Oct. 10, 1950 C. D. SPICER ET AL 2,525,050

GAUGING APPARATUS FOR LENGTHS OF TUBING OR ROD

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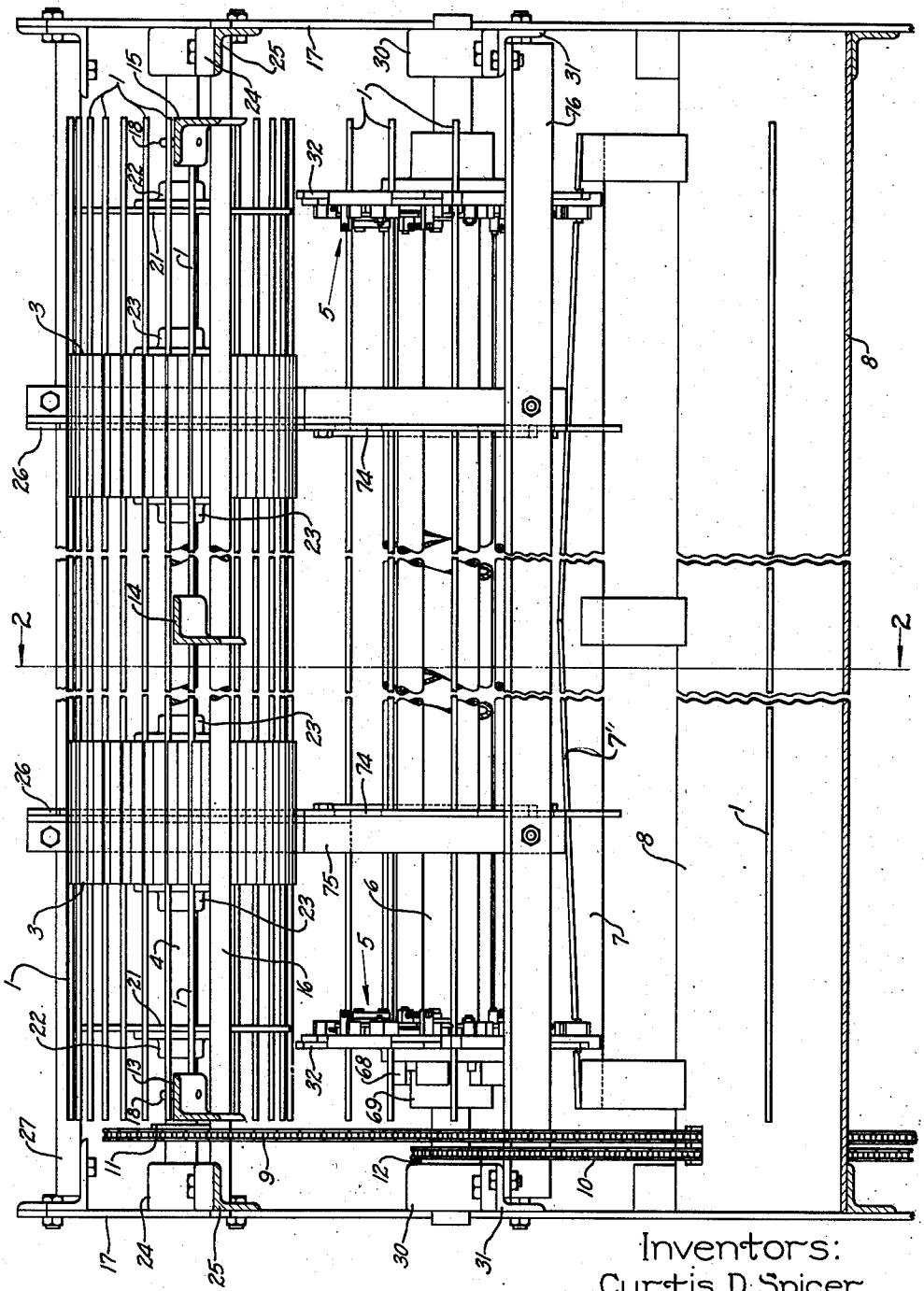


Fig. 1.

