APPARATUS FOR SUPPLYING WIRE FROM WIRE SUPPLY SPOOLS TO BENDING PRESSES

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[Signature]

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This invention relates to apparatus for supplying wire from a wire-supply spool to a wire-bending press having a wire cut-off. This invention is a division of my co-pending application Serial No. 431,984, filed February 23, 1942, which describes and claims an intermittently operating wire-feeder having feed rolls which move into the wire-bending press the correct amount of wire to be cut off and formed.

The object of the invention claimed in the present application is to minimize the jerk upon the wire when it is started on its movement by the feed rolls of the wire-feeder. To accomplish this, the wire passes from the supply spool over a resiliently supported slack-take-up guide wheel and to the feed rolls, and the spool is constantly rotated by a shaft driven by the wire-bending press. Enough braking pressure is applied to supply spool as it rotates to prevent over-travel and abnormal slack in the wire between the spool and the feeder.

A further object is to provide means for facilitating the ejection of an empty spool from brackets which support the spool in alignment with the press-operated shaft and means for facilitating the mounting of a full spool upon said brackets.

A further object is to provide for the disconnection of the spool from its drive and the elimination of a stopping brake thereto in response to the release of a member which will cause the clutch, connecting the crankshaft of the wire-bending press with its power source, to be disengaged when the press crankshaft arrives at a certain point in its travel.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a perspective view showing a wire unreeling device, embodying the present invention.

Fig. 2 is a perspective view of the wire unreeling device as viewed in the direction of arrow 2 in Fig. 1.

Fig. 3 is a plan view of the wire unreeling device.

Fig. 4 is a view in the direction of arrow 4 of Fig. 3.

Fig. 5 is a view in the direction of arrow 5 of Fig. 4.

Fig. 6 is a fragmentary, perspective view showing the drive shaft of the wire-bending press and its connection with a drive shaft of the wire unreeling device and a diagram of the clutch control mechanism of the wire-bending press.

The wire is unreeled by the mechanism constituting the invention of the present application and is formed in a wire-bending press having a feeding mechanism described and claimed in application, Serial No. 431,984. This mechanism receives the wire W from a supply spool S (Fig. 1) and Wire W passes from the spool S around a flexibly supported pulley 61 and between two sets of straightening rolls 62 and 63 carried on brackets 64 supported by bracket 95 and post 68 which are attached to the frame 67 of the wire-bending press. The wire unreeling mechanism, designated by numeral 70 in Figs. 1 and 2, is driven by the forming press shaft 25 which drives a sprocket 71 connected by a chain 72 (Fig. 6) with a sprocket 74 driving a shaft 78. The shaft 75 (Fig. 2) is mounted close to the floor which supports the wire forming press and unreeling device and it is protected by a cover 76. Another cover 77 encloses sprockets and a connecting chain, these parts being the sprocket 78 connected with shaft 75 (Fig. 4), a sprocket 76 connected with a shaft 80 and a connecting sprocket chain 81 which is held taut by an adjustable idler sprocket 82. As shown in Fig. 3, shaft 80 is supported by bearings 83 and 84 mounted in plates 85 and 86 respectively attached to a plate 87 mounted on an upper base 88 which in turn is mounted on a lower base 89. The shaft 80 drives a worm 90 meshing with a worm gear 91 which drives a shaft 92 supported by bearings 93 and 94 mounted in plates 87 and 86, respectively, located between plates 85 and 86 and attached thereto. The left end of shaft 92 is splined connected with a driving clutch 95 urged by a spring 96 into engagement with a driven clutch 100 carried by a shaft 101 supported by bearings 102 and 103 mounted in plates 104 and 105, respectively, located between plates 85 and 86 and secured thereto. Plate 105 extends to the upper base 88 and is secured thereto. Driving clutch 95 is shifted along the shaft 92 by fluid pressure means comprising a cylinder 110 (Fig. 4) mounted upon upper base 88 and enclosing a piston, not shown, connected by rod 111 and an adjustable rod 112 and a clevis 113 and a pin 114 with a lever 115 pivotally supported by a screw or stud 117 attached to frame plate 87. Lever 115 is connected by a pin 120, clevis 121, rod 122, clevis 123 and pin 124 with lever 125 connected with a shaft 126 supported by plates 85 and 86 and carrying a bifurcated lever 127 having pins 128 engaging an annular groove 129 formed in the hub of the clutch member 98. When it is desired manually...
to disconnect shaft 92 from shaft 101, a hand lever 130 (Fig. 2) connected with shaft 120 may be used to disengage the clutch members 95 and 100.

