July 19, 1932. A. V. SULLIVAN 1,868,182

BOX BINDING MACHINE

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Fig. 13.

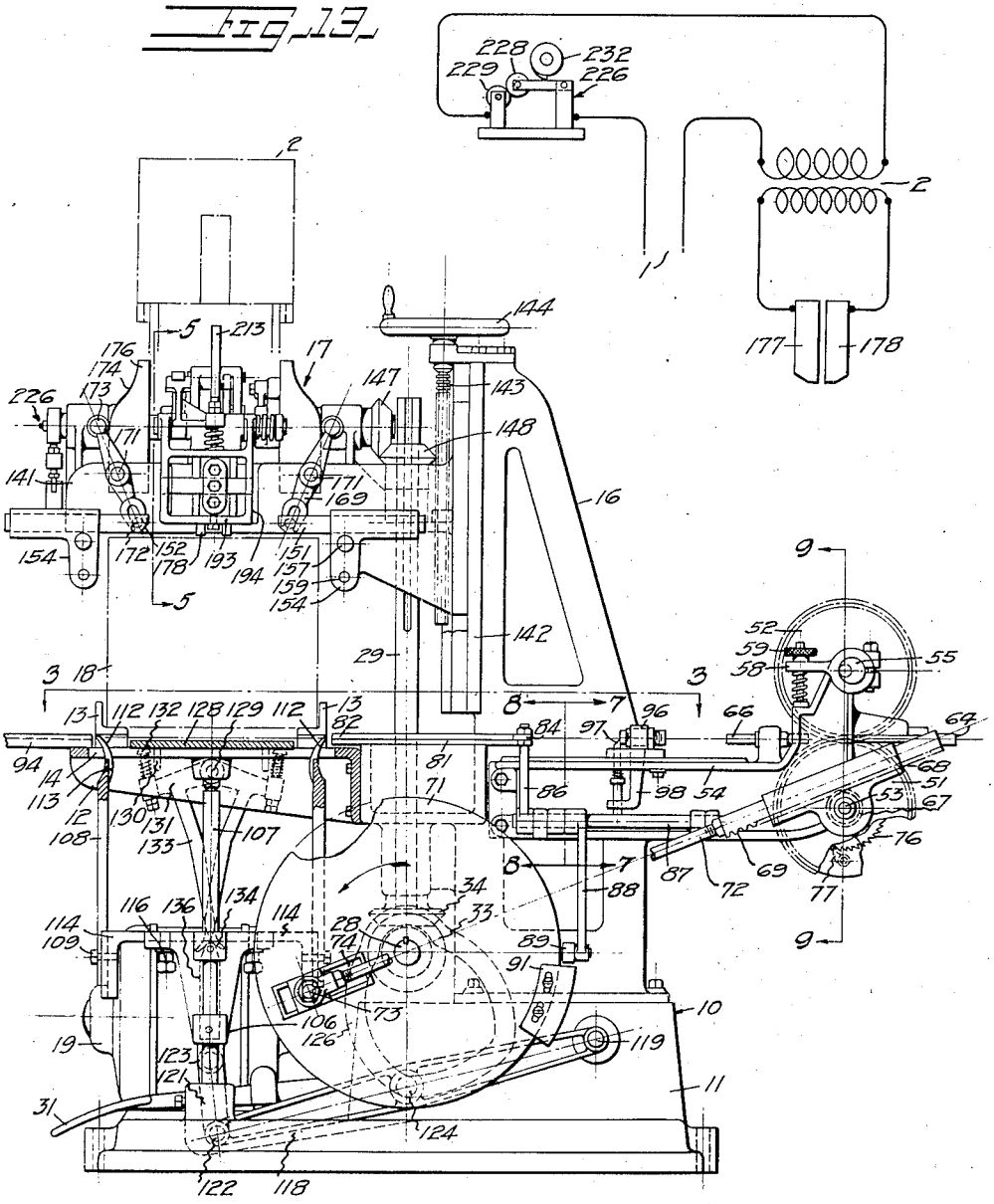


Fig. 1.

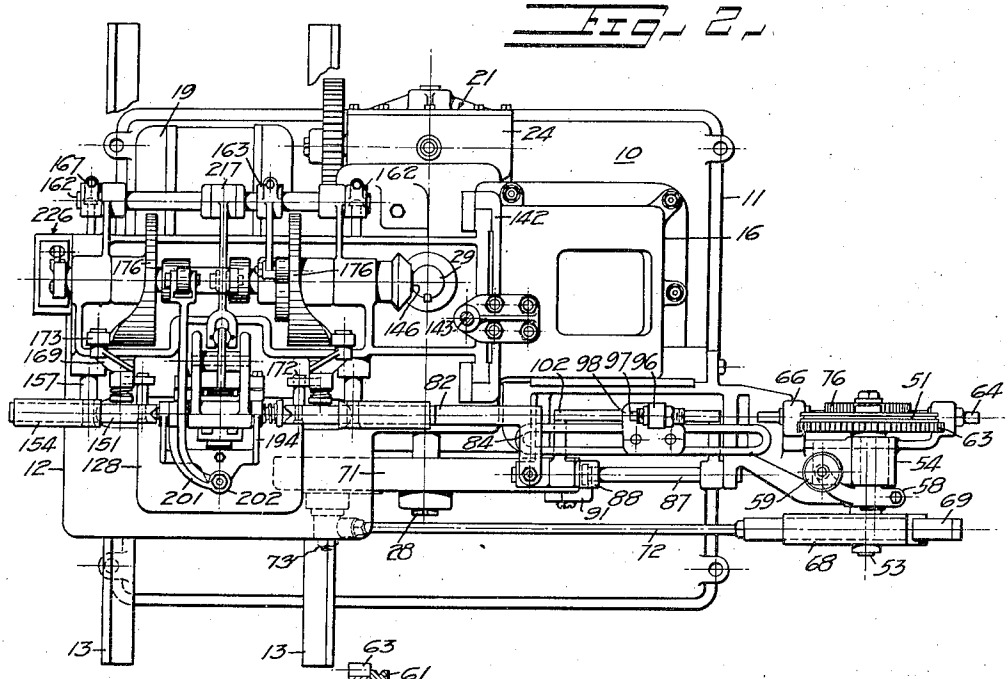
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BOX BINDING MACHINE

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FIG. 2.



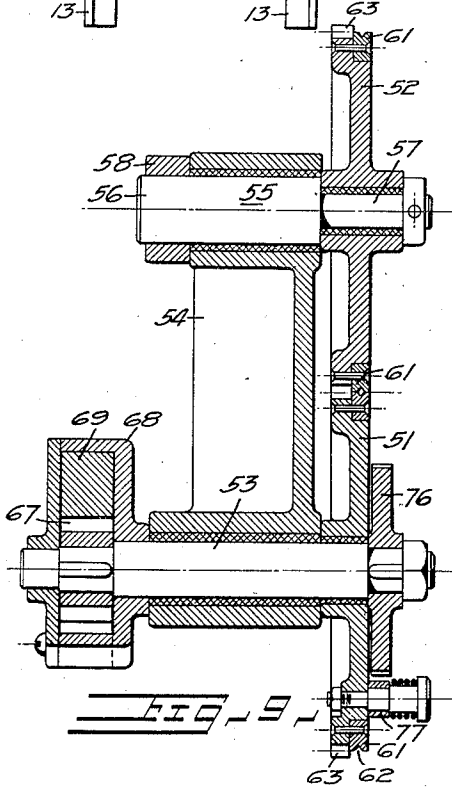


FIG. 9.

