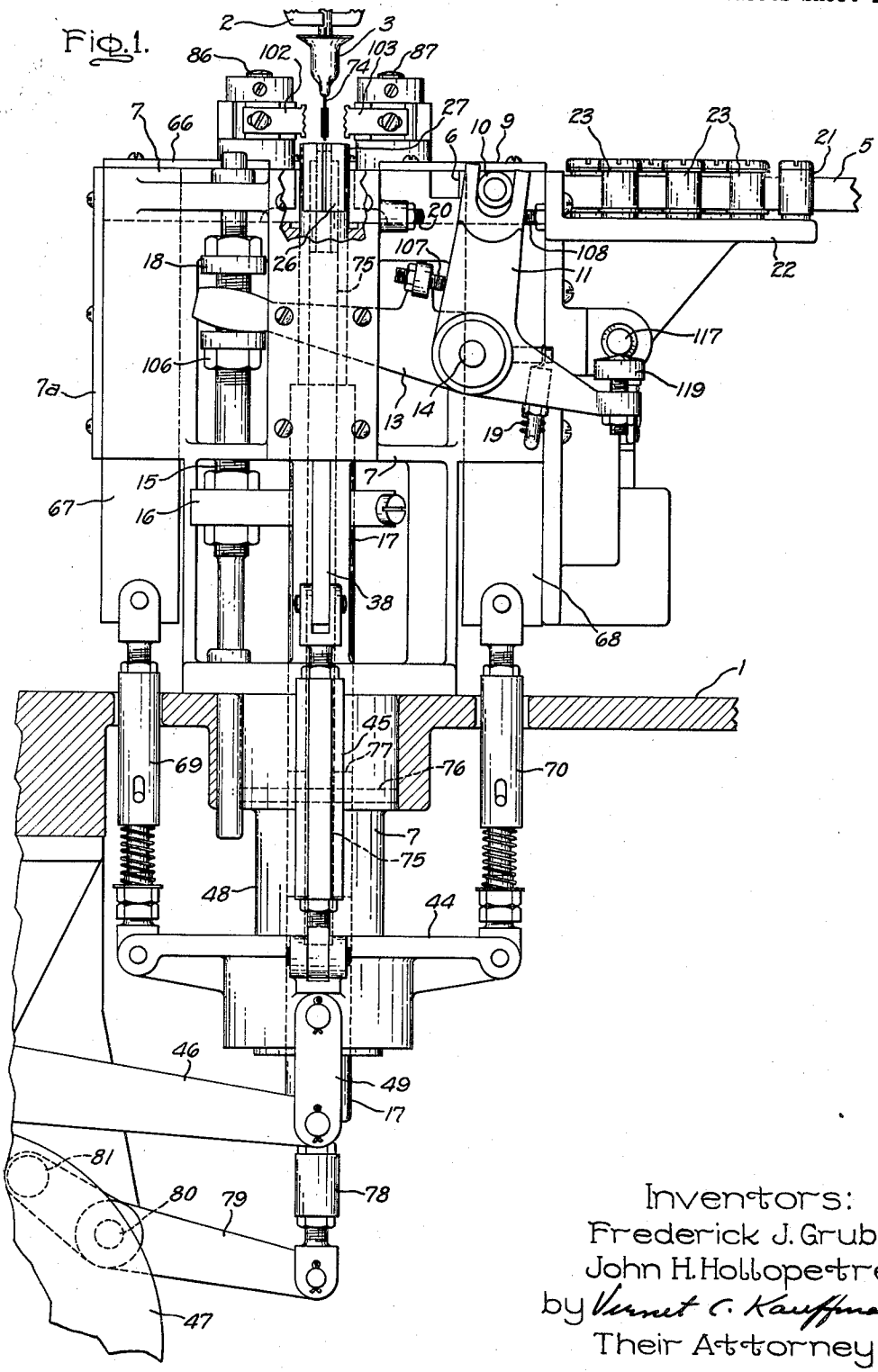
July 1, 1958 F. J. GRUBE ET AL 2,840,886

SHIELD FORMING AND MOUNTING METHOD AND APPARATUS

Filed Nov. 29, 1952 4 Sheets-Sheet 1

Fig. 1.



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SHIELD FORMING AND MOUNTING METHOD AND APPARATUS

Filed Nov. 29, 1952 4 Sheets-Sheet 2

Fig. 2.

