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Baur et al.

[11] **3,856,129**

[45] **Dec. 24, 1974**

[54] **APPARATUS FOR AUTOMATICALLY FEEDING CRT FACE PANELS TO A PANEL PROCESSOR**

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[73] Assignee: **Zenith Radio Corporation,** Chicago, Ill.

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[52] **U.S. Cl.** **198/19,** 198/25, 198/209

[51] **Int. Cl.** **B23q 7/00**

[58] **Field of Search** 198/19, 25, 209

[56] **References Cited**

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Assistant Examiner—Douglas D. Watts
Attorney, Agent, or Firm—John H. Moore; Cornelius J. O'Connor

[57] **ABSTRACT**

An apparatus for automatically inserting and retrieving cathode ray tube face panels from a panel processor which includes a programmer and an endless conveyor that carries a plurality of panel supporting carts. A prime mover controlled by the programmer steps the carts through a series of work stations, including an index station, disposed along a closed path. The apparatus comprises a platen having a pair of panel holders successively displaceable between the index station and a loading station. Means are provided for effecting a first reciprocation of the panel holder at the index station into engagement with an indexed cart to insert an unprocessed panel therein and thereafter, upon a second reciprocation to retrieve a processed panel from a subsequently indexed cart. Finally, platen driving means are provided for displacing the panel holder with the retrieved panel to the loading station while simultaneously displacing the other panel holder to the index station to insert an unprocessed panel into the subsequently indexed cart.

9 Claims, 8 Drawing Figures

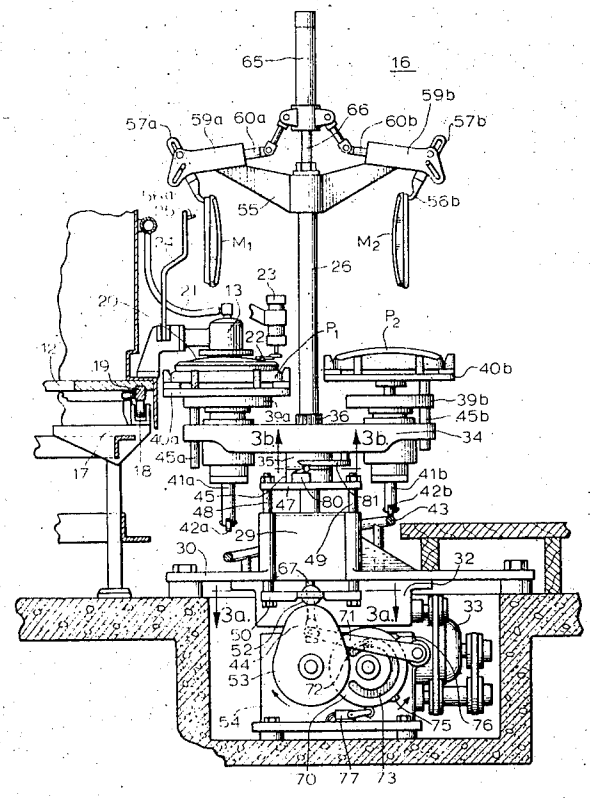


FIG. 1

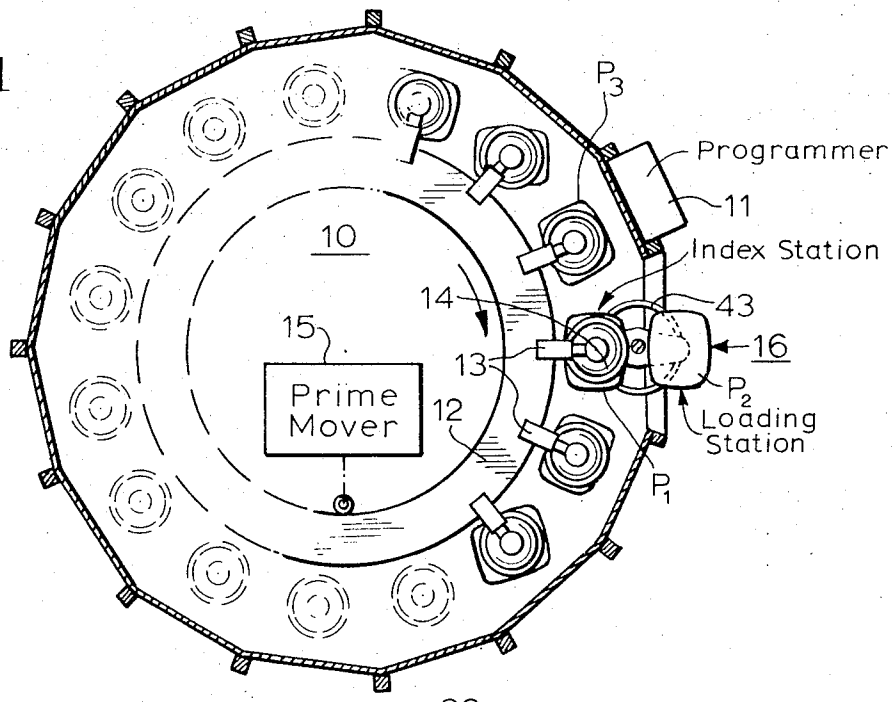
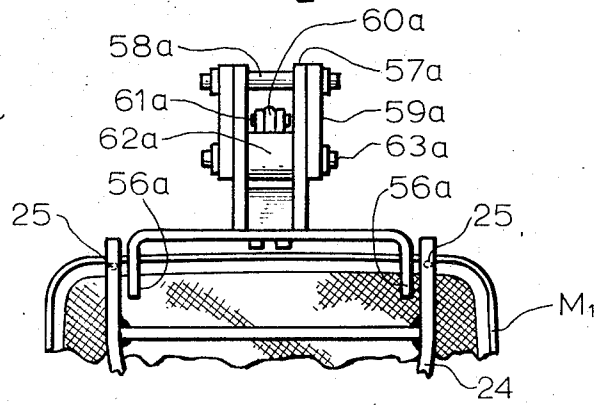


