Jan. 27, 1970 F. G. SUBT 3,492,457

FUEL HEATING ELEMENT

Filed Sept. 14, 1967

FIG. 1.

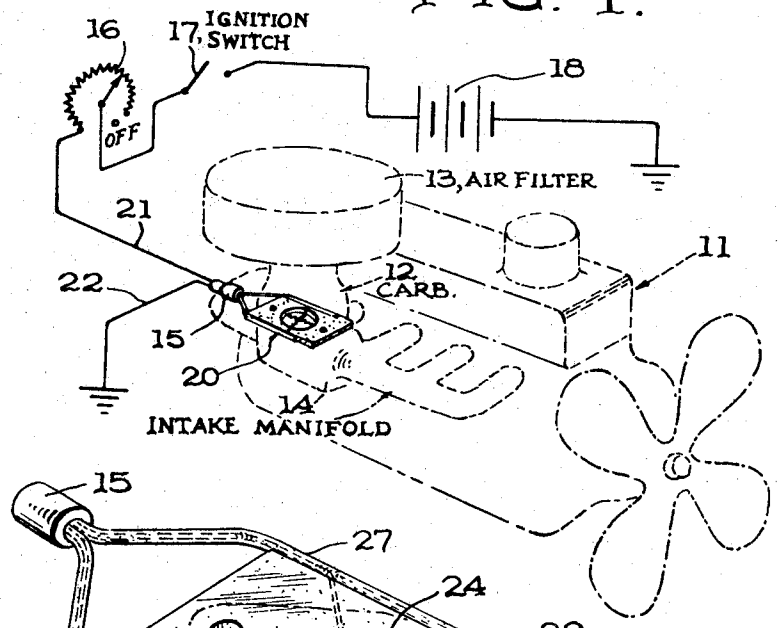


FIG. 2.

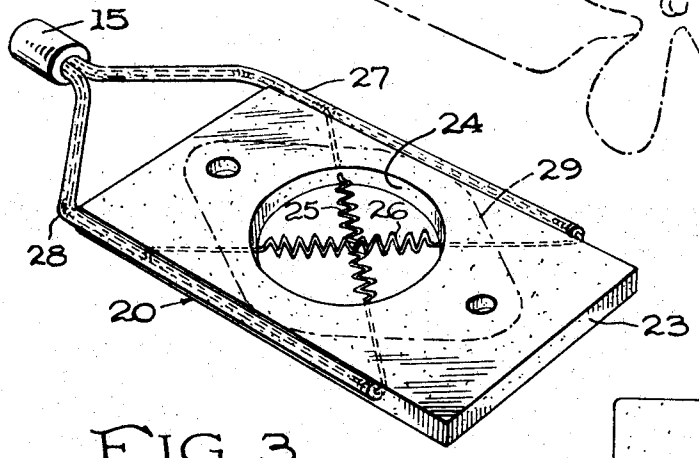


FIG. 3.

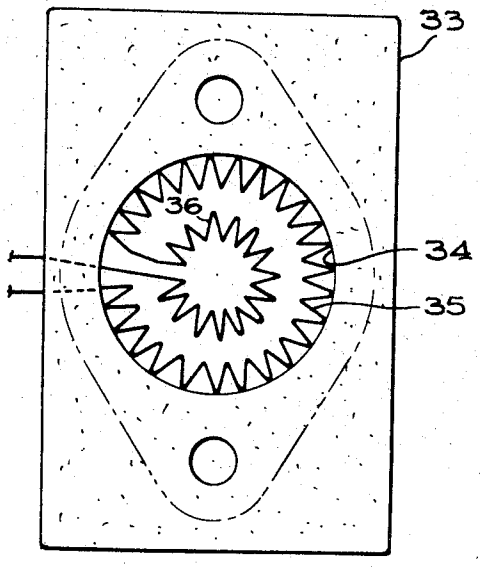
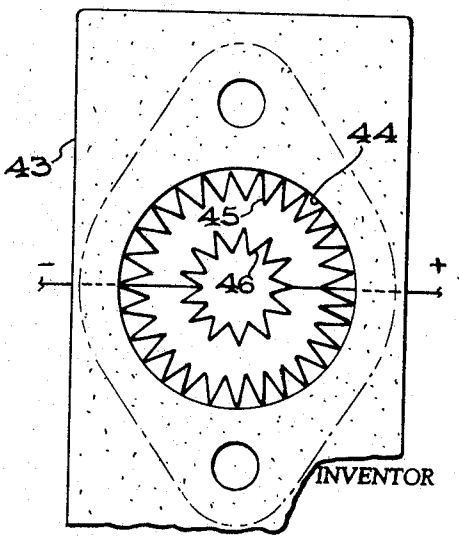