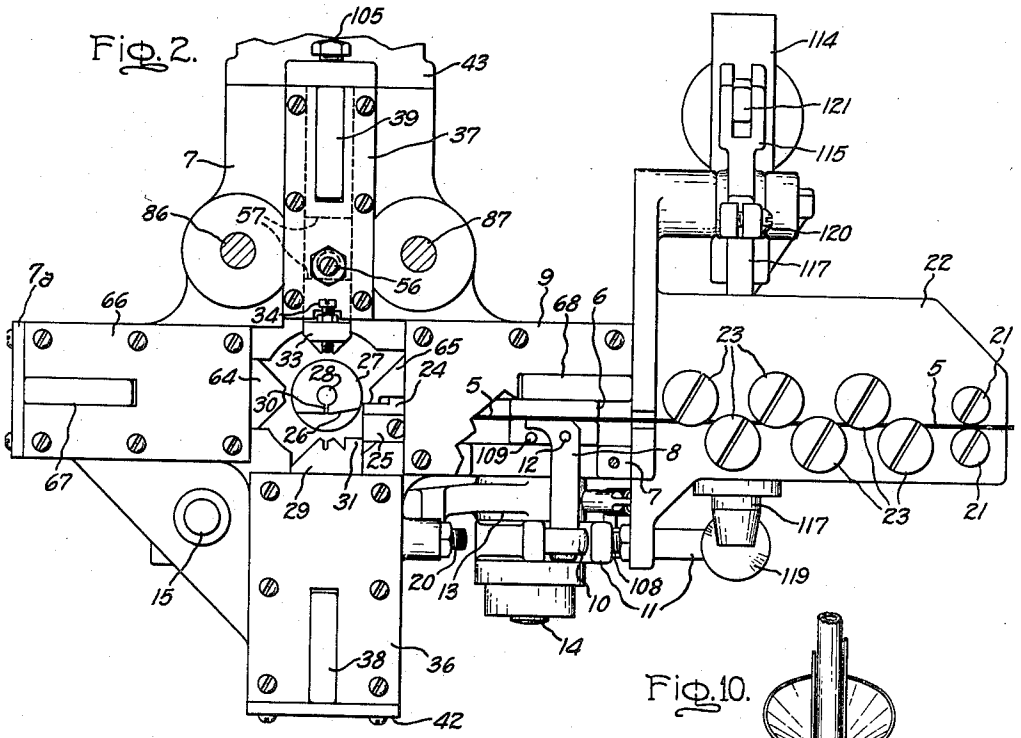


Fig. 9.

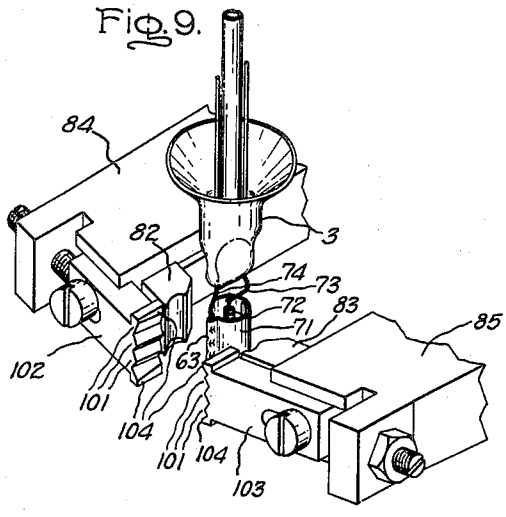
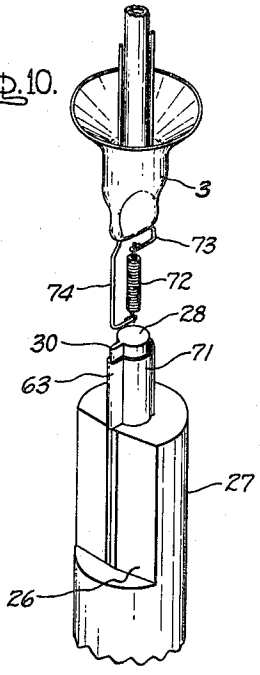


Fig. 10.



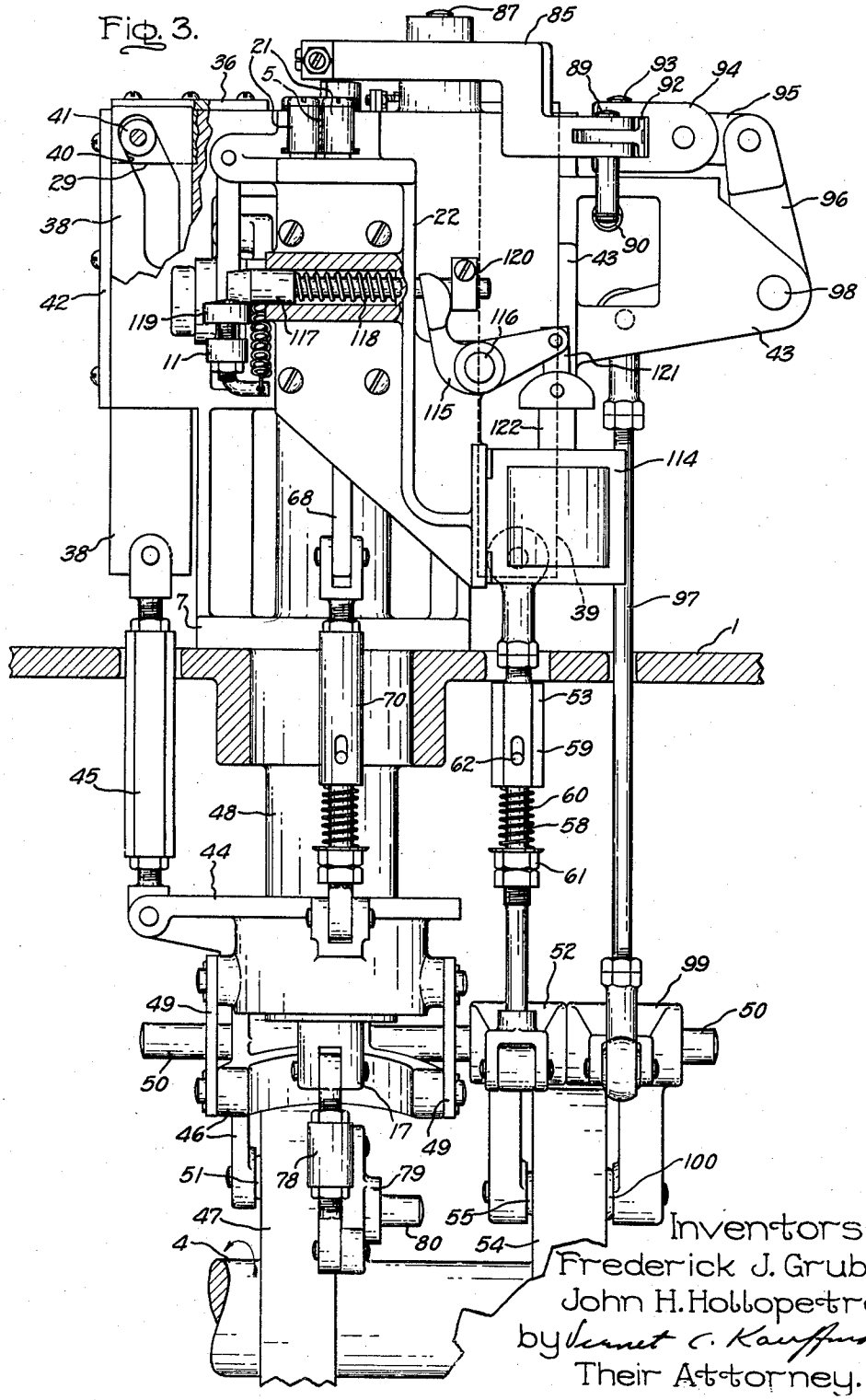
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SHIELD FORMING AND MOUNTING METHOD AND APPARATUS

