June 28, 1955 J. T. O'KEEFE ET AL 2,711,809

ROLLING MILL SWITCHING APPARATUS

Filed Aug. 5, 1954 3 Sheets-Sheet 1

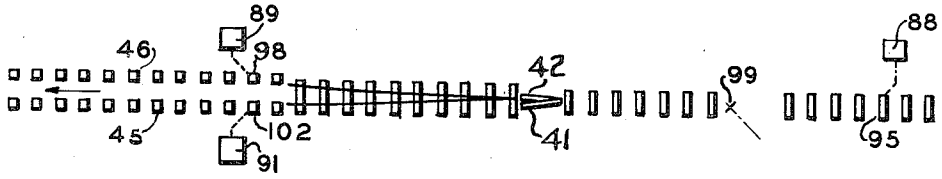


Fig. 1

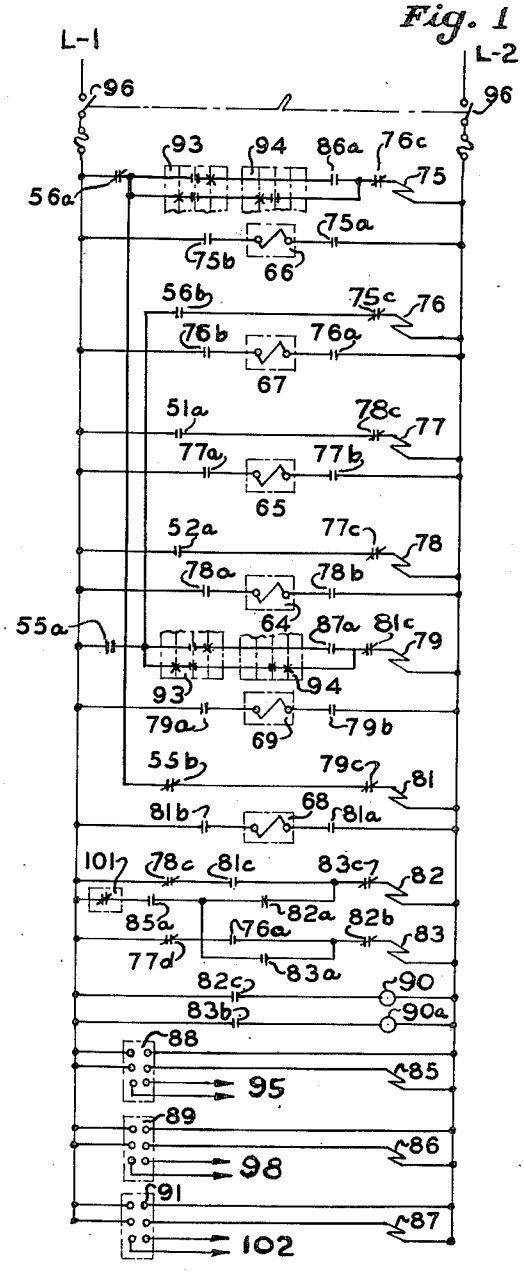


Fig. 7

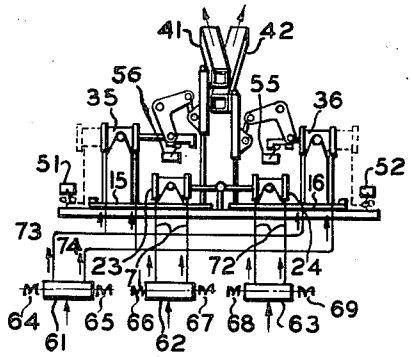


Fig. 5

Fig. 6

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Filed Aug. 5, 1954 3 Sheets-Sheet 2

