Dec. 31, 1968 W. H. GORDON, JR 3,419,705

HEATER FILAMENT FOR AN ELECTRICAL CIGARETTE LIGHTER

Filed Oct. 7, 1966

Fig. 1.

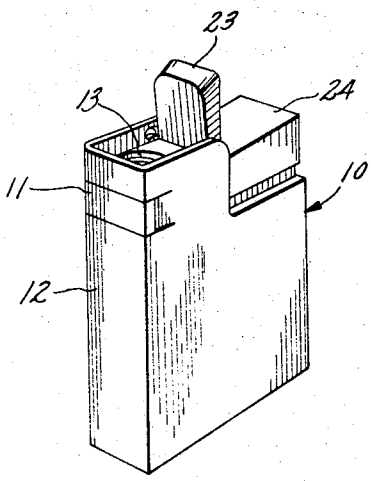



Fig. 2.

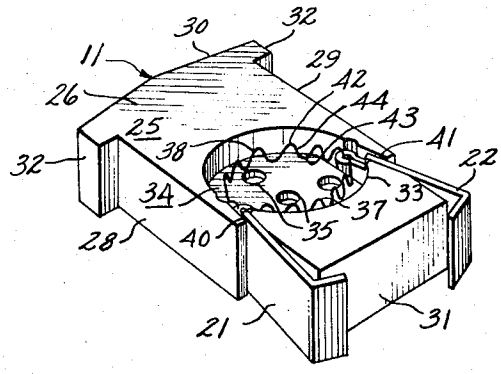



Fig. 5.

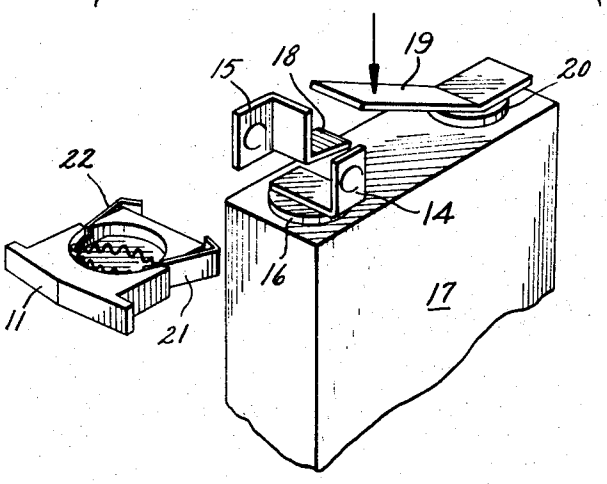



Fig. 3.

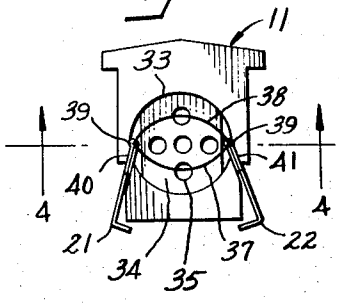
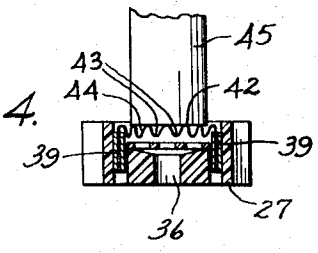



Fig. 4.

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# HEATER FILAMENT FOR AN ELECTRICAL CIGARETTE LIGHTER

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## ABSTRACT OF THE DISCLOSURE

An electric cigarette lighter heater filament having a sinusoidal configuration including alternating ridges and valleys connected to each other along the entire length of the filament with the ridges and valleys disposed substantially in a common plane such that the tip of a cigarette first comes in contact only with the ridges when lighting of the cigarette is attempted. The heater filament may be formed of an alloy comprising from 0.5–4.0 percent aluminum, from 0.5–3.0 percent yttrium, from 20.0–95.0 weight percent chromium and the balance iron.

The present invention relates to electrically operated cigarette lighters; and, more particularly, to electrical resistance heater filaments for use in these lighters.

