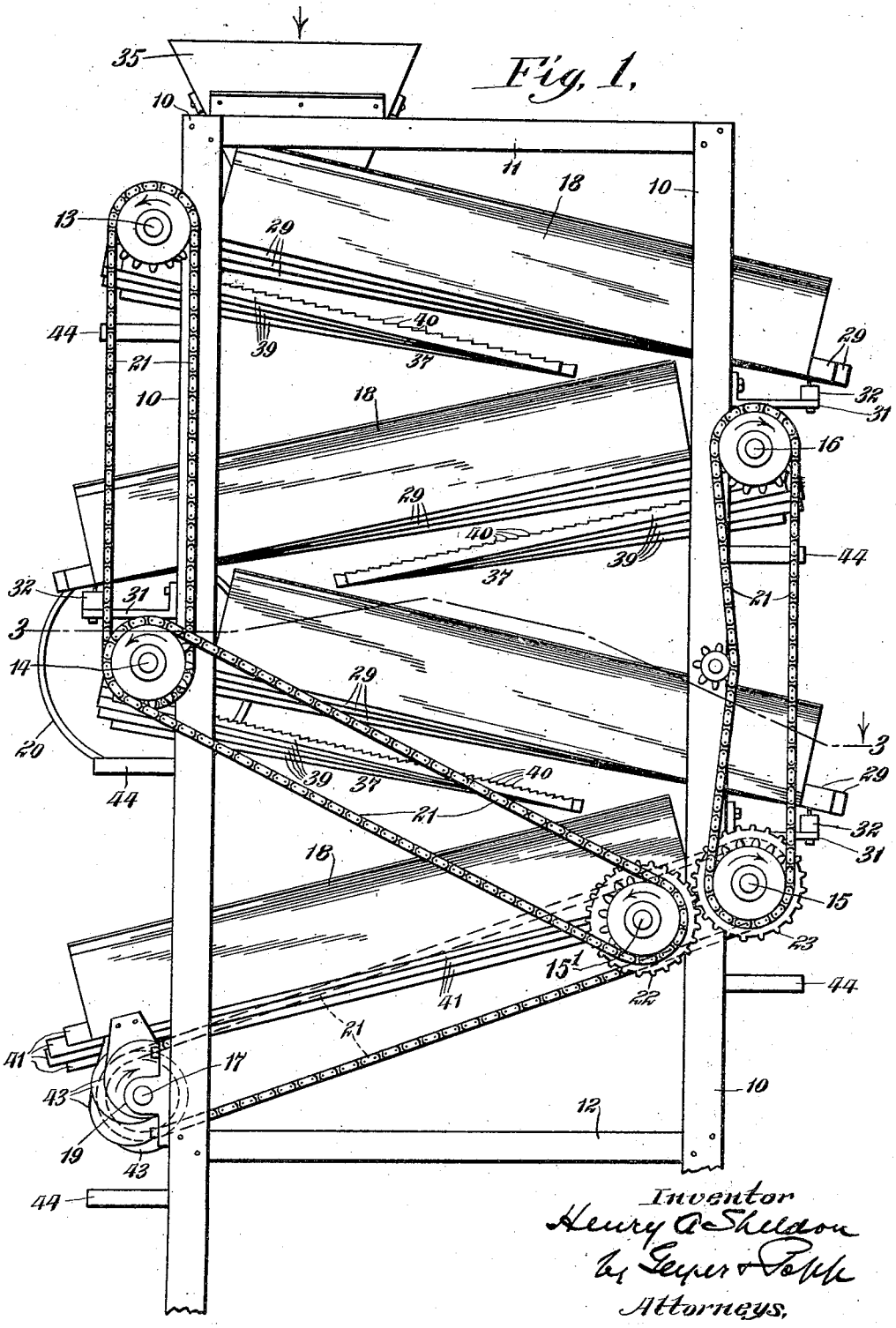
Sept. 16, 1924. 1,508,416

H. A. SHELDON

GRADER FOR FRUITS, VEGETABLES, AND OTHER ARTICLES

Filed Feb. 19, 1921 3 Sheets-Sheet 1

Fig. 1.



