Sept. 3, 1946. McSHERRY LUPTON 2,406,842

GRADING MACHINE

Filed Aug. 9, 1941 8 Sheets-Sheet 1

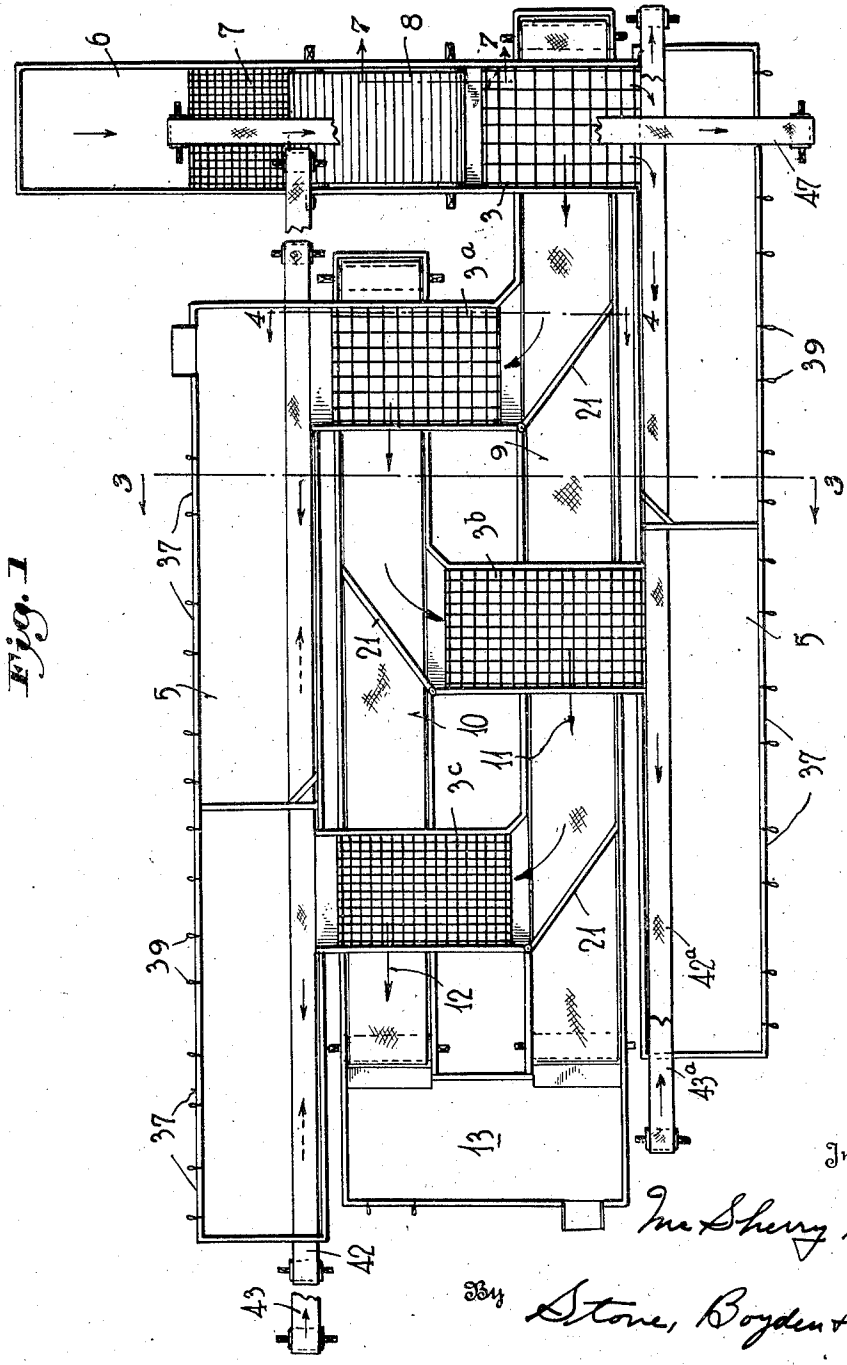


Fig. 1

Inventor
Ira McSherry Lupton

By Stone, Boyden & Isaac
Attorneys.

Sept. 3, 1946. McSHERRY LUPTON 2,406,842

GRADING MACHINE

Filed Aug. 9, 1941 8 Sheets-Sheet 2

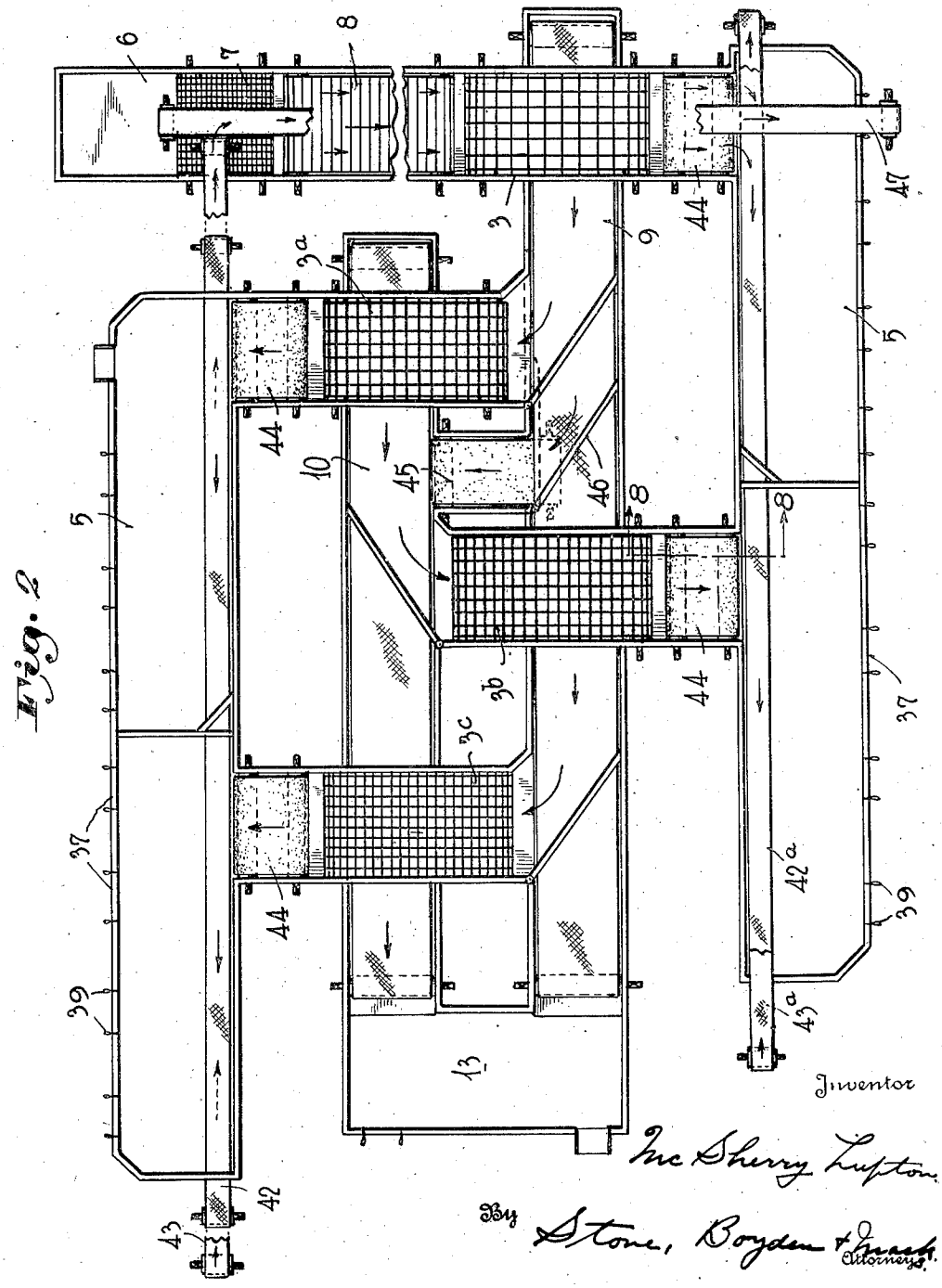


Fig. 2

Inventor

Mc Sherry Lupton

By Stone, Boyden & Branch

Attorneys.

