Feb. 24, 1942. C. F. RICHARD 2,273,893

METAL CLIP MACHINE

Filed Aug. 12, 1939 5 Sheets-Sheet 1

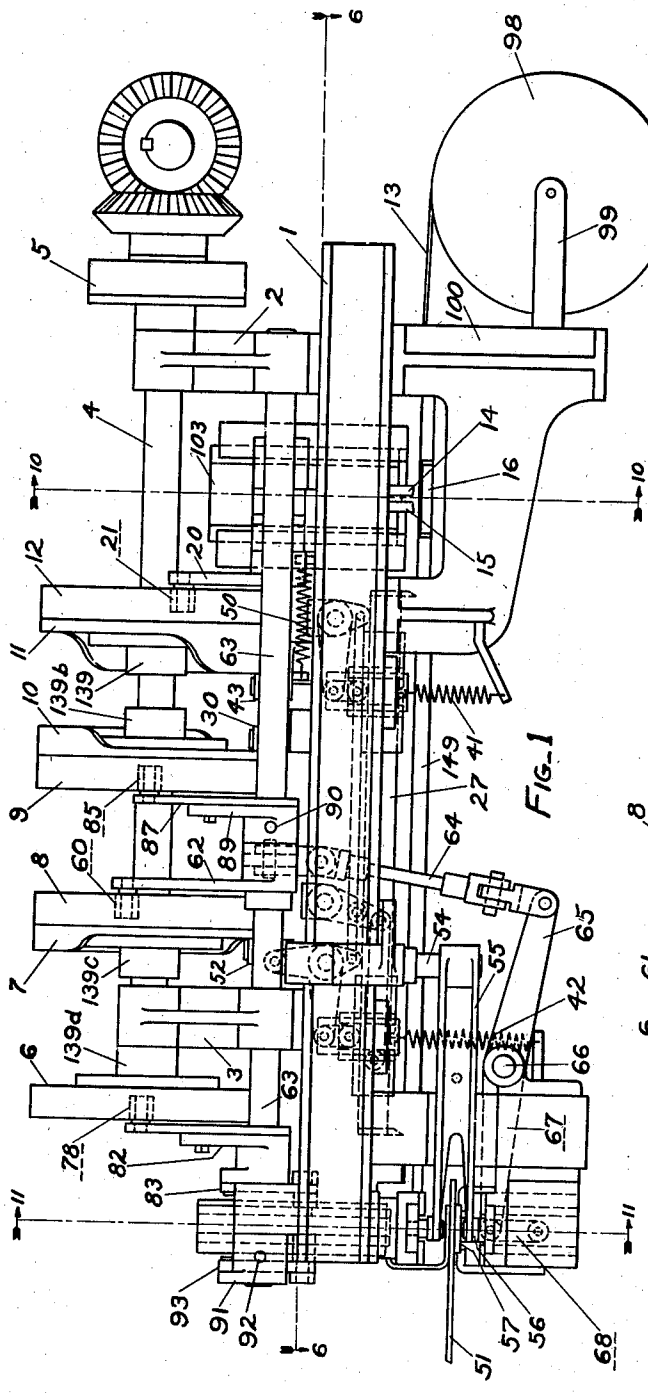


FIG. 1

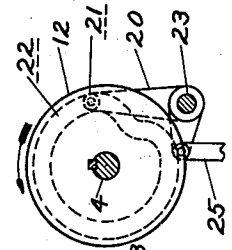


FIG. 5

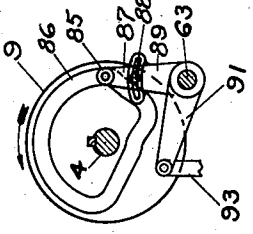


FIG. 4

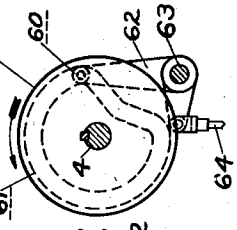


FIG. 3

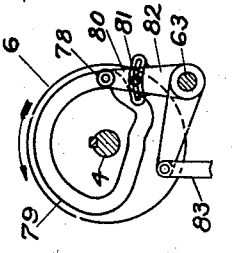


FIG. 2

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METAL CLIP MACHINE

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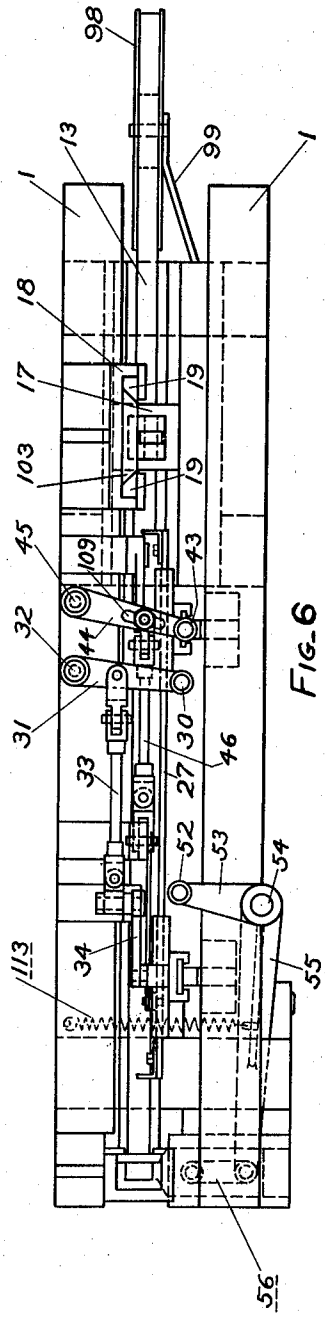


