

Dec. 2, 1969

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3,481,499

ARTICLE HOIST AND LATERAL TRANSFER MECHANISM

Filed March 25, 1968

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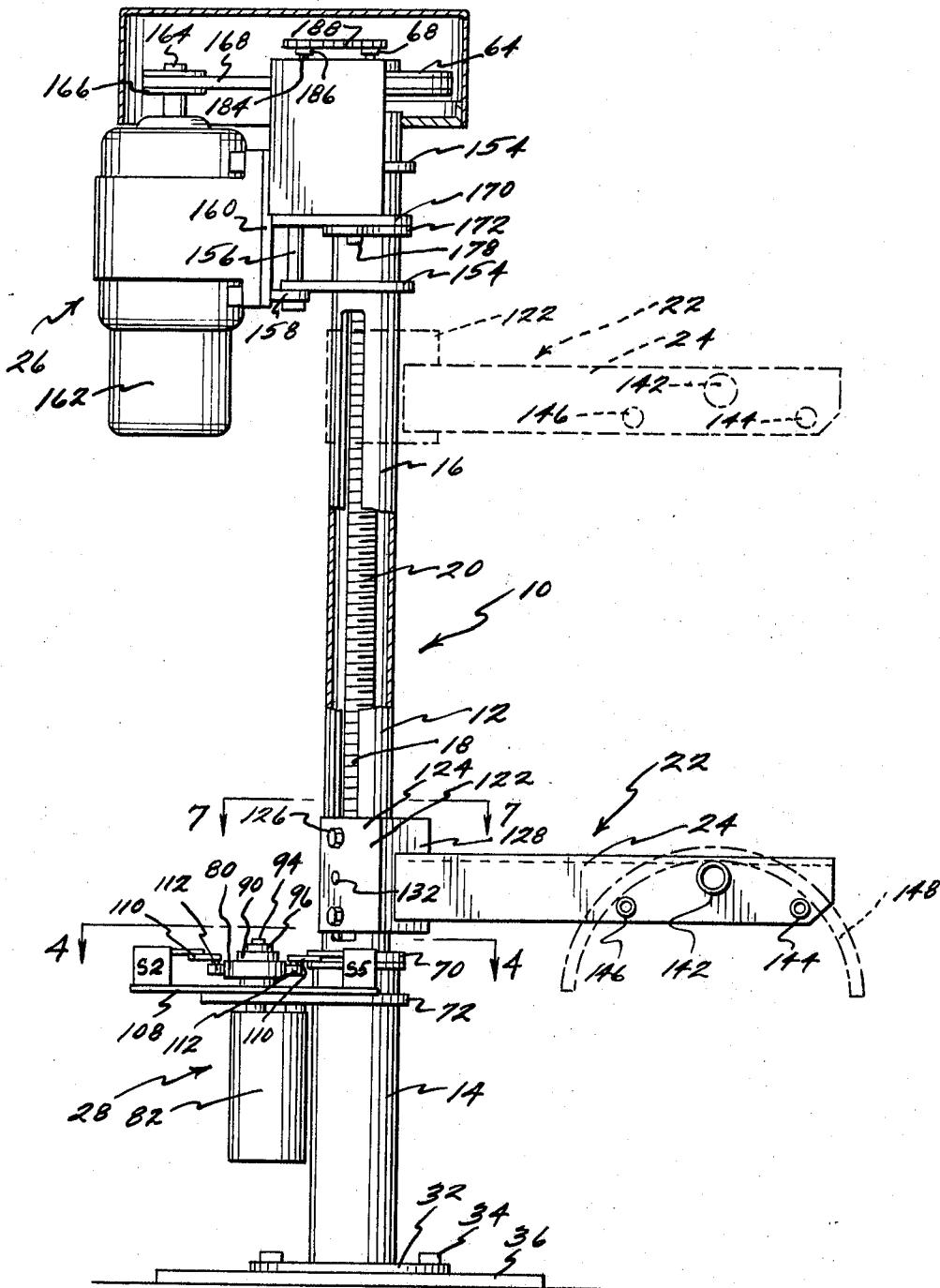


FIG. 1.

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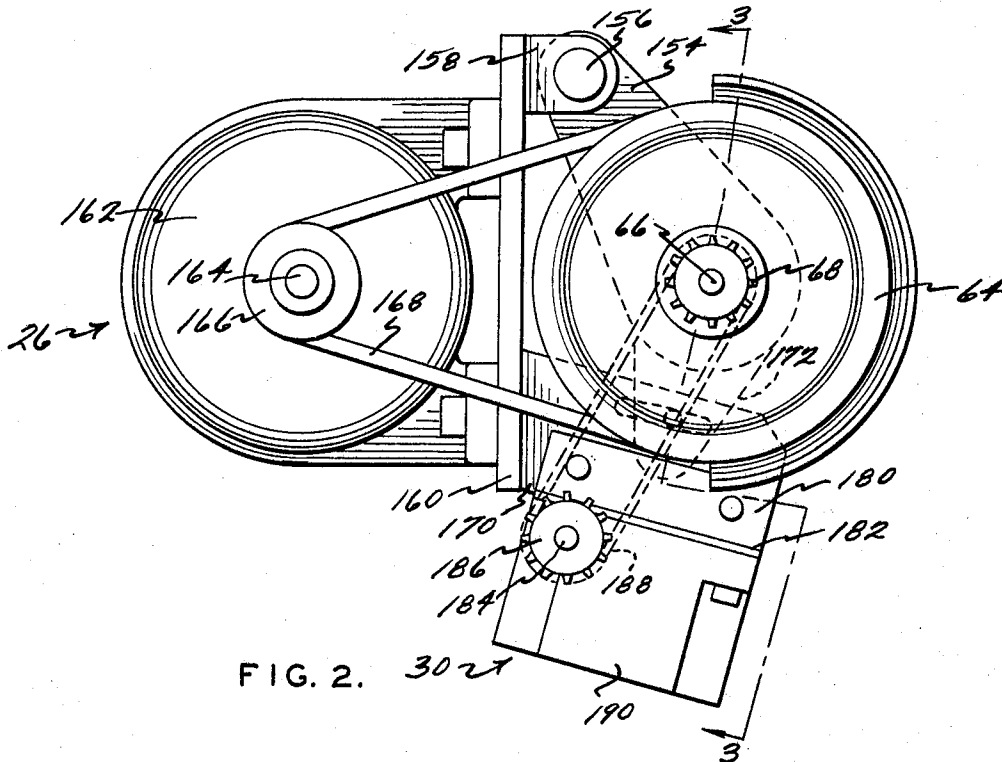
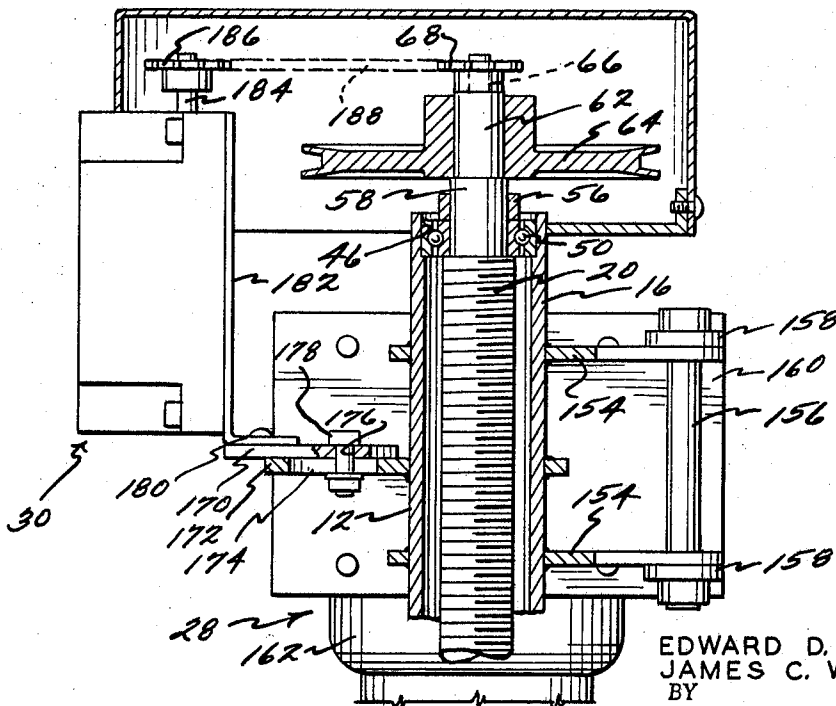
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ARTICLE HOIST AND LATERAL TRANSFER MECHANISM

