May 31, 1966 F. J. BROWN ET AL 3,253,735

APPARATUS FOR ORIENTING ARTICLES

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FIG - 1

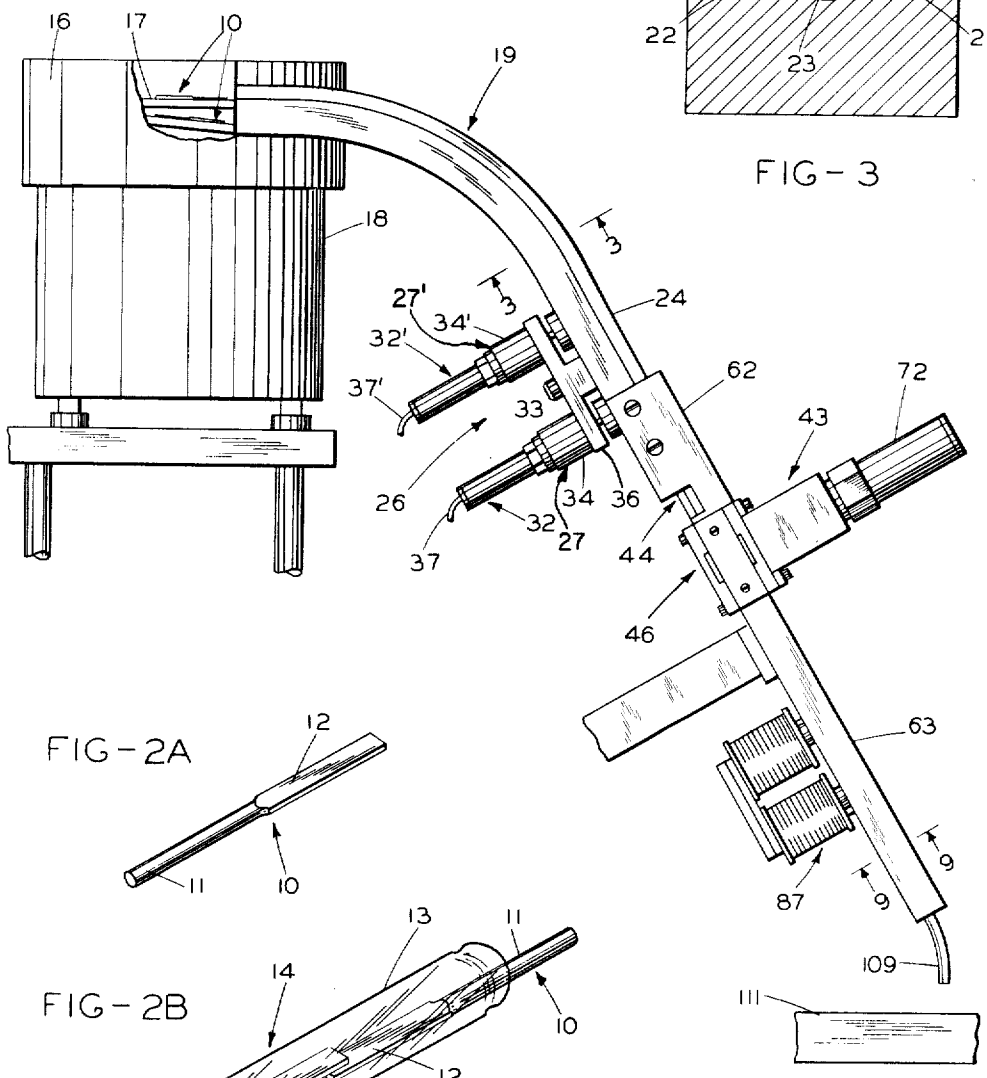


FIG - 3

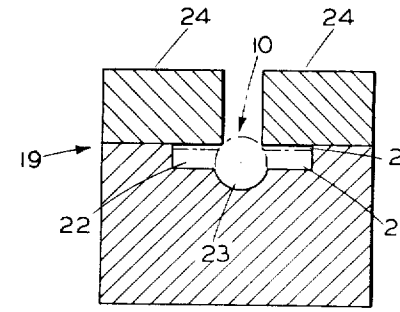
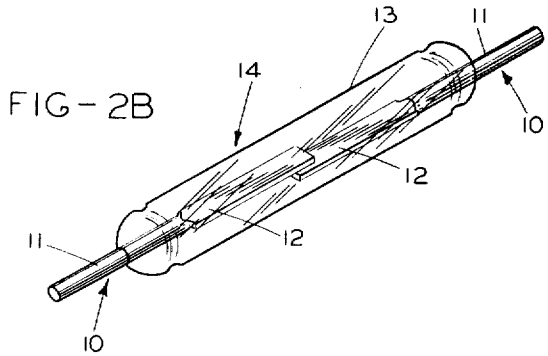


FIG - 2A

FIG - 2B



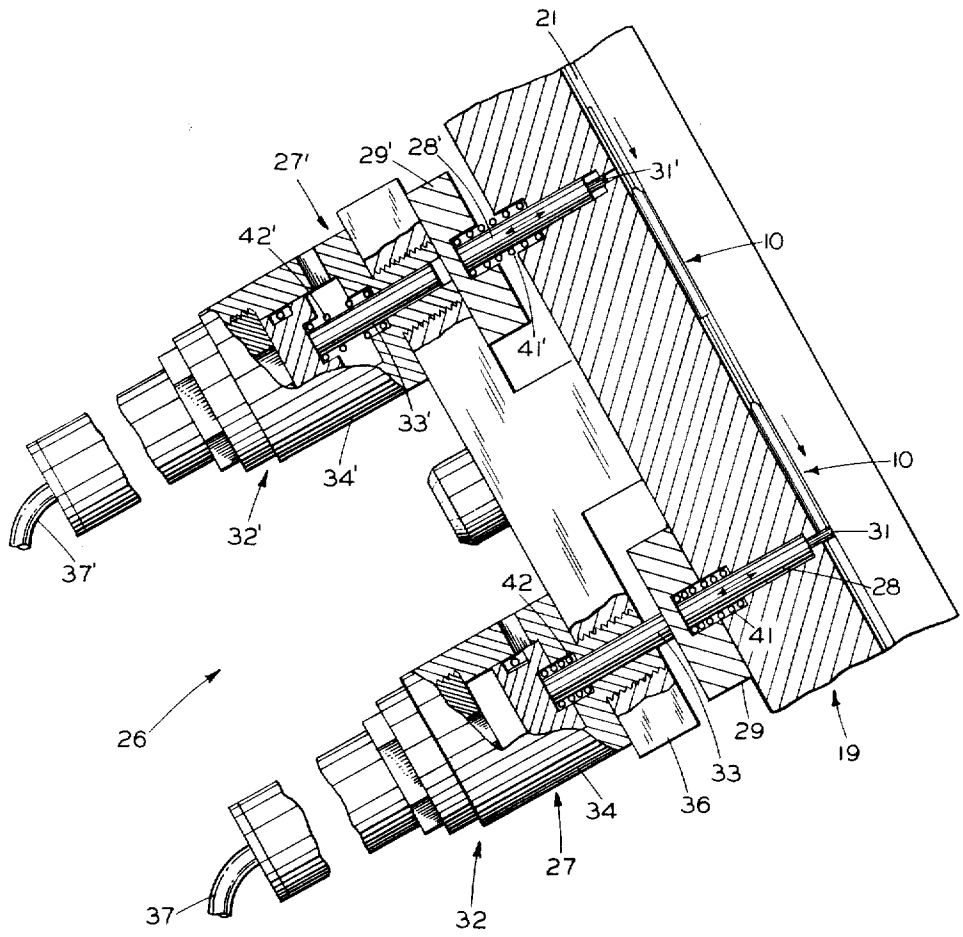
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FIG.- 4



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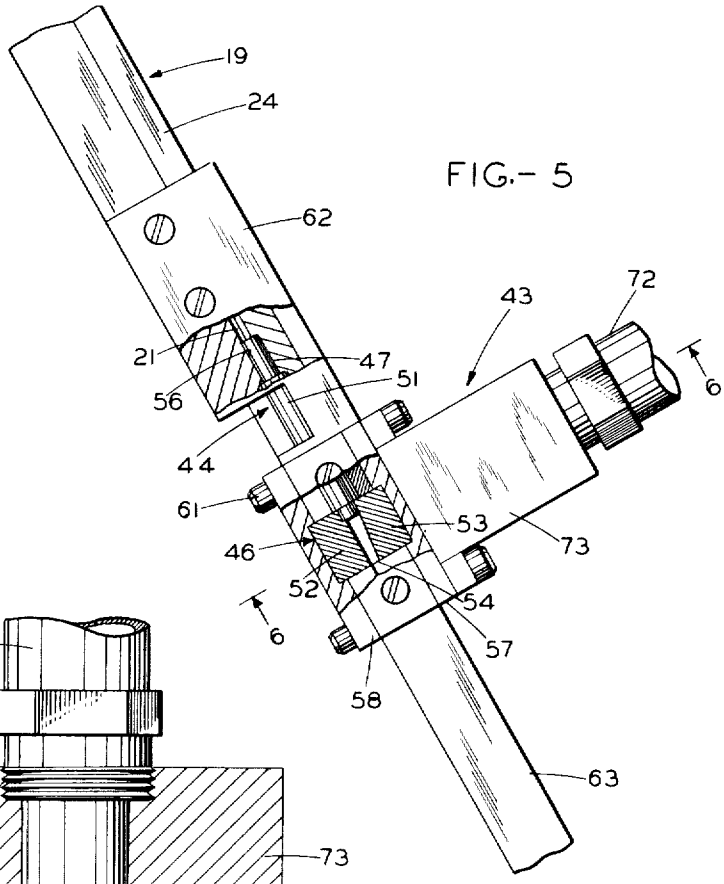


FIG.- 5

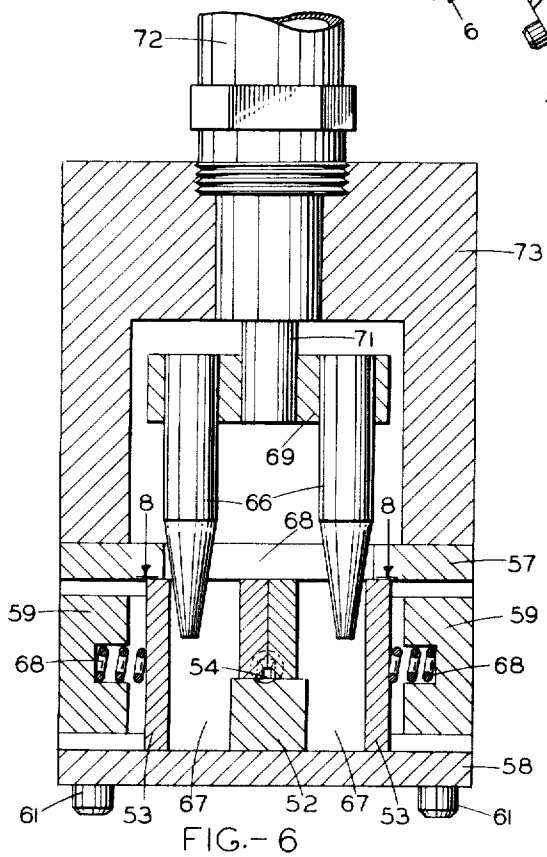


FIG.- 6

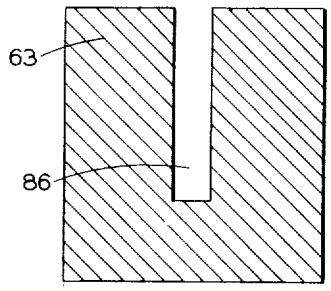


FIG.- 9

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FIG.- 8A

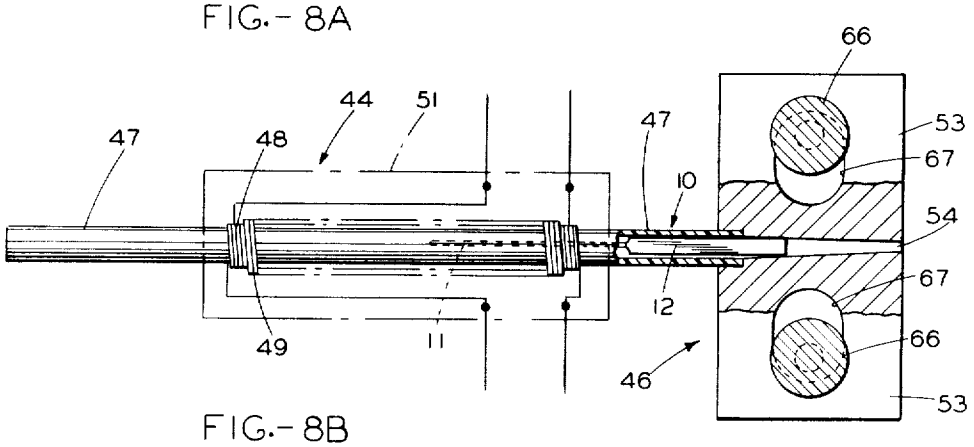
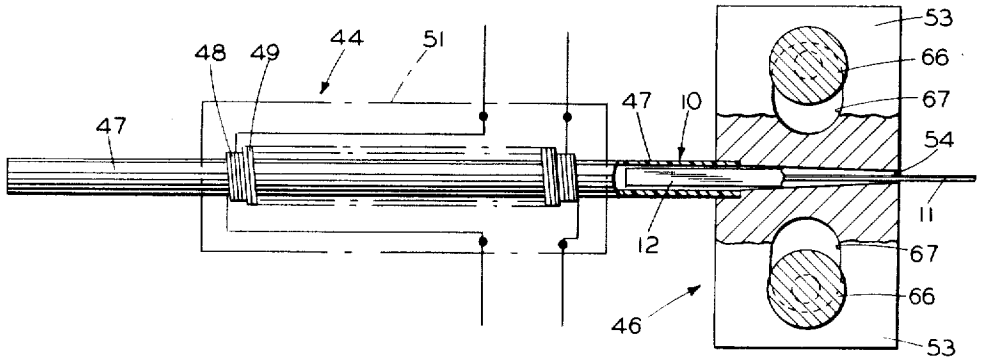


FIG.- 8B



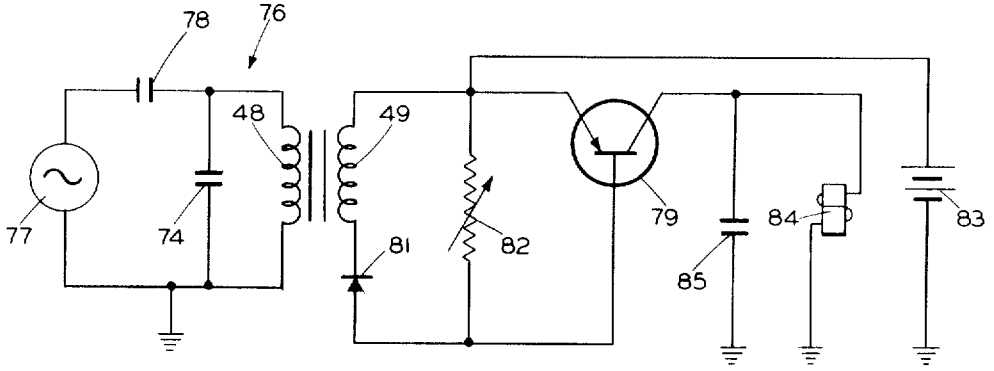


FIG.- 7

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FIG.-10

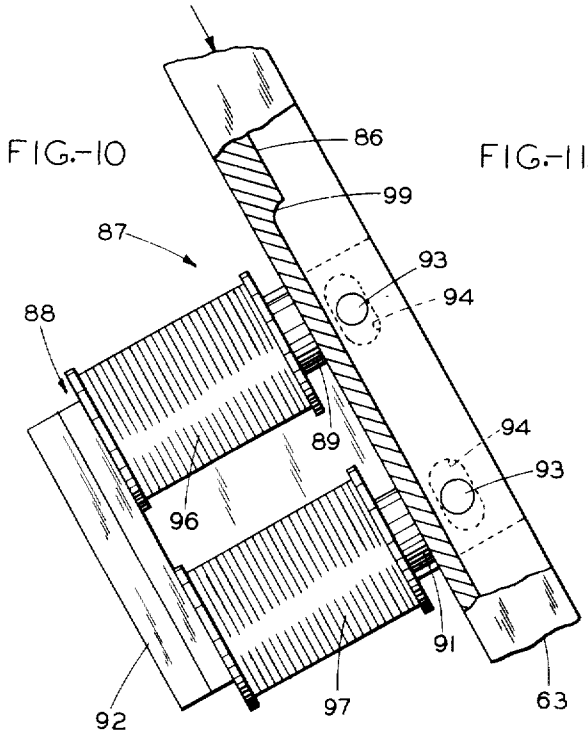


FIG.-11A

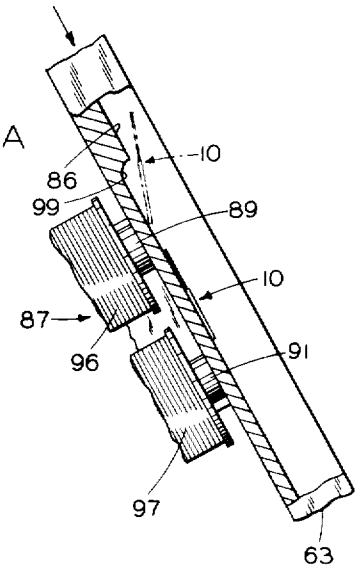


FIG.-11B

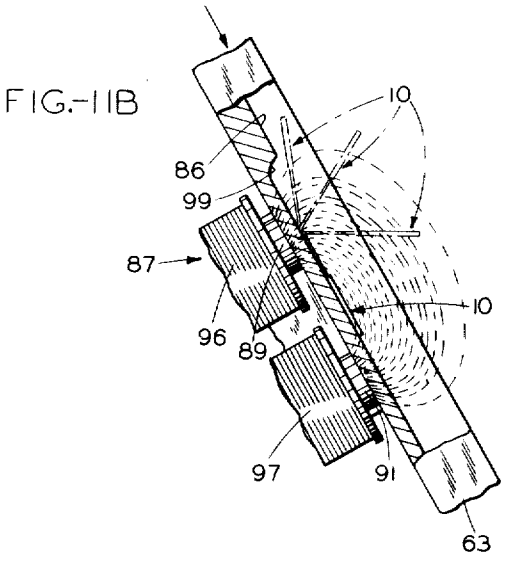
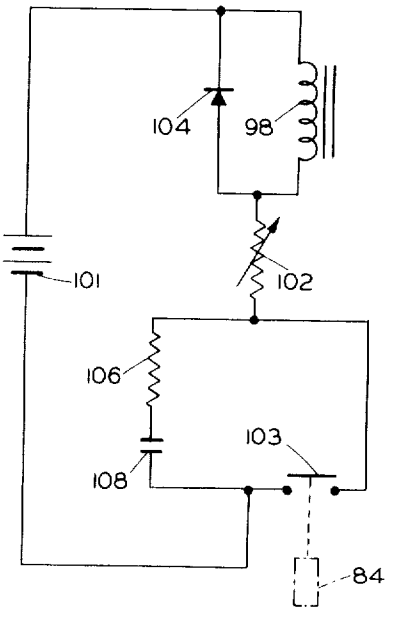


FIG.-12



United States Patent Office 3,253,735 Patented May 31, 1966

3,253,735

APPARATUS FOR ORIENTING ARTICLES

Ford J. Brown, Kutztown, Barry M. Eckhaus, Easton, and Nicholas F. Gubitose, Emmaus, Pa., assignors to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York

Filed Feb. 8, 1965, Ser. No. 430,814
10 Claims. (Cl. 221—9)

This invention relates to apparatus for orienting articles and, more particularly, to apparatus for orienting elongated, paramagnetic articles having asymmetrically shaped ends. Accordingly, the general objects of this invention are to provide new and improved apparatus of such a character.

In the manufacture of sealed contacts for use in ferreed switches, two metallic contacts are assembled in parallel, overlapping relationship, and are then sealed within a glass envelope. Each of the contacts is composed of a paramagnetic material and has a round end and a flat end. In order to facilitate the mass production of the sealed contacts it is first necessary to arrange the individual contacts in a manner compatible with such type production. One way this may be accomplished is to deposit a randomly arranged supply of the contacts in a vibratory feeding bowl which advances them, single file, to a track, and then to orient the contacts such that their like ends face in the same direction. Since the contacts, although arranged in a single file, are randomly arranged with respect to their endwise orientations, to orient them in the foregoing manner requires that the orientation of certain of the contacts be reversed in an end-for-end manner.

It is, therefore, another object of this invention to provide new and improved apparatus for reversing in an end-for-end manner the orientation of an elongated, paramagnetic article.

Another object of this invention is to provide continuous automatic equipment of a relatively simple nature for detecting the orientation of advancing elongated, paramagnetic articles having asymmetrically shaped ends, and for reversing those articles which are detected to be in an undesirable orientation.

With the foregoing and other objects in view, apparatus illustrating certain features of the invention may include first and second unlike magnetic poles. An article whose endwise orientation is to be reversed is advanced to the poles in a manner causing the leading end of the article to be attracted by the pole nearest thereto and the lagging end of the article to be attracted by the pole furthest therefrom, to thereby pivot the article about its leading end to a reverse orientation. Alternatively, the reversal can be accomplished with a single magnetic pole of sufficient strength, mounted along the base of an inclined track down which the article is advanced.

Preferably, the track is formed with a step in its base a short distance in advance of the magnet, or the first pole when two poles are employed, to provide additional gravity assistance to the pivoting of the article about its leading end. Further, the magnet is preferably an electromagnet which is energized when it is desired to reverse the orientation of an article and deenergized after reversal to release the reversed article.

Other objects, advantages and features of the invention will be apparent from the following detailed description of a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

FIG. 1 is an elevation view of apparatus embodying certain principles of the invention for orienting elongated, paramagnetic articles having asymmetrically shaped ends;

FIG. 2A is a perspective view of a paramagnetic contact having asymmetrically shaped ends which may be oriented with the apparatus of FIG. 1, and FIG. 2B is

a perspective view of a sealed contact incorporating two of the paramagnetic contacts illustrated in FIG. 2A;

FIG. 3 is an enlarged view taken along the line 3—3 of FIG. 1, illustrating the cross section of a first track employed in the apparatus;

FIG. 4 is an enlarged, fragmentary, elevation view, with parts broken away for the sake of clarity, of an escapement mechanism incorporated in the apparatus of FIG. 1;

FIG. 5 is an enlarged, fragmentary, elevation view, with parts broken away for the sake of clarity, of a detector incorporated in the apparatus of FIG. 1;

FIG. 6 is an enlarged view taken along the line 6—6 of FIG. 5;

FIG. 7 is a schematic diagram of a circuit forming part of the detector;

FIGS. 8A and 8B are enlarged views, taken along the line 8—8 of FIG. 6, with parts removed and broken away for the sake of clarity, illustrating how oppositely oriented contacts are positioned in the detector;

FIG. 9 is an enlarged view taken along the line 9—9 of FIG. 1, illustrating the cross section of a second track employed in the apparatus thereof;

FIG. 10 is an enlarged, fragmentary, elevation view, with parts broken away for the sake of clarity, of an orienting station incorporated in the apparatus of FIG. 1 and employing an electromagnet;

FIGS. 11A and 11B are elevation views, with parts removed for the sake of clarity, illustrating the passage through the orienting station of oppositely oriented contacts; and

FIG. 12 is a schematic diagram of an energization circuit for the electromagnet of the orienting station.

Referring now to the drawings, and particularly to FIG. 1, there is shown apparatus for orienting articles, such as contacts **10—10**, having asymmetrically shaped ends. As more clearly seen in FIG. 2A, each contact has a cylindrical or "round" end **11** and a paddle-shaped or "flat" end **12**. Additionally, each of the contacts **10—10** is composed of a paramagnetic material, by which is meant a material capable of experiencing attraction by a magnet to a sufficient degree for the purposes of this invention to be fulfilled. In the particular example, the material is "52 alloy," an alloy consisting of approximately 52 percent nickel and 48 percent iron. After being oriented, the contacts may be advanced to an assembly machine such as that disclosed in the co-pending application of N. F. Gubitose and J. J. Monahan, Serial No. 332,101, filed December 20, 1963, now Patent No. 3,223,446 and assigned to the assignee of the present application. In the assembly machine, two of the contacts **10—10** are assembled in parallel, overlapping relationship and then sealed within a glass envelope **13** to form a sealed contact **14** (FIG. 2B) for use in a ferreed switch (not shown).

Referring back to FIG. 1, the apparatus includes a vibratory feeding bowl **16** of a generally conventional type into which the contacts **10—10** are deposited in random order. The bowl **16** is provided with a spirally inclined track **17** about its inner periphery and is mounted on an electromagnetic drive unit **18**. When actuated, the drive unit **18** imparts vibrations to the bowl **16** in a manner such as to cause the contacts **10—10** therein to move radially outwardly of the bowl and in a circular path along its inner periphery. The track **17** is shaped such that, as the contacts **10—10** are advanced thereto, they are formed into a single file. The contacts **10—10** proceed up the track **17** until they reach the uppermost point thereof, whereupon the contacts are advanced to a first straight, downwardly inclined track **19**. As seen in FIG. 3, the track **19** is provided with a channel **21**

having lands 22—22 for receiving the flat end 12 of a contact 10 and an arcuate groove 23 for receiving the round end 11 thereof. The track 19 is further provided with cover plates 24—24 which serve to guide the contacts 10—10 through the channel 21.

Escapement

The contacts 10—10 proceed down the track 19 to an escapement mechanism, designated generally by the numeral 26, which serves to halt the advancement of the file of contacts and release the contacts one at a time for further advancement down the track. As best seen in FIG. 4, the escapement mechanism 26 comprises two identical, spaced units 27 and 27', only one of which, the unit 27, will be described in detail. The unit 27 includes a cylindrical pin 28 having a flange 29 at its lower end and a reduced upper end 31. The pin 28 is vertically movable into and out of the channel 21 of the track 19 through a complementary shaped bore formed in the body of the track. Movement is imparted to the pin 28 by actuation of an air cylinder 32 having a plunger 33 and a housing 34, the housing 34 being threadably fixed in one leg of an inverted T shaped member 36 secured to the underside of the track 19. When air (from a suitable source not shown) is supplied to the interior of the housing 34 through an air inlet line 37, the plunger 33 drives the pin 28 upwardly into the channel 21. The pin 28 and the plunger 33 are provided with respective compression springs 41 and 42 which serve to return these members to a downward position upon deactuation of the air cylinder 32. Additionally, the dual compression spring arrangement provides a "soft" upward movement of the pin 28 so that the pin does not strike a contact 10 with a force sufficient to damage it.

The pins 28 and 28' of the units 27 and 27' are alternately movable into and out of the channel 21 and are spaced such that, when the pin 28 is in its up position to impede the passage of a contact 10 down the track 19, the pin 28' is in its lower position beneath the next succeeding contact 10 to permit its advancement into abutment with the preceding contact. (This is the position of the pins 28 and 28' seen in FIG. 4.) In operation, the pin 28' is first moved upwardly to engage and hold the contact 10 in registration therewith. The pin 28 is then moved downwardly to allow advancement of the leading contact 10. The pin 28 is then returned to its up position and the pin 28' moved downwardly, whereupon the contact 10 previously held by the pin 28' advances to and is halted by the raised pin 28. In this manner, only one contact 10 at a time is released from the escapement mechanism 26.

Detector

After being released from the escapement mechanism 26, the released contact 10 travels down the track 19 to a suitable detector, designated generally by the numeral 43, which functions to detect which end of the contact, i.e., the round end 11 or the flat end 12, is leading. The specific detector 43 to be described herein forms the subject matter of the related co-pending application of B. M. Eckhaus and E. W. Nelson, Serial No. 430,958, filed on even date herewith and assigned to the assignee of the present application.

As is best seen in FIGS. 5 and 8A, the detector includes a coil unit 44 and a jaw unit 46 arranged in the path of travel of the advancing contacts 10—10, such that each contact 10 passes first through the coil unit 44 and is then momentarily stopped by the jaw unit 46 while the orientation of the contact 10 is sensed by the coil unit 44.

The coil unit 44 includes a nylon tube 47 mounted at its left end (FIG. 5) to the track 19 in alignment with the channel 21 so that the contacts 10—10 can advance therethrough. Two coils are wound around the tube 47,

a primary coil 48 and a secondary coil 49. Advantageously, the coils 48 and 49 are encapsulated in a suitable insulating material 51, such as epoxy resin. Electrically, the coils 48 and 49 are connected in the detecting circuit of FIG. 7 which will be described in detail below.

Referring to FIGS 6 and 8A, the jaw unit 46 includes a base 52 in the form of a rectangular block and a pair of like jaws 53—53 disposed on opposite sides of the base. The inner opposed surfaces of the jaws 53—53 are cut away such that when the jaws are closed, as shown in FIGS. 6 and 8A, the jaws envelop the base 52 and define with the base an enclosed tapered passageway 54 into which the contacts 10—10 advance from the tube 47. The entrance end of the passageway 54 receives the right end (as viewed in FIG. 5) of the tube 47, the left end of the tube 47 being pressed into a complementary shaped recess 56 formed longitudinally in the track 19.

The dimensions of the passageway 54 are such as to pass the round end 11 of the contact 10 therethrough but not the (wider) flat end 12. As illustrated in FIG. 8A, if a contact 10 advances to the passageway 54 from the escapement 26 with its flat end 12 leading, the flat end strikes the walls of the passageway near the entrance end thereof. This halts the contact 10 in a position where the major portion of the contact (most of the round end 11) is disposed within the coils 48 and 49. Conversely, if the round end 11 of the contact is leading (FIG. 8B), the round end 11 passes through the passageway 54 and the flat end 12 enters and strikes the walls of the passageway as previously described. This, however, halts the contact 10 in a position where no part of the contact is disposed within the coils 48 and 49.

As best seen in FIG. 6, the jaws 53—53 and the base 54 are supported by a top plate 57, a bottom plate 58 and two like side plates 59—59 which are secured to the top and bottom plates by screws 61—61. Additionally, as seen in FIG. 5, the side plates 59—59 are secured at their left ends to a support member 62 which is fixedly connected to the track 19. At their right ends the side plates 59—59 are secured to a second downwardly inclined track 63 which receives the contacts 10—10 after the detector has functioned.

The jaws 53—53, as best seen in FIGS. 6 and 8A, are movable toward and away from each other by a pair of identical pins 66—66 having conically tapered lower portions which are movable into respective bores 67—67 formed in the jaws 53—53 through an opening 68 formed in the top plate 57. The pins 66—66 are disposed eccentrically of the bores 67—67 such that as they enter the bores their tapered surfaces engage the top edges thereof and laterally move the jaws apart by camming action. As the jaws 53—53 move apart, they compress respective compression springs 68—68 which serve to return the jaws to their closed position when the pins 66—66 are moved out of the bores 67—67.

The pins 66—66 are fixedly connected at their upper ends to a transverse support member 69. The support member 69, in turn, is fixedly connected to the shaft 71 of an air cylinder 72 which when actuated drives the pins 66—66 into the bores 67—67. The air cylinder 72 is supported by a U-shaped member 73 which is secured to the top plate 57.

Referring now in detail to the circuit of FIG. 7, the primary coil 48 of the coil unit 44 is connected in parallel with a capacitor 74 to form a tuned cricuit 76, and the tuned circuit thus formed connected in a series circuit including an oscillator 77 and a capacitor 78. The secondary coil 49 is connected in the input circuit of a transistor amplifier 79. The input circuit of the transistor amplifier 79 additionally includes a rectifier diode 81 and a biasing resistor 82. D.C. bias voltage is applied to the transistor amplifier 79 by a suitable D.C. voltage source 83. The output circuit of the transistor

amplifier **79** includes a relay **84** having a capacitor **85** connected in parallel therewith.

The capacitors **74** and **78** are selected such that the tuned circuit **76** is at resonance with the oscillator **77** when no contact **10** is within the primary coil **48**. Accordingly, a relatively large signal at this time is inductively coupled to the secondary winding **49**. This signal, after rectification by the diode **81**, is applied to the input of the amplifier **79** which amplifies the signal and impresses it across the relay **84**. The magnitude of the amplified signal is such as to cause energization of the relay **84**. The relay **84** remains energized as long as no contact **10** is within the primary coil. When, however, a contact **10** is disposed within the coils **48** and **49**, i.e., when a contact is positioned within the passageway **54** with its flat end **12** leading (FIG. 8A), the inductance thereof changes because of the paramagnetic nature of the contact, resulting in a detuning of the tuned circuit **76** with a concomitant decrease in the signal developed thereacross. This, in turn, results in a lowering of the input signal to the transistor amplifier **79** which, in turn, results in a lowering of the signal impressed across the relay **84** to a value insufficient to maintain energization thereof. Accordingly, the relay **84** deenergizes. Thus, it is seen that the condition of the detector relay **84** after a contact **10** is positioned in the passageway **54** indicates the initial orientation of the contact. As will be seen below, the detector relay **84** performs a control function in the subsequent orienting of the contacts **10—10**.

After the detector **43** functions to detect which end of a contact **10** is leading, the jaws **53—53** are moved apart by the air cylinder **72** to release the contact for advancement down the track **63** which is provided with a channel **86** (best seen in FIG. 9) having relatively high side walls, for reasons which will become apparent from the following discussion.

Orienting station

Referring to FIG. 10, the released contact **10** proceeds down the track **63** to an orienting station, designated generally by the numeral **87**, which, in accordance with certain features of the invention, functions to reverse the orientation of the contact if the flat end **12** is leading. If the round end **11** of the contact **10** is leading, the contact passes through the orienting station **87** without a reversal of its orientation.

In the preferred embodiment of the invention, the orienting station **87** includes a horseshoe shaped electromagnet **88** having two poles **89** and **91**. The magnet **88** is supported by a bracket **92** which is connected to the side of the track **63** by means of screws **93—93** which pass through the side of the track and through oval shaped openings **94—94** in the bracket. The openings **94—94** enable adjustment of the longitudinal position of the magnet **88** relative to the track **63**. The magnet **88** is energizable by means of two windings **96** and **97** connected to each other so as to form one composite electrical coil **98** which is included in an energization circuit (FIG. 12) to be described in more detail below.

The base of the channel **86** has a step **99** therein in advance of the magnet **88**. When a contact **10** reaches the step **99**, it drops off the step and, because of gravity, partially pivots about its leading end. The height of the step **99**, and the angle of inclination of the track **63** are such that the contact **10** will not completely pivot, but will retain its initial orientation as long as the magnet **88** is not energized (FIG. 11A). When, however, the magnet **88** is energized, developing a magnetic field and magnetizing the poles **89** and **91** with unlike polarity, the pole **89** nearest to the advancing contact **10** attracts the leading end thereof while the other pole **91** furthest from the contact attracts the lagging end thereof (FIG. 11B). Accordingly, the contact **10** pivots about its leading end in an end-for-end manner to a reverse orientation.

While it is preferred to reverse articles with a horseshoe-type magnet having two unlike poles adjacent to the track **63**, it is also possible to reverse articles with a single magnetic pole corresponding to the pole **89** shown. In this instance, the shape and angle of the track **63**, and the strength of the magnet are set so that the article pivots about its leading end by the combination of gravity and the lines of magnetic force emanating from the single operative pole. In this situation, the magnet must generally be stronger and the angle of the track steeper than when the preferred combination of two operative poles is employed.

Referring now to the magnet energization circuit of FIG. 12, the coil **98** (which, as will be recalled, represents the two windings **96** and **97** in series) is connected in a series circuit which includes a source of D.C. power **101**, a variable resistor **102** and a contact **103** of the detector output relay **84**. A diode **104** is connected in parallel with the coil **98** for arc supression purposes and a contact protection circuit including a resistor **106** and a capacitor **108** is connected across the contact **103**.

As is readily seen, the coil **98** (and, hence, the windings **96** and **97**) is energized as long as the contact **103** is closed and is deenergized whenever the contact is open. It will be recalled that the detector output relay **84** (FIG. 7) remains energized (and, hence, the contact **103** open) as long as a contact **10** is not disposed within the coils **48** and **49**. In this connection, it should be noted that the capacitor **85** in parallel with the relay **84** precludes the relay from being deenergized during the transit of a contact **10** through the tube **47** to the passageway **54** (FIGS. 8A and 8B). Accordingly, when a contact **10** having its round end **11** leading is released by the detector jaws **53—53**, no energizing current is supplied to the windings **96** and **97** of the magnet **88** and, as seen in FIG. 11A, the contact **10** passes through the orienting station **87** without its orientation being disturbed.

When, however, a contact **10** having its flat end **12** is in the passageway **54** of the detector **43** (FIG. 8A), the detector relay **84** is deenergized closing the contact **103** and resulting in energizing current being supplied to the coil **98**, to magnetize the poles **89** and **91**. Accordingly, when the contact drops off the step it pivots (as seen in FIG. 11B) into the magnetic field resulting from the magnetized poles **89** and **91** and is reversed in an end-for-end manner so that its round end **11** is leading when the contact leaves the orienting station **87**. It should be noted that the capacitor **85** prevents the relay **84** from immediately reenergizing when the contact **10** is released from the detector **43**, the relay not reenergizing until the capacitor charges to the energization voltage of the relay. The capacitor **85** is selected such that it does not charge to this voltage until completion of the orientation of the contact.

Thus, as is seen, all of the contacts **10** leave the orienting station **87** with the same orientation, i.e., they all have their round ends leading. At the bottom of the track **63** the contacts enter a tube **109** which directs them to a suitable receptacle represented schematically by the block **111**.

Summary of operation

The contacts **10—10** are deposited in random order in the bowl **16** and are fed up the track **17** thereof in a single file to the track **19**. The contacts **10—10** then proceed by gravity down the track **19** to the escapement mechanism **26**, the pins **28** and **28'** of which are in the positions shown in FIG. 4. Accordingly, the advancement of the leading contact **10** is halted. The air cylinder **32** is then deactuated and the air cylinder **32'** actuated, whereupon the pin **28** retracts to release the leading contact and the pin **28'** is extended to engage and hold the next succeeding contact. The air cylinder **32** is then reactuated, and the air cylinder deactuated to return the pins **28** and **28'** to the positions shown in FIG. 4.

The contact **10** released from the escapement mechanism **26** proceeds down the track **19** to the detector **43**, the jaws **53—53** of which are in a closed position at this time to form the passageway **54** and thereby halt the advancement of the contact **10**. If the round end **11** of the contact **10** is leading (FIG. 8B), the contact is halted outside of the coils **48** and **49** and the detector relay **84** remains energized. If the flat end **12** of the contact **10** is leading (FIG. 8A), the contact is halted within the coils **48** and **49**, whereupon the detector relay **84** is deenergized, closing the contact **103** and energizing the magnet **88**. The air cylinder **72** is then actuated to open the jaws **53—53** and release the contact **10**. If the contact **10** is of the desired orientation (round end **11** leading), it passes through the orienting station **87** without its orientation being changed. If, however, the contact is improperly oriented (flat end **12** leading), the orientation thereof is reversed as the contact passes through the orienting station **87**.

The air cylinders **32**, **32'** and **72** are operated in timed sequence by a suitable electrical timing circuit (not shown).

It is to be understood that the above-described embodiments are merely illustrative of the principles of the invention. Other embodiments may be devised by persons skilled in the art which embody these principles and fall within the spirit and scope thereof.

What is claimed is:

1. Apparatus for reversing in an end-for-end manner the orientation of an elongated, paramagnetic article, which apparatus comprises:

(a) an inclined track down which the article is advanced in the direction of its elongation; and

(b) a magnet positioned along the base of the track so as to attract the leading end of the advancing article toward the magnet and stop the leading end adjacent to the magnet;

the shape and angle of the track and the strength of the magnet being set so that the article pivots about its leading end to a reverse orientation.

2. Apparatus in accordance with claim **1**, wherein the track is formed with a step in the base thereof a short distance in advance of the magnet to provide additional gravity assistance to the pivoting of the article about its leading end.

3. Apparatus in accordance with claim **1**, wherein: the magnet is an electromagnet; and means are provided for energizing the electromagnet when it is desired to reverse the orientation of an article advancing down the track, and for deenergizing the electromagnet after reversal of the article to release it.

4. Apparatus for reversing in an end-for-end manner the orientation of an elongated, paramagnetic article, which apparatus comprises:

(a) first and second unlike magnetic poles; and

(b) means for advancing an article to said poles in a manner causing the leading end of the article to be attracted by the pole nearest thereto and the lagging end of the article to be attracted by the pole farthest therefrom, to thereby pivot the article about its leading end to a reverse orientation.

5. Apparatus according to claim **4**, wherein the means for advancing the article includes a track having a step in the base thereof in advance of the poles which causes the article to partially pivot about its leading end to a position such as will enable the attractive forces of the poles to complete the pivoting of the articles to a reverse orientation.

6. Apparatus in accordance with claim **5**, wherein the track is inclined at a predetermined angle.

7. Apparatus for orienting elongated, paramagnetic articles having asymmetrically shaped ends so that the articles have their like ends facing in the same direction, which apparatus comprises:

(a) first and second selectively magnetizable members;

(b) means for feeding articles, single file, to the members in a manner such that when the members are magnetized an article advanced to the members has its leading end attracted by the member nearest thereto and its lagging end attracted by the member farthest therefrom, to thereby pivot the article about its leading end to a reverse orientation; and

(c) means in advance of the members for sensing the orientation of each of the articles and for magnetizing the members each time a sensed article is in an undesired orientation.

8. Apparatus according to claim **7**, wherein an escapement disposed along the predetermined path in advance of the detector is provided for halting the advancement of the file of articles, and for releasing the articles, one at a time, for advancement to the sensing means.

9. Apparatus according to claim **7**, wherein the means for feeding the articles includes a track having a step in the base thereof in advance of the magnetizable members which causes an article advanced thereto to partially pivot about its leading end to a position such as will enable the attractive forces of the magnetizable members to complete the pivoting of the article to a reverse orientation when the members are magnetized, but which will not cause complete pivoting of the article when the members are not magnetized.

10. Apparatus according to claim **9**, wherein the magnetizable members are the legs of a horseshoe-shaped electromagnet.

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