

July 9, 1968

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3,391,473

ROTATABLE COMPONENT DELIVERY TABLE

Filed Dec. 18, 1964

4 Sheets-Sheet 1

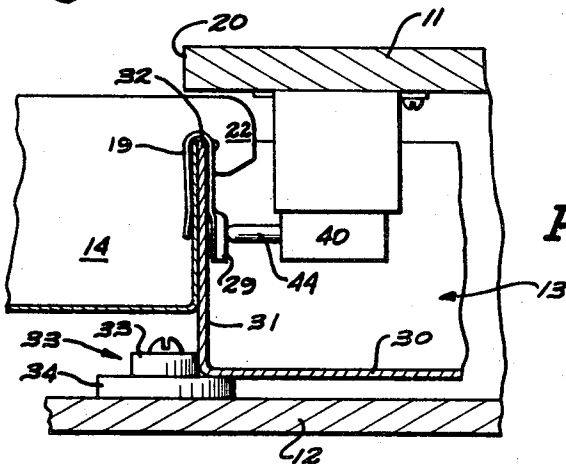
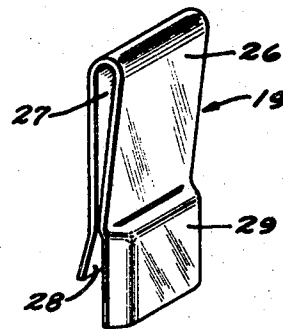
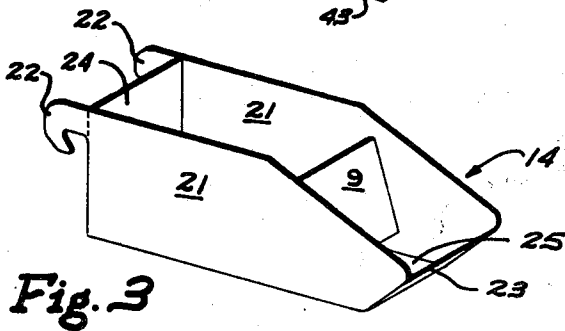
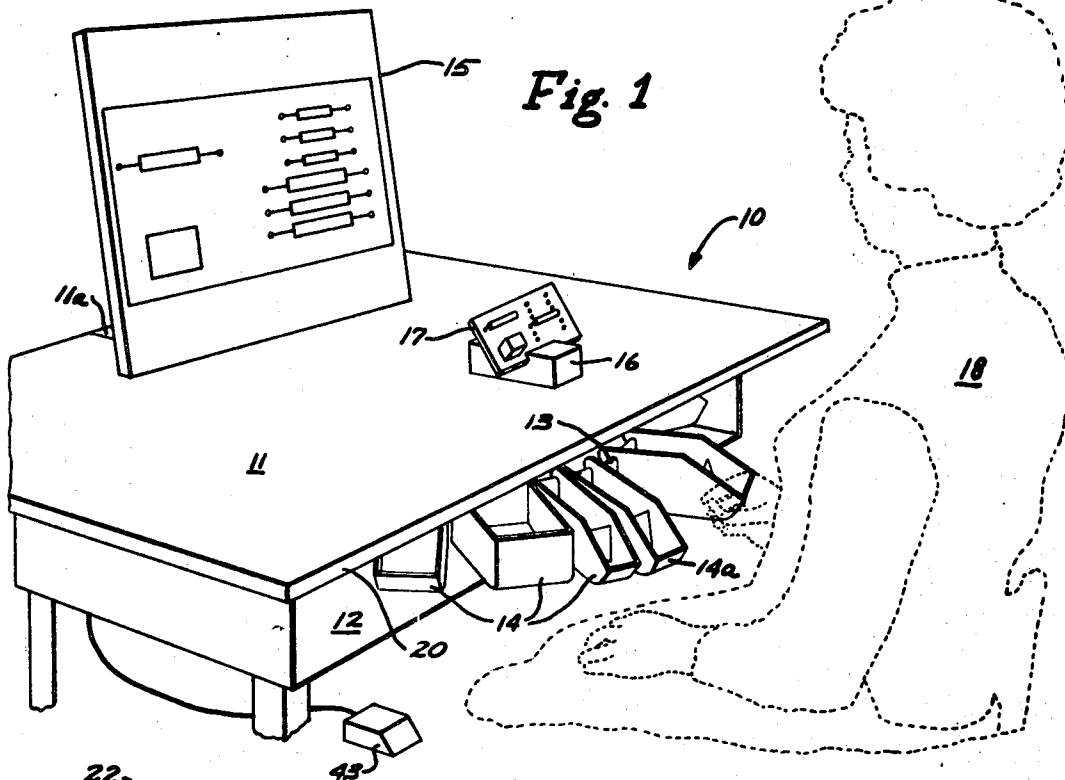