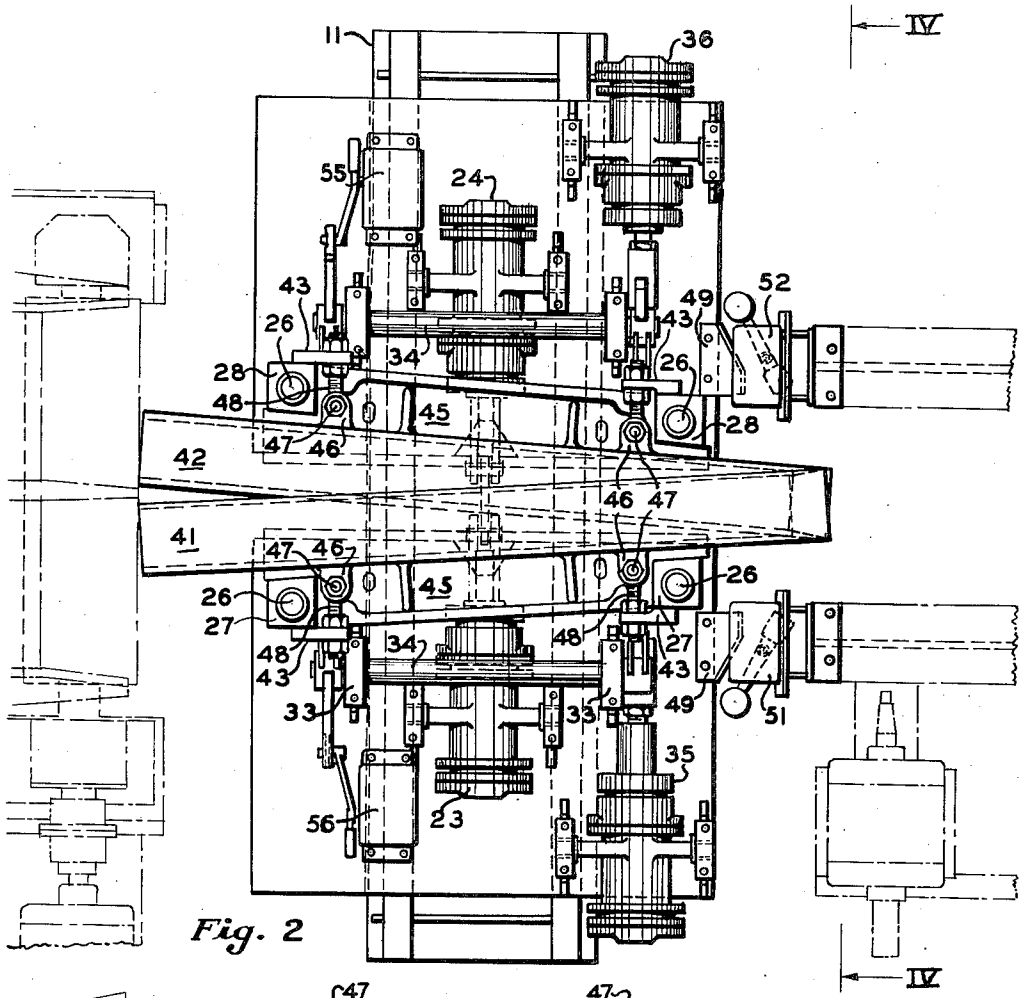


Fig. 2

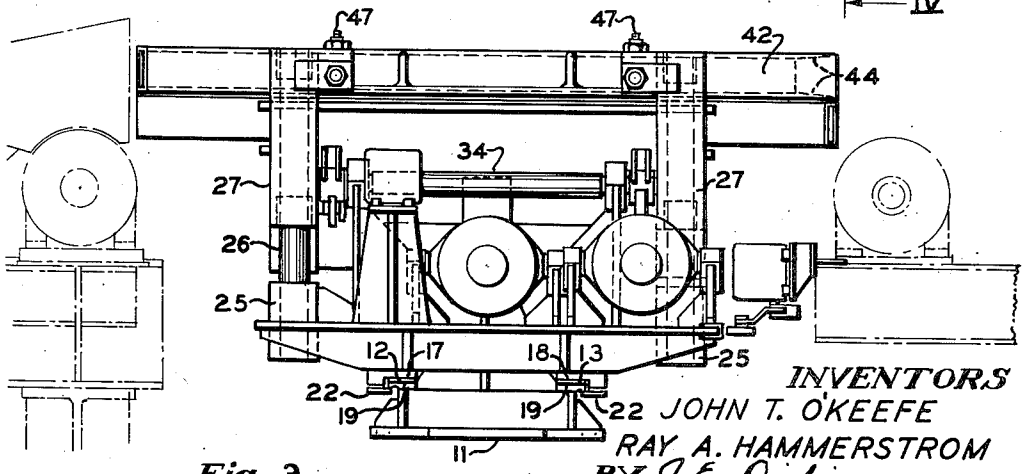


Fig. 3

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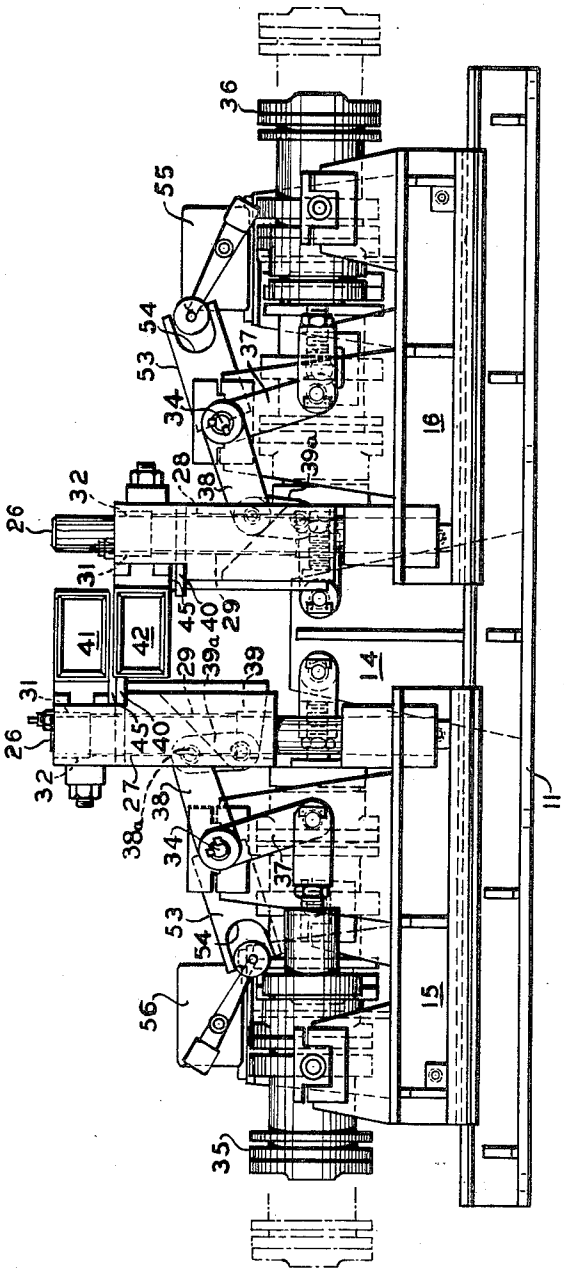


Fig. 4

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ROLLING MILL SWITCHING APPARATUS

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Application August 5, 1954, Serial No. 448,092

9 Claims. (Cl. 193—39)

This invention relates to a switching apparatus and in particular to a switch employed for alternately changing the direction of forward movement of elongated workpieces received at a common receiving station.

In the manufacture of metallic bars or rods in modern day rolling mills, as workpieces issue from the last mill stand, it is the customary practice to shear them into a number of pieces of shorter length, determined by the length of the hot bed to which they are directed. Inasmuch as the output of a mill of this type is extremely high, the usual practice for handling the workpieces is to employ two hot beds on to which the workpieces are alternately directed. In this operation it is necessary to employ a suitable switching mechanism arranged between the shear and the two hot beds which so operates to direct alternately the sheared workpieces to either of the beds.

As the shearing is performed on the "fly" and without imparting any delay in the forward progress of the pieces as they are sheared, due to the fact that the ends of the two sheared pieces are closely adjacent one another, the mechanism heretofore employed for switching alternately from one side to the other has not proved very satisfactory.

It is, accordingly, one of the objects of this invention to provide a switching apparatus for switching alternately any number of workpieces which are received at a common receiving station regardless of how close the trailing end of one rod may be to the leading end of the following one.

It is another object of this invention to provide a switching apparatus in the form of two angularly disposed guide boxes, either of which will normally be in position to receive a workpiece and direct it to the hot bed associated therewith.

It is a further object of this invention to provide a pair of switch guide boxes through which a plurality of workpieces may be alternately directed to a pair of hot beds or the like, the boxes being so arranged that each one of them is quickly withdrawn from its workpiece receiving position prior to the complete passage of a workpiece therethrough for permitting the other guide box to be shifted into the receiving station for accommodating the next succeeding workpiece.

