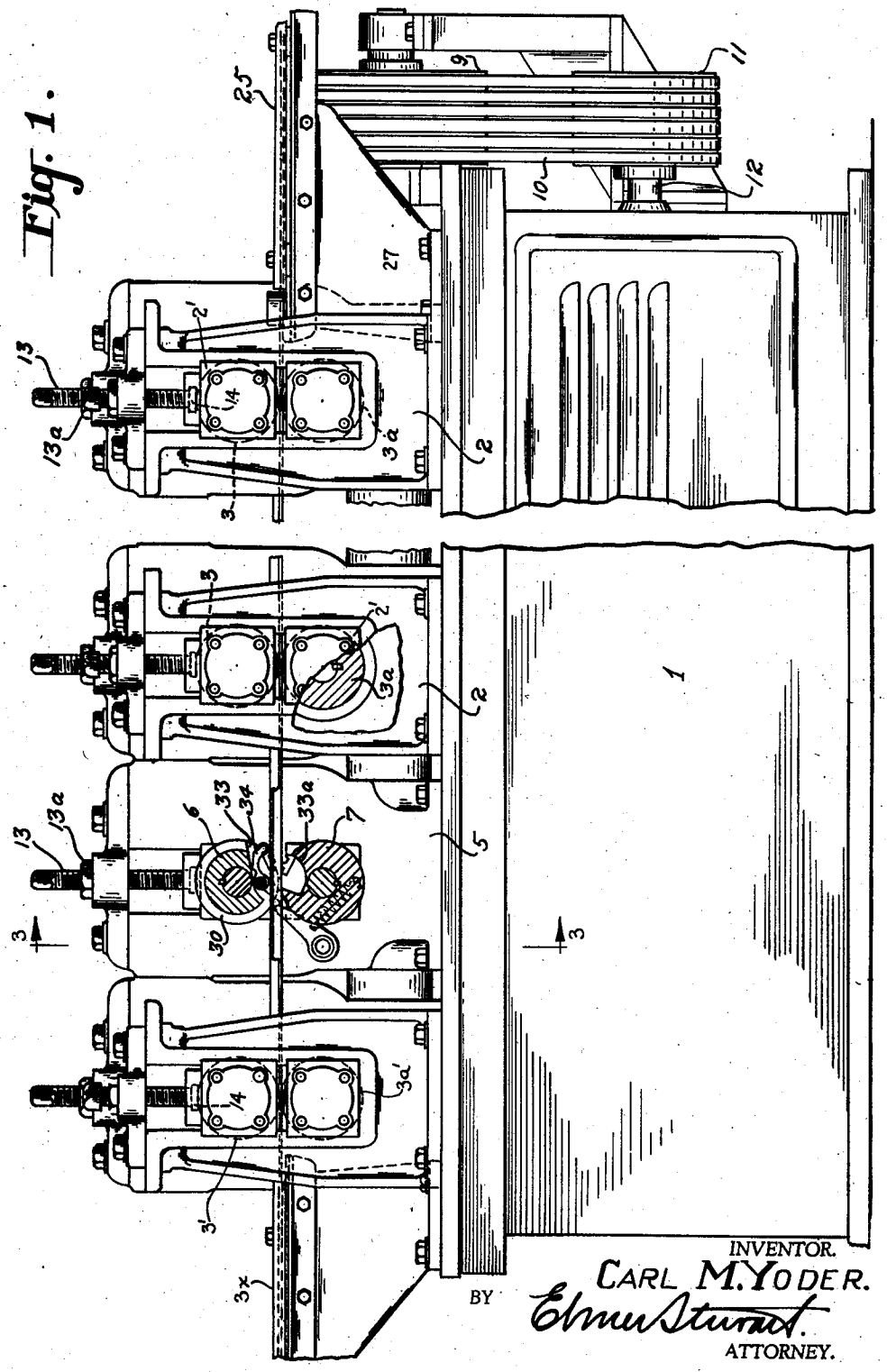
March 6, 1945. C. M. YODER 2,370,702

MACHINE FOR CRIMPING SHEET METAL

Filed March 22, 1939 7 Sheets-Sheet 1

Fig. 1.



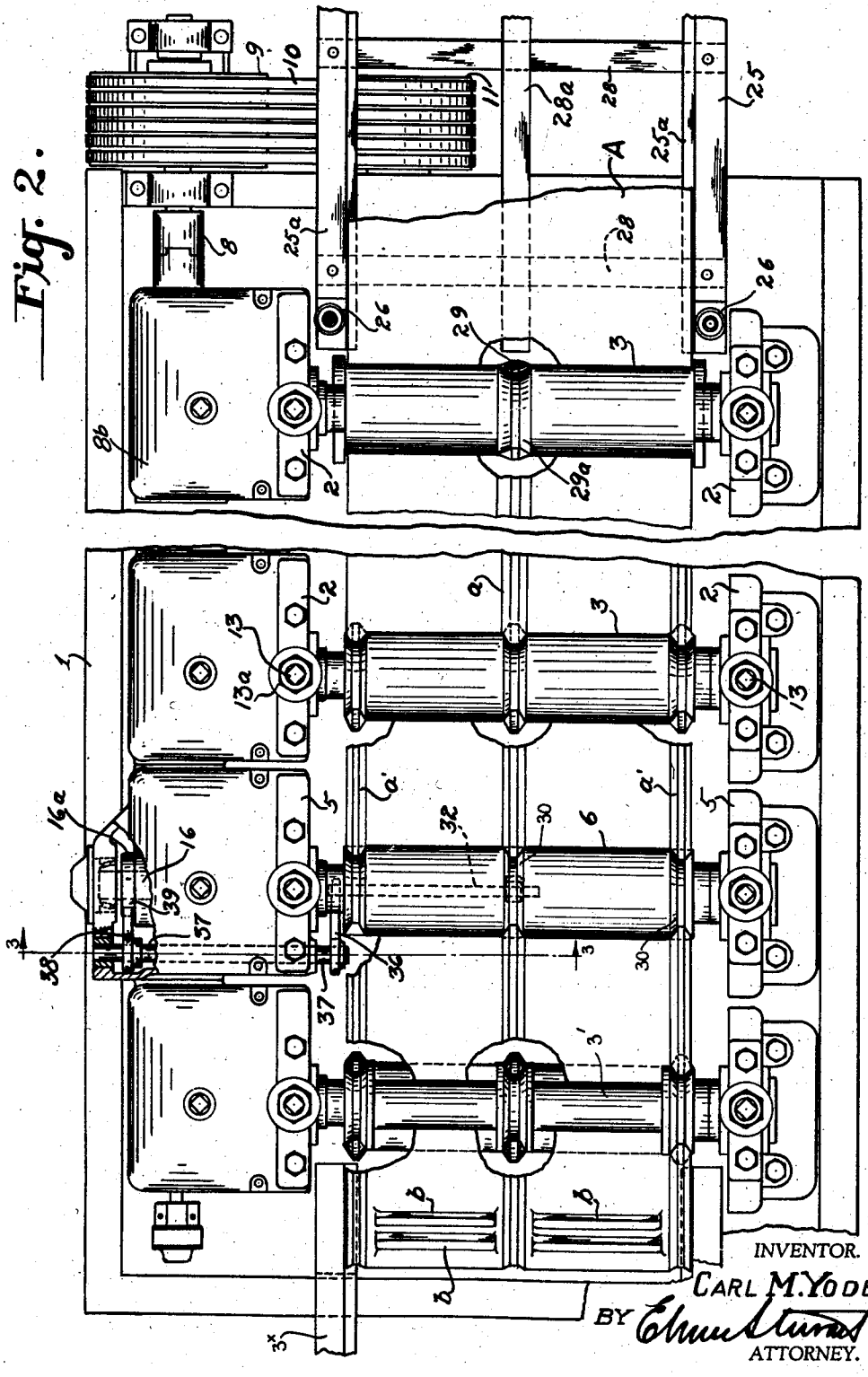
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MACHINE FOR CRIMPING SHEET METAL

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Fig. 2.