Filed Nov. 29, 1952 4 Sheets-Sheet 3

Fig. 3.



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SHIELD FORMING AND MOUNTING METHOD AND APPARATUS

Filed Nov. 29, 1952 4 Sheets-Sheet 4

Fig. 4.

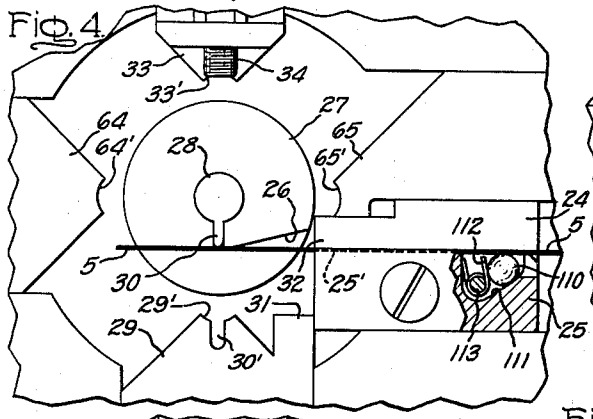


Fig. 5.

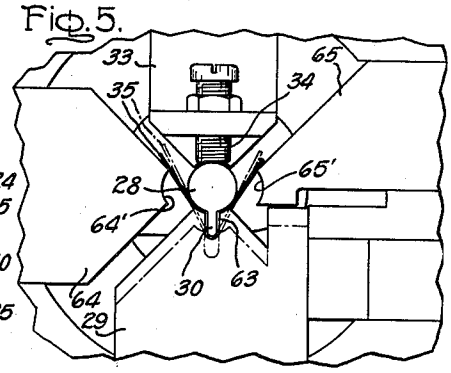


Fig. 6.

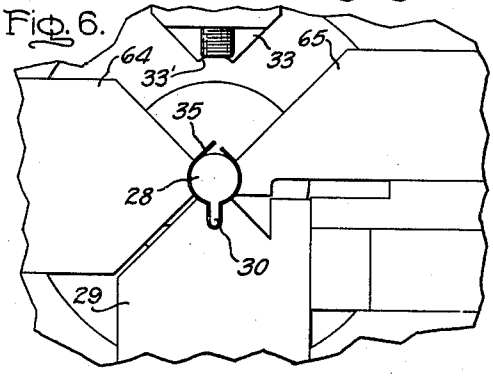


Fig. 7.

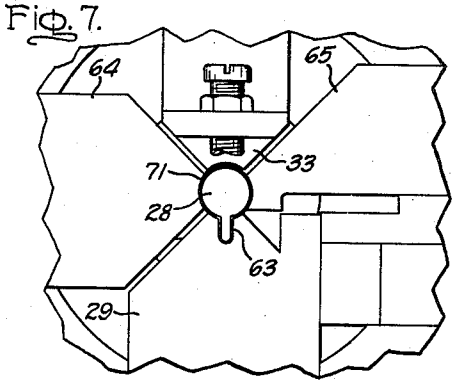
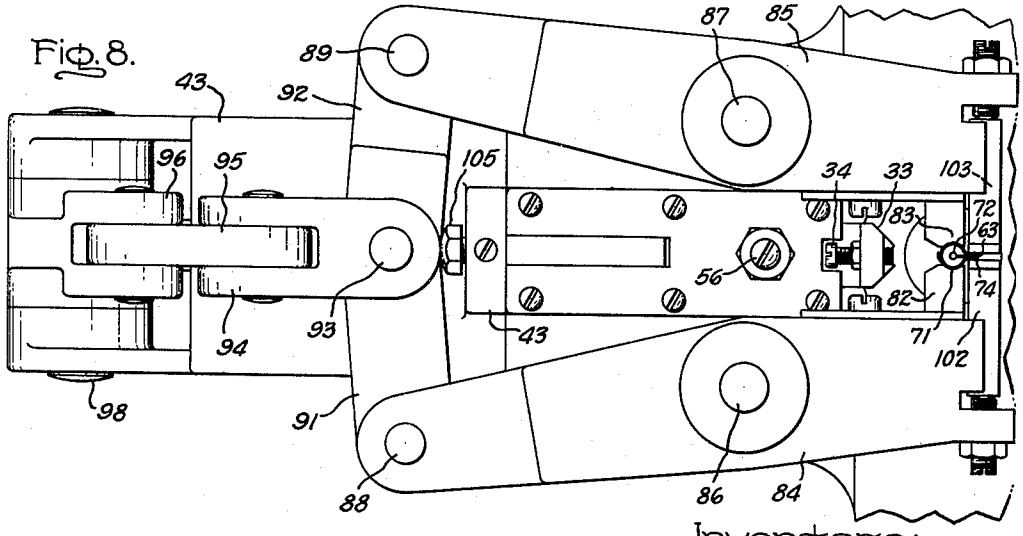


Fig. 8.