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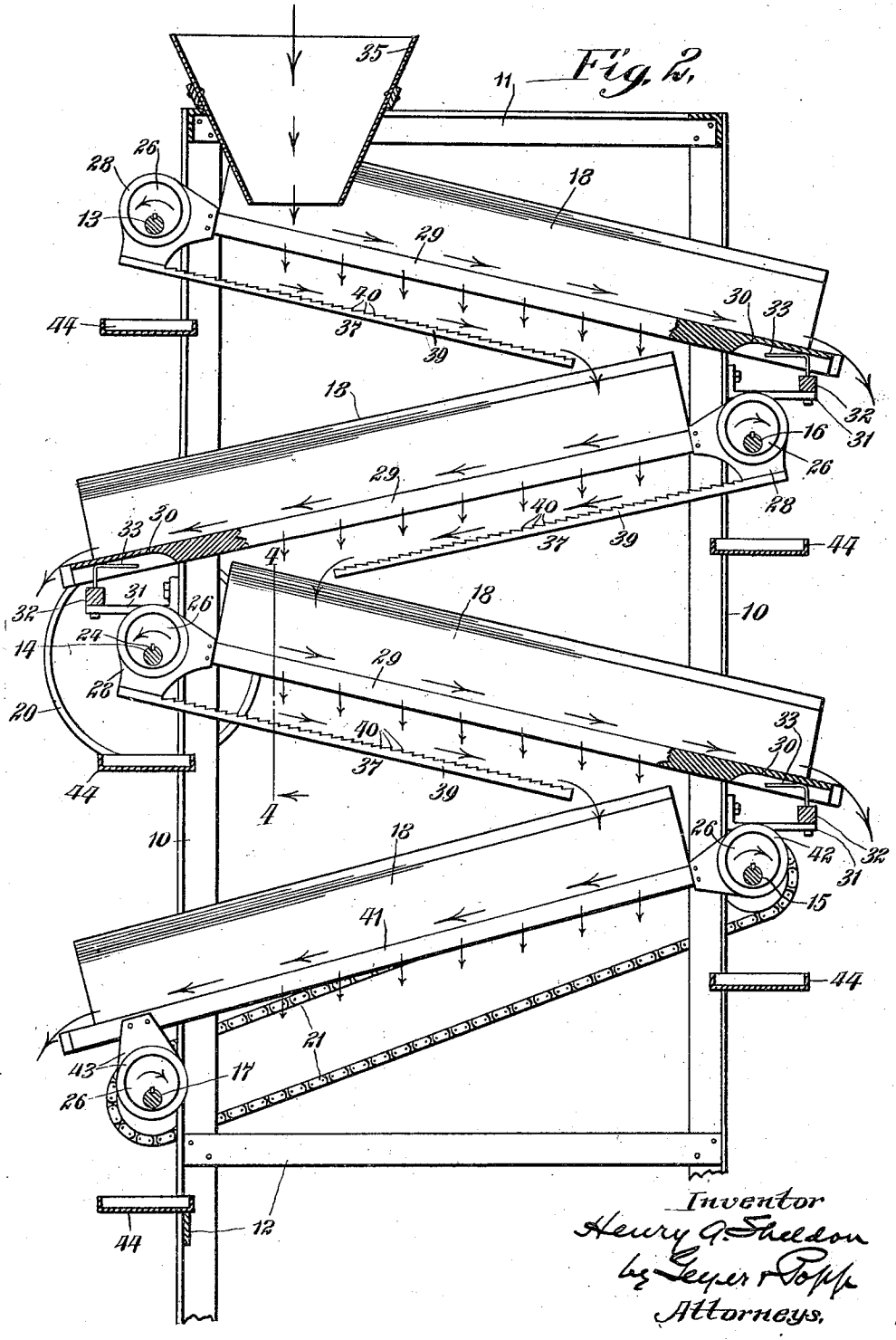
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GRADER FOR FRUITS, VEGETABLES, AND OTHER ARTICLES

Filed Feb. 19, 1921 3 Sheets-Sheet 2

Fig. 2.



