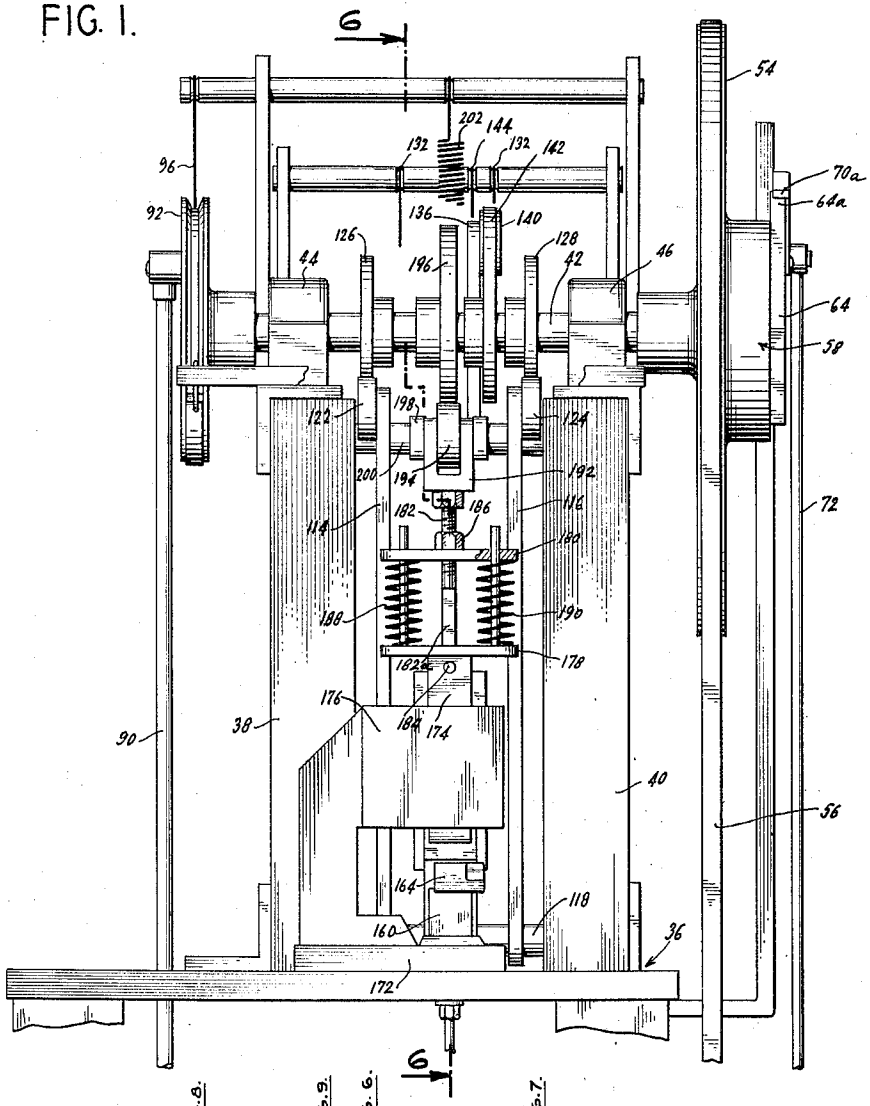
Sept. 3, 1957 R. W. WINBERG 2,804,622

CLIP-FORMING AND CLINCHING MECHANISMS

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FIG. 1.



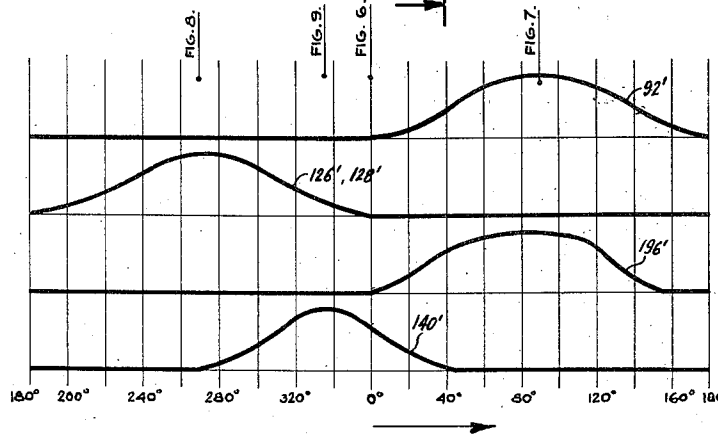


FIG. 2.

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CLIP-FORMING AND CLINCHING MECHANISMS

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FIG. 6.

