Nov. 26, 1929. L. H. MORIN 1,737,262

METHOD OF MAKING FASTENING DEVICES

Original Filed Oct. 7, 1926 4 Sheets-Sheet 1

Fig. 1.

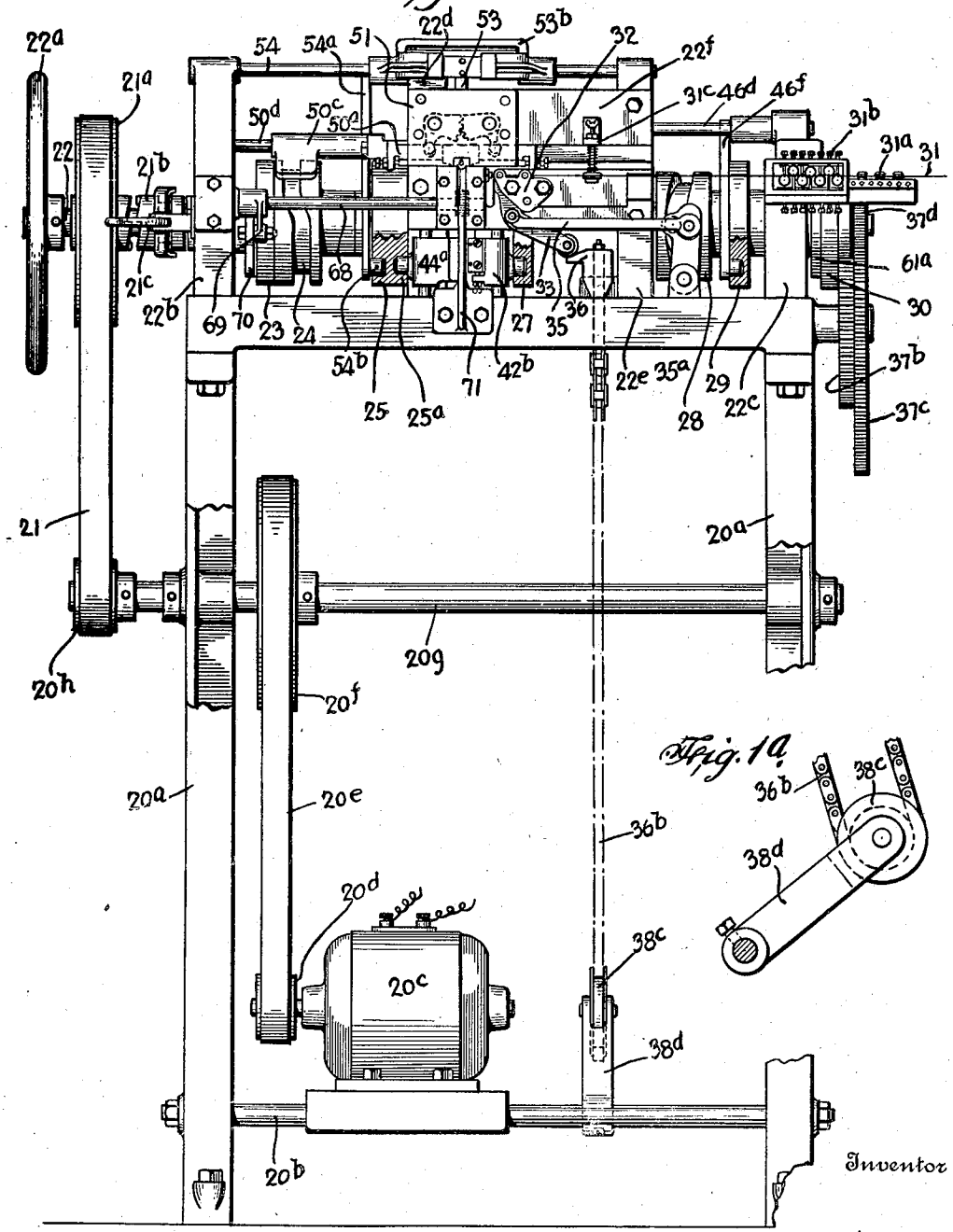


Fig. 1a.

Inventor

Louis H. Morin

By Howard C. Thompson

Attorney

Nov. 26, 1929. L. H. MORIN 1,737,262

METHOD OF MAKING FASTENING DEVICES

Original Filed Oct. 7, 1926 4 Sheets-Sheet 2

Fig. 2.

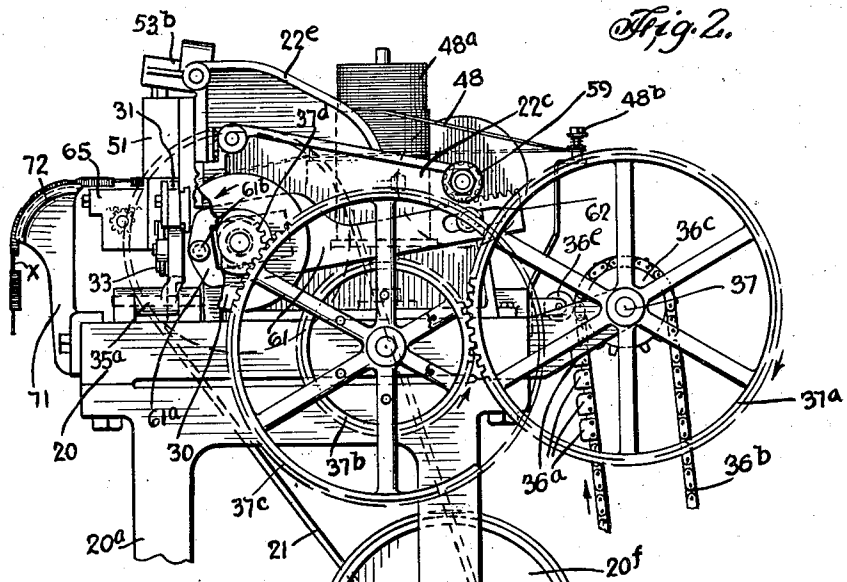


Fig. 4.

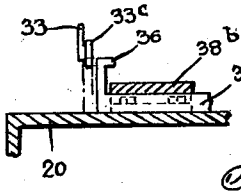


Fig. 3.

