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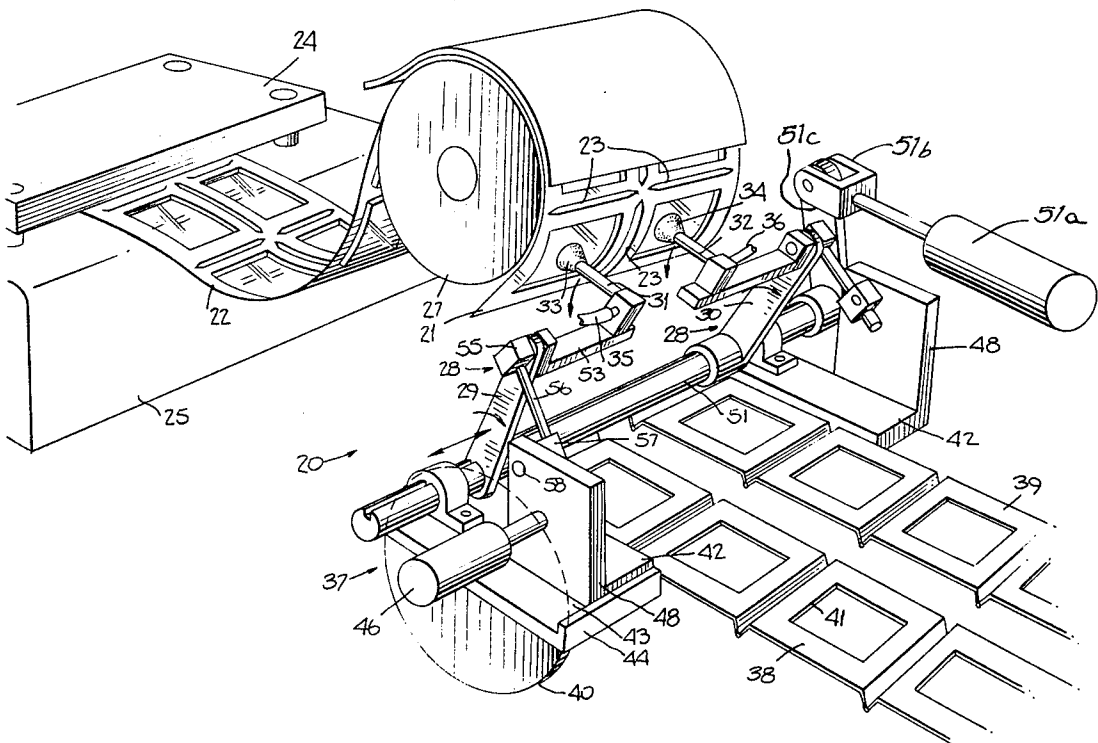
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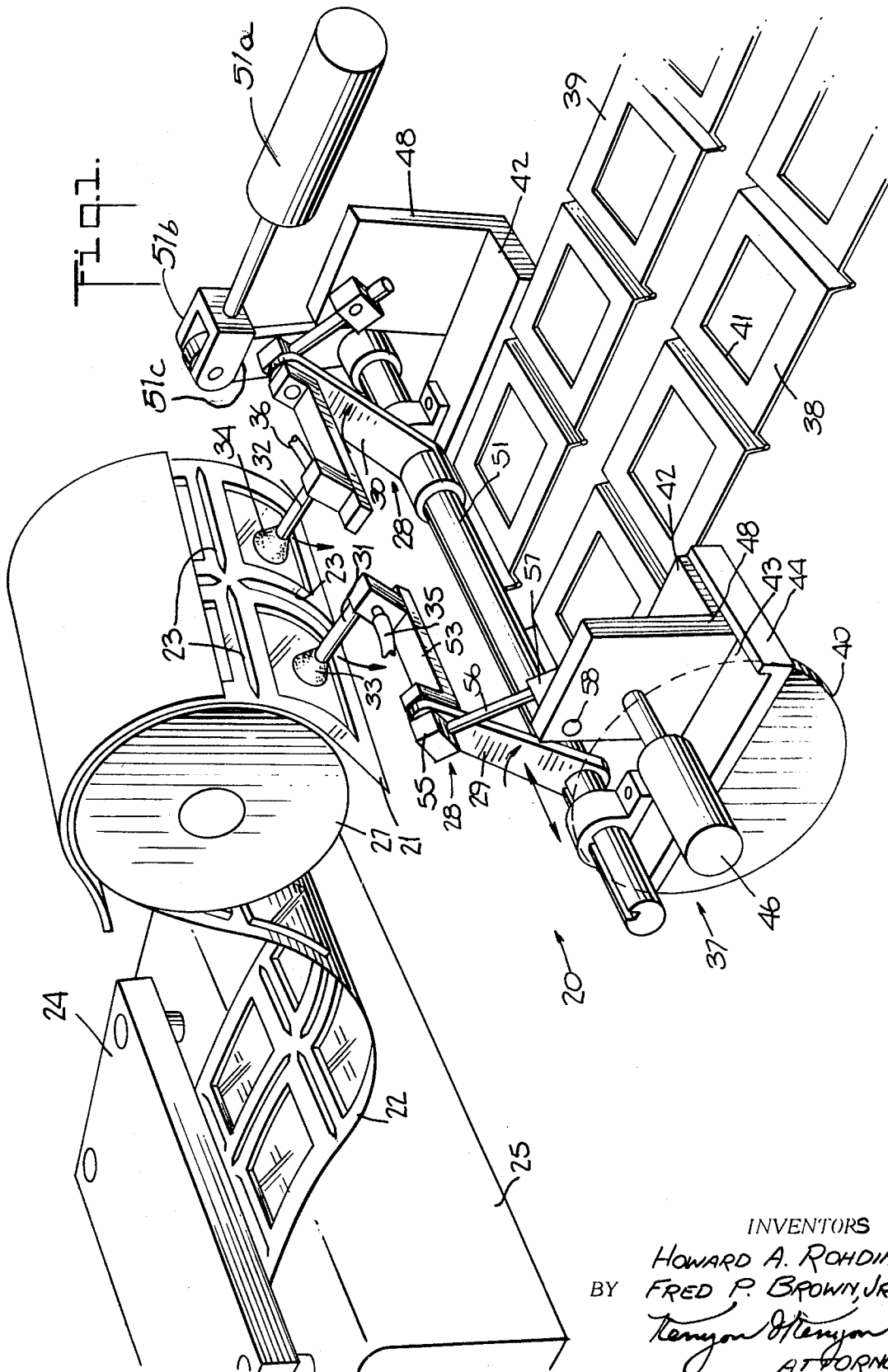
[54] **METHOD AND APPARATUS FOR TRANSFERRING ARTICLES AND THE LIKE**
32 Claims, 13 Drawing Figs.

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225/3, 225/99, 225/101, 198/30, 198/34
 [51] Int. Cl. **B26f 3/02**
 [50] Field of Search **225/99, 98,**
100, 101, 4, 5, 1, 106, 2, 3; 83/107, 103; 198/30,
34; 93/36 (A)

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ABSTRACT: The method and apparatus of the disclosure relate to the transfer of articles that are formed in a predetermined array at a fixed center-to-center relationship to form another predetermined array of articles which have a center-to-center relationship different from the first predetermined array. The apparatus includes at least one transfer arm, that is equipped with a suction cup for pulling an individual article from its position in the first predetermined array, and for holding the article while it is transferred from that position to a position in the second predetermined array.





