

[54] **APPARATUS FOR AUTOMATICALLY REGISTERING AND COMBINING TWO SHEET MEMBERS**

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Related U.S. Application Data

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[52] U.S. Cl. **271/227; 156/351; 156/364; 271/250**

[51] Int. Cl. **G05g 15/00**

[58] Field of Search 156/351, 360, 362-364; 271/226-228, 239, 250, 252-255; 93/36 SQ. 36.6; 112/2, 121.15; 198/235, 244, 288, 21

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Primary Examiner—Charles E. Van Horn

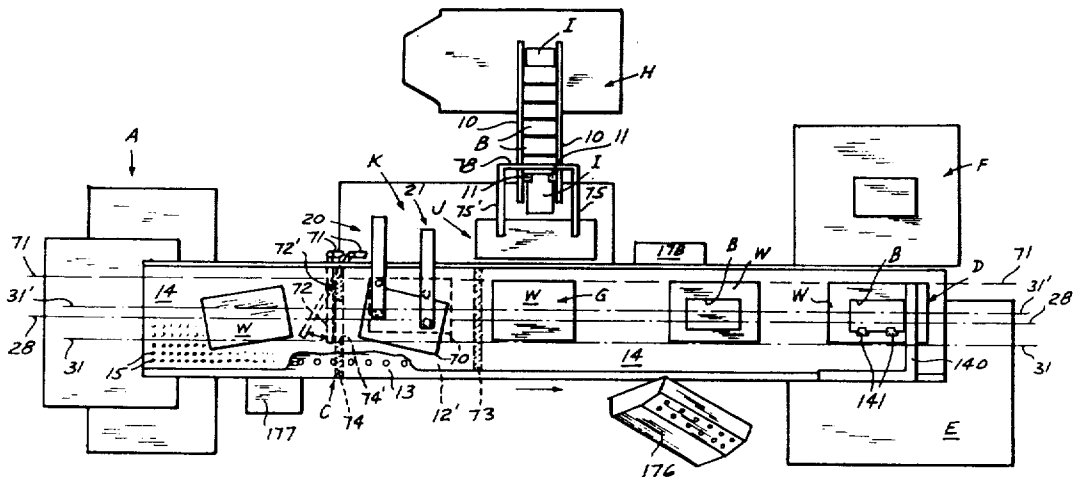
Assistant Examiner—David A. Simmons

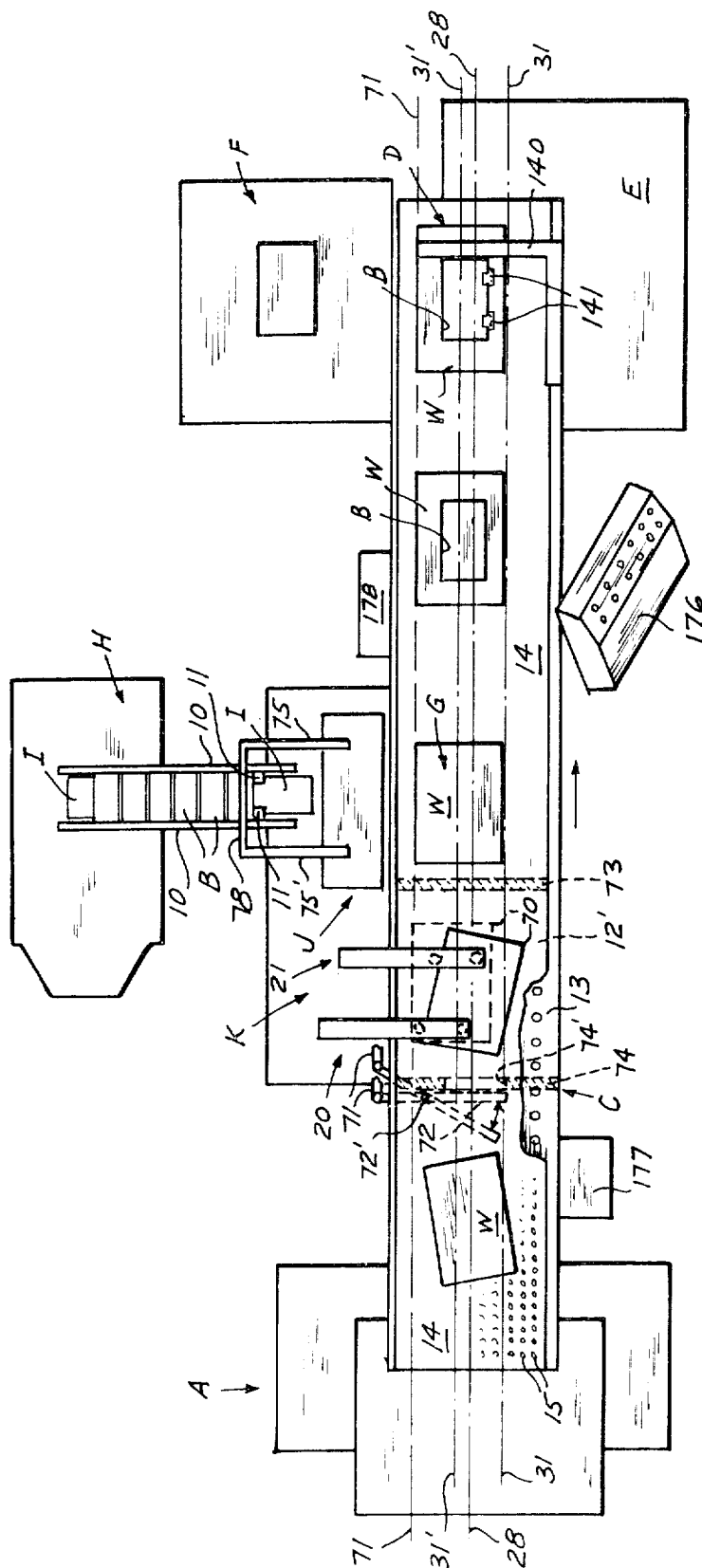
Attorney, Agent, or Firm—John J. Hart, Esq.

[57] **ABSTRACT**

The apparatus includes first means for shifting one sheet member deposited askew on a conveyor, transversely of the latter until an edge of such one sheet member extending in the direction of feed of the conveyor is brought into alignment with a reference line offset from but parallel to the longitudinal centerline of the conveyor, and second means for searching in a direction longitudinally of the conveyor for such one sheet member in its shifted position on the conveyor while such one sheet is being conveyed to a place of registration, and for simultaneously transporting a second sheet member to such place of registration, and when said second means has found such one sheet member at the place of registration and locked it in registration with the second sheet being transported, said second means deposits the second sheet member upon the first sheet member. Photocell units carried by the first and second means control the transverse shifting movements of the first means and search for the shifted first sheet member.