Nov. 26, 1929. L. H. MORIN 1,737,262

METHOD OF MAKING FASTENING DEVICES

Original Filed Oct. 7, 1926 4 Sheets-Sheet 3

Fig. 5.

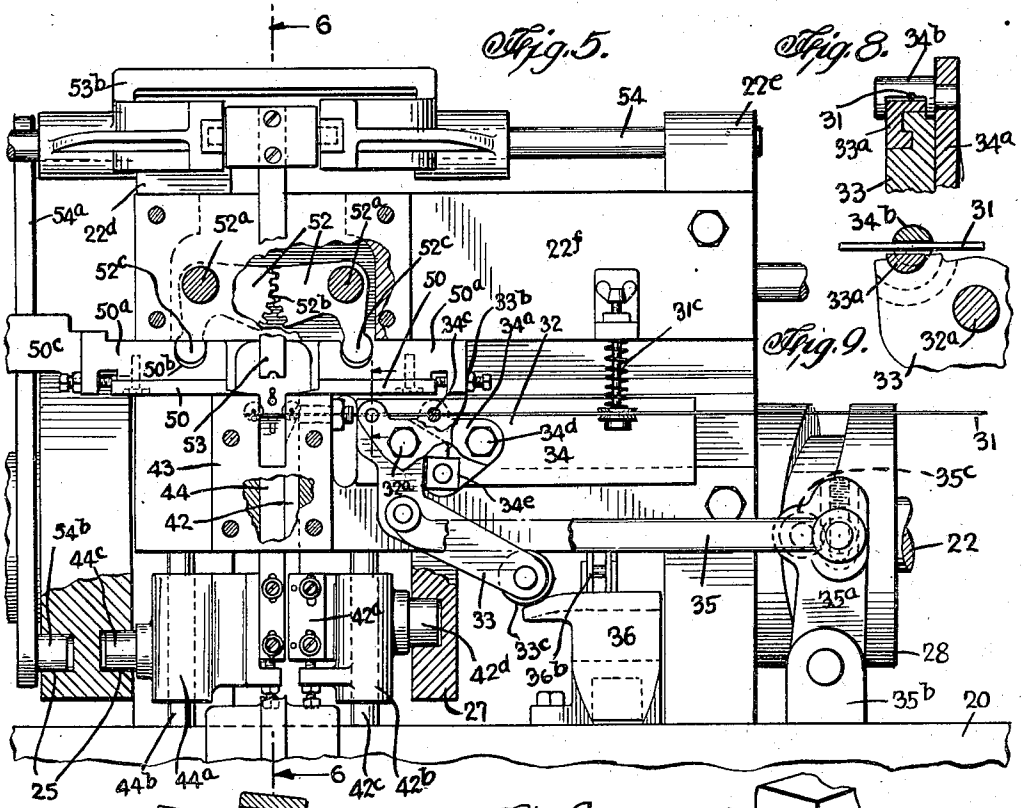


Fig. 8.

Fig. 9.

Fig. 6.

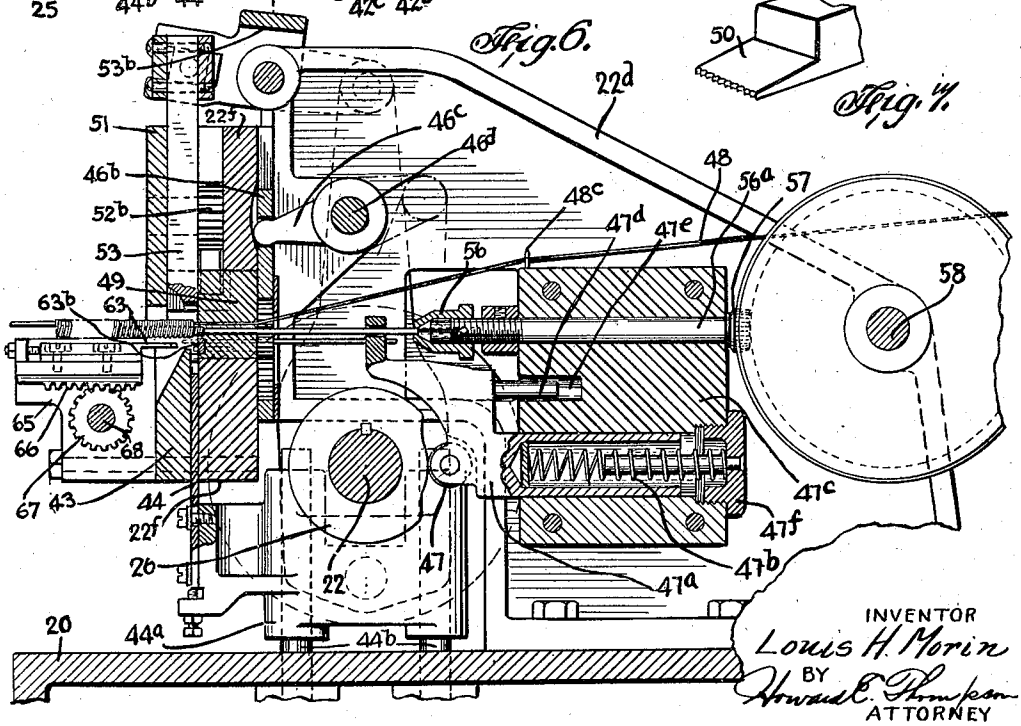


Fig. 7.

INVENTOR
Louis H. Morin
BY
Howard E. Thompson
ATTORNEY

Nov. 26, 1929. L. H. MORIN 1,737,262

METHOD OF MAKING FASTENING DEVICES

Original Filed Oct. 7, 1926 4 Sheets-Sheet 4

Fig. 10.

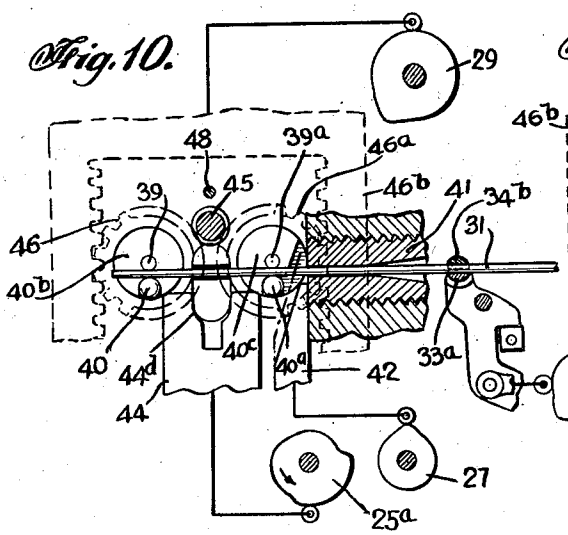


Fig. 11.

