United States Patent [19]

Frank

[11] **3,722,719**

[45] **Mar. 27, 1973**

[54] **METHOD OF AND APPARATUS FOR SAMPLE VIAL TRANSFERRING AND CHANGING**

[75] Inventor: **Edmund Frank**, Chicago, Ill.

[73] Assignee: **Packard Instrument Company, Inc.**, Downers Grove, Ill.

[22] Filed: **Apr. 10, 1970**

[21] Appl. No.: **27,411**

[52] **U.S. Cl.** .....**214/310**, 214/152, 214/301, 250/106 SC

[51] **Int. Cl.**.....**B65g 47/06**

[58] **Field of Search**....198/32; 250/106 SC; 214/300, 214/301, 310

[56] **References Cited**

UNITED STATES PATENTS

3,038,078 6/1962 Kern.....214/16.4

3,257,009 6/1966 Frank et al. 214/16.4

Primary Examiner—Gerald M. Forlenza
Assistant Examiner—Lawrence J. Oresky
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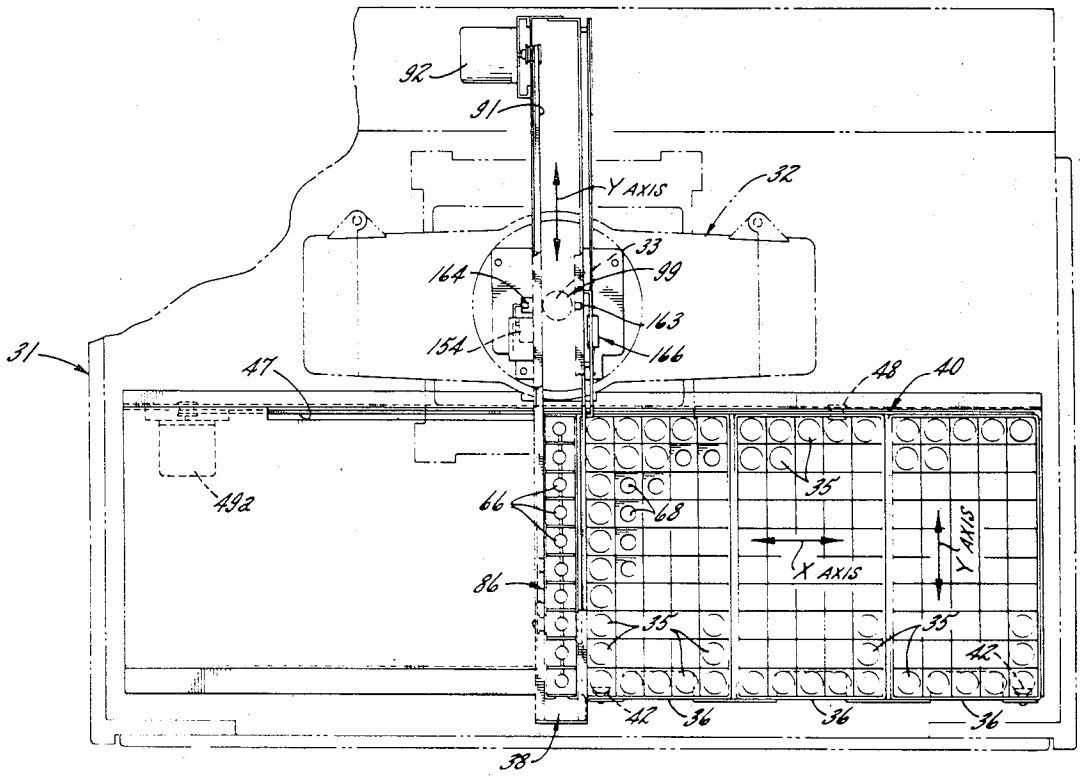
[57] **ABSTRACT**

An automated method and associated apparatus is provided for transferring sample vials and like regularized objects from a rectilinear array past a counting station in seriatim order. The array is indexed along an X-axis in at least one tray, rows of the array are indexed out of the plane of the array tray along a Z-axis by a comb member into a bottomless carriage, and individual vials in the carriage are then indexed seriatim along a Y-axis past a counting station. Photoelectric sensors are provided to override portions of the indexing mechanism if no sample vials are present in array rows or individual compartments.

13 Claims, 21 Drawing Figures



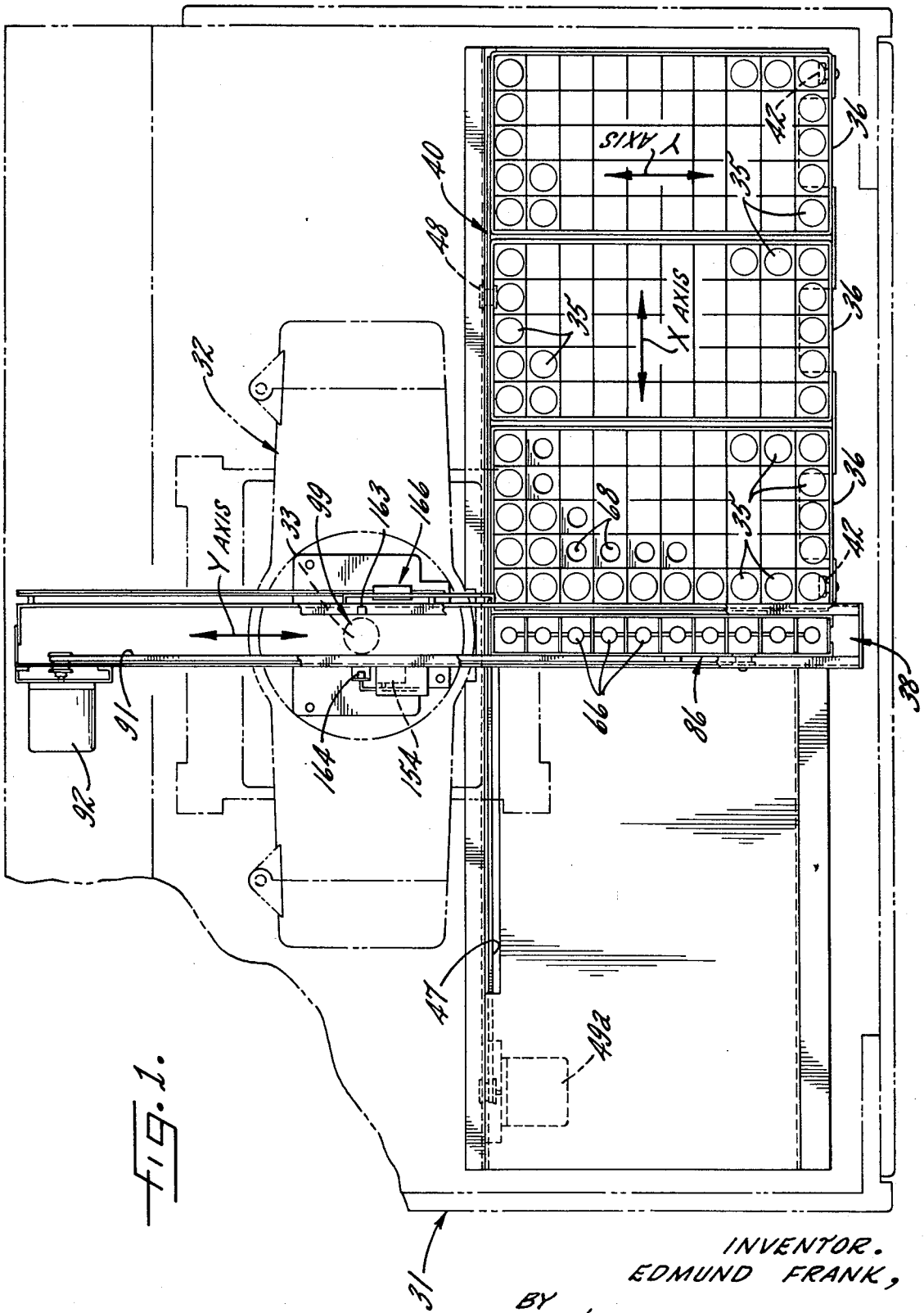


FIG. 1.

