

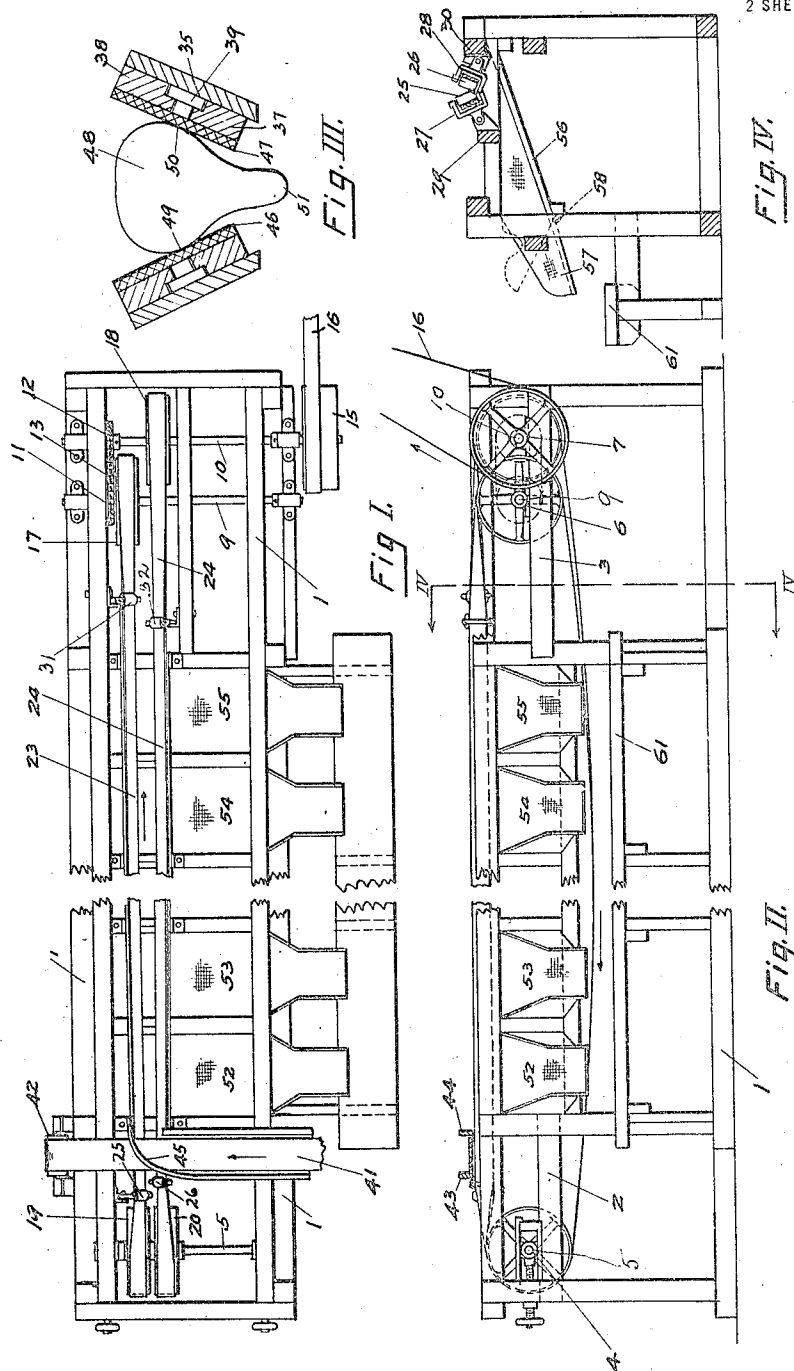
C. J. CLEAR.
GRADER.

APPLICATION FILED NOV. 11, 1919.

Patented Aug. 29, 1922.

2 SHEETS—SHEET 1.

1,427,264.



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2 SHEETS—SHEET 2.

Fig. V.