FIG. 2a



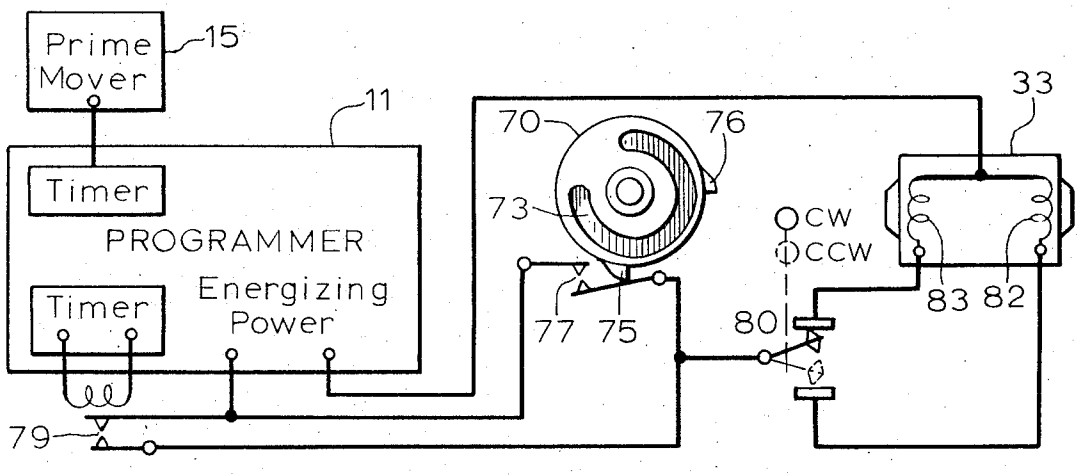


FIG. 5

FIG. 2

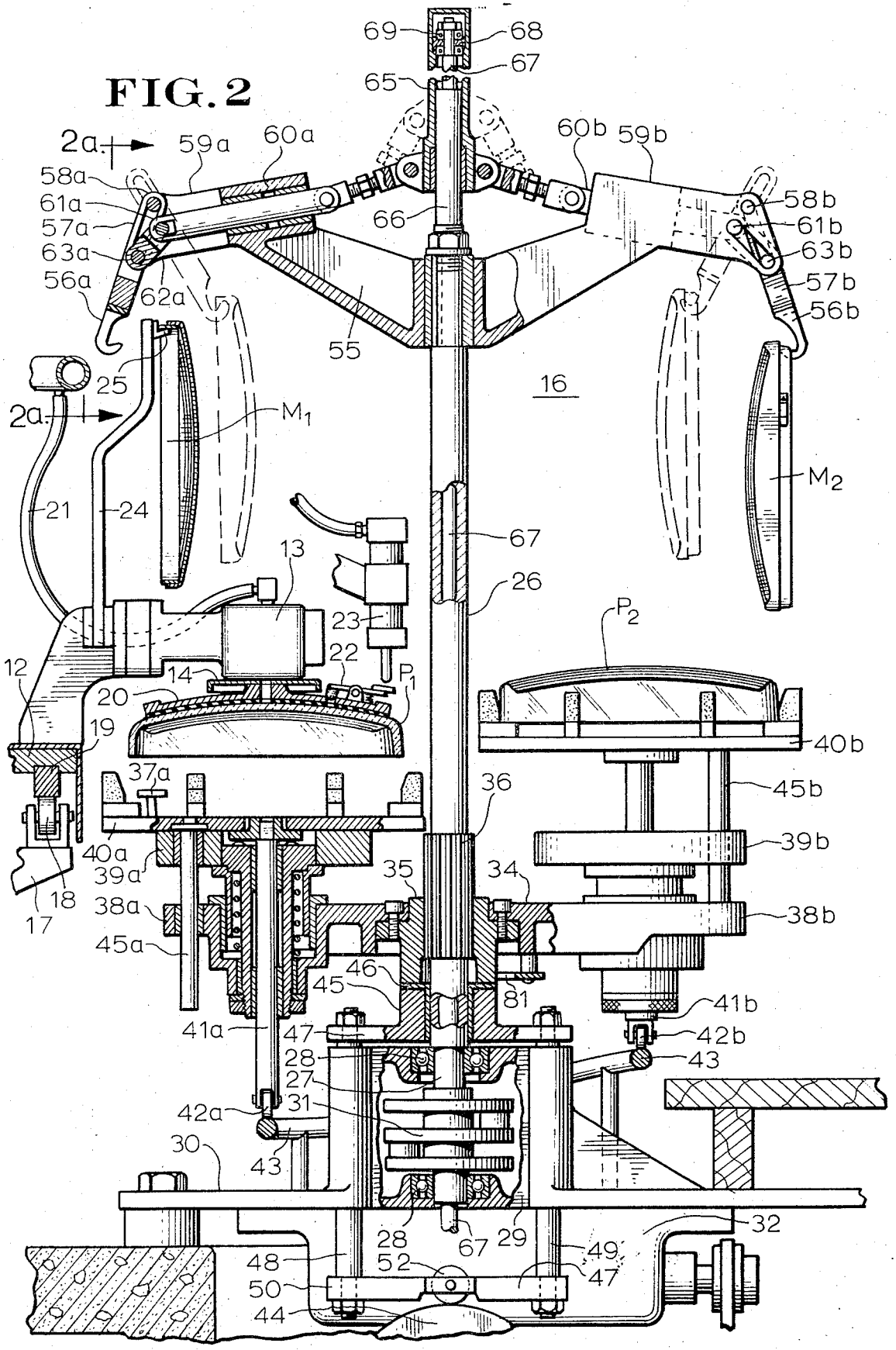

69
68
67
65
2a
59a
60a
60b
59b
58a
61a
57a
63a
56a
62a
66
58b
61b
63b
57b
56b
55
16
25
2a
M1
M2
21
24
67
13
26
23
P2
22
12
14
P1
20
19
40b
37a
36
45b
39b
40a
39a
35
34
18
17
38a
38b
45a
46
45
81
41b
41a
47
42b
28
43
27
31
42a
30
43
32
28
67
29
49
48
52
47
50
44

