Nov. 2, 1954 A. GREINER ET AL 2,693,204

COIL BENDING MACHINE FOR PROJECTION LAMP FILAMENTS

Filed May 29, 1952 4 Sheets-Sheet 1

Fig. 1.

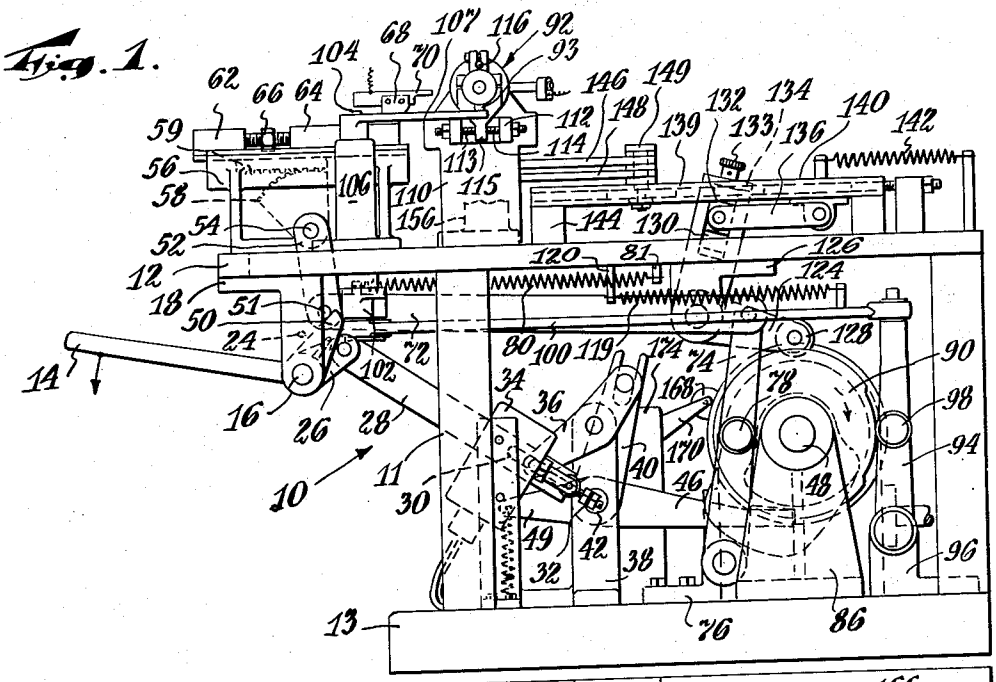
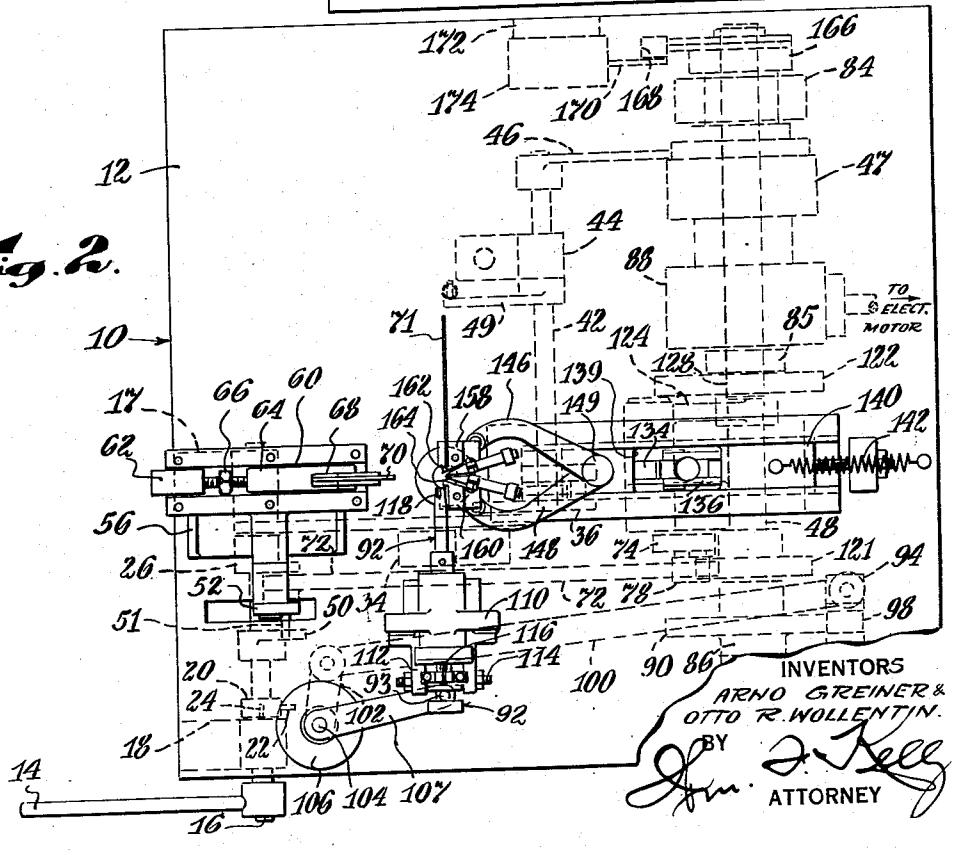


Fig. 2.



INVENTORS
ARNO GREINER &
OTTO R. WOLLENTIN.
BY
ATTORNEY

Nov. 2, 1954 A. GREINER ET AL 2,693,204

COIL BENDING MACHINE FOR PROJECTION LAMP FILAMENTS

Filed May 29, 1952 4 Sheets-Sheet 2

Fig. 3.

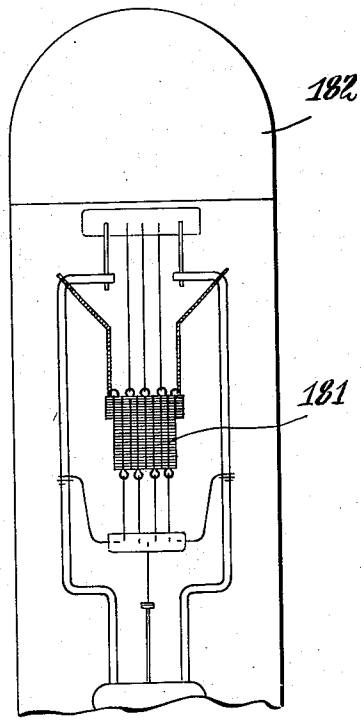


Fig. 4.

