Aug. 19, 1958 P. E. ASHTON ET AL 2,848,590

CIRCUIT BREAKER LIGHTER

Filed Oct. 9, 1956 2 Sheets-Sheet 1

Fig. 1.

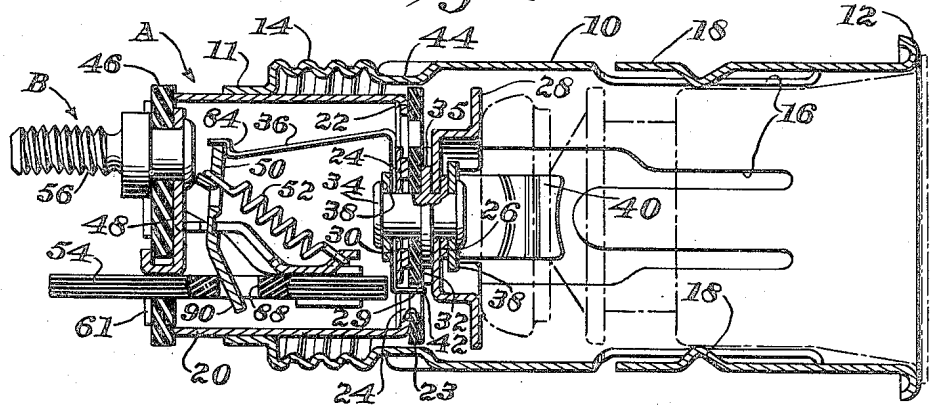


Fig. 2.

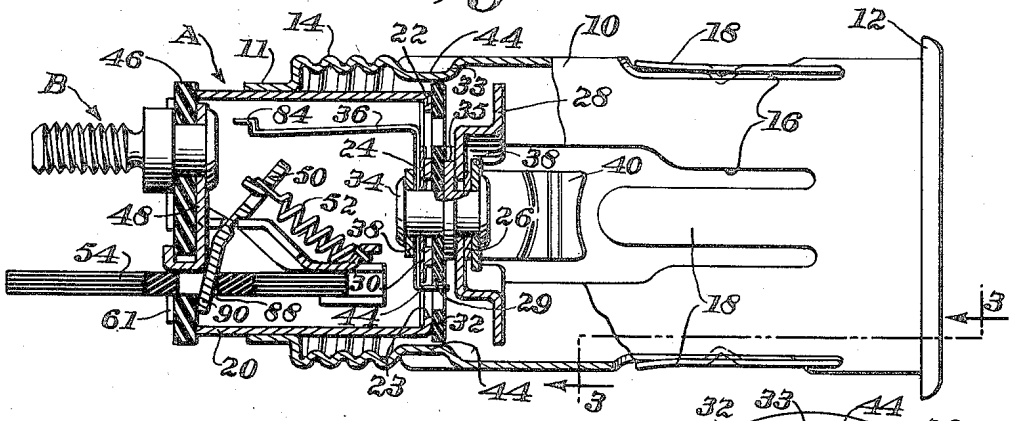


Fig. 11.

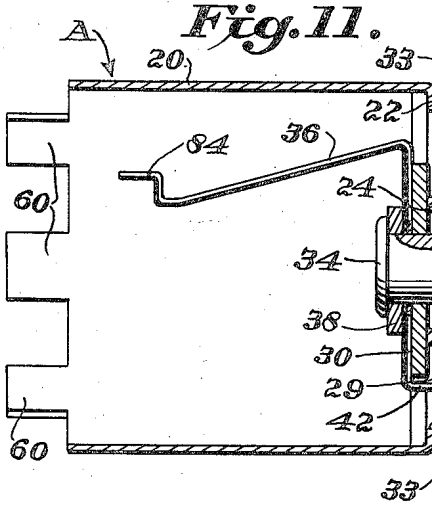
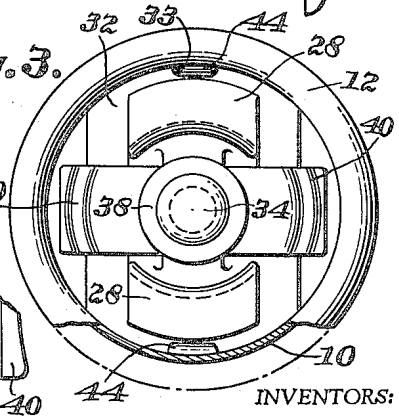


Fig. 3.