FIG. 6

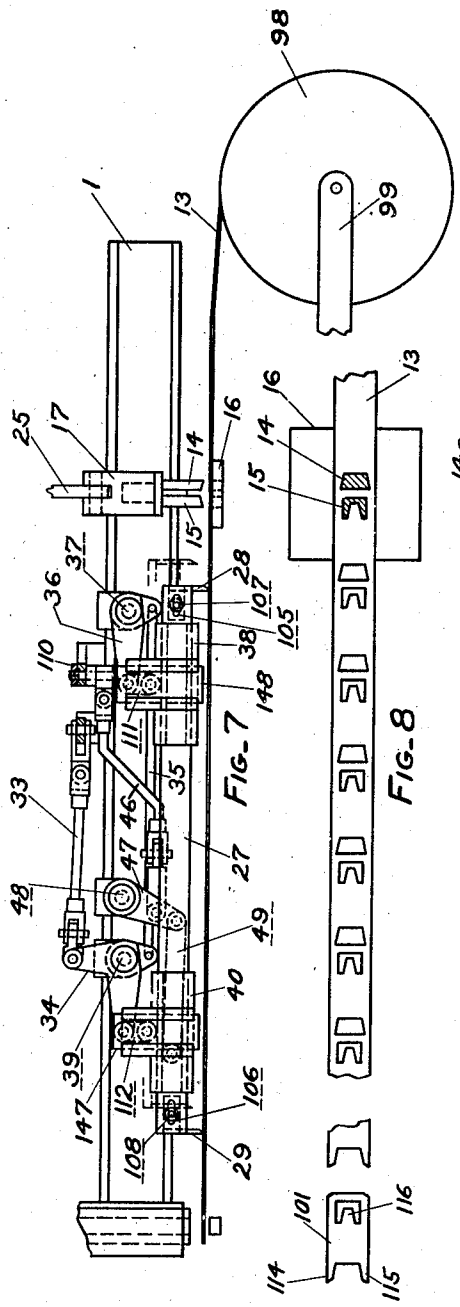


FIG. 7

FIG. 8

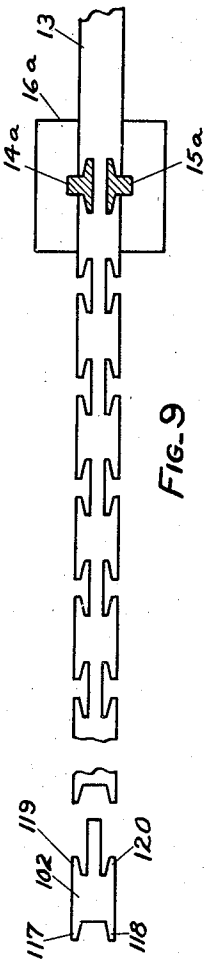


FIG. 9

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METAL CLIP MACHINE

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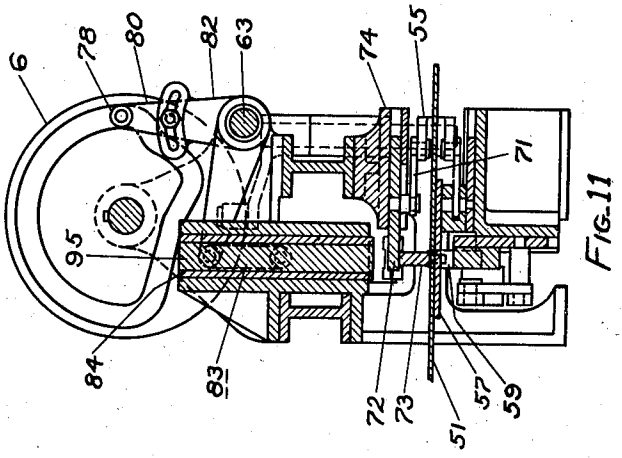


FIG. 11

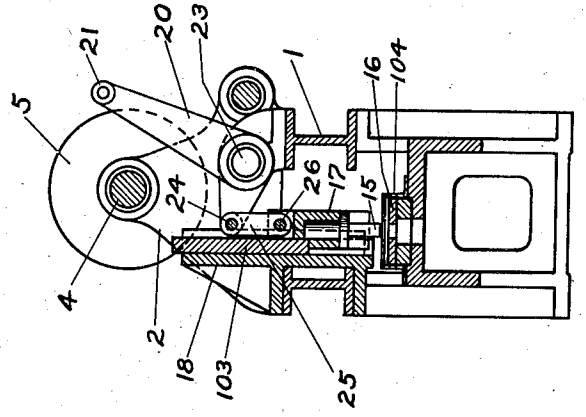


FIG. 10

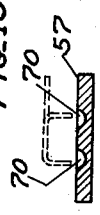


FIG. 15

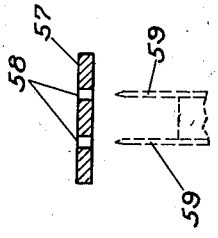


FIG. 14

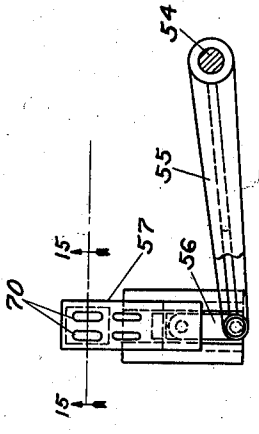


FIG. 13

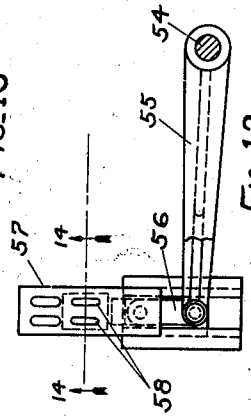


FIG. 12

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METAL CLIP MACHINE

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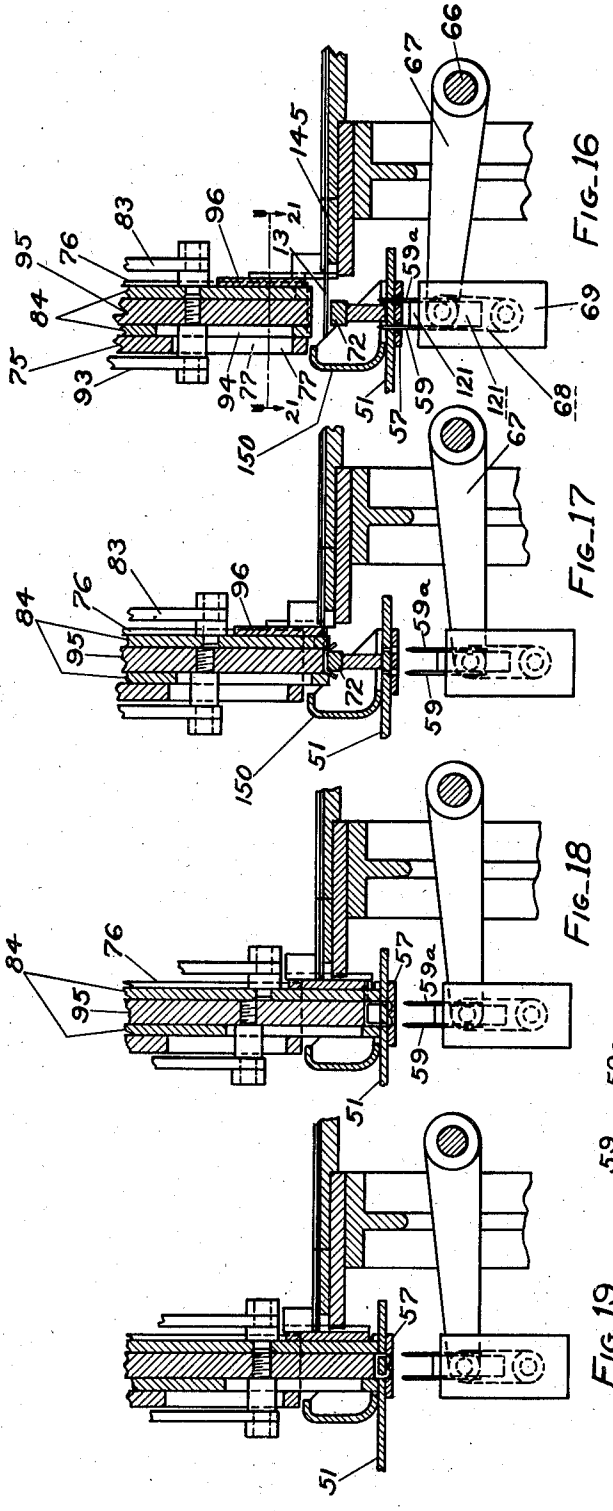


FIG. 16

FIG. 17

FIG. 18

FIG. 19

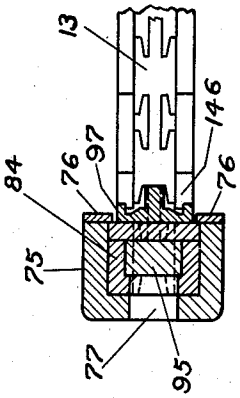


FIG. 22

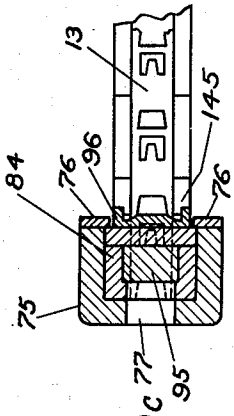


FIG. 21

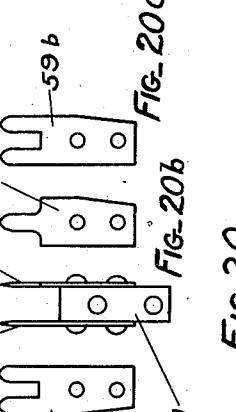


FIG. 20c

FIG. 20b

FIG. 20

FIG. 20a

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METAL CLIP MACHINE

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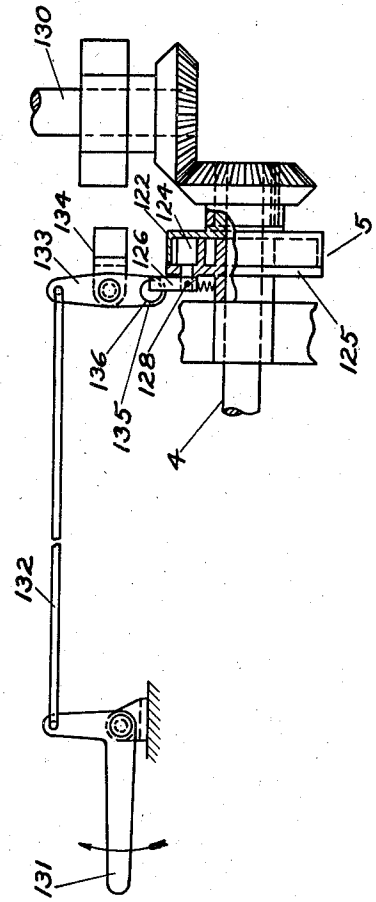