3 Claims, 9 Drawing Figures





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FIG. 2

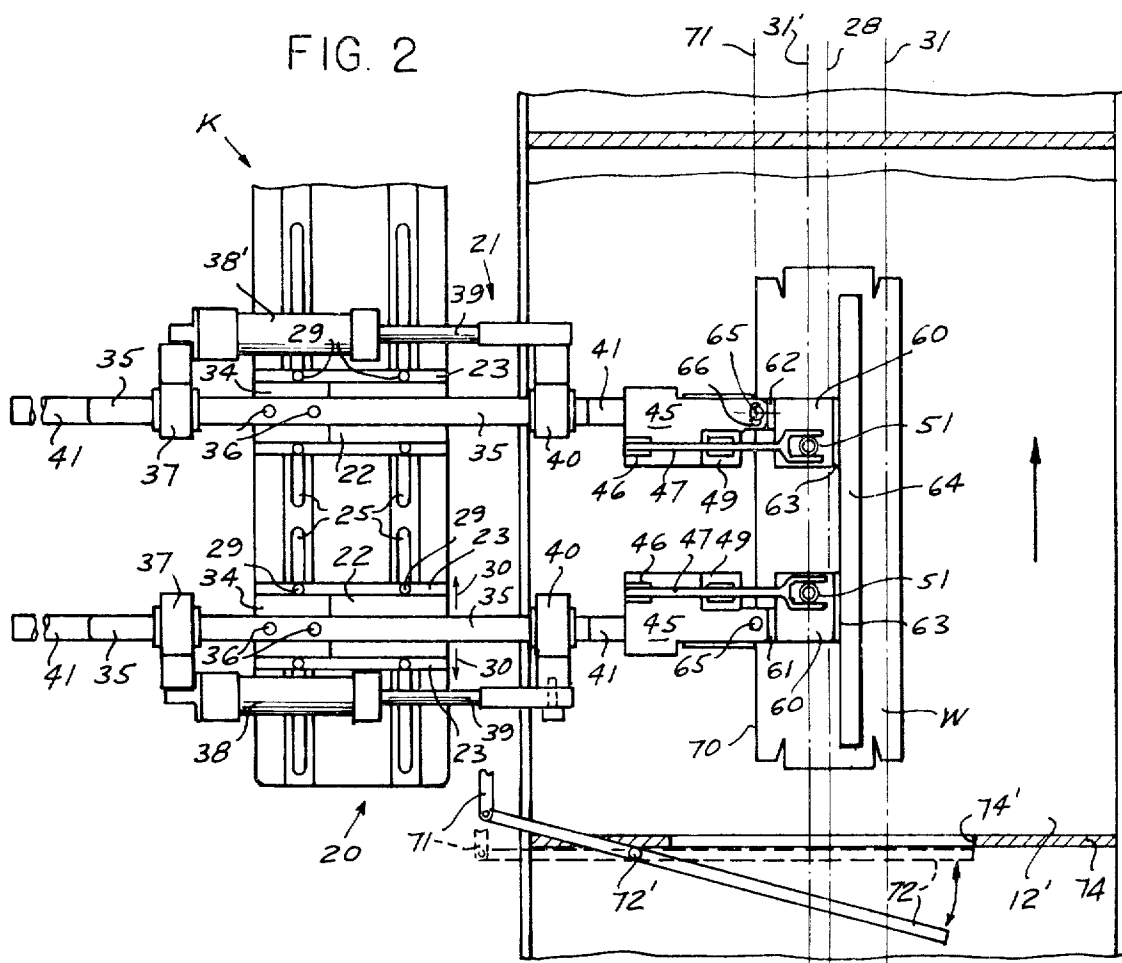
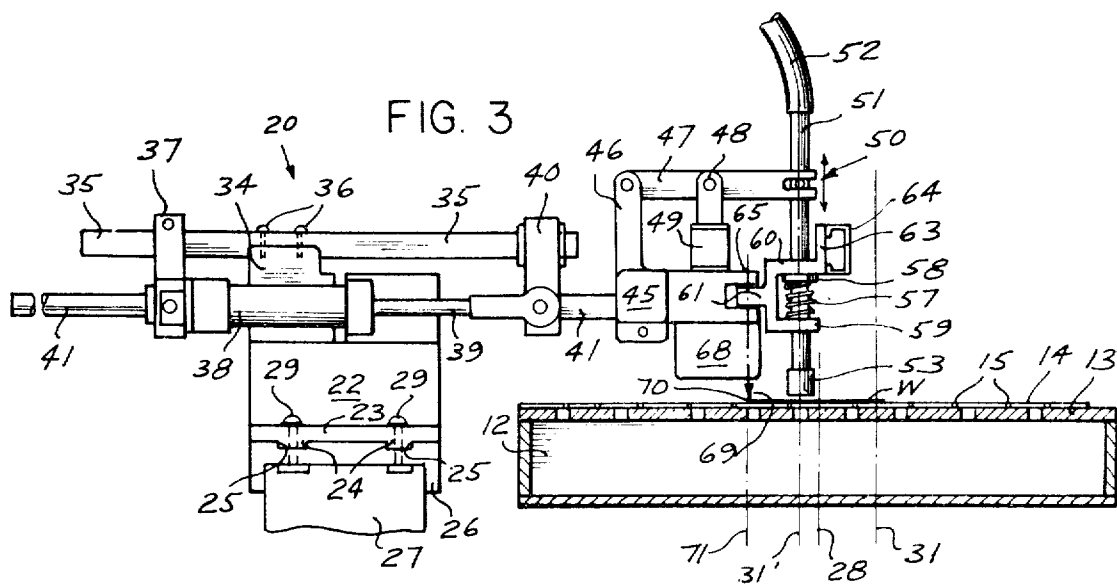