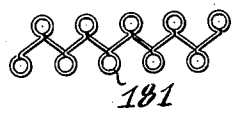


Fig. 14.

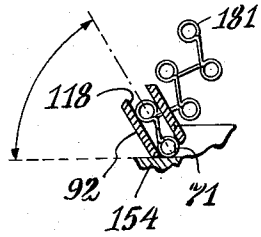


Fig. 15.

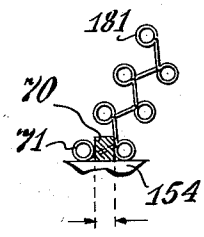


Fig. 17.

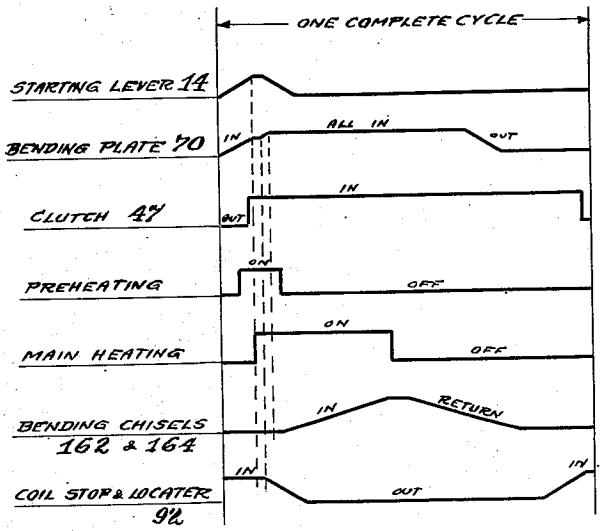
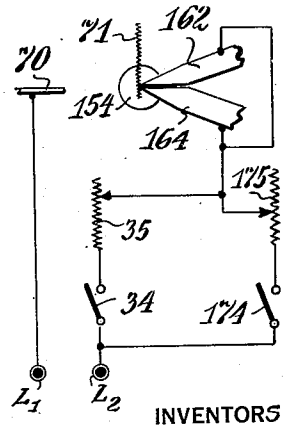


Fig. 16.



INVENTORS
ARNO GREINER &
OTTO R. WOLLENTIN.

BY

ATTORNEY

Nov. 2, 1954 A. GREINER ET AL 2,693,204

COIL BENDING MACHINE FOR PROJECTION LAMP FILAMENTS

Filed May 29, 1952 4 Sheets-Sheet 3

Fig. 5.

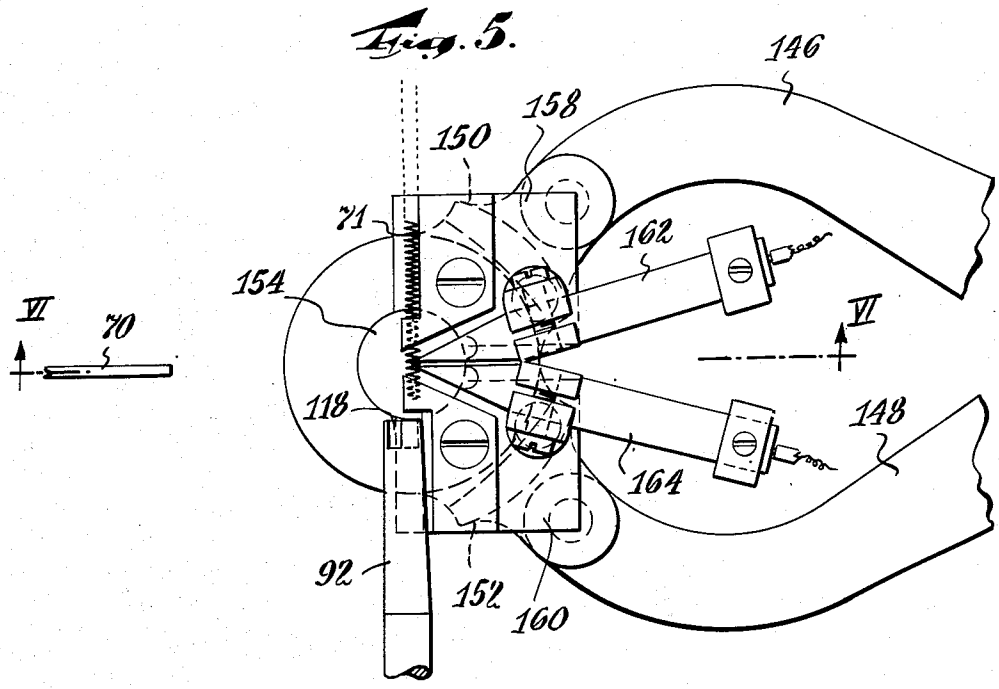
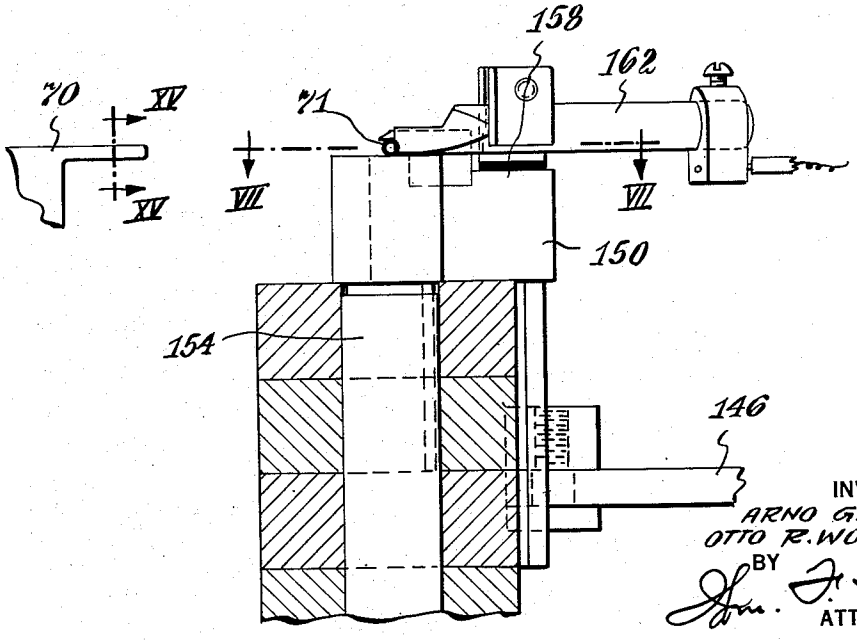


Fig. 6.