FIG. 24

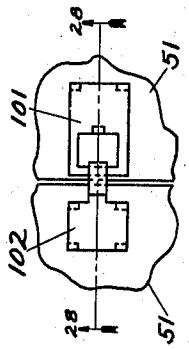


FIG. 27

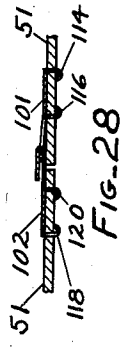


FIG. 28

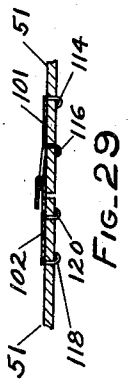


FIG. 29

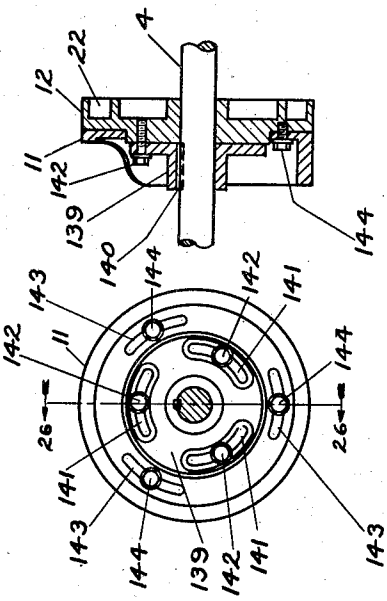


FIG. 26

FIG. 25

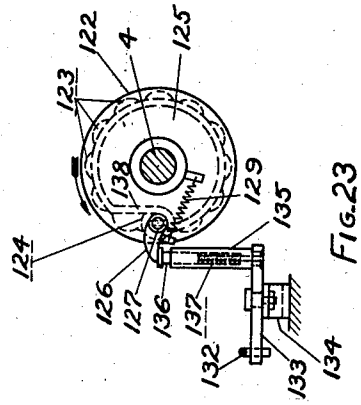


FIG. 23

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Patented Feb. 24, 1942 2,273,893

UNITED STATES PATENT OFFICE

2,273,893

METAL CLIP MACHINE

Charles F. Richard, Battle Creek, Mich.

Application August 12, 1939, Serial No. 289,863

17 Claims. (Cl. 1—2)

The present invention relates broadly to machines adapted for use in the manufacture of boxes, cartons, and the like, and in its specific phases relates more particularly to machines adapted for making and installing closure fasteners on articles of that type formed from corrugated board or fiberboard.

In the past it has been standard practice to make fruit and vegetable boxes, baskets, and crates out of wood, such containers normally being provided with cover members which have to be nailed or wired in closed position. To overcome these shortcomings, both in initial cost and excessive labor to use, as well as to simplify the opening of the container for inspection of the packaged fruit or vegetables, the present machine has been devised. Instead of making the fruit and vegetable containers out of wood, they may be made out of corrugated board or fiberboard and then provided with clip fasteners mounted in male and female pairs so that the cover of the container may be quickly closed and fastened in closed position after the container has been filled. This fastener also is adapted for quick opening for inspection or display of the packaged goods.

Accordingly, among the objects of the present invention is the provision of a machine adapted to take metal tape, for instance zinc alloy tape, form clips therefrom, and install same at the proper location for use as a closure fastener in containers formed from corrugated board or the like.

Another object of the invention is to provide means for punching the tape so that a subsequent simple shearing action will cause the formation of a closure clip blank.

Another object is to provide means for moving the metal tape endwise, following each punching action, a distance equal to the length of the material required for a clip.

Another object is to provide a mechanism for slitting the container member at the desired points for receiving the prongs of the metal clip.

A further object is to provide a mechanism for bending the prongs of the clip downward at right angles to the body thereof and at the same time shearing the end of the clip from the punched metal tape to form an individual clip.

A further object is to provide a mechanism for removing the member over which the prongs of the clip have been bent.

A further object is to provide a means for carrying the so formed clip downward and forcing the prongs of the clip through the preformed slits in the container member.

A still further object is to provide means for turning the prongs of the clip and clinching same as the downward carrying of the clip is completed.

A still further object is to provide a mechanism adapted for use in multiple form so as to make and install at one time all of the clip fasteners required for closing the cover of a carton or container formed from corrugated board or the like.

Still further objects and advantages of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain means for carrying out the invention, such disclosed means illustrating, however, but several of various ways in which the principle of the invention may be used.

In said annexed drawings:

Figure 1 shows a side view of one form of the present invention.

Figures 2, 3, 4, and 5 show four of the cam mechanisms of the present invention, and as viewed from the left in Figure 1.

Figure 6 is a top view of the lower portion of the mechanism of the present invention as viewed along the line 6—6 of Figure 1.

Figure 7 is a front view of the mechanism as viewed from the bottom edge of Figure 6, but with certain of the frame members and parts removed to show the inner parts and their relation to each other more clearly.

Figure 8 diagrammatically shows in enlarged form the passage of the clip stock through the mechanism of Figure 7 to produce a female clip ready for installation.

Figure 9 is similar to Figure 8 except that it shows the production of a male clip.

Figure 10 is a sectional view of the clip stock perforating mechanism as viewed along the line 10—10 of Figure 1, in combination with the cam connecting members used in the operation of same.

Figure 11 is a sectional view of the clip severing and installing mechanism as viewed along the line 11—11 of Figure 1.

Figure 12 is a fragmentary portion of the mechanism at the clip installing station, the parts being in position for the cutting of slits in the stock at the point to receive the clip.

Figure 13 is similar to Figure 12 except that the parts have been moved to the position for clinching the prongs of the clip after passage through the slits in the stock.

Figure 14 is a section taken along the line 14—14 of Figure 12.

Figure 15 is a section taken along the line 15—15 of Figure 13.

Figure 16 is a partially sectioned view showing the slitting of stock preparatory to installing a clip.

Figure 17 is a partially sectioned view showing the slitting mechanism retracted, the clip severed from the clip stock metal tape, and the prongs of the clip being bent at right angles to the clip body so as to pass through the slits in the stock.

Figures 18 is a partially sectioned view showing the clip carried down and the clip prongs entering the slits in the stock.

Figure 19 is a partially sectioned view showing the clip carried completely to the end of its installation travel and the clip prongs clinched.

Figure 20 shows an edge view of the stock slitting knife assembly for installing the female clips of Figure 8.

Figure 20*a* shows a double blade stock slitting knife as viewed from the left side of Figure 20.

Figure 20*b* shows a single blade stock slitting knife as viewed from the right side of Figure 20.

Figure 20*c* shows a double blade stock slitting knife adapted for substitution in the place of the single blade knife of Figure 20*b* when slits for the prongs at the tongue end of the male clips of Figure 9 are to be made.

Figure 21 shows a horizontal section view of the station for severing the female clips and bending the prongs thereof, as viewed along line 21—21 of Figure 16.

Figure 22 is similar to Figure 21 and shows a horizontal section view of the station for severing the male clips and bending the prongs thereof.