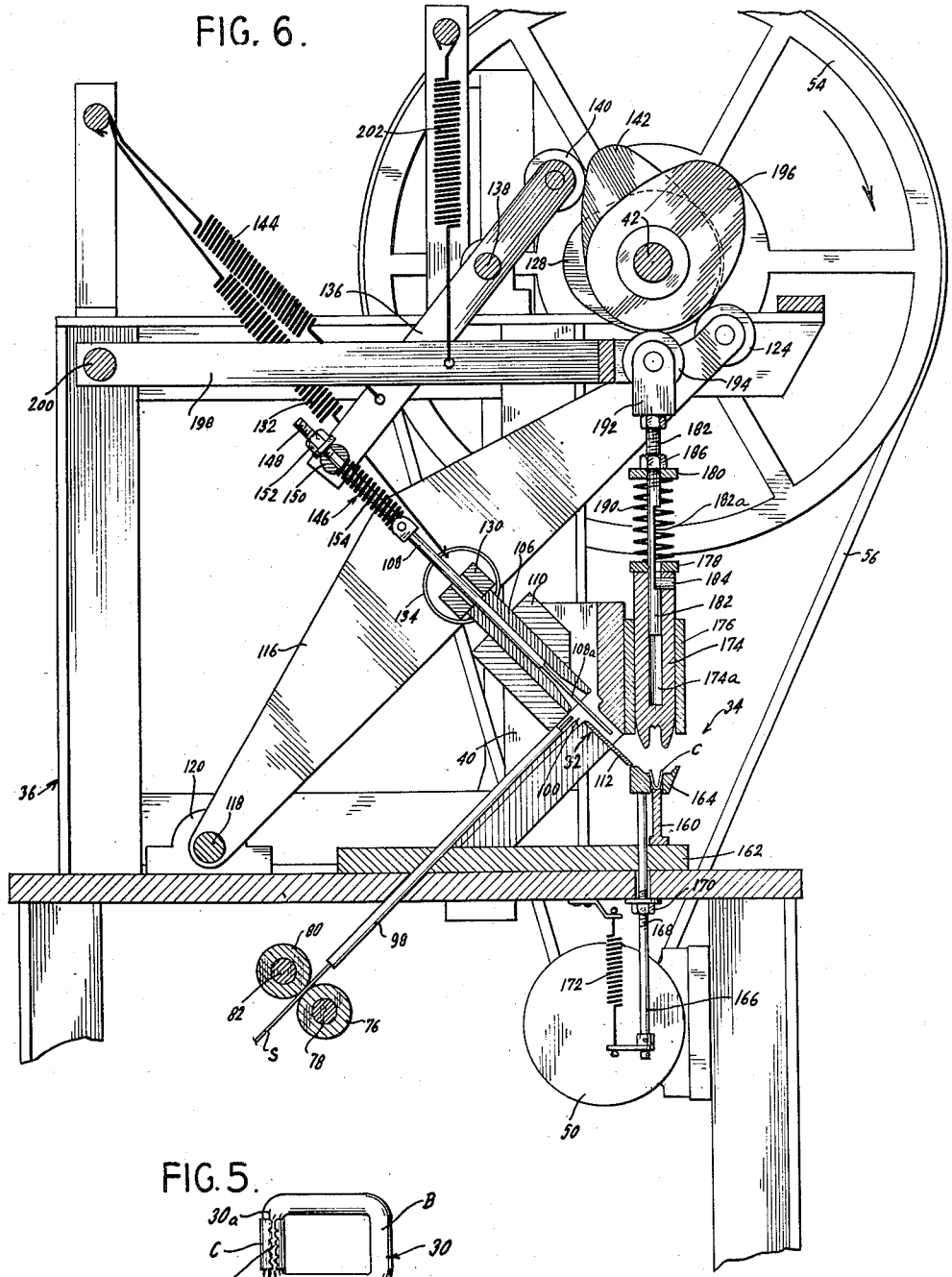


FIG. 5.

FIG. 3.

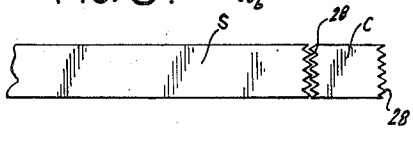
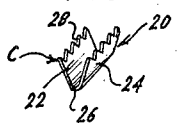


FIG. 4.



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CLIP-FORMING AND CLINCHING MECHANISMS

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FIG. 10.

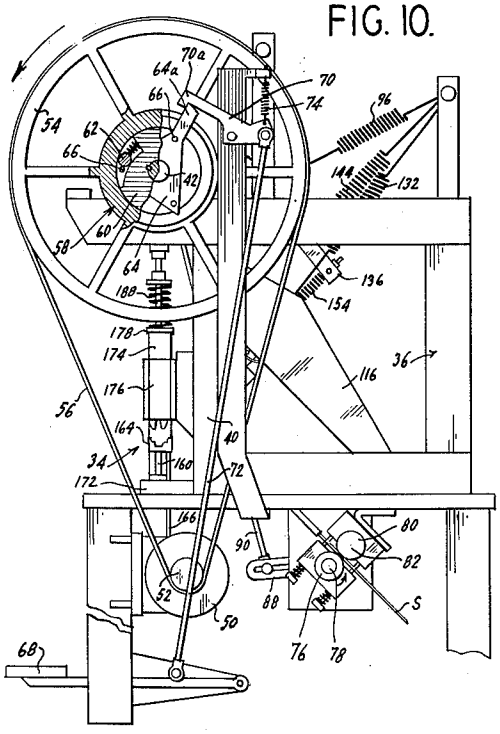
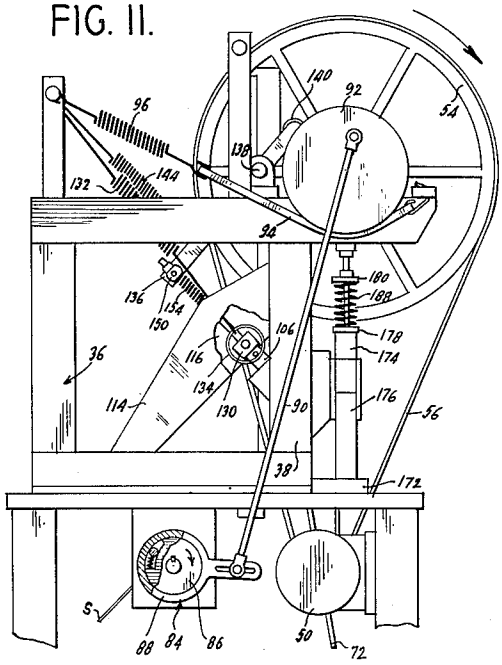


FIG. 11.



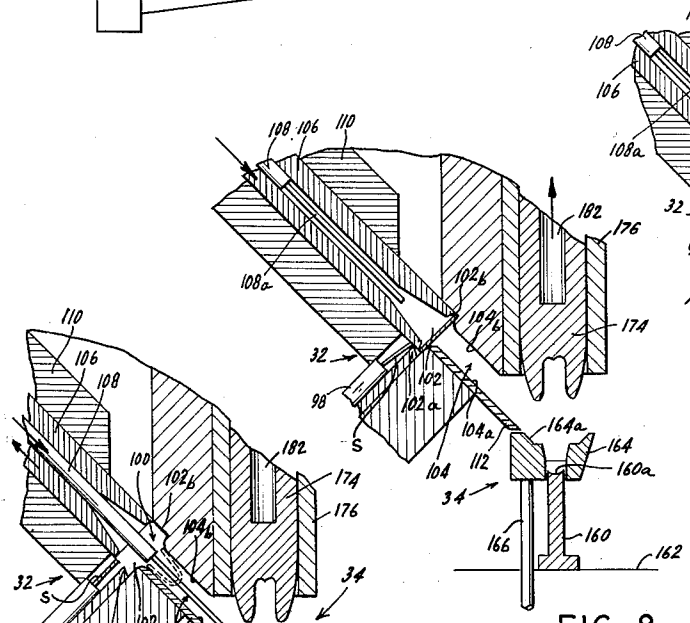


FIG. 8.

