March 14, 1961 A. W. SCHNICK 2,975,262

ELECTRICAL HEATING UNIT

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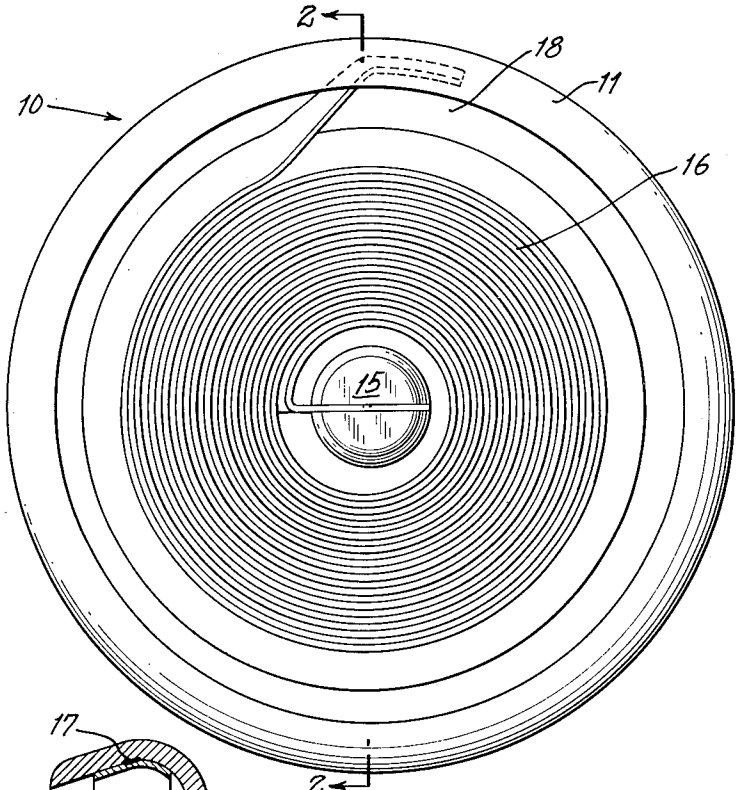


Fig. 1.

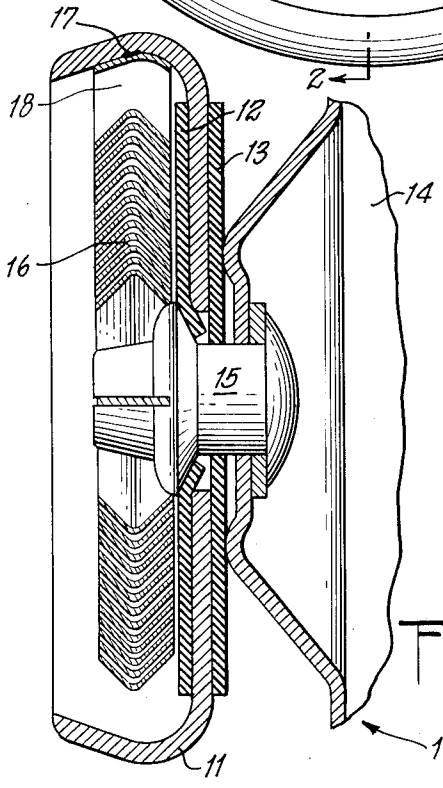


Fig. 2.

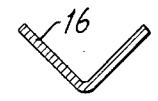


Fig. 3.

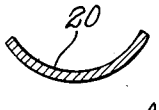


Fig. 4.

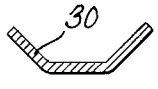


Fig. 5.



Fig. 6.

INVENTOR.
ARTHUR W. SCHNICK
BY
ATTORNEY

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ELECTRICAL HEATING UNIT

Arthur W. Schnick, Meriden, Conn., assignor to American Machine & Foundry Company, New York, N.Y., a corporation of New Jersey

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6 Claims. (Cl. 219—32)

My invention relates to electrical resistors and more particularly those resistors used as heating elements on so called electric cigar lighters supplied as accessories on automobiles.