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5 Sheets-Sheet 2



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ARTICLE HOIST AND LATERAL TRANSFER MECHANISM

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5 Sheets-Sheet 3

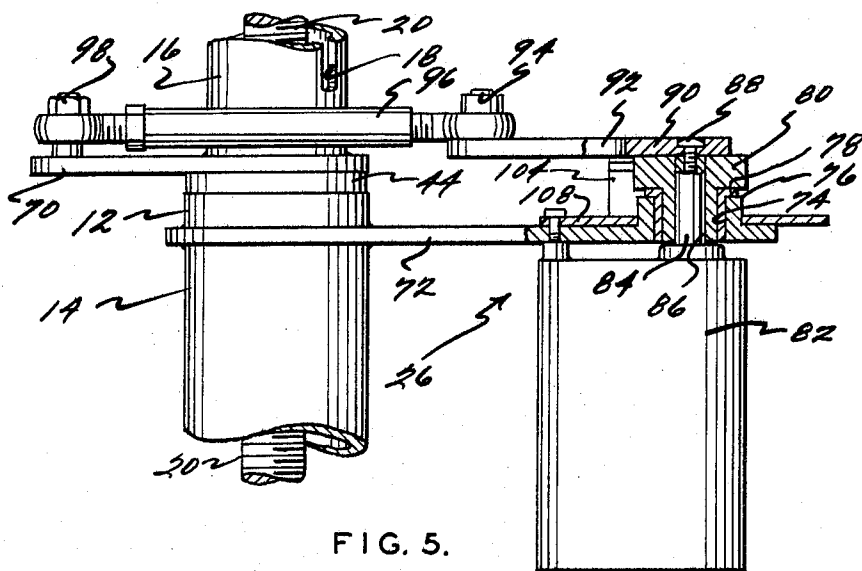


FIG. 5.

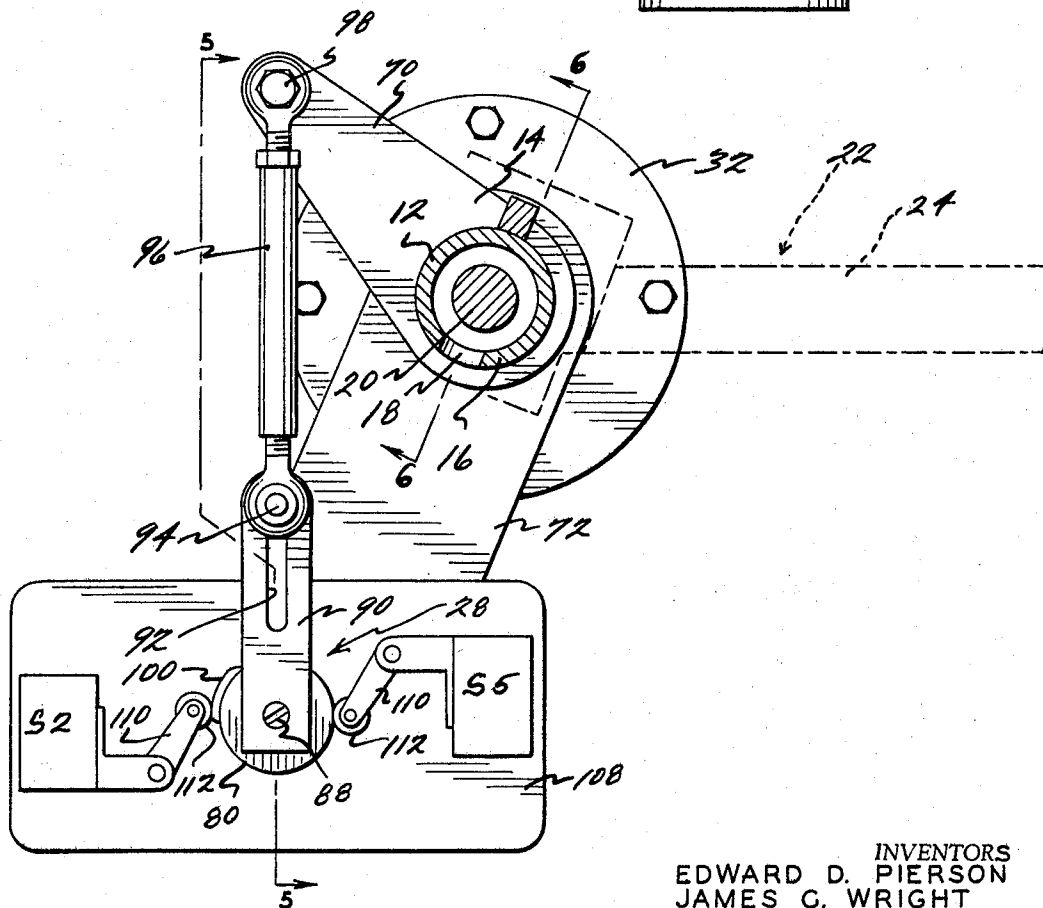


FIG. 4.

