Dec. 8, 1953 S. BALLARD, JR., ET AL 2,661,840

MEANS FOR GRADING ARTICLES BY SIZE

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FIG 1

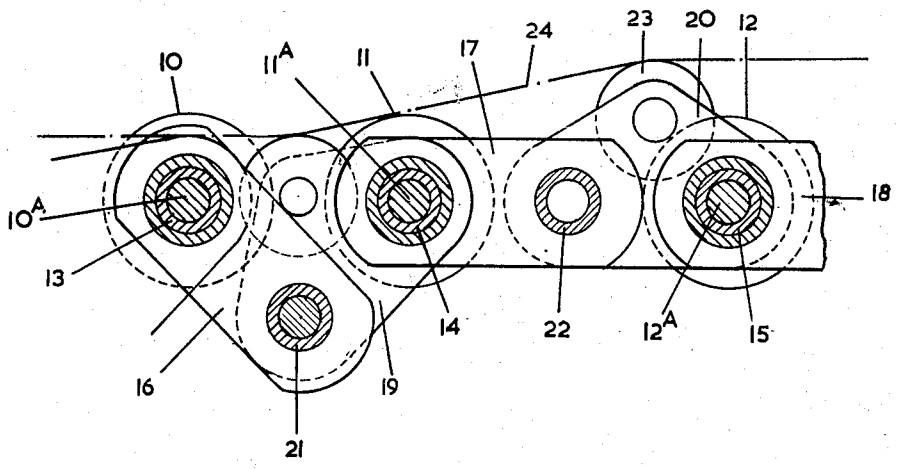
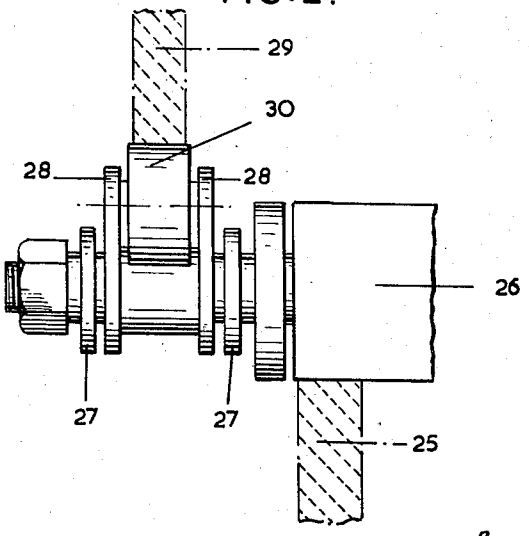


FIG. 2.