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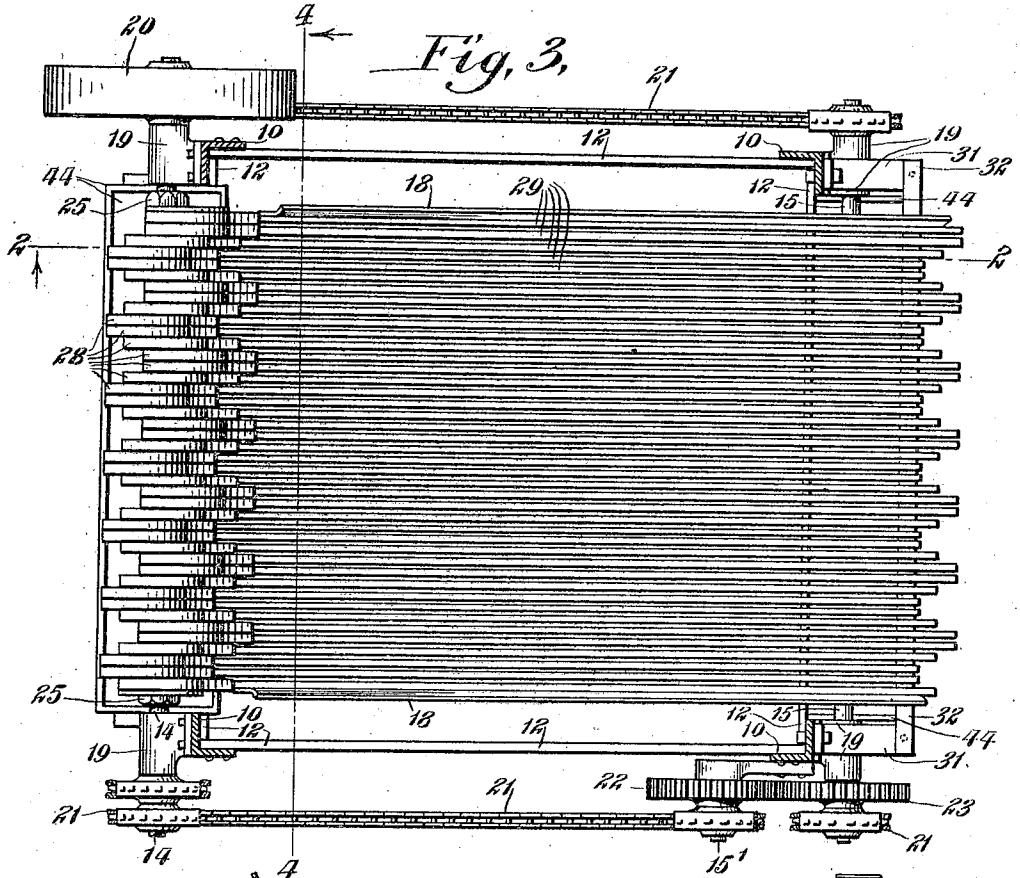
Sept. 16, 1924. 1,508,416

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GRADER FOR FRUITS, VEGETABLES, AND OTHER ARTICLES

Filed Feb. 19, 1921 3 Sheets-Sheet 3

Fig. 3.



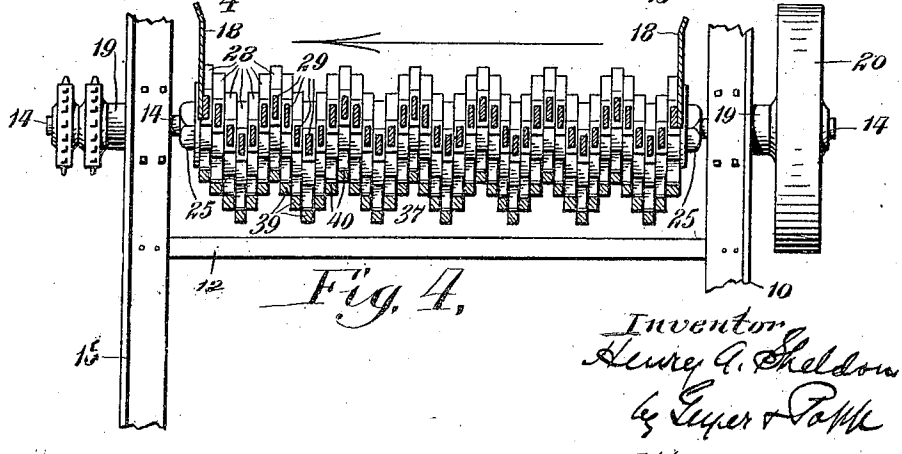


Fig. 4.

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Patented Sept. 16, 1924. 1,508,416

UNITED STATES PATENT OFFICE.

HENRY A. SHELDON, OF BUFFALO, NEW YORK, ASSIGNOR TO PEERLESS HUSKER COMPANY, OF BUFFALO, NEW YORK, A COPARTNERSHIP.

GRADER FOR FRUITS, VEGETABLES, AND OTHER ARTICLES.

Application filed February 19, 1921. Serial No. 446,250.

To all whom it may concern:

Be it known that I, HENRY A. SHELDON, a citizen of Canada, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Graders for Fruits, Vegetables, and Other Articles, of which the following is a specification.

This invention relates to a machine for automatically feeding, classifying, separating and grading a miscellaneous quantity of material into different sizes, and relates more particularly to a machine for grading string beans or small attenuated fruits and vegetables which have irregular size.

The object of the invention is to reliably and uninterruptedly classify, separate or grade the fruit or vegetables, either just as they come in from the fields, without any preliminary treating of the same, or after preliminary operations have been performed on them, and to do this work without any liability of clogging the machine or varying or altering the quality of any of the streams of graded fruit or vegetables which issue therefrom.

