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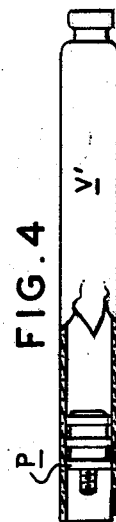
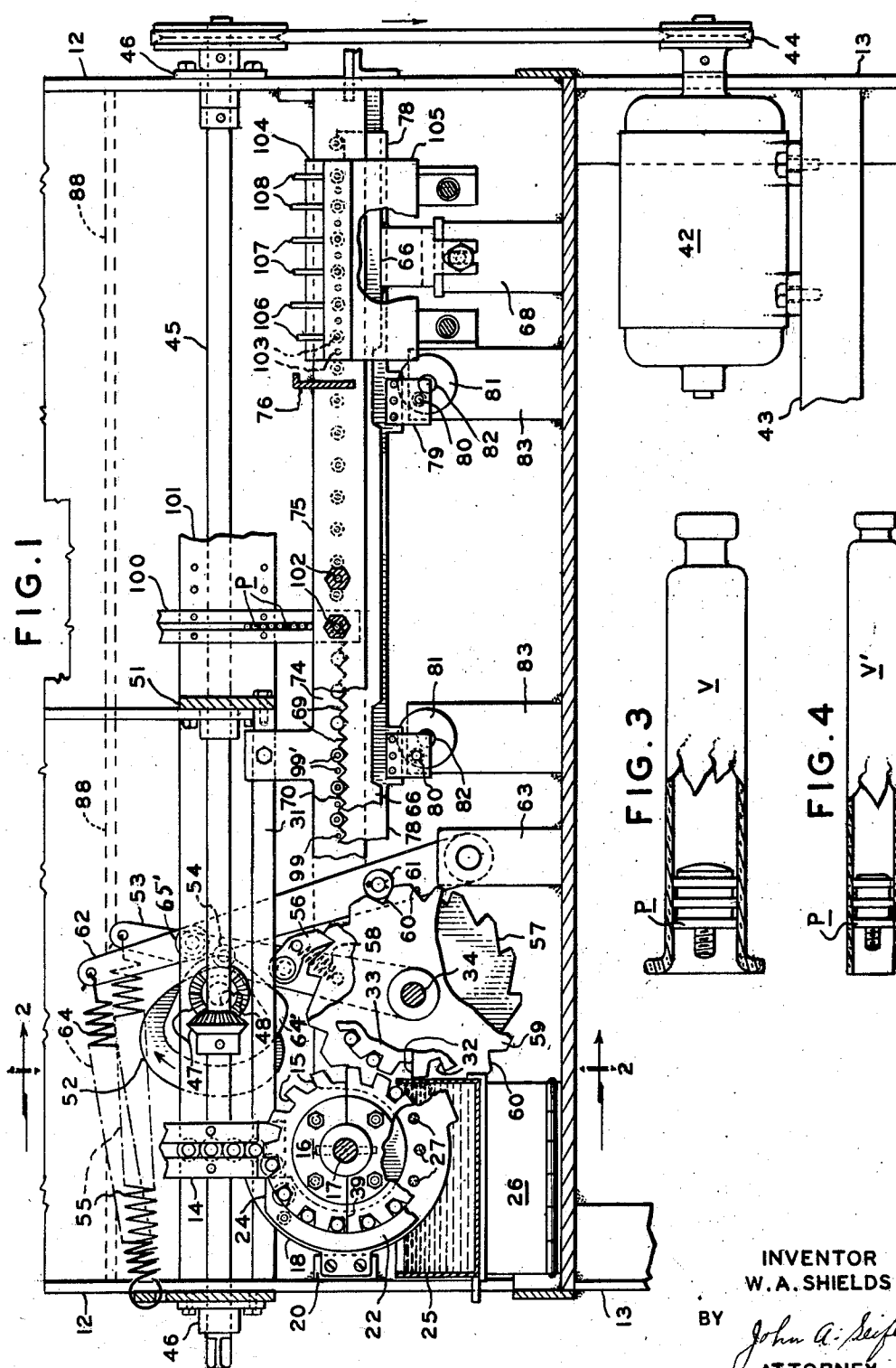
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MEANS FOR INTERMITTENTLY CONVEYING VIALS