Sept. 3, 1946. McSHERRY LUPTON 2,406,842

GRADING MACHINE

Filed Aug. 9, 1941 8 Sheets-Sheet 3

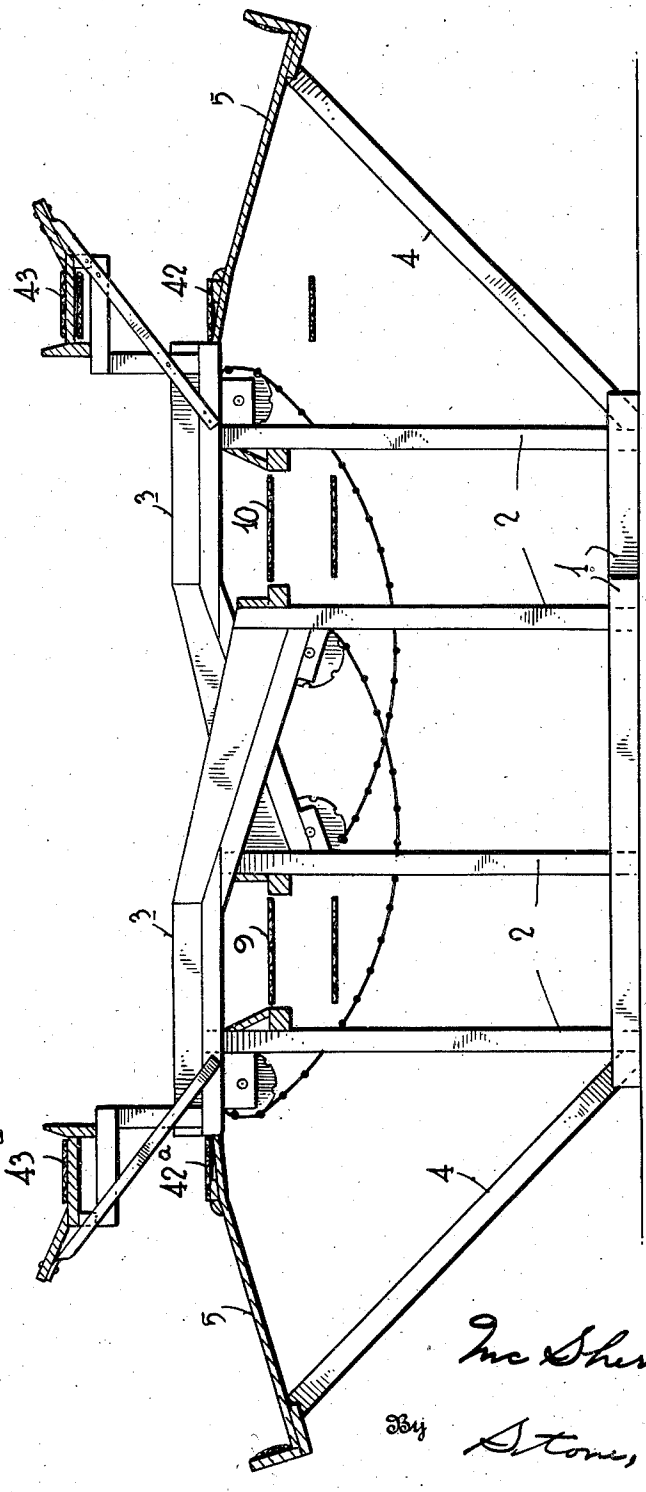


Fig. 3

Inventor

McSherry Lupton.

By Stone, Boyden & Mack

Attys.

Sept. 3, 1946. McSHERRY LUPTON 2,406,842

GRADING MACHINE

Filed Aug. 9, 1941 8 Sheets-Sheet 4

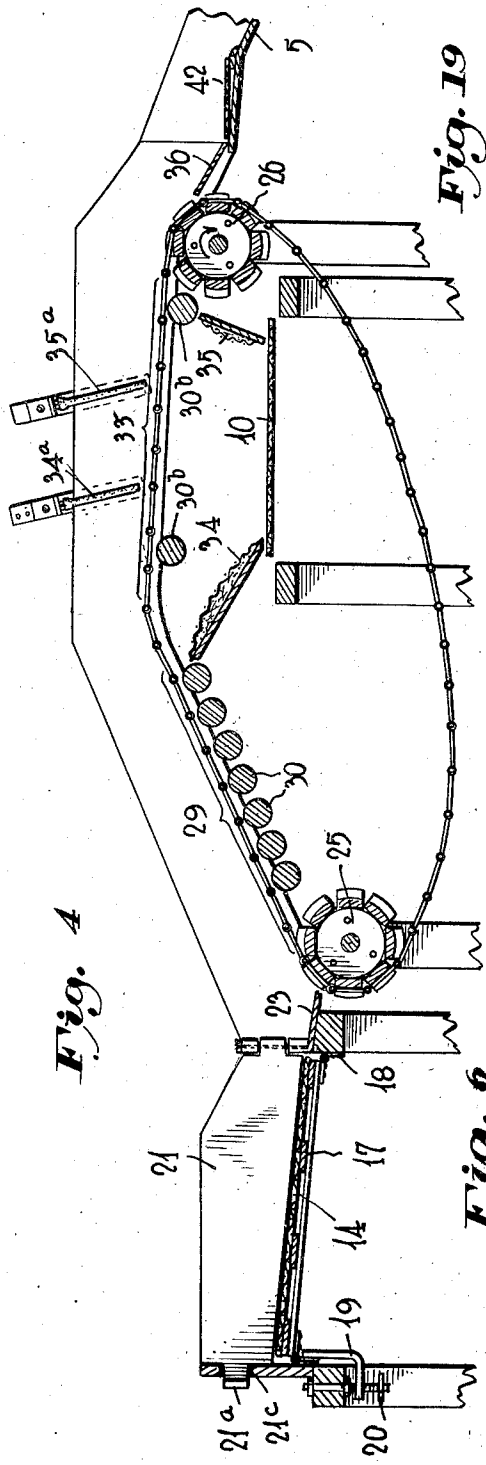


Fig. 4

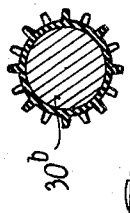


Fig. 19

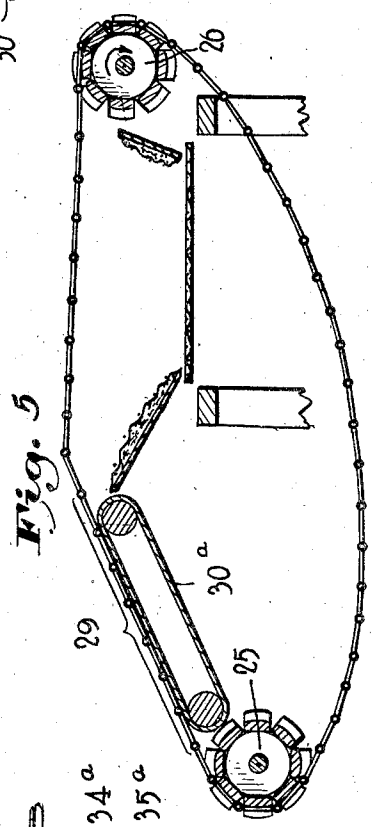


Fig. 5

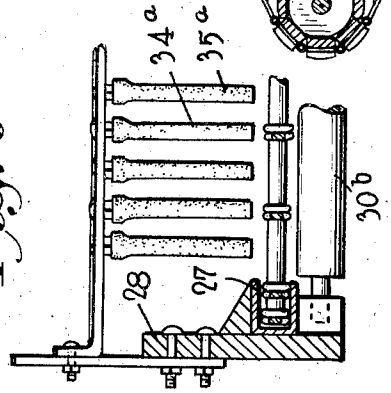


Fig. 6

Inventor

Mc Sherry Lupton

By Stone, Boyden & Knox.

