Nov. 17, 1942. F. ULRICH 2,302,075

SLIDE FASTENER MANUFACTURE

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FIG. 1.

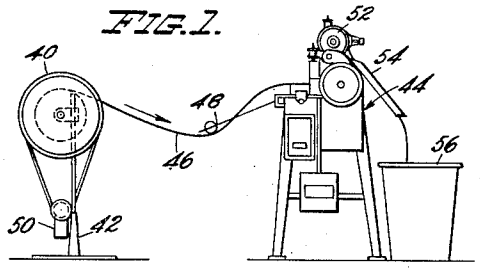


FIG. 2.

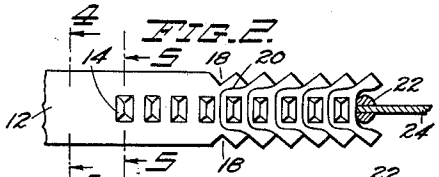


FIG. 3.

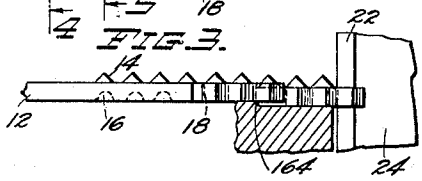


FIG. 4.

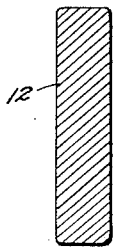


FIG. 5.

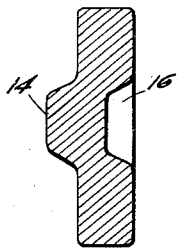


FIG. 6.

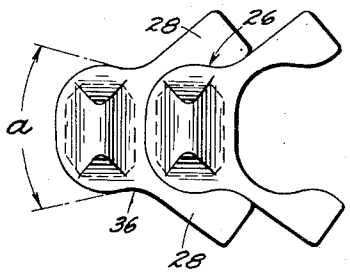


FIG. 7.

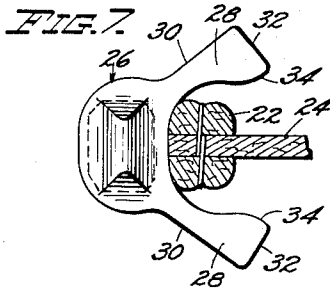
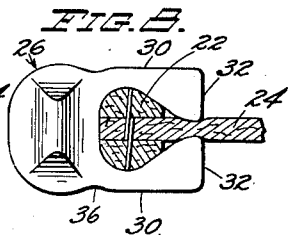


FIG. 8.



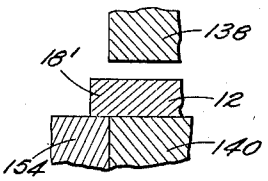


FIG. 9.

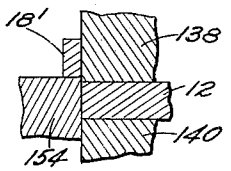


FIG. 10.

FIG. 11.

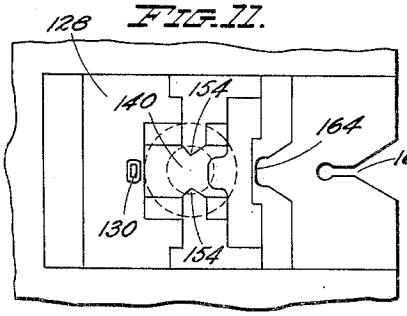
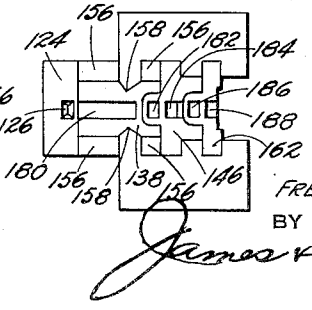


FIG. 12.



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FIG. 13.

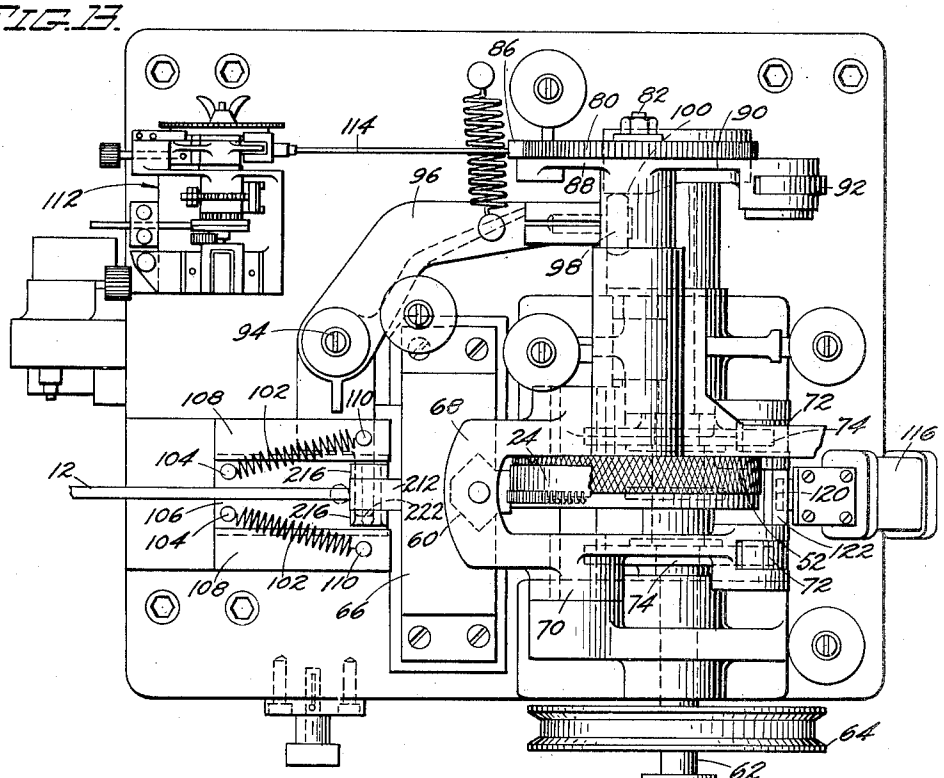


FIG. 14.