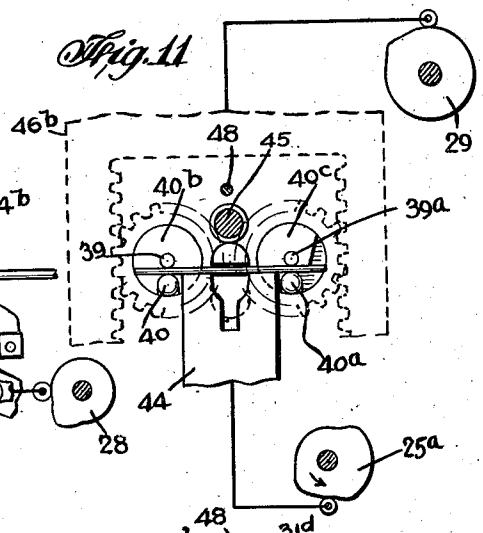


Fig. 12.

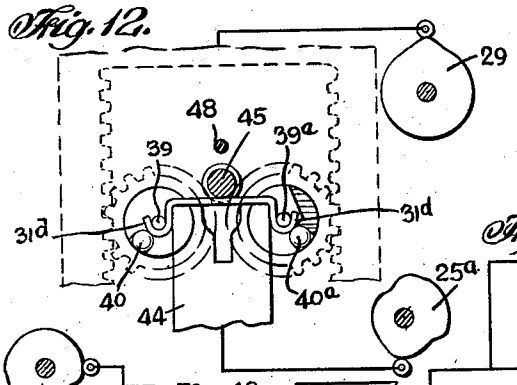


Fig. 13.

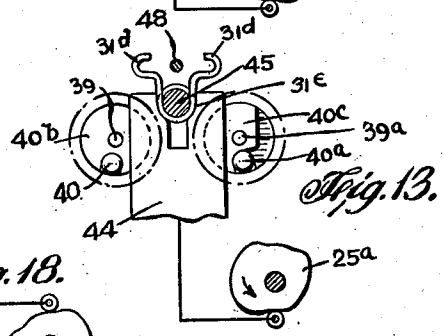


Fig. 18.

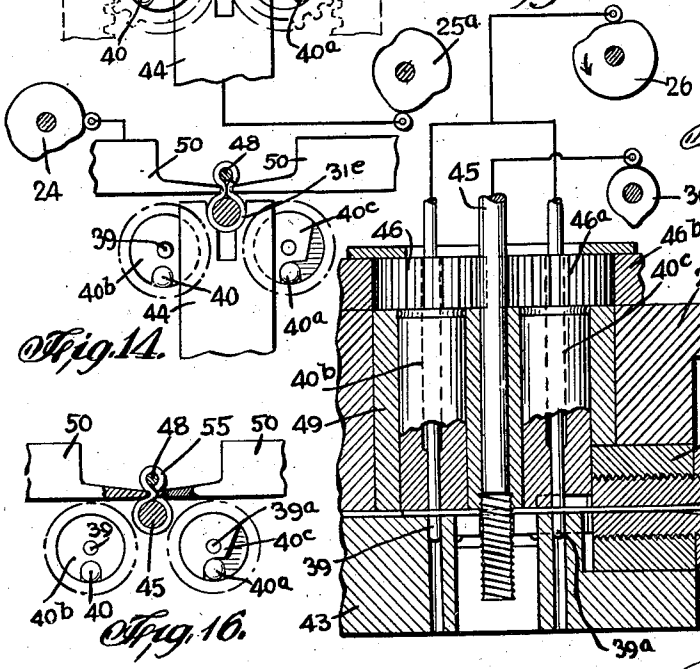


Fig. 15.

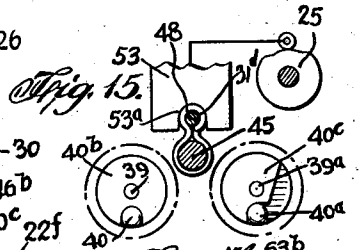


Fig. 14.

Fig. 17.

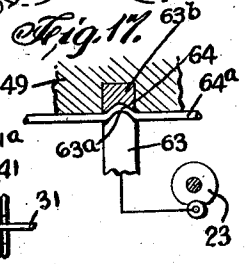


Fig. 16.

INVENTOR
Louis H. Morin
BY
Howard C. Thompson
ATTORNEY

Patented Nov. 26, 1929 1,737,262

UNITED STATES PATENT OFFICE

LOUIS H. MORIN, OF NEW YORK, N. Y., ASSIGNOR TO CAMBRIDGE RUBBER COMPANY, OF CAMBRIDGE, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

METHOD OF MAKING FASTENING DEVICES

Original application filed October 7, 1926, Serial No. 140,005. Divided and this application filed May 11, 1928. Serial No. 277,008.

This invention relates to fastening devices comprising stringers, each containing a plurality of links so fashioned that the separate stringers are adapted to be coupled together when the links thereof are interlocked, and particularly to a method for manufacturing devices of this class, and particularly devices similar to that shown, described and claimed in United States Patent No. 1,557,304, dated October 13, 1925, granted to Davis Marinsky; and the object of the invention is to provide a machine into which strands of wire and fabric are fed, means being provided to sever from the wire strand, workpieces of predetermined length, fashioning the workpieces into predetermined form and then passing the same onto a mandrel which also functions as a feed screw, and further passing the ends of the workpiece around the fabric or other mounting strand fed into the machine, and securing the workpieces to said strand to form of said workpieces, link members having loop portions which project radially from said mounting strand; a further object being to provide a method whereby the several link members may be arranged on the mounting strand in juxtaposition or abutting relation, and further whereby the operation of the mandrel and feed screw will discharge the links and mounting strand from the machine; a still further object being to provide means for rendering the wire feed inoperative for a predetermined period of time, to provide on the stringers formed, blank spaces or in other words, spaces where the links are not secured to the mounting strand, the strand serving merely to couple the stringers together to facilitate further production of the complete device; a further object being to provide a method whereby the number of links contained in the respective groups on the mounting strand may be governed, as well as the spaces between said groups; and with these and other objects in view, the invention consists in the construction of devices of the class referred to in accordance with the method hereinafter more fully set out.

