Aug. 9, 1966 K. M. ALLEN 3,265,206

POTATO CHIP SORTER

Filed Sept. 11, 1963 3 Sheets-Sheet 1

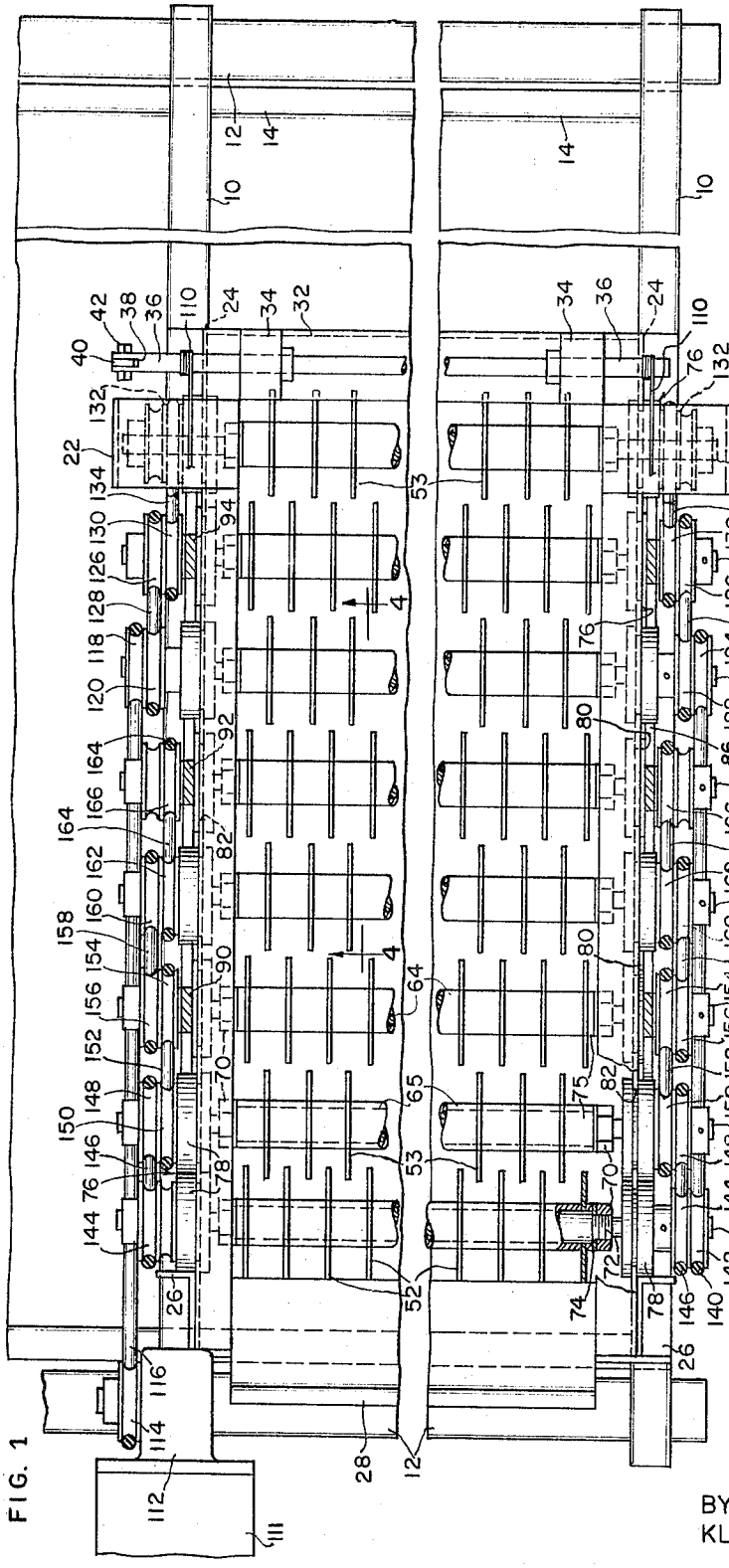


FIG. 1

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