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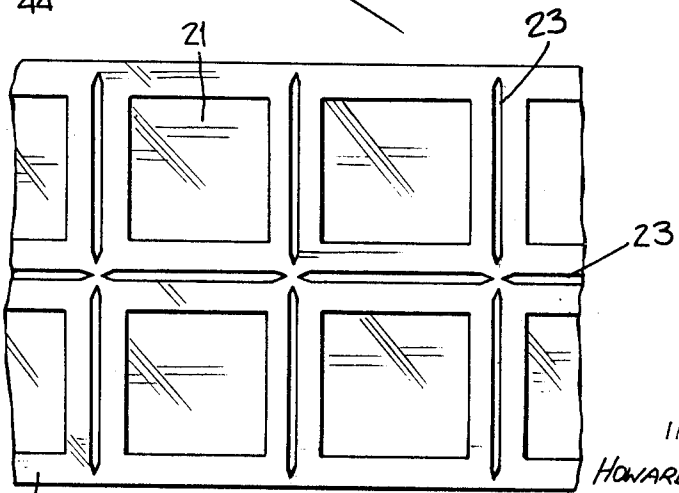
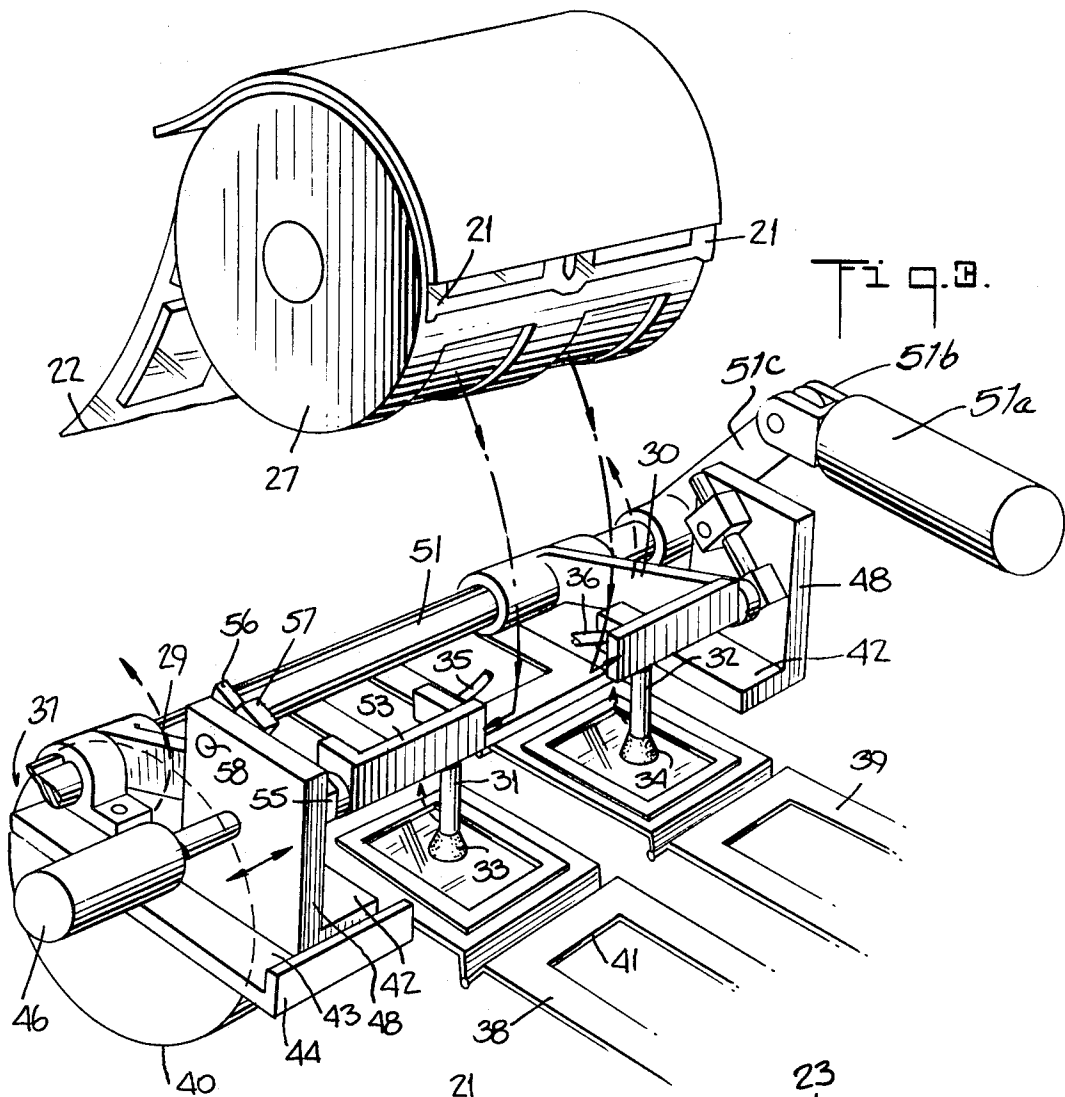
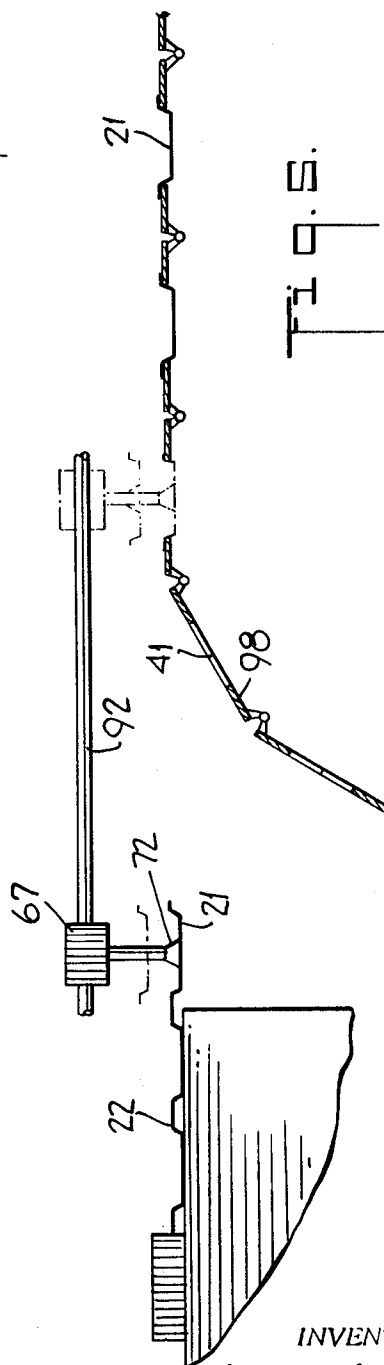


Fig. 2.