FIG. 4.



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FUEL HEATING ELEMENT

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ABSTRACT OF THE DISCLOSURE

A heating unit for preheating fuel to the carburetor, for connection between carburetor and intake manifold and consisting of heating coils located so as to intersect the flow of fuel to the carburetor and having a plug-in connection to the electrical system connected to the engine. Embodiments include concentrically placed coils in the plane of the supporting plate with a coil near the center of the plate opening and a coil within and near the periphery of the opening.

The present invention relates to a fuel heating element, and has particular reference to an improved heating element for placement between the carburetor and intake manifold.

A heating element which is so placed as to heat the fuel being fed to the carburetor has definite advantages for cold weather starting of engines and in preventing icing under wet conditions of the carburetor.

Also, preheating of the fuel mixture increases the vaporization of fuel droplets present and by accomplishing a more complete vaporization of the fuel under all conditions with the heating element of the present invention, a greater economy in gasoline usage is effected.

Furthermore, the design of the heating element of the present invention allows the intersection of the flow of fuel with minimum resistance to the flow, but at the same time creates a turbulence in the stream of flow which further assures proper and complete vaporization of fuel droplets present.

These as well as further advantages which are inherent in the invention will become apparent from the following description, reference being had to the accompanying drawings wherein:

FIG. 1 is a perspective view illustrating the connection and placement of the present invention in an internal combustion engine;

FIG. 2 is an enlarged perspective view showing details of one embodiment of the present invention; and

FIGS. 3 and 4 are top plan views of second and third embodiments of the present invention.

Referring first to FIG. 1, there is shown in dashed outline an internal combustion engine **11** with carburetor **12**, under air filter **13** and above the intake manifold **14** as usually found, for example, in an automobile. Located between carburetor **12** and intake manifold **14** is fuel heating element **20** fitted between the units using the usual gaskets for a tight fit and connecting to the electrical system of the vehicle within which the engine **11** is installed.

In order to facilitate the installation of fuel heating element **20** and its replacement when and if necessary, connection to the vehicle electrical system is made through a plug-in connector **15** having one lead **21** to a circuit through a variable resistance dashboard switch **16** and an ignition switch **17** connected to battery **18** which is normally grounded to the chassis. The other lead **22** from plug-in connector **15** is connected to a ground terminal.

One embodiment of fuel heating element **20** is shown in a detailed perspective view in FIG. 2 in an enlarged

form of the view in FIG. 1. A plate **23** which can be made of asbestos and may be approximately ¼ inch in thickness contains center opening **24** which is crossed by a pair of intersecting electrical resistance wires, such as of Nichrome wire, heating coils **25** and **26**. Each of coils **25** and **26** are connected to insulated copper wires **27** and **28** running along opposite edges of plate **23** by means of connecting wires passing within the asbestos plate **23**. Insulated copper wires **27** and **28** pass to connector **15** through which these wires are connected to leads **21** and **22** respectively.

Plate **23**, when made of asbestos, can be formed from two pieces of laminar asbestos, separated during manufacture while the wiring connections are placed between them, and then cemented or glued together.

Other materials besides asbestos can be used but the material should have certain qualities such as being an insulating material or wire connections therein must themselves be insulated. In addition the material should not be brittle so as to crack under tightening of bolts and nuts connecting carburetor and manifold. Also, the plate material should have sufficient resistance to thermal shock so as not to crack from heat variations due to weather and use of the engine.