INVENTORS
ARNO GREINER &
OTTO R. WOLLENTIN.
BY
ATTORNEY

Nov. 2, 1954 A. GREINER ET AL 2,693,204

COIL BENDING MACHINE FOR PROJECTION LAMP FILAMENTS

Filed May 29, 1952 4 Sheets-Sheet 4

Fig. 7.

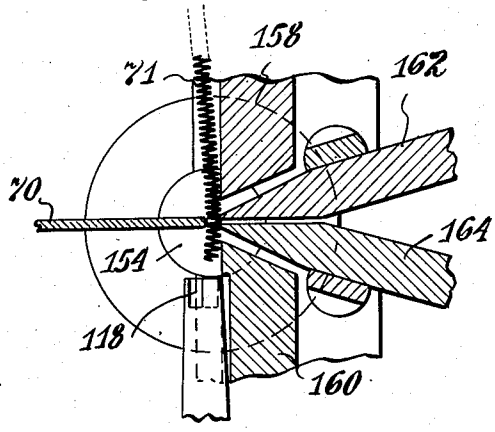


Fig. 8.

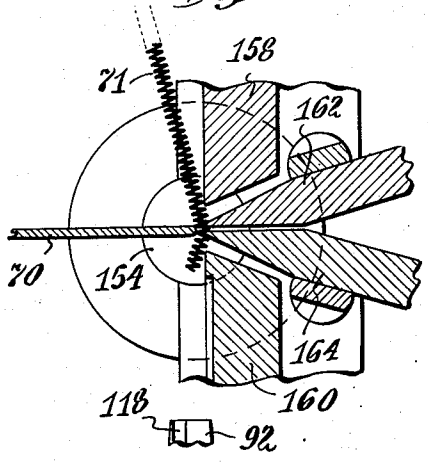


Fig. 9.

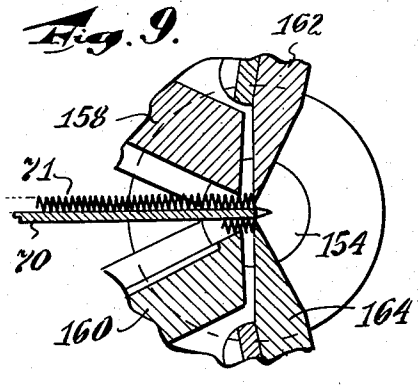


Fig. 10.

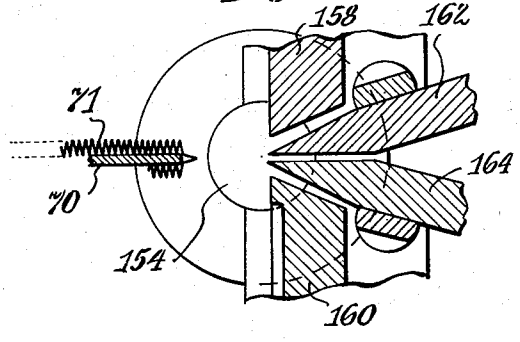


Fig. 11.

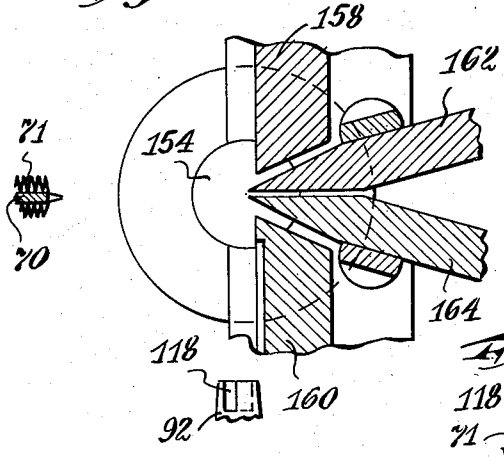


Fig. 12.

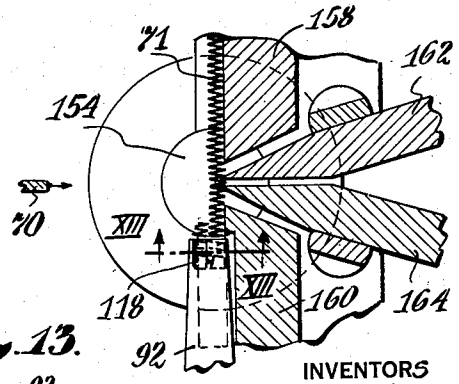
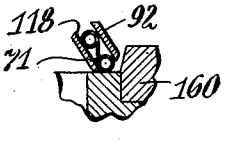


Fig. 13.



INVENTORS
ARNO GREINER &
OTTO R. WOLLENTIN.
BY
ATTORNEY

United States Patent Office 2,693,204 Patented Nov. 2, 1954

2,693,204

COIL BENDING MACHINE FOR PROJECTION LAMP FILAMENTS

Arno Greiner, Irvington, and Otto R. Wollentin, East Keansburg, N. J., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application May 29, 1952, Serial No. 290,776

6 Claims. (Cl. 140—71.5)

This invention relates to a coil bending machine and, more particularly, to one for bending coils for projection lamp filaments.

A conventional filament for an incandescent electric lamp, such as a projection lamp, is formed from a continuous coil into a bi-plane 10 section filamentary device having the first and last sections for mounting legs, the 2nd, 3rd, 8th and 9th section as outer sections and the remaining four sections as inner or center sections.

The purpose of this invention is to provide a coil bending machine for producing a bend in a continuously-wound coil formed of one turn of the coil at a predetermined distance or number of turns from a desired point on the coil. The bending operation, in the example cited, is performed nine times at desired predetermined intervals. All ten sections of the above mentioned lamp filament are alternately staggered and show a series of five loops on one side and a series of four loops on the other side.

