Sept. 11, 1945. C. NORTON 2,384,486

STRIP FORMING APPARATUS

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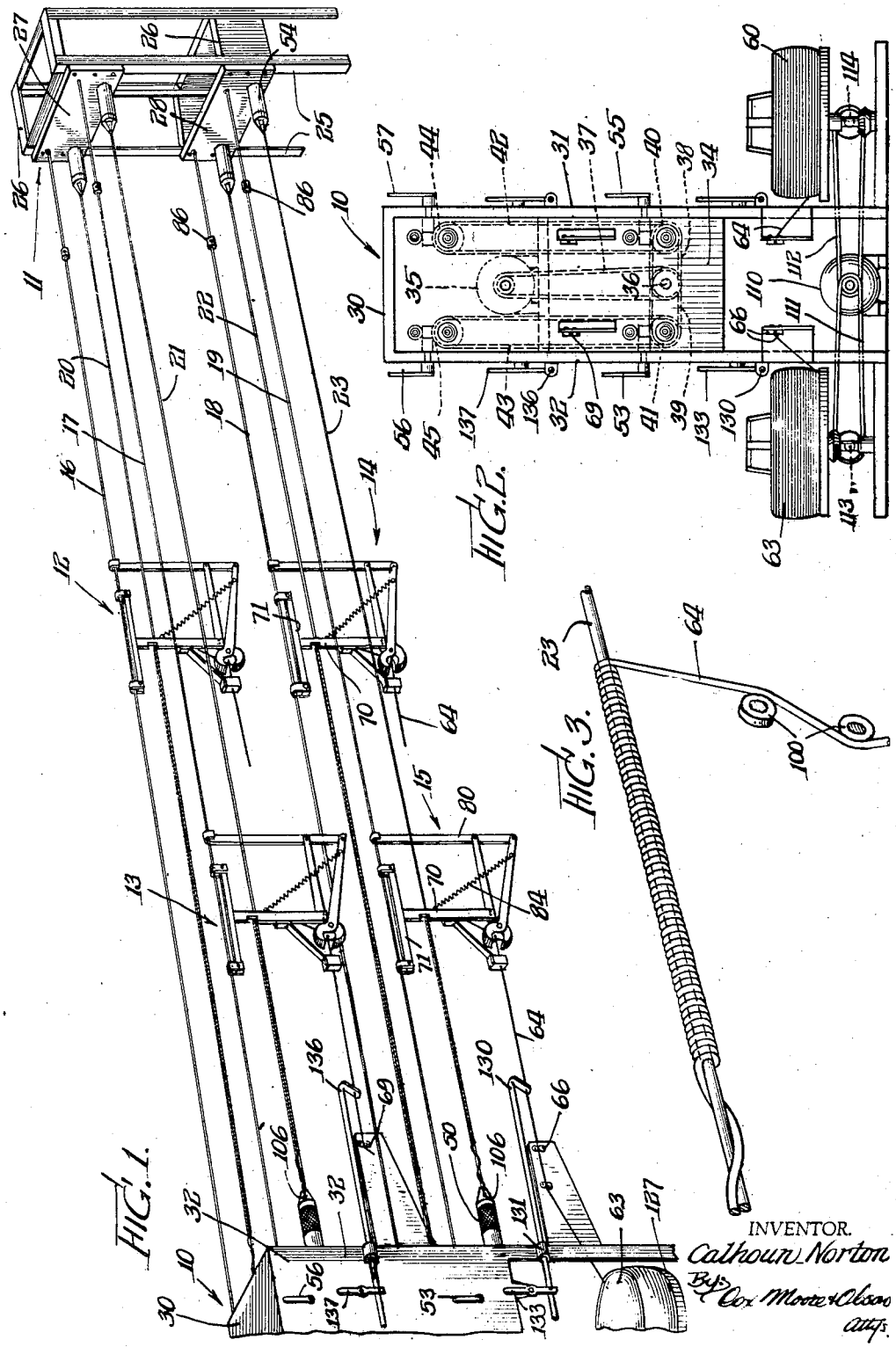


FIG. 1.

FIG. 2.

FIG. 3.

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FIG. 4.

