March 15, 1960 A. J. CIHLAR ET AL 2,928,453

APPARATUS FOR FEEDING AND FORMING ARTICLES

Original Filed Dec. 29, 1954 5 Sheets-Sheet 1

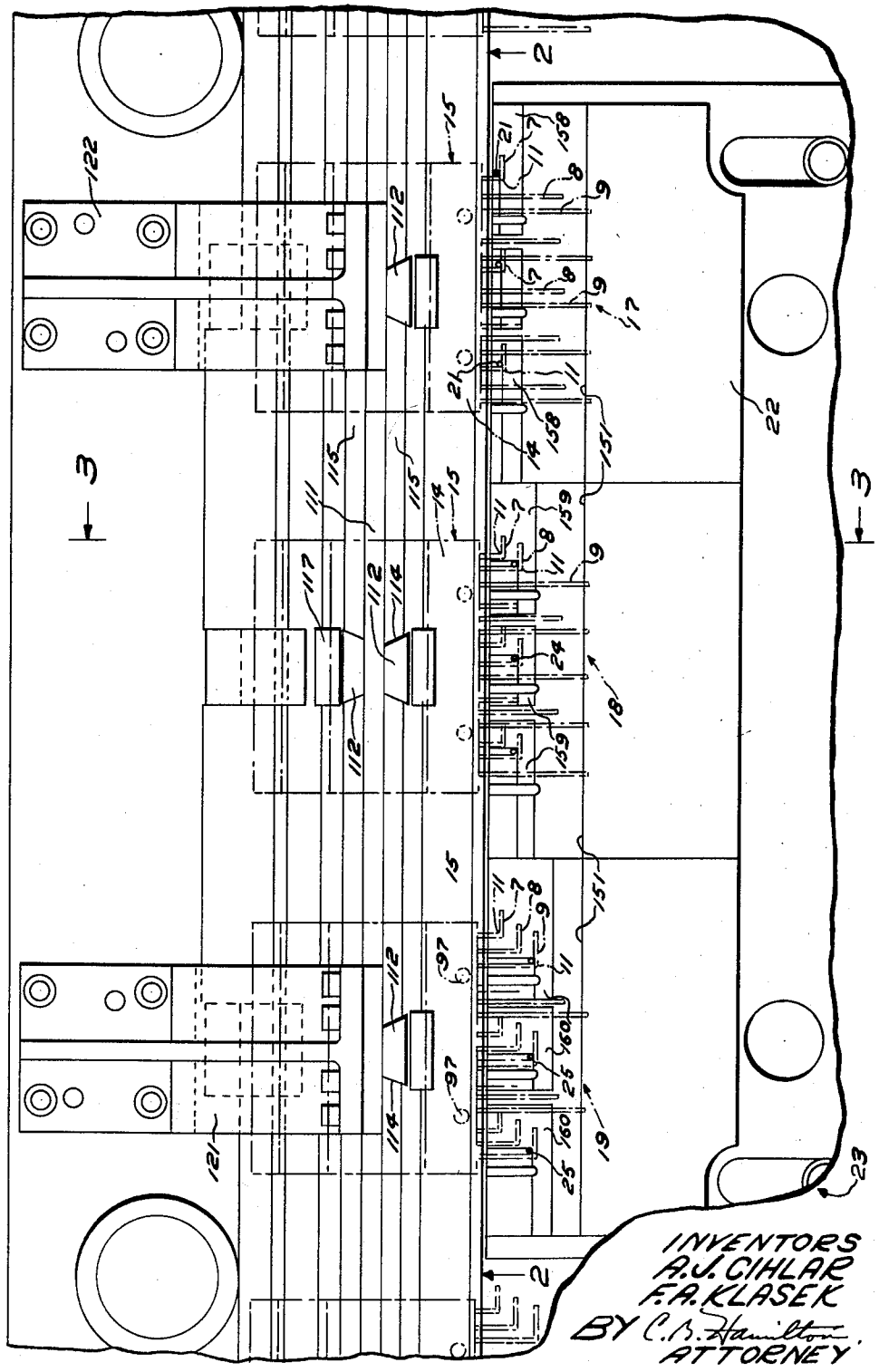


FIG. 1