INVENTORS:
Philip E. Ashton,
Arthur W. Schnick,
BY
Cushman, Darby & Cushman
ATTORNEYS.

Aug. 19, 1958 P. E. ASHTON ET AL 2,848,590

CIRCUIT BREAKER LIGHTER

Filed Oct. 9, 1956 2 Sheets-Sheet 2

Fig. 4.

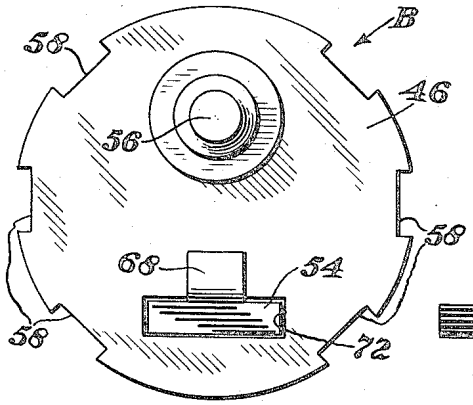


Fig. 5.

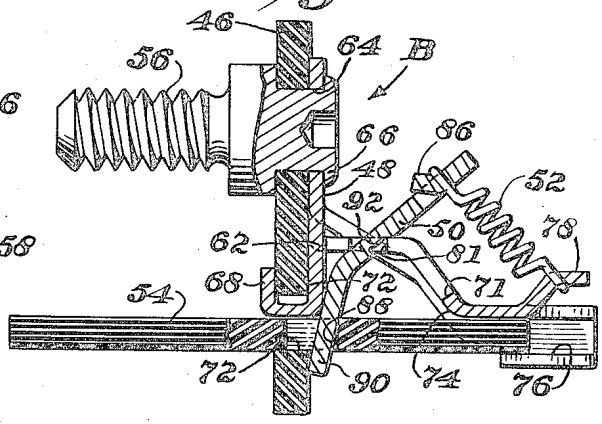


Fig. 7.

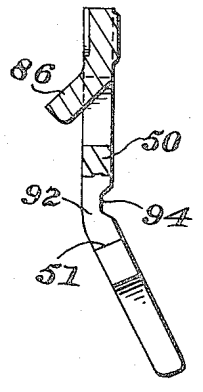


Fig. 6.

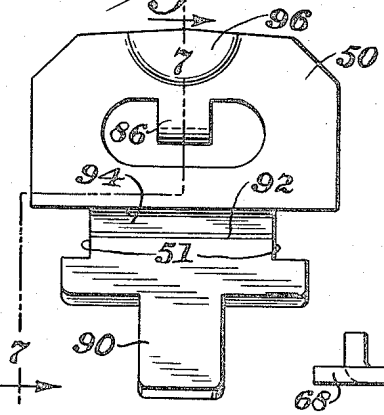


Fig. 8.

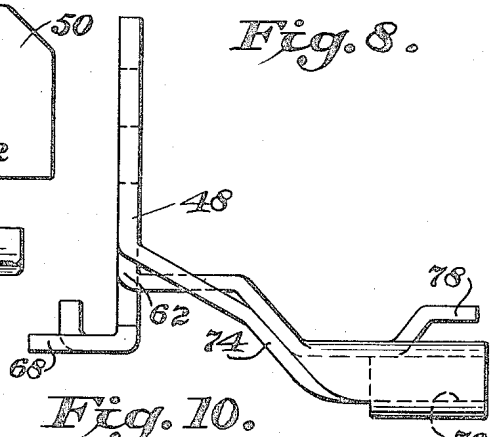


Fig. 9.

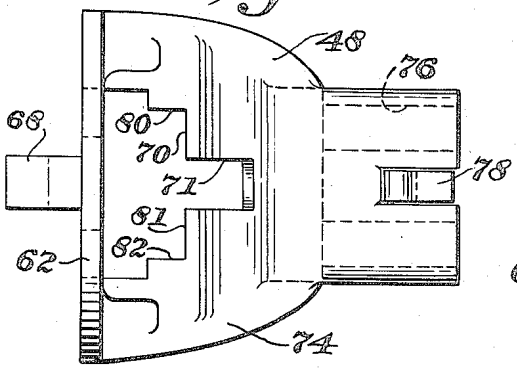
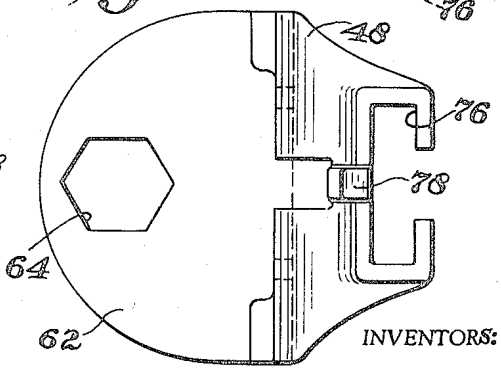


Fig. 10.



