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E. H. TAYLOR

2,148,591

LINK TRIMMING AND FUSE SIZING MECHANISM

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2 Sheets-Sheet 1

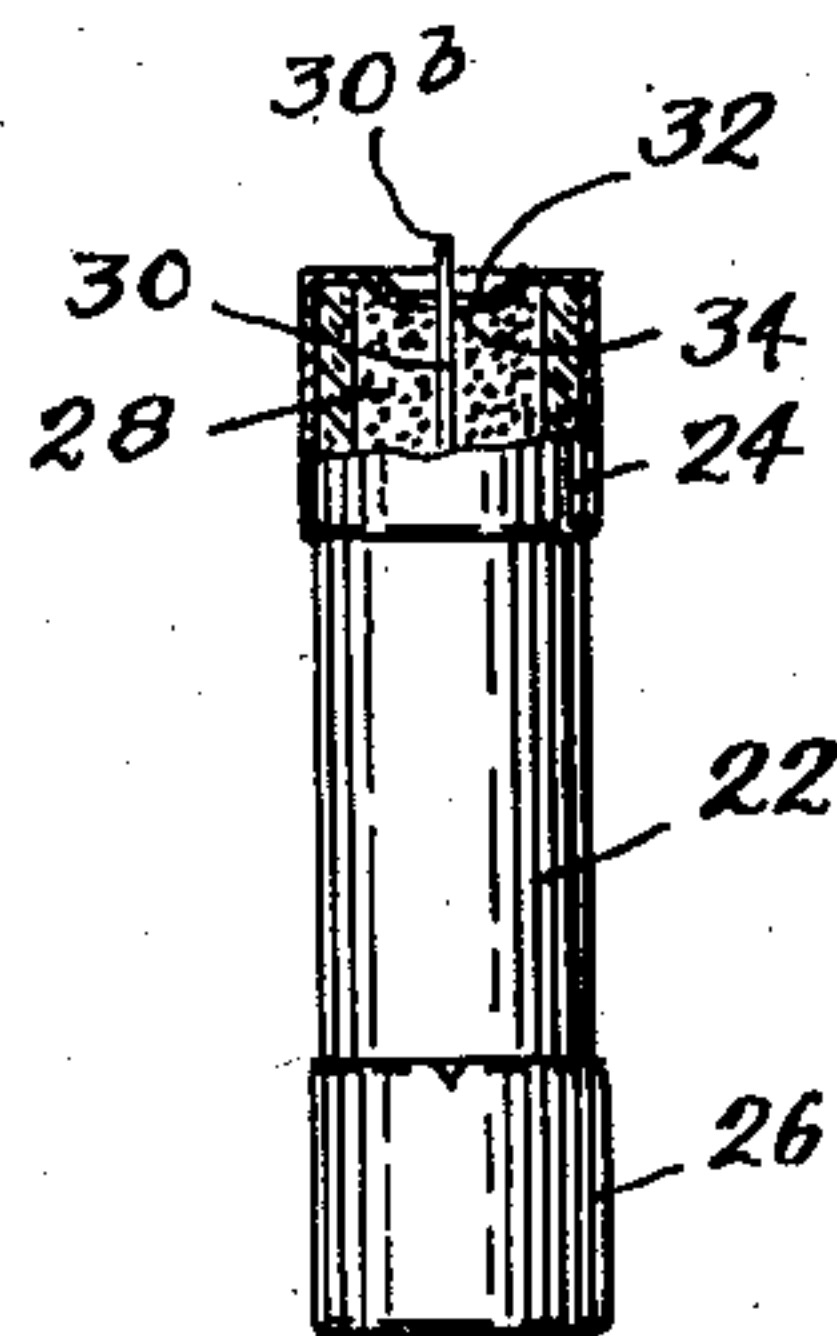


Fig. 5.