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MACHINE FOR CRIMPING SHEET METAL

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Fig. 3.

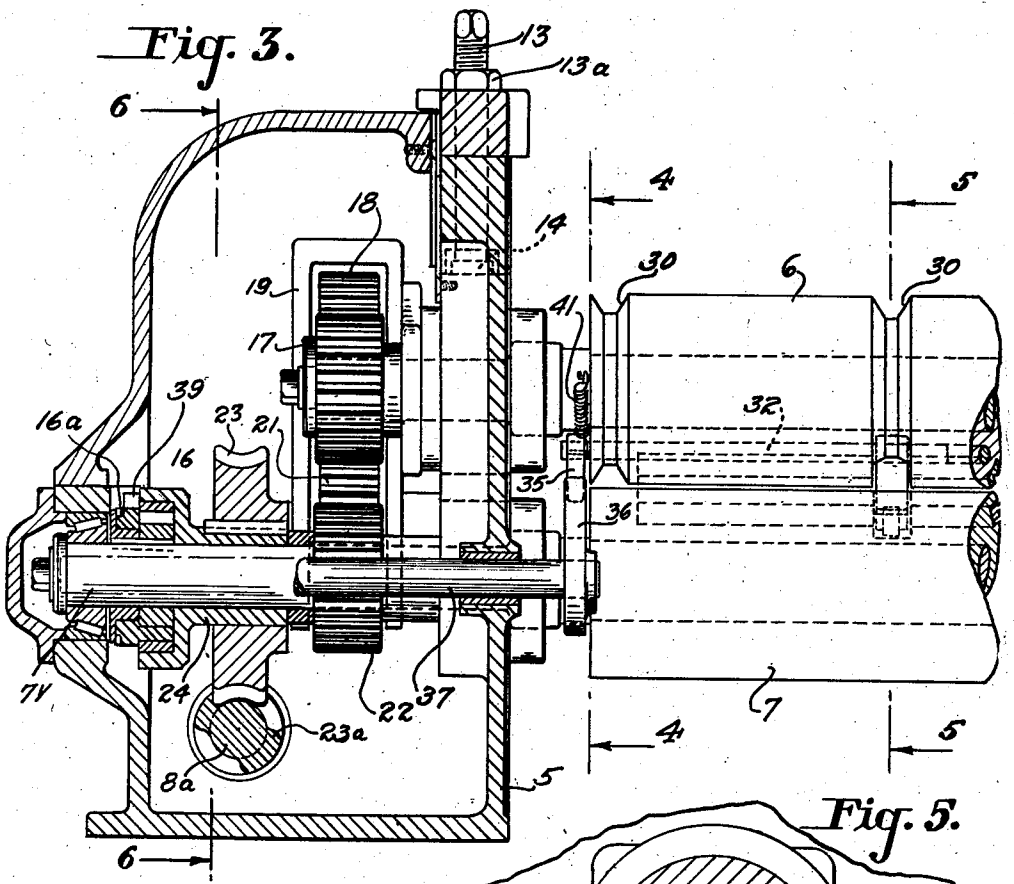


Fig. 4.

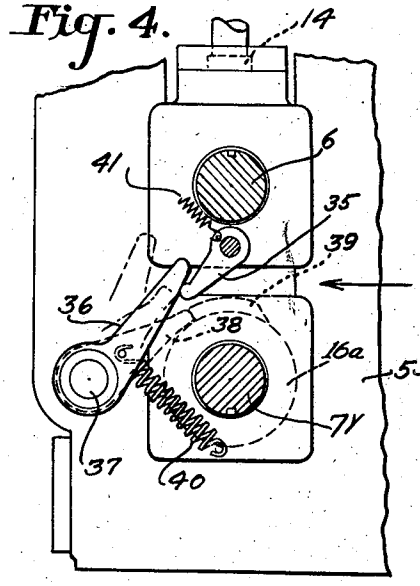
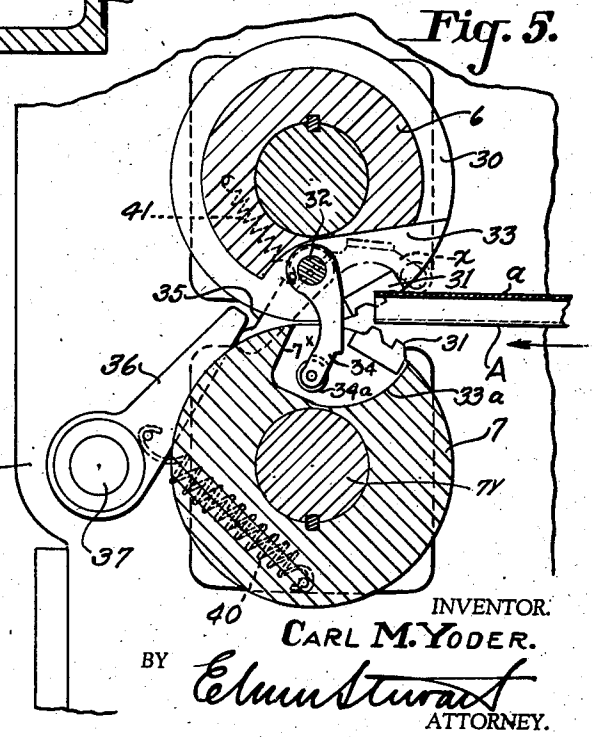


Fig. 5.



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MACHINE FOR CRIMPING SHEET METAL

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Fig. 10a.

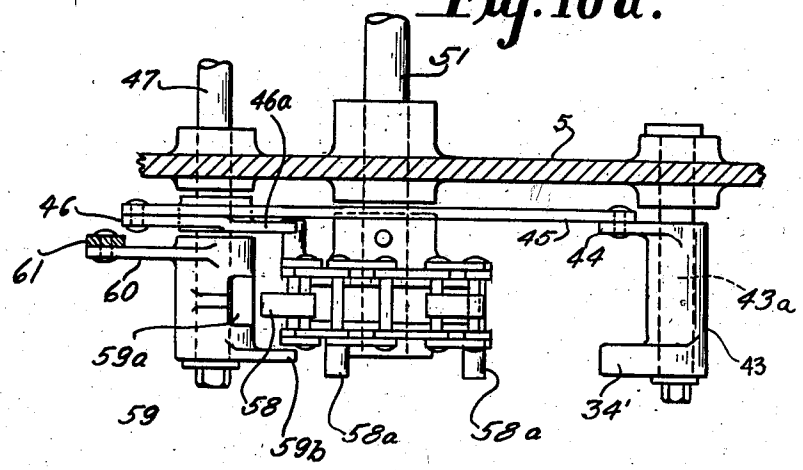


Fig. 11.

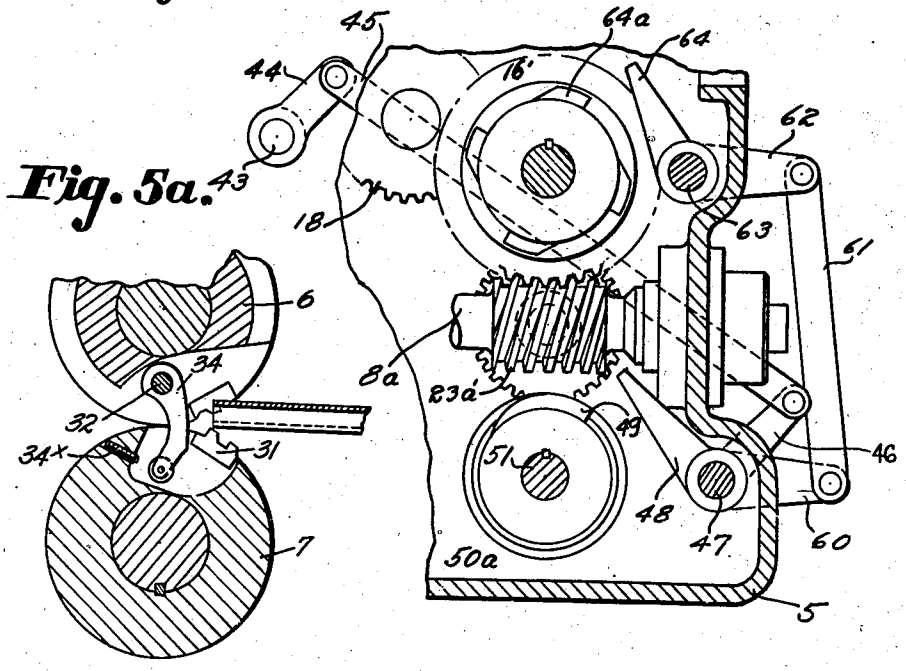


Fig. 5a.