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APPARATUS FOR FEEDING AND FORMING ARTICLES

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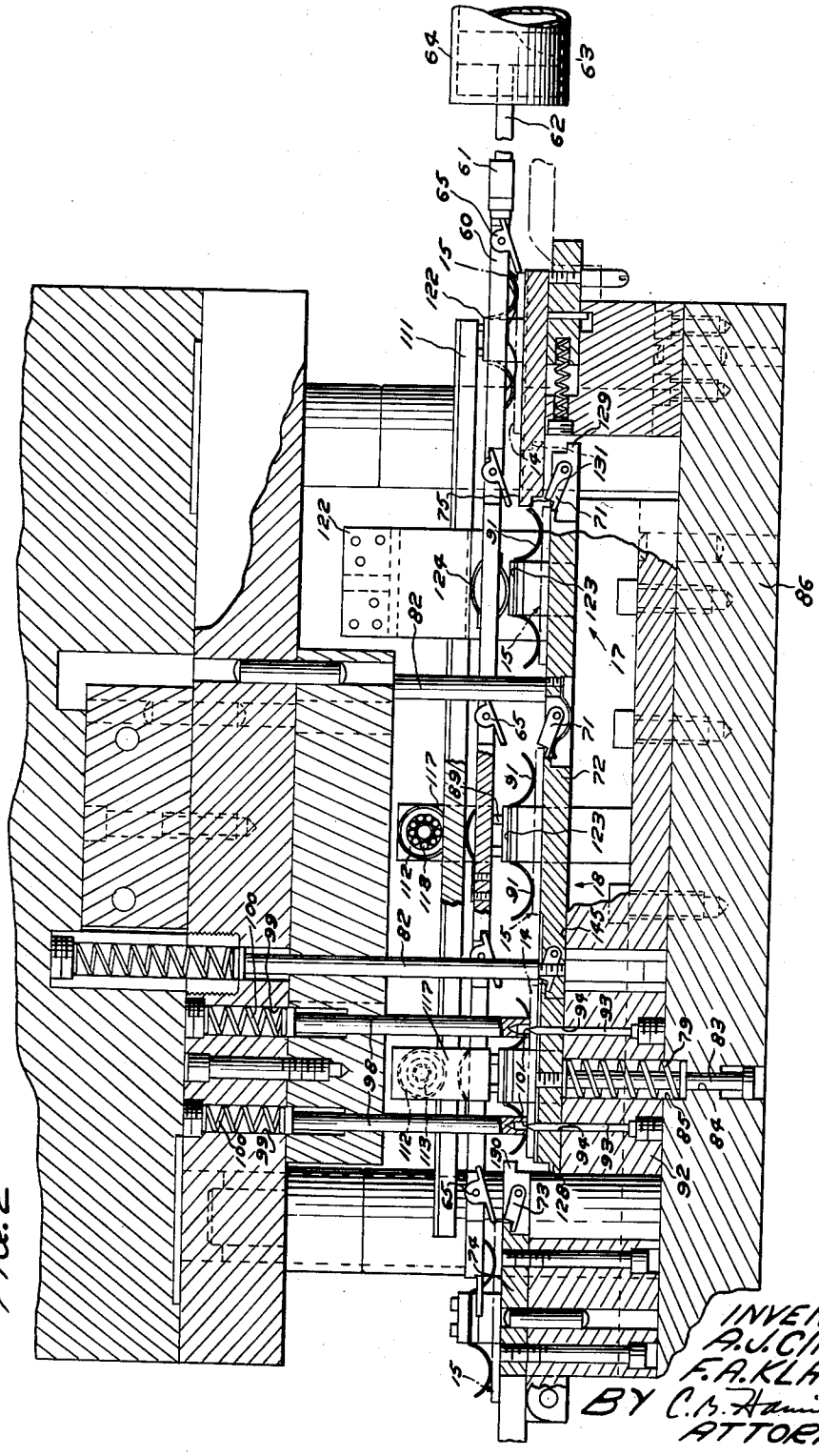