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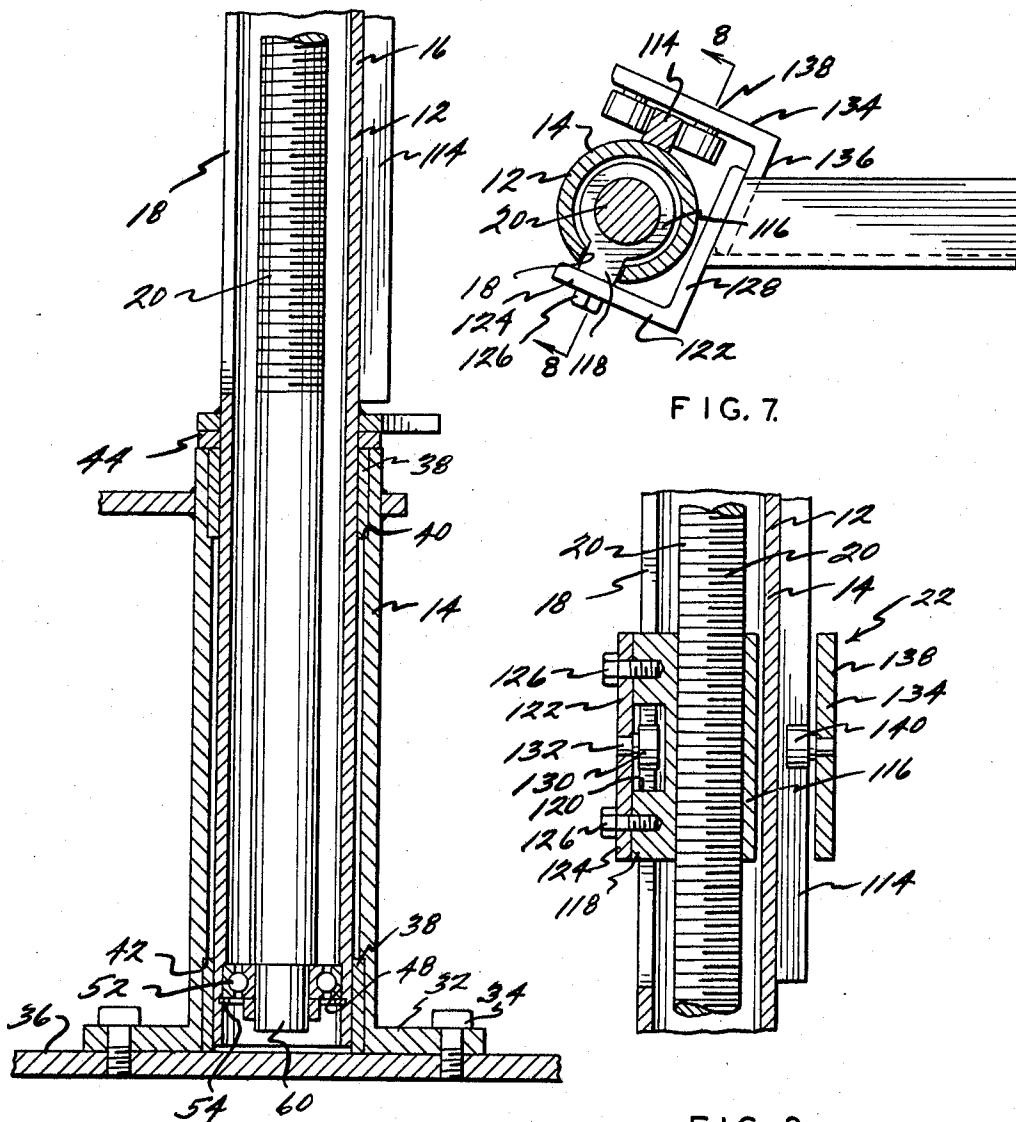
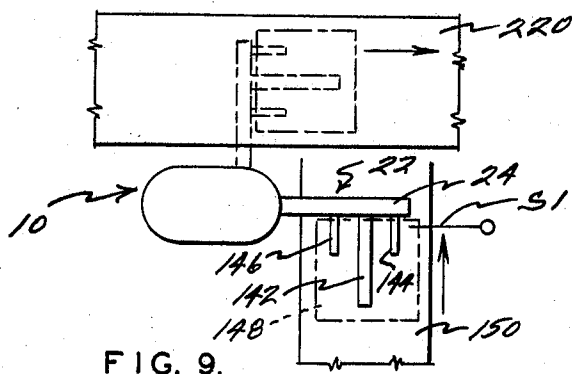
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ARTICLE HOIST AND LATERAL TRANSFER MECHANISM

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5 Sheets-Sheet 4



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ARTICLE HOIST AND LATERAL TRANSFER MECHANISM

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5 Sheets-Sheet 5

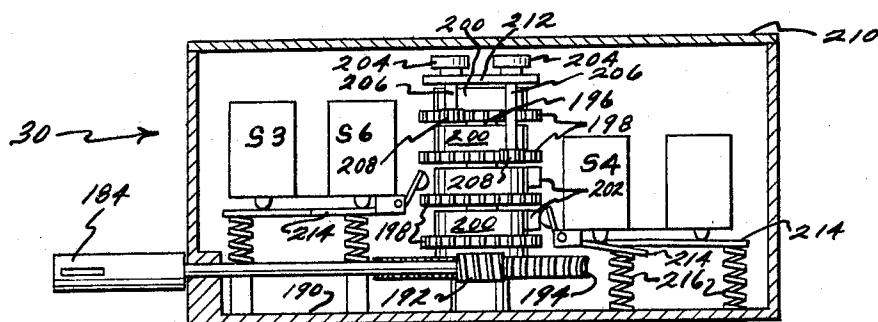


FIG. 10.

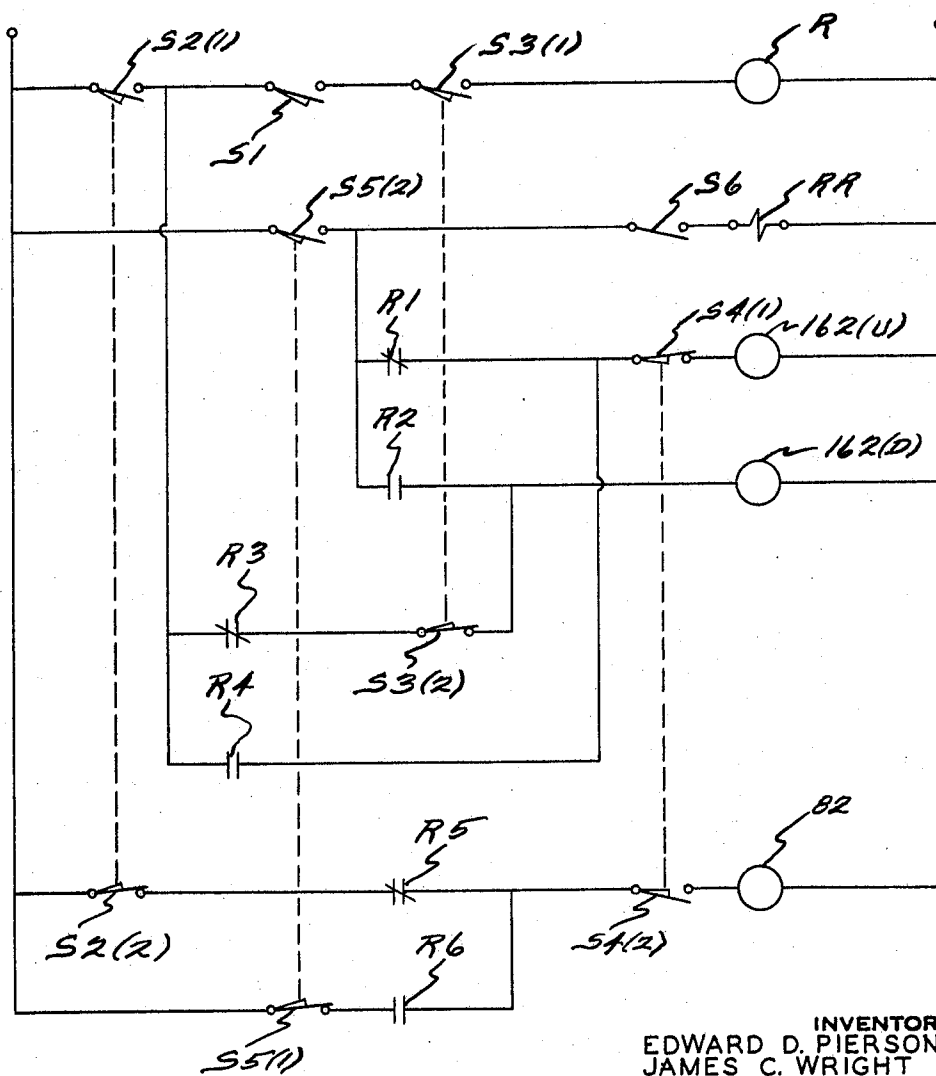


FIG. 11.