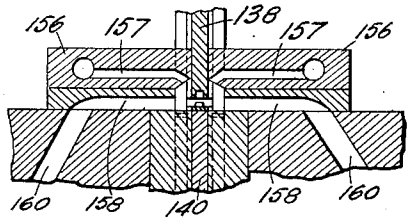


FIG. 16.

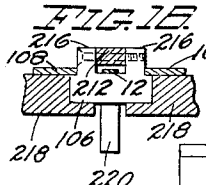


FIG. 15.

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FIG. 18.

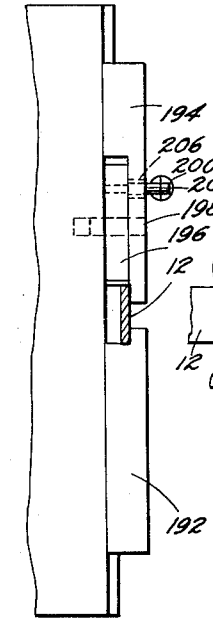


FIG. 17.

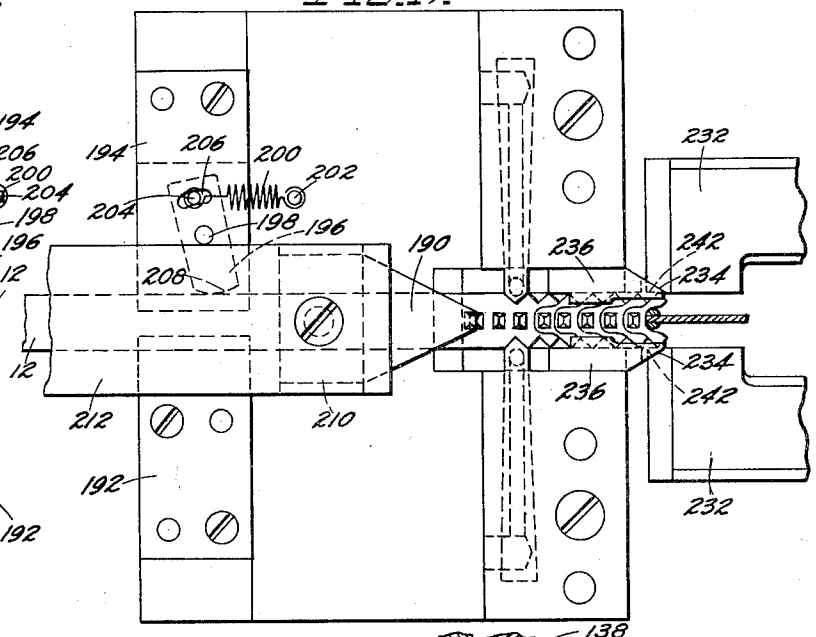


FIG. 19.

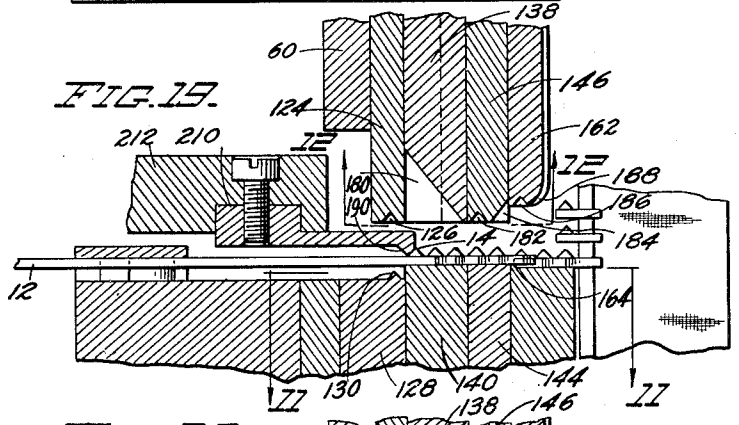
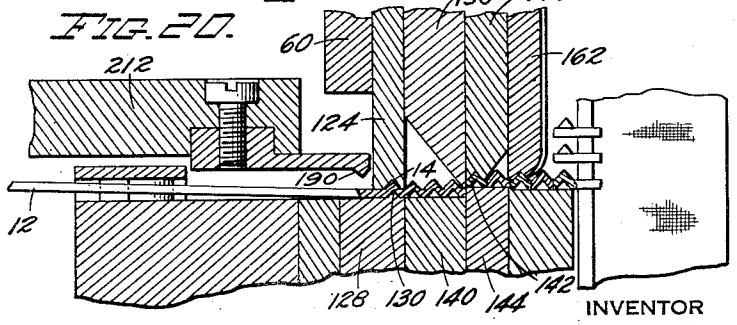


FIG. 20.



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FIG. 21.