Fig. 5

Fig. 4

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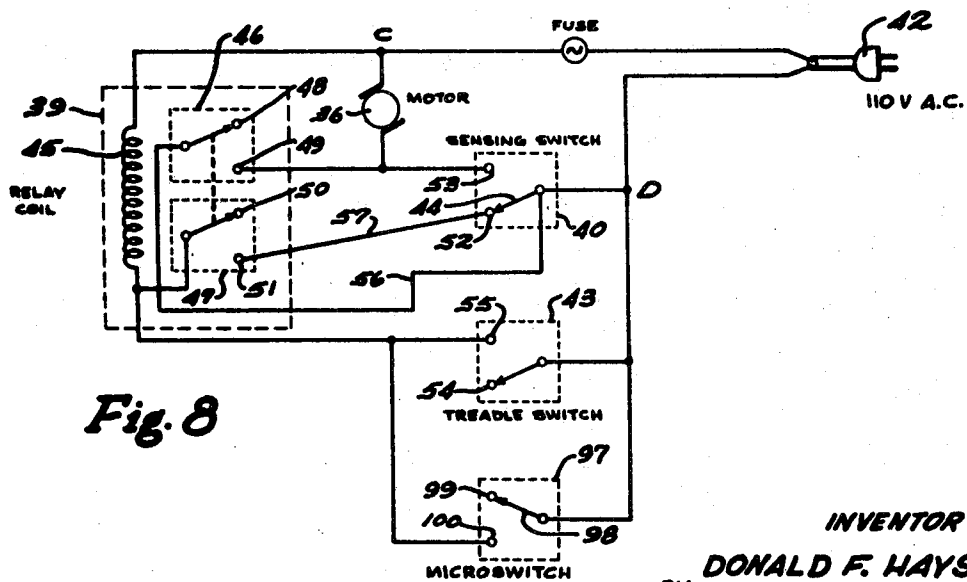
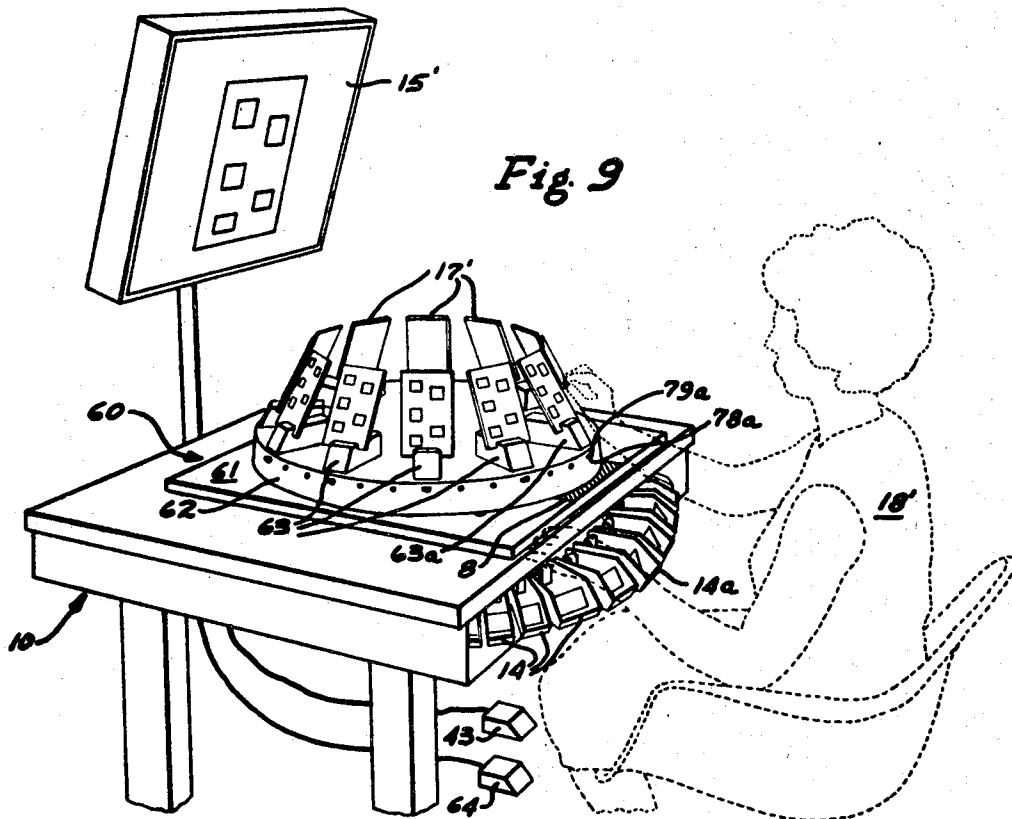
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ROTATABLE COMPONENT DELIVERY TABLE