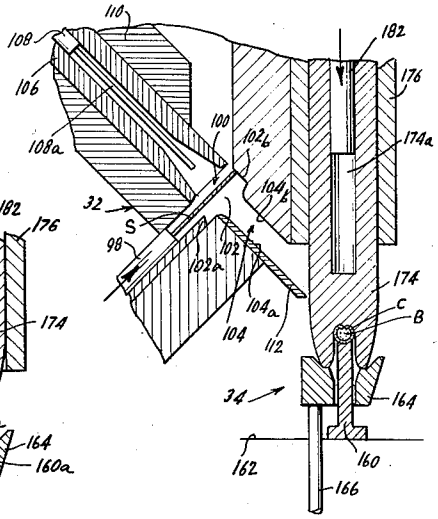


FIG. 7.

FIG. 9.

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United States Patent Office 2,804,622 Patented Sept. 3, 1957

2,804,622

CLIP-FORMING AND CLINCHING MECHANISMS

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Application August 26, 1955, Serial No. 530,778

13 Claims. (Cl. 1—177)

The present invention relates to forming and assembling apparatus, and particularly to a machine for forming spring clips from a strip of metal and for clinching the metal clips on an article, such as the inturned ends of a covered wire buckle. This is a continuation-in-part of application Serial No. 488,813, filed March 16, 1955.

In the manufacture of covered wire buckles, it is conventional to form a length of wire stock covered with leather, plastic, cloth or the like, into a generally rectangular shape or frame with terminal or end portions of the wire stock bent into end to end alignment. Thereafter, the aligned end portions of the buckle body are joined together by a metal clip which is clinched about the aligned end portions. The finishing operation usually is achieved by employing a more or less conventional foot or kick press in conjunction with machine-formed clips. This type of finishing operation necessitates manual feed of successive clips to the press along with the buckle body, followed by operation of the press. Obviously, this manner of finishing is tedious and time-consuming, especially when it is recalled that covered wire buckles are usually manufactured in very large quantities and at comparatively low unit cost.

In lieu of such tedious and time-consuming finishing operation, mechanisms have been devised for automatically feeding clips of a special construction from a hopper to a clinching punch or press at which the specially-formed clip is clinched about the inturned ends of the buckle body. Although such machine represents an advance over the prevalent finishing methods, the machine is limited in its application in that it requires clips of special construction. Apart from the increase in cost represented by employing such special clips, the need for such special clips limits the manufacturer's source of supply.

Investigation indicates that clips or especially simple configuration, as have been employed for many years, are suitable for clinching the inturned ends of the buckle body. Such clips are of generally U-shaped configuration and define a guideway into which the inturned ends of the buckle may be slipped. The U-shaped clip terminates at its opposite sides in serrated edges which, when turned inwardly during the clinching operation, serve as teeth and grasp the buckle covering. Practical considerations indicate that such clips should be both formed and clinched by the belt manufacturer. That is, from the viewpoint of economy, simplicity and availability, both the clip manufacturing and clip clinching operation should be achieved in the same machine, preferably starting from readily available metallic stock.

It is broadly known to provide a single machine which forms clips or ferrules and to apply such clips to cylindrical members; however, such machines in their broad application to the manufacture of covered wire buckles must take into account many practical considerations. Simplicity and reliability are prime requisites in gaining commercial acceptance by buckle manufacturers for a combined clip-forming and clinching machine; even the

most simple mechanical difficulties which might be encountered in other types of automatic machinery are a deterrent to use of such a machine by a buckle manufacturer, especially when it is recalled that cost considerations dictate the use of unskilled labor in operating such machines. Apart from the labor requirements, such clip-forming and clinching machines are usually placed in relatively small manufacturing operations having no facilities for minor adjustments or servicing. Usually the most simple repair or adjustment necessitates the services of an outside mechanic.

It is broadly an object of the present invention to provide a clip-forming and clinching machine obviating one or more of the aforesaid difficulties. Specifically, it is within the contemplation of the present invention to provide mechanisms which form lengths of metal stock into clips and transfer successive clips to further mechanisms for clinching the clips about an article, such as the inturned ends of a covered wire buckle.

It is a still further object of the present invention to provide clip-forming and clinching mechanisms suitable for use in the manufacture of covered wire buckles and which may be operated by highly unskilled personnel.

It is a still further object of the present invention to provide forming and clinching aparatus of the aforesaid character which assure virtualy trouble-free operation, and in the event of fouling, may be cleared of the trouble without requiring dismantling of parts, or servicing by a skilled repairman.

It is a still further object of the present invention to provide clip-forming and clinching mechanisms which may be operated with minimum risk of injury to the operator, and without extreme dexterity or care on the part of the operator.

A still further problem encountered in the forming or bending of a clip about the inturned ends of covered wire buckles is that of handling covered wires of different gauges and/or coverings of different thicknesses and materials. When changing over from one type of covered wire stock to another type, it is not uncommon to find that the clinching punch or die exerts excessive pressure on the covered wire stock, causing the covering to be marred, ripped, or otherwise distorted. Under such conditions, it is necessary to change the dies and/or change the length of the stroke. Such need for adjustment represents a loss of time and money, especially if short runs are made of buckles manufactured of various stock thicknesses.