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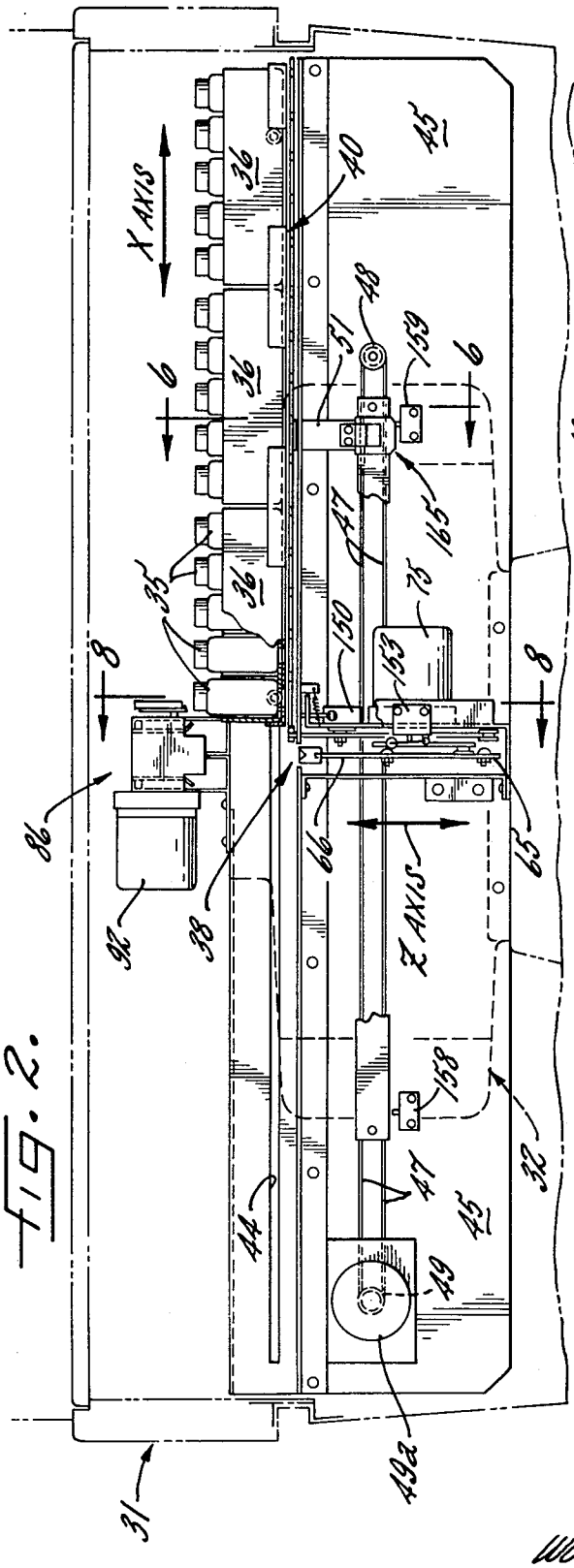

FIG. 2.

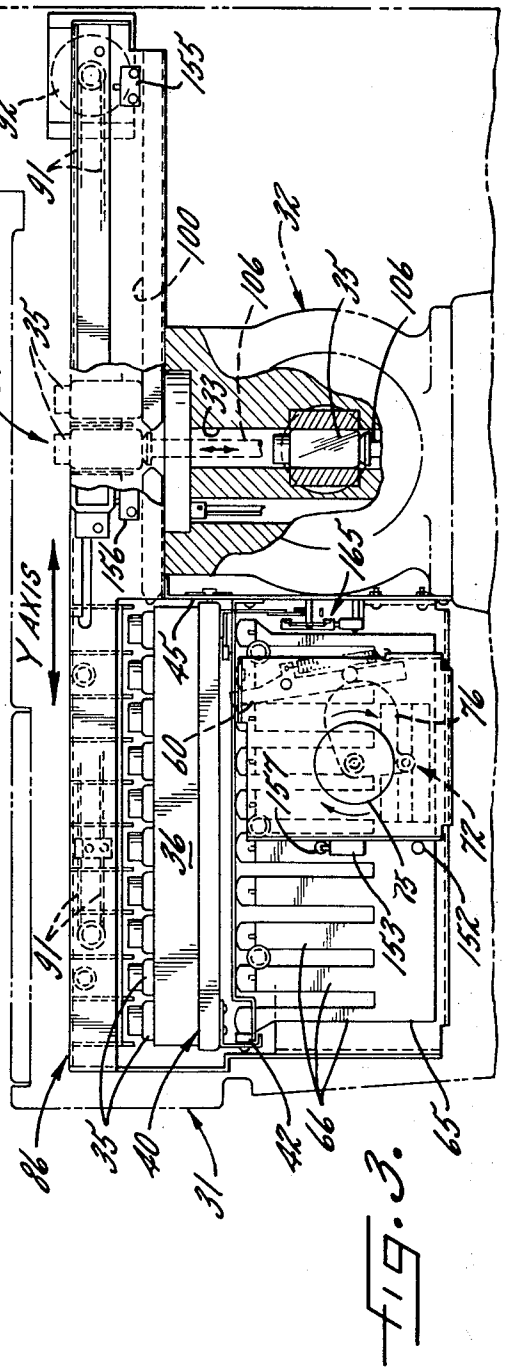

FIG. 3.

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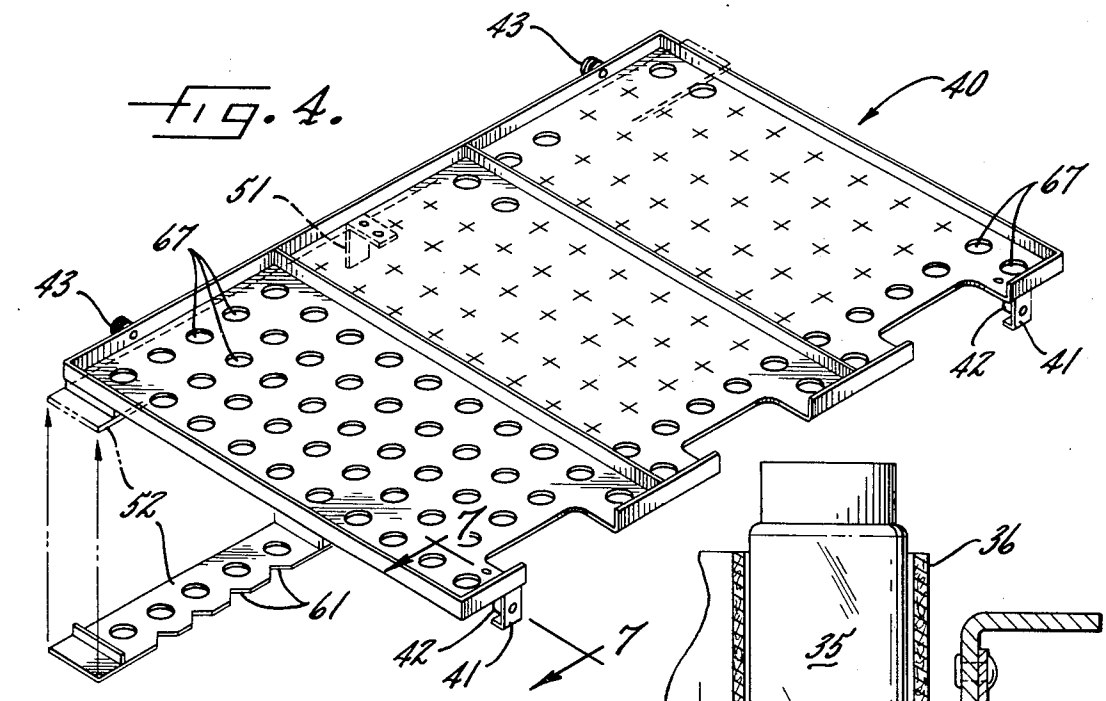

Fig. 4.

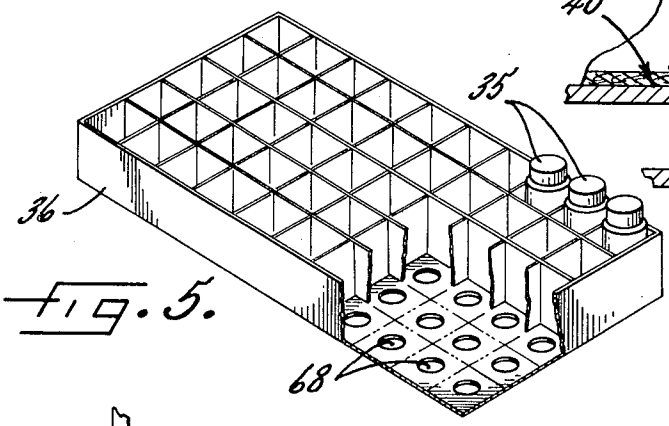

Fig. 5.