The bending machine of our invention is provided with a cam shaft which is driven by a fractional horse power electric motor. A hand lever is moved downwardly to advance a coil bending blade toward a continuous coil (positioned against a coil stop and locator on a bending head), just making contact therewith. In the course of its travel, the hand lever closes a coil-preheat micro switch in a circuit for preheating the coil. At the end of its motion, the hand lever trips a clutch release lever, thereby releasing a one revolution clutch which then moves the cam shaft through one cycle of the operation. A coil heating switch control (or No. 1) cam activates a second micro switch which supplies resistive heat to the continuous coil undergoing bending for a period of time which is controlled and varied by the adjustable characteristics of the cam itself.

A coil stop and locator (or No. 2) cam moves the coil stop and locator into its "out" position. Simultaneously a bending blade positioning (or No. 3) cam moves the coil bending blade forward into the coil and securing one turn of the coil between the blade and a pair of bending chisels, thereby establishing an electric heat circuit through the coil. The chisels are located respectively on a pair of hinged elements which are moved in a circular motion about a center hinge post by a pair of links, commonly connected to a longitudinal slide, which in turn is activated by a bending chisel operating (or No. 4) cam.

After the bending operation, the coil bending blade is retracted by means of the No. 3 cam to its neutral position and the bending chisels are returned to their starting position by the No. 4 cam. Simultaneously the No. 2 cam returns the coil stop and locator mechanism to its "in" position. Meanwhile the clutch has arrived at its starting position and is stopped there by engagement with the clutch release lever, thereby completing the cycle for forming one bend or loop in the continuous coil. Nine such cycles are required, in the example cited above, to complete the bending and forming of the ten sections of the projection lamp filament.

In its general aspects, an object of the present invention is to produce a coil bending machine for forming a bend or loop in a continuous coil from one predetermined turn thereof.

Another object is to produce a coil bending machine for forming a series of loops or bends in a continuous coil a predetermined desired distance apart, to thereby shape a bi-plane multi-section filament for a projection lamp.

Other objects and advantages of the invention will appear to those skilled in the art to which it appertains as the description proceeds, both by direct recitation and by implication by the context.

Referring to the accompanying drawing, in which like numerals of reference refer to similar parts throughout:

Figure 1 is an elevational view of a coil bending machine embodying our invention.

Figure 2 is a plan view of the coil bending machine of Figure 1.

Figure 3 is a fragmentary elevational view of a conventional projection lamp having a bi-plane multi-section filament which may be formed by the machine of our invention.

Figure 4 is a plan view of such a projection lamp filament.

Figure 5 is a plan view of a coil bending head showing a coil bending blade and a pair of hinged bending chisels at the start of a loop forming cycle.

Figure 6 is a vertical sectional view of the coil bending head on the line VI—VI of Figure 5, in the direction of the arrows.

Figure 7 is a horizontal sectional view of the coil bending head on the line VII—VII of Figure 6 showing the coil bending blade just making contact with a continuously wound coil which is to be bent.

Figure 8 is a view similar to Figure 7 showing the bending blade in its final position and one turn of the coil secured between the bending chisels.

Figure 9 is a view similar to Figure 8 showing the formation of a bend in the coil by circular motion of the hinged bending chisels toward the coil bending blade.

Figure 10 is a view similar to Figure 9 showing a retraction of the coil bending blade with the bent coil thereon and a return of the bending chisels to the neutral or starting position.

Figure 11 is a view similar to Figure 10 showing a further retraction of the coil bending blade and a return of the coil stop and locator into its "in" position.

Figure 12 is a view similar to Fig. 11 showing the coil in position for a second bend and the coil bending blade starting inwardly toward the coil for the start of the second cycle.

Figure 13 is a side sectional view of the coil stop and locator, on the line XIII—XIII of Figure 12 showing the position of a previously formed coil section with respect to the remaining coil section yet to be bent.

Figure 14 is a view similar to Figure 13, but showing the position of the already formed sections of the filament prior to bending of the sixth loop.

Figure 15 is a sectional view on the line XV—XV of Figure 6 but showing the position of the already formed sections of the filament with respect to the remaining unbent portion of the coil after the formation of the seventh loop.

Figure 16 is a schematic wiring diagram of the coil preheat circuit and coil heating circuit.

Figure 17 is a diagram of operations of the coil bending machine.

Referring to the drawings, and in particular to Figures 1 and 2, a coil bending machine for projection lamp filaments is designated by the reference numeral **10**. This machine has a frame **11** comprising a platform **12** and base **13** integrated by suitable side plates and corner supports. A hand lever **14** is mounted on an outer or hand lever shaft **16** which is rotatable in a pair of hand lever mounting brackets **17** and **18** depending from the bottom surface of the top mounting plate of the frame **11**.

Handlever mechanism

On this hand lever shaft **16** is affixed an adjustable collar **20**, shown in Figure 2, carrying an arm **22** which engages a stop **24** on the bracket **18**, thereby limiting the rotation of the shaft **16** and the hand lever **14**. Adjacent the bracket **17** an arm **26**, shown particularly in Figure 1, is secured at one end to the shaft **16** and pivotably connected at its other end to a bending blade slide rod **28** provided with an adjustable slot **30**, and having a normally open micro switch trip arm **32** on its lower end for closing a coil preheat micro switch **34** suitably affixed to the frame **11**. As shown in Figure 16, switch **34** is in series with a variable resistor **35** and one

of the bending chisels as hereinafter described. One end of a lever 36 mounted in a suitable bracket 38 (upstanding from the base 13) carries a pin which slides in the slot 30. The opposite end of the lever 36 carries a pin which is similarly engaged in a U-shaped slot in the upper end of a clutch release lever 40.

The other end of the clutch release lever 40 is secured to one end of a clutch release shaft 42 which rotates in a suitable bushing in the bracket 38 and another bushing in a similar bracket 44 (Fig. 2). On the other end of the shaft 42, adjacent bracket 44, is a clutch release lever 46 for releasing a one revolution clutch 47 on a main cam shaft 48. An arm 49, having a spring between its left hand end (when viewed in Fig. 1) and the base 13 of the frame 11, provides suitable return means for the clutch release shaft 42.

