To all whom it may concern:

Be it known that I, WILLIAM M. FROST, a citizen of the United States, and resident of Eureka, county of Lincoln, and State of Montana, have invented certain new and useful Improvements in Electric Insect-Destroyers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to electric insect destroyers of the general type wherein a plurality of lengths of electrically charged wire are disposed adjacent and parallel to each other in such a manner that the insects will be electrocuted by completing or closing the normally open circuit that is maintained, the current bridging the adjacent wires through the body of the insect that comes into contact with or in close proximity to said wires.

The invention relates more particularly to insect destroyers of this kind in which two wires are employed which extend parallel and adjacent to each other throughout the length or width of the supporting frame on which the electrical connections are mounted, said wires being provided with a number of reverse bends at the edges of the frame, and being led across the latter in opposite directions and in serpentine or zig-zag fashion. Although my invention is not limited to this precise arrangement, as will hereinafter appear, in any case the lengths of wire that traverse the supporting frame are oppositely charged, irrespective of whether or not each wire extends completely across the frame, or in other words, is divided into a number of separate transverse lengths.

In devices of this character, it is highly essential that the wires be properly tensioned, in order that they may be kept taut, without sagging, as the proper operation of the apparatus is dependent upon the space that is maintained between adjacent wires, such space being adjusted to suit the different conditions that exist, as regards the strength of current, the thickness of the wire and like considerations.

Under these circumstances, the primary object of my invention is to furnish, in an electric insect destroyer of the type indicated, suitable tensioning means which will act uniformly upon the several lengths of wire embodied in the device, in such a manner that the wires will be tightly stretched at all times, without regard to temperature or other conditions. This makes it possible to use fine wire, which is a desideratum where the device is to be used in show windows or in transoms or the like, as the wires are not readily visible and do not prevent the wired frame from being substantially transparent; and it is also possible to charge the wires with a relatively heavy current so that insects will be electrocuted if they merely pass between adjacent wires without coming into actual contact with them.

Owing to the relatively fine wire which I am enabled to use, and the consequent transparency of the device, the insects will often endeavor to fly through the same, only to be electrocuted at the moment that they form a bridge for the passage of current between adjacent wires.

According to one phase of my invention, the tension devices not only serve to give the lengths of wire the proper tension, but they also act as current distributing devices by means of which the current is fed to the wires at a number of different points. Electric connection is made directly with the tension devices, and the current flows from the latter, at a number of different points, into and through the parallel wire lengths.

The novel devices by which the invention is carried out will appear fully from the description and claims.

In the accompanying drawing: Figure 1 is a front elevation of an insect destroyer constructed in accordance with the invention, the device being of flat rectangular form, Fig. 2 is a rear elevation of the device shown in Fig. 1, Fig. 3 is a vertical transverse section through the same device, Figs. 4 and 5 are detail perspective views illustrating opposite edges of the frame and the tension devices associated therewith, Fig. 6 is an elevation of a portion of a modified form of the device, Fig. 7 is a vertical transverse section through the parts shown in Fig. 6, Fig. 8 is an elevation of a further modified form of the device, wherein the latter is of cylindrical shape, Figs. 9 and 10 are a top view and a bottom view respectively of the device shown in Fig. 8, and Fig. 11 is a vertical longitudinal section through a portion of said device.
Referring to the drawing, and particularly to Figs. 1 to 5, the device is illustrated as comprising a rectangular frame A preferably constructed of suitable strips of wood, and it is across this frame that the parallel lengths of wire \( a, a' \) that are to be electrically charged, are stretched, as shown. At opposite edges of the frame A, the same is equipped with longitudinally extending strips B of any suitable insulating material, and the wires are threaded through kerfs in said strips, as will hereinafter appear, in such a manner that the several wire lengths are equidistantly spaced, the oppositely charged wire lengths being, nevertheless, efficiently insulated from each other. Current is supplied to the wires by means of metallic feeding strips C screwed or otherwise applied to the back of the frame along the members of the latter that serve to support the insulating strips B, the feeding strips being arranged parallel to said insulating strips having their main or web portions \( c \) at right angles thereto, as appears from Fig. 3. Each feeding strip has mounted thereon at one end a binding post \( d \), to which the electric conductors or leads are connected, and a suitable induction coil \( e \) is preferably interposed between the binding posts and the battery or other source of current \( f \), in order to regulate the voltage.