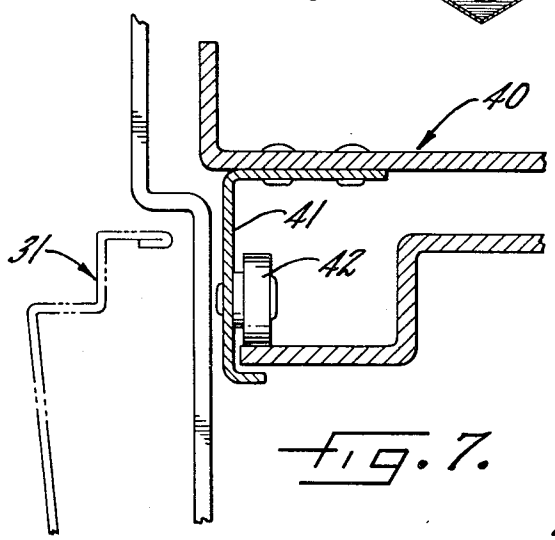

Fig. 7.

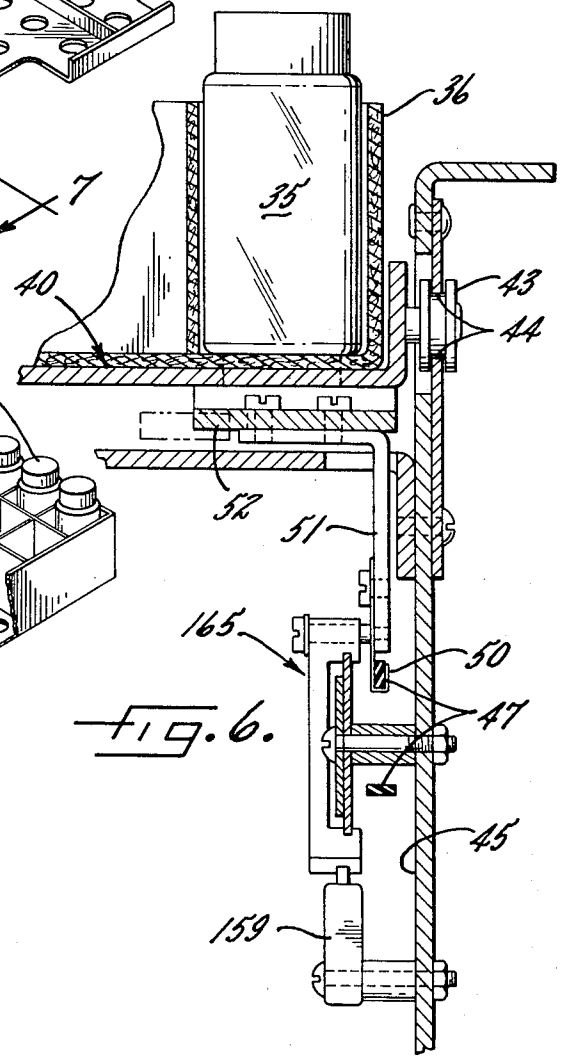

Fig. 6.

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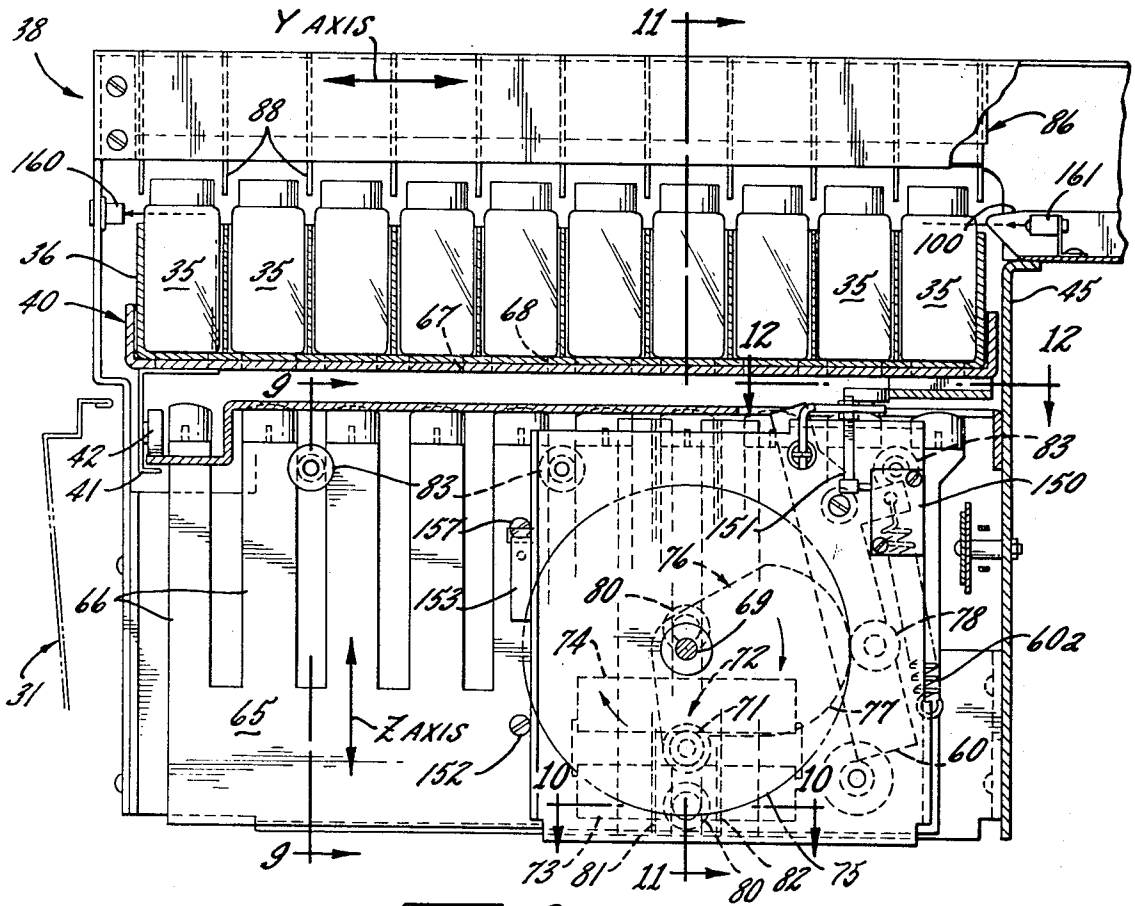

Fig. 8.

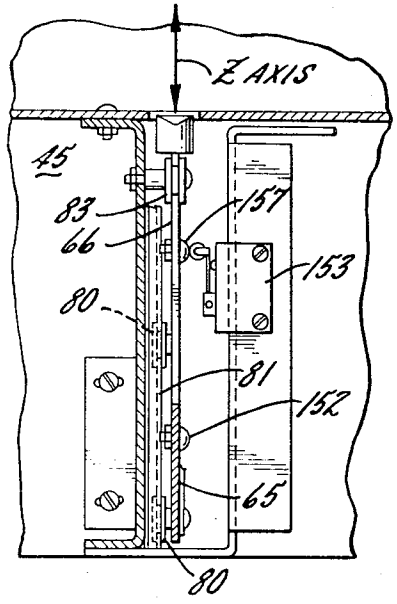

Fig. 9.

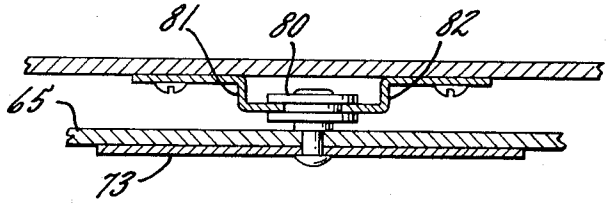

Fig. 10.

