Aug. 17, 1954 C. HARDEN 2,686,591

SIZER

Filed July 15, 1950 3 Sheets-Sheet 1

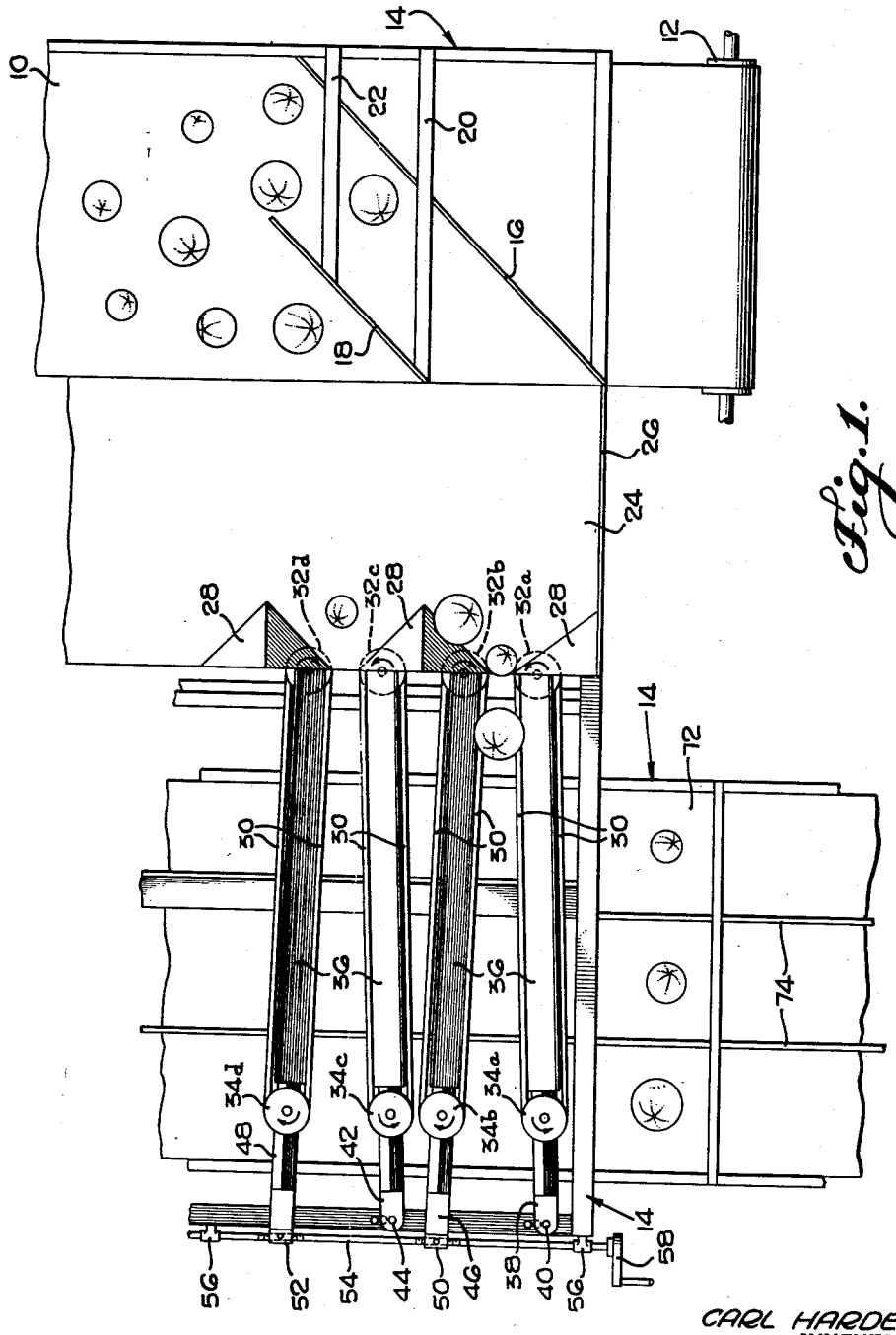

Fig. 1.