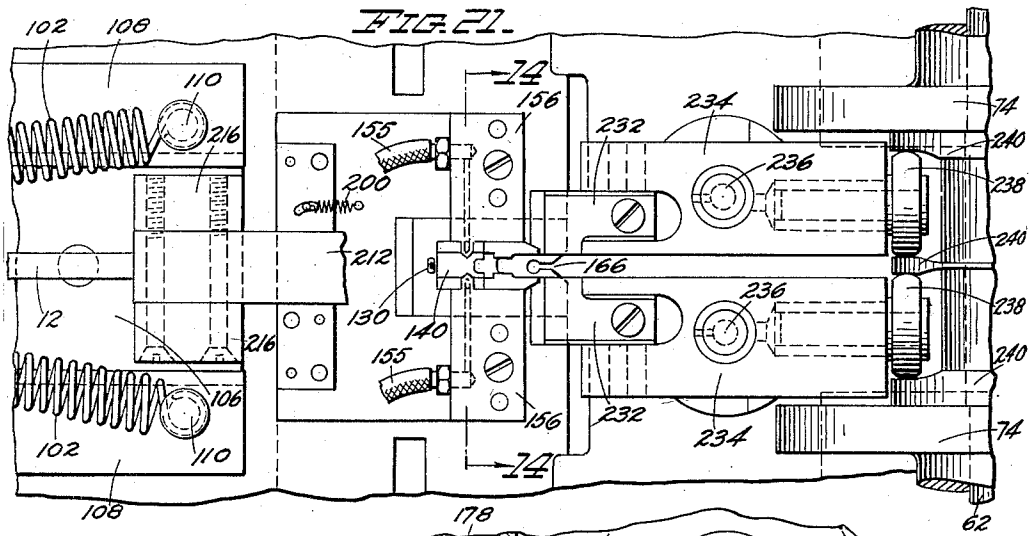


FIG. 23.

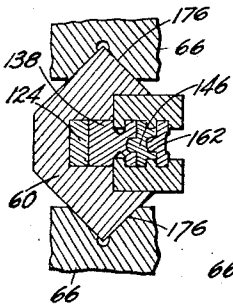


FIG. 22.

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Patented Nov. 17, 1942

2,302,075

UNITED STATES PATENT OFFICE

2,302,075

SLIDE FASTENER MANUFACTURE

Frederick Ulrich, Bayonne, N. J., assignor to Conmar Products Corporation, Bayonne, N. J., a corporation of New Jersey

Application March 28, 1939, Serial No. 264,551

13 Claims. (Cl. 153—1)

This invention relates to slide fasteners and more particularly to the manufacture thereof.

The present application is a continuation-in-part of my co-pending application, Serial No. 179,299, filed December 11, 1937, Patent No. 2,221,740, dated November 12, 1940, and entitled "Manufacture of slide fastener elements." It is also a companion application to my co-pending application, Serial No. 264,550, filed concurrently herewith. In said companion application, the manufacture of slide fasteners is divided into two stages, the first stage being the rolling of a smooth wire to form what may be termed a fastener wire, said wire being characterized by a closely spaced series of projections and recesses therealong, and also a closely spaced series of side notches. The spacing and configuration of the parts are such as to correspond to a series of embryo elements, provided that the head of one element is nested fully within and substantially fills the space within the spread jaws of the next element. The first stage of the process is preferably performed in a special rolling apparatus or rolling mill. The second stage of the process consists in severing the aforesaid rolled or deformed wire into separate fastener elements, and attaching the same in spaced relation along the edge of a tape.

The primary object of the present invention is to so design the attaching machine as to adapt the same to receive a smooth flat wire instead of a specially deformed fastener wire, or differently expressed, the primary object of the present invention is to completely eliminate the first stage of the process disclosed in my companion application, thus dispensing with the rolling mill.

Many features of the present attaching apparatus correspond to related features of the attaching apparatus disclosed in my aforesaid companion application, and many objects of the present invention similarly correspond to some of the objects in said application. For example, an object of the present invention is to minimize scrap or waste material when forming the fastener elements. Another object is to eliminate angular disposition of an element when clamped on the tape, either due to the pressure of the severing punch or due to a bend or kink in the wire. Further objects are to facilitate clamping of the jaws of an element on the tape even if the elements are laid out on such a pattern that the jaws of a succeeding element overlap those of a preceding element; to provide ample room for the various punches required in the machine without, however, interposing an excessive number of severed elements between the wire and the tape; to properly support and confine the severed elements between the end of the wire and the tape, and to prevent improper orientation thereof; to prevent longitudinal separation of the elements; to round the lower edge at the periphery of the head of the element; to so form the elements that they have parallel sides when the jaws are closed on the tape; and to insure thorough removal of bits of scrap or waste, even though these are comparatively minute in dimension.

Other objects of my invention having to do more particularly with the specific type of fastener machine here disclosed are to provide a forming punch for forming the interlocking means, or more specifically, the projections and recesses for the elements; to provide feed means adapted to successfully and accurately feed the metal stock, despite the fact that the stock is perfectly smooth until after it has been acted upon by the punches of the machine; and finally to provide means to interrupt the supply of fastener elements to the tape when a gap or space is to be provided on the tape between stringers, without necessitating interruption of the drive for the feed mechanism, and while keeping the severed elements locked against accidental movement by means of the punch assembly.

To the accomplishment of the foregoing and other objects which will hereinafter appear, my invention consists in the apparatus elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 is a side elevation of an apparatus embodying features of the present invention;

Fig. 2 is a plan view of a piece of stock formed and severed adjacent the tape and is explanatory of the invention;

Fig. 3 is a side elevation of the parts shown in Fig. 2;

Fig. 4 is a section through the smooth flat stock used in practicing the present invention;

Fig. 5 is a similar section after operation of the forming punch to form a projection and recess;

Fig. 6 shows the relation of the elements when severed;

Fig. 7 illustrates the application of an element to the tape before closing of the jaws;

Fig. 8 is a similar view after closing of the jaws;

Figs. 9 and 10 illustrate a detail explanatory of the notching of the side edges of the stock;

Fig. 11 is a plan view of the die taken approximately in the plane of the line 11—11 of Fig. 19;

Fig. 12 is an inverted plan view of the punch assembly taken approximately in the plane of the line 12—12 of Fig. 19;

