April 6, 1965 A. E. WHITECAR 3,176,839

MEMORY CONTROL APPARATUS FOR USE IN ASSOCIATION WITH MOVING ARTICLES

Filed Nov. 13, 1962 2 Sheets-Sheet 1

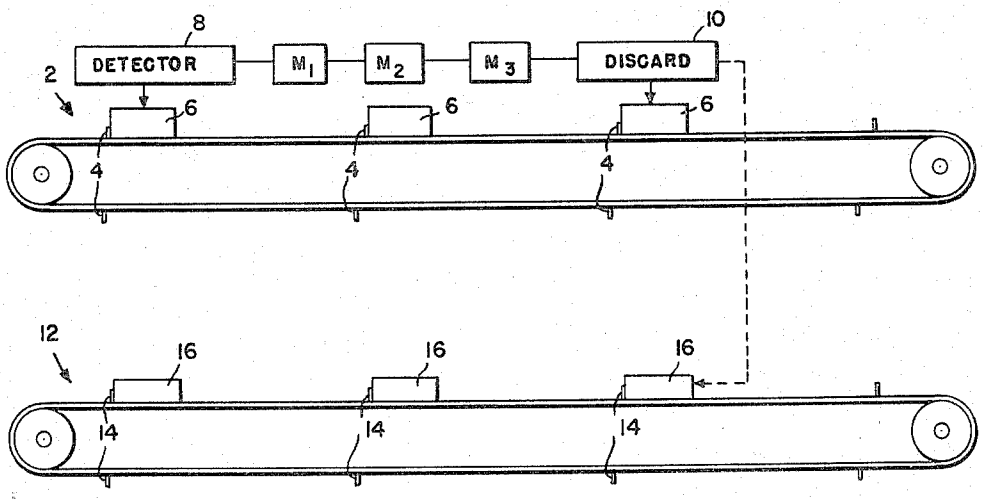


FIG. 1.

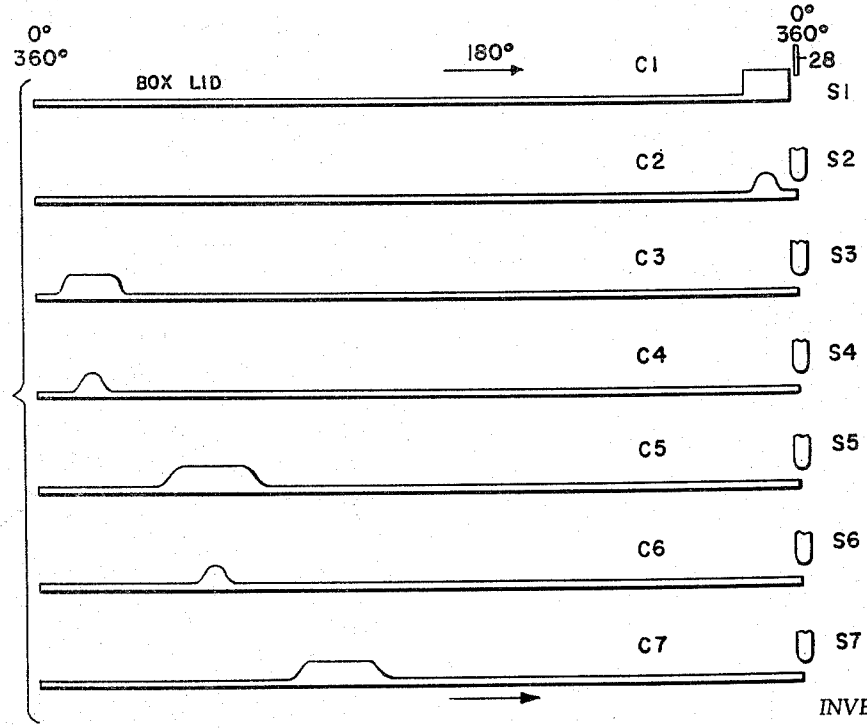


FIG. 3.