In the accompanying drawings: Figure 1 is a side elevation of the complete grading machine with the lower part thereof broken away. Figure 2 is a vertical longitudinal section thereof, taken on line 2—2, Fig. 3. Figure 3 is a horizontal section through the grading machine and taken on line 3—3, Fig. 1. Figure 4 is a fragmentary vertical transverse section through the grading machine taken on line 4—4, Figs. 2 and 3.

Similar characters of reference refer to like parts throughout the several views.

In its general organization, this machine comprises a main frame and a set or a plurality of sets of grading bars. Any desired number of sets of grading bars may be employed but in the drawings four sets are shown as an example. In the drawings the bars of each set are shown as inclined from the head end to the tail end of the set, but they may be employed in other positions. The bars are spaced apart to permit material of a size less than the width of the spaces between the bars to pass downwardly through these spaces while the material larger than these spaces escapes from the tail end of these bars or in case the bars were set in a horizontal position, the material would then escape over the side of the bars. In the machine as shown in the accompanying drawings, the grading bars of the several sets incline alternately in opposite directions so that the head of one set is above the tail of the set next below and thus cause the material passing through one set of bars to fall upon the next lower set of bars, the width of the spaces between the grading bars being progressively narrower from the uppermost set to the lowermost set. It is obvious that this arrangement can be altered to suit the particular articles being handled. The following description of the details of one of these sets of grading bars, their operating mechanism and the parts associated therewith apply to the other sets of grading bars and the corresponding companion parts.

The main, stationary frame of the grader may be variously fabricated, but the same preferably consists of a rigid, framework comprising four uprights or standards 10 disposed at the four corners of the machine and rigidly joined together at their upper ends by four horizontal tie beams 11 and intermediately stiffened and connected together by means of a number of horizontal stiffening bars 12. A plurality of oscillation shafts 13, 14, 15, 16 and 17 are disposed parallel to each other and journaled in bearings 19 on the front and rear outer faces of the main frame. These shafts are all driven from a main driving pulley wheel 20, preferably secured to the shaft 14, and are caused to be simultaneously rotated by means of a plurality of chain belts 21 and sprocket wheels 211, as shown in Fig. 1. A reversal of rotation is obtained in the two rear oscillation shafts 15 and 16 and also in the lowermost front oscillation shaft 17, by means of an intermediate or stub jack shaft 15^1 (note Figs. 1 and 3), which shaft is driven from the main driving oscillation shaft 14 by means of a chain belt and has secured thereto a spur gear 22 which, in turn, meshes with a spur gear 23 affixed to the lower rear oscillation shaft 15.

Confining our attention, for the present, to the drive oscillation shaft 14, the same is provided with a longitudinal keyway 24 which extends straight longitudinally and substantially the entire length of said oscil-

lation shaft 14. Keyed to said shaft and suitably retained lengthwise thereon between a pair of clamping nuts 25 are a considerable plurality of eccentrics 26 whose flat faces are parallel to and bear flat against each other. Each of these eccentrics has its keyway cut in such a manner that its eccentric center or throw is positioned at an equal angular or circumferential distance ahead of the eccentric which is immediately adjacent on the one longitudinal side thereof, and is positioned at an equal angular distance behind the eccentric which is immediately adjacent on the other side thereof. That is, the eccentric centers of the eccentrics form a spiral or helical path around the said drive shaft 14. In the arrangement illustrated in the drawings, each eccentric is sixty degrees ahead of its fellow, so that the length of a wave or complete spiral of the said helical path is equal to the width of six of such eccentrics, as best shown in Fig. 4. Of course, this wave length can be altered by either altering the width of the eccentrics or by altering the angular or circumferential displacement between adjacent eccentrics.