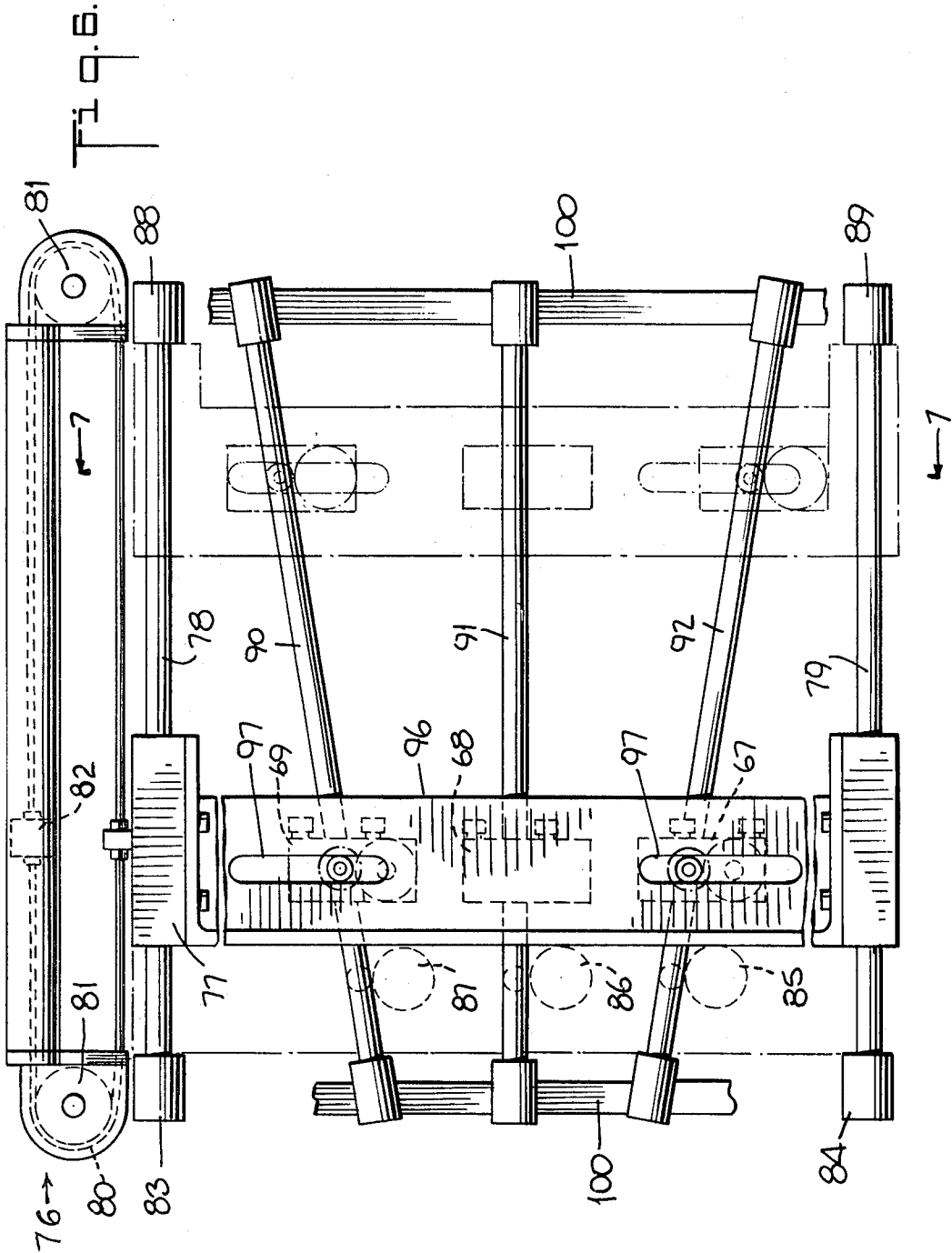
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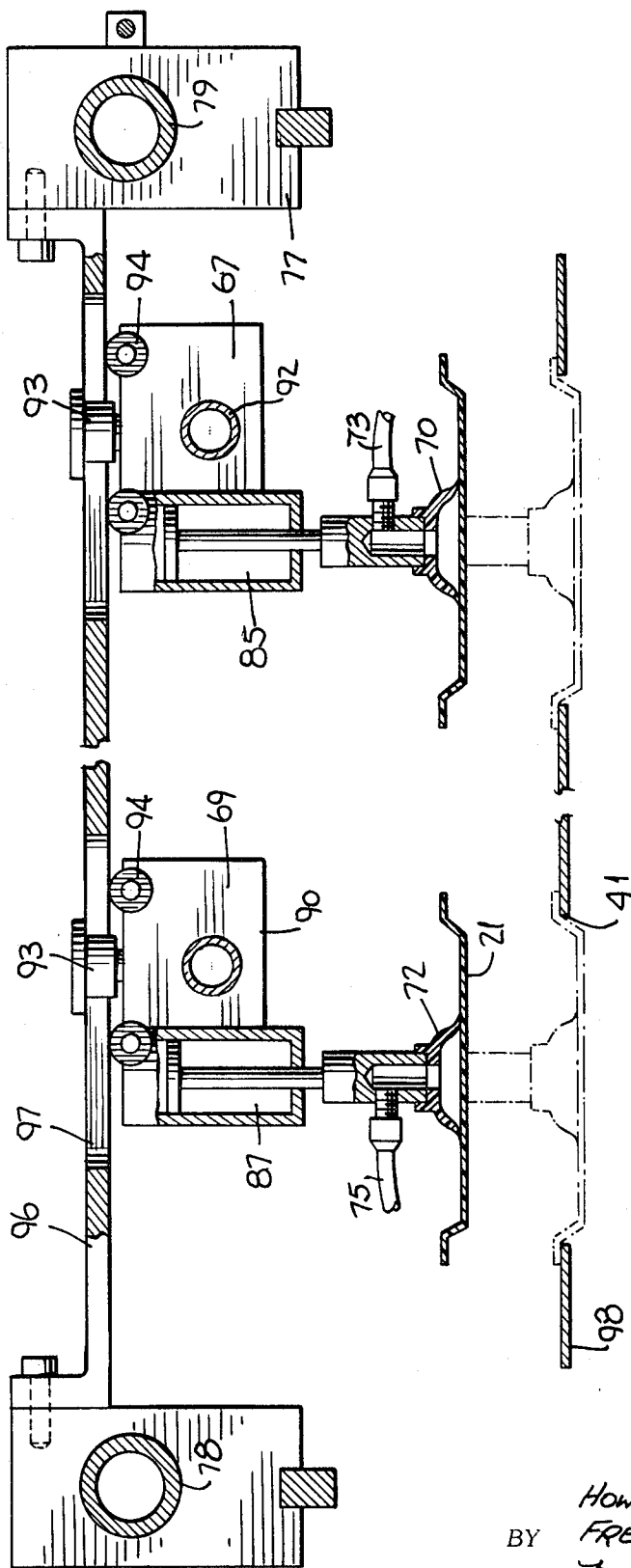
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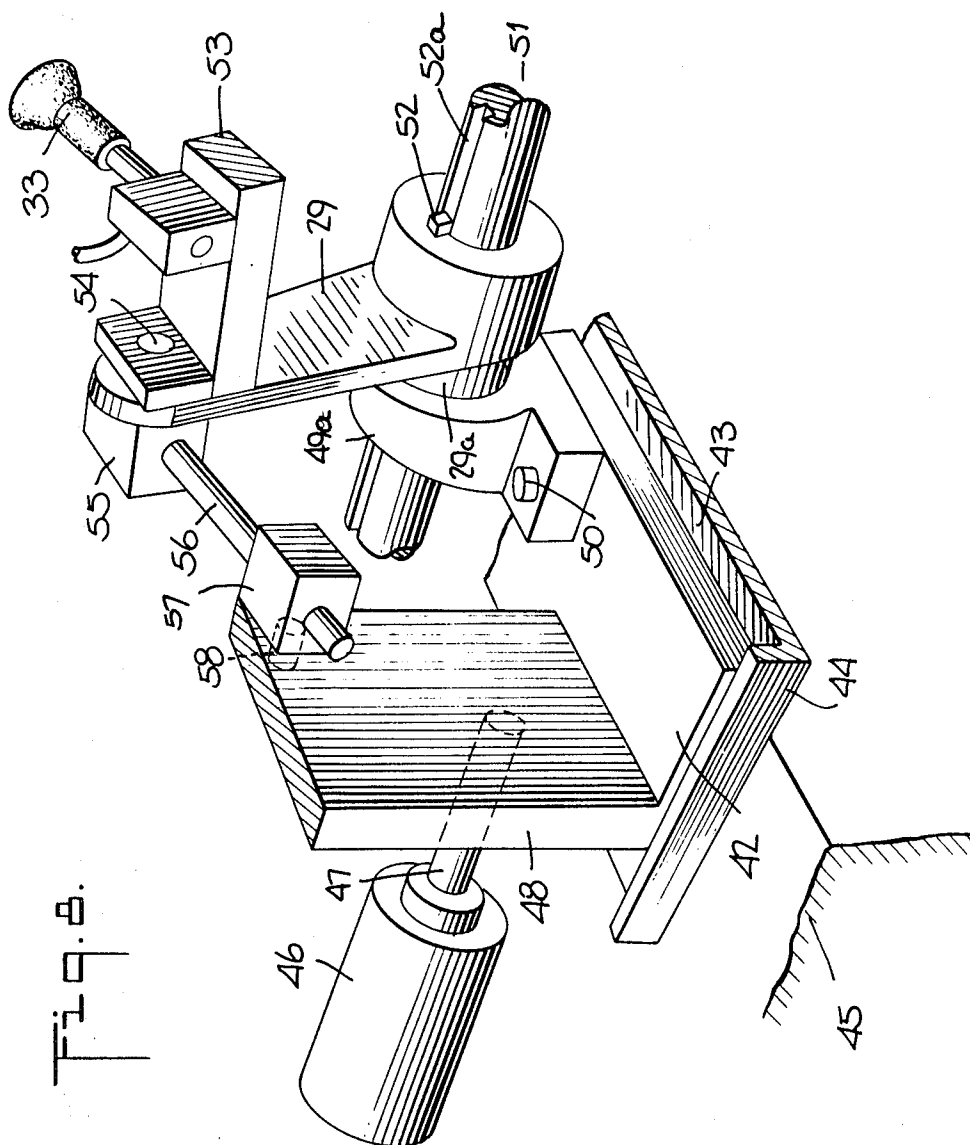