FIG. 3

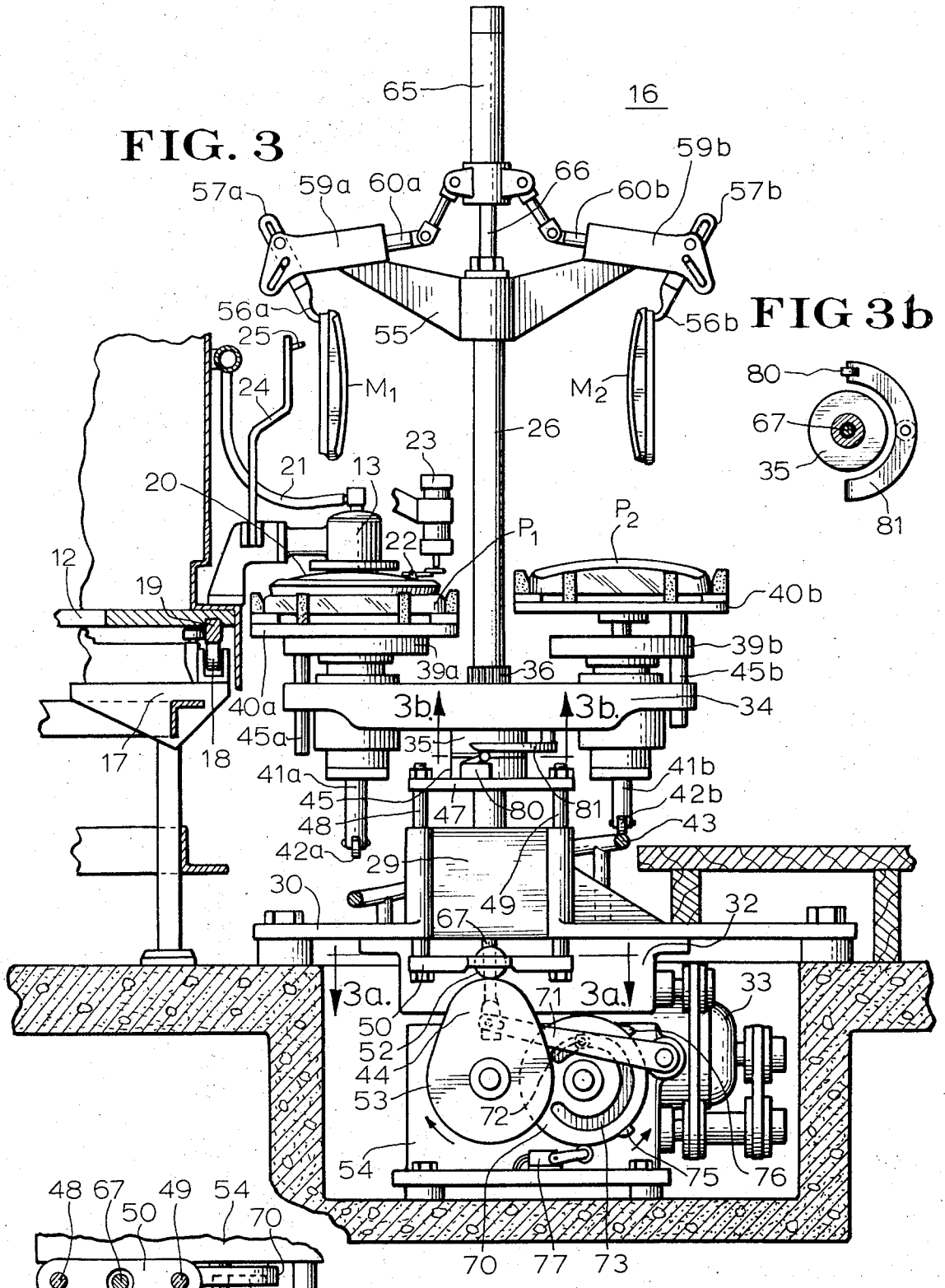
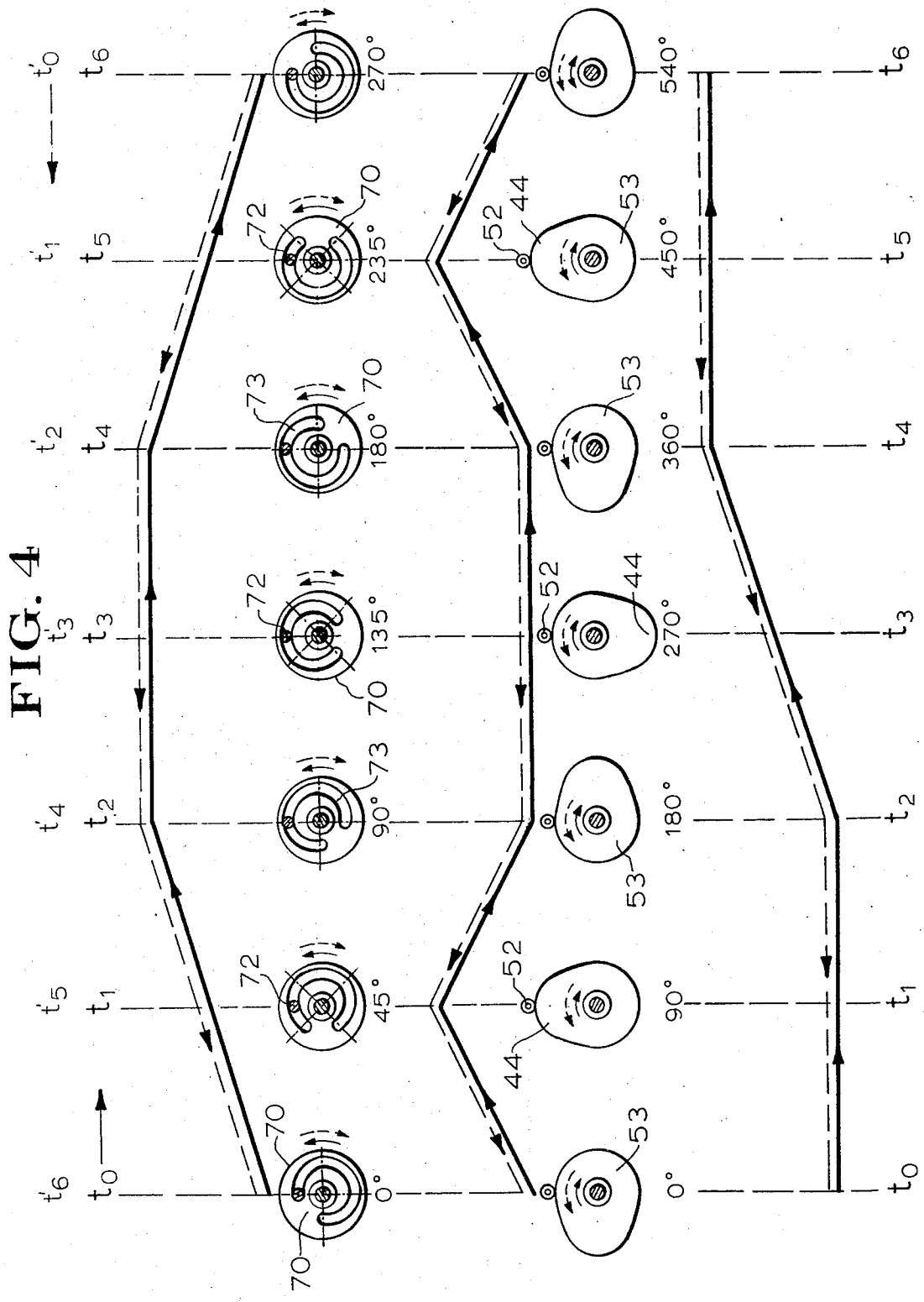