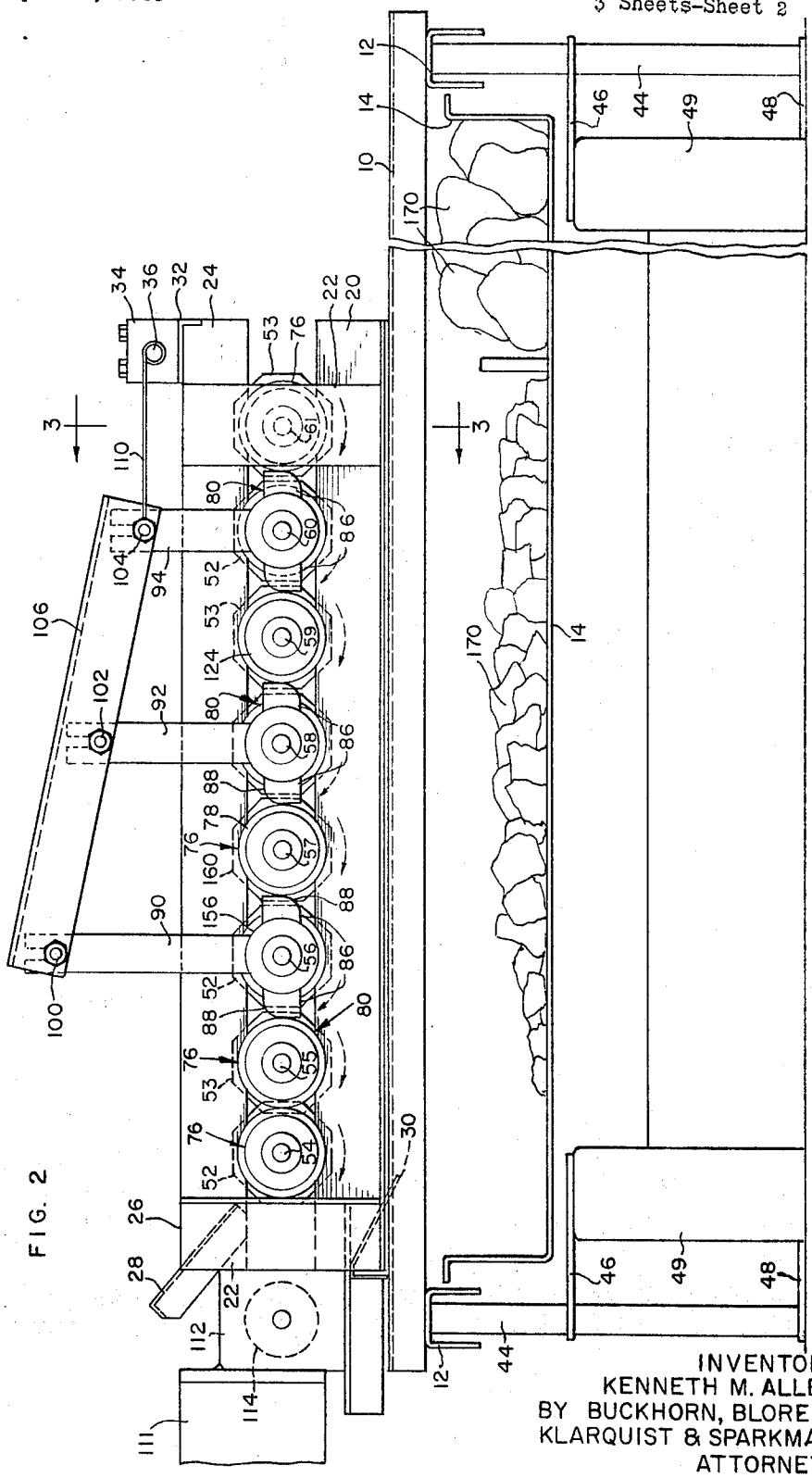


FIG. 2

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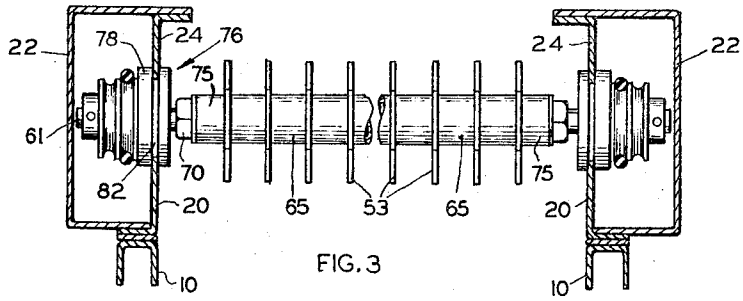


