Aug. 27, 1940. A. E. VOSLER 2,212,676

MATERIAL GRADING OR SIZING MACHINE

Filed June 16, 1938 4 Sheets-Sheet 1

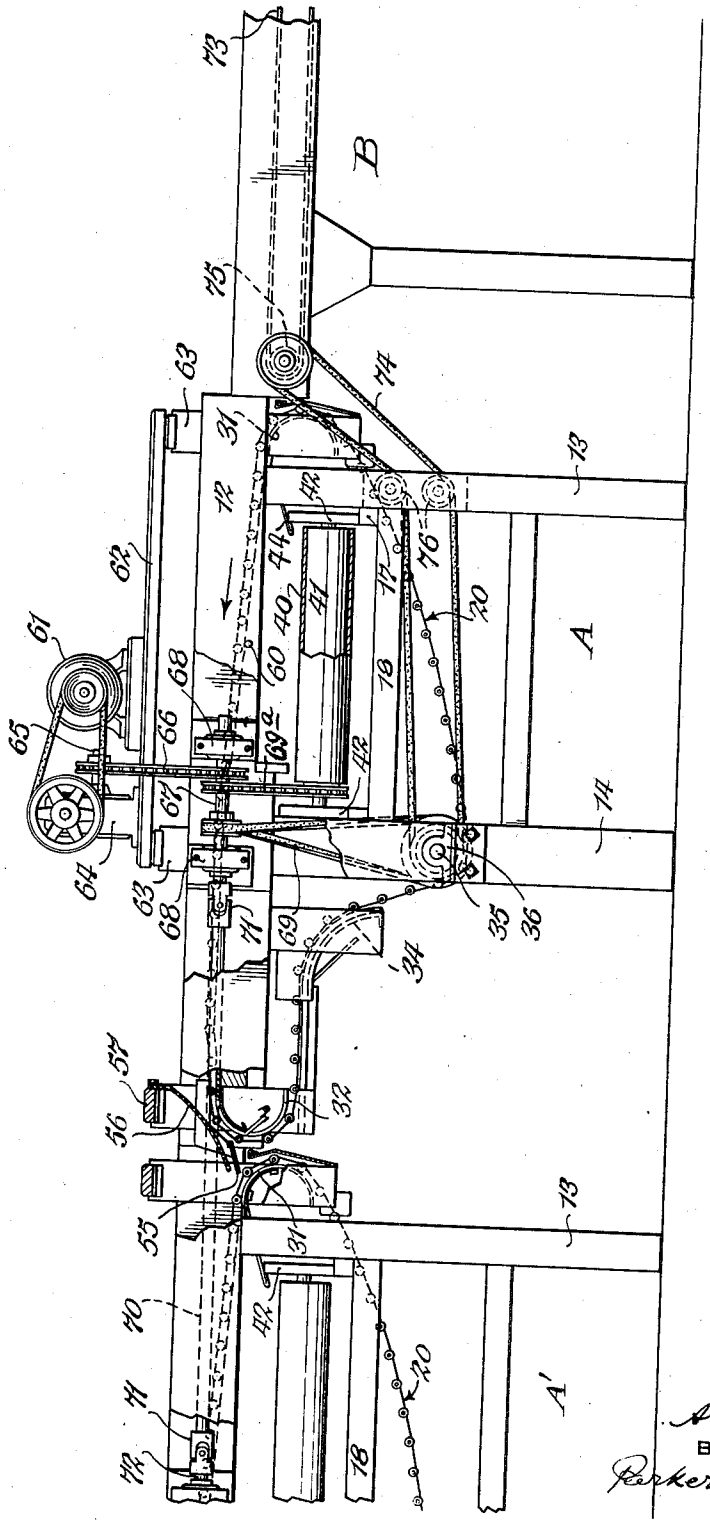


Fig. 1.

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Filed June 16, 1938 4 Sheets-Sheet 2

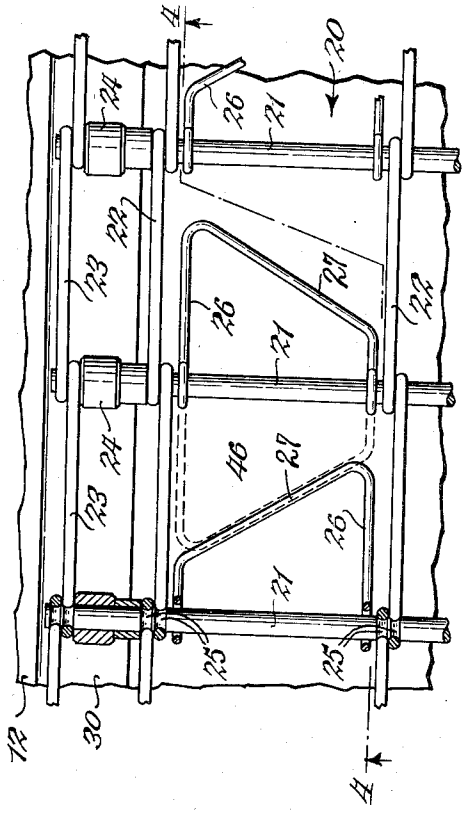


Fig. 3.

