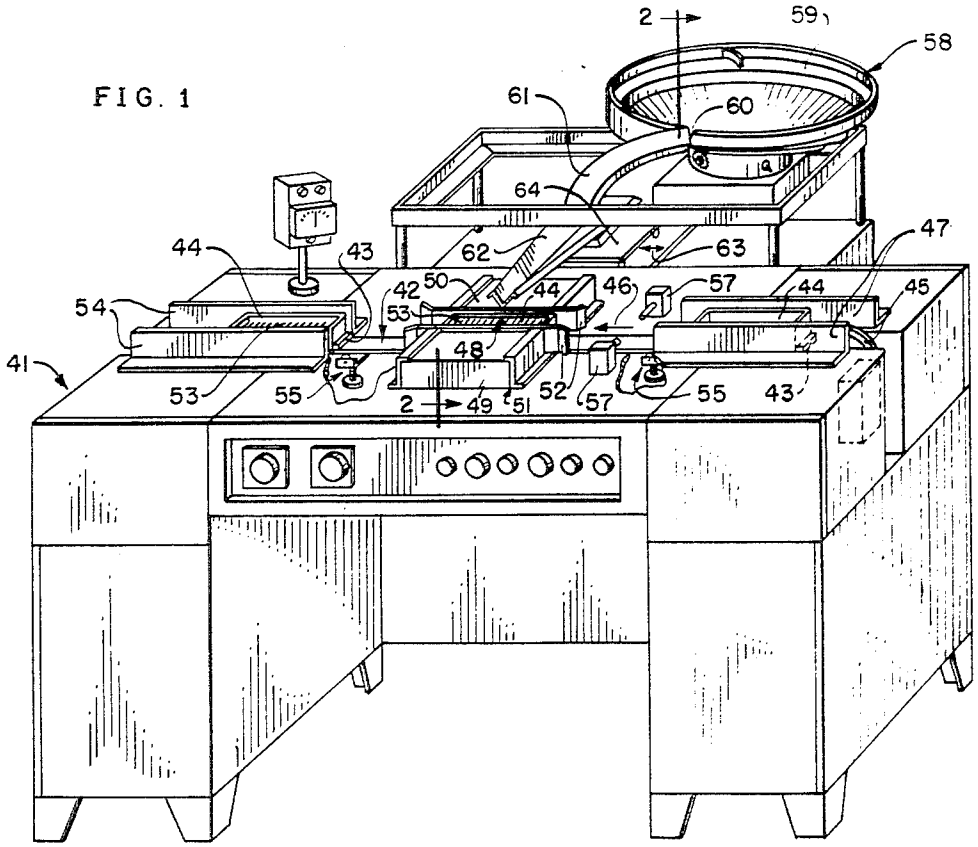
Oct. 21, 1969 A. K. LITTWIN 3,473,287

MAGNETICALLY AND ELECTRICALLY CONTROLLED MEASURING AND PACKAGING APPARATUS AND METHOD