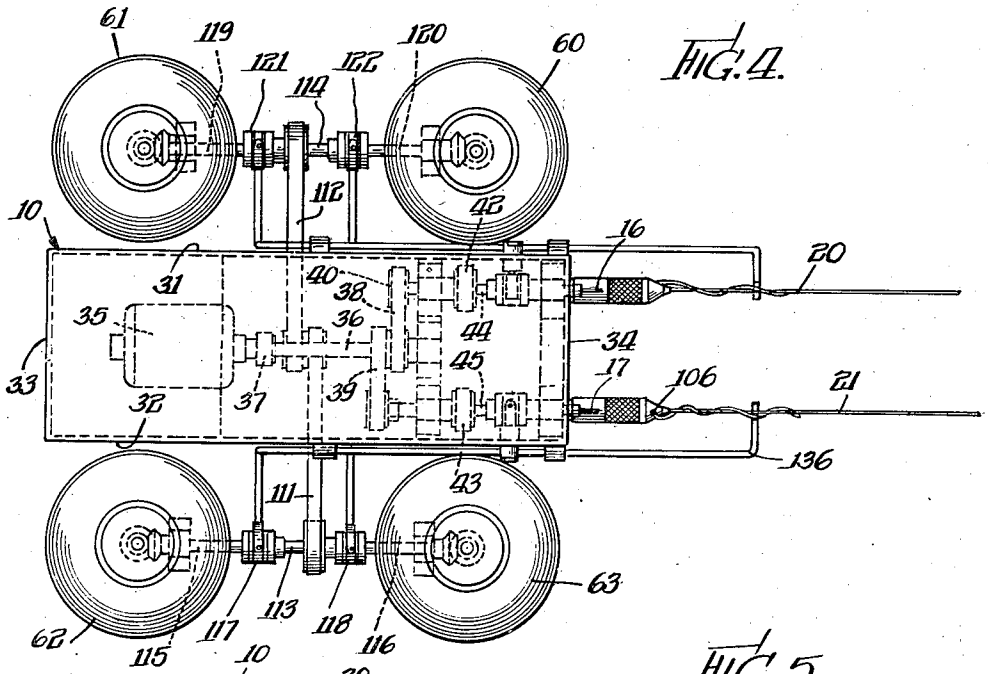
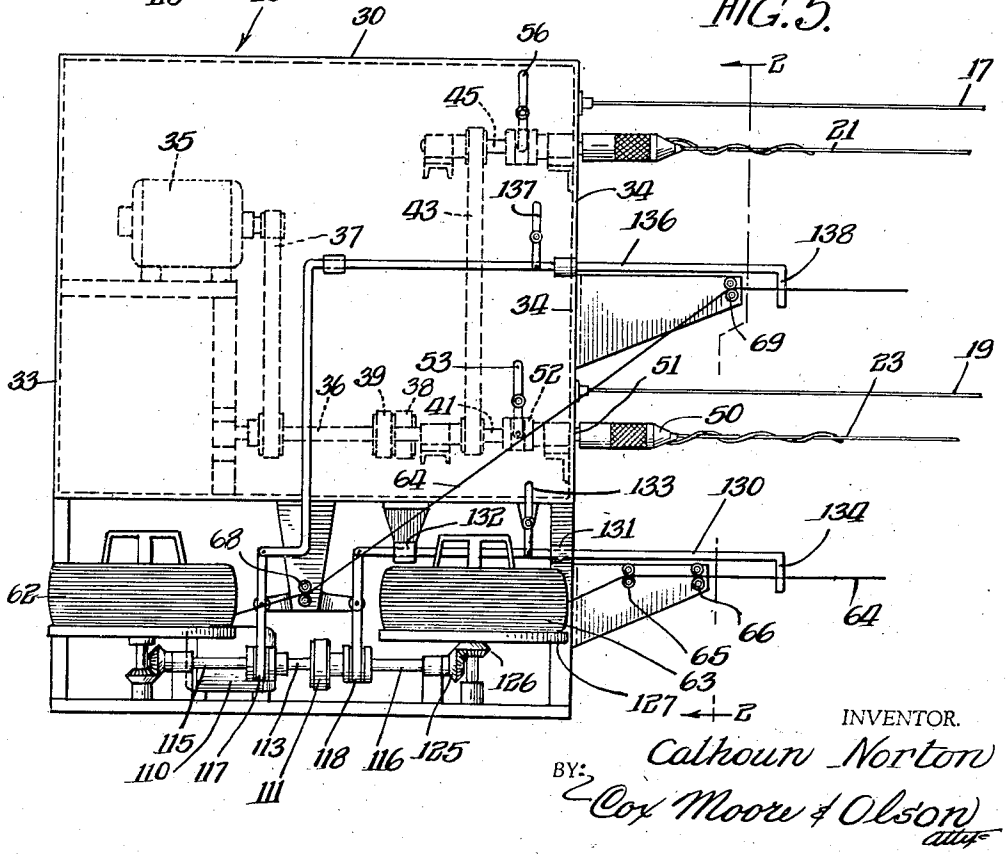


FIG. 5.



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FIG. 6.