FIG 3b

FIG. 3a

FIG. 4


t'0
t6
t'1
t5
t'2
t4
t'3
t3
t'4
t2
t'5
t1
t'6
t0
0°
45°
90°
135°
180°
235°
270°
360°
450°
540°
70
72
73
44
52
53

APPARATUS FOR AUTOMATICALLY FEEDING CRT FACE PANELS TO A PANEL PROCESSOR

BACKGROUND OF THE INVENTION

The subject invention relates in general to a color cathode ray tube processor and in particular to an improved apparatus for automatically inserting and retrieving cathode ray tube face panels and their associated masks from such a processor.

A color reproducing cathode ray tube, as distinguished from a monochrome tube, comprises a funnel shaped glass envelope, a flanged glass face panel which serves to support a luminescent screen and a color selection electrode in the form of an apertured mask. In one type of color tube which finds wide acceptance today, the screen is comprised of interleaved red, green and blue phosphor dots arranged in triads with each such triad formed of a red dot, a green dot and a blue dot. The phosphor dots can be applied by any known process, for example, slurry screening. In practicing this screen forming technique a coating comprising a photosensitive resist and one of the three color phosphors is applied over the image area of the face panel, dried and then exposed to actinic light through the aperture mask. As a consequence of this exposure the illuminated areas of the coating are rendered insoluble and the pattern thus established is developed by washing the exposed screen with water. The exposed elemental areas remaining after this wash constitute one set of the triad color elements. This procedure is followed for each of the remaining two colors with an appropriate adjustment in position of the exposing light source for each color phosphor to the end that the color phosphor dots are properly interspersed across the image area of the face panel.

The foregoing is but one of the processes through which the face panel progresses prior to the formation of a completed luminescent screen. The screened face panel, upon completion, is then joined to the envelope funnel by conventional frit sealing.

The processing of a face panel can comprise machinery of the type disclosed in U.S. Pat. No. 3,319,759 which issued to T. J. Hajduk et al., assigned to the same assignee as the subject invention. Another panel processor to which the invention finds ready application is disclosed in copending patent application Ser. No. 319,970 filed Dec., 29, 1972, also assigned to the same assignee as the subject invention. The latter processor comprises a circular conveyer which is stepped around a closed path so as to transport a plurality of panel supporting carts through a series of work stations. Insofar as inserting and removing a face panel and its mask from a panel processor, the prior practice has relied upon one or more operators to manually unload and then load each cart as it entered an index station. A shortcoming inherent in this practice resides in the fact that panel processing time is rendered subject to the dexterity of the operators. Moreover, the physical space available at the index station, taken in conjunction with the safety requirements that must be observed for a manual loading operation, constitutes another factor that can impose restrictions on the speed of the processor and therefore, panel processing time.

OBJECTS OF THE INVENTION

It is therefore a general object of the invention to provide an improved apparatus for automatically inserting and retrieving a color tube face panel from a panel processor.

It is another object of the invention to provide a face panel loading and unloading apparatus which renders the operational time of a tube processor substantially independent of an operator.

It is a specific object of the invention to provide a face panel handling apparatus which substantially reduces reliance upon operator dexterity in loading and unloading a panel processor.