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United States Patent Office

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SHIELD FORMING AND MOUNTING METHOD AND APPARATUS

Frederick J. Grube, East Cleveland, and John H. Holliopetre, Mayfield Heights, Ohio, assignors to General Electric Company, a corporation of New York

Application November 29, 1952, Serial No. 323,212

6 Claims. (Cl. 29—25.13)

Our invention relates to a method of and apparatus for automatically forming and mounting sheet metal shields or anodes constituting part of the internal electrode structure of electric lamps and similar devices.

It is an object of our invention to provide a method and automatic apparatus for forming a blank of sheet metal about a mandrel of the desired form, for transferring the formed shield or anode end foremost from the mandrel into proper relation to a filament or cathode of a "mount," and for attaching the shield or anode to said mount. It is a further object to provide for the feeding of the blanks in ribbon form from a continuous spooled supply and to adapt the apparatus for repeat cycles of operation for cooperation with an automatic mount making machine. The apparatus is, for instance, adapted for use in combination with an automatic mount making machine of the type disclosed in the application of L. E. Dilts Serial No. 323,315, filed of even date herewith and assigned to the same assignee as this application, now Patent No. 2,781,796 granted Feb. 19, 1957.

Another object of our invention is to provide apparatus capable of extensive uninterrupted periods of use in the forming and the mounting of generally cylindrical metal shields or anodes, and at low cost and with a minimum of attention.

Another object of our invention is to provide a method and apparatus for forming, from blanks cut from a ribbon of metal, shields or anodes having an accurately formed main portion of generally cylindrical shape and having an accurately formed corrugation along one side suited to slip snugly over a wire lead of a mount and be crimped to the lead. A feature of our invention is the formation of the corrugation from the center or medial portion of the blank by means of a die which forms said center portion about a ridge extending the length of a mandrel, followed by wrapping of the remainder of the blank around the mandrel by additional die members. A shield or anode so formed maintains its shape in both the corrugation and the main portion thereof so that it can be mounted at a definite position upon the wire lead of a mount and in a definite relation to the cathode thereof. The shield or anode also has a stiffness normally associated with more complex and costly shields or anodes even though the ends of the blank from which it is formed lie at an abutting or overlapping relation and are not normally fastened together.

Another object of our invention is to provide apparatus for effecting both the removal of the shield or anode from forming apparatus and the transfer of said shield or anode to proper relation to the lead and cathode of a mount by relatively simple means which because of its construction is adapted to extended periods of satisfactory and trouble free operation.

One embodiment of our invention provides for a spooled supply of metal ribbon to be fed end-foremost past one side of a mandrel and the shield to be formed from an end portion of the ribbon by dies cooperating

with said mandrel. The sequence of operation of the dies is such that one die first moves to clamp the adjacent end portion of the ribbon to the mandrel, then effects the shearing of said end portion to form a blank, and then presses said blank to the shape of the mandrel. This first-mentioned die also forms a corrugation across one dimension of the blank intermediate its ends, which corrugation is used to attach the shield to a mount. To this end, there are provided a matching groove and ridge in the meeting faces of the die and the mandrel, respectively. Other dies bend the ends of the blank extending on opposite sides of the first-mentioned die around the mandrel to either an abutting or a slightly overlapping relation. A shield made by this apparatus is accurately formed and stiff although the metal ribbon from which it is made is of iron or nickel in the order of .005 to .010 inch in thickness and the ends are not normally locked together in any way.

The transfer of the shield which takes place in the next step in the operation of the preferred form of apparatus provides for the shield to be forced off the end of the mandrel and, in the course of said operation, pushed end foremost over a lead and a cathode of a mount. Immediately following the transfer, the shield is permanently combined in the mount structure by a pair of jaws which crimp the corrugation of the shield and the enclosed lead so as to fasten them securely together.

Further features and advantages of our invention will appear from the following detailed description of a preferred embodiment illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is a side elevation of a shield forming and mounting apparatus comprising the invention, said apparatus being arranged at operative relation to a mount for a fluorescent lamp.

Fig. 2 is a plan view of the shield forming and mounting apparatus with the clamping jaws and other portions broken therefrom to shown underlying parts more clearly.

Fig. 3 is an elevation of the shield forming and mounting apparatus at right angles to Fig. 1 and showing in particular the operating means, the metal ribbon feed control and crimping means.

Figs. 4, 5, 6 and 7 are fragmentary plan views, on a larger scale, of the mandrel and shield forming dies at successive steps in the formation of a shield.

Fig. 8 is a plan view, on an intermediate scale, of the crimping jaws of the shield attaching means and the immediately associated mechanism.

Fig. 9 is a perspective view, on a large scale, of the end of the locating and crimping jaws at the moment of separation from the shield of a completed mount.

Fig. 10 is a perspective view, on a large scale, of upper end portions of the shield forming mandrel and the shield stripper at their initial operative position with respect to a lamp mount and at the moment a completely formed shield on said mandrel is about to advance over said mount by movement of the stripper.

The shield forming and mounting apparatus shown in the drawing is adapted to automatically repeated cycles of operation and to that end is suited to operate at one work station of an automatic mount making machine. When incorporated in such a machine, the apparatus is mounted upon a table 1 at one work station along an indexing conveyor 2 (only partly shown) for advancing the mounts 3, and it is operated by a drive shaft 4 (Fig. 3) located below the table 1 and rotating in synchronism with the movements of the conveyor 2.

