July 15, 1952 R. L. LONG 2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949 10 Sheets-Sheet 1

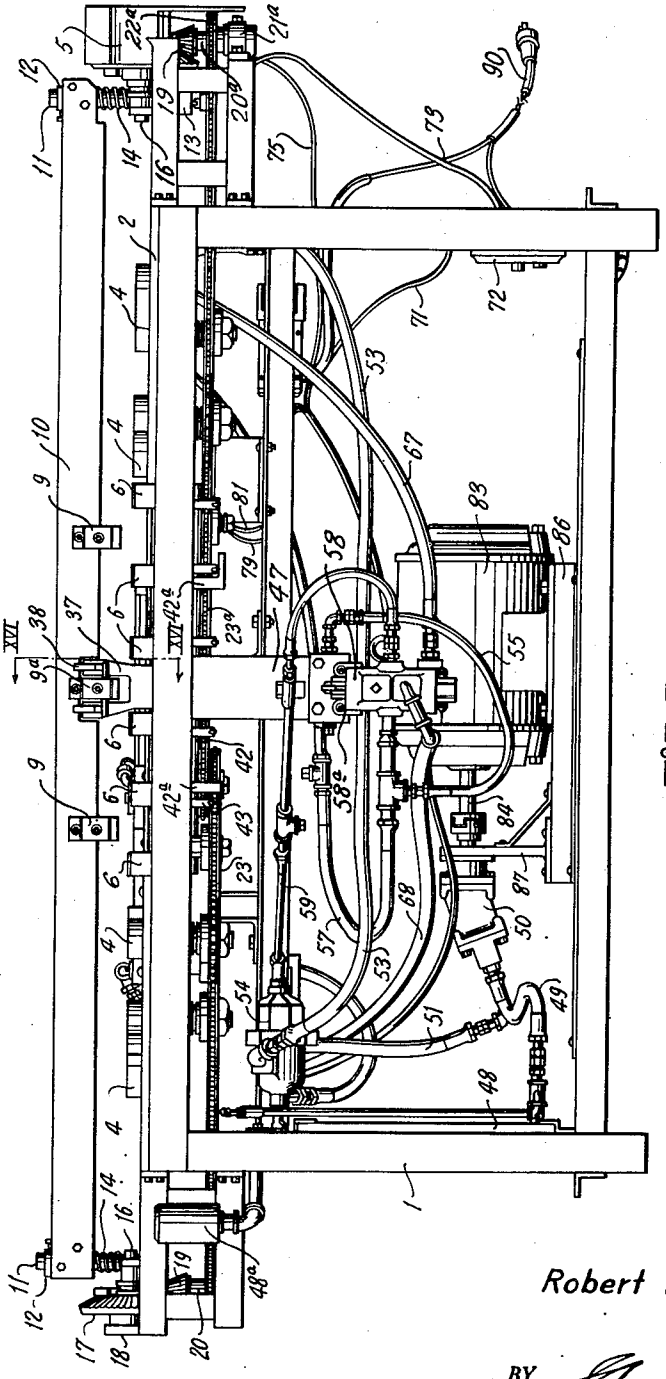


Fig. 1

Robert L. Long
INVENTOR.

BY

ATTORNEY

July 15, 1952 R. L. LONG 2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949 10 Sheets-Sheet 2

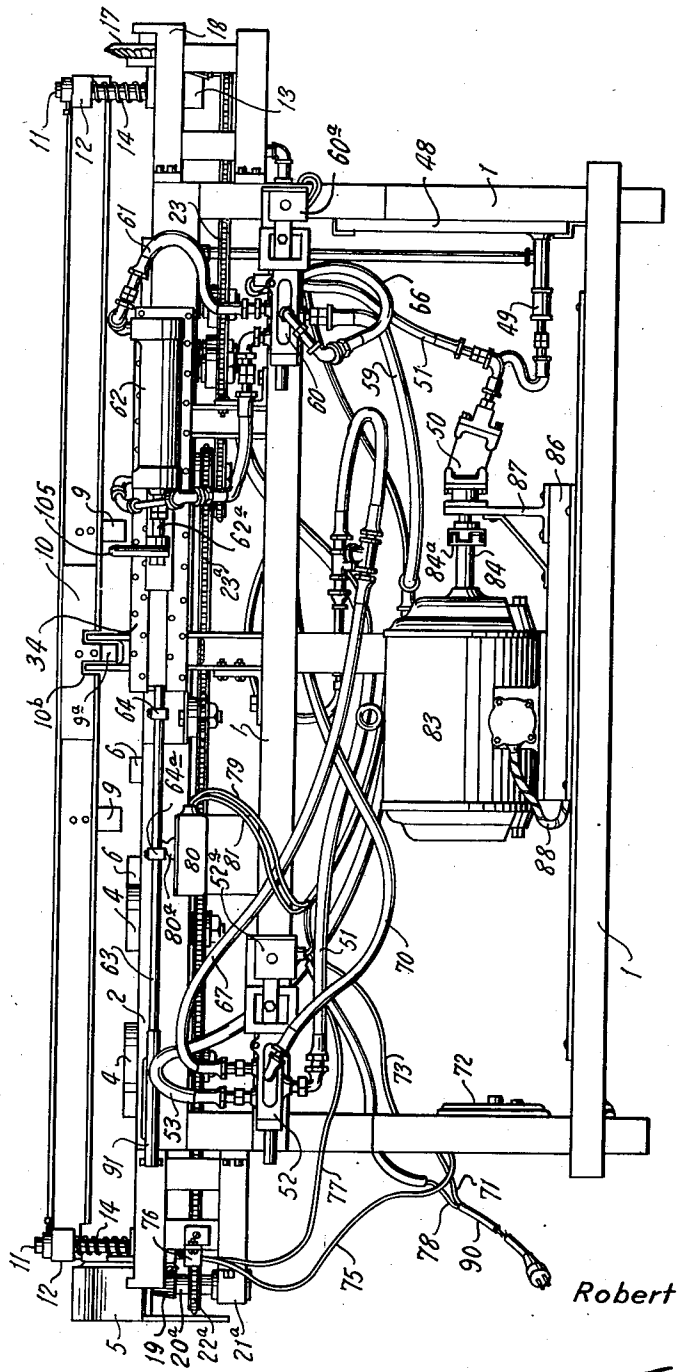


Fig. II

Robert L. Long
INVENTOR.

BY

ATTORNEY

July 15, 1952

R. L. LONG

2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949

10 Sheets-Sheet 3

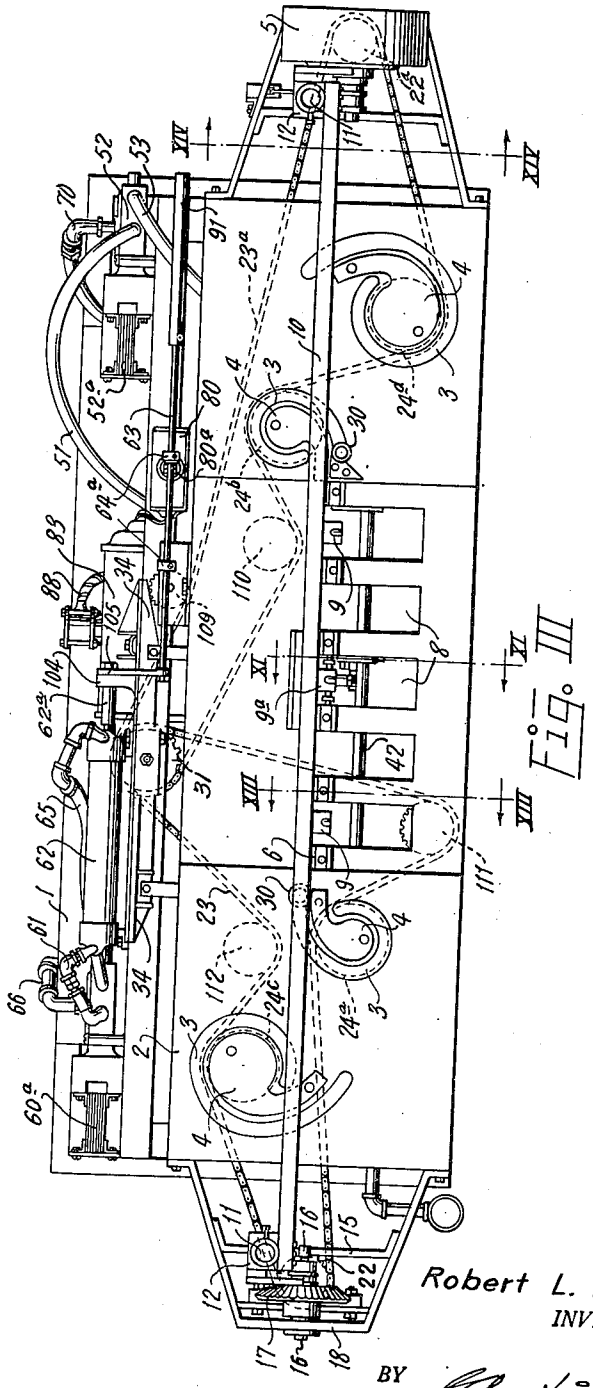


Fig. 3

Robert L. Long
INVENTOR.