The metallic feeding strips or distributing plates C are provided with a plurality of spring fingers that are preferably formed integral therewith, and these fingers are used to support the reverse bends which are created in the respective wires, for the purpose of tensioning the latter, as previously intimated.

Referring particularly to Fig. 1, it will be seen that the several parallel wire lengths \( a, a' \) are formed as parts of two continuous main wires D, E that are connected with the respective distributing plates C and therefore receive current of opposite polarity.

In Fig. 4, it is shown how one of the main wires D is extended from the upper distributing plate C over the grooved extremity \( c' \) of one of the spring fingers \( e' \) with which said distributing plate is provided, said wire being then continued down to form the wire length \( a' \) shown at the extreme right of Fig. 1.

At the bottom of the frame (Fig. 1) the reverse bend in the wire D, that is formed between the end length of wire \( a' \) and the next length \( a' \) of the same main wire is received in kerfs \( b \) extending transversely across the front face of the lower insulating strip B, as shown. The reverse bend formed at the upper edge of the frame between the second and third wire lengths \( a' \) is resiliently supported on the extremity \( c' \) of the second spring finger \( e' \), with which the corresponding feeding or distributing plate is provided, and the reverse bend at the lower end of the frame that is formed between the third and fourth wire lengths \( a' \) is conducted through and held in kerfs \( b \), as before, the main wire D and its several lengths \( a' \) being secured in the frame in the same way throughout the length or width of the latter. It is obvious that as the bends in the wire D are all supported on the spring fingers \( e' \) of one distributing plate, the entire length of the wire will be uniformly charged with electricity. The extremity of said main wire at the left of the frame is led over the end spring finger \( e' \) and suitably secured to the lower insulating strip, as indicated at \( b' \).

The fingers \( e' \) are curved over the edge of the frame A from the back of the same and their extremities extend to the front face of the frame, as shown in Fig. 3.

Referring particularly to the lower parts of Figs. 2 and 3, it will be seen that the spring fingers of the lower feeding strip or distributing plate differ somewhat in form from the spring fingers \( e' \) just described. The spring fingers \( e' \) of the lower distributing plate are curved or bow shaped as before, but their notched or grooved extremities \( c' \) are located at the rear of the lower insulating strip B and engage in suitable notches in the latter.

Referring particularly to Fig. 5, it will be seen that one extremity of the other main wire E, comprising the several lengths \( a, a' \), is attached to the end of the corresponding distributing plate, in any appropriate manner, after which said wire is led over the terminal spring finger \( e' \), forward through a transverse kerf \( b' \) formed in the edge of the insulating strip and upward to form the first length \( a \) shown at the right of Fig. 1. The upper extremity of this length \( a \) is then led through a kerf \( b' \) that extends over the front and top edges of the upper insulating strip, the rear part of the reverse bend formed in the wire being engaged in a notch \( b' \) formed at the rear face of the insulating strip and said wire being extended downward from said notch through a second kerf \( b' \) to form the second length \( a \) shown at the right of Fig. 1. It will therefore be understood that the main wire E has its upper reverse bends positioned in the kerfs and notches of the upper insulating block, and that its lower reverse bends are led through the kerfs \( b' \) of the lower insulating block and over the extremities of the lower spring fingers. The extremity of said wire which is opposite the extremity first mentioned, can be secured beneath the binding post of the lower distributing plate, as shown at the lower right hand corner of Fig. 2.

