Jan. 15, 1963 G. G. GRINNELL 3,073,355

SHEET BINDER

Original Filed Jan. 3, 1941 3 Sheets-Sheet 1

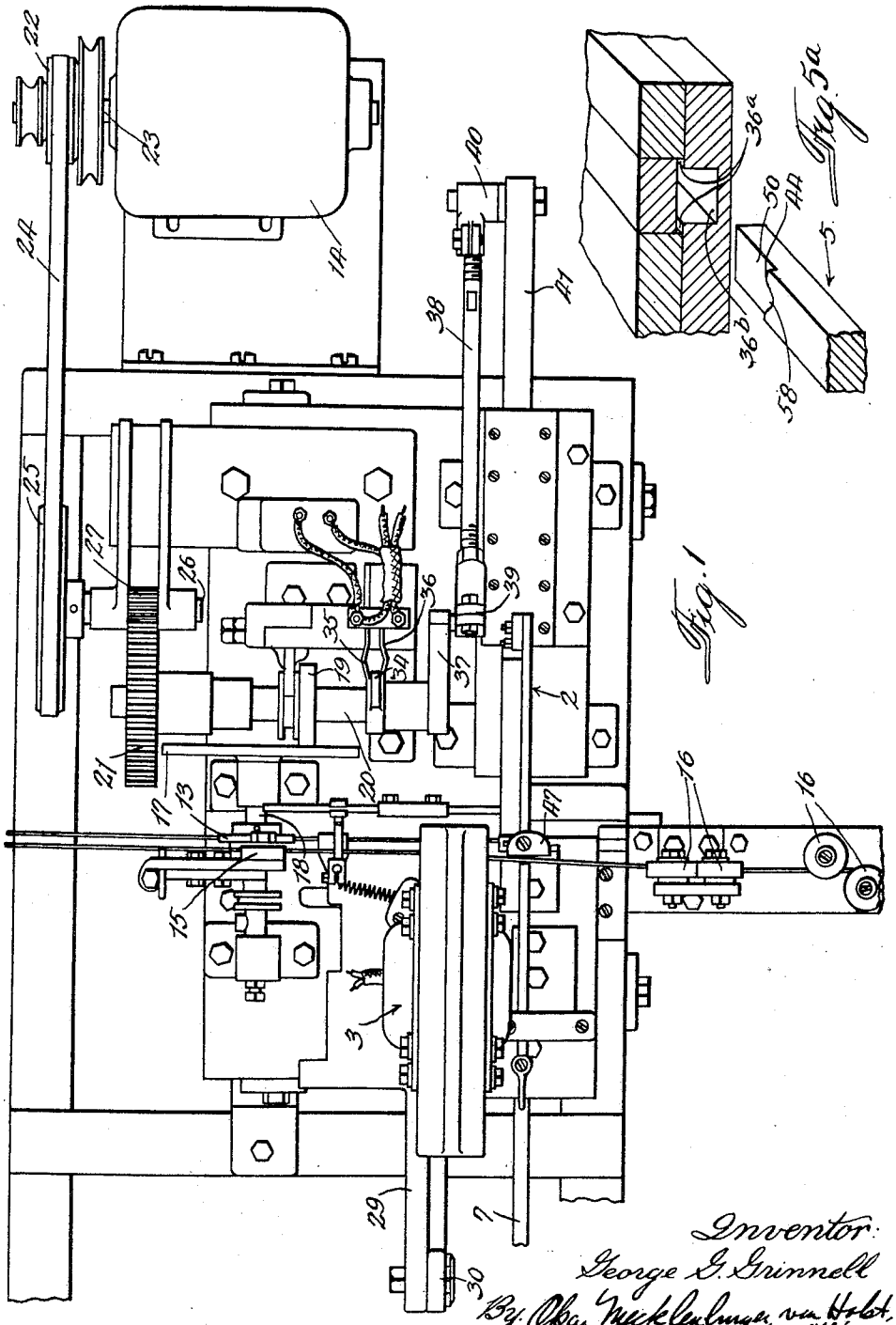