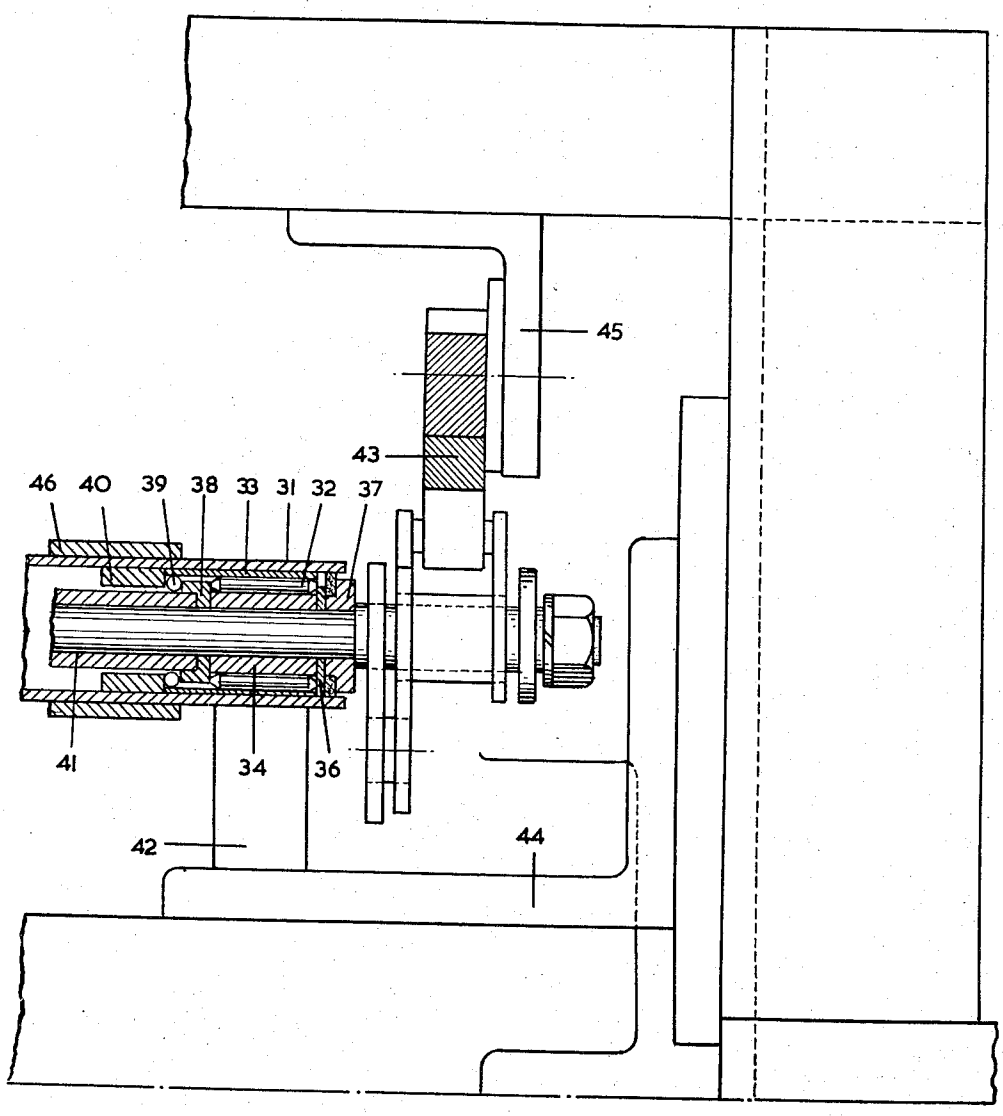
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FIG. 3.



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FIG.5.

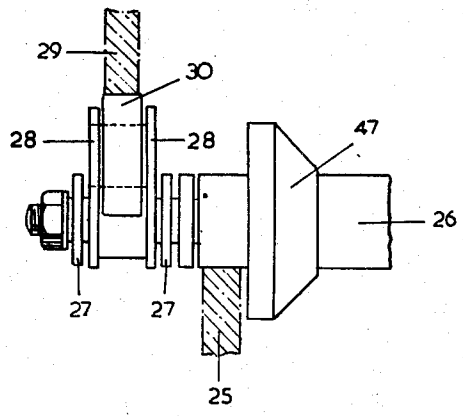
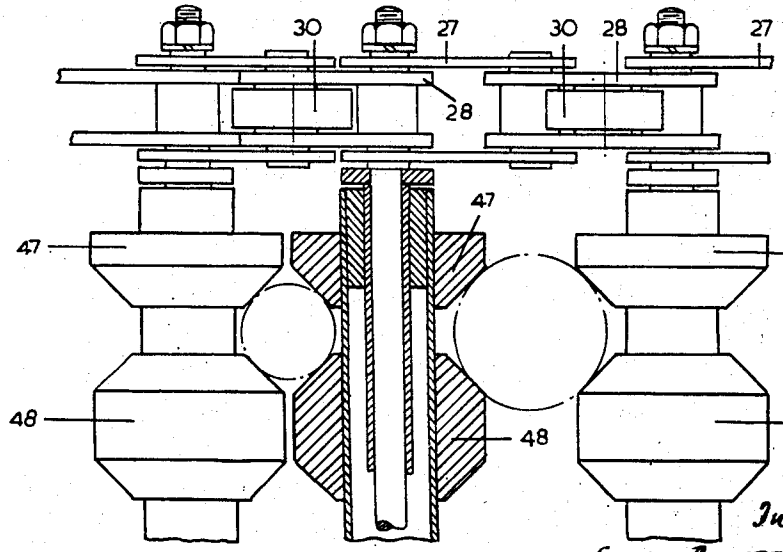


FIG.4.