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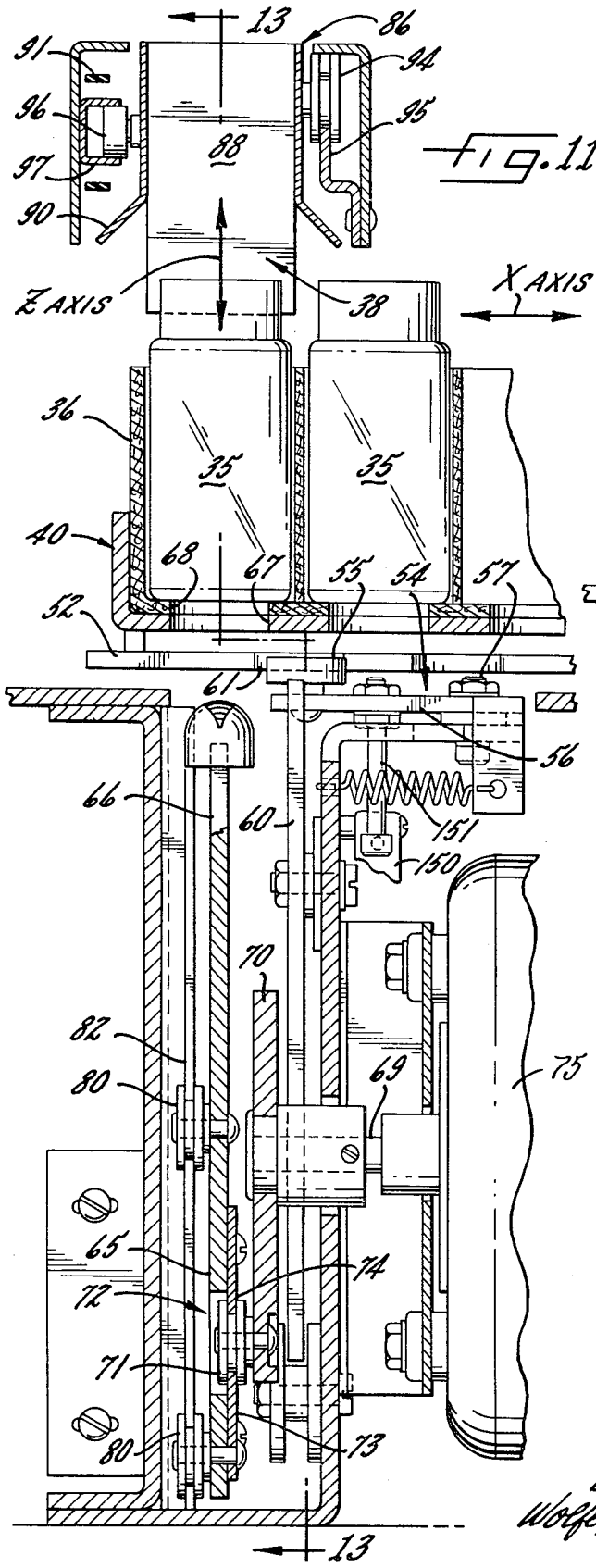

Fig. 11.

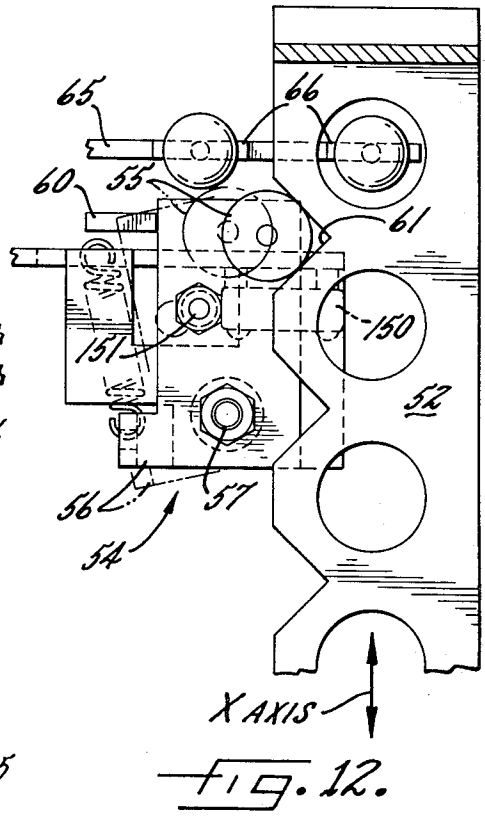

Fig. 12.

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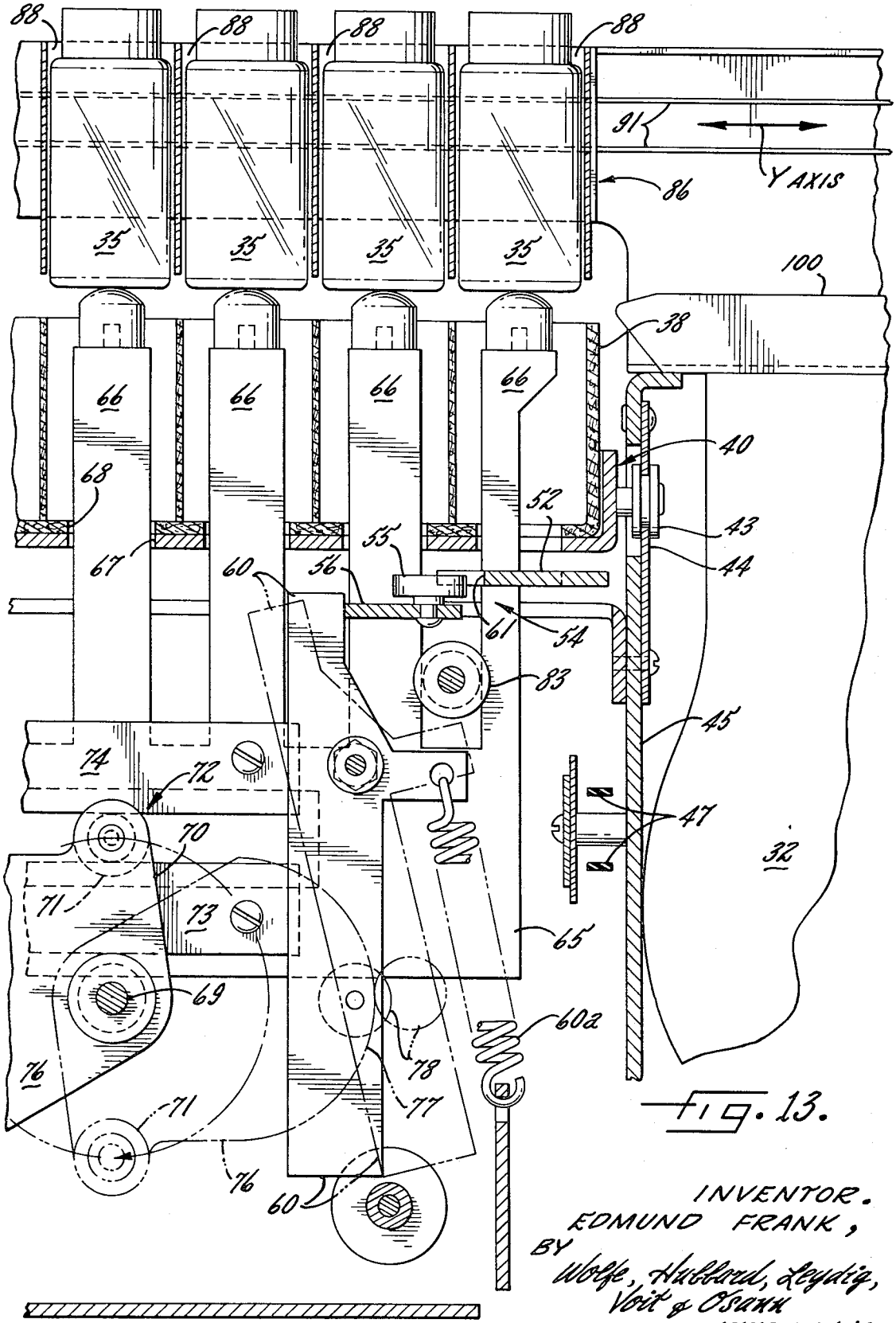

Fig. 13.