It is still a further object of this invention to provide means for automatically controlling the movement of the switch guide boxes in a timed relationship so that one of the switching elements will normally be in position to receive an oncoming workpiece.

The foregoing objects, as well as the various other novel features and advantages of this invention, will become apparent from the following specification and accompanying drawings of which:

Figure 1 is a plan view of shear and switching apparatus embodying the features of this invention and including run-out tables for directing the sheared bars to the hot beds;

Figure 2 is an enlarged and detailed plan view of the switching apparatus shown in Figure 1;

Figure 3 is an end view of the apparatus shown in Figure 2;

Figure 4 is a front elevation view taken at line IV—IV of Figure 2;

Figure 5 is a diagrammatic, perspective view of the apparatus shown in Figure 2, certain parts of the apparatus being omitted to illustrate the construction more clearly;

Figure 6 constitutes a wiring diagram showing the electric circuit for automatically controlling the operation of the switch disclosed herein; and

Figure 7 is a diagrammatic view showing the relative movements of the guides during the operation thereof.

With reference to the drawings, in particular, Figures 2, 3 and 4, the apparatus as illustrated therein comprises a sub-base 11 disposed transversely of and below the mill pass line and having surfaces 12 and 13 on its outer edges extending across its entire length and an upright crosspiece 14 arranged at a position equally distant from the ends thereof. Mounted on the sub-base there are two sliding bases 15 and 16, each arranged on opposite sides of the upright 14 and provided with sliding surfaces 17 and 18 which engage with the surfaces of the liners 19 affixed to the sub-base surfaces 12 and 13. Keeper plates 22 are attached to the sliding bases 15 and 16 for retaining the bases in their horizontal positions. The transverse movements of these bases are effected by individual cylinders 23 and 24 which are mounted on the bases, the piston rods being connected to the stationary upright portion 14 of the sub-base 11. In the construction shown on these drawings, the sliding bases 15 and 16 extend over the edges of the sub-base 11. On the inner corner of each of the sliding bases there is provided a pair of bosses 25 with vertical openings therethrough into each of which there is received a guide post 26. Each pair of posts 26 serves as a vertical guide and support for individual frames 27 and 28 which are provided with similar openings 29 having at their reamed ends 31 bushings 32 which slidably engage with the posts 26. Secured to the bases 15 and 16 and outboard of the two frames 27 and 28 there are pedestal bearings 33 for supporting a pair of rock shafts 34. Also secured to the bases 15 and 16 there are two piston cylinder assemblies 35 and 36, the piston rods of which are connected to lever 37 keyed to the shafts 34. From the shafts 34 and keyed thereto there extend inwardly two pairs of levers 38 to which there are pivotally connected links 39*a* which in turn are pivotally connected to brackets 39 secured to each of the frames 27 and 28. On each of the frames 27 and 28 there is provided a horizontally disposed plate 40 upon which there are supported guide boxes 41 and 42 which are secured to lugs 43 attached to and extending inwardly from the frames 27 and 28.

The guide boxes are provided with a wide tapering opening 44 at the entrance end for receiving and directing a workpiece therethrough. End brackets 45, extending outwardly from each of the guide boxes, have formed integral therewith suitable lugs 46 having openings therethrough and through which there are passed pins 47 for engaging with and securing thereto adjustable eye-bolts 48. As shown in Figure 2, the opposite ends of the bolts 48 are adjustably secured to the lugs 43. By means of this arrangement, adjustment is provided for the guide boxes both horizontally and vertically in order that the angle of deflection defined by the guide box position may be readily controlled and the pass line of the mill maintained.

For controlling in a timed relationship the vertical and horizontal movement of these guide boxes 41 and 42 in a manner so that they may be alternately brought into and withdrawn from the receiving position, a number of limit switches are employed which are operatively arranged to be actuated by movement of the sliding bases 15 and 16 and of the frames 27 and 28. Each sliding base 15 and 16 is provided with an outwardly projecting cam surface 49 arranged to engage with and trip limit switches 51 and 52 located adjacent thereto, and as shown in Figure 4, for each of frames 27 and 28, there are provided levers 53, keyed to the common supporting shaft

of levers 37 and 38, having at their outer ends an opening 54 into which there are received the rollers of limit switches 55 and 56.

