Oct. 24, 1967 K. F. RUSSELL 3,348,679

GROMMET MEANS FOR SIZING APPARATUSES

Original Filed May 29, 1961 4 Sheets-Sheet 1

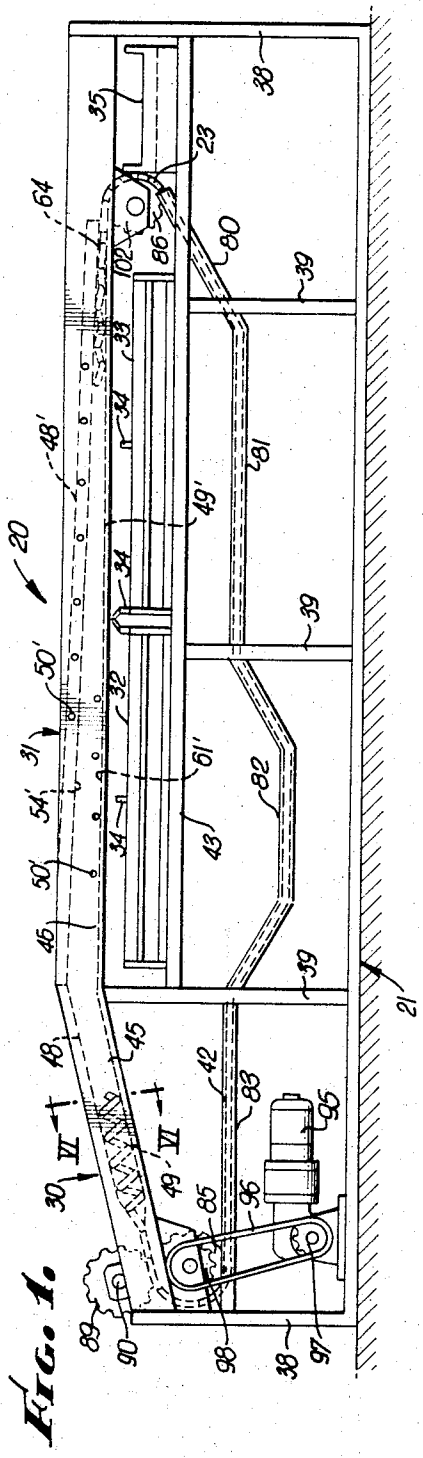


FIG. 1.

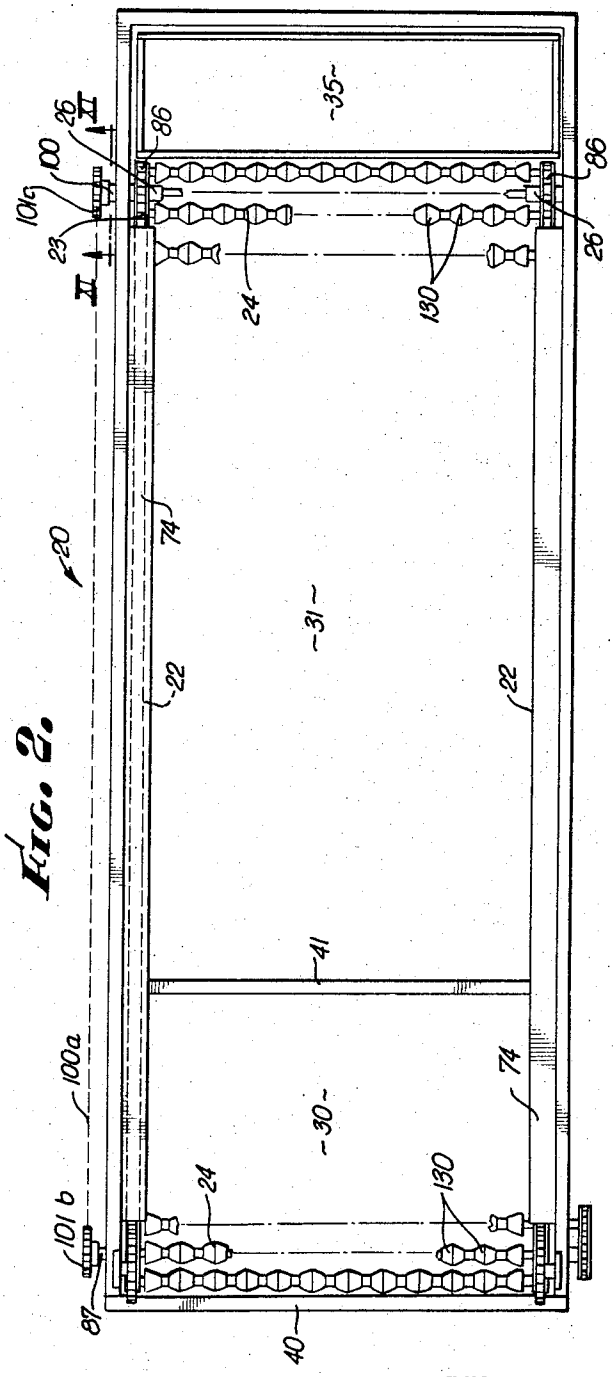


FIG. 2.

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Original Filed May 29, 1961 4 Sheets-Sheet 2

FIG. 3.