Figure 23 is an end view of the clutch and clutch operating mechanism.

Figure 24 is a partially sectioned top view of the clutch and clutch operating assembly.

Figure 25 is an end view of the assembly of cams 11 and 12.

Figure 26 is a sectional view taken along the line 26—26 of Figure 25.

Figure 27 is a top view of a pair of male and female clips suitably mounted and in engagement with each other.

Figure 28 is a sectional view taken along the line 28—28 of Figure 27.

Figure 29 shows a modified form of the assembly illustrated in Figure 28.

A single unit of the apparatus shown in the drawings involves the use of a series of cams mounted on a clutch operated shaft. These cams through suitable connecting parts and followers cause the operation of the various stations which work on metal clip tape to punch same as the preliminary step of clip formation, and prior to the next punching step, a suitable means acts to move the tape ahead a distance equal to the amount of stock required for one clip. The punched tape is delivered to a former which bends the clip prongs downward at right angles to the body of the clip, and at the same time severs the clip from the punched tape. The corrugated board member or the like onto which the clip is to be installed is mounted in place with clip receiving portion under the clip former, and slits cut to receive the prongs of the clip. After the slitting operation, the slitter and allied parts are retracted and the clip carried down until the clip prongs enter the preformed slits. The prongs are then forced through the slits onto a turner which clinches same on the underside of the corrugated board or the like. These same general steps are followed in installing either a male or female clip, a pair of which comprise one complete fastener. The general assembly of the mechanism, and operation of the various stations which perform the steps of forming and installing the clips, will now be described in detail.

The frame 1 of the machine has mounted thereon two upright cross-members 2 and 3. Journaled in the upper end of these cross-members is a main shaft 4, one end of which is connected by means of clutch 5 to a suitable source of power. Keyed to the main shaft 4 are cams 6, 7, 8, 9, 10, 11, and 12, the use of each of which will be described in connection with the parts operated thereby.

During one complete revolution of main shaft 4, the mechanism shown in Figure 1 goes through a complete cycle of operation. The starting and stopping of main shaft 4 for each cycle of operation may be accomplished in various ways, for instance by means of a clutch and clutch operating mechanism as shown in Figures 23 and 24. The driving member 122 of the clutch 5 is provided on the inner face of the flange portion thereof with a series of depressions having the form of segments of a circle 123 adapted for engagement with a dog 124 pivotally mounted on the driven portion 125 of the clutch. Finger 126 is mounted in fixed position on stub shaft 127, for instance, by means of a pin 128. Dog 124 is likewise fastened in fixed position on stub shaft 127 so that when finger 126 is rotated, dog 124 will move in unison therewith. Spring 129 is connected to finger 126 and adapted to apply a rotative pull on same in counter-clockwise direction as shown in Figure 23. The operation of the clutch is as follows: With driving member 122 of the clutch 5 rotating under power delivered through driving shaft 130, operating lever 131 is moved in the direction of the arrow (Figure 24) and by means of link 132 turns bar member 133, which is pivotally mounted on bracket 134, in clockwise direction about its pivot. A trip member 135 is mounted at the opposite end of bar member 133 from the point of connection to link 132. This trip member 135 may be of tubular form having protruding from its upper end an endwise slidable member 136 which is fastened in place in conventional manner preventing accidental removal. A compression spring 137 within the trip member acts to hold the endwise slidable member 136 in maximum extended position after the clutch has been tripped, and at the same time provides cushioning during disengaging of the clutch. The movement of operating lever 131 through link 132 and bar member 133, as described, moves trip member 135 out from under finger 126. Spring 129 is then free to exert tension on finger 126 to rotate same and dog 124 in a counter-clockwise direction against a stop member (not shown) and this takes place as soon as one of the segments 123 of driving member 122 reaches dog 124. The rotation of this dog about the axis of stub shaft 127 causes it to snap into place and engage with one of the segments 123 so as to rotatively lock driving member 122 with the

driven portion 125 of the clutch 5. The clutch is then in engagement and power delivered through driving shaft 130 is transmitted through the clutch to main shaft 4. As soon as the clutch starts to rotate, it carries finger 126 out of the way so that operating lever 131 may be reversed to return trip member 135 to its initial position. As the clutch nears the end of a complete revolution, finger 126 comes in contact with the end of endwise slidable member 136 which acts to rotate finger 126 in a clockwise direction and withdraw dog 124 from engagement with a segment 123 of driving member 122, thus releasing the driven portion 125 of the clutch and stopping the rotation of main shaft 4. The driven portion of the clutch 125 is preferably provided with a stop member 138 against which the side of dog 124 may bump after completing the disengagement, compression spring 137 in any event acting to cushion the rotative inertia of main shaft 4 and the parts moving therewith. This completes the one rotation cycle and places the clutch operating mechanism in condition for tripping when the next cycle is to be started.

With the metal tape 13 in place and with a supply of same carried by spool 98 mounted on arm 99 attached to frame supporter 100, the first step in the making and installing of metal clips involves punching openings in same according to the patterns shown in Figures 8 and 9. Where female clips 101 are to be made, as shown in Figure 8, the male portion of the punching die will have punching members 14 and 15, while the female member 16 will have openings of like cross section, but of slightly larger size into which the end of punching members 14 and 15 may pass when a pair of openings in the tape are punched. When male clips 102 are to be formed, as shown in Figure 9, then punching members 14*a* and 15*a* are used, and the female punching member 16*a* is provided with corresponding cross section, but slightly larger size openings into which the ends of punching members 14*a* and 15*a* may pass during the punching operation. The punching members 14 and 15 are suitably mounted on the lower end of holding member 17 (Figure 7) which is in turn connected to sliding member 103 (Figure 10) for reciprocating motion on supporting member 18 having suitable gibs 19 (Figure 6) for guiding sliding member 103 in its reciprocating motion. The extent and timing of this motion is controlled by means of cam 12 (Figures 1 and 5) and the connecting linkage. In simple construction this linkage consists of a bell crank 20 which has a roller follower 21 adapted to follow cam path 22 in cam 12. The bell crank 20 is mounted on a suitable pivot 23 and provided with a pivot member 24 (Figure 10) for connecting same to a link 25 which in turn is connected by means of pivot 26 to holding member 17 which carries punching members 14 and 15. Thus each time clutch 5 is tripped so as to cause shaft 4 to make one complete revolution, cam 12 with the mechanism connecting same to punching members 14 and 15 will cause the latter to pass downward into the corresponding openings of the female punching member 16 to punch prescribed openings in the metal tape 13 passing over said member 16. To facilitate the removal of the male punching dies from the metal tape 13 after punching, a stripper plate 104 (Figure 10) is used. This stripper plate is spaced above the female punching die a distance permitting free passage of the metal tape therebetween. The openings through the stripper plate are preferably of the same contour as the male punching dies, but approximately one sixty-fourth of an inch larger to provide adequate clearance with satisfactory stripping.

Just prior to punching the next pair of holes in the tape, the punched portion of same is pulled forward an amount such that the next set of holes will be punched at the proper position for the making of the required clip blank. The pulling of the punched tape endwise is accomplished through a puller bar 27 (Figures 1, 6, and 7) carrying hooks 28 and 29 which are adapted to engage the punched holes in the tape 13. In preferred construction, the hooks will engage the female clip tape at both sides of the base of prong 116, while in case of male clip tape, the hooks will engage the openings at the inner edge of the base of prongs 119 and 120. The use of hooks at both ends of puller bar 27 permits using up the punched portion of the tape when the machine is going to be changed from one type of clips to the other. To provide for adjustment of the spacing between the points of hooks 28 and 29, the body portion of each hook is provided with slots 105 and 106 respectively, and studs 107 and 108 respectively are used for anchoring the hooks at the slots to the ends of puller bar 27. This adjustability also facilitates shifting from one type of clip to the other. Variation in the amount of endwise movement of puller bar 27 is accomplished by providing arm 44 with a slot 109 to which one end of link 46 is adjustably joined, as by means of stud 110. The timing of the movement of the puller bar 27 is controlled through cams 10 and 11. Cam 10 controls the raising and lowering of puller bar 27, while cam 11 controls the endwise movement of this bar. In preferred construction, a metal tape supporter 149 (Figure 1) is used to support the punched metal tape as it passes under the forwarding mechanism.