Filed Jan. 12, 1967 3 Sheets-Sheet 1

FIG. 1



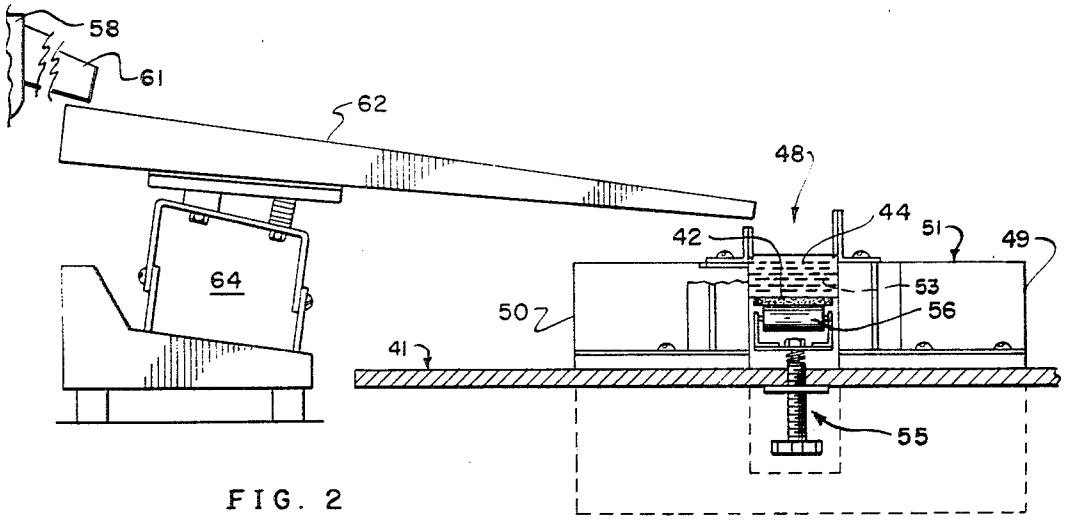


FIG. 2

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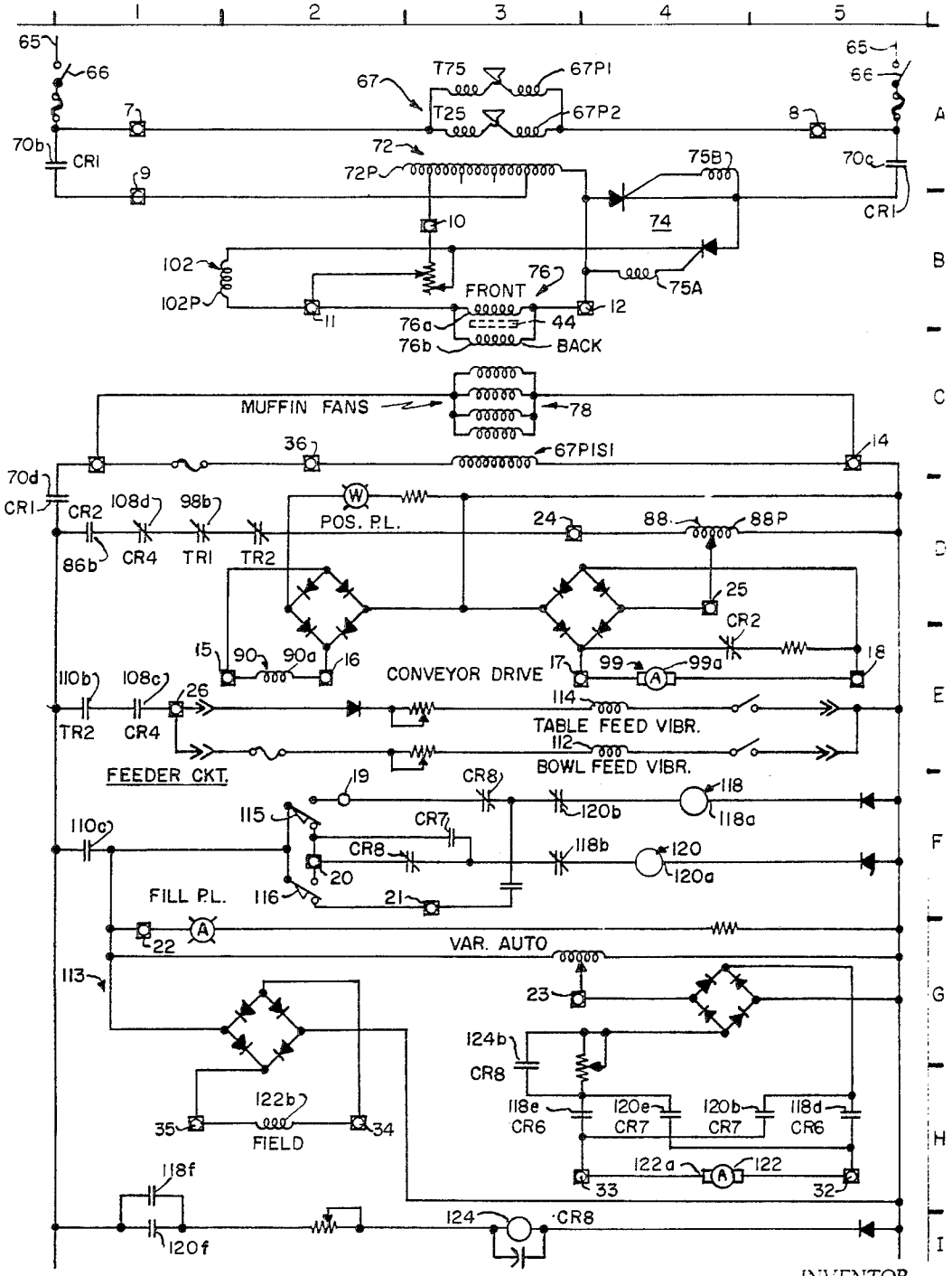