Attorneys.

Sept. 3, 1946. McSHERRY LUPTON 2,406,842

GRADING MACHINE

Filed Aug. 9, 1941 8 Sheets-Sheet 5

Fig. 8

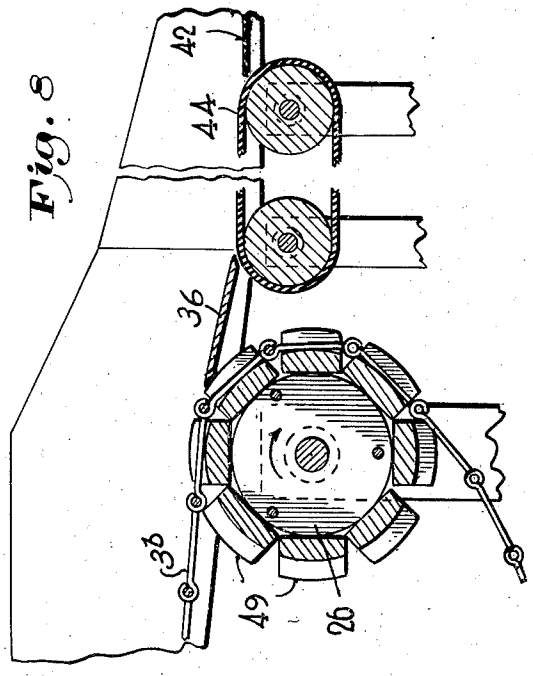


Fig. 9

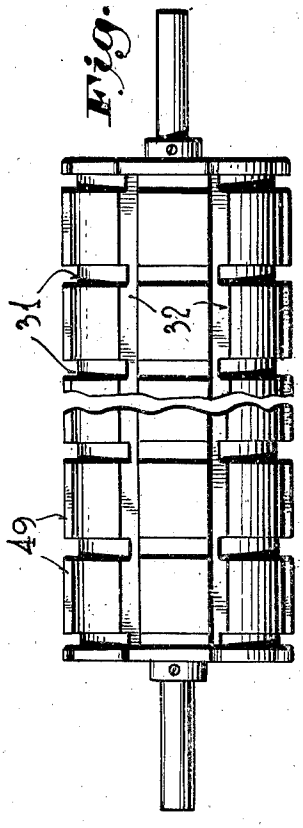
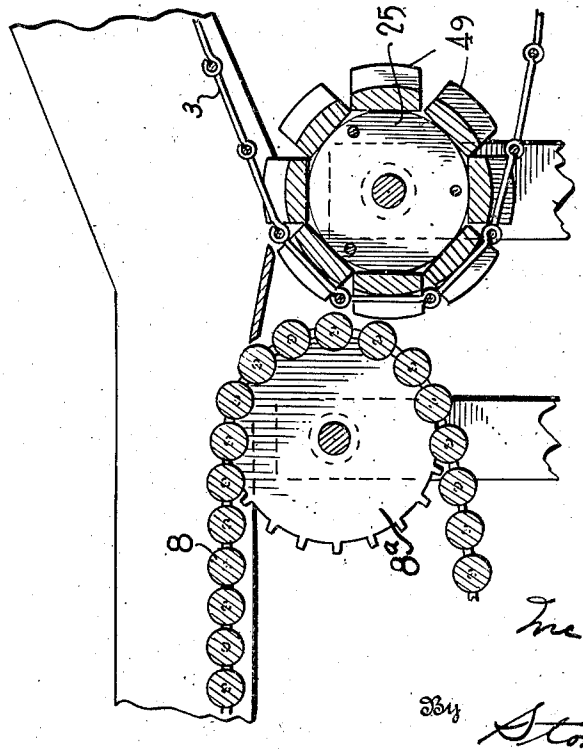


Fig. 7



Inventor

Mc Sherry Lupton.

By Stone, Boyden & Isaacs Attorneys

Sept. 3, 1946. McSHERRY LUPTON 2,406,842

GRADING MACHINE

Filed Aug. 9, 1941 8 Sheets-Sheet 6

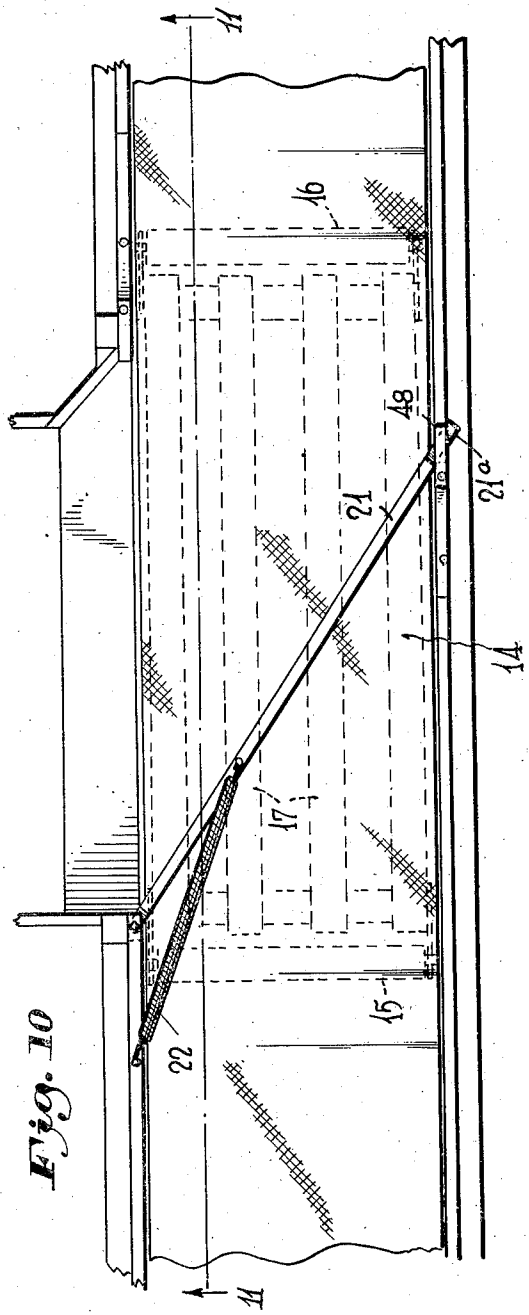


Fig. 10

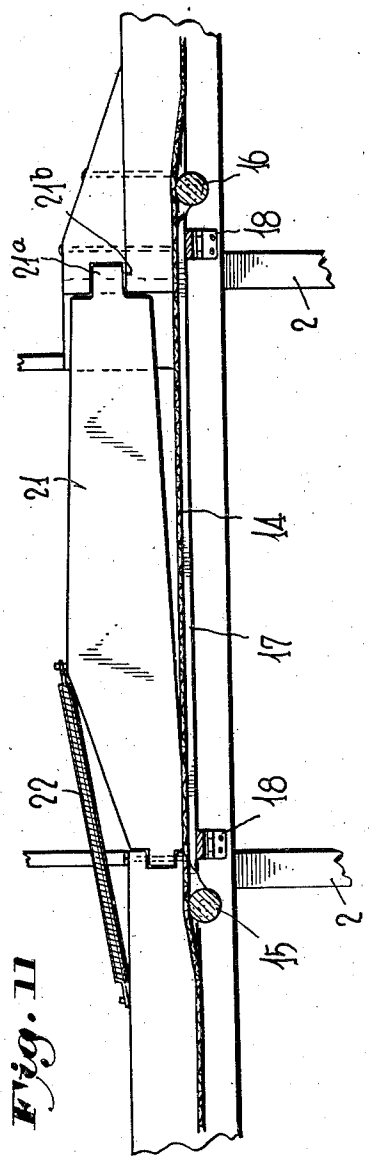


Fig. 11

Inventor

Mc Sherry Lupton.