Clutch part 88 drives clutch part 100 at a rate such that when the spool S is full of wire, the length of wire W unwound from the spool by the driving of shaft 75 by the press 20 is substantially the length required to form one hairpin. As the diameter of the wire coil remaining on the spool S decreases, the feeder shown in application #431,984, will pull out more wire than can be unreeled by the rotation of shaft 75. Therefore, spool S turns faster than shaft 92, and clutch part 100 overrun clutch part 88. However, the burden placed upon the feeder of pulling the spool S ahead of the press-rotated shaft 92 is decreasing because the mass of wire on the spool is decreasing.

Shaft 92 is prevented from moving endwise by attaching to its right end a collar 131 engaging the fixed bearing 94. A collar 122 attached to shaft 92 bears against the fixed bearing 94. Shaft 101 is prevented from moving endwise by the clutch 100 fixed thereto at the right end and engageable with the fixed bearing 94 and by the collar 133 fixed to the shaft and engageable with the fixed bearing 103.

The left end of shaft 101 is splined connected with a driving clutch 143 engageable with a driven clutch 141 attached to a shaft 142 extending through ball bearings 143 (removable with the shaft 142) received by recessed cradle plates 144 (Fig. 5) pivotally supported at 147 by pedestals 145 which are attached to feet 146 (Fig. 3) which are attached to base 85. Shaft 142 is provided with a threaded portion 147 for receiving a nut 148 which wedges a cone 149 against the flange 150 of spool S (Fig. 1) through which the shaft 142 extends when the spool is mounted upon the unreeling apparatus. The flange 150 of spool S (Fig. 2) is wedged against the cone 149 which is fixed to the shaft 142 at a predetermined distance from the clutch 141 which also is fixed to the shaft 142. Cone 149a (Fig. 4) carries an arm 152 provided with a link 153 adapted to fit in a hole 154 in the flange 151 of the spool.

The clutch 140 is normally engaged with the clutch 141 by a spring 160 (Fig. 4). Clutch 140 may be separated from clutch 141 by a lever 161 whose bifurcated upper end carries pins 162 received by an annular groove 163 in the hub of clutch 140. Lever 161 is pivotally supported by a pin 164 (Fig. 2) mounted on arm 165 of a bracket plate 166 (Fig. 4) attached to plate 160. Plate 160 carries a guide pin 167 extending through a hole 165 in lever 161 and surrounded by a spring 169 which is confined between the plate 168 and the lever 161 so as to urge lever 161 toward the left to cause clutch part 140 to engage clutch part 141. Therefore spring 169 supplements spring 168. Lever 161 is moved clockwise or toward the right in Figs. 2 and 4 by providing lever 161 with a wear piece 170 engaged by cam 171 (Fig. 3) provided by a bar 172 attached to a slide 173 connected by pin 174 (Fig. 4) with a lever 175 having branches 176a, 175b and 175c through which the pin 174 extends. Lever 175 is attached to a shaft 176 supported by bearing brackets 177 and 178 attached to the base 89 (Fig. 3). Shaft 176 is operated by a lever 180 (Fig. 2) and shaft 176 carries a lever 181 having bifurcations 181a and 181b (Fig. 4) between which a link 182 is located and is connected to lever 181 by a pin 183. Between the bifurcations 175a and 175b of lever 175 a link 184 similar to link 182 is located and is connected with lever 175 by the pin 174.

The pin 183 is received by elongated hole 185a in link 182 (Fig. 5). Pin 174 extends through a similar elongated hole in link 183. Therefore as lever 180 is moved toward the left or counterclockwise in Fig. 5, the bar 173 will move ahead of links 182 and 184 in order to effect the disengagement of clutch 140 from clutch 141 before the links 182 and 184 start to move toward the left. The upper ends of links 182 and 184 are pivotally connected at 186 with the cradle plates 144 which are pivotally connected at 187 with pedestals 145. Therefore, when links 182 and 184 are moved toward the left, the cradle plates 144 are rotated counterclockwise upon their pivots 187 in order to effect the discharge of an empty spool S which drops to the floor carrying with it shaft 142 and its bearings 143.

