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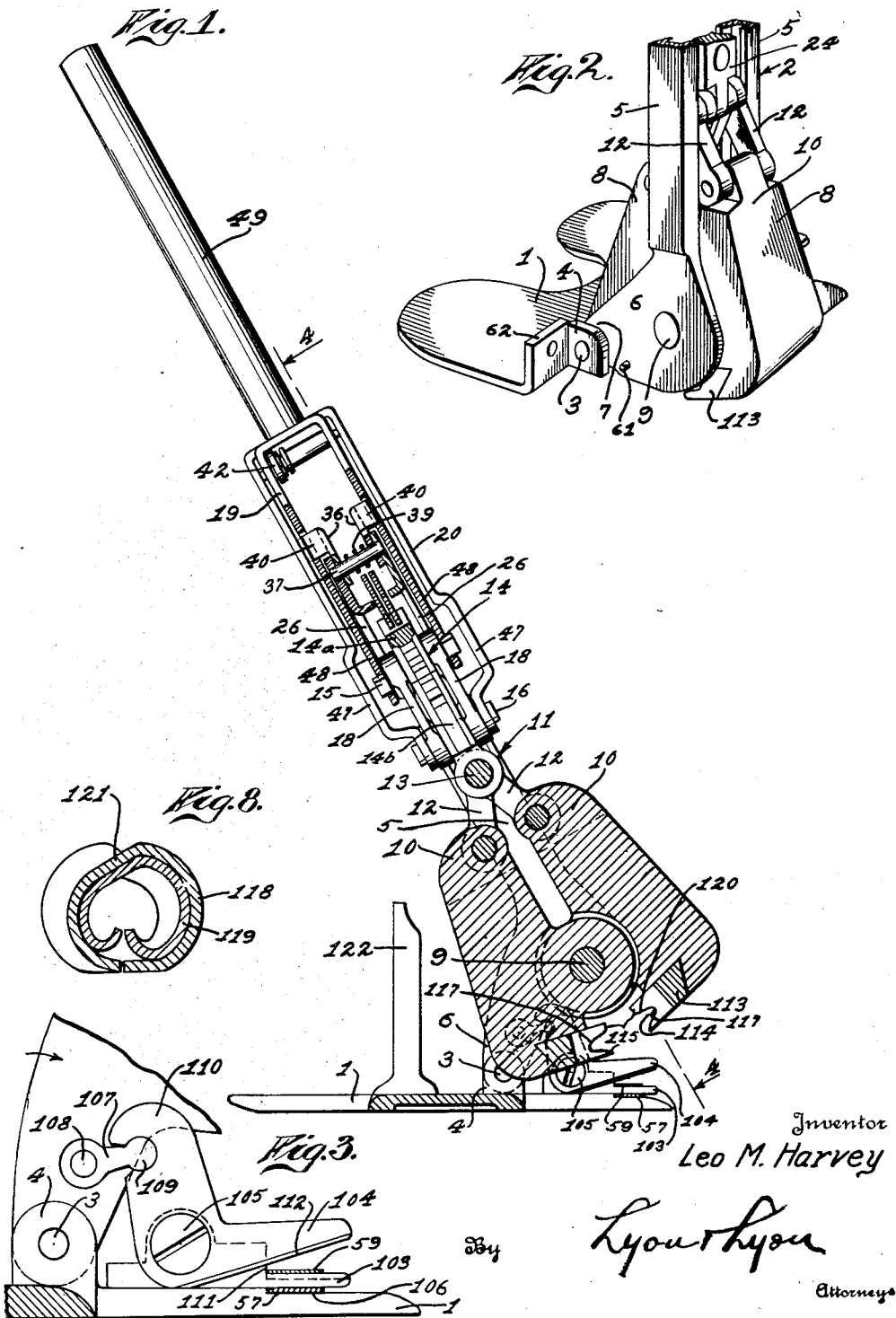
L. M. HARVEY

1,874,518

TIE FORMING MECHANISM

Filed May 1, 1929

4 Sheets-Sheet 1



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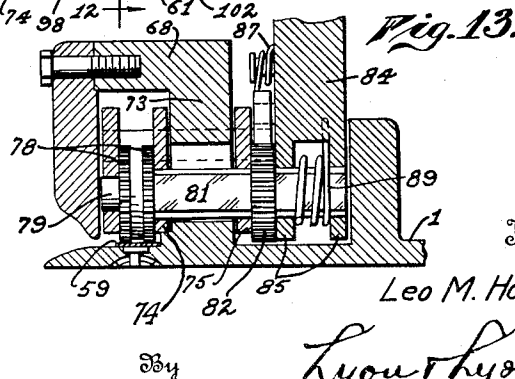
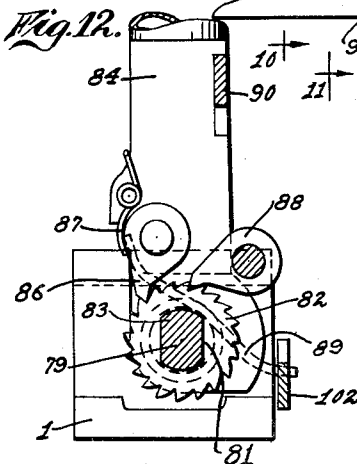
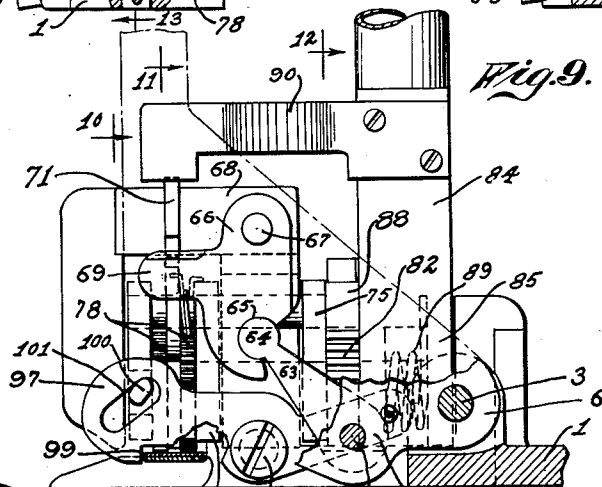
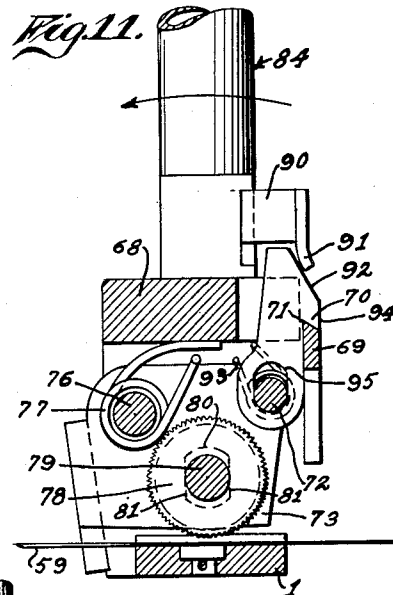
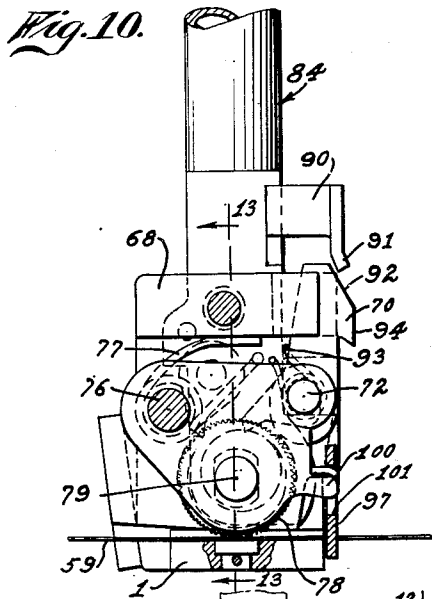
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TIE FORMING MECHANISM