BY

ATTORNEY

July 15, 1952 R. L. LONG 2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949 10 Sheets-Sheet 4

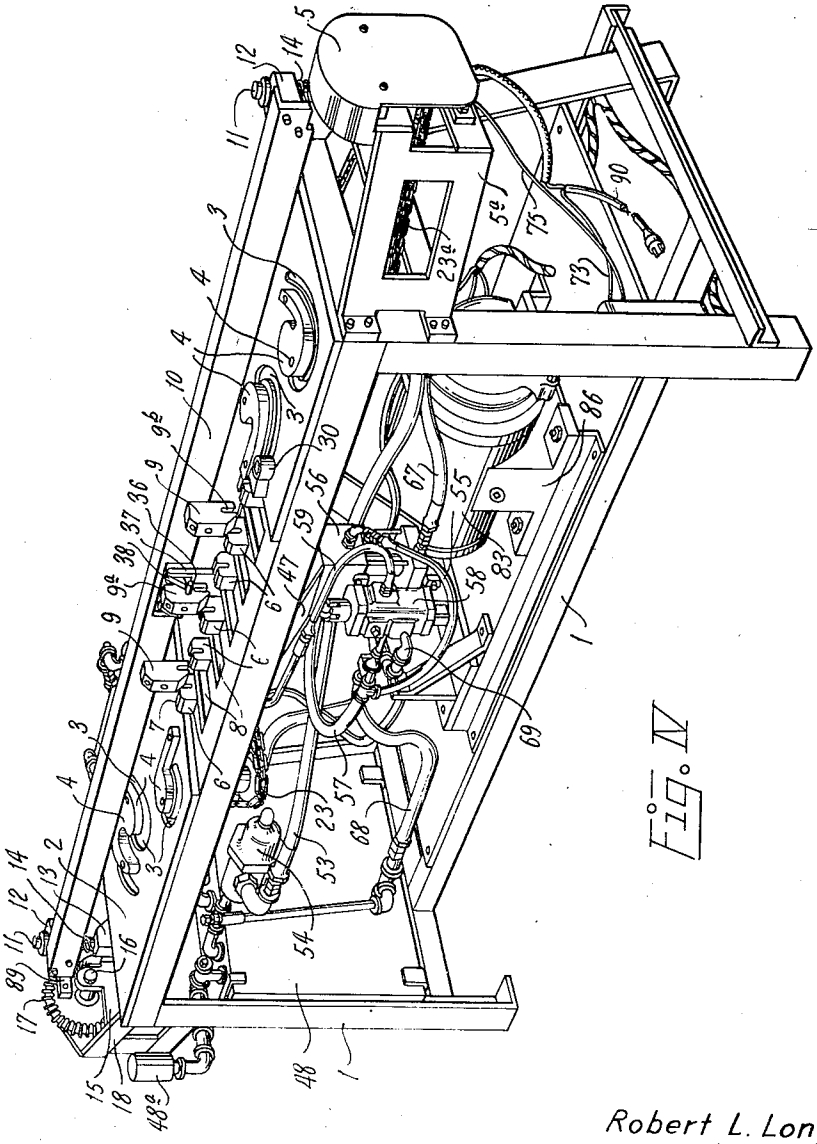


Fig. N

Robert L. Long
INVENTOR.

BY

ATTORNEY

July 15, 1952 R. L. LONG 2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949 10 Sheets-Sheet 5

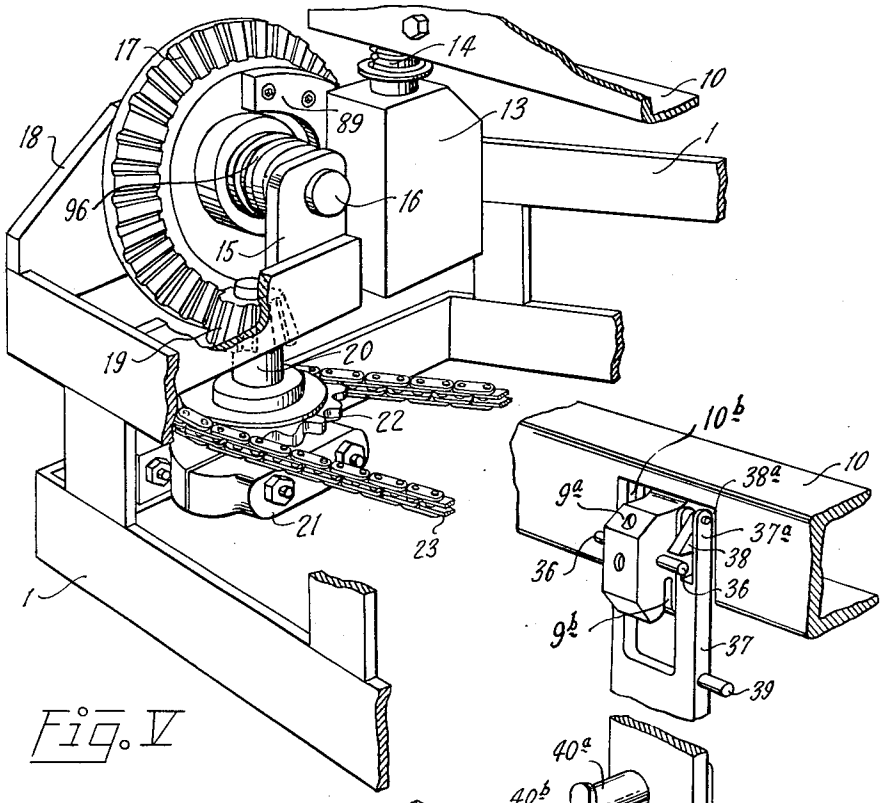


Fig. V

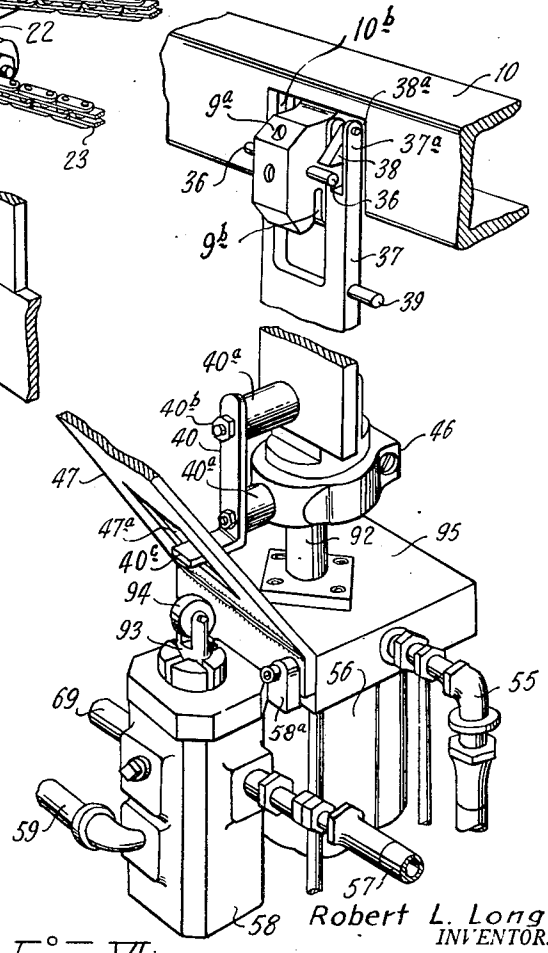


Fig. VI

Robert L. Long
INVENTOR.

BY

ATTORNEY

July 15, 1952 R. L. LONG 2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949 10 Sheets-Sheet 6

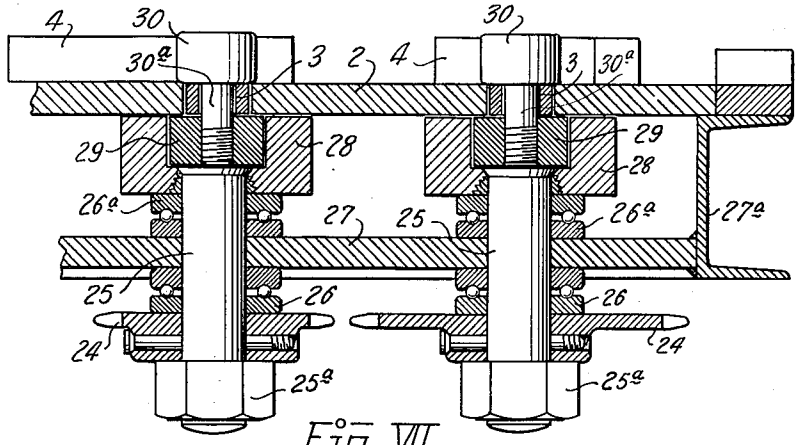


Fig. VII

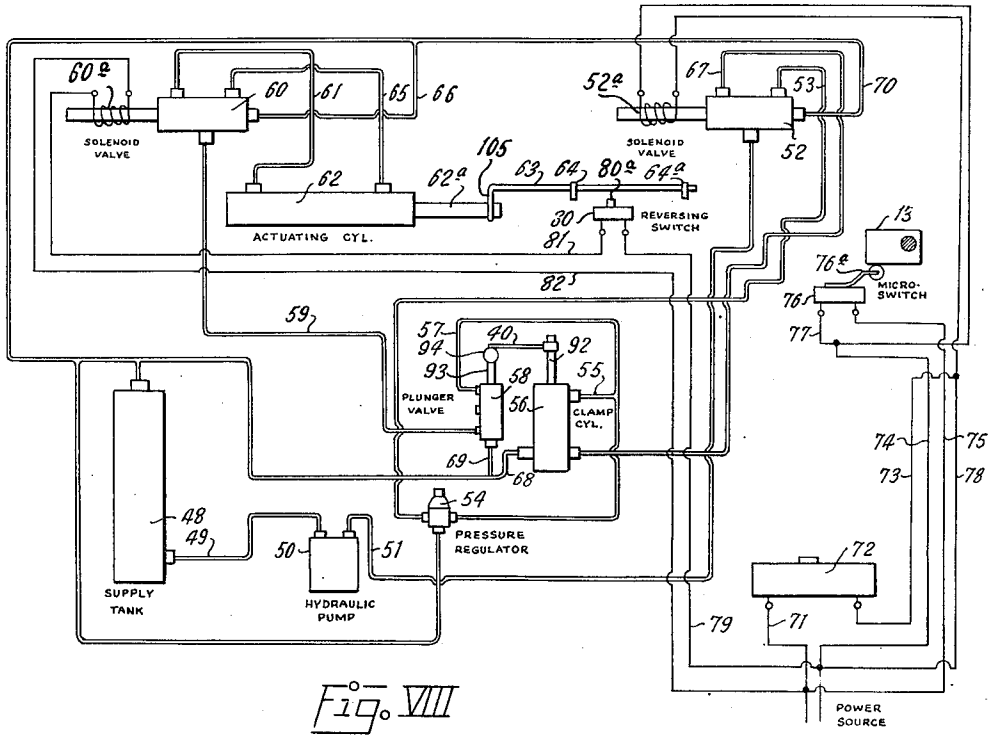


Fig. VIII

Robert L. Long
INVENTOR.