Portable electrically operated cigarette lighters having a self-contained power source, such as a battery contained in a lighter housing, have long been known in the art. One of the principal problems encountered in the design of a suitable lighter of this type resides in providing a suitable heater filament for igniting the cigarette. In this, it is to be noted that it is necessary for the designer to operate within rather limited available space and power input boundaries while still needing to obtain a relatively high heat output from the filament to reach the ignition point of tobacco in a relatively short period of time. It is also necessary, for complete user acceptance, to provide a filament that is strong and resists high temperature corrosion problems. Obviously a filament that would easily break after a short period of time would be undesirable from the user's standpoint.

To solve the above problems in the past, the filament designer has most often utilized a helically wound filament formed of an alloy having platinum as a principal constituent. It remains, however, that using the filament just mentioned has also introduced problems. Not the least of these problems is expense, because platinum is a relatively expensive metal. Furthermore, manufacturing costs are not insignificant because it is not simple to helically wind an extremely small filament in a proper manner. Furthermore, a platinum base filament tends to become more easily deformed in use from its original shape because platinum is relatively soft.

It is therefore an object of the present invention to provide an electrical resistance heater filament construction, for use in an electrically operated cigarette lighter which is relatively simple to manufacture and which has good strength properties and is capable of furnishing sufficient heat to light a cigarette in a relatively short period of time.

Another object is to provide an electrical resistance heater filament for a cigarette lighter which is formed of a relatively inexpensive alloy having good resistance heating properties, strength, long life and resistance to corrosion.

Briefly stated, in accordance with one aspect of the present invention, a filament is provided having a sinuous configuration including alternating ridges and valleys and connecting portions connecting each ridge with an adjacent valley. Adjacent ones of each of said ridges, valleys



and connecting portions are disposed substantially in a common plane. The filament is so disposed in a cigarette lighter that the tip of a cigarette contacts primarily only the ridges of the filament when the cigarette is applied thereto for the purpose of lighting the cigarette.

As another aspect of this invention an alloy of iron, chromium, aluminum and yttrium is utilized to form a cigarette lighter resistance heater filament having improved properties.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which I regard as my invention, it is believed the invention will be better understood from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a cigarette lighter with which the filament of the present invention may be used;

FIG. 2 is an enlarged perspective view of the filament assembly of the present invention;

FIG. 3 is a top plan view of the assembly of FIG. 2;

FIG. 4 is a view taken along the line 4—4 of FIG. 3 and also showing the manner in which the tip of a cigarette contacts the filament; and

FIG. 5 is an exploded perspective view of the lighter of FIG. 1 with exterior parts removed to show internal details.

Now referring to FIGS. 1 and 5 there is illustrated an electrically operated cigarette lighter **10** having a filament assembly **11** removably received therein through a slot in a side wall **12** of the lighter. When so positioned in the lighter, heater filaments included as a part of the filament assembly are aligned with an opening **13** through the top of the lighter so that a cigarette to be lit may be placed on these filaments. Internally of the lighter there are electrically conducting contact tabs **14** and **15** (see FIG. 5) located on opposite sides of the chamber which receives the filament assembly. One of the contact tabs **14** is connected to one terminal **16** of a battery **17**. The other contact tab **15** includes an extension **18** which is disposed beneath and normally spaced from a flexible electrically conducting strip **19** leading from the opposite terminal **20** of the battery. It is to be understood that when the filament assembly is properly placed in the lighter, first and second contact portions **21** and **22** forming a part of the filament assembly make electrical connection respectively and contact tabs **14** and **15**.

The opening **13** is normally closed by a cover member **23** which is manually actuated between opened and closed position by a thumb piece **24** slidably mounted on the lighter casing. It is to be understood that downward movement of the thumb piece opens the cover and also provides a downward component of force on the strip **19** to force the strip into contact with the extension **18** which, in turn, causes the electrical potential of the battery to be applied across the contact tabs **14** and **15**.