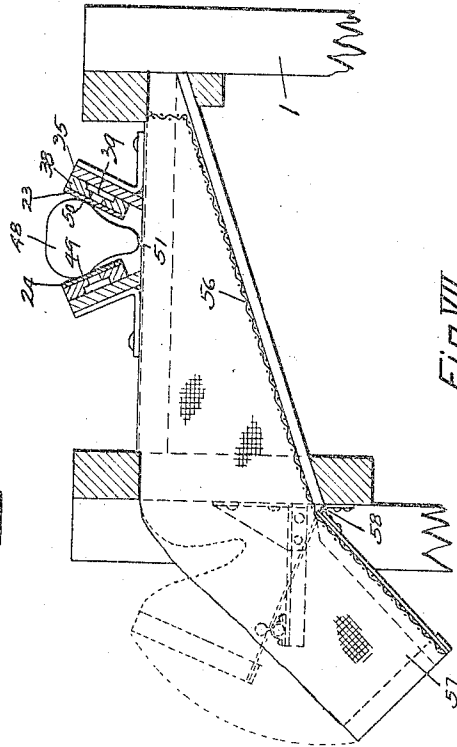


Fig. VI.

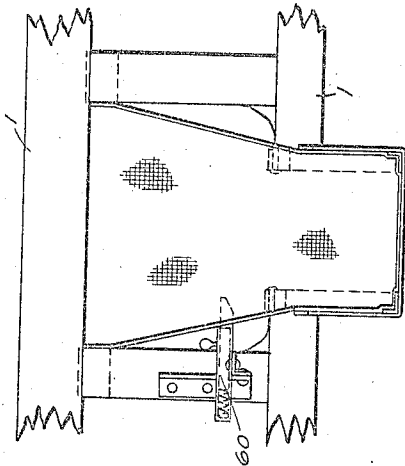


Fig. VII.

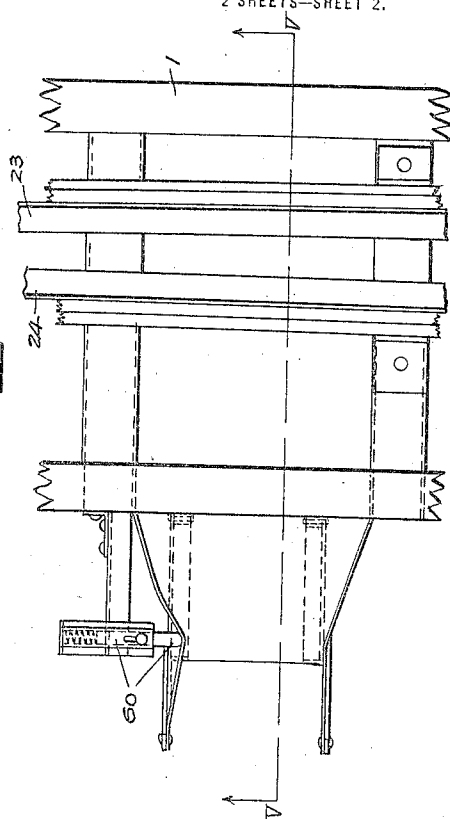
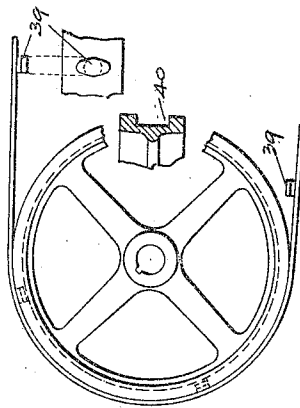


Fig. VIII.



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UNITED STATES PATENT OFFICE.

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GRADER.

1,427,264.

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Application filed November 11, 1919. Serial No. 337,298.

To all whom it may concern:

Be it known that CHARLES J. CLEAR, a citizen of the United States of America, a resident of Vancouver, in the county of Clarke, in the State of Washington, has invented certain new and useful Improvements in Graders, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to machines for grading articles by size, and has for its object the production of an improved machine for sorting and selectively separating a variety of articles according to uniformity of size.