BY

ATTORNEY

July 15, 1952 R. L. LONG 2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949 10 Sheets-Sheet 7

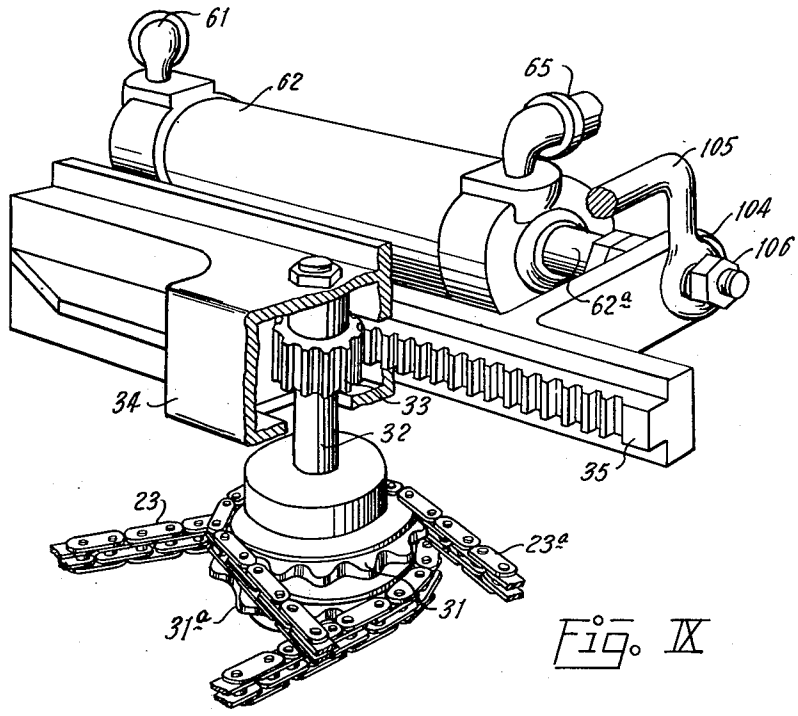


Fig. IX

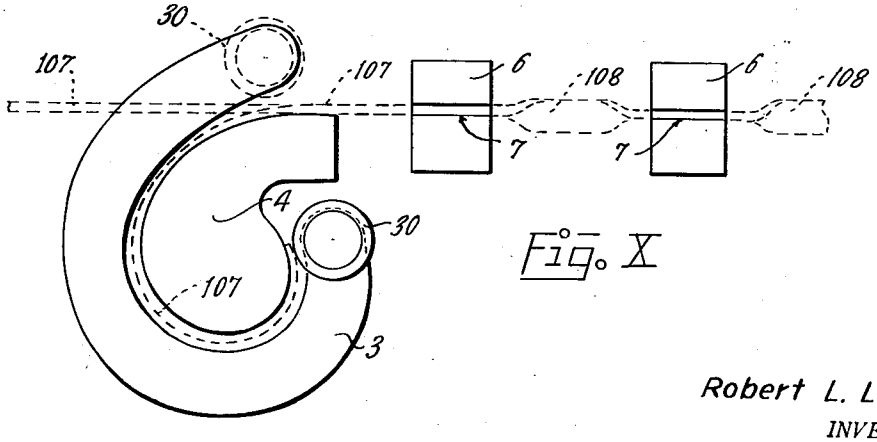


Fig. X

Robert L. Long
INVENTOR.

BY

ATTORNEY

July 15, 1952 R. L. LONG 2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949 10 Sheets-Sheet 8

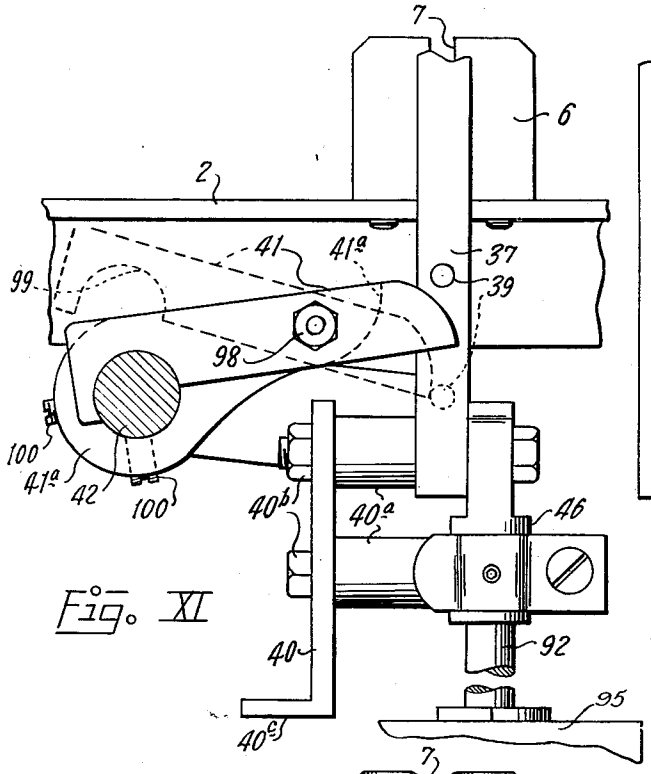


Fig. XI

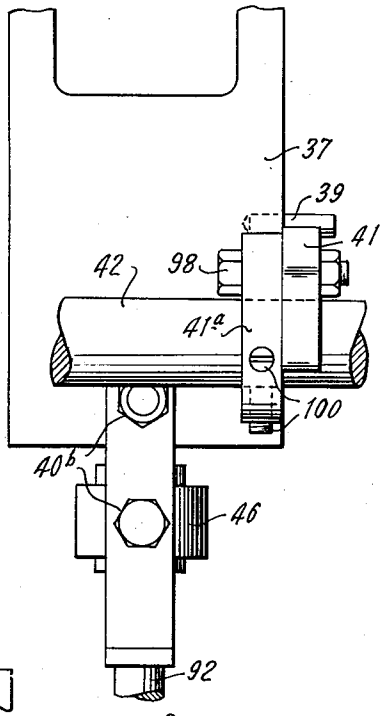


Fig. XII

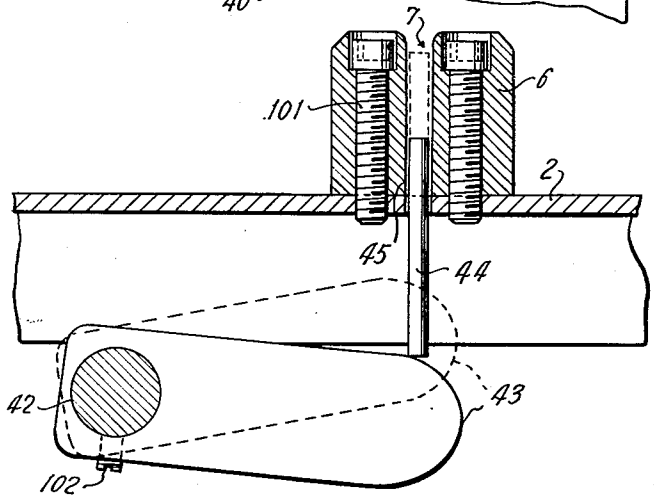


Fig. XIII

Robert L. Long
INVENTOR.

BY

ATTORNEY

July 15, 1952 R. L. LONG 2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949 10 Sheets-Sheet 9

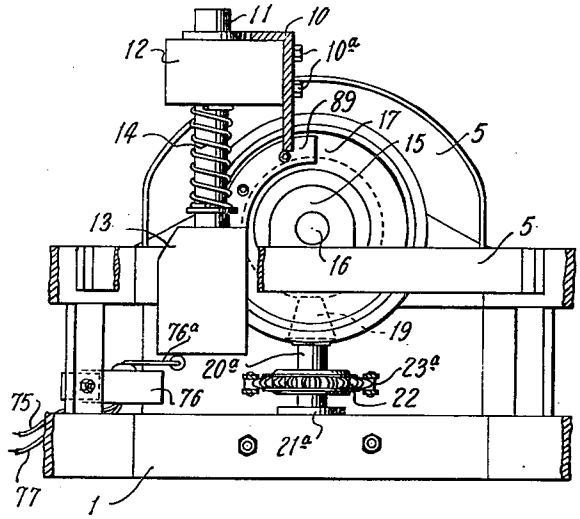


Fig. XIV

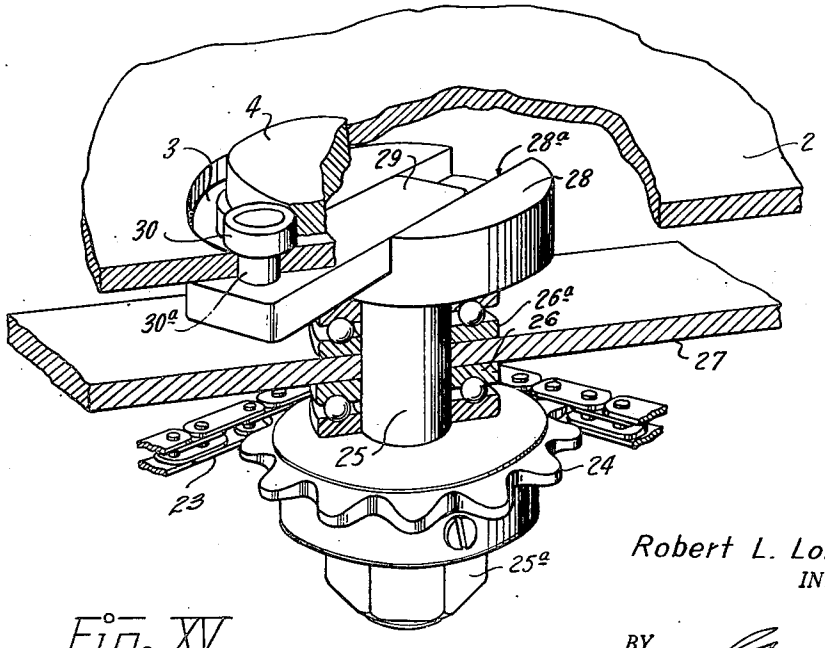


Fig. XV

Robert L. Long
INVENTOR.