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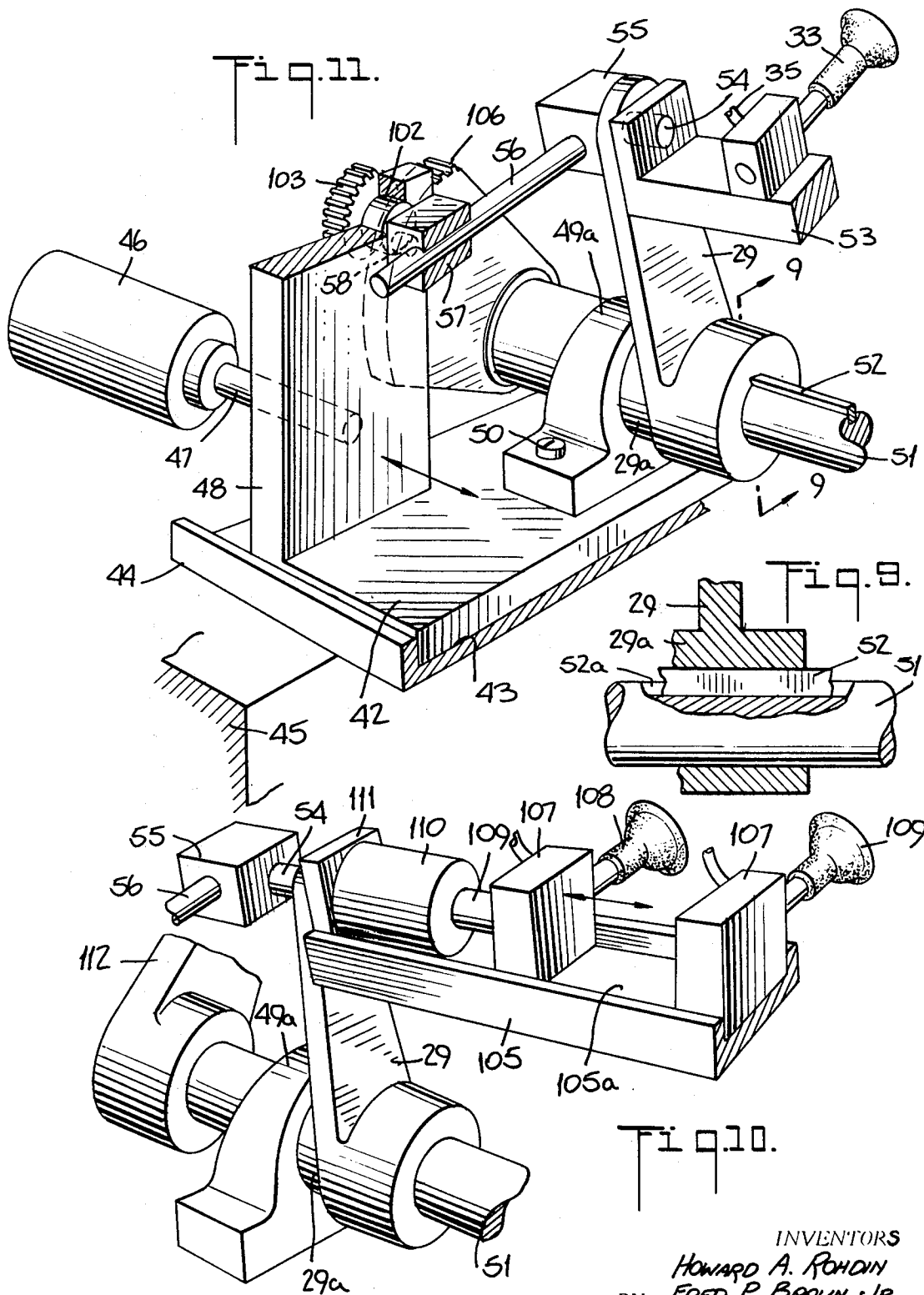
Fig. 2.

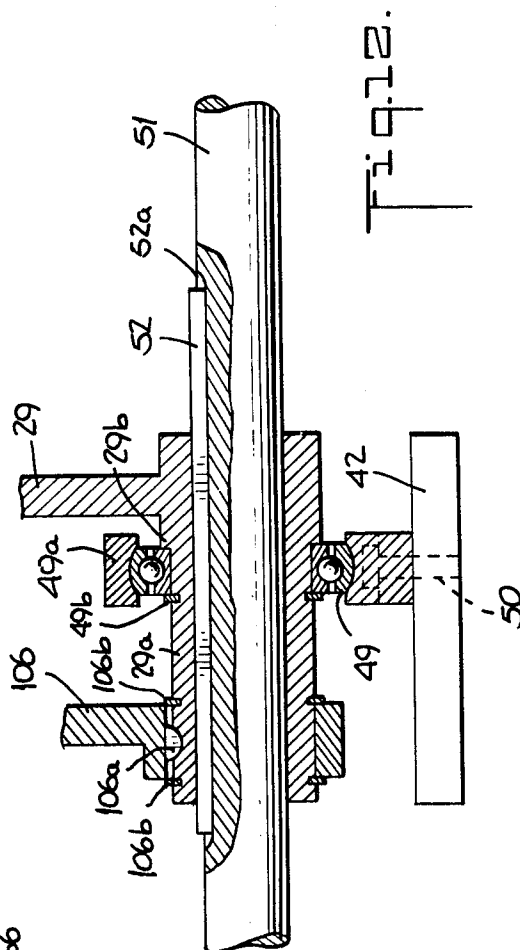
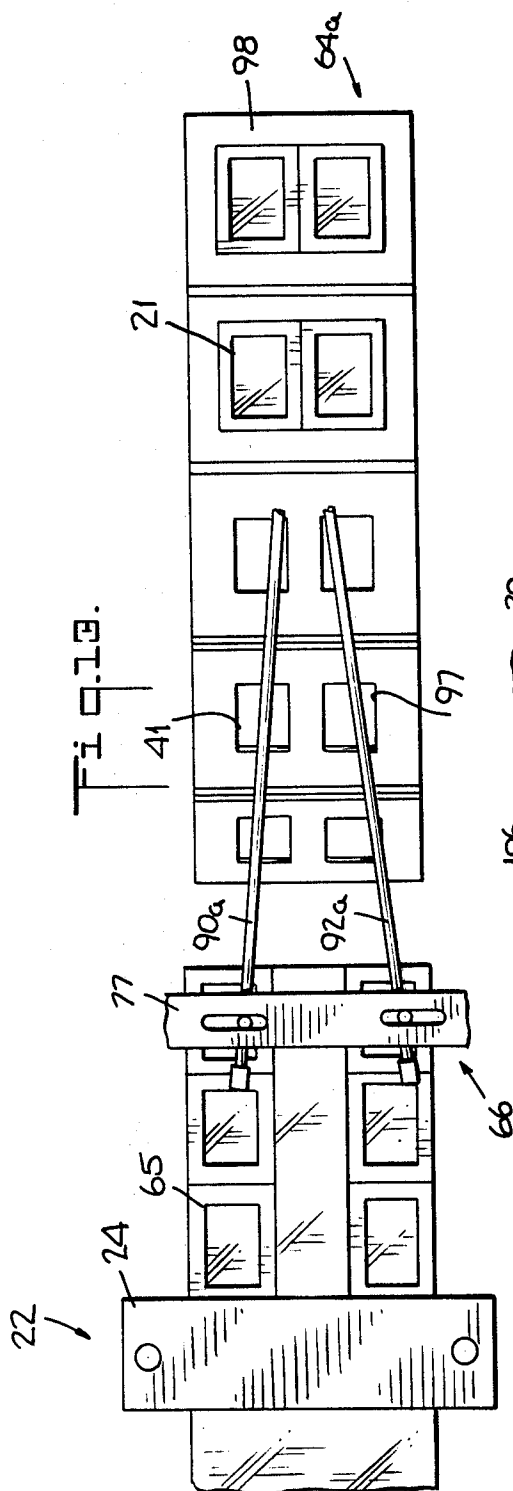


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METHOD AND APPARATUS FOR TRANSFERRING ARTICLES AND THE LIKE

BACKGROUND OF INVENTION

The invention relates generally to a method and apparatus for transferring articles, and in particular to apparatus, used in a blister packaging machine, for transferring blisters from a predetermined array of blisters each of which are located at a given center-to-center relationship to form another predetermined array of blisters which may have a different center-to-center relationship.