SUMMARY OF THE INVENTION

Apparatus constructed in accordance with the invention for automatically inserting and retrieving cathode ray tube face panels from a panel processor which includes a programmer, an endless conveyor carrying a plurality of panel supporting carts and a prime mover, controlled by the programmer for stepping the carts through a series of work stations, including an index station, comprises a platen having a plurality of panel holders successively displaceable between the index station and a loading station. Means are provided for effecting a first reciprocation of at least that one of the panel holders, instantaneously located at the index station, into cooperative engagement with an indexed one of the carts to insert an unprocessed panel in that cart and for thereafter effecting a second reciprocation of the same panel holder into engagement with a subsequently indexed cart to retrieve a processed panel from that cart. Finally, platen driving means are provided for displacing the aforesaid one panel holder and its retrieved panel to the loading station while simultaneously displacing another of the panel holders carrying an unprocessed panel to the index station for insertion in the subsequently indexed cart by the reciprocation means.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with further objects and advantages thereof may be best understood by reference to the following description taken in connection with the accompanying drawings, in the several figures of which like reference numerals identify like elements, and in which:

FIG. **1** is a plan view of a cathode ray tube face panel processor employing an automatic panel loader constructed in accordance with the invention;

FIG. **2** is an elevational view, partly in section, of the automatic panel loader shown in FIG. **1**;

FIG. **2***a* is a side view, taken along lines **2***a*—**2***a*, of a portion of the apparatus shown in FIG. **2**;

FIG. **3** is another elevational view of the subject panel loader showing additional details;

FIG. **3***a* is a sectional view, taken along lines **3***a*—**3***a* in FIG. **3**;

FIG. **3***b* is a sectional view taken along lines **3***b*—**3***b* in FIG. **3**;

FIG. **4** is a timing chart depicting diagrammatically the operation of the automatic panel loader; and

FIG. **5** is a schematic diagram of the control circuitry for the panel loader.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** is an overhead view of a panel processor **10**

of the type previously mentioned which, in addition to a programmer **11**, comprises an endless-type conveyor or carousel **12** that carries a CRT face panel. A prime mover **15**, in the form of an electric motor under the control of a programmer **11**, drives the carousel and its carts in a step-by-step manner through a series of work stations, including an index station, arranged in a closed circular path. As the cart-borne panels traverse this path from a point commencing, and subsequently terminating, at the index station, a series of screening operations are performed upon the panels to effectively convert them from unprocessed to processed panels. In addition to the aforementioned work stations, the processor can be said to include a loading station, specifically, an area adjacent the index station but readily accessible to an operator.

The present invention has to do, in particular, with an apparatus **16** for automatically inserting and retrieving face panels from processor **10**. Accordingly, attention is now directed to FIGS. **2** and **3** which illustrate details of panel loading apparatus **16**, as well as a section of panel processor **10**. Those parts of the processor which are shown include a portion of a support table **17** upon which a plurality of rollers **18** (only one shown) are rotatably supported for presentation to a circular rail **19** secured to the underside of conveyor **12**. Rollers **18** and rail **19** cooperate to provide a low friction rolling contact between the conveyor and table **17** so that the conveyor may be readily stepped through its work stations. The construction of one of carts **13**, specifically the one occupying the index station of the panel processor, is also shown. As depicted, the vacuum chuck **14** associated with cart **13** is seen to comprise a concave plate **20** having a contour matching the convex outer surface of a face panel. Plate **20** is coupled through a hose **21** to a vacuum pump, not shown, while a venting valve **22** is mounted atop the plate for presentation to an air actuated piston **23**. Additional details of the chuck are of no concern to the subject invention; suffice it to say, when a cart is to be loaded, the chuck upon encountering a face panel is activated by programmer **11** to create a partial vacuum between its internal concave surface and the convex surface of the panel sufficient to enable the chuck to support the panel. When a panel is to be released from the chuck, piston **23**, upon receipt of a signal from the programmer, opens valve **22** to relieve the partial vacuum created between the panel and the chuck. Finally, in addition to a chuck, each cart is provided with an upstanding arm **24**, the upper portion of which is bifuracted to present a pair of hooks **25**, only one shown, for transporting a mask M_1 together with its associated panel P_1 through processor **10**.

Apparatus **16** comprises a vertically disposed post **26**, the lower extremity of which is undercut to provide a spindle portion **27** which is rotatably supported by a bearing assembly **28** mounted within a housing **29** affixed to a base plate **30**. A driver **31** attached to spindle **27**, for effecting intermittent rotation, in 180° increments, of post **26** and platen **34**, is coupled via a speed reducer **32** and a belted pulley arrangement to a reversible electric motor **33** mounted beneath base plate **30**, see FIG. **3**. Driver **31** can comprise a parallel index drive, a unit available from Commercial Cam and Machinery Company of Chicago.

Panel loader **16** also includes a platen **34** comprising a hub **35** which is mounted upon a spline **36** secured to post **26**. In this fashion, platen **34** is coupled to post **26** for rotation therewith, while, at the same time, the hub and spline coupling permits a vertical displacement of the platen. Platen **34** further comprises a pair of oppositely disposed shelves **38***a*, **38***b* within respective spring-loaded platforms **39***a*, **39***b* are nested. These platforms, in turn, serve to support the face panel holders **40***a*, **40***b* each of which includes an upstanding depressible feeler button **37** positioned for engaging the sealing land of a face panel to be received by the holder. While only button **37***a* for holder **40***a* is visible in FIG. **2**, panel holder **40***b* is similarly equipped. Upon engaging a panel sealing land, this button relays a signal through the programmer to actuate piston **23** to open the vacuum chuck vent as required when a panel holder is reciprocated to retrieve a processed panel. However, in the case where a panel holder enters the index station bearing an unprocessed panel for insertion into a cart, the output signal from the already depressed feeler button is now prevented from actuating piston **23** by the programmer; instead, the vacuum pump is activated when the convex surface of the panel abuts vacuum chuck plate **20**. By virtue of the coupling between post **26** and platen **34**, afforded by hub **35** and spline **36**, it should be apparent that panel holders **40***a*, **40***b* are successively displaceable, in response to rotation of post **26**, between the index station within the carousel and the external loading station.