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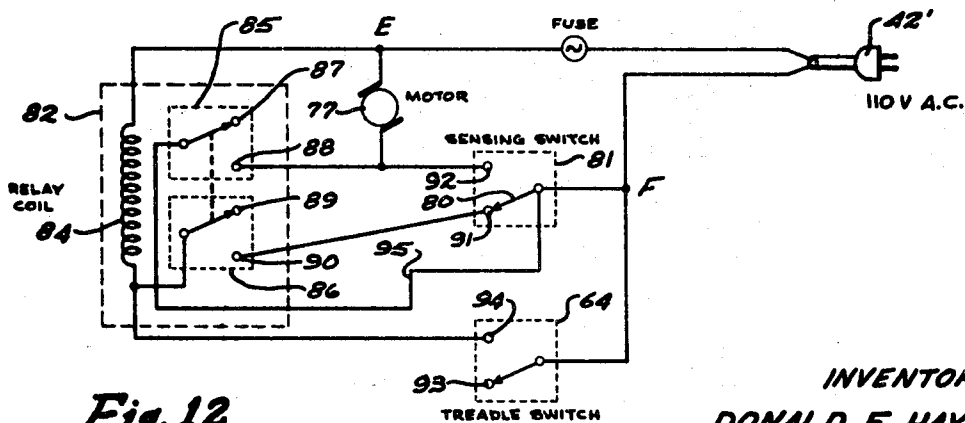
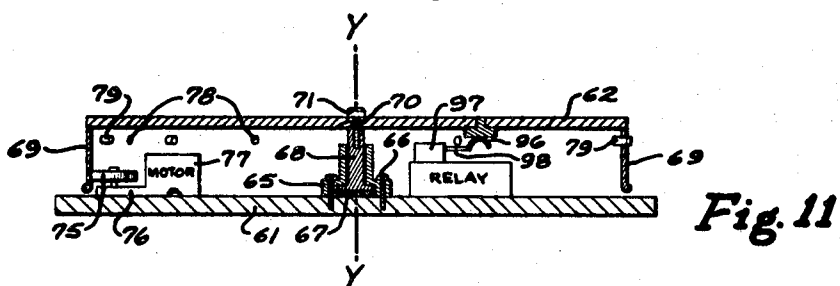
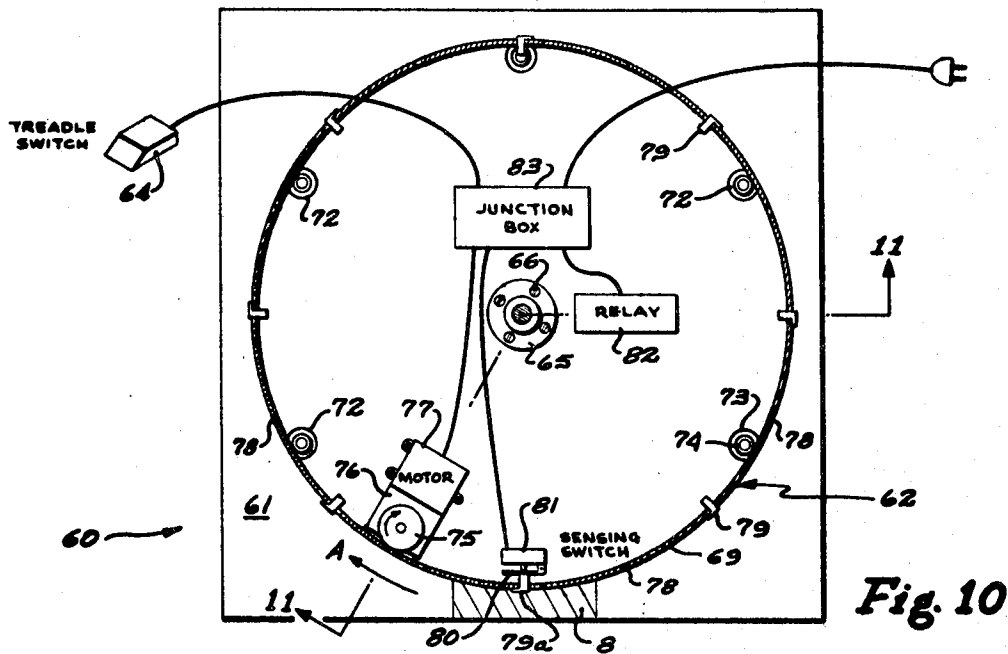


Fig. 12

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ROTATABLE COMPONENT DELIVERY TABLE
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ABSTRACT OF THE DISCLOSURE

A component delivery table having a rotatable tray is equipped with detachable bins which can be mounted to the perimeter of the tray to extend outboard from the tray. For each of the detachable bins there is an indexing element which will arrest the rotation of the tray when that one of the detachable bins is presented in an accessible location for the operation.