FIG. 3

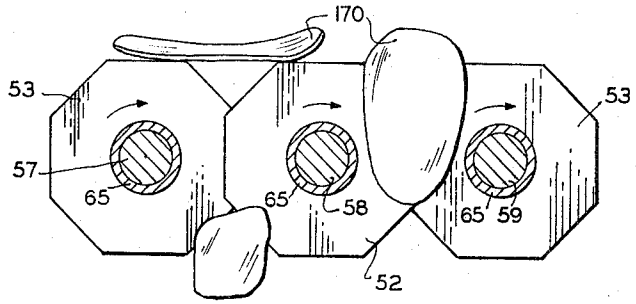


FIG. 4

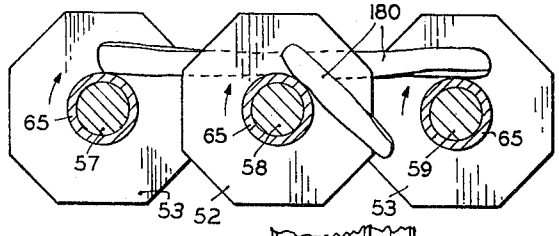


FIG. 5

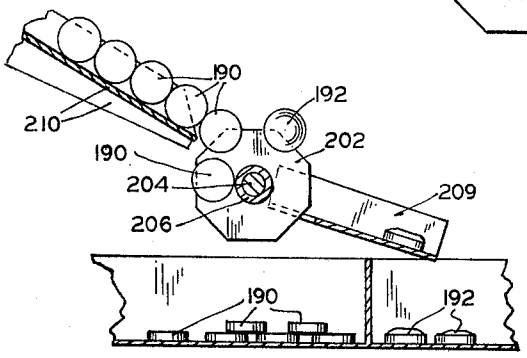


FIG. 6

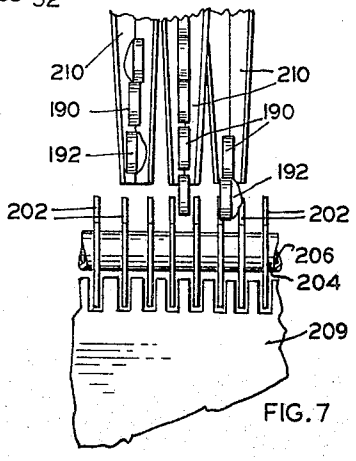


FIG. 7

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3,265,206

POTATO CHIP SORTER

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8 Claims. (Cl. 209—104)

This invention relates to sorting machines and more particularly to machines for sorting food products.

In the filling of small bags of food products such as potato chips, french fries, bacon rind and the like bridging by too wide, too long, too thick or clusters of the products sometimes interferes with filling the bags by bridging the openings to the bags and also by occupying too much space. Also in packaging corn chips shaped as flat discs, warped chips and clusters prevent compact packaging and are undesirable. It would, therefore, be desirable to provide sorting machines which separate oversize products according to excessive width, excessive length and excessive thickness to facilitate packaging the smaller containers therefor and to compactly package the food products.

An object of the invention is to provide a new and improved sorting machine.

Another object of the invention is to provide sorting machines which will separate products according to width, length and thickness.

Another object of the invention is to provide a sorting machine which can be easily and effectively adjusted.

A further object of the invention is to provide sorting machines for sorting frangible products, such as potato chips and the like, with very gentle actions so that the chips are not broken during the sorting operations, which machines also have large capacities.

A still further object of the invention is to provide simple, durable, easily cleaned sorting machines.

The present invention provides a sorting machine including a row of parallel rotating discs adapted to advance oversize articles therealong and permit smaller articles to drop therebetween. A sorting machine forming one embodiment of the invention includes a plurality of rows of rotating members spaced apart sufficiently that shorter french fries and narrower potato chips will drop therethrough, and longer french fries, wider potato chips and clusters thereof will be advanced therealong. Preferably the rotating members are in the form of discs octagonal in shape so as to provide a plurality of blunt teeth for advancing the articles therealong and the discs are mounted on shafts which together with spacer sleeves on the shafts space and frictionally drive the discs. Means are provided for adjusting the shafts laterally relative to one another to control the separation of the rows of discs. In a sorting machine forming an alternate embodiment of the invention, feeding means feed disc-like corn chips on edge onto spaces between a row of rotated discs, and unwarped chips drop therethrough while the discs move the warped chips on.