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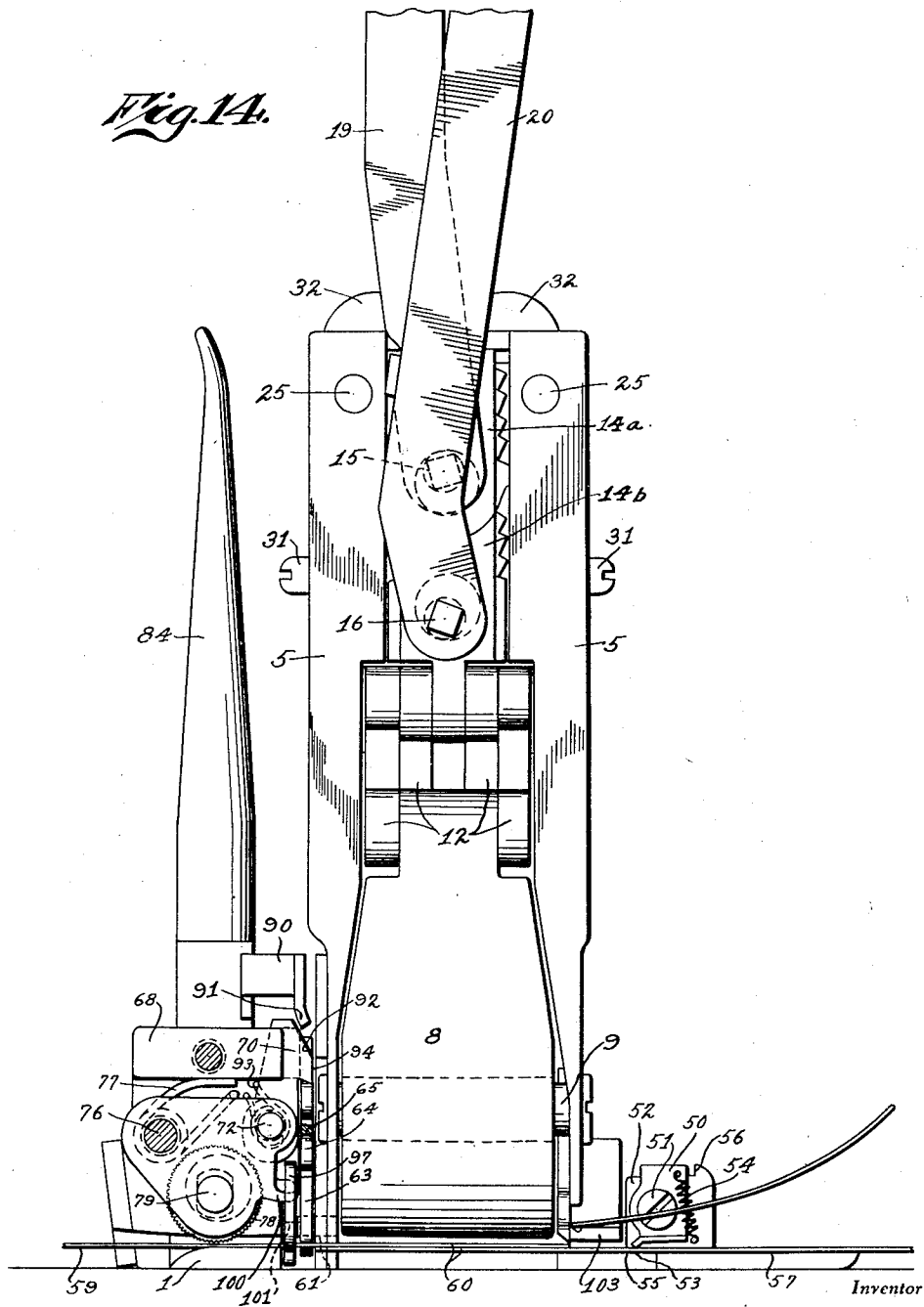
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TIE FORMING MECHANISM

Filed May 1, 1929

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UNITED STATES PATENT OFFICE

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TIE FORMING MECHANISM

Application filed May 1, 1929. Serial No. 359,588.

This invention relates to a machine for forming ties in the overlapping ends of binding straps. Such straps are used to a large extent as ties for bales, boxes or other articles. Machines have been devised for producing ties in box straps, but these machines have generally been complicated and include mechanism for handling the box and presenting it, with the strap in position, to the tie-forming mechanism. This necessitates a large and cumbersome machine which is costly to manufacture and which can not readily be adapted to operate upon boxes of different sizes.

The general object of this invention is to produce a small, portable, compact mechanism which can be readily put in position at the point where the tie is to be formed, and which can be readily operated by hand to produce the tie. In this connection it should be understood, however, that these straps are formed of steel and it requires considerable energy to bend or offset the metal to form the tie.

One of the objects of the invention is to provide the mechanism with simple and compact means for giving the operator of the machine sufficient leverage to produce a tie which, under ordinary circumstances, would require a powerful machine to form.

While I do not limit myself in the present specification and claims to mechanism adapted to form any particular kind of tie, I prefer to employ dies, or jaws, which will form a tie of the characteristic type set forth in my Patent No. 1,677,522, issued July 17, 1928.

It has been the general practice in machines for forming ties in metal straps to form the tie in overlapped ends of the strap or band, and the dies operate upon metal which is in tension. This tends to tear the edge of the metal where the tie is formed.

One of the objects of my invention is to construct the mechanism with means for enabling the tie to be formed in overlapped portions of the strap which are not in tension.