The invention herein set forth constitutes divisional subject matter of a prior application filed by me, October 7, 1926, and bearing Serial No. 140,005 and is fully disclosed in the following specification, of which the accompanying drawing forms a part, in which the separate parts of my improvement are designated by suitable reference characters in each of the views, and in which:

Fig. 1 is a front view of a machine made according to my invention, with parts of the construction broken away and in section.

Fig. 1ª is a detail view of a part of the construction shown in Fig. 1.

Fig. 2 is a side view of the machine seen in Fig. 1, with part of the construction omitted.

Fig. 3 is a plan view of the machine, with parts of the construction broken away and in section.

Fig. 4 is a partial section on the line 4—4 of Fig. 3.

Fig. 5 is a view similar to Fig. 1, and showing only a part of the machine on an enlarged scale, and with part of the construction broken away and in section.

Fig. 6 is a partial section on the line 6—6 of Fig. 5.

Fig. 7 is a perspective detail view of a crimping jaw, two of which are employed.

Figs. 8 and 9 are sectional, detail views of parts of a wire feed which I employ.

Figs. 10 to 17 inclusive, are diagrammatic views illustrating the several steps in the formation of the separate links of the fastener device in question, and securing the same to a mounting strand; and,

Fig. 18 is a horizontal, sectional view diagrammatically illustrating the arrangement of parts seen in Fig. 10 of the drawing.

In Fig. 1 of the drawing, I have shown at 20, the table or base of the machine proper, supported upon side frame members 20ª. Mounted upon rods 20ᵇ or other supports at the lower end of said frame members is an electric motor 20ᶜ on the shaft of which is a pulley 20ᵈ around which a belt or chain 20ᵉ is passed, said belt or chain passing around another pulley 20ᶠ on a shaft 20ᵍ supported in the frame member 20ª. One end of said shaft projects through the frame member and is provided with a pulley 20ʰ. A belt 21 passed around the pulley 20ʰ and a

pulley 21ª is freely mounted upon a driven shaft 22 of the machine, the pulley 21ª being coupled with the shaft through a clutch 21ᵇ operated by a hand lever 21ᶜ clearly seen in Fig. 3 of the drawing. A hand lever 22ª is secured to the shaft 22 outwardly of the pulley 21ª, by means of which, said shaft may be rotated whenever desired, and especially in making adjustments on the several parts of the machine.

The driven shaft 22 is mounted in two bearings 22ᵇ and 22ᶜ on the table 20 of the machine, and other bearings 22ᵈ and 22ᵉ are employed for supporting other shafts, later described. The shaft 22 extends transversely of the machine and secured thereto is a plurality of cams for actuating the several parts or mechanisms of the machine, said cams being designated by the reference numerals 23, 24, 25—25ª, 26 (note Fig. 6) 27, 28, 29 and 30, it being noted that the cams 25—25ª constitute one body having different cam faces on the opposite sides thereof.

The wire 31 from a spool or other source of supply, in entering the machine, first passes through two sets of straightening rollers 31ª and 31ᵇ arranged in different planes, then through an adjustable tension device 31ᶜ and into and through a wire feed 32 comprising a lever 33, a slide plate 34 slidably mounted in and keyed to a frame plate 22ᶠ extending between and secured to the front faces of the bearings 22ᵈ and 22ᵉ. Secured to the slide plate 34 is a supplemental plate 34ª, the lever 33 being pivoted to and between the plates 34—34ª as seen at 32ª. The short end of the lever 33 has a jaw piece 33ª movable relatively to a fixed jaw piece 34ᵇ on the plate 34ª to clamp and firmly grip the wire 31 in the movement of the slide from right to left in the feed of said wire. The wire also passes through an aperture in a fixed pin 34ᶜ secured to the plate 34ª. A screw 34ᵈ aids in securing the plate 34ª to the slide 34, and supported between the plate and the slide is a rectangular block 34ᵉ in connection with which a pawl portion 33ᵇ on the lever 33 operates.

Pivotally coupled with the lever 33 is a rod 35 which extends to the right and is pivoted to a rocker arm 35ª mounted in a block 35ᵇ supported on the table 20 of the machine. The arm 35ª carries a roller 35ᶜ which operates in the groove of the cam 28. The cam 28 serves to impart movement to the lever 33 and the carriage 34 to advance the wire 31 into the machine, it being understood that in the movement of the rod 35 to the right, the jaws 33ª—34ᵇ are opened and the feed device passes freely over the wire 31.

The free end of the lever 33 is provided with an anti-friction roller 33ᶜ which is adapted to pass over a shoe 36 when moved into the path of the roller 33c to hold the jaw 33ª of the lever 33 in inoperative position to prevent the feeding of the wire 31 for a predetermined number of cycles of the machine. The movement of the shoe 36 is controlled by employing a plurality of blocks 36ª on the links of a chain 36ᵇ which passes around a sprocket 36ᶜ secured to the shaft 37, geared to the shaft 22 through a chain of gears 37ª, 37ᵇ, 37ᶜ and 37ᵈ. The shoe 36 is mounted on a slide rod 36ᵈ having a roller 36ᵉ at its inner end in connection with which the blocks 36ª operate. A spring 36ᶠ is employed to normally hold said rod and the shoe 36 in inoperative position, but the same is moved into position to engage the roller 33ᶜ when the blocks 36ª engage the roller 36ᵉ and move the shoe 36 outwardly.

The shaft 37 is supported in a U-shaped bearing plate 38, and the rod 36ᵈ is supported in guide blocks 38ª and 38ᵇ, the latter being clearly seen in Fig. 4 of the drawing. It will also be noted that the chain 36ᵇ is passed around a guide pulley 38ᶜ supported in an adjustable arm 38ᵈ mounted on one of the rods 20ᵇ. With this construction, and further by the use of arms 38 of different lengths, the length of the chain 36ᵇ may be varied to suit the requirements, it being understood that the chain length will govern the number of fastening devices mounted in juxtaposition on the mounting strand employed, while the number of blocks 36ª will govern the length of the space between the groups of fastening devices on said strand.