FIG. 3



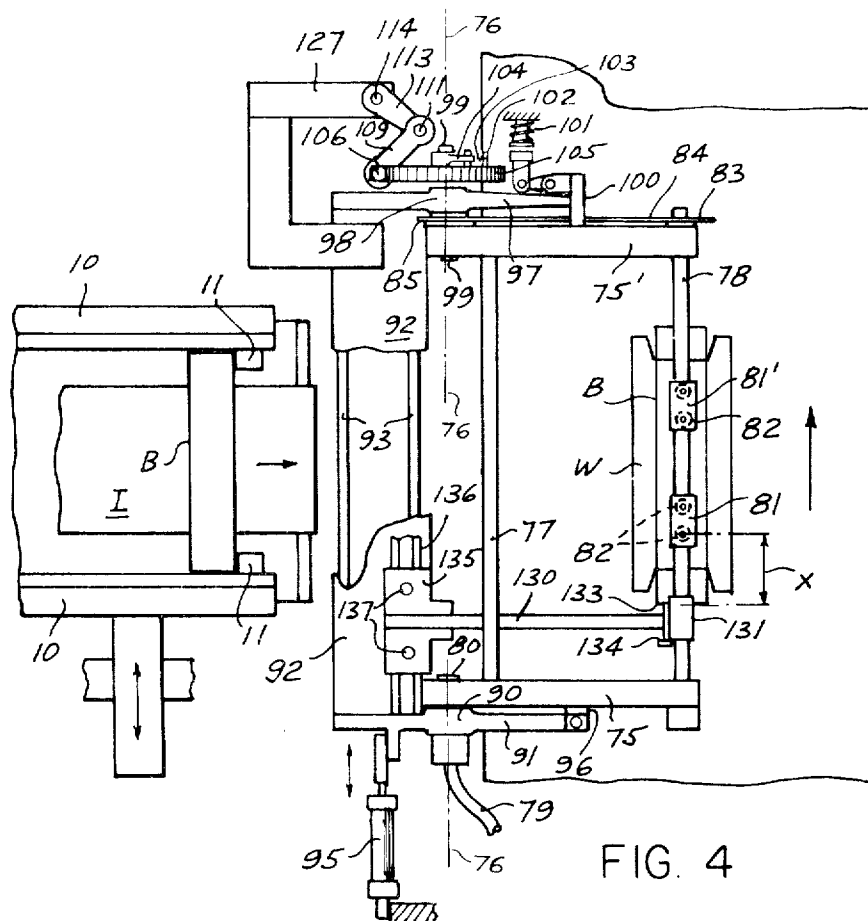


FIG. 4

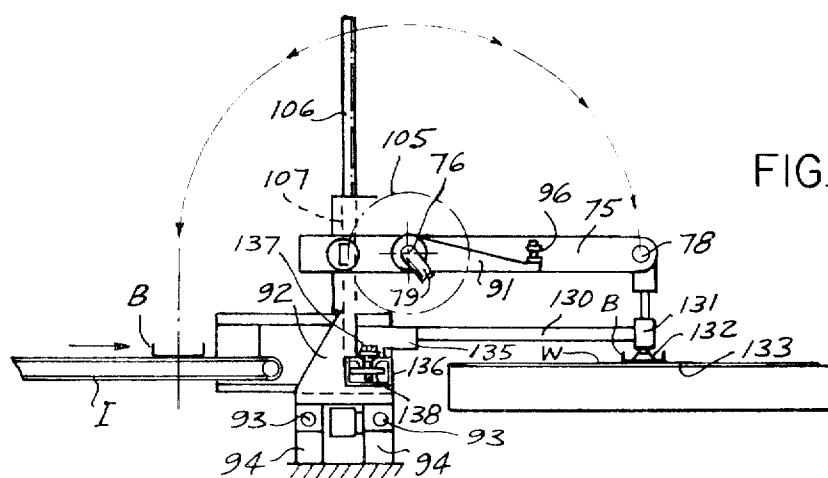


FIG. 5

SHEET 4

FIG. 6

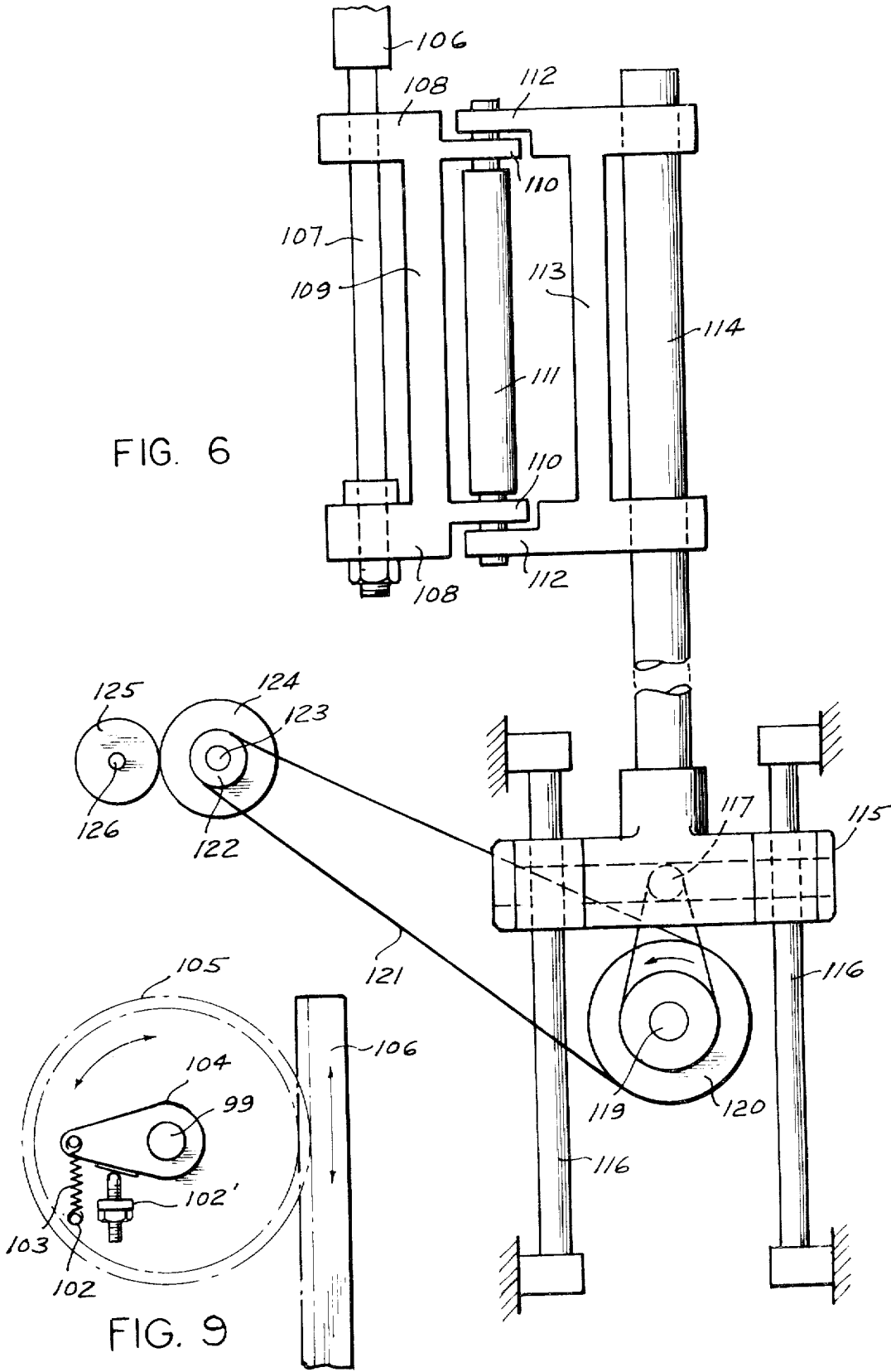
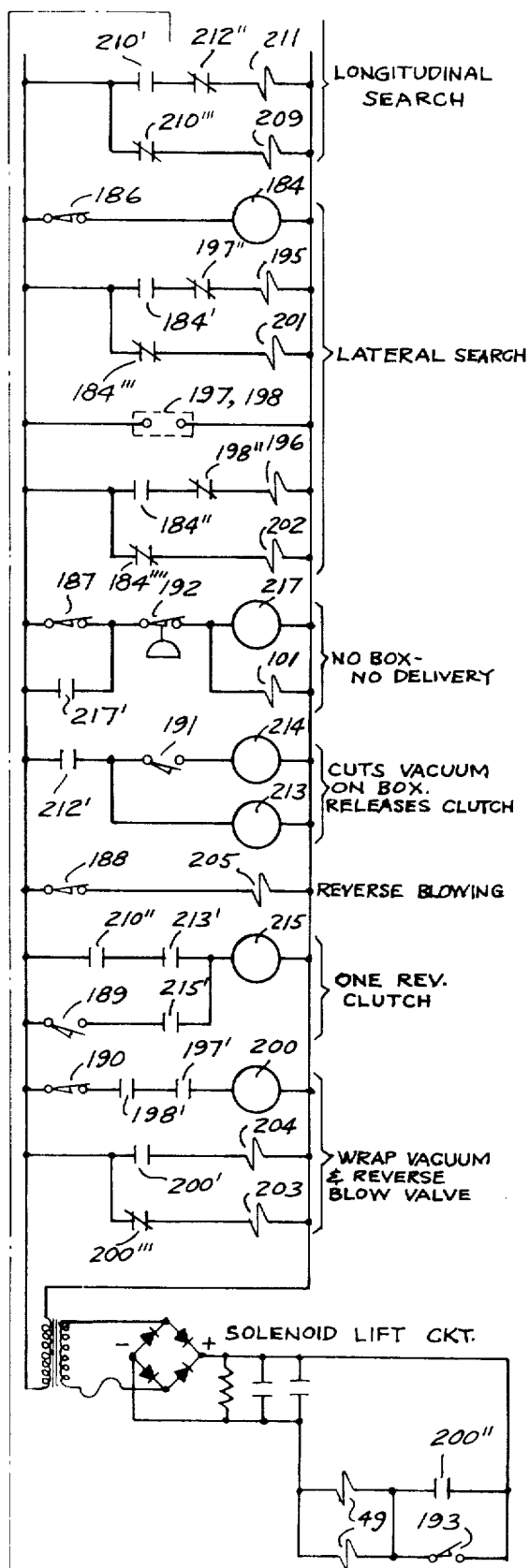
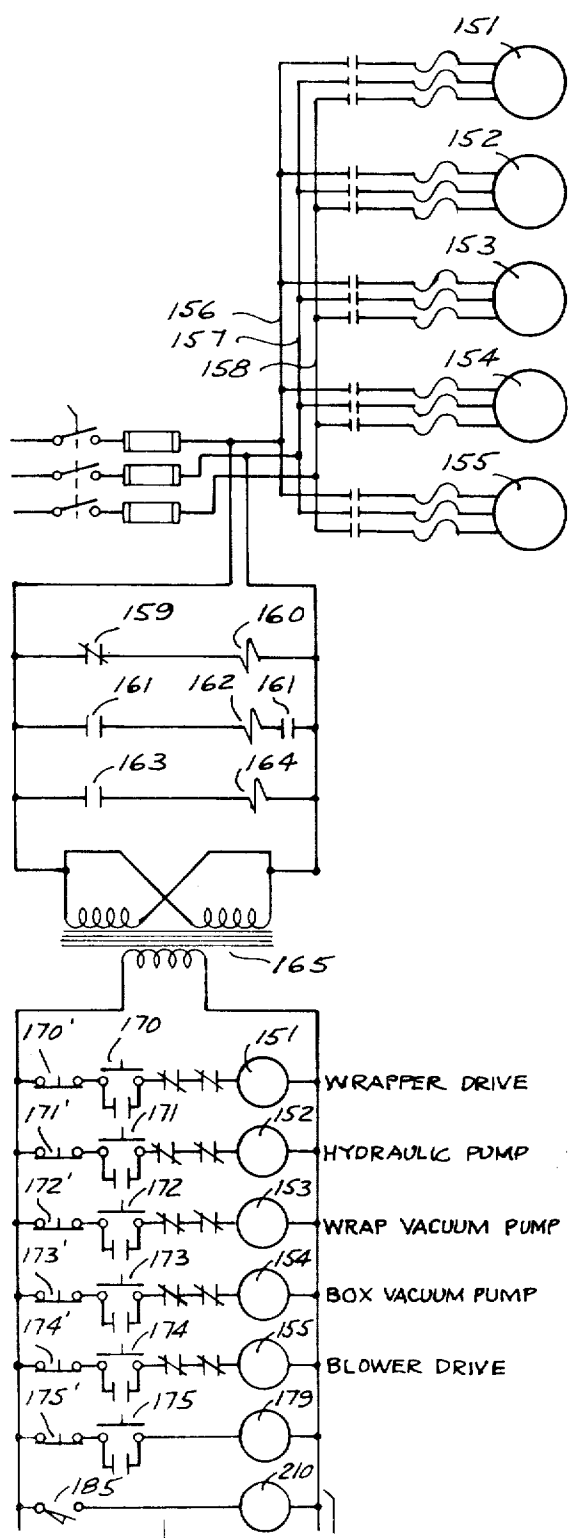