Adjacent the arm 22 on the hand lever shaft 16 is a bending blade trip arm 50, shown in Figure 1. The outer end of the arm 50 is engageable with a lower pin 51 extending from a bending blade arm 52 secured at its upper end to a gear segment shaft 54 which is rotatable thereby in suitable bearings on a coil bending head bracket 56. A bending blade gear segment 58, secured to the outer end of the shaft 54, engages a rack 59 which is slidable in a trough 60 formed in the upper surface of the coil bending head bracket 56.

It will be understood that downward movement of the hand lever 14 (Fig. 1) causes forward movement of the rack 59 by means of the connecting linkage just described. Secured on the slide rack 59 by suitable means, such as screws, is a pair of bending blade mounting plates or blocks 62 and 64, connected by a right and left hand adjustment screw 66. Adjustably mounted in a lateral slot in the forward end of the mounting block 64 is a bending blade holder 68 which carries thereon a bending blade 70 for movement against and then insertion into a space between two predetermined turns of a continuous coil 71.

Bending blade final positioning cam mechanism

Adjacent the bending blade trip arm 50, an adjustable bending blade connecting rod 72 (Fig. 1) is secured to the pin 51 carried on the lower arm of the bending blade arm 52, as shown in Figure 2. The other end of the connecting rod 72 is pivoted to the upper end of a bending blade cam arm 74, shown most clearly in Figure 1, which has its lower extremity pivoted in a suitable bearing on a bracket 76 mounted on the base 13 of the frame 11. The cam arm 74 carries a cam roller 78, a suitable distance between the bracket 76 and the connecting rod 72, for engagement with a bending blade final positioning cam 121, as hereinafter explained. Suitable return means for the connecting rod 72 is provided by a spring 80, shown in Figure 1, extending from the left end portion of the rod 72 to a mounting pin 81 depending from the platform 12 of the frame 11.

The main cam shaft 48 is mounted on three brackets 84, 85 and 86, shown in Figure 2, on the base 13 of the frame 11 and driven through gears in a gear box 88 by suitable means such as a 1/20 H. P. motor (not shown).

Coil stop and locator cam mechanism

As shown particularly in Figure 2, a coil stop and locator cam 90 is affixed to the shaft 48 adjacent the bracket 86, for moving a coil stop and locator 92, as hereinafter explained. A locator cam arm 94, shown in Figure 1 adjacent the cam 90, having its lower end rotatably pivoted to a suitable bracket 96 upstanding from the base 13 of the frame 11, carries a cam roller 98 and has its upper end connected to an adjustable locator connecting rod 100. The other end of the rod 100 is pivoted to a lower horizontal locator arm 102 (Fig. 2) having its other end fixed on a vertical locator shaft 104, which rotates in a bearing bracket 106 mounted on the platform 12. The upper end of the shaft 104 is connected by means of a horizontal upper locator arm 107, fixed thereon as shown in Fig. 2, to the coil stop and locator 92 by a vertical pin 93 on the end of arm 107, secured in an annular groove 108 in the end of the locator 92.

The coil stop and locator 92 is slidable (in a direction transverse to the bending blade 70) in a suitable bearing mounted in a coil stop and locator bracket 110. A U-shaped horizontal bracket 112, shown in Figure 2, is provided on the bracket 110 under the locator 92. Bracket 112 has a pair of adjustment screws 113 and 114 extending toward one another from its arm for engagement with a lug depending from a guide 115 carried on the locator 92 adjacent the groove 108 therein. An adjustable stop 116 is provided in the upper portion of the guide 115 for limiting forward motion of the locator 92 by engaging the outer surface of the bracket 110. The end of the locator 92 adjacent the blade 70 is provided with a coil positioning slot 118 (Fig. 5). A return spring 119 (Fig. 1) extends from a pin on the connecting rod 100, near its connection with the arm 94, to pin 120 depending from the platform 12.

Coil stop and locator cam

Adjacent the coil stop and locator cam 90 on the cam shaft 48, is the bending blade final positioning cam 121 which engages the roller 78 on the cam arm 74, as shown in Figure 1.

Bending chisel operating cam mechanism

Adjacent the cam shaft bracket 85 is the bending chisel operating cam 122 (Fig. 2). A bending chisel bell crank lever 124, shown in Figure 1, is pivoted on a bracket 126 depending from the platform 12 and has a cam roller 128 on one arm in engagement with the cam 122. The other arm of the lever 124 is bifurcated to leave a slot 130 in its upper end. A drive block 132 slides in the slot 130 and its movement is limited by adjustment screw 133 carried by a plate 134 bridging the slot 130. The block 132 is connected by a pair of links 136 to a driven block 138, depending from a bending chisel slide block 140. A center clearance hole or slot 139 shown in Figure 2, is provided in the slide block 140, through which the upper arm of the bell crank lever 124 moves. A slide block return spring 142 has one end connected to the slide block 140 above the driven block 138 and its other end connected to a suitable pin projecting from the platform 12. This block 140 is slidably carried by a mounting bracket 144 upstanding from the platform 12.

A pair of bending chisel links 146 and 148, shown in Figures 5 and 6, are connected by means of a common pivot pin 149 (Figs. 1 and 2) to the forward portion of the bending chisel slide block 140. The forward portions of the links are respectively connected to a pair of hinged elements 150 and 152 (Fig. 6) which swing about a center hinge post 154. This post 154 in turn is mounted on a suitable bracket 156 (Fig. 1) upstanding from the platform 12. The hinged elements 150 and 152 carry bending chisel mounting plates 158 and 160, respectively, on which are mounted bending chisels 162 and 164, respectively, in normally parallel spaced relation to each other, for insertion from the opposite direction into the adjacent spaces in the two preselected turns which bound the blade receiving space.

Coil heating switch control cam mechanism

On the end of the main cam shaft 48 adjacent the cam shaft bracket 84 is a coil heating switch control cam 166 (Figure 2) which engages a roller 168 on the end of a coil heating switch arm 170, pivoted on a bracket 172. This bracket 172 also supports a normally open heating control micro switch 174 which is suitably connected in series with a variable resistor 175, as shown in Figure 16.

Preheating circuit for turns

The coil preheating circuit (Fig. 16) has one side of the voltage supply L1 connected to the bending blade 70. The other side of the supply L2 is connected thru the normally open microswitch 34 and the variable resistor 35 to the bending chisel 164. The other bending chisel 162 is tied electrically to the chisel 164 by a suitable line. It will be understood that the downward motion of the hand lever 14 pushes bending blade 70 into contact with the continuous coil 71, and the coil in turn against the bending chisels 162 and 164, and closes switch 34, thereby completing the circuit.