This invention concerns a rotatable component delivery table which is especially adapted for use in the assembly of multi-component articles. The present rotatable component delivery table is useful by itself in the assembly of single multi-component articles and also is useful in combination with a rotatable work assembly table for the assembly of duplicate multi-component articles.

Component delivery tables and their utility are described in U.S. Patent 3,154,865. The prior art component delivery table includes compartmented rotatable trays and utilizes drive means which are located outboard of the tray.

The present component delivery table has the following features:

The drive means are disposed inboard of a rotatable circular tray;

The circular tray is adapted to receive a plurality of standard bins about its circumference for the components which are delivered by the table;

Each individual bin has an associated indexing element which serves to arrest rotation of the tray when that bin is delivered to a predetermined point of the circular locus of tray rotation.

The present invention, its objects and advantages, will be more fully described by reference to the accompanying drawings in which:

FIGURE 1 is a perspective illustration of the present component delivery table;

FIGURE 2 is a plan view of the present component delivery table with the table surface partly broken-away;

FIGURE 3 is a perspective illustration of a typical component bin which is well-known in the art;

FIGURE 4 is a perspective illustration of a combination clip member and rotation-arresting element;

FIGURE 5 is a fragmentary cross-section illustration, taken along the line 5—5 of FIGURE 6, showing the present component delivery table showing the manner of fastening a typical bin and the rotation-arresting operation of the clip member;

FIGURE 6 is a plan view of the undersurface of the present component delivery table showing the arrangement of various elements in relation to the bin delivery tray;

FIGURE 7 is a cross-section view taken along the line 7—7 of FIGURE 6 showing the present component delivery table and various elements;

FIGURE 8 is a schematic wiring diagram for the present component delivery table;

FIGURE 9 is a perspective illustration of the present component delivery table in operative combination with a rotatable work assembly table;

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FIGURE 10 is a plan view of the rotatable work assembly table of FIGURE 9;

FIGURE 11 is a cross-section view taken along the line 11—11 of FIGURE 10 showing the rotatable work assembly table; and

FIGURE 12 is a schematic wiring diagram for the rotatable work assembly table of FIGURES 9 through 11.

Referring to FIGURE 1 there is illustrated a component delivery table 10 according to this invention. The table 10 includes a working surface 11 an under carriage 12, a rotatably mounted tray 13 to which a plurality of individual bins 14 is secured. If desired, a chart 15 for operator instructions may be provided. A suitable assembly jig 16 is provided on the working surface 11 for retaining an incomplete multi-component article 17 which is to be assembled. The assembly operator is indicated in phantom outline and is identified by the numeral 18.

As seen in FIGURE 2, the tray 13 is rotatable about a generally vertical axis indicated by X. Each of the individual bins 14 is secured in outboard relation to the tray 13 by means of a clip 19. It will be observed that the tray 13 has come to rest with the forwardmost bin 14a presented beyond the front edge 20 of the working surface 11 where the contents of the forwardmost bin 14a are readily accessible to the operator 18. The individual bins 14 are readily available in commerce. The bin 14, as seen in FIGURE 3, includes generally parallel side walls 21 with hook-like hanger extensions 22. A front wall 23, a back wall 24 and a bottom wall 25 complete the bin 14. The front wall 23, the back wall 24 and bottom wall 25, may in some instances, be formed from a single piece of metal. A component-level maintaining baffle plate 9 frequently extends between the side walls 21. The construction of these commercially available bins 14 forms no part of the present invention.

A clip member 19, shown in FIGURE 4, has a general U-shape with a tray engaging surface 26 and a bin engaging surface 27. The bin engaging surface 27 has an outwardly bent flange 28 at its bottom edge to facilitate entry of the bin's back wall 24 into the opening of the clip 19. The tray engaging surface 26 is provided with a protuberance 29 which extends inboard of the tray engaging surface 26 toward the axis of tray rotation X. The protuberance 29 is a position-indexing element which serves as a rotation-arresting element for the rotatable tray 19 when the bin 14 (to which the clip 19 under consideration is affixed) is presented in the forwardmost position, such as the bin 14a in FIGURE 1 and FIGURE 6.