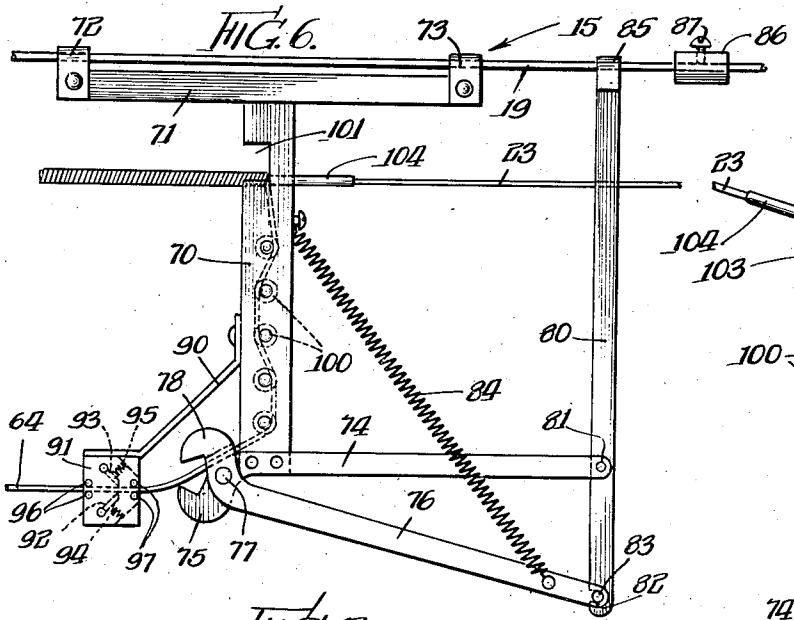


FIG. 7.

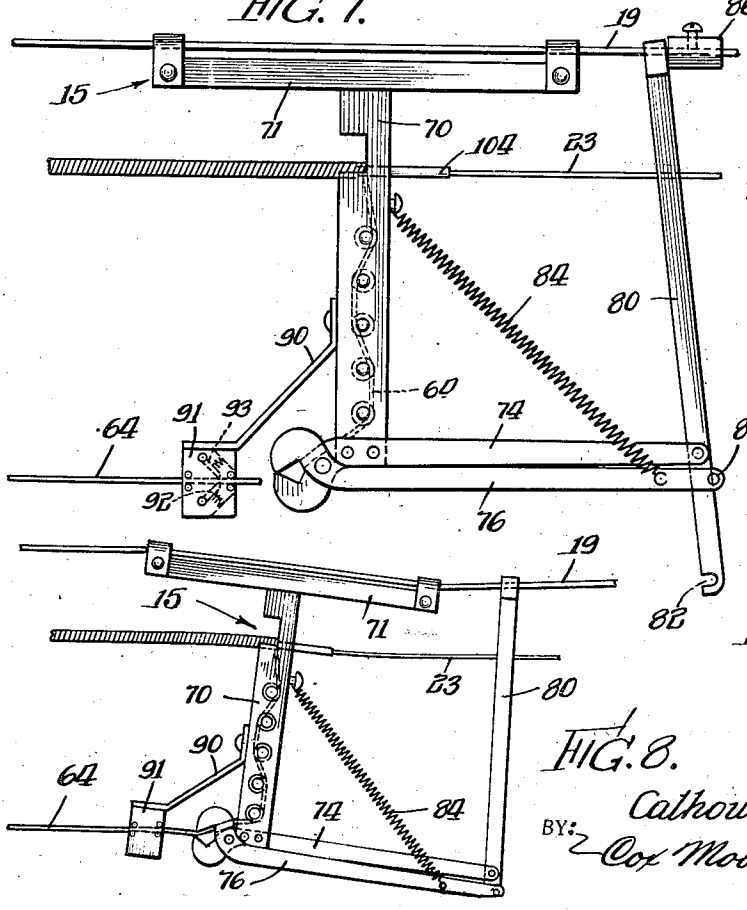


FIG. 9.

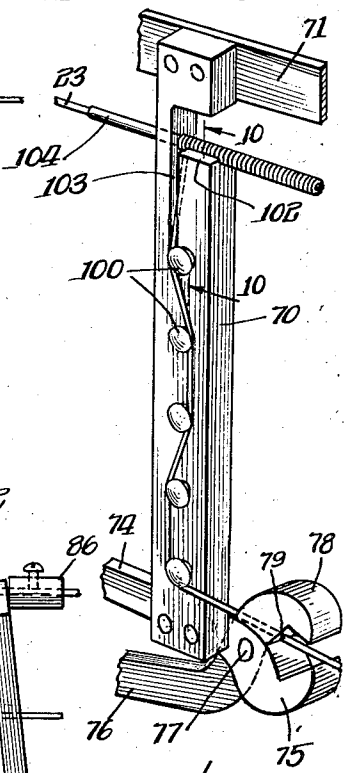


FIG. 10.

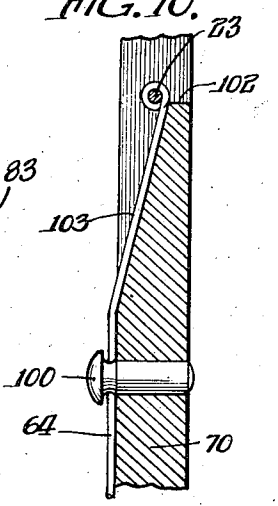


FIG. 8.

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UNITED STATES PATENT OFFICE

2,384,486

STRIP FORMING APPARATUS

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Application May 9, 1942, Serial No. 442,347

23 Claims. (Cl. 153—67)

This invention relates to strip forming apparatus, such for example as wire coiling machines and the like, and concerns particularly new and improved control mechanisms for such apparatus.