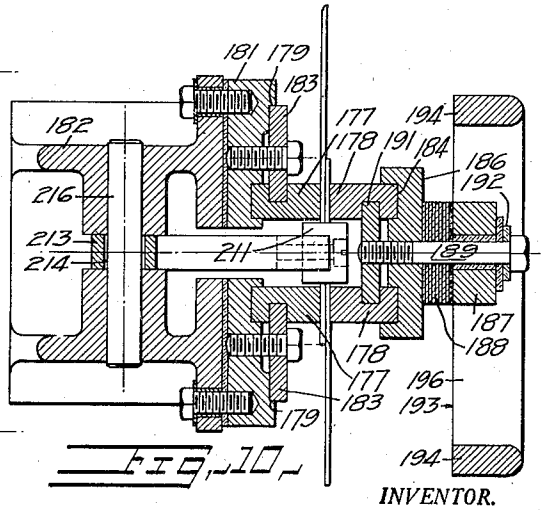


FIG. 10.

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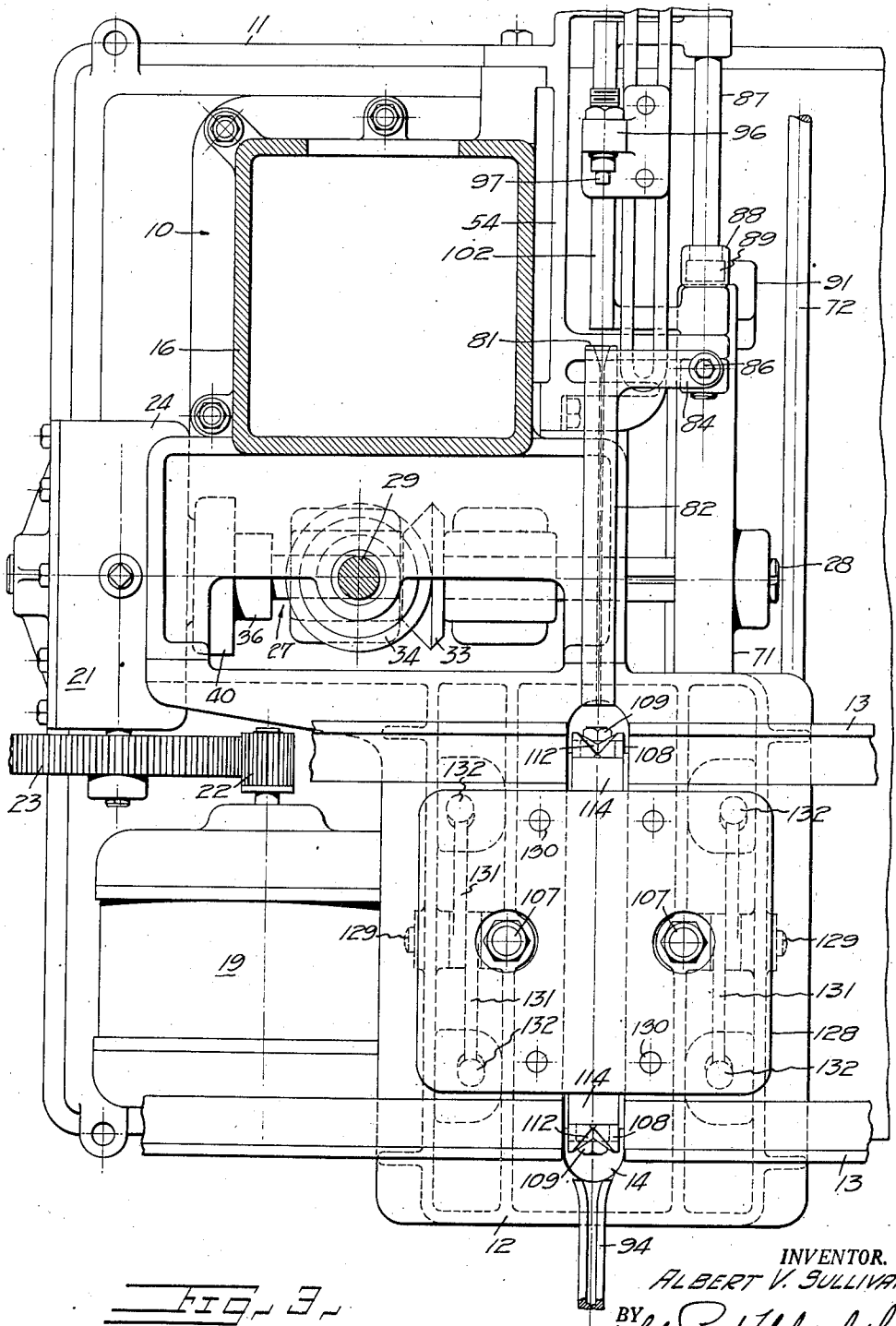


FIG. 3.

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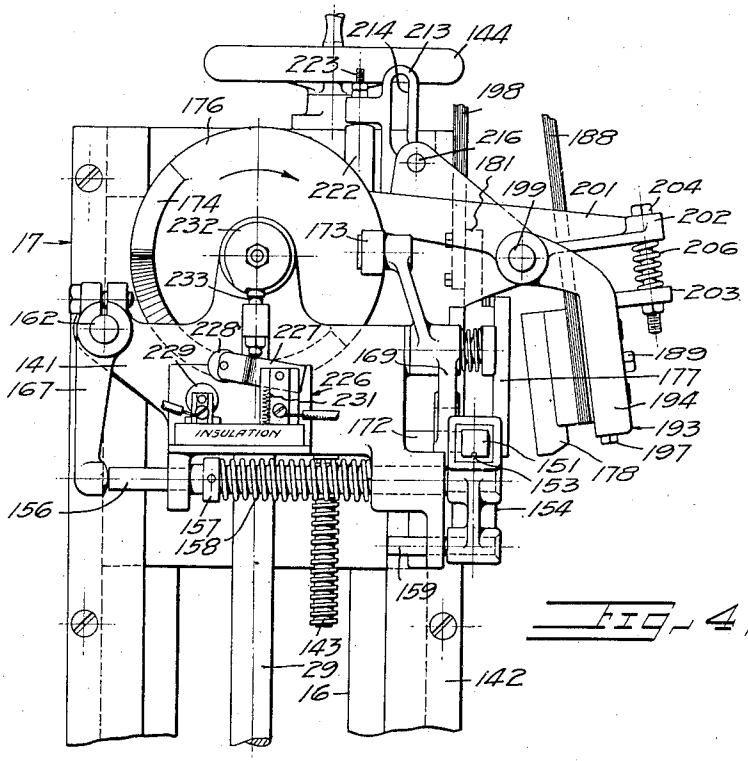


Fig. 4.