BY

ATTORNEY

July 15, 1952 R. L. LONG 2,603,269

SCROLLING AND TWISTING MACHINE

Filed April 29, 1949 10 Sheets-Sheet 10

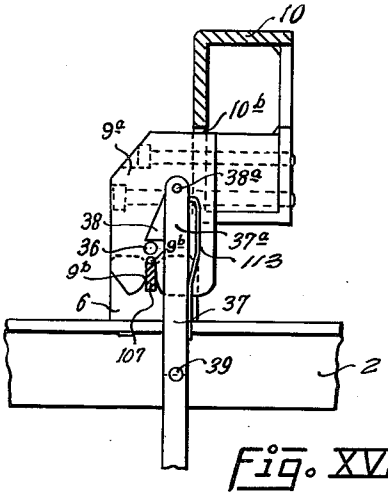


Fig. XVI

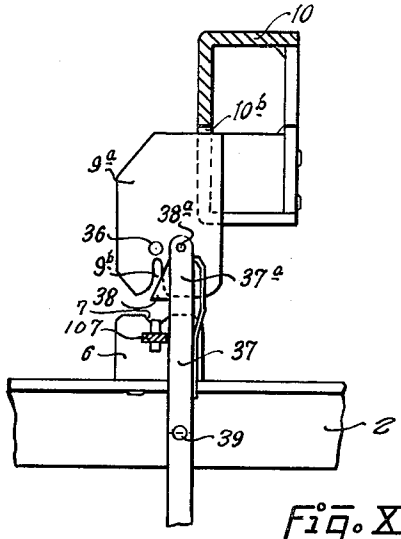


Fig. XVII

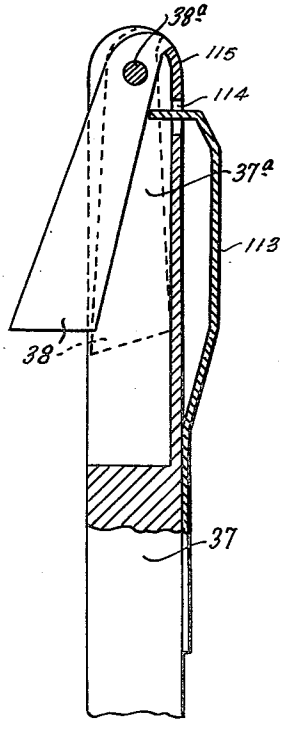


Fig. XVIII

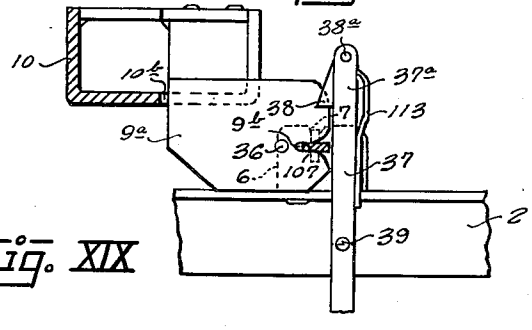


Fig. XIX

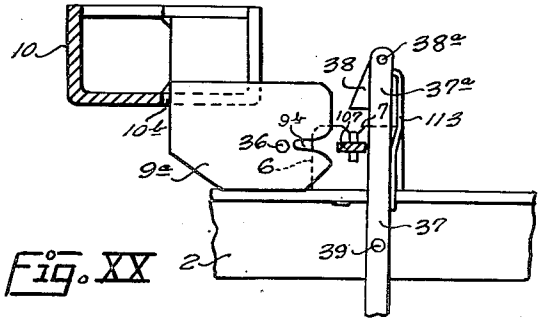


Fig. XX

Robert L. Long
INVENTOR.

BY

ATTORNEY

Patented July 15, 1952 2,603,269

UNITED STATES PATENT OFFICE

2,603,269

SCROLLING AND TWISTING MACHINE

Robert L. Long, Dallas, Tex., assignor to E. C. Paige, Dallas, Tex.

Application April 29, 1949, Serial No. 90,293

13 Claims. (Cl. 153—4)

1

This invention is concerned with a machine for simultaneously forming shapes on the ends of metal strips, twisting said strips intermediate the ends, and to provide for means to eject said strips from said machine after they have been scrolled and twisted.

My invention is primarily intended to provide a machine for automatically forming scrolls on the opposite ends of metal strips, which are used in assembling and manufacturing ornamental door grilles, such as the grilles disclosed in United States Letters Patent No. 2,082,012, issued to Paul W. Leffland. Since these grilles are made up of several diagonally disposed strips, which are pivoted or riveted at the places where they cross each other, it is necessary to provide 90 degree twists in the strips at the places where they cross, so that they will present correspondingly flat surfaces for such connection.

The metal strips from which these ornamental door grilles are made are usually about one-half inch wide, about one-eighth of an inch thick and about three or four feet long. Most of these grilles are made of two different lengths of strips. Ordinarily the scrolls on the opposite ends of each strip are scrolled in opposite directions.

Heretofore the scrolls and twists formed in the metal strips which go into the manufacture of the aforementioned grilles have been made by hand, and required at least seven manual operations in order to complete one strip. No satisfactory machine has been provided for making these scrolls and twists. This invention is intended to provide such a machine.

The present invention automatically forms the scrolls in the opposite ends of the metal strips which go into the manufacture of said grilles, twists the strips at the desired places, and ejects the strips from the machine, in one continuous operation. The only manual labor required is that of one man to put the strips into the machine, energize the machine and take them out after they have been formed and ejected.

It is to be understood that scrolled and/or twisted strips may be made in this machine to be used for other purposes other than in the manufacture of ornamental door grilles. For instance, strips might be scrolled for use in the manufacture of ornamental fenses, window guards, bannisters, columns, posts, barricades and for other purposes.

The machine with which this invention is concerned consists primarily of a coordinated and properly timed electrical and hydraulic system, which actuates and drives a chain drive system,

2

which in turn drives two sets of scrolling cams to perform the scrolling operation; and simultaneously operates a carrier bar with a plurality of twisting forks attached thereto which perform the twisting operation on the material.

Other and further objects of my invention will become apparent by reference to the drawings and detailed specification.

Preferred embodiments of my invention are shown in the attached drawings, in which:

Fig. I is a front elevational view of the scrolling and twisting machine.

Fig. II is a rear elevational view of the scrolling and twisting machine.

Fig. III is a top plan view of the scrolling and twisting machine.

Fig. IV is a perspective view of the scrolling and twisting machine.

Fig. V is a perspective view of the driven bevel gear and its driving bevel gear shown at the left end of Fig. I, and the mounting therefor, partially cut away.

Fig. VI is a fragmentary perspective view showing the hydraulic plunger valve, the hydraulic depressing cylinder, the carrier bar depressing yoke, carrier bar and the middle work twisting fork.

Fig. VII is a cross sectional elevation of the two scrolling cams and cam followers on one end of the scrolling and twisting machine, showing the mounting therefor.

Fig. VIII is a schematic representation of the electrical and hydraulic systems employed in my scrolling and twisting machine.

Fig. IX is a perspective view of the hydraulic drive cylinder with the rack gear attached thereto and the main drive sprocket pinion gear which drives the main drive sprockets, with the housing for said gears being shown partially cut away.

Fig. X is a plan view of a typical scrolling cam employed in my scrolling and twisting machine, showing a strip of material positioned therein and in the stationary work holder forks.

Fig. XI is a cross sectional elevational view taken along the line XI—XI of Fig. III, showing the work ejector rocker shaft, the work ejector rocker shaft actuating dog and the fixed work ejector dog.

Fig. XII is a fragmentary elevational view showing the work ejector rocker arm with the fixed work ejector dog and the work ejector rocker shaft actuating dog carried thereby.

Fig. XIII is a cross sectional elevational view taken along the line XIII—XIII in Fig. III, showing one of the work ejector cams affixed to the

work ejector rocker shaft, and the work ejector pin, which is actuated by the work ejector cam.

Fig. XIV is a cross sectional elevation taken along the line XIV—XIV of Fig. III, showing the microswitch and the carrier bar elevating spring positioned on the carrier bar guide pin.

Fig. XV is a perspective view, partially sectionalized and partially cut away, showing a typical scrolling cam used in my machine and the mounting and driving sprocket therefor.

Fig. XVI is a cross-sectional elevational view taken along the line XVI—XVI of Fig. I, showing the carrier bar in lowered position.

Fig. XVII is a cross-sectional elevational view taken along the line XVI—XVI of Fig. I, showing the carrier bar in raised position after the work has been twisted and before the yoke **37** has been raised.

Fig. XVIII is an enlarged cross-sectional elevational view showing the detailed construction and operation of one of the spring-loaded depressing fingers carried at the upper end of the yoke.

Fig. XIX is a cross-sectional elevational view taken along the line XVI—XVI of Fig. I, showing the carrier bar after it has been rotated by 90 degrees and before it is pushed outward to disengage the twisting forks from the work.

Fig. XX is a cross-sectional elevational view taken along the line XVI—XVI of Fig. I showing the carrier bar after it has been pushed outward to disengage the twisting forks from the work.

Numeral references are used to designate the various parts of the devices shown in the drawings, and like numerals designate like parts in the various figures.