My invention is particularly designed and adapted for the grading of delicate fruits and vegetables whose surfaces abrasion might damage, and especially of objects of irregular shape, for example, pears, lemons, cucumbers and carrots, which, by reason of their irregularity of shape, resist the usual methods of selective separation.

What constitutes my invention will be hereinafter specified in detail and succinctly set forth in the appended claims.

In the accompanying drawings,

Figure I is a top plan view of my invention complete in present preferred form of embodiment, the middle portion thereof being broken out for the accommodation of the scale to which the drawing is made.

Figure II is a side elevation of the subject matter of Figure I looking towards the main drive-pulley of the machine.

Figure III is a transverse section on an enlarged scale of the traveling belts shown in the previous figures and illustrative of their relative operative disposition toward each other and in respect to their longitudinal guides and supporters.

Fig. IV is a section on the line IV—IV of Figure II.

Figure V is a detail view in transverse section on enlarged scale of my machine showing a fruit pocket in section, the discharge chute thereof being shown open in full lines, and closed in dotted lines.

Figure VI is a front view of the subject matter of Figure V.

Figure VII is a top plan view of the subject matter of Figure V.

Figure VIII is a composite detail view of one of the sorting belt pulleys and a section of belt thereon detached.

Referring to the numerals on the drawings, 1 indicates a frame consisting prefer-

ably of an oblong rectangular structure, but constituting in effect a single or composite structure, of any suitable configuration and assemblage of parts and which may be made of wood or metal as preferred. The frame preferably comprises supporting members 2 and 3 disposed in pairs, respectively, towards its opposite ends. The paired members 2 carry, in suitable bearings 4 provided thereon, a shaft 5. In like manner, and on the same level with shaft 5, as in bearings 6 and 7, respectively, the paired members 3 carry two parallel shafts 9 and 10 which are geared together as by sprocket wheels 11 and 12 and an intermeshing sprocket belt 13. To the shaft 10 is secured at one end a main driving pulley 15 that is operatively connected as by a belt 16 with a source of power not illustrated.

To the shaft 9 is secured a belt pulley 17 and to the shaft 10 is secured a belt pulley 18. In line with the pulleys 17 and 18, respectively, are loose pulleys 19 and 20 upon the shaft 5. The pulleys, 17 to 20 inclusive, preferably correspond in diameter one with another. About the pulleys 17 and 19 is tautly passed an endless conveyor belt 23, having a flat smooth working face, and about the pulleys 18 and 20 is, in like manner, disposed a corresponding belt 24. The pulleys 17 and 18 are spaced a greater distance apart than the pulleys 19 and 20. Consequently, there is a gradual divergence provided between the respective belts in their stretches from the pulleys 19 and 20 towards the pulleys 17 and 18, respectively.

The shafts 9 and 10 may be if preferred driven at the same or slightly variant speeds, as preferred, in order to impart the same or variant speeds to the belts 23 and 24.

Adjacent to the pulleys 19 and 20 are guide rollers 25 and 26, carried, respectively, in open clevis-like frames 27 and 28, fixed adjustably, if desired, to the frame 1, as upon stringers 29 and 30 provided for them. In like manner, adjacent to the pulleys 17 and 18, corresponding guide rollers 31 and 32 are provided. The respective pairs of guide rollers 25 and 26, and 31 and 32, are obliquely disposed towards each other, as shown in Figure IV so as to impart to their respective belts 23 and 24 in passing under them a uniform angle of disposition relatively to each other, as is clearly shown in Figure III. By inclination of the surfaces

of the pulleys 17 and 18 towards each other, and likewise of the pulleys 19 and 20, the relative angular disposition of the belts 23 and 24 may be directly obtained without the necessity of guide rolls, but this is a mere mechanical detail. It is, however, essential that the vertical convergence of the belts shall conform to a sufficiently small angle to insure to each article a transversely traversable course between the working faces of the belts before its final selective point of discharge.