A pair of elongated cam rods **41***a*, **41***b*, individually secured to the undersides of holders **40***a*, **40***b*, extend downward through central apertures in their associated platforms and shelves. Affixed to the lower extremities of cam rods **41***a*, **41***b* are assigned rollers **42***a*, **42***b* in continuous engagement with a circular cam track **43** that undulates from a reference elevation in the index station to a predetermined elevation at the loading station. With this arrangement, then, the panel holder instantaneously located in the index station, holder **40***a* in FIG. **2**, is permitted to retract to the reference position clear of the path of movement of carts **13** through the index station. At the same time track **43**, in conjunction with cam rod **41***b*, causes the panel holder **40***b* occupying the loading station to ascend to the predetermined elevated position, with the track elevation selected to place panel holder **40***b* at a convenient height for the operator.

In order to prevent rotation of panel holders **40***a*, **40***b* relative to their platforms, respective stabilizer rods **45***a*, **45***b* are fitted to the underside of the panel holders so as to extend through cooperating apertures in the platforms and shelves associated with those holders.

As best seen in FIG. **2**, the hub **35** of the platen is rotatably supported upon a reciprocating means comprising a collar **45** having a horizontally disposed bearing surface **46** that engages the underside of hub **35**. Collar **45** includes a flange **47** that receives a pair of push rods **48, 49** which are axially journalled within a pair of vertically disposed bearings extending through housing **29**. A cross-piece **50**, which constitutes a drive plate for rods **48, 49** includes an offset portion **51**, see FIG. **3***a*, that is slotted to accommodate a roller **52**. This roller is in continuous contact with a cam **53** having a 180° constant radius portion and a 180° offset lobe **44**. Cam **53**, upon rotation, effects reciprocation of the push rods and, thereby, collar **45**, platen **34** and the panel holders. Cam **53** is coupled through a speed reducer **54** and a belted drive shaft to motor **33**. As will be de-

scribed in detail subsequently, cam **53** is arranged to be driven through an arcuate travel of 540° which effects two reciprocations of platen **34,** at which time the drive motor is deenergized. However, between such reciprocations, intermittent drive **31,** which is also coupled to motor **33,** effects a 180° rotation of post **26** and the panel holders. Rotation of the motor is then resumed in a reverse direction until another 540° of cam travel is completed to effect two more reciprocations of the platen and a 180° rotation, this time in the opposite direction, of the post and panel holders.

Secured to an upper portion of post **26,** for rotation therewith, is a two armed hanger **55** which serves to transport masks M_1 and M_2 between the carousel index station and the operator loading station. To this end the hanger comprises sets of double hooks **56***a*, **56***b* which extend from assigned ones of the hanger arms, see FIG. **2***a* for details of set **56***a*. As shown in FIG. **2***a* the hooks of set **56***a* are spaced apart a distance less than the spacing between hooks **25** on bifurcated cart arm **24.** This dimensioning permits the hanger hooks to pass between the bifurcation of arm **24** to retrieve or deposit a mask on hooks **25,** as required during operation. Hook set **56***b* is, of course, of like construction. Accordingly, further description of the hanger hooks will be addressed principally to hook set **56***a*, it being understood that set **56***b* is identical to set **56***a*.

As shown in FIGS. **2** and **2***a*, hook **56***a* is fastened to a pair of slotted bars **57***a* which are pivotally suspended from a pin **58***a* that bridges a pair of cover plates **59***a*. A control arm **60***a*, which is slideably journalled in the hanger arm, is connected by a pin **61***a* to a coupler **62***a* which, in turn, is rotatably connected to hook bar **57***a* by the pin **63***a*. In order to complete an articulated coupling between hook **56***a* and control arm **60***a*, the cover plates **59***a* are slotted to control and direct the travel of pin **63***a*, actually cover plate **59***b* best illustrates this slot. In any event, upon a displacement of arm **60***a* in a direction toward center post **26,** pin **63***a* is driven up the inclined slots in the cover plates **59** so as to elevate hooks **56***a*. Simultaneously, the conjoint action of pin **58***a* and the slots in hook bar **57***a* effects a rotation of the hook about pin **58***a*. An identical elevation and rotation of hook **56***b* is effected at the same time by a duplicate mechanism in which like parts are identified by like numerals suffixed with a lower case "*b*."

Each of arms **60***a*, **60***b* are connected to a cap **65** by a dual-pivot coupling arrangement, the construction and operation of which are deemed self-explanatory from the drawings. This cap is slideably mounted upon an extension **66** of post **26** for vertical displacement between an upper position in which hooks **56***a*, **56***b* are retracted (broken line construction in FIG. **2**) and a lower position in which the hooks are extended (solid line construction). To achieve this action cap **65** is coupled to the upper extremity of a control shaft **67** which is disposed within post **26** and restricted to a vertical displacement therein. Since cap **65** must be free to rotate about shaft **67,** as well as reciprocate with it, the upper inner wall of the cap is fitted with an inwardly directed ledge **68** which is captivated between a double-race bearing **69** fitted to the top of shaft **67.** In this fashion cap **58** is free to rotate about shaft **67** with hanger **55** and post **26,** as required, while still subject to vertical displacement by that shaft.