Fig. 1

Fig. 5a

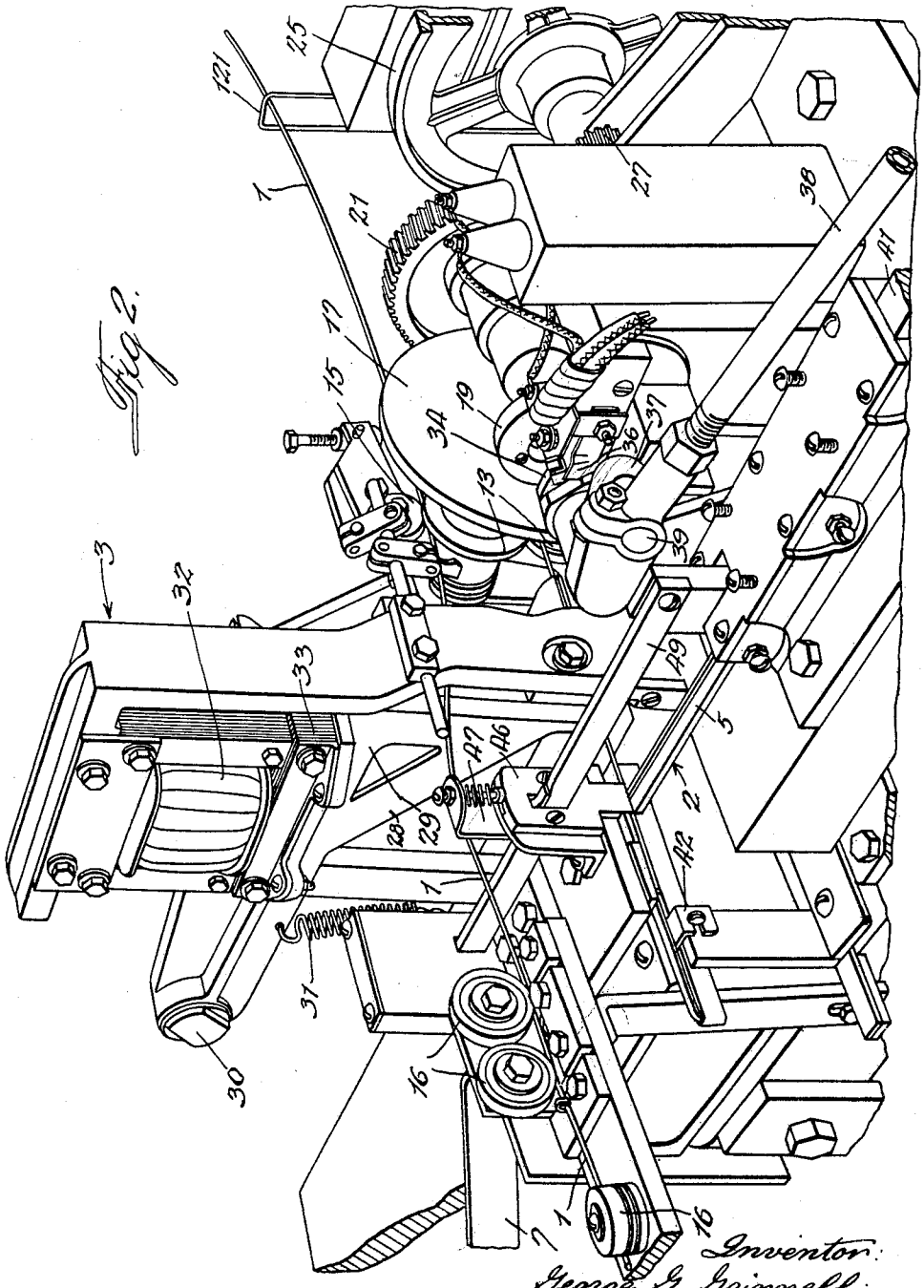
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Fig. 2.