It is among the objects of the present invention to provide clinching or forming mechanisms which are capable of exerting uniform clinching pressure, despite variations in thicknesses of the covered wire stock employed in the buckles being fed to the mechanisms. To advantage, a wide variety of covered wire buckles may be finished by the present mechanisms, with the assurance of self-adjustment of the clinching pressure, and substantial uniformity in clinching pressure from buckle to buckle.

The above objects as well as further advantages and features of the present invention will be best appreciated by reference to the following detailed description of several presently preferred but nonetheless illustrative embodiments of the present invention, when taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a front elevational view of an illustrative clip-forming and clip-clinching machine demonstrating features of the present invention;

Fig. 2 is a layout view showing the development for the several cam drives of the present machine and illustrating the timing for the present machine;

Fig. 3 is a plan view showing the metal stock from

which successive clips are formed, with a clip blanked out from the stock proper;

Fig. 4 is a perspective view of a typical clip manufactured by machines embodying features of the present invention;

Fig. 5 is a plan view showing the assembly of the clip of Fig. 4 and a covered wire buckle after clinching by the present machine;

Fig. 6 is a sectional view taken substantially along the line 6—6 of Fig. 1 and looking in the direction of the arrows;

Fig. 7 is a fragmentary elevational view showing the present clip-forming mechanisms with the clinching die in the extended position, the bending punch in the retracted position, and with a length of stock in position to be blanked by the cutting die;

Fig. 8 is an elevational view similar to Fig. 7, showing showing the clinching die in the retracted position; the bending punch in the retracted position and the cutting die in position after blanking a piece of stock from the continuous length of stock;

Fig. 9 is an elevational view similar to Fig. 7, showing the clinching die in the retracted position, and the bending punch in the extending position wherein a form clip is delivered to the clinching station;

Fig. 10 is an elevational view, taken from the right of Fig. 1 and with part sectioned, showing the details of the single cycle, pedally operated drive for the forming and clinching machine of the present invention; and,

Fig. 11 is an elevational view taken from the left of Fig. 1, showing the details of the intermittently operable drive for advancing the stripped stock to the cutting and forming mechanisms.

Preliminary to a detailed description of a machine embodying features of the present invention, reference will be made to Figs. 3 to 5 inclusive, which show in sequence, the stock S for forming clips (Figs. 3), the formed spring clip C (Fig. 4), and the clinched buckle B (Fig. 5). The spring clip C which is to be assembled about the inturned ends of the buckle B includes a generally U-shaped body 20 having divergent walls 22, 24 joined together by a curved bight 26, the walls terminating in serrated edges providing gripping fingers 28. The buckle shown in Fig. 5 includes a rectangular body 30 formed from a length of wire stock having thereon an appropriate leather, plastic or cloth cover, the rectangular body having inturned and aligned ends or terminal portions 30*a*, 30*b* about which the clip C is clinched.

In the assembly of Fig. 5, the clip of Fig. 4 encircles the aligned ends 30*a*, 30*b* and is formed such that the teeth 28 are embedded into and grip the cover of the rectangular body 30. The mechanisms to be now described form the continuous strip stock S into the open spring clips of Fig. 4, and thereafter upon manual feed of successive buckle frames 30 to the machine, are effective to clinch the open spring clips C into the engaged position illustrated in Fig. 5.

Referring now specifically to Figs. 1, 6, 10 and 11, there is shown an illustrative machine according to the present invention which includes a clip-forming station, generally designated by the reference numeral 32, and a clip-bending clinching station, generally designated by the reference numeral 34.

The machine includes a frame 36 having spaced apart uprights 38, 40 and other required framing portions. Disposed horizontally between the uprights or standards 38, 40 is a main cam shaft 42 which is journaled for rotation in bearings 44, 46 on the respective standards, 38, 40. The main cam shaft 42 is driven from an appropriate electric motor 50 mounted on the frame 36. A speed reducing coupling is introduced between the motor 50 and the shaft 42 and includes a small diameter pulley 52 connected to the motor shaft, a large diameter pulley 54 loosely journaled on the cam shaft 42 and a feed belt 56 trained about the pulleys 52, 54. A single cycle clutching mechanism, generally designated by the reference numeral 58 is interconnected between the large diameter pulley 54 and the cam shaft 42. As seen best in Figs. 10 and 11, the single cycle control for driving the cam shaft 42 through successive operating cycles, includes a driven plate 60 keyed to the cam shaft 42 and spring-bias coupling wedges 62 normally effective to provide a driving connection between the plate 60 and the pulley 54. This driving connection is periodically interrupted through provision of a control plate 64 having pins 66 disposed in operative positions relative to the respective wedges 62 such that upon rocking motion of the control plate in the clockwise direction in Fig. 10, the wedges 62 are displaced from the positions providing the driving connection between the plate 60 and the cam shaft 42. The control plate 64 and the associated pins 66 are rendered effective at the end of each cycle to disrupt the drive and are controlled from a depressible foot treadle 68 operative on a pivoted bell crank lever 70 connected to the treadle by a coupling rod 72. The control plate 64 includes a radially extending arm 64*a*, while the bell crank 70 includes a catch 70*a*, the bell crank being biased by the spring 74 such that the catch 70*a* engages the arm 64*a* at the end of a cycle and rocks the control plate 64 in a clockwise direction in an amount sufficient to interrupt the drive. It is to be expressly understood that other mechanisms are equally suitable for attaining the desired single cycle activation of the driven cam shaft 42.

Reference will now be made to the details of the mechanisms at the clip-forming station 32 wherein the continuous length of strip stock S is intermittently fed to a work location, severed, formed with serrated cutting edges providing the clinching teeth 28, and finally bent into the configuration of the U-shaped body 20 and delivered to the clip-clinching station 34. As seen best in Fig. 6, a strip stock feeder is provided which includes a roller 76 connected to a driven shaft 78, and a cooperating roller 80 keyed to a stub shaft 82. If required the assembly of the roller 80 and its shaft 82 may be supported on a carrier which is movable in relation to the roller 76 and spring biased toward the same to accommodate various stock thicknesses.