Fig. 13 shows the attaching apparatus in plan;

Fig. 14 is a detail explanatory of an air blast arrangement for the removal of scrap, this figure being a section taken approximately in the plane of the line 14—14 of Fig. 21;

Fig. 15 shows the upper part of the attaching apparatus in elevation;

Fig. 16 is a detail looking in the plane of the line 16—16 of Fig. 15;

Fig. 17 is a plan view explanatory of the feed mechanism, severing die, and clamping plates;

Fig. 18 is an end elevation of the parts shown in Fig. 17;

Fig. 19 is a section through the die with the punches in elevated position;

Fig. 20 is a similar section with the punches in down position;

Fig. 21 is a plan view of a part of the attaching apparatus drawn to enlarged scale;

Fig. 22 is a section taken in elevation through the ram and feed mechanism; and

Fig. 23 is a section through the ram, it being taken approximately in the plane of the line 23—23 of Fig. 22.

The fastener elements are formed from a strip of metal or wire indicated at 12 in Figs. 2 and 3. A section through this wire, drawn to enlarged scale, is shown in Fig. 4, and it will be observed that the wire is simple smooth flat stock. It is fed directly into the present apparatus, and is operated upon by a suitable forming punch to provide interlocking means, or more specifically, to provide a projection 14 on one side and a recess 16 on the opposite side. The recess 16 provides metal for the projection 14, as will be clear from inspection of Fig. 5. The wire 12 is next acted upon to notch the side edges by removing small triangular pieces of scrap, as is shown at 18 in Fig. 2. The object of this is to so shape the jaws of the elements that the jaws are brought to conventional parallel condition when closed. It will be observed in Fig. 2 that the pitch or spacing of the projections 14 and notches 18 is very close, these projections and notches corresponding to fastener elements only if the head of one element is disposed fully within the jaws of the next element, as is indicated at the right hand part of Fig. 2.

The stock is severed on the line 20 (Fig. 2) to form an individual fastener element. The severed element is restored to nested relation between the jaws at the end of the wire 12, and so a series of nested elements are formed and fed along, jaw first, toward the beaded edge 22 of a conventional tape 24. If desired, the elements may be acted upon by a rounding or finishing punch between the severing punch and the tape, all as is described in greater detail hereinafter.

The configuration of the fastener elements is better shown in Fig. 6, in which it will be seen that the head 26 of one element is located within and conforms to the interior of the jaws 28 of the next element, the head filling the space between the spread jaws. In other words, the jaws are so spaced and shaped as to receive the head 26 of the preceding element. In Fig. 7, I show an individual element moved against the beaded edge 22 of tape 24. The jaws are then closed, as shown in Fig. 8. The outer edges 30 of the jaws change from a divergent position to parallel position, and are preferably spaced apart an amount equal to the width of the head 26. The ends 32 of the jaws are preferably disposed substantially perpendicular to the outer edges 30, so that when the jaws are closed the ends 32 form a bearing surface for the slider of the finished slide fastener, which bearing surface is substantially perpendicular to the tape, as shown in Fig. 8. When the element is completed and fastened to the tape, it does not differ noticeably in external appearance from elements made by more conventional methods. At the inside the jaws are preferably provided with short walls 34 which provide a substantial bearing surface to prevent cutting or penetration of the tape.

Another detail may be described with reference to Fig. 6. The sides of the head are non-parallel, as is indicated by the angle a. Differently expressed, the head is necked or narrowed very slightly, as at the point 36, thereby providing an undercut relation between the successive elements. Even if this undercut is only a few thousandths of an inch, it is adequate to prevent longitudinal separation of the elements. When the element is closed there may be slight recess at the point 36 (Fig. 8), but this is not noticeable to the eye, and has been greatly exaggerated in the drawing. The undercut does not prevent transverse separation of the elements, such as takes place when the tape is moved vertically with the clamped element thereon.

The apparatus is shown in Fig. 1 of the drawings. A reel 40 of the flat metal wire is supported on a suitable stand 42. The wire is taken from reel 40 and is fed to a machine generally designated 44. A loop of slack wire 46 may be maintained between the reel 40 and machine 44, as by means of a feeler 48 controlling a motor 50 for intermittently unwinding the reel 40. The wire is intermittently fed toward a tape which is supported in vertical position, the tape being intermittently fed upwardly about a feed drum 52, and thence downwardly through a guide tube 54 into a suitable basket 56.

The head of machine 44 is shown in greater detail in Figs. 13 and 15 of the drawings. It comprises a timing shaft or cam shaft 62, carrying a pulley 64 belted to a driving motor. The punches are carried by a ram 60 (Fig. 13) slidable in a ram housing 66. The ram is reciprocated by a generally U-shaped rocker 68, pivoted on a spindle 70. The ends of the two branches of the rocker carry cam follower rollers 72 engaging cams 74 on cam shaft 62. The tape 24 is fed intermittently upward by means of tape feed drum 52, the tape being held frictionally against the drum by means of a shoe 78 (Fig. 15). Drum 52 is moved by a suitable pawl and ratchet mechanism, the ratchet wheel 80 (Fig. 13) being mounted at the end of a shaft 82 carrying the feed drum 52. Ratchet wheel 80 cooperates with a holding pawl 84 (Fig. 15) and a feed pawl 86, the latter being carried on an arm 88 pivoted on shaft 82 and having an oppositely extending arm 90 oscillated by means of a connecting rod 92 leading to an eccentric 93 (Fig. 15) on cam shaft 62.