It is an object of the invention to provide strip forming apparatus of improved construction and operating characteristics, and particularly to provide new and improved control mechanisms for controlling the operation of the machine.

More specifically stated, one of the objects of the present invention is to provide in a metal strip forming machine or the like, improved cut-off means for severing the metal strip after a predetermined length thereof has been formed into the desired shape, which cut-off means are particularly adapted for use in a machine of the type having a traveling carriage movable longitudinally of the work during the forming operation.

Another object of the invention is to provide in a strip forming machine, particularly of the type stated, means for automatically severing the strip in the event that the strip feeding means becomes jammed or otherwise exceeds a predetermined tension, whereby to preclude damage to the operating parts.

Still another object of the invention is to provide in a strip forming machine of the traveling carriage type, means for automatically returning the carriage at the end of a forming operation, such means automatically cooperating with the strip-severing or cut-off means, in the machine cycle.

Various other objects, advantages and features of the invention will appear from the following specification when taken in connection with the accompanying drawings wherein one preferred embodiment of the invention is set forth for purposes of illustration.

In the drawings, wherein like reference numerals refer to like parts throughout:

Fig. 1 is a general perspective view of a strip forming apparatus, specifically a wire coiling machine, constructed in accordance with and embodying the principles of the invention;

Fig. 2 is a transverse, vertical, sectional view through the machine on the line 2—2 of Fig. 5, particularly illustrating the head frame structure and associated parts;

Fig. 3 is a detail perspective view, illustrating the type of work adapted to be performed by the machine;

Fig. 4 is a top view of the head frame structure;

Fig. 5 is a side view of the head frame;

Fig. 6 is a detail view of the traveling carriage structure, more particularly illustrating the action of the strip cut-off or severing means;

Fig. 7 is a view similar to Fig. 6, but illustrating the position of the parts after the operation of the cut-off means;

Fig. 8 is a view, also similar to Fig. 6, but illustrating the action of the carriage when the strip feeding means jams or otherwise exceeds a predetermined tension;

Fig. 9 is a detail perspective view more particularly showing parts of the carriage structure; and

Fig. 10 is a detail sectional view of the carriage, on the line 10—10 of Fig. 9.

In the drawings the invention has been illustrated as applied to a machine for coiling wire or the like about an elongated mandrel, whereby to form an elongated convoluted or coiled wire structure of predetermined size; and certain features of the invention are particularly adapted to machines of this type. It is to be understood, however, that the invention in other of its features and aspects is adapted to other types of machines, including other types of metal strip forming apparatus.

Referring more particularly to the drawings, and first to Fig. 1 thereof, the machine illustrated comprises in general a head frame 10 and an end frame 11 in spaced relation, and cooperatively supporting the mandrels and trolley wires along which the forming carriages are adapted to be translated during the operation of the machine. In the particular embodiment illustrated there are four forming carriages as indicated at 12, 13, 14 and 15. The trolley wires respectively cooperating with these four carriages are illustrated at 16, 17, 18 and 19, and the mandrels respectively cooperating with the carriages are shown at 20, 21, 22 and 23. During machine operation the mandrels are rotatably driven, by means later to be described, whereas the trolleys are stationary, forming a longitudinal track structure for the traveling forming carriages. It is to be understood that the distance between the head and end frames is determined by the desired length of wire coil to be formed at each machine cycle, and may in a particular embodiment be a distance of a hundred feet or more. The head and end frames are suitably anchored, and remain relatively fixed at all times during the operation of the machine. The end frame comprises a series of supporting uprights 25, suitably cross-braced as indicated at 26, and carrying a pair of end plates 27 and 28 to which the mandrels and trolley wires are anchored.

Referring to Figs. 2, 4 and 5, it will be seen that the head frame 10 comprises a housing of generally rectangular shape having a top wall 30, side walls 31 and 32 and end walls 33 and 34, suitably demountable to permit of access to the inside of the housing. Internally of the housing there is provided a suitable prime mover, such as

an electric motor 35, adapted to drive a main drive shaft 36 by means of a vertically disposed belt 37. A pair of substantially horizontally disposed belts 38 and 39 connect the drive shaft 36 to stub shafts 40 and 41 associated, respectively, with the lower mandrels 22 and 23. A pair of vertical belts 42 and 43 in turn connect the stub shafts 40 and 41, associated with the lower mandrels, to stub shafts 44 and 45 associated with the upper mandrels, the arrangement being such that as the prime mover or motor 35 is operated, stub shafts 40, 41, 44 and 45 associated with the four mandrels will be rotatably driven at substantially constant speed.