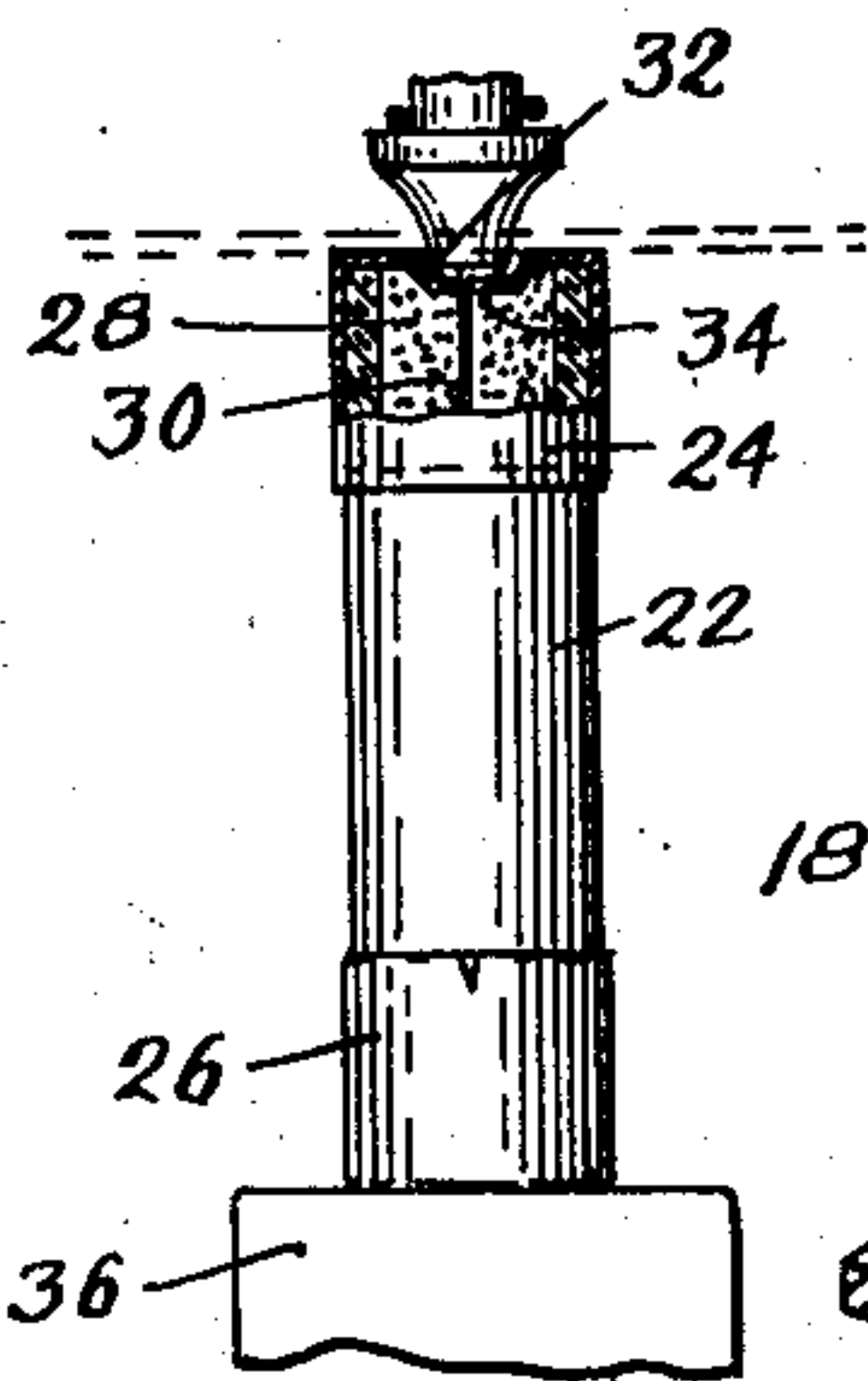


Fig. 6.