A complete understanding of the invention may be obtained from the following detailed description of sorting machines forming specific embodiments thereof, when read in conjunction with the appended drawings, in which:

FIG. 1 is a fragmentary, horizontal sectional view of a sorting machine forming one embodiment of the invention;

FIG. 2 is a fragmentary, side elevation view of the sorting machine of FIG. 1 with parts thereof omitted for purposes of clarity;

FIG. 3 is a fragmentary, vertical sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary, vertical sectional view taken along line 4—4 of FIG. 1 showing the sorting machine advancing potato chips and sorting out smaller and broken chips from the larger chips;

FIG. 5 is a view similar to FIG. 4 of the sorting machine operable to sort out shorter articles from those which are longer than a predetermined length;

FIG. 6 is a fragmentary, vertical sectional view of a portion of a sorting machine forming an alternate embodiment of the invention illustrating use of the machine to sort out warped, circular corn chips from flat, circular corn chips; and

FIG. 7 is an elevation view taken along line 7—7 of FIG. 6.

Referring now in detail to the drawings, the sorting machine shown therein includes base members 10 (FIGS. 1 to 3) supported by cross members 12 carried above a vibrating conveyor 14 of known construction which serves to advance products sorted by the sorting machine therefrom in separate rows. The channel-like base members 10 support a pair of angle members 20 fixed to the upper portions thereof, and also support U-shaped brackets 22 fixed at lower flanges thereof to the bases of the angle members 20. The brackets 22 carry upper angle members 24 on the upper flanges thereof, vertical flanges of the angle members 24 being mounted directly opposite corresponding portions of the lower angle members 20 to form parallel guideways therewith.

A pair of parallel vertical angle irons 26 rigidly secured to the angle members 24 are also secured to and support a feed chute 28 adapted to feed products to the sorting machine and carry a lower deflector plate 30 for directing small, fragmentary food products fed to the machine onto the left-hand portion of the conveyer 14, as viewed in FIGS. 1 and 2. An angular cover member 32 extends across the machine from the uprights 22 and supports bearings 34 journaling a capstan shaft 36 therein, which has a slot 38 in which a handle 40 is pivotally secured by a bolt 42. The cross members 12 are supported by vertical posts 44 fixed to brackets 46 and 48, carried by base 49 of the conveyer 14.

Discs 52, which are hexagonal in shape, are mounted in spaced parallel positions on shafts 54, 56, 58 and 60 with the discs 52 being spaced equidistantly along the shafts by spacer sleeves 64. The discs 52 on each of the shafts 54, 56, 58 and 60 are all aligned with the corresponding discs on the others of these shafts. Discs 53 on shafts 55, 57, 59 and 61 are aligned with the discs on the other of these latter shafts and the discs 53 are staggered relative to the discs 52 and are positioned midway therebetween. Spacer sleeves 65 separate the discs 53. Nuts 70 are threaded onto threaded portions 72 of the shafts, and with washers 74 and short end spacer sleeves 75 hold the spacer sleeves 64 and 65 in frictional contact with the discs 52 and 53 to provide a driving force thereto, the washers 74 being positioned between the nuts 70 and the end spacer sleeves 75 on the several shafts. The discs 52 and 53 thus are driven by friction with the spacer sleeves 64 and 65. The sleeves 64, 65 and 75 and washers 74 are driven by friction. The nuts 70 are adjusted on the shafts to provide the desired frictional pressure between the sleeves and the discs 52 and 53. The diameter of each of the discs 52 and 53 is somewhat over twice the external diameter of the spacer sleeve 64.