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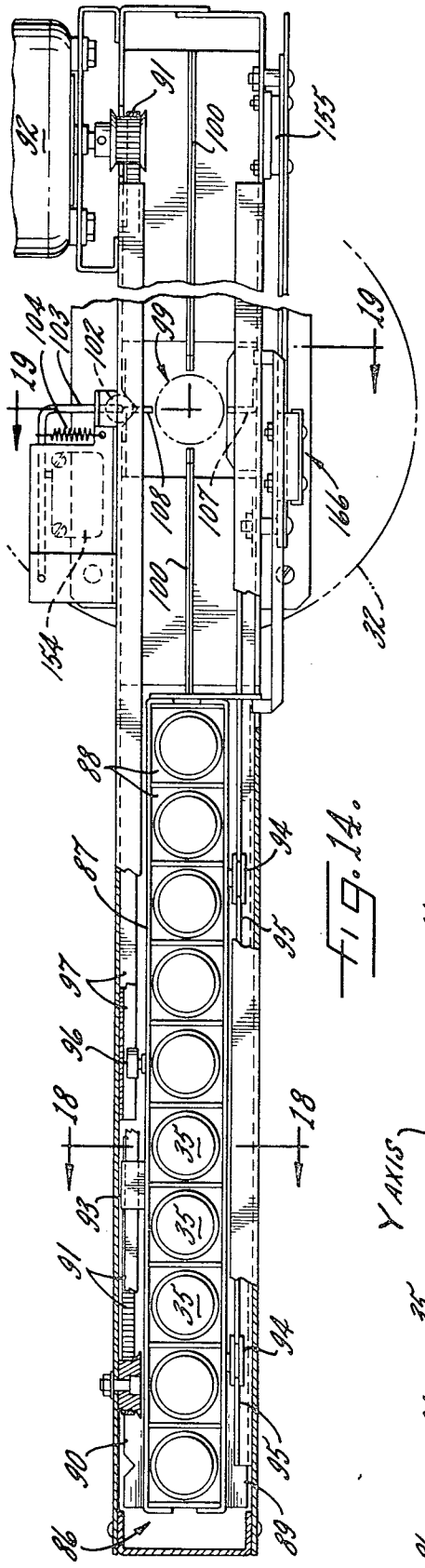

FIG. 14.

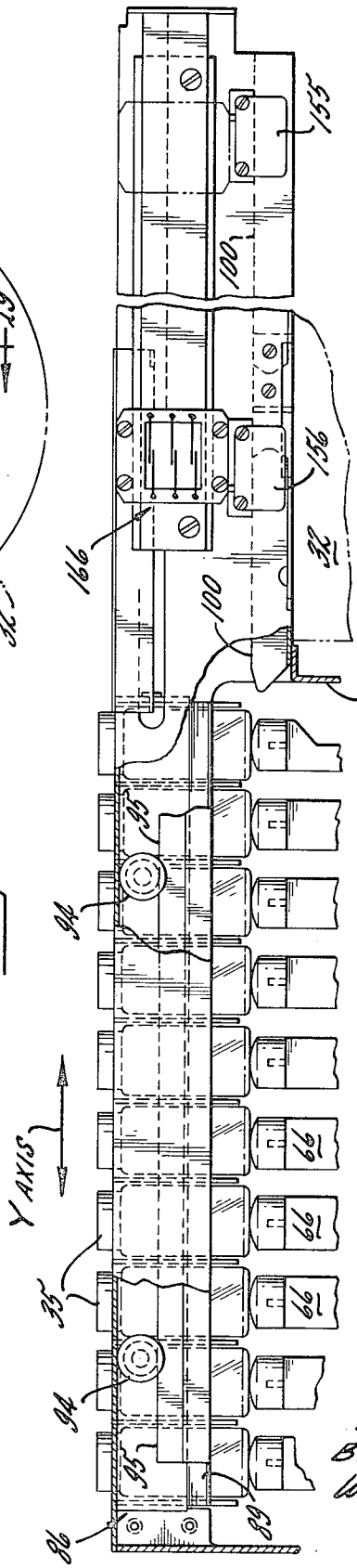

FIG. 15.

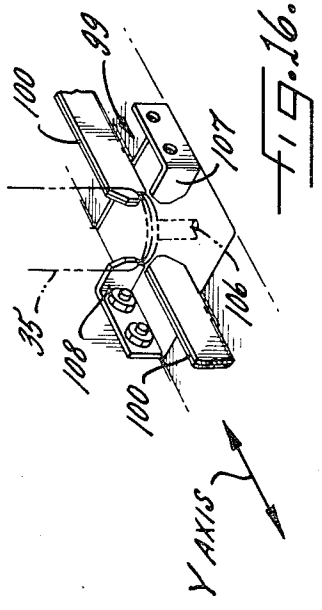

FIG. 16.

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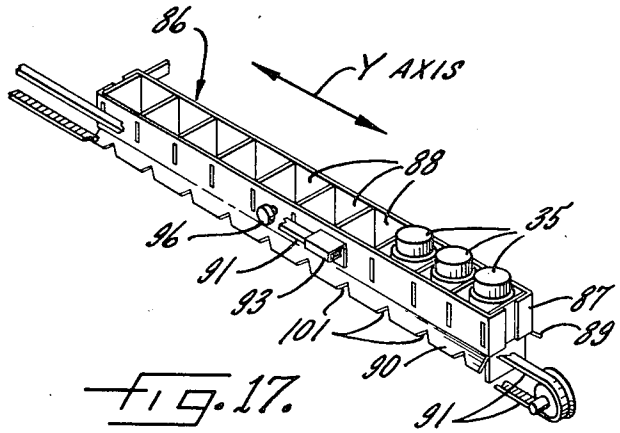

Fig. 17.

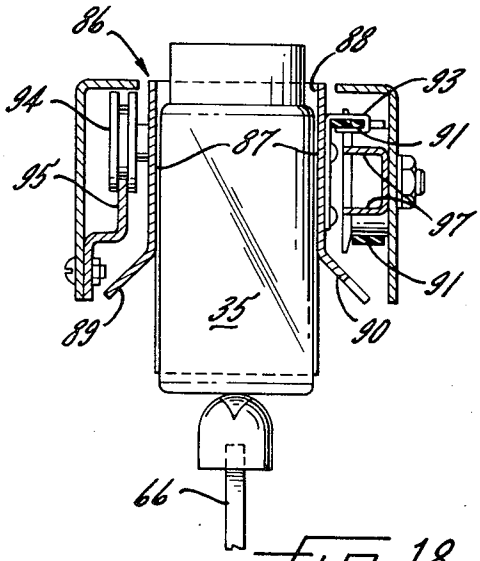

Fig. 18.

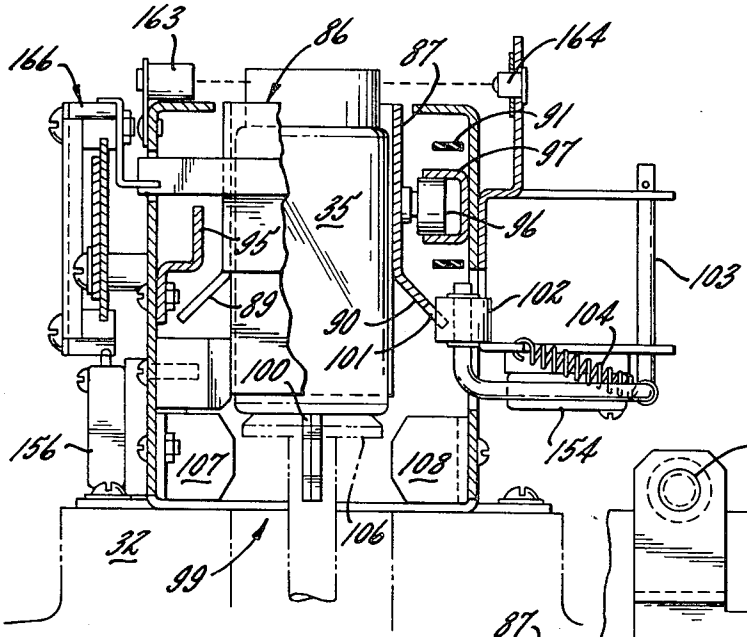

Fig. 19.

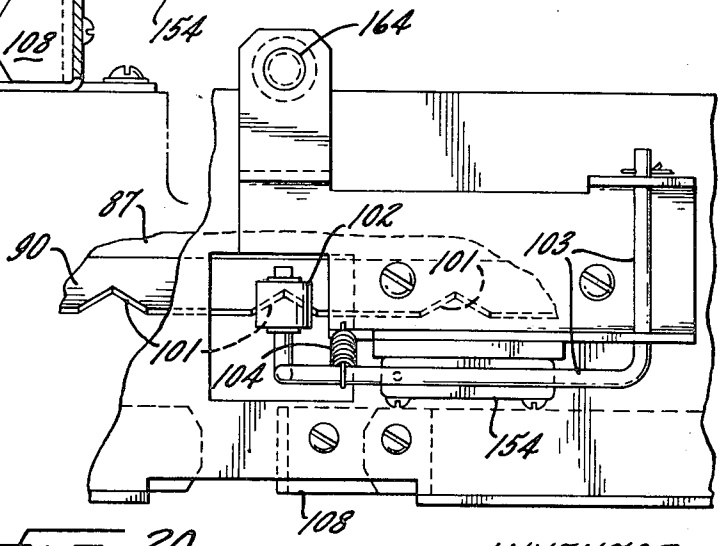

Fig. 20.