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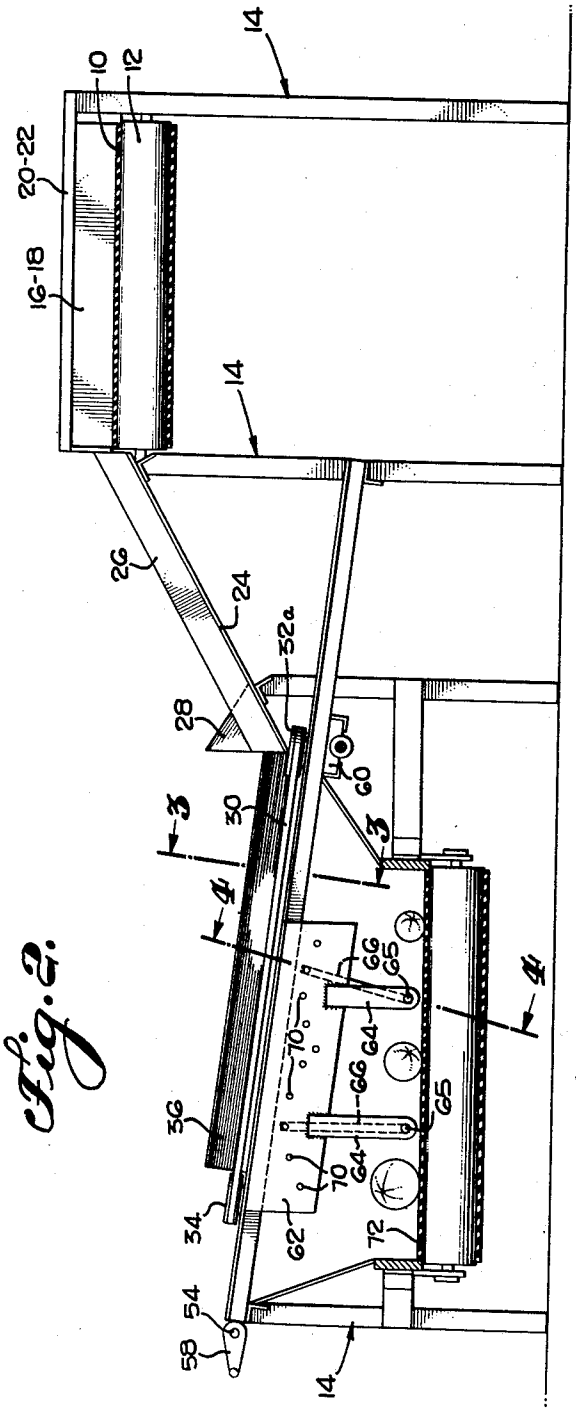

Fig. 2.

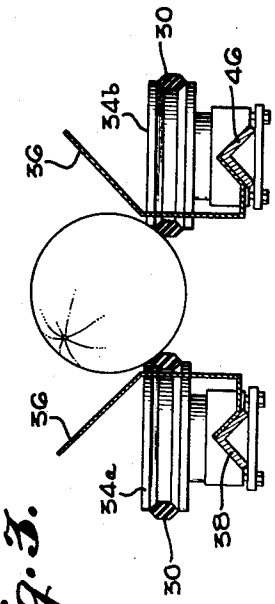

Fig. 3.

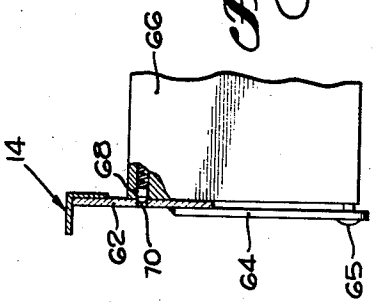

Fig. 4.

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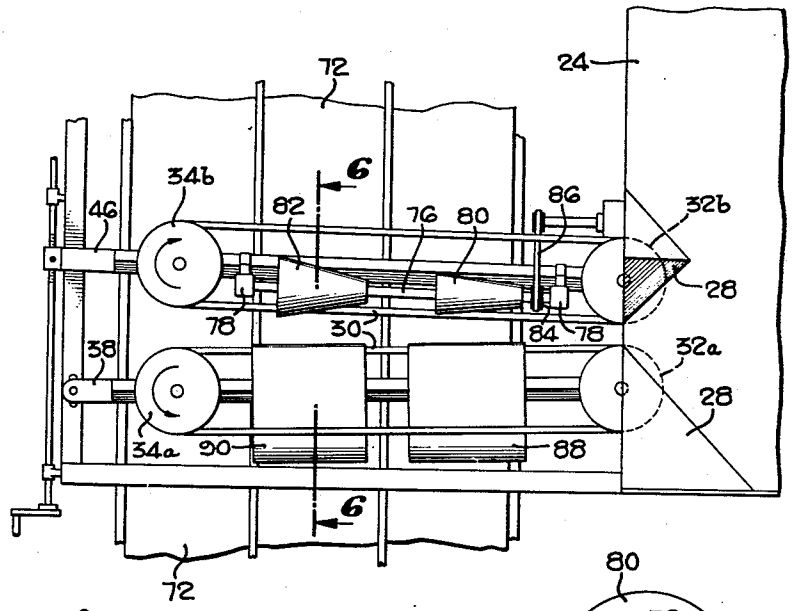

Fig. 5.