The control circuit for operating the cylinders 23, 24, 35 and 36 as shown in Figures 5 and 6 includes a plurality of double acting solenoid operated valves 61, 62 and 63 each having pairs of coils 64 and 65, 66 and 67 and 68 and 69 respectively, valves 62 and 63 being connected to cylinders 23 and 24 by pipes 71 and 72 and valve 61 with cylinders 35 and 36 by suitable pipes 73 and 74. It is to be noted that the pipes 73 and 74 connected to cylinders 35 and 36 are reversed so that opposite directional movement is effected in the operation of these two cylinders.

With reference particularly to Figure 6, the solenoids are included in an electrical circuit in which a number of relays are provided having relay coils 75, 76, 77, 78, 79, 81, 82 and 83. Also included in the circuit there are shown the various contacts associated with the aforementioned relays and to identify them readily with the particular relay to which they refer they are numbered 75*a*, *b* and *c*; 76*a* and *b*; 77*a*, *b*, *c* and *d*; 78*a*, *b* and *c*; 79*a*, *b* and *c*; 81*a* and *b*; 82*a*, *b* and *c* and 83*a*, *b* and *c*. In addition to the aforementioned relays auxiliary relays are also provided in the circuit having coils 85, 86 and 87 with suitable contacts 85*a*, 86*a* and 87*a* respectively and low energy relays of which the coils are not shown, which are identified by numerals as 88, 89 and 91. The purpose of having the low energy relays as designated is for safety reasons since circuits at the points at which they are employed are exposed so that workmen who may inadvertently come into contact therewith will not be injured. In order that the controls may be operated either automatically or manually, two switches 93 and 94 are connected into the circuit for changing readily from one mode of operation to the other. At the side of table ahead of the switching mechanism one of the table rollers 95 is insulated and is electrically connected to the low voltage control circuit of the low energy relay 88 for a purpose to be hereinafter defined. Although an insulated roller 95 is shown in the present embodiment of the subject invention, it will be apparent that other means may be substituted such as a photoelectric cell system or the like. By means of switch 96, the control circuit is connected to a source of power L1 and L2. In the circuit there are two lamps 90 and 90*a*, which when alternately lighted indicate to which hot bed, whether right or left, the workpieces will be directed. Beyond the switching mechanism there are two additional insulated rollers 98 and 102 electrically connected to the low voltage control circuit of the low energy relays 89 and 91 respectively.

The apparatus and the controls therefore defining this invention having been specifically set forth, the operation thereof may be briefly summarized as follows:

Let it be assumed that the switch 93 has been set for automatic operation. The circuit through the limit switch contacts 55*a* and 55*b*, and 56*a* is completed and as the contact 79*c* is normally closed, coil 81 is thereby energized which in turn causes contacts 81*a*, 81*b* and 81*c* to close thus energizing coil 68. Inasmuch as the guide box 42 is already in the workpiece receiving position, there will be no movement thereof until at least a portion of the workpiece has passed therethrough and is directed to the particular hot bed associated with that guide box. In Figure 1, as the workpiece initially passes over insulated roller 95, auxiliary relay 88 is energized which in turn causes the relays 85 and 82 to be energized. The closing of contact 81*c* completes the circuit for energizing coil 82 which in turn closes contact 82*a*, opens contact 82*b* and closes contact 82*c* to complete the circuit to light an indicator lamp 90, which indicates to the operator the particular hot bed to which the workpiece will be directed and in the instant case will show that the workpiece will be deposited upon the right hot bed.

As the workpiece leading end passes out of the guide box 42 and onto the right hot bed run-out table 46, contact is made with another insulated table roller 98 which closes the electrical circuit thus to energize auxiliary low energy relay 89 which in turn causes relay 86 to be energized and close contact 86*a* to complete the circuit for energizing relay coil 75. When coil 75 is energized contacts 75*a* and *b* thereof will close thereby closing the circuit for and energizing the solenoid 66 of the valve 62. Fluid under pressure will then be discharged through the valve 62 to the piston-cylinder assembly 23 thereby causing guide box 41 to move to the left of its top position.