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Original Filed Jan. 3, 1941 3 Sheets-Sheet 3

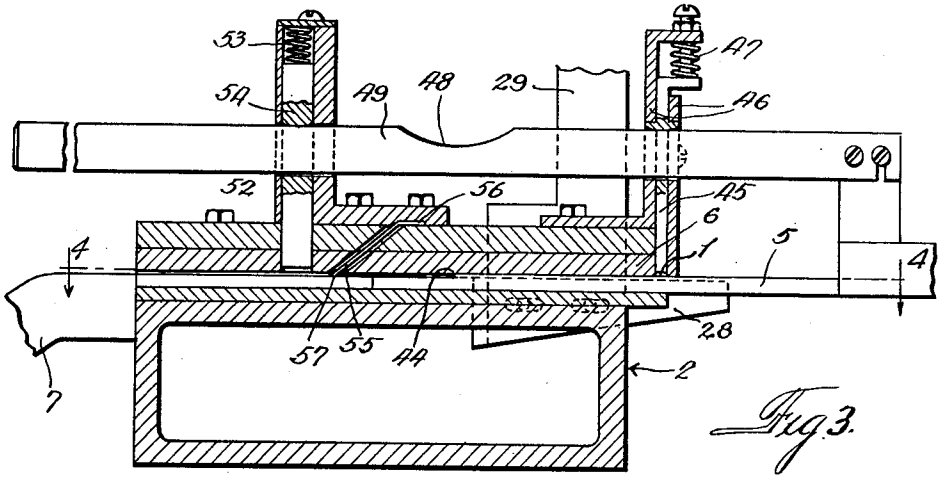


Fig. 3.

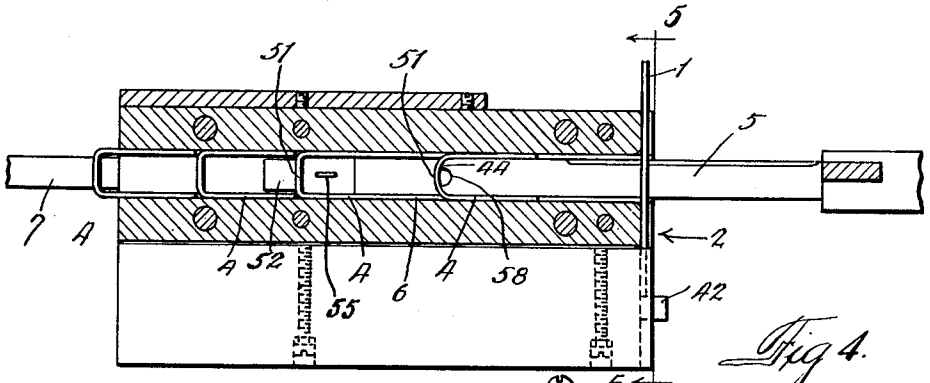


Fig. 4.

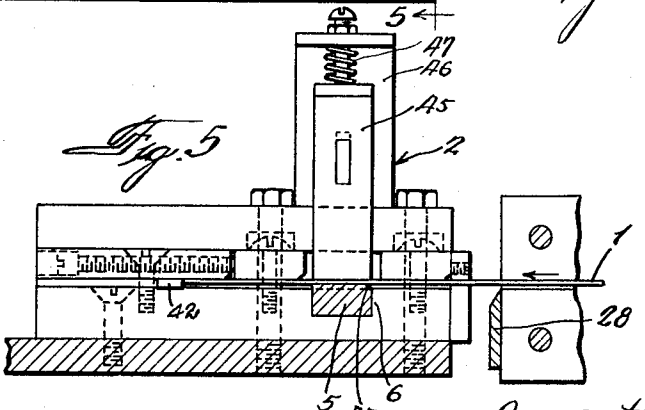


Fig. 5

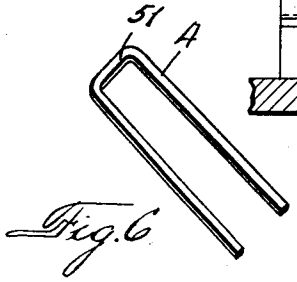


Fig. 6

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SHEET BINDER

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Application Feb. 11, 1954, Ser. No. 409,608, which is a continuation of application Ser. No. 175,456, July 22, 1950, which in turn is a continuation of application Ser. No. 596,883, May 31, 1945, which is a division of application Ser. No. 373,021, Jan. 3, 1941, now Patent No. 2,377,340, dated June 5, 1945. Divided and this application July 9, 1958, Ser. No. 747,448

10 Claims. (Cl. 140—71)

My invention relates to sheet binders.