The lower extremity of shaft **67** is coupled to a circular cam **70** via a pivotally mounted control arm **71** that carries a pin **72** which is seated in a groove **73** in cam **70.** This groove, although comprising three distinct 90° segments, presents an uninterrupted 270° track for pin **72.** As perhaps better seen in FIGS. **4** or **5,** the two end segments constitute mirror images of a track section having a radius that continually increases from its beginning to a point 90° displaced therefrom. The center 90° segment, on the other hand, is a constant radius section. Cam **70,** by virtue of the gearing arrangement within gear box **54** is caused to rotate 270° in the same period of time that the platen reciprocating cam **53** traverses 540°. Thus, cam **70** effects an elevation of shaft **67** during the time pin **72** traverses the first 90° segment to effect an inward retraction of the mask hanger hooks, then during traversal of the center 90° segment, the hooks are maintained retracted as this is the period during which the post and panel holders are rotated 180° by driver **31.** Finally, shaft **67** is retracted as pin **72** travels the third 90° segment effecting an outward motion of the hanger hooks. Cam **70** is also coupled through gear box **54** to motor **33.**

In addition to its cam track, cam **70** also comprises a pair of switch actuators **75, 76** which are spaced apart an arcuate distance of 270° and extend outwardly from the peripheral surface of the cam. At each extremity of the cam's travel, one of actuators **75, 76** engages the toggle of a switch **77** which, during operation of panel loader **16,** is normally closed. Electrically, this switch is located in the energizing circuit for drive motor **33** so that each time it is closed, by either of actuators **75** or **76,** motor **33** is deenergized, see FIG. **5.** In order to initiate another sequence, there is included in programmer **11** a timer actuated normally-open solenoid type starting switch **79** which is coupled across "off" switch **77** for the purpose of energizing motor **33** for at least a period of time sufficient to cause a rotation of cam **70** that displaces the actuator in contact with the toggle of switch **77.**

A reversing switch **80,** which controls the rotational direction of motor **33,** is mounted upon the flange **47** of collar **45** so as to present its toggle to a crescent-shaped cam member **81.** This cam, which subtends an angle of approximately 180°, is attached to the underside of platen **34,** see FIG. **3***b*. By virtue of its 180° crescent construction and placement under the platen, cam **81** engages the toggle of switch **80** only when the platen occupies the position shown in FIG. **3** and during the time the platen is being rotated 180° from that position. Since the toggle is depressed only during one orientation of the platen, switch **80** serves as a device for controlling the rotational direction of motor **33.** To this end, and as diagrammatically depicted in FIG. **5,** a depression of the switch's toggle energizes a coil **82,** a coil that induces a counterclockwise rotation of the motor. On the other hand, when the toggle is released, which occurs when cam **81** departs from the toggle as it would when post **26** and platen **34** have rotated 180° from the positions shown in FIG. **3** (in the direction indicated by the arrow encircling post **26**), a coil **83,** that produces a clockwise rotation of the motor, is energized. In other words, when the toggle of switch **80** is depressed, motor **32** is conditioned for counterclockwise rotation, but when the toggle is released the motor is conditioned for clockwise rotation.

The operational sequence of automatic panel loader **16** will now be discussed with reference to the timing charts shown in FIG. **4.** It will be assumed that an oper-

ational sequence is initiated by the programmer at time t_o, at which instant the panel loader is positioned in the manner shown by the solid construction lines in FIG. 2. At time t_o, then, motor 33 is energized through starting switch 79 to commence rotation of reciprocating cam 53 and circular cam 70 which actuates the mask hanger control shaft 67. As cam 53 rotates in a clockwise direction, as viewed in FIGS. 3 and 4, its lobe 44 is driven beneath roller 52 of the platen reciprocator to elevate platform 39*a* and panel holder 40*a* from their positions shown in FIG. 2 to the positions shown in FIG. 3. Note that platform 39*b* is simultaneously elevated; however, this action is of no consequence since panel holder 40*b* is already at a predetermined elevation due to cam track 43. At time t_1, therefore, panel holder 40*a* is in a position to receive processed panel P_1 which had been transported to the index station by cart 13. Accordingly, when button 37*a* of holder 40*b* encounters the sealing land of panel P_1, piston 23 is actuated to open valve 22 of the vacuum clutch which then releases the panel for retrieval by holder 40*a*. Holder 40*a* is then returned to its reference elevation as cam 53 permits roller 52 to ride down from lobe 44 to that portion having a constant radius. Thus, between times t_o and t_2, holder 40*a* ascended to the vacuum clutch, retrieved panel P_1 and then returned with the panel to a reference level.

Simultaneously, with the 180° displacement of cam 53 during time period t_o–t_2, cam 70 is rotated 90° through its first track segment to elevate control shaft 67 from its lowermost position to its uppermost position. This action on the part of shaft 67 serves to rotate hook pair 56*a* through the bifurcation of cart arm 24 to retrieve mask M_1 from hooks 25 and position it to the location illustrated by the broken construction lines in FIG. 2, that is, to a position clear of the cart and its hooks 25.

During the time period t_o–t_2 while panel P_1 mask M_1 were being retrieved an operator at the loading station would have placed an unprocessed panel P_2 on panel holder 40*b* and its associated mask M_2 on hook pair 56*b*. As depicted in the FIG. 4 time slot t_2–t_4, cams 53 and 70 are effectively idling to the extent that, while they are still rotating during this period t_2–t_4, the followers associated with these cams are traversing surfaces of constant radius so that the reciprocation mechanism for the work holders remains retracted and control shaft 67 for the mask hanger is maintained in an elevated position with masks M_1 and M_2 occupying the positions shown by dotted line construction in FIG. 2.

During this period then, while cams 53 and 70 are idling, a positive coupling is established between drive motor 33 and the driver 31 connected to post 26. To rotate the post, platen 34 and its panel holders 180° to carry holder 40*b* with its unprocessed panel P_2 into the index station, while holder 40*a* with its processed panel P_1 is carried to the operator loading station. Simultaneously, of course, masks M_2 and M_1 are transported with their associated panels to the index and loading stations, respectively. At this stage, time t_4, roller 52 has traversed cam 53's 180° track of constant radius and the pin follower 72 for cam 70 has traversed the 90° portion of its constant radius track. Another occurrence transpiring during time period t_2–t_4 is the elevation of panel holder 40*a* to the position previously occupied by panel 40*b* by virtue of the travel of cam rod roller 42*a* along inclined track 43.