The cycle of operation of the tape forwarder is as follows: After clutch 5 has been tripped to start shaft 4 to making a complete revolution, cam 12 with the connecting mechanism causes punching members 14 and 15 to punch openings in the metal tape and then move back to initial position. Following this and the clip forming and installing steps, the tape is ready for moving endwise a distance suitable to bring the tape in place for the next punching operation. The rotation of main shaft 4 brings cam 10 to the position where cam follower 30 is moved to the right, as viewed in Figure 6. This cam follower is mounted on the end of an arm 31, which in turn is mounted on a fixed pivot 32. A pivoted lifter link 33 connects arm 31 to a bell crank 34 (Figure 7) which is connected by link 35 to a second bell crank 36 mounted on fixed pivot 37. The other end of bell crank 36 is pivotally connected by means of link 111 to sliding carrier member 38 which is adapted to slide on mounting member 148. Bell crank 34 is mounted on a fixed pivot 39 and one arm of said bell crank is pivotally connected by means of link 112 to sliding carrier member 40 which is adapted to slide on mounting member 147. The cross-shaped sliding carrier members 38 and 40 carry puller bar 27 vertically without interfering with the controlled endwise movement of said bar. At the lower ends of sliding carrier members 38 and 40 are connected springs 41 and 42 (Figure 1) which act to lower the sliding carrier members 38 and 40 as soon as follower roller 30 in contact with

cam 10 will permit. When hooks 28 and 29 of puller bar 27 are in engagement with the openings punched in metal tape 13, they are ready for forwarding the tape the required distance and this is accomplished as follows: With cam follower 43 moved the maximum distance to the right and in contact with the cut-away portion of the face of cam 11, then further rotation of the latter moves cam follower 43 up the inclined face of the cam and to the left as viewed in Figure 1. This movement in turn swings arm 44 (Figure 6) in clockwise direction on its fixed pivot 45. Pivotally mounted on arm 44 is an endwise movable link 46, which in turn is pivotally mounted to arm 47 (Figure 7) mounted on fixed pivot 48. On the end of arm 47 opposite to fixed pivot 48 is pivotally connected link 49, the opposite end of which is pivotally connected to puller bar 27. Clockwise movement of arm 44 through the members connecting it to puller bar 27, moves the latter to the left and through hooks 28 and 29 moves the punched tape to the left. Spring 50 (Figure 1) is connected to arm 44 and acts to keep cam follower 43 in contact with the face of cam 11, thus causing the metal tape pulling mechanism to move to the position shown in dotted lines in Figure 7, when cam follower 43 moves to the right during further rotation of cam 11. The pulling mechanism thus goes through the following cycle of operation per revolution of main shaft 4: With cams 10 and 11 adjustably mounted on main shaft 4 and rotating in unison therewith, cam follower 30 will first remain in fixed position, thus permitting springs 41 and 42 to hold puller bar 27 down so that its hooks 28 and 29 are in engagement with the punched openings in metal tape 13. Cam follower 43 in contact with the face of cam 11 also remains in fixed position at the start of rotation of main shaft 4. Cam follower 30 in contact with the face of cam 10 then moves to the right as viewed in Figure 6, and through the connecting parts lifts puller bar 27 to the elevation shown in dotted lines in Figure 7. Cam follower 43 in contact with the face of cam 11 then moves to the right as viewed in Figure 6, and through the connecting parts moves puller bar 27 to the right until it reaches the position shown in dotted lines in Figure 7. Cam follower 30 in contact with the face of cam 10 then moves to the left as viewed in Figure 7 and lowers puller bar 27 until its hooks 28 and 29 engage the punched holes in metal tape 13. Cam follower 43 in contact with the face of cam 11 then moves to the left, as viewed in Figure 6, and through the connecting parts moves puller bar 27 to the left, as viewed in Figure 7, thus carrying metal tape 13 forward the distance required to place it in position for the next punching step.

As shown in Figure 1, all of the cams except number 6 are mounted in pairs on main shaft 4. This provides one convenient way for adjustably mounting same. Referring to cams 11 and 12, as typical of this set up, a flanged member 139 (Figures 25 and 26) is mounted on main shaft 4 and connected for rotation therewith by means of key 140 or the equivalent. This flanged member is provided with slots 141 through which studs 142 threadedly engage cam 12. It is thus obvious that by loosening studs 142, cam 12 may be adjusted over a considerable range. With cam 12 adjusted to the desired position and studs 142 tightened, cam 11 may also be adjusted and this is accomplished by providing cam 11 with slots 143 through which studs 144 pass and threadedly engage with the back face of cam 12. By loosening studs 144, cam 11 may be adjusted to the desired position and then the studs retightened to hold same in place. In constructing cams for assembly in this manner, it is preferable to machine same so that the assembling studs will be approximately at the center of the adjusting slots when in final operating assembly. Final adjustment of the cams over a considerable range in either direction is then readily attainable. The other cams, including cam 6, are mounted in similar manner, as is diagrammatically shown in Figure 1.

The punched tape is delivered to the mechanism which bends the prongs of the clip at right angles to the body thereof, shears the clip from the metal tape, and then installs the clip on a piece of corrugated board or the like which has been preslit so that the prongs of the clip may pass therethrough before clinching.

The slitting of the corrugated board 51 takes place in the following manner: Follower roller 52 in contact with the face of cam 7 is connected so as to cause arm 53 (Figure 6) to pivot back and forth on shaft 54 to which it is keyed and in turn to likewise move arm 55 also keyed to shaft 54. Spring 113 connected to arm 55 holds follower roller 52 in contact with the cam face of cam 7 throughout its cycle of operation. Arm 55 is pivotally connected through link 56 (Figure 12) to sliding member 57. This sliding member 57 has a pair of openings 58 therethrough. These openings act as passageways for the slitting knives 59 and 59a during the operation of slitting the corrugated board preparatory to passage therethrough of the prongs of the clip. At the start of rotation, cam 7 with cam follower 52 in contact therewith, is at the point where it causes sliding member 57 to be in position for the slitting operation. This is shown in Figure 12 with the openings 58 for the slitting knives directly under the clip installing mechanism, the location of which is indicated by the rectangle shown thereon in dashed lines. The mechanism for operating the knives and coacting therewith then goes into action as follows: Cam follower roller 60 (Figure 3) in contact with cam path 61 of cam 8 moves bell crank 62 pivotally mounted for free movement on shaft 63, in a counter-clockwise direction. This forces pivoted link 64 (Figure 1) in an endwise downward direction, which in turn causes arm 65 keyed to shaft 66 to move in a clockwise direction with shaft 66 as a pivot. This in turn moves arm 67 likewise keyed to shaft 66 in a clockwise direction. The outer end of arm 67 is pivotally connected to link 68 (Figure 16), which in turn is pivotally connected to sliding member 69 which carries slitting knives 59 and 59a on its upper end. This clockwise movement of arm 67 carries slitting knives 59 and 59a upward through slits 58 (Figure 12) and through the corrugated board 51 (Figure 16) at the points which are to receive the prongs of the clip to be installed. As cam 8 continues to rotate, cam follower roller 60 in contact with cam path 61 through the connecting linkage causes arm 67 to move in a counter-clockwise direction to initial position which moves the slitting knives 59 and 59a downward to the position shown in Figure 17. Cam follower roller 52 in contact with the face of cam 7 then moves arm 53 (Figure 6) in a counter-clockwise direction, which through the connecting mechanism moves sliding member 57 endwise to the position shown in Figure 13. This brings the clip prong turning grooves 70 in

clinching position under the clip forming and installing mechanism, the superimposed location of which is indicated by the rectangle shown in dashed lines.