Intermittent drive is provided to the feed rollers 76, 80 from the main cam shaft 42 through a coupling including a silent clutch of the ball or roller type, generally designated by the reference numeral 84. As seen in Fig. 11, the silent clutch 84 is driven in the clockwise direction and includes a driven member 86 connected to the shaft 78 of the roller 76. The driving member 88 of the silent clutch 84 is turned in clockwise motion during a portion of the control cycle through an appropriate eccentric coupling including a coupling rod 90 connected at one end to the driven member 88 and at the other end to an eccentric 92 on the main shaft 42. Accordingly for each cycle rotation of the main shaft, the eccentrically-operated clutching mechanism 84 is effective to turn the feeder rollers 76, 80 which in turn deliver a predetermined length of the stock S. Trained about the eccentric 92 is a braking band 94 which is biased into contact with the periphery of the eccentric 92 by a spring 96 anchored on the frame 36. The spring-biased braking band 94 avoids over running of the cam shaft 42 by its driving mechanisms. By adjusting the length of the coupling 90 in relation to the eccentric 92 and the silent clutch 84, the effective length of strip stock S intermittently fed by the feeder may be adjusted in accordance with operational requirements.

Referring again to Fig. 6, it will be seen that the feeder delivers the strip stock S upwardly at an angle of 45° to the horizontal through a guide 98 which terminates short of a female cutting die 100. As seen best in Figs. 7 to 9 inclusive, all of which views are on an enlarged scale, the female die 100 includes a cut-off cavity 102 which is formed with a cutting edge 102*a* and a stop

102*b*. The cutting edge 102*a* is slightly undercut and is serrated to provide the required clinching teeth 28 for the clips 20 upon cutting of successive blanks from the strip material S. The stop 102*b* is spaced in relation to the cutting edge 102*a* in accordance with the length of the stock fed by the intermittently-operated feeder. The cutting die 100 extends substantially in the 45° plane of advance of the stock S and the feed is adjusted in relation to the stop 102*b* such that the leading edge of the strip is substantially in contact with the stop 102*b*.

Opening upwardly into the bottom of the cut-off cavity 102 of the female die 100 is a forming channel 104 which includes opposed forming surfaces 104*a*, 104*b*. The entry end of the forming channel 104 merges into the floor of the cavity 102, while the exit end is directed toward the seat of the clinching mechanisms 34, as will subsequently be described in detail. The forming channel 104 is disposed substantially at an angle of 45° to the vertical and at right angles to the direction of feed of the strip stock S.

Disposed over the female cutting die 100 are nested cutting punch 106 and bending punch 108. The outer punch 106 is a male cutting die mounted with its line of action substantially in the longitudinal center plane of the forming channel 104, the male cutting punch 106 being slidably mounted in an appropriate bearing formed in a supporting bracket 110. The leading end of the cutting punch 106 is shaped in relation to the cut-off cavity 102 of the female die 100 to sever the length of the strip stock S which straddles the cut-off cavity 102 and to displace the same downwardly against the floor of the cavity 102. The action of the cutting punch 106 may be best appreciated by sequential reference to Figs. 7 and 8 which show in sequence the punch 106 withdrawn and advanced to the operative position. The nested bending punch 108, which is movable substantially in a medial path between the forming surfaces 104*a*, 104*b*, serves as both a bending die for forming the blank length of stock into the clip configuration and for advancing the formed clip C into the seat in the clinching mechanisms 34. The bending punch 108 terminates in a flat blade 108*a* which is effective upon being displaced through a predetermined thrust to engage the cut-off blank strip stock on the floor of the cut-off cavity 102, to form the cut-off blank into the U-shaped configuration of the clip, and to advance the clip through the required downward angular path toward the clinching mechanisms. Upon progressively inspecting Figs. 8, 9 and 6 the function of the bending blade 108*a* of the punch 108 will be appreciated. After the blank is cut off (Fig. 8) the blade is effective during the first portion of the stroke to preform the blank into the U-shaped configuration (for example, see the dotted line clip of Fig. 9) and thereafter during the remainder of this stroke to advance the clip into the clinching station 34. Upon withdrawal of the blade 108*a* the clip is left in position for operation thereon by the clinching dies. In the form illustrated, the forming surface 104*a* of the channel 104 is a plate 112 disposed at an angle of 45° to the vertical and providing a continuation beyond the exit end of the channel 104 along which the clip C may be guided under the control of the blade 108*a* of the punch 108.

Cam-control actuating mechanisms are operatively connected to the cutting punch 106 for advancing the same through a stroke sufficient to sever the continuous metal strip S into a blank and to seat the blank into cutting die 100. These mechanisms are arranged in a balanced system and include a pair of spaced-apart, vertically-extending actuating arms 114, 116 which are pivoted on a shaft 118 extending across the frame of the machine between bearings 120. The actuating arms extend upwardly and forwardly off the machine and carry cam followers 122, 124 riding on respective flat disc cams 126, 128 on the shaft 42. Extending between the actuating arms 114, 116 is a cross head 130 which is pivotally supported on the respective arms and bears against the adjacent end face of the cutting punch 106. The cross head 130 provides a driving connection against the punch 106 in response to clockwise pivoting of the arms 114, 116 about shaft 118. The punch 106 is biased against the cross head 130 and the cam followers 122, 124 biased against the respective cams 126, 128 by a spring 132 connected via a ring 134 to the punch 106 and anchored on a frame part.