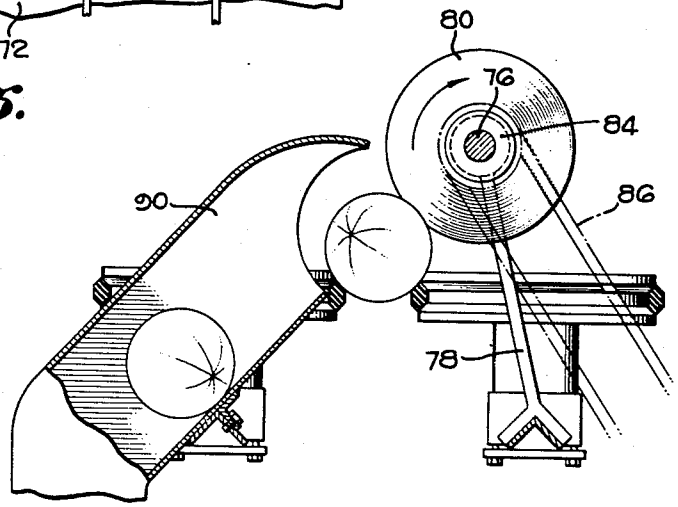

Fig. 6.

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UNITED STATES PATENT OFFICE

2,686,591

SIZER

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Application July 15, 1950, Serial No. 174,005

4 Claims. (Cl. 209—102)

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This invention relates to sizers of the type employing diverging belts for grading fruit or similar articles according to size.

In the processing of many types of products, for example citrus fruits, it is usually necessary that they be segregated according to size. Thus, prior to the crating of citrus fruits, it is usual that they be so segregated. Furthermore, when such fruits are to be processed, for example if they are to be fed to a juice extracting machine, it is essential that they be segregated as to size. In general, the requirements for a sizer for these purposes are reliability, accuracy, speed and simplicity. In addition, it is desirable that a sizer be compact, but at the same time readily accessible for cleaning purposes in order to prevent bacterial growth. None of the sizers currently in use possesses each of these desired features. Accordingly, it is a general object of the present invention to provide a sizer which possesses each of these features.

In addition to the above, it will frequently occur that during the operation of a sizer, the average size of the fruit or other articles will either vary or will be different from that for which the sizer was originally adjusted, with the result that instead of separating the articles into, for example, three approximately equal groups according to size, the great majority of the articles will be either large or small and consequently, a uniform segregation will not result. Under such circumstances, it is normally necessary to shut down the operation of the sizer, and with it any other machinery utilized to feed or be fed from the sizer. In accordance with the present invention, this undersirable necessity is obviated by the provision of a sizer which can be continually and easily regulated without interrupting its operation.

Accordingly, it is an object of the present invention to provide a sizer which will rapidly and accurately segregate articles according to size.

It is a further object of this invention to provide such a sizer which can be continually regulated without disturbing its operation.

It is another object of this invention to provide such a sizer which is compast, but in which all critical parts are readily accessible for cleaning, or for repair or replacement purposes.

It is still another object of this invention to provide such a sizer which, while occupying but a relatively small space, is capable of sorting articles into a number of different sizes in a single operation.

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It is still a further object of the present invention to provide such a sizer which can be simply and economically manufactured and maintained.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same:

Fig. 1 is a plan view of a sizer embodying the invention.

Fig. 2 is a side elevation of the sizer shown in Fig. 1.

Fig. 3 is a vertical section taken along the line 3—3 of Fig. 2.

Fig. 4 is a vertical section taken along the line 4—4 of Fig. 2.

Fig. 5 is a partial plan view of a modified sizer embodying the invention.

Fig. 6 is a vertical section taken along the line 6—6 of Fig. 5.