A method of packaging and a packaging machine, used in blister packaging operations, are described in U.S. Pat. No. 2,970,414 issued on Feb. 7, 1961, to H. A. Rohdin, a coinventor of the present invention. In this packaging operation, a plurality of blisters are formed in a sheet of plastic material. The plurality of blisters can be formed in a plurality of rows, parallel rows, or staggered in a repeated pattern. The sheet of plastic material is hereinafter referred to as a "web;" as used in this specification and the appended claims, a "web" includes a sheet having formed thereon at least one row of articles.

Referring to the above-identified packaging operation, a web having a plurality of rows of blisters is slit into separate webs comprised of rows of blisters. The separate webs are then diverged and blisters are cut therefrom to form rows of individual blisters, that can be filled with a consumer product and sealed to a backing card thereby to form a complete blister package. In a related packaging operation, the separate webs are converged prior to the cutting of individual blisters therefrom. Where the blisters have a deep form, the material taken from between the rows in making the deep form forms a gap between the rows into which the rows can be converged.

Slitting the web, diverging or converging the web, and cutting individual blisters therefrom can create difficulties in maintaining a given flange width or the blisters being cut. The packaging operation can be modified by placing perforations on a web which has formed thereon a plurality of rows of blisters; the perforations are placed between the blisters formed on the web; these perforations can be made at the same time that the blisters are formed.

SUMMARY OF THE INVENTION

It is the object of the present invention to provide a novel method for transferring articles.

It is another object of the present invention to provide a novel apparatus for transferring articles. It is still another object of the invention to provide a method and apparatus for transferring articles from a first predetermined array, that has a fixed center-to-center relationship among the articles, to form a second predetermined array of articles, that have a different center-to-center relationship.

Yet another object of the invention is to provide a method and apparatus for separating blisters from a web, and for transferring the separated blisters to form an array of individual blisters, that have a different center-to-center relationship from the corresponding relationship in the web.

It is an additional object of the invention to converge or diverge articles as they are moved along an arcuate path from one location to another location.

It is a further object of the invention to converge or diverge articles as they are moved along converging or diverging paths of travel extending from one location to another location.

In accordance with the invention, a method for transferring a plurality of articles comprises the steps of supplying a predetermined array of articles which have a fixed center-to-center relationship to an article transfer location. The method additionally includes the step of picking up an article and moving it to an article position to form at least one other predetermined array of articles which have a center-to-center relationship different from the center-to-center relationship in the first predetermined array.

Further objects and a more complete understanding of the invention are held by reference to the specification and claims, taken in conjunction with the drawings.

DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view of one embodiment of an article transfer apparatus, constructed in accordance with the invention, showing blisters being separated from a web of blisters.

FIG. 2 shows a web that has consecutive parallel rows of plastic blisters formed thereon.

FIG. 3 is a perspective view of the article transfer apparatus of FIG. 1, showing blisters being delivered to a conveyor after being diverged with respect to one another.

FIG. 4 shows a fragmentary plan view of another embodiment of article transfer apparatus constructed in accordance with the invention.

FIG. 5 is a fragmentary side elevational view of the FIG. 4 apparatus.

FIG. 6 shows a plan view in greater detail of the FIG. 4 apparatus.

FIG. 7 is a vertical section view taken along the line 7-7 in FIG. 6 and showing the transferred articles being lowered to a conveyor belt.

FIG. 8 shows a perspective view of a motion-imparting mechanism which can be used in the FIG. 1 apparatus.

FIG. 9 is a section view taken along line 9-9 in FIG. 11.

FIG. 10 is a perspective view of another embodiment of a motion-imparting mechanism, that can be used in FIG. 1 apparatus.

FIG. 11 shows a perspective view of the motion-imparting mechanism, described with reference to FIG. 8, that has been modified to include apparatus for imparting eccentric motion.

FIG. 12 is an elevational view of the device to shift the arm of the transfer apparatus.

FIG. 13 is a plan view of a portion of an embodiment of the invention similar to that of FIG. 4 but being adapted to converge rows of blisters during transfer.

DESCRIPTION OF EMBODIMENTS

One embodiment of an article transfer apparatus 20 constructed in accordance with the invention, and incorporated in the packaging machine disclosed in the above-referenced patent, is shown in FIG. 1. The apparatus 20 is specifically used for transferring blisters 21 from a web 22 of plastic material (FIG. 2); perforations or slits 23 extend between blisters 21.

The article transfer apparatus 20 includes a means 24 for supplying the web 22, for example, a storage cabinet 25, that encloses an inventoried web roll, that is advanced out of the cabinet 25 by motor driven roller 27 (FIG. 1). The apparatus 20 additionally comprises a means 28, including means for removing blisters 21 from the web 22, for transferring the removed blisters 21 along mutually diverging paths, for example, transfer arms 29, 30, each equipped with vacuum device means 31, 32, respectively, such as suction cups 33, 34, coupled by vacuum lines 35, 36 to a vacuum source (not shown). Mechanical grippers can be used in place of the vacuum devices to engage the blisters during the transfer.

In addition, the apparatus 20 includes means 37 for moving the transfer arm; specific embodiments of the means 37 are described more fully below, with reference to FIGS. 8-12.

In the operation of the article transfer apparatus 20, suction cups 33, 34 are positioned into contact with blisters 21 in web 22 (FIG. 1); the vacuum source is turned on, enabling the suction cups 33, 34 to pick up the pair of blisters when the transfer arms are actuated. When the transfer arms 29, 30 are rotated in the direction of the solid curved arrows in FIG. 1 and laterally separated by moving means 37 in the direction of the solid straight arrows in FIG. 1, the web is fractured along the lateral and transverse perforations 23 to remove the blisters 22 from the web, and to transfer the blisters along mutually diverging paths to conveyor belts 38, 39 (FIG. 3) which

are driven by motor 2; driven roller 40. When the vacuum source is turned off, the blisters 21 are released from the suction cups 33, 34 into apertures 41 in belts 38, 39. The transfer arms 29 and 30 are then returned in the direction of the dashed line arrows in FIG. 3 to their initial positions, preparatory to starting the next blister transfer cycle.

The belts 38, 39 carry consecutive parallel rows of individual blisters, spaced at centers larger than the blister center spacing in the web 22, to the work areas where consumer products are packaged in the individual blisters.

The rate of web supply from roller 27, the motion of transfer arms 29, 30 and the rate of advance of conveyor belts 38, 39 are synchronized by the packaging machine timer apparatus, such as described in detail in the above-referenced patent.

Referring now to FIGS. 8—11, there is illustrated two embodiments of means 37 for laterally moving the transfer arms 29 and/or 30. Thus either one or both of the transfer arms can be moved laterally with respect to the line of travel of the web. The first embodiment (FIG. 8) which corresponds to the embodiment shown in FIGS. 1 and 3, includes a mounting plate means 42 slidably positioned in the channel 43 of a stationary support means 44, that is secured to a table 45. The mounting plate 42 slides back and forth in channel 43 in response to the activation of air cylinder 46, that has a piston, whose throw determines the center-to-center spacing of the consecutive rows of individual blisters. The piston rod 47 of air cylinder 46 is secured to the vertical arm 48 of the plate 42. Alternatively, an electromechanical device such as a solenoid can be used in place of air cylinder 46.

