 which is connected with the header duct 20 in the identical manner which is illustrated in Figure 1.

A Venturi device 32 is mounted in the slip stream or propeller wash adjacent the fuselage 30 and may be secured to the fuselage by a bracket 33. The Venturi device 32 consists of a funnel shaped member 34 having an annular shroud 35 disposed around the enlarged end thereof as shown. As air flows through the shroud 35 as indicated by the arrows a suction effect is created within the funnel shaped member 34 to draw air therefrom. As a result, air is drawn through the container 18 and header duct 20 to cool the spark plug 12. The amount of air flowing through the container 18 may be controlled by a damper 36 located at the small end of the Venturi device 32. This damper has a control arm 37 extending therefrom and may be set to the desired position by a Bowden wire 38 leading to the dash board in the pilot's compartment of the airplane. A manual setting of the Bowden wire makes possible the regulation of the amount of air flowing through the container 18. It should be understood that the Venturi device 32 may be mounted any place in the slip stream or propeller wash of an airplane.

As best shown in Figures 4, 5, and 6, the preferred form of spark plug 12 used in this invention comprises a porcelain core 40 having an enlarged portion 41 near the bottom thereof and a tapered end 42. A contact point 43 of tungsten or other suitable metal extends from the bottom of the tapered end 42 and a binding post 44 connected with the contact point 43 extends from the top of the porcelain core 40.

A metal boss 45 is slipped over the porcelain core 40 until the bottom thereof abuts the enlarged portion 41 of the core. The boss 45 is threaded into a shell 46 having an enlarged opening 47 therein for receiving the enlarged portion 41 of the core 40 and the end of the boss 45. The bottom portion of the shell 46 tapers inward as at 48 to define a restricted opening 49 for receiving the end 42 of the core. The end of the shell 46 is threaded as shown at 50.

A shoulder 51 is formed between the openings 47 and 49 of the shell 46 and a packing gasket 52 is seated on this shoulder. Thus when the boss 45 is threaded into the shell 46 the enlarged portion 41 of the core 40 is compressed against the gasket 52 for sealing the space 49 from the space 47.

The threaded end 50 of the shell 46 carries a depending lug 53 at the bottom thereof separated from the portion 50 by a groove 54. The lug 53 carries the other contact point 55 of the spark plug. This construction maintains the heat generated by the spark passing between the contact points localized in the combustion chamber. The groove 54 "dams off" the travel of heat from the contact point 55 into the shell 46 and thereby aids in maintaining the spark plug in a cool condition. The size of the groove 54 may be varied to suit operating conditions of different internal combustion engines and thus make it possible to localize the heat generated by the spark and prevent the same from traveling into the upper portions of the spark plug.

The heat may be further localized within the combustion chamber by the use of an asbestos washer 56 (Figures 3 and 4) in place of the usual copper gasket. This asbestos washer 56 is a non-conductor both for heat and for electricity. Therefore in order to insure a good electrical contact between the shell 46 carrying the contact point 55 of the plug and the motor a metallic washer 57 shown in Figures 7 and 8 is used. This washer 57 is provided with laterally extending ears 58 and 59 which, when depressed into the spark plug well of the engine head 11 as shown in Figure 3 are bent upwardly and because of the inherent springiness of the metal forming the washer 57 a good electrical contact is maintained between the head 11 and the shell 46 of the plug. It has been found that the threaded portion 55 of the plug becomes fouled with carbon during use and cannot be relied upon for good contact between the engine head 11 and the plug. I have therefore found it desirable to use a type of washer such as shown in Figures 7 and 8 to maintain a good electrical contact. The use of the asbestos washer 56 and the groove construction for supporting the contact 55 very satisfactorily localizes the heat generated by the spark in the combustion chamber.

As best shown in Figure 5, the shell 46 of the plug is provided with a plurality of radially extending fins 46a in spaced relation from each other. These fins are formed integral with the shell 46 and receive therearound the container or shroud 18. This container 18 as best shown in Figures 3 to 5 comprises a cylindrical metal tube 60 which snugly fits over the fins 46a. The tube 60 is provided intermediate its ends with an inturned bead 61 adapted to snap in a corresponding groove formed in the fins 46a for maintaining the bottom of the container in spaced relation from the washer 57 so that air may enter into the tube at this point along the passageways 62 formed between the radiating fins 46a.

A circular opening 63 is formed in the side wall of the tube 60 near the top thereof for receiving the tube 19 which is welded, brazed or soldered in the opening 63 at one end and communicates with the header duct 20 at the other

end. The tube 19 is also welded, brazed or soldered to the header duct as shown.

The top of the cylindrical tube 60 is closed with a cover 64 which fits thereover as shown.

As shown in Figure 4 the cover 64 is provided with an enlarged opening 65 in the center thereof through which the binding post 44 of the plug may extend. An insulation washer 66 of asbestos, rubber or other material is disposed between the top of the core 40 of the plug and the cover 64 to maintain the cover in insulated relation from the cover. Binding post nuts 67 are threaded onto the binding post 44 and are in spaced relation from the cover 64 as shown. These binding post nuts are also spaced from the cover 64. The cover 64 may be held in position on the tube 60 by a peripheral flange 64a integral with the cover. The flange 64a frictionally grips the top of the tube 60.

It should be understood that the container 18 can be formed in one piece by a drawing operation but it is preferred to form the container with a removable cover as shown for inspection of the plug without removing the container.