FIG. 2

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APPARATUS FOR FEEDING AND FORMING ARTICLES

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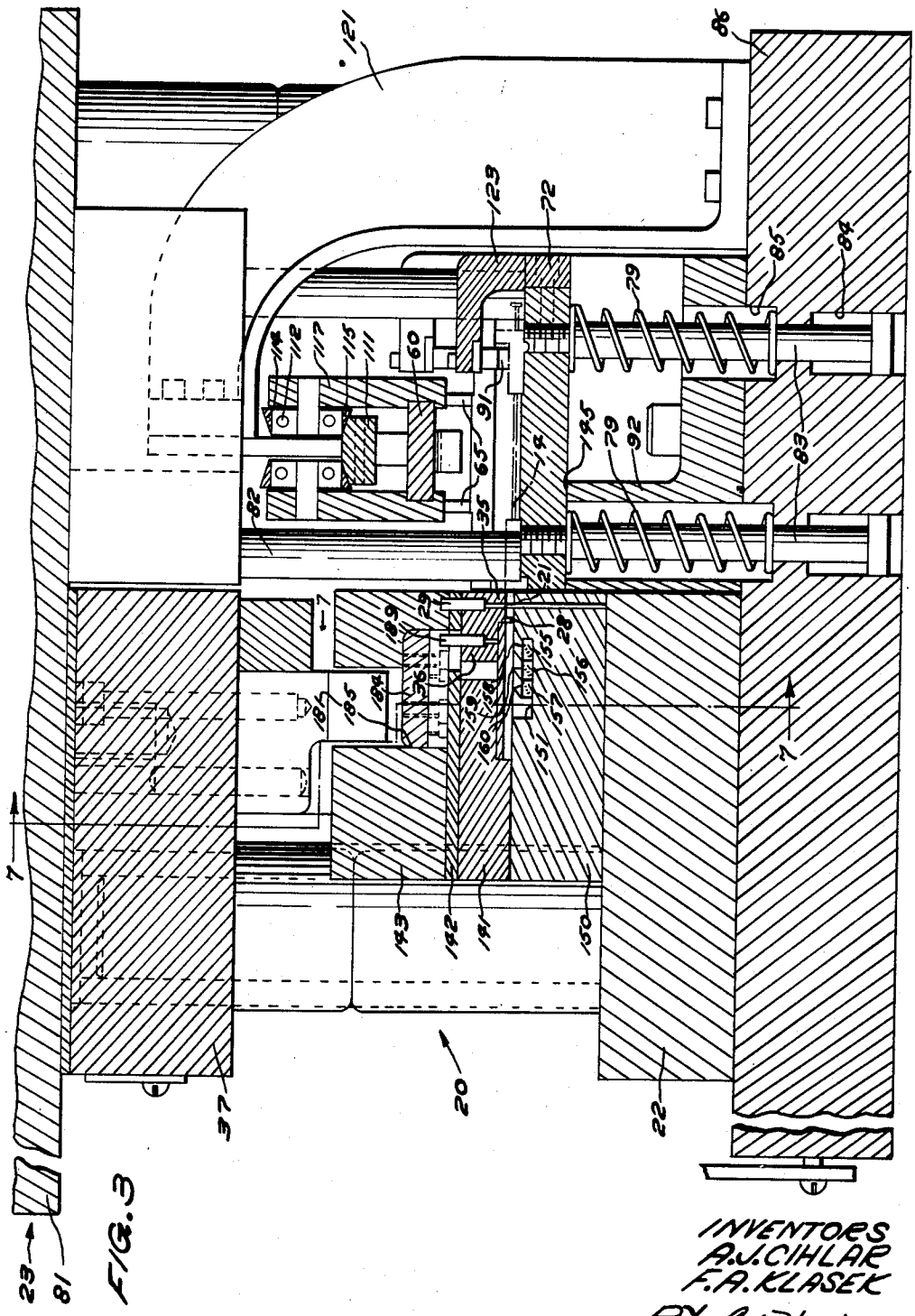