The parts of the lighter just described, other than the filament assembly, are set out by way of example only, and the filament forming the subject of the present invention may also be utilized in connection with other conventional portable electrically operated cigarette lighter constructions.

Reference may now be made to FIGS. 2–4 for an illustration of a filament and filament assembly forming a preferred embodiment of the present invention.

The filament assembly **11** includes a body portion **25** molded of any suitable heat resistant ceramic or plastic and has top and bottom surfaces **26** and **17**, opposite sides **28** and **29**, and front and rear ends **30** and **31**. The front end includes tabs **32** which extend slightly outwardly from the sides to permit the user to easily grasp the filament assembly when it is to be removed from the lighter

casing such as for cleaning or replacement. The top surface **26** of the body is cut away to provide a generally circular opening **33** which extends approximately half way through the body of the assembly. A thin sheet **34** of mica or other suitable heating insulating material is positioned at the bottom of this opening, and the sheet has apertures **35** therethrough for permitting air flow through these apertures to facilitate lighting a cigarette. This air flow path is further established by a smaller cut away portion **36** extending all the way through the bottom surface of the assembly so as to permit air to flow upwardly from the bottom surface of the assembly through the apertures **35** in the mica sheet when a user is inhaling on a cigarette to light it. A pair of electrical resistance heater filaments **37** and **38** are arranged in electrical parallel across opposite contact portions **21** and **22**. As seen clearly at FIG. 4, these filaments are spaced slightly above the mica sheet **34** and are supported only at the ends where they are connected to the contact portions **21** and **22**. This spacing of the filaments above the insulating sheet **34** is advantageous because with this spacing there is less tendency for any accumulated tars or tobacco to form a bridge between the filaments and the sheet **34**. If this bridge were formed it could possibly act as a heat sink to reduce the heating efficiency of the filament. Furthermore, by having the filaments spaced from the sheet, the efficiency is increased because the insulating sheet does not act as a direct contact heat sink. In addition, this spacing permits a preheating of the air in this space before it contacts the filament which also increases the efficiency of the unit.

One method of connecting the ends of the filament to the contact portions is to bend the ends of the contact portions back upon themselves to form circular openings **39** and then insert the ends of the filaments into these openings. Then, the openings are filled with solder to provide a good electrical connection. The contact portions **21** and **22** with the filaments **37** and **38** attached in the manner just described may be positioned in the body portion of the assembly by inserting the contact portions into opposite grooves **40** and **41** leading from the opening **33** to the opposite sides **28** and **29** of the body. The contact portions extend toward the rear end **31** of the body slightly spaced from the side walls, and are made of any suitable resilient electrically conducting material. This resiliency provides a wiping action between the contact portions **21** and **22** and internal contact tabs **14** and **15** thereby assuring good electrical contact between these parts when the filament assembly is inserted in the lighter.

Each filament may be said have a sinuous configuration including alternating ridges **42**, valleys **43** and connecting portions **44** connecting each ridge with an adjacent valley. As may be appreciated best, perhaps, by viewing FIGS. 3 and 4, adjacent ones of each of said ridges and valleys and connecting portions may be said to be disposed substantially in a common plane. This is in contradistinction to a heretofore known type of filament which is helically wound. While a helically wound filament of the prior art may, in a general sense, be said to include ridges and valleys, the portions connecting the ridges and valleys curve outwardly of the longitudinal axis of the filament. Therefore, in a helically wound filament any ridges and valleys cannot be said to be substantially in a common plane with the portions connecting the ridges and valleys. It should be noted that the present filament need not be wound on a mandrel as is commonly done to form a helical filament; but rather, the filament of the present invention may be formed simply by clamping a straight length of wire between 2 dies having mating faces of appropriate configuration to form the sinuous construction.

In the present construction when connecting portions **44** are described as being in a substantially common plane with an adjacent ridge **42** and valley **43** it is not to be inferred that the filament may not be bowed along the length thereof; and, in fact such a bow is utilized in a preferred embodiment disclosed in the drawing. If desired, an even greater bow could be formed.