Further actuating mechanisms are operatively connected to the bending punch 108 for removing the same through the required thrust in timed relation to the operation of the cutting punch 106. Such timing is selected such that the bending punch 108 is effective only after the advanced section of the strip S straddles the cut-off cavity 102 and is ready for forming and transport toward the clip-forming station 34. These mechanisms include an actuating arm 136 arranged intermediate the actuating arms 114, 116 and pivoted at 138. Adjacent its upper end the actuating arm 136 carries a cam follower 140 which rides upon the periphery of a further flat disc cam 142 which is seen in Fig. 1 to be offset to the right from the longitudinal center plane of the machine. The cam follower 140 is biased into engagement with the cam 142 by a further spring 144 which is anchored on the machine and is connected to the bending punch 108 by a yieldable coupling 146. As seen in Fig. 6, the punch 108 extends through an appropriate opening in the cross head 130 and carries a threaded bolt 148 which extends through a ball joint 150 and is fixed thereto by a nut 152. Surrounding the bolt 148 is a spring 154 suitably engaged between bearing supports. The arrangement of the coupling 146 which includes the ball joint 150 and the spring 154 is such that upon excessive loading of the punch 108 the coupling 146 will yield rather than cause fouling, jamming, misalignment or other mechanical disturbance to the machine. However, ordinarily the coupling is such that the required driving connection is provided between the actuating arm 136 and the punch 108. By adjusting the nut and bolt connection of the coupling 146 and/or changing the development of the cam 142, it is possible to attain the required forward stroke or thrust for the punch, as will be detailed hereinafter.

Reference will now be made to Figs. 1 and 6 to 9 inclusive for the details of the mechanisms at the clip-clinching station 34 which are effective, upon transfer of successive clips about the buckle frames. The mechanisms at the clip-clinching station 34 include an anvil 160 which projects upwardly from a supporting base 162 and is formed with a clip-supporting surface 160*a*.

Assembled with and surrounding the anvil 160 is a depressible cradle 164 which is secured to an upstanding rod 166 extending through the base 162 and the underlying frame part. An intermediate portion of the rod 166 is threaded, as at 168, and carries on it a stop nut 170 which is adapted to bear against the undersurface of the adjacent frame part as a stop. Operatively connected to the lowermost end of the rod 166 is a spring 172 which serves to bias the coupling rod 166 in the up direction. Through the arrangement of the stop nut 170, it is possible to adjust the vertical height of the cradle 164 to attain the desired orientation with respect to the anvil 160, specifically the surface 160*a*. In the adjusted position, illustrated in Figs. 6, 8 and 9 the cradle 164 and the anvil 160 cooperate to define a seat substantially complimentary to the open clip 20. As seen in Figs. 8 and 9, the cradle 164 includes an inclined surface 164*a* which forms a substantial continuation of the guide 112 whereby the clip C may be advanced into the seat formed by the cradle when in its upper limit position in relation to the anvil 160.

Disposed above the assembly of the anvil 160 and the cradle 164 is a female clinching punch 174 which is movable along a vertical line of action in substantial alignment

with the anvil-cradle assembly. The clinching punch **174** is mounted for vertical reciprocation on a bearing extension of a supporting bracket **176**.

Specially-constructed actuating mechanisms are operatively connected to the clinching punch **174** for achieving vertical, downward movement in relation to the anvil **160** and the cradle **164**. By progressively inspecting Figs. 6 to 9 inclusive, the cooperation between the clinching punch **174**, the anvil **160**, and the cradle **164** will be best appreciated. The clip and buckle assembly is completed while the punch **174** is in the retracted position (Fig. 6). Thereafter, under control of the actuating mechanisms, the punch **174** comes down until it engages and depresses the cradle **164**, in which position the cooperating forming surfaces of the punch **174** and of the anvil **160** are effective to form the clip about the buckle into the clinched shape shown in Fig. 5. After the forming operation is completed the punch begins its return stroke (Fig. 8) and remains in the retracted position during the delivery of the next clip to the cradle (Fig. 9).

The actuating mechanisms for imparting motion to the punch **174** are constructed to take into account the handling of covered wire stock in which the core and/or the cover are of varying thickness and materials and to avoid damage or injury to the machine upon fouling or jamming of the punch. As to the size problem if the length of the stroke of the punch **174** were fixed, in some instances it would cause unneeded and excessive clinching pressure. This excessive pressure would usually manifest itself by marring of the covering on the wire. Thus, as the dimensions of the assembly of the core and cover wire stock vary, it is necessary to adjust the effective stroke of the punch **174**. Obviously such adjustment requires the replacement of parts in the driving mechanisms, or a change in the overall length of the punch **174**. The mechanisms to be now described are constructed to be self-compensating such that the effective clinching pressure is the same from material to material despite variations in the thickness of the stock. Specifically, the actuating mechanisms include opposed plates **178**, **180**, the plate **178** being secured to the upper end of the clinching punch **174** and the plate **180** being supported on the rod **182**. The rod **182** is formed with a flat **182***a* intermediate the ends thereof and has one end extending into a guide bore **174***a* provided axially of the punch **174**. Engaged within the flat of the rod **182** is a stop pin **184** which limits the upward movement of the rod **182** in relation to the female clinching punch **174**. The upper end of the rod **182** is threaded and carries a nut **186** which limits upward movement of the plate **180** under the influence of the biasing springs **188**, **190** supported between the plates **178**, **180**. At the upper end of the coupling rod **182** is supported a bifurcated yoke **192** which carries a cam follower **194** riding on cam **196** secured to the cam shaft **42**. The yoke **192** and the follower **194** are held in contact with the cam **196** through provision of a forked lever **198** which is pivoted at **200** and biased by spring **202**. It will be appreciated that the spring-biased coupling is a collapsible linkage and normally provides a driving connection between the cam and follower and the clinching punch; however, when the opposing force to the movement of the clinching punch exceeds a predetermined value, the springs **188**, **190** permit collapse of the linkage and effectively limit the length of stroke of the clinching die. It will be appreciated that the force required to effect collapse of the linkage may be adjusted by varying the bias as controlled by adjustment of the nut **186** along the threaded portion of the rod **182**.