Clutches are provided for selectively clutching each of the mandrels to its respective stub shaft for driving operation. The arrangement for each of the mandrels is the same, and a description of one will suffice for all. Thus, referring to the mandrel 23, there is provided a chuck 50 adapted to releasably grip the end of the mandrel 23, the chuck being carried by a chuck shaft 51 adapted to be selectively clutched to the stub shaft 41 by means of a clutch 52. The clutch, which may be of any suitable design, is manually operable by means of a manual control handle 53. Referring to Fig. 1, the opposite end of the mandrel is connected to a chuck 54 fixed to a shaft freely rotatable within the plate 28. It will accordingly be seen that by manipulation of the handle 53 the mandrel 23 may be relatively connected to or disconnected from the constantly rotating stub shaft 41, the starting or stopping of the mandrel thus being under selective control at all times. The chucks 50 and 54 are releasable, whereby the mandrel 23 may be released to permit removal of the work. The four control handles for the four mandrel clutches are indicated at 53, 55, 56 and 57 in Fig. 2. As shown, the control handles are in convenient juxtaposition to their respective mandrels, but obviously they may be extended to a single control panel, if desired, in any particular installation.

The four supply reels or drums for feeding the metal strip or wire to the traveling carriages are illustrated at 60, 61, 62 and 63. The reel 63 supplies the wire or metal strip, as indicated at 64, to the carriage 15 associated with the mandrel 23, through the intermediary of guide rollers 65 and 66, Fig. 5, suitably journaled on the head frame. Similarly, the reel 62 feeds its wire 64 to the carriage 13 associated with the mandrel 21 by means of guide rollers 68 and 69. Similar provisions are made for guiding the wires from the reels 60 and 61 arranged on the opposite side of the head frame. Normally the reels are freely rotatable so that the wire or metal strip may be freely drawn therefrom by movement of the traveling carriages.

The detailed structure of the carriages is best illustrated in Figs. 1 and 6–10, the structure of each of the carriages being the same. As shown, each carriage, such as the carriage 15, comprises a main frame having a vertically disposed portion 70 and a horizontal portion 71. The horizontal portion is provided with U-shaped brackets 72 and 73 at each end thereof adapted to loosely embrace the trolley wire 19, whereby the carriage frame is freely translatable longitudinally of the trolley. The vertical frame portion 70 is provided at its lower extremity with an arm 74, the forward end 75 of which is formed as one jaw of a wire cut-off or severing means. A lever 76 is pivoted to the arm 74 as indicated at 77, the forward end 78 of the lever 76 being formed as the cooperating cutting jaw of the wire cut-off or severing means. As best shown in Fig. 9, the jaw 78 is provided with an opening or perforation 79 through which the wire or strip to be formed is adapted to loosely pass.

A lever 80 is pivoted to the opposite end of the arm 74, as indicated at 81, the lower end of the lever being formed with a notch or cut-out 82 adapted to be engaged with a pin 83 carried by the rear end of the lever 76. A tension spring 84, connected at one end to the lever 76 and at its other end to the frame portion 70 of the carriage, normally urges the lever 76 counterclockwise about its pivot 77, as shown in Fig. 6. When the parts are in the position illustrated in Fig. 6, with the notch 82 of the lever 80 in engagement with the pin 83 of the cut-off lever 76, the spring is constrained from operation, lever 80 thus acting as a latch lever for the cut-off means. The upper end of the lever 80 is reversely bent as indicated at 85, said end portion being adapted to loosely overlie the trolley wire. A release abutment 86 longitudinally adjustable on the trolley wire by means of a screw 87, is adapted for cooperation with the end of the latch lever, and upon engagement with the lever releases the same to permit the operation of the cutting means.

The vertical frame portion 70 of the carriage is also provided with a bracket 90 carrying a plate 91 at its end upon which a pair of retention or holding jaws 92 and 93 are pivotally mounted. These jaws are urged into gripping engagement with the wire 64 by a pair of compression springs 94 and 95. The jaws 92 and 93 in effect constitute a one-way clutch or holding non-return device, the jaws permitting the free passage of the wire 64 to the right, as indicated in Fig. 6, but the jaws at all times being immediately operable to prevent retraction of the wire to the left. The plate 91 is further provided with guide pins as indicated at 96 and 97, to guide the wire through the retention jaws.

Referring to Figs. 9 and 10, it will be seen that the carriage frame member 70 is further provided with a series of calibrating pins 100 around which the wire is drawn on its way to the forming station. These pins drag the wire slightly, and by use of a suitable number of them in the proper pattern, the tension of the wire at the forming station may be controlled to accurately size the formed wire coil.

The upper end of the frame portion 70 is provided with a cut-away section 101 providing a longitudinally grooved ledge 102 upon which the coiled wire is adapted to lay. A tapered slot 103 leads from the uppermost calibrating pin 100 to the ledge 102. The member 70 is further provided with an opening through which the mandrel wire 23 is adapted to loosely pass, a guide sleeve 104 being press-fitted into this opening and adapted to loosely engage the mandrel to further guide the translatable carriage in its movements.