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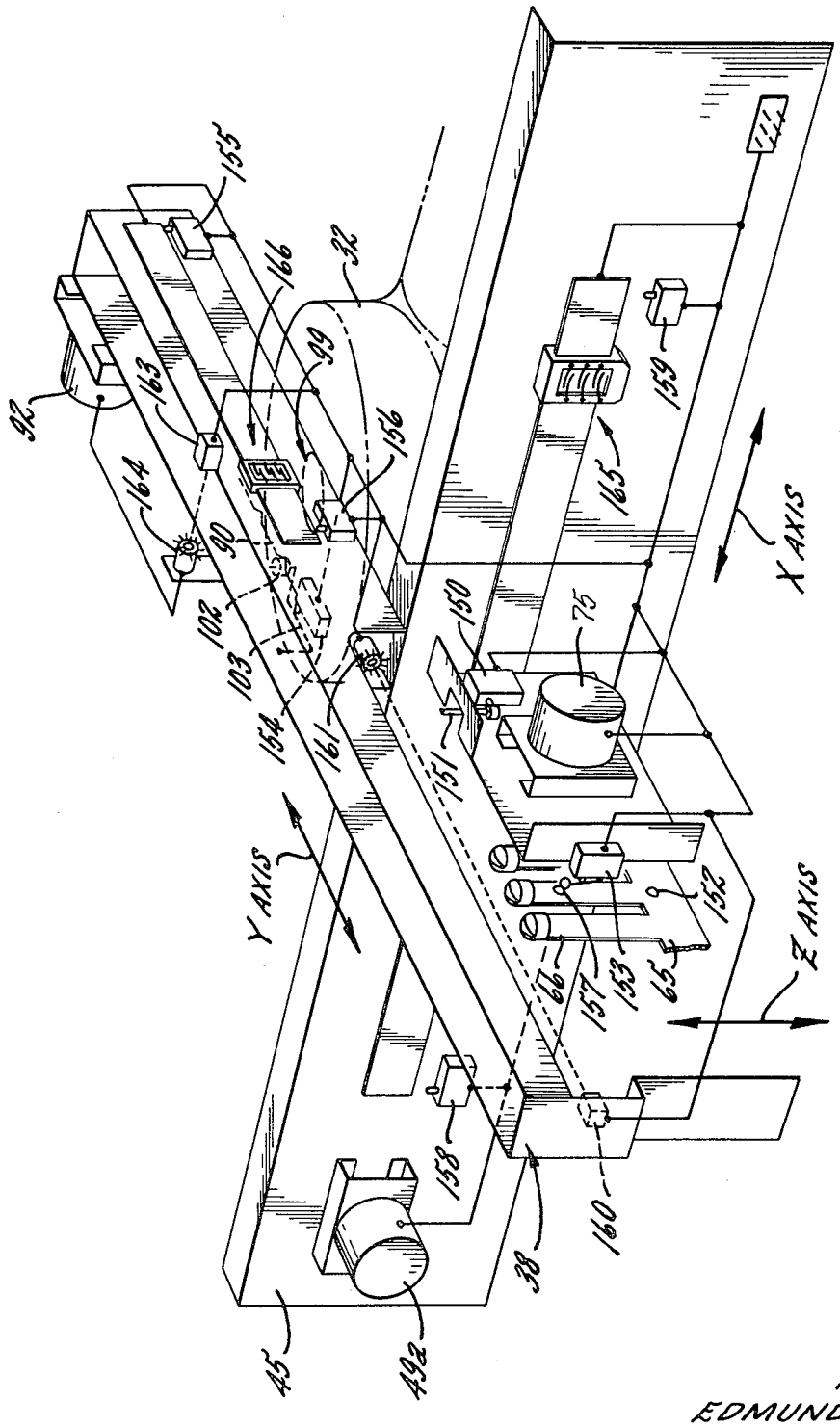

FIG. 21.

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METHOD OF AND APPARATUS FOR SAMPLE VIAL TRANSFERRING AND CHANGING

RELATED APPLICATIONS

Edmund Frank, Ser. No. 27,405, filed Apr. 10, 1970.

Edmund Frank and Edward F. Polic, Ser. No. 27,406, filed Apr. 10, 1970.

The present application is related to application Ser. No. 27,406 filed by Frank et al. as follows: Frank et al. (Ser.No. 27,406) made the generic invention which Frank (sole, Ser. No. 27,411) perfected. The perfected Frank embodiment is disclosed as the "best mode" and only mode in both applications ('406 and '411). Frank et al. (Ser. No. 27,406) who had the generic concept, have included generic claims in their application, while Frank (Ser.No. 27,411) has claims only to the embodiment that he invented.

DESCRIPTION OF THE INVENTION

This invention relates generally to changing and transfer methods and mechanisms for sample vials and the like and, more particularly, concerns method and mechanisms for unloading sample vials and like objects from trays or other regularized containers and for transporting the sample vials to and from a counting or other operation station.

BACKGROUND OF THE INVENTION

Liquid scintillation spectrometers, or apparatus designed to provide spectral analysis of test samples containing one or more radioactive isotopes disposed in a liquid scintillator contained in a sample vial, have been successfully employed in medical research and allied laboratories for several years. In such apparatus, trays holding an array of sample vials containing the scintillator and isotope are loaded into the apparatus, and the vials are thereafter manipulated seriatim into and out of a detector mechanism. To this end, annular trays such as that disclosed in U.S. Pat. No. 3,257,561 to Packard et al. have heretofore been provided, together with the sample vial transfer mechanisms therein disclosed. The wide acceptance of this type of scintillation spectrometer and its associated vial handling mechanism has led to the development of still other types of vial handling and changing apparatus capable of accommodating large numbers of sample vials. Such apparatus must be commercially attractive, easily operated, and simple to maintain.

It is, therefore, the general object of this invention to provide improved a changing and transfer methods and mechanisms for sample vials and like regularized objects, and wherein such mechanisms may be constructed at relatively low cost and can be easily repaired and maintained. Another important object of the invention is the provision of a changing and transfer mechanism which will operate without damaging the transferred vials.

It is yet another object to provide a reliable transfer mechanism which will not become jammed by the lodgement of a slightly misalined vial in the transferring mechanism.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIG. 1 is a top plan view showing the overall arrangement of the sample changing apparatus and the associated detecting and counting mechanism;

FIG. 2 is a fragmentary front elevational view of an exemplary apparatus, here depicting several sample-containing tray arrays;

FIG. 3 is an end elevational view of the exemplary sample changing apparatus shown in FIGS. 1 and 2;

FIG. 4 is an enlarged perspective view, partially exploded, showing an exemplary tray-supporting carriage used in the apparatus;

FIG. 5 is a perspective view in partial section showing a typical sample tray used in connection with the sample changing apparatus disclosed;

FIG. 6 is an enlarged sectional view taken substantially along the line 6—6 of FIG. 2 showing in detail an exemplary rear support and carriage drive mechanism used in the illustrated apparatus;

FIG. 7 is an enlarged sectional view taken substantially along the line 7—7 in FIG. 4 showing in detail the front support of the illustrated apparatus;

FIG. 8 is an enlarged sectional view taken substantially along the line 8—8 of FIG. 2 showing in greater detail the sample vial-elevating comb and its associated driving apparatus;

FIG. 9 is an enlarged sectional view taken substantially along the line 9—9 in FIG. 8 illustrating in detail apparatus for guiding the motion of the sample vial-elevating comb;

FIG. 10 is an enlarged sectional view taken substantially along the line 10—10 in FIG. 8 illustrating in detail the lower comb guide;

FIG. 11 is an enlarged sectional view taken substantially along the line 11—11 in FIG. 8 showing in detail the mechanism by which the sample vial-elevating and lowering comb is manipulated;

FIG. 12 is an enlarged sectional view taken substantially along the line 12—12 in FIG. 8 showing in detail the X-conveyor alinement switch and associated apparatus;

FIG. 13 is an enlarged sectional view taken substantially along the line 13—13 in FIG. 11, showing a typical embodiment of the comb elevating drive ,with the comb illustrated in its upwardmost position;

FIG. 14 is an enlarged partial top plan view, showing in further detail the Y-axis conveyor;

FIG. 15 is a partial side elevational view of the Y-conveyor, showing in further detail a number of the parts associated therewith;

FIG. 16 is an enlarged perspective view showing in further detail the sample vial positioning or pilot mechanism used in association with the elevator mechanism of the detector mechanism;

FIG. 17 is a perspective view showing further the details of the Y-axis carriage;

FIG. 18 is an enlarged sectional view taken substantially along the line 18—18 of FIG. 14, and showing yet further details in the Y-axis carriage;

FIG. 19 is an enlarged sectional view taken substantially along the line 19—19 of FIG. 14 , and showing yet other details in the Y-axis carriage mechanism;

FIG. 20 is a partial elevational view showing in further detail portions of the carriage movement control mechanism; and,

FIG. 21 is a perspective view showing in somewhat stylized or schematic form certain of the electrical wiring and connections used in the present embodiment of the invention.