The flat wire 12 is intermittently fed in a horizontal direction toward the tape 24 by feed mechanism which is described later, but at this point it may be observed that a feed dog (not shown) is carried on a slide 106, and is retracted or moved outwardly by means of a feed lever

pivoted at 94 (Fig. 13), the arm 96 of the feed lever carrying a cam follower roller 98 engaging a cylindrical cam 100 mounted on cam shaft 62. The forward or feed movement of the slide 106 is caused by pull springs 102 which are connected at one end to pins 104 projecting upwardly from the slide within the stationary gibs 108. The opposite ends of springs 102 are connected to stationary pins 110. The operation of the feed dog, while positive in the rearward direction, is yieldable in the forward direction, the reason for which is later explained.

The apparatus further includes a counter generally designated 112 (Fig. 13), the counter being connected by means of link 114 to a suitable eccentric or crank pin on cam shaft 62. After a predetermined number of fastener elements has been attached to the tape, the counter functions to interrupt the feed of the wire, without, however, interrupting the feed of the tape. More specifically, the counter energizes a solenoid 116 which draws an iron core 118 (Fig. 15) upwardly or inwardly, thereby causing a detent 120 to slip beneath a cross bar 122 extending between the arms of the rocker 68. The parts are so related that detent 120 slides beneath cross bar 122 only when the cross bar is in elevated position, that is, at the rise of the cams 74. The ram 60 is thus held in depressed position, and consequently the formation of additional fastener elements is interrupted until the solenoid 116 is again deenergized.

The punches carried by ram 60 may be described with reference to Figs. 12, 19 and 20 of the drawings. The forming punch is indicated at 124. This is recessed at 126 to form the desired projection on top of the wire. Punch 124 cooperates with a fixed die member 128 (see also Fig. 11), which is provided with a projection 130 to form the recess at the bottom of the wire. Projection 130 may be part of an insert in die member 128, instead of being integral therewith as shown.

The notching and severing punches are combined, and the combined punch is numbered 138. A spring pad 140 is located therebeneath. Punch 138 cuts the wire away from an element beyond the punch. The element 142 (Fig. 20) rests on the top surface of a stationary die member 144. It is held by spring pad 146, nested alongside the punches 124 and 138. In Fig. 19, the punches 124 and 138 and the pad 146 are shown in up position, while the wire 12 is elevated by spring pad 140. In Fig. 20, the punches are shown in down position, and while element 142 is held against die member 144 by pad 146, the punches 124 and 138 have forced the wire 12 down together with the spring pad 140, the wire being sheared completely from the element 142, and being provided with an additional projection and recess. When the ram 60 again rises, the wire 12 is raised by spring pad 140, thus restoring the jaws at the end of the wire to the head of the severed element 142.

The triangular notches (18 in Fig. 2) are formed by the punch 138 cooperating with appropriate stationary die parts. Referring to Fig. 11, the die has stationary die surfaces 154 which are pointed to conform to the desired notches in the wire. The spring pad 140 is indented to accurately receive the points 154. In Fig. 12 it will be seen that the punch 138 is provided with four heels 156, and that the punch is indented at 158 between the heels to mate with the die surfaces 154 of Fig. 11. Figs. 9 and 10 are fragmentary transverse sections at the die surfaces 154. In Fig. 9, the punch 138 is raised and spring pad 140 supports the wire 12 in elevated position. The triangular scrap or notch portion 18' of the wire is disposed about the stationary die surface 154 previously referred to. In Fig. 10, the punch 138 has moved down to the end of its stroke, thereby severing the wire 12 from the triangular piece of scrap 18', the latter remaining on the stationary die surface 154.

Inasmuch as the pieces of scrap are very tiny, it is desirable to insure dependable discharge of the same. Referring to Fig. 21, compressed air is supplied through pipes 155 to blocks 156 on top of the die. Changing now to Fig. 14, the compressed air is led inwardly through passages 157 and is then directed downwardly alongside the punch 138. The compressed air then flows outwardly through the passages 158, carrying the scrap with it, and then downwardly through discharge passages 160 leading to a suitable box beneath the machine.

As a refinement which, however, is by no means essential, I prefer to provide the apparatus with a finishing or rounding punch, this being indicated at 162 in Figs. 19 and 20. It is moved together with the other punches and forms a part of the punch assembly. The stationary die surface therebeneath is depressed and rounded somewhat, as is indicated at 164 in Figs. 3 and 19. The rounding punch 162 forces the subjacent element into the die curvature at 164, and thereby rounds the lower edge of the head. In Fig. 11 the downward step of the die surface is clearly indicated at 164, and its outline conforms to the exterior of the open-jawed fastener element. The fastener element remains at the slightly lower elevation of the right-hand part of the die surface until it reaches the tape and tape guide 166. Reverting to Figs. 2 and 3, there are five severed elements between the wire 12 and the tape 24, and the rounding punch operates upon the middle one of these five elements. The last two elements are always at the lower die level. The middle element is initially at the upper die level, but is moved to the lower die level by the rounding punch. The difference in elevation may be very slight, say $^{15}/_{1000}$ of an inch.

The mounting of the punch assembly is shown in Fig. 22, in which it will be seen that the forming punch 124 may be adjusted by means of a screw 168; the notching and severing punch 138 is adjusted by means of a screw 170; and the rounding punch 162 is adjusted by means of a screw 172. The spring pad 146 is nested between the punches 138 and 162, and is yieldably urged downward by means of a spring 174. The entire punch assembly is carried by ram 60 which is reciprocable in the guide or ways of ram housing 66. The relation between ram 60 and rocker 68 may be adjusted by screw 178. Fig. 23 shows the forming punch 124, the notching and severing punch 138, the spring pad 146, the rounding punch 162, and the ram 60, which in turn has its edges received in guides or ways 176 formed in the ram housing 66. Fig. 22 also shows the spring 141 supporting the spring pad 140 of the die.