The relationship of the individual bin 14a and the tray 13 can be seen in FIGURE 5. The tray 13 includes a circular base 30 and an upright circular side wall 31 with an upper rim 32. The tray 13 rests upon a plurality of support bearings 33 having a large diameter base portion 34 and a smaller diameter upper portion 35. The support bearings 33 are rotatably secured to the under carriage 12 by means of a screw and are disposed in a circular locus about the axis of rotation X. The circular base 30 rests upon the top of the base portion 34 and the tray side wall 31 engages the cylindrical side wall of the upper portion 35 of the support bearing 33. Thus the support bearings 33 rotatably support the tray 13 for rotation about the axis X. Preferably the support bearings 33 are fabricated from suitable plastic substances such as nylon.

Preferably the rotatable tray 13 is fabricated as a stamping from a single sheet of metal. 18-gauge cold-rolled steel stampings have been found suitable for the tray 13.

Mounted beneath the working surface 11 is a motor 36 connected through a reducing gear train 37 to a drive wheel 33 which is in peripheral engagement with the side

wall 31 of the tray 13 adjacent to the circular base 30. It will be observed from FIGURE 7 that the drive wheel 38 engages the side wall 31 below the level of the protuberance 29 of the clip 19. Also secured beneath the working surface 11 are a relay 39, a sensing switch 40 and a junction box 41. A source of electrical power is available through the electrical plug 42. An operator controlled treadle switch 43 extends beneath the component delivery table 10 for foot operation by the operator 18.

Operation

When the operator 18 closes the treadle switch 43, the rotatable tray 13 and its associated bins 14 commence rotation until the next succeeding one of the bins 14 is presented in the forwardmost position for ready access by the operator 18. The rotation of the tray 13 is instantly arrested and the forwardly presented bin 14 remains in the forwardmost position until the operator 18 closes the treadle switch 43 to recommence rotation of the tray 13.

It will be observed that the sensing switch 40 has a pivotal arm 44 which can be engaged by each of the protuberances 29 which are the position-indexing elements. This can be seen in FIGURES 5 and 6 wherein the protuberance 29 is in engagement with the pivotal arm 44. It will be observed (FIGURE 6) that movement of the tray 13 in a clockwise direction will disengage the protuberance 29 from the pivotal arm 44 and allow the resiliently mounted pivotal arm 44 to extend outwardly until it is engaged by the next-in-line one of the bins 14, through the protuberance 29 of the related clip 19.

Electrical circuitry

The electrical circuitry shown in FIGURE 8, for the present component delivery table includes the relay 39, the motor 36, the sensing switch 40, and the treadle switch 43. The relay 39 has a relay coil 45 and two relay switches 46, 47 which are mechanically ganged as shown. The first relay switch 46 includes an open contact 48 and a motor contact 49. The second relay switch 47 includes an open contact 50 and a sensing contact 51. A sensing switch 40 has a relay switch contact 52 and a motor contact 53. The treadle switch 43 has an open contact 54 and a relay coil contact 55. The electrical power source is designated by the plug 42 which is adapted for connection with a power supply.

The electrical circuitry shown in FIGURE 8 is illustrated in its normal position representing switch positions during a stationary dwell period. It will be seen that neither the motor 36 nor the coil 45 of the relay 39 is connected to the power source in this normal position.

The operator activates the circuit by depressing the treadle switch 43 to engage the contact 55 and close a first electrical circuit including the treadle switch 43 and the relay coil 45, thus sending current through the relay coil 45 and causing both relay switches 46, 47 to move to activated positions at contacts 49, 51 respectively. A second electrical circuit is closed thereby including a conductor 56, the first relay switch 46 and the motor 36. Likewise a third electrical circuit is closed including the sensing switch 40, a conductor 57, the second relay switch 47 and the relay coil 45. Through the third electrical circuit the relay coil 45 remains energized after the treadle switch 43 has disengaged from the relay contact 55 and returned to the open contact 54. The said first, second and third electrical circuits or paths are parallel with one another between the terminals C and D. The sensing switch 40 is normally biased to engagement with the motor contact 53, but, when the actuating arm 44 is depressed by a stationary protuberance 29 (see FIGURES 5 and 6) in a stationary position, the actuating arm 44 engages the relay contact 52 as seen in FIGURE 8. When the second electrical circuit closes through the first relay switch 46, the motor 36 turns to cause rotation of the tray 13 in the direction of the arrow B (FIGURE 6) whereby

the clip 19 passes the sensing switch 40 and releases the activating arm 44. The released arm 44 moves to motor contact 53 to close a fourth electrical circuit which includes the sensing switch 40 and the motor 36. The fourth electrical circuit is parallel with the first, second and third circuits between the points C and D. Movement of the activating arm 44 opens the third electrical circuit by disengagement from the relay contact 52 whereby the relay coil 45 is disconnected from the power source 42 and deactivated. Upon deactivation of the relay coil 45, both relay switches 46, 47 return to the open contacts 48, 50 respectively.

