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PATENT SPECIFICATION

479,923

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" " " Feb. 17, 1936. No. 13201/36.

Application Date (in United Kingdom): May 9, 1936.

Specification not Accepted

COMPLETE SPECIFICATION

Non-combustible Wick for Lighters or the like and a Method of Making the same

We, EVANS CASE COMPANY, a corporation of Massachusetts, United States of America, having a place of business at North Attleboro, Massachusetts, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a non-combustible wick for lighters especially cigarette lighters, or the like, and a method of making same.

One of the objects of this invention is to provide a wick for a cigarette lighter, or the like, which is simple in construction, sturdy and durable under conditions of rigorous use, and efficient in operation. Another object is to provide a wick of the above nature which is inexpensive to manufacture, and which may readily be installed in a cigarette lighter. Another object is to provide a wick of the above nature which does not crumble or become clogged or carbonized after extensive use. Another object is to provide a wick of the above nature which may readily be ignited under extreme temperature conditions. Another object is to provide a method of making a wick of the above nature which is inexpensive, and which may readily be practiced by unskilled labour, and also being well suited to high production requirements.

In the accompanying drawing in which are shown several of the various possible embodiments of our invention,

Figure 1 is a fragmentary elevation, partly in section, of a cigarette lighter having our wick installed therein, a portion of the lighter being broken away;

Figure 2 is an enlarged plan view of the portion of the cigarette lighter in which our wick is installed;

Figure 3 is an enlarged sectional view of certain of the parts in Figure 1;

Figure 4 is an enlarged perspective view of our wick;

Figure 5 is an enlarged elevation of our wick partly in section;

Figure 6 is an enlarged sectional view of certain of the parts of a modification of our invention; and

Figure 7 is an enlarged sectional view of certain of the parts of another modification of our invention.

Similar reference characters refer to similar parts throughout the several views of the drawings.

It might be well to point out various disadvantages inherent in cigarette lighter wicks now in common use. Such wicks are prone to fray at the exposed or ignition end thereof, with the result that strands or fibres of the wick may lie between the wick snuffer and its seat on the lighter. This effects a partial exposure of the wick, and causes undue evaporation of the fuel, and premature exhaustion thereof. Furthermore, such wicks burn down to such an extent, after a relatively short period of use, that there remains an insufficient amount of wick exposed to provide a flame. In many instances, it is difficult to pull the wick out of the lighter, and in any event considerable inconvenience results.

Wicks of this general type are further characterized by their tendency to become clogged, or carbonized, to such an extent that after a certain amount of use they do not give a clean, steady flame, and in many cases can not be ignited, although subjected to repeated showers of sparks. The installation of such wicks is in most cases quite difficult for the average user, and sometimes necessitates return of the lighter to the manufacturer, or causes the lighter to be discarded.

Other wicks, heretofore conceived, are

too porous and cause an excessive feed of fuel, or are not sufficiently porous, with the opposite result. Furthermore, many of them are so fragile that they are unable to withstand normal use without breaking, and in other cases they are unable to withstand extensive heating without crumbling. Still others are so formed that expansion resulting from heating loosens their connections in the lighters, or causes them to break from internal strains. The most common failing, however, of this type of wicks, is their inability to ignite when cold, apparently the only remedy for this failing is either to raise the temperature of the wick itself, or expose it to a flame, the intensity of which is substantially greater than that of the normal shower of sparks generated upon operation of the lighter. It should also be noted that in many instances the methods practiced in making these wicks are both cumbersome and so involved that an inferior wick often results. Another object is to provide a wick which rectifies these conditions and disadvantages.

Referring now to the drawing, and particularly to Figure 1, a lighter generally indicated at 10 includes a fuel tank 11 having a top wall portion 11*a*, on which is mounted a wick generally indicated at 12, a sparking wheel 13, a snuffer generally indicated at 14, and a finger piece 15. A piece of pyrophoric material 16 extends through top 11 and is urged against the bottom of sparking wheel 13 by a spring 17. Snuffer 14 and finger piece 15 are pivotally mounted in a bracket 18, and a rack 19 which is connected to snuffer 14 is operatively connected to sparking wheel 13 so that upon downward pressure on finger piece 15, sparking wheel 13 is rapidly rotated against pyrophoric material 16 to direct a shower of sparks on to and about wick 12, as indicated in Figure 1. A more detailed description of the preferred construction of our cigarette lighter appears in United States Patent 2,019,435 to Robert S. Blair.

Preferably top 11*a* of the lighter has formed in one end thereof an opening 20, which receives the reduced end 21*a* of a wick tube generally indicated at 21. Wick tube 21 is provided with a bore 21*b* into the fuel tank and terminating in a larger bore 21*c*, thus providing shoulders 21*e* there between. Conveyer 22, preferably formed from any desirable absorbent material, extends through bore 21*b* of the wick tube and the frayed end portion 22*a* thereof, extends into the larger bore 21*c* of the wick tube to lie therein between shoulders 21*e* and the bottom faces of wick 12.