INVENTORS:

Philip E. Ashton, and

Arthur W. Schnick,

BY Cushman, Darby & Cushman

ATTORNEYS.

United States Patent Office 2,848,590 Patented Aug. 19, 1958

2,848,590

CIRCUIT BREAKER LIGHTER

Philip E. Ashton and Arthur W. Schnick, Meriden, Conn., assignors to Cuno Engineering Corporation, Meriden, Conn., a corporation of Connecticut

Application October 9, 1956, Serial No. 614,948

10 Claims. (Cl. 219—32)

This invention relates to electric cigar lighters of the type generally used in automobiles, motor boats, aircraft and the like.

Almost all cigar lighters of the class above mentioned comprise a plug with a heating element having terminals, and a holder or socket having terminals connected to a source of electrical energy and arranged to cooperate with the terminals of the plug, the socket being suited for both storing and energizing the plug. Typical constructions, of which some millions are made and sold each year, are shown in United States Patents Nos. 2,495,657 and 2,531,901.

In these lighters, the plug is normally carried in the socket in a storage or open circuit position with its terminals separated from the co-operable terminals of the socket so that no current flows through the heating element. When it is desired to use the lighter, the plug is moved further into the socket so that a terminal on the plug is engaged and held by a thermostatic, latch-like terminal in the socket against the force of a spring adapted to return the plug to its storage position. Upon the heating element attaining a predetermined and suitable temperature, the thermostatic latch-like terminal relinquishes its hold on the plug terminal and the plug them moves to storage position whence it may be removed by the user for use, as is well known to those versed in the art. Normally, the time required to bring the heating element to its predetermined temperature (a bright red heat) is around ten seconds, current consumption being about 100 watts.

Obviously, as the heating element attains red heat in such a short time it may be greatly overheated, with an attendant possibility of fire if the circuit is held closed for a relatively prolonged period, as is sometimes done by an absent-minded user or by the accidental displacement of a piece of luggage or the like which may lean against the handle of the plug and press it into closed circuit position. There is a further potential danger in that when the plug is out of the socket the latter is open for the ingress of foreign objects such as nails or small coins, etc., which may be and have been inserted by children and which can cause a short circuit.

While unhappy events of this nature are relatively rare the potential hazard of fire in an automobile or motor boat or aircraft is such that the question of protection cannot be ignored and much serious thought has been given to means to avert such danger.

Proposals have been made to provide a destructible fuse or a circuit breaker that would "open circuit" in the event of excessive heat or current in the lighter. Some of these devices were objectionable in that they were located in the plug and afforded no protection against short circuit within the socket. Others were complex, expensive and difficult to manufacture. In still other cases the protective device was so located on the socket as to require that the wiring be disconnected before the fuse could be replaced or the circuit breaker be re-set to closed circuit condition.

Constructions which, as indicated above, require that the wiring be disconnected to replace the fuse or reset the circuit breaker commonly defeat their own purpose and create a further hazard as the user frequently either will by-pass the protective device or will use matches instead of the lighter and so, in either event, expose himself and others to unnecessary risks.

Accordingly it is an object of the present invention to provide a socket for a cigar lighter of the type described and which incorporates a circuit breaker which cannot be electrically by-passed.

A further object is the provision of a socket for an electric cigar lighter of the type described which socket embodies a protective circuit breaking device resettable to its normal current carrying condition without disconnection from its electrical supply source of the removal of any parts or the use of any tool.

Yet another object of the present invention is the provision of a combined cigar lighter socket and resettable protective circuit breaker wherein the means for restoring the circuit breaker to current carrying condition is an integral part thereof having an external part directly accessible for manual manipulation.

Other objects will become apparent on perusal of the appended drawings and this specification.