A further object of the invention is to provide mechanism for this purpose having simple means for automatically facilitating the application of the tension to the strap

before the dies or jaws form the tie, and also to provide automatic means for cutting off the loose end of the strap so that the cutting-off operation is effected incidentally to the movements which set the jaws in position and operate them.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combinations of parts to be described hereinafter, all of which contribute to produce an efficient tie forming mechanism.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawings:

Figure 1 is a section taken on a vertical plane through the lower portion of the machine, and also showing the overlapped ends of the binding strap in position to have the tie formed. The mechanism of the machine is shown in a position of rest with the tie-forming jaws withdrawn from their working position. In other words, the actuating portions of the machine are represented as swung back to occupy a position which opens up the part of the machine that receives the overlapping ends of the strap.

Figure 2 is a perspective showing the lower portion of the machine, the upper portion being broken away. This view shows the illustrated parts of the machine in position ready for the jaws to form the tie but represents the machine with the tension device removed from the machine.

Figure 3 is a vertical section through the lower portion of the machine taken on the side remote from the observer in Figure 1. This view is upon a larger scale than Figure 1 and particularly illustrates the means for automatically operating the cutter or knife that severs the loose end of the strap.

Figure 4 is a section through the lower portion of the machine taken about in the plane of the line 4-4 of Figure 1 but showing portions of the toggle connection for operating the jaws in elevation. This view also shows the tension mechanism at the side of the machine in front elevation.

Figure 5 is a plan showing the overlapped ends of a metal strap and shows its relation to the jaws or dies that form the tie, said jaws being shown partially in elevation and broken away so as to show them partly in cross-section.

Figure 6 is a section upon the same scale showing the same parts of the mechanism that appear in the upper part of Figure 4 but with the exception that while Figure 4 shows the operating levers in their upright, folded position, Figure 6 shows the mechanism with the parts in operation, and particularly illustrates the preferred details of the mechanism for imparting the force to the jaws that form the tie.

Figure 7 is a horizontal cross-section through the mechanism taken about on the line 7—7 of Figure 6, upon an enlarged scale.

Figure 8 is a cross-section upon an enlarged scale through a tie such as can be produced by using this mechanism.

Figure 9 is a vertical section taken about on the line 9—9 of Figure 4 upon an enlarged scale, and further illustrating the tension mechanism, certain parts being broken away.

Figure 10 is a vertical section taken about on the line 10—10 of Figure 9 and further illustrating the tension mechanism and particularly the swing frame which is swung up automatically to enable the overlapped ends of the strap to be received in the machine.

Figure 11 is a vertical section through the tension mechanism taken about on the line 11—11 of Figure 9.

Figure 12 is a section taken about on the line 12—12 of Figure 9 further illustrating the details of the tension mechanism.

Figure 13 is a vertical section through the tension mechanism taken about on the line 13—13 of Figure 10 and further illustrating this mechanism.

Figure 14 is a front elevation of the tie forming mechanism with certain parts broken away or shown in section. This view is upon a relatively large scale and represents the rocking frame of the device in an upright position and also illustrates a short end of stock which has been severed by the automatic operation of the cutter. This view also illustrates the connection between the rocking frame and the tension mechanism and shows the rocking frame in the act of swinging back as though it had formed the tie.

Before proceeding to a detailed description of the machine illustrated, it should be stated that in its general construction the machine preferably includes a guide which can be positioned over the overlapping strap ends and in this guide there is movably mounted a carriage which is actuated with a step-by-step movement, preferably through ratchet mechanism to cause the carriage to descend in the guide. Between the carriage and the jaws which form the tie I provide means for

increasing the leverage exerted by the hand-operated lever that actuates the jaws. For this purpose I prefer to use a toggle connection.

The guide is preferably pivotally mounted on a foot plate or base plate, which can rest upon a horizontal surface, for example, on the top of the box or bale carrying the binding strap. The construction is such that the guide constitutes a rocking frame on the base plate which is capable of being swung back so as to expose the upper side of the overlapped ends of the straps at the point where the tie is to be formed. When in this withdrawn position the overlapped ends of the band may be introduced into the machine and held in proper alignment ready for the guide to be swung back into an upright position. When the guide is swung back in this way, it carries with it the jaws which are held apart and which come into position adjacent the opposite edges of the strap. Before operating the jaws the strap is placed in tension by means of tension mechanism located at one side of the jaws.

One of the characteristics of my invention is that the machine is constructed in such a way as to enable the tie to be formed in overlapped ends of the strap which are not in tension although the entire band or strap is in tension. In order to accomplish this I locate the tension device on one side of the jaws and the gripper or clutch that holds the other end of the strap on the other side of the jaws.

According to my invention the tension device is constructed in such a way that it is capable of assuming the receiving position in which position it is set to receive the strap. In the operative position of the tension device, it is forcibly pressed down onto the strap and in this position the tension device may be operated to develop the desired tension in the strap.

In the present embodiment of the invention, the backward swinging movement of the guide may automatically effect the movement of the tension device into its receiving position, and means is provided for automatically throwing the tension device into its active tensioning position when the tension lever is actuated.

In the present embodiment of the invention the loose end of the strap is automatically cut off when the guide is swung up into its operating position preparatory to operating the jaws to form the tie. When the tension device is operated and the guide for the jaws is swung up into operating position, the overlapped ends of the strap are aligned by an automatically operating aligning device. Furthermore, the cutter, or knife, that severs the loose end of the strap maintains itself in its descended position and operates to press down on the severed end of the upper layer of the overlapped strap.

Referring more particularly to the parts, and especially to Figures 1 and 2, the machine comprises a base plate or foot plate 1 which is adapted to rest upon the top of a box or bale or other article to which the tension strap is to be applied. To this base plate a rock frame 2 is pivotally mounted, preferably by means of two aligned pins 3 attached in lugs 4 projecting up from the base plate. The rock frame 2 comprises two oppositely disposed channel-shaped guides 5 which are expanded at their lower ends to form enlarged heads or lobes 6 with laterally projecting ears 7 that carry the pins 3. These channels 5 form guides on their inner sides for guiding the mechanism that operates two jaws 8, which jaws are pivotally mounted on a common pin 9 at about the middle point of the heads 6. The upper portions of the jaws are formed into short arms 10 (see Figure 1), which are connected with the actuating lever or levers of the machine so as to swing the jaws on their common pivot pin 9 and force them together to form the tie as will be described hereinafter.

The connection to the jaws is preferably a toggle connection 11, including two pairs of short links 12 pinned at their lower ends to the arms 10 of the jaws and connected at their upper ends to a common pin 13 that attaches the links to the lower end of a carriage 14 (see Figure 1), that is guided to move downwardly in the guide.

The upper end of the rock frame 2 is provided with suitable means for giving the carriage 14 a step-by-step downward movement in the guide 5 so as to operate the toggle connection and force the jaws 8 together. This carriage is preferably composed of two blocks, 14^a, which is an upper block, and 14^b, which is a lower block. The pin 13 attaches the toggle connection to the lower end of the lower block 14^b (see Figure 6). The blocks 14^a and 14^b are provided respectively with rocker pins 15 and 16 which pass through them (see Figure 7), and these pins are of large diameter but have eccentric heads 17 of smaller diameter, to which are attached links 18. In other words, there are two links, one on each side of the blocks connecting the eccentric heads of the pins.