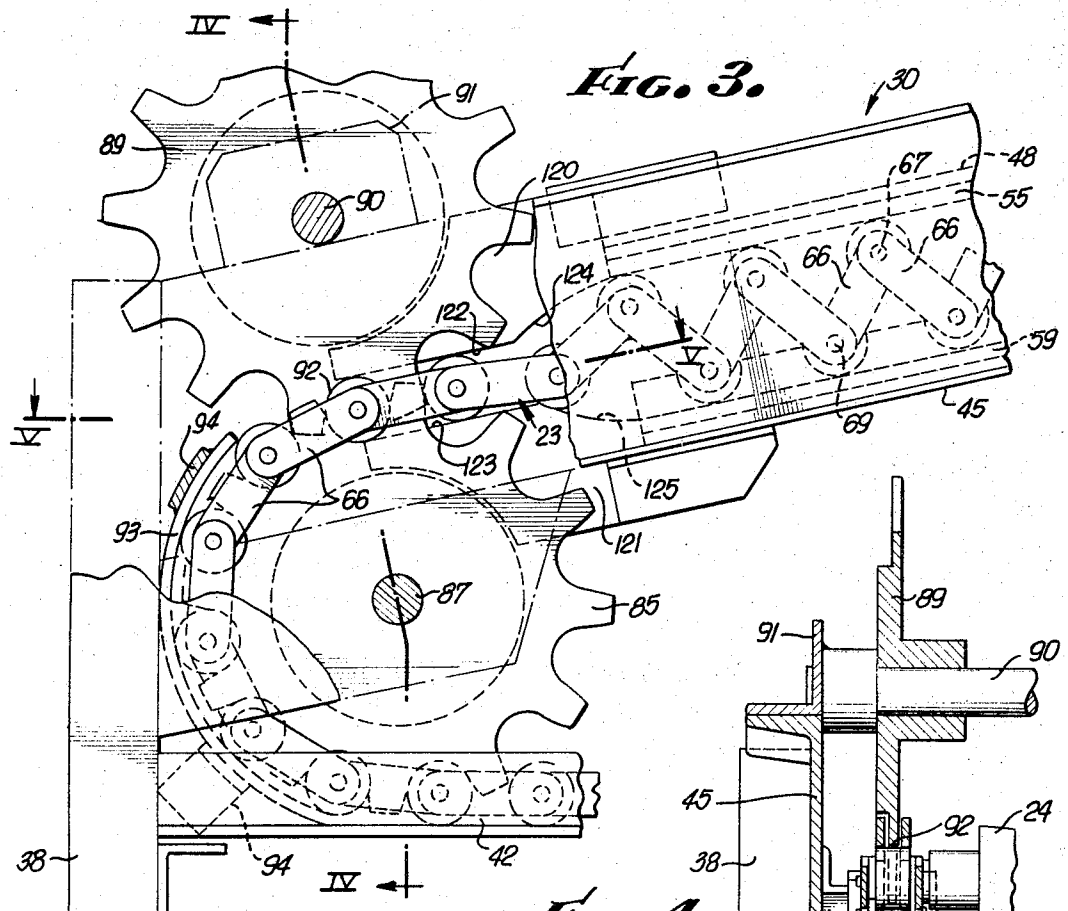


FIG. 4.

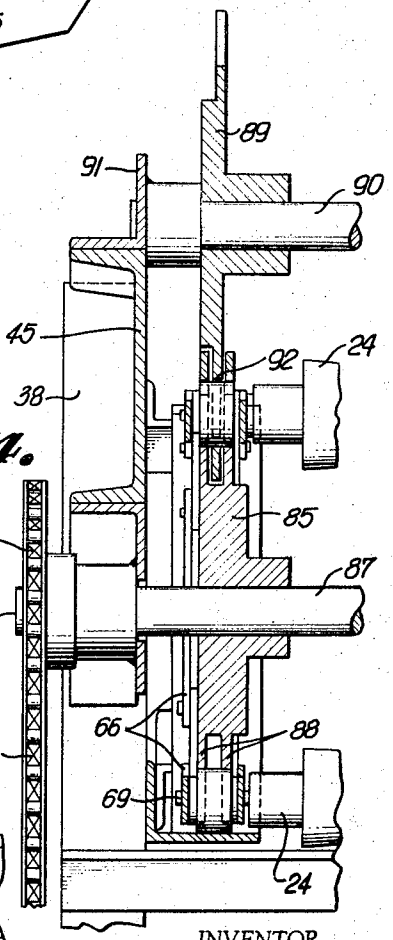
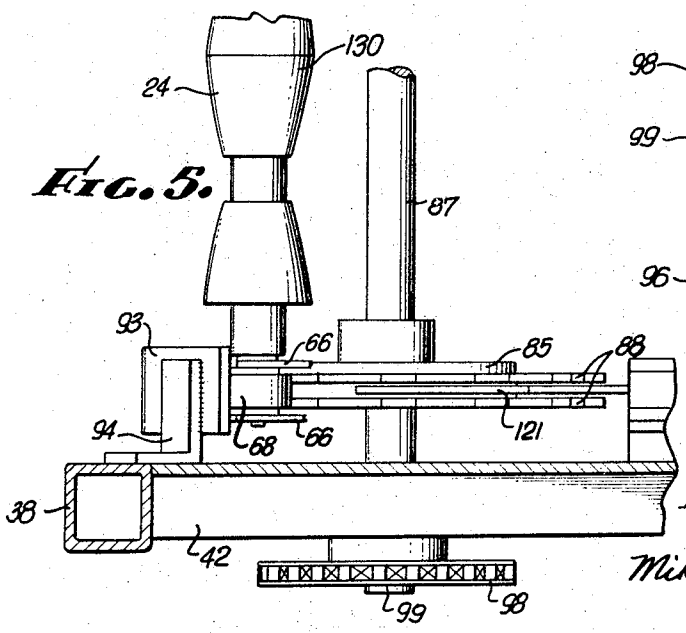


FIG. 5.



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GROMMET MEANS FOR SIZING APPARATUSES

Original Filed May 29, 1961 4 Sheets-Sheet 3

FIG. 8.

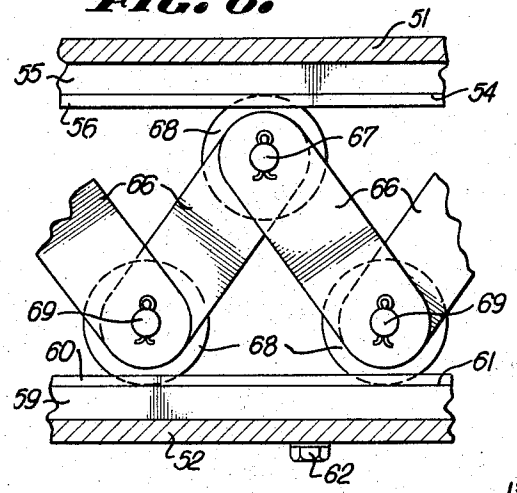


FIG. 7.