Filed May 28, 1962

6 Sheets-Sheet 1



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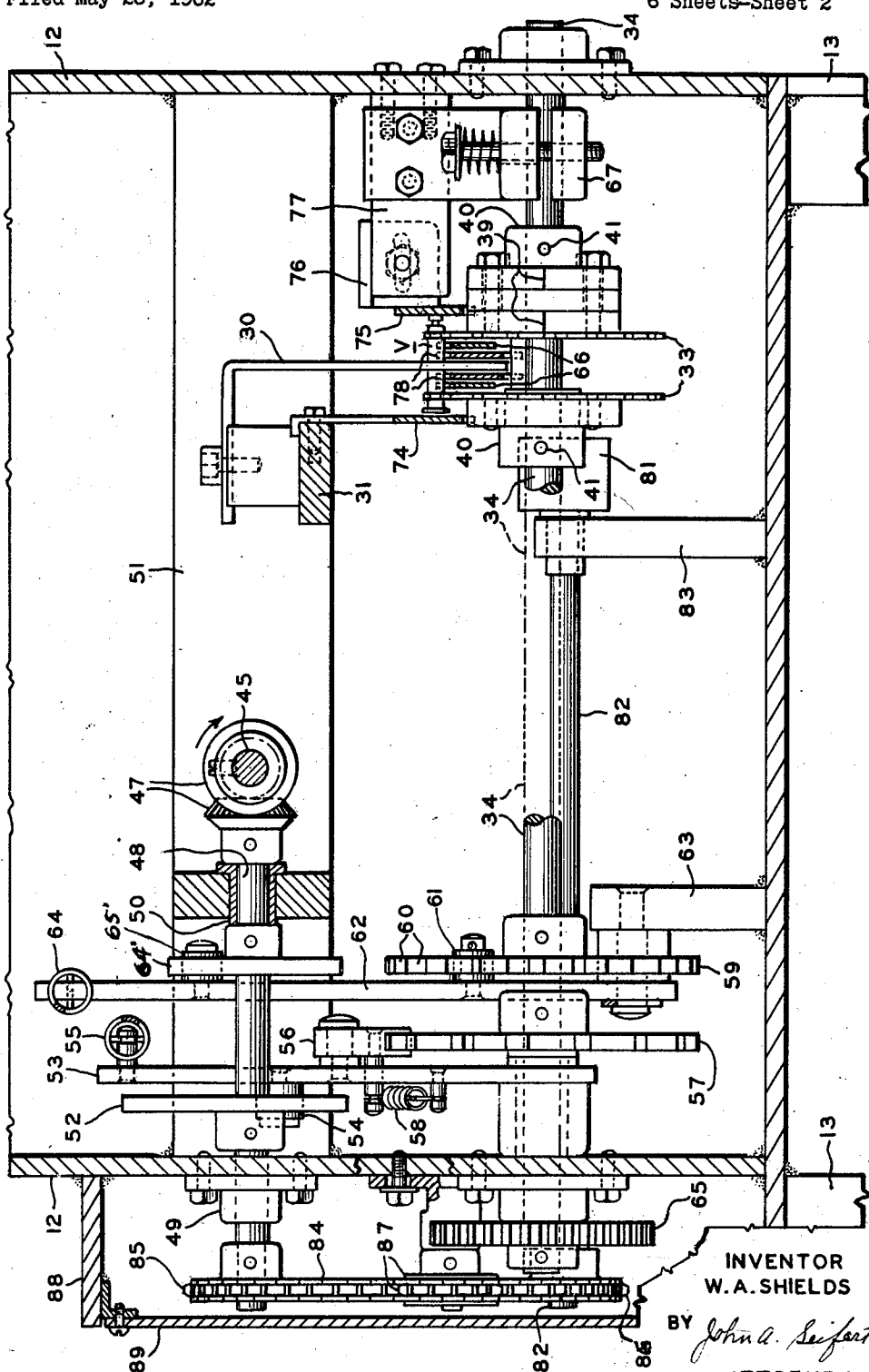
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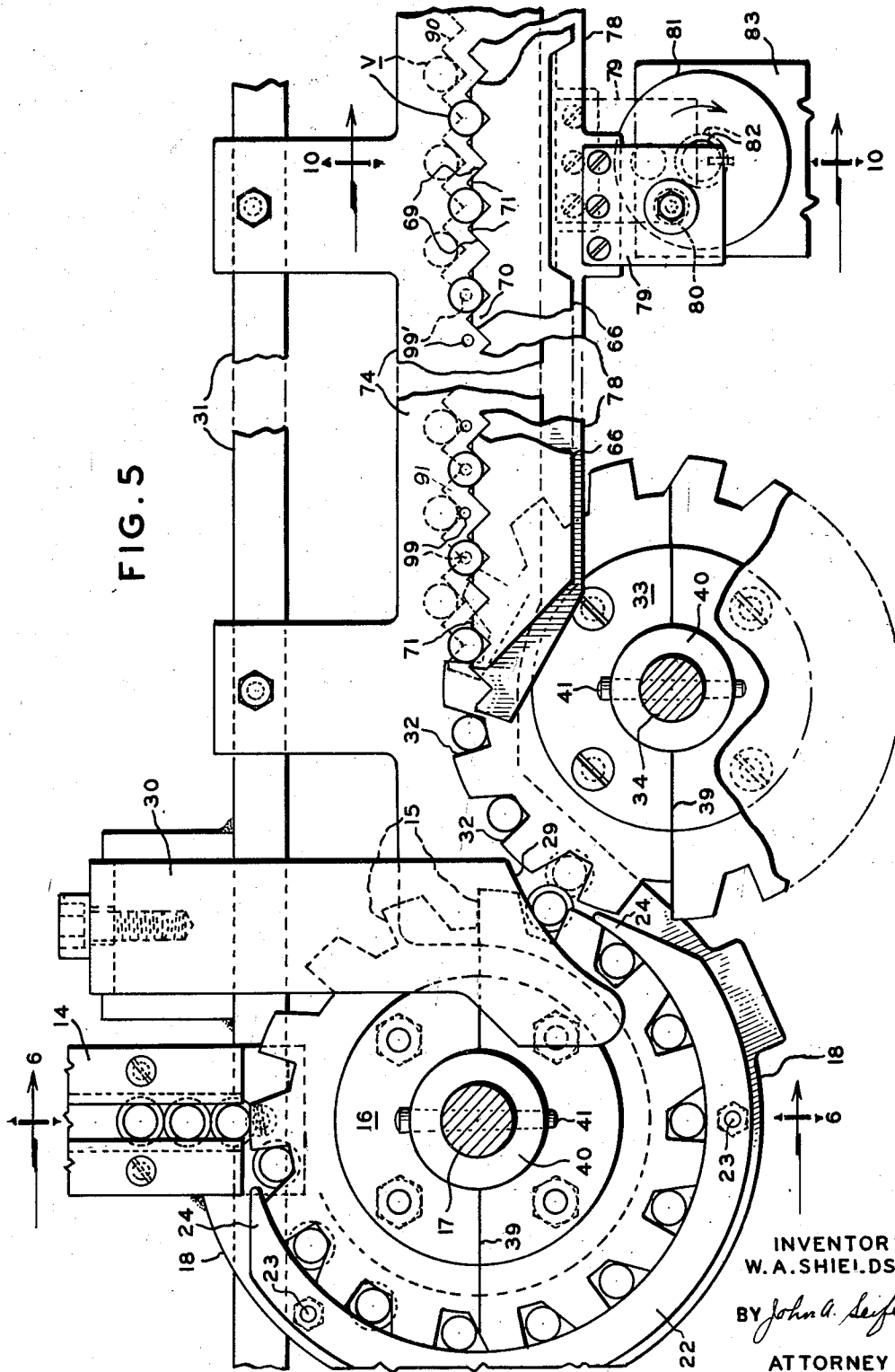
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FIG. 5