In feeding the wire 31 into the machine, the end portion thereof passes between two sets of pins 39—39ª, 40—40ª mounted in oscillatory members 40ᵇ and 40ᶜ respectively, the pins 40 and 40ª being movable with said members, while the pins 39 and 39ª are mounted in the axis of said members and are movable longitudinally thereof. The wire 31 is guided into position between the pins through a threaded sleeve 41 mounted in a block 41ª secured to the plate 22ᶠ. When the wire is in position, a cutter blade or shearing tool 42 is moved upwardly and transversely across the wire, to shear off a workpiece, the blade being supported between the plate 22ᶠ and a plate 43 secured thereto. The lower end of the blade 42 carries a plate 42ª adjustably supported on a block 42ᵇ movable vertically on two rods 42ᶜ, the block 42ᵇ carrying a roller 42ᵈ which operates in the groove of the cam 27 employed for imparting movement to the shear-off tool or blade 42.

At one side of the blade 42 is a forming tool 44 which moves upwardly with the blade 42 in the shearing operation, a predetermined degree, sufficient to engage the wire to hold the workpiece cut therefrom in position as seen in Fig. 11 of the drawing. The tool 44 is also supported and guided within and between the plates 22ᶠ and 43, and is adjustably coupled with a block 44ª slidable upon guide

rods 44[b], the block 44[a] carrying a roller 44[c] which operates in the groove of the cam 25[a]. The rods 42[c] and 44[b] are supported upon the table 20 of the machine as clearly seen in Figs. 5 and 6 of the drawing. The upper end of the forming tool 44 is provided with an arc-shaped recess 44[d] of such circumference as to bend the wire workpiece around a mandrel and feed screw 45 as later described.

The tool 44 has three distinct upward movements from the normal position of the tool seen in Fig. 10 of the drawing, the first movement being illustrated in Fig. 11, the second in Fig. 12, and the last in Fig. 13, and from the position shown in Fig. 13, it returns to the position shown in Fig. 10.

After the tool 44 has been raised to the position shown in Fig. 11, the end portions of the wire workpiece are fashioned to form open loops 31[d], which result is accomplished by the partial rotation of the oscillatory members 40[b] and 40[c] to move the pins 40 and 40[a] laterally and circumferentially with reference to the pins 39—39[a] from the position shown in Figs. 10 and 11 to that seen in Fig. 12. The members 40[b] and 40[c] are provided at their inner ends with gears 46—46[a] which mesh with a vertically slidable rack 46[b] supported in connection with the plate 22[f]. A rocker arm 46[c] is coupled with the upper end of the rack and mounted upon a shaft 46[d], said shaft being supported in the bearings 22[c], 22[d] and 22[e]. A lever 46[e] is secured to said shaft adjacent the bearing 22[c] with which lever, a link 46[f] is coupled, and carries a roller engaging the groove of the cam 29, note Fig. 1, to impart reciprocating movement to said shaft 46[d] to raise and lower the rack 46[b]. The raising of said rack causes the members 40[b] and 40[c] to rotate a partial revolution, forming the loops 31[d] as above stated. In this operation of forming said loops, the tool 44 has been raised slightly to bring the workpiece into engagement with the lower face of the mandrel and feed screw 45, and into one of the grooves between the threads of said screw.

For a short period of time, the tool 44 remains in the position seen in Fig. 12, and the pins 39 and 39[a] are moved backwardly or withdrawn from the face of the members 40[b] and 40[c], and at the same time, the pins 40 and 40[a] are partially returned to their normal position, after which the tool 44 advances upwardly around the mandrel 45 to form, centrally of the workpiece, a large loop 31[e] as seen in Fig. 13.

The above described operation of withdrawing the pins 39, 39[a] is accomplished by the action of the cam 26 upon a roller 47 supported in a slidable block 47[a] in connection with the upper end of which the two pins 39—39[a] are supported, the block 47[a] being normally held outwardly by a spring 47[b] arranged in a tubular portion of said block, the block being supported in a plate 47[c] secured to the bearing 22[d]. A pin 47[d] on the block 47[a] enters an aperture 47[e] in the plate 47[c] to key and guide said slide block in its movement. The spring 47[b] is seated in a cap 47[f] secured to the plate 47[c].

It will be understood that the withdrawal of the pins 39—39[a] permits of the upward movement of the workpiece into the position shown in Fig. 13 of the drawing. After the workpiece has been completely formed, and the tool 44 lowered into its normal position, said pins are again projected to receive the end of the wire fed into the machine. It will also be noted that when the workpiece is in the position shown in Fig. 13 of the drawing, the small loops 31[d] are arranged at the opposite sides of a mounting strand 48 which may be composed of any suitable flexible material taken from a spool 48[a] seen in Fig. 2 of the drawing, and passed around a tension device 48[b] forwardly through a guide loop 48[c] on the plate 47[c] and through an aperture in a bearing block 49 supported in the plate 22[f], in which block, the members 40[b] and 40[c] are mounted, as well as the mandrel 45. The strand is arranged just above the mandrel 45 and in axial alinement therewith, so that when the small loops and end portions of the workpiece are crimped together, the strand 48 will enter said loops and the loops will encircle said strand.

The next or crimping operation above referred to is accomplished by two similar crimping jaws 50, movable toward each other at a point between the mandrel and the strand 48, and just above the mandrel to complete the formation of the loop 31[e]. The edges of the jaws 50 are preferably provided with notches as seen in Fig. 7 of the drawing to receive and definitely space the wire of the workpiece and to retain the small loops side by side and in abutting relation when mounting the same on the strand 48. Each jaw 50 has an enlarged body 50[a] to which it is secured, said body being supported and guided in and between the plate 22[f] and a plate 51 secured to the plate 22[f]. Rocker arms 52 are pivoted between said plates as seen at 52[a] and having intermeshing segmental gear faces 52[b] whereby the movement of one rocker arm will correspondingly move the other arm, and said arms have ball ends 52[c] operating in sockets 50[b] in the bodies 50[a]. The body 50[a] as seen to the left in Figs. 1 and 5 of the drawing, has an extension 50[c] slidably mounted upon a rod 50[d] supported in the bearings 22[b] and 22[d], and which carries a roller operating in the groove of the cam 24 as seen in Fig. 1 of the drawing. From the foregoing, it will be seen that when the jaw 50 at the left of the drawing is moved to the right, the other jaw is moved to the left to bring said jaws together, performing the crimping operation seen in Fig. 14 of the drawing.