While the invention will be described in connection with a preferred embodiment, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications, and equivalents as may be included within the spirit and scope of the inventions as defined by the appended claims.

Turning first to FIG. 1, there is shown a liquid scintillation apparatus cabinet 31 housing a scintillation detector mechanism 32. A top opening 33 is provided in the scintillation detector mechanism 32 for the insertion of sample vials 35 into the sample detector mechanism 32. Rectangular arrays of the sample vials 35, spaced in columns and rows along respective X and Y cartesian coordinates of the arrays are normally carried in trays 36 (see FIG. 5). In the practice of the present invention, such trays are preferably constructed in the manner described in greater detail in the aforesaid copending Frank application, Ser. No. 27,405, assigned to the assignee of the present invention. In turn, arrays of the trays 36 may be loaded onto the sample changing apparatus and manipulated as hereinafter described. In the illustrated embodiment of the invention, it is contemplated that the sample vials 35 will carry a radioactive isotope-containing substance dissolved, suspended, or otherwise mixed in a liquid scintillation medium comprising a solvent and one or more of numerous commercially available scintillators or fluorescent materials, the sample vial having light-transmissive walls. Scintillations or light flashes may then be counted by means of appropriate photomultipliers and other apparatus carried within the liquid scintillation detector mechanism, at a counting station provided for that purpose.

For alining successive Y-axis rows of the sample vial array with a transfer station 38, indexing apparatus is provided. In accordance with the invention, such indexing apparatus includes therefor a carriage 40 (best illustrated in FIG. 4), upon which the trays 36 may be manually placed, and which supports and moves the trays 36 along the X-axis. For supporting the carriage 40 and for allowing motion of the carriage 40 along the X-axis in the illustrated embodiment, guide brackets 41 having front support rollers 42 mounted thereupon are secured, by any convenient means, to the bottom front of the carriage 40, as best seen in FIG. 7. For supporting the rear of the carriage 40, rollers 43 are provided which engage a track 44 mounted upon the vertical rear wall 45 of the apparatus.

The carriage 40 may be driven in either directed along the X-axis by a carriage drive mechanism. As best seen in FIG. 2, and in accordance with a feature of the invention, an endless belt 47 is passed around an idler 48 and a drive pulley 49. The pulley 49 is rotated by a small servomotor 49*a* mounted on the vertical rear wall 45 of the apparatus. As best seen in FIG. 6, a top portion 50 of the belt 47 is secured to a belt connecting bracket 51, which bracket is, in turn, connected to a carriage positioning switch 52. When the belt 47 is driven by the servomotor 49*a*, the belt connecting bracket 51 and position switch 52 are moved in a direction parallel to the X-axis, and the carriage 40, which is secured to the carriage position switch 52, is moved in unison therewith.

Precise alinement of the carriage 40 with the transfer station 38, is accomplished by means of an X-axis positioning mechanism 54, best seen in FIGS. 12 and 13. To this end, the carriage is positioned on the X-axis by a small contact roller 55 pivotally mounted on a roller plate 56, the plate itself being, pivoted about a fixed bearing 57. The plate 56 and roller 55 are urged into light contact with the carriage position switch 52. As will be more fully explained below, a strike lever 60 may be caused to contact the roller plate 56, and to urge the plate 56 having a switch finger 151 and a roller 55 mounted thereon to the right, as shown in FIG. 12, thus forcing the roller 55 to center within one of the notches 61 provided in the carriage position switch 52, in accordance with the invention. Such action of the roller 55 removes any slight misalinement of the carriage switch 52 and attached carriage 40 with the transfer station 38. Thus, the position of any given row of containers 35 may be accurately alined with the transfer station 38.

Indexing apparatus is also included for indexing a row of containers along the Z-axis between the transfer station 38 and additional transfer means. In accordance with this aspect of the invention, and as best seen in FIGS. 8 through 15, this indexing apparatus includes an elevating comb structure 65 having a plurality of teeth 66, which teeth 66 are adapted for insertion into and out of holes 67 and 68 formed for that purpose in the bottom of the carriage 40 and sample vial-containing trays 36, respectively. By moving the comb 65 upwardly when a row of sample vials 35 is alined with the transfer station 38, the vials 35 may be ejected upwardly from the tray 36.

In further accordance with the invention, the comb 65 is elevated by means of a Z-drive motor 75, the output shaft 69 of which is connected to and drives a cam arm 70 the latter being connected to, the slide 71 of a scotch gear arrangement 72. As the motor 75 rotates the cam arm 70, the slide 71 moves between two horizontally disposed slide rails 73 and 74.

Pursuant to the invention, the cam arm 70 is formed with an extension 76 having a cam surface 77 thereupon. A cam follower 78 is mounted upon the strike lever 60 described above. As seen in FIG. 13, rotation of the cam arm 70 simultaneously pivots the strike lever 60 by the action of the cam surface 77 and cam follower 78 which is mounted on the strike lever 60. As described above, the strike lever is positioned for engagement with the pivot plate 56 which carries the carriage positioning roller 55. Thus, as the comb teeth 66 are elevated through the carriage holes 67 and tray holes 68 to eject the vials 35 from the tray 36, the cam surface 77 and follower 78 cause the strike lever 60 to force the roller 55 into positioning engagement with the carriage position switch 52. A row of vials 35 is resultantly positioned accurately at the transfer station 38 immediately prior to the ejection of the vials 35 from the tray 36 by the comb tines 66.

In the illustrated embodiment of the device, the Z-axis, or vertical, motion of the comb 65 is guided by comb-mounted rollers 80 which operate in Z-axis oriented tracks 81 and 82, conveniently mounted on

the apparatus structure, and by rollers **83** mounted upon the structure between the tines **66**, as best seen in FIGS. **9**, **10** and **13**.

Indexing apparatus is provided for indexing a row of containers along the Y-axis so that the containers move past a loading station in seriatim order for alining the containers with the station. In the present embodiment, a Y-axis carriage **86** is disposed generally above the elevating comb **65** for motion along the Y-axis. As can be best seen in FIGS. **14** – **20**, the carriage includes a partitioned mobile conveyor **87** which contains a plurality of bottomless compartments **88** for receiving the Z-axis indexed vials **35**. Skirts **89**, **90** (FIG. **18**) are provided for guiding the upwardly thrust vials **35** into the appropriate compartments **88**.

When the vials **35** are introduced into the compartments **88**, the conveyor **87** is moved along the Y-axis by an endless belt **91** driven by a Y-axis drive motor **92**. The belt, as illustrated (FIG. **17**), is secured to the conveyor **87** by belt clamp **93**. As best seen in FIGS. **11** and **18**, the conveyor rides upon grooved rollers **94** which engage a corresponding track **95** on one side, and further ride upon smooth-surfaced rollers **96** which engage a C-shaped channel track **97** on the other side.

Y-axis indexing motion of the conveyor **87** is thus caused by activation of the Y-axis motor **92** (FIG. **14**). When set in motion, the carriage **87** drags the vials **35** which have been inserted into the compartments **88** across the tips of the comb tines **66** and, one after another, past a loading station **99** (FIGS. **1**, **14** and **19**). A vial-supporting track **100** is provided for those portions of the Y-axis not occupied by tines **66** on the comb **65**. To assist in positioning the compartments **88** over the loading station **99**, notches **101** are formed in one skirt **90** for engagement by a positioning roller **102**. This roller **102**, as best seen in FIGS. **19** and **20**, is mounted on a pivotable arm **103** which is biased, as by a spring **104**, into one of these notches **101**. The conveyor **87** is urged into an accurately located position over the loading station **99** by motion of this roller.

When a vial **35** is positioned at the loading station, as best illustrated in FIGS. **3**, **16**, and **19** it rests upon an elevator **106** which is operated by mechanisms (not shown) located inside the liquid scintillator detector mechanism **32**. The elevator may be lowered into the detector mechanism **32**, drawing with it the vial **35**, and positioning the latter in a counting station (not shown). Guides **107**, **108** are provided for centering the vial **35** on the elevator **106** during the downward and upward motion; the guides **107**, **108** and track **100** are tapered at their respective ends to assist in this guidance.