To mount upon the cradle plates 144 a filled spool which has considerable weight, lever 180 is first returned to normal position so that the cradle plates 144 will be in position to receive the bearings 143 which are mounted upon the shaft 142 which is passed through the full spool. The return movement of the cradle plates 144 is effected by moving the lever 180 (Fig. 5). This movement can be arrested by the striking of a pin 190 on lever 160 with a lug 191 of a lock pedal 192 which is pivotally supported on a pin 193 carried by a bracket 194 attached to base 85 and enclosing a spring 195 urging the lever 192 upwardly. At the time the pin 190 engages the lug 191, said pin 190 is in the dot dash line position 190a (Fig. 5), while the lug 191 is in the position 191a and lever 192 in the position 192a. The lever 190 is therefore held in the position 190b shown in dot dash lines. Therefore lever 190 has not returned to its normal position where in the cam 171 has been retracted from the wear piece 170 of lever 161. Therefore, the clutch 140 is still in a position wherein it would be disengaged from the clutch 141, were clutch 161 then in alignment with the driven pin 167, were the apparatus in position for receiving a new spool S together with its supporting shaft 142 and bearings 143 and the clutch 141 attached to the shaft 142. The placing of the new spool S upon the cradle plates 144 is effected through the assistance of a pair of levers 195 having notched lugs 197 for receiving the shaft 142 which projects from the ends of the spool. The levers 196 are supported by screws 198 which pass through elongated holes 199 (Fig. 5) in the plates 145. The levers are tied together by a handle bar 200. The lower ends of the levers 195 are engaged by levers 201a and 201b, lever 201a being a short lever and lever 201b being a long lever carrying a pedal pad 202 (Fig. 5). The levers 201a and 201b are both attached to a shaft 203 supported by brackets 204. Lever 201b is notched at 205 to clear the shaft 176.

The levers 152 are placed close to the floor (Fig. 2) and the spool S is rolled on the floor between these levers, then the levers 195 are raised by the handle bar 200 so that the notched lugs 197 will engage the under side of the shaft 142 passing through the spool S. Then, as the operator lifts up on the handle bar 200, he stands upon the pedal 220 in order to make use of his weight acting through levers 201a and 201b to assist in lifting the levers 195 vertically while he is moving them counterclockwise by pushing on the
handle 202. In this way, the heavy full spool S is elevated to a position above the cradle plates so that it may be pushed into alignment with the clutch 145 preparatory to drooping the shaft 142 and its bearings 143 upon the operator cradle plates 144. When the spool is thus positioned, the steps from the pedal 202 so that the levers 195 may descend. As the spool descends, its bearings 143 are engaged by retainer plates 210 pivotally supported on pins 211 and urged clockwise (Fig. 5) by springs 212 attached to the plates 210 and the studs 213 fixed to the pedestals 145. As the levers 196 descend the weight of the spool may be transmitted through its shaft and bearings 143 first to the upper ends 145a of the pedestal tals 145, thereby forcing the plates 210 downward. As the shaft 142 is moved into alignment with the clutch 146, the bearings 143 roll off the upper ends 145a of the pedestals 145 and into the recesses of the cradle plates 144 thereby permitting the retainer plates 210 to spring upwardly to normal position shown in Fig. 5. Then the operator depresses the pedal 192 in order that its lug 191 be clear of the pin 190, thereby permitting lever 180 to be moved to its normal position shown in Fig. 5, thereby causing the cam bar 111 to release the wear piece 110 of lever 161, thereby permitting spring 160 to cause clutch 140 to engage clutch 141. Then the new spool of wire is connected with the shaft 101.

The clutch (not shown) for connecting the press drive wheel 27 with its crankshaft 25 can be controlled manually by a lever 248 (Fig. 6) which rotates a shaft 255 or the shaft 256 may be automatically controlled by a arm 257 connected with a piston rod 258 connected with a piston (not shown) in cylinder 259. The ends of cylinder 259 are connected respectively by pipes 260 and 261 with a valve 262 having a pressure fluid inlet pipe 263 and an exhaust pipe 264. Valve 262 is controlled by a rod 265 connected with solenoid armatures 266 and 267 attracted respectively by solenoids 286 and 287. When solenoid 268 alone is energized, valve 262 is in a position to connect pipe 263 with pipe 260 to cause shaft 256 to turn counterclockwise to trip the press clutch for stopping when the die carrier 22 is in the position shown in Fig. 6. When the solenoid 269 alone is energized, the valve 262 is conditioned for causing clockwise rotation of shaft 256 to cause the press clutch. When the press is stopped as the result of passing pressure fluid through pipe 260, pressure fluid flows through pipe 270 to the upper end of cylinder 110 (Fig. 4) to cause rod 111 to move down to cause clutch part 98 to be disengaged from clutch part 90. Rotation of shaft 183 causes, but the press shaft 25 may rotate to outer-dead-center position at which position the press clutch disengages. When the press is started into operation as the result of admitting pressure fluid to pipe 260, pressure fluid passes through pipe 271 to the lower end of the cylinder 110 (Fig. 4) to cause rod 111 to move up to effect the engagement of clutch part 98 with clutch part 100 thereby connecting the spool shaft 142 with shaft 23 which rotates while the press shaft 26 is rotating.