Numeral **1** designates the general structural frame for the machine, which supports and carries the various mechanisms thereof. The frame supports a top flat table or bed plate **2**. In the top of the table **2** are four cam grooves **3**, which cam grooves assume the shape of scrolls. They may, however, be made in any shape desired. There are two of these cam grooves on each end of the table **2**. It will be noted that the inner cam grooves are scrolled in opposite directions to each other and that the two outer cam grooves are scrolled in opposite directions to each other.

Adjacent to, and inside each of the scrolls of the scrolled cam grooves **3** are form blocks **4**, the outer sides of which follow the contour of the inner sides of the cam grooves **3**. These form blocks **4** are rigidly attached to the table **2**.

The stationary work holder forks **6** (there being six of them shown in the embodiment of this invention) have a work holder slot **7** therein, which slots in each of said stationary work holder forks coincide with the slots in the other work holder forks, so that a strip of material may be placed sidewise therein and thus be held in place for twisting and scrolling. The stationary work holder forks **6** are rigidly mounted in spaced relation on the table **2** alternately between the work twisting fork clearance slots **8**, which clearance slots are provided so that the work twisting forks **9** and the middle work twisting fork **9a**, carried by the carrier bar **10**, may have clearance when the carrier bar **10** is brought over and downward in the manner hereinafter described. Each of the work twisting forks **9** and **9a** are rigidly attached to the carrier bar **10**, and have a slot **9b** therein, which is provided to receive the upper edge of the strip to be twisted, when the carrier bar **10** is brought downward as hereinafter described.

The carrier bar guide pin **11**, of which there is one on each end of the machine, slides through a bearing **12**, which bearing **12** is attached to the carrier bar **10** by means of bolts **10a** (Fig. XIV). There is a base block **13**, at each end of the machine, rigidly attached to the guide pin **11** below the carrier bar, and said base block is secured to a driven bevel gear **17**, at each end of the machine by means of bolts or welding or otherwise. As shown, in this embodiment of the invention, this is accomplished by means of the connecting block **89** which is secured to the base block **13** and the driven bevel gear **17** (Fig. XIV).

Positioned between the bearing **12** and the base block **13**, and around the guide pin **11** is the carrier bar elevating spring **14**, which is depressed when carrier bar **10** is lowered vertically.

Each of the driven bevel gears **17**, located at each end of the machine, has a shaft **16**, which passes through the gear and is rotatively supported at its ends by the supporting frame members **15** and **18**. As shown in Fig. V, a plurality of ball bearings **96** are placed on the shaft **16** between the gear **17** and the supporting bracket **15**, so that the gear will turn easily and not wobble.

A protecting housing **5** is arranged about the gears at one end of the machine.

The driver gear **19** which articulates with the driven gear **17** at each end of the machine, is supported by the shaft **20**, to which shaft is affixed the driving sprocket **22** (Fig. V). The shaft **20** extends through the driving sprocket **22**, and is supported at its lower end by the bearing **21**, which bearing **21** is affixed to the frame **1** by means of bolts or otherwise.

The driving sprocket **22a** is attached to the shaft **20a** at the other end of the machine, and such shaft rotates in a bearing **21a** secured to the frame of the machine.

The driving chains **23** and **23a** drive the sprockets **22** and **22a**, respectively, and also drive cam follower roller driving sprockets **24a** and **24c** on one end of the machine and cam follower roller driving sprockets **24b** and **24d** on the other end of the machine.

As shown in Figs. III and IX, driving chain **23** extends around the main driving sprocket **31a**, around the inner side of the idler **112**, around the outer side of cam follower driving sprocket **24c**, around the driving sprocket **22**, around the inner side of the cam follower driving sprocket **24a**, around the outer side of the idler **111** and back to the driving sprocket **31a**.

Driving chain **23a** extends around the main driving sprocket **31**, around the inner side of the idler **109**, around the driver sprocket **22a**, around the outer side of the cam follower roller driving sprocket **24d**, around the inner side of the cam follower roller driving sprocket **24b**, and around the outer side of the idler **110**. It may be seen that the pair of cam follower roller driving sprockets **24c** and **24d** on opposite ends of the machine will turn in the same direction; and that the pair of cam follower roller driving sprockets **24a** and **24b** will turn in the same direction, and in the opposite direction to the sprocket **24c** and **24d**.

Referring now to Fig. VII, which shows a detailed cross sectional view of the two typical cam follower rollers **30** on one end of the machine and their supporting mountings. Each cam follower roller **30** has a driving head shaft **25** which passes through the bearing support plate **27**. The bearing support plate **27** is secured to the channel

member 27a, which in turn is welded or otherwise attached to the machine frame 1. The sprocket 24 is secured to the shaft 25 by means of a screw passing through the sprocket and through the shaft, and is firmly held in place by a nut 25a therebelow. Between the sprocket 24 and the supporting plate 27 is a ball bearing 26, and between the upper surface of the plate 27 and the cam follower driving head 28, is another ball bearing 26a, which bearings allow for the free rotation of the shaft 25 in response to the rotation of the sprocket 24.

Cam follower roller 30 has a shaft 30a which shaft is detachably secured to the cam follower roller slide block 29 by being screwed therein. The cam follower roller driving head 28, attached to the upper end of the shaft 25, has a slot 28a extending thereacross (Fig. XV) in which slot the cam follower roller slider block 29 is adapted to slideably fit.

When the head 28 is rotated by the rotation of sprocket 24, the cam follower roller supporting shaft 30a is enabled to follow the slot 3, in its irregular path, by reason of the slide block 29 sliding back and forth in the slot 28a.

All of the scrolling cams in this machine are constructed exactly as described above.

The pinion gear 33 (Fig. IX) is enclosed in the housing 34, which housing is mounted on the main frame 1 of the machine. The pinion gear 33 has a shaft 32 the upper end of which shaft is rotatively secured to the top of the housing 34. The main drive sprockets 31 and 31a are rigidly secured to the lower end of shaft 32 so that they turn with the pinion gear 33.

The rack 35 articulates with the pinion gear 33, and is secured to the piston rod 62a by means of the bracket 104, which is made integral with the rack. The outer end of piston rod 62a extends through said bracket and is secured thereto by means of the nut 106, on the outer end of the rod 62a.

The cylinder 62 is secured to the frame 1 and the piston rod 62a is free to move laterally and carry the rack 35 with it when expelled from or retracted into the cylinder 62. The movement of the rack 35 turns the pinion gear 33 and thereby the main drive sprockets 31 and 31a.

The middle work twisting fork 9a is secured to the carrier bar 10 and has on each side thereof a carrier bar depressing pin 36 (Fig. VI), which pin is rigidly secured thereto.

The yoke 37 is secured to the upper end of piston rod 92, which rod extends into the carrier bar hydraulic depressing cylinder 56. The yoke 37 has bifurcated arms 37a. Between each of said bifurcated arms is mounted a spring loaded depressing finger 38, which finger is mounted by means of the pin 38a passing therethrough and through the bifurcated arms. The cut-outs or slots 10b are provided in the carrier bar 10 to provide clearance for the arms 37a when the carrier bar is brought over in the manner hereinafter described.

When the piston rod 92 is pulled downward into the cylinder 56, it may be seen that the fingers 38 will engage the depressing pins 36 and will thus pull the middle twisting fork 9a and carrier bar 10 downward with it. When the middle twisting fork 9a and carrier bar 10 moves downward and is rotated forward, the depressing pin 36 rotates away from the depressing finger 38 and passes above it when the carrier bar is returned to normal starting position. When the carrier bar 10 is returned to normal starting position, the yoke 37 moves upward and the pin 36 strikes the spring loaded depressing finger 38 and depresses it, allowing the pin to pass underneath the finger.

This operation is disclosed in detail in Figs. XVI to XX. After the carrier bar 10 has been pulled downward to the position shown in Fig. XVI, and the twisting forks 9 and 9a have engaged the edge of the piece of material 107 held in the slots 7 of the holding forks 6, it is rotated forward by 90 degrees to the position shown in Fig. XIX. As the carrier bar is rotated forward the depressing pins 36 leave the spring loaded depressing fingers 38, and the yoke 37 is retracted to the limit of its retraction. As the carrier bar rotates to the position shown in Fig. XIX, the work 107 is twisted at spaced intervals intermediate its ends by the twisting forks 9 and 9a in engagement therewith.

While the carrier bar is being so rotated, pressure is exerted thereagainst by such rotation and it is held down by frictional engagement between the work 107 and the slots 9b in the twisting forks 9 and 9a. At the moment the machine is reversed in the manner hereinelsewhere described such frictional engagement is released and the springs 14 relax and push the carrier bar 10 outward on the pins 11 to the position shown in Fig. XX, thus disengaging the twisting forks 9 and 9a from the work. The reversal of the machine rotates the carrier bar 10 upward after such disengagement to the position shown in Fig. XVII. It will be noted at this point that the yoke 37 is still retracted and that the depressing pins 36 are above the spring loaded depressing fingers 38. At the proper point in the cycle of operation, as hereinelsewhere described, and after the carrier bar has reached the position shown in Fig. XVII, the yoke 37 is again pushed upward. As the yoke 37 moves upward the pins 36 strike the upper sides of the spring loaded depressing fingers 38 and the depressing fingers are pushed inward against the flat springs 113 as shown in broken lines in Fig. XVIII. The springs 113 are secured to the backside of the yoke 37 and the upper end of each spring extends through an opening 114 between the bifurcated arms 37a on each side of the yoke and each spring engages the backside of a depressing finger 38, as shown in Fig. XVIII. A stop 115 is provided near the upper end of each of the bifurcated arms 37a for the purpose of limiting the inward movement of the upper end of the depressing fingers 38 about the pivots 38a. The depressing pins 36 depress the fingers 38 against the springs 113 and the pins 36 are allowed to pass underneath the fingers 38. The relaxation of the springs 113 then returns the fingers 38 to the position shown in full lines in Fig. XVIII. The yoke 37 and the carrier bar 10 are then in normal starting position, as shown in Fig. VI.