FIG. 7



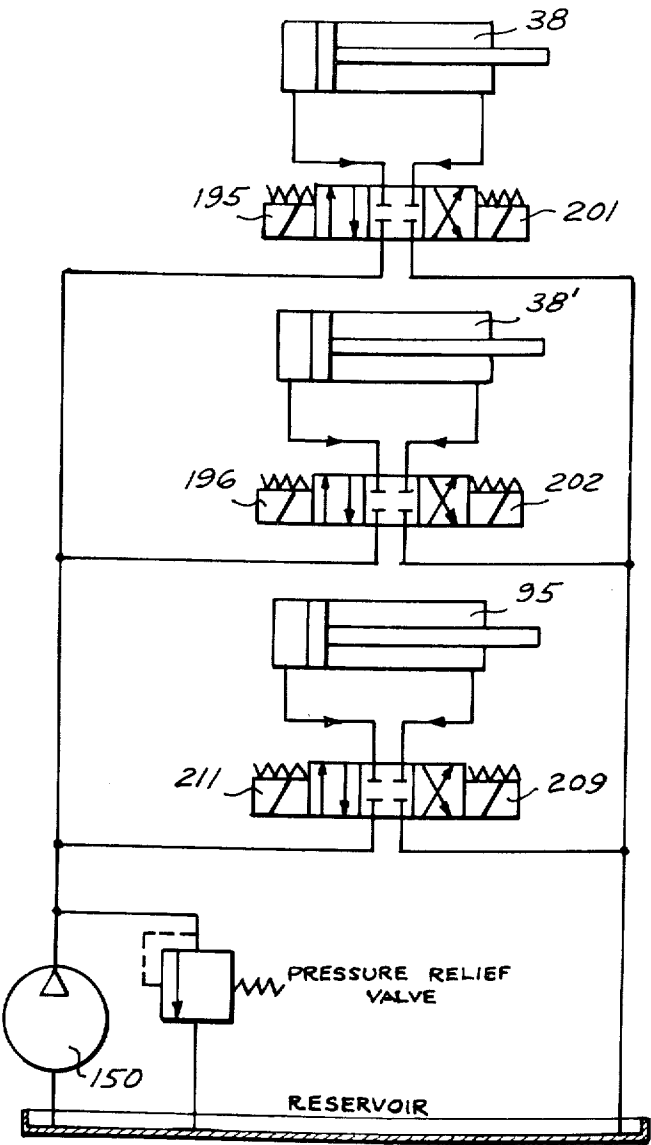


FIG. 8

APPARATUS FOR AUTOMATICALLY REGISTERING AND COMBINING TWO SHEET MEMBERS

This is a division of application Ser. No. 280,673, filed 8/14/72, now U.S. Pat. No. 3,856,607.

THE INVENTION

This invention relates to apparatus for automatically registering and combining two sheet members such as a wrap sheet to the outer surfaces of a cardboard container.

The primary purpose of the invention is to provide an improved apparatus that is capable of automatically and precisely registering two sheet members preparatory to combining them together and of effecting such accurate assembly at relatively high speed.

Another object of the invention is to provide an improved apparatus of the indicated type which is relatively simple in its construction and which can operate reliably for long periods producing accurately registered and combined sheet members.

A further object of the invention is to provide an improved apparatus of the indicated type capable of providing uniform handling and registration of sheet members having widely varying lengths, widths, or depth proportions.

Other objects of the invention, as well as the novel features thereof will become apparent from a perusal of the following description when read in connection with the accompanying drawings, which show by way of example a preferred embodiment of the invention, and in which

FIG. 1, shows in plan view a box wrapping system embodying the invention;

FIG. 2 is a plan view of the mechanism for making a lateral search of the wrappers carried by the system conveyor; FIG. 3 is a side elevational view of one of the two devices which constitute the mechanism shown in FIG. 2;

FIG. 4 is a plan view of the mechanism for spotting a stayed box upon a registered wrapper;

FIG. 5 is a side elevational view of the mechanism shown in FIG. 4;

FIG. 6 is a schematic side elevational view of the apparatus for actuating the box transfer mechanism;

FIG. 7 is a schematic diagram showing the essential elements contained in the electrical control circuit of the system;

FIG. 8 is a schematic diagram of the pertinent elements in the hydraulic circuit of the system; and

FIG. 9 is a detail showing the connection of the apparatus in FIG. 6 to the box transfer mechanism, the view being taken along the right side of the mechanism shown in FIG. 4.

Referring now more particularly to FIG. 1 of the drawings the box wrapping system depicted therein includes a gluer A of known construction suitable for applying adhesive material to wrappers W for box or container structures B. The gluer A delivers the wrappers W, coated face uppermost, to a conveyor C of known construction which advances the wrappers in a step-by-step fashion to a transfer station D where the wrappers together with the boxes B deposited thereon are successively carried by transfer mechanism E to a wrapping machine F. The boxes are successively deposited on the wrappers at an intermediate spotting station G

during the periods of dwell in the step-by-step feed of the conveyor. The boxes B are fabricated in a box staying machine H of any suitable known construction and having associated therewith a suitable conveyor I for feeding the stayed boxes B toward the spotting station G. The conveyor I is provided with adjustable side guides 10,10 for the boxes carried thereby and such guides adjacent to the discharge ends thereof are provided with adjustably mounted box stops 11,11. The leading boxes successively engaging the stops 11, 11 are successively transferred by box transporting apparatus J to the wrappers successively stopping at spotting station G.

The wrap conveyor C is preferably of the type disclosed in the Wolff et al. U.S. Pat. No. 2,958,267, dated Nov. 1, 1960 and generally comprises an elongated suction box or chamber 12, in FIG. 3, provided with a flat, perforated upper wall 13 and in communication with any suitable source of suction such as the suction side of a blower. The upper wall 13 supports the upper run 14 of an endless belt provided with perforations 15. Accordingly, during operative periods of the machine, the suction developed in the suction box 12 will be effective at the wrapper carrying surface of the conveyor through the perforations 15 of the upper run 14 of the conveyor belt as it travels over the perforated supporting wall 13. The suction so developed at the carrying surface of the upper belt run 14 is a relatively light suction which is sufficient to maintain the wraps in flattened condition and to hold them on the upper run 14 in the positions in which they are placed by the gluer A. Such suction, may be made insufficient to interfere materially with the slidable lateral shifting movement which is successively imparted to the wraps in order to reposition them accurately on the upper run 14 prior to their reaching the spotting station G, as will be presently explained, but preferably in accordance with the invention such suction is sufficient to positively secure the wraps on the conveyor run 14 and is temporarily reduced at the place where such shifting operation takes place as will be hereinafter more fully explained.