In addition to this I provide lever means for rotating these pins on their axes. This means preferably consists of two hand-levers 19 and 20 having angular or square holes in their ends engaging over square shanks 21 on the pins beyond their eccentric heads 17.

The sides of the blocks which are disposed toward the bottoms or webs 22 of the channels of the guide 5 are formed with inclined ratchet teeth 23 and 24, the ratchet teeth 23 cooperating with upper detent pawls 24^a mounted to rock on transverse pivot pins 25 in the upper portion of the guide. The ratchet teeth 24 of the lower block cooperate with bifur-

cated detent pawls 26. In other words, the pawls 26 are double pawls having extensions 27 at their upper ends mounted loosely on the pins 25. These pawls all normally engage the ratchet teeth, any suitable resilient means being used for this purpose. In the present instance I prefer to construct the detent pawls in such a way that when the upper pawls are released, the movement that releases them will automatically release the lower pawls. For this purpose the lower pawls 26 are provided with inclined webs 28, which are in the path of the lower ends 29 of the upper pawls (see Figure 6). With this arrangement it will be evident that if the lower ends of the upper pawls are rocked in an outward direction to release them from the ratchet teeth, they will engage the inclined webs 28 and throw the pawls 26 to their released position. The pawls 26 are normally pressed into engagement with their corresponding ratchet teeth 24 by coil springs 30 respectively mounted in removable spring housings 31 that may be screwed into the outer sides of the webs of the channels.

In order to hold the upper pawls 24 normally in engagement with the upper block, and at the same time enable them to be automatically released when the levers 19 and 20 are swung upwardly to the folded position indicated in Figure 4, I provide the upper detent pawls with tails 32, which extend over to the central longitudinal axis of the guide and are formed with sockets 33 on their upper sides that receive heads 34 formed on the end of two thrust links 35 that correspond to the pawls, said thrust links being attached to a small rocking plate 36 pivotally attached on a pin 37 that is fixed in ears 38 that extend up from the frame. In order to thrust the tails 32 apart to hold the lower ends of the upper detent pawls in engagement with the ratchet teeth 23, I provide a coil spring 39 around the pivot pin 37 and connect its ends respectively to the tails 32 of the pawls.

When the levers 19 and 20 are swung up into their folded position, as indicated in Figure 4, a laterally projecting lug 40 on the rock plate 36 will be engaged by a depressed face 41 on lever 19 that will rock the rock plate 36 slightly in a right-hand direction. This movement, however, will create a downward thrust in link 35 and thereby cause the release of the pawls 24. If desired, the levers 19 and 20 may be provided with a small spring-actuated latch 42 to latch them in this folded position, said latch operating as a snap-latch to cooperate with a pin 43 on the lever 20.

In the operation of the device it will be evident that if the levers 19 and 20 are rocked up and down, as indicated by the arrows in Figure 6, the blocks 14^a and 14^b will cooperate with the pawls 24^a and 26 to cause a step-by-step movement of the carriage in a downward direction. This will cause a

downward thrust on the toggle end 13, and force the jaws 8 of the machine toward each other.

In order to limit the downward movement of the upper block 14^a and cause the jaws to release themselves automatically when the tie has been formed, I provide the guide 5 with a transverse stop in the form of a post 44 (see Figure 6) that connects the flanges of the right-hand channel of the guide 5. This post is in the path of a lug 45 that projects outwardly at the lower portion of the upper block.

After the levers 19 and 20 have been operated to form the tie they should be swung up to their folded position, such as shown in Figure 4, and this will cause the automatic release of all the detent pawls, as indicated in this view. The blocks that form the carriage 14 may then be pulled up into their elevated or starting position, such as indicated in Figure 4.

One of the levers, for example, the lever 19, is provided with a laterally projecting ear 46 (see Figure 6), that limits the swinging movement of the levers toward each other. In this connection it should be understood that the levers 19 and 20 are of bifurcated form (see Figure 1). The lever 20 comprises two forks 47 that are located further out than the corresponding forks 48 of the other lever 19. The upper ends of the levers 19 and 20 are provided with handles 49 for actuating the levers. When the levers are in this position the pawls are of course released from the blocks.

At the right side of the jaws 8, as illustrated in Figure 4, a clutch, or gripper, device 50 is mounted on the base plate, which is in the form of a plate mounted to rock on a pivot screw 51, secured in a lug 52 projecting up from the base plate. This clutch plate 50 has a dog, or tooth, 53 at one side which inclines toward the left and the clutch plate is provided with a compression spring 54 that normally holds this dog 53 pressed down against the clamping face 55 on the upper side of the base plate. By pressing down on the upper end of the clutch plate 50 it can be rocked toward the right until it comes up against the stop shoulder 56, and this will raise the dog 53 from the clamping face 55 to permit one of the ends 57 of the strap to be introduced under the gripping plate. If tension is exerted in the end 57 tending to pull it toward the right, the gripping plate 50 will grip the strap end 57 and enable tension to be developed in the strap by means of the tension device 58 which is mounted on the other side of the jaws.

This tension device is constructed so that the other end 59 of the strap end can be placed in it in a position to overlie the gripped end 57 so that below the jaws there are two overlapping portions 60 of the band

which are not in tension. This is one of the novel features of my invention, that the bands at the point where the tie is formed are not in tension.

The tension device 58 may have any suitable construction enabling the strap to be placed in tension and held in tension when the tie is formed. I prefer, however, to construct this tension device so that it is capable of assuming a receiving position facilitating the introduction of the strap by lateral movement into the tension device, and I also prefer to move the tension device automatically into this receiving position when the rock frame of the machine is swung toward the left on its pivot pins 3, as viewed in Figure 1. For this purpose the adjacent head 6 (see Figure 2) is provided with an outwardly projecting pin 61 which operates to move the tension device into its receiving position. In order to accomplish this, the fixed frame of the tension device 58 is secured rigidly to an upwardly projecting lug 62 on the base plate (see Figure 2). This pin 61 is shown in Figure 9 with other mechanism illustrating how it effects the movement of the tension device to its receiving position.