Female clip 101 (Figure 8) is provided with prongs 114, 115, and 116, while male clip 102 (Figure 9) is provided with prongs 117, 118, 119, and 120. Thus before installing a female clip on corrugated board or the like 51, three slits for the prongs will be made, while in case of the male clip, four slits will be made. For the purpose of cutting these slits, suitable slitting knives, as shown in Figures 20, 20*a*, 20*b*, and 20*c* are used. Blade carrier 121 adapted for mounting on sliding member 69 (Figure 16) has the slitting knives fastened thereto. When corrugated board or the like 51 is to be slit for the reception of a female clip, slitting knives 59 (Figure 20*a*) and 59*a* (Figure 20*b*) are mounted on opposite sides of blade carrier 121, as shown in Figure 20. On the other hand, when installing a male clip, the blade carrier 121 is used with slitting knife 59*b* (Figure 20*c*) substituted for slitting knife 59*a* (Figure 20*b*). Assembled in this manner, the slitting assembly will cut the four slits required for installation of a male clip 102.

The arm 55 in side view as shown in Figure 1 is Y-shaped at one end, the lower branch of the Y being connected to link 56 for endwise movement of sliding member 57. The upper branch of the Y is pivotally connected to link 71 (Figure 11), the opposite end of which is pivotally connected to bar 72 over which the prongs of the clip are bent at right angles to the clip body preparatory to being carried down and installed on corrugated board member 51. Projecting from the lower face of the end of bar 72 is a supporter member 73 which acts to hold down corrugated board 51 when the slitting operation takes place, the slitting of the corrugated board and the bending down of the prongs of the clip taking place simultaneously. The slitter knives 59 and 59*a* then lower, following which arm 55 with its connecting links moves sliding member 57 and bar 72 to the right as viewed in Figure 11. The extent of this movement is indicated by Figures 12 and 13. A suitable supporting member 74 acts to guide bar 72 in its forward and back motion.

The upper portion of the mechanism used for shearing, forming, and installing the clips is shown in the course of its operation in Figures 16 to 19 inclusive. The sliding parts of the head portion move up and down inside of the head frame 75 (Figures 21 and 22) which is constructed substantially in U-shape section with plates 76, or the equivalent, forming ways which hold the sliding parts of the mechanism in place in the head frame. On the opposite side of the head frame from the plates 76 is provided a slot 77 through which a connection is made to one of the sliding members. Connection to the other sliding member is made through the opening between plates 76. At the start of the clip severing and forming steps, bar 72 is in the extended position shown in Figure 11, and the punched metal tape 13 extends over bar 72 as shown in Figure 16.

When clutch 5 is engaged, follower roller 78 in contact with cam path 79 of cam 6 starts moving arm 80 (Figure 2) in counter-clockwise direction. This arm is pivoted on shaft 63 and joined by adjustable member 81 to bell crank 82 which is also pivotally mounted on shaft 63. This movement of arm 80 causes link 83, which is pivotally mounted on bell crank 62, to move in an endwise downward direction. The lower end of link 83 is pivotally connected to former member 84 (Figure 16). The same rotation of main shaft 4 causes follower roller 85 to follow cam path 86 in cam 9 (Figure 4). This causes arm 87, which is pivotally mounted on shaft 63, to move in counter-clockwise direction. Adjustable member 88 joins arm 87 to arm 89 which is also mounted on shaft 63 and fastened thereto in any suitable manner, for instance, by means of a pin 90 (Figure 1). Mounted on the end of shaft 63 is an arm 91 which is also fastened thereto in any suitable manner, for instance, by pin 92. Pivotally connected to the end of arm 91 is a link 93 (Figure 16), the lower end of which is pivotally connected through slot 77 in head frame 75 and slot 94 in former member 84 to clip driver 95.

The former member 84 is provided adjacent its lower end between plates 76 (Figures 16 and 21) with a removable shearing knife 96 for use in connection with the shearing of female clips from suitably punched metal tape 13. At the under side of the punched tape is a removable shearing member 145 which cooperates with knife 96 in shearing the individual metal clips from the punched tape. Where male clips are being formed, removable shearing knife 97 and shearing member 146 (Figure 22) are used in similar manner.

The forming and installing of a clip is as follows: The rotation of cams 6 and 9 which are operably joined respectively to former member 84 and clip driver 95 causes both to start moving in a downward direction approximately at the same time. The cam path 79 of cam 6 is formed so that former member 84 travels downward at the start of motion faster than clip driver 95, and when these parts reach the position shown in Figure 17, former member 84 will start bending the prongs of the clip downward at right angles to the body of the clip over bar 72, and at the same time removable shearing knife 96 acts to sever to clip from the punched metal tape 13. The cam paths 79 and 86 of cams 6 and 9 respectively at this point allow former member 84 to continue downward an amount approximately equal to the length of the clip prongs and then both former member 84 and clip driver 95 are held momentarily stationary to permit bar 72 and sliding member 57 to move endwise as has been hereinbefore described. Before bar 72 is withdrawn, however, the metal clip will have been bent to the shape shown in Figure 18. Cams 6 and 9 then cause former member 84 and clip driver 95 to move down in unison to the position shown in Figure 18 where the lower end of former member 84 will be substantially in contact with the upper face of corrugated board 51 and the prongs of the metal clip directly in line with the slits made by knives 59 and 59*a*. Cam 6 at this point stops the downward movement of former member 84, while cam 9 continues the downward movement of clip driver 95 to force the clip prongs through the slits in corrugated board 51 and into turning grooves 70 in the face of sliding member 57 to clinch the prongs of the clip in place as shown in Figure 19. Cams 6 and 9 through the connecting members then raise former member 84 and clip driver 95 to their initial position where they are ready to pass through the succeeding cycle of forming and installing another clip.

The operation of the machine as a whole for making and installing male and female clips is

identical. For instance, to convert the machine from one which makes and installs female clips to one which makes and installs male clips, the metal clip punching die members 14 and 15, the female punching member 16 (Figure 8), and the corresponding stripper plate 104, are removed and in their place punching members 14a, 15a, 16a (Figure 9) and corresponding stripper plate are substituted. This change of punching dies also requires that removable shearing knife 96 and shearing member 145 (Figure 21) be replaced with removable shearing knife 97 and shearing member 146, as shown in Figure 22. Hooks 28 and 29 are then adjusted to the desired positions for the new clips by means of the adjustable mountings including slots 105 and 106 respectively on the ends of puller bar 27. The amount of endwise movement of puller bar 27 may also be adjusted by resetting the mounting connection of endwise movable link 46 at the point of fastening in slot 109 of arm 44.