As will be noted from FIG. 1 of the drawings, the mechanism K for laterally or transversely shifting the wraps on the upper conveyor run 14 form with the box transporting mechanism J the apparatus for accurately orienting and uniting together the wraps W and the boxes B. The mechanism K is spaced upstream from the mechanism J the distance that a wrap is carried by the conveyor run 14 in one movement of the latter so that in one dwell period a wrap pauses before the mechanism K and in the next successive dwell period pauses before the mechanism J. As will be observed in FIGS. 1-3 of the drawings, the mechanism K is composed of two spaced lateral searching devices generally designated 20 and 21 and of similar construction except in the few particulars hereinafter pointed out. Accordingly, except for such particulars, a detailed description of one of such devices 20 and 21 will suffice as a description of both of them.

Referring now more particularly to the lateral search devices 20 and 21 shown in FIGS. 2 and 3 of the drawings, it will be noted that each of such devices 20 and 21, comprise a supporting block 22 having side flanges 23 provided with depending guide members 24 that are slidably received in guide slots 25 extending longitudinally in a track member 26 secured to a fixed frame member 27 in any suitable fashion. The track member

26 is positioned on the machine parallel to the longitudinal centerline 28—28 of the conveyor so that the block 22 is adjustable thereon in the direction of such centerline as indicated by the arrows 30 in FIG. 2. The block 22 is secured in adjusted position in any suitable fashion as by the bolts 29. The upper end of the supporting block 22 is provided with a seat 34 to which is fixedly secured by bolts 36, a rod 35 that is disposed laterally to the longitudinal conveyor centerline 28—28. Clamped to the end of the fixed rod 35 projecting rearwardly from the seat 34, as by means of a bracket 37, is the rear end of a hydraulic cylinder 38 disposed in parallelism to the rod 35 supporting the same. The advanced end of the piston rod 39 of the hydraulic cylinder 38 is clamped to a bracket 40 that is slidably mounted on the other end of the fixed rod 35 projecting forwardly from the seat 34. The bracket 40 is also secured to a rod 41 which extends through and is slidably supported by the block 22. The slidable rod 41 is disposed parallel to the fixed rod 35 and laterally or transversely to the centerline 28—28 of the conveyor. The forward end of the rod 41 extends beyond the bracket 40 and part way over the upper run 14 of the conveyor belt so as to be in spaced parallel relation to such belt run. It will accordingly be understood that as a result of this arrangement, the hydraulic cylinder 38 which is fixed to the frame of the machine through the rod 35, seat 34 and the block 22, will when actuated, slidably reciprocate the rod 41 laterally across the upper run 14 of the conveyor belt.

Mounted on the forward end of each slidable rod 41 in the devices 20,21 is a block 45 having fixed thereto an upright support member 46, to the upper end of which is pivotally connected one end of a lever arm 47. Connected to the arm 47 intermediate its length is the upwardly projecting end of the core 48 of a solenoid 49 mounted on the block 45 and connected in a control circuit so as to pull down the lever arm 47 when energized. Connected to the outer end of the lever arm 47, as by a pin and slot connection 50, is a straight vertical rigid tube 51. The upper end of the tube 51 is connected by flexible tubing 52 to a suitable source of vacuum. The lower end of the tubing has mounted thereon a suction cup 53 made of any suitable material nonadherent to the adhesive on the wrapper W, such as Teflon. The tubing 51 extends freely through openings in the plate-like legs 59 and 60 of a forked member which is designated 61 in the device 20 and 62 in the device 21. A spring 57 and a collar 58 located between the legs 59 and 60 normally bias the tubing 51 to a raised position. The spring 57 is seated on the lower leg 59 and at its upper end seats against the collar 58 which is secured to the tubing 51. The upper leg 60 of the forked member, as is shown in FIG. 3, functions as a stop to the upward biased movement of the collar 58 and consequently of the tubing 51 under the tension of spring 57. The upper forked legs 60 are provided with integral vertical extensions 63,63 to which are secured a horizontal strut member 64 which ties the two search devices 20,21 together. The forked members 61 and 62 are mounted for pivotal movement about vertical axes 65 on the forward ends of the blocks 45. It will be observed in FIG. 2 of the drawings that the connection of the forked member 61 with its associated block 45 is such that the pivotal axis 65 thereof is a fixed axis, while the pin connecting the forked member 62 with its associated block 45 is mounted in an elongated open-

ing 66 which permits pivotal movement of such member without binding which might otherwise occur because of the connection of the two forked members by the strut 64. The blocks 45 each also carry a photocell sensing device 68, the light beam 69 of which is directed vertically toward the upper run 14 of the conveyor belt. The axes of the two light beams 69 coincide with the vertical axes 65 of the forked members 61 and 62 throughout the movements of such forked members, whereby the beams 69 and axes 65 will remain fixed relative to each other and will not move off the edge 70 of such sheet during the relative movements of the two devices 20 and 21.

It will be understood from the aforesaid description of the lateral searching mechanism K, that the two devices 20,21 forming such mechanism start from a retracted position in their search for a wrapper W on the upper conveyor run 14. When the wrapper has been found by the devices 20,21 and shifted laterally on the conveyor run as they return to retracted condition, the relation of the light beams 69 with the suction cups 53 on these devices is such that in the retracted condition of the devices 20,21, the longitudinal edge 70 of a shifted wrap located at the lateral searching station (see FIGS. 1—3) will have been shifted into aligned registry with a given imaginary reference line 71—71 offset from and parallel to the longitudinal centerline 28—28 of the conveyor C. As indicated in FIG. 1 of the drawings, the wraps supplied to the conveyor belt by the gluer A are not deposited on the conveyor in accurate position for combination with a box B but are deposited thereon in a random askew fashion depending on the conditions prevailing during the deposition thereof. It has been determined from experience that the longitudinal centerlines of such askewed wraps are usually within an inch and half transverse range starting at the longitudinal centerline 28 of the conveyor and extending forwardly from such centerline so that the longitudinal centerline 31—31 of such range is disposed about three-fourths inch to the right of the conveyor centerline 28—28, as viewed in FIGS. 1—3.

In order to provide an adequate distance in which the light beams or eyes 69 may start their search for wraps within such 1½ inch range of search and to enable the eyes to find the edge 70 of any wrap which might be slightly beyond the longitudinal edges of such range, the distance through which the eyes make their search is extended transversely about one quarter inch on both sides of such range so that the transverse range of search of the eyes is about 2 inches. Further, the eyes 69 and the suction cups 53 are so located on the devices 20,21 that when the latter are in their retracted positions with the wrap repositioned so that its edge 70 is in registry with the reference line 71—71, the centerline 31—31 of such searching range will also be shifted to about one-quarter inch to the left of the conveyor centerline 28—28 as viewed in FIGS. 1—3, i.e., to the line 31'—31'. This means that the reference line 71—71 which is set at a distance equal one-half of the wrap width from the line 31'—31' will be spaced from the conveyor centerline 28—28 a distance at least greater than one inch for wraps 2 inches wide or greater. In other words, the location of the reference line 71—71 with reference to the centerline 28—28 will depend on the width of the size of wrap which is being registered so that its centerline coincides with line 31'—31'. As a result of this arrangement, the de-

vices 20,21 will be able to bring most wraps deposited by the gluer onto the conveyor into proper registration at the searching station. The few wraps that are deposited on the conveyor by the gluer so as to be outside of the selected range will be advanced past the wrap searching station and the box spotting station G without a box being applied thereto and will be discarded.

When the wrap W that has been deposited in an askew condition on the conveyor by the gluer arrives at the wrap searching station, both devices 20 and 21 are advanced simultaneously from their retracted positions by the hydraulic cylinders 38 and 38', respectively. The first beam or eye 69 on such devices that finds the longitudinal edge 70 of the wrap causes the device carrying the photosensor 68 which emits such beam to be stopped in its searching forward movement, while the other device continues to move its beam 69 forwardly in its search for the wrap edge 70. When both lateral search devices 20 and 21 have completed their search for the wrap edge 70, vacuum is supplied to the vacuum cups 53 thereof and at the same time the solenoids 49 are energized to lower the vacuum cups to a position just short of contact with the wrap. By stopping the downward movement of the vacuum cups just short of contact with the wrap, allowance is made for any distortions that might be present in the paper material constituting the wrap and which might interfere with the operations of the suction cups if such distortions were contacted by the latter. The suction provided in the suction cups 53 is sufficient to pick up the portions of the wrap underlying the same.