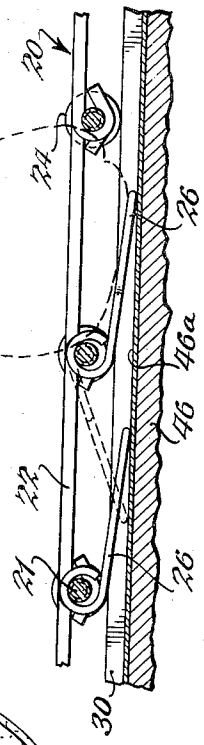


Fig. 4.

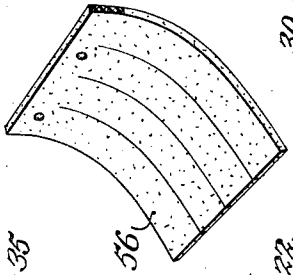


Fig. 6.

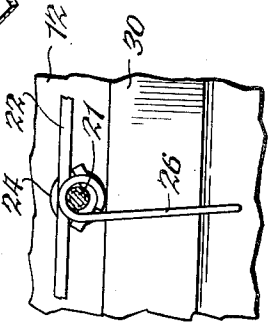


Fig. 5.

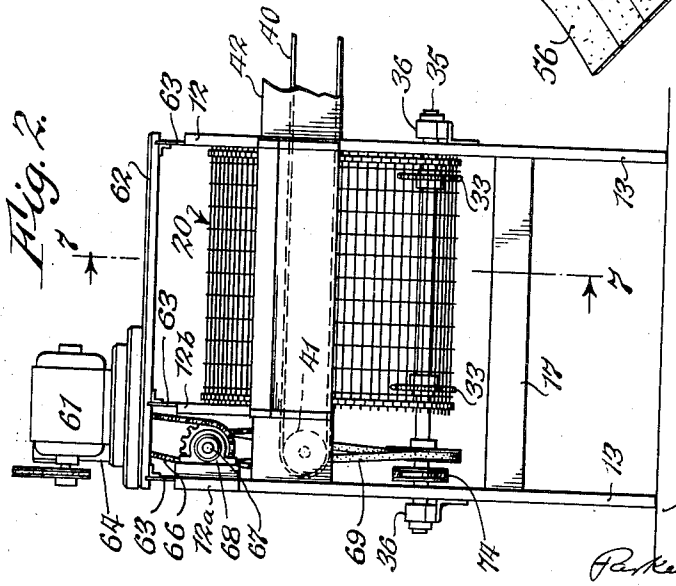


Fig. 2.

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MATERIAL GRADING OR SIZING MACHINE