In operation, assuming the forming carriage 15 to be adjacent the head frame, and the mandrel wire stationary, the operator threads the wire 64 to be formed between the guide pins 96 and 97 and the holding jaws 92 and 93 of the carriage plate 91, through the opening 79 of the cut-off jaw 78, around the calibrating pins 100 in the proper pattern, and through the slot 103 onto the forming ledge 102 of the carriage, the end of the wire further being anchored in suitable manner, as by being introduced into an opening

106 in the mandrel chuck 50. As the clutch control handle 53 is now operated, and the mandrel set into rotation, the wire will be drawn from the supply reel 63, through the various guiding devices, and onto the forming platform or ledge 102 of the carriage, and wrapped around the mandrel 23, in a manner best indicated in Fig. 3. As the wire is drawn to the coiling station, the formed coil is calibrated to proper size by the calibrating pins 100. As the coiling progresses, and the wire 64 is progressively coiled around the mandrel 23, the carriage 15 will be automatically translated by the wire as it is coiled, to the right as seen in Figs. 1 and 6, along the trolley wire 19. The operation automatically progresses until the carriage reaches the release or tripping device 86 secured at an appropriate position on the trolley wire 19. At this time the upper end of the latch lever 80 is engaged, causing the lever to be pivoted counterclockwise around the pivot 81, releasing the cutting lever 76, and permitting the spring 84 to operate to automatically cut the wire or metal strip 64. Continued rotation of the mandrel 23 draws the now severed trailing end of the wire 64 completely upwardly and around the mandrel, after which further translation of the forming carriage automatically ceases. Immediately as the cut-off or severing means operates, the holding jaws 92 and 93 become effective to prevent retraction of the leading end 64 of the wire from the carriage. Upon manipulation of the control handle 53, rotation of the mandrel 23 may now be arrested, the end of the mandrel and the wire 64 removed from the chuck 50, and the completely coiled wire drawn from the mandrel onto a suitable storage reel or the like. Fig. 6 shows the action of the carriage during the coiling operation, and Fig. 7 shows the position of the parts after the severing of the wire 64, during the completion of the coiling operation. The structure is simple and adaptable to use in a variety of applications, and rugged in operation.

A particular feature of the structure is the arrangement whereby if the wire 64 or other metal strip being formed or fabricated should foul upon the supply reel 63, or otherwise require more than a predetermined tension to draw it onto the mandrel, the strip cut-off means will immediately and automatically operate to sever the strip. This action is best illustrated in Fig. 8. It will be seen that as excessive tension beyond a predetermined amount is applied in drawing the wire 64 from its supply means, the carriage 15 will tend to rotate slightly clockwise, into the position illustrated. This movement is limited by the trolley 19, but will be sufficient to cam the latch lever 80 counterclockwise with respect to the carriage frame 70—71, thereby causing operation of the strip severing means in the same manner as when initiated by the tripping or release abutment 86. The operation is automatic and immediate acting, whereby to prevent mandrel breaking or other operating difficulties. It is to be understood that the rotation of the mandrel is at high speed. The rapid operation of the severing means, the action of which is directly dependent upon the tension applied to the wire 64, prevents mandrel breakage even under such high speed operation.

It is to be understood that each of the traveling forming carriages 12, 13, 14 and 15 is of similar construction, operating in a manner hereinbefore set forth in reference to the carriage 15.

While the supply reels 60, 61, 62 and 63 are normally freely rotatable, as hereinbefore stated, means is provided selectively operable under the control of the operator to apply a power operation to the reels in a reverse direction, whereby to automatically return the traveling carriages to an initial position. Such means is best illustrated in Figs. 2, 4 and 5.

A prime mover 110 is provided in the lower portion of the head frame housing, which motor is adapted, by means of a pair of belts 111 and 112, to drive stub shafts 113 and 114 located on either side of the head frame structure. The stub shaft 113 is adapted to be connected selectively with end shafts 115 and 116 by means of suitable clutches as indicated at 117 and 118, whereas the stub shaft 114 similarly may be connected to end shafts 119 and 120 by means of clutches 121 and 122. Referring, for example, to end shaft 116, this shaft is provided with a bevel gear 125 meshing with a bevel gear 126 connected to the support 127 for the reel 63. The arrangement is such that as the clutch 118 is operated to connect the end shaft 116 to the stub shaft 113, the wire reel or drum 63 will be reversely rotated at a relatively slow speed. Similar bevel gear connections are provided for connecting the end shafts 115, 119 and 120, respectively, with the supply reels 62, 61 and 60.

Referring further to clutch 118, the means for operating said clutch comprises an abutment member 130 longitudinally slidable within support brackets 131 and 132, and connected to the clutch 118 by suitable link connections. A manual control handle 133 is arranged for shifting the abutment member, and the abutment member is also adapted for automatic shifting in a manner presently to be described. The outer end of the abutment member is provided with a laterally extending portion 134 having an opening through which the wire 64 is adapted to be loosely passed.