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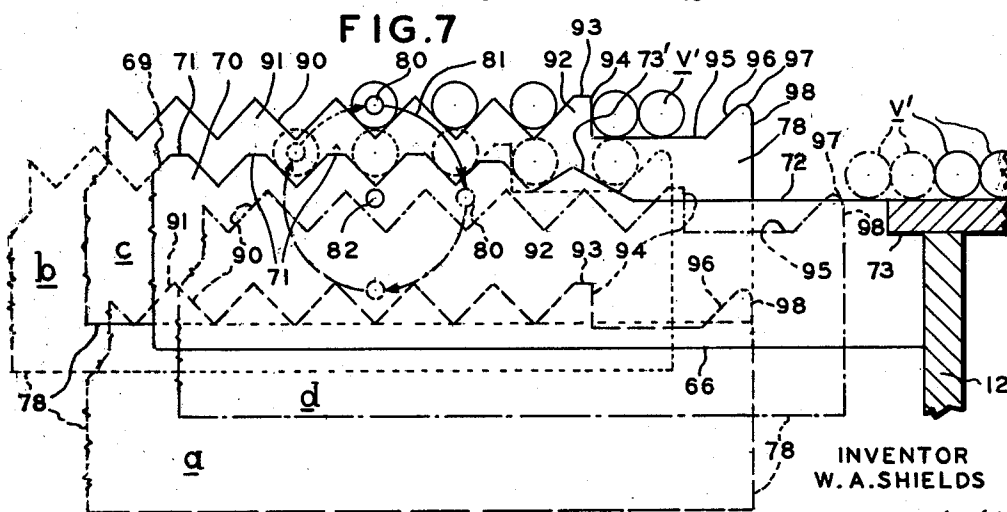
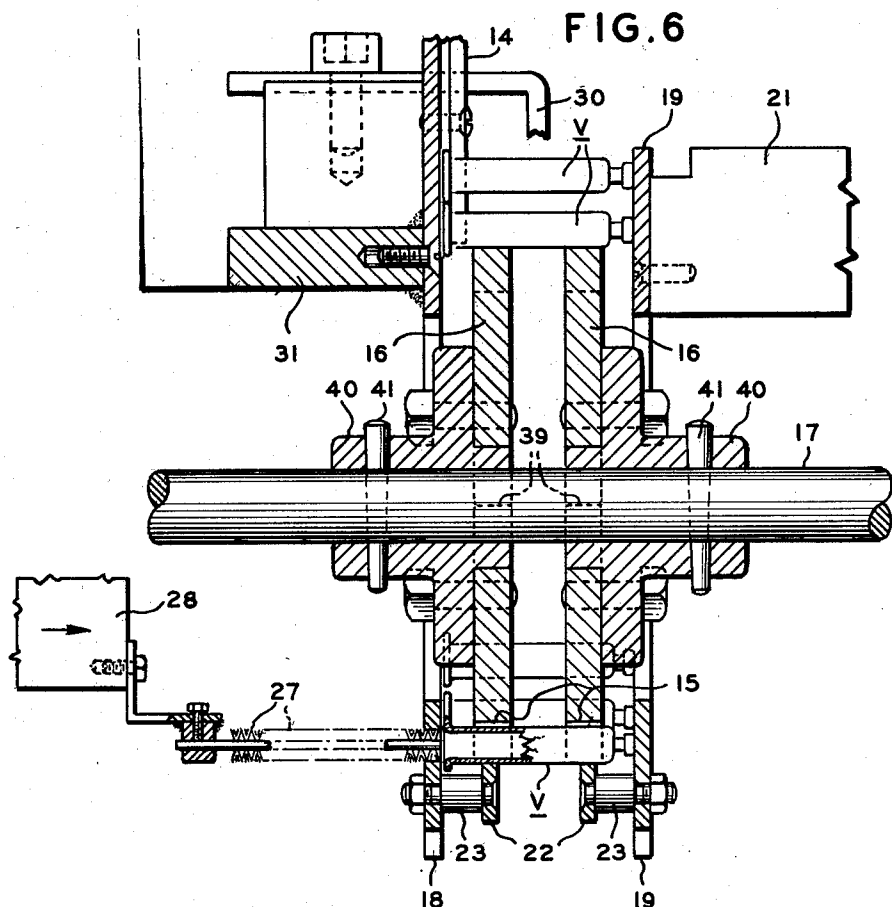
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MEANS FOR INTERMITTENTLY CONVEYING VIALS