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## ARTICLE HOIST AND LATERAL TRANSFER MECHANISM

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12 Claims

### ABSTRACT OF THE DISCLOSURE

This invention relates to an automatic combination elevator and turning mechanism by means of which stereo-plates of the type used in the printing of newspapers and magazines can be lifted from a conveyor coming from a shaver or other piece of apparatus and either lifted or lowered while being turned through some predetermined angle before being redeposited on a second intersecting conveyor that receives the output from several such shaver units. The unit includes a hollow upright slotted post, the upper portion of which is rotatable relative to the stationary base. A jackscrew is housed inside this post and is turned by a reversible motor mounted atop the rotatable portion thereof. A second motor attached to the stationary base of the post operatively-connects to the rotatable portion thereof and, by means of a combination of cams and pivot links, turns the latter back and forth through the pre-programmed horizontal angle of deflection. A horizontal arm connected to both the jackscrew elevator and rotatable portion of the post catches the plate from one conveyor and redeposits it on the other. An electrical circuit, including sensing and limit switches, responds to the presence of the incoming plate and initiates the operating cycle.

In the past decade or so, significant strides have been made in the automation of the newspaper publishing industry, both for the purpose of increasing production and to reduce the labor force, the latter being a significant and ever-increasing expense to the publisher. Among the operations that are susceptible to automation is that of handling the so-called "stereoplates" which consist of heavy hollow semi-cylindrical plates cast to provide the raised indicia that ultimately appear on the printed page after being transferred to the press. Obviously, there is a considerable number of these plates required for each edition of a daily newspaper and, after each has been used as aforementioned, it must be shaved to remove the indicia appearing thereon preparatory to being used over again.

Such a simple operation as feeding these plates to the shavers, removing the shaved plates and transferring them to another area of the plant for storage or immediate reuse requires the services of at least one man and, in some cases, several. In addition, these plates are quite heavy, and lifting them from one place to another over a prolonged period of time can become quite tiring, even for those who are quite used to this type of physical exertion.

The customary setup is to have several of the stereo-plate shavers arranged in a line so as to discharge the shaved plates out onto short inclined gravity conveyors arranged in parallel relation to one another and which intersect a common powered conveyor running at right angles thereto that accepts their combined output and delivers it to some remote location in the plant. Thus, the function to be performed automatically is one of lifting each of the plates from the gravity conveyor as it leaves the shaver, turning same to an "in-line" relation with the powered discharge conveyor, lowering same down onto

2

the surface thereof and returning it to its original position.

Ordinarily, this would not be a difficult task to perform automatically, especially if the powered discharge conveyor always ran at right angles to the gravity-fed conveyors and all the conveyors were the same height off the floor. Unfortunately, this ideal arrangement is seldom found in a newspaper plant. Quite often, the common powered conveyor does not run perpendicular to the direction of flow of the gravity conveyors meaning, of course, that the plates must be turned through an angle other than 90°. The more difficult, but equally prevalent problem, is to lift the plates from one level, deposit them at a second level above or below the first, and return the pickup arm to said first level. The mechanical and electrical elements required to accomplish the latter become quite complicated, although necessary in a versatile plate transfer apparatus capable of handling any of the situations likely to be encountered in an existing newspaper plant.

It has now been found in accordance with the teaching of the instant invention that the required versatility can be achieved by journaling a jackscrew for rotation inside a two-section hollow post, the lower portion of which is fixed, while the upper part is free to rotate relative to said lower section. A motor mounted on the lower section of the post and operatively-connected to the upper section thereof by a crank arm controlled by a rotating cam and a pair of limit switches can rotate said upper section back-and-forth through a relatively broad range of horizontal angles of deflection.

The rotatable section of the post is slotted and carries a horizontal arm projecting therefrom that operatively-connects to the jackscrew inside thereof. A reversible motor carried atop said movable post section turns the jackscrew to raise and lower the arm. A pilot screw paralleling the jackscrew is turned by the jackscrew drive, and a member mounted on said pilot screw actuates the limit switches necessary to control the movements of the unit.

It is, therefore, the principal object of the present invention to provide a unique automatic apparatus for lifting stereo-plates from one conveying surface and redepositing same on a second conveyor intersecting the first.

A second objective is to provide a device of the type afore-mentioned that can accept a plate from a conveyor at one level and transfer same to a second conveyor at a different level.

Another object of the invention herein disclosed and claimed is to provide a stereo-plate transfer unit that can be adjusted to swing the stereo-plate through a wide range of horizontal angles.

Still another objective is the provision of a lifting, turning and lowering mechanism, the movements of which are controlled by a pilot screw that actuates a series of limit switches operatively-connected to the main jackscrew drive and post-rotating subassembly.

An additional object of the invention is to provide a stereoplate handling unit that can be pre-programmed to answer the particular requirements of nearly all existing stereo-plate transfer operations such as are needed to automatically carry a stereo-plate from a shaver unit to an intersecting plate conveyor.

A further object is to provide a lifting and turning apparatus for stereo-plates that is rugged, versatile, compact, reliable, easy to service, powerful yet gentle, and even somewhat decorative.

Other objects will be in part apparent and in part pointed out specifically hereinafter in connection with the description of the drawings that follows, and in which:

FIGURE 1 is a front elevation of the stereo-plate transfer unit of the present invention, portions of the post and housing for the transmission between the jackscrew and

drive therefor having been broken away and shown in section to more clearly reveal the internal construction;

FIGURE 2 is a top plan view to an enlarged scale showing the unit with the transmission housing removed;

FIGURE 3 is a fragmentary section taken along line 3—3 of FIGURE 2 to the same scale;

FIGURE 4 is an enlarged section taken along line 4—4 of FIGURE 1;

FIGURE 5 is a fragmentary section taken along line 5—5 of FIGURE 4 to the same scale;

FIGURE 6 is a fragmentary section taken along line 6—6 of FIGURE 4;

FIGURE 7 is a fragmentary section to an enlarged scale taken along line 7—7 of FIGURE 1;

FIGURE 8 is a fragmentary section taken along line 8—8 of FIGURE 7;

FIGURE 9 is a diagrammatic top plan view showing the plate transfer unit in relation to the gravity-fed conveyor from a stereo-plate shaver and a discharge conveyor intersecting the latter;

FIGURE 10 is an elevation of the control mechanism to an enlarged scale, the case having been cut away and shown in section to reveal the interior construction; and,

FIGURE 11 is a schematic electrical diagram showing the control circuit.

Referring now to the drawings for a detailed description of the present invention and, initially, to FIGURE 1 for this purpose, reference numeral 10 has been employed to broadly designate the stereo-plate transfer unit which will be seen to include a vertically-disposed hollow post 12 having an outer stationary section 14 and an inner movable section 16 mounted for relative rotation inside said fixed section. The movable inner section 16 has a vertical slot 18 that exposes a jackscrew 20 journaled for rotation inside thereof which carries an externally-located horizontal arm subassembly that has been indicated in a general way by reference numeral 22. Arm 24 rides up and down the movable section of the post upon rotation of the jackscrew 20 which is driven by a reversible jackscrew drive mechanism that is indicated generally by reference numeral 26 and which fits atop post 12. The outer stationary section 14 of the post 12 carries the post-rotating drive mechanism that, once again, has been broadly designated by reference numeral 28 and which is operatively-connected to the movable section 16 of the post so as to turn the latter along with arm subassembly 22 from side-to-side. An electro-mechanical control mechanism that has been generally referred to by reference numeral 30 is driven by the reversible jackscrew drive mechanism 26 and is operative to control the excursion of arm subassembly 22 up and down the jackscrew, as well as the horizontal angular movement of the latter.