TERMINAL CODE

△ — AC VARIABLE STAGE

○ — BOX POS. TIMER & PHOTO CELL STAGE

□ — SENSING AMP. & TRIGGER STAGE

⊡ — INTERMEDIATE CONNECTIONS

FIG. 3A

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Filed Jan. 12, 1967 3 Sheets-Sheet 3

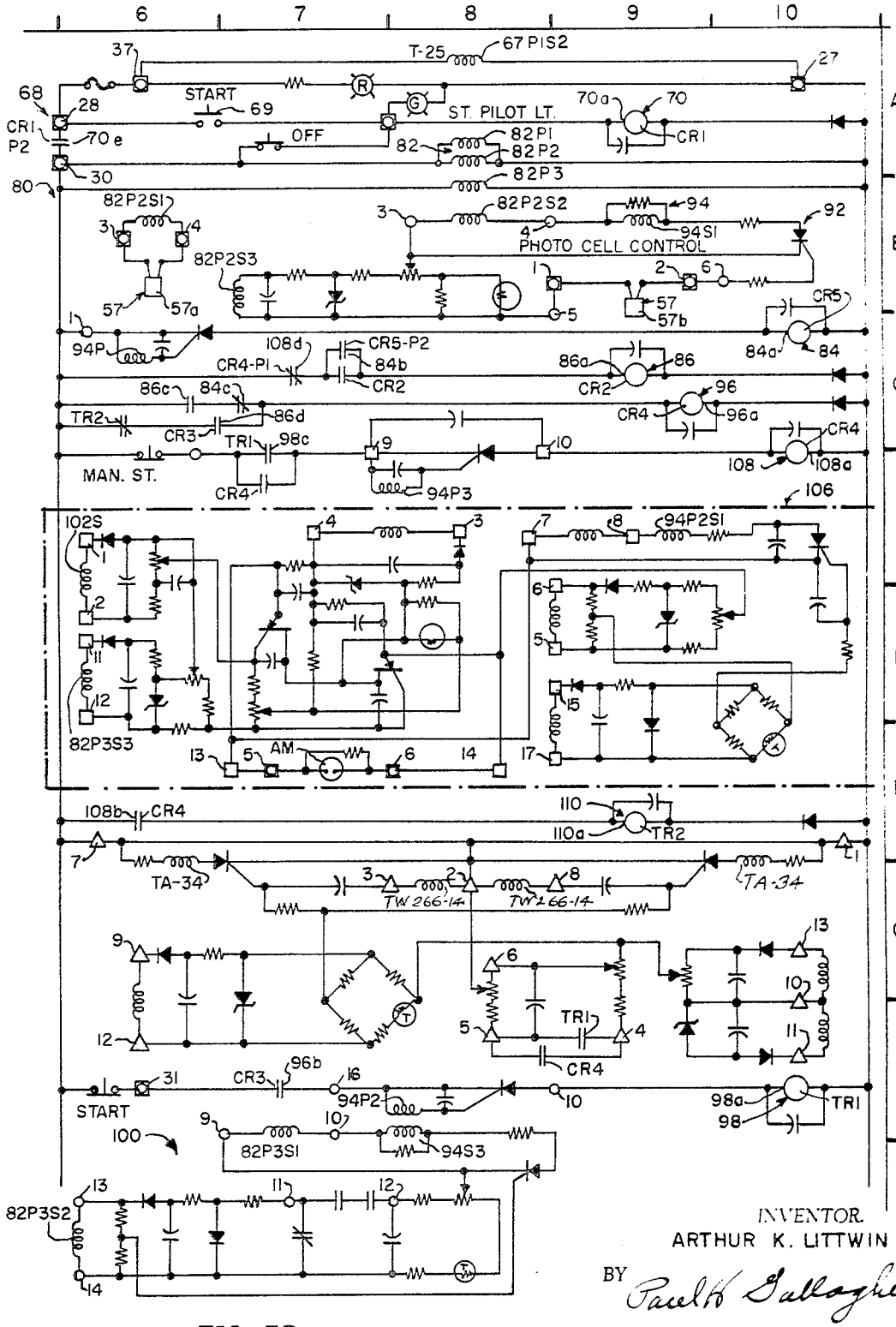

FIG. 3B

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3,473,287

MAGNETICALLY AND ELECTRICALLY CONTROLLED MEASURING AND PACKAGING APPARATUS AND METHOD

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Int. Cl. B65b 57/20, 35/56, 19/34
U.S. Cl. 53—35 16 Claims

ABSTRACT OF THE DISCLOSURE

The apparatus and method of the invention are particularly adapted for packaging articles that are magnetic, and electrically conductive. Such articles may be any of various kinds, one representative item being pieces of tubes used in the manufacture of hypodermic needles. These pieces are small, and inserted in a box or carton in a progressive manner and in the packaging operation it is desired of course that the needles all be oriented in the same direction. However, in the operation of packaging such small articles it heretofore has been difficult to orient them in a certain direction because of the speed at which they are produced and the fact that they are inserted in the box at a relatively rapid rate.

An object of the present invention is to provide apparatus and method for packaging articles of the character referred to including a novel arrangement utilizing magnetic forces for aligning the articles in the box as the articles are being inserted thereinto, so that they are all oriented in the desired predetermined position.

Another difficulty or problem encountered in packaging of this general kind as previously performed is that the counting or measuring of such articles has been difficult, particularly in the case of small articles.

Another object therefore of the present invention is to provide novel apparatus and method for packaging articles of the character indicated and in which current is flowed through the articles in the box as it is being filled, the reactance of the current varying according to the number of articles in the package, and electrical control apparatus is control by the varied reactance so as to interrupt the filling means pursuant to the articles in the box reaching a predetermined number.

Other detail objects of the invention are to provide specific advantageous construction and arrangement which include a conveyor for conveying the boxes to be filled and a photoelectric cell controlled by the boxes in the filling operation which in turn controls the filling apparatus.

