May 16, 1961 G. L. WEBB 2,984,805

ELECTRICAL RESISTOR ASSEMBLY

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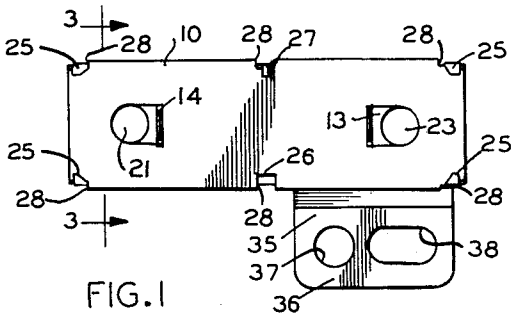


FIG.1

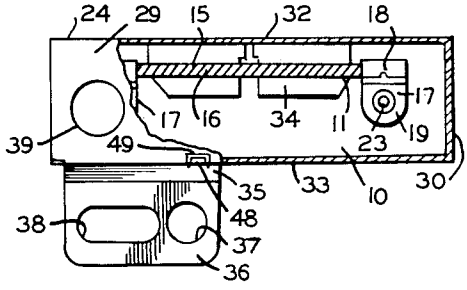


FIG.2

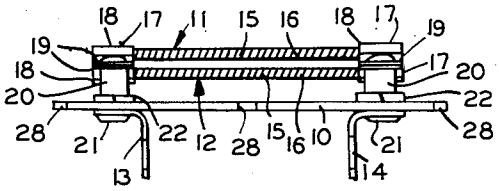


FIG.4

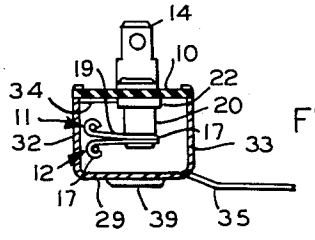


FIG.3

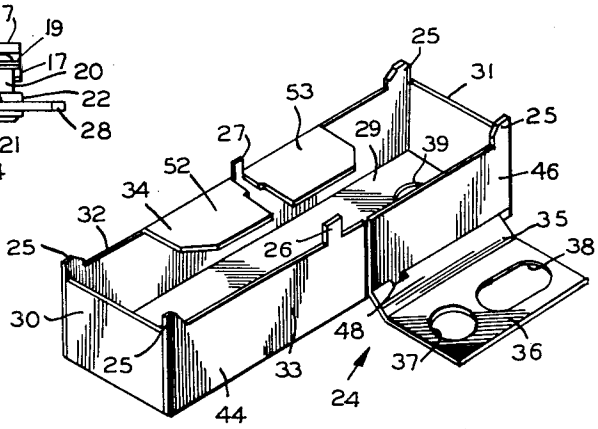


FIG.5

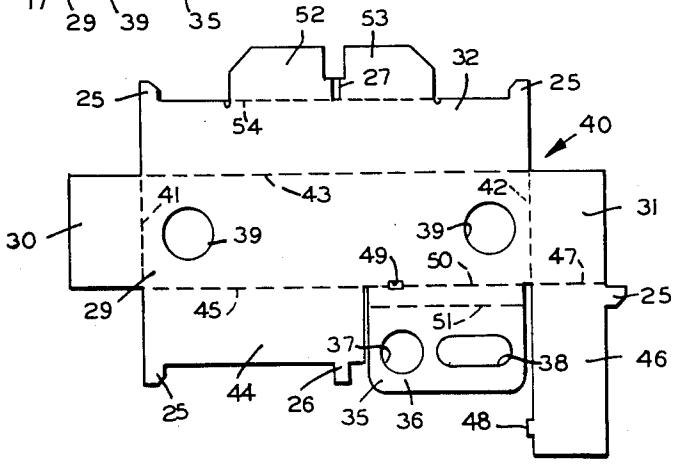


FIG.6

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ELECTRICAL RESISTOR ASSEMBLY

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This invention relates to electrical resistor assemblies and more particularly to such assemblies in which a resistance element generating substantial heat during normal use is enclosed in a casing comprising a metal housing and a cover plate of insulating material.

The principles of the present invention find a particularly useful application when embodied in a ballast resistor construction which is adapted, for instance, for connection in series with the primary winding of an ignition coil employed in an automotive vehicle. For this use, it is desirable that the ballast resistor have a positive temperature coefficient of resistance such that the primary ignition circuit when first energized during the starting operation of the vehicle motor has a substantially lower resistance than after a predetermined time sufficient for the engine to have become self-operative. The ballast resistor thus acts to provide good ignition output during the starting period when the voltage of the vehicle battery source is reduced while acting to thereafter reduce the ignition output to an effective operating value at which the detrimental effects of the primary ignition circuit current upon the timing switch contacts are minimized. It is also desirable that the resistance of the ballast resistor change in response to the variations in ignition current with changes in the speed of the vehicle engine such that the resistance of the primary ignition circuit is varied inversely with the speed of the vehicle engine. It will be evident that relation between the resistance of the resistance element and the current which passes through it must be within predetermined limits to achieve the designed operation.