From the foregoing description it will be clear, therefore, that each of the main wires D, E, is continued in a zig-zag or serpentine course throughout the width or length of the
frame, and that the lengths $a'$ of the wire D alternate with the lengths $a$ of the wire E, said lengths being parallel to each other and spaced apart at the proper distance. The upper reverse bends in the wire D are tensioned by the spring fingers $c'$ and the lower reverse bends are positioned in the kerfs $b$ of the lower insulating strip; while the lower reverse bends formed in the wire E are caught over the grooved extremities $c'$ of the lower spring fingers $c$ and the upper reverse bends in said wire are positioned in the kerfs $b'$ of the upper insulating strip.

In this way the two wires are uniformly tensioned and fed with current throughout their lengths, and yet they are effectively insulated from each other; and by properly manipulating induction coil $e$, the voltage can be so regulated that the mere passage of any insect, no matter how small, between adjacent lengths of the charged wires will be sufficient to form a bridge between said wires and thereby close the circuit, electrocuting the insect without its being necessary for it to come into actual contact with the wires.

In Figs. 6 and 7, I have shown a modified form of apparatus wherein the two long wires, extending throughout the length of the frame, are dispensed with, their place being taken by a number of short lengths of wire. The tensioning devices are also of different form and disposed adjacent one edge only of the frame. In these figures, G denotes the frame, which comprises upper and lower members $g$, $g'$. Extending parallel to the upper member $g$ and in close proximity thereto are two conducting rods $h$, $h'$ secured in the frame in any suitable manner and adapted for connection with the positive and negative leads. Parallel with said rods $h$, $h'$, and at a slight distance therefrom, is an insulating strip $i$ which extends between the two side members of the frame just as do the conductor rods. In the drawing, only one side member of the frame is shown, but it is evident that both sides are alike, and that the frame may be continued to any length. A second insulating strip $k$ is fixed in the frame parallel and adjacent to the bottom member $g'$. Connected with the conductor rod $h$ are a plurality of wires $m$. One end of each wire is connected with said rod and it is then threaded through an opening in the insulating strip $k$, through openings in the insulating strip $i$, back through the insulating strip $i$, the extremity of the wire being then extended back to the conductor rod $h$ and connected thereto. The wire is therefore given the shape of a U, with its extremities attached to the conductor rod, and the upper and lower parts of the same are spaced apart at a predetermined distance by means of the holes in the insulating strips. Similar wires $n$ are associated in the same way with the conductor rod $h'$, and it will be noted that the runs of these last named wires alternate with those of the wires $m$, viz., starting at the right of the device, say, the first run or length of wire is a part of a wire $m$, the second is a length or run of a wire $n$, and so on throughout the length of the device. The tensioning in this case is effected by means of small helical springs $o$ that connect the wire lengths at a point adjacent the insulating strip $i$ with the corresponding rods $h$, $h'$, or suitable points on the frame, it being apparent that in this way a longitudinal strain is exerted on each wire length, all of said lengths being tensioned in the same direction. The purpose of the tensioning device is the same as that of the devices previously described.

In Figs. 8 to 11, I have shown a still further modification, wherein the device is given a cylindrical shape. The frame comprises upper and lower insulating members $p$, $q$ that are spaced apart and locked together by means of suitable tie rods $r$. The wire lengths $s$, $s'$ are stretched between the annular frame members $p$, $q$, in which they are positioned in suitable grooves or kerfs. As a matter of fact, the wiring of this form of the device is much the same as that shown in Figs. 1 to 5, the main difference being in the form of the insulating strips. Two long wires made into a number of upright runs $s$, $s'$ or lengths are used, as before. At the top of the device, I have shown a feeding strip or distributing plate $t$ of annular form that is set in and secured to the upper insulating member $p$ (Figs. 9 and 11). Integral with this plate are curved spring tensioning fingers $t'$ which extend approximately to the outer edge of the upper frame member, the extremities of said fingers seating the upper reverse bends of the wire $s$, thereby tensioning said wire, the lower reverse bends of which are, as previously described, positioned in kerfs of the lower insulating member. At the lower end of the apparatus I have shown a modified form of tension device, which may be used to advantage in some cases. Said device comprises an annular spring member $u$ made up of a circularly arranged series of helical coils $u'$ connected by angular portions $u''$, the entire spring member being preferably formed of a single length of wire, as shown in Fig. 10.

