

- [54] **MERGING CONVEYOR**
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- [73] Assignee: **The Metromatic Corporation**, Landing, N.J.
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- [52] U.S. Cl. **198/32, 198/76**
- [51] Int. Cl. **B65g 47/24**
- [58] Field of Search **198/31, 32, 76, 80**

[56] **References Cited**

UNITED STATES PATENTS

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| 2,978,092 | 4/1961 | Phillips et al. | 198/32 |
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[57] **ABSTRACT**

A conveyor assembly which receives two lines of adjoining boxes, then separates the boxes in spaced relation, and finally combines the two lines into a single line by alternate interposition. Boxes having the same size may be combined by a mechanical control. Boxes of varying sizes may be combined by a cross-connected control means using a photosensitive detector, stopping one line of boxes as long as the other photosensitive detector is blocked.

4 Claims, 6 Drawing Figures

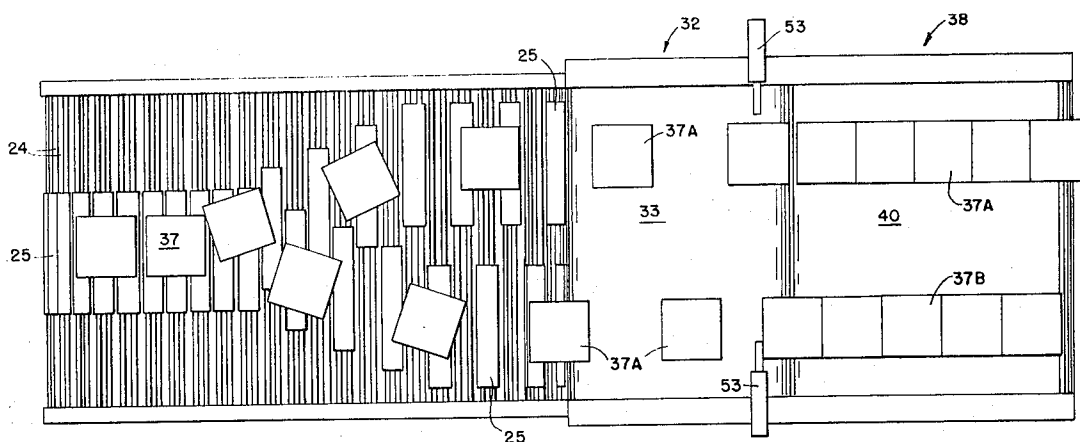


FIG. 1

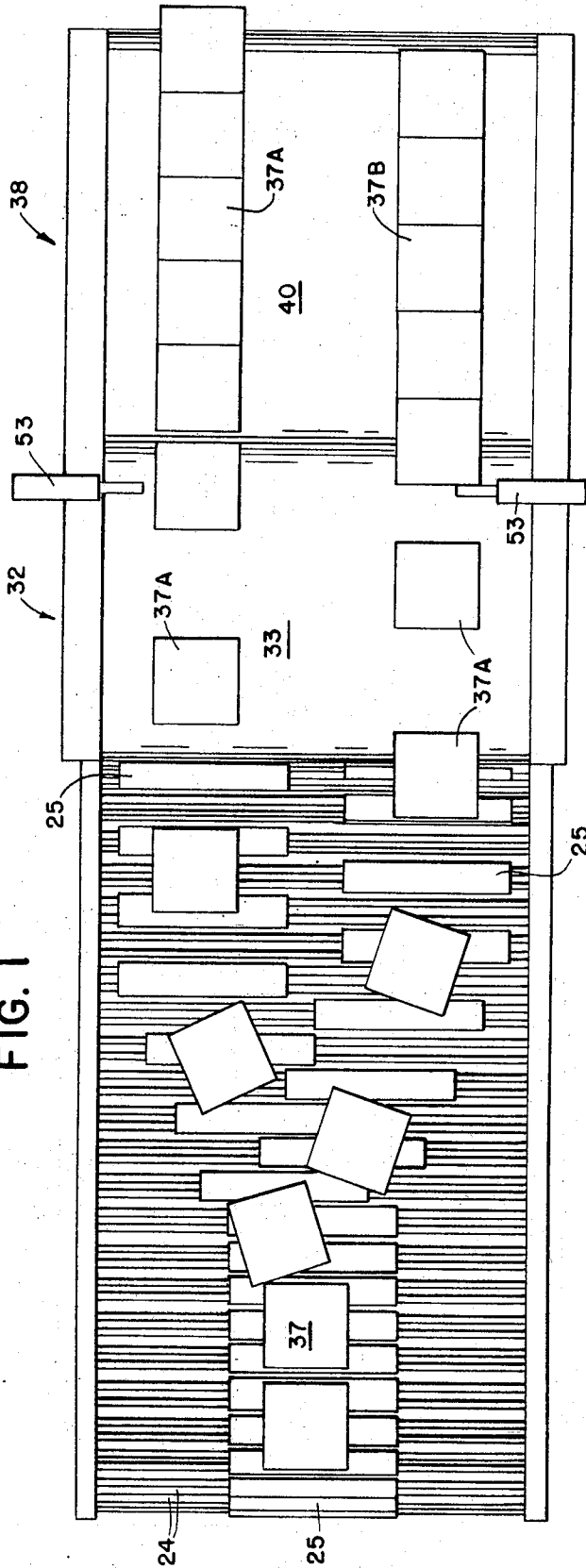


FIG. 2

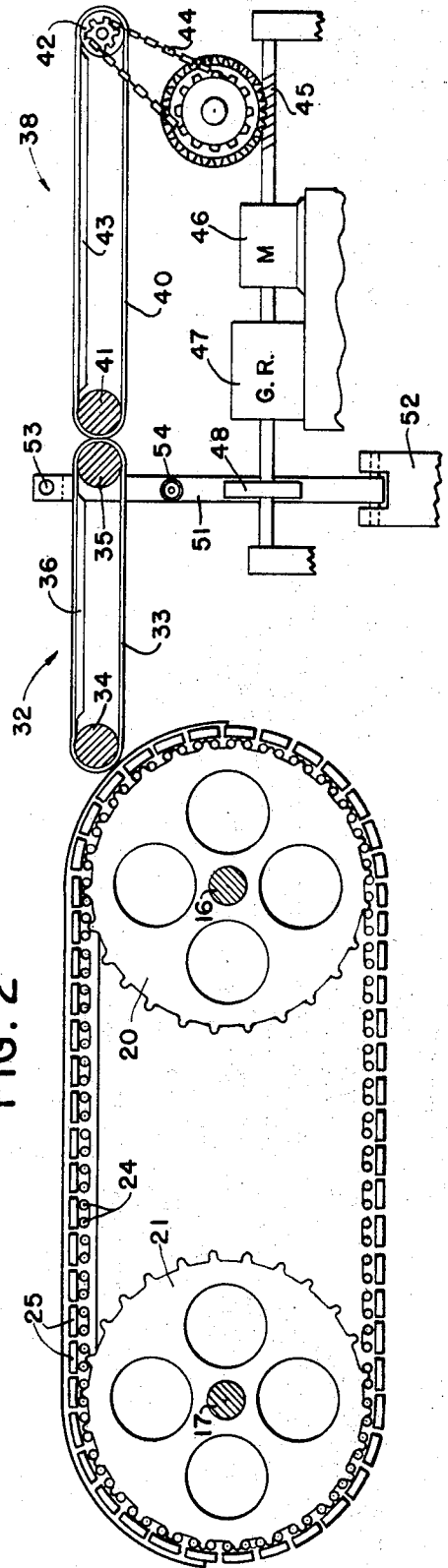


FIG. 3

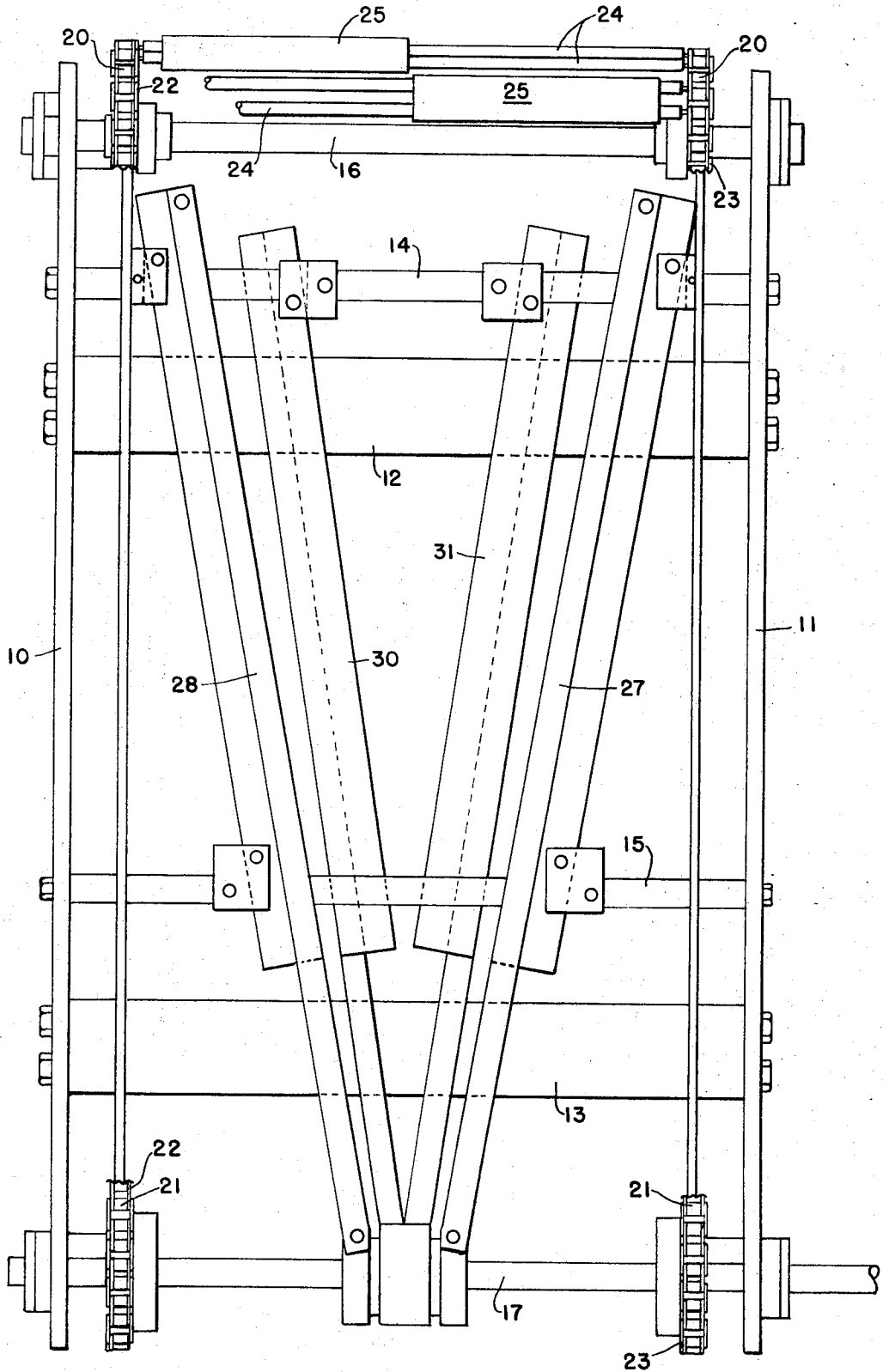


FIG. 4

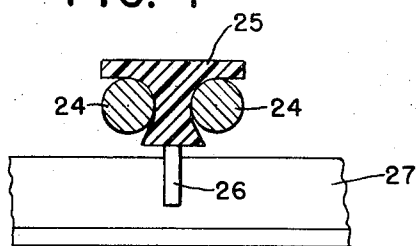


FIG. 5

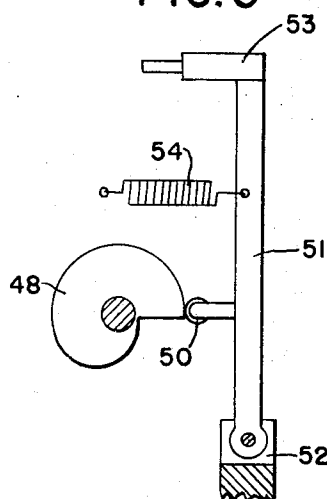
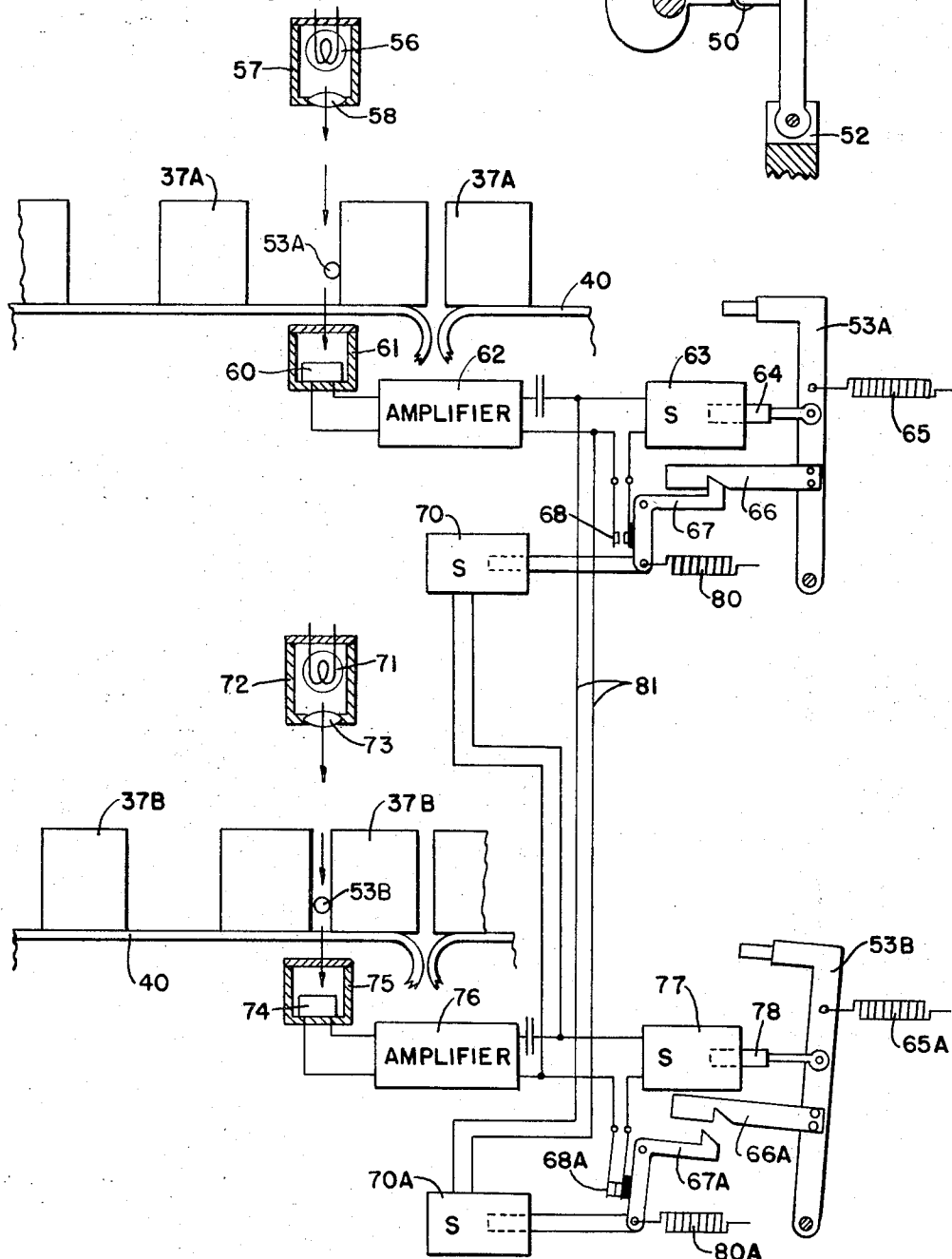