It is to be noted the filament is so arranged that when a cigarette **45** (see FIG. 4) is applied to the filament the cigarette contacts first primarily only the ridges **42**. I have found that this increases the lighting efficiency as compared, for example, to a structure wherein the plane of the sinuations would be substantially flat and parallel to the mica sheet **34**. To better appreciate this, consider as a first case the structure of my invention wherein the plane of the sinuations is substantially perpendicular to the top surface of the sheet **34**; and consider as a second case a structure wherein the plane of the sinuations would be substantially parallel to the top surface of the sheet. In either case, assuming the material and the length of wire are the same, the total wattage output is identical. In the first case, however, the output is applied along a shorter line than would be the condition in the second case. Therefore, the watts output per square inch of cigarette contact surface is greater in the first case causing more rapid ignition. Once ignited, even along a narrow line, this ignition rapidly propagates itself across the entire tip of the cigarette. Put another way, in the first case the heat output tends to be concentrated in the vicinity of the ridges which is where the cool cigarette tip contacts the filament. This provides for more rapid ignition at these points of contact where the heat is concentrated.

The filament, in preferred form, is approximately 10 mils in diameter with a spacing of approximately 30 mils between the center of a valley **43** and the center of an adjacent ridge **42** along the length of the filament. The gap between the bottom surface of the valleys and the mica sheet is on the order of 20 mils. The depth of the filament, which is the vertical distance between the outer bottom surface of the valleys and the outer top surface of the ridges, is 45 mils.

As a part of the present invention, I have found a known alloy which works remarkably well as a resistance heater filament for a cigarette lighter in that the alloy is relatively inexpensive but still provides the required amount of heat for rapid lighting and is strong and corrosion resistant to assure long operating life for the lighter filament. This alloy includes from 0.5 to 4.0 weight percent aluminum, from 0.5 to 3.0 weight percent yttrium, from 20.0 to 95.0 weight percent chromium, and the balance is iron. More specifically, a preferred composition includes 3.0 weight percent aluminum, 1.0 weight percent yttrium, 25.0 weight precent chromium and the balance iron. The alloy may be formed in ingots by vacuum melting and then drawn to the required diameter.

The foregoing is a description of an illustrative embodiment of the invention, and it is applicant's intention in the appended claims to cover all forms which fall within the scope of the invention.

I claim:

**1.** An electrical resistance heater filament assembly for use in an electrically operated cigarette lighter which comprises:

(a) a main body portion of electrically insulating material including a top surface, a bottom surface, and a pair of generally parallel side surfaces;

(b) a pair of electrical contacts located on opposite sides of said main body portion and supported by said main body portion;

(c) said main body portion having a generally circular opening located in the top surface thereof, at least a portion of which extends through the entire main body portion;

(d) a perforated heat insulating plate located in said opening and supported by said body;

(e) an electrical resistance heater filament supported by said contacts and located within said opening

and spaced from said heat insulating plate along its entire length whereby an air space is provided around the entire filament and said heat insulating plate is prevented from operating as a direct heat sink during the operation of said cigarette lighter; and

(f) said heater filament having a general sinuous configuration including alternating ridges and valleys and connecting portions connecting each ridge with an adjacent valley, said ridges lying in a common plane above the valleys in a manner permitting the tip of a cigarette to contact first, primarily, only the ridges of said filament when a cigarette is applied thereto.

**2.** The filament assembly as set forth in claim **1** wherein said filament is formed of an alloy comprising from 0.5 to 4.0 weight percent aluminum, from 0.5 to 3.0 weight percent yttrium, from 20.0 to 95.0 weight percent chromium, and the balance iron.

**3.** The filament as set forth in claim **2** wherein said alloy comprises essentially 3.0 weight percent aluminum, 1.0 weight percent yttrium, 25.0 weight percent chromium, and the balance iron.



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U.S. Cl. X.R.

219—267, 546, 553; 317—98; 338—321, 287, 315