Heating circuit for turns

In the main coil heating circuit, as shown in Figure 16, normally open microswitch 174 and variable resistor 175 in electrical series with each other, are in electrical parallel with the switch 34 and resistor 35. The circuit

is completed by the closing of switch 174 upon operation of the cam 166.

Operation

According to our invention, the continuous coil 71 is placed on the center hinge post 154, as shown in Figure 5, and moved by hand axially toward the locator 92, so that its forward end is sufficiently close to the coil-positioning slot 118 in said locator, to insure that the portion selected for bending will be sufficiently large to form a mounting leg coil section which we call #1. As the starting or hand lever 14 is moved downwardly, the bending blade 70 simultaneously starts its inward movement, as shown in Figure 17, toward coil 71 on the center hinge post 154. It will be understood that as the hand lever shaft 16 and the bending blade trip arm 50 rotate counterclockwise, due to the downward movement of the lever 14, the gear segment shaft 54 and the gear segment 58 thereon are rotated clockwise by means of the bending blade arm 52. This clockwise motion of the segment 58 moves the rack 59 to the right, as viewed in Figures 1 and 2, in trough 60, and hence until the bending blade 70 just touches the coil 71, as shown in Figure 7.

When the bending blade 70 has completed approximately ½ of its travel as shown in Figure 17, the normally open microswitch 34 in the coil preheat circuit is closed by the action of the trip arm 32 on the bending blade slide rod 28. The counterclockwise rotation of the hand lever shaft 16 and arm 26 thereon causes the slide rod 28, and hence the trip arm 32 thereon, to move diagonally upward, as shown in Fig. 1, to close the switch 34, also shown in Figure 16, and thereby supply preheat current to the coil 71. This switch 34 remains closed until the hand lever 14 is released.

Slightly before the lever 14 and the bending blade 70 reaches the end of their respective travels, the clutch release lever 46 on the clutch release shaft 42 releases the one revolution clutch 47, and the cam shaft 48, driven by the motor, with the cams 90, 121, 122 and 166 thereon, start their revolution. The clockwise rotation of shaft 16 and the arm 26 thereon, causing the diagonally upward movement of the slide rod 28, also causes the clockwise rotation of the shaft 42 and the clutch release lever 26 thereon, by means of the connecting linkage heretofore described.

As the main cam shaft 48 starts to turn, the micro switch 174 is closed by engagement of a raised portion of the coil heating switch control cam 166 with the roller 168 on the contact arm 170. As shown in Figure 16, closing of the switch 174 supplies heating current through the resistor 175 and the bending chisels 162 and 164 to the coil 71.

Further rotation of the main cam shaft 48 and bending blade final positioning cam 121 thereon, positions the bending blade 70 in its final position, approximately .015" further into the space between the two preselected turns of the coil 71, thereby securely holding one turn of the coil between the bending blade 70 and the two bending chisels 162 and 164, which are now inserted from the opposite direction in the adjacent spaces in the two preselected turns which bound the blade receiving space. A raised portion of the cam 121 moves the roller 78, and hence the cam arm 74 and the connecting rod 72, toward the left end of the machine, when viewed in Figure 1. This motion of the rod 72 moves the bending blade arm 52 on the gear segment shaft 54 and hence rotates clockwise the gear segment 58 on the other end of shaft 54, to cause the additional required motion of the bending blade 70, as shown in Figure 8.

Simultaneously, as shown in Figure 17, the coil stop and locator cam 90 moves the coil stop and locator 92 from its "in" position (Figs. 7 and 12) to its "out" position. Rotation of a raised portion of the cam 90 against the roller 98 moves the locator cam arm 94 and the connecting rod 100 horizontally to the right, when viewed in Figures 1 and 2. This motion rotates the lower arm 102 on the bottom of the vertical shaft 104, and hence the shaft 104 (and the upper arm 108 on the upper portion of the shaft 104 with its pin 93 on the outer end) clockwise in a horizontal plane. This pin 93 in the groove 108 on the rearward portion of the coil stop and locator 92, moves the locator 92 away from the post 154 or to its "out" position.

Further rotation of the main cam shaft 48 causes the bending chisels 162 and 164 to swing on the hinged elements 150 and 152 respectively about the center hinge post 154, as shown in Figure 9, and bend the coil 71 about its preselected turn into parallel sections aligned along the bending blade 70. This action of the chisels is accomplished by operation of the bending chisel operating cam 122 through its connecting linkage. A raised portion of the cam 122 moves the roller 128 on the pivoted bell crank lever 124 upward, and hence the drive block 132 in the slot 130 (Fig. 1) in the upper end of the crank 124 towards the center hinged post 154. This motion is transmitted to the bending chisel slide block 140 by means of the links 136 affixed to the driven block 138 on the slide block 140.

Simultaneously, as shown in Fig. 17, with the completion of the swinging of the bending chisels 162 and 164, the main heating switch 174 is opened by means of the coil heating switch control cam 166. Further rotation of the main cam shaft 48 moves the roller 128 on crank 124 off the raised portion of cam 122 thereby moving the slide block 140 and the bending chisels 162 and 164 connected thereto back to their starting position, with the aid of the return spring 142, as shown in Fig. 10.

Before the bending chisels complete their return to the starting or neutral position, roller 78 on the bending blade cam arm 74 runs off the raised portion of the bending blade final positioning cam 121 thus releasing the bending blade 70 and the now bent coil 71 thereon, by means of the connecting mechanism explained above and with the help of the return spring 80 on the end of rod 72 (Fig. 1).

A short time (Fig. 17) after the return of the bending chisels 162 and 164 to their starting position, the roller 98 rolls off the raised portion of the coil stop and locator cam 90 and the coil stop and locator 92 is returned to its "in" position, as shown in Figure 11, by means of the connecting mechanism explained above and the return spring 119 on the connecting rod 100 (Fig. 1).

Just before the end of the one revolution of the main cam shaft 48, which requires a few seconds, the clutch release lever 46 (Figs. 1 and 2) engages the one-revolution clutch 47 and stops further rotation of the main cam shaft 48 and the cams 90, 121, 122 and 166 thereon.