Referring to the drawings:

Figure 1 is a longitudinal section of a cigar lighter socket embodying the principles of the present invention and showing the parts in their normal current carrying position;

Figure 2 is a partial sectional view generally similar to Figure 1 but showing the circuit breaker parts in their open circuit position;

Figure 3 is a front elevation of the socket but partially in section along line 3—3 of Figure 2;

Figure 4 is a rear elevation of a major subassembly of the circuit breaker;

Figure 5 is a sectional side elevation of the structure shown in Figure 4;

Figure 6 is a front elevation of the circuit breaker arm;

Figure 7 is a cross-section of the part shown in Figure 6 and taken along the line 7—7 thereof;

Figure 8 is a side elevation of the bracket of the circuit breaker;

Figure 9 is a plan view of the bracket;

Figure 10 is a front elevation of the bracket;

Figure 11 is a sectional view, generally similar to a portion of Figure 1 and showing another major subassembly of the circuit breaker.

The cigar lighter socket described herein comprises a substantially cylindrical tubular metallic receptacle 10 having a bezel 12 at its front end and also having screw threads 14 which in cooperation with a tubular clamping element of conventional design (not shown) are suited to secure the socket to the instrument panel of an automobile or the like. The wall of receptacle 10 may have lancings 16 affording spring fingers 18 adapted to yieldingly hold a suitable plug carried therein. In addition to its mechanical functions the said wall usually serves as a grounded terminal for the circuit supplying electricity to the cigar lighter for heating the heating element thereof. The foregoing structure is not new and is of a well known form, being employed in almost all automobiles currently being made in the United States.

In addition to the above mentioned well known parts, the socket comprises a novel circuit breaker conveniently made of two major subassemblies generally designated A and B in the drawings and permanently embracing within its organization the whole of the "live" or ungrounded current carrying parts of the socket.

The subassembly shown in Figure 1 and designated A comprises a housing 20 preferably made of a cylindrical

metallic shell with an end wall 22 having a substantially central opening 24. It also includes a terminal member 26, a stop member 28, insulating washers 30 and 32, a circuit breaker thermostat 36 and metallic washers 38 all arranged and secured in the relative positions clearly shown in Figures 1, 2, 3 and 11. A rivet 34 passes through all of these parts and secures them together. The rivet fits snugly in the central hole of insulating washer 30, which in turn fits closely inside the housing 20. The opening 24 is considerably larger than the rivet 34, so that the latter is thus supported by but insulated from the housing 20. The terminal member 26 is most conveniently made of bi-metallic thermostatic material and provided with one or more arms 40, shaped for latch-like and electrical engagement with the heating unit cup of a conventional cigar lighter plug indicated by broken lines in Figure 1. The metallic stop member 28 is contiguous with the terminal member 26 and in electrical engagement therewith and serves to limit the inward travel of a cigar lighter plug. It also affords an auxiliary terminal suited to energize the cigar lighter plug element, if desired, when the arms 40 are warped to a plug releasing position by the heat of the heating element. Both terminal member 26 and stop member 28 are generally U-shaped and have their base portions pierced to fit closely on rivet 34 and are located thereon by collar 35 which is insulated from end wall 22 by insulating washer 32, also pierced to closely fit rivet 34. The circuit breaker thermostat 36 is preferably made from a flat strip of thermally responsive bi-metal bent into a rough L-shape and provided with a tail 42 suited for keying engagement with suitable apertures 29 in insulating washers 30 and 32 while having no contact with the walls of a clearance opening 23 in end wall 22; the base portion of the thermostat 36 also has a hole affording a close fit for rivet 34 which in conjunction with the tail 42 serves to prevent relative movement of the mutually engaging parts.

The receptacle 10 has a reduced diameter portion 11 in which the housing 20 is supported and secured in place by any suitable means, preferably spot welding. The receptacle 10 also has one or more portions of its wall depressed radially inward, as shown at 44 in Figures 1 and 3, to afford a key for engagement with insulating washer 32 which has its periphery suitably notched at 33 for this purpose and which is a close fit on the inner surface of receptacle 10. The terminal member 26 and stop member 28 may also preferably have portions affording keying engagement with insulating washer 32. Metallic washers 38 are arranged at each end of rivet 34 as shown in Figure 1, so that they serve to prevent the distortion of parts adjacent them when the ends of rivet 34 are being riveted over. The keying engagement of insulating washer 32 with the key portion 44 of receptacle 10 together with the welding together of housing 20 and reduced diameter portion 11 provides means whereby all components heretofore described may be interlocked against relative motion.