FIG. 6



MERGING CONVEYOR

BACKGROUND OF THE INVENTION

Manufacturing processes frequently have as their end result, boxes or containers which leave a processing operation in two separate lines. If the boxes or other containers are to be sent to a loading area in a single line, there must be a means for combining or merging the two lines into one. The merging operation should combine the two lines without scraping or abrasion so that the box surface remains smooth without scratches. This is particularly true if the boxes have labels or other indicia on their outside surface. The present invention first separates the boxes a small amount as they are moved past an automatic stop, then the stops further separate the boxes and place them in alternate relative position, and finally the conveyor base bars are merged by cams and the boxes are combined into a single line.

One of the features of the invention is the merging of two lines of boxes without the boxes moving against each other. There is no possibility of marring, scraping, or scratching due to mechanical contact.

Another feature of the invention includes an automatic means for handling boxes of different size. The boxes in one line control the spacing of the boxes in the other line in accordance with their length.

For a better understanding of the present invention, together with other features and details thereof, reference is made to the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of the conveyer showing two lines of boxes being merged.

FIG. 2 is a partial cross section view showing the merging bars, the two supply belts, and a power means for running one of the belts and operating the automatic stop.

FIG. 3 is a plan view of the merging conveyor with the carrying bars removed. This view shows the cam rods which move the bars together during the merging operation.

FIG. 4 is a detailed view of a carrying bar.

FIG. 5 is a side view of one of the automatic stops and a mechanical cam which operates it.

FIG. 6 is a schematic diagram of connections of a preferred form of the invention in which a pair of sensing devices is employed to control the operation of the stops.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1, 2, and 3, the combining conveyor comprises a base frame (FIG. 3) which includes side bars 10, 11, cross plates 12, 13, and two supporting rods 14 and 15. The side bars 10, 11 act as bearings for shafts 16 and 17 on which are mounted sprocket wheels 20 and 21. A sprocket chain 22, 23 meshes with the wheels and a plurality of rods 24 are connected between the chains to form a moving belt. The rods 24 are arranged in pairs and each pair supports a carrier base 25, shown in greater detail in FIG. 4. The carrier bases 25 are made of plastic material and slide easily along their supporting rods 24. As shown in FIG. 4, each carrier base is provided with a metal cam follower 26 which extends downwardly to make contact with one of the several cams 27, 28, 30, and 31.

The cams move the carrier bases 25 together into a single line when the bases are above the conveyor, then the bases are separated as they pass below the conveyor after discharging their packages. The general arrangement of rods, cams, and carrier bases is similar to the conveyor described in U. S. Pat. No. 3,511,357 issued to F. B. Vanderhoof in May 12, 1970.