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MACHINE FOR CRIMPING SHEET METAL

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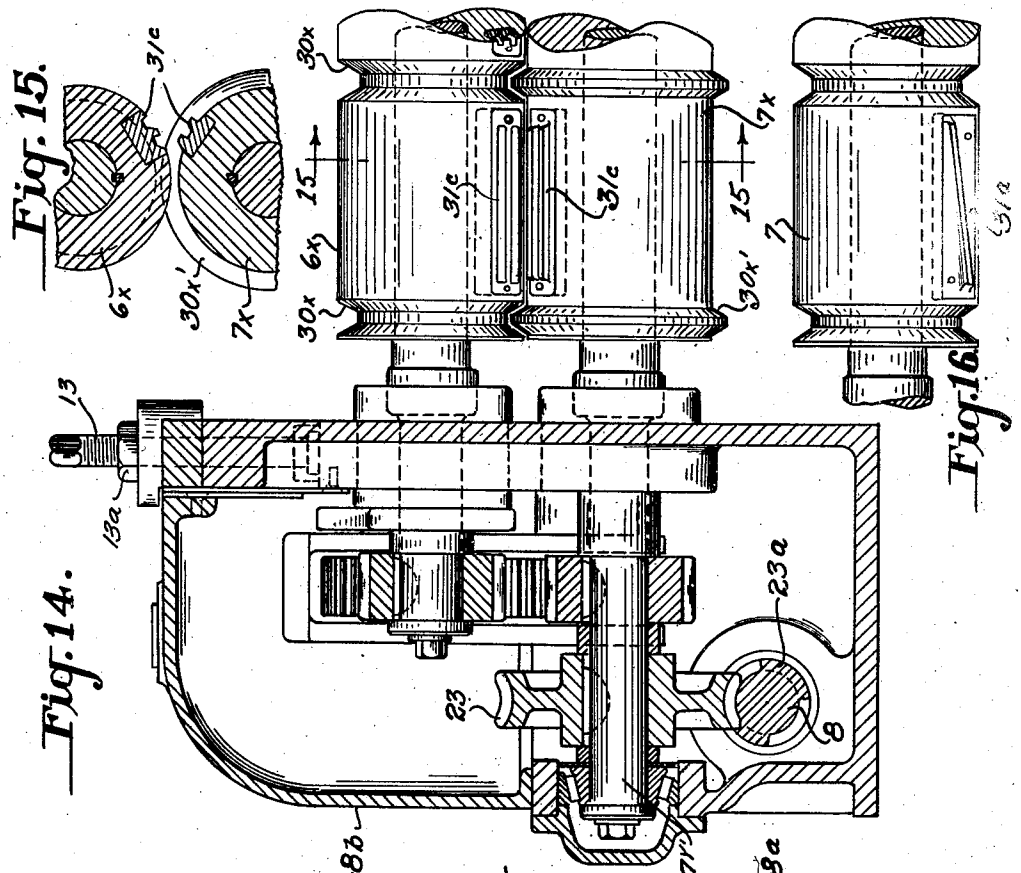


Fig. 6.

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MACHINE FOR CRIMPING SHEET METAL

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Fig. 8.

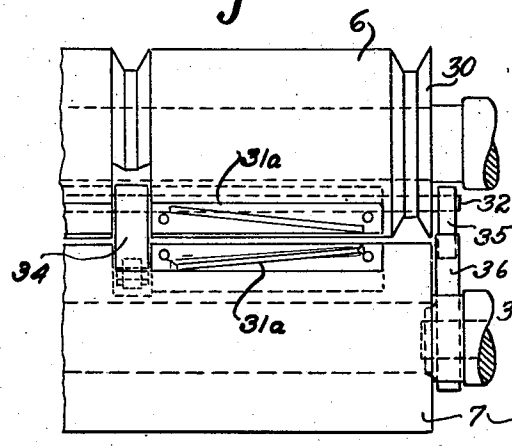


Fig. 7.

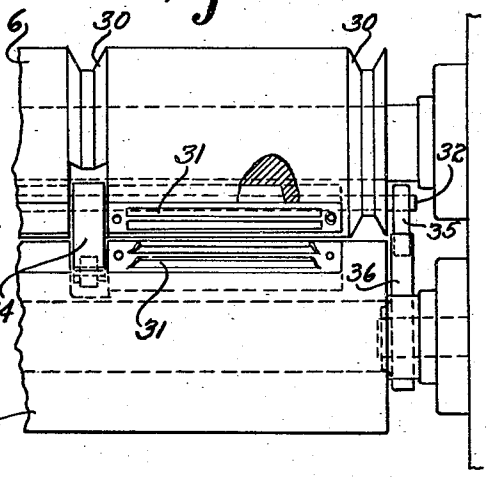


Fig. 17.

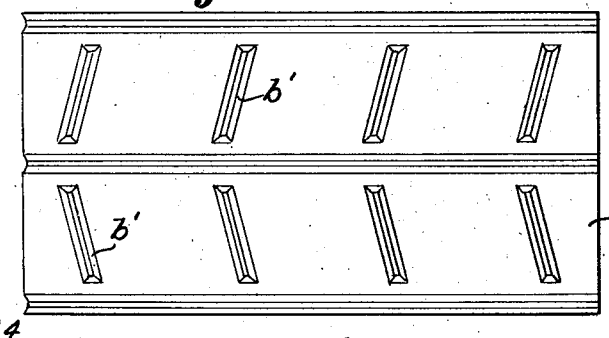


Fig. 18.

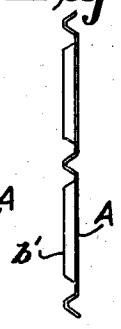


Fig. 20.



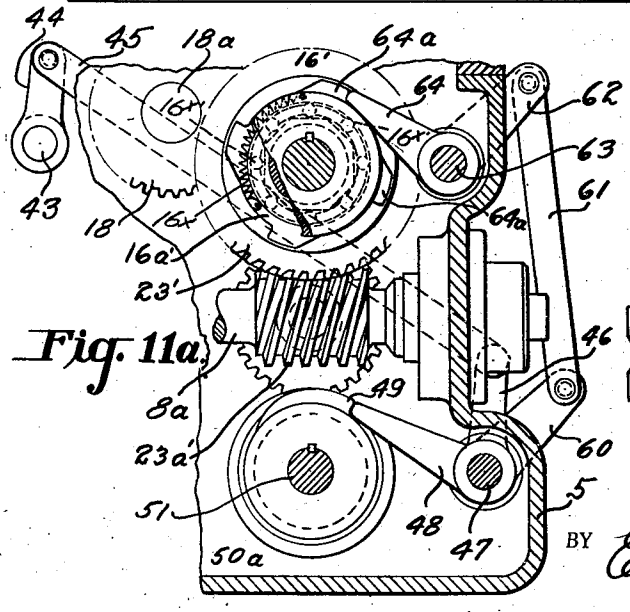
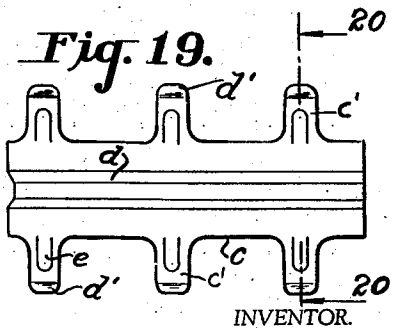


Fig. 11a.