For this purpose I employ a strut link 63 pivoted on pin 61 and having a round head 64 received in a socket 65 in a rock plate 66 mounted on a fixed pivot 67 on the frame 68 of the tension device. This rock plate 66 has a laterally projecting short arm 69 (see Figure 11) that engages at its upper edge with an undercut catch 70 formed on a strut link 71, the lower end of which is pivotally attached on a pin 72 which is secured to a swing frame 73, which constitutes a part of the tension mechanism. This swing frame 73 comprises two plates 74 and 75 connected by the pin 72 and mounted to swing up or down on a fixed shaft 76 (see Figure 11) mounted at the rear of the tension frame. A powerful coil spring 77 is mounted on the rock shaft 76 and exerts its force in a direction to press the swing frame downwardly toward the front of the machine. The swing frame 73 carries a tension roller 78 with a knurled face which is held through the agency of the spring 77 forcibly against the upper face of the upper strap end 59. This tension roller is carried rigidly on a shaft 79 that is rotated by means of a ratchet and pawl device. In order to enable the shaft 79 to rotate the tension roller 78, the shaft has an enlarged neck 80 with flat side faces 81 that fits into a correspondingly shaped opening in the roller 78.

The end of this shaft 79 that is disposed toward the jaws 8 of the machine is provided with a ratchet wheel 82 (see Figure 12) fitting on a flat-sided neck 83 on the shaft, and beyond this flat-sided neck 83 and to the right of it, as illustrated in Figure 13, a tension lever 84 is attached, said tension lever being bifurcated at the point where it attaches to

the shaft so that it presents two separated forks 85. This tension lever is of course loose on the shaft 79. It is provided with an actuating pawl 86 (see Figure 12), which is pressed by a spring 87 to hold it in engagement with inclined teeth of the ratchet wheel 82. On the frame 68 of the tension device a detent pawl 88 is provided to cooperate with the ratchet wheel 82 to hold it and the tension roller in any position to which the roller is advanced by the tension lever 84. In this connection it should be understood that in order to actuate the ratchet wheel 82, the tension lever 84 would move away from the observer, as illustrated in Figure 9. The movement of the lever 84 away from the observer rotates the ratchet wheel 82 by means of the actuating pawl 86. A coil spring 89, located on the rock shaft 79 between the forks 85, exerts its force in a direction to return the lever 84 after it has been actuated to rotate the tension roller. In other words, this spring exerts its force in a direction to rotate the lever 84 toward the right as viewed in Figure 12. This spring performs another function that will be referred to hereinafter.

As already described, when the rocking frame 2 of the machine is rocked back into the position in which it is illustrated in Figure 1, the movement of the rocking frame will be toward the right on its pivot pins 3, as illustrated in Figure 9. This will cause the strut link 63 to rock the rock plate 66, and the finger, or short-arm 69 of this rock plate, will pull up on the latch link 71, and thereby swing the swing frame 73 of the tension device up into its receiving position, at which time the face of the tension roller 78 will be held elevated.

I prefer to provide automatic means for releasing the swing frame automatically when the ratchet lever or tension lever 84 is actuated. For this purpose the tension lever is provided with a rigid laterally projecting arm 90 (see Figures 9 and 11). This arm at its end has a downwardly projecting inclined lip 91, (see Figure 11) that engages an inclined edge 92 at the upper end of the link 71. When the tension lever is swung in the direction of the arrow, as indicated in Figure 11, this lip 91 will rotate the link 71 in a backward direction and release it from the arm 69 of the rock plate 66. The spring 77 will then cause the swing frame 73 to move down so that the tension roller can engage the upper face of the upper strap end 59. The pin 72 is provided with a spring 93 that engages the link 71 and exerts its force in a direction to rotate the link toward the right as viewed in Figure 11.

In the operation of this mechanism it should be understood that when the movement of the tension lever releases the link 71 from the rocking plate 66, the link 71 will be pulled down by the swinging frame 73 so that

the forward edge 94 of the link 71 will lie against the inner face of the arm 69 of the rock plate 66. With this arrangement it will be evident that the link 71 will operate as a spring latch so as to swing out over the arm 69 as soon as the arm is again depressed, as it will be when the rocking frame 2 of the machine occupies the position indicated in Figure 9. I prefer to provide a short slot 95 in the link 71 where it connects to the pin 72 to permit some lost motion at this point.

In order to provide means for accurately aligning the overlapped portions 60 of the strap (see Figure 9), I provide the base plate at this point with an aligning shoulder 96, which operates as a stop for the inner edge of the strap ends when they are shoved laterally into place. In order to insure proper alignment, I provide aligning means cooperating with the shoulder 96, and this aligning means is in the form of a lever 97 (see Figure 9) mounted to rock on a fixed pivot 98 and having a notch in its lower edge with an aligning shoulder 99 at one side and opposite to the shoulder 96.

When the swing frame 73 is in its receiving position this lever 97 is held up with the shoulder 99 out of the path of the strap ends as they are slid into place. Any suitable means may be provided for rocking this lever 97 automatically. In the present instance I accomplish it by providing the swing frame 73 with an outwardly projecting finger 100 (see Figure 10), that projects through an inclined slot 101 in the outer end of this lever. This lever 97 is pressed downwardly by a spring, for which purpose I provide the lever with a tail 102 which is engaged by one end of the spring 89 for the tension lever 84 (see Figure 9). By making the slot 101 inclined, the movement of the actuating finger 100 is somewhat increased so as to give the necessary amount of movement to the shoulder 99.

It is preferable to provide automatic means for cutting off the upper strap end 59, actuated by the swinging movement of the rock frame 2 of the machine.

Referring particularly to Figures 1 and 3, I provide the base plate with a projecting rest plate 103, which constitutes the lower jaw of shears, the upper jaw being in the form of a swinging cutter or knife 104 mounted to rock on a fixed pivot screw 105. This jaw 103 is slightly elevated above a rest face 106 which supports the lower strap end 57.

The knife 104 is actuated by a short strut link 107 (see Figure 3) that is pivotally mounted at 108 on the outer side of the rocking frame 2, and this strut link has a round head 109 thrust in a socket formed on an arm 110 that projects up from the hub of the knife 104. In other words, the knife construction is virtually a bell crank lever, the arm of which is actuated by the strut link 107. From this construction it will be evident that when

the rocking frame 2 is swung toward the right, as illustrated in Figure 3, the knife 104 will sever the strap end from its loose end.

When this operation occurs the upper strap end 59 will lie on the shear 103, its inner edge being disposed against a stop shoulder 111 that aligns it with the lower strap end 57.

In the operation of the knife 104, after it has cut through the strap end 59, it will descend and remain in a depressed position so that its beveled edge 112 will hold down the severed end of the upper strap end 59 so as to hold it substantially against the upper face of the lower strap end 57. This mode of operation is made possible by the fact that when the cutter 104 has reached the limit of its downward movement, the strut link 107 will be substantially on its dead center.

The jaws 8 that form the tie of the character illustrated in Figure 8 may have the general characteristic construction illustrated in Figures 1 and 5, that is to say, the jaws are provided with two removable dies 113 which have two sockets, 114, facing each other and the adjacent faces of the dies are formed with fingers 115 arranged so that the fingers on one die lie opposite to corresponding recesses 116 in the opposite die. This permits the dies to come close together and enables the forming edges 117 of the dies to cooperate to bend the overlapping strap ends into two rolls, as illustrated in Figure 8, namely, an outer roll 118 and an inner roll 119. At the limit of the approaching movement of the dies, the upper edges 120 of the dies offset the material of the rolls, as indicated at the inclined faces 121, so as to form a tie such as patented to me in my Patent No. 1,677,522, issued July 17, 1928.

