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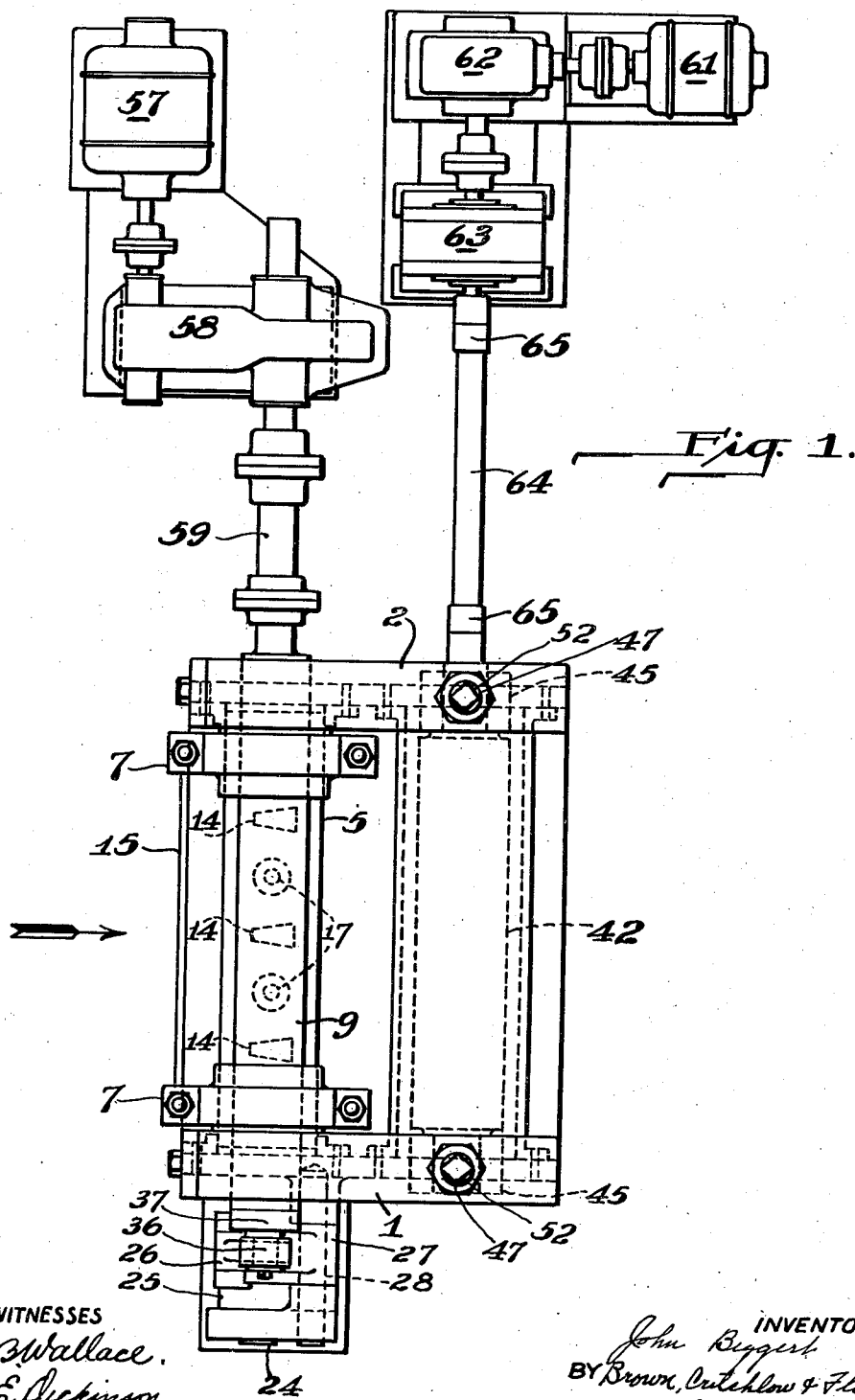
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METHOD AND APPARATUS FOR STITCHING METAL STRIP