FIG. 3

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APPARATUS FOR FEEDING AND FORMING ARTICLES

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FIG. 4

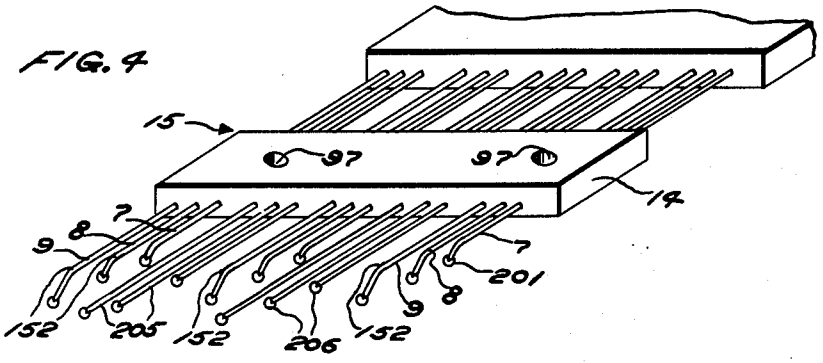


FIG. 5

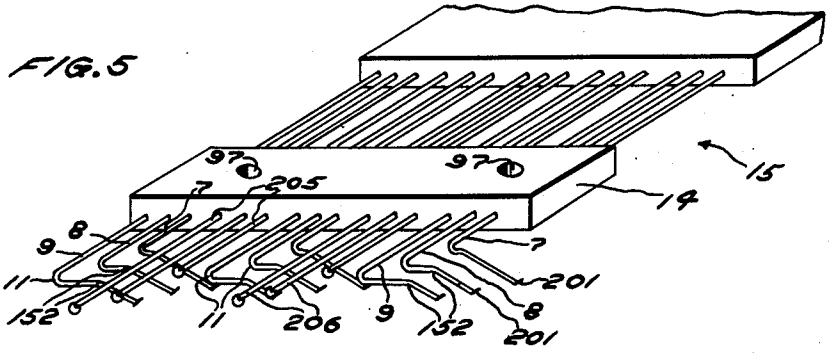
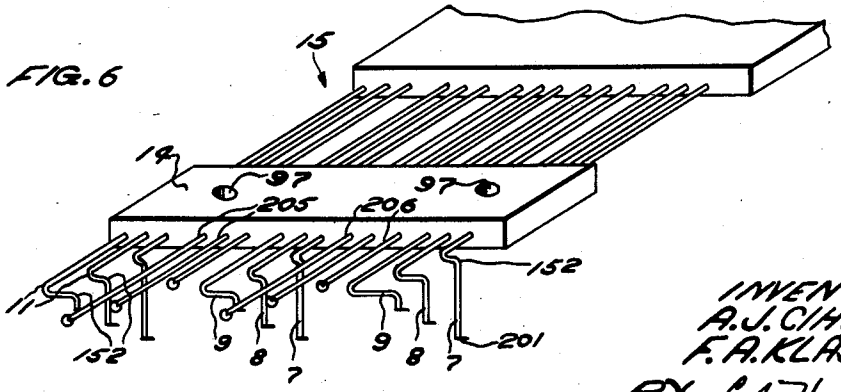


FIG. 6



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APPARATUS FOR FEEDING AND FORMING ARTICLES

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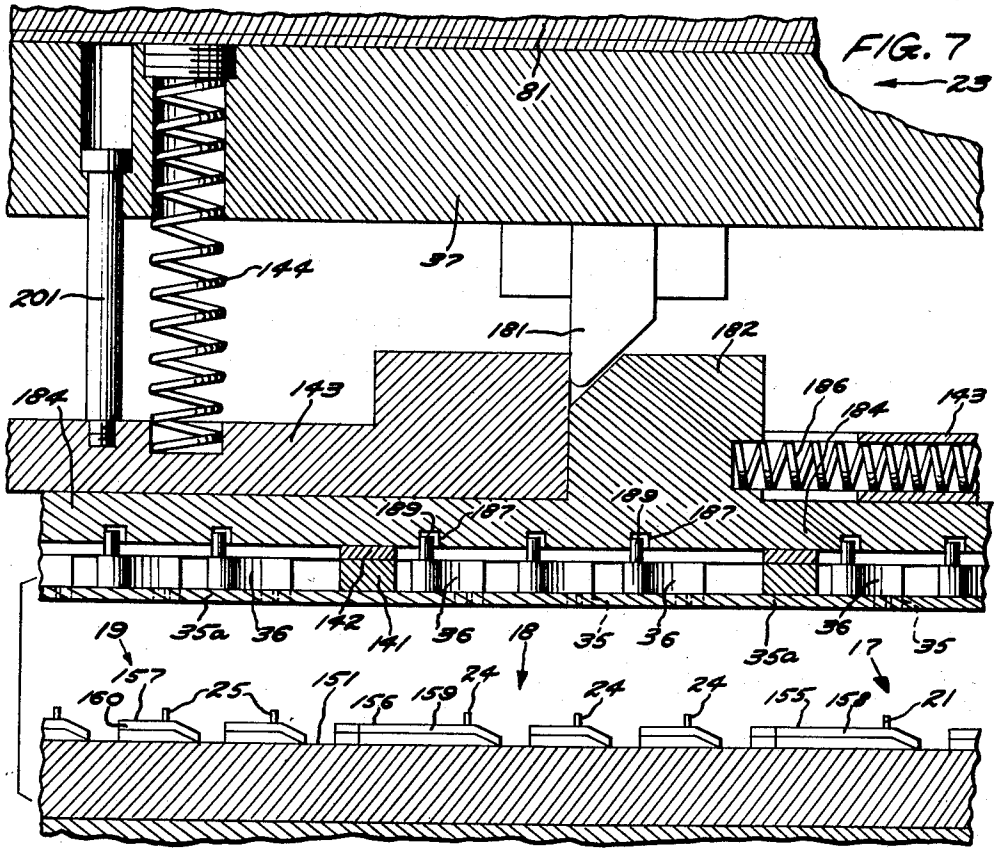