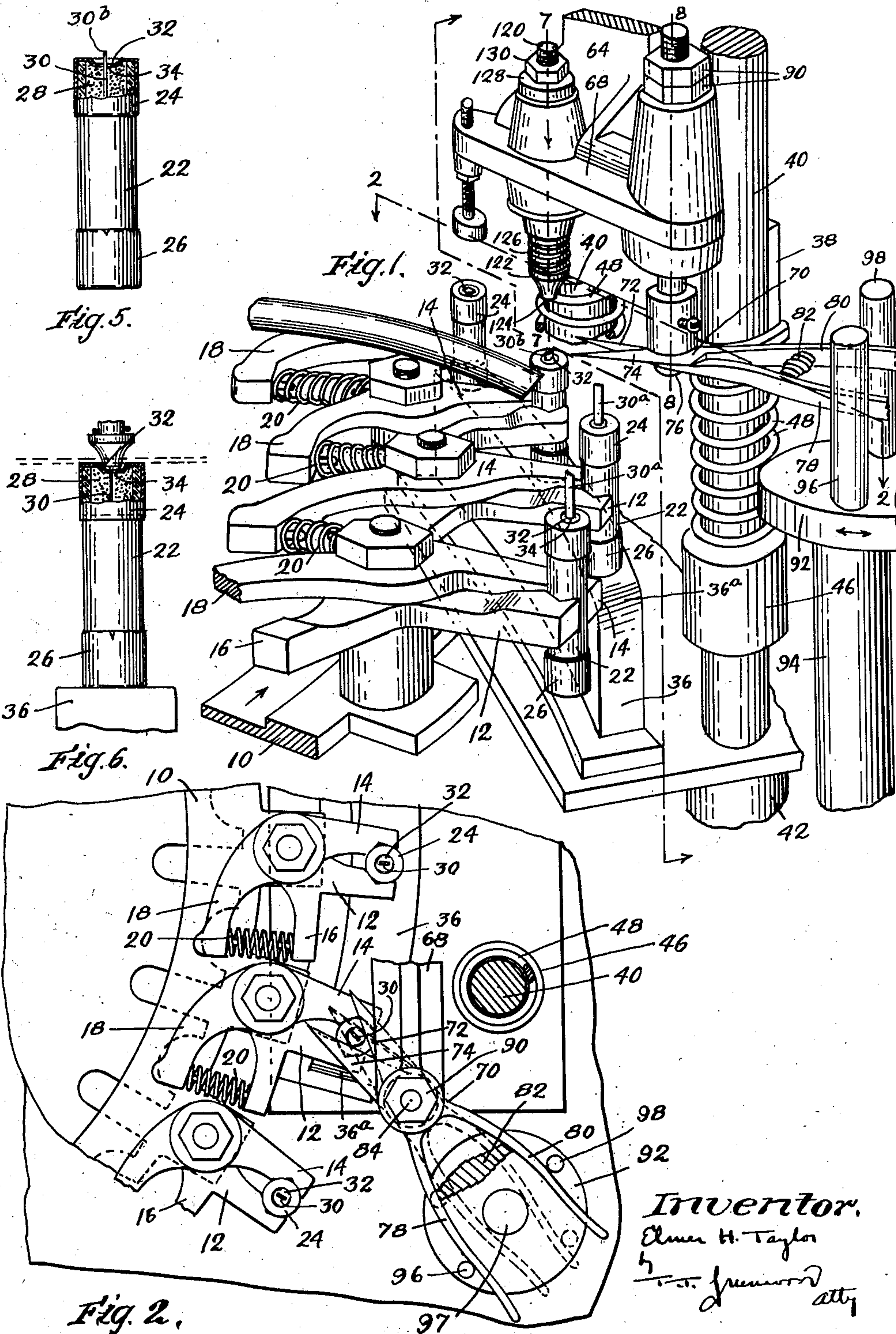


Fig. 1.

Inventor,  
Elmer H. Taylor  
by J. H. Greenwood atty

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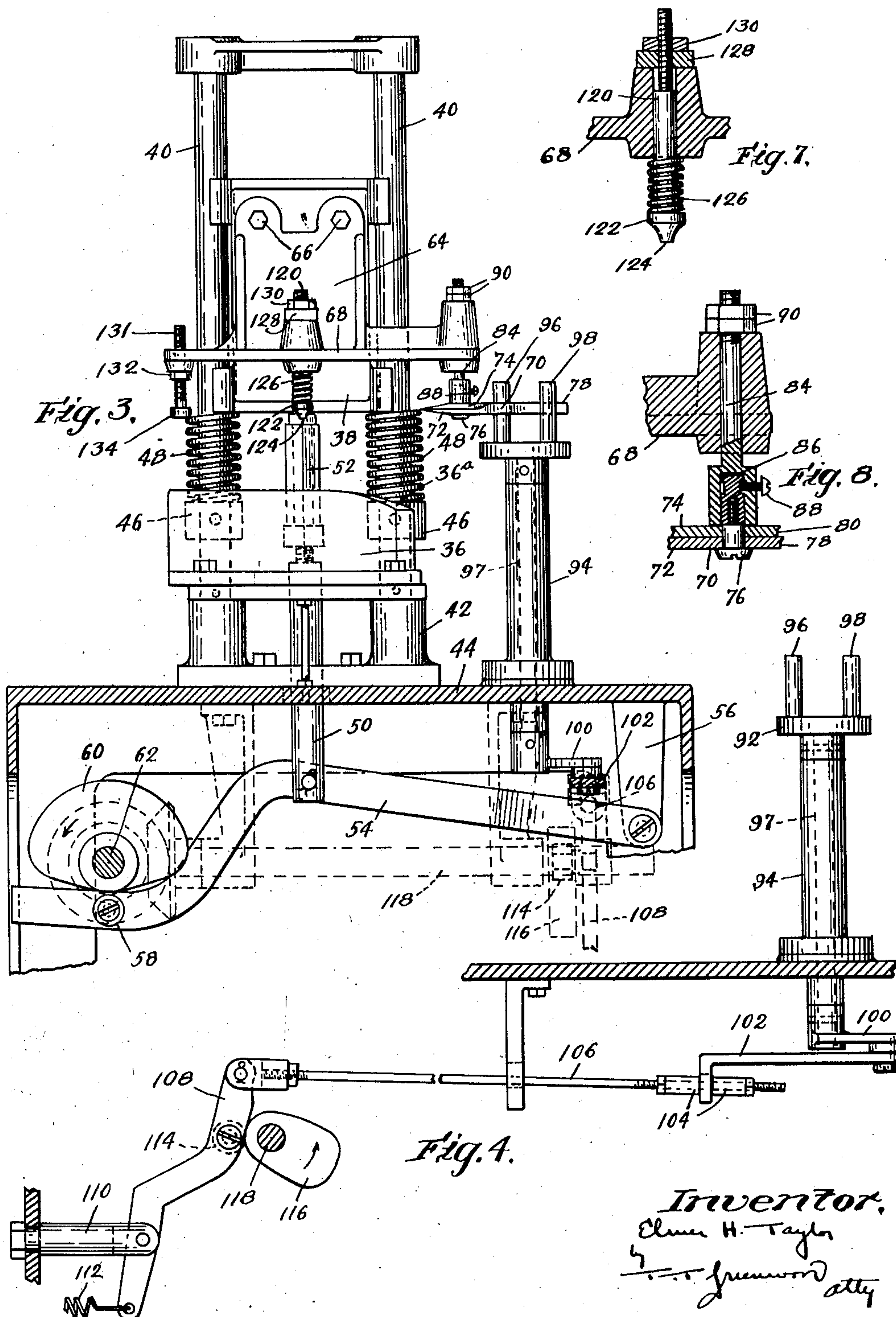
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2 Sheets-Sheet 2