By Stone, Boyden & Knack
Attorneys.

Sept. 3, 1946. McSHERRY LUPTON 2,406,842

GRADING MACHINE

Filed Aug. 9, 1941 8 Sheets-Sheet 7

Fig. 12

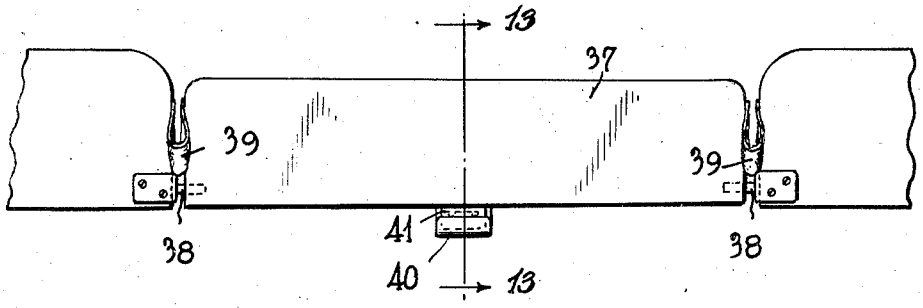


Fig. 13

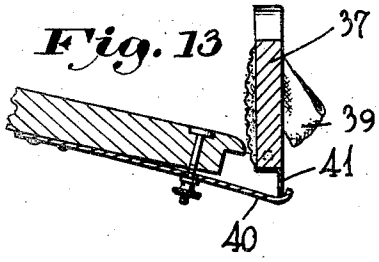


Fig. 14

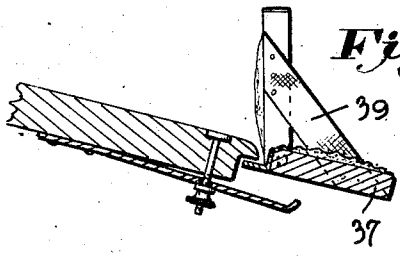
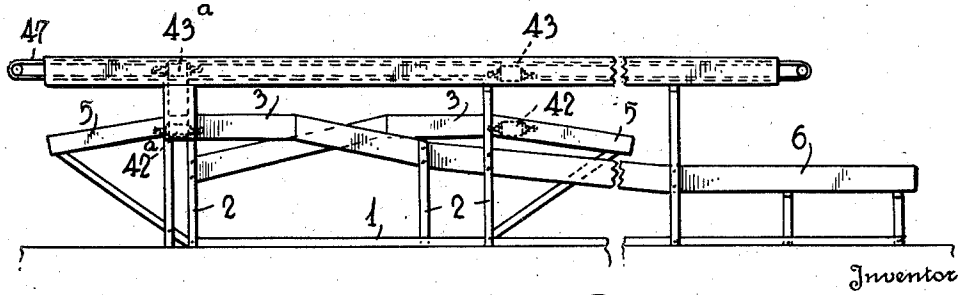


Fig. 15



Inventor

Mc Sherry Lupton.

By Stone, Boydon & Mack

Attorneys.

Sept. 3, 1946. McSHERRY LUPTON 2,406,842

GRADING MACHINE

Filed Aug. 9, 1941 8 Sheets-Sheet 8

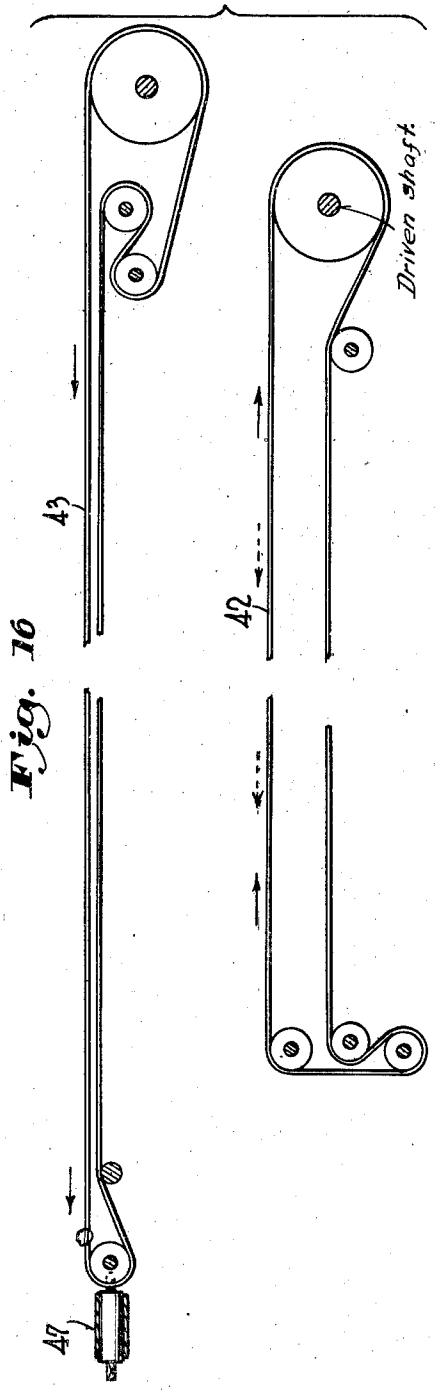


Fig. 16

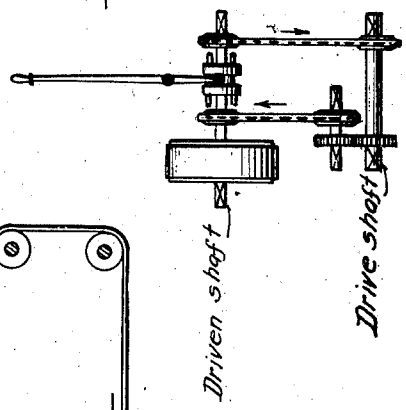


Fig. 18

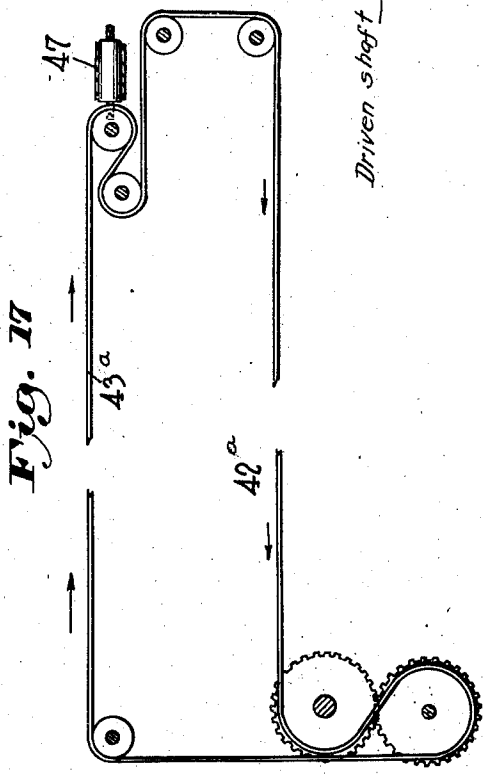


Fig. 17

Inventor

Mc Sherry Lupton

By Stone, Boyden & Greek
Attorneys

Patented Sept. 3, 1946

2,406,842

UNITED STATES PATENT OFFICE

2,406,842

GRADING MACHINE

McSherry Lupton, Winchester, Va.

Application August 9, 1941, Serial No. 406,177

14 Claims. (Cl. 209—84)

1

This invention relates to grading or sizing machines and more particularly to an improved machine for separating fruits, vegetables or other more or less analogous materials into different grades according to size.