If desired, the base plate of the machine may be provided with one or more posts, such as the posts 122 that operates as a rest to support the rocking frame 2 in an inclined position, that is to say, in a position more inclined than which it is illustrated in Figure 1.

The general mode of operation of the machine will now be briefly described.

When the rocking frame 2 is swung to its inclined position, as illustrated in Figure 1, the pin 61 (see Figures 2 and 9) exerts a thrust force in strut link 63, thereby rocking rock plate 66 and causing its arm 69 to pull up on latch or link 71 (see Figure 11). This causes the swing frame 73 of the tension device to swing up on its rock shaft 76 so that it will be held in an elevated receiving position with the tension roller 78 held elevated. At this time also the upward movement of the swing frame 73 operates through the agency of the finger 100 and inclined slot 101 (see Figures 10 and 9), to hold the aligning lever 97 in an elevated position. The strap ends 57 and 59 are then introduced by a lateral movement, the strap end 57 being positioned in the clutch or gripper device 50.

The strap, of course, has been previously passed around the article to be strapped, for example, a bale or box. After the upper strap end 59 has been brought into position lying over and substantially in alignment with the under strap end 57, it will lie over the shear plate 103 and under the cutter 104. At this time the jaws 8 will be in a position to hold the dies 113 apart (see Figure 1) and elevated above the strap ends. The rocking frame 2 is then rocked toward the right (see Figure 1), the rocking movement taking place about the pivots 3.

As this movement takes place, the strut link 107 actuates the cutter 104 to sever the loose end of the strap and the cutter 104 descends sufficiently to hold the upper strap end 59 down on the upper face of the lower strap end 57. At the same time the downward swinging movement of the rocking frame will bring the jaws 8 into position on each side of the overlying strap ends. The swinging of the rocking frame 2 upwardly will operate automatically through the medium of pin 61 (see Figure 2) to swing the swinging frame 73 of the tension device upwardly (see Figure 11). This is accomplished through the medium of the strut link 63 and rocking plate 66. This holds the tension device in its receiving position.

When the straps are properly aligned in this way, the tension lever 84 (see Figure 11) is swung toward the left. The first part of this movement operates to release the link 71 through the operation of the lip 91, and the inclined edge 92 at the upper end of the latch 71. This permits the spring 77 to force the swing frame forcibly down so as to hold the tension roller 78 firmly against the upper face of the upper strap end 59. The continued movement of the tension lever 84 to and fro will operate through the action of the pawls 86 and 88 (see Figure 12), to rotate the tension roller and place the strap in tension.

In this connection it should be understood that the frictional resistance between the knurled face of the roller and the upper face of the upper strap end is very high, whereas the frictional resistance of the lower strap end to the movement of the upper strap end is very slight; hence the upper strap end can slide freely on the lower strap end in developing different tension. In this connection attention is called to Figure 11, indicating that the pivot or rock shaft 76 for the swing frame is located toward the left of the shaft 79 of the tension roller 78. By reason of this the tension developed in the strap exerts a pull on the swing frame which would tend to move the roller 78 toward the left. This gives the swing frame and roller the effect of a clutch which jams if the tension is increased instead of releasing.

After the desired tension has been developed in the strap, the lever handles 49 are

unlatched from the latch 42 (see Figure 4) and the two bifurcated levers 19 and 20 are swung up and down (see Figure 6). This will cause the eccentric pins 15 and 16 to rotate in the blocks 14^a and 14^b, the eccentric necks of the pins cooperating with the pawls 29 and 26 to cause the blocks to move downwardly with a step-by-step movement. This will operate through the toggle connection 11 to force the jaws 8 in a direction to cause the dies 113 to come together and form the tie illustrated in Figure 8.

When the jaws have completed the formation of the tie, the stop shoulder 45 (see Figure 6) on the upper block will come against the stop post 44 and stop further downward movement of the upper block. Hence on the next movement of the levers the upper block will cause the lower block to be pulled up slightly, which will release the jaws from the formed tie. After this occurs, the two levers 19 and 20 should be folded up into their folded position illustrated in Figure 4. When this occurs the lever 19 will operate the rock plate 36 which, through the operation of the strut links 35, will release the upper detent pawls 24 from the upper block. This release movement of the upper detent pawls 24, through the operation of their lower ends 29, and the inclined webs 28, will throw the lower detent pawls also to their released position, (see Figure 4). The rocking frame 2 can then be swung down onto the post or posts 122 so as to raise the dies out of the way and permit the base plate to be slid back away from the tie band or strap.

It is understood that the embodiment of the invention described herein is only one of the many embodiments this invention may take, and I do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

What I claim is:

1. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame, a pair of jaws mounted in the frame for engaging the overlapping strap ends to form the tie, a ratchet-mechanism including lever means, and a toggle connection between the ratchet-mechanism and the jaws for forcing the jaws together to form the tie.

2. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guideway, a ratchet-mechanism with blocks movable along the guide toward the binding straps, jaws with a toggle connection between the blocks and the jaws, and lever means cooperating with the blocks to force the same downwardly and actuate the jaws through the toggle connection.

3. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a

carriage guided in the guide and including a part with rack teeth thereon, detent means cooperating with the rack teeth to hold the carriage against return after it is forced down, lever mechanism cooperating with the carriage to advance the same down along the guide, with a step-by-step movement jaws for forming the tie in the binding straps, and means connecting the carriage with the jaws to actuate the same.

4. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage guided in the guide and including a part with rack teeth thereon, detent means cooperating with the rack teeth to hold the carriage against return after it is forced down, lever mechanism cooperating with the carriage to advance the same down along the guide with a step-by-step movement, jaws for forming the tie in the binding straps, and a toggle connection between the carriage and the jaws for actuating the same.

5. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a pair of blocks one above the other guided in the said guide, said blocks having ratchet teeth, detent pawls carried on the frame to cooperate with the ratchet teeth to lock the blocks against upward movement, pins rotatably mounted in the blocks and having eccentric heads with links connecting the eccentric heads, and levers on the pins for rotating the same and cooperating with the said blocks and pawls to cause the blocks to move downwardly in the guide, a pair of jaws for engaging the strap ends to form the tie, and a toggle connection between the lower block and the jaws for actuating the same.

6. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage guided in the guide and including a part with rack teeth thereon, lever mechanism cooperating with the carriage to advance the same along the guide, jaws for forming the tie in the binding straps, a toggle connection between the carriage and the jaws for actuating the same, and detent pawls cooperating with the carriage to hold the same against upward movement, and means for locking the detent pawls in an inoperative position.

7. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a pair of blocks one above the other guided in the said guide, said blocks having ratchet teeth, detent pawls carried on the frame to cooperate with the ratchet teeth to lock the blocks against upward movement, pins rotatably mounted in the blocks and having eccentric heads with links connecting the eccentric heads, and levers on the pins for rotat-

ing the same and cooperating with the said blocks and pawls to cause the blocks to move downwardly in the guide, a pair of jaws for engaging the strap ends to form the tie, a toggle connection between the lower block and the jaws for actuating the same, and means actuated by the levers when in their folded position to move the detent pawls into their inactive position.

8. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage comprising an upper block and a lower block guided in said guide to move toward the binding straps, said blocks having ratchet teeth thereon, a lever corresponding to each block, detent pawls for engaging the ratchet teeth to prevent upward movement of the blocks, means cooperating with the said levers and blocks to cause the blocks to move downwardly in the guide when the levers are moved to and fro, a pair of jaws pivotally mounted in the frame, and a toggle connection between the lower block and the jaws for actuating the same.

9. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage comprising an upper block and a lower block guided in said guide to move toward the binding straps, said blocks having ratchet teeth thereon, a lever corresponding to each block, detent pawls for engaging the ratchet teeth to prevent upward movement of the blocks, means cooperating with the said levers and blocks to cause the blocks to move downwardly in the guide when the levers are moved to and fro, a pair of jaws pivotally mounted in the frame, a toggle connection between the lower block and the jaws for actuating the same, and a stop in the path of the upper block to limit the downward movement of the same.

10. A machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage having an upper block and a lower block guided in the said guide, pins rotatably mounted respectively in the blocks and having eccentric heads with links connecting the same, a lever corresponding to each pin for rotating it in its block, said blocks having ratchet teeth, detent pawls on the guide cooperating with the ratchet teeth to prevent the upward movement of the blocks, a pair of jaws pivotally mounted in the frame near the lower end of the guide for engaging the metal straps, and toggle links pivotally connected with the lower blocks and pivotally connected with said jaws for actuating the same.

11. A machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage having an upper block and a lower block guided in the said guide, pins rotatably

mounted respectively in the blocks and having eccentric heads with links connecting the same, a lever corresponding to each pin for rotating it in its block, said blocks having ratchet teeth, detent pawls on the guide cooperating with the ratchet teeth to prevent the upward movement of the blocks, a pair of jaws pivotally mounted in the frame near the lower end of the guide for engaging the metal straps, and toggle links pivotally connected with the lower block and pivotally connected with said jaws for actuating the same, said levers being capable of assuming a folded position substantially in line with the longitudinal axis of the guide, automatic means operating when the levers are moved to said folded position to move the pawls into an inactive position to release the blocks.

12. A machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage having an upper block and a lower block guided in the said guide, pins rotatably mounted respectively in the blocks and having eccentric heads with links connecting the same, a lever corresponding to each pin for rotating it in its block, said blocks having ratchet teeth, detent pawls on the guide cooperating with the ratchet teeth to prevent the upward movement of the blocks, a pair of jaws pivotally mounted in the frame near the lower end of the guide for engaging the metal straps, and toggle links pivotally connected with the lower block and pivotally connected with said jaws for actuating the same, the pawls for the upper block and the pawls for the lower block being constructed so that the releasing movement of the upper pawls will move the lower pawls into their inactive releasing position, and means for moving the upper pawls into their releasing position.

13. A machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage having an upper block and a lower block guided in the said guide, pins rotatably mounted respectively in the blocks and having eccentric heads with links connecting the same, a lever corresponding to each pin for rotating it in its block, said blocks having ratchet teeth, detent pawls on the guide cooperating with the ratchet teeth to prevent the upward movement of the blocks, a pair of jaws pivotally mounted in the frame near the lower end of the guide for engaging the metal straps, toggle links pivotally connected with the lower block and pivotally connected with said jaws for actuating the same, resilient means associated with the detent pawls for the upper blocks for holding the same in their operative position, and movable means connected with the upper pawls for moving them into their inactive released position.

14. A machine for forming ties in the over-

lapping ends of metal binding straps, the combination of a frame having a guide, a carriage having an upper block and a lower block guided in the said guide, pins rotatably mounted respectively in the blocks and having eccentric heads with links connecting the same, a lever corresponding to each pin for rotating it in its block, said blocks having ratchet teeth, detent pawls on the guide co-operating with the ratchet teeth to prevent the upward movement of the blocks, a pair of jaws pivotally mounted in the frame near the lower end of the guide for engaging the metal straps, toggle links pivotally connected with the lower block and pivotally connected with said jaws for actuating the same, the detent pawls corresponding to the upper block having tails with a spring connecting the same to normally hold the upper detent pawls in engagement with the ratchet teeth of the upper block, and means actuated by the levers when in their folded position for actuating the tails of the upper detent pawls to move the same into their releasing position.

15. A machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage having an upper block and a lower block guided in the said guide, pins rotatably mounted respectively in the blocks and having eccentric heads with links connecting the same, a lever corresponding to each pin for rotating it in its block, said blocks having ratchet teeth, detent pawls on the guide cooperating with the ratchet teeth to prevent the upward movement of the blocks, a pair of jaws pivotally mounted in the frame near the lower end of the guide for engaging the metal straps, toggle links pivotally connected with the lower block and pivotally connected with said jaws for actuating the same, the detent pawls for the upper block having tails, a rocker pivotally mounted on the frame adjacent the said tails, the said actuating levers being capable of assuming a folded position substantially in line with the longitudinal axis of the guide, and one of said levers having means for engaging the said rocker in the folded position of the levers to move the said rocker, means connecting the rocker with the said tails to release the upper detent pawls when the levers are in said folded position, and resilient means for normally holding the upper detent pawls in engagement with the upper block.

16. A machine for forming ties in the overlapping ends of metal binding straps, the combination of a frame having a guide, a carriage having an upper block and a lower block guided in the said guide, pins rotatably mounted respectively in the blocks and having eccentric heads with links connecting the same, a lever corresponding to each pin for rotating it in its block, said blocks having ratchet teeth, detent pawls on the guide co-

operating with the ratchet teeth to prevent the upward movement of the blocks, a pair of jaws pivotally mounted in the frame near the lower end of the guide for engaging the metal straps, toggle links pivotally connected with the lower block and pivotally connected with said jaws for actuating the same, the detent pawls for the upper block having tails, a rocker pivotally mounted on the frame adjacent the said tails, the said actuating levers being capable of assuming a folded position substantially in line with the longitudinal axis of the guide, and one of said levers having means for engaging the said rocker in the folded position of the levers to move the said rocker, means connecting the rocker with the said tails to release the upper detent pawls when the levers are in said folded position, resilient means for normally holding the upper detent pawls in engagement with the upper block, the detent pawls for the lower block having means engaged by the upper detent pawls to release the lower pawls when the upper pawls are released.