The shafts 54, 55, 57, 59 and 61 are journaled in nylon bearings 76 having concentric, cylindrical spacer discs 78, and having grooves 82 therein receiving the edges of the flanges of the angle members 20 and 24 and being slidable along the guideway formed by these flanges. The bearings 76 are composed of nylon or other low friction, plastic material. The shafts 56, 58 and 60 are journaled in nylon bearings 80 which are provided with annular grooves 82 slidably and keyingly mounting the

bearings 80 in the guideway formed by the members 20 and 24. Concentric with the bearings 80 are pairs of cam arms 86 having cam surfaces 88 thereon engaging the spacer discs 78 of the bearings 76. The cam arms 86 are carried by and are integral with pairs of actuating arms 90, 92 and 94. Each of the arms 90, 92 and 94 is slotted at the upper ends thereof and receives pins 100, 102 and 104, respectively, pivotally connecting the respective ends of the arms 90, 92 and 94 to a pair of parallel links 106. The pair of arms 90 are of identical length and are longer than the arms 92, which in turn are longer than the arms 94.

Cables 110 are connected to the pins 104 at one end of each cable and are secured at the other end of each to the capstan shaft 36. The cables are of such a length as to hold the arms 94 parallel to each other, and the links 106 hold the arms 90 and 92 parallel to each other and parallel to the arms 94. By rotating the capstan shaft 36 the cables 110 are taken up or let out equally, and the positions of the actuating arms 90, 92 and 94 are adjusted to turn the cam arms 86 to change the positions of the shafts 56, 57, 58, 59, 60 and 61, since the cam arms 86 determine the spacings between these shafts and between the shaft 56 and the shaft 55. The shafts 54 to 61 are all urged to the left as viewed in FIG. 2 by belt driving means, to be described hereinbelow. The cam arms 86 are identical with each other so that the spacing between each of the shafts 56, 58 and 60 for a given turning movement of the arms 90, 92 and 94, relative to the adjacent shafts 55, 57 and 59 will be identical. Since the movement of any group of the shafts to the left or to the right for a given adjustment of the capstan 36 is cumulative so far as movement of each shaft 57 to 61 to the right of the group is concerned, the arms 90, 92 and 94 are made of correspondingly different lengths such that the pivotal movement of each of the arms 90, 92 and 94, for a given adjustment, is always identical with the pivotal movement of each of the other of the arms 90, 92 and 94. That is, the arms 90, 92 and 94 are maintained parallel by reason of the links 106 and the differences in lengths of the arms 90, 92 and 94 to compensate for the cumulative movement of the shafts 58 and 60 relative to the shaft 56 and the greater movement of the shaft 60 relative to the shaft 58.

The drive of the shafts 54 to 61 (FIGS. 1 and 2) is effected by a motor 111, which drives a gear reducer 112 and a pulley 114. This drives a heavy, stretchable elastic belt 116 to drive pulley 118 keyed to the shaft 59, and the shaft 59 drives pulleys 120, 122 and 124 keyed thereto. The pulleys 118 and 120 are mounted at one end of the shaft, and the pulleys 122 and 124 are mounted on the other end of the shaft 59. The pulleys 120 and 122 drive pulleys 126 keyed to the shaft 60 through belts 128, which are stretchable or elastic and are maintained under tension. The shaft 60 drives pulleys 130 keyed thereto to drive pulleys 132 keyed to the shaft 61 through tensioned stretchable or elastic belts 134.

The pulley 124 keyed to the shaft 59 drives a tensioned elastic belt 140 to drive pulley 142 keyed to the shaft 54, and pulleys 144 keyed to the shaft 54 drive tensioned elastic belts 146 to drive the shaft 55 through pulleys 148 keyed to the shaft 55. Similarly, pulleys 150 keyed to the shaft 55 drive through tensioned elastic belts 152 and pulleys 154 keyed to the shaft 56 to rotate the shaft 56. Pulleys 156 keyed to the shaft 56 in turn drive tensioned elastic belts 158 and pulleys 160 keyed to the shaft 57. Pulleys 162 keyed to the shaft 57 drive the shaft 58 through tensioned elastic belts 164 and pulleys 166 keyed to the shaft 58. The belts 146, 152, 158 and 164 urge the shafts 55, 56, 57 and 58, respectively, to the left as viewed in FIGS. 1 and 2, and the belts 116 and 140 urge the shaft 59 continuously to the left, as viewed in FIG. 1, substantially all the shafts being urged by tension applied to opposite ends thereof so that there is no opportunity for cocking of the shafts. The shafts 60 and 61 are urged to the left by the belts 128 and 134, at both ends of each of the shafts 60 and 61.