The now bent coil 71 is removed from the bending blade 70 and inserted by hand into the coil stop and locator slot 118, shown in Figure 12, on the inner end of the coil stop and locator 92.

It will be understood that this slot 118 is positioned so that the distance from the inner face of the slot to the center of the hinge post 154, the point of contact of the bending blade 70 with the coil 71, is the desired distance or the desired number of turns between bends yet to be formed in the remainder of the coil 71. Considered another way, this above mentioned position of the slot 118 in locator 92 determines the length of the eight remaining inner and outer sections of a filament 181 shown in Figures 3 and 4 to be formed from the coil 71. Further the pitch between sections of the coil 71 can be controlled and hence a uniform light source can be obtained, as shown in Figure 14, by adjusting the angle which the axis of the slot 118 makes with the horizontal top of the post 154.

As the cycle is repeated and successive bends or sections of the filament 181 are formed in the coil 71 by the method described above, the coil 71 is positioned in the slot 118 at the start of each succeeding cycle, as shown in Figure 14, with the already formed five sections, positioned away from the swinging movement of the bending chisels 162 and 164.

Thus it will be seen from the foregoing description that our invention has provided a coil-bending machine 10 for forming a series of loops or bends in a continuous coil 71 a predetermined distance apart to produce a bi-plane multi-section filament 181 for a projection lamp 182, as shown in Figure 3.

This machine 10 comprises a main cam shaft 48 having thereon, a one revolution clutch 47, a coil stop and locator cam 90, a bending blade final positioning cam 121, a bending chisel operating cam 122, and a coil heating switch control cam 166 which through the appropriate connecting mechanism described above, respectively move a coil stop and locator 92 from its "in" to its "out" position, finally position the bending blade 70 against the coil 71 and the bending chisels

162 and 164, swing the bending chisels 162 and 164 about the center post 154 to form the desired loop in the pre-selected turn of coil 71 and provide heat to the coil 51 during the bending operation. A hand starting lever 14 and its connecting mechanism is provided for moving the blade 70 into contact with the coil 71, closing the coil preheat circuit shown in Figure 16 and releasing the one revolution clutch 47 on the main cam shaft 48, thus starting the one revolution of the shaft and the above mentioned cams thereon.

Although an embodiment of the invention has been described, it will be understood that modifications may be made within the scope of the invention.

We claim:

1. A machine for bending a continuous coil into a bi-plane multi-section projection lamp filament having a pre-determined desired number of turns between sections comprising a frame, a bending blade on said frame for movement against and then insertion into a space between two pre-selected turns of said coil, a pair of bending chisels on said frame in normally parallel spaced relation opposite said bending blade, for insertion from the opposite direction into the adjacent spaces in the pre-selected turns which bound the blade-receiving space, a coil stop and locator on said frame for determining the pre-selected turns, a coil stop and locator mechanism on said frame for moving said locator into its "in" and "out" positions, a coil preheating circuit for heating said coil prior to said bending, a main heating circuit for heating said coil during bending, a hand lever mechanism on said frame for advancing said bending blade into contact with said coil, closing said coil preheating circuit and tripping a clutch release lever, a bending blade final positioning mechanism on said frame for inserting said bending blade into the space between said pre-selected turns, a bending chisel operating mechanism on said frame for pivotably moving said bending chisels about a common axis away from each other and aligning said bent coil sections along said bending blade, to bend the pre-selected turn of said coil therearound into a loop, and thereby form the coil into two sections, and an automatic driving and timing mechanism on said frame for said coil stop and locator mechanism, said bending blade final positioning mechanism, and said bending chisel operating mechanism.

2. A machine for bending a continuous coil into a bi-plane multi-section projection lamp filament having a pre-determined desired number of turns between sections comprising a frame, a bending blade on said frame for movement against and then insertion into a space between two pre-selected turns of said coil, a pair of bending chisels on said frame in normally parallel spaced relation opposite said bending blade, for insertion from the opposite direction into the adjacent spaces in the pre-selected turns which bound the blade-receiving space, a coil stop and locator on said frame for determining the pre-selected turns, and automatic driving and timing mechanism on said frame comprising a main cam shaft mounted on said frame, and a one revolution clutch, a coil stop and locator cam, a bending blade positioning cam, a bending chisel operating cam, and a main coil heating switch control cam on said main cam shaft, a coil stop and locator mechanism on said frame for moving said locator into its "in" and "out" positions, a coil preheating circuit for heating said coil prior to said bending, a main heating circuit for heating said coil during bending, a hand lever mechanism on said frame for advancing said bending blade into contact with said coil, closing said coil preheating circuit and tripping said clutch release lever, a bending blade final positioning mechanism on said frame for inserting said bending blade into the space between said pre-selected turns, and a bending chisel operating mechanism on said frame for pivotably moving said bending chisels about a common axis away from each other and aligning said bent coil sections along the bending blade, to bend the preselected turn of said coil therearound into a loop, and thereby form the coil into two sections.

3. A machine for bending a continuous coil into a bi-plane multi-section projection lamp filament having a predetermined desired number of turns between sections comprising a frame, a bending blade on said frame for movement against and then insertion into a space between two pre-selected turns of said coil, a pair of bending chisels on said frame in normally parallel spaced relation opposite said bending blade, for insertion from the opposite direction into the adjacent spaces in the pre-selected turns which bound the blade-receiving space, a coil stop and locator on said frame for determining the pre-selected turns, an automatic driving and timing mechanism on said frame comprising a main cam shaft mounted on said frame, and a one revolution clutch, a coil stop and locator cam, a bending blade positioning cam, a bending chisel operating cam, and a main coil heating switch control cam on said main cam shaft, a coil stop and locator mechanism on said frame for moving said locator into its "in" and "out" positions, said coil stop and locator mechanism comprising a locator cam arm adjacent said coil stop and locator cam carrying a roller for engagement therewith, a locator connecting rod on the upper end of said locator cam arm having its other end secured to a lower horizontal locator arm, said lower horizontal locator arm in turn secured to the lower end of a vertical locator shaft, an upper locator arm on the upper end of said locator shaft carrying a vertical pin on its outer end, said coil stop and locator being slidable transverse to said blade and said bending chisels in a coil stop and locator bracket and provided with means for connection with said pin on said upper locator arm, a coil preheating circuit for heating said coil prior to said bending, a main heating circuit for heating said coil during bending, a hand lever mechanism on said frame for advancing said bending blade into contact with said coil, closing said coil preheating circuit and tripping said clutch release lever, a bending blade final positioning mechanism on said frame for inserting said bending blade into the space between said pre-selected turns, and a bending chisel operating mechanism on said frame for pivotably moving said bending chisels about a common axis away from each other and aligning said bent coil sections along the bending blade, to bend the preselected turn of said coil therearound into a loop, and thereby form the coil into two sections.