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MEANS FOR INTERMITTENTLY CONVEYING VIALS

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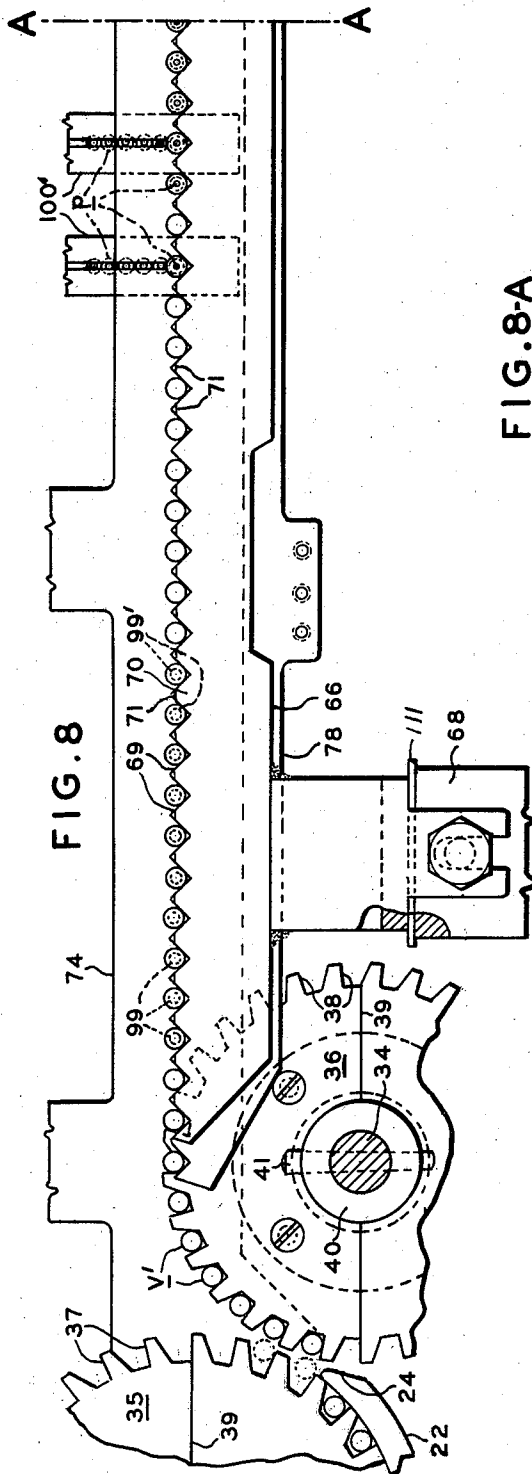
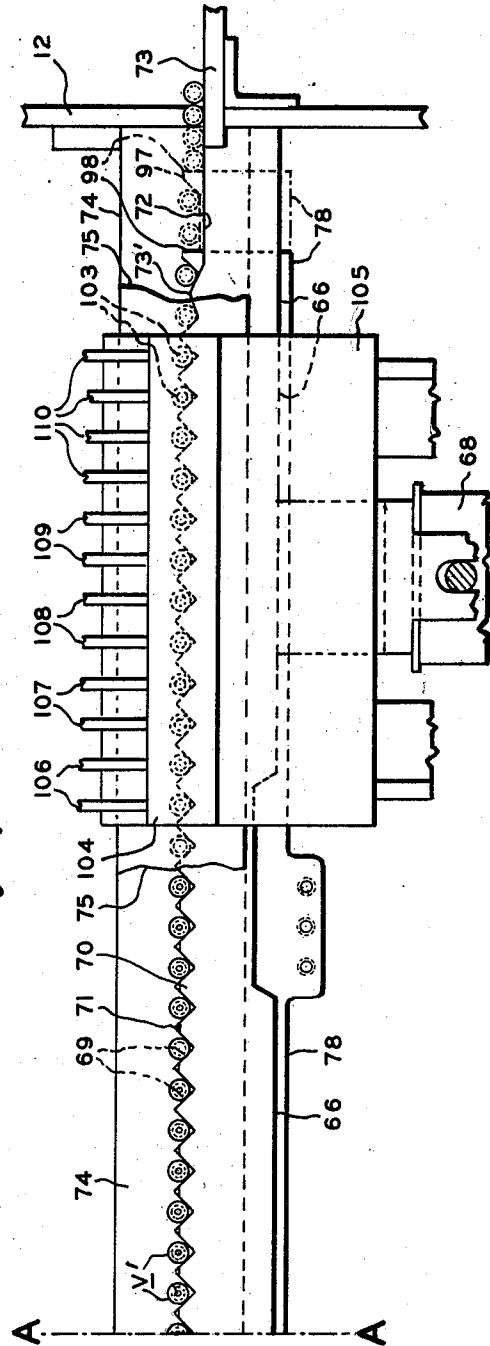