The lower end of post 12 is most clearly revealed in FIGURES 1 and 6 to which brief reference will now be made. The stationary section 14 thereof comprises a vertically-disposed hollow cylindrical member bordered on the bottom by an annular mounting flange 32 which is fastened by means of bolts 34 to a horizontal bedplate 36. A pair of shaft bushings 38 are seated against annular shoulders 40 and 42 formed inside stationary post section 14. The inner rotatable section 16 of the post 12 is journaled for rotation within these bushings 38 and is kept from dropping down all the way to the bottom of the outer section by annular flange 44 which is fastened to the inner post and bears against the top edge of the outer one.

In FIGURES 3 and 6 it will be seen that annular ball bearing seats 46 and 48 are provided in the upper and lower extremities of the inner post section 16 to receive roller bearings 50 and 52. The lower bearing 52 is held in place by a lock washer 54 seated in an annular groove provided for this purpose in bearing seat 48. Similarly, the upper bearing 50 is held in place by a collar 56 fastened to the jackscrew. Sections of reduced diameter 58 and 60 on the jackscrew 20 are journaled for rotation

within the aforesaid bearings 50 and 52 as shown. Thus, the inner post section 16 is free to rotate about its vertical axis relative to the outer stationary post section 14 and the jackscrew 20 is journaled for rotation relative to both of said post sections.

FIGURE 3 shows that the top end of the jackscrew is provided with a section of reduced diameter 62 upon which is mounted pulley 64 and a third section 66 of still smaller diameter to which is attached sprocket gear 68. The functions of the latter elements will be set forth in greater detail later in connection with the description of the reversible jackscrew drive 26 and the control mechanism 30. For the present, however, the detailed description will be primarily directed to post rotating subassembly 28 at the lower end of post 12, for which purpose reference will now be made to FIGURES 4 and 5.

Welded or otherwise attached to the inner movable section 16 of post 12 so as to rest atop flange 44 is a crank arm 70 that projects horizontally out to one side thereof. A motor-mounting plate 72 is fastened in like manner to the stationary section 14 of the post so as to project horizontally therefrom in a parallel plane spaced beneath the crank arm 70. A circular opening 74 near the outer end of plate 72 bordered by an upstanding annular flange 76 carries a flanged bushing 78 that, in turn, journals a cam 80 for rotation therein as shown most clearly in FIGURE 5.

Suspended from the underside of plate 72 is a low-speed electric gear motor 82, the output shaft 84 of which projects vertically up into the central opening 86 in cam 80 to which it is secured for conjoint rotation. Shaft 84 is internally-threaded as shown in FIGURE 5 and a bolt 88 is screwed therein that fastens a second crank arm 90 atop cam 80 so as to rotate therewith. Crank arm 90 contains a longitudinal slot 92 that adjustably receives the pivot pin 94 on one end of turnbuckle-type link 96, the other end of the latter being pivotally-connected to crank arm 70 by means of pivot pin 98. Thus, one can easily see that energization of motor 82 will function to rotate the inner movable section 16 of post 12 by means of crank arms 70 and 90 interconnected by connecting link 96. As will be noted presently, the inner section 16 of the post 12 need not rotate even one full turn and, for practical purposes, is probably required to swing arm 24 back-and-forth through a horizontal angle of a little over 90° at the most. FIGURE 4 shows the manner in which this back-and-forth swing of arm 24 is accomplished.

Cam 80 that rotates with motor shaft 84 carries a cam lobe 100 on the circumferential edge 102 thereof. A pair of limit switches S2 and S5 are fastened in fixed position atop a switch-mounting plate 108 that rests on motor-mounting plate 72. Each of these limit switches carries a pivotally-mounted actuating arm 110 having a roller 112 on the end thereof that rolls along circumferential edge 102 of cam 80 and up onto the lobe 100 thereof. These rollers 112 are positioned more or less diametrically-opposite one another against cam 80 in the particular arrangement shown in FIGURE 5. Now, if one assumes for the moment that limit switch S5 is closed to energize motor 82 so as to turn cam 80 counterclockwise as viewed in FIGURE 5 and that said switch will be actuated into open position when cam lobe 100 strikes its roller 112 so as to depress arm 110, then the inner section 16 of the post will have been rotated counterclockwise through about a quarter of a turn before the motor circuit de-energizes. As this takes place, the arm subassembly 22 (indicated by the broken line) will have swung counterclockwise through the same angle as it is attached to the inner section 16 of post 12 for rotation therewith as will be described in detail presently in connection with FIGURES 7 and 8. If we next close the motor circuit through the other limit switch S2, the motor shaft 84, cam 80 and crank arm 90 will continue to turn in a counterclockwise direction in order to return to the position shown in FIGURE 5; however, in so doing, crank arm 70, the inner section 16 of

post 12 and arm subassembly 22 will return to their original positions by moving clockwise rather than counterclockwise. As cam lobe 100 strikes the roller of switch S2 to open the latter and de-energize the motor circuit, all elements of the post-rotating mechanism 28 will occupy their original positions shown in FIGURE 4 with the post section 16, crank arm 70 and arm 24 having swung back-and-forth through about a quarter of a turn, while the motor shaft 84, cam 80 and crank arm 90 made one full revolution.

Now, minor adjustments in the angle through which arm subassembly 22 swings can be made by shortening or lengthening turnbuckle link 96. On the other hand, major adjustments in the aforesaid angle of swing are made by adjusting the effective lever arm of crank arm 90 by moving pivot pin 94 along slot 92. Shortening the turnbuckle has the same effect as lengthening the operating radius of crank arm 90, namely, that of lengthening the arc through which arm 24 swings and vice versa. Thus, the unit is provided with an adjustable means for controlling the angular arc through which the movable section 16 of the post rotates as well as the arm subassembly 22 carried thereby. It should, perhaps, be noted that as arm 24 is carried back-and-forth by movable post section 16 upon which it is mounted, said arm will also move up or down a tiny fraction of an inch due to its threaded connection with jackscrew 20. The jackscrew is held stationary by the reversible jackscrew drive mechanism 26 during the intervals when the arm undergoes its horizontal excursion and, conversely, said jackscrew drive is only operative to raise and lower same when the post-rotating mechanism 28 is inoperative.

Next, with particular reference to FIGURES 7 and 8, the manner in which arm subassembly 22 is constructed and operatively-connected to both the movable section 16 of post 12 and the jackscrew 20 will now be described. The fact has already been mentioned that post section 16 has a vertical slot 18 therein and it will also be noted that it is provided with an external vertical rib 114 located, in the particular form shown, diametrically-opposite said slot.

An internally-threaded sleeve 116 is screwed onto the jackscrew 20 inside the movable section 16 of the post 12 with its integrally-formed rib 118 projecting out through slot 18 onto the outside surface of the latter. Rib 118 is provided with a transversely-extending notch 120 intermediate the ends thereof as shown only in FIGURE 8. A first L-shaped bracket 122 has one of its flanges 124 attached to rib 118 by bolts 126 so that the other flange 128 thereof rides alongside the post in spaced parallel relation thereto as shown in FIGURE 7. A trunnion 130 is journaled for rotation on shaft 132 fastened to the inside of flange 124. This trunnion turns within notch 120 in the rib 118 and has a diameter greater than the width of the latter so as to engage the sides of slot 18 in the movable section 16 of post 12, thereby preventing the arm subassembly 22 from binding therein. A second L-shaped bracket 134 has one flange 136 thereof positioned in face-to-face parallel relation to flange 128 of the other L-shaped bracket 122 to which it is attached in the manner shown in FIGURE 7. The remaining flange 138 of bracket 134 extends behind the post across the edge of rib 114 and in spaced parallel relation to flange 124 of the first bracket, thus forming a generally U-shaped subassembly. A pair of trunnions 140 are journaled on the inside of flange 138 in position to ride along opposite sides of rib 114. Flange 124 is fastened to the overlapping flanges 128 and 136 of brackets 122 and 134 so as to project radially out from post 12 in perpendicular relation thereto as represented in FIGURES 1 and 7. The above-described bracket, together with the trunnions carried thereby, cooperates with the slot 18 and rib 114 to keep flange 124 in the exact same angular relation to the movable section 16 of post 12 regardless of its vertical position thereon.