The devices 20 and 21 are now actuated to retract the suction cups 53 laterally of the conveyor run 14 to positions in which the edge 70 of the wrap is brought into aligned registry with the longitudinal reference line 71—71'. In accomplishing this operation the suction cups 53 will remain in their lowered positions in which they are slightly spaced above the carrying surface of the upper conveyor belt run 14 and will merely shift the wrap on the conveyor belt to bring the edge 70 thereof into the said registered position. During such shifting movement of the wrap a damper 72 in the conveyor box 12 comes into operation to reduce the vacuum exercised on the wrap through the belt run 14 and thereby free it sufficiently to enable the suction cups 53 to accomplish such shifting movement of the wrap without changing the relationship of the suction cups 53 to the edge 70 of the wrap gripped thereby.

As is shown in FIGS. 1 and 2 of the drawings, the damper 72 is mounted for pivotal movement about a fixed axis 72' and is actuated by cam controlled means 71 from the transfer mechanism E. During the step-by-step movements of the conveyor C, the damper 72 is maintained in an opened position to permit a portion 12' of chamber 12 located in the region of the lateral searching apparatus K to be in communication with the source of suction. The chamber portion 12' is formed by a downstream partition 73 and an upstream partition 74 extending transversely of the chamber or box 12, and such chamber portion underlies the portion of the belt run which will be located in the region of the lateral searching apparatus K during the dwell periods of the conveyor C. The partition 74 is provided with a centrally located opening 74' which is closed by the damper 72 during each dwell period of the conveyor so as to reduce but not eliminate the vacuum in the chamber portion 12' and thereby to effect a reduction in the

hold exercised on the wrap through the belt run 14 during the shifting thereof into registered position. It will be understood that while the partition 73 seals one end of the chamber 12', the chamber 12 extending downstream from such partition will still be in communication with a source of vacuum to exercise a control over the registered wrap. When the edge 70 of the wrap is brought into registration with the imaginary reference line 71—71', the vacuum to the suction cups 53 is broken and compressed air is introduced to blow the wrap back onto the conveyor run 14. Soon thereafter, the solenoids 49 are deenergized to enable the springs 57 to lift the lever arms 47 to raise the suction cups. The vacuum effected through the upper belt run 14 on the repositioned wrap will retain it in its new position during its travel to the box spotting station G.

The mechanism at the spotting station G for removing a box B from the conveyor I of the staying machine 11 and depositing it upon a registered wrap W comprises a frame having two spaced side arms 75,75' mounted for pivotal movement about a pivotal axis 76—76'. The frame further includes a rear tie bar 77 located adjacently forward of and parallel to the pivotal axis 76—76' and fixedly secured to the side arms 75,75'. Rotatably mounted on the forward free ends of the side arms 75,75' is a hollow shaft 78 connected by a passageway provided in arm 75 and communicating with flexible tubing 79 which is attached to the hollow pivotal shaft 80 on which such arm is mounted and which is connected to a suitable source of vacuum. Adjustably mounted on the rotatable shaft 78 and in communication with the interior thereof are two units 81,81' each having a pair of depending suction cups 82. Rotatable movement is imparted to shaft 78 through a sprocket 83 secured to the end of such shaft projecting beyond the arm 75', a chain 84, and a sprocket 85 fixed to a hub provided on the bearing support member 98. It will thus be seen that as the arms 75,75' are pivoted about their axis 76,76', the sprocket fixed to support member 98 and having an axis common to axis 76,76', will through chain 84 rotate sprocket 83 and consequently shaft 78. Therefore, a box B which is being carried by the suction cups provided on shaft 78 will be maintained in a horizontal position as the arms 75,75' swing forwardly from the staying conveyor I to the upper run 14 of the conveyor C.

The shaft 80 which rotatably supports arm 75 is mounted in a bearing 90 provided in a forwardly projecting support member 91 attached at its rear end to one end of a slide 92 slidably mounted on rails 93 for movement parallel to the longitudinal centerline 28—28 of the conveyor C. As shown more clearly in FIG. 5, the slide rails or rods 93 are supported at their ends by members 94 secured to the frame of the machine. Longitudinal sliding movement is imparted to the slide 92 by a hydraulic cylinder 95 secured to the frame of the machine and having its piston rod connected to a suitable ear provided on the slide 92. The forward end of the member 91 also coacts with an adjustable stop 96 provided on arm 75 to limit the forward swinging movement of the frame toward the upper belt run 14 and thereby to control the position of the suction cups 82 relative to such belt run at the end of the forward swinging movement of such frame.

Attached to the other end of the slide 92 is a second forwardly projecting support member 97 provided with a bearing support 98 for the shaft 99 pivotally support-

ing the side frame arm 75'. The member 97 is provided at its forward end with a latch member 100 adapted to be moved under the arm 75' to prevent the latter from completing its forward swing in the event a registered wrap is not found at station G. The operation of the latch member 100 is controlled by a solenoid 101 the core of which is connected to latch member 100 and moves the latter across the path of movement of the arm 75' when the solenoid 101 is energized.

The swinging movements of the frame are effected through mechanism associated with the frame arm 75'. Such mechanism comprises a segmented gear wheel 105 engaged by a vertically disposed rack 106 and secured to shaft 99 by spring loaded means which may constitute at least one lever 104 secured to shaft 99 and connected by a spring 103 to a pin 102 provided on gear wheel 105, the rotational movement of the lever 104 and consequently of shaft 99, relative to gear wheel 105 being restricted by a stop 102' provided on gear wheel 105. The arrangement of such spring loaded means is such that when the rack 106 is in its upward stroke, i.e., rising, it positively drives shaft 99 through gear wheel 105, stop 102' and lever 104, with the spring 103 in its normal condition. When the forward stroke or travel of arm 75' is restrained by the solenoid latch 100 as previously explained, the spring 103 is stretched and permits an overstroke of gear wheel 105 thereby enabling the rack 99 to continue its upward movement to complete its stroke, without damage resulting from such stoppage of the arm 75. As is shown more clearly in FIG. 6 of the drawings, the rack 106 is secured to the upper end of a bar 107 to which is pivotally connected by suitable bearings provided in the spaced bearing arms 108, 108 of a hinge member 109 which forms part of an articulated or universal joint. The hinge member 108 is also pivotally connected by bearings in the spaced bearing arms 110, 110 thereof to the ends of a coupling or hinge pin 111 carried by the arms 112, 112 of a hinge member 113 secured to the upper end of a cam rod 114. The cam rod is guided in its vertical movements by a guide 127 in FIG. 4, secured to the frame of the machine. The cam rod 114 is provided at its lower end with a crosshead 115 slidably connected to two parallel spaced guide rods 116, 116 secured to the frame of the machine. Engaged with the transverse slot of the crosshead 115 is a slide block 117 provided on the outer end of a crank arm 118 secured to one end of a shaft 119. Also secured to shaft 119 is a gear wheel 120 which is connected by a chain 121 to a gear wheel 122 secured to a driven shaft 123. Shaft 123 is driven through a gear 124 secured thereto and meshing with a gear 125 mounted on a constantly rotating shaft 126. The gears 125, 124 are designed to provide a 2:1 reduction, while the gear wheel 122, chain 121 and gear wheel provide a 3:1 reduction. Thus, while shaft 125 rotates at 6 revolutions per cycle of operation of the machine, shaft 119 will rotate at 1 revolution per cycle. During this one cycle revolution of shaft 119, the cam rod 114 will be raised and lowered to raise and lower, respectively, the rack 106 and thereby through gear wheel 105 and shaft 99 to advance and retract, respectively, the side arms 75, 75' of the spotter frame. Due to the crosshead connection of the cam rod 114 with the crank arm 118, and the articulated joint connection between such crank arm 118 and the rack 106, the rack will be provided with a constant straight vertical movement throughout the entire

revolution of the crank arm 118 and the longitudinal movement of slide 92 parallel to the longitudinal centerline 28—28 of the conveyor C. As a result of this arrangement the stroke of the rack 106 will at all times be constant and accurate.