FIG. 8-A



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FIG. 9

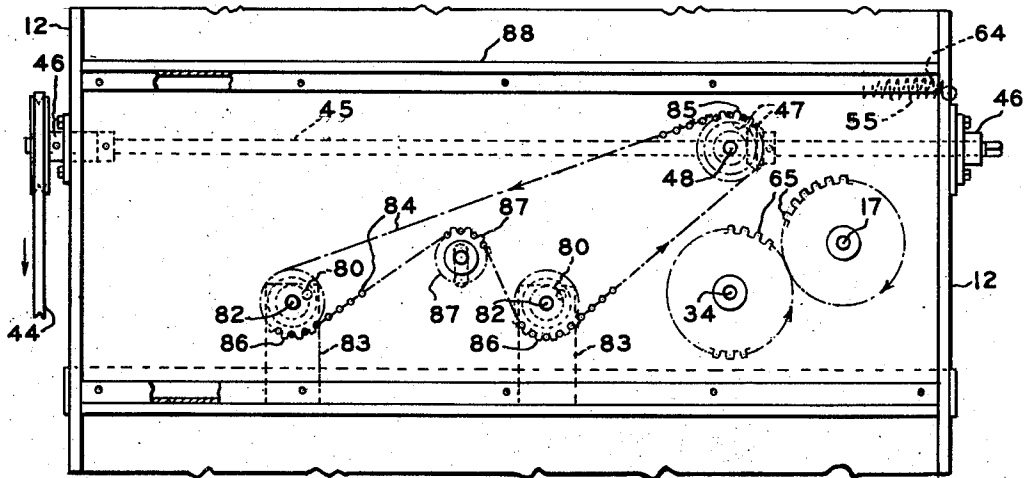


FIG. 11

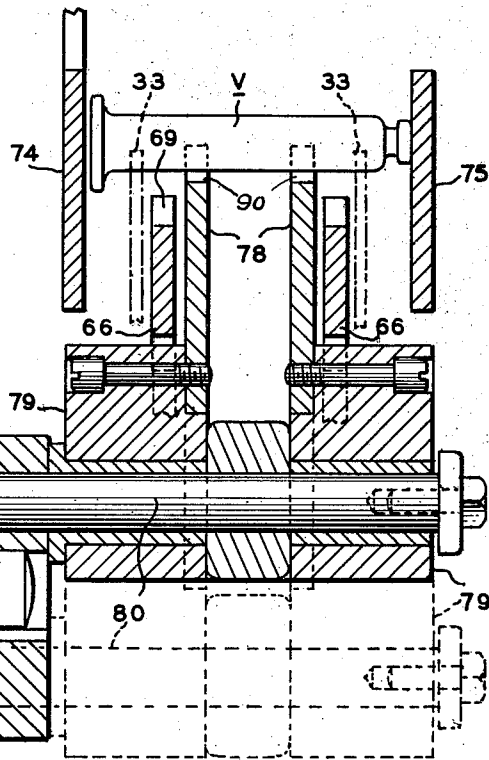
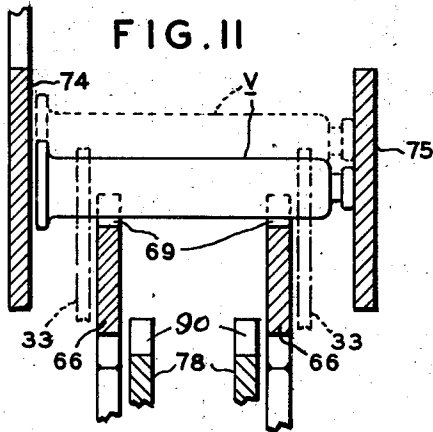


FIG. 10

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MEANS FOR INTERMITTENTLY CONVEYING VIALS

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13 Claims. (Cl. 198—107)

This invention relates to apparatus for cleaning vials and inserting a plunger into one end of each cleaned vial prior to filling said vial with a medicament through the opposite end and sealing said opposite end. The opposite end of the vial is sealed by a closure cap adapted to be punctured and connected to a hypodermic needle and the medicament is discharged from the vial through the hypodermic needle by pushing the plunger into the vial.

This invention is particularly concerned with improved means for intermittently conveying said vials to various devices for cleaning the vials and inserting the plungers as disclosed in my United States Letters Patent No. 2,948,004 issued August 9, 1960.

It is an object of the present invention to provide conveying means wherein it is possible to arrange the various devices for cleaning the vials and inserting the plungers in the vials in the same horizontal plane thereby simplifying the construction of the apparatus.

It is another object of the invention to support the vials in a predetermined horizontal plane during the drying of the vials, the inserting of the plungers into the vials and the cleaning of the vials to remove all lubricant from the vials used in inserting the plungers into the vials and render the vials clean thereby assuring positive and accurate positioning of the vials relative to the devices for performing said operations.

It is another object of the invention to continuously actuate a part of the vial conveying means relative to the devices for drying the vials, inserting the plungers, removing the lubricant from the vials and rendering the vials clean while intermittently actuating another part of the vial conveying means relative to a hopper chute for delivering the vials to the apparatus and a cleansing bath and means for transferring the vials from the intermittently actuated part to the continuously actuated part by a single power means.

It is a further object of the invention to provide interchangeability of the intermittently actuated part of the conveying means and of the transferring means, and adjustment of the continuously actuated part of the conveying means for conveying vials of different lengths and diameters.

Other objects and advantages of the invention will be set forth in the detailed description of the invention.

In the drawings accompanying and forming a part of this application:

FIGURE 1 is a front elevational view of the vial conveying means with a front wall of an enclosing cabinet removed;

FIGURE 2 is a cross-sectional view, on an enlarged scale, taken on the line 2—2 of FIGURE 1 looking in the direction of the arrows;

FIGURES 3 and 4 are views, partly in section, of vials showing the different diameters of vials handled by the conveying means;

FIGURE 5 is a front elevational view of the intermittently actuated part of the conveying means, the transferring means and a vial receiving end portion of the continuously actuated part of the conveying means showing the conveying of the vials of largest diameter;

FIGURE 6 is a cross-sectional view taken on the line 6—6 of FIGURE 5 looking in the direction of the arrows to show the delivery of vials to the intermittently actuated

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part of the conveying means and the scrubbing of the vials on said intermittently actuated part of the conveying means;

FIGURE 7 is a fragmentary view of a discharging end of the continuously actuated part of the conveying means and illustrating the movement of advancement of the vials by said conveying means;

FIGURES 8 and 8A are views of the conveying means showing the conveying of the vials of smallest diameter;

FIGURE 9 is a rear elevational view with a rear wall removed and showing means for actuating the conveying means;

FIGURE 10 is a cross-sectional view, on an enlarged scale, taken on the line 10—10 of FIGURE 5 looking in the direction of the arrows to show the manner of imparting continuous circular movement to the continuously actuated part of the conveying means and a vial at the apex of its circular movement; and

FIGURE 11 is a fragmentary view of continuously actuated part of the conveying means showing a vial in its period of rest.

The embodiment of the invention is enclosed in a cabinet 12 supported in elevation by legs 13.

The vials are delivered from a suitable hopper, not shown, by a chute 14 to successive recesses 15 equidistantly spaced in the periphery of a pair of disks 16 fixedly mounted in spaced relation to each other on a shaft 17 rotatably mounted in the front and rear walls of the cabinet 12. The vials are retained in the recesses 15 against longitudinal movement by arcuate plates 18 and 19, the plate 18 being supported on a side wall of the cabinet 12 by a bracket 20, as shown in FIGURE 1, and the plate 19 being supported from the front wall of the cabinet 12 by a bracket 21, as shown in FIGURE 6. The vials are retained in the recesses 15 against radial movement by a pair of rails 22 mounted on the plates 18 and 19 by spacers 23, as shown in FIGURES 5 and 6. The ends of the rails 22 are tapered, as at 24 in FIGURE 5, with the upper tapered end terminating at the chute 14 and the lower tapered end terminating beyond the vertical center of shaft 17.

The disks 16 move the vials through a cleansing bath contained in a tank 25 adjustably supported by a hinged frame 26 to position the tank in spaced relation to the bottom of the cabinet 12 to wash the vials supported in the recesses 15, as shown in FIGURE 1, and adjust the tank out of the path of travel of the disks 16 to permit removal of the tank for changing the cleansing bath.