The motor 36 continues to turn until the next-in-sequence protuberance 29 engages the activating arm 44 (FIGURE 6) and deflects the activating arm 44 out of engagement with the motor contact 53 and into engagement with the relay contact 52. The motor 36, thereby disconnected from the power source, is stopped and the circuitry is restored to the dwell relationship shown in FIGURE 8.

Loading bins

As seen in FIGURES 1 and 2, a pivotal lid 11a is cut from the working surface 11 and hinged thereto with hinges 57. The pivotal lid 11a is located remote from the front edge 20 to permit convenient removal of the bins 14 and replacement or reloading thereof.

Combination with automatic work table

As thus far described, the present component delivery table is the equivalent of those in the prior art, for example, as shown in U.S. Patent 3,154,865. Like the component delivery tables of the prior art, the present component delivery table can be utilized in combination with an automatic work assembly table of the type disclosed in my co-pending application S.N. 419,299, filed Dec. 18, 1964. Such combination is illustrated in FIGURE 9.

Referring to FIGURE 9, an operator 18' is seated before the present component delivery table 10 upon which is mounted a work assembly table 60 which has a base 61 and a circular rotatable tray 62. A plurality of work supporting blocks 63 are mounted on the top of the rotatable tray 62 which serves as a work supporting surface. Each of the blocks 63 supports an incomplete multi-component article 17'. The work supporting surface of the tray 62 is rotated about a vertical central axis whereby each of the incomplete articles 17' is presented in direct confrontation to the operator 18' in an assembly station which is indicated by the shaded region 8. The operator 18' performs a work operation on each of the incomplete articles 17' while that article remains in the assembly station 8.

The individual work operation may comprise, for example, the installation of a specific resistor in each of the individual incomplete articles 17'. The assembly operator 18' will obtain the necessary material for performing the specific work operation from suitable component delivery means such as the bins 14 which are sequentially delivered in confrontation to the operator 18'. A pictorial reproduction of the article 17' is visually presented on the chart 15'. Thus the operator 18' receives a supply of the component (to be installed) from the bins 14 and installs that component in each of the incomplete articles 17' in accordance with the visual instructions presented upon the chart 15'. After one of the individual components is assembled on one of the incomplete articles 17', the operator depresses a treadle switch 64 which causes the tray 62 to rotate for a fraction of one complete rotation until the next succeeding article 17' is presented stationary in the assembly station 8.

After all of the incomplete articles 17' have received the desired component from the bin 14a which confronts the operator 18', the component delivery table 10 is activated by the operator 18 depressing the treadle switch 43 whereby the next-in-sequence one of the bins 14 is pre-

sented in confrontation to the operator 18'. The operator 18' thereupon depresses the treadle switch 64 and installs the contents of the then-confronting bin 14 into each of the incomplete articles 17' in sequence.

With the present combination, the operator can assemble a plurality of multi-component duplicate articles by performing the identical work operation on each of the individual articles before proceeding to successive work operations.

The work assembly table

The work assembly table 60 has a base 61 which may comprise the rectangular sheet of wood, metal, plastic and the like with a hub 65 fastened thereto by screws 66. A disk-like bearing block 67 (for example, a nylon disk) fits into the hub 65. A shaft 68 rests on the block 67 and is rotatable within the hub 65. The tray 62 is preferably circular with a peripheral side wall skirt 69 and a central aperture 70. A bolt 71 extends through the aperture 70 and is threadably engaged in the shaft 68 to provide rotatable mounting of the tray 62 about a vertical axis shown by the broken line Y—Y.

A plurality of roller bearings 72 is provided, each having an enlarged lower portion 73 and an upper portion 74 of lesser diameter. The rim of the side wall skirt 69 rests upon the upper surface of the large lower portions 73 and is in peripheral engagement with the side walls of the upper portion 74 of the roller bearing 72 whereby the tray 62 is rotatably retained.

Driving means.—A driving wheel 75 is mounted in peripheral engagement with the inner surface of the side wall skirt 69. The drive wheel 75 is connected through a gear reducing box 76 to an electric motor 77 which is secured to the base 61 by screws as shown. Rotation of the drive wheel 75 in the direction of the arrow (FIGURE 10) causes rotation of the tray 62 in the direction of the arrow A.