17. In a machine for forming ties in the overlapping ends of metal binding straps encircling a box, the combination of a base plate, means carried on the base plate for placing the binding strap in tension, a pair of jaws movably mounted on the base plate and capable of assuming an open position toward one side of the base plate, means for moving the jaws laterally in a direction extending in a plane transverse to the direction in which the strap ends extend and across the overlapped strap ends while the jaws are in their open position, enabling the jaws to come into position on opposite sides of the strap ends while lying over the upper face of the box, automatic means for cutting off the loose end of the binding strap beyond the jaws, actuated by the said lateral movement of the jaws, and means for actuating the jaws thereafter to form the tie.

18. In a machine for forming ties in the overlapping ends of metal binding straps encircling a box, the combination of a base-plate to rest upon a horizontal support and adjacent the overlapping strap ends, a rock-frame movably supported on the base-plate to swing in a plane transverse to the direction in which the strap ends extend and substantially at right angles to the plane in which the strap ends lie, a pair of jaws movably mounted on the rock-frame normally held apart and cooperating with the rock-frame to swing down and come into position adjacent respectively to the side edges of the overlapping strap ends while lying over the face of the box, automatic means for severing the loose end of the strap beyond the jaws with means for actuating the same when the rock-frame is swung down, and means for actuating the jaws thereafter to engage the side edges of the band to form the tie.

19. In a machine for forming ties in the overlapping ends of metal binding straps encircling a box, the combination of a base-plate to rest upon a horizontal support and adjacent the overlapping strap ends, a rock-frame movably supported on the base-plate to swing in a plane transverse to the direction in which the strap ends extend and substantially at right angles to the plane in which the strap ends lie, a pair of jaws movably mounted on the rock frame constructed to engage the side edges of the band to form the tie capable of being held apart and operating when the rock-frame is swung downwardly to come into position adjacent respectively to the side edges of the overlapping strap ends while lying over the face of the box, a tension device supported on the base-plate at one side of the said jaws and capable of assuming a receiving position to receive the strap ends and an operating position for placing tension in the strap, and automatic means for moving the tension device into its receiving position when the rock frame is swung upwardly to move the jaws away from the overlapping ends.
20. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a base-plate to rest upon a horizontal support and adjacent the overlapping strap ends, a rock-frame movably supported on the base-plate to swing in a plane transverse to the direction in which the strap ends extend and substantially at right angles to the plane in which the strap ends lie, a pair of jaws movably mounted on the rock frame capable of being held apart and operating when the rock-frame is swung downwardly to come into position on opposite edges of the overlapping strap ends, a tension device supported on the base-plate at one side of the said jaws and capable of assuming a receiving position to receive the strap ends and an operating position for placing tension in the strap, automatic means for moving the tension device into its receiving position when the rock-frame is swung upwardly to move the jaws away from the overlapping ends, and automatic means for cutting off the loose end of the band on the side of the jaws remote from the tension device actuated by the downward swinging movement of the rock-frame.
21. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a base-plate to rest upon a horizontal support and adjacent the overlapping strap ends, a rock-frame movably supported on the base-plate to swing in a plane transverse to the direction in which the strap ends extend and substantially at right angles to the plane in which the strap ends lie, a pair of jaws movably mounted on the rock-frame capable of being held apart and operating when the rock-frame is swung downwardly to come into position on opposite edges of the overlapping strap ends, a tension device supported on the base-plate at one side of the said jaws and capable of assuming a receiving position to receive the strap ends and an operating position for placing tension in the strap, automatic means for moving the tension device into its receiving position when the rock-frame is swung upwardly to move the jaws away from the overlapping ends, and automatic means for cutting off the loose end of the band on the side of the jaws remote from the tension device actuated by the downward swinging movement of the rock-frame, and means for actuating the jaws thereafter to form the tie.
22. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a base-plate to rest upon a horizontal support and adjacent the overlapping strap ends, a rock-frame movably supported on the base-plate to swing in a plane transverse to the direction in which the strap ends extend and substantially at right angles to the plane in which the strap ends lie, a pair of jaws pivotally mounted on the rock-frame capable of being held apart and operating when the rock-frame is swung downwardly to come into position on opposite edges of the overlapping strap ends, a tension device mounted on the base-plate at one side of the jaws and capable of assuming a receiving position to receive the strap ends and an operating position for placing the strap in tension, means for actuating the jaws to form the tie and for opening the jaws thereafter, automatic means for moving the tension device to its receiving position when the rock-frame is swung upwardly after forming the tie, a tension lever, and means actuated thereby for placing the strap in tension.
23. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a base-plate to rest upon a horizontal support and adjacent the overlapping strap ends, a rock-frame movably supported on the base-plate to swing in a plane substantially at right angles to the plane in which the strap ends lie, a pair of jaws pivotally mounted on the rock-frame capable of being held apart and operating when the rock-frame is swung downwardly to come into position on opposite sides of the overlapping strap ends, a tension device mounted on the base-plate at one side of the jaws and capable of assuming a receiving position to receive the strap ends and an operating position for placing the strap in tension, means for actuating the jaws to form the tie and for opening the jaws thereafter, automatic means for moving the tension device to its receiving position when the rock-frame is swung upwardly after forming the tie, a tension lever, means actuated thereby

for placing the strap in tension, latching means for latching the tension device in its receiving position when brought to the receiving position by the upward swinging movement of the rock-frame, and automatic means for releasing the latching means when the tension lever is actuated to enable the tension device to move into its operating position.

- 10 24. In a machine for forming ties in the overlapping ends of metal binding straps, the combination of a base-plate to rest upon a horizontal support and adjacent the overlapping strap ends, a rock-frame movably supported on the base-plate to swing in a plane substantially at right angles to the plane in which the strap ends lie, a pair of jaws pivotally mounted on the rock-frame capable of being held apart and operating when the rock-frame is swung down to come into position on opposite sides of the overlapping strap ends, means for actuating the jaws thereafter to form the tie, a tension device mounted on the base-plate at one side of the jaws and including a swing frame with a tension roller carried thereby, said swing frame being capable of assuming an elevated receiving position to receive the strap ends and a depressed operative position in which the tension roller engages the strap to tighten the same, automatic means for moving the swing frame to its elevated position when the rock-frame is swung upwardly to remove the jaws from the strap ends after the tie has been formed, latching means to cooperate with the swing frame to latch the same in an elevated position when brought to the receiving position by the upward swinging movement of the rock-frame, a tension lever with means actuated thereby for actuating the tension roller to place the strap in tension, and automatic means actuated by the tension lever to operate the latching means to release the swing frame and permit the same to move into its operating position.

Signed at Los Angeles, Calif., this 6th day of April, 1929.

LEO M. HARVEY.