The spark plugs may readily be removed from the engine head 11 by disengaging the header duct 20 from the pipe 22 and withdrawing the containers 18 from the plugs. A gripping tool adapted to engage the radiating fins 46a of the plug is then disposed around the plug and the same is readily unseated from the head 11 by rotation of the shell 46 to unscrew the plug.

From the above description it should be evident that I have provided means for localizing the heat generated by a spark plug in the combustion chamber and means to cool the exposed parts of the plug by induced draft caused by operation of the motor in which the plugs are seated. These induced drafts are created without loss of operating power of the motor. The cooling device of this invention is simple in construction, can be manufactured at very low cost, is entirely automatic in operation and greatly improves the operating efficiency of internal combustion engines.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. A cooling device for spark plugs comprising an individual container adapted to be snapped around the exposed part of a single spark plug and carried by said plug and means for creating an induced draft to flow through said container around said spark plug.

2. A cooling device for spark plugs in use on internal combustion engines comprising containers adapted to be disposed over the exposed parts of said spark plugs, a header duct communicating with each of said containers, and means for withdrawing air from said header duct to flow fresh air through said containers around said spark plug.

3. A cooling device for spark plugs in operation on internal combustion engines comprising metallic containers adapted to be snapped around the exposed parts of said spark plugs, a header duct communicating with each of said containers near the top thereof, means communicating with one end of said header duct for withdrawing air therefrom to draw fresh air into said container around said spark plug and means for controlling the amount of air withdrawn through said header duct.

4. In combination with an internal combustion engine having a plurality of spark plugs extending therefrom, and an air intake to said engine, metallic containers disposed over each of said spark plugs, a header duct communicating with each of said containers near the top thereof, means for connecting one end of said header duct with the air intake to draw air through said duct from said containers for cooling the spark plugs and for heating the air fed to the engine, and means for controlling the amount of air drawn through said header duct.

5. In combination with an internal combustion engine having a plurality of spark plugs extending therefrom, and an air intake to said engine, a metallic container disposed over each of said spark plugs, a header duct communicating with said containers and with said air intake, and a damper in said header duct for controlling the amount of air flowing through said duct.

6. In combination with an internal combustion engine having a plurality of spark plugs extending therefrom, a container disposed over each of said spark plugs, a Venturi device communicating with said containers to draw air therethrough for cooling said spark plugs and manually operative means for controlling the amount of air drawn through said containers.

7. In combination with an internal combustion engine having a plurality of spark plugs extending therefrom, a metal container disposed over each of said spark plugs, and a Venturi device communicating with the interior of each of said containers for drawing air therethrough to cool the spark plugs.

8. In combination with a spark plug having a shell portion provided with a plurality of radially extending fins, a metal tube disposed around said fins, said tube having an open bottom in spaced relation from the bottom of said fins, means for closing the top of said tube, and means for drawing air thru said tube to cool the spark plug.

9. In combination with a spark plug having a shell formed with a plurality of radially extending fins and means for localizing the heat generated by the spark in the combustion chamber of an automotive engine, a container adapted to be snapped over said fins in spaced relation from the bottom thereof and means for circulating air through said container along the passageways formed between the fins for cooling the spark plug.

10. In combination with a spark plug having a shell formed with a plurality of radially extending fins and carrying a spark electrode on a grooved lug therebelow for localizing the heat of the spark within the combustion chamber of the engine, a metallic container adapted to be snapped around said fins in spaced relation from the bottom thereof to define together with the fins a plurality of passageways and means for withdrawing air from the top of said container to flow fresh air along said passageways for cooling said plug.

11. In combination with a spark plug having a shell portion provided with a plurality of radially extending fins and a threaded portion on said shell portion for threading the plug into an internal combustion engine, said threaded portion having a lug extending therebelow and separated therefrom by a groove, a contact rod secured in said lug, a container adapted to be snapped

around said radiating fins in spaced relation from the bottom thereof to define together with the fins a plurality of passageways for air around the spark plug and means communicating with the top of said container for withdrawing air therefrom to thereby draw fresh air through said passageways for cooling the plugs.

12. In combination with an internal combustion engine, a spark plug threaded therein, a lug extending from the bottom of said spark plug having a groove cut therein for damming off the lug from the plug, a contact rod extending from said lug below said groove, a heat insulating washer around the spark plug above the threaded portion thereof, a metallic washer around said plug pressed tightly thereagainst above said heat insulating washer, said metallic washer having laterally extending portions for contacting the engine to effect a good electrical contact between said contact rod and engine, a container disposed over said spark plug in spaced relation from the metallic washer and means for flowing air through said container for cooling said spark plug.

13. In a spark plug assembly including a spark plug and an internal combustion engine having a depressed well with a threaded opening at the bottom thereof communicating with the combustion chamber of the engine for receiving the spark plug in threaded relation in said opening, an asbestos washer around said spark plug above said opening and a spring metal washer fitted snugly around said spark plug above the asbestos washer, said metal washer having extending ears adapted to be depressed into the well of the engine to firmly contact the walls thereof.

14. In combination with an internal combustion engine having a plurality of spark plugs extending therefrom, individual containers covering the exposed part of each spark plug and carried by the spark plugs and means for positively impelling air through said containers around said spark plugs.

15. A cooling device for spark plugs comprising a container adapted to be disposed around substantially the entire exposed part of a spark plug and carried by said plug, and means for positively impelling air through said container around said spark plug.

LEO J. McKONE.