4. A machine for bending a continuous coil into a bi-plane multi-section projection lamp filament having a predetermined desired number of turns between sections comprising a frame, a bending blade on said frame for movement against and then insertion into a space between two pre-selected turns of said coil, a pair of bending chisels on said frame in normally parallel spaced relation opposite said bending blade, for insertion from the opposite direction into the adjacent spaces in the pre-selected turns which bound the blade-receiving space, a coil stop and locator on said frame for determining the pre-selected turns, an automatic driving and timing mechanism on said frame comprising a main cam shaft mounted on said frame, and a one revolution clutch, a coil stop and locator cam, a bending blade positioning cam, a bending chisel operating cam, and a main coil heating switch control cam on said main cam shaft, a coil stop and locator mechanism on said frame for moving said locator into its "in" and "out" positions, a coil preheating circuit for heating said coil prior to said bending, a main heating circuit for heating said coil during bending, a hand lever mechanism on said frame for advancing said bending blade into contact with said coil, closing said coil preheating circuit and tripping said clutch release lever, a bending blade final positioning mechanism, on said frame for inserting said bending blade into the space between said pre-selected turns, said bending blade final positioning mechanism comprising a bending blade cam arm adjacent said bending blade final positioning cam and provided with a roller for engagement with said bending blade cam, a bending blade connecting rod on the upper end of said bending blade cam arm, a bending blade trip arm secured at one end of said bending blade connecting rod, a hand lever shaft on said frame for carrying the other end of said bending blade trip arm, a gear segment shaft on said frame, a bending blade arm on said gear segment shaft in contact with the upper end of said bending blade trip arm and for causing rotary motion of said gear segment shaft, a gear segment on said gear segment shaft, a rack in engagement with said gear segment and means on said rack for mounting said bending blade and a bending chisel operating mechanism on said frame for pivotably moving said bending chisels about a common axis away from each other and aligning said bent coil sections along the bending blade, to bend the preselected turn of said coil therearound into a loop and thereby form the coil into two sections.

5. A machine for bending a continuous coil into a biplane multi-section projection lamp filament having a pre-determined desired number of turns between sections comprising a frame, a bending blade on said frame for movement against and then insertion into a space between two pre-selected turns of said coil, a pair of bending chisels on said frame in normally parallel spaced relation opposite said bending blade, for insertion from the opposite direction into the adjacent spaces in the pre-selected turns which bound the blade-receiving space, a coil stop and locator on said frame for determining the pre-selected turns, an automatic driving and timing mechanism on said frame comprising a main cam shaft mounted on said frame, and a one revolution clutch, a coil stop and locator cam, a bending blade positioning cam, a bending chisel operating cam, and a main coil heating switch control cam on said main cam shaft, a coil stop and locator mechanism on said frame for moving said locator into its "in" and "out" positions, a coil preheating circuit for heating said coil prior to said bending, a main heating circuit for heating said coil during bending, a hand lever mechanism on said frame for advancing said bending blade into contact with said coil, closing said coil preheating circuit and tripping said clutch release lever, a bending blade final positioning mechanism on said frame for inserting said bending blade into the space between said pre-selected turns, and a bending chisel operating mechanism on said frame for pivotably moving said bending chisels about a common axis away from each other and aligning said bent coil sections along the bending blade, to bend the preselected turn of said coil therearound into a loop, and thereby form the coil into two sections, said bending chisel operating mechanism comprising a bending chisel bell crank lever provided with a roller for engagement with said bending chisel operating cam and a bifurcated upper end, a bending chisel slide block connected to the bifurcated end of said bell crank lever, a slide block mounting bracket on said frame for slidably supporting said slide block, a pair of bending chisel links commonly connected to the forward portion of said slide block, a hinged element on the forward portion of each bending chisel link for carrying thereon said bending chisels and a center hinge post for carrying said hinged elements in pivotable movement thereabout.

6. A machine for bending a continuous coil into a biplane multi-section projection lamp filament having a

pre-determined desired number of turns between sections comprising a frame, a bending blade on said frame for movement against and then insertion into a space between two pre-selected turns of said coil, a pair of bending chisels on said frame in normally parallel spaced relation opposite said bending blade, for insertion from the opposite direction into the adjacent spaces in the pre-selected turns which bound the blade-receiving space, a coil stop and locator on said frame for determining the pre-selected turns, an automatic driving and timing mechanism on said frame comprising a main cam shaft mounted on said frame, and a one revolution clutch, a coil stop and locator cam, a bending blade positioning cam, a bending chisel operating cam, and a main coil heating switch control cam on said main cam shaft, a coil stop and locator mechanism on said frame for moving said locator into its "in" and "out" positions, a coil preheating circuit for heating said coil prior to said bending, a main heating circuit for heating said coil during bending, a hand lever mechanism on said frame for advancing said bending blade into contact with said coil, closing said coil preheating circuit and tripping said clutch release lever, a bending blade final positioning mechanism on said frame for inserting said bending blade into the space between said pre-selected turns, a bending chisel operating mechanism on said frame for pivotably moving said bending chisels about a common axis away from each other and aligning said bent coil sections along the bending blade, to bend the preselected turn of said coil therearound into a loop, and thereby form the coil into two sections, and a coil heating switch mechanism for transmitting motion from said coil heating switch control cam for closing a switch in said heating circuit, and comprising a heating switch arm carrying a roller thereon for engagement with said coil heating switch control cam, and a heating control switch in said coil heating circuit mounted on said frame and operable by said heating switch arm.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,726,480	Fehse	Aug. 27, 1929
2,181,288	Washburn	Nov. 28, 1939
2,272,869	Herzog	Feb. 10, 1942
2,449,653	Isaac	Sept. 21, 1948