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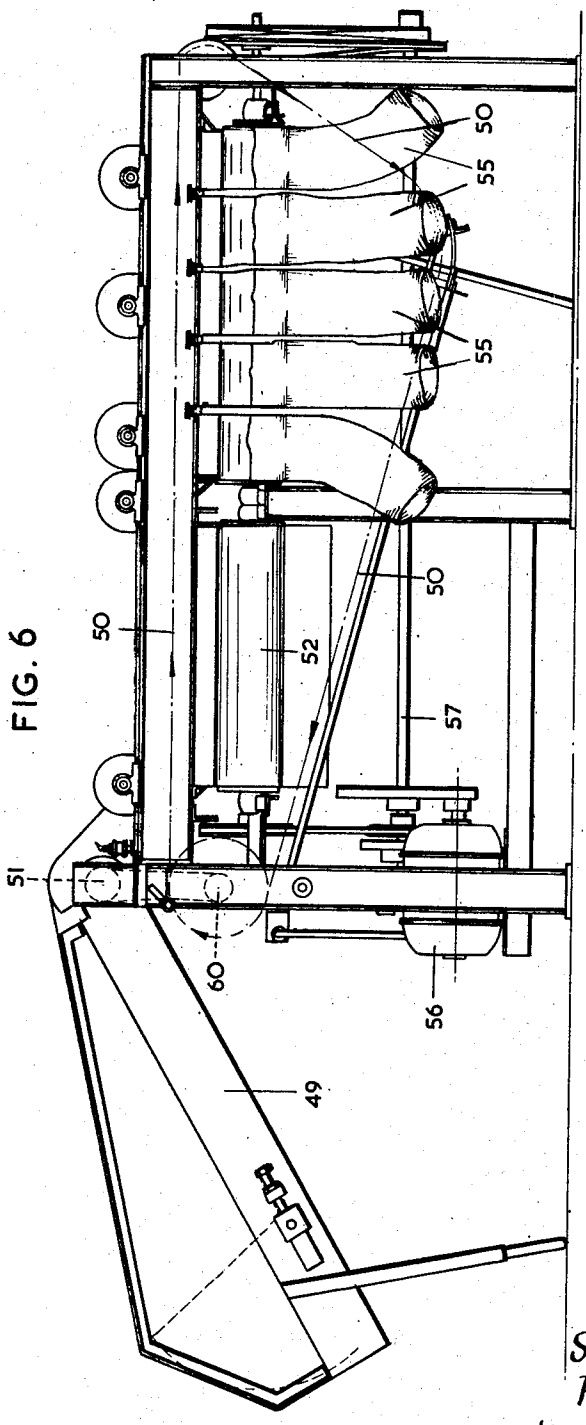