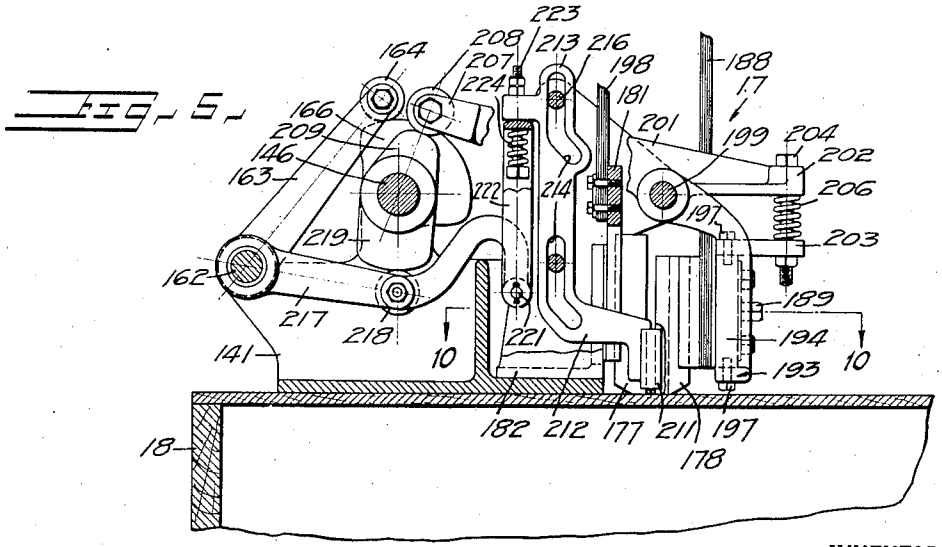


Fig. 5.

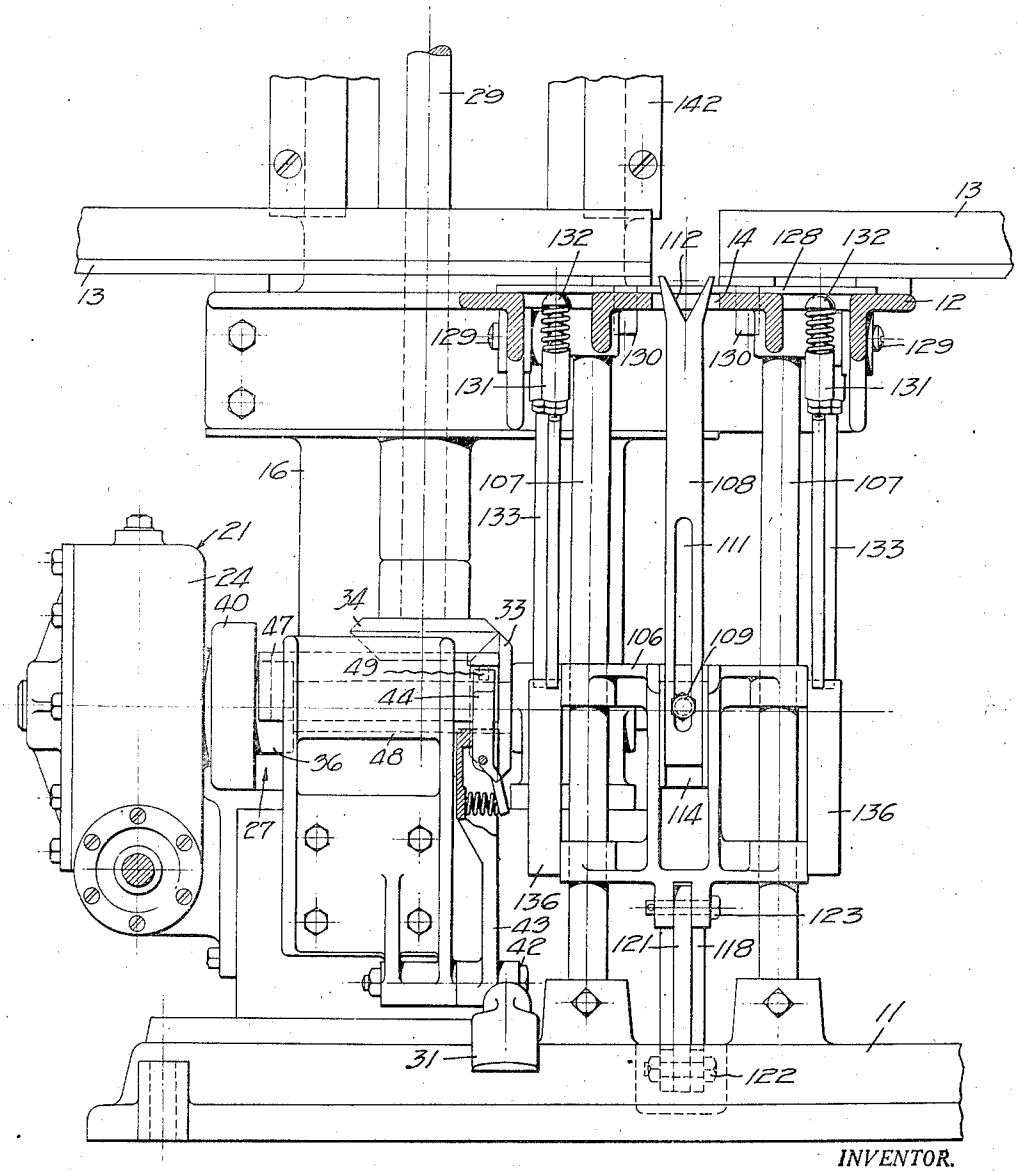
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Fig. 6.