Similar means is provided for operating the clutch 117. As illustrated in Fig. 5, such means comprises a longitudinally shiftable abutment member 136 associated with a manual control handle 137, and adapted to be connected by suitable linkage to the clutch 117. As in the case of the abutment member 130, abutment member 136 is provided with a laterally turned extension 138 through which the wire strip 64 is adapted to be passed. The means for operating clutches 121 and 122 is similar to that described in reference to clutches 117 and 118, but on the opposite side of the structure.

As has been previously brought out, upon the operation of the strip severing means of the carriages, either at the end of the coiling operation, or in the event of fouling of the wire upon its supply drum, the holding jaws, such as indicated at 92 and 93 in Fig. 6, immediately become operative to retain the severed end of the wire 64 in association with the carriage. Accordingly, the carriages may be returned to initial position, to the left as seen in Fig. 1, merely by the application of reverse rotation to the supply reels, by the selective manipulation of the clutches 117, 118, 121 or 122. For example, referring to clutch 118, a shifting of the abutment member 130 to the right causes the closing of the clutch and the reverse rotation of the supply reel 63. As the carriage 15 reaches home position, its plate 91 engages the end 134 of the abutment member 130, shifting the abutment member to the left and automatically opening the clutch. Inasmuch as the wire 64 passes through the lateral extension 134 of the abutment member, the engagement of the plate 91 therewith is insured.

The action in the case of each of the carriages is similar. It will thus be seen that means is provided for readily returning the carriages to initial position, such return means incorporating automatic provisions for disabling its operation as the carriages reach the home station.

It is obvious that various changes may be made in the specific embodiment of the invention set forth for purposes of illustration, without departing from the spirit thereof. Accordingly, the invention is not to be limited to the specific embodiment shown and described, but only as indicated in the following claims.

The invention is hereby claimed as follows:

1. A metal strip forming apparatus comprising means for forming a metal strip into an extended series of concentric convolutions, said means including a member bodily shiftable axially of said convolutions by the strip as it is coiled during the forming operation, and cutter means shiftable with said member and automatically operable as said member reaches a predetermined shifted position for disabling the effectiveness of said forming means by severing the strip.

2. A metal strip forming apparatus comprising an elongated rotatable mandrel, means for rotatably mounting the mandrel in a fixed frame, means for forming a metal strip around the mandrel in an extended series of convolutions extending helically of the mandrel, said means including a member bodily shiftable axially of the mandrel by the strip as it is coiled during the forming operation, and cut-off means engageable with the strip slightly in advance of the forming station automatically operable as the member reaches a predetermined position longitudinally of the mandrel for severing said strip.

3. A metal strip forming apparatus comprising an elongated mandrel, means for forming a metal strip around the mandrel into a series of convolutions extending helically of the mandrel, said forming means comprising a carriage shiftable axially of the mandrel during the forming operation, cutting means carried by the carriage along which the strip is adapted to pass, and an abutment arranged at a predetermined position longitudinally of the mandrel, said abutment being adapted to engage said cutting means for operating the cutting means as the carriage reaches a predetermined position.

4. A metal strip forming apparatus comprising an elongated mandrel, means for forming a metal strip around said mandrel in an extended series of helical convolutions, said forming means comprising a carriage bodily shiftable along the mandrel during the forming operation, cutting means carried by the carriage along which the strip is adapted to pass, latch means for normally holding the cutting means from operation, and a release abutment disposed at a predetermined position along the mandrel, said abutment being adapted to engage the latch means as the carriage reaches a predetermined position whereby to release the cutting means for operation.

5. A metal strip forming apparatus comprising an elongated mandrel, an elongated guide track disposed in parallel relation to the mandrel, means for forming a metal strip around the mandrel in a series of helical convolutions, said forming means including a carriage bodily shiftable along said mandrel and said guide track during the forming operation, cutting means carried by the carriage along which the metal strip is adapted to be passed, a spring for operating the cutting means, a latch for normally restraining the spring from operation, and means for releasing said latch whereby to effect the operation of said cutting means.

6. A metal strip forming apparatus comprising means for forming a metal strip into an extended series of coaxial convolutions, feeding means for feeding the metal strip to the forming means, and means comprising a control member automatically shifted to disable the effectiveness of said forming means when the tension required to transmit the strip to the forming means exceeds a predetermined amount.

7. A metal strip forming apparatus comprising means for forming a metal strip into an extended series of coaxial convolutions, said forming means comprising a member bodily shiftable axially of said convolutions during the forming operation, feeding means for feeding the strip to said member, cut-off means automatically operable for severing said strip, and means controlled by the tension of the strip in its transmission to said member for operating said cut-off means.

8. A metal strip forming apparatus comprising a mandrel, means for forming a metal strip around said mandrel into an extended series of helical convolutions, said forming means including a member shiftable longitudinally of said mandrel during the forming operation, feeding means for feeding the strip to said member, cutting means carried by the member along which the strip is adapted to be passed, and means for automatically operating the cutting means in accordance with the tension required to feed the strip to said member from the feeding means.