Once the vial **35** is drawn into the detector mechanism, the scintillations or light flashes occurring therein may be counted, as generally known in the art, over measured time or until a present count is reached. Thereafter, the sample vial is again thrust up into its Y-axis carriage compartment **88** by the elevator **106**, and the Y-axis drive motor is actuated to draw a succeeding vial over the elevator.

Embodiments of the switches and circuitry used to operate the mechanism in accordance with the invention are illustrated in FIG. **21** and elsewhere. When the indexing mechanism is activated by the operator, the X-axis drive motor **49***a* is activated, and draws the vial-supporting carriage **40** along the X-axis as described above. A limit switch **150** actuated by a switch finger **151** halts the X-drive motor **49***a* and X-axis motion of the carriage when the first row of vial compartments are positioned at the transfer station **38**.

The activation of switch **150** also activates the Z-axis motor **75** raising the comb **65** and thrusting the vials located in the transfer station upward along the Z-axis, until detent **152** located appropriately upon the comb **65** engages switch **153**, thereby halting the Z-axis drive motor **75** and the upward motion of the comb **65**. Switch **153** additionally activates the Y-axis drive motor **92** to move the indexing vials along the Y-axis as above described.

When biased roller **102** engages the first notch **101** on the skirt **90**, the pivotable arm **103** upon which the roller **102** is mounted activates switch **154** halting the Y-axis motor and motion. Mechanism (not shown) within the detector mechanism **32** then lowers and later raises the sample vial upon the elevator. completion of the upward motion of the elevator serves to reactivate the Y-axis drive motor by appropriate circuitry (not shown), thus indexing the next vial compartment over the counting station, whereupon the roller **102**, arm **103**, and switch **154** again halt Y-axis motion.

When all Y-axis carriage compartments have been indexed past the loading station, switch **155** is engaged by the Y-axis carriage, and the Y-axis motor is reversely driven. When the carriage is in its original location over the comb **65**, the Y-axis motion is halted by switch **156**. Switch **156** also reversely actuates the Z-axis drive motor **75**, which lowers the comb **65** and vials located thereupon until a detent **157** engages switch **153**, whereupon the Z-axis motion is halted and the X-axis drive motor **49***a* is reactivated to bring the next row of sample vials to the transfer station **38**. By appropriate circuitry, this operational cycle is continued until the X-axis carriage engages switch **158**, whereupon the X-axis motor **49a** is reversely and continuously driven until the X-axis carriage is returned to its original position, the reverse motion being halted by switch **159**.

The apparatus is further designed to manipulate the sample vials without engaging in useless motion where an empty compartment encountered. To this end, several optical switches are provided, the switches comprising a light source and a photo-sensitive cell. When an opaque object, such as the cap upon a sample vial, interrupts the light beam falling upon the cell, the cell-associated switch devices are actuated.

In accordance with the invention, therefore, an optical switch **160** and associated light source **161** are positioned so as to sense, by the interruption of the light beam, the presence, or absence of sample vials in any row of containers located at the transfer station **38**. If no sample vial is sensed in the row, appropriate circuitry causes the X-axis motor **49a** to continue the indexing motion without the activation of the Z-axis motor **75** or the Y-axis motor **92**. Similarly, the optical switch **163** and associated light source **164**, together with appropriate circuitry, cause continued Y-axis indexing of the Y-axis carriage if no sample vial is sensed within a Y-axis carriage compartment as the compartment passes the loading station **99**.

Means are further provided for indicating, to a control station (not shown), the designation for a sample vial located at the counting station. For this purpose, an

X-axis position readout switch **165** is included for sensing and indicating the sample vial row which is located at the transfer station **38** for indexing along the Y-axis. Similarly, a Y-axis position readout switch **166** is included for sensing and indicating the Y-axis carriage compartment which is located at the loading station **99**. By means of such switches, identification can be automatically made of the source of the scintillations being counted within the detector mechanism.

I claim as my invention:

1. A test sample changing apparatus for use with at least one rectangular array of sample vials disposed in columns and rows along respective X and Y cartesian coordinates of said array and for transferring all of said vials one at a time to a predetermined point, comprising, an apparatus frame, means on said frame defining said predetermined point, a transfer station on said frame spaced apart from said point along a Y-axis coordinate, a first carriage means for holding at least one rectangular array of vials on said frame at a location spaced from said station, said first carriage means being mounted on said frame with freedom for translatable movement with respect thereto along X-axis coordinates, first indexing means for incrementally indexing said carriage along the X-axis, means for sequentially alining and accurately positioning each Y-oriented row of vials in said array within said station, second carriage means including a pair of spaced Y-oriented sidewalls interconnected by a plurality of X-oriented spaced partitions, the sidewalls and partitions defining a series of open-ended compartments with each compartment centered about a Z-axis coordinate oriented perpendicular to both the X and Y axes and located at intersection of a given Y-oriented row of said array and a given X-oriented column of said array, transfer means including a comb-like elevator oriented along a Y-coordinate for engaging one end of each vial located in a single row alined with said transfer station and for transferring each engaged vial along a Z-axis coordinate into respective different ones of the open ended compartments in said second carriage, said transfer means thereby shifting each row of vials alined with said transfer station along Z-axis coordinates out of the plane of said array, and second indexing means for incrementally indexing each row of vials alined with said station along said Y-axis coordinate to sequentially position each vial contained in each said row at said predetermined point in seriatim order.

2. A test sample changing apparatus as set forth in claim **1** further characterized in that means are provided for returning each row of vials along said Y-axis coordinate to its position alined with said transfer station after the last vial contained in said row has been indexed to said point and before the next succeeding row has been indexed to a position alined with said station.

3. Apparatus as set forth in claim **1** further characterized in that said second carriage is disposed above said first carriage and said X-oriented partitions project downwardly between the X-oriented columns of vials in said array for guiding said vials during movement of said first carriage in an X-direction.

4. Apparatus as set forth in claim **3** further characterized in that said Y-oriented sidewalls of said second carriage diverge outwardly at their lower ends for guiding those vials in a row being indexed in a Z-direction into said compartments.

5. Apparatus as set forth in claim **1** further characterized in that said second carriage is translatable along said frame in a Y-oriented direction, and means are provided for accurately alining each of said compartments with said point.

6. Apparatus as set forth in claim **1** further characterized in that said comb-like elevator is disposed below said first carriage and said second carriage is disposed above said first carriage whereupon upward movement of said elevator causes the teeth of said elevator to engage the bottoms of said vials and to propel said vials upwardly through the open bottoms of respective different ones of said compartments and into said compartments.

7. Apparatus as set forth in claim **6** further characterized in that the upper ends of the teeth of said comb-like elevator define a substantially continuous track for supporting said vials during Y-indexing of said second carriage.

8. A method of indexing sample vials to a predetermined point from a rectangular array of vials disposed in columns and rows along respective X and Y cartesian coordinates, comprising the steps of:

A. indexing the entire array along the X-axis to position one of the rows of vials at a transfer station disposed on a Y-axis coordinate alined with said point;

B. shifting a comb-like elevator alined with and disposed below the Y-axis coordinate alined with said point in an upward direction to cause the teeth of the elevator to engage the bottoms of the vials disposed in the vial row located in the station and to force said vials upwardly into a Y-oriented transfer carriage disposed above the plane of said array; and,

C. incrementally indexing the Y-oriented transfer carriage along its Y-axis coordinate to successively position, in seriatim order, each vial in said row at said point.

9. The method of claim **8** further characterized in that the tips of the teeth of said elevator serve to support and guide successive ones of the vials as the vials are indexed in a Y-direction by said transfer carriage.

10. The method of claim **8** further characterized in that the Y-oriented transfer carriage is returned to the transfer station along the Y-axis coordinate after the last vial in each row has reached said point.

11. The method of claim **10** further characterized in that the comb-like elevator is shifted downwardly when the transfer carriage is returned to its original position disposed above the plane of said array so as to lower the vials contained therein to their respective original positions in said array.

12. The method of claim **11** further characterized in that following downward movement of the elevator and restoration of the previously Y-indexed row of vials to their original position in the array, the entire array is again indexed along the X-axis to position the next succeeding Y-oriented row of vials in the transfer station.

13. Apparatus as set forth in claim **1** further characterized in that said second indexing means is operative only while said row of vials is out of the plane of said array.

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