Briefly referring once again to FIGURE 1, it will be

seen that arm 24 carries three horizontally-extending tubular plate-supporting fingers 142, 144 and 146 projecting perpendicularly therefrom outboard of post 12. These fingers are arranged in a circular arc corresponding to the inside diameter of stereo-plate 148 that has been indicated by broken lines. The middle finger 142 is longer than the others as shown in FIGURE 9, and it provides the primary support for the plate while the shorter fingers 144 and 146 located on opposite sides thereof have as their main function the stabilization of the plate to keep it from rocking from side-to-side. Fingers 144 and 146 are spaced apart a distance considerably less than the inside diameter of the stereo-plate 148 so that it can ride over same as it leaves the shaver (not shown) even though it is slightly misaligned laterally on gravity conveyor 150 (FIGURE 9). When receiving a plate, arm 24 is, of course, dropped down so as to just barely clear the top of the conveyor in order to provide as much latitude as possible for said plate to move into position over all three fingers preparatory to being lifted up thereby.

The operating cycle is initiated automatically when a plate impinges against sensing switch S1 extending across the path thereof as shown in FIGURE 9. As the plate strikes this sensing switch, the control circuit becomes operative to energize the reversible jackscrew drive mechanism 26 which will now be described with particular reference to FIGURE 2 and 3 and which raises said plate free of conveyor 150.

Fastened to the upper end of the movable section 16 of post 12 are a pair of vertically-spaced parallel motor-mounting brackets 154. A vertically-disposed pivot pin 156 extending between the free ends of these brackets 154 also passes through a pair of ears 158 on the bottom of motor-mounting plate 160 near one edge thereof. A reversible electric gear motor 162 is fastened to plate 160 with its output shaft 164 extending vertically in spaced parallel relation alongside the upper end of the jackscrew. Motor 162 is, thus, pivotally-supported on the upper end of the movable section 16 of post 12 for movement relative thereto about a vertical axis defined by pivot pin 156.

The output shaft 164 of the motor carries a V-belt pulley 166 horizontally-aligned with pulley 64 on the upper end of the jackscrew to which it is operatively-connected by V-belt 168. The above-described pivotal mounting of motor 162, of course, provides the means for keeping belt 168 tight at all times. It is also, perhaps, worthy of mention at this point that the entire jackscrew drive mechanism 26 that has just been described, along with the control mechanism 30 which will be set forth in detail shortly, turns back-and-forth with movable section 16 of the post 12.

A horizontal platform 170 is welded to the bottom of motor-mounting plate 160 adjacent the edge thereof opposite ears 158 but in spaced parallel relation therebetween. This platform rests in face-to-face relation atop still another mounting bracket 172 that is fastened to the movable section 16 of post 12 in spaced parallel relation between brackets 154 but projecting toward platform 170 rather than ears 158. The latter bracket 172 contains an arcuate slot 174 curving about pivot 156 located in vertical alignment with an aperture 176 in platform 170 which receives bolt 178. Arcuate slot 174 cooperates with bolt 178 to enable motor 162 to be adjusted pivotally about its axis of pivotal movement 156 so as to maintain V-belt 168 properly tensioned.

Also attached to platform 170 is an L-shaped mounting bracket 180, the vertical leg 182 of which mounts the control mechanism 30. The aforesaid mechanism includes a vertically-disposed pilot screw 184 emerging from the upper end thereof that is located in spaced parallel relation to jackscrew 20. Pilot screw carries a sprocket gear 186 horizontally aligned with sprocket gear 68 atop the jackscrew and operatively-connected thereto by sprocket chain 188. Thus, reversible jackscrew drive mechanism 26 rotates the jackscrew 20 and the latter, in turn, drives

the pilot screw 184 of the control mechanism 30. Sprocket gears 68 and 186 are the same size, therefore, pilot screw 184 turns the same direction and the same speed as jackscrew 20.

FIGURE 10, to which reference will now be made, shows the interior construction of control mechanism 30. This figure is a somewhat schematic representation of the control mechanism, which is a commercially-available item and one of several such control mechanisms that can be employed to provide an automatic control for the movements of arm 24. No attempt has, therefore, been made to illustrate all of the mechanical and electrical details of the unit, but instead, just enough to show how this or a similar control mechanism might be employed in the transfer mechanism forming the subject matter hereof.

Pilot screw 184 of mechanism 30 is, in the particular form shown, turned in the same direction and at the same speed as jackscrew 20. Inside case 190 of the control mechanism, screw 184 carries a worm 192 that meshes with a second worm gear 194 mounted on a shaft 196. Shaft 196 has mounted thereon four identical spur gears, 198, each of which has an enlarged hub 200 carrying a switch-actuating cam 202 projecting radially from its periphery. Now, each of these four spur gears is mounted on shaft 196 for rotational adjustment relative thereto and to one another so that their respective switch-actuating cams can be set to operate at different intervals during the operating cycle. Setting of the individual spur gears is accomplished by loosening same from shaft 196 and turning them by means of an adjustment subassembly including a knob 204, a shaft 206 and a pinion 208 that mates with a particular spur gear. There are four such subassemblies in all, one for each spur gear, only two of which have been shown. Access to these knobs is had by removing the coverplate 210 of the case where they will be found atop endplate 212.

Mounted inside the case are four switches, only three of which are needed in the instant circuit, namely, S3, S4 and S6. These switches are independently actuated by pivotally-mounted actuators 214. Switch S4, for example, has a set of normally-closed contacts S4(1) and a set of normally-open contacts S4(2) (see FIGURE 11). Compression spring 216 normally biases switch S4 into its above-described "normal" position; however, when the cam 202 on the lowermost spur gear hub 200 in FIGURE 10 reaches the position shown, it rocks the switch actuator 214 down overcoming the bias of compression spring 216 so that its normally-closed contacts S4(1) open and its normally-open contacts S4(2) close. As will be explained presently, switch S4 is the limit switch that determines how high arm 24 rides up the jackscrew 20 before motor 162 is de-energized. Each of the other two switches is similarly actuated and deactuated, but at different intervals during the operating cycle.

The same procedure would be followed in setting all four of the limit switches and it need only be set forth in detail for one. If, as above, switch S4 has been selected and wired to shut off jackscrew drive motor when arm 24 reaches the highest point it travels up post 12, then it is only necessary to place arm 24 at this point on the jackscrew and set the cam on the lowermost spur gear hub to the position shown before fastening same to shaft 196. Then, whenever the arm rises to this height, cam 202 will be in position to contact actuator 214 and change the position of switch S4 so as to de-energize motor 162 stopping said arm.

The basic control circuit is as shown in FIGURE 11 to which reference will now be made. Switch S1 is the plate-sensing switch and is normally-open except when held closed by a plate impinging thereagainst. Normally-open contacts S2(1) of limit switch S2 are shown open; however, at the beginning of the operating cycle, they are being held closed by cam 100 located in the position shown in FIGURE 4. This, of course, means that its other

pair of normally-closed contacts S2(2) start out at the beginning of the operating cycle in open position.