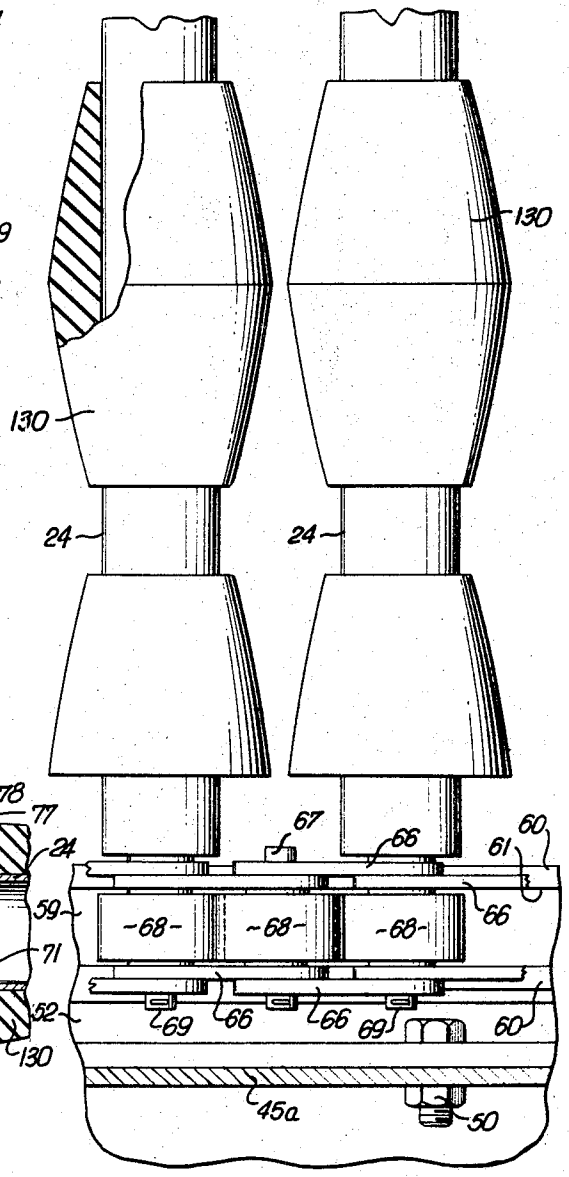


FIG. 6.

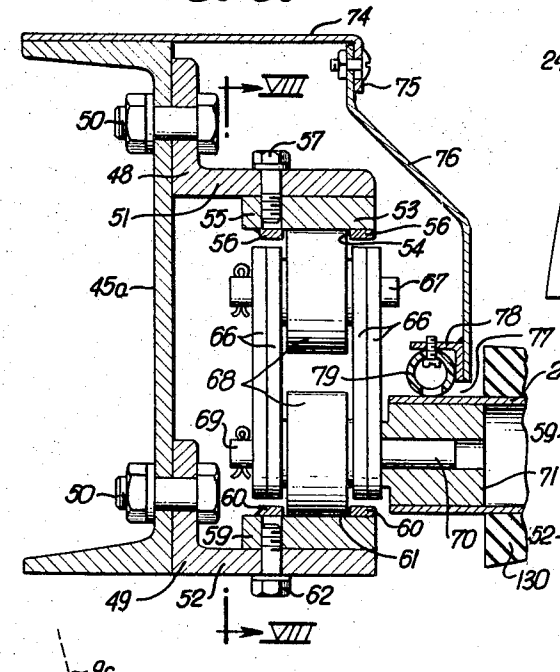
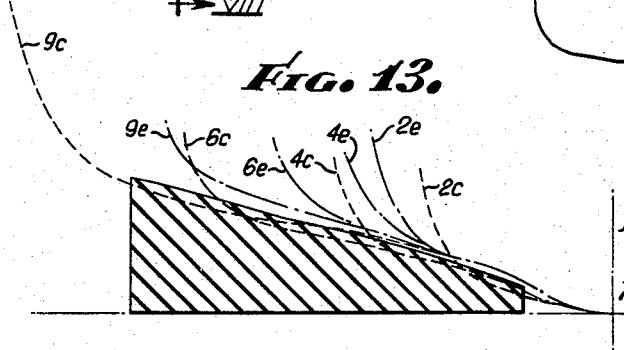


FIG. 13.



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GROMMET MEANS FOR SIZING APPARATUSES

Original Filed May 29, 1961 4 Sheets-Sheet 4

FIG. 10.

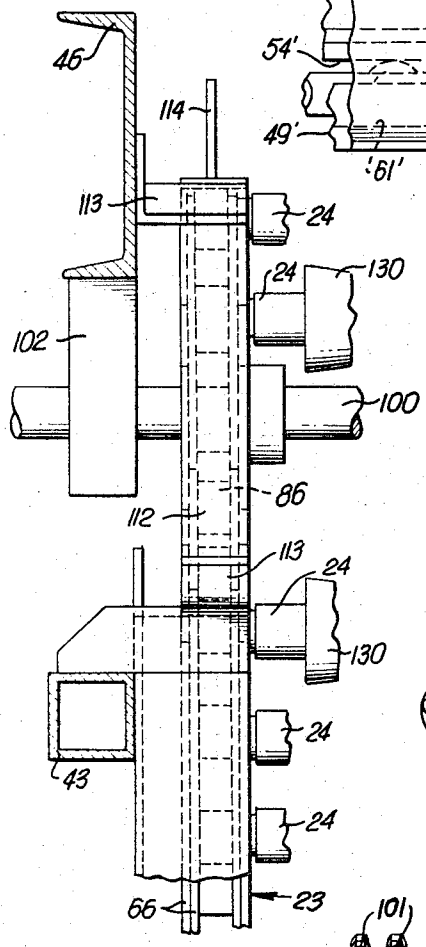


FIG. 9.