Predetermining step-wise movement.—A plurality of spaced apertures 78 is provided in the side wall skirt 69 for receiving suitable stop members 79 which are clipped to the skirt 69 to extend beneath the flat surface of the tray 62. The stop members 79 are provided at the same radial distance from the vertical axis Y—Y. During rotation of the tray 62, the stop members 79 pass through a circular locus which overlaps the path of travel of an actuating arm 80 of a sensing switch 81 which is fastened to the base 61.

The number of stop members 79 determines the number of stationary dwell periods which are provided for each complete rotation of the tray 62. The circumferential spacing of the stop members 79 determines the relative distance between stationary positions.

Referring to FIGURE 9, it will be seen that a stop member 79a is clipped to the aperture 78a directly beneath the block 63a. With the sensing switch 81 located adjacent to the assembly station 8 (FIGURE 10), each stop member 79 will create a stationary dwell for the work supporting surface of the tray 62 when that stop member is centrally positioned in the assembly station 8.

A suitable electromechanical relay 82 is fastened to the base 61 for purposes which will be described in connection with the circuitry diagram of FIGURE 12. A junction box 83 is shown as fastened to the base 61 for electrically connecting the electrical circuit elements by suitable wiring.

Electrical circuitry

The electrical circuitry for the present rotatable work assembly table includes the relay 82, the motor 77, the sensing switch 81 and the treadle switch 64. The relay 82 has a relay coil 84 and two relay switches 85, 86 which are mechanically ganged as shown. The first switch 85 includes an open contact 87 and a motor contact 88. The second relay switch 86 includes an open contact 89 and a sensing contact 90. A sensing switch 81 has a relay switch contact 91 and a motor contact 92. The treadle switch

64 has an open contact 93 and a relay coil contact 94. An electrical power source is designated by the plug 42' which is adapted for connection with the power supply.

The electrical circuitry shown in FIGURE 12 is illustrated in its normal position representing switch positions during the stationary dwell period. It will be seen that neither the motor 77 nor the coil 84 of the relay 82 is connected to the power source.

The operator 18' activates the circuit by depressing the treadle switch 64 to engage the contact 94 and close a first electrical circuit including the treadle switch 64 and the relay coil 84, thus sending current through the relay coil 84 and causing both relay switches 85, 86 to move to activated positions at contacts 88, 90 respectively. A second electrical circuit is closed thereby including a conductor 95, the first relay switch 85 and the motor 77. Likewise a third electrical circuit is closed including the sensing switch 81, the second relay switch 86 and the relay coil 84. Through the third electrical circuit, the relay coil 84 remains energized after the treadle switch 64 has disengaged from the relay contact 94 and returned to the open contact 93. The said first, second and third electrical circuits or paths are parallel with one another between the points E, F.

The sensing switch 81 is normally biased to engagement with the motor contact 92, but, when the actuating arm 80 is deflected by a stop member 79 (FIGURE 10) in a stationary position, the actuating arm 80 engages the relay contact 91 as seen in FIGURE 12. When the second electrical circuit closes through the first relay switch 85, the motor 77 turns to cause rotation of the tray 62 in the direction of the arrow A (FIGURE 10) whereby the stop member 79a passes the sensing switch 81 and releases the activating arm 80. Thereby the arm 80 moves to motor contact 92 to close a fourth electrical circuit including the sensing switch 81 and the motor 77. The movement of the activating arm 80 also opens the third electrical circuit by disengagement from the relay contact 91 whereby the relay coil 84 is disconnected from the power source 42' and deactivated. Upon deactivation of the relay coil 84, both relay switches 85, 86 return to the open contacts 87, 89 respectively.

The motor 77 continues to turn until the next-in-sequence stop member 79 engages the activating arm 80 (FIGURE 10) and the activating arm 80 moves out of engagement with the motor contact 92 and into engagement with the relay contact 91. The motor 77, thereby disconnected from the power of source, is stopped and the circuitry is restored to the relationship shown in FIGURE 12.

Correlation of work assembly table with component delivery table

By referring to FIGURE 9, it should be apparent that the operator 18' may sequentially depress the treadle switch 64 to cause rotation of the tray 62 until the components from the bin 14a are introduced into each of the incomplete articles 17'. Thereupon the operator 18' may depress both treadle switches 43 and 64 to cause tray 62 to advance one position and to replace the confronting bin 14a with the next-in-sequence component bin which contains the components needed for the next sequential work operation on the incomplete articles 17'.