Operation to separate or grade potato chips

The sorting machine is set with the shafts 55 to 61 spaced apart the desired distance, each adjacent pair of shafts being separated from each other a distance such that the spacer sleeves 64 and 65 are spaced from each other a desired distance, and potato chips 170 are supplied from a suitable source (not shown) to the chute 28 and are conveyed toward the right, as viewed in FIG. 1, by the discs 52 and 53 and the sleeves 64 and 65. The lower end of the chute 28 is spaced sufficiently close to the discs 52 and sleeves 64 on the shaft 54 that only very small, broken particles will drop between the discs and the lower end of the chute to the conveyor 14, and small and broken particles drop between the spacer sleeves on the shafts 54 and 55, these elements acting to remove crumbs and the like. The remainder of the chips 170 are carried by the discs 52 and 53 and the sleeves 64 and 65 toward the right. As they are fed to the right, the larger, generally circular chips tend not to drop onto the sleeves 64 and 65 and are advanced in generally horizontal positions by the octagonal discs 52 and 53 to the discharge end of the conveyor. If these larger chips do drop between the discs 52 and 53 onto the sleeves 64 and 65, they are too wide to drop between the sleeves and are fed by the sleeves and discs to the discharge end of the conveyor. The spacings between the discs 52, the spacings between the discs 53 and the spacings between the discs 52 and 53 are sufficient that the smaller chips to be sorted from the larger chips drop edgewise between the discs as the octagonal discs 52 and 53 agitate the chips while feeding them. The discs 52 and 53 may be mounted on the shafts with the blunt teeth thereof oriented at random to enhance the agitation of the chips. The chips are agitated sufficiently that if they are narrow or of a small diameter, they will drop between the spacer sleeves 62 and 65 onto the central portion of the conveyor 14, as viewed in FIG. 2. All the chips 170 which are too wide to drop between the discs, which are too long to drop between the sleeves and which are in clusters so that they are too thick to drop between the discs are advanced by the discs and the sleeves to the right beyond the shaft 61 and drop onto the right-hand portion of the conveyor 14, completely separated from the smaller chips which have dropped onto the central portion of the conveyor 14. The discs 52 and 53 tend to keep any chips dropping therebetween generally parallel to the discs 52 and 53, and the peripheral edges of the discs 52 and 53 are spaced sufficiently close that chips parallel to the spacer sleeves cannot drop between the adjacent edges of the discs 52 and 53. The blunt teeth or corners of the discs serve excellently to engage and advance the chips along the machine with a self cleaning action so that binding does not occur. The drive of the discs 52 and 53 is by friction with the spacer sleeves 64, 65 and 75, which in turn are driven by friction with the nuts 70.

Operation to separate or grade french fries

To feed food products such as french fries 180 (FIG. 5) or stiff bacon rind (not shown) or similar elongated food products, and sort out those above a predetermined maximum length, the shafts 56 to 61 are adjusted to space the peripheries of the spacer sleeves 64 and 65 apart such distances that the short french fries will pivot around one of the spacer sleeves 64 and drop between the spacer sleeves while the french fries above the minimum length will always substantially span portions of three adjacent parallel spacer sleeves 64 and 65 and be advanced thereby continuously toward the right and discharged at the right-hand end of the machine. This is illustrated in FIG. 5 where one of the french fries 180 is of the shorter length and drops between the spacer sleeves 64 and 65 as the left-

hand end of the french fry 180 clears the lefthand sleeve 65, while any longer french fry, when the lefthand end thereof clears the lefthand spacer sleeve, has its right-hand end of the french fry 180 clears the lefthand sleeve righthand spacer sleeve 64. This causes the longer french fry to be fed continuously to the right and discharged into the righthand side of the conveyor 14. The machine sorts or grades and feeds the french fries very gently. The discs 52 and 53 serve to comb the french fries to cause them to extend longitudinally in the direction of travel, so that the french fries drop between the discs 52 and between the adjacent discs 53 onto the sleeves 64 and 65.