Filed April 20, 1934

5 Sheets-Sheet 1



WITNESSES

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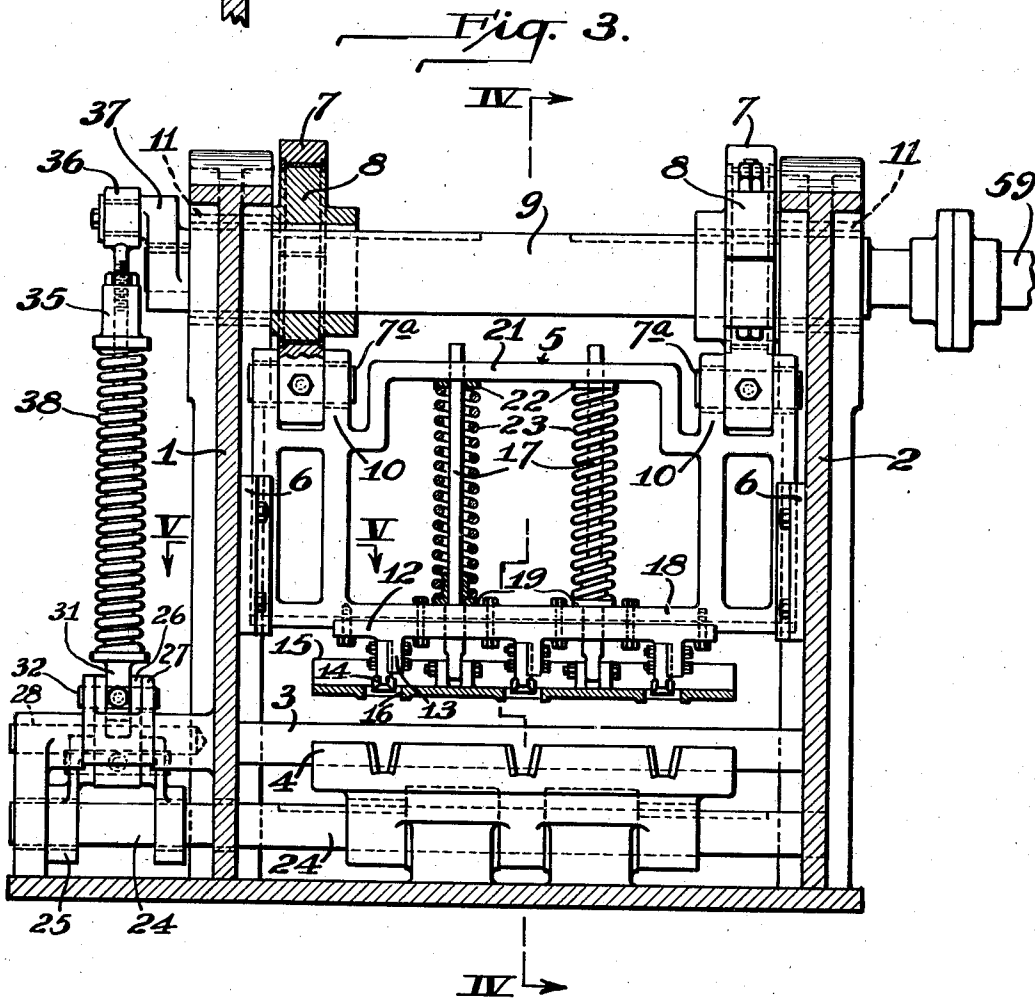
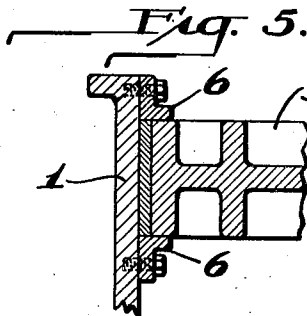
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METHOD AND APPARATUS FOR STITCHING METAL STRIP