Referring first to Figs. 1 through 4, wherein for the purpose of illustration, is shown a preferred embodiment of the invention, the numeral 10 designates a feed belt upon which fruit to be sized are deposited from a hopper, not shown. The feed belt 10 is carried by a roller 12 which is driven in any suitable manner and is carried by a frame generally designated as 14. Extending vertically from above the feed belt 10 are baffles 16 and 18 which serve to divide the fruit into two groups as shown. The baffles 16 and 18 are held in place by suitable cross arms 20 and 22 which are secured to the frame 14. Cross arms 20 and 22 are raised above the feed belt 10 a sufficient distance so that fruit may freely pass under them.

Fruit is deflected by the baffles 16 and 18, onto an inclined plate 24 having side walls 26 thereon to prevent the fruit from falling off the plate. At the lower edge of the plate 24 are located a series of guiding piers 28 which divert the fruit to the diverging sizing belts 30. For the purpose of illustration, there is shown in Fig. 1 but a single side wall 26, the other portion of the sizer being cut away. The sizer has been illustrated in this manner to show that it can consist of a number of sizing units, only two being shown in Fig. 1. A second side wall 26 is placed opposite to and parallel to that shown.

Carried by the frame 14 in a manner hereinafter described are a series of drive pulleys designated at 32*a*, 32*b*, 32*c* and 32*d*. Associated with each of these drive pulleys is a correspond-

ing idler pulley designated by the numeral 34. Each set of pulleys carries a sizing belt 30. As will hereinafter become apparent, each adjacent pair of diverging sizing belts 30 comprises one sizing unit which is independent of any other such units. For the purpose of illustration only, there is shown two such units in Fig. 1. It is to be understood, however, that the number of such sizing units may be varied from but a single unit to a relatively large number as desired. While the belts 30 are shown in the drawings as double-V type belts, others such as simple round belts may be used with good results. Associated with each belt is an inclined guide 36. Guides 36, which are best seen in Fig. 3, are utilized to maintain the fruit centered over the sizing belts 30. As seen, the pulleys 32*a* and 34*a* and the corresponding belt 30 carried thereby are mounted upon a cross beam member 38 which is bolted to the frame 14 as at 40. Similarly, the cross beam member 42 carries the pulleys 32*c*, 34*c* and the belt 30 associated therewith. The beam 42 is bolted to the frame 14 as seen at 44. Frame 14 is bored with a series of holes, with the result that the cross beam members 38 and 42 may be bolted thereto in different positions. This arrangement makes possible a coarse adjustment of the angle of divergence of adjacent sizer belts 30 as will hereinafter be explained. Additional cross beam members 46 and 48 are provided which carry the pulleys 32*b* and 34*b* and the belt 30 associated therewith and pulleys 32*d* and 34*d* and the belt 30 associated therewith respectively. The ends of the members 46 and 48 are provided with threaded sleeves 50 and 52 in which is threaded a transverse rotatable shaft 54. The shaft 54 is mounted upon the frame 14 by suitable brackets 56 and is provided with a crank handle 58. As the crank handle 58 is rotated, the cross beam members 46 and 48 will be displaced, thereby varying the angle of divergence between adjacent pairs of belts 30. In order to permit the displacement of the cross beam members 38, 42, 46 and 48 in the manners above described, each of these members is pivotally connected at its other end to the frame 14 as shown.

The drive pulleys 32*a*, 32*b*, 32*c* and 32*d* are driven through a gear box 60 which is connected to a suitable power source, not shown. For reasons which will hereinafter be described, adjacent pulleys, for example 32*a* and 32*b*, are preferably driven at different speeds.

Depending from the frame 14 is a plate 62 best seen in Figs. 2 and 4. Attached to the plate 62 are a pair of downwardly extending supporting arms 64 to which are pivotally connected, as at 65, a pair of baffles 66. Different angular positions of the baffles 66, which extend transversely beneath the belts 30, can be set by means of the spring and ball detents 68 and the holes 70 provided in the plate 62. In a manner which will be explained hereinafter, the position of the baffles 66 will regulate the sorting operation of the sizer.

Immediately below the baffles 66 is provided a distribution belt 72 which utilized to carry off the fruit after it has been sized. Baffle walls 74 are located above the distribution belt 72 to prevent any remixing of the fruit after it has been sorted as to size.