In the past, ballast resistor assemblies of the foregoing type have comprised a single wire wound resistance element which, because of its high heat dissipation during normal operation, is supported by expensive insulating material within a multipiece metal housing. For any one particular housing of this form of resistor assembly, possible variations in the resistance element are restricted within rather close limits by practical considerations and the resistance-current characteristics of the latter could be varied only by adjusting the spacing between the resistance element and the housing. Any one particular ballast resistor assembly, therefore, was not generally adaptable to meet the ballast requirements of other than the specific application for which it was designed.

Accordingly, it is an object of this invention to provide an improved resistor assembly construction in which the insulating portions thereof will not be heated to a high temperature.

Another object of this invention is to provide an improved resistor assembly construction utilizing a reduced number of parts which are economical to fabricate and assemble.

A further object of this invention is to provide an improved ballast resistor assembly construction which is readily adaptable to meet a wide variety of resistance-current characteristics.

In the preferred embodiment of the invention hereinafter described, the ballast resistor comprises resistance means supported by, but in spaced relation to, a plate member of insulation material and disposed within a metal housing which has an open end closed by the plate member. The metal housing is provided at its open end with an integral extension which is interposed between the resistance means and an adjacent portion of the plate member. According to one feature of the invention, the resistance means may comprise two resistance elements connected in parallel circuit with each other, each of which preferably has a high temperature coefficient of resistance.

Other objects and features of the invention will be apparent from reference to the following description and accompanying drawing in which:

Fig. 1 is a top plan view of a resistor embodying the present invention;

Fig. 2 is a bottom plan view of the resistor assembly with a portion of the housing cut away to show the construction;

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is an elevational view of the resistor assembly as seen from the bottom of Fig. 2 with enclosing housing removed;

Fig. 5 is an isometric view of the housing of the resistor assembly before being secured to the subassembly shown in Fig. 4; and

Fig. 6 is a plan view of the sheet metal blank from which the housing of Fig. 5 is fabricated.

Referring to the drawing, there is shown an electrical resistor assembly which includes a cover plate **10** formed of suitable insulating material, such as a glass fiber, reinforced polyester resin product, on one side of which are supported two resistors **11** and **12** while on the other side of plate **10** are secured two terminals **13** and **14**. Resistors **11** and **12** are preferably identical in physical and electrical characteristics and each comprises a core **15** of glass fibers, about which is spirally wound a resistance element **16** formed of a small wire made of a nickel alloy or other suitable metal having a high temperature coefficient of resistance. The opposite ends of each resistor are provided with flag terminals **17** each of which has a ferrule portion **18** crimped around the core **15** and over an end of a resistance element **16**. Each of the flag terminals **17** has a terminal portion **19** by which resistors **11** and **12** are mounted upon tubular supports **20**. A rivet **21** extends through the terminal **13**, the plate **10**, a clamping washer **22**, the support **20** and the terminal portions **19** of two adjacent terminals **17** with the end of the rivet **21** riveted over against the terminal **17** of resistor **11**. Another rivet **23** similarly extends through the terminal **14**, the plate **10**, another clamping washer **22**, another support **20** and the terminal portions **19** of the other terminals **17** with the end of rivet **23** riveted over against the other terminal **17** of resistor **11**. Terminals **17** are suitably bent so that resistance elements are in the desired spaced relation to each other and to the plate **10**. It will be apparent that the separate resistance elements **16** of resistors **11** and **12** are connected in parallel between terminals **13** and **14**.

The resistors **11** and **12** are enclosed in a casing formed by a housing **24** of steel material having a partially open top and the plate **10** which covers the open top of the housing and is held in position by lugs **25**, **26** and **27**. The lugs **25**, **26** and **27** are formed integrally with the housing **24** to fit into notches **28** in the edges of plate **10** and are bent over to hold the plate **10** upon the housing **24**. The housing **24** is of a generally box-like shape and includes a generally rectangular base **29**, end walls **30** and **31**, side walls **32** and **33**, and a partial top wall **34**. To provide means for attaching the resistor assembly to a

supporting surface, the base 29 of the housing 24 has an outwardly extending bracket portion 35 which has a transversely offset portion 36 provided with apertures 37 and 38 for receiving attaching bolts. The base 29 also has a pair of bosses 39 outwardly displaced to substantially the same extent as bracket portion 36 is offset.