The subassembly shown in Figures 4 and 5 and designated B comprises a disc 46, a conductive bracket 48, a circuit breaker arm 50 a tension spring 52, a reset plunger 54 and a terminal stud 56. The disc 46 is most desirably made of an insulating material such as a phenolic impregnated laminated fabric and may have its periphery notched as at 58 for keying and supporting engagement with a suitable series of fingers 60 formed at the open end of housing 20 and suited to be bent over onto said disc to secure it in place as shown at 61 in Figures 1 and 2. As shown in Figures 8, 9 and 10, the bracket 48, most conveniently made of sheet metal, has a base portion 62 pierced by hole 64 and is secured to disc 46 by means of terminal stud 56 which passes through a suitable hole in said disc and also through hole 64 and is riveted as at 66 to firmly secure the parts together. A tongue 68, integral with the bracket 48 and which is provided by metal displaced in lancing the opening 70 passes through a suitable opening 72 in disc 46 and is bent over as shown in Figures 5 and 4 to prevent relative rotation of disc 46 and bracket 48 on stud 56. In addition to the base portion 62, the bracket 48 also comprises a support portion 74 having an opening 70, a guideway 76, and a spring retaining hook 78. The opening 70 is stepped in width, the narrowest part 71 furnishes the metal necessary for tongue 68 and has no other function, the next wider portion 80, affords an edge 81 serving as a fulcrum or pivoting edge for circuit breaker arm 50 and also affords the margins 82 for cooperation with notches 51 in arm 50 to retain the latter in its desired location; the widest portion of the opening 70 affords a passage through which arm 50 may be inserted during assembly of the device as will be more fully explained below. The guide way 76 is defined by bending parts of the edges of the bracket into oppositely facing L-shapes and thereby providing a short substantially rectangular tubular portion to serve as a guide and support for reset plunger 54, which also passes through and is further guided by opening 72 in disc 46.

The circuit breaker arm 50 is shown in Figures 6 and 7 and is preferably made of sheet metal such as brass or bronze. As is apparent by a comparison of the positions of this part in Figures 1 and 2, it has a rocking bearing on edge 81 of bracket 48 while one end passes through reset plunger 54 and the other end may rest on contact surface 84 of step-like form provided by suitably bending the free end of thermostat 36. Tension spring 52 has one end engaged with a spring retaining hook 78 which may be provided by slitting and bending a tongue from a part of one wall of the guide way 76 in bracket 48. The other end of spring 52 is attached to arm 50 by any suitable means, such as that shown in the drawings, where a hook 86 is provided by an appropriately shaped piercing in the said arm; being so attached to the bracket 48 and to the arm 50, the spring 52 by its tension biases the arm 50 from the position shown in Figure 1 to that shown in Figure 2. The reset plunger 54 is most conveniently made of a flat strip of insulating material such as phenolic impregnated laminated paper or fabric; it is slidingly supported by guideway 76 and opening 72 in disc 46 and has a hole 88 for the reception of a finger 90 shaped on one end of arm 50, whereby the said arm and the plunger 54 may move in unison as will also be made clear by a comparison of Figures 1 and 2. The arm 50 is notched as at 51 to afford a neck portion 92, suited to be movably supported and retained between the margins 82 of bracket 48 while having a rocking bearing on edge portion 81 thereof. In order to provide a somewhat more precise and at the same time inexpensive bearing for the said arm we have found it expedient to coin a groove 94 in the neck portion 92. We have also found it desirable to coin a portion of one end of the arm 50 as at 96 to eliminate any burrs and to provide a smooth and well compacted contact portion for engagement with the mating contact surface 84 of thermostat 36.

In making up the subassembly B, the bracket 48 is secured to disc 46 by riveting over the end of terminal stud 56 as at 66 and the tongue 68 having passed through opening 72 is bent over to secure the parts against relative movement as before described. The reset plunger 54 is next slipped into its guides and circuit breaker arm 50 is passed through the widest part of opening 70 and, with the finger 90 in place in hole 88 of reset plunger 54, the groove 94 is seated on the edge 81; the tension spring is next attached to hooks 78 and 86 and the subassembly completed and ready to be placed over the open end of housing 20 and to be there secured by bending over the fingers 60 so that they hold the disc 46 with its attached parts in place.