Fig. 19.



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MACHINE FOR CRIMPING SHEET METAL

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Fig. 9

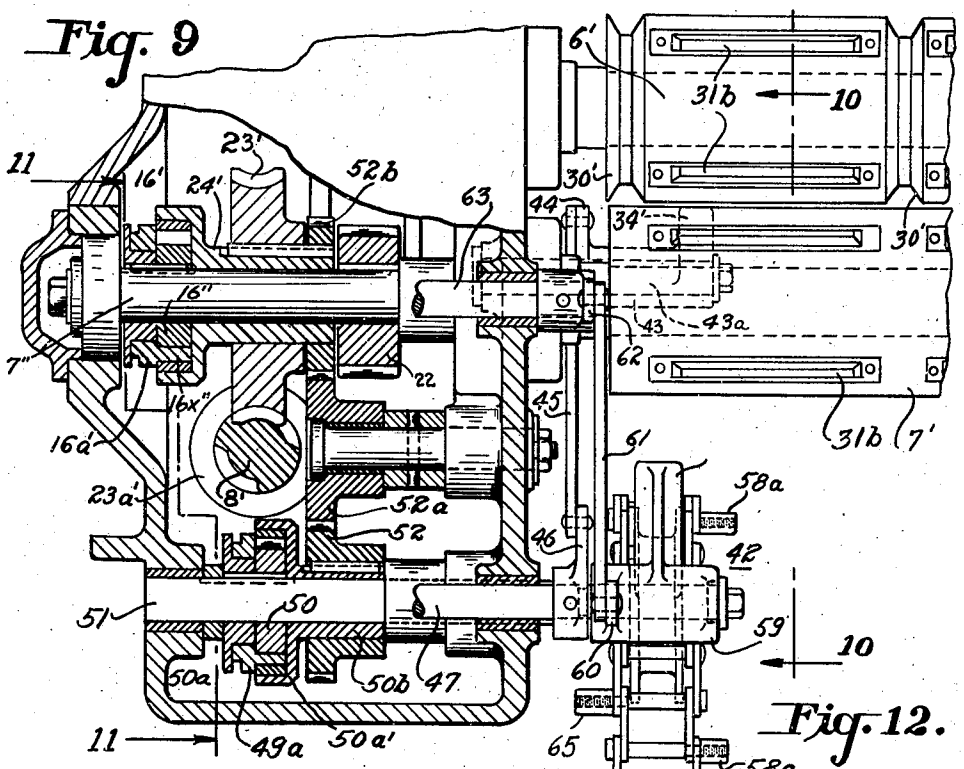


Fig. 12.

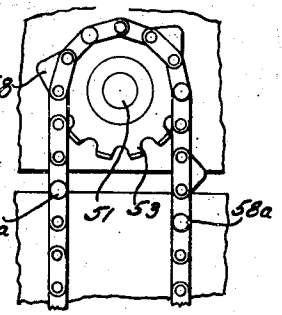


Fig. 10

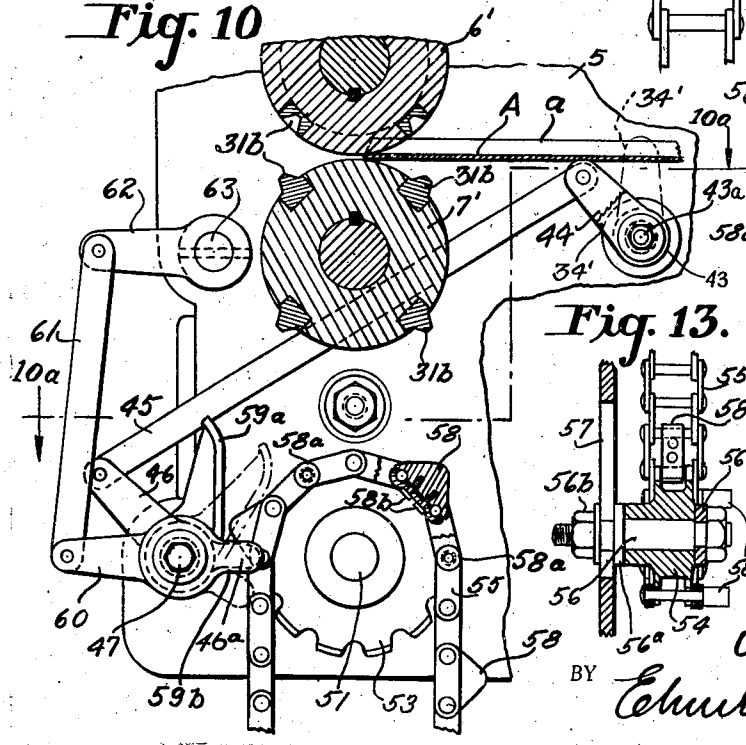
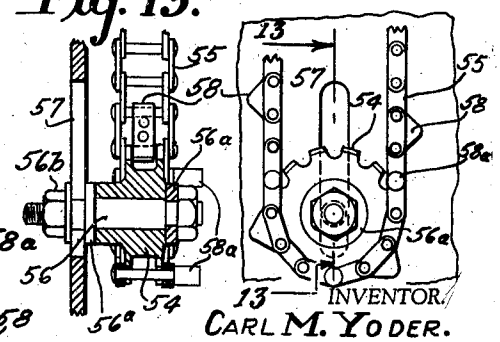


Fig. 13.



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Patented Mar. 6, 1945 2,370,702

UNITED STATES PATENT OFFICE

2,370,702

MACHINE FOR CRIMPING SHEET METAL

Carl M. Yoder, Lakewood, Ohio; Bertha L. Yoder, Lakewood, Ohio, executrix of said Carl M. Yoder, deceased

Application March 22, 1939, Serial No. 263,543

5 Claims. (Cl. 153—77)

This invention relates to a machine for crimping or embossing sections of sheet metal.

Another object of the invention is to provide an improved machine capable of crimping sections of sheet metal at any desired angle to their direction of movement.

Another object of the invention is to provide an improved machine capable of forming in sections of sheet metal one or more crimped portions extending longitudinally of each section and separate crimped portions disposed at an angle to the longitudinally crimped portions.

A further object of the invention is to provide in a machine of this character improved mechanism for controlling certain of the crimping devices.

To those versed in machines and processes in the art to which my invention relates, other objects of my invention will be apparent from the description hereinafter set forth.

The machine or apparatus disclosed herein consists of certain sets of rolls which emboss or reinforce sections of sheet metal along longitudinal lines and a set of rolls which embosses or reinforces the sections on transverse lines, but the invention is not to be limited to such combination of roll sets as certain of the improvements herein disclosed relate to the set of rolls for transversely embossing the sheet metal sections and the means for operating or controlling the rotation of these rolls; one form of construction showing a roll set controlled to provide one transverse embossment in each section and another form of construction showing a roll set controlled to provide one or more transverse embossments in each section.

Referring to the drawings,

Fig. 1 is a side elevation of a machine embodying my invention, parts being broken away.

Fig. 2 is a plan view.

Fig. 3 is a fragmentary view, enlarged, on the line 3—3 of Figs. 1 and 2.

Figs. 4 and 5 are sections on the lines 4—4 and 5—5, respectively, of Fig. 3; the latter figure being further enlarged.

Fig. 5a is a fragmentary section of parts shown in Fig. 5, but illustrating a modification.

Fig. 6 is a section on the line 6—6 of Fig. 3.

Fig. 7 is a fragmentary view of parts shown in Figs. 4 and 5, looking toward the right.