It will be noted more clearly in FIG. 4 of the drawings, that the slide 92 also carries a forwardly projecting bar 130 on the outer or forward end of which is mounted a photo-electric sensor unit 131 having a beam 132, in FIG. 5, which searches for the upstream edge 133 of a registered wrap W. The bar 130 is located between the frame side arm 75 and the frame vacuum unit 81 so that the beam 132 of the sensor unit 81 will be positioned a given distance X upstream from the upstream vacuum cup of such unit 81. The sensor unit 131 is movably connected to the bar 130 by a micrometer adjustment device 134 so that such given distance X can be determined with great exactness. A coarse adjustment of the sensor beam 132 with relation to the upstream vacuum cup of unit 81 is made by adjustment of the bar 130 with relation to the slide 92. As is shown in FIGS. 3 and 4 of the drawings, the bar 130 is mounted on a slide 135 mounted on a tubular beam 136 of rectangular shape secured to the slide 92. The top wall of the beam 136 is slotted longitudinally to provide rails for the slide 135 which is secured in an adjusted position on such rails by bolts 137 extending through such longitudinal slot and threadedly engaged with a plate 138 located within the beam 136.

It will be understood from the foregoing that as a wrap W registered by the lateral searching apparatus K moves downstream from such apparatus toward the box spotting station G, the frame side arms 75, 75' will be in a retracted position with the vacuum cups 82 located within the foremost box B on the staying machine conveyor I and accurately positioned thereon for receipt of such cups by the adjustable stops 11 in the previous cycle of the machine. During such downstream movement of the wrapper, vacuum will be furnished to the cups 82 enabling them to pick up the box, and the rack 106 will be raised in the manner previously explained to swing the frame arms 75, 75' forwardly. During such swinging movement of the arms, the shaft 78 will be correspondingly rotated in the manner previously explained so that the bottom of the box is maintained in a horizontal plane throughout the extent of such movement. The swinging movement of the arms will be continued until the bottom of the box is placed on the wrap under pressure provided the wrap is there in properly registered position to receive the box. Due to the fact that the box is held by suction cups 82 acting on the inside bottom of the box during the pick-up and delivery thereof, the entire box is under a positive, firm control while it is being picked-up, transported and delivered, and the bottom of the box will be adhered to the wrap evenly and firmly to provide a uniform adherence thereof to the wrap throughout its entire area.

During the forward swinging movement of the side frame arms 75, 75', the slide 92 will be moved by hydraulic cylinder 95 in a direction downstream and parallel to the conveyor travel. In so doing the frame arms 75, 75' and the parts associated therewith will be moved downstream and the beam 132 of the photosensor 131 will start to look for the trailing edge 133 of the registered wrap. It will be understood that the timing is such that the wrap will have moved downstream past the point where the photosensor can start its searching op-

eration and will shortly come to a stop at the spotting station G. As a result of this coordination of wrap search and box transfer and delivery it has been found the operation of a machine embodying the invention is materially faster than the operation of prior known machines. It is when the movement of the wrap has ceased that the beam 132 of the photosensor will locate the trailing edge 133 thereof. When this occurs, the arms 75,75' move the vacuum cups down the remainder of the distance to the belt surface to press the bottom of the box carried thereby against the glued side of the registered wrap. During this pressing operation the vacuum to the cups 82 is cut off enabling them to release the box as they are swung back by the arms 75,75' to a position enabling them to pick up the next box registered in pick-up position on the conveyor I. In the event that the beam 132 of the photosensor does not find the wrap by the time it comes to the end of its downstream range of movement, either because the wrap is missing, or so far out of register that something is wrong, the solenoid latch 100 comes into operation to prevent the completion of the forward stroke or swinging movement of the frame arms 75,75. When this occurs the box will be held in raised position above the belt run 14 until on a later cycle of the machine a properly registered wrap moves under the box and the photosensor looks for it in the manner above described and finds such wrap. In such a situation the staying machine H will be prevented from making another box until the box held by the vacuum cups 82 has been deposited on a registered wrap.

The box and wrap then proceed to the wrapping station D where a box stop 130 engages the box and stops the box and wrap in proper position to be transferred to the wrapping machine. This may be accomplished by clamps 141 constructed and operating in the manner disclosed in said Wolff et al., U.S. Pat. No. 2,958,267 to shift the gripped box assembly across the upper conveyor run 14 and into proper position in the wrapping machine F.

Considering now the electrical and hydraulic circuits shown in FIGS. 7 and 8 of the drawings, it will be understood that the wrapping machine F, the hydraulic pump 150 for supplying hydraulic fluid to the lateral search cylinder 38 and the longitudinal search cylinder 95, the vacuum pump (not shown) for supplying vacuum to the box holding suction cups 82, the vacuum pump (not shown) for supplying vacuum to the chamber or box 12 in the manner disclosed in said Wolf et al., U.S. Pat. No. 2,958,267 and a compressor (not shown) for supplying air under pressure to the wrap registering cups 53, are driven by separate motors 151-155, respectively, connected in the manner indicated through lines 156, 157 and 158 to a source of 220 voltage, 60 cycle, three phase alternating current. Also connected to such source through the lines 156, 157 and 158 is the normally closed relay 159 for controlling a one revolution clutch solenoid 160 that controls the operation of the machine or system. So long as control relay 159 is not engaged, it keeps the one revolution clutch engaged to prevent the machine from stopping. Lines 156, 157 and 158 also connect to such source a normally open relay 161 for controlling the vacuum release solenoid 162 that normally enables vacuum to be furnished to the box vacuum cups 82. When control relay 161 is closed to energize solenoid 162, the vacuum to the cups 82 is broken. Further connected to the

source through lines 156, 157 and 158 is a normally open relay 163 that controls a wrapper trip solenoid 164. When control relay 163 is closed to energize solenoid 164 the cycle of operation of the wrapping machine F is started. Since the transfer mechanism E and the box transporting apparatus J are all run by the same motor 151 for the wrapping machine F, when the latter is thus started up, the transfer mechanism E and the box transporting apparatus J will also start their cycles of operation. The current supplied to the circuit containing the control relays 159, 161 and 163 and their associated solenoids 160, 162 and 164, respectively, is passed through a control voltage transformer 165 which transforms the current supplied by the source into a 110 voltage, 60 cycle, single phase current which is utilized to operate the circuits containing the other controls.

The portion of the control circuit operating on 110 voltage current comprises the push button switches for controlling the operations of the motors 151-155, the control relays for the lateral and longitudinal wrap searches, the control relay which comes into operation when the box transporting apparatus J fails to pick up a box for delivery to a registered wrap, and the relays for controlling the pneumatic system. The push button switches 170-174 for closing the circuits and starting the motors 151-155, respectively, are normally open switches of the interlock contact type which when the buttons thereof are pushed to closed position maintain the circuits controlled thereby closed even though the buttons are released. The push button switch 175 for controlling the engagement of the clutch associated with the wrapping mechanism F is of a type similar to the switches 170-174. Associated with the push button switches 170-175 are normally closed or stop push button switches 170'-175', respectively. These push button switches 170-175 are mounted in a housing 176 located at the front end of the machine, in front of the conveyor C, as is shown in FIG. 1. Provided in a second housing 177 also located in front of the conveyor C is the programming mechanism. The hydraulic unit comprising pump, tank and three spring centered hydraulic valves is enclosed in a housing 178 located just to the rear of the conveyor C.