The operation of the embodiment of the invention illustrated in Figs. 1 through 4 will now be described. The fruit to be sized is deposited at random upon the feed belt 10 from a hopper or other suitable feeding means. As best seen in Fig. 1, a portion of this fruit will be diverted by the baffle 18 to the inclined plate 24. This fruit will roll down the inclined plate to the guiding piers 26 which are adjacent the drive pulleys 32*c* and 32*d*. These guiding piers will divert the fruit to pass over the belts 30 associated with these drive pulleys. The remaining portion of the fruit will be diverted by the baffle 16 and will pass to the belts 30 carried by the drive pulleys 32*a* and 32*b*. The fruit will then be carried by the pairs of diverging belts 30 until it reaches a point at which it will fall through the belts to the distribution belt below. As above described, the drive pulleys of each adjacent pair or unit are preferably driven at different speeds. This will cause the fruit to spin upon its major axis as it is carried by the belts 30 so that it will fall between the belts when it first reaches the point where the distance between the belts is greater than the smallest diameter of the revolving fruit. The inclined guides 36 are employed to insure that the fruit will ride over the belts and not tumble aside. As is apparent, the segregation of the fruit according to size will be determined by the angle of divergence between the belts 30 of each unit pair. The original operating angle is usually determined by an inspection of and an estimate of the average size of the fruit to be sorted. This angle is set by bolting the cross beam members 38 and 42 to the desired position on the frame. As will almost invariably occur in the operation of a sizer of this nature, however, after a short period of time, it will be found that the bulk of the fruit will run to either a larger or smaller size than originally anticipated with the result that the fruit will not be equally divided as to size. As an important feature of the present invention, this situation can be readily remedied without shutting down the operation of the sizer. This is accomplished in two ways. First, by simply turning the crank handle 58 the angle of divergence between adjacent cross beam members and consequently between each set of belts can be continually adjusted. By constantly regulating the angle of divergence through the crank handle 58, the operator is able to insure a uniform distribution of the fruit at all times. A second means of controlling the distribution of fruit is provided by the baffles 66. As seen in Fig. 2, the angular position of these baffles will control the distribution of the fruit upon the distribution belt 72. Thus, if it is found that the fruit being sized tends to a smaller size than anticipated with the result that an undesirably large proportion of the fruit is falling to the right hand portion of the distribution belt, this situation can be corrected by simply positioning the right hand baffle 66 to the position shown in Fig. 2. If this correction is insufficient, the baffle may be further extended. Thus, the adjustment of the baffles 66 and the crank handle 58 are complementary. Satisfactory operation can be accomplished by using either of these means alone or using them together. The location of the sizer and its accessibility will frequently determine which of the two means is most commonly employed.

It is thus seen that in accordance with the present invention a compact sizer is provided which can be continually regulated without interrupting its operation to insure a uniform distribution of fruit according to size. Further, the unit is small in size and all of its parts are readily accessible for cleaning or adjustment. The device is simple to maintain in that its principal wearing parts are the simple endless

belts 30 which can be easily and quickly changed.

While there has been shown in Fig. 1 simply a two unit sizer, that is, a sizer having but two pairs of sizing belts, it is obvious that if greater or lesser capacity is desired, the number of units may be increased or decreased.

While it has been found that the above described sizer is very satisfactory for most uses, occasionally it is desired to grade fruit into more than three sizes. While this result can be readily accomplished by simply increasing the number of baffles 66, and in the event this proves undesirable, the modification of the invention shown in Figs. 5 and 6 can be employed, which will accomplish this result. Since the modification consists of a simple attachment to the sizer shown in Figs. 1 through 4, it is deemed unnecessary to either illustrate or describe in detail those features which remain unchanged. Accordingly, Figs. 5 and 6 are directed only to the necessary attachment and show such attachment for but one sizer unit.

Referring to Figs. 5 and 6, there is shown a longitudinal shaft 76 journaled in brackets 78 which are carried by the cross beam member 46. Fixedly mounted upon the shaft 76 is a pair of knock-off members 80 and 82. The shaft 76 also carries a drive pulley 84 which is driven by a belt 86 in the indicated direction. Adjacent the knock-off members 80 and 82 are located chutes 90 and 88, respectively, which may be carried by the cross beam member 38. The chutes 88 and 90 lead to hoppers or to an additional distribution belt, not shown. The knock-off members are so spaced above the belts 30 that they will not strike any fruit which is small enough to pass through the belts 30. As shown in Fig. 6, however, fruit above this size will be struck by one of the rotating knock-off members and deposited into its corresponding chute. The knock-off members 80 and 82 may be of equal size, in which case their sizing function will be determined by the angular divergence between the cross beam members 38 and 46. Preferably, however, they are made of different sizes, as shown in Fig. 5. Furthermore, while the knock-off members have been illustrated in shape of conical segments, it is obvious that the spherical or other suitable shapes may be used.