The same thing is true of limit switch S3 which has already been mentioned briefly and which is housed inside control mechanism 30. Its contacts S3(1) are normally-open and its second pair of contacts S3(2) are normally closed; however, with the arm subassembly positioned as shown in full lines in FIGURE 9 ready to receive an incoming plate 148, switch S3 has already been actuated so as to close its normally-open contacts S3(1) and open its normally-closed contacts S3(2).

Now, at the instant an incoming plate on conveyor 150 reaches sensing switch S1 and actuates same into closed position, a circuit is completed to relay R which is thus energized through S2(1), S1 and S3(1). Relay R remains energized or "holds" even though one of the aforementioned contacts subsequently opens. Relay R will only release to open position upon energization of relay release RR as will be explained presently.

Relay R controls contacts R1 through R6, inclusive. As it is latched closed, its normally-open contacts R2, R4 and R6 close while its normally-closed contacts R1, R3 and R5 open. A circuit is also completed at this point to the "UP" winding 162(U) of reversible gear motor 162 of the jackscrew drive mechanism 26 through contacts S2(1), R4 and S4(1), all of which are closed at this point, contact S4(1) being the normally-closed contact of switch S4.

With motor 162 energized so as to turn the jackscrew 20 in a direction to raise arm 24, the fingers 142, 144 and 146 move up under plate 148 as shown in FIGURE 1 and raise same off of conveyor 150. The stereoplate is thus elevated to a level such as that indicated by broken lines in FIGURE 1 which is well above the surface of conveyor 150 which, in the particular arrangement shown in FIGURE 9, runs at right angles to discharge conveyor 220, although not necessarily at the same height. Shortly after the plate is elevated above the surface of conveyor 150, it loses contact with sensing switch S1 which reopens. As soon as arm 24 begins to elevate, limit switch S3 also resumes its normal position wherein its normally-open contacts S3(1) reopen and its normally-closed contacts close again. Relay R has already been energized at this point and it is "holding" even though the circuit thereto is broken through S1 and S3(1).

Once the arm 24 has reached the highest point in its travel as determined by the setting of switch S4 as previously explained in connection with FIGURE 10, motor 162 will be de-energized due to the actuation of switch S4 so as to open its normally-closed contacts S4(1) while closing its normally-open contacts S4(2).

Simultaneously with the de-energization of jackscrew drive motor winding 162(U) through open contact S4(1), a circuit is completed to post-rotating motor 82 through the normally-closed contact S5(1) of switch S5, closed relay contact R6 and closed contact S4(2). Motor 82 turns the movable section 16 of post 12 along with the arm subassembly 22 carried thereby horizontally in a counterclockwise direction as viewed in FIGURE 9 until it reaches the broken line position over discharge conveyor 220; whereupon, cam 100 actuates switch S5 (see FIGURE 4) to close its normally-open contacts S5(2) while opening its normally-closed contacts S5(1), the latter de-energizing motor 82.

When motor 82 was first energized, cam 100 moved off of switch S2 allowing its normally-open contacts S2(1) to reopen and closing its normally-closed contacts S2(2). Of course, with relay R still holding, its normally-closed contacts R5 remain open so that motor 82 will not be energized through S2(2), R5 and S4(2) when S5(1) opens.

When the normally-closed contacts S5(1) of switch S5 open due to cam 100 actuating the switch arm 110 controlling same, its normally-open contacts S5(2) close completing a current path to the "DOWN" winding

162(D) of jackscrew drive motor 162 through relay contact R2 that is being held closed by relay R which is still holding. Thus, arm subassembly 22 starts down over conveyor 220 carrying the plate and setting same down thereon. The conveyor immediately moves the plate away from the fingers 142, 144 and 146 as soon as they no longer support it. Once the plate is free and the arm has dropped from therebeneath to a position just above the surface of conveyor 220, normally-open limit switch S6 within the control mechanism is actuated to closed position.

Closing switch S6 completes a current path to RR through S5(2) which is being held in actuated position by cam 100. Element RR is a part of relay R and functions upon actuation to return the latter to its normal unlatched or released position; whereupon, the contacts R1 through R6 controlled thereby also return to their normal states.

As soon as relay R returns to its normal unlatched state, its contacts R2 reopen so as to de-energize the "DOWN" winding 162(D) of the jackscrew drive motor 162 while, at the same time, reclosing contacts R1 to energize the "UP" winding thereof 162(U) through contacts S5(2) of switch S5 which remain closed due to actuation of switch S5 by cam 100. Thus, the jackscrew 20, once again, begins elevating the arm subassembly 22 while the latter extends across discharge conveyor 220 at substantially right angles thereto.

With the arm subassembly moving up again, the plate having already passed off of the supporting fingers onto the moving conveyor 220, it once again actuates limit switch S4 opening the normally-closed contacts S4(1) thereof to de-energize "UP" winding 162(U) and closing its normally-open contacts S4(2). As previously-mentioned, when cam 100 moved around to actuate switch S5, it left switch S2 and allowed its contacts S2(1) and S2(2) to return to their normally-open and normally-closed positions, respectively. Therefore, a current path to motor 82 is established through closed contacts S2(2), R5 and S4(2). Motor 82, thus energized, continues to turn in the same direction as before but, as stated earlier, in doing so it now begins to swing arm 24 clockwise as viewed in FIGURE 9. As cam 100 leaves switch S5, its normally-open contacts S5(2) reopen and its normally-closed contacts S5(1) return to closed position preparatory to receiving another plate. Closing contacts S5(1) will not keep motor 82 energized after contacts S2(2) of switch S2 open upon actuation thereof by cam 100 because relay R remains unlatched and, therefore, its normally-open contacts R6 remain open breaking the circuit ahead of S5(1).

When arm subassembly 22 has completed its horizontal excursion back over to a position above conveyor 150, cam 100 actuates limit switch S2 so as to close its normally-open contacts S2(1) and open its normally-closed contacts S2(2) in preparation for another operating cycle.

The only thing that remains to be done at this point is to lower arm 24 back to its starting position preparatory to receiving another plate. With switch S2 actuated to closed contacts S2(1), relay R de-energized to leave its normally-closed contacts R3 closed, and normally-closed contacts S3(2) of switch S3 closed following removal of plate 148 from engagement with plate-sensing switch S1, a current path is established to "DOWN" winding 162(D) of the jackscrew drive motor 162. Jackscrew 20 lowers arm 24 until the latter reaches its starting position across conveyor 150; whereupon, limit switch S3 is actuated so as to open its normally-closed contacts S3(2) to de-energize "DOWN" winding 162(d) and, simultaneously, close its normally-open contacts S3(1) preparatory to receiving another plate. Sensing switch S1 is open and ready to initiate the operating cycle as soon as it is actuated into closed position by an incoming plate.

In closing, it should be pointed out that in some installations, conveyors 220 and 150 may not be at the same height nor at right angles to one another. If con-

veyor 220 is lower than conveyor 150, the transfer unit will be set up such that arm subassembly 22 starts near the top of post 12 with just enough vertical travel left to lift the plate clear of conveyor 150. Then, when setting the plate back down on conveyor 220, arm 24 will move well down toward the bottom of the post. The opposite would, of course, be true of a situation where conveyor 220 was at a higher level than conveyor 150.

A horizontal shift or swing of arm 24 through an angle of greater or less than 90° can be accomplished by adjustment of the crank arm linkage already described in detail.

Having thus described the several useful and novel features of our stereo-plate angle transfer, it will be seen that the many worthwhile objectives for which it was devised have been achieved.