The first crimping operation is not complete, and in the cycle of operation of the machine, a finished crimping operation is performed to fixedly secure the small loops 31^d on the mounting strand 48 as seen in Fig. 16 of the drawing.

Intermediate the two crimping operations, a vertical punch tool 53 moves downwardly, and the recess 53^a in said tool passes over the small loops 31^d and firmly compacts and compresses said loops on the mounting strand 48. The tool 53 is mounted in and between the plates 22^f and 51 and is guided thereby, and the upper end of said tool is mounted in a yoke-shaped rocker 53^b mounted upon a shaft 54 supported in the bearings 22^b, 22^d and 22^e. At one side of the rocker 53^b is a projecting lever 53^c with which is pivoted a link 54^a the free end of which carries a roller 54^b which operates in the groove of the cam 25. With this construction, the rocker 53^b is oscillated to impart vertical movement to the tool 53 for the purpose above stated.

After the last crimping operation, above referred to has been performed, the mandrel 45 is rotated sufficiently to feed the complete link designated as 55 outwardly, and to correspondingly feed the mounting strand 48 outwardly to allow for the formation of another link in abutting relation to the first named link, it being understood that the two small loops of the completed link are arranged on the mounting strand, while the one large loop projects radially therefrom. As previously stated, the mandrel 45 is supported in the block 49, and the same extends backwardly and passes through the block 47^a and is coupled with a chuck 56 supported on a shaft 56^a having at its inner end a beveled pinion 57 which meshes with a beveled gear 57^a mounted upon a shaft 58 supported in the bearings 22^d and 22^c.

Secured to the shaft 58 where it projects through the bearing 22^c is a gear 59 having a clutch face whereby a spring pressed clutch collar 60, keyed to the shaft 58, will rotate said shaft when the gear 59 is rotated in one direction, and will remain stationary to move outwardly when said gear is rotated in the opposite direction. A rack 61 is in operative connection with the gear 59, said rack being provided with an enlarged head 61^a through which the shaft 22 passes, the head being in the form of a yoke carrying a roller 61^b which operates in the groove of the cam 30, note Fig. 3 of the drawing. The other end of the rack 61 is provided with an elongated aperture in connection with which a pin 62 operates to support the teeth of the rack in engagement with the gear 59, the pin 62 being mounted upon the bearing 22^c note Fig. 2 of the drawing. It will be apparent that the inward or backward movement of the rack 61 will cause the mandrel to be operated through the gears 57 and 57^a, and the forward movement of said rack will retain the mandrel in fixed position, the clutch 60 moving outwardly against the tension of the clutch spring 60^a. It will also be understood that the threads of the feed screw or mandrel 45 will govern the pitch or angular arrangement of the large loops of the links 55. The direction of the pitch may be varied by using mandrels having oppositely arranged threads, or in other words, left and right handed threads may be employed.

The formation of the separate links, as above described, relates to links in which the large loops are straight or unkinked. In devices of the class under consideration, at least one of the two stringers to be coupled together must be composed of links having kinked or offset portions to interlock with the other or plain links. In the formation of the stringers, wherein the links are provided with kinked or offset portions, I provide a punch 63 having a V-shaped end 63^a to form a kink 64 in the wire or rod of a workpiece 64^a cut therefrom, the female portion 63^b of the punch being arranged in alinement therewith, as clearly seen in Fig. 17 of the drawing. This operation is performed in the workpiece 64^a when it is in a position similar to that shown in Fig. 11 of the drawing. The punch 63 is slidably mounted in a block 65 secured to the plate 43, said punch having a rack 66 on its under face for engagement with a gear 67 mounted upon a shaft 68 supported in the block 65, and the bearing 22^b. Secured to the shaft 68 adjacent the bearing 22^b is a rocker arm 69 having a link 70 pivoted thereto, the link 70 carrying a roller engaging the groove of the cam 23 whereby the shaft 68 is given rotary, oscillatory movement in the cycle of operation of the machine to advance the punch 63, to form the kink in the workpiece prior to the formation of the small and large loops therein.

It will be understood that when the plain or unkinked link is formed, the punch including its supports, is removed from the machine and replaced whenever it is desired to produce the kinked links thereby. However, in actual production, one machine may be fitted with the kinking means while the other would be without such means.

A workpiece supporting guide 71 is supported in connection with the table 20 of the machine in front of the block 65, said guide having a channeled arc-shaped face 72 in which the stringers coupled by the mounting strand, are placed, and over which said stringers pass in the operation of the machine, it being understood that a large number of link sections, which will constitute independent stringers in the production of the devices in question, are made and collected in a basket or other container po-

sitioned beneath the guide 71, and on the floor or other surface, it being understood that the separate sections of links are severed one from the other by cutting the mounting strand at the spaces "x" on said strand. It will also be understood that the links are fed outwardly through the machine by the feed screw or mandrel in the intermittent rotary movement imparted thereto.