In order to stiffen the belts and maintain their flat working faces in uniform regularity of angular disposition towards each other between the respective rollers 25—26 and 31—32, last above specified, I provide against the backs of the belts, in their respective upper stretches, longitudinally disposed flat supporting plates 35, each of which is fixedly supported upon the frame 1, and extends substantially the full length of each stretch of belt between its respective guide rollers. If the length of the plates 35 should require it, as it usually does, supporting members 36 for said plates may be provided at intervals upon the frame 1. Upon the opposing faces of the plates 35 are provided longitudinal guide plates 37 and 38 spaced and shaped to accommodate between them guide buttons 39 fixed to the backs of the respective belts 23 and 24, the pulleys 17—20 being suitably split or channeled for their accommodation, for example, as indicated at 40 in Figure VIII. The buttons 39 serve to hold the respective belts snugly in juxtaposition against the faces of their respective guide plates 37 and 38.

In consequence of the angle of divergence of the stretches of the belts 23 and 24 from their respective pulleys 19 and 20 and that of their vertical downward convergence, as shown in Figure III, said belts cooperate to effect the sorting function of the machine in the manner explained in the following paragraph.

The longitudinal divergence of the belts 23 and 24 is a necessary feature of my machine and it must be very gradual, but may be somewhat varied at discretion. It is the angle of vertical downward convergence of longitudinally divergent, movable belts that distinguishes my invention from what is old in the art, in respect to the sorting function of the machine. As between the belts 23 and 24 the vertical and the horizontal constitute the extreme theoretical limits within which their relative disposition may be effected. But, if both belts are located either in horizontal planes or in vertical planes, there will be no vertical convergence between them, though they still be longitudinally divergent and may still operate in a fashion as sorting elements. If they be

relatively disposed at a wide angle, say of ninety degrees, they will constitute in effect nothing more than flat divergent belts provided with a trough tending to hold between them articles to be sorted and prevent the spilling of the same over the sides of the belts. This trough-like effect is all that is shown in the prior art, but my invention is differentiated therefrom by providing a functionally effective transverse extent in the two belts, and by disposing them relatively towards each other at an acute angle. By that means an article may be caught and suspended by the belts between points adjacent to their upper edges, whence, it must travel between them in a downwardly oblique direction in order to gain its liberation from confinement by the belts. It is during its period of travel along this oblique line between the belts that the article is made to respond to the action of gravity, with the effect of having imparted to it a delicate balance between opposite points of suspension. Such method of suspension is available for the sorting of all articles, and is essential to the sorting of articles of irregular shape, like a pear for example. At the same time, during the selective operation, the movement of the belts imparts to each article a slight rolling motion about its vertical axis that adjusts each article towards that delicate degree of suspension between the belts that is necessary to its liberation therefrom by gravity, as aforesaid, with that substantial accuracy and precision which the object of my invention demands. To the end above specified the fruit is fed into the machine by any suitable means, as, for example, upon a transverse conveyor belt 41 that travels over a pair of pulleys represented by one pulley 42 in Figure I, between side rails 43 and 44. Above the point at which the belt 41 crosses the belts 23 and 24 is provided a sweeper 45, preferably consisting of a curved extension of the side rail 43 across and above the belt 41, so that by the movement of the said belt in the direction of the arrows shown thereon in Figure I, the fruit is smoothly swept with a gentle motion from the belt 41 which carries it, and caused gently to drop between the traveling belts 23 and 24 whose lower edges 46 and 47 are, at the point of fruit intake, separated (see Figure III) by a space less in extent than the diameter of the minimum sized object to be sorted or the shortest diameter of such object, if it be oblong like a pear, for example. Consequently, as an individual object, represented in Figure III by a pear 48, drops between the downwardly convergent opposing faces of the belts 23 and 24, it is caught and lightly held between them only at two opposite contact points 49 and 50. The object being pear-shaped, as indicated at 48, in