Secured individually to the central rear part of each eccentric strap 28 is a grading bar 29 which inclines downwardly and away from the said drive shaft 14. Extending upwardly from the rear lower face of each grading bar is a guide slot 30 which extends centrally and longitudinally of said grading bar and is of less width than the width or transverse, horizontal thickness of the said grading bar. Secured suitably to the main frame of the machine are horizontally and outwardly projecting brackets 31 which carry, at their outer ends, a horizontal transverse supporting bar 32. Extending upwardly and then inwardly from the upper face of said supporting bar are a plurality of L-shaped guide fingers 33. Each guide finger is received within one of the aforesaid guide slots 30 of a companion grading bar, so that the lower end of each bar is restrained against transverse displacement, the said guide finger bearing laterally against the vertical side walls of the companion guide slot 30. It may be noted that inasmuch as this guide slot extends upwardly from the lower face of the grading bar, it follows that the upper and side faces of said grading bar are smooth and unbroken and free from projections. It should also be noted, that although the eccentrics are arranged face to face, the grading bars are spaced apart relatively to each other. Therefore if string beans or other articles are placed upon the upper faces of said grading bars, such beans or other articles will fall through between the said grading bars as are either equal in width or less in width than the distance between adjacent grading bars. The space between the uppermost set of grading bars (which are connected to the uppermost oscillation shaft 13) is relatively great. Thus, as the ungraded, heterogeneous mass of beans or other articles which are fed into the feeding hopper 35 fall onto the upper faces of the head of the uppermost grading bars 29, only the coarsest of this mass of beans, or other articles, are able to roll all the way down upon the upper faces of said bars and drop off the lower or tail end of the incline thereof. Thus all but the very coarsest of said beans, or other articles, are dropped onto the set of grading bars which are connected with the oscillation shaft 16. These last mentioned grading bars are somewhat closer together than are the uppermost grading bars, that is, the intervening space between adjacent grading bars is narrower in width.

As before stated, only the coarsest of the beans, or other articles, which drop through the bars connected to the shaft 13 are able to travel down the entire length of the second set of grading bars and fall off the lower or tail end thereof. The rest of the beans or other articles drop through onto the third set of grading bars next below (attached to oscillating shaft 14) where as before the intervening space between said bars is less in width than the distance between the bars of the set immediately above, and again the coarsest of the remaining beans or other articles are moved down the sloping surface of said bars and dropped off the lower end of the slope thereof. This same procedure is repeated with reference to the lowermost set of grading bars 41, which latter are however actuated somewhat differently, though not necessarily, from the upper three sets of grading bars 29.

For the purposes of explanation, it may be assumed that the theoretical helixes of the oscillation shafts (formed by the graphs of all of the eccentric centers of the eccentrics) extend circumferentially back in the direction of the arrows shown in Figs. 1 and 2, which arrows indicate the rotation of the oscillation shafts. The upper surfaces of the grading bars are, as best seen in Fig. 4, of the shape of waves or sinusoidal rounded ridges which extend parallel and longitudinally of the machine. These waves are caused to progress laterally of the machine and laterally of the direction in which the waves extend, by reason of the rotation of the companion oscillation shaft and the arrangement of the eccentrics 26. In the case of the uppermost set of bars 29 (i. e., which may be termed the primary grading bars), this wave motion is laterally of the machine from the rear side of the machine, as shown in Figs. 1 and 2 forwardly and laterally, toward the forward side thereof. This wave motion causes the beans or other articles to

be moved laterally of the machine, so that the bulk of the same are carried over to one side of the same. The beans or other articles are prevented from entirely moving laterally off from the grading bars, by reason of a guard plate 18, one of which is secured to each of the outermost grading bars, except where it is desirable to discharge over the side of the bars rather than the end, in which case the guard plate 18 is removed. The shaft 16 is rotated in the opposite direction from the shaft 13 and hence the lateral wave movement in the particular set of grading bars 29 which are actuated by the said oscillation shaft 16 (i. e., which may be termed the secondary grading bars) is in a lateral direction which is opposite to the lateral wave movement of the said primary grading bars aforementioned. Inasmuch as the bulk of the beans or other articles have been thus deposited on the one lateral side of said secondary grading bars, and inasmuch as the lateral wave movement is toward the other side of the machine, it follows that the bulk of the beans or other articles will be moved transversely across the entire width of the said secondary grading bars and across the entire width of the machine. It should be noted, however, that the waves themselves extend at all times longitudinally of the machine so that the beans, or other articles are forced to maintain a longitudinal position in the trough of the waves and thus be maintained in the most favorable position for falling through between the bars. If a plurality of beans, or other articles, happen to be still connected by the common stem upon which they grew, each individual bean, or other article, will tend to assume a lengthwise position in the said trough and if it is narrow enough, it will fall through and be pulled downwardly off from the stem by reason of the up and down relative movement of the adjacent grading bars. This occurs because the adjacent grading bars move up and down relatively to each other despite the fact that the wave tops move uniformly horizontally in the one continuous lateral direction. This is exactly analogous to a water wave in which the wave sweeps uniformly horizontally, but the adjacent water particles move up and down relatively to each other. It will be obvious also that this alternate up and down movement of the adjacent grading bars, prevents any clogging of beans or other material therebetween, as is the case with an ordinary rotary drum grader in which the opposite sides of the apertures are stationary relatively to each other.