While the vials are submerged in the cleansing bath, they are scrubbed by brushes 27 moved into and out of the vials by a reciprocating carrier 28 operated in the manner described in my Patent No. 2,948,004. The brushes are move through openings in the plate 18, as shown in FIGURE 6.

After the vials have been scrubbed, they are moved by the disks 16 past the lower tapered end 24 to drop from the recesses 15 by gravity under the stripping action of an arcuate edge 29 at the lower end of a member 30 having the upper end bent laterally and secured to a beam 31 suspended in the cabinet 12, as shown in FIGURE 2. The disengaged vials are guided by the arcuate edge 29 into equidistantly spaced recesses 32 in the peripheries of a pair of disks 33 fixedly mounted in alignment with the disks 16 on a shaft 34 rotatably supported in bearings in the front and rear walls of the cabinet 12, as shown in FIGURE 2. The peripheries of the disks 33 are spaced from the peripheries of the disks 16 and the lower tapered ends 24 of the rails 22 terminate at the beginning of said space between the peripheries of the disks 16 and 33.

As shown in FIGURES 1, 2, 5 and 6, the disks 16 and 33 are provided with a multiple of recesses 15 and 32,

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such as fifteen recesses, respectively, which are of a width slightly larger than the diameter of the vials of largest diameter handled by the conveyor, as indicated at *v* in FIGURE 3. When it is desired to handle vials of smaller diameter, as indicated at *v'* in FIGURE 4, the disks 16 and 33 are replaced by pairs of disks 35 and 36, respectively, having a double multiple of recesses 37 and 38, such as thirty, respectively, as shown in FIGURE 8. To facilitate replacement of the disks 16 and 33 by the disks 35 and 36, all of the disks are transversely split, as shown at 39, and mounted on hubs 40 secured to the shafts 17 and 34 by tapered pins 41, as shown in FIGURES 6 and 8.

Simultaneous intermittent movement is imparted to the disks 16 and 33 or disks 35 and 36 from power means, such as an electric motor 42, mounted on a platform 43 supported by the legs 13 below the cabinet 12, as shown in FIGURE 1. The motor 42 is connected by a belt 44 to a drive shaft 45 rotatably supported in bearings 46 in the side walls of the cabinet 12. The drive shaft 45 is connected by beveled gearing 47 to a shaft 48 rotatably supported in a bearing 49 in the rear wall of the cabinet 12 and in a bearing 50 supported by a transverse tie member 51 secured to the front and rear walls of the cabinet 12, as shown in FIGURE 2. Continuous rotation of the shaft 48 is converted into intermittent rotation of the shaft 34 by a cam 52 secured on the shaft 48 and an arm 53 rotatably mounted on the shaft 34 and having a roller or follower 54 yieldingly urged into engagement with the cam 52 by a spring 55 connected to the free end of the arm 53 and anchored to a side wall of the cabinet 12, as shown in FIGURES 1, 2 and 9. The arm 53 is provided with a pawl 56 yieldingly urged into engagement with a ratchet wheel 57 fixedly mounted on the shaft 34. The pawl 56 is yieldingly urged into engagement with the ratchet wheel 57 by a spring 58 anchored at the opposite ends to pins extended from the arm 53 and the pawl 56, as shown in FIGURES 1 and 2. To hold the shaft 34 against movement during the retrograde movement of the pawl 56 over the ratchet wheel 57, there is provided a detent wheel 59 fixedly mounted on the shaft 34 having notches 60 engaged by a roller 61 mounted on an arm 62 rotatably mounted on a bracket 63 secured to the bottom of cabinet 12. The roller 61 is yieldingly urged into engagement with the notches 60 by a spring 64 connected to the free end of the arm 62 and anchored to a side wall of the cabinet 12, as shown in FIGURE 1. The roller 61 is moved out of the path of travel of the notches 60 while the pawl 56 is advancing the ratchet wheel 57. This is accomplished by a cam 64' fixed on the shaft 48 and a follower or roller 65' on the arm 62 yieldingly urged into engagement with the cam 64' by the spring 64. The shaft 34 is prevented from being rotated by the pawl 56 and the ratchet wheel 57 beyond its predetermined distance by an overthrow brake 67 supported by the front wall of the cabinet, as shown in FIGURE 2.

The ratchet wheel 57 and the detent wheel 59 are of the same diameter and arranged with the same number of recesses or notches corresponding to the number of recesses 15 and 32 in the disks 16 and 33, respectively.

The intermittent rotation of the shaft 34 is transmitted to the shaft 17 by meshing spur gears 65 fixed to the ends of said shaft projecting from the rear wall of the cabinet 12, as shown in FIGURES 2 and 9.

The vials *v* or *v'* are delivered by the disks 33 or 36 to a pair of rack bars 66 supported by transverse members 68 mounted on the bottom of the cabinet. The upper edge of each rack bar 66 is provided with equidistantly spaced V-shaped notches 69 formed by inverted V-shaped teeth 70 having the apexes flattened, as at 71 in FIGURES 5, 7, 8 and 8A. The rack bars 66 are spaced from each other with the vial receiving ends extended between the disks 33 or 36 so that the first notches 69 at said ends receive successive vials from the recesses

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32 or 38, as shown in FIGURES 5 and 8. The notched edges of the rack bars 66 at the vial delivering ends thereof are arranged with a straight surface 72 extending in the same horizontal plane of a vial discharging platform 73, as shown in FIGURES 7 and 8A. The vial discharging platform 73 delivers the vials to a suitable depository or to apparatus for filling the vials with a medicament, not shown. The tooth of each rack bar adjoining the straight surface 72 is of greater length and is arranged with a pointed apex, as shown at 73' in FIGURES 7 and 8A. The straight surface 72 and the adjoining portion of the tooth 73' of each rack bar 66 are in a horizontal plane below the bottoms of the notches 69, as shown in FIGURES 7 and 8A, for a purpose to be hereinafter described.