By the operation of the machine and while the spool S is turning, the peripheries 150a and 151a of its ends 150 and 151 are engaged by a brake plate 221 (Fig. 2) attached to a shaft 220 supported by brackets 145a attached to the pedestals 145 and urged upwardly by a spring 222 (Figs. 4 and 5) to a lever 220 (Fig. 2) fixed to shaft 220. Spring 222 is attached by a chain 223 to a sprocket 224 which is loosely journalled on a stud 225 screwed into the left pedestal 145. Stud 225 is fixed to a disc 226 having radial teeth 227 for engaging similar formed teeth 228 in the hub of sprocket 224. A spring 229 confined between sprocket 224 and a nut 230 on stud 225 urges the teeth 228 of sprocket 224 into engagement with the teeth 227 of the disc 226, thereby retaining the sprocket 225 in any desired position of adjustment into which it may have been moved by a handle 231 connected with said sprocket 224. By grasping the handle and pulling the sprocket 224 out of engagement with the disc 226 and turning the handle the tension of the spring 229 may be adjusted to adjust the braking operation on the spool; and the release of the handle 221 permits the spring 229 to hold the sprocket 224 in the desired position of adjustment.

The brake plate 230 is controlled also in response to the application of pressure fluid to the cylinder 110. When the press 20 stops, rod 111 and lever 115 (Fig. 4) move down to disengage clutch parts 98 and 100 as has been explained. When lever 115 moves down it carries with it a block 240 (Figs. 4 and 5) pivotally supported at 241 by the lever 115. Block 240 is engaged by a spring 242 to receive a rod 245, the upper end of which is threaded to receive adjusting nuts 243 and 244. Between the nuts 244 and block 240 there is located a spring 245 which transmits pressure yieldingly from the block 240 to the nuts 244 thence to the rod 242. The rod 242 transmits this pressure to a pin 246 at the left end of a lever 247 pivoted at 248 (Fig. 5) and having a lever arm 249 pressing upwardly against the brake plate 221. An extra braking pressure is applied to the spool S sufficient to stop it when the press 20 stops so that no wire will be unreeled until the press starts. The starting of the press is accomplished by relief of this extra braking pressure, leaving spring 222 (Fig. 4) only effective to apply the brake plate 221. When threading wire through the feeder of application #431,084, the spool S is relieved of extra braking pressure, by moving lever 130 (Fig. 2) to the left which causes lever 115 to be locked and lever arm 246 (Fig. 5) to be retracted from plate 221.

An apron 250 protects the shafts 176 and 233 as the spool rolls from the floor into a position to be elevated by the levers 195.

The apparatus is not limited to the following manner:

Before threading the wire from a full spool S, which has been placed in unreeling position in the manner described, the press 20 is stopped by causing the solenoid 286 to be energized by closing a suitable switch (not shown). For safety and economy, the power drive (not shown) of the flywheel pulley 27 should be rendered inoperative. The pedal 192 (Fig. 5) is left in position 192a so that the lever 180 cannot be pulled from position 180a. This provides for separation of clutch parts 140 and 141 (Fig. 2). While lever 130 is located so as to lift bar 114 and thus to relieve the pressure of lever 240 (Fig. 5) on brake 221, wire is pulled from the spool S and is fed into the feeder of application #431,084. The wire having been passed through the feeder and into the press 20, the pedal 192 is pressed and lever 180 is moved from position 180a to position 180b (Fig. 5) to provide for the engagement of clutch parts 140 and 141. The wire-bending press and the wire-feeding mechanism are caused to operate. The press shaft 26 (Fig. 6) operates to drive the unreeler shaft 142, which drives the spool S so that unreeling of the wire takes place continuously as long as shaft 20 is rotating. The feeding mechanism
of application Serial #431,984 operates to move the wire intermittently at a time when the wire forming dies of the press are separated. As the wire is started into motion by the wire feeder, it is not jerked from the spool 8 since a slack portion has been provided between the spool and the feeder, said slack portion passing over a resiliently supported spool 66 (Fig. 1). After the wire is fed between the dies of the bending press, the press shaft 26 operates a wire-cutting device and causes the dies to form the severed wire into a hairpin for the use as a single turn on the conductor. The slack in the wire between the unreeler and the feeder is restored during the idle status of the feeder, while the unreeler is being continuously driven by the press shaft.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In apparatus for supplying wire from a wire supply spool to a bending press having an operating shaft, the combination comprising the press operating shaft, a supply spool, a shaft extending through the spool and drivingly connected therewith, frames for supporting the shaft to permit rotation of the spool, a drive shaft connectible with the spool shaft and driven by the press shaft, a clutch for connecting the shafts and permitting the spool shaft to overrun the drive shaft, means for stopping the spool, and means for disengaging the clutch and for rendering the spool stopping means effective.