Fig. 8 is a view similar to Fig. 7, but showing a modification.

Fig. 9 is a fragmentary view of another modified form of construction, partly in section; the parts being shown in operated position.

Fig. 10 is a section on the line 10—10 of Fig. 9.

Fig. 10a is a section on the line 10a—10a of Fig. 10.

Fig. 11 is a section on the line 11—11 of Fig. 9.

Fig. 11a is a section similar to Fig. 11, but showing the parts in their normal positions.

Fig. 12 is a fragmentary side view of parts shown in Figs. 9 and 10.

Fig. 13 is a fragmentary section on the line 13—13 of Fig. 12.

Fig. 14 is a fragmentary view, partly in elevation and partly in section, similar to Figs. 3 and 9, but showing a different form of construction.

Fig. 15 is a fragmentary section on the line 15—15 of Fig. 14.

Fig. 16 is a fragmentary view showing a modified form of operating element for use in the construction shown in Fig. 14.

Fig. 17 illustrates a section of material which has been crimped transversely by mechanism such as shown in Figs. 9 to 13 or Figs. 14 to 16.

Fig. 18 is an end view of section shown in Fig. 17.

Fig. 19 is a fragmentary view of section of material crimped in a different manner from that shown in Figs. 2 and 17.

Fig. 20 is an end view of the section shown in Fig. 19.

In carrying out my herein disclosed process, the sections of sheet metal are reinforced longitudinally and transversely and where the sections are utilized as a sheathing or roofing certain of the crimps on each section may be meshed and interlocked with certain crimps on an adjoining section or sections, whereby a continuous surface and other advantages result.

In the drawings, 1 indicates a frame adapted to support a series of housings 2, disposed in pairs, which are spaced longitudinally of the frame 1, each pair of housings being provided with bearing boxes 2' (preferably containing anti-friction bearings) for supporting upper and lower rolls 3, 3a. As these housings and the mountings for the rolls are similar in construction and driven in the same manner, only the first set of rolls 3, 3a, and the last set of rolls 3, 3a, are shown.

5 indicates a pair of housings positioned beyond the housings for the last set of rolls 3, 3a, and provided with bearing boxes for supporting upper and lower rolls 6, 7, to which reference will later be made. The housings 5 are preferably mounted on the same support with the housings 2. Accordingly, in such arrangement, the housings 5 support the rolls 6, 7, in such relation to

the rolls 3, 3a, that the operations performed by the rolls 6, 7, (as later set forth) take place on one portion of each section of the sheet metal stock while the set of rolles 3, 3a are operating on another portion of the same section, but it will be obvious that the rolls 6, 7 may be spaced any suitable distance from the sets of rolls 3, 3a, so as to act on each section at a later period, for example, after each entire section has passed beyond the rolls 3, 3a.

The housings 2 and the housing 5 at one side of the frame 1 are shaped to house the gearing for driving each set of rolls 3, 3a and 6, 7, from a shaft 8, preferably formed in sections 8a (see Fig. 6), whereby the drive for each set of rolls may constitute a unitary assembly with the adjacent housing, access to the latter being provided by means of a removable section 8b. At one end, the shaft 8 is fixed to a pulley 9 driven by an endless member 10 from a pulley 11, which is fixed to the shaft 12 by a suitable motor (not shown) mounted within the frame 1. The rolls 6, 7 may be driven by a separate shaft or a separate motor, dependent upon the distance the rolls 6, 7 are spaced from the last set of rolls 3, 3a.

Each upper roll 3 and the roll 6 are adjustable toward and from the adjacent lower roll by means of screws 13 each engaging a nut 13a mounted on the upper end of the adjacent housing 2 or 5 and having at its lower end a head 14 which rotatably fits a socket provided on the adjacent bearing box for the upper roll, so that by rotating the screws 13 and holding the nuts 13a stationary, each upper roll may be adjusted in either direction.

To compensate for the roll adjustment above set forth, I provide an arrangement of gearing for driving the rolls in any position of adjustment. As the gearing for driving each set of rolls 3, 3a is similar, and the gearing for the set of rolls 6, 7 (in Figs. 1 to 7) differ therefrom in intermittently driving them through a one-revolution clutch 16, which may be of any desired form of construction, reference is made to Figs. 3 and 6 as follows: the shaft of each upper roll is provided with a gear 17 which meshes with a gear 18 mounted on a shaft 18a. The shaft 18a has bearing in the side members of a yoke 19 which is swingable about a shaft 20, the latter being mounted in the side walls of the housing 2 or 5. A link 19a formed with openings so as to fit over the shaft of the upper roll and shaft 18a serves to maintain the gears 17 and 18 in meshing relation and prevents the upper end of the yoke 19 from swinging outwardly. The shaft 20 supports a gear 21 in mesh with the gear 18 and a gear 22 keyed to the shaft of the adjacent lower roll (see Figs. 3, 6 and 14), the roll shaft being mounted in bearings provided in the outer side walls of the adjacent housing. The shaft for each lower roll 3a has keyed to it a worm gear 23 in mesh with a worm 23a fixed to the adjacent shaft section 8a (see Fig. 14), whereas the shaft 7y for the lower roll 7 rotatably supports a sleeve 24 (see Figs. 3 and 6) to which the adjacent worm gear 23 is keyed, whereby the sleeve is continuously driven. The outer end of the sleeve is provided with one element of the clutch 16, another element thereof being keyed to the shaft 7y, so that when the one-revolution clutch 16 is operated, as later set forth, the power of the shaft 8 is transmitted through the worm 23a, worm gear 23, sleeve 24 and clutch 16 to the shaft 7y of the lower roll 7. The gearing between the shafts for each set of rolls serves to rotate the upper roll at the same speed as that of the lower roll.

The one revolution clutch 16 is substantially similar to the clutch elements shown in Letters Patent No. 2,205,389 (Figs. 4, 5 and 7), the clutch elements therein being controlled by a cam, whereas the clutch elements herein are controlled by an arm, which in one position holds the clutch elements in inoperative position, but when operated permits the clutch elements to engage to thereby effect a driving connection from the sleeve 24 to the shaft 7y.

The sections of sheet metal (one being shown at A) are successively delivered to the first set of rolls 3, 3a, over a guide device 25, preferably consisting of outer guide members 25a having side walls between which each section slides and rollers 26 loosely mounted on the guide device inwardly of said side walls (see Fig. 2). The members 25a are supported on the frame 1 by brackets 27 (only one being shown) and connected together by cross members 28, which support an intermediate member 28a arranged parallel to the members 25a to prevent sagging of the sections A as they are delivered to the rolls 3, 3a.

The sets of rolls 3, 3a being driven, as already set forth, serve to feed each section between them from one set of rolls to the next and simultaneously carry out the first step of my process in forming one or more longitudinally extending crimps in the section, by preference a centrally disposed crimp *a* and crimps *a'* along or adjacent each lateral edge of the section. As will be understood, each crimp *a* is formed progressively by providing on each pair of rolls 3, 3a, complementary crimping elements consisting of a circumferential rib 29 on one roll (preferably the lower roll) and a circumferential complementary groove 29a on the other roll; the radius of the rib on each succeeding lower roll increasing with a corresponding decrease in the radius of the groove in the respective related upper roll, so that the metal section is gradually deformed by these crimping elements from its normal plane to the maximum height of the crimp. The deformation of the metal section to form the centrally disposed crimp *a* may start with the first set of rolls 3, 3a, but by preference the deformation of the metal section to form the crimps *a'* starts with one of the succeeding sets of rolls 3, 3a. I provide as many sets of rolls 3, 3a as may be necessary to completely form the crimps *a* and *a'* as determined by their height and width, as well as the kind, quality and thickness of the stock, but to simplify the illustration only the first set of crimping rolls 3, 3a, and the last set of crimping rolls 3, 3a are shown, since the intermediate roll sets, their mountings and drive means are of similar construction.