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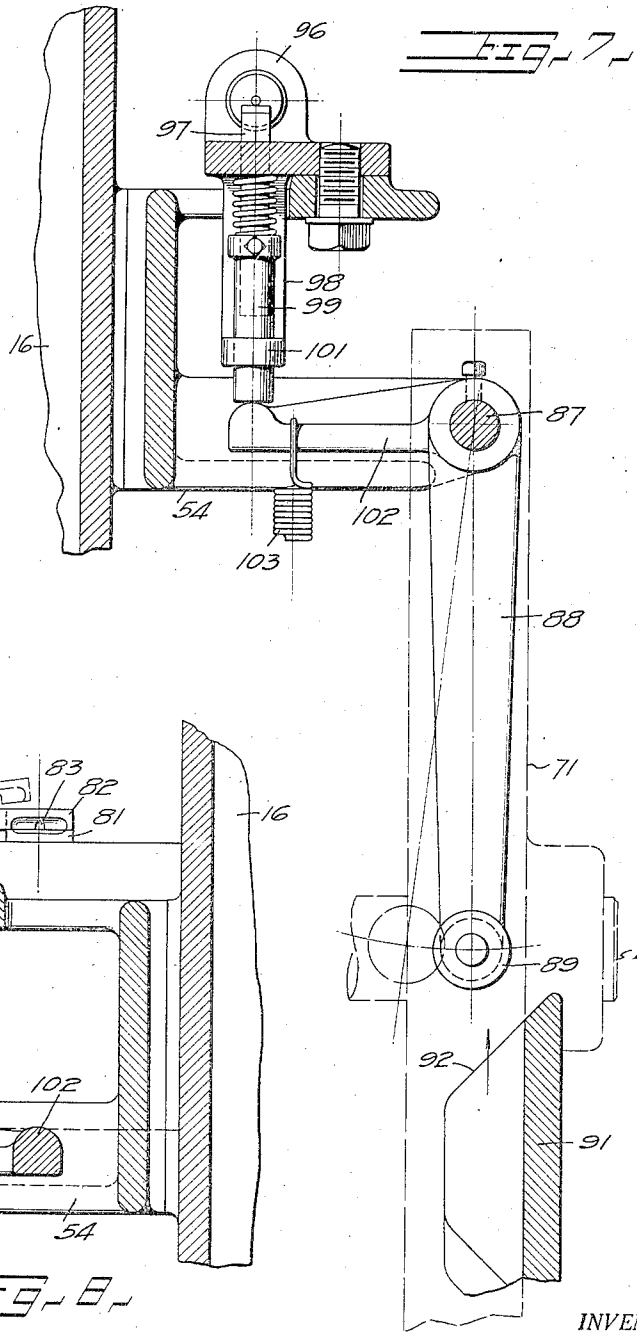


FIG. 7.

FIG. 8.

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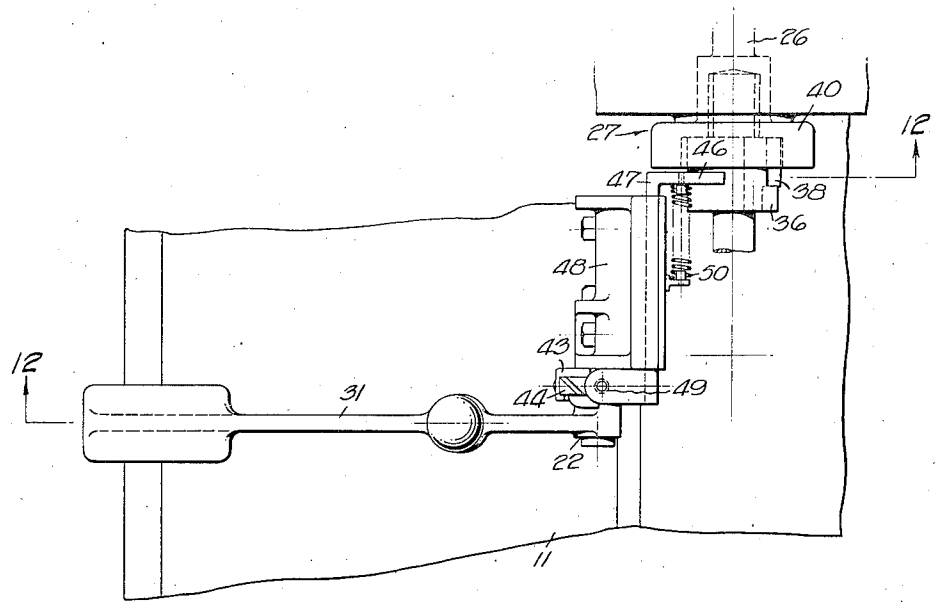


Fig. 11.

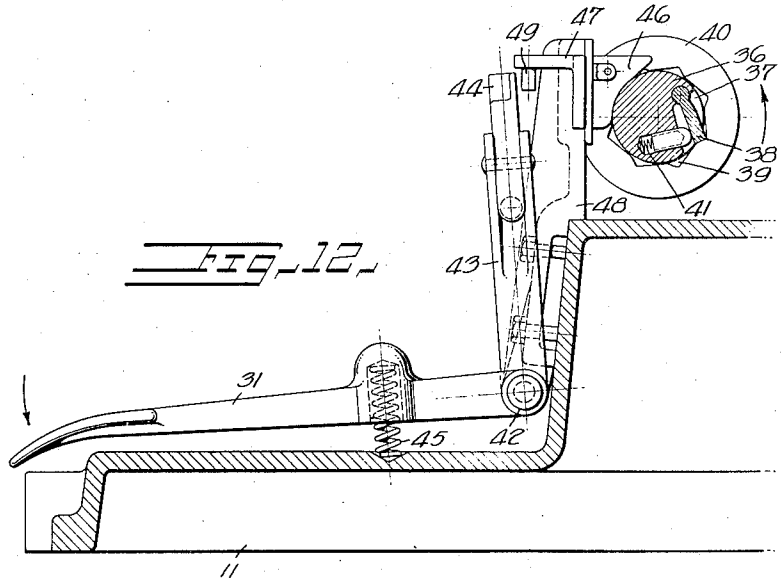


Fig. 12.

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Patented July 19, 1932 1,868,182

UNITED STATES PATENT OFFICE

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BOX BINDING MACHINE

Application filed October 22, 1930. Serial No. 490,464.

This invention relates generally to machines for binding boxes, bundles or the like with wire or other equivalent metallic elements. It relates particularly to machines of this character in which the ends of the wire are secured together by electrical welding.

It is a general object of the invention to devise a box binding machine which will be reliable in operation, which will have a relatively high capacity, and in which all of the various functions of the machine will be performed automatically.

It is a further object of the invention to devise a machine of the above character which will effect a relatively strong electrical weld between the ends of the binding wire or other metallic binding element, and which will have novel means for properly holding and positioning the overlapping ends of the wire during a welding operation.

It is a further object of the invention to devise novel means for positioning the metallic binding element upon four sides of the box or other bundle being bound, whereby after the overlapping ends of the binding element have been secured together, the element will be relatively tight upon the box.

It is a further object of the invention to devise means which will properly subject a wire or equivalent binding element to further mechanism for laying the wire about four sides of the box being bound. In this connection the machine is characterized by the fact that the binding wire is cut to a predetermined length prior to being presented to mechanism for positioning the wire about the sides and top of the box to be bound.

Further objects of the invention will appear from the following detailed description in which the preferred embodiment has been set forth in detail in conjunction with the accompanying drawings. It is to be understood that the appended claims are to be accorded a range of equivalents consistent with the state of the prior art.

Referring to the drawings:

Figure 1 is a side elevational view of a machine incorporating the present invention.

Fig. 2 is a plan view of the machine shown in Fig. 1.

Fig. 3 is an enlarged cross sectional view taken along the line 3—3 of Fig. 1.

Fig. 4 is an enlarged detail of the parts mounted upon the head of the machine, looking at the left hand end of the machine as illustrated in Fig. 1.

Fig. 5 is an enlarged cross sectional detail taken along the line 5—5 of Fig. 1.

Fig. 6 is an enlarged detail view, partly in cross section, illustrating certain parts associated with the lower part of the machine. This view is taken looking at the left end of the machine as illustrated in Fig. 1.