The operation of the various steps in the punching, forming, and installing of a clip takes place in the following order during one complete rotation of main shaft 4 upon operation of clutch 5: When the clutch is operated, cam 12 causes punching members 14 and 15 to perforate metal tape 13. At the same time, as this punching step takes place, cam 6 causes former member 84 to lower and start bending the prongs of the metal clip over bar 72 and shearing knife 96 to sever a clip from the end of the punched metal tape. This severing and starting the turning of the prongs of a metal clip over bar 72 takes place while the lower ends of punching members 14 and 15 are still in the openings punched in metal tape 13. This presents the advantage of holding the punched metal tape against endwise movement when the shearing of the clip and bending of its prongs takes place. At the start of rotation of main shaft 4, bar 72 and sliding member 57, both of which are controlled by cam 7, are in place under the clip forming and installing station. Simultaneously with the punching of the metal clip tape and the severing and bending down of the prongs of an individual clip, cam 8 causes slitter knives 59 and 59a to move upward and cut slits through corrugated board 51 so that same is ready to receive the prongs of the metal clip. Cam 8 then causes knives 59 and 59a to lower so as to be out of the way for the succeeding steps in the clip installation. Cam 7 then causes bar 72 and sliding member 57 to move endwise an amount sufficient to completely remove the end of bar 72 from under former member 84 and clip driver 95, and at the same time to move sliding member 57 endwise from the position shown in Figure 12 to that shown in Figure 13 which will place turning grooves 70 at the proper location for use in clinching thhe prongs of the metal clip. The former member 84 then carries the clip downward until its prongs are ready to enter the slits cut in corrugated board or the like 51. Cam 9 at this point causes clip driver 95 to pass downward and force the prongs of the clip through the slit openings in corrugated board 51 so that they enter turning grooves 70 of sliding member 57 and are turned and clinched at that point. Cams 6 and 9 then return former member 84 and clip driver 95 to their uppermost position. Cams 10 and 11, while former member 84 and clip driver 95 are approaching their uppermost positions, start bringing the hooks of puller bar 27 into engagement with the punched tape holes, following which the tape is moved endwise a sufficient distance to put it in position for the forming and installing of a clip, as well as the punching of an additional pair of openings at the punching station. Puller bar 27 is then left in its initial position which is shown in solid lines in Figure 7. Near the end of the cycle when former member 84 and clip driver 95 are near or at their uppermost positions, cam follower 52 in contact with the face of cam 7 moves arm 55 in clockwise direction as viewed in Figure 6, thus placing sliding member 57 in the position shown in Figure 12 where it is ready for the slitting operation, and at the same time placing sliding bar 72 in place for the bending of clip prongs thereover in the next cycle of operation. This completes the cycle of operation and leaves the mechanism ready to start and the next succeeding cycle.

After the male and female clips have been installed at suitable points on a box or carton formed from corrugated board or the like, they will have the appearance shown in top view in Figure 27 when in closing engagement. The clinching of the prongs is shown in Figure 28 and a modified form of this clinching in Figure 29. From the latter it will be noted that the prongs 116 and 120 are clinched in the opposite direction to the like prongs shown in Figure 28. This type of clinching provides a stronger anchor for the clips and is readily accomplished by merely shifting sidewise the corresponding turning groove 70 (Figures 13 and 15) so that both prongs of the clip are clinched in the same desired direction.

Other modes of applying the principle of my invention may be employed instead of those explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a machine adapted to utilize suitable metal tape, means to form such tape into metal clips, each of said clips being of unit construction with prongs and an extending anchoring member, means to cut prong receiving openings in a suitable article on which said pronged clips are to be installed, and means to install the clips at proper location on said article with said prongs extending through said openings and clinched to said article.

2. A machine for making metal clip fasteners from thin strip metal and fastening same on articles of various types, which comprises means for punching openings in said strip metal at spacings such that shearing at a prescribed point will produce a clip blank with prongs, means for turning the preformed prongs of the end clip of said punched strip metal over a suitable member so that all of said prongs point in the same direction and are substantially at right angles to the body of said clip, said prong turning means also carrying said clip to the point of its installation following severance from the strip of metal, means for shearing the clip blank from the end of the punched strip metal, means for following said clip as it is carried prongs first to the article on which it is to be installed, said following means acting to drive the clip prongs through said article, and means for clinching the end of each of said prongs so as to fasten said clip in place on said article.

3. A machine for making and installing metal

clip fasteners on articles of various types, which comprises means for holding metal tape adapted for use in making clips, means for punching openings in said metal tape at spacings such that shearing at a prescribed point will produce a clip blank with prongs, means for cutting clip prong receiving slits at prescribed location in the article on which a clip is to be installed, means for supporting the end of said punched tape while the preformed prongs thereof are being turned at right angles to the punched tape, means for shearing the clip blank from the punched metal tape while the blank is in contact with said supporting means, means for removing the clip blank supporting means, means for turning said prongs on said supporting means, and after the latter's removal carrying the preformed clip blank to the article on which same is to be installed, means for forcing the prongs of the clip through the slits made therein, means for turning said prongs to clinch same, and means to forward the metal tape a distance such that the next punching operation will perforate the metal tape at the proper clip formation spacing.

4. A machine for making and installing metal clip fasteners on articles of various types, which comprises a frame having mounted thereon a main shaft connected through a suitable clutch to a source of power, a series of cams mounted on said main shaft for rotation in unison, means for holding metal tape adapted for use in making clips, cam controlled means for punching openings in said metal tape at spacings such that shearing at a prescribed point will produce a clip blank with prongs, cam controlled means for cutting corresponding prong receiving slits at prescribed location in the article on which a clip is to be installed, means for supporting the end of said punched tape while the preformed prongs thereof are being turned at right angles to the punched tape, cam controlled means for shearing the clip blank from the punched metal tape while the blank is in contact with said supporting means, cam controlled means for removing the clip blank supporting means, cam controlled means for turning said prongs on said supporting means, and after the latter's removal carrying the preformed clip blank to the article on which same is to be installed, means for forcing the prongs of the clip through the slits made therein, means for turning said prongs to clinch same, cam controlled means for moving said turning means in place for turning the clip prongs and then moving same to permit cutting prong receiving slits in the article on which a clip is to be installed, and cam controlled means to forward the metal tape a distance such that the next punching operation will perforate the metal tape at the proper clip formation spacing.

5. In a machine for installing pronged metal clip fasteners on containers and the like, the combination which includes a frame, a former member movable in said frame, means cooperating with said former member in turning the prongs of the metal clip substantially at right angles to the body thereof to facilitate the gripping and carrying of the clip by the former member to the clip installation point, means for withdrawing said cooperating means at the end of the right angle bending of the clip prongs, a clip driver adjacent said former member and movable relative thereto, a former member operating cam, means for operably connecting said cam to said former member, a clip driver cam, means for operably connecting said clip driver cam to said clip driver, a reciprocable sliding member having clip prong turning grooves on its face in position to cooperate with said clip driver, and means for withdrawing said prong turning groove portion of said sliding member from under said clip driver at the end of each clip driving step and then returning same in time for the next clip driving step.

6. In a machine for installing pronged metal clip fasteners on containers and the like, the combination which includes a frame, means for perforating metal clip fastener stock at prescribed points while leaving same in continuous strip form ready for shearing, a former member movable in said frame, means for shearing said clip while held by said former member, a clip driver adjacent said former member and movable relative thereto, a former member operating cam, means for operably connecting said cam to said former member so that the latter will carry the sheared clip held by it to the clip installation point, and means for operably connecting said clip driver cam to said clip driver for the driving of said clip held by said former member.

7. In a machine for installing pronged metal clip fasteners on containers and the like, the combination which includes a frame, means for perforating metal clip fastener stock at prescribed points while leaving same in continuous strip form ready for shearing, a former member movable in said frame, means for shearing said clip while held by said former member, a clip driver adjacent said former member and movable relative thereto, a former member operating cam, means for operably connecting said cam to said former member so that the latter will carry the sheared clip held by it to the clip installation point, a clip driver cam, means for operably connecting said clip driver cam to said clip driver for the driving of said clip held by said former member, means over which the former member is adapted to form said clip by bending the prongs thereof substantially parallel to each other and perpendicular to the body of the clip prior to the driving of same, and means for removing said last named means at the end of the clip prong bending step and then returning same in time for the bending of the prongs of the next clip.

8. In a machine for installing metal clip fasteners on containers and the like, the combination which includes a frame, a former member movable in said frame, a clip driver adjacent said former member and movable relative thereto, a former member operating cam, means for operably connecting said cam to said former member, a clip driver cam, means for operably connecting said clip driver cam to said clip driver, a clip shearing means, means over which the former member is adapted to bend the prongs of the metal clip fasteners substantially perpendicular to the body thereof, cam controlled means for withdrawing said means over which the prongs of the metal clip fasteners have been bent, a reciprocable sliding member having clip prong turning grooves on its face in position to cooperate with said clip driver, and means for withdrawing said prong turning groove portion of said sliding member from under said clip driver at the end of each clip driving step and then returning same in time for the next clip driving step.