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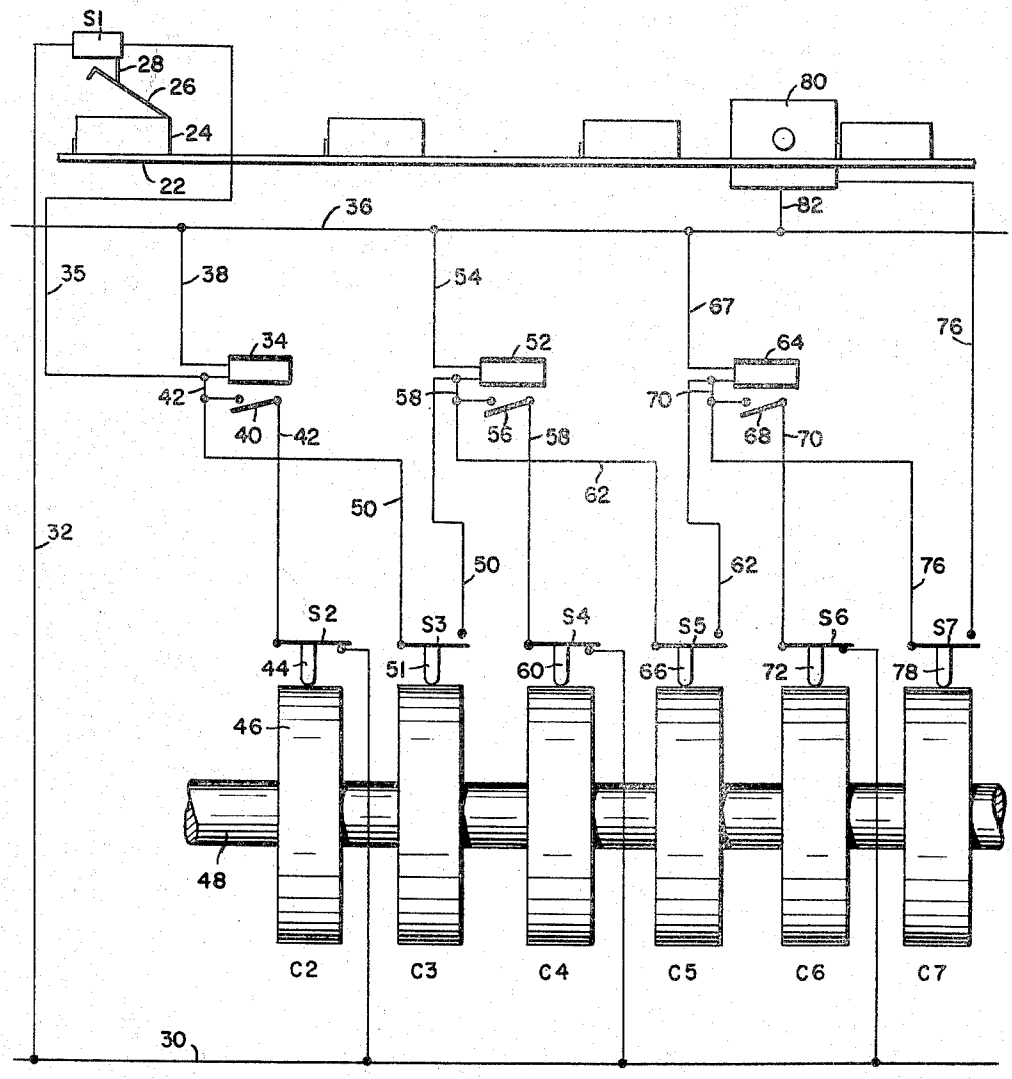


FIG. 2.

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MEMORY CONTROL APPARATUS FOR USE IN ASSOCIATION WITH MOVING ARTICLES

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1 Claim. (Cl. 209—74)

This invention relates to memory control apparatus which is of particular utility in association with article moving means.

In various manufacturing procedures, it is frequently desired to detect the condition or characteristic of articles being conveyed in succession at one point and to effect an operation responsive to the detected condition or characteristic at a later time at a point remote from the point of detection. A simple illustration is where a conveyor is employed in a packaging line and it is desired, for example, to detect any package which has not been filled for the purpose of removing the improperly filled package from the conveyor. Frequently due to the crowding of mechanism at the detecting station, it is desirable to remove the unfilled package at a point remote from the detection station. Another typical example is where a plurality of conveyors are moving a number of parts to a point of assembly, for example, a box bottom, a box top and an item which is to be placed within the box. If the item to be boxed is missing at one point on the conveyor conveying these items, it is desirable to have means to remove the box bottom and box top at the corresponding positions on the other conveyor in order that an empty box will not be shipped out. Here again, it is frequently not possible to cause the removal of the box bottom and top at the moment of detection of the absence of the item to be packaged, but rather it is necessary to detect first and then at a subsequent later time eject the box bottom and top. The memory system of this invention has as its primary object the solution of such problems and similar problems, particularly where the period of time between detection and the subsequent operation is greater than the period that it takes the conveying system to convey the articles the distance at which the articles are spaced.