9. A metal strip forming apparatus comprising an elongated mandrel, means for forming a metal strip around said mandrel into an extended series of convolutions, said forming means including a carriage longitudinally shiftable of the mandrel during the forming operation, means for feeding the metal strip to said carriage, cutting means carried by the carriage, a spring for operating the cutting means, a latch for normally retaining the spring from operation, and means controlled by the tension in the metal strip in its passage to the carriage for operating said latch.

10. A metal strip forming apparatus comprising means for forming a metal strip into an extended series of coaxial convolutions, means comprising a shiftable control member automatically shiftable for disabling the effectiveness of said forming means after a predetermined number of convolutions have been formed, and means for disabling the effectiveness of said forming means comprising a control member shiftably controlled by the tension in the strip during the forming operation whereby the forming means may be automatically disabled in the event the tension in the strip exceeds a predetermined amount.

11. A metal strip forming apparatus comprising means for forming a metal strip into an extended series of coaxial convolutions, said means including a member movable axially of said convolutions during the forming operation, cut-off means operable to automatically sever the strip when said member reaches a predetermined position, and cut-off means automatically operable for severing the strip when the tension in the strip exceeds a predetermined maximum.

12. A metal strip forming apparatus as defined in claim 11, wherein both of said cut-off means include common strip severing elements.

13. A metal strip forming apparatus compris-

ing a mandrel, means for forming a metal strip around said mandrel into an extended series of coaxial convolutions, said forming means including a carriage shiftable by the strip as it is coiled from an initial position longitudinally of the mandrel during the forming operation, power means for reversely operating said carriage toward said initial position, and control means for selectively operating said power means.

14. A strip forming apparatus as defined in claim 13, wherein means is provided for automatically disabling said power means as the carriage is returned to initial position.

15. A metal strip forming apparatus comprising an elongated mandrel, means for forming said strip around said mandrel in an extended series of convolutions extending helically on the mandrel, said means including a carriage bodily shiftable from an initial position axially of the mandrel during the forming operation, cut-off means carried by the carriage along which the strip is adapted to pass and for severing said strip, and holding means comprising a non-return gripping device for holding the strip end on the carriage after the operation of said cut-off means.

16. A metal strip forming apparatus comprising an elongated mandrel, means for forming said strip around said mandrel in an extended series of convolutions extending helically on the mandrel, said means including a carriage bodily shiftable from an initial position axially of the mandrel during the forming operation, cut-off means carried by the carriage along which the strip is adapted to pass and for severing said strip, holding means comprising a non-return gripping device for holding the strip end on the carriage after the operation of said cut-off means, and power means for pulling on said strip while it is engaged by the holding means whereby to restore the carriage toward initial position.

17. A metal strip forming apparatus comprising an elongated mandrel, an elongated trolley disposed in parallel relation to the mandrel, means for forming a metal strip around the mandrel in a series of helical convolutions, said forming means including a carriage bodily shiftable along said mandrel and said trolley during the forming operation, calibrating means carried by the carriage through which the metal strip is adapted to be passed, and means automatically operable as the carriage reaches a predetermined position along the mandrel for disabling the effectiveness of said forming means.

18. A metal strip forming apparatus comprising a mandrel, means for forming a metal strip around said mandrel into an extended series of coaxial convolutions, said forming means including a carriage shiftable by the strip as it is coiled from an initial position longitudinally of the mandrel during the forming operation, and means adapted to pull said strip for reversely operating said carriage along said mandrel toward its initial position.

19. A metal strip forming apparatus comprising an elongated mandrel, means for forming a metal strip around said mandrel into an extended series of helical convolutions, said forming means including a member shiftable longitudinally of the mandrel during the forming operation, feeding means for feeding the metal strip to said member, and means comprising a control member automatically shifted to disable the effectiveness of said forming means when the tension required to transmit the strip to said member exceeds a predetermined amount.

20. A metal strip forming apparatus comprising means for forming a metal strip into an extended series of coaxial convolutions, feeding means for feeding the metal strip to the forming means, means for severing the strip, and means comprising a control member automatically shifted to operate the severing means and thereby disable the effectiveness of said forming means when the tension required to transmit the strip to the forming means exceeds a predetermined amount.

21. A metal strip forming apparatus as defined in claim 10, wherein said means for disabling the effectiveness of the forming means after a predetermined number of convolutions have been formed comprises means for severing the strip.

22. A metal strip forming apparatus as defined in claim 10, wherein said means for disabling the effectiveness of the forming means controlled by the tension in the strip comprises means for severing the strip.

23. A metal strip forming apparatus comprising a mandrel, means for forming a metal strip around said mandrel into an extended series of coaxial convolutions, said forming means including a carriage shiftable by the strip as it is coiled from an initial position longitudinally of the mandrel during the forming operation, cut-off means automatically operable as the carriage reaches a predetermined position longitudinally of the mandrel for severing said strip, power means for reversely operating said carriage toward said initial position, and control means for selectively controlling said power means.

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