Sorting machine of FIGS. 6 and 7

To separate circular, plane or flat, disc-like chips 190 from warped, circular, disc-like chips 192, there is provided a sorting machine 189. The sorting machine 189 includes octagonal feeding discs 202 similar to the discs 52 and 53 separated from each other and driven frictionally by spacer sleeves 204 shorter than the sleeves 64 and 65. A shaft 206 drives the discs and sleeves clockwise as viewed in FIG. 6. The discs 202 are mounted in close, parallel positions. The machine 189 has staggered, inclined, feeding troughs or chutes 210 generally V-shaped in cross-section and each converging to a narrow "V" at its discharge end 212 from a wide "V." The troughs 210 discharge the chips 190 and 192 in substantially vertical planes into the spaces between the discs 202. The discs 202 are spaced apart a distance slightly greater than the thickness of each flat chip so that plane or flat chips drop therebetween while warped chips do not. The sleeves 204 and the lower ends of troughs 210 are spaced horizontally apart a distance slightly greater than the diameter of the chips so that the flat chips drop therebetween.

The discs 202 and the sleeves 204 advance to the right, as viewed in FIG. 6, all the warped chips 192. The warped chips 192 cannot drop between the spaces between the discs 202, and are conveyed over the discs and are discharged onto a chute 209 leading to a conveyor 211 so that the warped chips 192 are completely separated from the flat chips 190 on the conveyor. The handling of the chips 190 and 192 is very gentle.

The sorting machines described above serve very effectively to sort materials, according to width, length and thickness. The machines may be adjusted in matters of seconds, and are simple, rugged and durable in construction. The machines have large capacities and feed and sort the various products very gently, even though rapidly. The several shafts are all identical, and only two different types of bearings need be provided, one type for the shafts 56, 58 and 60 and the other type for the other shafts. The several shafts with the discs thereon are driven surely and are urged to the left continuously at both ends thereof so that the bearings slide freely without cocking on the members 20 and 24. While the above-described machines have been described as operable to sort potato chips, french fries, corn chips and bacon rind and the like, they obviously are effective to sort out many other materials. For example, the machines serve to sort out clusters of breakfast food or lumps of granular material from the separate particles by permitting the separate particles to drop through the disced rolls while feeding the clusters or lumps on to a separate discharge point. While the rolls of the machine of FIGS. 1 to 5 beyond the first two or "crumb" rolls are shown as being equidistantly spaced from each other, obviously the separating cams can be of progressively increasing, different sizes to separate the rolls progressively farther apart so as to effect a progressive grading or classifying operation with the conveyor 14 having suitably placed longitudinal dividers thereon. The machine of FIGS. 1 to 5 also serves to orient and classify according to length food products such as asparagus, string beans and the like, and separates undersized products as well as oversized products from the products of a desired range of sizes. While the several shafts are shown as being driven at the same speed, each successive shaft, proceeding away from the infeed end of the machine, can be rotated at a higher speed than the preceding shaft to separate or string out successive products being advanced thereby.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. In a sorting machine,
a pair of parallel, substantially horizontal guideways,
a plurality of pairs of bearings mounted slidably in the guideways,
a plurality of shafts mounted by the pairs of bearings,
a plurality of discs mounted in laterally spaced apart positions on each of the shafts,
means connecting the discs drivingly to the shafts,
means for driving the shafts in the same direction,
means for urging the bearings toward the same end of each of the guideways.
stop means at said end of the guideways,
and adjustable means for adjusting the spacing between the shafts and the discs carried by the shafts.

2. In a sorting machine,
a pair of opposed guide plates spaced vertically from each other and defining a substantially horizontal guideway,
a plurality of bearings having external peripheral grooves adapted to receive the pair of guide plates for slidably supporting the bearings in the guide plates,
a plurality of shafts journaled in the bearings,
means urging the bearings into engagement with each other,
cam members having actuator arms and a pair of oppositely disposed cam arms mounted pivotally on alternately positioned shafts for engaging the bearings of the other shafts,
means for urging the bearings together,
a link connecting the actuator arms together at points thereon spaced progressively different predetermined distances from the shafts on which the cam members are mounted for pivoting the cam members,
the configurations of the cam arms and the links of the actuator arms being so proportioned that the actuator arms are maintained parallel to one another with the cam arms held continuously in contact with the adjacent bearing members.