Commencing now at t_4, cam 53 again drives roller 52 up its offset lobe 44 to elevate platen 34 to now present holder 40*b* and its unprocessed panel P_2 to vacuum chuck 14. Of course, as panel P_2 is driven against plate 20 of the chuck, the programmer initiates operation of the vacuum pump to develop a partial vacuum between the convex surface of the panel and the concave surface of chuck plate 20. The spring-loaded platform 39*b* serves as a pressure relief mechanism to the extent that it permits platen 34 to drive panel P_2 against chuck plate 20 with sufficient pressure to enable the chuck to effect a firm coupling with the panel. This insertion of panel P_2 into the vacuum chuck is completed at time t_5 so that continued rotation of cam 53 permits the holder 40*b* to return to the reference position clear of the panel and cart, which action is completed by time t_6.

Meanwhile during this same period, t_4–t_6, the last segment of cam track 73 returns control shaft 67 to its lowermost position thereby rotating the mask hanger hooks 56*a*, and 56*b* downward and outward so as to now deposit mask M_2 upon cart hooks 25. As cam 70 completes this function, its actuator 76 engages the toggle of "off" switch 77 to deenergize drive motor 33.

Accordingly, as described above, during the time period extending from t_o through t_6, cam 53 is rotated through 540° to complete two reciprocations of platen 34 and the panel holders. During the same period, cam 70 is rotated 270° to elevate and then retract control shaft 67 to first retrieve mask M_1 from a cart and thereafter to deposit mask M_2 on that cart. As also noted, during the same time span, the intermittent coupling arrangement between driver 31 and motor 33 is effected so as to permit a 180° revolution of post 26, the panel holders and the hanger arms.

During the above-described course of events, conveyor 12 of the processor remained stationary. Accordingly, upon receipt of a signal from the programmer, prime mover 15 is energized and carousel 12 is advanced one station to place newly inserted panel P_2 into the processing chain, while advancing the just processed panel P_3 to the index station. As advance of the carousel is arrested, the programmer through a timer activates start switch 79 to initiate rotation of motor 33. However, it should be noted that cam 81 has now been displaced 180° from the position shown in FIG. 3 so that the toggle for reversing switch 80 is no longer depressed and the motor rotates in an opposite direction, that is, clockwise. It should also be noted that cams 53 and 70 will also be driven in a direction opposite to that above described. The operational sequence for apparatus 16 is again the same as described above. Specifically, by retracing the tuning charts of FIG. 4 along the broken line arrows, it is apparent that a reciprocation of the platen to retrieve processed panel P_o' occurs during t_o'–t_2', as does retrieval of its mask. From t_2' until t_4', cams 53 and 70 again idle while driver 31 rotates the post, platen and panel holders 180°. The period t_4'–t_6' again sees an unprocessed panel and its mask inserted into the cart that delivered panel P_3 while P_3 and its mask are removed by the operator and replaced with still another unprocessed panel and its mask. As cam 70 completes its rotation, it now presents actuator 75 to the toggle of "off" switch 77 to again deenergize motor 33. The programmer again ad-

vances the carousel and the entire process beginning at t_o is repeated again.

While a particular embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

We claim:

1. Apparatus for automatically inserting and retrieving cathode ray tube face panels from a panel processor, said processor including a programmer, an endless conveyor carrying a plurality of panel supporting carts and a prime mover, controlled by said programmer for stepping said carts through a series of work stations, including an index station, disposed along a closed path, said apparatus comprising:

a platen having a plurality of panel holders successively displaceable between said index station and a loading station;

means for effecting a first reciprocation of at least that one of said panel holders instantaneously located at said index station into cooperative engagement with a first indexed one of said carts for inserting an unprocessed panel in said first cart and for thereafter effecting at said second station a second reciprocation of said one panel holder into cooperative engagement with a subsequently indexed cart for retrieving a processed panel from said subsequent cart;

and platen driving means for displacing said one panel holder and said retrieved processed panel to said loading station while simultaneously displacing another of said panel holders carrying an unprocessed panel to said index station for insertion into said subsequently indexed cart by said reciprocation means.

2. Apparatus as set forth in claim **1** in which said platen comprises a pair of oppositely disposed panel holders.

3. Apparatus as set forth in claim **1** which further includes a rotatably supported post coupled to said platen for displacing said panel holders between said index station and said loading station.

4. Apparatus as set forth in claim **1** in which said means for effecting reciprocation of said panel holder comprises a rotatably mounted reversible cam displaceable through an arcuate distance of 540° in effecting said first and second reciprocations of said panel holders.

5. Apparatus as set forth in claim **3** which further includes a multi-arm hanger supporting a like plurality of aperture masks and mounted upon said post for conjoint rotation with said panel holders.

6. Apparatus as set forth in claim **5** which further includes a control shaft disposed within said post for actuating said hanger to deposit that one of said aperture masks instantaneously located at said index station upon a cart borne mask holder.

7. Apparatus as set forth in claim **6** which additionally includes a reversible rotatably mounted cam displaceable through an arcuate travel of 270° for depositing a mask upon said first cart during said first reciprocation and for removing a mask from said subsequently indexed cart during said second reciprocation.

8. Apparatus as set forth in claim **1** which further includes means for automatically elevating that one of said panel holders entering said loading station to a predetermined elevation.

9. Apparatus as set forth in claim **8** in which said elevating means comprises a circular track undulating from a reference elevation at said index station to said predetermined elevation at said loading station and a cam follower depending from each of said panel holders in continuous engagement with said track.

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