A typical example of such a lighter is disclosed in United States Letters Patent No. 2,531,901 to Ashton, where Figures 9, 10 and 11 show a type of "plug" having wide commercial acceptance. Several millions of lighters of the type disclosed and others generally similar, are sold each year and their dimensions have become substantially standardized in the industries concerned. The size of the cup which carries the heating element is approximately .700" diameter by .150" deep and the heating element is a flat spiral formed from a resistance ribbon of approximately 8" long x .02" thick x .062" wide. The courses or turns of the spiral are separated from each other, the gap between turns being generally .01" to .02" wide. These elements are for use with 6 volt circuits and contain sufficient mass of metal to hold red heat for about 10 seconds after being withdrawn from the supporting and current supplying socket. They attain a bright red heat in about 10 seconds and consume approximately 110 watts.

It has been found very difficult to arrange a heating element for 12 volt circuits in the space afforded by the now accepted standard size of heating element cup. Those elements which have been commercially produced for such use are generally about 14" long x .014" thick by .062" wide and they are shaped similarly to the six volt element described above. Such elements get red hot in about 7 seconds and retain their useful heat for about the same time; they consume approximately 160 watts. They are mechanically weak and burn out very quickly if held in circuit after attaining red heat.

My invention has among its objects the construction of a heating element suited for housing in a cup of the size mentioned above and for use in 12 volt circuit and which (*a*) is mechanically strong, (*b*) retains its useful heat for a longer period than is done by previous constructions, (*c*) consumes a lower wattage than previous constructions do, and (*d*) does not cause so much heating of the plug member as is done by previous construction.

Reference is now made to the drawings:

Figure 1 is a front elevation of a cigar lighter igniting unit embodying my new resistance element.

Figure 2 is a section on the line 2—2 of Figure 1.

Figure 3 is a cross section of the resistance wire before winding into the spiral shown in Figure 1.

Figure 4 is a cross section of an alternative shape of resistance wire before winding.

Figure 5 is a cross section of another alternative form of resistance wire before winding.

Figure 6 is a cross section of still another form of resistance wire before winding.

Referring now in detail to the drawings, the lighter **10** comprises a cup **11** mounted between electrical and heat insulating disks **12, 13** of mica, the cup and disks

being secured to the plunger tube **14** by the connector stud **15**.

The resistance element **16** is a tightly wound flat spiral of resistance wire .062 by .008 by 16 inches, of V cross section, without any substantial clearance between the turns or courses of the spiral. A clearance between turns or courses is included in the drawings for clarity in illustration, but no substantial clearance exists.

The material of the wire must be one which forms an insulating oxide when hot, one suitable type of substance being alloys of aluminum chromium and iron. The commercial product sold under the trade name "Kanthal DS" is very satisfactory for the purpose.

The successive courses of the spiral being in contact, short circuits are prevented by the insulating oxide. It has been found satisfactory to wind the spiral from bright wire and to pass an 8 volt current through it. The oxide forms in about one minute over most of the surface area of the wire, and short circuits between adjacent courses which persist for a longer period are readily detected by a bright red spot. If the spot is poked with a blunt object such as a nail the courses will be separated sufficiently to destroy the "short" and permit the formation of the oxide almost instantaneously. The winding of the spiral without appreciable clearance between turns permits a small outside diameter which will fit in the conventional cup with plenty of room for the insertion of the electrode for welding the spiral to the cup as at **17**. The substantial space **18** between the outermost turn of the spiral and the cup permits the cup wall to remain appreciably cooler.

Due to the close winding of the ribbon the new element is free to radiate heat from its two plane or end surfaces only, while the conventional elements, having their turns spaced apart, are free to radiate heat directly from all surfaces of the ribbon. This seems to be the reason for my new 12 volt element holding its red heat for about as long as the standard 6 volt element does although the latter has greater mass and a much smaller area than the 12 volt element and consumes approximately 1100 watt-seconds as compared to 700 watt-seconds for the 12 volt element.

While the within construction has been made in order to fill a specific need, namely a 12 volt cigar lighter, it is evident that the resistance unit having an interlocking and self insulating form whereby the general mass is self supporting, may without modification of the inventive concept, be applied to many other uses.