FIG. 6

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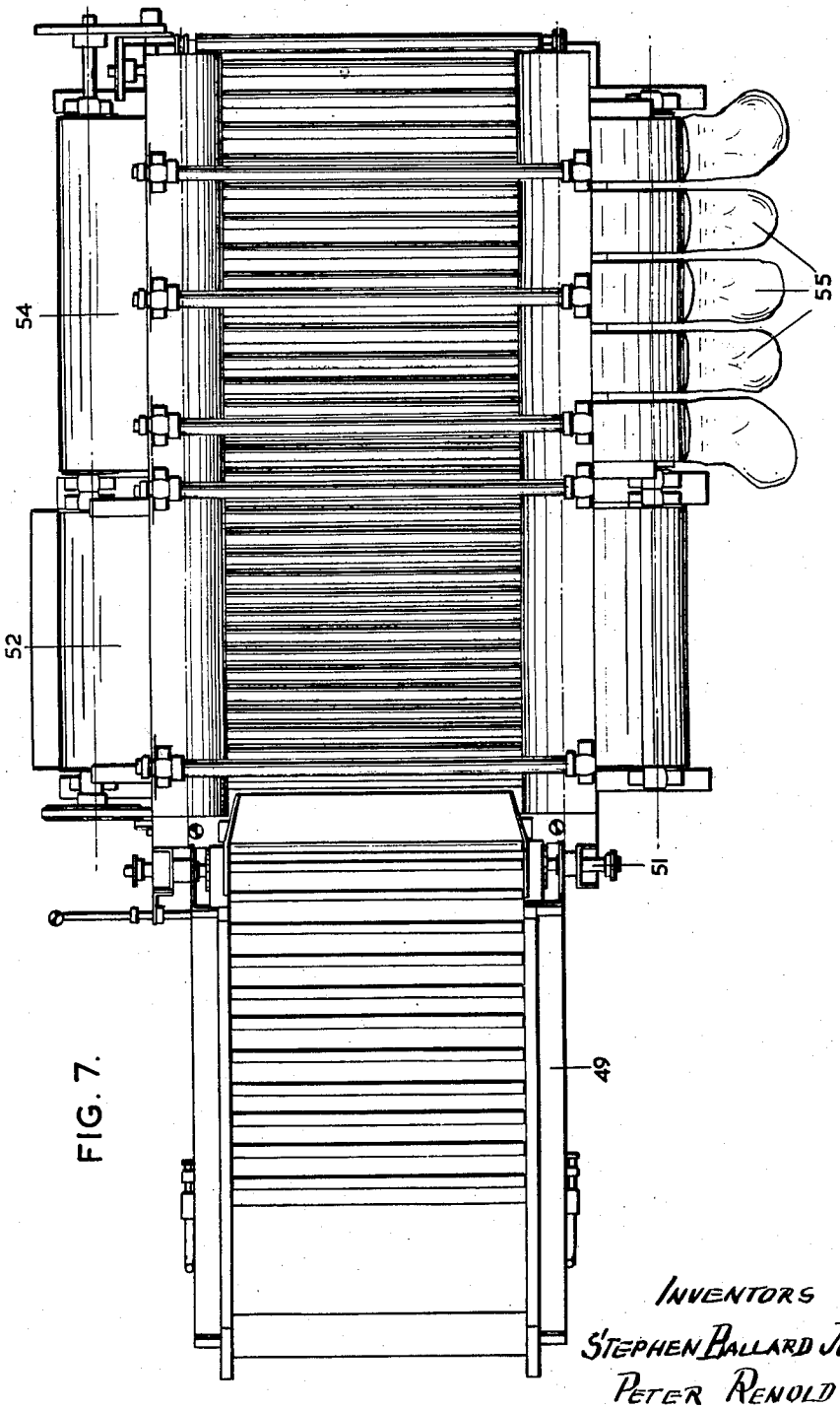


FIG. 7.