What is claimed is:

1. The transfer mechanism for lifting a stereo-plate from a first conveyor and depositing same upon a second moving conveyor intersecting the first which comprises: an upstanding hollow post adapted to be mounted adjacent the corner formed by the first and second intersecting conveyors, said post including a lower fixed section and an upper movable section mounted within said fixed section for relative axial rotation, said movable section having a longitudinal slot therein; a jackscrew journaled for rotation within the movable post section; an arm subassembly projecting laterally from the movable post section, said subassembly being connected to the movable post section for rotation therewith and to the jackscrew through the longitudinal slot for relative movement up and down said post, said arm subassembly including an arm positioned to swing out over both the first and second conveyors upon rotation of the movable post section, and pick-up means projecting from said arm adapted to lift a stereo-plate free of the first conveyor and redeposit same on said second conveyor; reversible jackscrew drive means mounted upon the movable post section and connected to the jackscrew, said drive means being operative upon actuation in a first mode to raise the arm subassembly up the post and in a second mode to lower same; post-rotating means mounted on the fixed post section and connected to the movable post section, said means being operative upon actuation with the arm subassembly in elevated position to swing same through a predetermined horizontal angle between a first position projecting out over the first conveyor and a second position similarly located with respect to the second conveyor; and, control means connected to the jackscrew drive means and post-rotating means, said control means including plate-sensing means located in the path of a stereo-plate entering on the first conveyor and operative upon actuation thereby to energize the jackscrew drive means in its first mode as to lift said plate up the post by means of the arm subassembly located therebeneath, first limit switch means responsive to the arrival of the arm subassembly at a predetermined height on the post, said first limit switch means being operative upon actuation when the jackscrew drive means is in its first mode to de-energize same and energize the post-rotating means so as to swing the arm subassembly from its first into its second position, and said first limit switch means being operative upon actuation with said jackscrew drive mechanism in its second mode to de-energize same and energize said post-rotating means so as to swing said arm subassembly from its second position back to its first position, second limit switch means responsive to the arrival of the arm subassembly in its second position, said second limit switch means being operative upon actuation to de-energize the post-rotating means and energize the jackscrew drive means in its second mode, third limit switch means responsive to the arrival of the arm subassembly in discharge position where it has deposited the stereo-plate upon the second conveyor and the latter has removed said plate therefrom, said third limit switch means being operative upon actuation to shift the

jackscrew drive mechanism from its second mode back into its first mode, fourth limit switch means responsive to the return of the arm subassembly into its first position from its second position, said fourth limit switch means being operative upon actuation to de-energize the post-rotating means and energize the jackscrew drive means in its second mode, and fifth limit switch means responsive to the return of the arm subassembly to its original intake position over the first conveyor located to receive another incoming stereo-plate, said fifth limit switch means being operative upon actuation to de-energize the jackscrew drive means.

2. The stereo-plate transfer mechanism as set forth in claim 1 in which: the movable post section includes a longitudinal rib located in circumferentially-spaced parallel relation to the longitudinal slot therein; and, in which the arm subassembly includes a connector connecting the arm to the movable post section for rotational movement therewith and to the jackscrew for movement therealong longitudinally of said movable post section, said connector having an internally-threaded member threadedly connected to the jackscrew and a tongue projecting therefrom out through the longitudinal slot onto the exterior of the movable post section, bracket means interconnecting the tongue and arm, said bracket means including a flange extending laterally across the longitudinal rib, and guide means depending from said bracket flange in engagement with said longitudinal rib, said guide means being positioned and adapted to maintain the tongue centered within the longitudinal slot.

3. The stereo-plate transfer mechanism as set forth in claim 1 in which: the pickup means includes one horizontally-disposed finger projecting perpendicularly from the arm positioned to pass underneath the arched stereo-plate moving toward same on the first conveyor and engage said plate along a line midway between its parallel side edges upon elevation of the arm subassembly.

4. The stereo-plate transfer mechanism as set forth in claim 1 in which: the reversible jackscrew drive means includes a reversible motor mounted atop the movable post section with its output shaft in spaced parallel relation alongside the jackscrew, and power transmission means operatively-interconnecting said output shaft and jackscrew.

5. The stereo-plate transfer mechanism as set forth in claim 1 in which: the post-rotating means comprises a gear motor mounted on the fixed shaft section with its output shaft in spaced parallel relation alongside the movable post section, a first crank arm fastened to the movable post section projecting laterally therefrom, a second crank arm connected to the output shaft of the motor for rotation therewith in a plane paralleling and closely adjacent the plane of rotation of said first crank arm, and a connecting link having its opposite ends pivotally-connected to the free ends of the first and second crank arms, said crank arms link cooperating upon rotation of the motor shaft through approximately the first half turn to swing the arm subassembly from its first to its second position, and upon rotation of said motor shaft through approximately its second half turn to return said arm subassembly from its second position back to its first position by reversing the direction of movement thereof.

6. The stereo-plate transfer mechanism as set forth in claim 1 in which: the control mechanism includes a pilot shaft operatively-connected to the jackscrew for rotation therewith in the same direction and at a speed bearing a fixed ratio thereto, three independently adjustable cam-type switch-actuating means operatively-connected to the pilot shaft, the first of said switch-actuating means being responsive to rotation of said pilot shaft and operatively-

connected to the first limit switch means so as to actuate same simultaneously with the arrival of the arm subassembly at said predetermined height on the post, the second of said switch-actuating means being responsive to rotation of said pilot shaft and operatively-connected to the third limit switch means so as to actuate same simultaneously with the arrival of the arm subassembly in its discharge position, and said third switch-actuating means being responsive to rotation of said pilot shaft and operatively-connected to the fifth limit switch means so as to actuate same simultaneously with the arrival of the arm subassembly in its intake position.

7. The stereo-plate mechanism as set forth in claim 1 in which: the post-rotating means includes a motor having an output shaft operatively-connected to the movable post section; and, in which the control means includes a cam-type switch actuator connected to the shaft of said post-rotating motor for rotation therewith and to the second and fourth limit switch means, said switch-actuating means being operative to actuate said second limit switch means upon arrival of the arm subassembly in its second position, and said switch-actuating means being operative to actuate said fourth limit switch means upon the return of said arm subassembly to its first position.

8. The stereo-plate transfer mechanism as set forth in claim 2 in which: the tongue has a transverse opening therethrough aligned with the longitudinal slot in the movable post section, and in which a trunnion is journaled for rotation within said transverse opening in position to bear against the sides of said slot so as to maintain the tongue centered therein.

9. The stereo-plate transfer mechanism as set forth in claim 2 in which: the guide means comprises a pair of trunnions journaled for rotation on the inside of the bracket flange in position to ride along opposite sides of the longitudinal rib.

10. The stereo-plate transfer mechanism as set forth in claim 3 in which: the pickup means includes two additional horizontally-disposed fingers located in spaced parallel relation on opposite sides of said first finger, said three fingers being positioned in tangential relation to a cylindrical surface having substantially the same radius of curvature as the inside arch of a stereo-plate.

11. The stereo-plate transfer mechanism as set forth in claim 5 in which: the connecting link is adjustable to vary the spacing between the pivot axes on opposite ends thereof, said adjustment being adapted to vary the horizontal angle through which the arm subassembly swings between its first and second positions upon each half revolution of the gear motor.

12. The stereo-plate transfer mechanism as set forth in claim 6 in which: the three cam-type switch actuating means are arranged in stacked relation one above the other for conjoint rotation about a common axis, each of said switch-actuating means being independently adjustable rotarily relative to the other two so as to vary the time sequence at which they actuate their respective limit switches.

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214—89