Another detail object is to provide a novel spout arrangement for directing the articles into the box.

Still another object is to provide a spout for the purpose stated involved in a novel arrangement in which the spout both travels in a reciprocating manner for spreading the articles in the box and is vibrated for expediting the passage of the articles therethrough.

A further object is to provide a novel arrangement for controlling the movement of the boxes along the conveyor which utilizes positive engagement means on the conveyor for engaging the boxes, and friction retarding arrangement for assuring the boxes being engaged by the positive means on the conveyor.

A still further object is to provide apparatus and method of the foregoing character utilizing magnetic forces for aligning the articles in the box, and utilizing a novel arrangement for later demagnetizing the articles in the box to substantially eliminate the magnetism imposed thereon by the magnetic forces.

Other objects and advantages of the invention will appear from the following detail description taken in conjunction with the accompanying drawings wherein—

FIGURE 1 is a perspective view of apparatus made according to the present invention;

FIGURE 2 is a sectional view taken at line 2—2 of FIGURE 1;

FIGURE 3A is one-half of a diagram of the electrical circuit utilized in the apparatus; and

FIGURE 3B is the other half of the electrical circuit.

In the diagram of FIGURES 3A and 3B certain numbers are utilized to correlate mutually related elements, and not as reference numerals in the following description; these numbers progress to **38** while the reference numerals in the description begin with **41**.

Referring particularly to FIGURE 1, the apparatus includes a base **41** in the form of a cabinet utilized for enclosing many of the operating components. Mounted in the apparatus is a conveyor indicated in its entirety at **42** preferably in the form of a flat belt having a plurality of cleats **43** for positively engaging the boxes or cartons **44** in which the articles are packaged. The belt is trained on pulleys **45** driven by suitable means within the cabinet (see description of circuit of FIGURE 3), and moves as indicated by the arrow **46**, or from right to left as viewed in FIGURE 1. The box **44** is placed in position on the conveyor between a pair of side wall elements or flanges **47** which are so positioned as to provide frictional retardation of the movement of the box so that the cleats **43** will engage the box and carry it along positively, to carry out a triggering step to be referred to hereinbelow.