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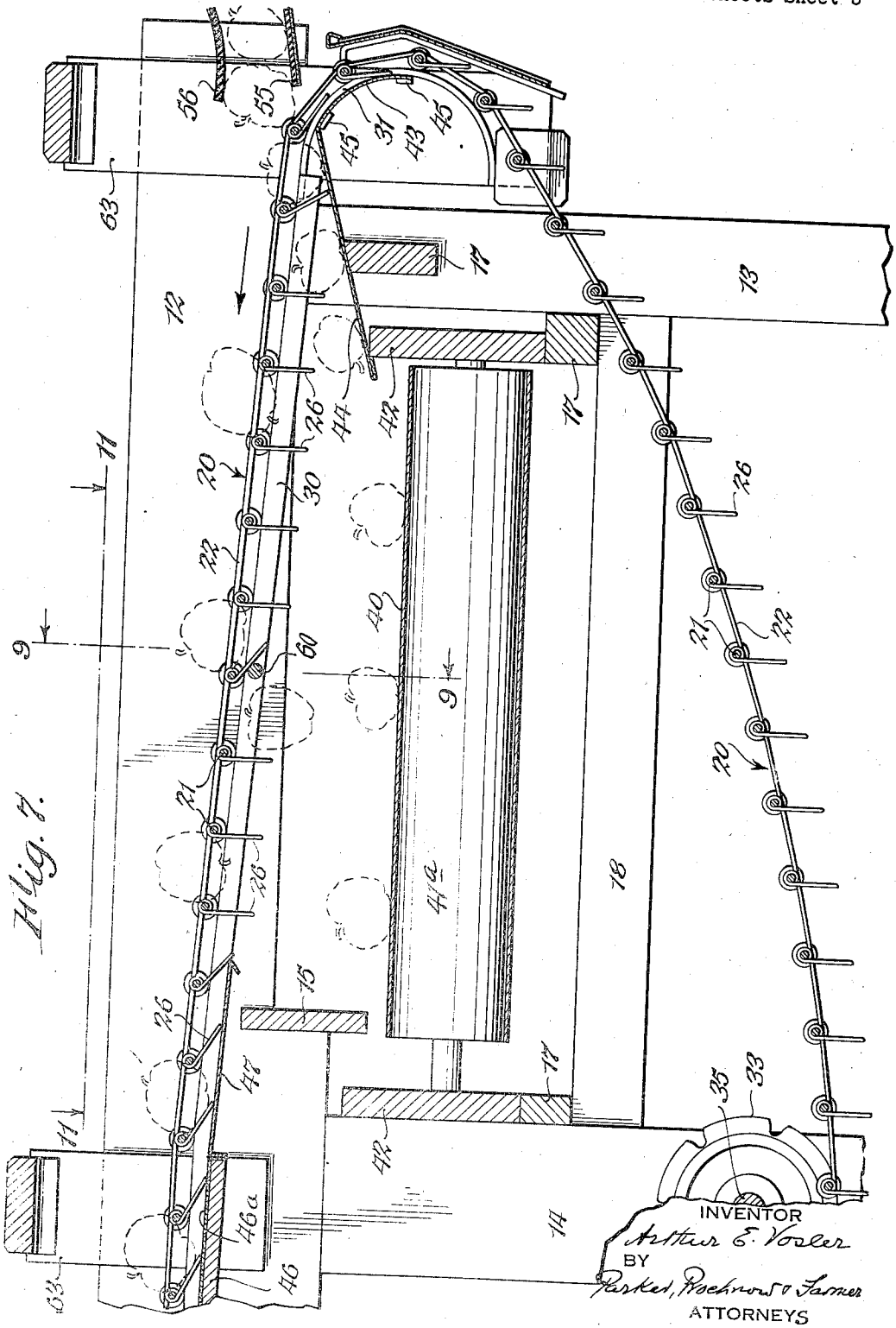


Fig. 1.

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MATERIAL GRADING OR SIZING MACHINE

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Fig. 9.

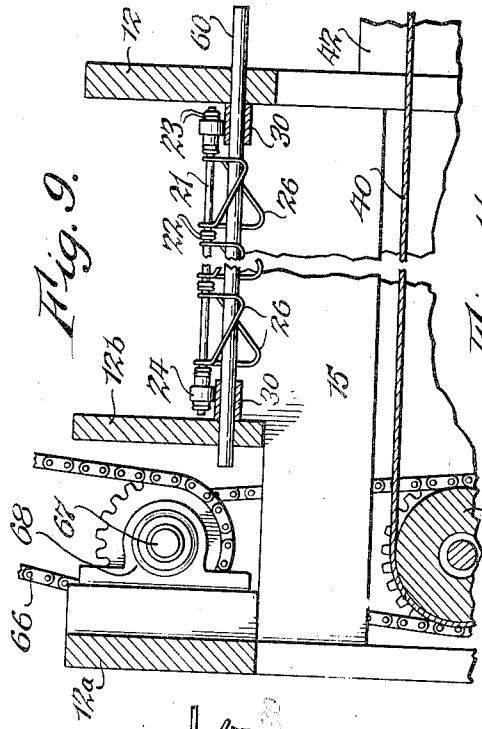


Fig. 11.

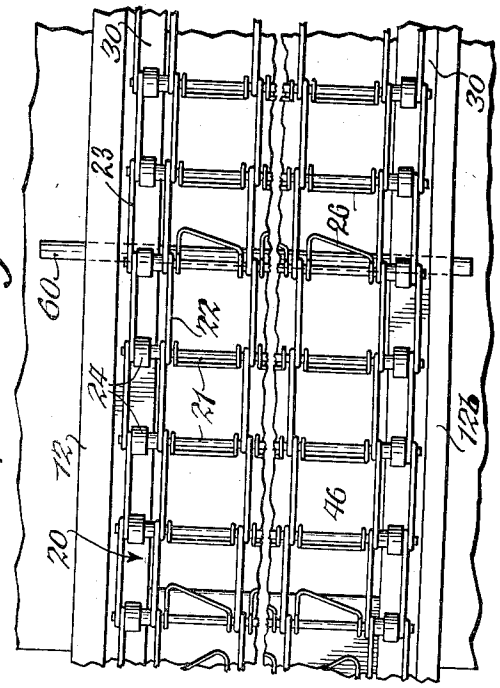


Fig. 8.