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5 Sheets-Sheet 3



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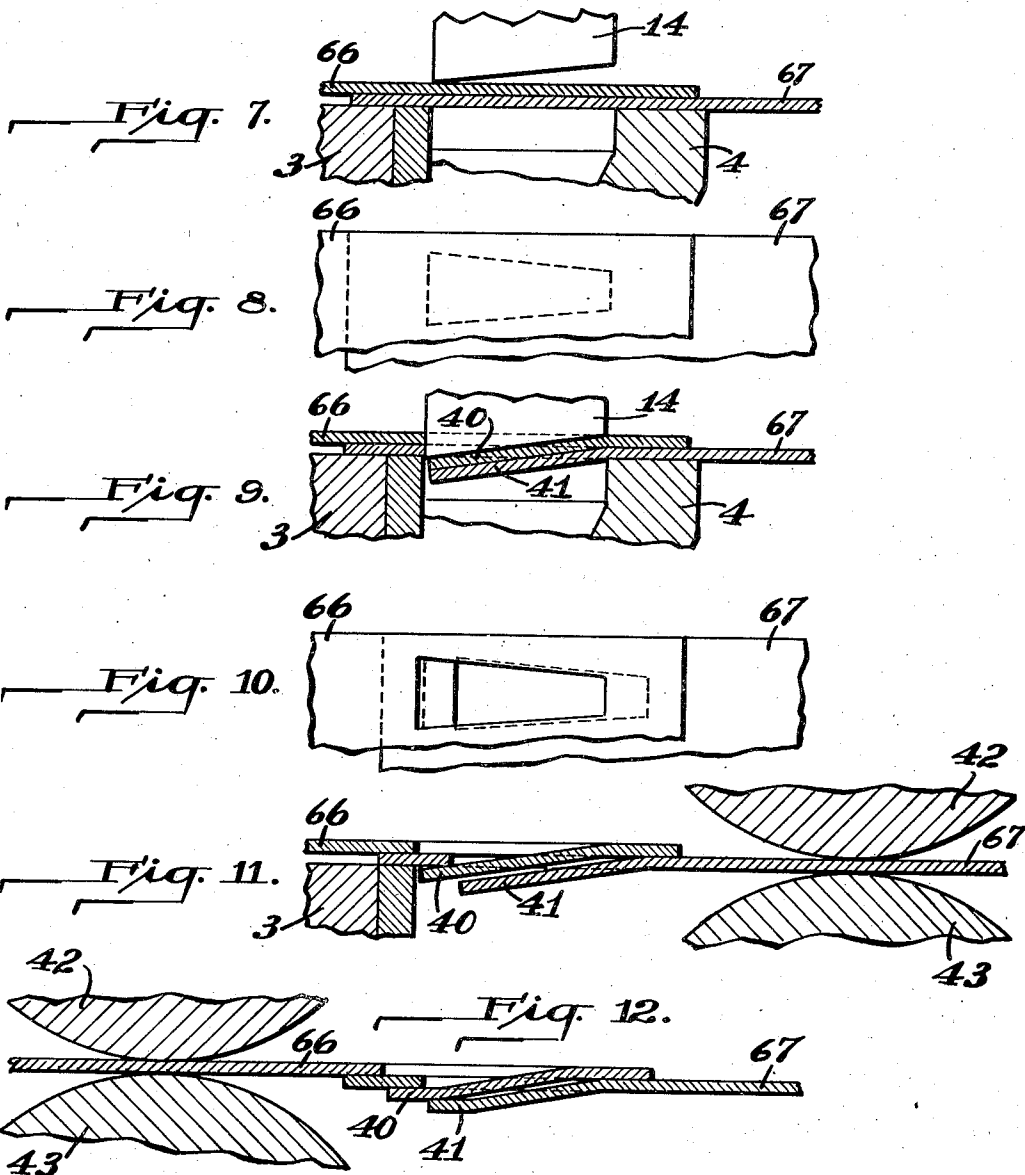
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METHOD AND APPARATUS FOR STITCHING METAL STRIP.

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR STITCHING
METAL STRIPJohn Biggert, Crafton, Pa., assignor to United
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7 Claims. (Cl. 164—109)

This invention relates to the handling and treating of metal strip, and more particularly to a method and apparatus for connecting, or stitching, the ends of two or more pieces of such material together to facilitate the handling and manipulation thereof in various continuous treating processes such as pickling and annealing.

An object of the invention is to provide a novel and improved method of joining the ends of metal strip together by a simple punching and clamping or stitching operation.

Another object is to provide an improved apparatus for accomplishing the aforementioned operations which is simple and sturdy of construction, and efficient and dependable in operation.

These and various other objects as well as the various other novel features and advantages of the invention will be apparent when the following detailed description is read in conjunction with the accompanying drawings of which Fig. 1 is a plan view of a strip-stitching machine constructed in accordance with the invention; Fig. 2 an end view of the machine shown in Fig. 1 except for a part of the rocking mechanism for the movable portion of the lower die of the punch press which is shown in section; Fig. 3 a sectional view taken on the line III—III of Fig. 2; Fig. 4 a sectional view taken on the line IV—IV of Fig. 3; Fig. 5 a sectional view taken on the line V—V of Fig. 3; Fig. 6 a sectional view on larger scale taken on the line VI—VI of Fig. 2; Fig. 7 a fragmentary sectional view showing the ends of two pieces of strip in position in the punch press ready to be connected together and illustrating the punch just prior to its entry into the strip; Fig. 8 a plan view looking down on the strip and illustrating in dotted lines the shape of the punch press die; Fig. 9 a view similar to Fig. 7 but showing the punch at the lower end of its punching stroke; Fig. 10 a view showing the strip ends after they have been punched and moved relative to one another sufficiently to lock them together; Fig. 11 a view similar to Fig. 9 showing the ends of the strips after they have been locked together as shown in Fig. 10, but prior to their entry between the compressing or pinch rolls of the stitching machine; and Fig. 12 a view illustrating the stitch after the ends of the strip have been passed through the pressing rolls.