A belt conveyor 32 is mounted adjacent to the combining conveyor and includes a flexible belt 33 mounted on cylinders 34 and 35. A flat base member 36 is mounted under the belt 33 to sustain the weight of the boxes 37. A second belt conveyor 38, similar to the first, is mounted adjacent to it so that the boxes traveling on the second conveyor will be delivered to the first conveyor 32 and then delivered to the combining conveyor. The second conveyor 38 includes a flexible belt 40, two supporting cylinders 41 and 42, and a base 43 for holding the weight of the boxes 37. Cylinder 42 is driven by a chain 44 coupled to a worm gear 45, and an electric motor 46. The other side of motor 46 is connected to a gear reducer 47 and a cam 48. Cam 48 is shown in greater detail in FIG. 5 where it acts on a cam follower 50 to operate a lever 51, pivoted on a base support 52 and terminated at its upper end by a package stop arm 53. A spring 54 holds the cam follower 50 and lever 51 in resilient contact with the cam 48.

The operation of this form of the invention is as follows: First, the motor is started and all the conveyor belts are put into motion. Belt 40 moves at moderate speed, belt 33 moves about 15 percent faster than belt 40 and the combining conveyor bases 25 move at about the same speed as belt 33. A first line of boxes 37A from one source is deposited on the first belt 40 at one side of the conveyor arrangement as shown in the drawing in FIG. 1. A second line of boxes 37B from another source is deposited on belt 40 at the other side. The boxes in each line are generally in contact with each other on the first belt. The second belt 33 moves about 15 to 20 percent faster than the first belt so, as each box moves to the second belt, it is moved away from the line, separating the boxes by a small distance. As the box moves to the left, as shown in FIG. 1, the cam 48 and spring 54 move the stop arm 53 into the space between the boxes and the line of boxes on belt 40 is stopped, permitting the box 37A on the second belt to move ahead still more and widen the gap between boxes. After a short time interval, determined by the speed of the cam 48, the stop arm 53 is withdrawn and the next box on belt 40 is allowed to move to the second belt 33. The same cycle of events occurs at the other side of belts 40 and 43 except that the cams 48 and the stop arms 53 alternate in their operation and the result is a series of boxes in staggered array as shown.

When the two lines of boxes are transferred to the combining conveyor, the carrier bases 25 are arranged in two lines, one for each line of boxes. The double array of boxes is due to the linear cam rods 30 and 31 on the lower side of the conveyor which separate the bases as they move rearwardly after discharging their boxes. Soon after the boxes are deposited on the combining conveyor belt, the carrier bases 25 are moved toward the center of the belt by rod cams 27 and 28 (see FIG. 3). When the carrier bases reach their central position, all the boxes 37A and 37B are in a single line

and are moved to some other facility, either another belt or a packaging means.

The above described machine is simple in operation and can be relied upon to combine two lines of boxes when the boxes are all the same size. When different sizes of boxes are in the two lines or when it is desired to change the size of the boxes, a more general type of stop means must be used. FIG. 6 illustrates an automatic control which uses light beams to operate the stop arms 53 and the levers 51. A lamp 56, enclosed in a box 57, has its light focused into a parallel beam by a lens 58. The single beam from this source is directed toward one of the lines of boxes 37A and when there is no box to cut off the light, the beam shines on a photoconductive cell 60, mounted in a box 61 under the conveyor belt 40. Pulses from cell 60 are applied to amplifier 62 and then to a solenoid 63 having a core 64 coupled to a stop arm 53A, similar to stop arm 53 except that a spring 65 exerts a force to pull the arm away from the row of boxes. Arm 53A has a latch bar 66 secured to its shank and a latch 67 is arranged to engage the bar 66 during a portion of the operating cycle. A pair of electrical contacts 68 are mounted adjoining a portion of the latch and are closed when the latch 67 is disengaged from the bar 66. the latch 67 is operated by a solenoid 70.