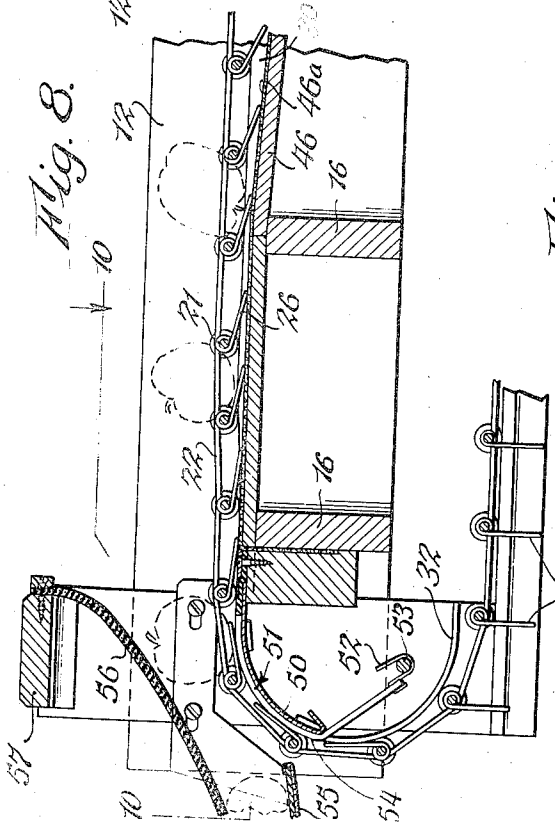
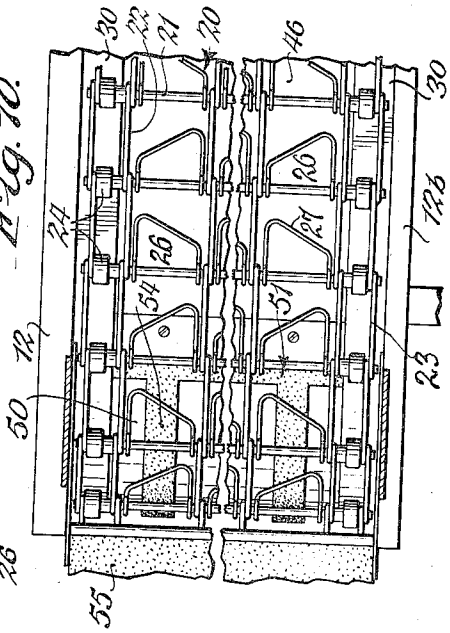


Fig. 10.



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Patented Aug. 27, 1940 2,212,676

UNITED STATES PATENT OFFICE

2,212,676

MATERIAL GRADING OR SIZING MACHINE

Arthur E. Vosler, Medina, N. Y., assignor to Friend Manufacturing Co., Gasport, N. Y.

Application June 16, 1938, Serial No. 214,055

12 Claims. (Cl. 209—84)

This invention relates to grading or sizing machines and more particularly to improvements in machines for separating fruits, vegetables or other more or less analogous materials into different grades according to size, one object of my invention being to provide an efficient, economical and desirable sizing or grading machine of novel, improved construction.

My invention is especially suited to the sizing of apples, and while, for the sake of brevity and clarity of description, the material on which the machine operates may be referred to herein as apples, it is not thereby intended to restrict the invention to such use, since machines embodying the invention are adapted for grading other fruits and materials.

Other objects of the invention are to improve grading or sizing machines so as to insure a more accurate and thorough separation of the fruit or material into different desired sizes and provide a machine which will not bruise, scrape or mar fruits, such as apples, and will operate expeditiously with the minimum of noise; in which the separation is effected by a travelling screen which also functions as a conveyor to carry the fruit to and from the separating place or station and prevent the dragging of the fruit over tables or surfaces which might mar or scrape the tender skins of fruit, such as apples; in which the screen is provided with movable carrying elements arranged relative to the screen openings so as to support and carry the apples along out of contact with stationary surfaces or parts and at the separating station to move to permit the passage of apples under a predetermined size through the screen openings; in which the screen comprises a flexible link or mesh fabric of improved construction having swinging carrying links arranged to project into or beneath the screen openings for supporting and carrying the apples along, and which swinging links swing out of the way to permit the passage of the smaller apples through the screen openings at the separating station; in which the screen is in the form of an endless travelling belt which is supported and guided by stationary tracks or guides which avoid the necessity for revolving supporting and driving drums for the screen; in which the travelling screen is arranged to function as a separating element and also as a conveyor for carrying the fruit from one separating station to a succeeding separating station, receiver or other unit of the machine, and thus avoid the necessity of a separate conveyor, with its attendant driving and mounting means for conveying the fruit between one separating station and another separating station or machine unit; and in which the machine has the other features of improvement and advantage hereinafter described and set forth in the claims.

In the accompanying drawings:

Fig. 1 is a side elevation, partly in section, showing a fruit grading machine embodying my invention and comprising a feed unit and two separating units.

Fig. 2 is an elevation of the front or feed end of the separating unit.