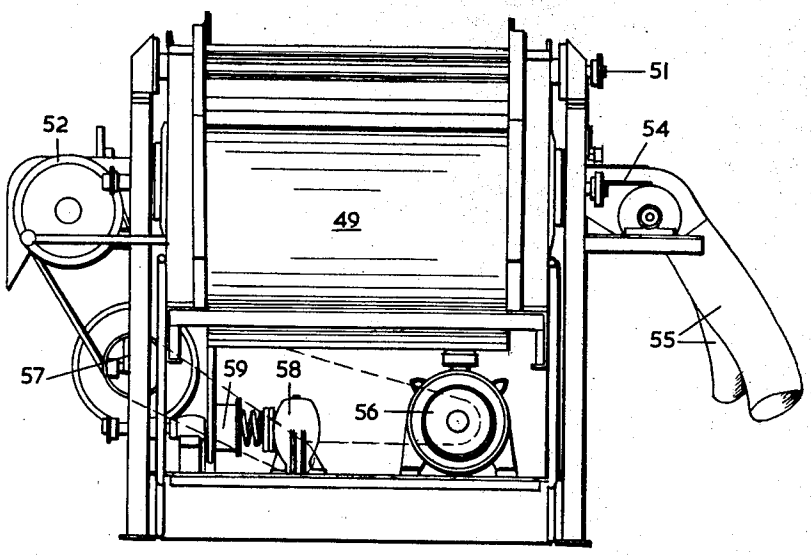
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MEANS FOR GRADING ARTICLES BY SIZE

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FIG. 8.



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Patented Dec. 8, 1953

2,661,840

UNITED STATES PATENT OFFICE

2,661,840

MEANS FOR GRADING ARTICLES BY SIZE

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Application September 10, 1951, Serial No. 245,782

4 Claims. (Cl. 209—106)

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This invention relates to new or improved means for grading articles by size.

The invention is concerned with a machine which is primarily intended for grading fruit such as apples, plums, and tomatoes but is applicable to the grading of any other articles of spherical, ovoid, or similar outline.

According to our invention a machine for grading articles by size comprises a conveyor in which transverse bars or rollers are carried at their ends by or form the connecting pivots of alternate links of travelling chains and means are provided for progressively varying the spacing between adjacent bars or rollers by movement of the intermediate pivots of the chain links into and out of the normal plane of the chain. When all the pivots of the chain links are in the same plane the spacing between the bars or rollers is at a maximum and the spacing can be progressively reduced by moving the intermediate pivots of the links out of that plane so that adjacent links are inclined to each other at a progressively greater angle, the link pivots which carry the bars or rollers being guided in or on straight tracks in the usual manner while the intermediate pivots carry rollers co-operating with separate inclined guides or ramps and are free to move into and out of the plane of the guided link pivots.

The chains are carried over sprockets at each end of the conveyor in the usual way, one or both of the sprockets being driven, and as the total effective length of each chain will remain constant and the links will be at their maximum spacing when passing over the sprockets the driving of the chains presents no difficulty.

Articles to be grade will be fed on to the conveyor at a point where the spacing between the bars or rollers is at a minimum, and as the articles are carried along the spacing increases progressively so that articles of progressively increasing size will drop through between the bars or rollers, the articles of different sizes being received by separate shoots, trays, conveyor belts or other receptacles below the grading conveyor.

The movement of the intermediate link pivots into and out of the plane of the chain can be effected in various ways.

Usually the guides or tracks for the movable link pivots will be so arranged that the spacing between the bars or rollers of the conveyor will be rapidly reduced to a minimum after the chains come off the sprockets at the feeding end of the conveyor and the articles to be graded will be fed on to the conveyor at or immediately after the

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point of minimum spacing. The spacing will then be gradually increased and will reach its maximum before the chains pass on to the sprockets at the other end.

Two practical means for carrying our invention into effect and some modifications are illustrated diagrammatically in the accompanying drawings in which—

Figure 1 is a side elevation of a chain showing two pairs of links with one intermediate pivot in its normal position and the other depressed.

Figure 2 is a fragmentary end elevation of a portion of the chain and guides.

Figure 3 is an elevation in part section showing the mounting and arrangement of the rollers.

Figure 4 is a plan of a portion of a grading machine employing shaped members on the rollers to define openings for the articles to be separated.

Figure 5 is a side elevation of one end of one of the rollers shown in Figure 4.

Figure 6 is a side elevation of a complete machine.

Figure 7 is a plan view, and

Figure 8 is an end elevation viewed from the loading end of the same machine.