9. In a machine for installing metal clip fasteners on containers and the like, the combina-

tion which includes a frame, means for perforating metal clip fastener stock at prescribed points while leaving same in continuous strip form ready for shearing, a former member movable in said frame, a clip driver adjacent said former member and movable relative thereto, a former member operating cam, means for operably connecting said cam to said former member, a clip driver cam, means for operably connecting said clip driver cam to said clip driver, a clip shearing means for severing individual clips from said perforated continuous strip metal clip fastener stock, means over which the former member is adapted to bend the prongs of the metal clip fasteners substantially perpendicular to the body thereof, cam controlled means for withdrawing said means over which the prongs of the metal clip fasteners have been bent, and cam operated means for cutting slits in the member on which the metal clip fasteners are to be installed, said slits being positioned to receive the prongs of the metal clip fastener.

10. In a machine for installing metal clip fasteners on containers and the like, the combination which includes a frame, a former member movable in said frame, a clip driver adjacent said former member and movable relative thereto, a former member operating cam, means for operably connecting said cam to said former member, a clip driver cam, means for operably connecting said clip driver cam to said clip driver, a clip shearing means, means over which the former member is adapted to bend the prongs of the metal clip fasteners substantially perpendicular to the body thereof, cam controlled means for withdrawing said means over which the prongs of the metal clip fasteners have been bent, cam operated means for cutting slits in the member on which the metal clip fasteners are to be installed, said slits being positioned to receive the prongs of the metal clip fastener, a reciprocable sliding member having means on its face for turning and clinching the prongs of said metal clip fasteners after they have been passed through the slits under the influence of said clip driver, and means for withdrawing said prong turning portion of said sliding member from under said clip driver at the end of each clip driving step and then returning same in time for the next clip driving step.

11. In a machine of the character described, the combination which includes a puller bar, at least one sliding carrier member for said puller bar, said carrier member being adapted to permit said puller bar to slide endwise thereon, a mounting member for said sliding carrier member, said mounting member being adapted to have said sliding carrier member slide thereon in a direction perpendicular to the endwise movement of the puller bar, a cam for controlling the endwise movement of said puller bar, means for operably connecting said cam to said puller bar, a cam for controlling the movement of said sliding carrier member, and means for operably connecting said cam to said sliding carrier member.

12. In a machine of the character described, the combination which includes a means for perforating strip material in prescribed pattern, a puller bar, a pair of sliding carrier members for said puller bar, said carrier members being adapted to permit said puller bar to slide endwise thereon, a mounting member for each of said sliding carrier members, said mounting members being adapted to have said sliding carrier members slide thereon in a direction perpendicular to the endwise movement of the puller bar, a cam for controlling the endwise movement of said puller bar, means for operably connecting said cam to said puller bar, a cam for controlling the movement of said sliding carrier members, means for operably connecting said cam to said sliding carrier members so that the latter will move in unison in the same direction, and means on said puller bar for engaging the perforations in said strip material and moving same endwise during endwise movement of said puller bar in one direction.

13. In a machine of the character described, the combination which includes a means for perforating strip material in prescribed pattern, a puller bar, a pair of sliding carrier members for said puller bar, said carrier members being adapted to permit said puller bar to slide endwise thereon, a mounting member for each of said sliding carrier members, said mounting members being adapted to have said sliding carrier members slide thereon in a direction perpendicular to the endwise movement of the puller bar, a cam for controlling the endwise movement of said puller bar, means for operably connecting said cam to said puller bar, a cam for controlling the movement of said sliding carrier members, means for operably connecting said cam to said sliding carrier members so that the latter will move in unison in the same direction, means for adjustably varying the endwise movement of the puller bar, and means on said puller bar for engaging the perforations in said strip material and moving same endwise during endwise movement of said puller bar in one direction.

14. In a machine of the character described, the combination which includes a means for perforating strip material in prescribed pattern, a puller bar, a pair of sliding carrier members for said puller bar, said carrier members being adapted to permit said puller bar to slide endwise thereon, a mounting member for each of said sliding carrier members, said mounting members being adapted to have said sliding carrier members slide thereon in a direction perpendicular to the endwise movement of the puller bar, a cam for controlling the endwise movement of said puller bar, means for operably connecting said cam to said puller bar, a cam for controlling the movement of said sliding carrier members, means for operably connecting said cam to said sliding carrier members so that the latter will move in unison in the same direction, means for adjustably varying the endwise movement of the puller bar, and hook means at least on one end of said puller bar, said hook means being adapted to engage the perforations in said strip material and move same endwise during endwise movement of said puller bar in one direction.

15. A machine for making and installing metal clip fasteners on articles of various types, which consists of a frame, suitable bearing containing members mounted on said frame, a main shaft mounted on said bearings, a suitable clutch adapted for one rotation operation mounted on said shaft and adapted to connect same to a suitable source of power, means for operating said clutch, a series of cams mounted on said main shaft for rotation in unison, means in connection with said cams for adjusting same, means for holding suitable metal tape adapted for use in making clips, a punching die mechanism controlled through one of said cams and adapted to punch suitable openings in said metal tape at

spacings such that subsequent shearing at prescribed points will produce clip blanks with prongs, slitting knives suitably connected to another of said cams and adapted for cutting prong receiving slits at prescribed location in the article on which a clip is to be installed, a bar means for supporting the end of said punched tape while the preformed prongs thereof are being turned at right angles to the punched tape, shearing means controlled by one of the cams and adapted for shearing the clip blank from the punched metal tape while the blank is in contact with said supporting bar, cam controlled means for removing the clip blank supporting bar from the prong turning point and then returning same at the proper time for the turning of the prongs of the next clip blank, a former member and a clip driving member each suitably connected to and controlled by separate cams one of which controls said shearing, said former member and clip driving member being adapted to deliver the preformed clip blank to the article on which it is to be installed and the driving member to then force the prongs of the clip through the slits made therein, the cams and connecting means for said former member and clip driver then returning both to initial position, means for turning said prongs to clinch same, means for connecting said prong clinching mechanism to the cam controlled supporting bar operating mechanism so that the supporting bar and prong clinching members move in unison, and means for forwarding the punched metal tape a distance such that the next punching operation will perforate the metal tape at the proper clip formation spacing, said forwarding mechanism utilizing two cams and connecting members, one of said cams and the connecting mechanism acting to move the metal tape forwarding mechanism endwise, while the other cam and its connecting mechanism acts to move the forwarding mechanism perpendicular thereto, thus producing a forwarding mechanism which first lifts perpendicular from the punched tape, then moves endwise and lowers perpendicular into pulling engagement with the punched tape, following which it moves endwise in opposite direction to pull the tape to the point required for the next punching operation.

16. In a machine of the character described, the combination which includes a means for suitably perforating metal tape, a puller bar for said perforated metal tape, at least one sliding carrier member for said puller bar, said carrier member being adapted to permit said puller bar to slide endwise thereon, a mounting member for said sliding carrier member, said mounting member being adapted to have said sliding carrier member slide thereon in a direction perpendicular to the endwise movement of the puller bar, a cam for controlling the endwise movement of said puller bar, means for operably connecting said cam to said puller bar, a cam for controlling the movement of said sliding carrier member, and means for operably connecting said cam to said sliding carrier member.

17. In a machine of the character described, the combination which includes a means for suitably perforating metal tape, a puller bar for said perforated metal tape, at least one sliding carrier member for said puller bar, said carrier member being adapted to permit said puller bar to slide endwise thereon, a mounting member for said sliding carrier member, said mounting member being adapted to have said sliding carrier member slide thereon in a direction perpendicular to the endwise movement of the puller bar, a cam for controlling the endwise movement of said puller bar, means for operably connecting said cam to said puller bar, a cam for controlling the movement of said sliding carrier member, means for operably connecting said cam to said sliding carrier member, means for forming metal clip blanks from said perforated metal tape, and means for forming said blanks into clips and installing same.

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