*Inventor,*  
 Elmer H. Taylor  
 by J. J. Greenwood *att'y*



## UNITED STATES PATENT OFFICE

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LINK TRIMMING AND FUSE SIZING  
MECHANISM

Elmer H. Taylor, Newburyport, Mass., assignor to  
The Chase-Shawmut Company, Newburyport,  
Mass., a corporation of Massachusetts

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25 Claims. (Cl. 153—2)

This invention relates to the manufacture of electric fuses of the cartridge type and has particular reference to mechanism for preparing the end of the fusible link for the soldering thereof to an end cap.

The electric fuse with which the manufacture of this invention is particularly concerned comprises a tubular enclosing casing of suitable insulating material, as fibre, having metal terminal caps on the ends of the casing, a fusible element or link extended lengthwise within the casing and soldered to the end caps, and a loose filler of electrically insulating arc-quenching material in the casing around the fuse link. The end walls of the end caps or at least one end cap is provided with a recess or depression in which the end of the fuse link is adapted to be terminated, the depression receiving the bent-over end of the link and the solder which bonds the link to the end cap.

In the manufacture of the fuse the partly assembled fuse at one stage of its manufacture consists of the casing with the end caps thereon, the filler within the casing and the fuse link soldered to one end cap and projecting through the other end cap and to a distance therebeyond that is greater than is required for bending it at right angles to the body of the link within the casing and disposing it within the recess of the end cap in condition to receive the solder.

It is an object of the present invention to provide mechanism automatically operative upon a succession of such fuses to trim off excess lengths of the projecting ends of the fusible links all substantially to the same amount and to bend over the shorter projecting ends into the recesses in the end caps thereby to condition the links and the end caps to receive the solder.

It is also an object of the present invention to provide means for exerting endwise pressure on the fuse whereby to force the end caps firmly upon the insulating casing so that the over-all length of all of the succession of fuses is substantially the same, said means preferably also serving to dispose the similar ends of all fuses in the same plane to receive a further manufacturing operation upon them.

Another object is generally to improve the construction and operation of fuse manufacturing mechanisms.

Fig. 1 is a perspective detail of a fuse link trimming and bending mechanism embodying the present invention.

Fig. 2 is a plan view of the trimming mechanism taken along line 2—2 of Fig. 1.

Fig. 3 is a sectional elevation taken in front of the trimming and pressing mechanism of Fig. 1, the fuse carrier being removed.

Fig. 4 is a section taken along line 4—4 of Fig. 3.

Fig. 5 is an elevation partly in section of the fuse subsequent the snipping operation but prior to the bending and pressing operation.

Fig. 6 is a view similar to Fig. 5 but illustrating the manner in which the end of the fuse is bent into the end cap recess.