Fig. 7 is an enlarged cross sectional detail taken along the line 7—7 of Fig. 1.

Fig. 8 is an enlarged cross sectional view taken along the line 8—8 of Fig. 1.

Fig. 9 is an enlarged cross sectional view taken along the line 9—9 of Fig. 1.

Fig. 10 is an enlarged cross sectional view taken along the line 10—10 of Fig. 5.

Fig. 11 is an enlarged plan detail view of the clutch mechanism forming a part of the machine.

Fig. 12 is a cross sectional view taken on the line 12—12 of Fig. 11.

Fig. 13 is a circuit diagram illustrating electrical connections in the welding electrodes.

The specific form in which the invention is disclosed consists of suitable means for supporting a box in position to be bound. A mechanism is provided fc positioning a severed length of wire beneath the box, with the ends of the wire protruding from both of the box sides. Suitable mechanism then engages the protruding portions of the wire to lay the same upon the front and back sides of the box, after which the wire is engaged by means for bending and laying the same in overlapping relationship upon the top of the box. A presser member engages the overlapping ends of the wire while welding electrodes engage the overlapping portions to form a suitable electrical weld connection. Following the binding of the box, it can be repositioned upon its support for binding at a different point, or it can be removed from the support for permitting binding of subsequent boxes.

Referring to Fig. 1 of the drawings, the machine as illustrated consists of a suitable frame structure 10, which is provided with a base portion 11. The frame also includes a stationary horizontal bracket 12 above which a box is positioned for a binding operation, and positioned above bracket 12 suitable guide means is provided such as the spaced angle bars 13. When the machine is in operation angle bars 13 are spaced apart a proper distance to receive the box to be bound. As shown in Fig. 3, bracket 12 is provided with an elongated slot 14 extending centrally thereof, and angle bars 13 are interrupted to from gaps corresponding to the width of this slot. The frame 10 also includes an upstanding bracket 16 upon which an adjustable head 17 is mounted. When a box 18 to be bound is placed upon bracket 12, it is immediately below adjustable head 17 and is in position for a binding operation.

To facilitate making the various functions of the machine automatic, it is preferable to utilize a single source of power, which in this instance is represented by electric motor 19 (Fig. 1). This motor is suitably mounted upon base portion 11 and is connected to the working parts of the machine by a suitable speed reducing drive 21 (Fig. 3). As representative of a suitable speed reducing gearing pinion 22 of motor 19 is shown engaging a gear 23. Gear 23 is connected to a worm or planetary gear assembly mounted within housing 24. Shaft 26 extending from housing 24 (Fig. 11), operates at a reduced speed with respect to the motor shaft and is connected to the various working parts of the machine through a suitable clutch assembly 27. Clutch assembly 27 serves to operably connect shaft 26 with the horizontal shaft 28 and a vertical shaft 29 (Fig. 1), and is initiated in operation by a suitable manually controlled member such as a foot lever 31. As will be presently explained clutch assembly 27 drives shafts 28 and 29 when foot lever 31 is depressed and released, and is automatically disengaged to interrupt driving of shafts 28 and 29 after shaft 26 has completed a predetermined angular movement. Shafts 28 and 29 are preferably connected together by means of the bevel or miter gears 33 and 34.

The clutch assembly 27 is illustrated in detail in Figs. 3, 11 and 12. It consists of an enlarged portion 36 formed upon one end of shaft 28. Portion 36 is provided with a recess as indicated at 37, and mounted within this recess there is a pivoted dog 38. Dog 38 operates within a cavity 39 provided in the female clutch member 40 formed on the free end of shaft 26, and the inner periphery of clutch member 40 is toothed as shown to engage with dog 38 when member 40 is rotated in a counterclockwise direction as viewed in Fig. 12. Compression spring 41 normally urges dog 38 toward engaged position.

In order to control operation of the clutch assembly described above, foot lever 31, which is pivotally mounted to the frame of the machine as indicated at 42, is provided with an upwardly extending arm 43. The upper end of arm 43 is provided with a cam member 44. Lever 31 is normally biased toward its uppermost position by compression spring 45. In the rotation of clutch member 40, the projecting edge of dog 38 is brought into contact with cam face 46 and the dog 38 thus disengaged from clutch member 40. Cam member 46 is mounted upon one end of bar 47, and this bar in turn is slidingly supported by stationary bracket 48. The other end of bar 47 carries a pin 49 which extends in the path of movement of cam 44. Spring 50 serves to normally urge cam 46 towards clutch member 40. Cam 44 is pivotally connected to arm 43 and is spring biased toward a limiting position in which it engages pin 49 in its path of movement. When foot lever 31 is released cam 44 trips over pin 49 and cam 46 remains in the position as shown in Figs. 5, 11 and 12 to retain dog 38 in released position. Upon depressing foot lever 31 cam 44 initially engages pin 49 and movement of this pin causes movement of cam 46 to release dog 38. The clutch is thereupon immediately engaged. Upon completing movement of lever 31 pin 49 is disengaged from cam 44, whereupon cam 46 is returned to its normal position by the spring 50 to effect disengagement of the clutch when one revolution is completed.

The means for feeding the wire or other metal binding element consists of a pair of feed rollers 51 and 52, illustrated in detail in Fig. 9. Roller 51 is loosely mounted upon one end of a shaft 53, this shaft being journaled in a bracket 54 extending rearwardly of the frame of the machine. Roller 52 is carried by a shaft 55, one portion 56 of which is journaled to bracket 54, and another portion 57 of which is excentric to portion 56. Roller 52 is journaled to the shaft portion 57, whereby upon rotation of shaft 55 it can be urged toward roller 51. An arm 58 is fixed to shaft 55, and by means of an adjustable thumb nut 59, varying forces can be applied to arm 58 tending to rotate the same in one direction. Rings 61 are mounted upon rollers 51 and 52, and the peripheral surfaces of these rings are provided with grooves 62 adapted to register as shown in Fig. 9. In order to cause both rollers to rotate in synchronism, their peripheral portions are also provided with inter-engaging gear teeth 63. As shown in Fig. 1, the wire from a suitable source of supply, such as a reel, is fed thru a guide tube 64, and engaged between rollers 51 and 52. After passing thru rollers 51 and 52 the wire is led thru another guide tube 66.

The guiding means for periodically rotating roller 51 can consist of a pinion 67 mounted upon one end of shaft 53 (Fig 9). A casing 68 is swiveled to shaft 53, and slidably extended thru casing 68 there is a gear rack 69 which engages the teeth of pinion 67. Referring to Fig. 1 it will be noted that a wheel 71 is mounted upon one end of shaft 28, and that this wheel is connected to one end of rack 69 by means of a connecting rod 72. The actual connection between rod 72 and wheel 71 can consist of a crank pin 73 carried by a journal block, which in turn is adjustably mounted in the radial groove 74. Referring again to Fig. 9 ratchet wheel 76 is mounted upon the end of shaft 53 remote from pinion 67. A pawl 77 is mounted upon roller 51, and this pawl is spring biased so as to be normally urged into engagement with the teeth of ratchet wheel 76. Therefore upon reciprocation of rack 69 responsive to rotation of wheel 71, ratchet wheel 76 is recurrently oscillated in opposite directions; in one direction pawl 77 ratchets over its cooperating teeth, and in the other direction pawl 77 engages the ratchet teeth to rotate rollers 51 a predetermined angular amount.

Additional means for guiding the wire fed thru rollers 51 and 52 consists of a pair of relatively movable bars 81 and 82. (Figs. 1 and 8). Bar 81 is fixed to the main frame of the machine whereby the wire as fed by rollers 51 and 52 passes longitudinally over the upper surface of the same. The lower face of bar 82 is provided with a longitudinal groove 83 adapted to accommodate the wire and the end of this groove nearest the source of wire can be widened. During a certain portion of the cycle of operation of the machine bar 82 is moved to an out of the way position to release the wire. To accomplish this result bar 82 is carried by a laterally extending portion 84, which in turn is mounted upon the upper end of arm 86. (Fig. 8). Arm 86 is in turn mounted upon a horizontal shaft 87, which is journaled to one side of bracket 54. (Figs. 1 and 2.) Arm 88 (Fig. 1) is also mounted upon shaft 87, and carries a cam roller 89 at its lower end. Cam member 91 is adjustably mounted upon wheel 71, and is provided with cam surface 92 adapted to engage roller 89 during rotation of wheel 71. (Fig. 7). Therefore during a portion of the angular movement of wheel 71, cam member 91, by striking roller 89, rocks shaft 87 a certain angular amount, to cause bar 82 to move upwardly and away from bar 81, as shown in dotted lines in Fig. 8.

It may be explained at this time that a wire fed by rollers 51 and 52 and passing between bars 81 and 82, can pass between bracket 12 and a box 18 positioned above the same. Since immediately before the wire is laid upon the sides and top of the box, its forward end protrudes a substantial distance from the front side of the box, it is convenient to accommodate this protruding portion in a suitable guide member 94. This guide member can be in the form of a channel fixed to bracket 12 and extending outwardly through the front of the machine.

In order to cut or sever the wire into predetermined lengths an additional guide tube 96 is adjustably mounted between guide tube 66, and bars 81 and 82. A cutting blade 97 is positioned adjacent one end of tube 96, (Fig. 7) and this blade is slidably mounted in the bracket 98, upon which tube 96 is mounted. The lower end of blade 97 is adjustably fixed within a socket member 99 which in turn is slidably retained by a guide portion 101, depending from bracket 98. An actuating finger 102 is adjustably mounted upon shaft 87, and this finger engages the lower end of socket member 99. Tension spring 103 serves to normally bias shaft 87 in a counterclockwise direction as viewed in Fig. 7. When cam member 91 engages roller 89 to rock shaft 87 in a clockwise direction as viewed in Fig. 7, finger 102 elevates blade 97 to sever the wire extending thru tube 96.

The means for positioning the binding wire upon the front and back sides of the box 18, preferably consists of a cross head 106, which is disposed beneath bracket 12. (Figs. 1 and 6). This cross head is slidably mounted upon a pair of spaced parallel rods 107 which extend from brackets 12 to the base 11 of the machine. Mounted upon the front and back sides of cross head 106 are the upstanding arms 108. In order to permit arms 108 to be adjusted vertically with respect to cross head 106, the connection between these parts can consist of screws 109 extended thru elongated slots 111 in arms 108. The upper end of each arm 108 is forked to provide an upwardly faced V-shaped notch 112. The upper portion 113 of each arm is also curved convexly as shown in Fig. 1, for a purpose which will be presently explained. In order to permit an adjustment of the space between arms 108, thus permitting the machine to accommodate itself to boxes of different sizes, it is convenient to form the cross head 106 with adjustable right angle members 114, to which the arms 108 are mounted as has been previously described. These members 114 are adjustably secured to the main body of the cross head by means of cap screws 116. As shown in Fig. 6, the upper ends of forked arms 108 preferably extend thru slots 14 in bracket 12 so that upon elevation of cross head 106 these arms are projected upwardly adjacent the front and back sides of the box to be bound.

For elevating and lowering the cross head 106 suitable mechanism is shown consisting of a beam 118, one end of which is pivotally mounted to the machine base 11 as indicated at 119. A link 121 has a pivotal connection

122 with the other end of beam 118, and a pivotal connection 123 with cross head 106. (Figs. 1 and 6.) Mounted upon an intermediate portion of beam 118 there is a roller 124 (Fig. 1) which is adapted to engage in a cam groove 126 formed in the inner face of wheel 71. Therefore upon rotation of wheel 71 beam 118 is repeatedly oscillated with a movement determined by the character of cam groove 126.

For laying and securing the wire about box 18 it is desirable to urge the box upwardly against the lower face of the head structure 17. To accomplish this result a plate 128 is disposed upon bracket 12 and between the guide members 13 (Fig. 1), this plate being guided by pins 130 which are slidingly retained in apertures formed in bracket 12. Alined pivot pins 129 are mounted upon bracket 12 below plate 128, the axis of these pins being normal to the plane of forked arms 108. Fingers 131 are pivotally carried by pins 129, and each finger is provided with a slidable spring pressed plunger 132. (Figs. 1 and 6). Secured to and depending from fingers 131, are the arms 133. The lower ends of arms 133 terminate in outwardly and opposite curved portions 134. These arms are adapted to be engaged and actuated by members 136 which have upper rounded ends, and which are mounted upon opposite sides of cross head 106. As is evident from Fig. 1 when cross head 106 is elevated members 136 are imposed between arms 133, thus spreading these arms to move fingers 131 upwardly. Spring pressed plungers 132 are thus caused to elevate plate 128 against the bottom of the box 18.

It may be explained at this point that at the time of upward movement of cross head 106, a length of wire extending below box 18 and in alinement with the notches 112 in arms 108, is laid upon the front and back sides of the box. Subsequently the wire is engaged by parts associated with head 17 to bend the ends of the wire upon the top of the box and to secure the overlapping portions together. The head 17 preferably consists of a body portion 141, which is mounted for vertical adjustment upon the upstanding frame bracket 16. Thus bracket 16 is shown provided with a vertical track 142 which is slidably engaged by body 141. A feed screw 143 is threaded thru a nut fixed to body 141 and can be rotated by convenient hand wheel 144.

As shown in Figs. 1 and 2 a horizontal shaft 146 is journaled upon the body 141 and is operably connected to the vertical shaft 29 by means of miter gears 147 and 148. Gear 148 is splined to shaft 29 to permit vertical movement of the head.

To effect engagement with the wire to lay and bend the same upon the top of the box, a pair of wire engaging tools 151 are provided. These tools are in the form of bars beveled as indicated at 152 on their inner opposed ends, and provided with wire engaging grooves 153 (Fig. 4), in their lower faces. They are slidably carried by guide members 154 whereby they are constrained to move in a plane parallel to the top surface of the box. When the machine is in operation a compound movement is imparted to these tools 151. While the wire is being laid upon the front and back sides of the box these tools are in a retracted position. However, when arms 108 reach their uppermost position these tools are projected into the plane of the wire, after which they are moved inwardly in opposite directions to engage and lay the wire upon the top of the box.