FIG. 7

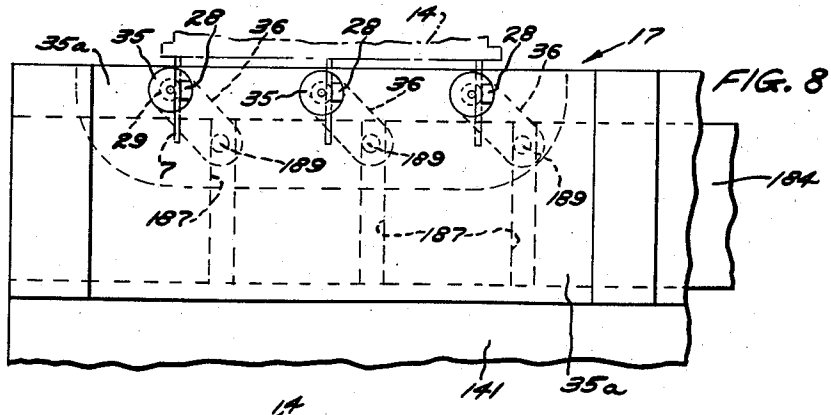


FIG. 8

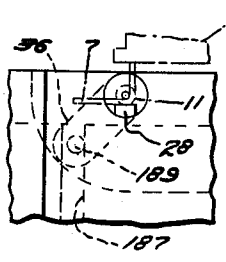


FIG. 9

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2,928,453

APPARATUS FOR FEEDING AND FORMING ARTICLES

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Original application December 29, 1954, Serial No. 478,336. Divided and this application October 25, 1956, Serial No. 618,333

8 Claims. (Cl. 153—45)

This invention relates to apparatus for feeding and forming articles, and more particularly to apparatus for feeding combs of wire spring relays and bending wires of wire spring relay combs.

This application is a division of copending application Serial No. 478,336, filed December 29, 1954, entitled "Methods of Forming Articles," now Patent No. 2,834,393.

An object of the invention is to provide new and improved apparatus for bending terminal portions of wire spring relay combs.

Another object of the invention is to provide new and improved apparatus for feeding articles, such as, for example, combs of wire spring relays.

Another object of the invention is to provide apparatus for feeding wire spring relay combs along a predetermined path and moving the combs downwardly into operative engagement with wire bending elements.

Another object of the invention is to provide apparatus for bending wires of a wire spring relay comb sequentially to form terminal ends.

A further object of the invention is to provide apparatus for feeding articles from station to station of a device for bending wires sequentially to right angle positions.

An apparatus illustrating certain features of the invention may include a path along which wire spring relay combs may be slid by a feed bar and including a section resiliently mounted and depressible out of the plane of the remainder of the bed to move the combs into working positions for operation of bending elements of a press. The bed is provided with a plurality of stop pawls permitting the combs to be slid thereover in one direction only, and a plurality of pawls carried by the feed bar are provided for feeding the combs in one direction only. Means also may be provided on the depressible portion of the feed bed for orienting the wire spring relay combs thereon and for clamping the combs.

A complete understanding of the invention may be obtained from the following detailed description of an apparatus forming specific embodiments thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a top plan view of a portion of an apparatus for practicing a method forming one embodiment of the invention;

Fig. 2 is a vertical section taken along line 2—2 of Fig. 1;

Fig. 3 is a vertical section taken along line 3—3 of Fig. 1;

Figs. 4, 5 and 6 are perspective views of a wire spring relay comb in several stages of forming;

Fig. 7 is a fragmentary enlarged sectional view of the apparatus taken along the line 7—7 of Fig. 3 and showing the wire-bending mechanism with portions thereof in raised position;

Fig. 8 is an enlarged fragmentary bottom plan view of the wire-bending mechanism showing wire-bending crank arms in their normal inoperative position; and

Fig. 9 is a fragmentary bottom plan view showing one of the wire-bending crank arms in operative position and indicating in dotted lines a wire bent by the crank arm through 90°.

Referring now in detail to the drawings, there is shown therein an apparatus for forming ends of wires 7, 8 and 9 (Figs. 4, 5 and 6) to horizontal right angle bends 11, the wires projecting beyond molded blocks 14 of wire spring relay combs 15. The apparatus includes three forming stations 17, 18 and 19 (Fig. 1), and the right angle bends 11 in the wires 7 are formed at the station 17, the right angle bends 11 in the wires 8 are formed at the station 18 and the right angle bends 11 in the wires 9 are formed at the station 19. The bends 11 in the wires 7 are formed around pins 21 projecting from a bed or bottom platen 22 of a tool unit 20 replaceable in a press 23. Pins 24 and 25 are similarly mounted on the bed 22 at the stations 18 and 19, respectively, for bending the wires 8 and 9, respectively. The wires are engaged and bent around the pins 21, 24 and 25 by dogs illustrated by a dog 28 (Figs. 3 and 7 to 9) mounted on projections 35 formed on crank arms 36. The projections or journals 35 on the crank arms 36 are rotatably supported in suitable apertures in a supporting plate 35*a*. The dogs 28 and the crank arms 36 are mounted by a shaft 29 pivotally about the centers of the projections 35 on an upper platen 37 of the tool unit 20.