An additional sizing can be accomplished by spacing the knock-off members 80 and 82 above the belt 30 such a distance that a certain size fruit will be carried off the ends of the sizing belt to a suitable chute without being struck by the knock-off members. By varying the number of knock-off members employed and their individual spacing from the belt 30, it is thus seen that the fruit may be segregated into any reasonable number of sizes. This flexibility of the sizer embodying the present invention is one of the principal advantages thereof.

In order to utilize the attachment shown in Figs. 5 and 6, it is necessary to remove the inclined guides 36 from the sizer shown in Figs. 1 through 4. Were these guides not removed, they would interfere with the operation of the knock-off members and prevent the large sized fruit from reaching the chutes 88 and 90.

By the attachments shown in Figs. 5 and 6, there is provided a simple and compact sizer which will simultaneously grade fruit into five different sizes. It is to be understood, however, that either fewer or more knock-off cones and their associated chutes may be employed to alter this number.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a sizer, the combination of a frame, a pair of diverging adjacent cross beams each pivotally connected at one end thereof to the frame, one of the said cross beams being bolted at its other end to the frame, a rotatable transverse shaft, means connecting the other end of the other said cross beam to the said transverse shaft whereby as the transverse shaft is rotated, the angle of divergence between the said cross beams is varied, pulleys mounted upon the said cross beams, a pair of endless belts carried by the said pulleys, a longitudinal shaft disposed above the said pair of endless belts, one or more rotating knock-off members carried by the said rotating shaft and chute disposed adjacent said members.

2. In a sizer, the combination of a frame, a pair of diverging adjacent cross beams each pivotally connected at one end thereof to the frame, one of the said cross beams being bolted at its other end to the frame, a rotatable transverse shaft, means connecting the other end of the other said cross beam to the said transverse shaft whereby as the transverse shaft is rotated, the angle of divergence between the said cross beams is varied, pulleys mounted upon the said cross beams, a pair of endless belts carried by the said pulleys, one or more baffles extending beneath and transversely of the said cross beams, means for varying the vertical angle of each said baffle, a longitudinal rotating shaft disposed above the said pair of endless belts, one or more knock-off members carried by the said rotating shaft and chutes disposed adjacent said members.

3. In a sizer for grading fruit or the like according to size, in combination, a frame, a feed belt, an inclined plate, one or more baffles for diverting fruit from the feed belt to the inclined plate, one or more pairs of diverging sizing belts adjacent the lower end of the inclined plate, means for continually varying the angle of divergence between the sizing belts of each such pair, a distribution belt for carrying away the graded fruit after it has fallen between the said sizing belts, a longitudinal shaft disposed above one of the said pairs of sizing belts, one or more knock-off members carried by the said rotating shaft and chutes disposed adjacent said members, the distance between the said knock-off members and the said pair of belts being such that fruit of a predetermined size will be knocked from the belts and into the said chutes by the said knock-off members.

4. In a sizer for grading fruit or the like according to size, in combination, a frame, a feed belt, an inclined plate, one or more baffles for diverting fruit from the feed belt to the inclined plate, one or more pairs of diverging sizing belts adjacent the lower end of the inclined plate, means for adjusting the angle of divergence between each such pair of sizing belts, said means comprising a cross beam carrying one of said belts of each pair and adapted to be bolted to one of a plurality of positions on the said frame; additional means for continually varying the angle of divergence between each such pair of sizing belts, said additional means comprising a second cross beam carrying the other of said belts of

each pair, a rotatable transverse shaft, and a sleeve attached to said second cross beam and threaded in said sleeve; a distribution belt disposed beneath the said sizing belts, one or more baffles disposed beneath the said sizing belts and above the said distribution belt and means for varying the vertical angle of each said baffle, a longitudinal shaft disposed above one of the said pairs of sizing belts, one or more knock-off members carried by the said rotating shaft and chutes disposed adjacent said members, the distance between the said knock-off members and the said pair of belts being such that fruit of a predetermined size will be knocked from the belts and into the said chutes by the said knock-off members.

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