It is obvious that, as the beans, or other articles, are travelling laterally, they are also caused to slide longitudinally downwardly, thus helping to aline the beans, or other articles, in the bottom of the wave troughs, so that they can readily fall through. This longitudinal movement also causes the coarser beans, or other articles, and the stem branches to be moved downwardly and dropped off the lower end of the inclined upper surfaces of the grading bars. It is axiomatic that when any one of the grading bars is being elevated, its frictional contact with the beans, or other articles, thereupon is greatest. This fact is made to perform a very useful function in this improved grader, the arrangement being such that as each bar rises upwardly it is also moving longitudinally toward the high end of the grading bars. This tendency to move the beans, or other articles, longitudinally toward the higher ends of the bars is an alternating tendency and opposes the normal longitudinal sliding movement of the beans or other articles toward the lower end of the incline. The result obtained thereby is that the beans or other articles are shuffled longitudinally, and alternately moved at a higher speed toward the lower end of the incline, and incidentally during the same short space of time during which a trough is being formed which is the same time and position when the beans or other articles are most likely to fall through between the bars.

It is obvious that a considerable portion of the beans or other articles will fall through between the grading bars before having traveled very far down the inclined faces of the same. Unless provided for, such beans, or other articles, would not be able to traverse the entire width of the particular set of grading bars which is located immediately below, and thus a thorough grading action of all the beans or other articles would not be obtained. Such non-uniform grading of the beans or other articles cannot, however, obtain in this improved grader, by reason of the fact that beneath each set of grading bars (except of course the lowermost set), is arranged a conveyer 37 which is inclined in the same direction as are the companion grading bars immediately above the same. This conveyor consists of a plurality of longitudinal parallel conveyer bars 39, whose upper, outer, or front ends are suitably secured to the flat lower faces of companion eccentric straps 28. Every one of the conveyer bars 39 is disposed in very close horizontal juxtaposition to its neighboring conveyer bar, as it is not intended that any beans, or other articles, should fall through between said conveyer bars, inasmuch as the sole object of the conveyer bars is to convey the beans or other articles (such as fall upon it), down toward the upper end of the set of inclined grading bars immediately below. It is furthermore desirable to accelerate this conveying movement so as to eliminate any possibility of cloggage, and also to increase the capacity per hour of the ma-

chine. For this reason the upper faces of the said conveyer bars 39 are each provided with rip saw or ratchet teeth 40, which hasten the beans or other articles downwardly as the conveyer bars are moved longitudinally back and forth. The movement of these conveyer bars causes a continuous wave motion which impels the beans or other articles to move laterally toward the one side of the grader in the same manner in which the beans or other articles are forced to move laterally by the lateral wave motion of the grading bars. This is obvious inasmuch as each conveyer bar 39 is connected to the same eccentric strap as is its companion grader bar. As far as the conveyer feature is concerned, each set of these conveyer bars might be replaced by a suitably inclined or tipped stationary sheet metal conveyer slide, but the construction shown is preferred, inasmuch as there is always some foreign matter adhering to and some long stems connected with, the beans or other articles and for this reason the jostling motion (to which the beans or other articles are subjected by reason of the conveyer bars) is very desirable in removing this foreign matter from the beans or other articles and loosening and pulling the stems off from the same.

The lowermost set of grading bars 41 are constructed and actuated (though not necessarily) somewhat differently from the upper three sets of grading bars. The only difference however is that the bars and hence also the beans are subjected to a somewhat more vigorous treatment. Each of said grading bars 41 is secured at its upper end to an eccentric strap 42 in a manner similar to the other sets of grading bars, and hence is similarly actuated both as to its lateral wave movement and also as to its longitudinal movement. The lower end of each of said bars 41 is however connected to an additional eccentric strap 43, which latter is actuated by an eccentric 26 on the shaft 17 in synchronism with its companion upper eccentric strap 42. The result is that the height of each wave is uniform for its entire length whereas in the case of the other three upper sets of grading bars, the height of the waves shades off to zero over the supporting bars 32. However, the machine could be made with two eccentrics on all of the bars, or only with one eccentric on all of the bars.

It is desirable that all of the eccentrics receive a reasonable amount of lubrication. To prevent the lubricant from dropping onto the conveyer immediately below, a number of suitable horizontal drip pans 44 are provided, one of which is arranged under and parallel with each one of the oscillation shafts and is suitably and removably connected to the main upright frame bars 10. This machine is capable of accurately, quickly and uninterruptedly grading string beans or other fruits and vegetables even though the ends of the same be partly mutilated or connected with either loose or stiff stems. This is true because the machine grades according to the width of the bean or other article and this width is in the middle of the bean or article, which is the strongest part of the same, is the least likely to be decayed and is farthest removed from the more or less variable ends of the same. The machine is applicable for grading of any fruits or vegetables whatsoever, such as beans, peas, husked corn, corn kernels, pears, cucumbers, etc., particularly where a grading as to width is desired. This machine is particularly adapted for the handling of any elongated material where the only positive grading obtainable is on the basis of the width of the material or where the material is so irregular as to be liable to clog an ordinary grader having apertures in fixed relation relatively to each other.