Pillow block 49a, spaced from vertical arm 48, is secured by cap screws 50 to the plate 42. A shaft 51 is journaled through the bearing of the pillow block 49a. Shaft 51 is driven by actuator 51a connected by device 51b to crank arm 51c attached to the shaft. The transfer arms 29, 30 (transfer arm 30 not shown in FIG. 8) are slidably mounted on the shaft 51. Arm 29 contains a keyway which slidably engages key 52 (FIGS. 8 and 9), that is fixedly positioned in keyway 52a formed in shaft 51.

Transfer arms 29, 30 are equipped with suction cups 33, 34 (suction cup 34 not shown in FIG. 8), respectively. The mounting arrangement is the same for each transfer arm 29, 30, consequently only transfer arm 29 is described in detail. The suction cup 33 is mechanically secured to a bracket 53, that is mounted on a rotatable pin 54, journaled in the transfer arm 29; a member 55 is mounted on the other end of the pin 54.

A guide shaft 56 is seated in member 55 and is slidably journaled in a movable member 57, which has pivot pin 58 journaled or pivotally mounted in the vertical arm 48 of the mounting plate 42. The bracket 53, the members 55, 57, the rotatable pin 54, the pivot pin 58, and the shaft 56 comprises a means, responsive to the rotation of the shaft 51 in a first direction, for rotating the suction cups 33 in a second direction.

Arm 29 having base portion 29a can be slidably mounted with respect to shaft 51 and driven thereby as shown in the right side of FIG. 12 as viewed in the patent drawings. Thus base portions 29a (FIG. 8) is pivotally supported within pillow block 49a mounted on plate 42 by cap screw 50. The sliding coupling between shaft 51 and base portion 29a is provided by key 52 in keyway 52a (FIG. 9).

In operation, shaft 51 is indexed in the clockwise direction (as viewed in the position shown in FIG. 8) to move suction cup 33 adjacent to a blister 21 in web 22 (blister 21 and web 22 not shown in FIG. 8); the suction cup 33 is actuated to pick up the blister 21, and the shaft 51 is then indexed in the counterclockwise direction to rotate the transfer arm 29; at this time, guide shaft 56 slides into member 57, and member 57 pivots in the clockwise direction; pin 54 also rotates in the clockwise direction, thereby rotating member 55 and bracket 53 in that direction; consequently, as transfer arm 29 rotates counterclockwise, suction cup 33 rotates clockwise. Shaft 51 is indexed in the counterclockwise direction, until the blister

21 held by suction cup 33 is parallel to the plane of conveyor belt 38 (not shown in FIG. 8).

Air cylinder 46 can be activated at any time during the counterclockwise rotation of the transfer arm 29 to drive piston rod 47 to the right or left as viewed in FIG. 8, thereby moving transfer separated 29 longitudinally on shaft 51. In this way blister 21 is carried along a path which converges or diverges from the path taken by transfer arm 29 to a position directly on a receiving surface such as a table or in an aperture 41 in conveyor belt 38. The suction cup 33 is then deactivated to release blister 21. Air cylinder 46 is deactivated, and the shaft 51 is indexed in a clockwise direction to return the transfer arm means 29 to its initial position, preparatory to initiating the next blister transfer operation. When the rows of blisters are separated prior to transfer, as for example, when the material between rows of blisters is consumed during the working of blisters with a deep form, the air cylinder can be actuated to cause arm 29 to converge with respect to arm 30. In addition to delivering the blisters to a conveyor, the machine of the invention can deliver the blisters to any other receiving surface such as table, moving belt or a web of plastic material.

FIG. 10 shows a modification of the embodiment of FIG. 8. Support 105 includes a track 105a in which is mounted base 107 of suction cup 108. Piston rod 109 of cylinder 110 is connected to base 107. The cylinder which is mounted upon bracket 111 extending from support 105 enables base 107 to be reciprocated in track 106 in the direction of the arrow shown in FIG. 10.

Pin 54 is pivotally mounted with respect to arm 29 and is connected to bracket 111 of support 105. Shaft 56 which is coupled to member 55 controls the motion of support 105 and thereby suction cup 108 when arm 29 is reciprocated by the motion imparted to shaft 51 by means of crank 112. Thus the control of support 105 by the connection thereto from pin 54 is similar to that discussed above with respect to the embodiment of FIG. 8.

With the embodiment of Fig. 10 it can be seen that suction cup 108 can be reciprocated along track 15a without requiring the reciprocation of the linkage connected to arm 29 including pin 54 and without requiring the reciprocation of arm 29 itself. When it is desired to have reciprocating suction cups 108 along with a nonreciprocating suction cup 109, base 107 of suction cup 109 can be fixed with respect to support 105. By the provision of additional cylinders 100 for reciprocating bases 107, more than one reciprocating suction cup can be provided for support 105.

FIG. 11 shows another modification of the apparatus of FIG. 8. In the modification of FIG. 11 eccentric motion is imparted to pivot pin 58 during the movement of guide block 57. To obtain the eccentric motion of the pivot pin, the pivot pin which is attached to guide block 57 is inserted into an opening in shaft 102. The opening in shaft 102 is offset from the axis of rotation thereof. In addition shaft 102 is secured to gear 103 which is driven by sector gear 106.

Shaft 51 extends through the cylindrical base portion 29a of arm 29 (FIG. 12). Base portion 29a is supported with respect to plate 42 by means of ball bearing 49 which is retained in pillow block 49a. The pillow block is secured to plate 42 by cap screws 50. By providing bearing 49 with an outer race having a partially spherical cross section, misalignment of the ball bearing can be eliminated. Bearing 49 is maintained in position against shoulder 29b of the base portion 29a by means of snapping 49b.

The base portion of sector gear 106 is secured to base portion 29a by means of key 106a. Snaprings 106b retain sector gear 106 in position with base portion 29a. The base portion 29a receives shaft 51 through its length and is retained to the shaft to rotate therewith by means of key 52 disposed in slot 52a (FIG. 11). In this way it can be seen that both the drive for imparting an eccentric motion to pivot pin 58 as well as the operation of arm 29 can both be caused to move laterally by means of cylinder 46 having piston rod 47 connected to upright 48 extending from plate 42.

With the arrangement of FIG. 11 an arcuate motion is imparted to pin 54 during the movement thereof. The eccentric motion of pin 58 and guide block 57 and the imparting mechanism thereof is more fully disclosed and claimed in the copending U.S. Pat. Application entitled "Apparatus and Method for Handling Blisters or the Like" of Fred P. Brown, Jr., which is assigned to the assignee of the present application.

By controlling the lateral motion of transfer arms 29 and/or 30, the transferred articles can be delivered to a receiving surface in a number of different arrays each having different center-to-center distances between the articles or compared to those of the articles prior to transfer. By programming the control of the lateral motion of the transfer arms, the array in which the transferred articles are delivered can be varied on a cyclical basis. Similarly the longitudinal movement of the transfer arm can be varied to affect the array in which the transferred articles are delivered.

Where the method and apparatus of the invention is intended to fracture blisters along the longitudinal lines of slits or perforations in web 22, the transfer arms can be diverged with respect to one another in order to fracture the slits or perforations as the blisters are held by the vacuum cups. Subsequently the transfer arms can be returned to an interval with respect to one another which is the same interval at which the arms were located at the time the blisters were separated from the web. As a result, the blisters can be placed on a receiving surface with the same center-to-center relationship as the blisters had when in web 22.

Another embodiment of an article transfer apparatus, constructed with the invention, is shown in FIG. 4. The article transfer apparatus 64 includes a means for supplying a web 22 that has formed therein blisters 21, for example, a web roll fed from a supplying means 24.

The article transfer apparatus 64 additionally comprises means 66, including means for removing blisters 21 from the web 22, for transferring the removed blisters along mutually diverging paths, for example, transfer arms 67, 68, 69, each equipped with suction cups 70—72 (FIG. 7) coupled by vacuum lines 73—75 to a vacuum source (not shown).