It will be understood from the foregoing that when it is desired to put the machine or system into operation, the push button switches 170-174 are temporarily closed to start, respectively, the motor 151 for the wrapper drive, the motor 152 for the hydraulic pump, the motor 153 for the wrap vacuum pump, the motors 154 for the box vacuum pump, and the motor 155 for the blower drive. At the same time the push button switch 175 is closed to energize a control relay 179 thereby actuating the clutch (not shown) to start the drives for operating the transfer mechanism E, the wrapping machine F, the staying machine H and the box transporting apparatus J. Prior to the actuation of the push button switches 170-175, a push button switch (not shown) is actuated to start the gluer A which causes the conveyor C to start its intermittent advancing movement of the belt run 14. The start of the box transporting apparatus J also starts the rotation of a shaft in the programmer 177 provided with cams for controlling the operation of a number of programming switches 185-193. At 0° cam shaft time, the belt run 14 in each cycle of the machine starts the travel of its set distance and then comes to a dwell at a certain

camshaft time. When the belt run 14 stops in each period of dwell, the programming switch 186 is actuated to close a control relay 184 and thereby start the previously described lateral search by the photosensors 68 on the searching devices 20 and 21. The start of this search by the two devices 20 and 21 is initiated with the closing of control relay 184 having normally open contacts 184' and 184'', and normally closed contacts 184''' and 184'''. When relay 184 is closed, it energizes the solenoid valves 195 and 196 controlling the hydraulic cylinders 38,38' to cause the latter to commence the advancing strokes of the slidable rods 41. When the eyes or light beams 69 of the photosensors 68 find the edge 70 of the wrap W the contacts 197', 197'' and 198' and 198'', respectively of two double pole relays 197 and 198 associated with the photosensors 68 are opened to deenergize the hydraulic solenoid valves 195 and 196. This centers the valves, that is, blocks both sides of such valves, so that the hydraulic cylinders 38,38' cannot be moved forward or backward. When the solenoid valves 195 and 196 are deenergized, solenoid valve 196 closes to energize a control relay 200 having two normally open contacts 200' and 200'' and an normally closed contact 200''', to cause the opening of a path enabling vacuum to reach the vacuum suction cups 53 of the devices 20 and 21. At the same time the energization of control relay 200 also causes the closing of solenoid valves 201 and 202 thereby energizing their associated solenoids 49,49 on the devices 20 and 21 to bring the suction cups 53 down to positions enabling them to grip the wrap. Switch 186 then opens, deenergizing control relay 184 which reverses its contacts to cause the energization of the solenoid valves 201 and 202, thereby causing the lateral search hydraulic cylinders to return to retracted position in which the edge 70 of the wrap W will be aligned with the reference line 71—71. Switch 190 then opens to deenergize control relay 200 which causes the energization of vacuum control switch 203 and the deenergization of vacuum control switch 204 thereby cutting the supply of vacuum to the cups 53 holding the wrap. At the same time switch 188 closes and causes the energization of the compressed air solenoid valve 205 to introduce air under pressure to the suction cups 53 and thereby blow the registered wrap W down against the conveyor run 14 where it will be retained in registered position on such run by the vacuum exercised through the conveyor belt. Switch 193 which has remained closed while suction is provided in the cups 53 prevents the solenoids 49,49 from being deenergized. However, as soon as compressed air is delivered to the cups 53, switch 193 opens, causing the deenergization of solenoids 49,49 so that the cups 53 are biased upwardly by the springs 57,57 mounted on the tubes 51,51 supporting such cups. The wrap which has thus been shifted by the devices 20,21 is repositioned in registered condition on the conveyor run 14.

In the next cycle of the machine the wrap so registered on the conveyor run 14 is moved by the latter toward the adjacent spotting station G. As the registered wrap is moving into the spotting station G, but before the conveyor and such wrap has come to a complete stop in the next dwell period of the conveyor, and after the crank operated arms 75,75' have commenced their forward stroke to bring a box over such arriving registered wrap, the switch 185 closes to energize a control relay 210 having normally open contacts 210' and

210'' and a normally closed contact 210''', thereby causing control relay 210 to be actuated to energize the solenoid valve 211 controlling the longitudinal search hydraulic cylinder 95 attached to the slide 92. The energization of valve 211 causes cylinder 95 to start the longitudinal search for the edge 133 of the registered wrap W which has passed the eye or beam 132 of the photosensor 131. When the eye 132 finds the edge 133 of the registered wrap, which occurs during the beginning of the next successive dwell period of the conveyor and while the wrap is in a stationary condition at station G, contacts 212'' of a double poled relay are actuated to deenergize the solenoid valve 211 and thereby lock the longitudinal search cylinder 95 and immobilize it. This causes contacts 212' of such double poled relay to close thereby immediately energizing a control relay 213 having a normally open contact 213' and when switch 191 closes energizing control relay 214. When control relay 214 is energized the vacuum provided in the suction cups 82 holding the box B being delivered to station G is cut off and releases the box to the wrap. As previously explained, this occurs immediately after the cups 82,82 have pressed the bottom of the box into adhering relation with the registered wrap at station G. When control relays 210 and 213 are both energized, control relay 215 having a normally open contact 215' becomes energized to prevent the drive clutch of the machine from becoming disengaged and permitting the machine to continue with its cycle and complete the operation of the box spotting apparatus J. When control relay 215 is closed it creates a holding circuit through switch 189. The closed holding switch 189 opens momentarily to determine if the registered wrap has been found. If such is the case nothing happens. But if the wrap has not been found by the longitudinal search mechanism, a one revolution clutch solenoid 160 is deenergized thereby releasing the clutch trip and bringing the main clutch shaft of the machine to a stop. This stops the operation of the crank arm 114 and the frame arms 75,75' will not swing back, but will hold the box B in a raised condition, approximately one-half inch above the conveyor run 14, until the machine makes its next cycle. If a wrap is then found in the next cycle the machine will continue its operation in that cycle and deliver the box so held during the previous cycle. Switch 185 then opens, deenergizing control relay 210 to cause the deenergization of solenoid valve 209, thereby causing the longitudinal search cylinder 95 to return to retracted position, in position to start the next search.

It will be understood from the foregoing that prior to being picked up by the transport arms 75,75', the box is properly aligned by stops 11, 11 which are so constructed and arranged that they engage the box at its front corners and low down adjacent to the score lines which form the junctures between the bottom and sides of the box, to assure as accurate alignment as possible.

In the event a box is not picked up from the staying machine conveyor I by the vacuum cups 82, because no box has come into registration against the stops 11,11, the resulting loss of vacuum through the open cups 82 as the arms 75,75' start their forward stroke will cause the normally closed vacuum switch 192 to remain closed. Meanwhile, and shortly after the arms 75,75' have started their forward movement, switch 187 has closed thereby energizing control relay 217 having a normally open contact 217' and solenoid 101 in FIG.

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4. This causes solenoid 101 to move the latch 100 into blocking position to stop the forward stroke of the arm 75' and thereby prevent the cups 82 from coming into contact with the adhesive on the wrap W at station G. When switch 187 closes it also closes contacts on control relay 217 to keep the solenoid 101 energized until a box is picked up in a succeeding cycle of the machine, whereupon vacuum switch 192 will open to deenergize control relay 217 and remove the latch 100 thereby permitting the box so picked up to be delivered to a wrap at station G.

What is claimed is:

1. Apparatus for automatically registering articles being conveyed toward a station, comprising means for carrying a plurality of the articles in successive relation along a given path, a plurality of sensing means movable over said carrying means and each capable of developing a signal when sensing a given reference line on an article conveyed by said carrying means, means for moving said sensing means independently until each has found the given reference line, gripping means associated with each sensing means and capable of gripping the article at different locations thereof when its associated sensing means has found such reference line, and means for moving the gripping means in coactive relation to shift the articles gripped thereby until said given reference line is brought into given registration with a second reference line in a given fixed position.

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2. Apparatus as defined in claim 1, including means for depositing said articles on said carrying means in an inexact manner with their longitudinal centerlines in nonparallel relation to the longitudinal centerline of said carrying means, but contained in a longitudinal area of given width and having a longitudinal centerline located to the other side of and in spaced parallel relation to said longitudinal centerline of said carrying means, said articles when repositioned by said gripping means being shifted on said carrying means so that their longitudinal centerlines are located to said one side of and in spaced parallel relation to said longitudinal centerline of said carrying means.

3. Apparatus as defined in claim 1, in which the gripping means associated with each sensing means comprises a suction member, first moving means for moving said suction member over the surface of said carrying member, second moving means capable of moving said suction member toward an article positioned on said carrying member surface to a given advanced position short of engagement with the article when the associated sensing means has found said given article reference line, and means to provide said suction member with a suction sufficient to enable it to shift the article while being moved in said given advanced position over the surface of said carrying means by said first moving means.

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