Movement of guide box 41 to the left will trip the limit switch 51 and close contact 51*a* thereby completing the circuit through normally closed contact 78*c* thereby to energize relay coil 77 and to close contacts 77*a* and *b* thus to energize solenoid 65 of the valve 61. Fluid under pressure will cause reverse action of the piston-cylinder assemblies 35 and 36 thus to move guide box 42 to its top position and guide box 41 to its lower position. The downward movement of the guide box 41 will trip limit switch 56 to open contact 56*a*, thus to break the circuit and deenergize relay coils 75 and 81 and at the same time close the contact 56*b* and complete the circuit for relay coil 76. This action is made possible for during this sequence of operation the normally closed contact 75*c* is open.

When the guide box 42 moves upwardly limit switch 55 is released, causing the contact 55*b* to open and deenergize relay coil 81 and to close contact 55*a*, thus to energize relay coil 76 after which contacts 76*a* and 76*b* close to complete the circuit for energizing solenoid 67 of the valve 62. Fluid under pressure is thus admitted to the piston-cylinder assembly 23 to move the guide box 41 into the workpiece receiving station directly beneath guide box 42.

With the guide box 41 in position to receive the next workpiece, upon operation of the shear 99 the normally closed relay 101 connected into the shear control circuit opens momentarily, thus to deenergize relay coil 82 and permit contact 82*b* to close and complete the circuit and to energize relay coil 83. Contact 83*b* will then close to complete the circuit for and light the second lamp 90*a* to indicate that the next workpiece will be directed by the guide box 41 to the hot bed at the left, in the meantime the circuit for the lamp 90 having been broken to disconnect the current from that lamp.

With the guide box 41 in position, the sequence of operations following the entry therein of a rod to be directed to the hot bed at the left is somewhat the same as that described for the operation of the device after a rod was introduced into and passed through the guide box 42 and therefore the steps of operation are not specifically set out as they may be readily traced by means of the circuit as shown in Figure 6. The elements in the electrical system for effecting the return of the guide boxes 41 and 42 to their initial positions as shown in Figure 4 include insulated roller 102 and associated relays 91 and 87, relay contact 87*a*, relay 79 and contacts 79*a*, 79*b* and 79*c*, solenoid 69 of air valve 63, limit switch 51, relay 78 with contacts 78*a* and 78*b*, solenoid 64 of air valve 61, limit switch 55, relays 76, 79 and 81, limit switch 56, relays 77 and 81, solenoid 68 of air valve 63, limit switch 52 and contact 101 and relay 83.

Let it be assumed that with the guide boxes 41 and 42 in the position as shown in Figure 4 the operator desires to operate the device manually and direct workpieces alternately to the two hot beds. The selector switch 93 is set to the manual operating position and after a portion of the first workpiece has passed through the guide box 42 the hot bed selector switch is moved to the left hot bed position thus completing the circuit to energize coil 75 to close contacts 75*a* and 75*b* which in turn energize coil 66 of valve 62 to admit fluid to

cylinder 23 to move guide box 41 outward. Movement of guide box 41 trips limit switch 51 closing contact 51*a* and energizing relay coil 77 which closes contacts 77*a* and 77*b*, thus to energize coil 65 of valve 61, admitting fluid to cylinders 35 and 36 moving guide box 41 downward and guide box 42 upward respectively. As guide box 41 moves downward limit switch 56 is tripped, opening contact 56*a* to deenergize relay coils 75 and 81 and closing contact 56*b*. Guide box 42 in moving upward trips limit switch 55, opening contact 55*b*, closing contact 55*a*, and completing the circuit to relay coil 76 thereby closing contacts 76*a* and 76*b* to energize solenoid 67 of valve 62. Fluid is thereby admitted to cylinder 23 thereby to move guide box 41 to its lower, inward, workpiece receiving position, thus to place the guide boxes in an inverted position with respect to that shown in Figure 4. The lamps for indicating the rod switch guide box positions function in the same manner as that for automatic operation.

In accordance with the provisions of the patent statutes, we have explained the principle and operation of our invention and have illustrated and described what we consider to represent the best embodiment thereof. However, we desire to have it understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. An apparatus for alternately changing the direction of the forward movement of elongated workpieces comprising a support, a pair of guides carried by said support normally arranged one above the other having their axes angularly disposed with respect to a common point, means for imparting vertical and horizontal movement to said guides so that said guides can be alternately arranged to receive a workpiece directed to a common receiving station.