This application is a division of my copending application Serial No. 409,608, Patent No. 2,850,927, filed February 11, 1954 which is a continuation of my application Serial No. 175,456, filed July 22, 1950, now abandoned, which is a continuation of my application Serial No. 596,883, Patent No. 2,855,763, filed May 31, 1945, which is a division of my application Serial No. 373,021, filed January 3, 1941 (now Patent No. 2,377,340).

One of the objects of my invention is to provide apparatus for forming U-shaped fasteners from wire, each fastener having two leg portions and a wire crosspiece portion connecting the leg portions.

It is another object of this invention to provide a novel fastener-forming apparatus in which the wire from which the fasteners are formed is continuously fed into engagement with a forming tool whereby the utmost in efficiency of operation is assured.

It is a still further object of this invention to provide a novel tool and die combination employing cam-actuated stop means and wire positioning means which function in synchronism with the reciprocally moving tool member whereby U-shaped fasteners are formed of uniform configuration in a continuous manner.

Further objects and advantages of the invention will be apparent from the description and claims.

In the drawings, in which my invention is illustrated,

FIG. 1 is a plan view of the fastener forming mechanism;

FIG. 2 is a perspective view showing the wire feeding apparatus, the wire severing apparatus, and the tool and die forming apparatus;

FIG. 3 is a longitudinal vertical sectional view showing the tool and die forming apparatus;

FIG. 4 is a horizontal section on the line 4—4 of FIG. 3;

FIG. 5 is a vertical transverse section on the line 5—5 of FIG. 4;

FIG. 5*a* is a perspective view showing the tool and forming die; and

FIG. 6 is a perspective view of one of the fastener elements.

Referring to the drawings in detail, the construction shown comprises a mechanism for withdrawing flat wire 1 from a reel, straightening it, and feeding it to a forming device 2 (FIGS. 3, 4 and 5), mechanism 3 for cutting the wire into sections of the proper length for forming the U-shaped fasteners 4, the latter mechanism including a plunger 5 and die 6 for forming the severed sections into U-shaped fastener devices 4.

The mechanism for withdrawing the wire from the reel and feeding it to the forming die comprises a pair of friction feed wheels 13 (FIGS. 1 and 2) constantly driven from the motor 14, for frictionally feeding the wire 1 to the forming device 2, a pair of friction feed rolls 15 for insuring a sufficient supply of wire to the feed rolls 13, also constantly driven from the motor 14, and guiding and straightening rolls 16 for straightening the wire as it is removed from the reel and guiding it to the feed rolls 15.

In order to adjust the speed of the feed rolls 13 and 15 to insure the proper rate of supply, a variable speed drive is provided between the motor 14 and feed rolls comprising a friction disc 17 (FIGS. 1 and 2) mounted on the shaft 18 of the feed rolls 13 and 15 and a friction wheel 19 shiftable across the face of this friction disc 17 and splined to a shaft 20 on which the gear 21 is mounted. This gear 21 is driven from the motor 14 by means of a pulley 22 on the motor shaft 23, a belt 24 running over this pulley, and a pulley 25 over which this belt 24 runs mounted on a shaft 26 on which the pinion 27 is mounted which meshes with the gear 21. Any suitable means may be provided for controlling the speed of the motor 14.