A work ejector actuating pin 39 is disposed on one side of the carrier bar depressing yoke 37. The operation of this actuating pin will be described in detail hereinafter.

The plunger depressing arm 40 is mounted to the carrier bar depressing yoke 37 by means of the bracket members 40a and the nuts 40b.

The depressing arm 40 has a lateral extension 40c thereon which when lowered, comes in contact with the roller 94 at the top of the plunger valve rod 93. This action occurs when the piston rod 92 is drawn into the cylinder 56. The rod 93 is thus pushed into the valve 58, actuating it in the manner and for the purpose which will be hereinafter described.

Referring now to Figures I, XI, XII and XIII, the fixed work ejector actuating dog 41a is secured to the rocker shaft 42 by means of the set screws 100. The rocker shaft 42 is pivotally mounted by the brackets 42a underneath the table 2, so that it is free to rotate about its longitudinal axis. The work ejector rocker shaft actuating dog 41 is pivotally secured to the fixed dog 41a by means of the pivot bolt 98, and said actuating dog 41 has a slot 99 cut in the outer end thereof, which slot is adapted to fit the contour of rocker shaft 42.

There are a series of work ejector cams 43 which are secured to the rocker shaft 42 by means of set screws 102 (Fig. XIII). There is one of these cams 43 disposed underneath each of the stationary work holder forks 6.

The work ejector pin 44 extends loosely through the hole 45, which hole extends through the table 2 and through the bottom of the stationary work holder forks 6. The pin 44 is free to move upward and downward in the work holder fork slot 7, which slot holds the strip of material being formed. The stationary work holder forks 6 are secured to the table 2 by means of the machine screws 101 (Fig. XIII).

The inner ends of the work ejector cams 43 are rounded and are adapted to engage the lower end of the slideable pin 44.

The piston rod 92, which extends into the cylinder 56, is joined to the carrier bar depressing yoke 37 by means of the connector member 46 (Fig. XI).

The cylinder 56 is braced and held in place by the brace 47, which has a cut out 47a therein, to admit the passage therethrough of the plunger depressing arm 40, so that it may come in contact with the roller 94 at the top of the plunger valve rod 93 (Fig. VI).

Returning to the description of the ejector mechanism, when the carrier bar 10, carried by the carrier bar 10, carried by the yoke 37 moves upward in response to the movement of piston rod 92 out of cylinder 56, at the end of a cycle of operation of the machine, the pin 39 on the side of the yoke 37 will engage the underside of the pivoted actuating dog 41 and will cause the rocker shaft 42 to turn about its longitudinal axis, carrying with it the work ejector cams 43. The outer ends of work ejector cams 43 will thus be caused to move upward and will push the pins 44 upward in the slots 7. Thus the strip of material being processed which is disposed in the slots 7 in the stationary work holder forks 6, will be ejected upward out of the slots 7.

As the yoke 37 continues to move upward, carrying with it the pin 39, the pin will pass the pivoted actuating dog 41, and the actuating dogs 41 and 41a will be allowed to fall back into normal operating position in readiness for the next cycle of operation of the machine.

When the machine is energized and the yoke is drawn downward by the piston rod 92 receding into the cylinder 56, the actuating pin 39 is allowed to pass the pivoted actuating dog 41 by reason of the fact that the pin 39 strikes the curved inner end of the dog 41 and causes it to pivot on the pivot bolt 98, thus raising up the outer end away from the rocker shaft 42, in the manner shown in dotted lines in Fig. XI. After the pin has passed the inner end of the dog 41, the outer end of the dog will fall back in place over the rocker shaft 42.

The hydraulic supply tank 48 has a filler cap 48a. The supply tank 48 is filled with any suitable hydraulic fluid for the operation of the various hydraulic valves and cylinders used in this machine.

The hydraulic pump 50 is driven by the electric motor 83 through the shaft 84. The shaft 84 is coupled to the rotor of the hydraulic pump by means of the coupling 84a.

The electric motor 83 is mounted on the mounting 86, and the bracket 87 supports the hydraulic pump. A suitable power lead 88 is provided for the electric motor.

Referring now to Fig. VIII, the hydraulic line 49 leads from the supply tank 48 to the pump 50, and the hydraulic line 51 leads from the pump to the hydraulic solenoid valve 52. The hydraulic line 53 leads from the solenoid valve 52 to the pressure regulator 54, and the hydraulic line 55 conveys fluid from the pressure regulator to the carrier bar depressing cylinder 56. The hydraulic line 57 conveys fluid from the pressure regulator 54 to the plunger valve 58. Hydraulic line 59 leads from the plunger valve 58 to the drive cylinder solenoid valve 60, and the hydraulic line 61 leads from the drive cylinder solenoid valve 60 to the work side of the hydraulic drive cylinder 62.

The hydraulic line 65 conveys fluid from the hydraulic solenoid valve 60 to the return side of the drive cylinder 62; and the hydraulic line 66 leads from the hydraulic solenoid valve 60 to the supply tank 48.

The hydraulic line 67 leads from the solenoid valve 52 to the release side of the carrier bar depressing cylinder 56; and the hydraulic line 68 conveys fluid from the carrier bar depressing cylinder to the supply tank. The hydraulic line 69 causes communication between the plunger valve 58 and the hydraulic supply tank. Hydraulic line 70 returns fluid from the hydraulic solenoid 52 to the supply tank.

Likewise, the electrical system for actuating driving and operating this machine may be best seen and understood by referring to the schematic drawing shown in Fig. VIII. The electrical conductor 71 leads from the power source to one side of the push button switch 72. The switch 72 is of the momentary contact type which may be closed by pressing on the button thereon, but when the pressure is released from the button, a spring therein causes the automatic opening of the switch.

The electrical conductor 73 leads from the other side of the switch 72 to the solenoid 52a, which solenoid actuates the conventional solenoid valve 52. The electrical conductor 74 leads from one side of the power source to one side of the microswitch 76.

The power source for the operation of this machine consists of the usual commercial power of 115–120 volts A. C. (but it may be adapted for use of other sources of power).

The electrical line 75 leads from one side of the power source to the other side of the microswitch 76. The microswitch 76 is of the usual commercial type with an actuator arm or button 76a thereon. As used in this machine, it is normally closed until the base block 13 comes in contact with the actuating button 76a to open the circuit.

The electrical line 77 is connected to the same side of microswitch 76 as lead 74, and is connected to one side of the solenoid winding 52a; and the electrical line 78 leads from the other side of the solenoid back to the other side of the power source to complete the microswitch circuit. The microswitch is thus connected in series with the

power source and the solenoid winding 52a, and in parallel with switch 72.

The microswitch 76 is held open by pressure of one of the blocks 13 until the machine is energized by closing the momentary contact switch 72. The momentary closing of switch 72 is sufficient to start the forward rotation of carrier bar 10 and thus lift the block 13 off of the contact 76a on microswitch 76 and close the microswitch. It remains closed until the carrier bar 10 returns to starting position, in the manner hereinafter described, and thereby again brings block 13 against the contact 76a thereon. The closing of microswitch 76 energizes the solenoid valve 52, and thus eliminates the necessity of holding the switch 72 closed during a cycle of operation, and provides for the automatic de-energization of valve 52 at the end of a cycle of operation.

Electrical line 79 leads from one side of the power source to one side of the reversing switch 80. The reversing switch 80 is a toggle switch with a toggle 80a thereon. The electric line 81 leads from the other side of the reversing switch 80 to one side of the solenoid 60a; and electric line 82 leads from the other side of the solenoid 60a back to the other side of the power source to complete the reversing switch circuit.

The arm 105 is secured to the bracket 104 of the rack 35, and the outer end of piston rod 62a, and is held in place thereto by nut 106; and said arm extends over the gear housing 34 (see Figs. III and IX) and is connected to the inner end of the reversing switch tripping rod 63.

Referring again to Fig. VIII the rod 63 has two dogs thereon, 64 and 64a, which are adapted to come in contact with the toggle 80a on the toggle switch 80, as the rod moves laterally in response to movement of the rack 35. The tube 91, which is mounted to the main frame 1, is provided as a support for the reversing switch rod 63. The outer end of rod 63 fits loosely into the tube 91, so that it may slide back and forth therein in its lateral movement.

The carrier bar depressing cylinder 53 is mounted to and supported by the mounting brace 47 which mounting brace 47 is secured to the main frame 1, and is welded to the cap 95 for cylinder 53. The plunger valve 58 is mounted to the cap 95 by means of bracket mounting 58a (Figs. I and VI).

In Fig. X is shown a fragmentary view, partially diagrammatical, which shows a metal strip, in dotted lines, in position in one of the scrolling cams, and in the stationary holding forks 6. As shown, it is placed edgewise in the slots 7 between the cam follower roller 30 and the upper side of the form block 4.

The form block 4 is raised from the table, and is adjacent to the inside of the scroll-shaped slot 3. The cam follower roller 30 is shown at the top in dotted lines before it begins its rotation around the groove 3. Before the rotation is started, the metal strip 107 is straight and extends outwardly, as shown by dotted lines. When the cam follower roller starts around the groove 3 toward the position in which it is shown in solid lines, it presses the metal strip 107 against the form block 4 and thus forms the end of the metal strip into a scroll. The slots 9b in the twisting forks 9 embrace the edge of the strip 107 when the carrier bar 10 comes down, the operation of which will be fully explained hereinafter, and when the carrier bar comes over in its arcuate movement, the strip 107 is twisted to form twists therein, as is indicated by the numeral 108.

This invention may be more clearly disclosed and understood by explaining in detail its operation and function in orderly sequence, which description follows:

To place the machine in operation, it of course must be connected to a suitable power supply, which starts the electric motor 83 and the hydraulic pump 50.