Fig. 3 is a plan, partly in section, of a portion of the sizing screen.

Fig. 4 is a longitudinal, sectional elevation thereof on line 4—4, Fig. 3.

Fig. 5 is a similar elevation showing one of the fruit-supporting links or members swung down to position to permit the passage of the fruit through the opening of the screen.

Fig. 6 is a perspective view of the flexible fruit-retarding device at the delivery end of the separating unit.

Fig. 7 is an enlarged, longitudinal, sectional elevation on line 7—7, Fig. 2, showing a portion of the sizing screen and associated parts of the machine.

Fig. 8 is a similar view of the delivery end portion of the screen and associated parts.

Fig. 9 is a broken, transverse, sectional elevation through the separating unit on line 9—9, Fig. 7.

Fig. 10 is a fragmentary, sectional plan view on line 10—10, Fig. 8.

Fig. 11 is a similar plan showing the position of the parts of the sizing screen as they pass the separating station or place of separation.

The separating unit of the machine has a stationary supporting frame which, as shown, is constructed principally of wood and comprises parallel, horizontal frame rails or members 12, 12a extending longitudinally at opposite sides of the unit, and each suitably secured to and supported by front and rear upright legs 13 and 14, suitably cross bars 15 and 16 connecting the side rails, and suitable cross and longitudinal braces 17 and 18 connecting the supporting legs. An intermediate longitudinal rail 12b extends parallel with and between the side rails 12 and 12a, adjacent the latter, this rail being suitably supported and secured in place in the stationary frame.

The separating or sizing screen 20 is in the form of an endless belt arranged to travel lengthwise between the longitudinal rails 12 and 12b

and is of link or open mesh formation, preferably comprising cross rods 21 connected by longitudinal links 22, which rods and links are spaced apart longitudinally and laterally to form between them rectangular openings of proper dimensions to allow apples under a predetermined size to pass through the openings. At the opposite side edges of the screen, side links 23 connect the cross rods 21 outwardly beyond the adjacent links 22, and rollers 24 are journalled on the cross rods 21 in the spaces between the side links 23 and adjacent longitudinal links 22, these rollers being adapted to travel on guides or tracks for supporting the screen and guiding its travel. As shown, the longitudinal links are formed with eyes at their ends encircling the cross rods 21 in circumferential grooves 25 in the rods, whereby the links are hinged on the rods but prevented from shifting along the rods to thus maintain the proper spacing of the links.

In addition to the links and rods which form the separating openings, the screen is provided with movable fruit-supporting or carrying members 26, one for each separating opening, which are arranged to swing freely to and from positions in which they project into or beneath the separating openings. Each carrying member 26 preferably consists of a bent wire or more or less U or V-shape having terminal eyes which loosely surround an adjacent cross rod 21 to permit the member 26 to swing freely on the rod. In their preferred form the members 26 have inclined cross bars 27 and are arranged alternately in reversed order so that the cross bars of the carrying members on one cross rod 21 will incline oppositely to the cross bars of the members on the next adjacent cross rod 21 of the screen, whereby if two carrying members on adjacent cross rods 21 should swing into the same separating opening, their cross bars 27 will be parallel with each other, as indicated by the full and dotted line positions of the members in Fig. 3, the purpose of which formation and arrangement of the carrying members will appear hereinafter.

The sizing screen is supported and guided in its travel by stationary supporting and guide means including longitudinal tracks 30 fixed to and projecting inwardly from the frame rails 12 and 12b in position for the rollers 24 at the opposite edges of the screen to roll along on said tracks. These tracks 30, as shown, incline upwardly somewhat toward the rear or delivery end of the unit, and at opposite ends of the inclined tracks 30, substantially semi-circular tracks 31 and 32 suitably secured on the machine frame, form downwardly and reversely curved continuations of the tracks 30 about which the screen passes and on which the supporting rollers thereof travel. The lower run of the screen between the curved end guides 31 and 32 passes under and around driving sprocket wheels 33 (see Figs. 2 and 7), and between these sprocket wheels 33 and the rear, curved guide 32, the screen passes downwardly and forwardly over stationary curved rails 34 on which the rollers 24 of the screen travel. The driving sprocket wheels 33 for the screen mesh with the screen cross rods 21 and are secured on a cross shaft 35 which is journaled in suitable bearings 36 fixed on opposite sides of the frame. This shaft is driven, as later described, so as to propel the screen and cause the upper run thereof to travel rearwardly in the direction of the arrows in Figs. 1 and 7.