It is a further object of this invention to provide a simple inexpensive electro-mechanical memory apparatus which can readily be designed to solve problems of the type indicated above.

The apparatus of the invention comprises a detector associated with means effecting movement of articles in succession which initiates the operation of a series of memory units which at the end of a period of time longer than the time it takes the articles to move a distance equal to the distance between the uniformly spaced articles initiates the operation of a device at a remote position.

The invention and its objects will be further clarified by the reading of the following description in conjunction with the drawings in which:

FIGURE 1 is a diagrammatic view of an embodiment of the invention;

FIGURE 2 is a diagrammatic view of a specific memory system which can be employed in the invention; and

FIGURE 3 is a lay-out of the cams employed in the device of FIGURE 2.

Referring to FIGURE 1, a conveyor 2 having equally spaced conveyor slats 4 conveys with approximately uniform spacing a series of box bottoms 6 towards an assembly station (not shown). A detector 8 detects whether or not the items to be packaged in box bottoms 6 have been placed within the box bottoms. Where the item to be packaged has not been so placed, the detector initiates the operation of a memory unit indicated at M1. After a

predetermined interval memory unit M1 initiates the operation of memory unit indicated at M2 and becomes free for response to another signal from the detector 8. The cycle of operation of M1 occurs in a period of time which is less than the time required for the conveyor to move the article a distance equal to the spacing between them. M2, after a predetermined period of time, initiates the operation of the memory device indicated at M3 and frees itself for response to another initiating signal from memory device M1. Similarly, memory device M3 after a predetermined period of time initiates the operation of a discard device indicated at 10 and then frees itself for response to another initiating signal from memory device M2. Discard device 10 acts to remove the box bottom 6 which was detected as being empty from conveyor 2 and which has been conveyed to a position opposite discard device 10.

By way of further illustration, a conveyor 12 identical to conveyor 2 having slats 14 which engage and advance box tops 16 is operated in synchronism with conveyor 2. The operation of discard device 10 also acts to remove the box top 16 which was carried on conveyor 12 in a position so as to be assembled with the box bottom 6 which was detected as being empty. Thus when one of the three items to be assembled i.e., the item to be packaged was detected as being missing the other two items, i.e., the box bottom 6 and the corresponding box top 16 were removed from their respective conveyors.

It will be appreciated that any of the well known detectors suitable for detecting the condition or characteristic to be detected can be employed. Illustrative are a feeler controlled switch, a weighing device controlled switch, a photo-electric cell and a pneumatic controlled feeler. Similarly, a wide variety of memory units which are electronic or electro-mechanical can be employed.

The novel memory unit of this invention shown in FIGURES 2 and 3 is advantageous for many applications due to the fact that it is relatively inexpensive and easy to design and modify. As shown in FIGURE 2, a conveyor 22 is conveying cardboard boxes 24 having hinged lids 26, a micro-switch S1 has an operating lever 28 which detects a box 24 whose lid 26 has not been properly closed. Switch S1 is connected to power line 30 by a line 32 and is connected to one side of relay 34 by a line 35. The other side of relay 34 is connected to power line 36 by a line 38. Normally open switch 40 of relay 34 is in holding circuit line 42 which is connected to line 35 and power line 30 and contains normally closed switch S2.

Switch S2 has an insulated cam follower 44 which is adapted to be engaged by a cam 46 mounted to rotate with a shaft 48. Shaft 48 is driven by conveyor 22 by means not shown and rotates 360° during the period that conveyor 22 moves a distance equal to the distance between boxes 24. Conveyor 22 is continuously moving but can also be moved intermittently.

A line 50 connects line 42 to one side of relay 52, the other side of which is connected to line 36 by line 54. Normally open switch 53 has an insulated cam follower 51 which engages a cam C3 which rotates with shaft 48. Switch 56 of relay 52 which is normally open is in a holding circuit line 58 connecting line 50 to power line 30. Normally closed switch S4 in line 58 has an insulated cam follower 60 which is adapted to be engaged by cam C4 secured to shaft 48. A line 62 connects line 58 to one side of a relay 64 and contains a normally open switch S5 which has an insulated cam follower engaging cam C5 secured to shaft 48. Relay 64 is connected to power line 36 by line 67. Switch 68 of relay 64 is in a holding circuit line 70 which connects line 62 to power line 30. Switch S6 in line 70 which is normally closed has an insulated cam follower 72 adapted to be engaged by cam C6 which is secured to shaft 48. A line 76 con-

nects line 70 to one side of a solenoid 80, the other side of which is connected to power line 36 through a line 82. A normally open switch S7 in line 76 has an insulated cam follower 78 adapted to be engaged by cam C7 which is secured to shaft 48.