A major object of this invention is to provide a grading machine for sizing apples which includes a plurality of grading units, conveyor belts for delivering fruit to the grading units, and bins for receiving the graded fruit to be packed, all compactly arranged so as to occupy a minimum amount of space, yet so that every element of the machine is readily accessible by the operator or fruit packer.

Another object of this invention resides in the provision of means for eliminating any one of the grading units from the series when desired without in any way interfering with the operation of the other units of the series.

Still another object of this invention is to provide main conveyor belts for delivering fruit to the grading units having those portions opposite the receiving end of each grading unit adjustably inclined or tilted toward the grading unit to thereby facilitate delivery of the fruit to the grading units.

A further object of this invention is to provide each grading unit with resilient, rubber fingers supported above the links of the upper stretch of the sizing chain of each unit for turning and positioning the fruit relatively to the sizing opening of the sizing chains and thereby preventing undersized fruit from riding through on the links of the sizing chain.

The foregoing and additional features of the invention will become apparent from the following description and claims, taken in connection with the accompanying drawings, in which:

Fig. 1 is a plan view of the fruit grading machine;

Fig. 2 is a plan view of one modification of the grading machine having the same essential features as shown in Fig. 1, but providing aisles between adjacent bins;

Fig. 3 is a sectional view taken along line 3—3 of Fig. 1, looking lengthwise of the machine in the direction of the arrows;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1, looking in the direction of the arrows, showing the use of rollers beneath the elevating portion;

Fig. 5 shows a modified sizing chain arrangement, using a belt in lieu of rollers;

Fig. 6 is a fragmentary section of one of the grading units showing the resilient rubber fingers

2

and their relative position with respect to the sizing chain;

Fig. 7 is a fragmentary section, somewhat enlarged, along the line 7—7 of Fig. 1, showing the relation of the sorting rolls with respect to the receiving end of the sizing chain of the first grading unit;

Fig. 8 is a fragmentary section, also enlarged, along line 8—8 of Fig. 2, showing the delivery end of the sizing unit with respect to the spacer belt and the distributing belt of the packing bin;

Fig. 9 is a side elevation of the roller of this invention for driving a sizing chain;

Fig. 10 is a plan view of a portion of one of the main conveyor belts and gate showing their relation with respect to the receiving end of a grading unit;

Fig. 11 is a view on line 11—11 of Fig. 10, but showing the gate in closed position;

Fig. 12 is a view of a portion of the side of one of the packing bins showing the construction of one of the doors;

Fig. 13 is a section along line 13—13 of Fig. 12;

Fig. 14 is a section along line 13—13 of Fig. 12 but showing the padded door in its open position;

Fig. 15 is an end view of the grading machine, looking toward the right hand end of Fig. 1;

Fig. 16 is a view showing the relation of the distributing belt and off-grade return belt with respect to each other and the end utility belt;

Fig. 17 is a modified belt arrangement showing the use of a single endless belt instead of two endless belts as in Fig. 16;

Fig. 18 shows a suitable driving and reversing mechanism for the lower distributing belt; and

Fig. 19 is a cross sectional view looking lengthwise of one of the rubber covered rollers used beneath the grading chain showing projecting rubber teats.

Referring now to the drawings and particularly to Fig. 3, it will be seen that the supporting frame of the grading machine is constructed principally of wood and comprises base members 1, to which are secured vertical leg members 2, on which are mounted the grading units and their associated mechanism indicated generally at 3, 3^a, 3^b and 3^c. Also attached to the base members 1 are legs 4, for supporting the packing bins 5, the legs 4 being inclined inwardly toward their lower ends to conserve floor space. 3, 3^a, 3^b and 3^c identify also the grading chains of the respective units.

As shown in the plan view Fig. 1, the grading or sorting machine comprises a feed bin 6 which

may be inclined to feed the fruit onto the eliminating chain 7 which is a small mesh chain or screen for removing undersized fruit and foreign matter such as leaves, twigs, pebbles, etc. From this eliminator 7 the fruit, apples in this instance, are fed to a belt of sorting rolls 8 driven by a sprocket wheel 8a, shown enlarged in Fig. 7. This belt of sorting rolls is provided at this point so that an operator may remove off-grade fruit such as rotten or badly bruised fruit before it reaches the first grading unit. Thus far, this is the usual procedure in most grading machines.

The plurality of grading units 3, 3a, 3b and 3c are spaced along two parallel main conveyor belts 9 and 10 at right angles thereto and in staggered relation with respect to each other in such an arrangement that the conveyor belt 9 passes beneath the sizing chains of alternate grading units 3 and 3b and commnuicates with the receiving end of succeeding alternate grading units 3a and 3c. Conveyor belt 10 passes beneath grading units 3a and 3c and communicates with the receiving end of grading unit 3b and every succeeding alternate grading unit where more than four grading units are used.

The conveyor belts 9 and 10 are driven in the same direction, as indicated by the arrows 11 and 12 and have a bin 13 arranged at their delivery ends. As shown in Figs. 4, 10 and 11, those portions 14 of the conveyor belts opposite the receiving end of each of the grading units 3, 3a, 3b and 3c are adjustably inclined to facilitate delivery of fruit to the grading units. This inclined or tilted portion of the belt is supported by rollers 15 and 16 at the ends and throughout the intermediate portions by the adjustably hinged slatted framework 17. This slatted framework is hinged at 18 on its inner side to the supporting frame of the machine and adjustably supported at its outer side as indicated at 19. Thus it will be seen that this portion of the belt resting on this slatted framework 17 can be tilted to any degree desired by rotation of the screw threaded bolt 20 thereby raising or lowering the outer side of the slatted framework 17 on which the conveyor belt rests.

Hinged at one side of the receiving end of each grading unit is a gate 21 which is adapted when in the open position and extended transversely of the conveyor belt to shunt fruit to the grading unit from the conveyor belt as shown in Fig. 10, and when in the closed position, as shown in Fig. 11, closes the receiving end of the grading unit and allows the fruit to be carried by the belt past the gate to another grading unit. A spring 22 is provided to hold the gate in an open position or to be ineffective when the gate is closed. The bottom edge of the gate is beveled progressively from its pivoted end toward its free end, as shown best in Fig. 11, so that when the gate is in its open position extending transversely of the inclined portion 14 of the conveyor belt, its bottom edge will be closely adjacent the upper surface of the inclined portion 14 of the conveyor belt. Both the hinge and free ends of the gates 21 are shown as having projections 21a intermediate their height. These projections at the free ends of the gates are adapted to enter complementary recesses 21b in the door opening (Fig. 11) and 21c in the opposite wall (Fig. 4). This construction serves to prevent the gate from being forced up by matter accumulating or catching beneath it.

The parts of each of the grading units are alike except that the mesh of the sizing chain of each unit varies in accordance with the size of the apples to be graded out by the particular grading unit. Therefore only one of the grading units will be described in detail, this description applying to the other grading units with the exception noted above in regard to the mesh of the sizing chain.

As best shown in Figs. 4, 5, 6, 7, 8 and 9, each grading unit comprises an inclined plate 23 for spacing the gap between the delivery belt 9 and its inclined portion 14, and the sizing chain 24. The supporting and driving means for the sizing chain consists of end rollers 25 and 26, which latter is power driven to move the chain, guide channels 27, and sides 28 (Fig. 6). Placed beneath but out of contact with the rising stretch 29 of the sizing chain are a plurality of rollers 30 to raise any apples which might be extending part way through the chain and re-position them so that they can go through the chain opening if they are of the correct size. Fig. 5 shows a slight modification of the above arrangement. Instead of using a plurality of rollers 30 immediately beneath the rising stretch 29 of the sizing chain, a short endless belt 30a is supported just beneath the rising stretch 29 of the sizing chain and serves the same purpose as the rollers 30, namely, to raise any fruit which might be projecting part way through the chain and to reposition the same so that it can go through the chain opening if it should. At the upper end of the rising stretch 29 and toward the end portion of the upper stretch 33 of the chain are two rollers 30b which are located just beneath the surface of the chain whereby fruit projecting through the links may be urged upward and thus freed. The rollers 30b may be provided on their exterior with short rubber teats or they may be covered with sponge rubber, either of such coverings serving to engage the surface of fruit without damaging the same. Likewise, the rollers 30 may be similarly covered. In Fig. 19, there is illustrated an enlarged cross sectional view of such a roller as just previously described, and which has the outer surface provided with short projecting rubber fingers or teats. The rollers 30 and 30b in Fig. 4 are not illustrated as carrying the rubber coating, as this is sufficiently illustrated in Fig. 19.