The angular portions $u''$ that are formed in said wire between the coiled portions $u'$ serve to retain the lower reverse bends of the wire $s'$, which wire is drawn through the angular portions in the manner indicated, it being understood that the upper reverse bends of said wire $s'$ are positioned in the kerfs of the upper frame member, (Fig. 9). Electrical connection is made with the upper distributing plate or strip $t$ by means of a
binding post $t$ carried thereby, and at the lower frame member $q$ carries a binding post $q'$ to which the circular tension member $u$ is connected, as shown. This last described
form of my apparatus is particularly intended for use with a suitable light to attract the insects.

In Fig. 8, I have shown an electric light bulb $V$ within the cylinder formed by the device, and it is obvious that in approaching the light the insects will pass between the wires $a, a'$ and be electrocuted in the manner previously described.

I wish it to be distinctly understood that I have used the term “zig-zag” herein and in the claims, in its broad or generic sense and as covering the parallel arrangement of the lengths or runs of the continuous wires brought about by stringing the latter across the frame in the manner indicated.

Without limiting myself to the constructions shown, I claim:

1. In an electric insect destroyer, a plurality of parallel lengths or runs of wire, means to supply the adjacent lengths or runs with current of opposite polarity, and spring tension devices acting directly on said lengths or runs.

2. In an electric insect destroyer, a plurality of parallel lengths or runs of electrically charged wire, the adjacent runs being of opposite polarity and alternate runs being of the same polarity, and spring tension means acting directly on said lengths or runs in a longitudinal direction to maintain them taut, and at a predetermined distance from each other.

3. In an electric insect destroyer, a plurality of lengths or runs of wire, a tension device for the same, and means to feed current to the wire through the tension device.

4. In an electric insect destroyer, parallel lengths or runs of wire, tension devices each connected with certain of said lengths or runs, and means to supply the tension devices with current of opposite polarity.

5. In an electric insect destroyer, the combination of a frame, parallel wire lengths traversing the same, and spring tension devices at opposite sides or edges of the frame and over which the wires are extended.

6. The combination of a frame, wires strung on the frame and extending along-side of each other in zig-zag fashion, and a tension device engaging the reverse bends of one of the wires.

7. The combination of a frame, wires strung on the frame and extending along-side of each other in zig-zag fashion, and tension devices acting directly on reverse bends of the respective wires.

8. The combination of a frame, kerfed insulating strips applied to opposite edges thereof, continuous wires strung zig-zag fashion on the frame and extending along-side of each other, reverse bends of said wires being positioned in the kerfs of said insulating strips, and tension devices having fingers engaged with other reverse bends of the wires.

9. The combination of an open frame, kerfed insulating strips applied to opposite edges thereof, continuous wires strung zig-zag fashion and alongside of each other on the frame and engaging the kerfs in said insulating strips, and distributing plates having spring fingers engaged with reverse bends of the wires.

10. In an electric insect destroyer, a frame, wires strung thereon in zig-zag fashion and alongside each other to present a plurality of runs or lengths of wire traversing the frame, and current distributing devices engaged with reverse bends of the wires.

11. In an electric insect destroyer, a frame, wires strung thereon alongside each other and presenting a plurality of parallel runs or lengths traversing the frame, and distributing plates to which current is supplied, having spring tensioning fingers engaged with reverse bends of said wires.

In testimony whereof I affix my signature, in presence of two witnesses.

WILLIAM M. FROST.

Witnesses:
H. E. ROCKWELL,
CHAS. J. O'NEILL.