Fig. 7 is a sectional detail of the bending and pressing plunger taken along line 7—7 of Fig. 1.

Fig. 8 is a detailed sectional elevation of the shear holding plunger taken along line 8—8 of Fig. 1.

The trimming, bending and pressing mechanism embodying the present invention includes an intermittently advanceable fuse carrier 10 having a plurality of equally spaced fuse holders, each holder comprising a stationary jaw 12 and a pivoted jaw 14. Each pair of jaws is adapted to grip a fuse casing therebetween, as illustrated in Fig. 1, all of the casings being vertically extended. The jaws have rearwardly extended tails 16 and 18, respectively, between which a compression spring 20 is disposed, which spring exerts pressure in opposite directions on the tails to maintain the jaws in releasable engagement with the fuse casings. The carrier 10 and the jaws with the casings therein are advanced intermittently in a step by step manner into and out of positions where the excessive projecting lengths of the fuse links are trimmed off so that the links are all the same length and the ends of the links are bent to receive the solder.

Each of the fuses advanced by the carrier comprises a tubular enclosing casing 22 of insulating material, as fibre, see Figs. 1, 5 and 6, having metal end caps 24 and 26 on the ends thereof. The end cap 26 is usually crimped permanently onto the casing prior to its presentation to the mechanism of the present invention. The end cap 24, however, is loosely applied to the casing. The casing contains a filler 28 of an electrically insulating arc-quenching material. A fusible element or fuse link 30 extends longitudinally within the casing and has its lower end soldered to the end cap 26 and its upper end 30a, see Fig. 1, extended outwardly of the end cap to a distance which is in excess to that required to solder the fuse link to the end cap. The end wall of the end cap is provided with a recess or depression 32 therein and the bottom of the recess is provided



with an aperture 34 through which the fuse link extends.

The excess projecting end 30a of the fuse link is adapted to be trimmed off to a shorter projecting length 30b, see Fig. 5, and this projecting end is adapted to be bent substantially at right angles to the body of the fuse and into the bottom of the recess 32, as illustrated in Fig. 6, and thereby be in position to receive a mass of solder which is introduced into the recess to bond the bent end of the link and the end cap securely together.

The carrier 10 advances the fuses with their projecting link ends uppermost onto and over a stationarily supported anvil 36, the anvil standing preferably at such height that each of the fuses as it passes over the inclined leading edge 36a of the anvil is caused to be moved upwardly slightly within the gripping jaws of the carrier so as to insure that all fuses will stand at the same height relatively to the trimming and bending and pressing mechanism.

Said mechanism includes a slide plate 38 which is vertically reciprocable on and between vertical guide rods 40 which are fixed in a base plate 42 secured to a bed 44. Collars 46 are secured to said guide rods 40 beneath said plate 38 and compression springs 48 encircle said rods and rest upon said collars and also bear against the lower edge of said plate to raise it following the lowering thereof. A connecting rod 50 is secured to the lower end of said plate 38 and extends downwardly therebelow and has intermediate its ends a length adjusting means 52 by the adjustment of which the maximum elevation of said plate with respect to the fuses may be altered. The lower end of said connecting rod is pivotally connected to the intermediate end of a vertically reciprocable lever 54, one end of which is pivotally supported by a bracket 56 and the other end of which carries a cam roller 58 that rides upon a cam 60 fixed to a continuously rotating shaft 62, the rotation of which is in timed relation to the movements of the carrier 10. The shape of the cam 60 is such that the slide plate 38 is caused to be moved downwardly and held for a substantial length of time stationary in its lowermost position, during which time the operation of trimming the excess projecting length of fuse element takes place.

The fuse engaging parts of the mechanism are carried by a bracket 64 attached to the inner face of the slide plate 38 by bolts 66 and having at its lower end a horizontal inwardly projecting shelf 68 which carries and supports the fuse engaging elements.

The link trimming mechanism includes a pair of shears or scissors 70 having cooperating cutting blades 72, 74 pivotally connected by a pivot screw 76 and having handles 78, 80 extended on opposite sides of the pivot screw and normally pressed apart to maintain the cutting blades separated by a compression spring 82 disposed between and bearing against the handles. The scissors are maintained horizontally upon the bottom end of a vertical rod 84, the pivot screw 76 extending into an axially directed recess 86 of the rod, see Fig. 8, and retained removably therein by a set screw 88. The rod 84 is carried by the shelf 68 and is vertically movable therein and is also free for angular movement. The height of the scissors is adjusted by nuts 90 that are screw-threaded on the upper end of the rod and bear upon the shelf to limit the low position of the scissors. The position of the blades of the scissors is such that they are above the projecting

fuse link and descend upon opposite sides of the link so that the link is between them and in position to be severed by the blades.