The driving and supporting rollers 25 and 26 constituting respectively an advance or receiving roller are shown in plan or side elevation, in Fig. 9. The surface of the roller is slotted circumferentially as at 31 and axially as at 32 so as to receive the longitudinal and transverse links of the chain, in such manner that no portion of the chain protrudes above the surface of the roller as it passes around the same. Beneath the upper stretch 33 of the sizing chain and on either side of the conveyor belt 10 that passes beneath the grading unit for receiving fruit which has passed through the sizing chain are inclined padded baffles 34 and 35 for preventing the fruit from leaving the belt (Fig. 4).

The grading chain illustrated is provided with rectangular openings, the links crosswise and lengthwise being straight. The rollers 25 and 26, as shown in Figs. 7, 8 and 9, by reason of the circumferential and axial slots, have projecting block-like elements 49, which are adapted to project through the openings in the chain after the manner of square gear teeth. The blocks illustrated have a peculiarly advantageous configuration by reason of the fact that their outer contour is curved circumferentially while being axially straight. The curved surfaces are shown in Figs. 4, 5, 7 and 8. Prior to this invention, it has

been the practice to have such projecting block elements **49** with flat outer surfaces. Now, however, it has been found, as result of the present invention, that the action of the blocks provides a peculiar advantage during the engagement of the block with fruit being treated and especially as the block enters the opening in the chain upon the rising movement of the block. The combined curvature of the surface of the block, together with the movement of the block upon entering the chain as to assume the position shown in Fig. 8, is one in which the fruit is least subjected to bruising. Similarly, with respect to Figure 7, when the block at the top of the roller **25** begins to leave the link of the chain, any fruit resting on the block is gradually lowered and the final departure of the block away from the plane of the chain link is characterized by the curved surface of the block receding from the plane of the link. The curved surface of the block tends to gradually lower the fruit onto the chain, whereas the older form having a right angle edge would have tended to damage the fruit by reason of the 90° angle of the edge of the block being projected upwardly for the fruit to rest upon.

Above the upper stretch of the sizing chains are positioned two sets of bodily resilient, rubber fingers **34ª** and **35ª** depending toward and adjacent the chain (Fig. 6), one set **34ª** lying in a plane coinciding with the longitudinal elements of the chain so as to prevent the fruit from riding through on the chain at the joint between the longitudinal and transverse links. A second set of bodily resilient rubber fingers **35ª** depends adjacent the chain so as to overhang the sizing openings of the chain so as to reposition any fruit which might be caught crosswise or otherwise incorrectly lodged temporarily in the openings of the sizing chain. The sets of fingers **34ª** and **35ª** are positioned in spaced relation with respect to each other along the upper stretch of the sizing chain. In Fig. 6 is illustrated an enlarged view of the rubber fingers **34ª** and **35ª**, looking to the right along the upper portion of Fig. 4. At the delivery end of the sizing chain, an inclined plate **36** is provided to bridge the short gap between the sizing chain and the packing bin **5**. The inclined plate **36**, constituting a discharge apron, is illustrated in an enlarged view in Fig. 8 as having its underneath surface at its advance edge, that is, the edge next adjacent the blocks **49** of the discharge roller **26**, bevelled, whereby the upper surface is brought as closely as possible to the path of revolution of the blocks **49**. It will also be observed that the upper and advance edge of the plate **36** is positioned approximately at the top of the roller **26**, this being possible by reason of the fact that the curvature of the blocks **49** defines the outermost path of revolution of any portion of the blocks and therefore also any portion of the path of revolution of the roller. By referring to Figs. 1 and 2, it will be seen that the sizing chains of alternate grading units travel in the same direction.

Arranged at the discharge end of each grading unit are padded packing bins **5** having a plurality of padded doors **37** pivoted to the outer side of the bins. These doors **37** are as best shown in Figs. 12, 13 and 14, pivoted at **38** to the bottom surface of the bins. The door **37** is so pivoted to the side of the bin that when in its closed position, as best shown in Figures 12 and 13, its outer surface is flush with the side of the bin so that it presents no obstruction protruding beyond the side of the bin. For holding the door in its closed position, an adjustable spring **40** is provided secured at one end to the bottom of the bin and having its free end bearing against a downward projecting piece **41** secured to the bottom edge of the door. One of the advantages of this door, hinge, and detent construction is that the door does not snap shut upon being closed, but to the contrary, closes to its final position only as moved by the person operating it. The piece **41** is in constant frictional engagement with the spring **40** during the closing movement and toward the end of that action the piece **41** comes to rest against the upturned edge of the spring piece **40**. The nature of the closing movement is in contrast to the effect provided by certain constructions in which the door, upon snapping shut, may actually strike fruit resting on the table near its edge and throw it with resultant damage to the fruit. When the doors **37** are in the open position, the inner surface of the door is flush with the inner bottom surface of the bin so as to prevent the fruit from becoming bruised due to any drop or bump as it is discharged from the bin. Webs of canvas **39** are secured to the ends of the door and the sides of the bin and serve to guide the fruit and prevent it from rolling off the sides of the door as it comes out of the bin.

Travelling along the surface of each bin and next adjacent the discharge end of the grading chains **3**, **3ª**, **3ᵇ**, **3ᶜ** and the belts **44** are substantially horizontal distributing belts **42** and **42ª** for receiving the graded fruit as it is discharged from the delivery end of each grading unit for the purpose of evenly distributing the fruit lengthwise of the bins **5** for preventing piling up or over-crowding of the fruit in that portion of the bin opposite the delivery end of each grading unit. These distributing belts **42** and **42ª** are adapted to be driven in either direction by suitable driving and reversing mechanism, (Fig. 18). Above the level of the bins **5** are provided off-grade return belts **43** for returning off-grade fruit to a receptacle at one end of the machine.

As shown in Fig. 16, and also at the right hand side of Fig. 3, separate endless belts may be used, one for the distributing belt **42** and the other for the off-grade return belt **43**. As a modification of this particular arrangement, the use of a single belt is shown in Fig. 17, and also at the left hand side of Fig. 3, wherein the bottom side **42ª** travels along the inner side of the bottom surface of the bin and acts as a distributing belt and the returning upper portion **43ª** of the same endless belt is used for the off-grade return belt.

Arranged at the delivery end of the off-grade return belt **43** or **43ª** for receiving the off-grade fruit, is a utility belt **47**, Figs. 1, 2 and 15, which takes the off-grade fruit from the off-grade belt and returns it to one end of the machine, where it may be caught in a receptacle, not shown. This belt **47**, as shown in plan views **1** and **2**, is positioned on a level above the sorting rolls and sizing chain in the first grading unit. As shown in the sectional view of Fig. 3 at the right hand side of the machine, two endless belts are used, one for the distributing belt **42** and the other for the off-grade return belt **43**, and on the left hand side of the machine, a single endless belt is used, the bottom side of which acts as the distributing belt **42ª** and the upper returning side **43ª** of the same endless belt acts as the off-grade return belt above the level of the bin.