Figure III, the contact points 49 and 50 constitute an axis of suspension therefor between the faces 23 and 24 that is disposed transversely to the fruit and toward its larger end. Consequently its preponderant weight causes the stem-end 51 of the fruit to swing downwardly upon the axis 49—50 substantially to the vertical position as shown in Figure III. Because the opposing faces of the belts 23 and 24 gradually diverge in a horizontal angle from the point of fruit intake, the axis 49—50 is permitted thereby gradually to slide downwardly and obliquely along the convergent smooth working faces of said belts until a point is reached in the travel of the belts at which the length of said axis approximates something less than the distance between the points 46 and 47, when the fruit, by its own weight, drops from between the belts 23 and 24 to the receptacles provided below the same for its reception.

Because of the fact that a pear is, by reason of its peculiar shape, found most difficult of selective separation according to size, the pear is employed by way of example in the foregoing description and in the accompanying drawings. A tapered vegetable like a carrot is in effect pear-shaped. In respect to an oblong object, such as a cucumber, for instance, instead of one axis of suspension indicated by 49—50 in Figure III of the drawings, there may be, and generally is, a plurality of axes of suspension between the faces of the belts 23 and 24. Consequently, while there would, in such case, be a dropping of the preponderant end of the object between the belts 23 and 24, the object would not immediately reach a vertical position. If the belts or conveyors 23 and 24 be driven at slightly different speeds, the result would tend to effect longitudinal alignment of articles interposed between them, but even when they travel at the same rate of speed, the drop from the belt 41 to the moving and longitudinally divergent belts 23 and 24 appears to be generally all sufficient to accomplish the desired alignment. In other respects the principle of selective separation is substantially the same as that already described.

For the reception of the graded fruit, I prefer to provide, at a short distance immediately below the belts 23 and 24 a longitudinally disposed row or series of pockets 52, 53, 54 and 55, the number of pockets being indefinite and determinable by the work which the machine is to do. Each of the pockets is preferably inclined and has a bottom 56 made, for example, of canvas or other yielding material to catch the fruit without bruising it. Each pocket terminates in a discharge-chute 57 that is preferably hinged, as indicated at 58, to an upright of

the frame 1, and which may be raised and lowered at will. When raised, it may be secured in the pocket-closing position as by latch mechanism of any suitable description, for example that indicated in the drawing by the numeral 60. The discharge-chute 57 serves as a means for confining fruit dropped into its respective pocket until such time as the extent of accumulation therein demands discharge. For convenience of such discharge, I prefer to provide below the several discharge-chutes 57 a bench 61 that extends the collective length of all the pockets and is adapted to support, for each pocket individually, a pan or other receptacle for the fruit discharge of its respective pocket. It is important in sorting delicate articles to make the chute 57 long enough to reach, when open, substantially to the bottom of the receptacle into which it discharges, so that the contents of the chute may roll or slip into the receptacle without any drop or bruising impact.

In view of such description as has already been given, the operation of my machine may be briefly described in the following language. By power communicated through the belt 16 the pulley 15 imparts rotative motion to both the shafts 9 and 10 which causes the belts 23 and 24 to travel in one direction. For such fruits as pears that are suspended between them on a single axis, it is best that the belts 23 and 24 travel at equal rates of speed, but with oblong fruits like cucumbers, suspended from a plurality of axes, there may be an aligning advantage in causing the belts to travel at slightly different rates of speed. If now the belt 41 be in operation in the direction of the arrows applied to it in Figure 1, and fruit, for example, be supplied thereto, the fruit will be deposited one by one in the manner already described, between the traveling belts 23 and 24, through the action of the sweeper 45. The smallest fruit will, in accordance with the principle of operation hereinbefore specified, drop by gravity at once into the pocket 52. A next larger size falls into the pocket 53, and so on until the last pocket, indicated in the drawings by the numeral 55, is reached. Some pockets will fill more rapidly than others, according to the run of fruit in point of size, but all the fruit will be taken care of in their respective pockets until, as each pocket becomes filled, the accumulation of fruit therein is drawn off by an attendant through manipulation of its discharge-chute 57 in the manner specified. The accumulation of the fruit in the several pockets is always gradual, so that the attention of a single attendant is sufficient for the proper care and manipulation of the machine.