Coils **25** and **26** are electrical resistance wire such as Nichrome wire used for heating purposes since due to the coil effect, the length of the wire and the heat it contributes is greatly magnified without a corresponding increase in resistance to the flow of the fuel and air mixture from carburetor **12** to intake manifold **14**.

An outline **29** of a gasket to be placed at the top of plate **23** for its tight fitting connection to carburetor **12** is shown. Similarly, such a gasket is placed below plate **23** to allow the close fit necessary for its connection with the intake manifold **14**.

Heating coils **25** and **26** are positioned as shown in FIG. 2 so as to intersect the flow of fuel from the carburetor **12** to intake manifold **14**, not only near the walls of opening **24** but in the center or across the path of the moving fuel mixture. In this way, by the intersection of the cross section of fluid flow, coils **25** and **26** are in contact with a greater amount of the fuel flowing past them and with a minimum amount of restriction of the flow.

Since the pipe walls of the intake manifold are usually quite hot, any liquid particles entrained in the flow of fuel and passing near the walls will be vaporized by the heat from those walls. Therefore, it is the liquid particles in the main body of flow nearer the center of the opening **24** which also must be heated to the point of vaporization.

FIGS. 3 and 4 show different embodiments of the heating coil design from that of the embodiment of FIG. 2. In both embodiments of FIGS. 3 and 4 there are plates **33** and **43** respectively having concentric coils **35**, **36** and **45**, **46** respectively. Coils **35** and **45** are located adjacent the walls of openings **34** and **44** respectively, while coils **36** and **46** form circular coils closer to and surrounding the center of openings **34** and **44** respectively. The coil structures of both the embodiments of FIGS. 3 and 4 are substantially similar except that coils **35** and **36** are in series connection and both wire ends from these coils exit on the same side of plate **33** from where they will be connected to connector **15**. Coils **45** and **46** are in parallel connection with wire ends exiting from plate **43** on opposite sides thereof in the manner of the embodiment in FIG. 2.

In the latter embodiments having concentric coils additional efficiency of operation is introduced. The flow of fuel in the intakes of most combustion engines is in laminar flow which due to skin resistance from the pipes causes the layers closest to the pipe walls to travel slower and obtain the benefits of increased vaporization from

contact with the heated walls while preventing absorption to the degree for best efficiency by the layers of fuel flowing closer to the center of the pipe. As a result, vaporization occurs near the pipe walls while droplets in the main stream closer to its center may or may not be vaporized. With the concentric coils of the present invention outer coil **35** or **45** not only increases the overall heating effect but also because of its design and position creates a turbulence which disturbs the smooth laminar flow of fuel. This is extremely necessary to assure vaporization of the fuel droplets and is done without creating a substantial resistance to cut down the rate of flow. At the same time inner coil **36** or **46** provides the heating effect closer to the center of the flow where additional heating for vaporization is required.

The heating element of the present invention has been described in the one environment as located between carburetor and manifold but need not be limited to such use. The heating element may also be used with appropriate modification for the improvement of heating when placed in the path of any fluid flow wherein the effects of laminar flow detrimental to thorough overall heating must be overcome.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention and the invention is not to be considered limited to what is shown in the drawings and described in the specification.

What is claimed is:

1. A heating unit for heating of a flowing fuel mixture comprising

a supporting plate having an opening therethrough through which the fuel mixture is caused to flow,

heating coils positioned within said opening in the form of at least two concentrically placed portions located substantially in a single plane with said supporting plate and with one of said concentrically placed portions forming a substantially circular ring around the center axis of said opening and a second of said concentrically placed portions forming a substantially circular ring adjacent and within the periphery of said opening,

an electrical supply means connected to said heating coils.

2. The heating unit of claim **1**, further characterized by

said at least two concentrically placed portions of said heating coils connected in series with each other.

3. The heating unit of claim **1**, further characterized by

said at least two concentrically placed portions of said heating coils connected in parallel with each other.

4. The heating unit of claim **1**, further characterized by

said supporting plate formed of asbestos.

5. The heating unit of claim **1**, further characterized by a plug type connector electrically connecting said heating coils to said electrical supply means.

6. The heating unit of claim **1**, further characterized by a variable resistance switch connected between said heating coils and said electrical supply means.

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