The combs 15 are fed from right to left, as viewed in Fig. 2, by a feed bar 60 adjustably fastened by a connector 61 to a piston rod 62 of a piston 63 mounted in a pneumatic cylinder 64 controlled by a suitable four-way valve (not shown). The cylinder 64 and the piston 63 reciprocate the rod 62, and, each time the rod 62 is reciprocated, feed pawls 65 engage and push the blocks of the combs 15 to the left a distance just sufficient to move the combs from one station to the next. Each time the feed bar 60 is retracted, the pawls 65 ride over the combs 15 without moving the combs, the combs being held against movement back with the feed bar by holding pawls 71 mounted on a resiliently mounted plate 72 and pawls 73 mounted on a fixed plate 74.

After each feeding movement and retraction of the bar 60, the press 23 is operated and an upper platen 81 thereof carrying the platen 37 is moved downwardly to move the plate 72 against springs 79 through push rods 82 downwardly out of the plane of the plate 74 and a feeding station plate 75. The springs 79 are mounted on rods 83 slidable in bores 84, and are seated in counterbores 85 in a fixed base plate 86 to which the lower platen 22 is secured. The combs 15 are pressed against the plate 72 by leaf springs 91, and the wires 7, 8 and 9 of the combs 15 are moved over the pins 21, 24 and 25. Downward movement of the plate 72 is limited by a block 92 which supports tapered locating pins 93 projecting into bores 94 in the plate 72. As the plate 72 is moved downwardly from its uppermost or feed position to its lowermost or work position, the blocks 14 of the combs 15 carried thereby are moved over the pins 93, which enter close-fitting bores 97 to precisely and firmly locate the combs 15 on the plate 72. Three sets of presser rods 98, urged downwardly in bores 99 in the platen 81 by springs 100, are mounted in alignment with the pins 93 and receive the tapered ends of the pins 93 in complementary sockets 101. The presser rods 98 aid the springs 91 in keeping the blocks 14 seated on the plate 72 as the plate 72 is lowered.

The feed bar 60 (Figs. 1 and 3) is supported by a fixed, rigid guide rail 111 and pairs of tapered rollers 112 mounted on bearings 113 and having tapered or frusto-conical portions 114 rotatable along tapered upper surfaces 115 of the rail 111. The rollers 112 are mounted

rotatably on plates 117 bracketing the rail 111 and fixed to the feed bar 60 to form a trolley type suspension for the bar 60. The rail 111 is rigid, and is supported at its ends by fixed brackets 121 and 122. The arcuate holddown springs 91 are carried by brackets 123 fixed to the plate 72, and leaf spings 124 fixed to the feed bar 60 press against the bottom of the rail 111 to urge the feed bar to a predetermined level limited by the rollers 112 and the rail 111. The springs 124 permit upward movement of the bar 60 by warped or dislocated blocks 14. The upward movement of the plate 72 by the springs 79 is limited by lap joint type projections 128 and 129 on the plate 72 which engage complementary projections 130 and 131, respectively, on the fixed plates 74 and 75 forming slides for the combs at opposite ends of the plate 72.

The upper platen 37 of the press 23 carries, by mounting pins or bolts (not shown), assembly plates or bars 141, 142 and 143 (Fig. 3) thereon, which are urged downwardly away from the platen 37 by compression springs 144 (Fig. 7). As the platen 37 is moved downwardly, it moves the plate 72 downwardly to a stop 145 to move the wires 7, 8 and 9 to the pins 21, 24 and 25, recesses 151 being provided in a block 150 on the platen 22 for clearance for the ends of the wires, which have 30° downwardly directed bends 152 (Fig. 4) therein so that they may travel under adjacent groups of wires as the 90° horizontal bends are formed therein. Supports 155, 156 and 157 (Fig. 3) having sloping or relieved portions 158, 159 and 160 support the wires 7, 8 and 9 to keep the wires from slipping downwardly out of contact with the dogs after the dogs are brought down into the plane of the wires and are actuated to bend the wires around the pins 21, 24 and 25. The sloping portions extend on two adjacent sides of the pins 21, 24 and 25 to support the wires throughout their bending movement.