The scissors are moved together and allowed to separate under the action of the spring 82 by means including a horizontal disc 92 supported at the upper end of a bracket 94. The disc is provided with a pair of upstanding pins 96, 98 between which the handles 78, 80 of the scissors are disposed and against which they bear. The disc 92 is adapted to be oscillated between full and dotted line positions, as illustrated in Fig. 2, whereby to close the scissors and permit the spring 82 to open the scissors.

The disc 92 is fixed to the upper end of a vertical shaft 97 which is journaled in the bracket 94 and at its lower end has a laterally outstanding arm 100 fixed thereto. Said arm is pivotally connected to one end of a link 102, see especially Fig. 4, the other end of which is connected by an adjustable connection 104 to a connecting rod 106. The remote end of said connecting rod is pivotally connected to a cam lever 108 pivoted to a suitable standard 110. Said cam lever intermediate its ends is provided with a cam roller 114 which rides upon a cam 116 fixed to a shaft 118 rotatable conjointly with the aforesaid cam shaft 62 so that the opening and closing of the scissors is carried out in timed relation with the movements of the slide plate 38, the scissors being closed and opened at the time the slide plate is stationary momentarily in its lowermost position. A retractile spring 112 is connected with said cam lever 108 and serves to hold the cam roller 114 constantly engaged with the cam 116. The adjustment of the position of the rod 82 in the bracket of the slide plate is such that the scissor blades are allowed to rest upon the top of the end cap, there being such freedom of axial movement between the rod 84 and the bracket as to permit this positioning of the scissors. Thus the projecting ends 30a of the fuse links of the successively presented fuses are trimmed off to the same length.

The fuses then pass to a mechanism which presses or bends over the trimmed ends of the link into the cups 32 of the end caps. Said pressing mechanism, see especially Figs. 1 and 7, comprises a plunger 120 vertically movable in the shelf 68 of the bracket 64 and having at its lower end an enlarged head 122 formed with a reduced link engaging face 124. The compression spring 126 encircles said plunger between the head and the underside of the shelf and tends to urge the plunger constantly for movement in a downward direction. A collar 128 encircles the projecting upper end of the plunger and overlies the shelf and is secured adjustably in set position by means including a lock nut 130. The collar and lock nut can be adjusted to raise and lower the plunger with respect to the fuse. The link engaging face 124 of the plunger is not much smaller in diameter than the diameter of the recess 32 in the end cap of the fuse. The plunger in its downward movement engages the trimmed end of the fuse link and by reason of its fulcrum engagement with the edge of the hole 34 of the end cap bends the link-end over at substantially right angles to the body of the fuse and against the bottom face of the recess as illustrated in Fig. 6. The plunger can yield in engagement with the fuse to permit continued downward movement of the slide plate and also for the purpose of taking care of small irregularities in over-all lengths of the successive



fuses. The spring pressure exerted by the plunger upon the uppermost end cap also serves to move the end cap downwardly upon the end of the tubular casing of the fuse if the end cap is not seated thereupon and is free for such movement under the pressure of the spring 126.

The operation of the plunger in seating the upper end caps upon the casing is not entirely relied upon, however, and additional mechanism is provided for this purpose. Said mechanism includes a vertical rod 131 which is screw-threaded adjustably into the shelf 68 and is locked in any adjusted position therein by a lock nut 132. Said rod is disposed in said shelf in position to overlie a fuse at the time it is stationary. The rod is provided at its lower end with an enlarged end 134 which is adapted to engage the end cap of the successive fuses after they have passed one station beyond the link bending station and press all the end caps downwardly into the same plane so that the tops of the ferrules of all fuses are always in the same relation.

I claim:

1. Electric fuse making mechanism comprising an advanceable carrier having a plurality of fuse holders advanceable therewith each adapted to hold a fuse having a fuse link one end of which is fixed to the fuse and the other end of which is extended outwardly beyond the end cap, and stationarily-located trimming mechanism including a pair of cooperating trimming elements automatically operative upon the succession of fuses in said holders advanced to the action of said elements for trimming the projecting ends of the fuse links.

2. Electric fuse making mechanism comprising an advanceable carrier having a plurality of fuse holders each adapted to carry a fuse having a fuse link projecting outwardly thereof, means for trimming off part of the projecting link, an anvil upon which the bottoms of the fuses rest, and mechanism automatically operative upon the succession of fuses on said anvil for bending the trimmed ends of the fuse link of the successive fuses down upon the ends of the fuses.