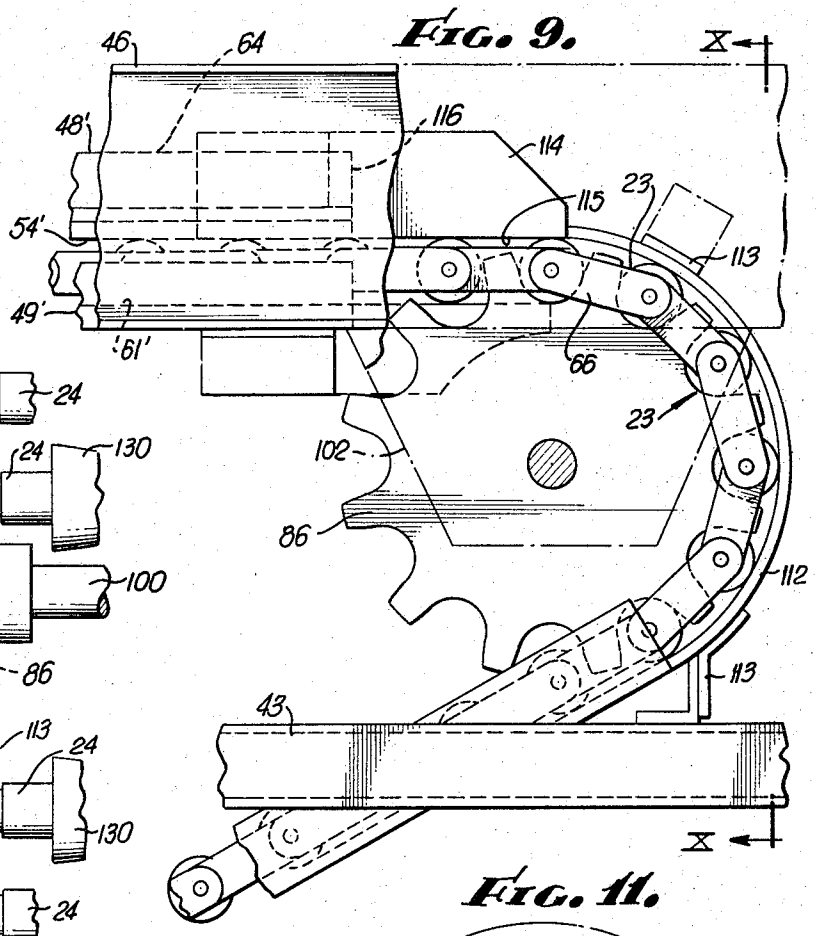


FIG. 11.

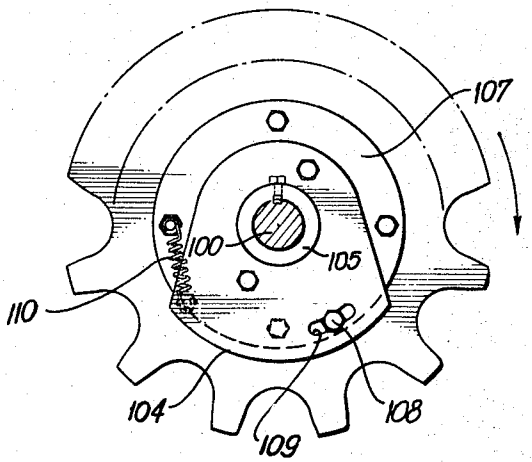
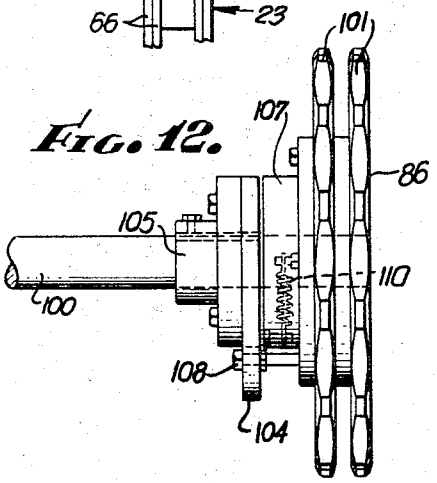


FIG. 12.



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3,348,679

GROMMET MEANS FOR SIZING APPARATUSES

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Original application May 29, 1961, Ser. No. 113,304, now Patent No. 3,179,429, dated Apr. 20, 1965. Divided and this application Apr. 13, 1965, Ser. No. 447,646
4 Claims. (Cl. 209—84)

This application is a copending divisional application of application Ser. No. 113,304, filed May 29, 1961, now Patent No. 3,179,429.

This invention relates to an apparatus for sizing articles of variable size, form and volume such as potatoes, grapefruit, oranges, lemons and other kinds of produce, the present application being directed particularly to the grommet means adapted for sizing articles by volume.

Prior proposed machines for sizing such articles have included various constructions and arrangements for orienting such articles and then progressively separating the articles from small size to large size. Some prior proposed machines have included an endless conveyor provided with transversely extending sizing rolls interconnected at their adjacent ends by a complex linkage means so as to permit said sizing rolls to become progressively spaced further apart during advancement of the conveyor. Such progressive separation of the sizing rolls has been heretofore provided by track means including inclined, tapered or converging track surfaces which are engaged by wheels or track rollers carried by such complex linkage means. The connection between the track rollers and the linkage means heretofore included offset or cantilever link constructions wherein wheels supporting a sizing roll were disposed in a plane spaced from the plane in which the linkage was supported and made operable. This construction produced rapid wear of bearings on the sizing rolls and on track and linkage rollers. Such constructions of prior proposed sizing machines were thus relatively complicated, expensive to manufacture because of special construction, and required continuous maintenance and care.

This invention contemplates a novel apparatus for sizing such articles which obviates many of the disadvantages of the prior proposed sizing machines and which provides a simple, effective, less expensive sizing apparatus having a novel mode of operation. The present invention contemplates a sizing apparatus capable of sizing by volume as well as by dimensional size, and employing a simple, effective arrangement for mounting sizing rolls while using a well known form of roller chain.