The apples are fed onto the front end portion of the upper run of the sizing screen between the rails 12 and 12b which confine the apples laterally on the screen, and, as the screen travels along, the apples which are small enough pass or fall through the screen openings onto a receiver 40 and are thus separated from the larger apples, which are carried along and delivered from the rear end of the screen. The receiver 40 shown consists of an endless belt conveyor of canvas or other suitable material arranged between the upper and lower runs of the screen to travel in a direction transversely to the direction of travel of the screen so as to carry away apples that pass through the screen. This conveyor belt 40 may pass around a driving roll or drum 41 suitably journalled on the machine frame, and extends out to one side from the separating unit and around an idle roll or drum 41a, Fig. 7, mounted at a distance from the separating unit. Sideboards extending out laterally from the separating unit frame at opposite sides of the conveyor belt 40 confine the apples on the belt. 42 indicates one of these sideboards. The other may be formed by an extension of the frame cross bar 15.

At the receiving end of the sizing screen, a curved guide or shield 43 extends crosswise from one to the other of the curved tracks 31, and a table or shelf 44 extends rearwardly from the upper end of this guide over the top edge of the adjacent sideboard 42 for directing the apples which may fall through the openings of that portion of the screen overlying the shelf, onto the conveyor belt 40. The guide 43 and shelf 44 may be formed by a suitably bent metal plate secured to and supported by lugs 45 secured to and extending from the curved tracks 31 and by the cross bar frame 17 and the sideboard 42. At the opposite side of the receiving conveyor 40, a table 46 extends rearwardly from a point over the adjacent edge of the conveyor 40 to the rear ends of the inclined tracks 30 for the screen 20. This table extends crosswise between the longitudinal frame bars 12 and 12b beneath and near the upper run of the screen and may be formed by boards with a top covering 46a of canvas or other suitable more or less yielding material, and a metal plate 47 which is secured to the table boards and tracks 30 forms a front extension of the table.

The swinging fruit-carrying links 26 of the sizing screen are adapted to hang vertically from the cross rods 21 of the screen and thus leave the screen openings unobstructed except where they pass over the tables and screen guides, and as the screen passes upwardly and rearwardly around the front guides 31, the links 26 will engage the curved guide 43 which will deflect the links so that they will trail over the guide and inclined shelf or table 44 at the receiving end of the screen and partially obstruct the screen openings. As the upper run of the screen travels along, the links will gradually swing down until, when they clear the inclined shelf, they will hang vertically down from the upper run of the screen. Any apples which pass through the openings of the screen during their travel over the shelf 44 will thus be lowered gently onto the shelf by the swinging links 26 and caused to slide gently down the inclined shelf onto the receiving conveyor 40, and apples of small enough size can fall freely through the openings of that portion of the upper run of the screen overlying the receiving conveyor between the vertically depending swinging links. When, in their onward passage, the depending swinging links engage the inner edge of the table 47, they will be again deflected up-

wardly and will assume more or less horizontal, trailing positions beneath the separating openings of the screen, as shown in Figs. 7 and 8. The rear ends of the guide tracks **30**, (see Fig. 8) are bevelled or incline downwardly somewhat toward the plane of the table **46**, so that as the links **26** approach the delivery end of the separating unit, they will be practically horizontal. This trailing and lifting of the links causes them to engage and gradually lift any apples projecting down into the openings of the upper run of the screen, and thus prevent the apples from wedging into the openings and from dragging along on the surface of the table **46—47**. This prevents scraping, marring or bruising of the apples.

Extending rearwardly and downwardly from the rear end of the table **46** is a curved guide or shield between the curved roller guides **32**. Preferably this shield, (see Figs. 8 and 10) is formed by a curved metal plate **50** over which is stretched a longitudinally slotted covering sheet **51** of rubber or other suitable yielding or cushioning material over which the swinging links **26** drag as the screen passes around the guides **32**. The covering **51** may be attached at its front end to the frame and stretched over the guide plate **50** by hooks **52** at the rear end of the covering engaged with a securing bar **53** in the stationary frame. The hinge eyes of the longitudinal and swinging links of the screen are adapted to enter the longitudinal slots of this covering **51** while the free ends of the swinging links **26** ride on the strips **54** of the covering between the slots. Thus, the trailing ends of swinging links are further tipped upwardly toward the screen openings as the screen passes around the guide **50** and gradually lift the apples off of the screen rods and links, or out of the separating openings, and thus gently discharge them off of the delivery end of the screen.

The large apples tail off of the sizing screen onto a downwardly inclined shelf **55** by which they are directed onto a succeeding separating unit A' of other unit of the machine. The shelf **55** also preferably has a rubber or other yielding top covering.

For retarding the speed of delivery of the apples from the sizing screen, a retarding device or drag **56**, preferably consisting of a longitudinal slitted sheet of yielding or flexible material, such as soft or sponge rubber, is attached at its front edge to a supporting bar **57** extending crosswise of the separating unit above the screen, with the free, rear end of the sheet hanging down loosely above the rear end of the screen and the shelf **55**. This slitted sheet drags over the apples as they pass off of the screen and over the shelf **55** and thus impedes their speed and prevents them from being quickly or roughly thrown from the sizing screen.