It may be pointed out, with reference to Fig. 12, that the punch 138 is cut away at 180 to clear the projections on the wire reaching the cutting edge of the punch. The spring-pressed pad 146 is recessed at 182 to fit around the projection of the element being severed from the wire, hence

the pad acts as a locating pad to insure a uniform location of the periphery of the head about the projection and recess. The spring pad 146 is cut away at 184 to clear the projection of the next element. The rounding punch 162 is recessed at 186 to fit about the projection of the element being rounded, in order not to flatten or deform the element. This punch is also cut away at 188 to clear the projection of the next element. These recesses are also shown in Fig. 19, the severing punch 138 being cut away at 180; the spring pad 146 being recessed at 182 and cut away at 184; and the rounding punch 162 being recessed at 186 and cut away at 188.

To make the feed of the wire positive and accurate, it is fed by means of a dog 190 (Fig. 19) which bears against the most recently formed projection on the wire. The dog may be rigidly mounted because no vertical movement is required. I prefer to feed the wire with the aid of the projection thereon, even though this necessitates movement of the feed dog 190 beneath the forming punch 124, as is clearly shown in Fig. 19. Feed dog 190 is retracted to the position shown in Fig. 20 before the punch descends. There is little or no tendency for the wire to move back with the feed dog, because the wire is smooth, and any such tendency is adequately resisted when using an undercut relation between the severed elements, such as was heretofore described in connection with Fig. 6. A check dog or lock for the flat wire is therefore optional rather than essential, but such a lock is shown in Figs. 17 and 18 of the drawings.

The wire 12 moves between guides 192 and 194. Guide 194 is cut away to receive a lock 196 pivoted at 198 and normally urged in clockwise direction by means of a spring 200, the right-hand end of which is carried by a stationary pin 202, and the left-hand end of which is connected to a pin 204 projecting upwardly from lock 196 and passing through an appropriate slot 206. The end 208 of the lock 196 is made eccentric with respect to the center 198, and the operation is such that the wire 12 is automatically locked against rearward movement, though no substantial resistance is offered to forward movement.

The feed dog 190 is rigidly secured at 210 to an arm 212 (Figs. 17, 19 and 20) which in turn is rigidly secured to the slide 106 (Figs. 13, 15, 16, 21 and 22). In the present case, arm 212 is fixedly mounted between ears 216 formed integrally with and projecting upwardly from the slide 106. The slide 106 is reciprocable in guides or ways formed in a part 218 (Fig. 16) of the machine, the slide being held in position by means of the gibs 108. A pin 220 (Figs. 15, 16 and 22) depends from the slide 106 and is operated upon by the end 222 of the feed arm 96, through an adjusting screw 224. Inasmuch as the part 222 of the feed arm bears against one side only of pin 220, (it being cut away on the opposite side of the pin), the slide is moved positively toward the left, while its movement toward the right is solely under the influence of the feed springs 102.

When producing a gap or space between stringers the punch assembly is locked in its down position, as shown in Fig. 20, and the forming punch 124 is therefore disposed directly in front of the then retracted feed dog 190. The feed cam 100 (Fig. 13) continues its rotation, but the feed dog, and with it the slide 106 and the feed arm 96, are held in retracted position. The parts may vibrate slightly if there is a substantial clearance between the end of the feed dog 190 and the punch 124, but this vibration, even if permitted, is harmless, and in practice may be reduced to a negligible amount by using only a slight clearance between the feed dog and the forming punch. Locking the ram in down position eliminates unnecessary reciprocation, and avoids moving the jaws at the end of the wire repeatedly into and out of engagement with the head of the element last severed.

The endmost element is clamped on the tape by an oppositely movable pair of clamping plates. Referring to Figs. 21 and 22, the clamping plates 232 are secured to levers 234 pivoted at 236. The other ends of the levers 234 carry cam followers 238 which run between cylindrical cams 240, carried on the main shaft 62 of the machine. The cams are so shaped as to oppositely move the clamping plates. Referring now to Fig. 17, it will be seen that the corners 242 of clamping plates 232 are so located as to engage the jaws of the endmost element and at the same time to clear the jaws of the element next to the end. The clamping plates are thinned to come beneath the ends 234 of guides or rails 236 which confine and guide the severed elements. When the clamping plates 232 move together, they compress the spread jaws of the endmost element from the open condition of Figs. 17 and 7, to the closed condition of Fig. 8.

It is believed that the construction and operation of the present invention, will be apparent from the foregoing detailed description. Flat wire is fed to a single machine where it is operated upon by a forming punch to form a projection and recess, and by a severing and notching punch which removes triangular pieces of waste and which severs the wire of the fastener elements so shaped that the head of one element is nested within and substantially fills the space of the spread jaws of the next element. The elements are kept in nested relation and are fed toward an intermittently moved tape where the endmost element is clamped on the tape. If desired, a finishing operation such as that produced by the rounding punch may be applied to the elements between the cutting punch and the tape. The movement of the tape disengages the attached element from the next element, whereupon the series is again advanced to bring another element astride the tape.

In respect to timing, it may be explained that in the first part of the machine the ram descends, and then rises, while the feed dog is retracted. The feed dog then advances and returns, whereupon the ram again descends. In the meantime, in the second part of the machine, the jaws of the endmost element are clamped by the clamping plates, and in this part of the machine the timing is such that the clamping plates are open when the tape rises with the previously clamped element. The timing relation between the two parts of the machine is not at all critical, but it will be understood that the feed dog must move forward after the tape rises with the previously attached element, and that at this time the clamping plates must be wide open. The clamping plates should not be closed until after the feed dog has moved forward.

When a predetermined number of elements have been attached to the tape, as determined by the counter, the counter energizes the solenoid, which holds the ram down, and this in turn holds the feed dog back. The tape continues to be fed by the pawl and ratchet mechanism operating the tape drum.