In a preferred combination of the work assembly table 60 and component delivery table 10, the treadle switch 43 can be eliminated or inactivated whereby the component delivery table 10 will be actuated automatically upon one complete rotation of the work assembly table 60. This can be readily accomplished as seen in FIGURE 11 where a suitable stop member 96 is disposed on the under surface of the tray 62 between the axis Y—Y and the side wall skirt 69. Upon rotation of the tray 62, the stop member 96 describes a circular locus about the axis Y—Y. A micro-switch 97 is conveniently located so that its actuating arm 98 is located within the locus of rotation of the

stop member 96. Thus upon each complete rotation of the tray 62, the stop member 96 will pass the micro-switch 97 and engage the actuating arm 98.

Referring to FIGURE 8, it should be apparent that the microswitch 97 with its actuating arm 98 can be installed in parallel with the treadle switch 43 in the electrical circuitry there illustrated. The actuating arm 98 will be normally biased into engagement with the open contact 99 of the micro-switch 97. Upon engagement with the stop member 96, the actuating arm 98 will move into engagement with a relay contact 100 whereby a fifth electrical circuit of FIGURE 8 is closed and the step-wise rotation of the tray 62 is commenced. The fifth electrical circuit includes the micro-switch 97 and the relay coil 45. The fifth electrical circuit is parallel with the first, second, third and fourth electrical circuit between the terminals C, D.

I claim:

1. Apparatus for assembly by a single operator of duplicate articles, each of the multi-component type, including:

a rotatable work assembly table including plural working stations and a rotatable component delivery means including plural component containers,

said rotatable work assembly table being adapted to deliver each of the said working stations sequentially into a working area which is accessible to the operator;

said rotatable component delivery means being adapted to deliver each of the said component containers sequentially into the said working area;

switch means for rotating said work assembly table to advance the next-in-sequence one of the said working stations into the said working area;

switch means for rotating the said component delivery means to advance the next-in-sequence one of the said component containers into the said working area,

and means connected with the said work assembly table for activating the last-mentioned switch means, whereby the said component delivery means is rotated upon the complete rotation of the said work assembly table.

2. A component delivery table comprising:

a working surface having a front edge;

a rotatable tray having a circular base, an upright circular sidewall and an upper rim;

a plurality of individual bins, each supported by the said upright sidewall outboard of the said tray;

said tray being retained beneath the said working surface for rotation about a generally vertical axis of rotation coincident with the center of the said base, the forwardmost one of said bins projecting forwardly beyond the said front edge whereby the contents of such bin are accessible for removal;

a clip bonding each said bin to the said sidewall and having a protuberance extended inwardly toward the said axis of rotation;

drive means secured to the underside of the said working surface for rotating the said tray and the said bins as a unitary structure, said drive means including a drive wheel which is in peripheral engagement with the inner surface of the said sidewall;

control means for activating the said drive means;

stop means secured to the underside of the said working surface inboard of the said sidewall and including switch means operatively coupled to said control means and adapted to be engaged with one said protuberance at a time to arrest the rotation of the said tray.

3. A component delivery table comprising:

a working surface having a front edge;

a rotatable tray having a circular base, an upright circular sidewall and an upper rim;

a plurality of individual detachable bins, each supported by the said upright sidewall outboard of the said tray;

said tray being retained beneath the said working surface for rotation about a generally vertical axis of rotation coincident with the center of the said base, the forwardmost one of said bins projecting forwardly beyond the said front edge whereby the contents of such bin are accessible for removal;

a position-indexing element removably associated with each said bin, said position-indexing element extending from said bin inwardly toward the said axis of rotation;

drive means secured to the underside of said working surface inboard of the said sidewall for rotating the said tray and the said bins as a unitary structure;

control means for activating the said drive means;

stop means secured to the underside of the said working surface inboard of the said sidewall and including switch means engageable with one said position-indexing element at a time to arrest the rotation of the said tray only when the tray is in a position where an attached bin is disposed in accessible relation to the said front edge of the working surface.

4. The component delivery table of claim 3 having an opening in the said work surface remote from the said front edge, to provide access to said bins.

References Cited

UNITED STATES PATENTS

1,278,584	9/1918	Buchheit	108—94
1,490,326	4/1924	Joleen et al.	108—21
2,209,858	7/1940	Steiert	108—21
2,890,088	6/1959	Lepry et al.	108—20
3,142,269	7/1964	Keck	101—103
3,154,865	11/1964	Conner	35—13
1,029,231	6/1912	Ryan	211—78
2,999,502	9/1961	Joyce	129—16
1,531,358	3/1925	Thompson	312—234.1

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