As before mentioned, the swinging fruit-supporting links **26** are arranged with the inclined cross bars of alternate links inclined in opposite directions, and their loose hinging on the cross rods of the screen allow some play of the links on the rods both lengthwise and transversely of the screen. Therefore, in the operation of the machine, if any link should be thrown over into the same separating opening with an adjacent link, the inclined cross bars of the two links will be parallel with each other, as shown by the full and broken lines in Fig. 3, and the links can shift sufficiently to pass each other, thus preventing possible binding or interlocking of the two so as to prevent their intended free swinging movements. In their fruit-supporting positions, the inclined cross bars of the links extend substantially diagonally of the screen openings and therefore will effectually support the apples regardless of the varying sizes and shapes.

During the travel of the upper run of the screen over the receiving belt conveyor **40**, it is possible that some apples on the screen small enough to pass through the screen openings might nevertheless assume positions, which because of irregular shapes of the apples, prevent them from passing through the openings. In order to ensure the passage of such apples through the screen openings, a rod **60** extends crosswise between the tracks **30** beneath the upper run of the screen in position to engage the depending swinging links **26** and swing them upwardly so as to lift and jostle or change the positions of the apples on the screen to positions in which such apples will pass through the openings. This ensures a more thorough separation of all of the apples intended to be separated from those of larger size on the sizing screen.

The sizing screen is driven from an electric or other suitable motor through the medium of drive mechanism preferably arranged as follows:

61 represents the motor which is mounted on a base **62** fixed on suitable supporting standards **63** rising from the stationary machine frame. An encased speed reduction gearing **64** mounted on the base **62** may be belted or otherwise operatively connected to the motor, and a shaft or element **65** of this gearing is connected, as by a sprocket chain **66** and wheels, to a horizontal countershaft **67** which is journalled in bearings **68** suitably mounted on the machine frame between the frame rails **12***a* and **12***b*. This countershaft **67** drives the operating sprocket shaft **35** for the sizing screen, as by a belt **69** connecting pulleys on said shafts. The countershaft **67** extends longitudinally between the rails **12***a* and **12***b*, which thus serve as safety guards or shields for the countershaft, its bearings and wheels or pulleys. Shaft **67** also drives the conveyor **40** as by a chain **69***a* and chain wheels.

This arrangement of the countershaft lends itself readily to simple driving connection with the driven parts of other units of the machine. Thus, the machine as illustrated in Fig. 1 of the drawings, comprises the separating unit A, which has been described, a succeeding similar separating unit A' having a screen of suitably larger mesh for separating the next larger grade of apples from the apples of mixed size fed to the machine, and a feed unit B arranged in advance of the separating unit A for delivering the mixed apples thereto. For example, for driving the sizing screen of the second unit A' it is simply necessary to provide a coupling shaft **70** connected by flexible couplings **71** of any suitable type to the rear end of the countershaft **67**, and to the front end of a similar countershaft **72** on the second separating unit. The flexible couplings **71** allow for reasonable misalinement or different relative positions of the countershafts of these two units. The feed belt **73** of the feed unit may be driven by a chain or belt **74** passing around pulleys on the shaft **35** of the unit A and on the driving roll **75** of the feed belt. This chain passes under idle guide pulleys **76** on the frame of the unit A. Thus, it will be seen that the driven elements of the units of the machine in

advance and in rear of the first separating unit are operated through simple inexpensive drive connections from the countershaft of the unit A.

The described drive mechanism makes it possible to provide grading or sizing machines of very flexible type suited to various different requirements. For instance, instead of the machine comprising the feeding and two succeeding separating units shown in the drawings, the feeding unit could be replaced by a picking table unit, a culling unit or other preceding unit, and any other unit, such as a packing or delivery conveyor unit, could be provided in place of the second separating unit A', and the units for whatever purpose, preceding or succeeding the unit A which has the driving motor and countershaft, can be driven through the medium of a coupling shaft, such as 70, coupled either to the front or rear end of the countershaft 67.

Sizing or grading machines of the type described are commonly equipped with conveyors for carrying away the culls or defective fruit and with other appurtenances, but, as the present invention is not concerned with such features, they are not disclosed herein.

I claim as my invention:

1. In a grading machine, a travelling screen of open mesh formation having numerous openings both lengthwise and crosswise thereof through which larger pieces of material may pass for separation from material larger than a given size on the screen, said openings being of constant uniform size, separate independently movable piece-supporting members, one for each of said openings, hinged to the screen to swing freely independently of each other to and from hanging positions between the screen openings in which they do not obstruct the openings, and a relatively stationary surface over which said screen passes during its travel and which underlies the several openings of the screen during its travel over said surface and holds all of said members in trailing positions in which they support the material on the screen out of contact with said surface during its travel thereover with the screen, all of said members being freed to swing to their non-obstructing positions at the same station in advance of said surface to allow free passage of the material through all of the screen openings at said station.