The plug 90, which provides electrical power to the solenoids is also plugged into a suitable power source. A complete cycle of operation of this machine may be best described and understood by referring to Fig. VIII, which shows a schematic layout of the electrical and hydraulic system for the operation of this machine.

The momentary contact switch 72 is energized by pressing the button thereon, which places the machine in operation. This switch is only momentarily closed, but it energizes the solenoid 52a which operates the solenoid valve 52.

Referring to Fig. XIV, while the machine is out of operation and before switch 72 has been pressed, guide pin base block 13 presses down against the contact 76a of the microswitch 76 and thus holds the switch open. This switch is in parallel with the momentary contact switch 72. It will cause the energizing circuit for the relay 52a to be closed when the pressure is released from the contact 76a, thus closing the switch.

When the solenoid 52a has actuated the solenoid valve 52, in the manner described above, hydraulic fluid, which comes from the supply tank 48, and through pump 51 is allowed to flow through the solenoid valve into line 53, and thence through the pressure regulator 54. This hydraulic fluid is under pressure because it flows through the pressure regulator 54.

The opening of the solenoid valve 52 allows hydraulic fluid under pressure to flow through line 53 and pressure regulator 54 to the upper part of depressing cylinder 53 through line 55. This causes the piston rod 92 to be drawn into the cylinder and pulls the yoke 37 downward with it. The dogs 38 (Fig. VI) on either side of the yoke 37 engage the pins 36 on either side of the middle work twisting fork 9a, and thus pulls the carrier bar 10 down with it. The metal strips to be scrolled and twisted have already been placed edgewise in the slots 7 of the work holder fork 6. When the carrier bar 10 is pulled downward, the slots 9b engage the upper edge of the strip of material being worked. Also, when the carrier bar 10 is pulled downward, the bearings 12 slide downward on the carrier bar guide pins 11 and depress the springs 14 (Figs. V and XIV).

Referring back to Fig. VIII, after the hydraulic fluid has passed through the pressure regulator 54, it goes into a split line, one line 55 entering the top port of the carrier bar depressing cylinder and the other line 57 entering the top port of the plunger valve 58. The plunger valve 58 is ordinarily closed, until opened in the manner which will be hereinafter described. The plunger valve is closed when the plunger 93 is in extended position. When the yoke 37 is pulled downward, as described above, the lateral projection 40c of the arm 40 comes in contact with the roller 94 and pushes downward on the plunger 93 of valve 58, which opens the valve and the hydraulic fluid under pressure is permitted to flow through the valve and through line 59 into the solenoid valve 60.

The solenoid valve 60 selects the direction for the hydraulic fluid to flow through the actuating cylinder 62. The valve 60 is so set that the fluid

first comes out through line 61 and forces the piston rod 62a outward. This carries with it the rack 35, which causes the rotation of the main driving pinion gear 33, which in turn, through shaft 32, causes the drive sprockets 31 and 31a to rotate.

Through means of the chains 23 and 23a the scrolling cams on each end of the machine are rotated in opposite directions, and the drive bevel gears 19 on each end of the machine are caused to turn and rotate the driven bevel gears 17.

The operation of one of the scrolling cams will be best understood by referring to the illustration shown in Fig. XV, which is typical of all four of the cams used on this machine. The chain 23 will cause the sprocket 24 to turn, which in turn causes the driving head 28 to rotate. The shaft 30a, supporting the cam follower roller 30, follows the slot 3 as the head 28 rotates. The sliding block 29 is slideably positioned in the groove 28a in the top of the head 28, and as the shaft 30a follows the contour of the groove 3, the end of the sliding block 29 on which the cam follower roller 30 is mounted is permitted to vary its distance from the central point of the head 28 and thus the cam follower roller is allowed to follow the outer contour of the forming block 4. The strip of material being scrolled is forced between the cam follower roller 30 and the forming block 4, and is thus made into a scroll, which has the contour of the outer side of the forming block 4.

At the same time that the scrolling operation is taking place, as explained, the carrier bar 10 is being brought over in an arc, to perform the twisting operation. The chains 23 and and 23a are wrapped around the sprockets 22 at either end of the machine. When the rack 35 is moved by the expulsion of the piston rod 62a from cylinder 62, thus turning the sprockets and the chains, the chains turn the bevel gear driving sprockets 22, which in turn rotate the drive bevel gears 19 and thus rotate the driven bevel gears 17. Each of the driven bevel gears 17 has a block 13 attached thereto, which connects them with the guide pins 11 and the carrier bar 10. As the driven bevel gears 17 are caused to rotate in the same direction in the manner above described, they will carry with them the carrier bar 10 and will cause it to rotate about the center of the driven bevel gear shaft. The carrier bar 10 will thus be rotated by 90 degrees. The strip of material being scrolled and twisted, having been previously placed edgewise in the slots 7 of the stationary work holder fork 6, and having been engaged by the slots 9b in the twisting forks 9 and 9a when the carrier bar 10 was pulled downward, will be twisted by 90 degrees at the point where it is engaged by the twisting forks 9 and 9a.

When the carrier bar 10 has reached the end of its 90 degree rotation, the dog 64 on the arm 63, which arm is carried by the piston rod 62a, strikes the toggle 80a on the reversing switch 80, and opens the switch, thus de-energizing the solenoid 60a.

When the piston rod 62a is withdrawn into the cylinder 62, in the manner hereinafter described, the dog 64a will strike the toggle on switch 80 and close it again, thus energizing the solenoid 60a and placing it again in position for operation.

The solenoid 60a is normally energized, except when de-energized by opening switch 80.

When the solenoid 60a is de-energized, the flow of hydraulic fluid through the solenoid valve 60 is reversed and now it flows through line 65 into the opposite end of the actuating cylinder 62. This causes the piston rod 62a to be withdrawn into the cylinder, and thus reverses the movement of the rack 35 and the rotation of the various components driven by it. During the forward and downward rotation of the carrier bar 10 in the manner hereinelsewhere described, the frictional engagement of the twisting forks 9 and 9a with the strip of material engaged thereby holds the carrier bar 10 down on the guide pins 11 against the tension of the springs 14, by reason of the twisting strain between the work and the slots in the twisting forks by the forward rotation of the carrier bar. At the moment the arcuate movement of the carrier bar is reversed, this frictional pressure is relieved and the carrier bar is then pushed outward along the guide pins 11 to the outer ends of the guide pins by the relaxing of the springs 14 to the position shown in Fig. XX.

The reversal of direction of rotation of the driven bevel gears 17 will return the carrier bar 10 to its original vertical position, and the cam follower rollers are returned to their original starting positions in the slots 3.

As the carrier bar guide pin blocks 13 shift back to vertical position, one of them contacts the contact 76a on the microswitch 76 which opens the microswitch and de-energizes the solenoid 52a, which causes a reversal of the fluid flow in solenoid valve 52. The hydraulic fluid is now under low pressure, since it is not going through the pressure regulator, and enters the bottom port of the depressing cylinder 56 through the line 67, which causes the piston rod 92 to move upward, and at the same time the hydraulic fluid may flow out through the line 68 and return to the supply tank.

As the piston rod 92 starts upward, the arm 40 is lifted, thus permitting the plunger 93 of plunger valve 56 to return to its outer extremity, which shuts off the flow of hydraulic fluid to solenoid valve 60, thereby stopping the drive system.

The piston rod 92, thus moving upward, carries with it the yoke 37 and the pin 39 thereon strikes the bottom edge of the dog 41, (Fig. XI) causing the dog 41 to rotate the shaft 42, to which are attached the cams 43. The cams 43 in turn strike the pins 44, causing them to push the strip of material, which has been scrolled and twisted, out of slots 7 in the work holder forks 6. At the same time the spring loaded depressing finger 38 has gone past and above the carrier bar depressing pin 36, and the yoke 37 again is in position engaging the pin 36, and the machine is in readiness for another cycle of operation.

The only work required in order to perform the aforedescribed cycle of operation is for the operator to put a strip of material in the machine, energize the switch 72 and take the strip of material out of the machine. One operator can do this work.

Only two of the cam follower rollers 30 are in operation at the same time. Either the two outer scrolling cams are in operation at the same time or the two inner ones are in operation. This adapts the machine to make two different lengths of scrolled and twisted strips. The cam follower rollers are interchangeable; that is, they may be changed from either the outer cams to the inner cams or vice versa by merely unscrewing them from the slide block 29 and screwing it into the slide block of the scrolling cam to which it is desired to be changed. Likewise, one or all of

the cams may be taken out of scrolling operation by merely removing the cam follower roller therefrom. In this way the machine may be adapted to scroll only one end of a strip of material placed therein; or it may be adapted to merely make twists in material and not scroll or shape it.

Modifications and changes may be made in this machine and still not depart from the spirit and scope of the appended claims. For instance, the machine may be adapted for merely scrolling or shaping a strip of material without twisting it by removing the work twisting forks 9 and 9a from the carrier bar 10, or by adjusting them so that they will not engage the edge of the material to be worked. Also, the scrolling cams may be placed at any desired distance apart, so that this machine may be adapted to scroll the ends of any length of strip.

It is to be understood that the drawings and descriptions herein merely illustrate and describe one embodiment of this invention, and that other and further modifications can be made thereof and still remain within the scope of the appended claims.

I claim:

1. In a device of the class described, one or more shape forming members adapted to shape the opposite ends of a strip of material placed therein; a plurality of holding members adapted to hold a strip of material in place in said forming members; a horizontally disposed member rotatably mounted above said forming members and above said holding members; a plurality of spaced holding members carried by said horizontally disposed member, and adapted to engage said strip of material and to twist it when the horizontally disposed member is pulled downward and rotated in an arc; means for pulling said horizontally disposed member downward in position for said holding members carried thereby to engage the edge of the piece of material; and means for actuating said forming members and said horizontally disposed member in different planes, whereby the opposite ends of a strip of material being worked in said machine may be shaped, and the intermediate portion thereof is twisted about its longitudinal axis at spaced intervals.