The operation of my apparatus will be readily understood from the foregoing description when taken in connection with the accompanying drawings and the following statement. In the cycle of operation, the wire is first fed into and between the pins in the members 40b and 40c with the parts in the position seen in Fig. 10 of the drawing, the cams cooperating with the parts being diagrammatically illustrated. The next operation consists in cutting off a portion of the wire to form a workpiece and to bring the forming tool 44 into engagement with the workpiece to retain it against accidental displacement from said pins, at which time, the kink forming punch is brought into operation assuming that the kink is desired, and this position of the parts is seen in Fig. 11 of the drawing. The next step consists in raising the tool 44 and rotating the members 40b and 40c to form the small loops 31d at the ends of the workpiece, and further to bring the central part of the workpiece into engagement with the mandrel 45, this position of the parts being seen in Fig. 12 of the drawing. In the next step of the cycle of operation, the forming tool 44 advances still further upwardly and wraps the wire around the mandrel to form the large loop 31e and to bring the small loops 31d in alinement with the mounting strand 48 as seen in Fig. 13 of the drawing. The crimping jaws 50 are then advanced to partially crimp the workpiece around the mandrel, and the small loops 31d around the strand 48 as seen in Fig. 14. The punch 53 is then brought downwardly to securely force the loops 31d onto the mounting strand 48 as seen in Fig. 15, after which the crimping jaws 50 are again brought into engagement with the workpiece to firmly crimp the same intermediate the large loop and the small loops on the strand, thus fixedly retaining the links to the strand, which operation is indicated in Fig. 16 of the drawing. The last operation in the cycle consists in feeding or advancing the formed link as well as the mounting strand on the mandrel by its rotation in order to permit the formation of another link in the manner above described. As a matter of fact, the feeding operation of the finished link takes place at the same time that the end of the wire is fed into position to be sheared off to form another workpiece, in order that there will be no lost motion in the machine operation, it being understood that the operation of the mandrel can take place at any time between the operations seen in Figs. 10 to 12 inclusive. It will also be understood that in the above described operation of raising the tool 44 from the position shown in Fig. 12 to that shown in Fig. 13, the pins 39 and 39a are withdrawn or moved backwardly to permit the upward movement of the workpiece over the outer face of the members 40b and 40c. It will also be understood that after a predetermined number of links have been mounted upon the strand 48 which may be governed by the number of links in the chain 36b, the blocks 36a on said chain will operate to advance the shoe 36 to put the wire feed mechanism out of operation and to hold the same in inoperative position for a period which will govern the length of the space desired between the groups of links arranged on the mounting strand. As soon as all of the blocks 36a have passed over the roller 36e, the wire feed mechanism will be returned to its normal or operative position and will continue to feed the wire into the machine to permit the formation of the links.

It will be understood that while I have shown and described the formation of the links of stringers of specific construction, that my improved machine or apparatus is not necessarily limited to the particular type of link formation herein set out nor am I necessarily limited to the specific structure of the several parts of the apparatus nor the mode or ratio of gearing employed, and various other changes in and modifications of the construction herein shown and described may be made within the scope of the appended claims without departing from the spirit of my invention or sacrificing its advantages.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. The herein described method of manufacturing flexible stringers composed of a plurality of links secured to a mounting strand which consists in feeding an endless metallic strand into a machine, severing the strand to form a workpiece of predetermined length, curling the ends of the workpiece to form loops on said ends, fashioning the central portion of the workpiece to form a loop therein, moving the looped ends into common alinement and with said loops encircling a strand normally positioned between said ends and then firmly compressing the last mentioned loops on said mounting strand to secure the same thereto.

2. The herein described method of manufacturing flexible stringers composed of a plurality of links secured to a mounting strand which consists in feeding an endless metallic strand into a machine, severing the

strand to form a workpiece of predetermined length, curling the ends of the workpiece to form loops on said ends, fashioning the central portion of the workpiece to form a loop therein, moving the looped ends into common alinement and with said loops encircling a strand normally positioned between said ends and then firmly compressing the last mentioned loops on said mounting strand to secure the same thereto, and then feeding the link thus formed and said strand outwardly to permit of the formation of another link, and securing the second named link to said strand in abutting relation to the first named link.

3. The herein described method of manufacturing flexible stringers composed of a plurality of links secured to a mounting strand, which consists in feeding an endless metallic strand into a machine, severing the strand to form a workpiece of predetermined length and forming a kink or offset portion centrally of the workpiece, curling the ends of the workpiece to form loops on said ends, fashioning the central kinked portion of the workpiece to form a loop therein, moving the looped ends into common alinement and with said loops encircling a strand normally positioned between said ends, and then firmly compressing the last mentioned loops on said mounting strand to secure the same thereto.

4. The herein described method of manufacturing stringers comprising a mounting strand with a plurality of independent links mounted on and secured to said strand, which consists in fashioning a workpiece to form a link body of predetermined form, passing portions of said body around a mounting strand and securing the same to said strand, with that portion of the links on the strand in abutting relation.

5. The herein described method of manufacturing stringers comprising a mounting strand with a plurality of independent links mounted on and secured to said strand, which consists in fashioning a workpiece to form a link body of predetermined form, passing portions of said body around a mounting strand and securing the same to said strand, which that portion of the links on the strand in abutting relation, and arranging the links on said strand in groups spaced apart and coupled together by said strand.

6. The herein described method of securing a plurality of links to a mounting strand which consists in feeding a wire into a machine, severing the wire to form a workpiece of predetermined length, and fashioning said workpiece to form a link having strand encircling portions, placing said portions on the strand and firmly compressing the same thereon to fixedly attach the link to the strand and to retain the same against displacement therefrom.

7. The herein described method of securing a plurality of links to a mounting strand which consists in fashioning a workpiece from a metallic strip, bending the workpiece centrally to form a loop, arranging a mounting strand adjacent and between the end portions of said workpiece, fashioning the ends of said workpiece to wrap the same around said strand and compressing said wrapped ends onto the strand to retain the same against displacement therefrom and to leave the central loop portion of the workpiece projecting radially from said strand.

8. The herein described method of securing a plurality of links to a mounting strand which consists in fashioning a workpiece from a metallic strip, bending the workpiece centrally to form a loop, arranging a mounting strand adjacent and between the end portions of said workpiece, fashioning the ends of said workpiece to wrap the same around said strand and compressing said wrapped ends onto the strand to retain the same against displacement therefrom and to leave the central loop portion of the workpiece projecting radially from said strand, and securing a similar workpiece to the strand in an adjacent and abutting relation with reference to the first named workpiece and with the loop portion thereof in spaced relation to the looped portion of the first named workpiece.

9. The herein described method of manufacturing the coupling links of stringers of the class described which consists in feeding a metal strand into a machine, severing a workpiece from said strand, bending the central portion of the workpiece to form a comparatively large loop therein, fashioning the ends of said workpiece to form smaller loops, moving the looped ends into opposed relation and then bringing said looped ends together and fashioning the same to form ring-like members thereof arranged in abutting relation to each other and with the openings of said ring-like members in common axial alinement.