2. An apparatus for alternately changing the direction of the forward movement of elongated workpieces comprising a support, a pair of guides carried by said support normally arranged one above the other having their axes angularly disposed with respect to a common point, means for imparting transverse and vertical movement to said guides and control means operative with said guides for controlling the vertical and transverse movements thereof in a timed relationship so that said guides are alternately arranged to receive a workpiece directed to a common receiving station.

3. An apparatus for alternately changing the direction of the forward movement of elongated workpieces comprising a base, guide posts vertically supported by said base, means for transversely moving said guide posts relative to each other, a pair of guides carried by said guide post normally arranged one above the other having their axes angularly disposed with respect to a common point, means for imparting vertical movement to said guides so that said guides can be alternately arranged to receive a workpiece directed to a common receiving station.

4. An apparatus for alternately changing the direction of the forward movement of elongated workpieces comprising a base, guide posts vertically supported by said base, means for transversely moving said guide posts relative to each other, a pair of guides carried by said guide posts normally arranged one above the other having their axes angularly disposed with respect to a common point, means for imparting vertical movement to said guides and control means operative with said base and guide posts for controlling the vertical and transverse movement of said guides in a timed relationship so that said guides are alternately arranged to receive a workpiece directed to a common receiving station.

5. An apparatus for alternately changing the direction of the forward movement of elongated workpieces comprising a base, guide posts vertically supported by said base, means for transversely moving said guide posts relative to each other, a pair of frames slidably mounted on said posts, means for imparting vertical movement to said frames, a pair of guides carried by said frames normally arranged one above the other having their axes angularly disposed with respect to a common point and automatic control means operative with said base and frames for controlling the vertical and transverse movement of said guides in a timed relationship so that said guides are alternately arranged to receive a workpiece directed to a common receiving station.

6. An apparatus for alternately changing the direction of the forward movement of elongated workpieces comprising a pair of slidable bases, guide posts vertically supported by each of said bases, a pair of frames slidably mounted on said posts, hydraulic means for imparting vertical and transverse movement to said frames and bases, a pair of guides carried by said frames normally arranged one above the other having their axes angularly disposed with respect to a common point and control means operative with said hydraulic means for controlling the vertical and transverse movement of said guides in a timed relationship so that said guides can be alternately arranged to receive a workpiece directed to a common receiving station.

7. An apparatus for alternately changing the direction of the forward movement of elongated workpieces arranged transversely between a delivery and receiving table comprising a pair of slidable bases, means for transversely moving said bases relative to each other, guide posts vertically supported by each of said bases, a pair of frames slidably mounted on said posts, means for imparting vertical movement to said frames, a pair of guides carried by said frames normally arranged one above the other having their axes angularly disposed with respect to said receiving table adapted to receive a workpiece directed thereto and control means operative with said slidable bases and frames for controlling the vertical and transverse movement of said guides in a timed relationship so that said guides can be alternately arranged to receive a workpiece directed to said receiving table.

8. An apparatus for alternately changing the direction of the forward movement of elongated workpieces comprising a pair of slidable bases, means for transversely moving said bases relative to each other, guide posts vertically supported by each of said bases, a pair of frames slidably mounted on said posts, means for imparting vertical movement to said frames, a pair of guides carried by said frames normally arranged one above the other having their axes angularly disposed with respect to a common point, and control means operative with said slidable bases and frames for controlling the vertical and transverse movement of said guides in a timed relationship so that said guides can be alternately arranged to receive a workpiece directed to a common receiving station.

9. An apparatus for alternately changing the direction of the forward movement of elongated workpieces comprising a pair of slidable bases, independent means for transversely moving said bases relative to each other, a plurality of guide posts vertically supported by each of said bases, a pair of frames slidably mounted on said posts, independent means for imparting vertical movement to said frames, a pair of guides carried by said frames normally arranged one above the other having their axes angularly disposed with respect to a common point, control means operative with said slidable bases and frames for controlling the vertical and transverse movement of said guides in a timed relationship so that said guides can be alternately arranged to receive a workpiece directed to a common receiving station including workpiece contact means operative with said apparatus for starting the operation thereof.

No references cited.