The tool unit 20 (Fig. 3) includes a cam or wedge 181 carried with the platen 37 for pushing, when lowered, a cam follower 182 (Fig. 7) to push a horizontally movable actuating slide 184 along a guideway 185 formed in the plate 143. The slide 184 is returned on the up stroke of the platen by a spring 186 (Fig. 7). The slide 184 has a plurality of transversely disposed grooves 187 (Figs. 7 to 9) for receiving the upwardly extending end portions of pins 189 mounted on the ends of the crank arms 36. Movement of the slide 184 turns the crank arms 36 (Figs. 8 and 9) about the centers of the shafts 29 and the projections 35 during the latter portion of the downward stroke of the platen to bend the wires 7, 8 and 9, engaged by the dogs 28, 90° horizontally around the pins 21, as described more fully and claimed in our copending application Serial No. 478,337, filed December 29, 1954. The plate 143 normally is urged downwardly away from the platen 37 by the springs 144, and as the platen 37 starts back up, the plates 141, 142 and 143 remain down against the block 150 until the cam 181 has retracted and the slide 184 has returned the crank arms 36 to their normal, wire-clearing positions. Then the plates 141, 142 and 143 are lifted upwardly from the block 150, and from the plate 72 by headed pins 201 extending upwardly from the plate 143 and mounted for limited movement in counterbores in the platen 37 (Fig. 7) after the plate 72 is stopped by the plates 74 and 75. The piston 63 (Fig. 2) then may be actuated to reciprocate the feed bar 60 and feed each of the combs one station to the left, as viewed in Fig. 2. On the forward stroke of the feed bar 60, the furthermost right comb 15 at the feed position is fed under the holddown springs 91 to the station 17, and each of the combs 15 are fed one station to the left. On the retracting stroke of the feed bar 60, the pawls 71 and 73 keep the combs from being pulled back to the right.

Operation

The combs 15, prior to arrival at the press 23, have

spades 201 (Figs. 4, 5 and 6) formed thereon and the 30° vertical bends 152 are made at progressively farther points from the block 14 proceeding from the wires 7 to the wires 9. The bends 152 also are provided prior to the arrival at the press that, as the bends 11 are formed, the spade portions 201 will pass under and not be obstructed by adjacent groups of wires 205 and 206. Each comb is pushed by the bar 60 step-by-step from the station to the right of the station 17, as viewed in Fig. 2, from the station 17 to the station 18, from the station 18 to the station 19 and from the station 19 to the station to the left thereof. The press 23 is reciprocated between each feeding movement. On each downward movement of the platen 81, the rods 82 first push the plate 72 against the stop 145 and the plate 141 (Fig. 3) against the block 150. The rods 98 push the blocks 14 down on the alignment pins 93 (Fig. 2) to precisely locate the combs 15, and the wires 7, 8 and 9 rest on the supports 155, 156 and 157 in the recesses 151. On further downward movement of the platen 81, the cam 181 actuates the actuating slide 184 to swing the crank arms 36 to bend the wires 7, 8 and 9 to form the 90° horizontal bends 11, the spades 201 and end portions of the wires swinging under the wires 205 and 206 as the bends are formed. The supports 155, 156 and 157 support the wires as the bends 11 are formed. The bends 11 in the wires 7 are formed at the station 17, those in the wires 8 at the station 18 and those in the wires 9 at the station 19.

After the combs 15 have been moved out of the press 23, another press (not shown) forms bends corresponding to the bends 11 in the wires 205 and 206 after 30° bends corresponding the bends 152 have been made. Another press (not shown) then bends the wires 7, 8, 9, 205 and 206 to make the bends 152 90°. By first forming the 30° bends rather than the full 90° vertical bends, the wires may be bent into the 90° horizontal bends 11 without slippage on the wires by the bending dogs, which is of particular importance in bending the wires 7 where a very short horizontal portion projects beyond the bends 11. By bending the wires 7, 8 and 9 at different stations and the wires 205 and 206 in a different press sufficient space is provided to make the bending elements rugged and durable.

The above-described apparatus rapidly forms the several bends very accurately, and feeds the combs surely and precisely.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An article-handling apparatus, which comprises a base, a horizontal feed bed secured to said base and having a central portion depressible from a feed position to a work position, rail means spaced above and extending along the bed, ratchet feed means movable along the rail means for indexing articles along said bed, a plurality of pins secured to said base for entering holes in articles as the articles are lowered with the central portion of the feed bed to orient the articles, and means for pressing the articles and the central portion of the feed bed downwardly.