The roll 6 is formed with circumferential grooves 30 to accommodate the crimps *a*, *a'*, as the sections feed between them, but such roll is related to the roll 7 so as to avoid feeding of the sections A since these rolls are driven intermittently, as already set forth.

The rolls 6, 7 in making one revolution operate to carry out the next step of my process, namely, that of deforming each section of sheet metal A at an angle to its direction of movement. In the form of construction shown in Figs. 1 to 7, the rolls 6, 7 are provided with complementary crimping elements 31 each disposed longitudinally of and removably mounted in the body of the adjacent roll, the male element being carried by the lower roll 7 to crimp the metal in the same direc-

tion as the crimps *a*, *a'*. By preference, I provide two sets of elements **31**, one set at either side of the crimp *a*. In the arrangement shown in these figures the crimping elements form crimps *b* in each section at right angles to the direction of movement of the sections A, but by arranging the elements helically as shown at **31***a* in Fig. 8, the resulting crimps will be inclined to this directional movement. In the arrangement referred to the intermittent operation of the rolls **6**, **7** by the clutch **16** is controlled by each section, so that the machine is simplified in that the provision of operating connections synchronized with the operation or rotation of any of the rolls **3**, **3***a* are eliminated. The control means for the clutch **16** comprises the following: **32** indicates a shaft suitably mounted eccentrically in bearings within the roll **6** and in advance of the adjacent crimping element **31**. Centrally of the rolls **6**, **7**, preferably in alinement with the adjacent groove **30** therein, they are cut away to form recesses **33**, **33***a*, respectively, to accommodate an arm or trip **34** which is fixed to the shaft **32**, the arm when in normal position depending from the shaft **32** and extending into the recess **33***a* across the path of movement of each section A as the latter feeds between the rolls. At its outer end, beyond the end of the roll **6** adjacent its drive means, the shaft **32** is provided with a lever **35** (see Figs. 4 and 5) arranged to engage with and operate a lever **36** fixed to a rock shaft **37**, which is mounted in bearings provided in the inner and outer walls of the adjacent housing **5** (see Figs. 2 and 3). Adjacent its outer end, the rock shaft **37** is provided with an arm **38** normally disposed in engagement with a lug **39** (see dotted lines in Fig. 4) carried by the release element **16***a* of the one revolution clutch **16**. With the parts positioned as shown in Figs. 4 and 5, it will be seen that in the forward movement of the section A its advancing front end will engage the arm **34** and swing it clockwise (as viewed in Fig. 5) and rock the shaft **32**; the shaft **32** in turn through the levers **35**, **36**, rocks the shaft **37** which swings the lever **38** outwardly in opposition to the tension of a spring **40** (which is connected at one end to the lever **36** and suitably anchored at its other end—see Figs. 4 and 5) and disengages it from the shoulder **39** to release the clutch element **16***a*, whereupon a spring (similar to that shown at **16***x* in Fig. 11*a*) connected to the clutch element **16***a* operates the latter to effect engagement of the clutch elements and thereby connect the sleeve **24** to the shaft **7***y* of the roll **7**, whereby the rolls **6**, **7** are rotated; and as the arm **38** is connected to the spring **40**, it swings back into its normal position after the shoulder **39** passes the arm **38**, in the path of the shoulder, to thereby arrest the clutch element **16***a* and throw out the clutch **16**, thereby permitting one revolution only of the rolls **6**, **7**. It will thus be seen that the rolls **6**, **7** make one revolution and then stop, the effect of which is to move the crimping elements **31** into engagement with the section A and crimp it as the section passes through and between these rolls. As shown, the crimping elements **31** on the roll **7** extend radially beyond its periphery and the elements **31** on the roll **6** are within the periphery thereof, so that the crimps *b* extend upwardly. In each operation of the rolls **6**, **7**, the arm **34** is revolved to the position shown in dotted lines at *x* (Fig. 5), in engagement with the advancing section A, on which it rides until the rear end of the section feeds past the arm. The arm **34** then swings down to its normal position in the path of the succeeding section A. The free end of the arm **34** is provided with a roller **34***a* which rolls on the section when the arm is in its inoperative position indicated at *x*. As the arm **34** is mounted in line with the crimp *a*, the roller **34***a* rolls on the upper portion thereof. By preference, I provide a spring **41** which is connected to the lever **35** and a pin on the adjacent end of the roll, the spring being put under tension when the arm **34** is arrested by the section A and held in its inoperative position *x*, so that upon release of the arm the spring rocks the shaft **32** to return the arm **34** to normal position, the swinging movement thereof being limited by the engagement of the lever **35** with the lever **36**, which is held in position against outward movement due to the tension of the spring **40** on the lever **36** since the tension or resistance to expansion of the spring **40** is greater than that of the spring **41** to make the lever **36** effective as a stop in the return movement of the arm **34**.

To prevent any lag or slippage in the operation of the clutch **16**, upon release of the arm **38** from the shoulder **39**, to start rotation of the rolls **6**, **7**, I provide on one of the rolls **6**, **7** an abutment which is engaged by the arm **34** as it is being operated by the advancing end of the section A, so that the latter through the arm will start rotation of the rolls **6**, **7**. The abutment preferably consists in arranging the rear wall of the recess **33***a* in relation to the normal position of the arm **34** so as to be engaged thereby immediately after the arm **38** has disengaged the shoulder **39**. As shown in Figs. 1 and 5, the rear wall **7***x* of the recess, when the roll **7** is in normal position, extends upwardly and rearwardly, and the arm **34** engages with the wall **7***x* at a point remote from the axis of the roll **7** and in a direction substantially at right angles to a radius cutting the wall **7***x*, so that the arm, as it is operated by the moving section, will be effective to initially start rotation of the rolls and thus permit the drive means, through the clutch **16**, to quickly insure rotation of the rolls **6**, **7** at their maximum speed. If any adjustment is found to be required to change the relation of the arm **34** to the abutment **7***x*, a screw **34***x* (see Fig. 5*a*) may be mounted in this wall portion of the roll so that one end of the screw will serve as the abutment and effect adjustment of such end by a turn of the screw.

3', **3***a'* indicate a set of rolls mounted on the support **1** beyond the rolls **6**, **7** and driven by gearing similar to that herein referred to for driving the rolls **3**, **3***a*, for feeding the sections after passing the rolls **6**, **7** and delivering them to a suitable support **3***x* or carrier (not shown). The rolls **3'**, **3***a'* preferably consist of a plurality of sets of collars each disposed in alinement with one of the crimps *a*, *a'*, and shaped on their peripheries to receive and engage the walls of the crimps.

Fig. 8 illustrates a modification wherein the rolls **6**, **7** are provided with crimping elements **31***a* (already referred to), extending helically, so that the crimps formed thereby in the advancing sections extend at an inclined angle, for example, at the angle shown in Fig. 17. In this form of construction the rolls **6**, **7** are controlled as already described in connection with the construction shown in Figs. 1 to 7, inclusive.