Generally speaking, the present invention contemplates an apparatus for sizing such articles including an endless conveyor means comprising a plurality of transversely extending parallel sizing rolls having specially contoured grommets thereon for sizing substantially in accordance with volume of the article. Along each side of the conveyor means are provided track means including opposed top and bottom track grooves or guide tracks facing each other and lying in the same vertical planar zone. A link chain of well-known construction may include a track roller at the connection of adjacent ends of adjacent links, alternate track rollers having inwardly extending pivot shaft extensions for supporting the sizing rolls. The latter track rollers engage the bottom guide track while the other intermediate track rollers engage the upper guide track. Means including a floating biased sprocket at the discharge end of the conveyor means serves to impart to the chain means sufficient compressive forces against the direction of movement of the chain means so that the track rollers are forced into alternate engagement with the bottom and top guide tracks. The

tracks are vertically spaced; the upper track being selectively downwardly inclined through a sizing section of the conveyor means so that as the sizing rolls are advanced toward the end of the apparatus they are progressively urged into further spaced relation to thereby provide progressively larger openings for permitting larger articles to pass between the sizing rolls. A single drive means may be provided for driving a pair of front sprockets which may have a direct drive connection with the pair of rear sprockets which are floatingly biased toward the front sprockets, all of said sprockets being rotated at virtually the same rate of rotation.

A primary object of this invention, therefore, is to disclose and provide a novel apparatus for sizing articles of variable form and volume, such as potatoes, citrus fruit, and the like.

Another object of the invention is to disclose and provide sizing rolls provided with grommets for selectively positioning and orienting articles to be sized according to volume.

A particular object of the invention is to provide sizing roll means on which grommets each have a composite curved surface determined by major and minor dimensions of fruit to be classified, such classification of fruit being by volume and based upon independent curves derived from articles of constant volume and of varying size.

Various other objects and advantages of this invention will become readily apparent upon the following description of the drawings in which an exemplary embodiment of the invention is shown.

In the drawings:

FIG. 1 is a side view of a sizing apparatus embodying this invention;

FIG. 2 is a top plan view of FIG. 1;

FIG. 3 is a fragmentary enlarged side view of the feed end of the apparatus shown in FIG. 1;

FIG. 4 is a fragmentary transverse sectional view taken in the plane indicated by line IV—IV of FIG. 3;

FIG. 5 is a fragmentary sectional view taken in the plane indicated by line V—V of FIG. 3;

FIG. 6 is a fragmentary enlarged sectional view taken in the plane indicated by line VI—VI of FIG. 1;

FIG. 7 is an enlarged top plan view of a portion of the apparatus adjacent FIG. 6 with the top track removed;

FIG. 8 is a sectional view taken in the plane indicated by line VIII—VIII of FIG. 6;

FIG. 9 is an enlarged fragmentary side view of the discharge end of the apparatus shown in FIG. 1;

FIG. 10 is a fragmentary sectional view taken in the plane indicated by line X—X of FIG. 9;

FIG. 11 is a longitudinal sectional view taken in the plane indicated by line XI—XI of FIG. 2 with the sizing rolls omitted;

FIG. 12 is a fragmentary elevational view from the right of FIG. 11; and

FIG. 13 is a fragmentary view of composite curves plotted to determine the exterior surface configuration of a grommet.

In general, an apparatus generally indicated at **20** embodying this invention may comprise a frame means **21** provided with a pair of track means **22** extending for substantially the entire length of the frame means, a chain means **23** which is guided along said track means **22**, sizing rolls **24** connected with said chain means and extending transversely of the frame means, and means **26** associated with the chain means and the drive means for holding the chain means in desired contact folded or extended relation.

As best seen in FIG. 1, the apparatus may include a feed end at **30** to which articles to be sized may be fed in any well-known suitable manner. At feed end **30**, all of the

articles are oriented and distributed upon the sizing rolls **24** which are in closely spaced adjacent relation. As the articles are moved along the frame means **21** they are introduced to a sizing section **31** of the apparatus **20** wherein the smaller articles are first separated from the other articles by the spacing between the sizing rolls **24**. In the sizing section **31** the articles separated fall upon transversely moving conveyor belts **32** and **33** which may be provided with selectively spaced dividers **34** so as to group the articles according to a selected limited range of size and transport the sized articles to a collecting area. Any articles which are not separated in the sizing section **31** may be discharged at the discharge end **34** of the conveyor onto another transversely moving conveyor belt **35** which will convey any remaining oversized articles to a suitable collecting area.

The frame means **21** may comprise a plurality of suitably interconnected structural frame members. In this example, upstanding end and intermediate frame members **38** and **39** along each side of the frame means may be interconnected by transverse frame members **40** and **41**. Along each side of the frame means **21** may be provided suitable side frame members such as **42** and **43**. The upper ends of the upstanding frame members **38** and **39** may be interconnected by an upwardly inclined channel section member **45** which terminates adjacent the end of a longitudinally extending channel section member **46** which extends for the remaining length of the frame means. The channel section members **45** and **46** provide frame supports for the track means **22**. It will be understood that any suitable structural members may be used in fabricating the frame means **21** and that for strength and rigidity, as desired, other frame constructions may be employed.

The track means **22** includes at the feed section **30** a pair of uniformly spaced apart longitudinally extending parallel angle section members **48** and **49** (FIG. 6) secured to the web of the channel section member **45** as by a plurality of spaced nut and bolt assemblies **50**. Each angle section member **48** and **49** may be of approximately the same size and may be disposed on web **45***a* in similar manner with inwardly extending horizontal legs **51** and **52** lying or disposed directly opposite each other. A guide track **53** having a downwardly facing groove **54** may be provided on the bottom face of leg **51** by a suitable bar **55** having secured to its bottom face parallel spaced metal strips **56** defining therebetween the track groove **54**. The bar **55** may be secured to leg **51** by a plurality of longitudinally spaced cap screws **57** or by other suitable means such as welding.

In similar manner, the upper surface of leg **52** may carry a bar **59** provided with parallel spaced metal strips **60** defining therebetween a track groove **61**, said bar **59** being secured as by cap screws **62** in suitable longitudinal spaced relation along leg **52**. There is thus provided on the members **48** and **49** a pair of opposed top and bottom guide tracks defined by the guide grooves **54** and **61**, respectively, which are disposed in directly opposed face-to-face relation.