Referring in detail to these drawings the numerals 1 and 2 designate the end uprights or supporting frames of the embodiment of the invention illustrated. At the base of these uprights on the entrance side of the machine a plurality of punch dies is provided which consists of a stationary

member 3 rigidly secured between the uprights and a plurality of cooperating movable die-forming elements 4, the number of which depends upon the number of punches employed in the machine which in turn may vary with the width of the machine or the width of the strips to be joined together.

Directly over these stationary and movable die elements 3 and 4, a punch-supporting frame 5 is mounted for guided vertical reciprocation between pairs of spaced guides 6 attached to the inner faces of the uprights 1 and 2. The upper end of this frame is pivotally attached adjacent its edges by pins 7a engaged in brackets 10 to a pair of yokes 7 that are mounted upon a pair of eccentrics 8 provided on a drive shaft 9 supported in suitable bearings 11 located in the tops of the uprights 1 and 2. On the lower end of this punch-supporting frame 5 there is secured a punch carrier 12 provided with a plurality of spaced lugs 13 to which the punches 14 are attached, being affixed thereto in such a way that they may be easily renewed or repaired. When the shaft 9 is rotated the eccentrics 8 and yokes 7 cause the frame 5 to be reciprocated, moving the punches into and out of engagement with the die-forming elements 3 and 4.

To firmly hold the strip ends in place during the punching operation and effectively prevent the strips from clinging to the punches as they are pulled out of the dies, a stripping element 15 is mounted on the lower end of the frame 5. This stripper as shown in Figs. 3 and 4 is extended across the bottom of the frame 5 and provided with openings 16 through which the punches 14 are allowed to move. Between its ends there is connected to it a plurality of pairs of spaced oppositely disposed rods 17. These are extended upwardly through suitable openings in the lower cross-piece 18 and the upper cross piece 21 of the frame 5 and provided with keyed collars 19 above the cross-piece 18 which normally support the stripper just below the ends of the punches 14. On these rods coil springs 23 are provided with their lower ends bearing against the collars 19 and their upper ends engaging suitable loosely mounted fittings 22 disposed adjacent the upper cross-piece 21. Under the influence of such springs when the frame 5 is moved downwardly the stripper 15 is yieldingly forced against the ends of the strips before the punches contact them, and likewise held against them on the up stroke of the punches until after the punches are lifted out of contact with the strips,

thereby effectively stripping the material from the punches.

As shown in Figs. 4, 7 to 12, inclusive, the punches 14 are so designed as to punch from the strip ends trapezoidal shaped tongue-like portions 40 and 41 which are attached to the body of the strips at their narrow ends and which have their free ends deflected downwardly sufficiently so that they lie below the lower edge of the lower strip. After these portions are punched from the strips and the punching elements released, the strips are moved relative to each other as shown in Figs. 10 and 11 to thereby lock the two strips together. This locking is produced by the tongues 40 and 41 being slid below the body of the strips and as will be readily appreciated is accomplished with little effort without straining the punched lugs as the sides thereof are tapered outwardly so as to permit them to be so moved without the frictional edge resistance which is encountered when straight sided punchings are employed to produce the stitches.

To facilitate the removal of the strips from the press after the punching operation, the sides and rear edges of each of the lower punch dies are formed in a movable element 4, which as shown in Fig. 4 is mounted on a shaft 24 supported in the base of the uprights 1 and 2 and adapted to be rotated out of the path of the punchings 40 and 41 as the punch frame 5 is moved away from the strips.