The operation of the apparatus of FIGURE 2 will be clear from the above description taken together with the lay-out of the cams C1–C7 shown in FIGURE 3, no attempt having been made in FIGURE 2 to show the shapes of these cams. The zero position of the cam corresponds to the position of conveyor 22 where an open lid 26 of box 24 would engage arm 28, the lid 26 in effect acting as the cam operating on switch S1. Box lid 26 in FIGURE 3 is depicted as the cam C1 operating switch S1.

In operation, a box 24 having an open lid 26 would act through the engagement of lid 26 with arm 28 to energize switch S1 and in turn through line 35 to energize relay 34. On being energized, relay 34 closes switch 40 of holding circuit 42, switch S2 being in the closed position. Cam C2 momentarily opens switch S2 to deenergize relay 34 if switch S1 is open. As lid 26 moves past switch S1, this switch opens.

During each 360° rotation of shaft 48, the following occurs. After about 205° of rotation cam C7 closes switch S7 to energize solenoid 80 if line 76 is energized. Cam C6 momentarily opens switch S6 during the time that switch S5 is closed. After about 250° of rotation, cam C5 closes switch S5 to energize relay 64 if line 62 is energized. While switch S3 is closed, cam C4 momentarily opens switch S4. After about 315° of rotation, cam C3 closes switch S3 which through line 50 results in energizing relay 52 if line 50 is energized.

As shown in the cam lay-out of FIGURE 3, switches S1, S3, S5, and S7 are each closed at a different period of time.

From the above description of operation, it will be apparent that assuming that switch S1 is energized by a box lid 26, relay 34 will be energized to close switch 40 in holding circuit 50. After 315° of rotation cam C3 closes switch S3 to energize relay 52.

During the second 360° of rotation assuming S1 to be open, cam C2 will open switch S2 to deenergize relay 34. After about 250° of rotation, cam C5 will close switch S5 to cause energizing of relay 64 and the closing of switch 68 in holding circuit 70. While switch S5 is closed, cam C6 opens and closes switch S6 in holding circuit 70 which has no effect since line 62 was energized. Shortly thereafter switch S5 is permitted to open again and cam C4 will open switch S4 to deenergize relay 52 if line 50 is deenergized as it is in the illustrative case. During the third 360° of rotation after about 205° of rotation, cam C7 will close switch S7 to energize solenoid 80 which will move the box 24 detected with an open lid off conveyor 22. Next, cam C6 opens switch S5 to deenergize relay 64 if line 62 is deenergized.

From the above description, it will be apparent that the number of memory units will be picked depending upon the time that is desired between detection and operation. In the above illustration, the solenoid would operate after shaft 48 has been turned about 925° and hence would be positioned a distance along the conveyor line from switch S1 equal to the distance the conveyor would travel during the 925° rotation of shaft 48. Any number of memory units can be employed in order to have the proper distance between the point of detection and the point of operation. Each memory unit can provide for a delay of something less than 360° of rotation of shaft 48. If a series of improperly open lids is detected, the relays of the memory units will all remain energized causing each of the detected boxes to be moved off the conveyor.

The above described embodiment is advantageous in that changes in speed or stopping of the conveyor do not affect the operation of the memory units.

It will be understood that the above described embodiments are illustrative and are not intended to be limiting.

What is claimed is:

A memory control apparatus for use in association with moving articles in combination with means effecting movement of articles in succession along a predetermined path with approximately uniform spacing between them comprising; a series of signal receiving and transmitting means each being made operable to transmit a signal on receipt of a signal, said series of signal receiving and transmitting means comprising circuit means including a plurality of relays each having a coil and a switch, the coils of the relays being connected in parallel, and the switch of each relay being in series with the coil of the next adjacent relay, a switch in the circuit between each said first mentioned switch and the said coil, a holding circuit for each relay, and a switch in each holding circuit, means located at one position along said path for transmitting a signal to the first in series of said signal receiving and transmitting means on detection of an article having a predetermined characteristic, rotatable cam means to operate the last two mentioned switches to provide for the successive energizing and deenergizing of the relays to successively operate at predetermined intervals the signal receiving and transmitting means to provide for an earlier one initiating the operation of a later one by the transmission of a signal from an earlier one to a later one and to free the earlier one for the receipt of a new signal, means for rejecting an article located at another later station along said path spaced from the first mentioned position by a distance greater than said spacing of the articles and responsive to a signal from the last of said signal receiving and transmitting means to reject the article detected as having a predetermined characteristic.

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