The projection of tools 151 into the plane of the wire is effected by virtue of the fact that guide members 154 are movably mounted upon the body 141. Thus referring to Fig. 4, each of the guide members 154 is mounted upon a horizontal rod 156, which in turn is slidably carried upon the under side of head 141. A collar 157 is mounted upon each rod 156 and a compression spring 158 pressing upon collar 157 tends to normally bias each rod 156 and its associated guide member 154, to a retracted position. Angular movements of guide member 154 are prevented by pins 159, which project from the same, and which slidably engage apertures in head 141. Rods 156 are actuated by means deriving its movement from rotation of shaft 146. Thus referring to Figs. 4 and 5, a rock shaft 162 is carried by head 141, and extends parallel to rotatable shaft 146. Arm 163 mounted upon shaft 162 is provided with a roller 164 at its free end. Cam 166 mounted upon shaft 146 is adapted to engage roller 164, to rock shaft 162. Referring to Fig. 4, fingers 167 are also mounted upon opposite ends of shaft 162, and engage the ends of pins 156. Therefore for each revolution of shaft 146, cam 166 rocks shaft 162 to periodically project rods 156, together with the tools 151.

In order to cause tools 151 to move inwardly in opposite directions after they are projected, a pair of levers 169 (Fig. 1) are provided with pivotal connections 171 with the body 141. The lower end of levers 169 are forked and extending into these forks are pins 172 projecting laterally from tools 151. The upper ends of levers 169 are provided with rollers 173 (Fig. 4), and these rollers are adapted to engage the curved surfaces 174 of duplicate cams 176. Cams 176 are also mounted upon the rotatable shaft 146. The formation of the cam surfaces 174 are such that after tools 151 are projected as has been previously described, levers 169 are simultaneously rocked in opposite directions to move tools 151 inwardly. After the overlapping ends of the wire have been secured together as will be presently ex-

plained, tools 151 are first moved outwardly in opposite directions, and then retracted from the plane of the wire.

It has been previously mentioned that the preferred manner of securing together the overlapping edges of the binding wire is to weld them together electrically. Thus referring to Figs. 4, 5 and 10 I provide two stationary welding electrodes 177, and two movable electrodes 178. Electrodes 177 are in the form of conductor bars which are disposed in grooves 179 provided in a suitable mounting plate 181. (Fig. 10.) Plate 181 is in turn mounted in a vertical plane upon a standard 182, which in turn is mounted upon the body 141 as shown in Fig. 5. Suitable insulation between plate 181 and standard 182 prevents direct electrical connection between electrodes 177 and the remainder of the metal parts of the machine. Lock bars 183 serve to removably fix the electrodes 177 to plate 181.

Movable electrodes 178 are also in the form of conductor bars which are disposed in grooves 184 provided in a plate 186. Plate 186 is in turn mounted upon a block 187, and this block is adjustably carried by a structure to be presently explained. A laminated bus conductor 188 extends between plate 186 and block 187, and this assembly is retained together by bolt 189. This bolt is threaded into a bar 191 which is locked in recesses in electrodes 178, and is insulated from block 187 by the insulating bushings 192. The structure upon which block 187 is mounted consists of a swinging arm 193 (Figs. 4 and 5) which is provided with side depending portions 194 (Fig. 1), and connected lateral members 196. Block 187 extends between lateral members 196 and is adjustably secured thereto by the cap screws 197. Electrical connection to the stationary electrodes 177 can be made thru the bus conductor 198, which is connected to plate 181. (Fig. 5.)

Arm 193 is pivotally carried by a shaft 199 which extends in a horizontal direction, and which in turn is carried by standard 182. Its movements are determined by lever 201 which is also carried by shaft 199. Its forward portion 202 is loosely connected to a projecting portion 203 of arm 193. (Fig. 4.) A compression spring 206 surrounding pin 204 normally urges portions 202 and 203 apart, so that arm 193 is normally urged in a clockwise direction with respect to lever 201, as viewed in Figs. 4 and 5. The other portion 207 of lever 201 carries a roller 208, arranged to engage the surface of a cam 209. (Fig. 5.) This cam is also mounted upon shaft 146 and the contour of its surface is such as to properly time movements of arm 193, together with the movable electrodes.

As will be apparent from Fig. 10, the electrodes serve to engage two spaced portions of the overlapping wires. In order to insure proper arrangement of the wires and in order to hold the ends of the wires during a welding operation, it is preferable to provide additional wire gripping means. This means in this instance is formed by a presser block 211 (Figs. 5 and 10), which is mounted upon the projecting portion 212 of a slidable bar 213. As shown in Fig. 10 presser block 211 during a welding operation is disposed between the electrodes 177 and 178, to press down upon the portions of the wire extending between the electrodes. This block must also be given a compound movement in order to retract and project it into the plane of the wire. Thus bar 213 is provided with ankled slots 214 which are engaged by stationary pins 216. Thus when bar 213 is elevated it is first moved vertically to lift block 211 and then laterally to retract the block from the plane of the wire. Movements of bar 213 are effected by an arm 217 which is loosely mounted upon shaft 162 (Fig. 5). Cam roller 218 on arm 217 engages the surface of a cam 219, mounted upon shaft 146. The end of arm 217 has a pivotal connection 221 with a yoke 222. Bolt 223 connects the upper end of yoke 222 with bar 213, while a compression spring 224 provides a resilient connection.

In order to properly control the supply of current to the welding electrodes a timing switch 226 is also provided (Fig. 4). This switch can consist of an arm 227 carrying a roller contact 228. Contact 228 cooperates with stationary roller contact 229. Arm 227 is biased toward open position by compression spring 231. Shaft 146 carries a cam 232, and interposed between the surface of this cam and arm 227 there is a slidable actuating pin 233.

The electrical connections for the electrodes and the welding transformer are shown in Fig. 13. The current supply lines 1 are connected in series with the primary of the transformer 2 and the automatically controlled switch 226. The welding electrodes 177 and 178 are connected across the secondary of the welding transformer. When the circuit to the primary of the transformer is closed by closing of switch 226 current is supplied to electrodes 177 and 178, to effect a direct electrical weld between the overlapping wire portions.