The box is carried to a filling station indicated generally at **48** where it is filled, the conveyor stopping for so positioning the box. The box in its filling position is disposed between magnetic poles **49** and **50** of an electromagnet **51**, which provide magnetic forces for aligning the articles in the box, and adjacent the poles **49** and **50** are wall elements or flanges **52** functioning in a manner similar to the wall elements **47**. After the box is filled it is carried away from the filling station, to a position at the left, where it is shown filled with articles **53** which will be referred to again. At this position also side wall elements or flanges **54** may be provided for controlling and confining the filled box. Preferably the wall elements **47**, **52**, and **54** are adjustable respectively toward and from each other, to accommodate boxes of different sizes. The boxes may be inserted in place and removed therefrom automatically, or manually, as desired. The top run of the conveyor belt may be adjustably positioned vertically by height adjustment means **55** of suitable kind, including for example rollers **56** (FIGURE 2) which directly engage the belt. Photoelectric cell means indicated generally at **57** is provided with elements on opposite sides of the conveyor between which the boxes pass for controlling the movement of the conveyor as well as the feeding means referred to below.

The articles **53** shown in the box at the left of FIGURE 1 may be, as indicated above, steel articles such as small diameter steel tubes utilized in making hypodermic needles. The invention is not limited to use with steel tubes, but is applicable to packaging any of a wide variety of articles that are magnetic and electrically conductive.

In the filling operation, the articles to be packaged are inserted in a vibratory bowl feeder **58** of known kind in the operation of which the articles progress up a peripheral inclined ramp **59** and emerge through an opening **60** into a transfer trough **61**. The articles emerging from the transfer trough then move into a feeder trough or spout **62** from which they drop into the box at the filling sta-

tion 48. The bowl feeder assembly 58 is vibrated, as indicated, in a known manner and means is also provided for vibrating the transfer trough 61 and the feeder trough 62 together with the bowl feeder, for moving the articles from the bowl feeder into the box.

In addition to the vibration imparted to the feeder trough or spout 62, this member is also reciprocated transversely as indicated by the double headed arrow 63. This spout is mounted on a reciprocating table 64 of suitable construction and the table is reciprocated by suitable means not shown in FIGURE 1 but included in the circuit diagram of FIGURES 3A and 3B, for distributing the articles transversely of the apparatus and throughout the length of the box at the filling station. The reciprocating means may be of any suitable kind, adjustable for varying its range of reciprocation to accommodate boxes of different lengths. The transfer trough 61 may be pivoted at its upper end to accommodate the relative movement between the spout and the stationary bowl feeder 58.

FIGURE 2 shows certain of the structural elements of the apparatus of FIGURE 1 and particular attention is directed to the magnet poles 49, 50 in relation to the box at the filling station. The poles set up a magnetic field through the articles 53 in the box and align them directly transversely across the box so that they lie in an even and uniform stack. Even if the articles should tend to assume other positions in falling into the box, the magnetic forces set up align them quickly and accurately across the box in the intended position.

Attention is now directed to the circuit diagram of FIGURES 3A and 3B. For ease in locating the various elements in the circuit, the diagram is provided with coordinates on the margins, utilized in the description below to indicate the locations of the elements. A main line is shown at 65 (A–1, 5) having switches 66 (A1, 5) therein, and upon closure thereof circuit is completed through a transformer means 67 (A–3). This transformer means, as well as all of the other transformer means to be referred to later, may include single windings, or multiple windings, as preferred; in some instances a transformer includes a single winding as preferred for practical consideration, but shown as multiple windings in the diagram for convenience in analysis of the circuit. In the case of all of the transformers referred to herein each complete transformer will be identified with a reference numeral while the primaries and secondaries thereof are identified by the same reference numerals with the letters P and S respectively.