In Fig. 2 is shown a plan view of the grading machine with slight modifications. Spacer belts **44** are positioned between the delivery end of

each grading unit and its respective bin. The spacer belts 44 travel in the same direction as the sizing chain of the grading unit with which the particular spacer belt is associated for delivering fruit, as it comes from the grading unit to the distributing belts in the bins. This arrangement, as shown in Fig. 2, provides space between the conveyor belts 9 and 10 and adjacent parallel bins 5 so that operators will be afforded easy access to either side of the bins and any portion of the operating mechanism of the grading machine.

Also shown in Fig. 2 is a cross belt 45 on the same level as the main conveyor belts 9 and 10 for transferring fruit from the conveyor belt 9 to the conveyor belt 10, thereby eliminating one of the grading units from the series when desired. Pivoted at the receiving end of the cross belt 45 is a gate 46 of the same type as gate 21, which is adapted, when extended transversely to the conveyor belt 9, to shunt fruit from the conveyor belt to the cross belt 45 and when in its closed position, allows fruit to continue along the conveyor belt 9 to the next grading unit.

Referring to Fig. 10, it will be noted that the pivoted gate 21, when extended transversely to a conveyor belt, forms a definite path for shunting the fruit from the conveyor belt, said path increasing as it approaches the receiving end of the grading unit for preventing the fruit from jamming the entrance to the grading unit. To achieve this result, the length of the pivoted gate 21 is such that when extended transversely to the conveyor belt, the distance from its free end 43 to the nearest point on the opposite side of the conveyor belt is always less than the width of the opening of the receiving end of the grading unit.

The operation of the grading machine is as follows: Apples are dumped into the receiving bin 6 (Fig. 1) from which they are fed to an eliminator chain 7 which removes foreign matter such as leaves, twigs and also any under sized fruit. From the eliminator chain, the apples travel next to a belt of sorting rolls 8 alongside of which an operator stands to pick out and remove any off-grade apples. The apples reach the first grading unit 3 as they come from the sorting rolls 8. The sizing chain 3 of this first grading unit is of a mesh larger than any of the succeeding grading units so that the largest or first grade fruit is carried through by the sizing chain and is delivered to the distributing belt 42^a and thence over the surface of the bin to be packed. The fruit smaller in size than the largest or first grade fruit passes through the sizing chain 3 onto the main conveyor belt 9, where it is delivered to the next sizing unit 3^a in the series. It will be noted that the chain moves upward away from any fruit which has passed through it. The sizing chain of this unit 3^a is smaller than that of the preceding grading unit and therefore the next size fruit is carried through by the chain and delivered to its respective bin 5 to be packed. At this point, if it is desired to cut out this grading unit 3^a in the series, the pivoted gate 21 (Fig. 1) is closed and the fruit is carried by the conveyor belt either to the last grading unit 3^c, or according to the modification shown in Fig. 2, is transferred to the other main conveyor belt by the cross belt 45 where it is delivered to the grading unit 3^b.

The undersized fruit passes through the sizing chain of the grading unit 3^a onto the belt 10 and is delivered to the sizing chain of the next grading unit 3^b which is of a mesh smaller than that of the preceding grading unit. The next sized fruit is carried through by the sizing chain and delivered to its respective bin to be packed. Fruit smaller than this grade passes through the sizing chain onto the conveyor belt 9 and is delivered to the sizing chain of the last grading unit, which is of a mesh still smaller than that of the preceding grading unit. The smallest sized fruit is carried through by the sizing chain of this unit and delivered to its respective packing bin, and the smallest or undersized fruit passes through onto the conveyor belt 10 and is delivered to the bin 13 at the end of the conveyor belts 9 and 10.

It will be seen that this grading machine is very flexible in its use in that any one or more of the grading units may be eliminated or cut out from the series by merely closing the pivoted gate at the receiving end of any particular grading unit. This is especially desirable where, for instance, a lot of fruit which is being sorted or graded consists largely of only two or three sizes. On the other hand, if a particular lot of fruit contains more than four sizes, the arrangement of this machine is such that additional grading units may be added for grading additional sizes of fruit without materially altering or rearranging any of the existing grading units. This is an especially important feature of this invention.

The fruit packers stand along the side of the bins, and release the fruit from the bins into baskets or other packing containers by merely placing the basket or container beneath any one of the doors 37 and opening the door allowing the fruit to roll into the basket or container. It will be noted that no protruding obstructions exist along the side of the bin when the doors are in their closed position. Therefore, the packer is free to move along the side of the bin without hindrance.

The structure of the present invention provides particular advantages by reason of the fact that the fruit is not permitted to fall through the links of the grading chains. In the construction illustrated, the chain continues to move upward after fruit, capable of passing through the link openings, has actually passed through the openings. Thus by reference to Figs. 4 and 5, it will be noted that the fruit which passes through the links after having been moved upwardly over the rollers 30 in Fig. 4 or belt 30^a in Fig. 5 may slide or roll downwardly over the padded inclined surfaces of the baffle 34. Attention is especially directed to the fact that the fruit is not permitted to drop but the inclination of the surface 34 is quite gradual and that the separation of the fruit from the grading chain is facilitated by the continued movement of the chain upwardly away from the upper end of the padded surface 34.

Claims directed to the bin details, including the mounting of the door, as shown in Figs. 12, 13 and 14, are presented in application Serial No. 686,543, filed July 26, 1946, Grading machine bins, a divisional case.

I claim:

1. In a fruit grading machine of the class set forth, the combination with parallel main conveyor belts of a plurality of grading units spaced along said conveyor belts to receive fruit therefrom, each of said grading units extending from a belt to receive fruit therefrom and bridging a next adjacent belt to discharge fruit thereon, said units being in staggered relation in that alternate units extend from the same belt, each grading unit comprising an endless sizing chain and supporting and driving means therefor, and a bin for each grading unit for receiving graded fruit.

2. In a sorting machine of the class set forth, the combination with a plurality of conveyor belts of a plurality of grading units adapted to receive fruit from said conveyor belts to be graded, each comprising an endless sizing chain extending substantially transverse to the line of movement of said belts, and supporting and driving means therefor adapted to drive alternate sizing chains in the same direction and adjacent chains in opposite directions, means cooperating with said conveyor belts to guide fruit to be graded from a first one of said conveyor belts to a grading unit adapted to deliver to an adjacent conveyor belt and from the adjacent belt to an adjacent grading unit adapted to deliver to the said first of said conveyor belts and a bin for each grading unit for receiving graded fruit therefrom to be packed.

3. In a fruit grading machine of the class set forth, the combination with a plurality of conveyor belts, of a plurality of grading units each comprising an endless sizing chain and supporting and driving means therefor adapted to drive alternate sizing chains in the same direction and adjacent chains in opposite directions, said grading units being spaced along said conveyor belts in staggered relation such that a conveyor belt passes beneath a grading unit to receive undersize fruit which has fallen through that grading unit and the same conveyor belt communicates with the receiving end of an adjacent grading unit for delivering said undersized fruit thereto, and a bin for each grading unit for receiving graded fruit from the discharge end of said grading unit.

4. In a fruit grading machine of the class set forth, the combination with parallel main conveyor belts, of a plurality of grading units each comprising an endless sizing chain, supporting and driving means therefor adapted to drive alternate sizing chains in the same direction and adjacent chains in opposite directions, said grading units being spaced along said conveyor belts at right angles thereto and in staggered relation with respect to each other such that a conveyor belt passes beneath the sizing chain of a grading unit to receive undersize fruit which has fallen through that sizing chain, and the same conveyor belt communicates with the receiving end of the sizing chain of an adjacent grading unit for delivering said undersized fruit thereto, a bin for each grading unit, and a relatively short endless conveyor belt extending in alignment with and as a substantial continuation of said grading chain and interposed between the delivery end of each grading unit and its respective bin for receiving the graded fruit from the sizing chain and delivering it to said bin.