The means 3 for severing the wire into sections of the proper length comprises a shearing knife 28 underneath the wire 1 as it travels, as shown in FIGS. 3 and 5, and an L-shaped arm 29, on which this knife is mounted, pivotally mounted at 30 (FIGS. 1 and 2). A spring 31 is provided which normally holds the knife 28 in lowered position. An electromagnet 32 is provided cooperating with an armature 33 on the knife arm to effect the severing action of the knife. This electromagnet 32 is energized in timed relation with the staple-forming tool 5 by means of a U-shaped circuit-closing conductor 34 (FIGS. 1 and 2), mounted on the same motor-driven shaft 20 on which the motor-driven gear 21 is mounted. Each revolution of this shaft will close the circuit for the electromagnet through the contacts 35 and 36 and the U-shaped conductor 34.

The mechanism for forming the U-shaped fastener comprises the die element 6 having opposed guides or grooves 36*a* (FIG. 5*a*) for receiving and forming the arms of the U-shaped fastener, and a plunger tool 5 slidable in a guideway 36*b* cooperating with this die 6, operating transversely of the direction of travel of the wire 1 and serving to force the severed section of wire into the die to cause the section to assume the U-shape as shown in FIGS. 3, 4, 5 and 6.

The plunger tool 5 is operated from the same motor-driven shaft 20 which feeds the wire 1 and controls the movement of the knife 28, by means of a crank 37 mounted on the motor-driven shaft 20, a connecting rod 38 pivotally secured at 39 to the crank 37, and a wrist pin connection 40 with the slide 41 to which the fastener-forming tool 5 is secured. With this construction, it will be seen that each revolution of the motor-driven shaft 20 will cause a section of wire to be cut off by the knife 28 and will cause the tool 5 to make one complete stroke back and forth to form one of the U-shaped fasteners. At the same time the friction feed wheels 13 will be rotated to cause the wire to be advanced sufficiently to provide material for another fastener. An adjustable stop 42 (FIGS. 2 and 4) is interposed in the path of travel of the wire to stop the travel for an instant while the wire is being severed. The instant the section is severed off, the plunger tool 5 engages the middle part of the section and forces it into the die. Means are provided for enabling the feeding of the wire to be resumed while the plunger die is making this stroke back and forth. For this purpose, the edge of the plunger is beveled, as shown at 43 (FIG. 5), to enable the advance end of the severed wire to ride up along this incline 43 and to pass across and above the plunger as the plunger is making its back-and-forth stroke, as shown in FIG. 5.

In order that the plunger may engage the wire when the plunger begins its advance, the front end of the plunger is relieved to provide a fastener-engaging shoulder 44 (FIGS. 3, 4 and 5*a*). In order to insure that the wire is brought down so as to be in the path of this shoulder 44 when the plunger 5 begins its advance, a cam-controlled, spring-pressed depressor slide 45 is pro-

vided. This depressor slide 45 is mounted in fixed guides 46 adjacent the entrance to the die and is urged downwardly by means of a compression spring 47. The downward movement of this depressor slide is controlled by a cam depression 48 in a cam bar 49 which reciprocates with the plunger tool 5, as shown in FIGS. 2 and 3. When the plunger tool 5 is withdrawn so that the relieved front portion 50 (FIG. 5a) of the plunger is underneath the wire 1, the cam depression 48 will have been moved to a position which will enable the wire depressor 45 to move downwardly to force the wire 1 onto the relieved portion 50 of the plunger tool. This insures that the flat wire will not buckle up and elude the front edge of the shoulder portion 44 of the forming tool in its initial movement.

In order to straighten out the connecting portion 51 of the U-shaped fastener, a reciprocable cam-controlled, spring-pressed stop 52 is provided (FIGS. 3 and 4). This stop 52 is moved up and out of the way by the cam bar 49 to enable the ejection of the completed fasteners and is moved down into the path of the connecting part 51 of a succeeding fastener by means of a compression spring 53 when the depressed cam portion 48 of the cam slide comes underneath the follower portion 54 of the reciprocable stop.

In order to insure that the fastener 4 is not withdrawn or partially withdrawn as the plunger tool 5 returns, a snap spring detent 55 is provided, secured at one end at 56 and having its free end 57 in position to snap down into the recess 58 in the shoulder 44 of the tool 5 behind the crosspiece 51 of the U-shaped fastener when this crosspiece is pressed against the reciprocable stop 52. The die 6 and tool 5 are relieved and rounded off where necessary to facilitate the bending and forming operations.