3. In a sorting machine,
a pair of opposed guide plates spaced vertically from each other and defining a substantially horizontal guideway,
a plurality of bearings having external peripheral grooves adapted to receive the pair of guide plates for slidably supporting the bearings in the guide plates,
means urging the bearings toward engagement with each other,
a plurality of shafts journaled in the bearings,
sorting elements carried by the shafts,
a plurality of spacer cams each having a pair of oppositely disposed cam arms for engaging adjacent bearings,
the spacer cams being pivotal on alternate ones of the shafts,
and means for adjusting the cam members in synchronism with each other.

4. In a sorting machine,
a pair of opposed parallel guideways,
each guideway having a pair of opposed vertical plate portions,

a plurality of bearings having external annular grooves adapted to receive the edge portions of the plate portions for slidable movement of the bearings along the guideways,
a plurality of shafts journaled in the bearings,
a plurality of polygonal discs carried by the shafts,
and adjustable spacer means carried by the bearings for separating the bearings from each other,

5. In a sorting machine,
a plurality of shafts,
a plurality of pairs of bearings mounting the shafts,
guide means mounting the bearings slidably laterally of the shafts,
adjustable spacer means positioned between the bearings,
a plurality of pulleys mounted in pairs on the ends of each of the shafts,
a plurality of elastic belts connecting the pulleys of the shafts, urging the shafts toward one another at opposite ends of the shafts and drivingly interconnecting the shafts,
a plurality of sorting discs mounted on the shafts,
and means for driving one of the shafts.

6. In a sorting machine,
a pair of parallel, spaced apart, generally horizontal guideways,
a plurality of pairs of first bearings slidably mounted in the guideways,
a plurality of pairs of second bearings mounted in opposed positions slidably in the guideways and alternating with the first bearings,
each of the first bearings being provided with a spacer disc,
a plurality of shafts journaled in the pairs of bearings,
means urging the pairs of bearings toward the same end of the guideways,
a plurality of pairs of cam members each having a pair of opposed cam arms and mounted on the shafts with the second bearings,
the cam members also having actuator arms,
a pair of links pivotally connecting the actuator arms at points on the actuator arms spaced progressively greater distances from the center of the bearings associated with the cam arms proceeding toward the direction of said end of the guideways,
the differences in said distances being such and the cam throws of the cam arms being such that the cam arms are maintained parallel to one another for any rotative adjustment of the actuator arms by the link,
a capstan shaft,
a pair of cables secured to the capstan shaft at one end of each and to the links at the other end of each,
manually operable means for rotating the capstan to adjust the links and the actuator arms,
a plurality of pairs of pulleys mounted on the shafts,
a plurality of elastic stretchable belts interconnecting the pulleys of the shafts and urging the shafts toward one another and drivingly connecting the shafts together,
a plurality of octagonal discs freely rotable on the shafts,
a plurality of spacer sleeves positioned on the shafts between the discs,
means holding the spacer sleeves in frictional engagement with the discs to form frictional driving interconnection therebetween,
means for feeding material into the machine at one end thereof,
and means for driving the shafts to feed the chips from said one end of the machine toward the other end of the machine whereby the smaller chips are dropped between the discs and the spacer sleeve and the larger chips are advanced by the discs and the spacer sleeves to the other end of the machine.

7. In combination,
a plurality of rotor members including shafts and adapted when rotated to advance food products,
bearing means journaling the shafts,
guide means mounting the bearing means in positions in which the shafts are substantially parallel and for movement of the bearing means toward and away from each other,
adjusting means for moving the rotor members and bearing means toward and away from each other,
means for holding the bearing means in adjusted positions,
expansible and contractible drive means for rotating the rotor members in the same direction so that the rotor members tend to advance food products toward a discharge end thereof,
first receiving means positioned directly below the rotor members for receiving food products dropped between the rotor members,
and second receiving means adapted to receive food particles advanced by the rotor members to the discharge end.

8. In a machine for separating chip-like food products,
a plurality of side-by-side feeders for discharging chip-like food products on edge,
a plurality of discs,
means mounting the discs in vertical, parallel positions spaced apart a predetermined distance and adapted to receive therebetween food products discharged by the feeders whereby food products of an overall thickness less than said distance drop between the discs,
each feeder comprising a chute having a discharge end and having an upwardly facing V-shaped passage tapering from a wide "V" at a point spaced from the discharge end of the chute to a narrower "V" at the discharge end thereof,
and means for rotating the discs in a predetermined direction to advance over the discs food products of an overall thickness greater than said distance.

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