Fig. 9 to 13, inclusive, illustrate a form of construction wherein each section may be provided with one or more transversely arranged reinforcing crimps and spaced uniformly or otherwise

predetermined distances when two or more crimps are formed in each section. This form of construction also permits two or more reinforcing crimps to be formed in each section in predetermined spaced relation without making it necessary to employ large sized rolls for the crimping elements. In these views 6', 7' indicate the upper and lower rolls carrying the crimping elements 31b, the male elements being mounted on the lower roll 7' and the female elements being mounted on the upper roll 6', and the latter roll being formed with circumferential grooves 30' to accommodate the reinforcing crimps *a*, *a'*, formed by the set of rolls 3, 3*a*, as already set forth. For illustrative purposes I have shown four sets of crimping elements 31b (one male element and one female element constituting a set) on the rolls 6', 7', which operate in any predetermined order (successively or otherwise) under the control of a mechanism indicated as an entirety at 42; but it will be understood that the number of sets of crimping elements may be decreased or increased to meet any desired spacing of the crimps. The rolls 6', 7' are drivingly connected and driven similarly to the driving connections and driving means for the rolls 6, 7, as already set forth, namely, a clutch 16' having one element connected to the shaft for the lower roll 7' and the other clutch element connected to the sleeve 24', to which is keyed the worm gear 23' in mesh with the worm 23*a'* driven by the shaft 8', but the clutch 16' for the rolls 6', 7', instead of being operated directly by each section of material A, I incorporate between the device 34', which is engaged by each section A, and the clutch 16', the mechanism 42 which controls the driving, stopping and periods of rest of the rolls 6', 7', in any predetermined manner, whereby all or certain of said sets of crimping elements 31b are brought into engagement with each sheet metal section at desired portions thereof between its front and rear ends to crimp it. The device 34' in this form of construction is fixed to or formed integral with the outer end of a sleeve 43 suitably mounted on a stud shaft 43*a* carried by the adjacent side wall of the adjacent housing 5 below the plane in which the sections A feed (see Figs. 9 and 10). The trip device 34' is normally disposed as shown in dotted lines in Fig. 10, so that its free end portion is arranged in the path of movement of the advancing front end of each section as the latter is fed forwardly by the rolls 3, 3*a* to the rolls 6', 7', such advancing end operating to swing the device to the position shown in full lines, to set in operation the control or indexing mechanism 42, which is constructed and operates in the following manner, the parts thereof being shown in operated position. 44 indicates a lever (which may be in alinement with the device 34') fixed to the sleeve 43 between the housing 5 and lower roll 7'. The outer end of the lever 44 is pivoted to one end of a link 45, the opposite end of which is pivotally connected to one arm 46 of a bell crank, (the other arm 46*a* of which will be later referred to) fixed to the inner end of a shaft 47. The shaft 47 is suitably mounted in the inner and outer side walls of the adjacent housing 5. The outer end portion of the shaft 47 is provided with a dog 48 normally disposed in engagement with the shoulder 49 of a lock and release member 49*a* arranged to operate one element 50 of a suitable clutch 50*a*. The element 50 is keyed to a driving shaft 51, suitably supported in the side walls of the housing and extends inwardly beyond the inner side wall thereof for a purpose later set forth; whereas the other element 50*a'* of the clutch 50*a* is provided with a sleeve 50*b* which rotates on the shaft 51. The sleeve 50*b* is provided with a gear 52, which is in mesh with an idler gear 52*a*, the latter being in mesh with a gear 52*b* keyed to the sleeve 24', whereby the sleeve 50*b* is continuously driven by the shaft 8' through the worm 23*a'* and worm gear 23'. The clutch 50*a* may be of any well known construction, for example, similar to the clutch 16' (see Figs. 9 and 11), having the lock and release member 49*a*, which in one position, maintains the clutch elements disengaged and upon disengagement of the dog 48 therefrom permits them to engage under the influence of the spring 16*x* to transmit power from the driven element 50 to the element 50*a'*. On its extended end, the shaft 51 is provided with a sprocket 53 around which and a guide sprocket 54 runs an endless chain 55, the chain being removable from the sprockets. The sprocket 54 rotates on a stud shaft 56 between inner and outer collars 56*a*, the inner end of the shaft extending through an elongated slot 57 formed in an adjacent wall of the support 1 (see Figs. 12 and 13). As shown in Fig. 13, the inner collar 56*a* is clamped to the supporting wall by a nut 56*b*, which when loosened permits the stud shaft to be adjusted along the slot 57 to take up slack in the chain 55. The chain 55 may be of any desired length and where necessary, on account of its length, it may be guided around two or more guide sprockets. The chain 55 is provided with one or more operating or indexing elements 58 and one or more operating or indexing elements 58*a* for controlling the operation of the lock and release element 16*a'* of the clutch 16', whereby the clutch element fixed to the shaft for the lower roll 7' is connected to the driven element of the clutch and disconnected therefrom, in a pre-arranged manner or order to rotate the rolls 6', 7', and stop them in any predetermined position, that is, with one set of crimping elements in position to form a crimp in the succeeding rotary movement of the rolls. Each operating element 58 serves to connect in the clutch 16' and each operating element 58*a* serves to disconnect the clutch, and as each of the elements 58, 58*a* is removably mounted on the chain links, they may be arranged in any desired order and relation; or by providing separate chains 55, the elements on each chain may be arranged in a different order and relation. It will thus be seen that if all of the elements 58*a* except one thereof are omitted from the chain 55, once the rolls 6', 7' are started rotating, the sets of crimping elements 31b will operate successively and form crimps in transversely spaced relation longitudinally of the section until the element 58*a* becomes effective; or by spacing each element 58*a* from the succeeding element 58, so that the section A advances while the rolls 6', 7' are at rest, the spacing between adjoining crimps may be varied in any desired manner. It will also be seen that by proper positioning of each element 58*a* relative to the succeeding element 58 either a uniform or non-uniform spacing of the crimps *b* may be formed in each section, the minimum spacing of the crimps being dependent upon the spaced angular relation of the sets of crimping elements on the rolls 6', 7'. In all arrangements of the operating elements 58, 58*a*, the operating elements 58*a* are positioned to effect stoppage of the rolls 6', 7', in a predetermined position or positions, so that when the rolls are at rest, the section A is free to be advanced between them without en-

gagement with the crimping elements 31b. In the illustrated construction of rolls 6', 7', I have provided four sets of crimping elements 31b; if only one crimp is to be formed in the section A or if two or more crimps spaced a greater distance from each other than the spacing of the crimping elements on the rolls, then each operating element 58a is related to the operating element 58 in advance thereof on the chain 55 so as to stop the rolls following the operation of each set of crimping elements with the succeeding set in the position shown; if two or more crimps are to be formed by successively related sets of crimping elements, each operating element 58a is related to the operating element 58 in advance thereof on the chain 55 to stop the rolls following the operation of the last set of crimping elements with the succeeding set in the position shown. By preference each operating element 58 is mounted on the chain 55 between its side bars and each operating element 58a is provided by extending laterally the pivot pins between certain of the chain links and suitably mounting on such extended end rollers, so that one series of operating elements traverse a path different from that traversed by the other series, this arrangement permitting a wide range of control of the crimping rolls 6', 7', as already set forth. Each operating element 58 is cam-shaped and engages two adjoining pivots pins to which it is clamped by a plate engaged by screws 58b and threaded into the inner wall of the element. The operating elements 58, 58a control the clutch 16' through the following instrumentalities: 59 indicates a bell-crank fulcrumed on the shaft 47 inwardly of the bell-crank provided with the arms 46, 46a, the arms 59a, 59b of the bell crank 59, when in normal position, being shown in dotted lines (Fig. 10), and disposed in operative relation to the elements 58, 58a, respectively; that is, the arm 59a is normally arranged in the path of movement of the operating elements 58 and the arm 59b is out of the path of movement of the elements 58a.

When the arm 59a is engaged by each of the operating elements 58, the arms 59a, 59b are swung to the position shown in full lines, the latter arm being then positioned in the path of movement of the operating elements 58a so that when the arm 59b is engaged by the succeeding element 58a the arms 59a, 59b are returned to their normal positions. It will thus be seen that so long as the chain 55 is driven, the bell crank may be swung in one direction to start the rolls 6', 7' rotating and in the opposite direction to stop them, so that by pre-arranging the elements 58, 58a, one or more crimps may be formed in each section and the spacing between them may be varied, except that the minimum spacing will correspond to the angular relation of the crimping elements on the rolls 6', 7'. The bell-crank 59 is provided with a separate arm 60 to which is pivoted one end of a link 61, the other end thereof being pivoted to an arm 62 fixed to the inner end of a rock shaft 63. The outer end of the rock shaft 63 is provided with a dog 64 normally engaging one of the shoulders 64a on the lock and release member 16a' of the clutch 16', but arranged to be released therefrom, as shown in Fig. 11, by the operation of the separate arm 60, to connect in the clutch 16'. It will be understood that the lock and release member 16a is provided with shoulders 64a equal in number to the number of sets of crimping elements 31b and similarly spaced, so that the clutch 16' may be disconnected to stop the rolls 6', 7' at predetermined positions as already described.