To actuate the die elements 4 in the manner referred to the shaft 24 has keyed to it at one end a crank or yoke-like lever 25 which is in turn connected at its free end to a pair of pivotally connected links 26 and 27, the latter of which is pivotally secured to a shaft 28 mounted on the outside of the end upright 1. At the union of these two links 26 and 27 a flexible connecting rod designated generally by the numeral 30 is connected. As shown, this connecting rod comprises a tubular rod 33 which is connected by a fitting 31 formed in its lower end to a pivot 32 to which the two connecting links 26 and 27 are connected. Within the tubular portion 33 of this rod there is arranged a reciprocable plunger 34 which is connected by a rod 30 to a yoke 36 pivotally secured to a crank 37 provided on the outer end of the punch frame actuating drive shaft 9. Between this lower fitting 31 and an upper fitting 35 located on the upper end of rod 30 there is arranged a helical spring 38 which is utilized to permit the movable die sections 4 to be moved into operative position before the punches of the punch press reach the die and to effect the retraction of such sections out of engagement with the strip after the punches have been removed from the die.

In accordance with this construction when the shaft 9 is rotated to move the punch frame 5 downwardly the crank 37 connected to the connecting rod 29 is moved in a corresponding direction, causing the link connections 26 and 27 to be moved downwardly, and the lever 25 to be rotated to the left whereby moving the die elements 4 into their punch-receiving positions which they reach before the crank 37 reaches the lower end of its stroke. As soon as the die sections 4 are in their operative positions the springs 38 begin to flex and take up the further displacement of the rod 30, the compression in such springs which is so established being utilized to assist in holding the die in its operative position. To positively insure the return of the die elements 4 to their inoperative positions on the

up stroke of the rod 30 a sleeve 39 is secured to the inside of the tube 33 at its upper end to be engaged by the plunger 34. Hence as the rod 30 is carried upwardly the plunger 34 engages this sleeve 39 and positively lifts the tube 33, thereby returning the die elements 4 to their inoperative positions.

To firmly lock the stitch and thereafter pass the resultant continuous strip out of the press, a pair of pinch or pressure rolls 42 and 43 is provided. These rolls are mounted in suitable bearings 44 and 45 disposed in a pair of windows 46 provided in a rearwardly extending portion of the uprights 1 and 2.

As will be readily appreciated from an observation of Figs. 11 and 12 one or both of the pinch rolls must be yieldably mounted in order to accommodate the overlapped portions of the composite strip as they are moved therebetween. To provide for this in the present structure the upper bearings 45, carrying the upper roll 42, are mounted for vertical adjustment and biased toward the lower roll by a pair of spring coils 48 which have their lower ends engaged in recesses 49 in the tops of the bearings 45 and their upper ends disposed to engage fittings 51 provided at the lower end of a pair of screws 47 mounted in the tops of the windows 46, said screws being equipped with non-circular ends 52 for the reception of any suitable tool for effecting their adjustment. Depending on the thickness of the strip, the pressure applied by these springs, while sufficient when the rolls are driven to pass the strip through the press, may or may not be sufficient to firmly lock or press the overlapped portions thereof and the stitching flaps together. To provide a positive means for supporting the rolls in carrying out this locking operation an adjustable wedge or stop is arranged between the upper ends of the bearings 45 and shoulders 53 formed in the windows 46. These wedges each comprise a tapered bifurcated fitting 54 secured to the top of the bearing by any suitable means such as screws 50. Mounted above the fitting 54 is a cooperating wedge shaped member 55 which is movable relatively thereto by means of adjusting screw 56. By adjusting the member 55 as will be apparent from Fig. 6 the distance between the top of the member 55 and the shoulder 53 may be varied. This distance represents the amount of space required between the rolls to accommodate the overlapped portions of the strip entered between them before the positive pressure is applied. As will be apparent from the above, the displacement of the rolls necessary to allow for single, double, or triple thickness of the strip may be permitted and after which any further opening of the rolls is prevented by reason of the wedge 55 being brought into contact with the shoulder 53 thereby providing a positive resistance for the rolls to lock the stitching flaps together.

To operate the punch press an individual motor 57 is connected to the drive shaft 9 through a suitable gear reducing unit 58 and a flexible shaft 59. The pinch rolls 42 and 43 are likewise driven by separate motor 61, although this particular driving arrangement is not necessary. As illustrated, this motor is connected through a reduction unit 62, a pinion stand 63, and the pinions thereof connected by a pair of shafts 64 to the ends of the pinch rolls 42 and 43, flexible coupling 65 being used with such shafts to permit the upper pinch roll to be adjusted without interfering with the drive.