2. An article-handling apparatus, which comprises a base, a horizontal feed bed secured to said base and having a central portion depressible from a feed position to a work position, rail means spaced above and extending along the bed, ratchet feed means for indexing articles along said bed, trolley means movable along the rail means supporting the feed means, a plurality of leaf spring clamps carried by the central portion of the bed for clamping articles to the central portion of the bed, a plurality of pins secured to said base for entering holes

in articles as the articles are lowered with the central portion of the feed bed to orient the articles on the bed, and means for pressing the articles and the central portion of the feed bed downwardly.

3. An apparatus for bending articles, which comprises a fixed vertically upstanding bending element, an article-supporting plate extending transversely to and spaced from the bending element, means urging the plate to a retracted position relative to the bending element such that a portion to be bent of an article on the plate is retracted from the bending element, means for holding the article against the plate, a presser for pressing the plate to a work position such that said portion of the article is positioned adjacent to the bending element, a rotatable bending element carried with and operable by the presser for engaging said portion and bending said portion in cooperation with the fixed bending element, and means for advancing the article along the plate.

4. An apparatus for bending articles, which comprises a plurality of fixed vertically upstanding bending elements, an article-supporting plate extending transversely to and spaced from the bending elements, means urging the plate to a retracted position relative to the bending elements such that portions to be bent of articles on the plate are retracted from the bending elements, means for holding the articles against the plate, a presser for pressing the plate to a work position such that said portions of the articles are positioned adjacent to the bending elements, bending elements carried with and operable by the presser for engaging said portions and bending said portions around the first-mentioned bending elements after the plate has been moved to its work position, and means for advancing the articles step-by-step along the plate.

5. An apparatus for bending articles, which comprises a plurality of fixed vertically upstanding bending elements, an article-supporting plate extending transversely to and above the bending elements, means urging the plate upwardly to an upper position relative to the bending elements such that portions to be bent of articles on the plate are above the bending elements, leaf springs carried by the plate for pressing the articles against the plate, a presser for pressing the plate downwardly to a lower position such that said portions of the articles are positioned adjacent to the bending element, bending elements carried with and operable by the presser for engaging said portions and bending said portions around the bottom bending elements after the plate has been moved to its lower position, a reciprocable feed bar extending above the plate, and a plurality of feed pawls carried by the feed bar for pushing the articles along the plate.

6. An apparatus for bending articles, which comprises a base, a plurality of fixed vertically upstanding bending elements mounted on said base, an article-supporting plate extending transversely to and above the bending elements, means on said base for urging the plate upwardly to an upper position relative to the bending elements such that portions to be bent of articles on the plate are above the bending elements, leaf springs carried by the plate for pressing the articles against the plate, a presser for pressing the plate downwardly to a lower position such that said portions of the articles are positioned adjacent to the bending elements, bending elements carried with and operable by the presser for engaging said portions and bending said portions around the bottom bending elements after the plate has been moved to its lower position, a reciprocable feed bar extending above the plate, a plurality of feed pawls carried by the feed bar, a plurality of stop pawls mounted on the plate, means carried by the presser for pressing the articles against the plate, and lining pins secured to said base for entering holes in the articles to locate them as the plate is moved to its lower position.

7. An apparatus for working articles, which comprises a base, a plurality of fixed vertically upstanding article-working elements mounted on said base, an article-supporting plate extending transversely to and spaced from the article-working elements, means on said base for urging the plate to a retracted position relative to the article-working elements such that portions to be worked of articles on the plate are spaced from the article-working elements, means for pressing the supporting plate downwardly against the influence of the urging means to position said portions of the articles adjacent to the working elements, means for moving the plate to a work position such that said portions of the articles are positioned adjacent to the article-working elements, means for advancing the articles along the plate including a reciprocable feed bar extending above the plate and a plurality of feed pawls carried by the feed bar, a plurality of stop pawls mounted on the plate, means carried by the presser for pressing the articles against the plate, and lining pins on said base for entering holes in the articles to locate them as the plate is moved to its lower position.

8. An apparatus for working articles, which comprises a base, a plurality of fixed vertically upstanding article-working elements mounted on said base, an article-supporting plate extending transversely to and above the article-working elements, means urging the plate upwardly to an upper position relative to the article-working elements such that portions to be worked of articles on the plate are above the article-working elements, leaf springs carried by the plate for holding the articles against the plate, a presser for pressing the plate downwardly to a lower position such that said portions of the articles are positioned adjacent to the article-working elements, article-working elements carried with and operable by the presser for engaging said portions and working said portions around the bottom article-working elements after the plate has been moved to its lower position, a reciprocable feed bar extending above the plate, a plurality of feed pawls carried by the feed bar, a plurality of stop pawls mounted on the plate, means carried by the presser for pressing the articles against the plate, and lining pins secured to said base for entering holes in the articles to locate them as the plate is moved to its lower position.

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