The transformer 67 includes primaries 67P1 and 67P2 (A–3) and upon energization of the transformer, the secondary 67P1S2 (A–8) energizes the circuit 68 (A–6) which includes a start switch 69 (A–6) thereacross, this start switch being utilized to initiate operation of the apparatus. Upon the start switch 69 being thus closed, a relay 70 (A–9) is energized, having a coil 70*a* (A–9) which closes contacts 70*b* (A–1) and 70*c* (A–5) which in turn energize transformer 72 (A–3) the multi-tap primary 72P thereof (A–3) being connected across the main line 65 (A1, 5) in series with back-to-back semi-conductors or SCR's 74 (B–4). Closure of the relay contacts 70*b* (A–1), 70*c* (A–5) also energizes magnetizing-demagnetizing winding 76 (B, C–3) including in the present instance separate winding 76*a* (B–3) and 76*b* (C–3) associated with the magnetic poles 49, 50 (FIGURE 1) respectively. Energization of the windings 76 sets up a magnetic circuit in the poles 49, 50 for magnetizing the articles or needles for aligning them in the box at the filling station, and later demagnetizing them.

Energization of the relay 70 (A–9) also closes contacts 70*d* (D–1) which puts in circuit the secondary 67P1S2 (A–8) and it also energizes various motor windings 78 (C–3) of cooling fans in the apparatus.

Energization of the relay 70 (A–9) closes contacts 70*e* (A–6) which completes circuit to all of the righthand portion of the diagram below those contacts, and identified 80. This energizes transformer means 82 (A–8) which for convenience includes primaries 82P1 (A–8), 82P2 (A–8) and 82P3 (B–8). Thereupon relay 84 (C–10) is energized closing contacts 84C (C–7) which in turn energize relay 86 (C–9) in series therewith. The relay coil 86*a* (C–9) thereupon closes contacts 86*b* (D–1) which sets up circuit through auto transformer 88 (D–4) having a primary 88P (D–4) in series with those contacts. Closure of these contacts also completes circuit through the motor 90 (E–4) driving the conveyor 42 (FIGURE 1). Upon the conveyor being thus driven, a box 44 is placed thereon between the side flanges 47 at the right of FIGURE 1, and fitted down tight onto the conveyor, whereby a cleat 43 engages the box and carries it therealong. As the box thus travels along the conveyor it passes between the elements of the PE cell means 57, the components 57*a* and 57*b* thereof being shown in the circuit of FIGURE 3B (B–6 and B–9). The light source 57*a* (B–6) is energized by a secondary 82P2S2 (B–8) and 82P2S3 (B–7) in a PE cell control indicated in its entirety at 92 (B–10). Also in this PE cell control is the secondary 94S1 (B–9) of a transformer 94 (B–9) having a primary 94P (C–6) in series with the relay coil 84 (C–10). Upon the box interrupting the beam to the PE cell and de-energization of the transformer 94 (C–6), the relay coil 84*a* (C–10) is de-energized, whereupon the contacts 84*c* (C–7) close, energizing relay 96 (C–9) having a coil 96*a* (C–9) in series with those contacts. At this point the relay 86 (C–9) remains energized, closing the contacts 86*c* (C–6) in series with the relay 96 (C–9). The relay 96 is held energized by the holding contacts 86*d* (D–6). After the box passes the PE cell position, the light beam is of course reactivated and relay 84 (C–10) is again energized. A timing phase is thus initiated through the control of this relay and the relay 96 (C–9), i.e., upon de-energization of the relay 84 (C–10), the relay 96 (C–9) is energized through contacts 84*c* (C–7) and closes contacts 96*b* (H–7) and energizes primary 94P2 (H–8) and thereby energizes a timing relay 98 (H–10) having a coil 98*a* (H–10) in series with that primary. Energization of this coil opens normally closed contacts 98*b* (D–1) which opens circuit to the conveyor drive and stops it with the box at the filling station. This timing control is provided by a sub-circuit indicated generally at 100 (H–6) having a secondary 82P3S1 (H–7) and another secondary 94S3 (H–8). Another secondary 82P3S2 (I–6) is provided in this sub-circuit.