The vials are retained in the notches 69 of the rack bars 66 against lateral or longitudinal movement by guide rails 74 and 75 mounted on the outsides of the rack bars 66 and the disks 33 or 36 as continuations of the plates 18 and 19, respectively. The rail 74 is suspended from the beam 31, as shown in FIGURES 2 and 5, and the rail 75 is supported by slide blocks 76 adjustably mounted on arms 77 fixed on the front wall of the cabinet 12, as shown in FIGURE 2, to adjust the rail 75 from and toward the rail 74 for guiding vials of different lengths. The rack bar 66 adjacent to the guide rail 75 is adjustably mounted on the transverse members 68 to be adjusted corresponding to the adjustment of the guide rail 75.

The vials are intermittently advanced to successive notches 69 of the rack bars 66 by a second pair of rack bars 78 mounted on the insides of the rack bars 66 by blocks 79 rotatably supported on pins 80 eccentrically fixed in circular heads 81 concentrically fixed on shafts 82 rotatably supported in standards 83 mounted on the bottom of the cabinet 12, as shown in FIGURES 1, 2, 5, 9 and 10. The shafts 82 are continuously rotated from the shaft 48 by a sprocket chain 84 engaging a sprocket wheel 85 on said shaft 48 and sprocket wheels 86 on the shafts 82, as shown in FIGURES 2 and 9. Slack in the chain 84 is taken-up by an idle sprocket wheel 87 rotatably supported on the outside of the rear wall of the cabinet 12. The spur gears 65, sprocket chain 84 and sprocket wheels 85, 86 and 87 are mounted on the outside of the rear wall of the cabinet 12 and enclosed in a housing 88 closed by a removable cover plate 89, as shown in FIGURE 2.

The rack bars 78 are provided with equidistantly spaced notches 90 formed by teeth 91 having pointed apexes except at the vial delivering end of each rack bar 78 where a tooth 92 is provided with a flattened apex 93 and a straight vertical rear face 94 adjoining a straight horizontal surface 95 ending in a tooth having an inclining front face 96, a rounded apex 97 and a straight vertical rear face 98 forming part of the vial delivering end edge of each rack bar 78, as shown in FIGURE 7, whereby more than one vial is supported on the straight surface 72 of each rack bar 66 without jamming said vials.

The vials *v* of largest diameter are conveyed as shown in FIGURES 1, 2, 5, 6, 10 and 11 by the disks 33 transferring successive vials *v* on said disks 33 to the notches 69 of the rack bars 66 while the rack bars 78 are in position *a*, as shown in FIGURE 7, and the disks 33 deliver the vials *v* to said notches 69 at a rate of speed in relation to the rate of circular movement of the rack bars 78 so that the rack bars 78 will move one vial *v* to alternate notches 69 of the rack bars 66 during the successive positions *b*, *c* and *d* of the rack bars 78, as shown in FIGURE 7.

The vials *v'* of smallest diameter are conveyed as shown in FIGURES 8 and 8A by the disks 36 delivering vials *v'* to the rack bars 66 while the rack bars 78 are in position *a* of FIGURE 7 at a rate of speed in relation to the rate of circular movement of the rack bars 78 so that the rack bars 78 will move two vials to adjacent

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notches 69 of the rack bars 66 during the successive positions *b*, *c* and *d* of the rack bars 78.

While the vials *v* and *v'* are at rest on the rack bars, which occurs when the rack bars 78 are in positions *a* and *d* of FIGURE 7, said vials are first subjected to streams of water injected into the vials through openings 99 equidistantly spaced in a part of the guide rail 74 adjacent to the disks 33 or 36. The openings 99 are in communication with a jacket, not shown, supported on the outside of the guide rail 74 and connected to a supply of a rinse, such as hot water, not shown. After the vials are subjected to the streams of hot water to remove the cleansing substance, such as a detergent, from the vials, the vials are subjected to streams of a drying fluid, such as compressed air supplied from an air compressor, not shown, to equidistantly spaced openings 99' in a part of the guide rail 74 following the part of the guide rail 74 provided with the openings 99.

After the vials *v* have been dried, they are presented to the delivery end of a chute 100 supported by a bar 101 suspended in the cabinet 12, as shown in FIGURE 1. The chute 100 delivers plungers *p* (FIGURE 3) from a hopper, not shown, to a vial *v* on the rack bars 66 and during the period of rest of the vials *v* on said rack bars 66, the lowermost plunger in the chute 100 is inserted by a rod 102, indicated in a general way in FIGURE 1, and actuated in the manner described in my Patent No. 2,948,004.

After the vials *v'* have been dried, they are presented to the delivery ends of a pair of chutes 100' supported by the bar 101. The chutes 100' deliver plungers *p'* (FIGURE 4) to spaced vials *v'* on the rack bars 66 and during the period of rest of the vials *v'* on said rack bars 66, the lowermost plungers *p'* in the chutes 100' are simultaneously inserted by a pair of rods similar to the rod 102 and actuated in the same manner, as shown in FIGURE 8.

The plungers *p* or *p'* are coated with a lubricant to facilitate insertion into the vials *v* or *v'*.

After the plungers *p* or *p'* have been inserted in the vials *v* or *v'*, the lubricant is removed from the vials to render the vials clean and in condition to be filled with a medicament. This is accomplished by successively presenting each vial having a plunger inserted therein in horizontal alignment with a series of nozzles, indicated in a general way at 103 in FIGURES 1 and 8A, mounted in a carriage 104 slidable on a base 105 mounted on the interior of the front wall of the cabinet 12. The nozzles 103 are grouped in pairs and each pair of nozzles is connected in communication with a supply of suitable cleansing materials, such as hot water, distilled water and silicon. In FIGURE 1, there are shown three pairs of nozzles. The first pair is connected by hoses 106 to a source of hot water. The second pair of nozzles is connected to a source of distilled water by hoses 107. The third pair of nozzles is connected by hoses 108 to a source of air under pressure. In FIGURE 8A, there are shown six pairs of nozzles 103. The first three pairs are connected by hoses 106, 107 and 108 to a source of hot water, a source of distilled water and a source of air under pressure. The fourth pair of nozzles 103 is connected by hoses 109 to a source of silicon. The fifth and sixth pairs of nozzles are connected by hoses 110 to a source of air under pressure.