In practicing the invention the leading end 66 of one strip is fed into the punch press in juxtaposition with the trailing end 67 of a preceding strip. When the ends of two strips are thus located with respect to each other the motor 57 is set in motion by any suitable control, not shown, causing the shaft 9 to rotate. This, as previously described, causes the punch supporting frame 5 to be moved downwardly. Coincident with the downward movement of the punching frame, die elements 4 are rotated through the operation of the connecting rod 29 and toggle connections 25, 26 and 27 into cooperative position with the stationary member 3, reaching their operative position before the punches reach the strip. During the continued downward movement of the frame 5 the stripper 15 engages the ends of the strips to hold them in place and the punches are passed therethrough, striking from the strips the trapezoidal shaped lugs illustrated in Figs. 7 to 12.

Further rotation of the shaft 9 after the punch operation is completed causes the frame 5 to be moved upwardly toward its position of rest. During this upward movement the punches 14 are first withdrawn from the strip, the stripper 15 remaining in contact with the strip sufficiently long to insure the strip being removed from the punches. In sequence the die elements 4 are pulled away from the strips and are rotated into their inoperative position which allows the unobstructed movement of the overlapped ends of the strip toward the pinch rolls.

At the first movement of the pinch rolls only the strip 67 is moved until the lugs 40 and 41 engage the rear ends of the punch openings in the other strip 66. The two are then moved and the stitch passed through the pinch rolls whereupon the lugs 40 and 41 are firmly pressed against the body of the strips as shown in Fig. 5 to provide a sturdy and firmly locked stitch. Thereafter the two pieces may be passed continuously through a treating operation.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. Apparatus for stitching the ends of two metal strips together comprising a punch press equipped with punches adapted to strike from the strip ends when placed therein, tongue-like lugs having outwardly flared side edges and attached to the body of the strips at their narrow ends, and means for moving one of said strips relative to the other after the lugs are formed to lock the strips together and to also firmly press the lugs into engagement with the strip and with each other to enhance the grip of the stitch.

2. Apparatus for stitching the ends of two metal strips together comprising a punch press consisting of a punch mounted on a reciprocable punch carrier, means for reciprocating said carrier, a two-piece die disposed to cooperate with

said punch, a strip clamping and stripping member mounted on said carrier, yieldable means for causing said latter member to clamp the strip to said die in advance of the punch reaching the die and hold said strip until after the punch is removed from it, and means for moving one section of said die into and out of operative position in timed relation with said punch.

3. The method of joining the ends of two pieces of metal strip together consisting of placing the ends thereof in juxtaposition, striking therefrom superimposed tongue-like lugs having outwardly flared side edges, deflecting the free ends of said lugs below said strip, moving one strip end to lock said lugs against the rear edges of the openings in the strip formed thereby and pressing said lugs firmly against each other and against the strips proper to enhance the locking effect of the stitch so formed.

4. Apparatus for stitching the ends of two metal strips together comprising a punch press equipped with one or more punches designed to strike from strip mounted thereunder, one or more outwardly flared lugs attached to the strip at the narrow end thereof, a pair of pinch rolls for drawing the strip through the press and tightly locking the stitch formed, means for operating said press, and means for actuating said pinch rolls.

5. A strip stitching machine comprising a supporting frame, a punch die mounted in said frame, a punch carrier mounted over said die for vertical reciprocation in said frame, means for reciprocating said carrier, a punch mounted on said carrier which is designed to cooperate with said die to simultaneously strike from two pieces of strip mounted thereon, tongue-like lugs of a trapezoidal shape attached at their narrow ends to the strip, means for moving one of the strips to engage said lugs against the strip at the rear edge of the opening so formed in the lower strip, means for adjusting said die to permit such movement of the strip, and means for moving the stitched strips out of the press and firmly pressing the stitching lugs against the strip to enhance the grip of the stitch.

6. A strip stitching machine comprising a supporting frame, a punch die mounted in said frame consisting of a stationary forward section and an adjustable rearward section, means for pivotally supporting said rearward section, a punch disposed to cooperate with said die to produce a trapezoidal shaped punching attached at its narrower end to the material from which it is cut, means for operating said punch, means operated in synchronism therewith for moving said adjustable die section into and out of operative position and means for clamping the material to the die and stripping it from said punch.

7. In a strip stitching machine, a punch press for striking from strip ends mounted thereon stitch-forming lugs, a pair of pinch rolls associated therewith for pulling the strip through the machine and locking the strip ends together after they are punched, and means for positively determining the extent of separation of said pinch rolls.

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