It will be noted that each component of our socket is arranged for keying engagement in one form or another with cooperating components. In this way we have provided means whereby all elements having important align-

ment requirements may be maintained in correct orientation without the need of highly skilled labor at assembly or critical adjustment thereafter. It will be further noted that once the assembly has been made, no moving current-carrying parts are exposed or exposable but all are tightly housed and protected against deleterious external influences and the only part requiring or susceptible to manipulation is the exposed end of the reset plunger **54**.

When our novel socket is connected to a source of electricity and with a suitable plug in place and in position for energizing, current will pass through terminal stud **56**, bracket **48**, contact breaker arm **50**, thermostat **36**, rivet **34** and terminal member **26** to the plug (details of which being well known, are omitted) and thence to ground via the walls of receptacle **10**. Should the plug be held in closed circuit position longer than is desirable heat will be transmitted from the heating unit of the plug, by radiation and conduction, to thermostat **36** which is arranged to warp, under the influence of heat, away from arm **50** which when cleared by contact surface **84** will be moved by spring **52** to the position shown in Figure 2, and in being so moved the arm **50** will cause the reset plunger **54** to move in an outward direction. After the parts concerned have regained normal temperature the reset plunger **54** may be moved inward by slight digital pressure and the circuit breaker restored to normal current carrying condition. In the event of a short circuit occurring in the receptacle such as might be caused by the introduction of a foreign metallic body, the thermostat **36** will, by virtue of heat consequent on its resistance to the passage of heavy currents, warp in the same manner as when exposed to an unduly high ambient temperature and thereby initiate the above described circuit breaking series of events.

We have found that in the case of a cigar lighter operating on 12 volts and drawing about 100 watts that the thermostat **36** may well be made of a strip of bi-metal ¼" wide, .015" thick and having a free arm length of substantially 31/64" and that a desirable nominal composition of the bi-metal is, on the high expansion side, 79% Fe, 2% Cr and 19% Ni; while the low expansion side is 61% Fe and 39% Ni. We have also found it desirable to impose a load of ¾ to 1 lb. through spring **52**, onto the contact surfaces of arm **50** and thermostat **36** at **84**. With such arrangements and loads, we have found that the circuit breaker will function repeatedly and reliably with either short circuits or high ambient temperatures as the initial cause of warping of the thermostat.

We claim:

1. In a cigar lighter having a holder in which a removable plug having a heating element is adapted to be received and manually moved into a position to be heated; a terminal in said holder having means thereon for engaging the plug when in such position so as to energize the heating element thereof to a normally-attained predetermined temperature; means defining a housing on said holder rearwardly of said terminal; a circuit breaker mounted in said housing comprising a thermally-responsive arm having a portion normally disposed in an operative position and movable into a release position in response to excessive temperature conditions and a movable arm having a portion resiliently urged into an inoperative position out of engagement with said thermally-responsive arm in response to the movement of the latter into its release position; exposed means operatively connected with said movable arm within said housing and extending outwardly therefrom for moving said movable arm portion into an operative position in normally-retained engagement with said thermally-responsive arm portion; and means for electrically connecting said arms in series between said terminal and a source of electrical current.

2. In a cigar lighter having a holder in which a removable plug having a heating element is adapted to be received and manually moved into a position to be heated; a terminal in said holder having means thereon for engaging the plug when in such position so as to energize the heating element thereof to a normally-attained predetermined temperature; means defining a housing on said holder rearwardly of said terminal; a circuit breaker mounted in said housing comprising a pair of normally interconnected arms electrically connected in series with said terminal, one of said arms being operable in response to excessive-temperature conditions to move into a release position, the other of said arms being biased to move away from said one arm in response to the movement of the latter into said release position; and reset means for moving said arms back into interconnected relation after they have been moved apart, said reset means including an end portion extending outwardly of said housing in exposed condition so as to be manually engaged without the necessity of removing any covering parts.

3. In a cigar lighter having a holder in which a removable plug having a heating element is adapted to be received and manually moved into a position to be heated; a terminal in said holder having means thereon for engaging the plug when in such position so as to energize the heating element thereof to a normally attained predetermined temperature; means defining a housing on said holder rearwardly of said terminal; a circuit breaker mounted in said housing comprising a thermally-responsive arm having a free end normally disposed in an operative position and movable into a release position in response to excessive-temperature conditions, and an oscillating arm of electrically-conductive material having a free end resiliently urged into an inoperative position out of engagement with said thermally-responsive arm in response to the movement of the latter into its release position; exposed means operatively connected with said oscillating arm within said housing and extending outwardly therefrom for moving the free end of said oscillating arm into an operative position in normally retained engagement with the free end of said thermally-responsive arm; and means for electrically connecting said arms in series between said terminal and a source of electrical current.