2. In apparatus for supplying wire from a wire supply spool to a bending press having an operating shaft, the combination comprising the press operating shaft, a supply spool, a shaft extending through the spool and drivingly connected therewith, frames for supporting the spool shaft to permit rotation of the spool, a drive shaft connectible with the spool shaft and driven by the press shaft, a clutch for connecting the shafts and permitting the spool shaft to overrun the drive shaft, means for stopping the spool, control means for stopping the press shaft, and means responsive to the functioning of said control means for disengaging the clutch and for rendering the spool stopping means effective.

3. In apparatus for supplying wire from a wire supply spool to a bending press having an operating shaft, the combination comprising the press operating shaft, a supply spool, a shaft extending through the spool and drivingly connected therewith, a clutch driven part carried by the spool shaft, a clutch driving part operated by the press shaft and shiftable into engagement with the clutch driven part, frames for supporting the spool shaft with its clutch part in alignment with the clutch driving part, means for elevating the spool to the position wherein it is supported by the frames, and means for moving the clutch driving part out of engagement with the clutch driven part and thereafter for causing the elevation of the spool shaft from the supporting frames.

4. In apparatus for supplying wire from a wire supply spool to a bending press having an operating shaft, the combination comprising the press operating shaft, a shaft extending through the spool and drivingly connected therewith, a clutch driven part carried by the spool shaft, a clutch driving part shiftable into engagement with the clutch driven part, means operated by the press operating shaft for rotating the clutch driving part, cradle plates for supporting the spool shaft either in alignment with the clutch driving part or in a position out of alignment with the clutch driving part, wherein the spool is discharged, frames supporting the cradle plates for movement into either of said positions, and means actuated by a single manually operated member for causing, in response to the movement of the manual member in one direction, said clutch parts to be uncoupled and the cradle plates thereafter to be moved into spool discharging position and for causing, in response to the movement of the manual member in the other direction, the cradle plates to be returned to the first mentioned position and the clutch parts thereafter to be coupled.

5. In apparatus for supplying wire from a wire supply spool to a bending press having an operating shaft, the combination comprising the press shaft, a supply spool, a shaft extending through the spool and drivingly connected therewith, frames for supporting the spool shaft to permit rotation of the spool, means for ejecting the spool and shaft from the frames, means for transmitting motion from the press shaft to the supply spool and drivingly connected therewith, a clutch and a coupling connecting the clutch with the press driving shaft, means for effecting the stopping of the press shaft, means under the control of the press shaft stopping means for effecting disconnection of said clutch, and means for disconnecting said coupling and thereafter for operating the ejecting means.

6. In apparatus for supplying wire from a wire supply spool to a bending press having an operating shaft, the combination comprising a supply spool, a shaft extending through the spool and drivingly connected therewith, frames for supporting the spool shaft to permit rotation of the spool, a brake plate for engaging the spool, adjustable resilient means for urging the brake plate against the spool with pressure sufficient for tensioning the wire as it is unreeled, and other means for urging the plate against the spool with pressure sufficient to stop rotation of the spool.

7. In apparatus for supplying wire from a wire supply spool to a bending press having an operating shaft, the combination comprising the press operating shaft, a supply spool, a shaft extending through the spool and drivingly connected therewith, frames for supporting the spool shaft to permit rotation of the spool, a brake plate for engaging the spool, means for urging the brake plate against the spool with pressure sufficient for tensioning the wire as it is unreeled, control means for stopping the press shaft, and other means responsive to the functioning of said control means to stop the press shaft, for urging the plate against the spool with pressure sufficient to stop rotation of the spool.

8. In apparatus for supplying wire from a wire supply spool to a bending press, the combination with a power operated drive shaft, a supply spool, a shaft extending through the spool and drivingly connected therewith, frames for rotatably supporting the spool shaft in alignment with the drive shaft, means for connecting the shafts, and means for lifting the spool and spool shaft to the frames and including two supply spools adapted to be operated by a person concurrently, one of the devices being pulled up by the hands and the other being pushed down by the feet.

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