Still referring to Figure 1, wick 12 which is preferably dome shaped, and which will be described in greater detail hereinafter, is disposed in bore 21*c* of wick tube 21, and rests upon the frayed upper end of conveyer 22. Wick 12 is held in the wick tube by bending over in any suitable manner the upper edge 21*d* of the wick tube (see Figure 2), this edge thus engaging the curved surface thereof, and holding it in its installed position. Edge 21*d* is also preferably beveled to provide a seat for snuffer 14 to prevent evaporation of fuel when the snuffer is closed.

It may now be seen that fuel from tank 11 may be carried by conveyer 22 to the bottom portion of wick 12 and from there such fuel may travel to the outer surface of the wick by capillary action; this action provides a blanket of fuel vapour adjacent the outer surface of the wick. Upon downward pressure of finger piece 15, snuffer 14 is raised and sparking wheel 13 is actuated; a shower of sparks is directed against wick 12 and causes ignition of the blanket of fuel vapour lying thereabout. Upon release of finger piece 15, snuffer 14 resumes its seated position about wick 12 to prevent evaporation of fuel when the lighter is not in use.

Snuffer 14 includes a cap portion 30 having a beveled edge portion 30*a* substantially similar in diameter to beveled edge 21*d* of wick tube 21. Furthermore, cap 30 is sufficiently deep to accommodate wick 12 in its diameter when the snuffer is closed down upon the wick tube. Thus, when the snuffer 14 is in its closed position, cap 30 completely engages the wick, and edges 21*d* and 30 co-operate to substantially seal the wick from the atmosphere.

As best shown in Figures 3 and 4, wick 12 is preferably a dome shaped shell having an opening 12*a* in the bottom, giving access to a recess 12*b* formed in the interior of the wick. It is our opinion that in providing wick 12 (Figure 1) with recess 12*b*, we in effect provide a small storage chamber for vaporized fuel which may flow quite readily through the capillaries of the wick. It would seem that the provision of this recess also prevents an excessive concentration or condensation of liquid fuel within the body of the wick, which might impede the production of fuel vapour immediately after ignition of the wick. Furthermore, this recess reduces substantially the mass of the wick and although the thermal conductivity of the wick is quite low, as will be pointed out hereinafter, this recess further prevents conduction of heat away from the exposed surface of the wick where it is needed.

While the shape of wick 12 described above is admirably suited for all conditions of practical use, other shapes may be used. Thus in Figure 6, we have shown a wick 31 substantially tubular in shape. Wick 31 may be formed from material similar to the material used in the formation of wick 12 and preferably rests upon shoulder 21*e* of wick tube 21. Wick 31 may be held within wick tube 21 in any desired manner and the bore 31*a* thereof is substantially equal in diameter to the bore 21*b* of wick tube 21. Thus, conveyer 22 extends upwardly from the fuel tank through bores 21*b* and 31*a* so that a substantial portion thereof is in engagement with the walls of wick 31.

Under other circumstances we might prefer to utilize a wick having the general shape of wick 32 shown in Figure 7. In this case, the holder 33 for the wick which extends through the top portion 11*a* of the fuel tank 11 is different in shape. It has a continuous inner bore 33*a* extending from the top to the bottom thereof. Wick 32, which is preferably formed from material similar to that used in the construction of wicks 31 and 12, preferably extends all the way through holder 33 and into the fuel tank to contact the absorbent material 34 within the tank. Furthermore, wick 32 has formed on the outer surface thereof a series of spaced annular ridges 32*a*, 32*b*, 32*c* and 32*d*. In this manner, we provide a larger exposed wick surface for ignition purposes.

Wick 12 is formed of a refractory material, the characteristics and physical and chemical properties of which are preferably as follows:

Crushing Strength - - - - -	6000 to 7000 pounds per square inch
Thermal Conductivity in C.O.S. Units	.0035 to .0049 from 200° C. to 1400° C.
Coefficient of Thermal Expansion -	Less than 10.2×10^{-6}
Burning Temperature - - - -	Approximately 1600° C.
Melting Point - - - - - -	2000 to 2700° C.

Insoluble, or substantially insoluble, in water.

While there are several substances having generally the above characteristics, we have found that zirconia is the most suitable material from which to form our wick. Accordingly it will be understood that references made hereinafter to "Zerite" will refer to materials having the above noted characteristics.