In the sizing section **31** of the apparatus **20**, the track means **22** includes a similar track construction as above described (FIG. 6) with the exception that the top angle section member **48'** is secured to the web of the channel section frame member **46** in non-parallel converging relation to the bottom angle section member **49'** (FIG. 1). The angle section members **48'** and **49'** carry guide tracks defined by continuations of the track grooves **54** and **61** and are indicated herein as top track groove **54'** and bottom track groove **61'**. In this example, the upper guide track **54'** converges at a preselected slope with the bottom horizontal guide track **61'** so that at the end **64** of said track means **22** the guide tracks are spaced apart only slightly greater than the rollers of the roller chain means **23**. It will be understood that the upper track groove **48'** may be disposed in other than continuous straight converging relation as shown with respect to the bottom track **61'**, and, if desired, may be comprised of a plurality of stepped track sections which progressively decrease the vertical space between the track grooves in order to achieve desired group separation of articles which may have different sizing characteristics. It will be readily apparent that since the upper angle section member **48'** carrying the top guide track **54'** is secured to the frame member **46** as by selectively spaced nut and bolt assemblies **50'** that any desired arrangement or adjustability of the top guide track **54'** with respect to the bottom track guide **61'** may be readily made by simply providing a different arrangement of spaced holes in the web so as to selectively space the top guide track from the bottom guide track.

The chain means **23** may be a well-known standard type of roller chain means comprising a plurality of links **66** each pivotally interconnected at its ends with adjacent links **66** and providing a pivotal mounting **67** for a chain roller **68**. As best seen in FIG. 6, the roller axles **69** of alternate rollers which may engage the bottom track guide may include an axle extension **70** which may project into a bearing **71** provided at each open end of the roller **24**. Each sizing roll **24** is thereby directly pivotally connected by shaft extension **70** to the roller **68** of the chain means which engages the bottom track **61** of the track means.

Means to protect and guard the track means and the roller chain means **23** operable therein and to also prevent mutilation and damage to articles being fed to sizing rolls **24** may comprise a top guard wall **74** secured to the top flange of the channel section member **45** in any suitable manner, said top guard wall **74** having an inner depending lip **75** provided with an adjustable connection to a generally inwardly and downwardly bent depending side wall **76**. The sidewall **76** extends into proximity with the sizing roll **24** as shown at **77** and the bottom longitudinal edges of the side wall **76** may be provided with suitable brackets **78** for connecting thereto a resilient longitudinally extending tube **79** of suitable material such as neoprene for sealing the space between the sizing rolls **24** and the bottom edge of the guard side wall **76**. Walls **74** and **76** may extend for the length of the track means **22**.

The chain means **23** may be an endless chain means and has its top run or lay movable along the track means **22** through the infeed section **30** and the sizing section **31**. At the end of the track means **22** the endless chain means **23** may be directed downwardly along the bottom run or lay in a path defined by an inclined section **80** (FIG. 1) which leads to a substantially horizontal section **81** which feeds the chain means to a chain reservoir or dip **82**. After leaving dip **82** the bottom run of the chain means extends horizontally along a section at **83** and is then directed upwardly into the incoming or infeed section of the top run of the chain means. The chain reservoir dip **82** in the path of travel of the bottom run of the chain means provides ample space for collecting or accumulating a sufficient amount of roller chain so that it may be uniformly fed to the upper lay of the chain means without stretching or tensioning of the chain means.

Means for driving the endless roller chain means **23** and for moving the transverse sizing rolls **24** connected therewith along the upper run of the chain means may comprise a pair of front sprockets **85** and a pair of back sprockets **86**. The pair of front sprockets **85** may be interconnected by a sprocket shaft **87** and each of said front sprockets **85** may include spaced apart sprocket members **88**. The sprocket members **88** receive therebetween in interleaved relation tooth portions of a top idle sprocket **89** which may be carried on a shaft **90** supported by a bracket **91** carried on the top of the top flange of the channel section member **45**. The top sprocket **89** in its interleaved engagement with the spaced sprocket members **88** serves to grasp and hold a roller **68** of the chain means as at **92**. Rollers **68** being fed to

the interleaved top and bottom sprockets **89** and **88** are confined and guided into close relationship with the sprocket roller openings in the bottom sprockets by a curved guide wall **93** secured to the frame member **38** as by angle clips **94** or other suitable manner.

It will thus be apparent that the provision of the top sprocket **89** and the manner in which the rollers **68** and links **66** of the chains are contained as they pass around the bottom sprocket **85** positively assures that each roller of the chain means is held in selected relation with respect to the sprocket and cannot be urged out of the roller sprocket openings because of forces acting on the chain means as later described.

The drive means for the roller chain means **23** may also include a motor means **95** carried by the frame means below the infeed section **30** of the sizing apparatus. The motor means **95** may be of any suitable make and manufacture and may be connected with the sprockets **85** by a drive chain means **96** having engagement with a drive member **97** at a drive shaft and having connection with a driven pulley or sprocket **98** carried on an outer extension **99** of the sprocket shaft **87**. The back sprockets **86** may be driven at virtually the same rate of rotation as the front sprockets **85** by means of a direct drive connection between the sprocket shaft **87** and the sprocket shaft **100** interconnecting the pair of sprockets **86** at the back end of the sizing apparatus. Such interconnection between the sprocket shafts **87** and **100** may be any direct ratio driving arrangement and may include an endless chain **100***a* in engagement with sprockets **101***b*, **101***c* and carried on outer shaft extensions of sprocket shafts **87** and **100**.

Means for holding the top run or upper lay of the chain means **23** under a compressive force which causes the chain means to be disposed in compact folded relation at the inclined section **30** of the sizing conveyor and to maintain said upper run of the chain means in engagement with top and bottom tracks during progressive expansion of the sizing rolls may comprise a pair of spaced sprocket elements **101** (FIG. 12) which comprises a rear sprocket **86**. The sprocket elements **101** are not fixed to sprocket shaft **100** but instead are freely mounted thereon. Sprocket shaft **100** has an extension which may be supported in a depending bracket **102** carried by the bottom flange of the channel section member **46**.

Inwardly of sprocket elements **101** a tension plate **104** may be secured to a hub member **105** which may be keyed to the shaft **100** in well-known manner for rotation therewith. The inner sprocket element **101** may include a hub portion **107** which may extend into proximity with the tension plate **104** and which may carry an adjustable guide bolt **108** extending through a curved slot **109** provided in the tension plate **104**. The tension plate **104** and the hub **107** of the inner sprocket element **101** may be interconnected by a suitable coil spring **110** having one end connected by a bolt to the hub member **107** and its other end by a bolt to the tension plate **104**.