3. Electric fuse making mechanism comprising an advanceable carrier having a plurality of fuse holders each adapted to contain an electric fuse having a projecting fuse link, means for trimming off the excessive lengths of projecting ends, and mechanism automatically operative upon the succession of fuses in said holders having means engageable with the opposite ends of the fuses and applying endwise pressure thereto.

4. Electric fuse making mechanism comprising an advanceable carrier having a plurality of holders adapted to contain fuses in parallel relation having projecting fuse links, each fuse comprising an enclosing casing and end caps thereon, mechanism automatically operative upon the succession of fuses in said carrier for applying endwise pressure upon the similar end caps of the fuses for positioning them all in approximately the same plane, and means for trimming the projecting fuse links.

5. Electric fuse making mechanism comprising an advanceable carrier having a plurality of fuse holders each adapted to contain a fuse having a fuse link extended beyond the end thereof, link trimming mechanism advanceable into and retractible from operative relation with the ends of the fuse links, and means for operating said trimming mechanism when it is in advanced position.

6. Electric fuse making mechanism comprising an advanceable carrier having a plurality of fuse holders each adapted to contain an electric fuse having a fuse link the end of which is extended beyond the end of the fuse, trimming mechanism for cutting off excessive projecting lengths of the fuse links including scissors, means for reciprocating said scissors toward and away from the link, and means for operating said scissors to sever the link.

7. Electric fuse making mechanism comprising means for advancing into and out of link trimming position a succession of fuses having fuse links projecting from the ends of the fuses, and trimming mechanism comprising a scissors support reciprocable toward and away from the fuse links, scissors pivotally mounted upon said support in position to receive the fuse links between them, and means for operating said scissors to sever the end of the link.

8. Electric fuse making mechanism comprising means for advancing a succession of electric fuses having links projecting from the ends thereof into and out of a trimming position, and trimming mechanism for the fuse links comprising a scissors, means for moving the scissors toward and upon the ends of the fuse with the projecting fuse link therebetween and also moving said scissors away from the fuse, and means for operating said scissors when it is upon the end of the fuse.

9. Electric fuse making mechanism comprising means for advancing a succession of fuses having fuse links projecting from the ends thereof into and out of a link trimming position, and mechanism for trimming the links comprising a member reciprocable toward and away from the end of the fuse, a rod carried by and movable with said support and also movable longitudinally in said support, scissors pivotally carried by said rod and movable therewith, and means for operating said scissors.

10. Electric fuse making mechanism comprising means for advancing a succession of fuses having fuse links projecting from the ends thereof into and out of a link trimming position, and link trimming mechanism comprising a member reciprocable toward and away from the end of the fuse, a rod carried by and movable with said reciprocating member and also movable longitudinally in said member, said rod being substantially parallel with the fuse, and a pair of pivotally connected scissors carried by the end of and extended transversely of said rod and movable therewith into and out of operative position with the fuse link, and means for operating said scissors.

11. Electric fuse making mechanism comprising means for advancing a succession of vertical fuses each having a fuse link projecting from the end thereof into and out of link trimming position, and link trimming mechanism comprising a vertically reciprocable carrier, a rod movable with said carrier and also movable longitudinally in said carrier, a horizontally disposed pair of scissors having a center pivot fixed to the lower end of said rod, said scissors being reciprocable by said carrier into and out of operative position with the projecting fuse link, and means for operating said scissors.

12. Electric fuse making mechanism comprising means for advancing a succession of vertical fuses into and out of link trimming position, each fuse having a link projecting from the upper end thereof, and link trimming mechanism compris-



ing a horizontal pair of scissors disposed above said fuses, means for reciprocating said scissors vertically toward and away from the successive fuses, and means for operating said scissors when they are in lowered and operative position.

13. Electric fuse making mechanism comprising means for advancing a succession of fuses each having a fuse link projecting from the end thereof into and out of a link trimming position, and link trimming mechanism comprising scissors, means for reciprocating the scissors into and out of operative position with the link, said scissors having handles, and means engageable with both of said handles for opening and closing said scissors.

14. Electric fuse making mechanism comprising means for advancing a succession of fuses each having a fuse link projecting from the end thereof into and out of a link trimming position, link trimming mechanism comprising scissors, means for reciprocating the scissors into and out of operative position with the link, said scissors having handles, means engageable with both of said handles for opening and closing said scissors, said means including an oscillable disc having diametrically opposed pins between which and in engagement with which said handles are disposed, and means for oscillating said disc.