Accordingly, to utilize the characteristics and properties of zirconia to their best advantages, we mix together approximately equal parts of zirconia and a finely ground organic material, such as cork or sawdust, and one-third part of mono ammonium phosphate, the proportions being by volume. After dampening this mixture slightly, we place small amounts of it in polished steel dies and mold our wicks, preferably under heavy pressure. When the wicks are removed from the dies they are quite firm and may be readily handled. The molded wicks are then transferred to a furnace where they are slowly heated to any temperature in excess of 1400° F. At this temperature the cork is completely carbonized; that is, a destructive distillation of the organic material will have taken place, leaving a network of capillary canals interlaced throughout the body of the wick.

It is our belief that under the action of excessive heat the ammonium phosphate breaks down releasing ammonia as a gas, perhaps a chemical reaction taking place between the phosphate and the zirconia. While other salts might be used in place of ammonium phosphate, the latter is preferred as we have found that under the action of excessive heat it does not tend to bubble and accordingly distort the wick. It may be that the binding material upon the application of intense heat undergoes a chemical change or enters into chemical combination with the zirconia, as we find that the particles of zirconia are firmly bound together, and the resultant moulded wick is an extremely hard and integral mass, is apparently crystalline in structure, and is able to withstand temperatures far in excess of those to which it is subjected in normal use.

Upon testing wicks formed from Zerite when installed in a cigarette lighter, we have found that they may be readily ignited even though the temperature of the wick itself is well below 0° C. We have found that wicks formed from Zerite can be ignited at very low temperatures. Furthermore, experiment shows that this is not true of wicks formed from other refractory materials. We can not state definitely the reasons for this phenomena but believe that the low heat conductivity of zirconia and like materials has an important bearing thereon. The ignition of a wick is dependent upon continued ignition of the blanket of fuel vapour emanating from the wick. Thus heat must be concentrated at the surface of the wick during the ignition stage. Where the wick is formed from material such as Zerite having low conductivity the heat initially applied thereto remains at the surface where it is needed for ignition.

This theory would seem substantiated by the inability of other refractories having great heat conductivity to operate under low temperature conditions.

Again other factors may account for the efficient operation of my wick under low temperature conditions. It would seem that zirconia has less affinity for a volatile fuel than many other refractories. Such being the case, the vapour pressure of the blanket of fuel vapour surrounding the surface of the zirconia wick would be correspondingly greater. Thus low temperature operating conditions making ignition more difficult would be compensated for by greater vapour pressure of the vapour surrounding the zirconia wick; that is, an adequate supply of fuel for ignition purposes. Further still, it is possible that zirconia has little affinity for water. Hence zirconia wicks would contain less water to solidify in their pores and impede the passage of fuel when placed in low temperatures.

While a wick made from the materials mentioned above functions perfectly, certain materials might be substituted therefor under certain conditions. For example, certain other "rare earth refractories" may be used in place of zirconia, we might use the oxides of cerium, beryllium, and yttrium, or the di-oxides of uranium and thorium or tetra-oxide of venadium, these materials having such characteristics as incandescence at relatively low temperatures and low heat conductivity, together with an extremely high fusing point. Ammonium phosphate is used as a binder, although it is possible to use other inorganic salts; for example, the chlorides of barium or sodium. Such salts combine the characteristic of a high melting point with extreme cohesiveness and stability. Further, other organic materials may be substituted for the cork, i.e., any organic material capable of destructive distillation or decomposition.

In any event, wicks of the character described above may be easily manufactured from inexpensive materials and permanently installed in cigarette lighters or the like. Lighters with such wicks function perfectly under all of the normal temperature and weather conditions, and considerable inconvenience in the maintenance of lighters in working condition is obviated. It is unnecessary to adjust or clean such wicks or replace them.

Accordingly, it may now be seen that we have provided a wick which is readily ignitable regardless of temperature conditions, and which efficiently and practicably fulfills the several objects set forth hereinabove.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. A lighter comprising ignition apparatus such as a sparking wheel for generating a shower of sparks and a wick in the path of the sparks characterised in that the wick is a hard integral mass capable of fluid absorption.

2. A lighter according to claim 1, in which the wick is made of non-inflammable material.

3. A lighter according to claim 2, in which the wick is porous.

4. A lighter according to claims 1, 2 or 3, in which the wick is formed from material having the characteristic of low heat conductivity.

5. A lighter according to claim 4, in which the material from which the wick is formed has the characteristic of high incandescence at low temperatures.

6. A lighter according to claims 4 and 5, in which the wick is made from zerite.

7. A lighter according to claims 4, 5 or 6, in which the wick is made from zirconia.

8. A lighter according to any of the preceding claims in which the wick is substantially dome-shaped.

9. A lighter according to claim 8, in which the wick is hollow.

10. A lighter according to claims 8 or 9, in which there is a holder on the top of the fuel tank and the wick fits within the holder.

11. A lighter according to claim 10, in which the holder has an internal shoulder and the wick fits above the shoulder.

12. A lighter according to claim 11, in which the sides of the holder are turned inwardly to hold the wick in position.

13. A lighter according to claims 8, 9, 10, 11 or 12, in which there is a fuel conveyor between the wick and the fuel tank.