It will thus be apparent that rotational force components transmitted to sprocket shaft **100** will be transmitted through the hub **105** and tension plate **104** to the sprocket means **86** through and against the tension of spring **110**. The guide bolt **108** may be adjusted along the length of slot **109** in order to provide selected tension in the spring **110** and as a result the sprockets **86** will rotate at virtually the same rate of rotation as the forward drive sprockets **85** while subject to the bias of spring **110** in a direction opposite to the travel of the chain.

Thus a compressive force is imposed upon the chain means and is directed toward the front end of the sizing apparatus for holding the roller chain means in the desired folded relation as determined by the uniform and variable spacing apart of the top and bottom tracks. At the discharge end of the track means **22** and as the spacing between the top and bottom tracks decreases to spacing substantially that of the roller diameter, the roller chain will tend to assume its flat expanded relation before it reaches the discharge end because of the weight of the chain, accumulated slack in the chain, and of possible slight differences in rotation of the shafts **87** and **100**. The compressive forces of the springs **110** acting upon the floating sprockets **86** will maintain and hold the rollers **68** in positive contact with the top and bottom track grooves so that the chain means does not unfold along its length in the track means except as desired.

At the discharge end of the sizing conveyor, the sprockets **86** may be provided with a curved guard member **112** supported by suitable spaced brackets **113** which may be secured to the frame means in suitable manner. Above each sprocket means **86** and interleaved between the top portions of the sprocket members **101** may be a longitudinally extending plate **114** which is provided with a bottom edge **115** against which the rollers may bear as they leave the end of the track means **22**, the rollers being held in a selected defined path as they approach and are engaged by the sprocket means **86**. The plate **114** may be secured to a bracket **116** in suitable manner.

At the forward feed section of the sizing conveyor, means are provided for directing adjacent rolls **68** of the roller chain means into alternate displaced relation along the track means. As noted above, the front sprockets **85**, the top sprockets **92**, and the curved guide plate **95** cooperate to confine the rollers **68** of the chain means to a selected path. This selected path is further defined as the rollers are directed alternately into engagement with the top and bottom track means by a pair of longitudinally extending plates **120** and **121** provided with opposed parallel guide edges **122** and **123**, respectively, which cause each roller to move with its axis along a straight path perpendicular to a diametrical plane passing through the axis of the shafts **87**, **90** of the top and bottom sprockets. After a roller has passed slightly beyond the periphery of the sprockets **86** and **92**, each of the edges **122** and **123** smoothly merges with diverging slightly concave edges **124** and **125** which smoothly merge with the top and bottom track grooves respectively. Each edge **124** and **125** may be only slightly curved and a chord of each such edge may form an angle of approximately 24 to 30 degrees. This angle, together with the length of edges **124** and **125**, are relatively critical in order that the rollers **68** may be alternately fed to the top and bottom grooves rsepectively without jamming of the roller chain.

It should be noted that along the top run of the roller chain means not only are both ends of the roller chain means (at the front and back sprockets **85** and **86**) held in a confined path but also that the biased back sprockets **86** serve to impose a compressive force in a direction against the direction of travel of the chain means in such a manner that the rollers are positively held in said selected path of travel and are alternately directed into engagement with the top and bottom guide tracks. It should be noted that the upwardly inclined feed section **30** of the track means will provide a gravitational force also tending to require the rollers to be directed alternately to the top and bottom track grooves.

Along each sizing roll **24** may be provided a plurality of axially spaced grommets **130**. Depending upon the type of article being sized the shape, configuration, length and diameter of the grommets **130** may vary. For example, if lemons are being sized then one shape of grommet may be preferred; if potatoes are being sized another shape or configuration of grommets may be used. In the present example, the grommets illustrated are shaped and configured to size potatoes in accordance with volume.

The particular configuration of the exterior surface of a grommet **130** and its length may be determined by plotting the exterior configuration of the grommet surface as follows and with respect to potatoes which are quite irregular in shape, in length, and in diameter. If the sizing classification is, for example, two ounces, four

ounces, six ounces and nine ounces, a series of curves may be plotted wherein the potato is considered of elliptical cross section and the major and minor axes are varied while volume is kept constant. For example, in the sizing classification of nine ounces and assuming elliptical cross section of the potato, a series of curves may be plotted according to such elliptical cross section. Such curves may be plotted as in FIG. 13, the designation of *9e, 6e, 4e, 2e* representing 9, 6, 4 and 2 ounce elliptical. The density of the potato may be determined and considered as a constant.

The potato may also be considered as including a generally cylindrical configuration with hemispherical ends. Then in similar manner a plurality of curves as *9c, 6c, 4c, 2c* may be plotted for different dimensions along the major and minor axis with constant volume. After these two sets of curves have been plotted for a particular sizing classification they may then be superimposed as indicated in FIG. 13 and a composite of the constant volume curves selected. The composite curve may also be determined by combining curve characteristics of the other volume sizing classifications so that the resultant exterior configured surface of the grommet may represent a composite of all of such curves. When grommets so configured and shaped are placed in selected spaced relation along the sizing rolls and in alignment, it will be apparent that two adjacent rolls and the adjacent four grommets define a pocket which has the peculiar composite curved configuration as determined above. Thus as the sizing rolls are advanced along the sizing section, potatoes having the smaller size will be supported at four points by the four grommets at points on the surface of the grommets relating to the predetermined volume of an article. Thus the smaller size classifications will contact the grommets at that portion of the composite curve correlated to its classificaion and as the sizing rollers spread apart such potatoes as are sized by volume will fall between the rollers and through the pockets onto the collecting transversely moving conveyor.

As the sizing conveyor continues to advance and the sizing rolls are spaced further apart by the convergence of the top and bottom tracks, potatoes having a volume as progressively predetermined by the configuration of the grommets will be permitted by the sizing rolls and grommets to fall onto the transversely collecting conveyor.