By making the machine with the bars horizontal instead of inclined the machine could be used to grade articles which are spherical in shape and which would therefore roll off the inclined bars before a proper grading could be obtained.

I claim as my invention:

1. A grader of the character described, comprising a plurality of paralliel, longitudinal bars which are inclined from their head or receiving ends toward their tail or delivery ends and which are spaced laterally from each other, and actuating means for reciprocating said bars lengthwise and vibrating the same vertically so that as a whole the upper surfaces of the same produce a wave-like motion crosswise of the several bars and cause the material resting thereon to move by gravity diagonally over the several bars from the head end to the tail end of the same, the crest of each wave being formed by a plurality of bars, the inclined sides of the waves being formed by a plurality of bars and the trough of the waves being formed by a plurality of bars.

2. A grader of the character described, comprising a plurality of parallel, longitudinal bars which are inclined from their head or receiving ends toward their tail or delivery ends and which are spaced laterally from each other, and actuating means for reciprocating said bars lengthwise and vibrating the same vertically so that as a whole the upper surfaces of the same produce a wave-like motion crosswise of the several bars and cause the material resting thereon to move by gravity diagonally over the several bars from the head end to the tail end of the same, said actuating means being constructed to vibrate the head end of the bars more than the tail ends of the same, the crest of each wave being formed by a plurality of bars, the inclined sides of

the waves being formed by a plurality of bars and the trough of the waves being formed by a plurality of bars.

3. A grader of the character described, comprising a plurality of parallel, longitudinal bars which are inclined from their head or receiving ends toward their tail or delivery ends and which are spaced laterally from each other, and actuating means for reciprocating said bars lengthwise and vibrating the same vertically so that as a whole the upper surfaces of the same produce a wave-like motion crosswise of the several bars and cause the material resting thereon to move by gravity diagonally over the several bars from the head end to the tail end of the same, said actuating means being constructed to cause said bars to move toward the head ends of the same while in their upper position, the crest of each wave being formed by a plurality of bars, the inclined sides of the waves being formed by a plurality of bars and the trough of the waves being formed by a plurality of bars.

4. A grader for fruits, vegetables, etc., comprising a plurality of primary grading bars in spaced relationship relatively to each other, a plurality of secondary grading bars arranged below the said primary grading bars, means for moving the fruits or vegetables lying on the upper surfaces of said primary bars in a direction laterally of said bars, and means for moving the fruits of vegetables lying on the upper surfaces of said secondary bars in a lateral direction which is opposite to the lateral movement of the vegetables lying on said primary bars.

5. A grader for fruits, vegetables, etc., comprising a plurality of substantially parallel primary grading bars, means for giving said primary grading bars a sinusoidal or wave movement which travels laterally in the one direction, a plurality of secondary grading bars arranged below the said primary grading bars, and means for giving said secondary grading bars a sinusoidal or wave movement which travels in a lateral direction oppositely to the sinusoidal movement of said primary grading bars.

6. A grader for fruits, vegetables, etc., comprising a plurality of substantially parallel, primary grading bars, a plurality of substantially parallel, secondary grading bars arranged below said primary bars, means for moving the fruits or vegetables laterally of said primary grading bars in the one direction, and means for moving the fruits or vegetables laterally of said secondary grading bars in a direction opposite to the movement of the fruits or vegetables on said primary bars.

7. A grader for fruits, vegetables, etc., comprising a plurality of primary grading bars, a plurality of secondary grading bars, and means for creating a transverse, sinusoidal or wave movement in both sets of grading bars, the travel of said wave movement in the primary grading bars being in a direction opposite to that of the travel of the wave movement in the secondary grading bars.

8. A grader of the character described, comprising a plurality of parallel, longitudinal bars which are inclined from their head or receiving ends toward their tail or delivery ends and which are spaced laterally from each other, and actuating means for reciprocating said bars lengthwise and vibrating the same vertically, so that as a whole the upper surfaces of the same produce a wave-like motion crosswise of the several bars and cause the material resting thereon to move by gravity diagonally over the several bars from the head end to the tail end of the same, said actuating means being constructed to cause said bars to move toward the heads ends of the same while in their upper position, comprising a plurality of eccentrics associated with the bars, respectively, and each eccentric being a fraction behind and a fraction ahead of the eccentrics of the adjacent bars, the crest of each wave being formed by a plurality of bars, the inclined sides of the waves being formed by a plurality of bars and the trough of the waves being formed by a plurality of bars.