The spiral unit **16** has a cross section of wire, except for its terminal portions, illustrated in enlarged scale in Fig. 3. This form is a simple ninety degree V.

In Figure 4 is illustrated a wire **20** of arcuate cross section, and in Figure 5 is illustrated a wire **30** of double angular cross section. All of these forms may be described as segmental tubular.

In Figure 6 is illustrated a wire **40** of Z or double and reversed angular cross section. All of the four forms are superior to wire of rectangular cross section because when wound tightly spirally they interlock to prevent axial deformation of the coils and greatly increase the mechanical strength of the resistance unit.

An outstanding defect of twelve volt heating elements constructed to fit the now standard cup of .7 inch outside diameter of automobile cigar lighters, is the tendency of the flat spiral coil to bulge out of flat shape. This tendency is aggravated by the violent axial acceleration and deceleration of the plug upon its release by the thermostatic switch almost universally used in connection therewith to supply current for the heater element. The tendency of the coil to depart in service from its flat shape as manufactured also derives partly from the changes in molecular tension resulting from alternate

heating and cooling. Greater mechanical strength is therefore considered crucial in the success of the within heating unit compared to earlier models. In all the illustrated forms of the invention, the resistance wire of the coil has a cross section, the boundaries of which cross and recross a line parallel to the axis of the coil. Thus each course has portions which embrace or straddle the next inner course to resist deformation of the coil in an axial direction.

It will thus be seen that there is provided a device in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use. As various possible modifications might be made in the embodiments above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A cordless electric cigar lighter plug of the type adapted to be housed and heated in a socket and to be separated therefrom for use, a heating element comprising a spirally wound annulus of resistance ribbon of multiple reversed angular cross-section along at least a part of its length, successive courses of said spiral being substantially in contact each with the next whereby said annulus resists deformation in an axial direction, said courses being insulated from each other at their points of contact solely by an insulating oxide formed on the surface of said ribbon, terminals for said heating element, one of said terminals comprising a metallic carrier on said plug connected to the outer end of said heating element.

2. The invention as defined in claim 1 wherein said carrier is a cup enclosing said heating element.

3. In a 12-volt cigar lighter of the type having an igniting unit removable from a holder for use, a heating element comprising a flat, tightly wound, spiral coil formed of solely one continuous length of thin resistance wire with the sides of the wire in substantially face-to-face engagement thereby forming a compact igniting heat-retaining mass, said wire consisting of a metal alloy including iron and aluminum having the property upon being heated of producing oxide on its surfaces, the convolutions of the coil being adhered together to prevent relative shifting thereof and axial deformation of the coil by oxide coatings formed in situ on the side surfaces of the wire upon being heated after the coil is wound and before being energized by said 12-volt current, said oxide electrically insulating the convolutions of the coil from each other sufficiently to prevent shorting-out of

adjacent convolutions when the coil is energized by said 12-volt current.

4. The invention as defined in claim 3 in which the wire is of segmental tubular cross-section.

5. In a cigar lighter for a 12-volt system of the type having an igniting unit removable from a holder for use, a heating unit comprising a flat, tightly wound, spiral coil formed of solely one continuous length of thin resistance wire so tightly wound that its successive courses are in substantially face-to-face engagement and continuous contact throughout forming a compact igniting heat retaining mass, said wire consisting of a metal alloy including iron and aluminum having the property upon being heated of producing oxide on its surface, the convolutions of the coil being prevented from relative shifting and axial deformation of the coil by oxide coating formed in situ on the side surfaces of the wire upon being heated after the coil is wound and before being energized by said 12-volt current, the engaging faces of said coil being solely insulated from each other throughout their continuous areas of contact by insulating oxide formed on the contacting surfaces of the wire, said oxide electrically insulating the convolutions of the coil from each other sufficiently to prevent shorting out of adjacent convolutions when the coil is energized by current when in use.

6. The invention as defined in claim 5 in which the resistance wire is of segmental tubular cross-section.

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