4. In a cigar lighter having a holder in which a removable plug having a heating element is adapted to be received and manually moved into a position to be heated; a terminal in said holder having means thereon for engaging the plug when in such position so as to energize the heating element thereof to a normally-attained predetermined temperature; means defining a housing on said holder rearwardly of said terminal; a circuit breaker mounted in said housing comprising a thermostatic arm connected with said terminal and having a free end normally disposed in an operative position and movable into a release position in response to excessive-temperature conditions, a bracket mounted within the housing having means thereon for connection with a source of electrical current, a circuit breaker arm swingably mounted intermediate its ends on said bracket and spring means between said circuit breaker arm and said bracket for resiliently urging one end of said circuit breaker arm into an inoperative position out of engagement with said thermostatic arm in response to the movement of the latter into its release position; and a plunger having one end slidably mounted within said bracket, an opposite exposed end extending outwardly of the housing, and an aperture intermediate said ends receiving the opposite end of said circuit breaker arm so that movement of said plunger inwardly will operate to swing the one end of said circuit breaker arm against the action of the spring means into normally retained engagement with the free end of said thermostatic arm after the same have moved apart.

5. A cigar lighter as defined in claim 4 wherein said bracket includes an intermediate portion having a pair

of adjacent apertures of different widths formed therein, and wherein said circuit breaker arm has a pair of opposed notches forming a reduced intermediate portion arranged to seat within the smaller of said apertures, the larger of said apertures being of a size sufficient to permit the passage of the portion of said circuit breaker arm adjacent said notches therethrough.

6. A cigar lighter as defined in claim 4 wherein said bracket includes a pair of opposed L-shaped flanges extending from one end thereof so as to form a guideway for slidably receiving the one end of said plunger.

7. A cigar lighter as defined in claim 4 wherein said housing defining means comprises a tubular member extending from said holder and discs of insulating material disposed at the ends of said tubular member.

8. A cigar lighter as defined in claim 7 wherein the means on said bracket for connection with a source of electrical current comprises a second terminal extending through the other of said discs and securing said bracket thereto.

9. A cigar lighter as defined in claim 8 wherein said bracket includes a bent portion struck therefrom so as to form said adjacent apertures, said bent portion having a projection extending through the other of said discs.

10. A circuit breaker comprising a tubular housing, discs of insulating material disposed at the ends of said housing, a terminal extending through each of said discs, a bracket having one end secured to one of said terminals within said housing and an opposite end extending therein, said bracket including an intermediate portion having adjacent apertures of different widths formed therein, a circuit breaker arm plate having notches formed in opposite edges thereof so as to provide a reduced intermediate portion, the portion of said arm plate adjacent said notches being of a width sufficient to permit entry thereof through the larger of said bracket apertures and the width of the intermediate portion of said arm plate being of sufficient size to enter the smaller of said bracket apertures so as to form a pivotal axis for said arm plate, a spring between said bracket and said arm plate resiliently urging the latter into said smaller bracket aperture, the opposite end of said bracket having a pair of opposed L-shaped flanges extending therefrom so as to form a guideway, a plunger having one end slidably mounted within said guideway and an opposite end extending through the disc through which said one terminal extends, said plunger having an aperture formed therein intermediate its ends, one end of said arm plate being engaged within said plunger aperture, a thermostatic arm having one end portion thereof secured to the other of said terminals and an opposite end normally positioned in retained inter-engaged relation with the opposite end of said arm plate, the opposite end of said thermostatic arm being operable to move into a release position in response to excessive-temperature conditions whereby said spring is operable to move the opposite end of said arm plate away from said thermostatic arm.

References Cited in the file of this patent

UNITED STATES PATENTS

2,409,917	Von Hoorn	Oct. 22, 1946
2,442,693	Jackson	June 1, 1948
2,548,825	Schwend et al.	Apr. 10, 1951
2,563,174	Kitman	Aug. 7, 1951
2,704,318	Jorgensen et al.	Mar. 15, 1955