A similar arrangement is provided for the other row of boxes 37B. A lamp 71 within a box 72 sends a beam of light from lens 73 toward a photoconductive cell 74 in box 75. The electrical current pulses generated by the cell 74 are amplified by amplifier 76, the output of which is connected to solenoid 77. The core 78 of solenoid 77 is coupled to a stop arm 53B, resiliently urged by spring 65A and having a latch bar 66A. A latch 67A, shown in the drawing in an disengaged position, operates a pair of contacts 68A. As before, the latch 67A is operated by a solenoid 70A.

The amplifiers 62 and 72 are also cross connected to solenoids 70 and 70A so that a current pulse received by either will operate the solenoid associated with the other stop arm to unlatch it whenever an output pulse is transmitted. Springs 80 and 80A return the latches to their latching position whenever the current is cut off from solenoids 70 and 70A.

The operation of this portion of the invention is as follows: Let it be assumed that stop arm 53A is in the position shown and is holding one of the boxes 37A to increase the separation between the box held and the box ahead of it. The beam of light from lens 58 shines on cell 60 but solenoid 63 is not operated because contacts 68 are open. Solenoid 70A is operated by current sent over conductors 81 and the latch 67A is released, permitting stop arm 53B to be pulled out of the way and permit boxes 37B to move past the sensing position. This condition remains until the beam from lens 73 shines through a space between the boxes 37B.

When cell 74 receives light from lamp 71, the output from amplifier 76 is applied to solenoids 77 and 70 causing the stop arm to enter the space between boxes 37B and also operating the latch 67 to release stop arm 53A and permit box 37A to pass the sensing position. Box 37B is now held by arm 53B and with the light beam from lens 58 shut off by a moving box, the current to solenoid 70A is cut off and spring 80A moves latch 67A back to its latching position to hold arm 53B in its box holding position. This condition prevails until a space between moving boxes 37A permits light to

shine on cell 60. Then the cycle of events is repeated, unlatching of arm 53B and latching arm 53A into position. The spaces between boxes provided by the holding action are long enough to permit the converging action desired. If one of the boxes 37A is longer or shorter than the other boxes, the space between boxes in the other line is made longer or shorter by the holding action of arm 53B so that sufficient space is created to permit a merging action when the box lines are joined.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A merging conveyor system for joining two lines of articles into a single line by alternate transfer comprising:

- a. a first conveyor unit including a plurality of transversely mounted spaced rods with means for moving the rods toward a delivery position;
- b. a plurality of carrier bases slidably mounted on the rods for carrying articles, each of said bases including a cam follower rod extending below the rod plane;
- c. cam means under the rods for engaging the cam followers to merge the bases when they are carrying articles and to separate the bases in alternate sequence when the bases are moving toward a carry position;
- d. a second conveyor unit adjoining the first unit for delivering articles to the first conveyor in two lines, the articles in each line spaced from each other by a distance which is more than the length of the articles;
- e. a third conveyor unit mounted for delivering articles to the second conveyor in two lines, said third conveyor moving at a speed which is appreciably less than the speed of the second conveyor for increasing the article spacing on the second conveyor;
- f. a stop arm system mounted on each side of the second conveyor for stopping the motion of the article lines until a nonconflicting spacing between the articles is realized; and
- g. a photosensitive sensing system for each of said lines coupled to a solenoid and a stop arm for stopping one line of articles when an article is sensed on the other line.

2. A conveyor system according to claim 1 wherein said rods are moved toward a delivery position by two chains secured to the ends of the rods, and by a pair of sprocket wheels coupled to the chains.

3. A conveyor system according to claim 1 wherein a first half of said carrier bases have their cam follower rods offset toward one side of the conveyor to engage a first merging cam, and wherein the second half of said carrier bases have their cam follower rods offset toward the other side of the conveyor to engage a second merging cam, said first and second bases disposed alternately along the length of the conveyor.

4. A conveyor system according to claim 1 wherein each of said stop arm systems include a stop arm, a first solenoid for moving the stop arm into article engaging position, a mechanical latch for holding the stop arm in engaging position, and a second solenoid for engaging the stop arm.