2. In a device of the class described, a plurality of scroll forming members adapted to scroll the ends of a strip of material placed therein, each said forming member having a cam follower roller and a forming block between which may be placed edgewise the strip of material; a plurality of holding members adapted to hold a strip of material in place between the cam follower roller and the forming block in said forming members; a horizontally disposed member rotatably mounted above said forming members and above said holding members; a plurality of spaced bifurcated members carried by said horizontally disposed member and adapted to engage said strip of material when the horizontally disposed member is pulled downward and to twist the strip of material when the horizontally disposed member is rotated in an arc; means for pulling the horizontally disposed member downward to cause engagement of the piece of material by said bifurcated members; and means for rotating said rollers and the said horizontally disposed member in their respective planes; and means for returning said horizontally disposed member and the cam follower roller to starting position after the material has been scrolled and twisted.

3. In a device of the class described, a plurality of scroll forming members adapted to receive and scroll the ends of a strip of material placed therein; a plurality of holding members adapted to hold a strip of material in place in said forming members; a horizontally disposed member rotatably mounted above said forming members and above said holding members; a plurality of spaced twisting forks carried by said horizontally disposed member, and adapted to engage the said strip of material and to twist it when the horizontally disposed member is brought downward and rotated in an arc; means for lowering the horizontally disposed member, thereby causing engagement of the strip of material by said twisting forks; means for actuating said forming members and the said horizontally disposed member in different planes, so that the piece of material being worked therein is scrolled on its ends and twisted about its longitudinal axis; means for actuating said forming members and said horizontally disposed member in opposite directions from the initial rotation and thereby returning the operating mechanism to normal starting position.

4. In a device of the class described, a plurality of scrolling members adapted to scroll the opposite ends of a strip of material placed therein; a plurality of holding members adapted to hold a strip of material in place in said scrolling members; a horizontally disposed member rotatably mounted above said scrolling members and above said holding members; a plurality of spaced bifurcated members carried by said horizontally disposed member and adapted to engage said strip of material when the horizontally disposed member is pulled downward; means for pulling the horizontally disposed member downward so that the bifurcated members will engage the strip of material; means for actuating said scrolling members and the horizontally disposed member in their respective planes, so that the strip of material positioned therein is scrolled on its ends and the intermediate portion thereof is twisted about its horizontal axis at spaced intervals; means for pushing the horizontally disposed member outward and thus disengaging the bifurcated members from said strip of material after it has been scrolled and twisted; means for reversing the movement of the scrolling members and the horizontally disposed member to return same to normal starting position.

5. In a device of the character described, two pairs of scroll forming members, each such pair being adapted to scroll the opposite end of a strip of material placed therein, and each pair being adapted to scroll the ends of a different length of material and each such scroll forming member being adapted to interchangeably receive a roller member, whereby said scroll forming member may be selectively put in scroll forming operation; a plurality of holding members adapted to hold strips of material in position in the scroll forming members; a horizontally disposed member rotatably disposed above all of said scroll forming members and above said holding members; a plurality of spaced bifurcated twisting members carried by said horizontally disposed member, and adapted to engage a strip of material placed in said scroll forming members; and means for actuating said scrolling members and said horizontally disposed member in different planes whereby the opposite ends of a strip of material being worked in said machine may be scrolled and the intermediate portion

thereof twisted about its horizontal axis at spaced intervals.

6. In a device of the class described, a plurality of scroll forming members each member being adapted to scroll the end of a strip of material placed therein when operated; a plurality of holding members adapted to hold a strip of material in place in said scroll forming members; a horizontally disposed member rotatably mounted above said scroll forming members and above said holding members; a plurality of spaced holding members carried by said horizontally disposed member and adapted to engage said strip of material and to twist it when the horizontally disposed member is pulled downward and rotated in an arc; means for pulling the horizontally disposed member downward; and common means for actuating said scroll forming members and rotating the said horizontally disposed member.

7. In a device of the class described, a plurality of scroll forming members each said member being adapted to scroll the end of a strip of material placed therein; a plurality of holding members adapted to hold a strip of material in place in said scroll forming members; a horizontally disposed member rotatably mounted above said scroll forming members and above said holding members; a plurality of spaced twisting forks carried by the horizontally disposed member and adapted to engage said strip of material when the horizontally disposed member is pulled downward, and to twist said strip of material when the horizontally disposed member is rotated in an arc; means for pulling the horizontally disposed member downward; means for actuating said scroll forming members and said horizontally disposed member in different planes so that the piece of material being worked therein is scrolled on its opposite ends and twisted about its horizontal axis.

8. In a device of the class described, a plurality of forming members each said member being adapted to scroll the end of a strip of material placed therein; a plurality of holding members adapted to hold a strip of material in place in said forming members, a horizontally disposed member rotatably mounted above said forming members and above said holding members; a plurality of spaced twisting forks carried by said horizontally disposed member and adapted to engage said strip of material; means for pulling the horizontally disposed member downward so that the twisting forks will engage the strip of material; means for actuating said forming members and the horizontally disposed member in different planes, so that the strip of material positioned therein is scrolled on opposite ends and twisted about its longitudinal axis; means for pushing the horizontally disposed member outward and thus disengaging the twisting forks from said strip of material, said means including a spring positioned at each end of said horizontally disposed member and between said member and the frame for said machine so that when the horizontally disposed member is pulled downward, the springs are depressed and when it is released the springs relax and push the horizontally disposed member outward.

9. In a device of the class described, a plurality of scroll forming members adapted to receive and scroll the ends of a strip of material placed therein, each of said forming members including a guide groove substantially in the shape of a scroll, with a forming block disposed therein and thereabove, and a cam follower roller detachably attached to a sliding block, with a shaft thereon extending through said guide groove, a rotating head with a groove therein, said sliding block being slidably disposed in said groove so that the cam follower roller may follow the irregular path of the aforesaid guide groove; a plurality of holding members adapted to hold a strip of material in place in said forming members; a horizontally disposed member rotatably mounted above said forming members and above said holding members; a plurality of spaced twisting forks carried by said horizontally disposed member, and adapted to engage the said strip of material and to twist it when the horizontally disposed member is brought downward and rotated in an arc; means for lowering the horizontally disposed member, thereby causing engagement of the strip of material by said twisting forks; means for actuating said forming members and said horizontally disposed member in different planes, so that the piece of material being worked therein is scrolled on its ends and twisted about its longitudinal axis; means for actuating said forming members and said horizontally disposed member in opposite directions from the initial rotation and thereby returning the operating mechanism to normal starting position.

10. In a device of the class described, a plurality of scroll forming members adapted to receive and scroll the ends of a strip of material placed therein; a plurality of holding members adapted to hold a strip of material in place in said forming members; a horizontally disposed member rotatably mounted above said forming members and above said holding member; a plurality of twisting forks carried by said horizontally disposed member and adapted to embrace said strip of material and to twist it when the horizontally disposed member is brought downward and rotated in an arc; means for pulling the horizontally disposed member downward, said means including a yoke member attached to hydraulically controlled piston rod, which yoke member is adapted to engage one of the twisting forks on its movement downward and thus pull the horizontally disposed member downward with it; means carried by said yoke for actuating mechanism for driving said forming members and said horizontally disposed member; and means for actuating said forming members and said horizontally disposed member in different planes, so that the piece of material being worked therein is scrolled on its ends and twisted about its horizontal axis; and means for actuating the said forming members and the said horizontally disposed member in opposite direction from the initial rotation, and thereby returning the machine to normal starting position.

11. Shaping mechanism for use in a machine of the class described, comprising a guide slot in the shape of a chosen design; a forming block following the contour of the slot; a rotatable head; a groove in said head; a slideable member disposed in said groove; a shaft carried by said slideable member and extended upward through said slot and adapted to follow the slot when the head is rotated; a roller member disposed on the outer end of said shaft and spaced from said forming block a sufficient distance to allow the insertion between said roller and said forming block of a piece of material to be shaped; and means for rotating said head.

12. In a device of the class described, one or more shaping members adapted to shape the opposite ends of a strip of material placed therein;

a plurality of holding members adapted to hold a strip of material in place in said shaping members; a horizontally disposed member rotatably disposed above said shaping member; one or more engaging members disposed on the horizontally disposed member and being adapted to engage the edge of a piece of material held by the holding members when the horizontally disposed member is pulled downward; means for pulling said horizontally disposed member downward; and means for actuating said shaping members and the horizontally disposed member in their respective planes.

13. In a device of the class described; a table member; a plurality of holding members disposed on said table and adapted to receive and hold a strip of material placed therein; a horizontally disposed member rotatably disposed above said table; guide means slideably supported said horizontal member for guiding the horizontal member when pulled downward; one or more bifurcated members carried by said horizontally disposed member; means for pulling said horizontally disposed member downward in position for said bifurcated members carried thereby to engage the edge of the piece of material; and means for rotating said horizontally disposd member, whereby a piece of material engaged by said holding members may be twisted about its longitudinal axis at one or more places.

ROBERT L. LONG.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
83,523	Miller	Oct. 27, 1868
107,305	Sugden	Sept. 13, 1870
441,929	Buckley	Dec. 2, 1890
540,513	Polyblank	June 4, 1895
654,373	Wikstrom	July 24, 1900
681,334	McKibben	Aug. 27, 1901
740,241	Coombs	Sept. 29, 1903
796,685	Waybright	Aug. 8, 1905
1,432,199	Nennan	Oct. 17, 1922
1,496,801	Werner	June 10, 1924
1,667,911	Van Veen	May 1, 1928
1,968,010	Bailey	July 31, 1934
1,957,395	Kirchner	May 1, 1934
2,119,399	Muschong	May 31, 1938
2,128,620	Lyons	Aug. 30, 1938
2,217,333	Dahlman	Oct. 8, 1940
2,318,344	Urschel	May 4, 1943

FOREIGN PATENTS

Number	Country	Date
522,677	Great Britain	Apr. 20, 1943
588,956	Great Britain	June 6, 1947