It is found in use that my machine may be relied upon to perform the selective func-

tion required of it, and to deposit even pears, which require the most delicate handling, without danger of bruising the fruit in the slightest degree. Its utility, however, is not limited to the sorting of pears, nor even of other fruits and vegetables, such as carrots, cucumbers, lemons, etc., but may be extended to the sorting of any objects which differ in size one from another.

10 " What I claim is:

1. In a machine for grading articles by size, the combination with driving mechanism, of a pair of flat, endless belts having cooperative longitudinally divergent and 15 transversely downwardly convergent working faces, and means disposed against the back of each belt so as wholly to support its working face in true cooperative relationship to the other belt.

2. In a machine for grading articles by size, the combination with driving mechanism, of a pair of longitudinally divergent flat, endless belts, each having only a single flat article-engaging face, and both of said 25 faces having functionally efficient transverse sorting convergence one towards the other.

3. In a machine for grading articles by size, the combination with driving mechanism, of a pair of flat endless belts having flat smooth working faces angularly disposed one towards the other, and supporting plates operatively disposed against the backs of said belts, respectively, to stiffen 35 support and maintain them in position.

4. In a machine for grading articles by size, the combination with driving mechanism, of a pair of belts having flat working faces angularly disposed one towards the 40 other, grooved backing plates for each belt, and buttons on the back of each belt, working in the groove of its respective plate.

5. In a machine for grading articles by size, the combination with driving mechanism, and a pair of belts adapted in operation to make selection of articles, of a series of yielding inclined pockets operatively disposed below said belts and adapted to receive the selective discharge of articles 50 therefrom, each pocket being provided with a flexibly attached discharge-chute, and means for operatively effecting, at will, a confining or a discharging position with respect to each chute.

6. In a machine for grading articles by size, the combination with driving mechanism, and a pair of belts adapted in operation to make selection of articles, of a series of yielding pockets operatively disposed below said belts and adapted to receive the selective discharge of articles 60 therefrom, each pocket being provided with a flexibly attached discharge-chute terminating within close reach of a receptacle for graded articles, and operative means for lifting or 65 for lowering each discharge chute.

7. In a machine for grading articles by size, the combination with driving mechanism, of a pair of longitudinally divergent, flat, endless belts, and guide rollers for each 70 belt, said guide rollers constituting means for holding and directing the belts in vertically convergent planes between the points of supply and discharge.

8. In a machine for grading articles by size, the combination with driving mechanism, of a pair of longitudinally divergent, flat, endless belts having smooth working faces held in co-operative, angular disposition one towards the other by means of guide 80 rollers provided therefor, and correspondingly downwardly convergent supporting plates operatively disposed against the backs of said belts, respectively, to support and maintain them in cooperative positions. 85

9. In a machine for grading articles by size, the combination with driving mechanism, and a pair of selectively disposed belts, of a series of yielding inclined pockets operatively disposed below said belts and 90 adapted to receive the selective discharge of articles therefrom, each pocket terminating in a flexibly attached discharge-chute, and means for fixedly adjusting said chute in either of two operatively effective positions. 95

10. In a machine for grading articles by size, the combination with driving mechanism, of a pair of single faced smooth surfaced endless belts having portions thereof disposed longitudinally in complementary 100 divergent relationship, said portions being uniformly disposed in downwardly convergent planes, the angle of whose convergence is functionally efficient for the suspension of articles between them. 105

In testimony whereof, I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES J. CLEAR.

Witnesses:

JOSEPH L. ATKINS,
LEICESTER B. ATKINS.