A transformer 102 (B–2) has a primary 102P (B–2) and a secondary 102S (D–6) which controls an amplifier in turn controlling a sensing triggering circuit indicated in its entirety at 106 (D–10). Energization of the timing relay 98 (H–10) referred to above also closes the contact 98*c* (D–7) thereby energizing relay 108 (D–10) and closing contacts 108*b* (F–6) which in turn energize timing relay 110 (F–9) in series therewith. These two relays 108 (D–10), 110 (F–9) close contacts 108*c* (E–1), 110*b* (E–1) and energize a bowl feed vibrator 112 (E–4) and a table feed vibrator 114 (E–4), the former vibrating the bowl 58 (FIGURE 1) and the latter vibrating the feed spout 62. Additionally upon energization of the relay 110 (F–9), contacts 110*c* (F–1) are closed, energizing, or conditioning to be energized, a sub-circuit 113 (G–1) for driving the table 64 (FIGURE 1) in reciprocatory movements for carrying the feeding spout 62 back and forth across the length of the box. The table actuates cam switches 115 (F–2), 116 (F–2) respectively at the end of its range of movement thereby selectively controlling relays 118 (F–4) and 120 (F–4) which include respectively contacts of the same numerals followed by subscripts *b*, *c*, etc., the circuit including a motor 122 (H–4) for driving the table, the motor including the components 122*a* (H–4), 122*b* (H–2) as indicated. Upon reciprocation of the table the motor is reversed through the control switches 115 (F–2), 116 (F–2) and the relays 118 (F–4), 120 (F–4). Upon closing of the contacts 118*f* (I–1), 120*f* (I–1), the relay

124 (I–3) is energized, for accelerating the drive of the table, this relay including contacts **124***b* (G–3).

Vibration of the bowl **58** (FIGURE 1) and of the spout **62** feeds the articles or needles into the box at the filling station and, as the box fills, the increase in the quantity of the articles in the box increases the reactance in the magnetizing coils **76***a* (B–3) and **76***b* (C–3) which is correspondingly reflected in a reduction of voltage in the primary **102P** (B–2), and the latter in turn reduces the voltage in the secondary **102S** (D–6). Thereupon, the secondary **102S** (D–6) and another secondary **82P3S3** (E–6) set up a null to the input of the amplifier, and the output of the amplifier sets up a null to the input of the sensing triggering circuit **106** (D–10). Thereupon the relay **108** (D–10) is de-energized, through transformer windings **94P2S1** (D–9) and **92P4** (D–7). De-energization of the relay **108** (D–10) enables the contacts **108***c* (E–1) to open, de-energizing the vibrators to the bowl feed and table feed. Also the contacts **108***b* (F–6) are open, deenergizing the relay **110** (F–9) which permits the contacts **110***c* (F–1) to open, de-energizing the subcircuit **113** (G–1) and terminating the reciprocating drive to the table **64**. Additionally de-energization of the relay **108** (D–10) enables the contacts **108***d* (D–1) to close, again energizing the conveyor drive motor **90** (E–4,2) and driving the conveyor. The travel of the conveyor brings a new box from between the flanges **47** across the PE cell means **57**, and the foregoing cycle is repeated.

The magnetizing-demagnetizing windings **76***a* (B–3), **76***b* (C–3) produce an AC magnetic force. In the filling of the box, the articles or needles are magnetized in alternate polarity in successive AC cycles and thereby held in aligned position across the box as they drop thereinto. The magnetic effect in either direction does not persist, thereby eliminating any tendency to draw the articles to one side with such force as would turn them sideways and render it difficult to re-align them. Because of the reversal of polarity according to the AC, any tendency to draw the articles to one side of the box excessively, is quickly counteracted by a similar tendency to draw them to the other side, with the result that they remain oriented with their ends directed toward the respective magnetic poles and thus perfectly aligned crosswise in the box.

The windings **76** (B–3) also produce a de-magnetizing effect when they are de-energized to zero, or near zero, value of current, being shut off by the SCR arrangement **74** (B–4), the windings **75***A* (B–4) and **75***B* (A–4) being regulated to shut off at the desired value near zero, in a known manner. Thus the magnetic effect utilized for aligning the articles in the box is neutralized by the timely shutting off of the magnet under the control of the transistor arrangement **74**.