After the vials are cleaned, they are advanced to the notches 69 of the rack bar 66 in front of the teeth 73' and advanced by the vertical straight edges 94 of the rack bars 78 to the straight surfaces 72 of the rack bars 66. Finally the vials on the straight surfaces 72 are advanced to the platform 73 by the vertical straight edges 98 of the rack bars 78, as clearly shown in FIGURES 7 and 8A.

As hereinbefore described, the guide rail 75 and the rack bar 66 nearest said guide rail 75 are adjusted toward and away from the guide rail 74 and the rack bar 66 nearest said guide rail 74 to accommodate vials of dif-

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ferent lengths. To accommodate vials *v* or *v'* of different diameters, it is necessary to raise both rack bars 66 to a higher horizontal plane when the rack bars 66 are supporting vials *v'* than the horizontal position of the rack bars 66 when they are supporting the vials *v* to properly position the vials in the horizontal position relative to the openings 99 and 99', the rods 102 and the nozzles 103. This is accomplished by placing shims between the rack bars 66 and the transverse members 68, as shown at 111 in FIGURES 8 and 8A.

Having thus described my invention, I claim:

1. Means for intermittently conveying vials in horizontal position comprising a first pair of rack bars having notches on one edge of each bar and fixedly mounted in spaced relation to each other with the notches uppermost to support the vials during periods of rest in the conveying of the vials, and a second pair of rack bars having notches in one edge of each bar of said second pair and mounted in spaced relation to each other and to the first pair of rack bars with the notches uppermost, and a pair of cranks connected to spaced intermediate portions of the second pair of rack bars and continuously rotated to impart simultaneous circular movement in vertical planes to the second pair of rack bars to lift the vials from the first pair of rack bars and advance the vials to successive notches in the first pair of rack bars, said first pair of rack bars having a vial receiving end, a hopper chute extending in a substantially vertical plane adjacent said receiving end supporting the vials in superposed horizontal planes, a first pair of discs mounted in spaced relation to each other and having equidistantly spaced recesses to successively engage and remove the lowermost vial from the hopper chute, a second pair of discs rotatably mounted in alignment with the first pair of discs and adjacent the vial receiving end of the first pair of rack bars and having equidistantly spaced peripheral recesses to receive the vials from the first pair of discs and deliver them to the notches of the first pair of rack bars.

2. Means for intermittently conveying vials in horizontal position as claimed in claim 1, wherein one rack bar of the first pair of rack bars is adjustably mounted to provide adjustment of said rack bar toward and away from the other rack bar of the first pair of rack bars to accommodate vials of different lengths.

3. Means for intermittently conveying vials in horizontal position as claimed in claim 1, wherein the second pair of rack bars is provided with a vial discharging end having a notch arranged with a straight surface to facilitate the discharge of the vials from said rack bars, and the remaining notches of the second pair of rack bars being of V-shape to retain the vials on the second pair of rack bars during the advancing of the vials to successive notches of the first pair of rack bars.

4. Means for intermittently conveying vials in horizontal position as claimed in claim 1, wherein the first pair of rack bars is provided with a vial discharging end, the notched edge of the first pair of rack bars at the vial discharging end being arranged with a straight surface, a tooth adjacent to said straight surface forming part of a notch and provided with a pointed apex, and the remaining notches of the first pair of rack bars being formed by teeth having flattened apices to facilitate advancement of the vials by the second pair of rack bars.

5. Means for intermittently conveying vials in horizontal position as claimed in claim 1, power means operatively connected to the pair of cranks to impart continuous circular movement to said second pair of rack bars and operatively connected to both pairs of disks to simultaneously impart intermittent movement to both pairs of disks.

6. Means for intermittently conveying vials in horizontal position as claimed in claim 1, wherein the peripheries of the pairs of disks are spaced apart, arcuate guide rails extending around the peripheries of the first pair of disks from the hopper chute to the space between the

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pairs of disks to retain the vials in recesses of the first pair of disks and permit the transfer of the vials from the first pair of disks to the second pair of disks.

7. Means for intermittently conveying vials in horizontal position as claimed in claim 4, wherein the first pair of rack bars is provided with a vial discharging platform adjoining the vial discharging end thereof, and the vial discharging end of said first pair of rack bars being provided with a straight surface on the notched edge extending flush with the vial discharging platform.

8. Means for intermittently conveying vials in horizontal position as claimed in claim 5, wherein each disk of both pairs of disks is arranged with a plurality of recesses, and the power means imparts continuous circular movement to the second pair of rack bars and intermittent movement to both pairs of disks in a ratio to cause the second pair of rack bars to advance the vials to successive alternate notches in the first pair of rack bars.

9. Means for intermittently conveying vials in horizontal position as claimed in claim 5, wherein each disk of both pairs of disks is arranged with a double multiple of recesses, and the power means imparts continuous circular movement to the second pair of rack bars and intermittent movement to both pairs of disks in a ratio to cause the second pair of rack bars to advance the vials to successive notches in the first pair of rack bars.

10. Means for intermittently conveying vials in horizontal position as claimed in claim 5, wherein the pairs of disks are operatively connected to each other, and the

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power means is operatively connected directly to the second pair of disks.

11. Means for intermittently conveying vials in horizontal position as claimed in claim 6, a member extending between the disks of the first pair of disks and having an arcuate edge to engage and remove successive vials in the recesses of the first pair of disks to the recesses of the second pair of disks.

12. Means for intermittently conveying vials in horizontal position as claimed in claim 8, wherein the multiple recesses in the pairs of disks consist of fifteen.

13. Means for intermittently conveying vials in horizontal position as claimed in claim 9, wherein the double multiple recesses in the pairs of disks consist of thirty.

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