I have found that fasteners with a colored coating may be made by providing the wire with a coating of coloring material before the fasteners are formed. The forming of the fasteners does not materially injure the coating. This enables fasteners to be made in various colors to harmonize with the tablet covers or the like.

It is thus seen that a novel fastener-forming apparatus has been provided which is adapted to form U-shaped fasteners from continuously fed wire of rectilinear cross-sectional configuration. The above-described apparatus is simple in details of construction and possessed of a few sturdy parts which have a long useful life.

Further modifications will be apparent to those skilled in the art, and it is desired, therefore, that the invention be limited only by the scope of the appended claims.

I claim:

1. Apparatus for forming U-shaped fasteners from wire, each fastener having two leg portions and a wire crosspiece portion connecting said leg portions, said apparatus comprising a die having a longitudinal passageway, a reciprocating tool movable in said passageway, said passageway being formed integrally with spaced parallel guide channels straddling said passageway for receiving and guiding said fastener leg portions, said reciprocating tool having spaced edge portions of arcuate configuration projecting forwardly of the opposed lateral edges of said tool for engaging said wire whereby said wire will not be bent at a sharp angle when engaged thereby, said arcuate forward edge portions being intermediate said guide channels when disposed in said passageway and engageable with a portion of wire from which said fastener crosspiece is formed, whereby the same may be forced into said die passageway and said wire portions straddling said portion engaging said tool forward edge portions may be bent relative thereto and forced into said parallel guide channels straddling said passageway.

2. Apparatus of claim 1 in which each of said parallel guide channels and said wire have substantially the same rectilinear cross section.

3. Apparatus for forming U-shaped fasteners from wire, each fastener having two leg portions and a wire crosspiece portion connecting said leg portions, said apparatus comprising a die having a longitudinal passageway, a reciprocating tool movable in said passageway, said passageway being formed integrally with spaced parallel guide channels straddling said passageway for receiving and guiding said fastener leg portions, the width of said channels being substantially the same as the thickness of said wire, said reciprocating tool having a relieved surface portion reciprocally movable into said die passageway, said relieved surface portion being intermediate said guide channels when disposed in said passageway, said reciprocating tool surface portion being engageable with a portion of wire from which said fastener crosspiece is formed whereby the same is forced into said die passageway and said straddling wire portions are forced into said parallel guide channels; means for continuously feeding wire across said die and into the path of movement of said tool relieved surface portion, the side of said tool disposed closer to the wire feeding means having a sloping surface whereby said continuously fed wire may be readily thrust from the path of said tool upon contacting said sloping surface in the course of tool movement in said die.

4. The apparatus of claim 3 in combination with means operating in synchronism with said tool and adjacent the point of entry of said tool into said die for positioning said continuously fed wire thrust from the path of said tool into the path of said tool relieved surface portion upon withdrawal of said latter portion from said die.

5. Apparatus for forming U-shaped fasteners from wire, each fastener having two leg portions and a wire crosspiece portion connecting said leg portions, said apparatus comprising a die having a longitudinal passageway, a reciprocating tool movable in said passageway, said passageway being formed integrally with spaced parallel guide channels straddling said passageway for receiving and guiding said fastener leg portions, the width of said channels being substantially the same as the thickness of said wire, said reciprocating tool having spaced edge portions of arcuate configuration projecting forwardly of the distal ends of the opposed side edges of said tool for engaging said wire whereby said wire will not be bent at a sharp angle when engaged thereby, said arcuate forward edge portions being intermediate said guide channels when disposed in said passageway and engageable with a portion of wire from which said fastener crosspiece is formed, whereby the same may be forced into said passageway and said wire portions straddling said portion engaging said tool forward edge portions may be bent relative thereto and forced into said parallel guide channels straddling said passageway, and reciprocally movable stop means movable into a position transversely disposed to the movement of said wire engaged by said spaced arcuate forward edge portions of said tool whereby said stop means may impart a straight-line configuration to the wire portion interposed between the wire portions engaging said spaced, arcuate forward edge portions of said tool.