Figure 1 shows diagrammatically in side elevation a portion of a chain forming one side of a conveyor for the articles to be graded. The conveyor is formed by parallel rollers 10, 11, 12 rotatably mounted on spindles 10^A, 11^A, 12^A, of which the ends are fixed in or extend through alternate hollow pivots 13, 14, 15 connecting the links of the chain. The rollers are guided to travel in a horizontal plane so that the pivots 13, 14, 15 also travel in a horizontal plane. Alternate links 16, 17, 18 of the chain are of normal shape but the intermediate links 19, 20 are triangular in shape with two link pivots on the base side which are shown as being spaced at the same distance apart as the pivots of the adjacent plain links but may be spaced at any convenient pitch.

The triangular link 19 carries the pivot 14 of the roller 11 and an independent pivot 21 connecting it to the plain link 16. The triangular link 20 carries the pivot 15 of the roller 12 and an independent pivot 22 connecting it to the plain link 17. The apex of each triangular link carries a roller 23 which is normally elevated above the plane of the chain, and the base of each triangular link normally is in alignment with the lower edge of the adjacent plain links, all the link pivots being in the same horizontal

plane. That is the position shown at the right hand side of Figure 1 for the link 20.

Depression of the roller 23 by engagement with an inclined overhead guide as indicated by the line 24 causes the triangular link to swing downwardly about the end of the base carrying the roller pivot, the link 19 being shown in its fully depressed position. This movement of the triangular link causes the free pivot 21 connecting it to the next plain link to be displaced out of the plane of the chain and draws together the rollers 10 and 11 carried by the pivots at the other ends of the plain and triangular links. Thus the normal spacing between adjacent rollers is reduced by an amount dependent on the extent to which the roller 23 is depressed as will be appreciated by a comparison of the spacing between the rollers 10 and 11 with that between the rollers 11 and 12.

For the purposes of illustration the guide 24 is shown steeply inclined but in a grading machine the inclination will be very small so that the progressive change in the spacing of the rollers from a minimum to a maximum will occupy the major part of the length of the conveyor and allow plenty of room for the separate shoots, trays, or other receptacles for graded articles of different sizes.

In a preferred layout the overhead guides with which the rollers on the triangular links in the chains engage will be arranged to reduce the spacing between the grading rollers to a minimum immediately after the chains leave the sprockets at one end of the conveyor, to maintain the minimum spacing for a predetermined distance, and then to increase the spacing gradually up to the maximum.

Articles to be separated are fed on to the conveyor just in advance of the point at which the roller spacing has been reduced to a minimum and over the part of the conveyor where the minimum spacing is maintained any stalks, leaves, or other foreign matter together with any very small articles will drop through. Then as the articles are carried on by the conveyor over the part where the spacing between the rollers is gradually increasing the articles will be graded according to size and delivered into different trays or shoots below the conveyor.

The grading rollers are conveniently arranged to roll adjacent each end on horizontal tracks as shown diagrammatically at 25 in Figure 2. In that figure 26 is one of the grading rollers, 27 are plain links of the chain, 28 are triangular links, and 29 is the overhead track co-operating with the rollers 30 on the triangular links.

The rollers are preferably mounted on ball or roller bearings on their spindles to reduce to a minimum the power required to drive the conveyor.

Figure 3 shows a practical arrangement in which the roller is formed by a tube 31 mounted to rotate at each end on needle roller bearings 32 working between a thin liner 33 in the sleeve and a bush 34 on the spindle 35. The bush and bearing rollers are located in one direction by a disc 36 backed by a flanged boss 37 and in the other by a flanged disc 38 co-operating with a ball-thrust bearing 39 arranged between the disc and an internal sleeve 40 in the tube. A spacing sleeve 41 is mounted on the spindle between the disc 38 and a complementary disc at the other end of the spindle.

The end of the roller rolls on a horizontal guide 42 and the triangular links of the chain co-operate with an overhead guide 43, the guides being mounted on angle-section members 44, 45 forming part of the fixed frame of the conveyor.