More specifically, the curvature of the grommets is such that for each variation of the relationship between major and minor axes of articles having same volume (and approximately the same weight), the article will pass through the grommet pocket at a preselected spacing apart of the sizing rolls. Thus a potato of 9 ounces will be passed through a pocket if it is a long thin potato or a short round-like potato.

It will be readily understood that an effective, simplified sizer construction has been described which utilizes standard roller chain means and which reduces wear and maintenance on the sizer roll and chain assembly. Moreover, the configuration of the track means may be readily changed so that predetermined sizing classifications may be readily obtained.

It will be understood that other means may be used to hold and maintain the chain means in folded relation in contact with the tracks. Such other means may include means for imparting a uniform drag force to the movement of the top lay, such as an idle sprocket engaged with the roller chain, friction means engaged with the roller chain, an upwardly inclined section adjacent the discharge end, and the like. It will be understood that the drag force should be controllable so that a relatively uniform force is imparted to the chain means against its direction of movement.

While simple sleeve bearings have been illustrated to provide a connection between the sizing roll and chain roller, other bearings may be used such as roller or ball bearings. Such freely rotatable sizing rolls may be required to be controlled as to rate of rotation. If the rate is too fast, articles may be bounced and tossed on the infeed section **30**; if tool slow, articles may not be properly oriented. The invention contemplates means for controlling the rate of rotation of the sizing rolls as by increasing or decreasing the diameter of an attachable circular flange member carried at one end of a sizing roll for rolling contact with a top or bottom friction member as previously described. In this instance the bottom track flange **52** may be slightly wider to cooperate with the circular member between roller chain and the end grommet **24**. Other structural changes may be made at this vicinity to accomplish this purpose.

It is important to note that each roller chain means **23** is so disposed with its rollers and links in the same vertical longitudinally extending planar zone as that defined by the top and bottom oppositely facing guide tracks. Since each sizing roll **24** is carried by an extension of one of the shafts of the rollers **68** it will be apparent that offset or moment loading of the linkage arrangement will be substantially eliminated and wear and maintenance of the track means and the roller chain means will be reduced to a minimum.

It will be understood by those skilled in the art that means may be provided on the infeed section **30** for rotating the normally freely rotating sizing rolls in either direction in order to produce desired orientation of the particular article being sized. It may also be desirable to provide such means along the sizing section of the conveyor for particular articles although it will be understood that for many articles positive rotation of the sizing rolls in the sizing section may not be desired. Such means for causing rotation of the rolls may simply consist of a friction member in contact with ends of the rolls in order to impart rotational movement thereto as the rolls are advanced by the chain means.

It will be readily understood that an effective, simplified sizer construction has been described which utilizes standard roller chain means and which reduces wear and maintenance on the sizer roll and chain assembly. Moreover, the configuration of the track means may be readily changed. It will be understood that other means may be used to hold the chain means in folded relation in contact with the tracks such as an upwardly inclined section adjacent the discharge end.

All changes and modifications coming within the scope of the appended claims are embraced thereby.

I claim:

1. In combination with a sizing apparatus for articles of irregular shape, each including a major and minor dimension and having a plurality of parallel sizing roll members, each member being rotatable about an axis, means to orient each article on the sizing rolls with respect to its major dimension, and means to progressively spread said sizing roll members apart at selected article classification zones for classifying said articles in accordance with selected volume, the provision of: a plurality of spaced grommets on said roll members in alignment, adjacent grommets on adjacent roll members having point locations for supporting an article, each of said grommets having external surfaces generated by rotating a composite curve about said axis and having a minimum diameter at edges of said grommets and a maximum diameter at the central portion of said grommets, the composite curve forming said external surfaces being derived from a plurality of independent curves, each based on shapes of constant volume while maximum and minimum dimensions of said shapes are varied to provide spacing of point locations on said surfaces to form pocket openings irregularly variable in the shape of the openings substantially in accordance with the volume of the said shapes.

2. In combination with a sizing apparatus for articles of irregular shape and including a major and minor dimension and having a plurality of sizing roll members, means to orient each article on said sizing roll members

with respect to its major dimension, and means to progressively spread said sizing roll members apart at selected article classification zones for classifying said articles in accordance with selected volume, the provision of: a plurality of grommet members on each roll member in axial spaced relation, each of said grommet members having an external surface configuration composed of a plurality of point locations, each point location on said surface forming with corresponding point locations of like surfaces on adjacent grommet members an opening of selected area, the several point locations along said surfaces at a selected spacing of said sizing roll members providing a plurality of openings of approximately the same selected area of opening whereby variation in major and minor dimensions of articles to be sized are compensated for and articles of approximately the same volume and of selected different major and minor dimensions are passed through said opening at the selected spacing of the roll members.

3. Sizing roll means for use in apparatus for sizing articles other than spherical and of variable shape and size according to volume, comprising: a pair of spaced cylindrical roll members, a plurality of spaced grommets on said roll members in alignment whereby adjacent pairs of grommets on said roll members provide four point locations to define a pocket opening for supporting a non-spherical article at four points thereof, each of said grommets having an external surface generated by a composite curve, rotated about the axis of the cylindrical roll member and having a minimum radius at opposite ends of said grommet and a maximum radius at the central portion of said grommet, the point locations on each surface being correlated to the locations on the coaxial surface of the adjacent grommet and to the point locations on the surfaces of the pair of grommets on the adjacent roll member to provide a pocket opening determined by said four point locations, said point locations being so spaced each from the other that articles of approximately the same volume but of different shape are passed through said pocket opening.

4. A grommet member for use in sizing apparatus for classifying and sizing non-spherical articles by volume and for use with spaced cooperable like grommet members, comprising: an external surface on said grommet member generated by rotating a composite curve about an axis and having a minimum radius at ends of the grommet member and a maximum radius at the central portion of the grommet member, said composite curve comprising a plurality of point locations spaced from said axis, each point location on said curve forming with corresponding point locations of adjacent like curves on adjacent grommet members an opening of selected area, the several point locations along said curve at any one spacing of the axes of adjacent grommets providing a plurality of openings of approximately the same selected area whereby variation in major and minor dimensions of articles to be sized are compensated for and articles of approximately the same volume are passed through the pocket openings at any one of said spacings.

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