2. In a grading machine, the combination of successive travelling screens each having numerous screen openings, the openings of each screen being of constant uniform size, but the openings of a succeeding screen being larger than those of the screen preceding it, said preceding screen having separate independently movable members, one for each of its openings, hinged to swing freely independently of each other to and from hanging positions in which they allow free passage of material through the screen openings, and a relatively stationary surface which lies under and adjacent to a portion of the preceding screen and over which the several openings of said screen pass in the travel of the screen and which surface holds all of said swinging members in trailing positions in which they support the material on the screen out of contact with said surface during its travel thereover with the screen, all of said members being freed to swing to their non-obstructing positions at the same station in advance of said surface to allow free passage of the material through all of the screen openings at said station, and said preceding screen functioning to deliver the material carried thereby over said surface to the succeeding screen.

3. A grading machine according to claim 1, in which said travelling screen comprises longitudinally spaced transverse rods flexibly connected by transversely spaced longitudinal links, to provide numerous longitudinal and transverse rows of screen openings of constant uniform size.

4. In a grading machine, the combination of a travelling screen of open mesh formation having numerous openings both lengthwise and crosswise thereof through which pieces of material may pass for separation from material larger than a given size on the screen, said openings being of constant uniform size, a receiver past which the screen travels and which is arranged to receive material which passes through the several screen openings as they pass said receiver, separate independently movable piece-supporting members, one for each of said openings hinged on the screen to swing freely independently of each other to and from non-obstructing hanging positions between the screen openings, and a surface at one side of said receiver over which said screen travels and which underlies the several openings of the screen during its travel over said surface and which holds all of said members in trailing positions beneath the screen openings in which they support the material on the screen out of contact with said surface during its travel thereover with the screen, all of said members being freed to swing to their non-obstructing positions while passing said receiver to allow the free passage of material through all of the screen openings to the same receiver.

5. A grading machine according to claim 4, in which two surfaces arranged and functioning as recited in claim 4 are provided one in advance of and one in rear of said receiver.

6. A grading machine according to claim 4, in which said surface is inclined to gradually approach closer to the line of travel of the screen to raise said supporting members nearer to the screen openings as they advance over said surface.

7. A grading machine according to claim 4, in which a stationary curved guide curves rearwardly and downwardly from the rear end of said surface and around which the screen travels, said guide underlying the several supporting members on the screen during its travel over said guide and being shaped to shift said supporting members toward the screen to dislodge the material from the screen.

8. A grading machine according to claim 4, in which a guide curving downwardly and rearwardly from the rear end of said surface has a yielding longitudinally slotted cover on which said supporting members trail between the longitudinal slots of the cover and which is shaped to shift said supporting members toward the screen to dislodge the material from the screen.

9. In a grading machine, the combination of a travelling screen of open mesh formation having numerous openings both lengthwise and crosswise thereof through which pieces of material may pass for separation from material larger than a given size on the screen, said openings being of constant uniform size, a receiver past which the screen travels and which is arranged to receive material which passes through all of the screen openings as they pass said receiver, separate independently movable piece-supporting members, one for each of said openings, hinged on the screen to swing freely independently of each other to and

from non-obstructing hanging positions between the screen openings, and a shelf arranged in advance of said receiver and over which said screen travels and which underlies the several openings of the screen during its travel over said shelf and inclines downwardly toward the receiver, all of said supporting members trailing on said shelf in the travel of the screen thereover and gradually swinging to freely hanging positions as the screen moves away from said shelf for gently delivering the material passing through said screen openings to said receiver.

10. A grading machine according to claim 1 in which said travelling screen is formed by longitudinally spaced transverse rods and transversely spaced longitudinal links flexibly connecting said transverse rods, and each of said separate independently movable piece-supporting members consists of a bent wire having spaced connected legs hinged by eyes at their free ends to a transverse screen rod.

11. A travelling screen for the purpose described comprising longitudinally spaced transverse rods and transversely spaced longitudinal wire links with looped ends flexibly connecting said rods and forming numerous longitudinal and transverse rows of screen openings, and separate independently movable piece-supporting links one for each of said openings, hinged to said transverse rods to swing freely independently of each other to and from vertical hanging positions between the screen openings and trailing positions in which said piece-supporting links obstruct the screen openings, said piece-supporting links having inclined cross bars connecting spaced substantially parallel legs of unequal lengths with terminal eyes by which they are hinged on said transverse rods to swing freely.

12. A travelling screen according to claim 11, in which said piece-supporting links have inclined cross bars connecting spaced legs hinged at their ends to said transverse rods and are arranged alternately lengthwise of the screen with said cross bars oppositely inclined.

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