6. Apparatus for forming U-shaped fasteners from wire, each fastener having two leg portions and a wire crosspiece portion connecting said leg portions, said apparatus comprising a die having a longitudinal passageway, a reciprocating tool movable in said passageway, said passageway being formed integrally with spaced parallel guide channels straddling said passageway for receiving and guiding said fastener leg portions, the width of said channels being substantially the same as the thickness of said wire, said reciprocating tool having spaced forward edge portions of arcuate configuration for engaging said wire whereby said wire will not be bent at a sharp angle when engaged thereby, said arcuate forward edge portions being intermediate said guide channels when disposed in said passageway and engageable with a portion of wire from which said fastener crosspiece is formed, whereby

the same may be forced into said passageway and said wire portions straddling said portion engaging said tool forward edge portions may be bent relative thereto and forced into said parallel guide channels straddling said passageway, reciprocally movable stop means movable into a position transversely disposed to the movement of said wire engaged by said spaced arcuate forward edge portions of said tool whereby said stop means may impart a straight-line configuration to the wire portion interposed between the wire portions engaging said spaced, arcuate forward edge portions of said tool, and a resiliently biased detent disposed in said passageway having a distal end movable into the space between said tool spaced forward edge portions upon withdrawal of said tool forward edge portions from said die passageway whereby the formed wire engaging said tool is engaged by said detent, removed from engagement with said tool and retained in said die passageway.

7. Apparatus for forming U-shaped fasteners from wire, each fastener having two leg portions and a wire crosspiece portion connecting said leg portions, said apparatus comprising a die having a longitudinal passageway, a reciprocating tool movable in said passageway, said passageway being formed integrally with spaced parallel guide channels straddling said passageway for receiving and guiding said fastener leg portions, said reciprocating tool having a distal portion disposed beneath the plane of said die guide channels, and a tool edge spaced from said tool distal portion movable out of said die passageway, disposed above the plane of said tool distal portion in the plane of said parallel guide channels; said tool edge comprising spaced portions of arcuate configuration disposed forwardly of the lateral end limits of said tool edge, said tool spaced portions being engageable with a portion of wire from which said fastener crosspiece is formed, whereby the same may be forced into said die passageway by said tool portions and said wire portions straddling said portion engaging said tool forward edge portions may be bent relative thereto and forced into said parallel guide channels.

8. The apparatus of claim 7 in combination with means operating in synchronism with said tool and adjacent the point of entry of said tool into said die for positioning a portion of said wire on said tool planar portion in the path of said tool edge movement when said tool edge is outside said die passageway.

9. Apparatus for forming U-shaped fasteners from wire, each fastener having two leg portions and a wire crosspiece portion connecting said leg portions, said apparatus comprising a die having a longitudinal passageway, a reciprocating tool movable in said passageway, said reciprocating tool having an edge portion spanning the interval between said guide channels and having a height substantially equal to the height of said guide channels, said edge portion comprising spaced twin arcuate portions disposed forwardly of the lateral end limits of said tool edge; said arcuate portions defining a central recess therebetween, said tool spaced portions being engageable with a portion of wire from which said fastener crosspiece is formed, whereby the same may be forced into said die passageway by said tool portions and said wire portions straddling said portion engaging said tool forward edge portions may be bent relative thereto and forced into said parallel guide channels.

10. Apparatus for forming U-shaped fasteners from wire, each fastener having two leg portions and a wire crosspiece portion connecting said leg portions, said apparatus comprising a die having a longitudinal passageway, a reciprocating tool movable in said passageway, having a fastener-forming end portion reciprocally movable into said passageway, means continuously feeding wire across said die and into the path of movement of said tool fastener-forming end portion, the side of said tool disposed closer to said wire feeding means being formed so as to thrust said continuously fed wire above and over said reciprocating tool, and means operating in synchronism with said tool adjacent the point of entry of said tool into said die for positioning said continuously fed wire into the path of said tool fastener-forming end portion upon withdrawal of said latter portion from said die.

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