In addition, the apparatus 64 includes means 76 for moving the transfer arms 67, 68, 69, for example, carriage 77 that is driven along track rods 78, 79 (FIG. 6) by a cable 80, that is supported on idler pulleys 81 and driven by air-operated piston 82. The assembly of means 76 can be of the type manufactured by TOL-O-MATIC, INC. of Minneapolis, Minnesota.

In operation of the transfer apparatus 64, carriage 77 is moved toward the left-hand carriage stop 83, 84 (FIG. 6) when the blisters are separated along transverse perforations from the web. FIGS. 4 and 5 show the carriage at the station when the blisters are picked up from the web. In this position, suction cups 70, 71, 72 are directly over a row of adjacent blisters 21. The suction cups 70, 71, 72 (FIG. 7) are lowered by actuation of pistons 85, 86, 87 (FIGS. 6 and 7) to engage the blisters; the vacuum source is turned on; and the suction cups 70, 71, 72 (FIG. 7) engage the blisters and the cylinders 85—87 are actuated, thereby raising the suction cups. As a result of raising the suction cups fracturing of the web occurs along the lateral perforations 23, thereof, enabling the roll of blisters 21 to be removed from the web.

The carriage 77 is then moved toward the right-hand stops 88, 89 (FIG. 6) or toward the right as view in FIG. 4. During the motion, transfer arms 67, 69, that are journaled on diverging guide rods 90, 92 diverge from the path followed by transfer arm 68, that is journaled on guide rod 91; the guide rods are supported on stationary frame 100. During the movement of carriage 77 (FIG. 7), bearings 93, mounted on transfer arms 67, 69 roll along the inner wall of slots 97, that are formed in a mounting plate 96. In addition, bearings 94, also mounted on transfer arms 67, 69, roll along the undersurface of the mounting plate 96.

The diverging motion imparted to transfer arms 67, 69 causes them to move away from transfer arm 68. As a result the longitudinal perforations of the blisters are fractured as the transfer arms advance.

When the carriage 77 (FIG. 6) reaches the right-hand stops 88, 89, the transfer arms are positioned over a row of adjacent apertures 41 in conveyor belt 98 (FIG. 5). At this time, suction cups 70, 71, 72 are lowered to place the blisters 21 in the apertures 41. When the blisters are disposed in apertures 41, the application of vacuum to the suction cups is terminated and the blisters are thereby released. The suction cups are then elevated with respect to the blisters and the carriage 77 is returned to its initial position.

When it is desired to converge the rows of blisters, apparatus 64a shown in FIG. 13 can be employed. Apparatus 64a substantially corresponds to apparatus 64 although guide rods 90a and 92a converge in the direction of travel of the web, rather than diverge.

Although the blisters 21 have been supplied to the above-described article transfer apparatus in the form of a preperforated web, it is to be understood that the web can be upperforated, and automatically cut into webs comprised of rows of blisters as the web to be cut is advanced out of the storage cabinet 25. Moreover, the blister web can be supplied to the article transfer apparatus directly from a blister forming apparatus, for example, the blister forming apparatus described in the above-referenced patent.

Furthermore, conveyor belts 38, 39 (FIGS. 1 and 3) 98 (FIGS. 5 and 7) can be replaced by self-supporting webs of packaging material, such as apertured paper board. In this case, the packaging material webs, with blisters inserted in the apertures, are conveyed to a work area where consumer products are placed in the blisters.

Furthermore, it is to be understood that the FIG. 1 embodiment can be modified so that both of the transfer arms 29, 30 can converge or diverge laterally on the shaft 51, thereby decreasing or increasing, respectively the center-to-center separation of the rows of individual blisters as compared to that spacing obtained when both transfer arms 29, 30 diverge laterally on the shaft 51.

In addition, it is apparent that the transfer arms 29, 30 can be constructed and arranged on either side of the supplied web 22, thereby removing and transferring individual blisters 21 along paths that diverge at right angles to the path along which the supplied web advances.

The machine of the invention is capable of providing positive control of the article throughout the transfer process. Thus the article is firmly attached by vacuum to the suction cup from the time at which the article is separated from the web until the time at which the article is placed upon the receiving surface. In this way the article can be transferred with a degree of precision which is impossible to obtain when the delivery of the article to a receiving surface is dependent upon gravity or an air blast.

Although the above-described apparatus has been illustrated in its use as means for transferring plastic blisters, in a blister-packaging operation, it is to be understood that the apparatus can be used to remove and to transfer other articles along mutually diverging or converging paths, thereby to form an array of individual articles.

It is to be further understood that, while specific embodiments of the invention have been described as shown, variations in structural detail within the scope of the appended claims, are possible and are contemplated. There is no intention, therefore, of limitation to the exact abstract of description of embodiments herein presented.

It is claimed:

1. The method of transferring a plurality of articles arranged in a medium in the form of a first array of articles from the medium to their respective positions in a second array having article positions spaced in a center-to-center relationship along a line extending through the centers thereof different than the center-to-center relationship in the first array, comprising the steps of:

- a. supplying the medium;
- b. engaging each article of the first array at the article transfer location with a vacuum cup device positioned adjacent to the article and applying a vacuum to the vacuum cup device;

- c. removing the article from the medium and carrying it at an angle to the first line to another article location to form a second array of articles thereat, each article of the second array at the other article location having a different predetermined center-to-center relationship with respect to one another along a second line extending through the centers thereof than that of the array being supplied, whereby the plurality of articles are transferred from the first array to the second array
2. The method according to claim 1 wherein the articles being transferred while being advanced in the direction of travel from the first array to the second array are simultaneously moved in a direction orthogonally thereto.
3. The method according to claim 2, wherein predetermined fractions of the plurality of articles are removed from a continuous medium and transferred to their respective positions in the other array.
4. In a blister packaging operation, the method of transferring a plurality of blisters formed in a sheet of blister material and arranged therein in an array, from the sheet to positions in another array spaced in a center-to-center relationship different than the spacing of the blisters formed in the sheet, comprising the steps of:
 - a. supplying the sheet;
 - b. engaging the blister with a vacuum means in order to separate the blisters from the sheet;
 - c. moving the separated blisters away from the sheet in a first direction; and
 - d. moving the separated blisters in a second direction different than said first direction prior to releasing the blisters in the other array thereby changing the center-to-center relationship.
5. The method according to claim 4, wherein the resultant motion of a blister during the moving steps is vectorially resolvable into motion components having mutually orthogonal directions.
6. The method according to claim 5, wherein predetermined fractions of the plurality of blisters are removed from the sheet and transferred to their respective positions in the other array.
7. The method according to claim 6, wherein rows of at least two end and a middle adjacently spaced blister indentations formed on the sheet are supplied, a plurality of indentations at a time, and removed and transferred therefrom, and which further includes the steps of transferring the end blisters in each row in directions that differ from the direction of transfer taken by the middle blister.
8. The method according to claim 6, wherein rows of adjacent blister indentations formed on the sheet are supplied, a plurality of indentations at a time, and removed and transferred therefrom.
9. An article transfer machine for transferring articles from means for supplying a plurality of articles arranged in an array of articles, said machine comprising means for separating articles from the plurality of articles being supplied, means for moving the separated articles away from the supply in one direction and means for simultaneously moving the separated articles in another direction orthogonal to the one direction during the movement of the articles to their respective positions in another array, the article positions in the other array being spaced in a center-to-center relationship different from the center-to-center relationship of the articles in the supplied array.
10. An article transfer machine in accordance with claim 9 and further comprising means for receiving the other predetermined array of articles.
11. An article transfer machine in accordance with claim 9 in which said moving means includes transfer arm means for conveying a supplied article from its position in the array to its position in the other array.
12. An article transfer machine in accordance with claim 11 in which said transfer arm means includes means for picking up a supplied article.
13. An article transfer machine in accordance with claim 12 and including:
 - i. means for supporting said picking up means for movement with respect to said transfer arm means, and
 - ii. means mounted on said supporting means for moving said picking up means with respect to said transfer arm means in a direction at an angle to the direction of the movement of said transfer arm means as said transfer arm means conveys a supplied article, whereby said moving means causes the center-to-center relationship of the other array to be different from that of the array.
14. An article transfer machine in accordance with claim 11, wherein said moving means includes means for imparting cyclic motion to said transfer arm means, said imparting means being so constructed and arranged that said transfer arm means in response thereto undergoes resultant motion that is vectorially resolvable into motion components having mutually orthogonal directions, thereby to convey a supplied article from a position in the array to a position in the other array.
15. An article transfer machine in accordance with claim 14 wherein said imparting means includes:
 - i. means for supporting said transfer arm means;
 - ii. means for moving said supporting means; and
 - iii. means for guiding said transfer arm means in the direction of said resultant motion during the motion of said support means.
16. An article transfer machine for transferring articles from a means for supplying a plurality of articles arranged in a medium to form an array of articles, said machine comprising:
 - means for separating the supplied articles from the medium and for moving the separated articles to their respective positions in another array, the article positions in other array being spaced in a center-to-center relationship that is different from the center-to-center relationship of the articles in the array, said separating and moving means including:
 - i. a stationary support means;
 - ii. mounting plate means slidably positioned on said support means;
 - iii. means for reciprocating said plate means;
 - iiii. a bearing secured to said plate means;
 - v. a rotatable shaft journaled in said bearing;
 - vi. transfer arm means mounted on said shaft and rotating therewith for conveying a separated article from its position in the array to its position in the other array, said arm means adapted to move longitudinally on said shaft during movement of said plate means, said arm means including vacuum-operated means for picking up a supplied article;
 - vii. and means responsive to the rotation of said shaft in a first direction for rotating said vacuum-operated means in a second direction, said rotating means including a member pivotally mounted on said mounting plate means and an elongated guide shaft secured to said device means and slidably journaled through said member.
17. An article transfer apparatus for transferring an article from means for supplying a plurality of articles on a web, said apparatus comprising means for removing the articles from the web and for transferring the removed articles by first rotating them away from the supply and further moving the articles in a direction extending substantially parallel to the axis of rotation, thereby to form an array of consecutive rows of individual articles spaced in a center-to-center relationship different from that of the articles being supplied.
18. A blister transfer apparatus for transferring a blister from means for supplying a web having formed thereon a plurality of blisters, said apparatus comprising means including means for removing the blisters from the web and means for transferring the removed blisters by first rotating them away from the supply and further moving the articles in a direction extending substantially parallel to the axis of rotation, thereby to form an array of rows of individual blisters spaced in a center-to-center relationship different from that in the web.