The feeding of sufficient material to constitute a blank

for the shield is effected by advancing the metal ribbon 5, already threaded through said apparatus, in a right-to-left direction (Figs. 1 and 2). The main supply of the metal ribbon 5 is contained upon a spool (not shown) at a fixed position to one side of the apparatus and is in the form of a band of metal, usually nickel or iron, of the correct width for the shields and in the order of .005 to .010 inch thick. The advancement of the ribbon is produced upon movement of the feed slide 6 within horizontal ways in the main supporting frame 7 of the apparatus and said slide 6 and ribbon 5 are moved together by a dog 8. The slide 6, which is located in ways below the cover plate 9, is moved together with the ribbon 5 when the roller 10 on the outer end of the dog 8 is moved by the lever 11 to pivot the dog 8 sufficiently about the pivot pin 12 to cause it to first grip the ribbon 5 between its toe and the upstanding adjacent wall of the slide 6, and to then move bodily to carry the ribbon and slide forward. Other parts of the ribbon feeding means comprise an operating arm 13 located adjacent lever 11 on the pin 14 extending from the side of the frame 7; a vertical operating rod 15 located to one side of the center of the apparatus; and a connecting bar 16 joining the operating rod 15 with a vertically movable hollow core 17 within the center of the frame 7. These parts operate during an interval in which the hollow core 17 is being moved downward under the control of the main operating means located below the table 1 and associated with the main drive shaft 4 and produces a corresponding downward motion in the operating rod 15 because of the solid connection formed therebetween by the bar 16. The operating rod 15 slides vertically in the bearings provided by portions of the frame 7 in engagement with the ends thereof and causes the upper nuts 18 to turn the arm 13 counterclockwise about the pin 14 so that the helical spring 19, which joins posts in arm 13 and lever 11, turns said lever 11 correspondingly. At the limit of the feeding motion, the lever 11 bears against the stop screw 20, and the spring 19 is expanded by the continuing movement of the arm 13.

The advancement of the metal ribbon 5 pulls additional material from the spooled supply between a pair of guide rolls 21 on a bracket 22 attached to one side of the frame 7 and between the alternately positioned rollers 23 farther along said bracket 22, which rollers 23 function as a conventional type of straightener. The forward end of the metal ribbon 5 is advanced through a slot 25' (Fig. 4) formed by an undercut in one block 25 of the pair of stationary blocks 24 and 25 (Figs. 2 and 4) at the mouth of the ways in frame 7 for the slide 6, and thence along a guiding face 26 (Fig. 10) in the otherwise cylindrical stripper 27 to a position adjacent the side of the mandrel 28. The forward end of the ribbon 5 and the immediately adjacent parts of the apparatus then appear as shown in Fig. 4.

The next operation of the apparatus causes the endmost portion of the ribbon 5 to be gripped between the face of the die 29 and the longitudinal ridge 30 along the immediately adjacent side of the mandrel 28, and further causes said endmost portion, which is to be made into the shield, to be sheared from the remainder of the ribbon 5 by the movement of the knife edge 31 of said die 29 across the knife edge 32 of block 24. Also included in this step in the operation of the apparatus is the advance of the die 33 toward the mandrel 28 to the extent that the screw 34 thereon bears against the side of the mandrel 28 opposite from the die 29 so that said mandrel 28 is prevented from being pushed out of alignment in the apparatus by said die 29. Since the advance of the dies 29 and 33 occurs at a time when the ribbon feeding operation has been completed, the full downward movement of the hollow core 17, the source of said operation, will have occurred and the stripper 27, which is mounted upon the upper end thereof, will have also been lowered below the paths of movement thereof and will not interfere with the travel of said dies 29 and 33 to proper relation to the mandrel 28. One other movement is also included in the presently described operative step, said movement being a further advance of the die 29 which bends the severed blank portion 35 of the metal ribbon 5 to the extent shown in dot-dash lines in Fig. 5 wherein said blank 35 is caused to be bent part way around the ridge 30 on the mandrel 28 and into engagement with each side thereof.

Both dies 29 and 33 are correspondingly arranged in horizontal slide ways in the top portion of the frame 7 in which they are held by the cover plates 36 and 37, respectively, and are caused to take their respective motions by the upward motion of cam slides 38 and 39 (Fig. 3) extending upward through slotted outer end portions of the frame. As shown in connection with die 29 and slide 38, the die 29 is displaced by an inclined portion of a cam track 40 engaging a roller 41 fixed upon the die 29. Operating means for the slides 38 and 39 in turn, is provided in the main actuating mechanism located below the table 1 and on the lower portion of the frame 7 which retains said slides 38 and 39 in vertical slide ways behind the cover plate 42 and the bracket 43, respectively. The holding, shearing, and bending motions of the die 29 are the result of an upward movement of a platform or collar 44 to which the cam slide 38 is connected by the linkage 45, and occur when the lever 46 is moved appropriately through its engagement with the cam 47 on the drive shaft 4. The platform 44 is slid vertically upon a cylindrical lower end portion 48 of the frame 7 and is connected to the lever 46, in a manner to prevent rotation with respect thereto, by the links 49, 49. Motion of the lever 46 is about the pivot shaft 50 in accordance with the shape of a track in one face of the cam 47 and engaged by the roller 51. The motion of the opposite die 33, on the other hand, is the result of an upward movement of the end of the lever 52 of the operating means, to which the cam slide 39 is attached by the linkage 53, and is determined by the change in position of portions of a track in the face of the cam 54 on drive shaft 4 and engaged by a roller 55 on said lever 52. In order to avoid the possibility of the die 33 or the screw 34 thereon being pressed against the mandrel 28 with sufficient force to push it from proper alignment in the apparatus, said screw 34 is adjusted to engage the mandrel 28 while the face of the die 33 is still spaced a distance equal to the thickness of the metal ribbon 5 therefrom, and a stop for the movement of the die 33 is provided by a screw 56 (Fig. 2) which projects into a cross slot 57 of limited length in the top of said die 33. The screw 56 has an eccentric lower end and can be turned within the cover plate 37 to a position where it is engaged by the end wall of the slot 57 when the proper movement in the die 33 has taken place. The excess motion of the operation is then absorbed in the linkage 53 (Fig. 3) by the upward movement of the end of the rod 58 into the sleeve 59 and the compression of the helical spring 60 butting against the nuts 61 on a lower portion of the rod 58. A pin 62 extending through the end of the rod 58 and into slots in opposite sides of the sleeve 59 prevents the linkage 53 from separating when the die 33 and the slide 39 are free to move in either direction.

The next operations to occur in the apparatus are advancing movements of the dies 64 and 65 located at opposite sides of the mandrel 28 (Fig. 4) to positions nearer said mandrel 28 and adjacent the ends of the blank 35 as shown in Fig. 5 so that said ends are prevented from springing outward into the path of movement of the faces of the dies 64 and 65 in the immediately following interval when the die 29 completes its full motion toward the mandrel 28. The movements of the dies 64 and 65, which are located in horizontal ways below the cover plates 66 and 9, respectively, in the frame 7, are produced

in a manner corresponding to that effecting movement in die 29 by vertically arranged cam slides 67 and 68 located in slotted rear portions of the frame and moved vertically with respect thereto in ways in the frame 7 behind the cover plate 7a and bracket 22. Rollers (not shown) fastened to the dies 64 and 65 ride in cam tracks (also not shown) in the slides 67 and 68, respectively, to actuate said dies 64 and 65. The slides 67 and 68 are connected at their lower ends to platform 44 of the operating means of the apparatus by the linkages 69 and 70 which correspond to the linkage 53 associated with the slide 39 and die 33, and at the present moment convert the motion of said platform 44 into motion in the dies 64 and 65. All portions of the apparatus are now properly located for continuation of the forming of the blank 35.

A succession of movements occurring in the dies 29, 33, 64 and 65 now has the effect of wrapping the ends of the blank 35 around the mandrel 28. This succession of movements, as are all movements of the apparatus, are produced very rapidly without appreciable interruption in the continuous operation of the apparatus and are introduced by a further advance of the die 29 causing said blank 35 to be formed around the ridge 30 and the immediately adjacent side portion of said mandrel 28 by the arcuate face portion 29' and the slot 30' which corresponds in shape to the ridge 30. The apparatus and the blank 35 then appear as shown in full lines in Fig. 5, the blank having a corrugation 63 extending the full width thereof. The die 33 is now withdrawn from its position against the mandrel 28 as shown in Fig. 6 so as to provide clearance for the ends of the blank 35, and the arcuate faces 64' and 65' of dies 64 and 65 are simultaneously closed on said mandrel 28 to force additional portions of the blank 35 into conformity with the said mandrel 28. The final bending operation occurs when the die 33 is again advanced toward the mandrel 28 to cause its arcuate face 33' to press the ends of the blank 35 thereagainst. In certain instances, the ends of the blank 35 will be in abutting relation; however, it is preferable to adjust the apparatus so that one end of the blank is slightly longer than the other and said longer end is caused to overlap said other end as shown in Fig. 7. The dies 33, 64 and 65 force the blank 35 tightly against the mandrel 28 in every instance regardless of any variation in the blank 35, since excessive motion is provided in the operating means for said dies 33, 64 and 65 and provision is made in the linkage 69 and 70 for absorbing the over travel of said means.

The shield 71 (Fig. 7) is now completely formed and will continue to hug the mandrel 28 when in the succeeding operations of the apparatus all four dies 29, 33, 64 and 65 are withdrawn by the downward motion of the cam slides 38, 39, 67 and 68, respectively, under the control of the operating means. The separation operation, of which the retraction of the dies 29, 33, 64 and 65 is a part, also includes immediately followiog operations which both eject the shield 71 from said apparatus and, in the course of so doing, advance it end foremost over the cathode 72 and the longer lead 74 of the two leads 73 and 74 of the mount 3 (Fig. 10) to proper mounting relation thereto.

The relative positions of the mandrel 28 and the mount 3 are such that the mandrel 28 is directly in alignment with the cathode 72, and is orientated so that the ridge 30 and, accordingly, the corrugation 63 is aligned with the lead 74 paralleling one side of said cathode 72. The arrangement of the mandrel 28 and mount 3 makes it possible for the shield 71 to be transferred to said mount 3 by the normal upward motion of a stripper 27 which is moved up over the mandrel 28 to an extent sufficient to push said shield 71 from said mandrel 28 and to the proper elevation with respect to the mount 3. The mandrel 28 as shown in Fig. 1 is a stationary element of the apparatus in that it is attached to an end of a rod 75 located within the hollow interior of the stripper 27 and the hollow core 17, and in that the lower end of the rod 75 is anchored by a transverse pin 76 retained by a lower portion of the frame 7 and extending through clearance slots 77 in the walls of the hollow core 17. The stripper 27, on the other hand, is attached to the upper end of the hollow core 17 and has the vertical movements introduced therein by the operating means of the apparatus in engagement with the lower end thereof beyond the lower end 48 of the frame 7. The hollow core 17 is attached by the adjustable link 78 to the lever 79 of the operating means and is moved by the motions of the lever 79 about the stationary pin 80 in accordance with the advance of various portions of the track in the back face of cam 47 into engagement with a roller 81 on said lever 79.

Although the shield 71 is in part maintained in proper alignment with the mount 3 during its transfer by the engagement of the open interior of the corrugation 63 with the lead 74, it is also guided by the passage of the cylindrical main portion thereof up between the guide blocks 82 and 83 (Figs. 8 and 9) on the jaws 84 and 85 of the shield attaching means. The jaws 84 and 85, which are located upon the pivot pins 86 and 87 projecting beyond the frame 7 at positions on opposite sides of the die 33, are in a partly closed position because of the timed operative functions of a toggle arrangement engaging the pins 88 and 89 in the outer ends thereof and under the control of operating means below the table 1. The force of the toggle-joint is against the constant jaw-opening influence of the helical spring 90 (Fig. 3) joining the lower ends of the pins 88 and 89 and is applied against said pins 88 and 89 by the links 91 and 92, respectively, when the center pin 93, the connecting block 94, the bar 95 and the upper end of the lever 96 are moved toward the jaws 84 and 85. The lever 96 transforms the vertical motion of the rod 97, extending to the operating means, by its motion about the pivot pin 98 in the bracket 43 and is actuated by motion of the lever 99 of said operating means about the shaft 50 under the influence of a roller 100 in engagement with a track in the back face of cam 54.

More accurate location of the main cylindrical portion of the shield 71 occurs when the guide blocks 82 and 83 are closed further by the motion of the jaws 84 and 85 which motion is primarily effected to crimp the corrugation 63 onto the lead 74 of the mount 3. This latter motion of the jaws 84 and 85 is produced by still further motion of the lever 96 and the operating means and causes the serrations 101 in the coacting faces of the jaw ends 102 and 103 to close on the shield corrugation 63 so as to indent and otherwise bend said corrugation 63 and the lead 74 sufficiently to bind them together. The serrated faces of the jaw ends 102 and 103 are angled toward each other at the edge adjacent the cylindrical portion of the shield 71 so that the corresponding portion of the corrugation 63 is indented more deeply and so that the lead 74 is forced into and locked in the base of said corrugation 63. Matching portions 104 above and below the serrations in the faces of the jaw ends 102 and 103 seat against correspondingly located portions of the corrugation 63 at the limit of motion, which is determined by the seating of a portion of the link 92 against the bolt 105 in an upstanding portion of bracket 43, and keep it and the lead 74 from being bent out of alignment. At the conclusion of the crimping operation the final function of the mounting of the shield 71 on the mount 3 is completed and such remaining operations in the cycle as have not been described and relate only to the return of the jaws 84 and 85 to their original position, occur. The return of the jaws 84 and 85 is effected by the return movement of the toggle-joint under the control of operating means and separates all portions of said jaws 84 and 85 widely so that the completed mount can pass from operative relation thereto and so that another mount 3 can be advanced to op-

erative relation thereto. During the past interval, the stripper 27 is lowered and the next cycle of operation is started by the feeding of another portion of the ribbon 5 upon downward motion of the hollow core 17.

Another undescribed return motion occurred within the apparatus prior to the attachment of the shield 71 to the mount 3, said return operation being the retraction of the ribbon feeding slide 6 to a position to again advance the ribbon 5. This particular return operation is brought about by the upward movement of the hollow core 17 when the stripper 27 is caused to function and the resulting corresponding motion in the operating rod 15 and clockwise motion of the operating arm 13. The full motion of the operating rod 15 is not taken by the operating arm 13 inasmuch as the contraction force of the spring 19 is not sufficiently powerful to turn said arm 13 when the nuts 18 are carried from engagement therewith and it does not move until the corresponding nuts 106 further along the rod 15 engage said arm 13. The position of the nuts 18 and 106 determines the amount the operating arm 13 will be returned and to a certain extent determines the amount of ribbon 5 that will be fed. In the return movement of the operating arm 13, the screw 107 thereon engages the edge of lever 11 and turns it to the extent that it is brought against the stop screw 108 on the frame 7. The return of lever 11, in turn, swings the feed dog 8 about the pin 12 to a position outward from the ribbon 5 and against the stop pin 109 in the slide 6 so that the pressure of lever 11 shifts the feed dog 8 and the slide 6 as a single unit. The ribbon 5 must not move back with the feed slide 6 inasmuch as the bite measured off the ribbon 5 by the return movement represents the amount of ribbon 5 which will be fed by said slide 6 in the next cycle of operation. To prevent any such return motion of the ribbon 5, a clutch in the form of a roller 110 (Fig. 4) in a tapering pocket 111 in the block 25 is provided opposite the forward end thereof. Portions of a spring 112 coiled around a pin 113 retained by the block 25 and bearing against the walls of the pocket 111 and said roller 110 press the said roller 110 against the ribbon 5 and into the narrow part of the pocket 111 so that any back movement of said ribbon 5 is prevented by wedging of the roller 110 against it.

In the normal use of the shield forming and mounting apparatus with automatic mount making apparatus, it is often desirable for one or more cycles of operation to be skipped in order to avoid the feeding of a shield when a mount is not fed to operative relation to said shield forming and mounting apparatus or when an improperly constructed mount is fed to said apparatus. Under normal conditions an electrical control circuit is maintained to the solenoid 114 (Fig. 3) which circuit causes the solenoid 114 to tilt the lever 115 about the pivot pin 116 so that the stop plunger 117 is pulled back into a portion of bracket 22 and is out of the path of movement of the stud 119 on the operating lever 11 of the ribbon feeding means. However, should conditions be such that the cycle of operations of the forming and mounting apparatus is to be skipped, the control circuit will be interrupted by feeler means (not shown) arranged to detect the absence of a mount or the presence of a defective mount in the holder 2 just prior to its arrangement at operative relation to said apparatus and at a time when the ribbon feeding means thereof starts the cycle of operations. Under these conditions the stop plunger 117 will be moved to the position shown, by the expansion force of the helical spring 118 behind the head end thereof and said head end will wedge itself against the conical head of the stud 119 so that the operating lever 11 cannot move. The pressure of the spring 118 is sufficiently strong to advance the plunger 117 under the resistance of motion in the lever 115, which bears against the collar 120 on an end portion of said plunger 117, in the link 121 and in the armature 122 of the solenoid 114 and to wedge the head end of the plunger 117 against the stud 119 so as to prevent creeping of the feeding means during idle cycles.