The timing of the various mechanisms at the clip-forming station **32** and at the clip-clinching station **34** will be best appreciated by reference to Fig. 2, which shows the development of the various cams forming the controls of the present invention. As a further aid to understanding the drawings, designations have been provided on the layout of Fig. 2 showing the corresponding positions of the elements in the Figs. 6 to 9. For example, along the degree vertical line is the legend "Fig. 6." Upon inspection of Fig. 6, the cutting punch **106** is seen to be in the retracted position, and the bending punch **108** moving in its return stroke. Specifically referring from top to bottom in Fig. 2, the layout **92'** (eccentric **92**) corresponds to the operative period for the feeding mechanisms which advance the strip material S. As to the clinching station, such feeding occurs during approximately one-half of the cycle and while the clip is being clinched about the buckle. The second layout **126'**, **128'** (cams **126**, **128**) is for operation of the cutting mechanisms which occur during the other half cycle from operation of the feeding mechanisms. The next layout **196'** (cam **196**) corresponds to the operation of the clinching punch **174** which occurs only after the bending punch **108** has completed the transfer of the open clip C to the seat. The lowermost layout **140'** is for movement of the bending punch **108** which occurs during the return stroke of the cutting mechanisms and before operation of the clinching punch. The design for the cam **140'** may, if required, be altered to include a longer period during which the punch **108** is in the advanced position of Fig. 9. This design may be needed to avoid any tendency for the clip C to bounce back upon delivery to the seat provided by the anvil **160** and the cradle **164**.

As an aid to a more thorough understanding of the present machine a typical cycle of operation will be described;

The operator stands at a location forwardly of the machine and manually inserts the buckle frame **30** along the path of downward movement of the clinching punch **174**, as may be best appreciated by inspecting Fig. 6. At the start of operation, a formed clip C is in position for assembly with the partially completed buckle. Thereupon the operator depresses the foot treadle **68** which imparts to the cam shaft the required drive for single cycle operation. Upon depressing the foot treadle, the sequence of operation illustrated in Figs. 6 to 9 inclusive occur in accordance with the timing detailed in conjunction with Fig. 2. The operator must coordinate to remove the buckle with the clip clinch thereabout in advance of delivery of the next clip to the seat as illustrated in Fig. 9.

From the foregoing detailed description, it will be appreciated that the present mechanisms provide for the automatic formation of successive clips and for the delivery of the clips by positive and reliable means into a clinching station which is readily accessible to an operator. The operator need merely manually feed buckles to the machine, trip the foot control and remove the completed buckle to achieve both clip formation and clip clinching. Production of as many as twenty-five hundred buckles an hour may be achieved by the described mechanism.

Although the present invention has been described in conjunction with the formation of clips for covered wire buckles and the clinching of such clips about the covered wire buckles, which is the primary application intended for the present machine, it will be expressly understood that other uses for the machine are contemplated.

Although there has been described an excellent embodiment of the present invention, a range of alternatives, modifications, omissions and additions are contemplated; accordingly the appended claims should be afforded a latitude of interpretation consistent with the spirit and scope of the invention.

I claim:

1. In a machine for forming clips from a continuous length of metal strip and for bending successive clips about parts to be clinched, a stationary clinching die, a depressible cradle assembled with said stationary clinching die and cooperating therewith to define an upwardly opening clip-receiving seat, a movable clinching die, means for driving said movable clinching die through a prede-

termined thrust relative to said stationary clinching die whereby a clip may be clinched about said parts, clip-guiding means arranged at an angle to said clinching dies and having a forming channel directed toward said seat, feed means for delivering a length of said metal strip across said forming channel, cutting means operative along a path in alignment with said forming channel for severing said length from said strip, and a movable blade movable through said forming channel for medially engaging the cut length to form said cut length into a U-shaped clip and for advancing said clip into said seat.

2. A machine for forming clips from a strip of metal and clinching successive clips about the inturned ends of a buckle comprising cutting means for severing blanks from said strip, means including a moving blade and cooperating forming parts extending at an angle to the vertical for bending said blank medially to form a U-shaped clip, a male clinching die having a supporting surface, a movable cradle cooperating with said male clinching die to define a seat for receiving successive clips for assembly with the inturned ends of said buckle, a female clinching die arranged above said male clinching die and movable through a downward thrust relative to said male clinching die and operative to depress said cradle relative to said male clinching die and to clinch said clip about said inturned ends, said blade being movable through a downward thrust directed toward said seat and being effective to transfer successive U-shaped clips through and beyond said cooperating forming parts and into said seat.

3. A machine according to claim 2 wherein said moving blade is disposed and is operative at an angle of approximately 45° to the vertical.

4. In a clip forming and clinching machine, a forming station including nested cutting and bending punches movable along a first line of action extending at an angle of 45° to the vertical, a cutoff cavity along said first line of action bounded by spaced apart edges, a shaping channel in alignment with and opening upwardly into said cutoff cavity, means operative along a second line of action extending at an angle of 45° to the horizontal for delivering lengths of a continuous metal strip into said forming station straddling said cutoff cavity, a clinching station including cooperating male and female die parts operative along a third vertically-extending line of action, said female die part being constructed to accommodate clip for clinching, first actuating mechanisms operatively connected to said cutting punch for moving said cutting punch through a downward stroke for severing said continuous metal strip into a blank and for seating said blank in said cutoff cavity, and second actuating mechanisms operatively connected to said bending punch for moving said bending punch through a downward stroke, said bending punch being arranged medially of said shaping channel and being extensible therethrough to displace said blank through said shaping channel and toward said female die part.

5. In a machine for forming clips from a continuous length of metal strip and for bending successive clips about parts to be clinched, a stationary clinching die, a depressible cradle encircling said stationary clinching die and cooperating therewith to define an upwardly opening clip-receiving seat, a movable clinching die, means for driving said movable clinching die through a downward thrust relative to said stationary clinching die whereby a clip may be clinched about said parts, clip-guiding means arranged at an angle of approximately 45° to said clinching dies and including a forming channel having its exit end directed toward said seat, feed means arranged at an angle of approximately 45° to the horizontal for delivering a length of said metal strip across said forming channel, cutting means operative along a path in alignment with said forming channel severing said length from said strip, said cutting means including a cutoff cavity in communication with the entry end of said forming channel, and a blade movable through said cutoff cavity and said forming channel for medially engaging the cut length to form said cut length into a U-shaped clip and beyond the exit end of said forming channel to advance said clip into said seat.