The part of the roller between the guides may be covered with a rubber sleeve 46 to prevent damage to the fruit or other articles being graded.

Alternatively, as shown in Figures 4 and 5 there may be mounted on the rollers axially spaced members 47, 48 of suitable material such as moulded rubber each having the form of a short cylinder with a frustum of a cone on both ends or on one end in the case of the members at the ends of the rollers. When these members are mounted on the rollers in axially spaced relationship their conical faces co-operate with those of the adjacent members and of the members on the next roller to define openings of substantially square outline in plan.

The effective size of these openings is varied by the variation in the spacing of the rollers as the conveyor travels along. This is clearly shown in Figure 4 where three rollers are illustrated in plan with the spacing between two of them at its minimum and the spacing between the other two at its maximum.

The other parts of the mechanism shown in Figures 4 and 5 have been given the same reference numerals as the corresponding parts in Figure 2.

Figures 6, 7 and 8 show the mode of operation of a preferred form of the complete machine. The fruit or other articles to be graded are carried by the feed conveyor 49 on to the grader chain 50. The feed conveyor 49 is adjustable in height from the position shown in Figure 6 up to the horizontal, pivoting about the spindle 51. For the first part of its horizontal travel the grader chain 50 is closed up to its minimum spacing, and only the smallest articles, such as twigs, leaves and other foreign matter, fall through on to a cross-belt 52 and are carried aside. Beyond the cross-belt 52 the grader chain 50 is progressively opened out by the action of the overhead guide (not shown in Figure 6) and the articles fall in graded sizes as described above on to a second cross-belt 54, being thence carried to chutes or other collecting devices 55 along the side of the machine.

Power for the machine is provided by motor 56, which drives layshaft 57. Thence drives are taken to the two cross-belts 52 and 54, which extend across the machine underneath the top run of the grader chain and over the bottom run. A third drive from layshaft 57 is taken through reduction gearbox 58 and safety dog-clutch 59 to the main grader chain 50 and the feed conveyor 49 via spindles 60 and 51 respectively.

We claim:

1. A machine for grading articles by size comprising a conveyor consisting of two spaced parallel driven chains each formed by links of normal contour alternating with triangular links, spaced pivots on the base of each of said triangular links connecting it to the ends of adjacent links, a roller at the apex of each tringular link having its axis spaced from a plane containing the axes of the base pivots, transverse conveying members extending between the chains and carried by alternate link pivots, means for constraining said alternate link pivots to move in a common plane over a part of their travel, and guides inclined to said common plane co-operating with said rollers for moving said triangular links angularly about the alternate link pivots and mov-

ing the intermediate link pivots out of and into said common plane.

2. A machine for grading articles by size comprising a chain conveyor having parallel conveying members extending transversely between parallel driven chains, each of said chains comprising plain links alternating with intermediate links of triangular outline, spaced pivots in the base of each triangular link to which said plain links are connected, one end of each conveying member carrying one of said base pivots of each triangular intermediate link, a roller at the apex of each of said intermediate links, means for constraining the conveying members to travel in a common plane over the operative part of the conveyor, and guides inclined with respect to said plane cooperating with said rollers on the intermediate links for moving said intermediate links angularly about said base pivots carrying the conveying members and controlling the displacement of the other base pivots out of said plane to vary the spacing between the conveying members progressively along a portion of the operative part of the conveyor.

3. A machine for grading articles by size according to claim 2 wherein said conveyor members comprise rollers mounted to rotate on antifriction bearings on spindles, the ends of said spindles forming chain link pivots.

4. A machine for grading articles by size according to claim 2 wherein said conveyor members comprise rollers carrying axially spaced members of resilient material each of said members having the form of a short cylinder with a frustum of a cone on each end and the conical faces of said members cooperating with those of the adjacent members and of the members on the next roller to define openings of substantially square outline in plan.

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