15. Electric fuse making mechanism comprising means for advancing a succession of fuses each having a fuse link projecting from the end thereof into and out of a link trimming position, link trimming mechanism comprising scissors, means for reciprocating the scissors into and out of operative position with the link, said scissors having handles, means engageable with both of said handles for opening and closing said scissors, said means including an oscillable disc having diametrically opposed pins between which and in engagement with which said handles are disposed, and means for oscillating said disc, said pins being of sufficient length to maintain engagement with said handles during the reciprocatory movements of said scissors.

16. Electric fuse making mechanism comprising a stationary anvil, means including fuse-grippers having frictional gripping engagement with the fuses for advancing over said anvil a succession of fuses each having a fuse link projecting from the upper end of the fuse, means operative upon the successive fuses to trim off excessive projecting lengths of links, and reciprocating means operative endwise upon the successive fuses for bending over the outer ends of the trimmed links when the fuses are on said anvil.

17. Electric fuse making mechanism comprising means for advancing a succession of fuses each having a fuse link projecting from the fuse into and out of a link bending position, and means for bending sidewise the ends of the links of the successive fuses including a plunger, a yielding support therefor, and means for reciprocating the plunger into and out of yielding pressure engagement with the links of the successive fuses.

18. Electric fuse making mechanism comprising means for advancing a succession of fuses each having a fuse link projecting from the fuse into and out of a link bending position, means for bending over the links of the successive fuses including a plunger carrier reciprocable toward and away from the fuses, and a plunger carried by said carrier and movable therewith into and out of engagement with the links of the fuses, said plunger having a yielding engagement with said

carrier which permits said plunger to yield in engagement with the fuse.

19. Electric fuse making mechanism comprising means for advancing a succession of fuses each having a fuse link projecting from the fuse into and out of a link bending position, means for bending over the ends of the links of the successive fuses including a plunger support reciprocable toward and away from the fuses, a plunger carried by said support and movable therein, and spring means acting on said plunger to maintain it yieldingly in outermost position, said spring means adapted to yield to permit movement of said support independently of said plunger when the plunger is in engagement with a fuse.

20. Electric fuse making mechanism comprising an anvil, means for advancing a succession of vertically disposed fuses into and out of link bending position on said anvil, said fuses each having a link projecting from the upper end thereof, and means for bending over the projecting ends of the links comprising a plunger support, means guiding said support for vertical movement, means for reciprocating said support, and a plunger carried by and movable with said support and disposed in vertical line with a fuse on said anvil and movable with said support into and out of engagement with the end of the fuse link.

21. Electric fuse making mechanism comprising an anvil, means for advancing a succession of vertically disposed fuses into and out of link bending position on said anvil, said fuses each having a link projecting from the upper end thereof, means for bending over the projecting ends of the links comprising a plunger support, means guiding said support for vertical movement, means for reciprocating said support, a plunger carried by and movable with said support and disposed in vertical line with a fuse on said anvil and movable with said support into and out of engagement with the end of the fuse link, and yielding means for mounting said plunger on said support, said yielding means adapted to yield when said plunger is in engagement with the fuse.

22. Electric fuse making mechanism comprising an anvil, means for advancing a succession of vertical electric fuses with their lower ends upon said anvil, each of said fuses comprising a casing and end caps on the ends of the casings, and means for fixing the over-all lengths of the fuses including a member movable toward and away from the free end of the fuse on the anvil and for applying endwise pressure thereto, and means for reciprocating said member into and out of a definite position with respect to said anvil whereby to compress the over-all length of the fuse between it and said anvil.

23. Electric fuse making mechanism comprising means for advancing a succession of fuses progressively into and out of a succession of operative positions, link trimming mechanism located at one position and including a pair of scissors reciprocable toward and away from the end of the fuse, and link bending mechanism for bending over the trimmed ends of the fuse links, a common carrier for said trimming and bending mechanism, and means for reciprocating said carrier.

24. Electric fuse making mechanism comprising means for advancing a succession of fuses successively into a plurality of operative positions, trimming mechanism located at one position operative for trimming off the projecting ends of the fuses, bending mechanism located at another



operative position for bending over the trimmed ends of the fuse link, and length adjusting mechanism disposed at a third operative position, a common carrier for said trimming, bending and length adjusting mechanisms, and means for reciprocating said carrier to reciprocate said mechanisms toward and away from the fuses.

25. Electric fuse making mechanism comprising means for advancing a succession of fuses

progressively into and out of a succession of operative positions, link trimming mechanism located at one position, link bending mechanism for bending over the trimmed ends of the fuse, and means for operating said trimming and bending mechanism in timed relation with movements of said fuse advancing means.

ELMER H. TAYLOR.