The many advantages of the invention will also be understood from the detailed description. The invention produces only a small amount of scrap. It utilizes a simple, smooth flat wire, and eliminates die rolling to form embryo elements. The elements are of generally conventional type in that the outer walls of the jaws come into substantially parallel relationship when closed, while the ends of the jaws are substantially perpendicular to the tape. The feed of the wire is made a positive, predetermined amount by operating the feed dog against a projection formed on the wire after the wire has already been operated upon by the forming punch. Locking the ram in down position to provide a gap space prevents loosening of the fit between elements, and automatically interrupts the movement of the feed dog. The use of a series of severed elements provides room for the punches and the associated spring pad. It frees the jaws of the endmost element for the clamping operation, and it avoids angular positioning of the element, as by reason of the punch thrust or a bend in the wire. The sides of the head are non-parallel and converge so as to provide an undercut of the elements after they are severed and engaged, and this prevents longitudinal separation. The nesting of the elements prevents improper orientation as they are moved toward the tape.

It will be apparent that while I have shown and described my invention in a preferred form, many changes and modifications may be made in the structure disclosed, without departing from the spirit of the invention defined in the following claims.

I claim:

1. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to guide a smooth, flat wire, a forming punch movable transversely of the wire, said punch functioning to form a recess on one side and a projection on the opposite side of the wire, a feed dog riding beneath said punch when said punch is elevated and bearing against said projection formed by said punch in order to positively feed said wire, and timing means whereby said feed dog is retracted from the path of the punch when the punch descends.

2. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to guide a smooth, flat wire, a forming punch movable transversely of the wire, said punch functioning to form a recess on one side and a projection on the opposite side of the wire, a feed dog riding beneath said punch when said punch is elevated and bearing against said projection formed by said punch in order to positively feed said wire, timing means whereby said feed dog is retracted from the path of the punch when the punch descends, and a severing punch movable transversely of the wire for severing the wire into fastener elements having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws.

3. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittenly feed a tape, means to guide a smooth, flat wire toward the tape, a forming punch movable transversely of the wire, said punch functioning to form a recess on one side and a projection on the opposite side of the wire, a feed dog riding beneath said punch when said punch is elevated and bearing against said projection formed by said punch in order to positively feed said wire, resilient means urging the feed dog forward, a feed cam for positively retracting the feed dog when the punch descends, a severing punch movable transversely of the wire for severing the wire into fastener elements, clamping plates for clamping the elements to the tape, a counter, and means responsive to the counter to lock the punch in depressed position, whereby the feed dog is held against forward movement by the punch, in order to provide a gap or space between stringers.

4. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to intermittently feed a tape, means to guide a smooth, flat wire toward the tape, a forming punch movable transversely of the wire, said punch functioning to form a recess on one side and a projection on the opposite side of the wire, a feed dog riding beneath said punch when said punch is elevated and bearing against said projection formed by said punch in order to positively feed said wire, resilient means urging the feed dog forward, a feed cam for positively retracting the feed dog when the punch descends, a severing punch movable transversely of the wire for severing the wire into fastener elements having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, a punch-operating cam, a rocker arm between said cam and the punch, clamping plates for clamping the jaws of the endmost element to the tape, a counter, means responsive to the counter to lock the rocker arm in outermost position with the punch in depressed position, whereby the feed dog is held against forward movement by the punch, in order to provide a gap or space between stringers on the continuous tape.

5. Apparatus for the manufacture of slide fasteners, said apparatus comprising means to guide a smooth, flat wire, a forming punch movable transversely of the wire, said punch functioning to form interlocking means on opposite sides of the wire, a severing punch movable transverseiy of the wire for severing the wire into fastener elements, and a reciprocable feed dog for intermittently feeding the wire past the punches, said feed dog being so dimensioned and mounted that it acts upon the interlocking means formed by the forming punch in order to provide a positive feed movement for the wire.

6. In the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, the method which includes intermittently feeding a tape, intermittently feeding a smooth, flat wire toward the tape, said wire having a width just equal to the width of an element with spread jaws, each of the repeated feed distances equalling only a small fraction of the length of an element, operating upon the wire to form a recess on one side of the wire and a projection on the opposite side of the wire, and to cut away small triangular pieces of scrap in order to notch the side edges of the strip to conform to the outer ends of spread jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, and to sever the strip away from a small projecting piece of the strip, the severance being on an outline such as to define fastener elements with the head of one element

nested fully within and substantially filling the space within the spread jaws of the next element, whereby the elements are formed without scrap other than the aforesaid small triangular pieces of scrap at the side edges of the wire, restoring the wire and severed element together again in nested relation, intermittently moving the nested severed elements toward the tape, and clamping the jaws of the endmost element on the tape in order to secure the element to the tape, while giving the element approximately parallel sides.

7. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a flat, smooth wire toward a tape, said wire having a width just equal to the width of an element with spread jaws, punches movable transversely of the wire, said punches operating to form a recess on one side of the wire and a projection on the opposite side of the wire, said punches further operating to sever the wire from a piece of the wire projecting beyond the severing punch and corresponding to one element, the outline of the severing punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, a spring pad beneath the wire at the punch to restore the wire to the element previously severed therefrom, feed means to intermittently feed the wire to the punches and tape, each of the repeated feed distances equalling only a small fraction of the length of an element, and clamping plates at the tape for clamping the elements to the tape, said plates having approximately parallel working faces when closed.

8. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire toward a tape, said wire having a width just equal to the width of an element with spread jaws, punches movable transversely of the wire, said punches functioning to form a recess on one side and a projection on the opposite side of the wire, and further functioning to sever the wire from a piece of the wire projecting beyond the severing punch, and corresponding to one element, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, a spring pad beneath the wire at the punch to restore the wire to the element previously severed therefrom, feed means to intermittently feed the wire to the punches and tape, each of the repeated feed distances equalling only a small fraction of the length of an element, the punch being spaced from the tape by an amount such that a series of severed elements nested together with the head of each filling the jaw space of the next lie between the punch and the tape, a rounding punch between said severing punch and said tape, said rounding punch functioning to round the lower peripheral edge of the head of the element, and clamping plates at the tape for clamping the endmost element to the tape, said plates having approximately parallel working faces when closed.

9. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire, punch and die mechanism including a plurality of punches movable transversely of the wire, said punches functioning to form a recess on one side and a projection on the opposite side of the wire, and functioning to cut small triangular shaped pieces of metal from the sides of the wire, and further functioning to sever the wire, the outline of the severing punch being such that the severed piece constitutes a fastener element having a head with spread jaws, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, air blast means for helping remove said small triangular pieces of scrap, and feed means to intermittently feed the wire to the punches, each of the repeated feed distances equalling only a small fraction of the length of an element.

10. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire toward a tape, punch and die mechanism including a plurality of punches movable transversely of the wire, said punches functioning to form a recess on one side and a projection on the opposite side of the wire, and functioning to cut small triangular shaped pieces of metal from the sides of the wire, and further functioning to sever the wire from a piece of the wire projecting beyond the severing punch, the outline of the punch being such that the projecting piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, a spring pad beneath the punch to restore the wire to the element previously severed therefrom, stationary die surfaces beneath the wire at opposite sides of the spring pad cooperating with one of the aforesaid punches for removing the small triangular shaped pieces of scrap, air blast means for helping discharge said triangular pieces of scrap, feed means to intermittently feed the wire to the punches and tape, each of the repeated feed distances equalling only a small fraction of the length of an element, and clamping plates at the tape for clamping the elements to the tape, said plates having approximately parallel working faces when closed.

11. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimensions adjacent the head, said apparatus comprising means to guide a smooth, flat wire having a width just equal to the width of an element with spread jaws, a punch and die operating to form a recess on one side of the wire and a projection on the opposite side of the wire, and operating to sever the wire, said die having a generally keyhole shaped slot for supporting and guiding an upwardly fed tape having a beaded edge, said die further having a convex cutting portion shaped to conform to the head of the element being severed, said die further comprising a depressible spring pad fitting within and mating with said convex cutting portion, said pad lifting the wire clear of the die for forward feed after formation of the projection and recess, said punch having a concave side mating with the aforesaid convex die portion, the arrangement being such that, when the punch descends, it severs the wire from an element supported on the stationary die portion at the end of the wire, the element being left stationary on the die while the wire is punched downwardly away from the same, the outline of the punch and die being such that the severed piece constitutes a fastener element having a head with spread jaws projecting forwardly therefrom, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, and feed means to intermittently feed the wire to the punch and die, each of the repeated feed distances equalling only a small fraction of the length of an element.

12. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire, a punch and die functioning to form a recess on one side and a projection on the other side of the wire, and further functioning to cut small, triangular pieces of scrap to give the jaws the desired perpendicular ends, and further functioning to sever the wire, said die having a generally key-hole shaped slot for supporting and guiding an upwardly fed tape having a beaded edge, said die further having a convex cutting portion shaped to conform to the head of the element being severed, said die further comprising two pointed or triangular-shaped side pieces for cutting notches in the side edges of the wire, said die further comprising a depressible spring pad fitting within and mating with said convex cutting portion and triangular cutting portions, said pad lifting the wire clear of the die for forward feed after formation of the projection and recess, said punch having a concave side mating with the aforesaid convex die portion, said punch further having triangularly grooved channels in the sides mating with the aforesaid triangular die portions, the arrangement being such that, when the punch descends, it severs the wire from an element supported on the stationary die portion at the end of the wire, and further severs the wire from two triangular pieces of scrap supported on the aforesaid triangular die portions, the element and scrap being left stationary on the die while the wire is punched downwardly away from the same, the outline of the punch and die being such that the severed piece constitutes a fastener element.

13. Apparatus for the manufacture of slide fasteners having fastener elements with approximately parallel sides and jaws with ends that are approximately perpendicular to the sides for best cooperation with a slider, said jaws being narrowed to much smaller dimension adjacent the head, said apparatus comprising means to guide a smooth, flat wire, punch and die mechanism functioning to form a recess on one side and a projection on the opposite side of the wire, and functioning to cut small triangular shaped pieces of metal from the side of the wire, and further functioning to sever the wire, said die having a generally keyhole shaped slot for supporting and guiding an upwardly fed tape having a beaded edge, said die further having a convex cutting portion shaped to conform to the head of the element being severed, said die further comprising two pointed or triangular-shaped side pieces for cutting notches in the side edges of the wire, said die further comprising a depressible spring pad fitting within and mating with said convex cutting portion and triangular cutting portions, said pad lifting the wire clear of the die for forward feed after formation of the projection and recess, said punch having a concave side mating with the aforesaid convex die portion, said punch further having triangularly grooved channels in the sides mating with the aforesaid triangular portions, the arrangement being such that, when the punch descends, it severs the wire from an element supported on the stationary die portion at the end of the wire, and further severs the wire from two triangular pieces of scrap supported on the aforesaid triangular die portions, the element and scrap being left stationary on the die while the wire is punched downwardly away from the same, the outline of the severing punch being such that the severed piece constitutes a fastener element having a head with spread jaws, the head being of such dimension as to fill the space between the jaws, and said jaws having the aforesaid approximately perpendicular ends of such dimension that when the jaws are closed their sides are substantially parallel, air-blast means for moving said small triangular pieces of scrap outwardly from the triangular die portions, and feed means to intermittently feed the wire to the punch and die, each of the repeated feed distances equalling only a small fraction of the length of an element.

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