The circuit incorporates the novel features of aligning the articles **53** by magnetic forces, and then demagnetizing them and utilizing the reactance produced by the mass of articles which are incorporated in the electrical circuit, for shutting off the filling operation when the box is filled to a predetermined level. It will be understood that in the use of the articles as in making hypodermic needles, as well as in many and most other operations, it is desired that those articles be free of magnetism, or relatively free thereof, to facilitate their handling in the various manufacturing steps.

While I have herein disclosed a certain preferred form of the invention, it will be understood that changes may be made therein within the spirit and scope of the appended claims.

I claim:

1. Apparatus of the character disclosed comprising means for conveying a box along a predetermined path to a filling station, filling means for placing magnetic articles in the box at the filling station, and magnet means including AC circuit means having pole members on opposite sides of the box at the filling station and operative for reversibly magnetizing the articles and thereby aligning them in direction between the magnet members.

2. Apparatus according to claim **1** and including means for demagnetizing the articles after the filling operation, said demagnetizing means including said AC circuit and operative for applying AC to the articles.

3. Apparatus according to claim **2** wherein the magnet means is an electromagnet, and including means for reducing the current therein.

4. Apparatus of the character disclosed comprising means for conveying a box along a predetermined path to a filling station, electrically controlled filling means for inserting electrically conductive articles in the box at the filling station, circuit means, means controlled by the articles in the box for varying current flowing through said circuit means, and control means responsive to the varied current operative for shutting off the filling means upon the articles reaching a predetermined quantity in the box.

5. Apparatus according to claim **4** wherein the means for terminating the filling operation is operative for so terminating it in response to the value of the current flowing through the circuit means being reduced to a predetermined value, the current being reduced as the box is filled.

6. Apparatus according to claim **5** and including reactance means interposed in said current and including a transformer winding, the reactance of said reactance means decreasing pursuant to the quantity of articles in the box increasing, and means responsive to said decrease in reactance for shutting off the filling means.

7. Apparatus according to claim **6** and including a circuit having an electromagnet with windings associated with poles defining a gap at the filling station, the box at the filling station being disposed in the gap, said circuit including a reactance winding in series with the pole windings, the articles upon being deposited in the box varying the reactance in said reactance winding, and upon increase of the articles decreasing the reactance, the shutting off means including a winding forming a transformer secondary with said reactance winding, and relay means responsive to reactance variations in the secondary winding for shutting off the filling means.

8. Apparatus of the character disclosed comprising a frame, a conveyor for carrying boxes to a filling station, electrically controlled means for filling a box with elongated electrically conductive articles at the filling station including a spout having a discharge end at the box, magnet means for aligning the articles in mutually parallel position in the box and in a predetermined relation thereto, means for reciprocating the discharge end of the spout along the box during the filling operation, and means responsive to current flow in the electrically controlled means itself controlled by the articles in the box for shutting off the filling means.

9. Apparatus according to claim **8** and including control means responsive to movement of a box along the conveyor, means yieldingly retarding movement of the box, and means on the conveyor engaging the box and positively moving it.

10. Apparatus according to claim **9** wherein the retarding means includes spaced wall elements at opposite sides of the conveyor frictionally engaging the box.

11. Apparatus according to claim **10** and including PE cell means controlled by the box in moving along the conveyor, and means controlled by the PE cell means for stopping the conveyor for positioning the box at the filling station.

12. Apparatus according to claim **9** wherein the filling means includes a bowl, and means is provided for vibrating the bowl and spout.

13. Apparatus according to claim **12** and including a transfer trough interconnecting the bowl and spout, the bowl and transfer trough are stationary in position, the spout has a stationary receiving end associated with the transfer trough and a movable delivery end reciprocating

along the box at the filling station, and the vibrating means is operative for also vibrating the transfer trough.

14. A method of filling a box with elongated magnetic articles comprising progressively inserting the articles into the box, and applying AC magnetic forces to the articles longitudinally thereof in the inserting operation for thereby aligning the articles in predetermined position in the box.

15. The method according to claim **14** and including the step of demagnetizing the articles in the box after the filling operation.

16. The method according to claim **14** and utilizing an electromagnet for producing the magnetic forces, varying the reactance in the electromagnet in response to the progressive filling of the box, and utilizing the varied reactance for controlling electrical means for shutting off the filling means.

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U.S. Cl. X.R.

53—55, 59, 236