Although a preferred embodiment of our invention has been disclosed it should be understood that the invention is not limited to the specific construction or arrangement of parts shown, but may be widely modified within the spirit and scope of the invention as defined by the appended claims.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. The method of forming and mounting a shield on a lamp mount comprising a stem having a pair of lead wires of different lengths extending longitudinally therefrom on opposite sides of the axis of the stem and with their ends bent laterally inwards to the said axis and supporting therebetween a filament substantially in alignment with said axis, which method comprises shaping a rectangular sheet metal blank by forming a corrugation across one dimension of the blank intermediate its ends and forming the remainder of the blank to a generally cylindrical configuration about an axis parallel to said corrugation, and assembling the shield so formed with said lamp mount by aligning the shield axially with the mount stem and with the corrugation thereon aligned with the longer one of said pair of lead wires and its laterally bent end and effecting relative axial movement between the shield and mount to bring the filament within the shield and the said longer lead wire within the corrugation, and then crimping the said corrugation about said longer lead wire.

2. The method of forming and mounting a shield on a mount having a cathode and a lead wire extending therefrom in substantially parallel relation with the outer end of the lead wire bent over laterally to support the cathode, which method comprises holding the mount with the cathode adjacent to and in axial alignment with a mandrel and with the lead wire and its laterally bent end in longitudinal alignment with a longitudinal ridge on a side of said mandrel, placing a rectangular sheet metal blank against said ridge to extend laterally of said mandrel and approximately equidistantly to both sides thereof and forming the sheet metal blank around and in conformity with said mandrel and the ridge thereon to form a tubular shield having a longitudinal corrugation thereon, sliding the shield axially off the mandrel and around the cathode with the corrugation enclosing the said lead wire after its laterally bent end has passed through, and securing the shield by affixing its corrugation to said lead wire.

3. Apparatus for forming electrode shields and securing them to electrode mounts comprising a mandrel having a longitudinally extending ridge along one side thereof, means to introduce a generally rectangular sheet metal blank into operative relation to said mandrel with the blank adjacent to said ridge and extending transversely thereacross, cooperating die means arranged to wrap said blank around said ridge and around the remainder of said mandrel to form a tubular shield having a longitudinal corrugation thereon, holder means arranged to be in longitudinal alignment with said mandrel and to hold a mount with a lead wire thereon in longitudinal alignment with the ridge on said mandrel, stripper means arranged in juxtaposition to said mandrel to push the shield longitudinally off said mandrel toward said holder means to enclose said lead wire in said corrugation, and means mounted adjacent said mandrel for securing the shield by its corrugation to said lead wire.

4. Apparatus for forming electrode shields and securing them to electrode mounts comprising a mandrel having a longitudinally extending ridge along one side thereof, ribbon feeding means located adjacent said

mandrel and arranged to introduce a sheet metal ribbon into operative relation to said mandrel with an end portion thereof adjacent to said ridge and extending transversely thereacross, cooperating die means including means for severing said end portion to form a blank and means arranged to wrap said blank around said ridge and around the remainder of said mandrel to form a tubular shield having a longitudinal corrugation thereon, holder means arranged to be in longitudinal alignment with said mandrel and to hold a mount with a lead wire thereon in longitudinal alignment with the ridge on said mandrel, stripper means arranged in juxtaposition to said mandrel to push the shield longitudinally off said mandrel toward said holder means to enclose said lead wire in said corrugation, and means mounted adjacent said mandrel for securing the shield by its corrugation to said lead wire.

5. Apparatus for forming electrode shields and securing them to electrode mounts comprising a mandrel having a longitudinally extending ridge along one side thereof, a stripper member movable longitudinally over the mandrel and having a guiding face substantially normal to the plane of said ridge and tangential to its outer edge, ribbon feeding means located adjacent said mandrel and arranged to feed a sheet metal ribbon across the guiding face of said stripper and into operative relation to said mandrel with an end portion thereof adjacent to said ridge and extending transversely thereacross, cooperating die means including means for severing said end portion of the ribbon to form a blank and means arranged to wrap said blank around said ridge and around the remainder of said mandrel to form a tubular shield having a longitudinal corrugation thereon, holder means arranged to be in longitudinal alignment with said mandrel and to hold a mount with a lead wire thereon in longitudinal alignment with the ridge on said mandrel, and means operable to effect sequential actuation of said ribbon feeding means, retraction of said stripper member, actuation of said die means toward said mandrel to effect the wrapping of the blank therearound followed by retraction of the die means and advancement of the stripper member to push the shield from the mandrel toward said holder means to enclose said

lead wire in said corrugation, and means mounted adjacent said mandrel for clamping said corrugation to said lead wire.

6. Apparatus for forming electrode shields and securing them to electrode mounts comprising a mandrel having a longitudinally extending ridge along one side thereof, means to introduce a generally rectangular sheet metal blank into operative relation to said mandrel with the blank adjacent to said ridge and extending transversely thereacross, cooperating die means arranged to wrap said blank around said ridge and around the remainder of said mandrel to form a tubular shield having a longitudinal corrugation thereon, holder means arranged to be in longitudinal alignment with said mandrel and to hold a mount with a lead wire thereon in longitudinal alignment with the ridge on said mandrel, stripper means arranged in juxtaposition to said mandrel to push the shield longitudinally off said mandrel toward said holder means to enclose said lead wire in said corrugation, and means mounted adjacent said mandrel for securing the shield by its corrugation to said lead wire and comprising jaws having opposed serrated faces and guide blocks mounted on said jaws and having opposing face portions conforming to the shape of the mandrel, and means for closing said jaws to cause the said blocks to direct the shield into proper alignment with said mount and to cause the said serrated faces to crimp together the said corrugation and the lead wire enclosed therein.

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