9. A grader for fruits, vegetables, etc., comprising a drive shaft, a plurality of eccentrics arranged on said shaft and arranged progressively an equal angular distance ahead of each other, a supporting bar, a plurality of guide fingers extending upwardly from said supporting bar, and a plurality of grading bars secured individually to said eccentrics, and individually provided with longitudinal slots at their lower ends which extend upwardly from the lower surfaces thereof and receive the aforesaid guide fingers.

10. A grader for fruits, vegetables, etc., comprising a drive shaft, a plurality of eccentrics arranged on said shaft and arranged progressively an equal angular distance ahead of each other, a supporting bar, a plurality of guide fingers extending upwardly from said supporting bar, and a plurality of grading bars secured individually to said eccentrics, and individually provided with longitudinal slots at their lower ends which extend upwardly from the lower surfaces thereof and receive the aforesaid guide fingers, each of said slots being of less width than the width of the respective grading bar in which it is formed.

11. A grader for fruits, vegetables, etc., comprising a plurality of inclined grading bars arranged in spaced relationship rela-

tively to each other, means for oscillating one after another of said grading bars, and an inclined conveyer disposed beneath said grading bars and adapted to convey longitudinally the vegetables which fall through between the said grading bars.

12. A grader for fruits, vegetables, etc., comprising a plurality of grading bars spaced relatively to each other, conveyer bars disposed beneath said grading bars, and means for oscillating said grading bars, for producing a transverse wave motion of the same for moving vegetables transversely on the upper surfaces of said grading bars and similarly on the upper surface of said conveyer bars, the crest of each wave being formed by a plurality of bars, the inclined sides of the waves being formed by a plurality of bars and the trough of the waves being formed by a plurality of bars.

13. A grader for fruits, vegetables, etc., comprising a plurality of grading bars, a conveyer arranged beneath said grading bars, and means for creating sinusoidal waves in both the said grading bars and the said conveyer, which waves in both cases move transversely of the grader.

14. A grader for fruits, vegetables, etc., comprising a plurality of grading bars spaced relatively to each other, a plurality of conveyer bars arranged in juxtaposition to each other and disposed beneath said grading bars, and means for oscillating said grading bars and said conveyer bars.

15. A grader for fruits, vegetables, etc., comprising a plurality of grading bars spaced relatively to each other, a plurality of conveyer bars arranged in juxtaposition to each other and disposed beneath said grading bars and provided with ratchet teeth, and means for oscillating said grading and conveyer bars.

16. A grader for fruits, vegetables, etc., comprising a plurality of inclined grading bars, a drive shaft, a plurality of eccentrics secured to said drive shaft and arranged progressively an equal angular distance ahead of each other and secured to said grading bars, a plurality of inclined conveyer bars arranged in juxtaposition and secured individually to said eccentrics and individually provided with ratchet teeth.

17. A grader for fruits, vegetables, etc., comprising a plurality of superimposed sets of grading bars, each alternate set being inclined in the same direction and the relative spacing of the grading bars in the sets being progressively less, a set of conveyer bars in juxtaposition to each other arranged beneath each set of grading bars, and means for oscillating the grading bars of each of said grading bar sets.

18. A grader for fruits, vegetables, etc., comprising a drive shaft, a plurality of grading bars connected with said shaft and oscillated thereby, and a drip pan arranged beneath and disposed lengthwise of said drive shaft.

19. A grader for fruits, vegetables and other articles comprising a plurality of substantially parallel primary grading bars, a plurality of substantially parallel, secondary grading bars, means for moving the fruits, vegetables, etc., laterally of said primary grading bars in one direction and means for moving the fruits, vegetables, etc. laterally of said secondary grading bars in the opposite direction.

20. A grader for fruits, vegetables, etc., comprising a plurality of substantially parallel primary grading bars, a plurality of substantially parallel, secondary grading bars, means for moving the fruits, vegetables, etc. laterally of said primary grading bars in one direction and means for moving the fruits, vegetables, etc., laterally of said secondary grading bars in another direction.

21. A grader for fruits, vegetables, etc., comprising a plurality of primary grading bars, a plurality of secondary grading bars, and means for creating a transverse, sinusoidal or wave movement in both sets of grading bars, the direction of travel of said wave movement in both sets of bars being in opposition to each other.

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