5. In a fruit grading machine of the class set forth, the combination comprising a feed bin, an eliminator chain for removing undersized fruit and foreign matter, sorting rolls, two main parallel conveyor belts both driven in the same direction, four grading units each comprising an endless sizing chain and supporting and driving means therefor adapted to drive every alternate sizing chain in the same direction, said sorting rolls feeding the fruit from the feed bin directly to the first and largest mesh sizing chain, said grading units being spaced along said main conveyor belts at an angle thereto and in staggered relation with respect to each other such that the conveyor belts pass beneath the sizing chain of alternate grading units and are in communication with the receiving end of succeeding alternate grading units, gates for the receiving end of each grading unit adapted to shunt fruit to the grading unit from one of the main belts when extended transversely to said main belt or to close the receiving end of the grading unit thereby allowing the fruit to be carried by the belt to another sizing unit, a cross belt on the same level as said main belts and adapted to transfer fruit from one main belt to the other, a shunt gate for the receiving end of said cross belt and adapted when extended transversely to the main belt to shunt fruit from one main belt onto the cross belt thereby eliminating one of the grading units from the series when desired, and a receiving bin for each grading unit for receiving the graded fruit.

6. A fruit grading machine comprising a grading unit, a conveyor belt for delivering fruit to the grading unit, said grading unit being located along said conveyor belt at an angle thereto, side walls extending upwardly from the level of said belt and lengthwise thereof, the conveyor belt opposite the receiving end of the grading unit being inclined downwardly toward the grading unit, and a pivoted gate for the receiving end of the grading unit adapted in one extreme position to constitute a section of the side walls and having a similar surface and upright position and having its bottom edge bevelled so that when said gate is extended transversely of the belt, its bottom edge along its length will be closely adjacent the upper surface of the inclined portion of the belt, said gate when in the other extreme position extending lengthwise of said belt and substantially in alignment with one of said side walls.

7. A fruit grading machine comprising a grading unit, a conveyor belt for delivering fruit to the grading unit, said grading unit being located along said conveyor belt at an angle thereto, side walls extending upwardly from the level of said belt and lengthwise thereof, the conveyor belt opposite the receiving end of the grading unit being inclined downwardly toward the grading unit, and a pivoted gate for the receiving end of the grading unit having its bottom edge inclined progressively from its pivoted end toward its free end so that when extended transversely of the conveyor belt, its bottom edge will correspond to the inclination of the belt opposite the receiving end of the grading unit, said gate, when in the other extreme position, extending lengthwise of said belt and substantially in alignment with one of said side walls, said gate having a similar surface and upright position as said side walls.

8. In a fruit grading machine of the class set forth, the combination with main conveyor belts, of a plurality of grading units spaced along said conveyor belts at an angle thereto and in staggered relation with respect to each other such that the conveyor belts pass beneath alternate grading units and a conveyor belt is in communication with the receiving end of succeeding alternate grading units, the main run of which belt extends horizontally both lengthwise and transversely, that portion of the conveyor belt in communication with the receiving end of a grading unit being adjustably inclined downwardly toward the grading unit to thereby facilitate delivery of the fruit from the belt to the grading unit, side walls extending upwardly from the level of said belt and lengthwise thereof, a pivoted gate for the receiving end of each grading unit adapted in one extreme position to constitute a section of one of the side walls and having similar surface and upright position and adapted to shunt fruit

to the grading unit from the conveyor belt when extended transversely to the belt, and to close the receiving end of the grading unit when in alignment with a side wall, thereby allowing the fruit to be carried by the belt to another grading unit, said pivoted gate having its bottom edge beveled progressively from its pivoted end toward its free end to correspond to the inclined portion of the conveyor belt opposite the receiving end of the grading unit, so that when said gate is extended transversely to the belt its bottom surface will be flush with the inclined upper surface of the belt.

9. A fruit grading machine comprising a plurality of grading units, a plurality of conveyor belts arranged in substantially parallel relation for delivering fruit to the grading units, said grading units being spaced along said conveyor belts at an angle thereto, adjacent units extending in opposite directions from adjacent belts and each unit bridging a belt next adjacent the one from which the unit receives fruit for the purpose of releasing thereto relatively small sized fruit, a receiving zone for each grading unit, and a distributing belt travelling in a line parallel to said main belt along the upper surface of each zone on that side thereof next adjacent the discharge point of a grading unit for receiving graded fruit from each grading unit and distributing the same lengthwise over the surface of the zone to prevent piling up or over-crowding of the graded fruit at the discharge end of each grading unit.

10. A fruit grading machine comprising a plurality of grading units, a plurality of conveyor belts arranged in substantially parallel relation for delivering fruit to the grading units, said grading units being spaced along said conveyor belts at an angle thereto, adjacent units extending in opposite directions from adjacent belts and each unit bridging a belt next adjacent the one from which the unit receives fruit for the purpose of releasing thereto relatively small sized fruit, a receiving zone for each grading unit, a distributing belt travelling in a line parallel to said conveyor belts along the upper surface of each zone on that side thereof next adjacent the discharge point of a grading unit, for receiving the graded fruit and distributing the same lengthwise over the surface of the zone, and return belts on a level above each zone for returning off-grade fruit to a receptacle.

11. A fruit grading machine comprising a plurality of grading units, a plurality of conveyor belts arranged in substantially parallel relation for delivering fruit to each grading unit, said grading units being spaced along said conveyor belts at an angle thereto, adjacent units extending in opposite directions from adjacent belts and each unit bridging a belt next adjacent the one from which the unit receives fruit for the purpose of releasing thereto relatively small sized fruit, a receiving zone for each grading unit, a distributing belt extending along the upper surface of each zone in a line parallel to said main belts and on that side of said zone next adjacent the discharge point of a grading unit, and adapted to travel in either direction for receiving graded fruit from each grading unit and distributing the same lengthwise over the surface of the zone to prevent piling up or over-crowding of the graded fruit at the discharge end of each grading unit.

12. In a fruit grading machine of the class set forth, the combination with parallel main conveyor belts of a plurality of grading units spaced along said conveyor belts to receive fruit therefrom, each of said grading units extending from a belt to receive fruit therefrom and bridging a next adjacent belt to discharge fruit thereon, said units being in staggered relation in that alternate units extend from the same belt and are adapted to move fruit in opposite directions in a path substantially transverse to the path of movement of said main conveyor belts, each grading unit comprising an endless sizing chain and supporting and driving means therefor, and a bin for each grading unit for receiving graded fruit.

13. In a fruit grading machine of the class set forth, the combination with a plurality of grading units arranged in parallel relation, of a plurality of spaced conveyor belts arranged in parallel relation to each other and transverse to said grading units for delivering fruit to said grading units, a cross belt on the same level as said conveyor belts and extending transversely to said conveyor belts and with its receiving end located in advance of the receiving end of one said grading units and adapted to transfer fruit from one main belt to another, means co-operating with said conveyor belts to guide fruit to be graded from a first one of said conveyor belts to a grading unit adapted to deliver to an adjacent conveyor belt and from said adjacent conveyor belt to a second grading unit adapted to deliver to said first conveyor belt, and means to deflect fruit from said one main belt to said cross belt whereby fruit may be shifted from one conveyor belt to another and prevented from being delivered to the next adjacent grading units adapted to receive fruit from the same conveyor belt.

14. In a fruit grading machine of the class set forth, the combination with a plurality of conveyor belts spaced apart and having an aisle between adjacent belts, of a plurality of grading units spaced in staggered relation along said main belts and adapted to receive fruit from said conveyor belts to be graded, a bin for each grading unit, an aisle between a bin and the next adjacent conveyor belt, each grading unit comprising an endless chain extending from one conveyor belt across and above the adjacent conveyor belt and terminating with its end toward but spaced from one of said bins, and a short endless conveyor belt extending in alignment with and as a substantial continuation of each of said grading chains and serving to bridge an aisle and interposed between the delivery end of each grading unit and its respective bin for receiving the graded fruit from the sizing chain and delivering it to the bin.

McSHERRY LUPTON.