To describe the mode of operation of the complete machine, it will be presumed that one or more boxes have been previously bound and that the operator is about to bind a box which has just been placed above the table bracket 12. Motor 19 is operating continuously but shafts 28 and 29 are stationary. During the preceding cycle of operation rollers 51 and 52 have revolved in opposite directions to feed the wire between the bars

81 and 82, and beneath the box 18 during the last part of the cycle while operations are taking place upon the top of the box. Upon depression of pedal 31 shafts 28 and 29 are started in rotation, and engagement of cam member 91 with roller 89 causes blade 97 to sever the wire. The severed length of wire which underlies box 18 is of sufficient length to entirely encompass the box with overlapping portions for forming a weld connection, and the portions of the wire which extend from the front and back sides of the box are substantially equal. Immediately after the wire has been severed upward movement of cross head 106 commences, and the wire is engaged by forked arms 108. It should be noted that at this time tools 151 are in retracted position out of the plane of the arms 108 and out of the plane of the wire. As arms 108 move upwardly along the sides of the box they are sprung outwardly to a limited extent whereby the wire is tensioned across the bottom of the box and about the lower corners. At the same time that arms 108 commence upward movement plate 128 is pressed upwardly against the bottom of the box so that the wire is gripped and the bottom of the box is elevated and pressed into contact with the lower surface of the head body 141. When arms 106 have reached their uppermost position shafts 29 and 146 are rotated a sufficient angular distance to cause tools 151 to be projected into the plane of the wire. Immediately thereafter tools 151 are moved inwardly to bend the ends of the wire upon the top surface of the box, and in overlapping relationship as shown in Fig. 10. When tools 151 have moved inwardly to the limit of their movement bar 213 (Fig. 5) is moved downwardly to bring the presser block 211 into engagement with the overlapping portions of the wire between the electrodes. At the same time that the presser block 211 is moved into engagement with the wire, the movable electrodes 178 are swung downwardly and inwardly toward the stationary electrodes, to grip the overlapping wire portions immediately adjacent the sides of block 211, as shown in Fig. 10. At the instant the electrodes grip the wire, or immediately thereafter, switch 226 is closed for an interval sufficient to weld the wires together. After the weld has been completed movable electrodes 178 swing outwardly and upwardly, and at the same time pressure block 211 moves into disengaged position and the tools 151 are retracted. The box is now tied and can be expelled for the binding of a new box.

I claim:

1. In a machine for binding boxes and the like, means for encompassing a box with a metallic binding element with the ends of the element in overlapping relationship directly against one side of the box, and means for welding together the overlapping portions of the element.

2. In a machine for binding boxes and the like, means for positioning a metallic binding element about the box with the ends of the element in overlapping relationship directly against one side of the box, and means for electrically welding the overlapping portions of the element together at at least two points.

3. In a machine for binding boxes and the like, means for positioning a metallic binding element about the box with the ends of the element in overlapping relationship on one side of the box, means for pressing the overlapping portions of the element against one side of the box, and means for electrically welding the overlapping portions of the element together at at least two points.

4. In a machine for binding boxes and the like, means for positioning a metallic binding element about the box with the ends of the element in overlapping relationship on one side of the box, a presser member adapted to engage said overlapping portions and to press the same against said side of the box, and welding electrodes adapted to engage said overlapping portions adjacent opposite sides of the presser member.

5. In a machine for binding boxes and the like, means for positioning a metallic binding element about the box with the ends of the element in overlapping relationship on one side of the box, a presser member adapted to engage said overlapping portions and to press the same against said side of the box, two pair of welding electrodes adapted to be positioned adjacent opposite sides of the presser member, and means for causing the electrodes to engage said overlapping portions at spaced points adjacent said opposite sides of the presser member.

6. In a machine for binding boxes and the like, box supporting means, mechanism for positioning a metallic binding element about said box with the ends of the element in overlapping relationship adjacent one side of the box, and means operative automatically responsive to operation of said mechanism for directly welding the overlapping portions of said element together.

7. In a machine for binding boxes and the like, box supporting means, means for positioning a length of wire below said box, a pair of forked arms adapted to engage the ends of the wire, said arms being spaced apart a distance substantially equal to the width of the box, and means for elevating said arms to lay the ends of the wire adjacent opposite sides of the box.

8. In a machine for binding boxes and the like, box supporting means, means for positioning a length of wire below said box, a pair of forked arms adapted to engage the ends of the wire, said arms being spaced

apart a distance substantially equal to the width of the box, means for elevating said arms to lay the wire adjacent opposite sides of the box, and means for laying the wire in overlapping relationship upon the top of the box.

9. In a machine for binding boxes and the like, a box support, an operating head adapted to overlie a box upon the support, a vertically movable plate adapted to underlie said box, means for positioning a length of a metallic binding element below the box and above said plate, means for positioning the ends of the wire about the sides and top of the box, and means for elevating said plate to force the box against said head during said last mentioned operation.

10. In a machine for binding boxes and the like, a box support, means for positioning a length of a metallic binding element below a box on the support, forked arms adapted to engage the portions of the element projecting beyond opposite sides of the box, means for elevating said arms to lay said element upon opposite sides of the box, a pair of tools adapted to engage the portions of the element projecting beyond the top of the box, means for projecting said tools into engagement with said element and into the plane of the side and bottom portions of the element whereby the end portions of the element are positioned in overlapping relationship adjacent the top of the box, and means for securing said overlapping end portions together, all of said means functioning automatically and in timed sequence.

11. In a machine for binding boxes and the like, a box support, means for positioning a length of a metallic binding element below a box on the support, forked arms adapted to engage the portions of the element projecting beyond opposite sides of the box, a pair of tools adapted to engage the portions of the element projecting beyond the top of the box, means for projecting said tools into the plane of the side and bottom portions of the element, means for forcing said tools in opposite directions whereby the end portions of the element are laid in overlapping relationship adjacent the top of the box, and means for securing said overlapping end portions together, all of said means functioning automatically and in timed sequence.

12. In a machine for binding boxes and the like, a box support, means for feeding a length of metallic binding element beneath a box on the support, and means for cutting said element from the source of supply whereby equal portions of said severed element extend beyond opposite sides of the box.

13. In a machie for binding boxes and the like, a box support, a clutch controlled source of power, means driven from said source of power for projecting a length of said element below a box on the support, means automatically operable for severing said element from said source of supply, and means for positioning the severed length of said element about the box.

14. In a machine for binding boxes and the like, an electric motor, means driven by said motor for withdrawing a length of a metallic binding element from a source of supply, and means driven by the motor for encompassing a box with the length of binding element thus withdrawn.

15. In a machine for binding boxes and the like, an electric motor, means driven by said motor for withdrawing a length of a metallic binding element from a source of supply, means driven by the motor for encompassing a box with the length of binding element thus withdrawn with the ends of the element in overlapping relationship, means driven by the motor for positioning welding electrodes adjacent the overlapping portion of the element, and an electric switch opened and closed by said motor for controlling the period of energization of said electrodes.

16. In a machine for binding boxes and the like, an electric motor, means driven by said motor for withdrawing a length of a metallic binding element from a source of supply, means driven by the motor for encompassing a box with the length of binding element thus withdrawn with the ends of the element in overlapping relationship, a pair of welding electrodes, means driven by the motor for positioning said welding electrodes adjacent the overlapping portion of the element, an electric switch opened and closed by said motor for controlling the period of energization of said electrodes, a clutch interconnecting said motor with all of said motor driven means, and means operable at the end of a complete cycle of operations to automatically disengage said clutch.

17. In a machine for binding boxes and the like, means for encompassing a box with a metallic binding element and for securing the binding element in this position, and means operable during the operating period of said first mentioned means for positioning another binding element beneath the box in readiness for a succeeding binding operation.

In testimony whereof I have hereunto set my hand.

ALBERT V. SULLIVAN.