From the foregoing description it will be noted that while the rolls 6', 7' may be started and stopped by the operation of the clutch lock and release member 16a' one or more times during the feeding of each section, the clutch 50a remains drivingly connected to the shaft 51 to rotate it and drive the chain 55 so long as the trip device 34' remains in operative position. The trip device 34' after being operated by the advancing end of each section A, as already described, is held in such position by its engagement with the under side of the section, but is free to be returned to normal position after the rear end of the section feeds beyond it. To disconnect the clutch 50a and return the trip device 34' to normal position, I provide on the chain 55, on that side thereof opposite to the operating elements 58a, a laterally extending member 65 (preferably constructed similarly to each of the elements 58a) which is arranged to engaged the bellcrank arm 46a and swing the bell crank to normal position and rock the shaft 47 and through the arm 46, link 45 and lever 44, swing the trip device 34' to normal position and through the shaft 47 swing the dog 48 into the path of movement of the shoulder 49 and thus disconnect the clutch 50a from the shaft 51 to stop rotation of the latter and operation of the chain 55.

The clutches 16, 16' and 50a are similar in construction, clutch 16' being illustrated somewhat in detail in Figs. 9 and 11a. As shown in Fig. 9, one clutch element is fixed to the sleeve 24' and encloses the clutch element 16'' which is fixed to the shaft 7''. Between and carried by the element 16'' are a plurality of cams and a ball 16x' for each cam (see dotted lines in Fig. 11a), the balls being located between spaced lugs 16x'' extending laterally from the release member 16a'; also, the spring 16x is connected to the release member 16a' and the clutch element 16'' and is held under tension when the arm 64 is engaged with a stop 64a (Fig. 11a), but upon release of the arm 64, the spring 16x rotates the member 16a' which, through the lugs 16x'' carried thereby, moves the balls 16x' into engagement with the cams, whereby the clutch elements are connected to connect the shaft 7'' to the sleeve 24'. Upon re-engagement of the arm 64 with the next or a succeeding stop 64a, the rotation of the member 16a' is arrested, the balls 16x' are released from the cams, whereby the shaft 7'' is disconnected from the sleeve 24', and the spring 16x is put under tension ready for the next operation.

In Figs. 9, 11 and 11a, the operation of each of the clutches 16' and 50a is controlled by an arm, which is positively operated to release the adjacent release element of the clutch, whereby the latter becomes effective, and to re-engage the release element and effect a disengagement of the clutch elements; whereas in Figs. 1 to 5, the arm is normally biased into engagement with the release element of the clutch 16 and is tripped by operation of the device 34, so that it immediately returns to normal position and hence permits the clutch to make one revolution each time the arm is tripped.

Figs. 14 and 15 illustrate a different form of construction in which the rolls 6x, 7x, which carry the transversely arranged sets of crimping elements 31c, are geared together in the manner already set forth, but the shaft 7y' for the lower roll 7x is connected directly to the worm gear 23 so that the rolls are continuously rotated to

form transverse crimps in spaced relation longitudinally of the section at one or either side of the crimp *a*. The roll 6*x* may be formed with circumferential grooves 30*x* and the roll 7*x* provided with circumferential ribs 30*x'* in alinement with the grooves 30*x* to accommodate the crimps *a*, *a'*, as each section feeds between these rolls. By providing helically shaped crimping elements (as indicated at 31*a* in Fig. 16), the reinforcing crimps, when formed, will be inclined as shown at *b'* in Fig. 17.

It will be understood that the crimping elements 29, 29*a*, on the rolls 3, 3*a*, and the crimping elements on the rolls which form the transverse crimps may be variously shaped to form reinforcements or reinforcing embossments of any desired design and arrangement and that the sections to be reinforced prior to their being fed to the sets of rolls, may be subjected to a preliminary cutting operation, dependent upon the application of the sections in their final form; for example, the lateral portions of the sections may be cut away at *c* to form laterally extending wings *c'* (see Figs. 19 and 20) and the sets of rolls 3, 3*a* shaped to deform the sections as shown at *d* and the wings at *d'* and the transverse crimping rolls to deform the wings as shown at *e*.

It will be noted that the rolls carrying the transverse crimping elements are set in operation by the advancing end of each section, either directly as shown in Figs. 3, 4 and 5, or indirectly as shown in Figs. 9, 10, 11, and the element that is engaged by the section is held in operated position until the section has passed through the transverse crimping rolls. The sections may be of any desired length or vary in length without changing or affecting the manner in which these rolls operate.

To those skilled in the art to which my invention relates many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. My disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

What I claim is:

1. In a machine of the class described, the combination with means for feeding sections of sheet metal and driving mechanism for said feeding means, of a pair of rolls having on their peripheries crimping elements arranged to transversely emboss the metal sections during feeding thereof, the shafts for said rolls being geared together for simultaneous rotation, a clutch having one element connected to and driven by said driving mechanism, another clutch element fixed to the shaft for one of said rolls and spring operated means normally connecting said clutch elements together, a pivoted stop for engaging an element of said spring operated means for holding said means in an inoperative position, a spring normally tending to swing said stop into engagement with the last mentioned element, and connected together devices, one of said devices being related to said stop and operable to trip the latter from said last mentioned element and the other device being disposed intermediate the ends of one of said rolls and in the path of movement of each section and arranged to be operated thereby to operate said first mentioned device.

2. A machine as claimed in claim 1 wherein the connected together devices are carried by one of said rolls.

3. In a machine of the class described, the combination with means for feeding sections of sheet metal and driving mechanism for said feeding means, of a pair of rolls having on their peripheries crimping elements arranged to transversely emboss the metal sections during feeding thereof, the shafts for said rolls being geared together for simultaneous rotation, a driving connection between said driving mechanism and the shaft for one of said rolls, said connection comprising spring controlled normally engaged clutch elements, and a spring operated trip device for normally holding said elements in disengaged relation, and means controlled by the advancing end of each section for tripping said device, said tripping means including an element carried by one of said rolls intermediate the ends thereof and normally disposed in the path of movement of each section.

4. In a machine of the class described, the combination with means for feeding sections of sheet metal and driving mechanism for said feeding means, of a pair of rolls having on their peripheries crimping elements arranged to transversely emboss the metal sections during feeding thereof, the shafts for said rolls being geared together for simultaneous rotation, and the peripheries of said rolls being formed with related recesses, and means for drivingly connecting one of said shafts to said driving mechanism, comprising a clutch, a device pivotally mounted on one of said rolls in the recess thereof in the path of movement of the sections and arranged to be engaged and operated by the advancing end of each thereof and operating connections between said device and said clutch, said device extending into the recess of the other roll and arranged when operated by each section to engage the rear wall of the adjacent recess and supplement the operation of said driving means to start rotation of said rolls.

5. In a machine of the class described, the combination with means for feeding sections of sheet metal and driving mechanism for said feeding means, of a pair of rolls having on their peripheries crimping elements arranged to transversely emboss the metal sections during feeding thereof, the shafts for said rolls being geared together for simultaneous rotation, a clutch having one element connected to and driven by said driving mechanism, another clutch element fixed to the shaft for one of said rolls and spring operated means normally connecting said clutch elements together, a pivoted stop for engaging an element of said spring operated means for holding said means in an inoperative position, and connected together devices, one of said devices being related to said pivoted stop and operable to disengage it from said spring operated means and the other device being arranged between and intermediate the ends of said rolls and normally disposed in the path of movement of each section and arranged to be operated thereby to operate said first mentioned device.

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