6. In a machine for forming clips from a continuous length of metal strip and for bending successive clips about parts to be clinched, a stationary clinching die, a depressible cradle assembled with said stationary clinching die and cooperating therewith to define an upwardly opening clip-receiving seat, a movable clinching die, means including a coupling for driving said movable clinching die through a predetermined thrust relative to said stationary clinching die whereby a clip may be clinched about said parts, said coupling including biasing means arranged to permit collapse of said coupling when said movable clinching die encounters an excessive opposing force during its predetermined thrust, clip-guiding means arranged at an angle to said clinching dies and having a forming channel directed toward said seat, feed means for delivering a length of said metal strip across said forming channel, cutting means operative along path in alignment with said forming channel for severing said length from said strip, and a movable blade movable through said forming channel for medially engaging the cut length to form said cut length into a U-shaped clip and to advance said clip into said seat.

7. In a machine for forming clips from a continuous length of metal strip and for bending successive clips about parts to be clinched, a stationary clinching die, a movable clinching die, means for driving said movable clinching die through a predetermined thrust relative to said stationary clinching die whereby a clip may be clinched about said parts, clip-guiding means arranged at an angle to said clinching dies and having a forming channel directed toward said stationary clinching die, feed means for delivering a length of said metal strip across said forming channel, cutting means operative along a path in alignment with said forming channel for severing said length from said strip, and a blade movable through said forming channel for medially engaging the cut length to form said cut length into a U-shaped clip and to advance said clip toward said stationary clinching die.

8. A machine for forming clips from a strip of metal and clinching successive clips about the inturned ends of a buckle comprising means having a serrated cutting edge for severing blanks from said strip, means including a moving blade and cooperating forming parts for bending said blank medially to form a U-shaped clip, a male clinching die having a supporting surface, a cradle movable in a vertical path and cooperating with said male clinching die to define a seat for receiving successive clips for assembly with the inturned ends of said buckle, means including a spring operatively connected to said movable cradle for adjusting the vertical location of said movable cradle relative to said male clinching die, a female clinching die movable through a predetermined stroke relative to said male clinching die and operative to depress said cradle relative to said male forming die and to clinch said clip about said inturned ends, said blade being effective to transfer successive U-shaped clips through and beyond said cooperating forming parts and into said seat.

9. A machine according to claim 8 wherein the adjusting means connected to said cradle includes a vertically-extending rod connected at its upper end to said cradle, said spring being operatively connected to said rod and arranged to urge said rod upwardly, and an adjustable stop on said rod for limiting the upward travel of said rod under the influence of said spring.

10. In a machine for forming clips from a continuous length of metal strip and for bending successive clips about parts to be clinched, a stationary clinching die, a depressible cradle assembled with said stationary clinching die and cooperating therewith to define an upwardly

opening clip-receiving seat, a movable clinching die, means for driving said movable clinching die through a predetermined thrust relative to said stationary clinching die whereby a clip may be clinched about said parts, clip-guiding means arranged at an angle to said clinching dies and having a forming channel directed toward said seat, feed means at one side of said forming channel for delivering a length of said metal strip across said forming channel, a stop at the other side of said forming channel adapted to engage the leading end of said metal strip when said metal strip is delivered across said forming channel, cutting means operative along a path in alignment with said forming channel for severing said length from said strip, and a movable blade movable through said forming channel for medially engaging the cut length to form said cut length into a U-shaped clip and for advancing said clip into said seat.

11. In a clip forming and clinching machine, a forming station including nested cutting and bending punches movable along a first line of action, a cutoff cavity along said first line of action bounded by spaced apart edges, a shaping channel in alignment with and opening upwardly into said cutoff cavity, means for delivering lengths of a continuous metal strip into said forming station straddling said cutoff cavity, a clinching station including cooperating male and female die parts, said female die part being constructed to accommodate clips for clinching, first actuating mechanisms operatively connected to said cutting punch for moving said cutting punch through a predetermined stroke for severing said continuous metal strip into a blank and for seating said blank in said cutoff cavity, and second actuating mechanisms operatively connected to said bending punch for moving said bending punch through a predetermined stroke, said first actuating mechanisms including a pair of spaced apart actuating arms arranged symmetrically of said cutting punch, a cross head pivotally supported on said actuating arms and operatively connected to said cutting punch, and a cam drive and follower operatively connected to each of said actuating arms.

12. In a machine for forming clips from a continuous length of metal strip and for bending successive clips about parts to be clinched, a stationary clinching die, a movable clinching die, means for driving said movable clinching die through a predetermined thrust relative to said stationary clinching die whereby a clip may be clinched about said parts, the driving means including a vertical rod, means slidably supporting said vertical rod on said movable clinching die and arranged to limit the upward travel of said vertical rod relative to said movable clinching die, opposed lower and upper plates supported on said vertical rod, said lower plates being connected to said movable clinching die, biasing springs supported between said plates and means limiting the upward movement of said upper plate under the influence of said biasing springs, clip-guiding means arranged at an angle to said clinching dies and having a forming channel directed toward said stationary clinching die, feed means for delivering a length of said metal strip across said forming channel, cutting means operative along a path in alignment with said forming channel for severing said length from said strip, and a blade movable through said forming channel for medially engaging the cut length to form said cut length into a U-shaped clip and to advance said clip toward said stationary clinching die.

13. In a machine for forming clips from a continuous length of metal strip and for bending successive clips about a part, a stationary clinching die, a movable clinching die, means for driving said movable clinching die through a prescribed thrust relative to said stationary clinching die whereby a clip may be bent about said part, clip-guiding means arranged at an angle to said clinching dies and having a forming channel directed toward said stationary clinching die, feed means for delivering a length of said metal strip across said forming channel, cutting means operative for severing said length from said strip, and a blade movable through said forming channel for engaging the cut length intermediate its ends to form said cut length into a clip and to advance said clip toward said stationary clinching die.

No references cited.