19. The blister transfer apparatus according to claim 18 in which the means for transferring the removed blisters includes at least one transfer arm means for conveying a removed blister along a path which varies from the path along which the web is supplied.

20. The blister transfer apparatus according to claim 18 in which said means for transferring the removed blisters includes:

- i. a rotatable shaft;
- ii. at least one transfer arm mounted on the shaft and adapted to be moved longitudinally on the shaft for conveying a removed blister along a path which varies in direction from that of the path along which the web is supplied;
- iii. means for rotating the shaft; and
- iiii. means for moving said transfer arm longitudinally on the shaft as said transfer arm conveys a removed blister.

21. The blister transfer apparatus according to claim 18 in which said means for transferring the removed blisters includes:

- i. a guide rod which varies in direction from the path along which the web is supplied;
- ii. a transfer arm journaled on said rod for conveying removed blisters along the varying paths; and
- iii. means for moving said transfer arm with respect to said rod.

22. A machine for transferring articles from means for supplying articles to a first location comprising:

- a. a carriage;
- b. means for conveying said carriage along a path of travel extending from the first location to a second location spaced apart therefrom;
- c. means mounted upon said carriage for selectively engaging an article at the first location and during the conveying of said conveying means between the first location and the second location and for disengaging the article at the second location, said means for selectively engaging and disengaging an article comprises:
 - i. a vacuum cup device facing the article to be transferred, and
 - ii. means for selectively applying vacuum to said cup device at the first location and during the conveying of said carriage between the first and second location and for terminating the vacuum applied to said cup device at the second location, and
 - iii. means for selectively advancing said vacuum cup device adjacent to the article at the first location and for retracting said cup device during the conveying to the second station, and
- d. means for moving said article engaging and disengaging means with respect to said carriage in a direction extending at an angle to the direction of carriage travel, whereby the movement of said article engaging and disengaging means with respect to said carriage causes the position of the article with respect to the path of conveying of said carriage to vary between the first and second locations.

23. A machine in accordance with claim 22 in which said advancing and retracting means is advanced at the second location to deposit the article upon a receiving surface.

24. A machine in accordance with claim 22 in which said advancing and retracting means comprises an actuator device for advancing said cup device away from said carriage and for retracting said cup device toward said carriage.

25. A machine in accordance with claim 22 in which said means for moving said article engaging and disengaging means with respect to said carriage means comprises a guide member coupled to said engaging and disengaging means and extending at an angle to the direction of travel of said carriage, whereby said guide member directs the position of the article with respect to the path of conveying to vary between the first and second locations.

26. The method of transferring a plurality of articles comprising the steps of:

- a. supplying an array of articles which have a predetermined center-to-center relationship to an article transfer location;
- b. picking up articles from the array and moving it to an article position to form another array of articles; and
- c. changing the center-to-center relationship of the articles for at least a portion of the movement of the articles from the array to the other array by simultaneously moving the articles with respect to one another in a direction orthogonal to that of moving the articles to the article position during the movement of the articles to the article position.

27. In a blister packaging operation, the method of transferring a plurality of blisters formed in a sheet of blister material and arranged therein in an array with a predetermined center-to-center relationship between adjacent blisters, the blisters being transferred from the sheet to positions in another array comprising the steps of:

- a. supplying the sheet;
- b. separating the blisters from the sheet;
- c. transferring the separated blisters to their respective positions in the other array; and
- d. changing the center-to-center relationship of the separated blisters for at least a portion of the movement of the separated blisters being transferred to the other array by moving the articles with respect to one another in a direction different than that of moving the articles to the article position.

28. An article transfer machine for transferring articles from means for supplying a plurality of articles arranged in an array of articles, said machine comprising:

- a. means for separating articles from the plurality of articles being supplied;
- b. means for moving the separated articles to their respective positions in another array; and
- c. means for changing the center-to-center relationship of the separated articles for at least a portion of the movement of the articles to the other array by moving the articles with respect to one another in a direction orthogonal to that of moving the articles to the article position.

29. A machine for transferring articles comprising:

- i. a rotatable shaft;
- ii. means for reciprocating said shaft about its longitudinal axis;
- iii. a transfer arm mounted adjacent one end thereof on said shaft and moving therewith;
- iiii. means pivotally mounted adjacent the other end of said transfer arm for engaging an article to be transferred, said engaging means having the engaging portion thereof maintained at a fixed distance from the pivotal connection therebetween;
- iiiii. a guide block pivotally mounted with respect to the frame of the machine; and
- iiiii. means for pivotally and slidably connecting said engaging means for said guide block to cause said engaging means to revolve in a direction opposite to that of said rotatable shaft and transfer the article.

30. A machine for transferring articles in accordance with claim 29 wherein said engaging means in response to said connecting means faces in a substantially horizontal direction when engaging the formed article to be transferred and faces downwardly in a substantially vertical position when releasing the article which has been transferred.

31. A machine for transferring articles in accordance with claim 29 wherein said engaging means comprises a vacuum pickup means.

32. A machine for transferring articles in accordance with claim 31 which further includes means for applying vacuum between said pickup means and the article during engagement and transferring of the article and for terminating the vacuum between said pickup means the article when releasing and depositing the article.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,580,442 Dated May 25, 1971

Inventor(s) Howard A. Rohdin and Fred P. Brown, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 21, "web;" should be -- "web"; --
Column 4, line 6, "separated" should be -- arm --
Column 4, line 40, "15a" should be -- 105a --
Column 4, line 46, "100" should be -- 110 --
Column 6, lines 17-18, "upperforated" should be -- unperforated--
Column 6, line 52, "it" should be -- its --
Column 8, line 32, after "in", second occurrence, add -- the --
Column 10, line 55, "for" should be -- to --
Column 10, line 71, after "means" insert -- and --

Signed and sealed this 16th day of November 1971.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents