United States Patent

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[54] **ARTICLE SEGREGATING MACHINE**
10 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **198/33,** 209/80
[51] **Int. Cl.** **B65g 47/24**
[50] **Field of Search** 198/33, 33 R1, 33 R2, 33 R3, 33 R4, 40, 165; 209/80, 82; 221/157, 158, 159, 162, 161

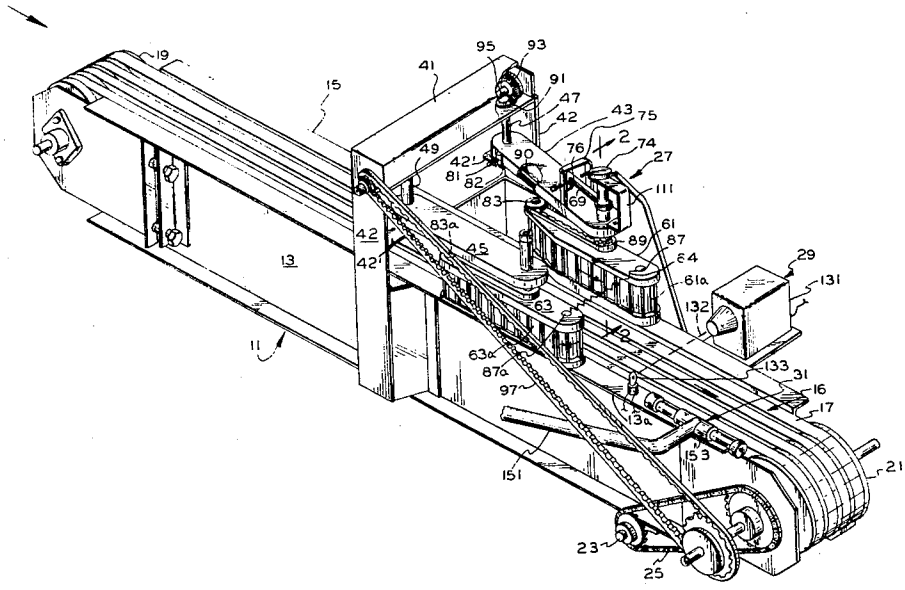
[56] **References Cited**

UNITED STATES PATENTS

3,367,477	2/1968	Leth	198/33
3,343,673	9/1967	Thacker et al.	209/80
3,469,689	9/1969	O'Neill, Jr.	209/80
3,289,808	12/1966	Simmons	198/33
3,119,487	1/1964	Wyle et al.	198/33(R4)
3,101,832	8/1963	Wyle et al.	198/33(R4)
3,420,369	1/1969	Sorbie	209/80

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Assistant Examiner—H. S. Lane
Attorney—Buckhorn, Blore, Klarquist and Sparkman

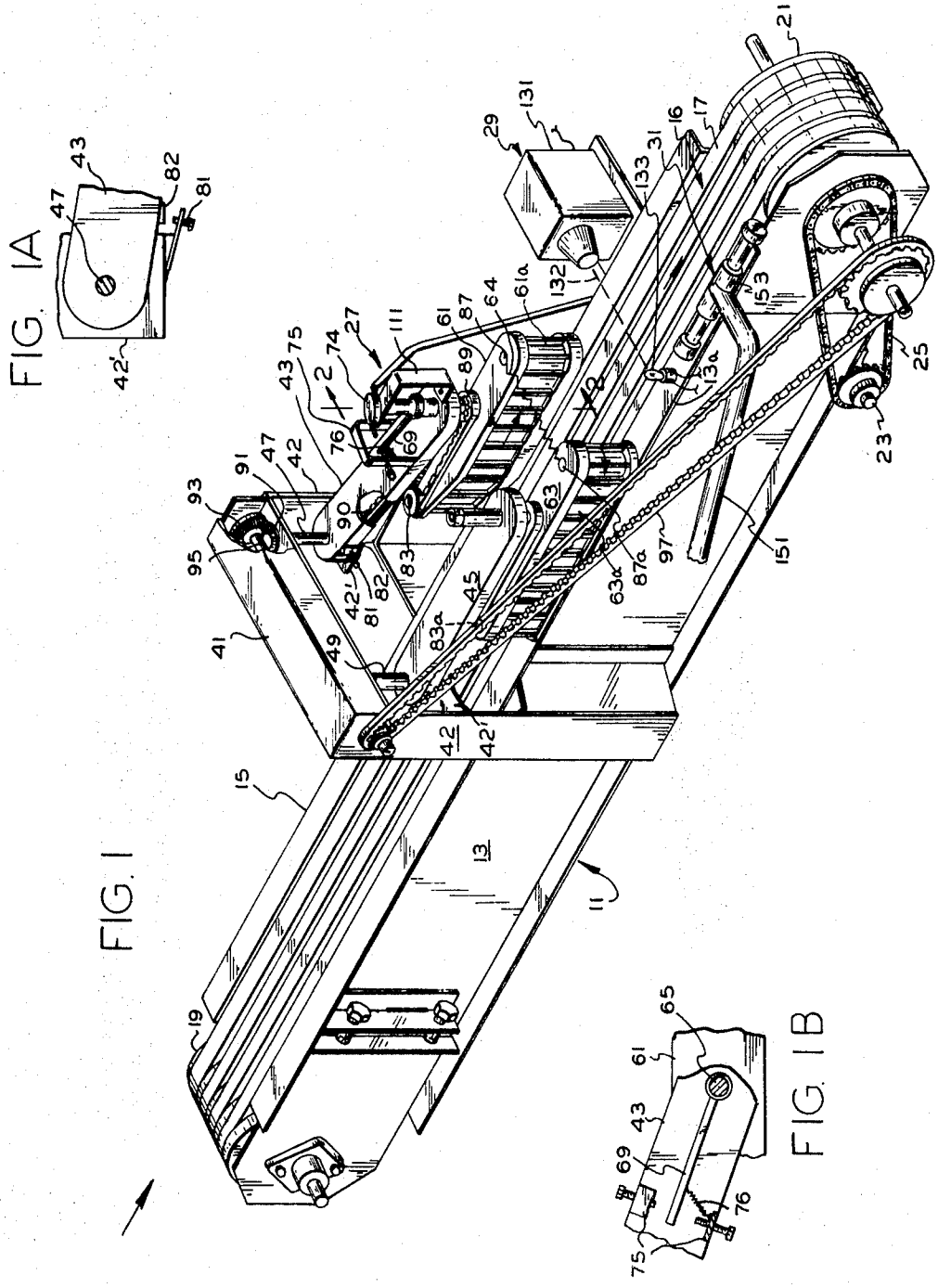
ABSTRACT: A corn ear segregating machine in which ears of corn are carried in single file fashion against a rockable sensing shoe which senses the end-for-end orientation of an ear of corn at the time the ear intercepts the light beam of a photocell unit, whereby a rejection system is actuated if the ear is traveling butt end first but not actuated if the ear is traveling tassle end first.



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SHEET 1 OF 2



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FIG. 3

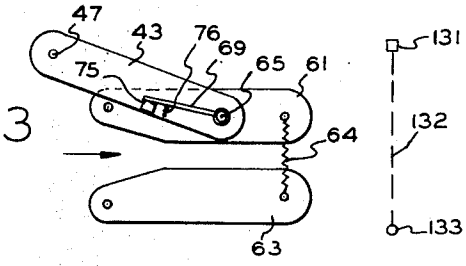


FIG. 6

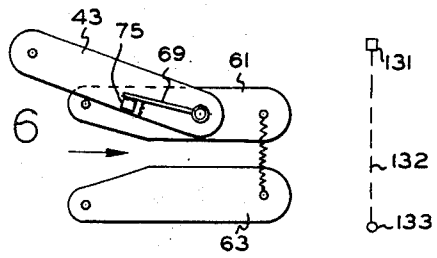


FIG. 4

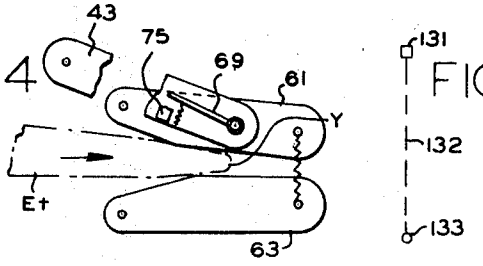


FIG. 7

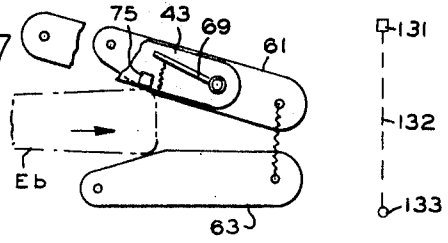
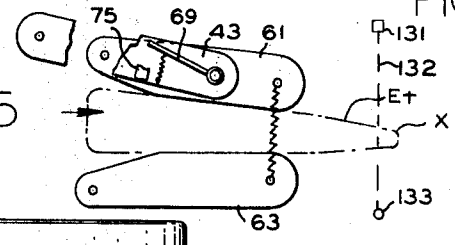


FIG. 8

FIG. 5



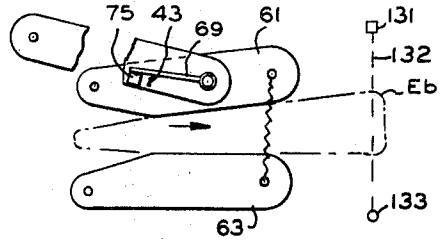


FIG. 2

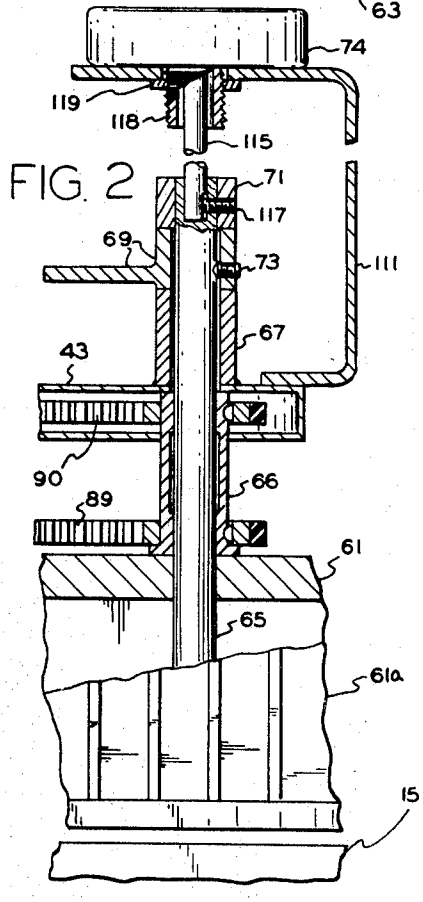
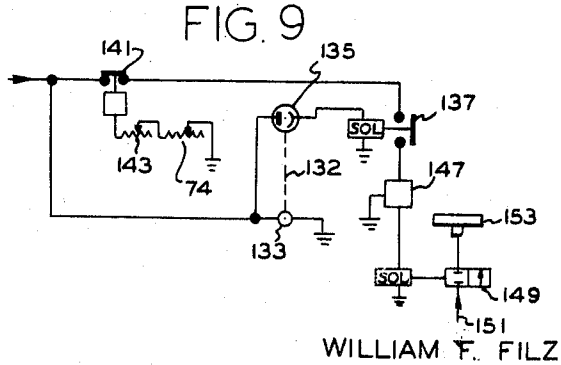


FIG. 9



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ARTICLE SEGREGATING MACHINE

The present invention relates to a machine for segregating unsymmetrical articles of commerce from one another depending on the orientation of the articles relative to a sensing system.

The segregating machine shown in the drawings is designed for handling ears of corn and delivering the same to processing apparatus with the ears similarly oriented. Such orientation is achieved by two sensing means on the machine, one of which senses the disposition of an article while the other senses the position of the article. The two sensing means control the operation of a rejecting means which rejects articles which are oriented one way while accepting articles oriented the opposite way.

A preferred embodiment of the present invention is shown in the accompanying drawings, wherein:

FIG. 1 is a perspective view of a machine of the present invention;

FIG. 1A is a fragmentary plan view of a part of FIG. 1;

FIG. 1B is a fragmentary plan view of a part of FIG. 1;

FIG. 2 is a vertical section taken along line 2–2 of FIG. 1;

FIGS. 3—5 are successive diagrammatic views showing the operation of the sensing shoe when receiving an ear traveling tassle end first;

FIGS. 6—8 are successive diagrammatic views showing the operation of the sensing shoe when receiving an ear traveling butt end first; and

FIG. 9 is a circuit diagram including part of the sensing means of FIG. 1.

The machine shown in the drawings has been adjusted to reject ears traveling butt end first through the machine but to accept tassle end first ears. With a minor change, the machine could perform the reverse operation as will be explained hereinafter.

FIG. 1 shows that the apparatus has a frame 11 made up of a pair of upright spaced side members 13 and 15 which are held apart in spaced relation by crossmembers, not shown. The frame supports a conveyor 16, which comprises a series of endless belts 17. The belts are trained around spaced pulley units 19 and 21 which are rotatably mounted between the side members 13 and 15 of the frame 11. The conveyor is driven by a motor (not shown) which drives a cross-shaft 23, the latter being drivingly connected to the downstream pulley unit 21 by a chain and sprocket drive 25.

The receiving end (left-hand end) of the conveyor 16 receives corn ears in single file fashion from any suitable sorting device, such as for instance, a conventional shuffle feeder (not shown). The feeder delivers the ears to the conveyor 16 with their axes disposed generally parallel to the direction of travel of the conveyor 16, but in random relation insofar as concerns their end-for-end disposition, i.e., some of the ears are delivered to the conveyor 16 with their tassle end foremost and others with their butt end foremost.

The conveyor 16 conveys the ears in single file fashion past two sensing means 27 and 29, which together sense whether an ear is traveling butt end first or tassle end first. If the former, the two sensing means actuate a separating device 31 which issues a blast of air to knock such ear off the conveyor. A container or conveyor (not shown) is provided for receiving the rejected ears. If, however, the ear is traveling tassle end first, the two sensing means sense this condition and do not actuate the separating device. Thus, the butt end first ears are separated from the tassle end first ears. The accepted ears are discharged at the right-hand end of the machine into a processing machine (such as a husker), or onto a conveyor (not shown) to enable subsequent operations to be performed on them.

The rejected ears are, of course, oriented similar to one another, i.e., all of them are disposed butt end first. These ears can be simply deposited onto a second conveyor (not shown) traveling in the opposite direction from that of conveyor 16. The second conveyor would thus feed such ears tassle end first toward a second processing machine (such as a husker).

The first sensing means 27 includes a hollow overhead crossmember 41 which is supported by depending legs 42, the latter being secured to the main frame 11 in straddling relation to the conveyor 16. Each leg 42 has a shelf bracket 42' fixedly secured thereto. A pair of hollow sensing arms 43 and 45 are pivotally mounted on the shelf brackets 42' by means of shafts 47 and 49 which rotatably extend through the arms.

A pair of hollow shoes 61 and 63 are mounted on the downstream ends of the arms 43 and 45, respectively. Shoe 61 is a sensing shoe, while shoe 63 is an idler shoe whose function is to hold an ear of corn in contact with the sensing shoe as the ear is carried between the shoes by the conveyor 16. Each shoe has a driven ear-engaging belt therearound, the belt for shoe 61 being labeled 61*a* and the belt for shoe 63 being labeled 63*a*. These belts are driven at the same speed as conveyor 16 and hence aid in conveying the ears and prevent frictional drag between the shoes and an ear of corn as the ear is carried therepast by the conveyor 16. The two shoes constitute a power-driven chute means.

As will be presently described in detail, shoe 61 is mounted for pivotal movement relative to its arm 43, and its arm 43 is permitted limited swinging movement relative to the frame 11. The shoe 63 is normally stationary, but its position can be changed by a pivotal adjustment of it relative to the frame in a manner to be presently described. A tension spring 64 connects the right-hand ends of the shoes 61 and 63 and urges them toward one another.

FIG. 2 shows the manner in which shoe 61 is pivotally mounted on its arm 43, namely, by a pivot shaft 65 which at its lower portion extends through and is rigidly secured to the shoe 61. The upper portion of shaft 65 rotatably projects through a sleeve shaft 66 which itself rotatably projects into the downstream end of arm 43. The shaft 65 also extends upwardly through a spacer collar 67, a stop finger 69 and an upper collar 71. The spacer collar 67 is preferably secured to the arm 43, such as by brazing or welding. The stop finger 69 is secured to the pivot shaft 65 by a setscrew 73, whereby to suspend and support the shoe on the arm 43. Above the shaft 65 is a potentiometer 74 which is mounted in a manner to be presently described.

The stop finger 69 extends to the left between the legs of a stop bridge 75 which is secured to the arm 43. The stop finger and bridge cooperate to limit pivotal movement of the shoe 61 relative to its arm 43. A tension spring 76 urges the finger 69 against the inner leg of the stop bridge. The arm 43 can swing on its shaft 47, but a pair of stops 81 and 82 limit inward swinging movement of the arm 43 beyond a predetermined position.

Spring 76 is stronger than spring 64. This means that spring 76 biasingly holds the shoe 61 in its most counterclockwise position relative to arm 43 while spring 64 is effective to pull arm 43 inwardly until stop 81 engages stop 82. In this condition of the machine, shoe 61 is disposed in generally parallel relation to shoe 63 (FIG. 3) and is spaced from shoe 63 by a distance less than the diameter of the size corn to be handled.

The drive to the belt 61*a* includes a pair of pulleys which are concealed by the belt because it is trained about them. The pulleys have shafts 83 and 87 journaled in the shoe 61. The shaft 83 projects upwardly and is driven by a chain and sprocket drive 89 from the sleeve shaft 66. The latter is driven at its upper end by a belt and sprocket drive 90 from the associated shaft 47 (FIG. 1). The shaft 47 rotatably projects into the hollow crossmember 41 where it carries a bevel gear 91. The latter meshes with a bevel gear 93 on a cross-shaft 95. The cross-shaft is rotatably mounted in the crossmember 41 and is driven by a belt and sprocket drive 97, which in turn is driven by the main motor of the machine via the pulley unit 21.

The gear ratio from the pulley unit 21 via the drive 97, cross-shaft 95, shaft 47 and the drives through the hollow arms and on the top of the shoes 61, is one-to-one so that the rate of travel of the belt 61*a* is the same as that of the conveyor 16.

The belt 63*a* of shoe 63 is driven in a manner similar to that of belt 61*a* of shoe 61. The shoe 63 itself is mounted in a

manner similar to that of shoe **61**, except that there are no stops for shoe **63** and the pulley shaft **87***a* of the shoe **63** extends downwardly through a hole in the upper flange **13***a* of the side frame member **13**. A nut on the lower end of the shaft **87***a* acts to prevent inadvertent pivotal movement of the shoe **63** but enables the shoe position to be intentionally varied to attain its optimum position relative to shoe **61**. This optimum position is one that is approximately parallel to shoe **63** and to the conveyor **16** (FIG. 3).

If desired, shaft **83***a* can be made to extend down through a slot in flange **13***a* and be equipped with a nut to assure that shoe **63** will be held in any position of adjustment. Or, the nut could be left off shaft **83***a* and the nut be loosened on shaft **87***a* so that shoe **63** would have free but limited swinging movement relative to the frame **11**.

FIG. **2** shows that a bracket **111** mounts the potentiometer **74** above the pivot shaft **65** in a position with the potentiometer shaft **115** disposed in alignment with the pivot shaft **65** and projecting into a bore formed in the pivot shaft. A setscrew **117** secures the shaft **115** to the pivot shaft **65**. The threaded mounting sleeve **118** of the potentiometer fits through a hole in the bracket **111**, and a nut **119** threads on the sleeve to secure the potentiometer in place on the bracket. The hole in the bracket **111** will normally be made somewhat oversize to facilitate proper shifting of the potentiometer to attain alignment of the shaft **115** with the shaft **65**.

It is pointed out that the potentiometer **74** setting can be changed not only by relative movement between the shoe **61** and the arm **43**, but also by swinging movement of the arm **43** about the shaft **47**, provided that the position of the shoe to the arm is changed.

The sensing means **29** includes a photocell unit **131** mounted on the frame member **15**. Across from the photocell unit is a constantly energized light source **133** (of conventional form) which projects a beam of light **132** into the photocell unit **131**. The photocell unit includes a photocell **135** (FIG. **9**) which functions when activated to effect energization of a solenoid switch **137** to close the same.

A normally closed relay switch **141** is connected in series with the solenoid switch **137** and has its own circuit which includes a variable resistor or potentiometer **143** and the potentiometer **74** (previously described). The arrangement is such that when the potentiometer **74** setting is changed sufficiently by clockwise movement of the shoe **61** relative to its arm **43**, the relay switch **141** will be actuated to its open position. If afterward, the potentiometer setting is changed back to its original value, the relay switch will return to its closed position.

The purpose of variable resistor **143** is to facilitate adjustment of the sensitivity of the relay switch circuit. With ears of a certain range of sizes, it may be desirable to have the circuit operated with only a small extent of rocking movement of shoe **61**, while with another range of sizes, it may be desirable to have the circuit operate only after substantial displacement of the sensing shoe **61**.

When the relay switch **141** and the solenoid switch are both closed, a time delay circuit **147** is energized to effect a delayed energization of a solenoid valve **149**. The valve functions to control the supply of air under pressure from a line **151** to an airblast head **153** which is part of the separating device **31**. The delay effected by the delay circuit is sufficient to enable an ear of corn to clear the shoes **61** and **63** prior to being hit or subjected to the blast of air. Although the heat **153** is located in spaced relation to the downstream ends of the shoes **61** and **63**, it is possible for the upstream end of an ear to be located between the downstream ends of the shoes and for the upstream end of an ear of corn to be located opposite a portion of the airblast head **153**. It would be undesirable to have the blast of air acting on the ear of corn prior to its leaving contact with the shoes **61** and **63**.

FIGS. **3** through **5** show diagrammatically the operation of the sensing shoe **63** and its arm, when receiving an ear of corn traveling tassle end first; whereas FIGS. **6** through **8** show the operation of the sensing shoe **63** when receiving an ear of corn traveling butt end first. For simplicity in explanation, in connection with FIGS. **3** through **8**, it will be assumed that any time the finger **69** is separated from the stop **75**, the setting of the potentiometer **74** (secured to shaft **65**) will be such as to cause opening of the relay switch **147**, whereas any time the finger **69** is against the stop **75** it will be assumed that the potentiometer setting is such that the relay switch **141** is in its normally closed position.

The ears of corn shown in FIGS. **4**, **5**, **7** and **8** are depicted as being rather more regularly tapered than the usual ear of corn. This was done for simplicity in disclosure, but it will be understood that the machine handles the usual ear of corn in the same manner that it handles the ear depicted in the drawings.

FIG. **3** shows the positions of the shoes **61** and **63** prior to engagement therewith of an ear of corn which is being conveyed along the conveyor **16** tassle end first. As the ear E*t* engages the shoes, the sensing shoe **61** will be pivoted in a clockwise direction (FIG. **4**) away from the stop **75** so that the relay switch **141** will be opened. The light beam **132** will of course not have been broken because the ear of corn has not advanced far enough.

As the ear E*t* progresses between the shoes, it will eventually assume the position shown in FIG. **5** with the tassle end breaking the light beam **132** so that the photocell unit **131** will cause solenoid switch **137** to close. However, at this time the finger **69** will still be separated from the stop **75** so relay switch **141** will still be open. Therefore, the delay circuit **147** will not be energized. Thus, the tassle end ear E*t* will continue its travel through the machine and pass the airblast head **153** and be discharged off the right-hand end of the machine into a husker or other processing machine.

Now, referring to FIGS. **6** through **8**, FIG. **6** shows the same position of the shoes as does FIG. **3**. FIG. **7** shows the ear of corn traveling butt end first and labeled E*b* contacting the shoe **61** to pivot it clockwise to separate the finger **69** from the stop **75**. This will cause relay switch **141** to open. However, photocell switch **137** will still be open so the delay circuit **147** will not be energized.

FIG. **8** shows that as the butt end ear E*b* continues its passage between the shoes **61** and **63**, the tapered end of the ear will come between the shoes and when it does, the shoe **61** will be pivoted in a counterclockwise direction to bring the finger **69** back into engagement with the stop **75** so that switch **141** is now closed. At this time the butt end of the ear is intercepting the light beam **132** which will effect closure of the solenoid switch **137**. With both switches **141** and **137** closed, the time delay circuit **147** will be energized. The time delay circuit will first effect a time delay to give the ear E*b* a change to clear the shoes **61** and **63** and be disposed in a position opposite the head **153**, after which the circuit **147** will cause the solenoid valve **149** to be energized so that a blast of air issues from the head **153** to knock off the ear E*b* from the conveyor **16**.

The rejected ears E*B* drops onto a reverse direction conveyor (not shown) which will feed such ears tassle end first into a second husker or other processing machine (not shown).

It is obviously a simple matter to arrange the FIG. **9** circuitry so that the ears traveling tassle end first will be rejected and the ears traveling butt end first are accepted. This could be accomplished by making the switch **141** a normally open switch, rather than a normally closed switch.

While the specific arrangement shown includes an airblast separator **31**, any other suitable knockoff system could be provided, or an arrangement could be provided for changing the orientation of incorrectly oriented ears to reverse them end-for-end.

The machine could readily handle husked ears as well as unhusked ears. In fact, a machine embodying the concepts of the present invention could handle various other articles of commerce which are unsymmetrical end-for-end.

Having described the invention in what is considered to be the preferred embodiment thereof, it is desired that it be understood that the invention is not to be limited other than by the provisions of the following claims.

I claim:

1. A sensing system designed to react differently to ears of corn traveling tassle end first than to ears of corn traveling butt end first,

said system including detection means for engaging each ear as it passes by the sensing system,

means movably mounting said detection means so that it is actuated differently when engaged by a tassle-end-first ear than when engaged by a butt-end-first ear,

means to sense such difference in actuation whereby to facilitate different handling of the differently oriented ears,

a second detection means for sensing each ear as the ears pass thereby,

said second detection means having the same reaction regardless of the end-to-end disposition of the ears,

the second detection means being so located in relation to the first detection means that the second detection means is actuated during the time that the first detection means is being actuated and is always actuated after said first detection means has been actuated, regardless of the end-to-end disposition of the ears,

and separating means responsive to a predetermined coaction of the two detection means for effecting separation of the differently oriented ears of corn.

2. A sensing system designed to react differently to ears of corn traveling tassle end first than to ears of corn traveling butt end first,

said system including detection means for engaging each ear as it passes by the sensing system,

means movably mounting said detection means so that it is actuated differently when engaged by a tassle-end-first ear than when engaged by a butt-end-first ear,

means to sense such difference in actuation whereby to facilitate different handling of the differently oriented ears;

a conveyor for conveying the ears along in single file fashion with their axes parallel to their direction of travel but with the ears disposed in random end-for-end disposition,

said detection means comprising an ear engaging member disposed adjacent the conveyor,

pivot means mounting said member so that it is pivoted by an ear of corn as the ear passes therepast,

said member assuming a different pivoted position when the butt end of an ear is next to said pivot means than when the tassle end is next to said pivot means,

and means for sensing the difference in the positions of said member to facilitate separation of the differently oriented ears,

means sensing the presence of the forward end of an ear while the rear end is still disposed at said pivot means,

and means actuated by both of said sensing means to effect separation of the differently oriented ears of corn.

3. A sensing system designed to react differently to ears of corn traveling tassle end first than to ears of corn traveling butt end first,

said system including detection means for engaging each ear as it passes by the sensing system,

means movably mounting said detection means so that it is actuated differently when engaged by a tassle-end-first ear than when engaged by a butt-end-first ear,

means to sense such difference in actuation whereby to facilitate different handling of the differently oriented ears,

a second detection means for sensing each ear as the ears pass thereby,

said second detection means having the same reaction regardless of the end-to-end disposition of the ears,

the second detection means being so located in relation to the first detection means that the second detection means is actuated during the time that the first detection means is being actuated and is always actuated after said first detection means has been actuated, regardless of the end-to-end disposition of the ears,

and separating means responsive to a predetermined coaction of the two detection means for effecting separation of the differently oriented ears of corn,

a frame on which is mounted a conveyor for conveying ears along in single file fashion with their axes parallel to their direction of travel, but with the ears disposed in random end-for-end disposition,

said first detection means including an ear engaging shoe locate above but next to said conveyor and in a position to engage each ear as the ear is conveyed therepast,

guide means opposite the shoe for retaining each ear in engagement with the shoe,

an arm mounted on said frame for swinging movement in a horizontal plane,

vertical pivot means mounting said shoe on said arm in spaced relation to the axis about which said arm swings,

said pivot means being located intermediate the ends of said shoe,

means biasingly holding said shoe in a predetermined position relative to said arm,

means biasingly holding said arm in a predetermined position relative to said frame,

switch closing means for closing a first switch whenever said shoe leaves said predetermined position by a predetermined amount,

said second detection means including secondary sensing means disposed downstream of said shoe and operable to close a second switch anytime any portion of an ear of corn is presented to such secondary sensing means,

said secondary sensing means being so located that it operates while the same ear that causes it to operate is in engagement with said shoe,

said shoe being disposed in said predetermined position whenever a tassle-end-first ear reaches said secondary sensing means and being disposed in another position whenever a butt-end-first ear reaches said secondary sensing means,

and means operable when both switches are closed to effect segregation of said butt-end ears from said tassle-end ear.

4. A sensing system for segregating elongate articles which are nonsymmetrical as regards their end-for-end configuration,

means for conveying said articles along in single file fashion with their axes parallel to the direction of travel but with said articles disposed in random end-for-end disposition,

a first sensing means for engaging each article as it passes therepast and for reacting differently if the article is disposed in one of its possible two end-for-end dispositions than it does if the article is disposed in the other of its possible two end-for-end dispositions,

second sensing means downstream of said first sensing means and actuatable by an article at the time it is in engagement with said first sensing means,

said second sensing means being actuated in the same manner regardless of the end-for-end orientation of said articles,

and means responsive to a predetermined actuation of said two sensing means for effecting segregation of articles oriented one way from articles oriented the other way.

5. A sensing system for sensing the different positions of a series of articles,

a sensing member,

an arm swingably mounted at one end and pivotally carrying said sensing member at its other end,

an endless element disposed about said sensing member,

drive means on said arm for driving said endless element,

means for conveying articles past said sensing member at the same lineal rate of speed as that of said endless element,

and article segregating means responsive to said sensing member.

6. A sensing system for articles of commerce, comprising:

a conveyor for carrying articles of differing longitudinal orientation along a predetermined path,

power-driven chute means coextensive with at least part of said conveyor to engage an article on said conveyor and grip the same therebetween and aid in conveying said article along,

said power-driven chute including sensing means deflectable by said article and responsive to the disposition of said article to react one way when said article is oriented one way and to react a different way when an article is oriented another way.

7. A sensing system as in claim 6 in which there are second sensing means disposed sufficiently close to the first mentioned sensing means as to respond to the presence of a portion of an article while another portion of the article is at said first mentioned sensing means,

and means responsive to the concurrent reaction of said sensing means to produce segregating signals.

8. A sensing system for a series of articles, some of which are oriented one way, and others of which are oriented a second way,

means for conveying said articles along in single file fashion with some of said articles oriented one way and other of the articles oriented a second way,

first sensing means responsive to the presence of an article at said sensing means for reacting one way if an article is oriented said one way, but reacting a different way if the article is oriented said second way,

said first sensing means including article engaging means for contacting an article for sensing purposes,

power means for moving said engaging means along at the same rate as said conveyor,

second sensing means disposed in spaced relation to said first sensing means in the line of travel of said articles but being disposed sufficiently close to said first sensing means as to respond to the presence of a portion of said article at said second sensing means at the same time that another portion of such article is disposed at said first sensing means,

and means responsive to actuation of said two sensing means for reacting in one fashion when said article is oriented said one way and reacting in a different fashion when said article is oriented said other way.

9. A sensing system comprising:

a sensing member disposed to successively engage a series of articles brought relatively therepast and to react in one fashion to articles oriented one way and in a different fashion to articles oriented another way,

means mounting said sensing member for pivotal movement about one axis and for bodily movement in a direction angularly related to said axis,

a flexible element surrounding said sensing member and movable relative thereto,

control means carried by said mounting member next to said axis and bodily movable with said sensing member and actuated by the pivotal movement of said sensing member,

and means responsive to said control means for segregating said articles according to the orientation of said articles.

10. A sensing system for elongate articles of commerce that are nonsymmetrical lengthwise,

conveying means for conveying such articles along a predetermined path in single file relation with the axes of said articles parallel to said path,

an elongate sensing member disposed next to said path with its axis parallel to said path so as to have full length contact with each article as each article is moved therepast and so that said elongate sensing means assumes different positions during its engagement with each article,

said elongate sensing member including an elongate body portion and a peripheral portion,

means to drive said peripheral portion relative to said body portion,

means responsive to the position of said elongate sensing means only after said elongate sensing means has engaged at least a major portion of an article for effecting segregation of said articles.