10. The herein described method of manufacturing the coupling links of stringers of the class described which consists in feeding a metal strand into a machine, severing a workpiece from said strand, bending the central portion of the workpiece to form a comparatively large loop therein, fashioning the ends of said workpiece to form smaller loops, moving the looped ends into opposed relation and then bringing said looped ends together and fashioning the same to form ring-like members thereof arranged in abutting relation to each other and with the openings of said ring-like members in common axial alinement and forming a laterally offset portion in the first named loop.

11. The herein described method of manufacturing the coupling links of stringers of the class described which consists in feeding a metal strand into a machine, severing a

workpiece from said strand, bending the central portion of the workpiece to form a comparatively large loop therein, fashioning the ends of said workpiece to form smaller loops, moving the looped ends into opposed relation and then bringing said looped ends together and fashioning the same to form ring-like members thereof arranged in abutting relation to each other and with the openings of said ring-like members in common axial alinement, and compressing the strand intermediate the first and second named loops to form a reduced neck portion.

12. The herein described method of fashioning the links of stringers of the class described which consists in employing a strip of wire, cutting off a predetermined length of the wire to form a workpiece, fashioning the ends of said workpiece to form open loops, then fashioning the central portion of the workpiece to form a comparatively large loop member and to bring the looped ends into opposed relation, and then moving the looped ends toward each other to overlap the same and then closing said looped ends to form ring-like bodies, the openings of which are in common alinement.

13. The herein described method of manufacturing stringers of the class described which consists in feeding a wire into a machine, cutting off predetermined lengths of wire to form independent workpieces, forming open loops at the ends of said workpieces, then moving said looped ends into opposed relation and forming a comparatively large loop centrally of said workpiece in this operation, arranging a mounting strand intermediate the opposed ends of the workpiece, moving said looped ends toward each other, passing the loops over said workpiece in crossed relation and compressing said looped ends onto said mounting strand to secure the same against displacement therefrom.

14. The herein described method of manufacturing stringers of the class described which consists in feeding a wire into a machine, cutting off predetermined lengths of wire to form independent workpieces, forming open loops at the ends of said workpieces, then moving said looped ends into opposed relation and forming a comparatively large loop centrally of said workpiece in this operation, arranging a mounting strand intermediate the opposed ends of the workpiece, moving said looped ends toward each other, passing the loops over said workpiece in crossed relation and compressing said looped ends onto said mounting strand to secure the same against displacement therefrom, and compressing that part of the workpiece intermediate the central loop and said looped ends, to aid in securing the workpiece to said strand and to form a substantially circular body of said central loop.

15. The herein described method of manufacturing stringers of the class described which consists in feeding a wire into a machine, cutting off predetermined lengths of wire to form independent workpieces, forming open loops at the ends of said workpieces, then moving said looped ends into opposed relation and forming a comparatively large loop centrally of said workpiece in this operation, arranging a mounting strand intermediate the opposed ends of the workpiece, moving said looped ends toward each other, passing the loops over said workpiece in crossed relation and compressing said looped ends onto said mounting strand to secure the same against displacement therefrom, compressing that part of the workpiece intermediate the central loop and said looped ends to aid in securing the workpiece to said strand and to form a substantially circular body of said central loop, and then fashioning and mounting a similar workpiece on the strand in an adjacent and abutting relation to the first named workpiece.

16. The herein described method of manufacturing stringers of the class described which consists in feeding a wire into a machine, cutting off predetermined lengths of wire to form independent workpieces, forming open loops at the ends of said workpieces, then moving said looped ends into opposed relation and forming a comparatively large loop centrally of said workpiece in this operation, arranging a mounting strand intermediate the opposed ends of the workpiece, moving said looped ends toward each other, passing the loops over said workpiece in crossed relation and compressing said looped ends onto said mounting strand to secure the same against displacement therefrom, compressing that part of the workpiece intermediate the central loop and said looped ends to aid in securing the workpiece to said strand and to form a substantially circular body of said central loop, then fashioning an mounting a similar workpiece on the strand in an adjacent and abutting relation to the first named workpiece, and feeding the finished and mounted workpiece and said strand into position to permit of the mounting of the next successive workpiece on said strand.

17. The herein described method of manufacturing stringers of the class described which consists in feeding a wire into a machine, cutting off predetermined lengths of wire to form independent workpieces, forming open loops at the ends of said workpieces, then moving said looped ends into opposed relation and forming a comparatively large loop centrally of said workpiece in this operation, arranging a mounting strand intermediate the opposed ends of the workpiece, moving said looped ends toward each other, passing the loops over said workpiece in crossed relation and compressing said looped

ends onto said mounting strand to secure the same against displacement therefrom, compressing that part of the workpiece intermediate the central loop and said looped ends to aid in securing the workpiece to said strand and to form a substantially circular body of said central loop, then fashioning and mounting a similar workpiece on the strand in an adjacent and abutting relation to the first named workpiece, feeding the finished and mounted workpiece and said strand into position to permit of the mounting of the next successive workpiece on said strand, and intermittently advancing the strand through the machine for a short distance without applying workpieces thereto to form independent stringer bodies consisting of a plurality of links formed from said workpieces and arranged on said strand.

18. The herein described method of manufacturing stringers of the class described which consists in arranging a mounting strand in predetermined position in a machine, feeding a strip of wire into the machine, fashioning said strip to form a link member comprising a projecting ring body and parts encircling said strand, securing a multiplicity of said link bodies to said strand in abutting relation to form groups consisting of a plurality of said link bodies and intermittently advancing the strand to form blank intervals which subdivide said link sections one from the other.

19. The herein described method of manufacturing stringers of the class described which consists in arranging a mounting strand in predetermined position in a machine, feeding a strip of wire into the machine, fashioning said strip to form a link member comprising a projecting ring body and parts encircling said strand, securing a multiplicity of said link bodies to said strand in abutting relation to form groups consisting of a plurality of said link bodies and intermittently advancing the strand to form blank intervals which subdivide said link sections one from the other and forming laterally offset portions centrally of the outer ends of the loops of said links.

In testimony that I claim the foregoing as my invention I have signed my name this 2nd day of May, 1928.

LOUIS H. MORIN.