The housing 24 is preferably made from a one-piece sheet metal stamping or blank 40 as shown in Fig. 6. The housing end walls 30 and 31 are formed by bending the blank 40 on lines 41 and 42, respectively, at right angles to the base 29, while side wall 32 is formed by bending the blank 40 on line 43 at right angles to the base 29. The side wall 33 is formed of a first portion 44 bent at right angles to the base 29 along line 45 and a second portion 46 integral with end wall 31 and bent at right angles thereto along line 47 with its bottom edge overlying the base 29 at its junction to the mounting bracket 35. Movement of the side wall portion 46 is prevented by an integral tongue 48 which projects into a perforation 49 in the base 29. The blank 40 is angularly bent in opposite directions along lines 50 and 51 to displace bracket portion 36 to the desired extent from the plane of the base 29. Extensions 52 and 53 of side wall 32 are bent nearly perpendicularly along the line 54 to define the partial top wall 34.

To assemble the resistor assembly, the resistors 11 and 12 are secured to the plate 10 to form the subassembly shown in Fig. 4, and the subassembly is positioned so that resistors 11 and 12 project into the housing 24 through the open top and will be positioned between the base 29 and the partial top wall 34 when plate 10 is moved to cover the top of housing 24. The plate 10 is then aligned upon the housing 24 with lugs 25, 26 and 27 extending into their respective notches 28. The lugs are then bent into engagement with the cover to secure the cover to the housing.

It will be seen from the foregoing description that the top wall 34 is interposed between resistor 12 and the adjacent portion of the plate 10 and serves to shield the plate from radiant energy of the resistance element 16. Although only about a fourth of the cover is shielded by the top wall 12, the top wall is surprisingly effective in preventing any substantial transfer of heat to the plate. Consequently, the plate 10 need not be formed of expensive insulating materials capable of withstanding high temperatures, but may be formed from the more inexpensive, heat-resistant materials such as polyester resin laminates.

It will also be evident from the foregoing description that the resistance-current characteristics of the resistor assembly may be adjusted in a number of ways. In addition to choosing resistance elements 16 of selected resistance values and temperature coefficients of resistance, the resistance characteristics may be modified by adjusting the spacing of the resistors with respect to each other and to the walls of the housing 24. It will be evident that the temperature, and hence the resistance, of a temperature-sensitive resistor for any particular current flow will be dependent upon the effective rate at which heat is dissipated from the resistor. The quantity of heat imparted by the resistors to each other and to the walls of the housing, of course, depends upon the positions of the resistors relative to each other and the housing 24.

While a specific embodiment of the invention has been shown and described, it is to be understood that the invention is not to be limited to the precise details herein shown and described, since the same may be carried out in other ways falling within the scope of the invention as claimed.

What is claimed is:

1. An electrical resistor of the type including an enclosure having an outer insulated wall and a resistance element located within said enclosure, said resistor comprising two prefabricated main subassemblies; one of said subassemblies including a wall member of electrical insulation material, a resistance element and means for supporting said resistance element on one side of said member with an air space between said element and said member; the other of said subassemblies including a unitary sheet metal housing open at one end and having side walls, a metal strip secured in heat-conducting relationship to one of said side walls and extending partially across said open end, and a base wall at said other end thereof; said metal strip being dimensioned and shaped to permit entry of said resistance element into said housing through said open end to a position where said metal strip is interposed between said resistance element and said member; and means for connecting said member to said one end of the housing for securing the two subassemblies in cooperative relationship with said resistance element in said position.

2. An electrical resistor of the type including an enclosure having an outer insulated wall and a resistance element located within said enclosure, said resistor comprising two prefabricated main subassemblies; one of said subassemblies including a generally rectangular wall member of electrical insulation material, a pair of spaced supports secured to one side of said member and a resistance element supported adjacent its ends by said supports to provide an air space between said element and said member; the other of said subassemblies including a one-piece sheet metal housing defining a generally rectangular-shaped chamber open at one end and having four substantially closed side walls, a substantially closed base wall at the other end thereof, and an extension of one of said side walls displaced from the plane of said one wall to extend partially across said open end in generally parallel relation to said base wall; said extension being dimensioned and shaped to permit entry of said resistance element into said housing through said open end to a position where said extension projects between said supports and is interposed between said resistance element and said member; and means for connecting said member to said one end of the housing for securing the two subassemblies in cooperative relationship with said extension in said position.

3. An electrical resistor according to claim 2 wherein said base wall is formed along one edge with an integral extension defining a bracket for mounting said resistor; at least a portion of the side wall adjoining said one edge of the base wall being formed of a member integral with an immediately adjacent side wall and having a tongue projecting into a perforation provided in said base wall at the junction thereof to said bracket.

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