14. A lighter according to claim 13, in which the conveyor is formed from absorbent material.

15. A lighter according to any of the preceding claims, in which the wick is substantially tubular in shape having open ends, the inner end being in communication with the fuel tank.

16. A lighter according to claim 15, in which the fuel conveyor fits within the wick.

17. A lighter according to any of the preceding claims, in which there are spaced annular ridges formed on the outer surface of the wick.

18. A lighter according to any of the preceding claims, in which there is a snuffer member mounted on the top of the

lighter and adapted to move over the wick.

19. A lighter according to claim 18, in which the snuffer member is pivoted on the top of the lighter and has a finger piece connected thereto for actuation.

20. A lighter according to claims 17 or 18, in which the sparking wheel is actuated by the snuffer.

21. A lighter according to claim 19, in which a piece of flint-like material is constantly urged against a sparking wheel.

22. A lighter according to any of the preceding claims, in which the wick is formed from a ceramic having low heat conductivity suspended in a heat resisting binder.

23. A lighter according to claim 22, in which the ceramic is zirconia.

24. A lighter according to claim 23, in which the binder is ammonium phosphate.

25. A lighter according to claim 24, in which the wick is made from three parts of zirconia to one part phosphate salt.

26. A method of forming a wick for a lighter according to claim 1, which consists in mixing refractory material with a heat resistant salt, molding the mixture under pressure, and baking the resultant product.

27. A method according to claim 26, in which the refractory material is zirconia.

28. A method according to claims 26 or 27, in which the salt is ammonium phosphate.

29. A method according to claim 28, in which equal parts of refractory material and organic material are mixed together with one third part of salt and the resultant mixture is molded under pressure and thence baked.

30. A method according to claim 29, in which the organic material is cork.

31. A method according to claim 30, in which the wick is baked at an approximate temperature of 1400° Fahrenheit.

32. A method of forming a wick for a lighter or the like substantially as described with reference to the accompanying drawing.

33. A lighter substantially as described and as shown by the accompanying drawing.

Dated this 9th day of May, 1936.
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2, Broad Street Buildings,
Liverpool Street, London, E.C.2,
Patent Agents for the Applicants.

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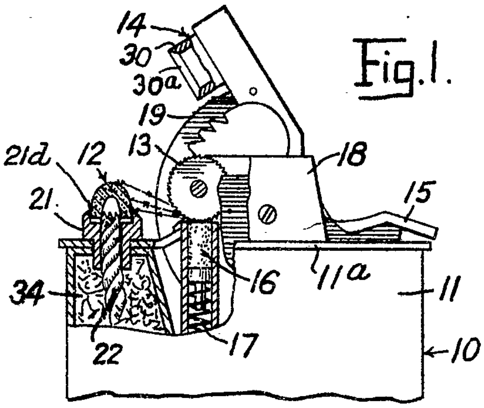
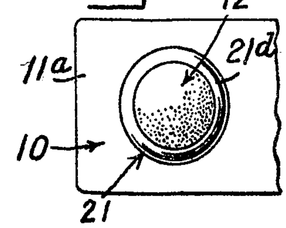


Fig. 1.

Fig. 2.



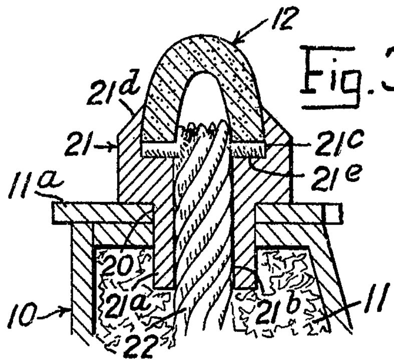


Fig. 3

Fig. 4.

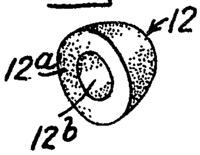
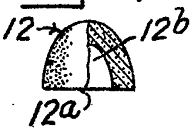


Fig. 5.



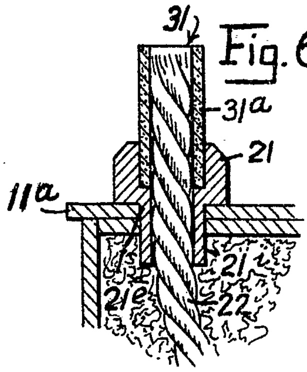


Fig. 6.

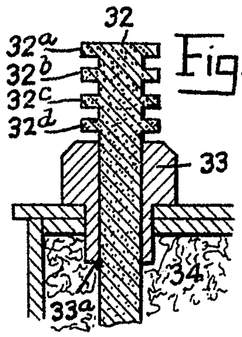


Fig. 7.

Malby & Sons, Photo-Lith.