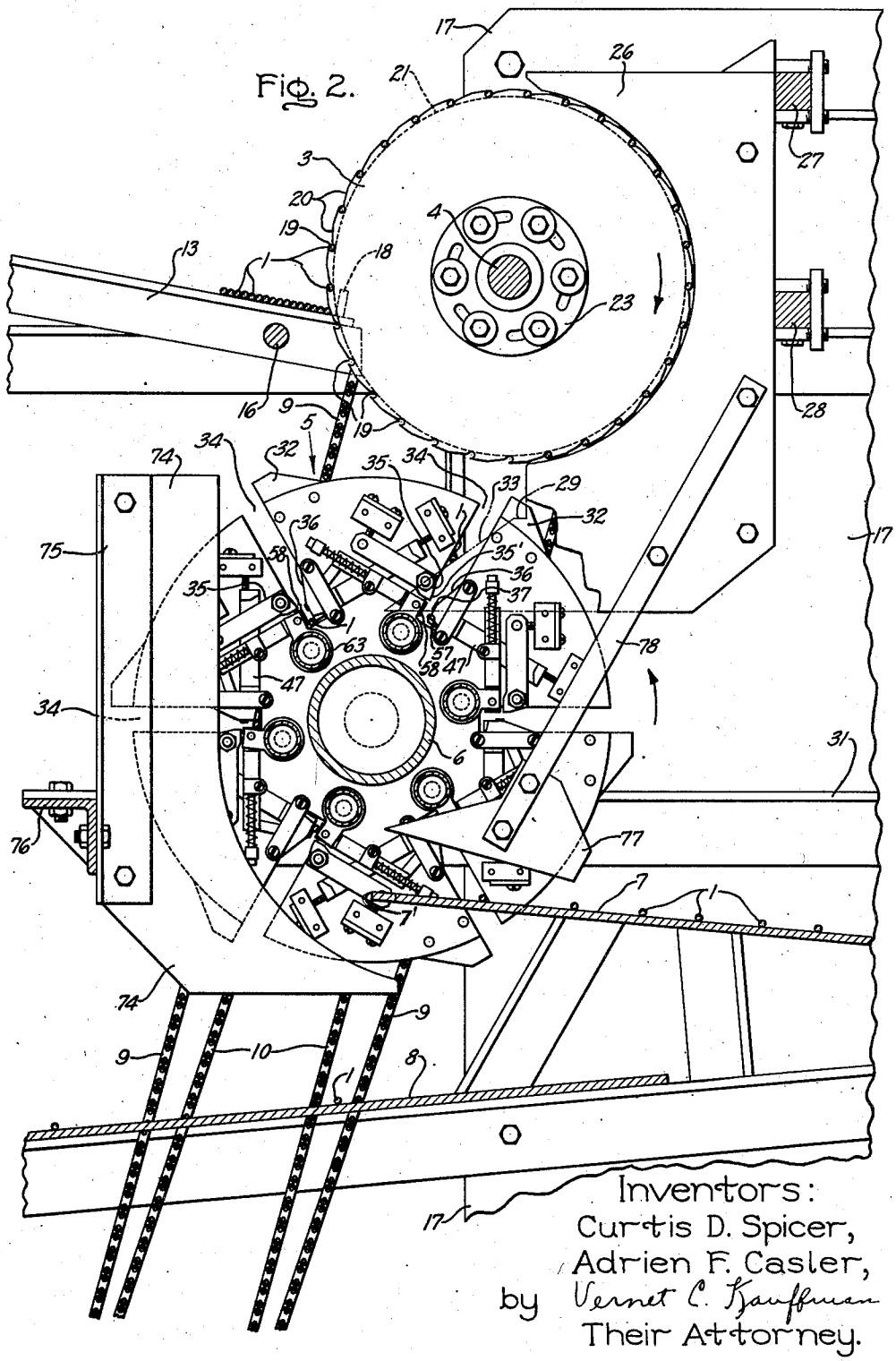
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Fig. 2.




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Fig. 3.

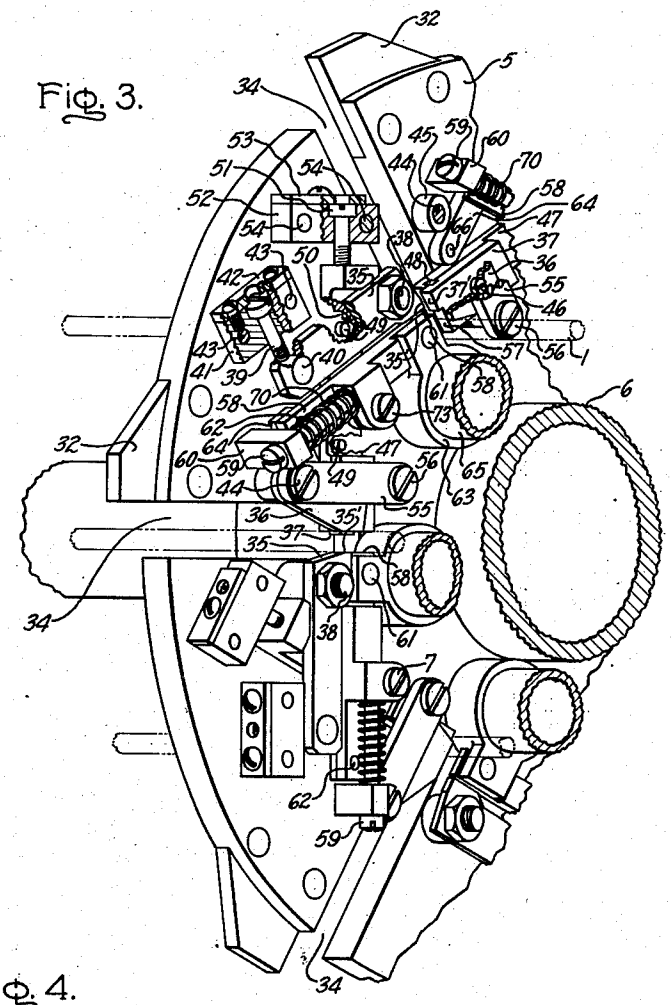
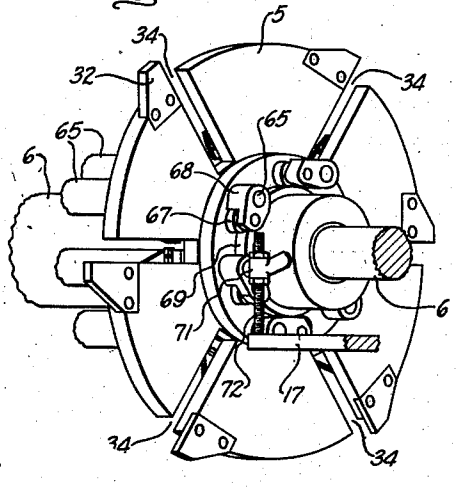


Fig. 4.



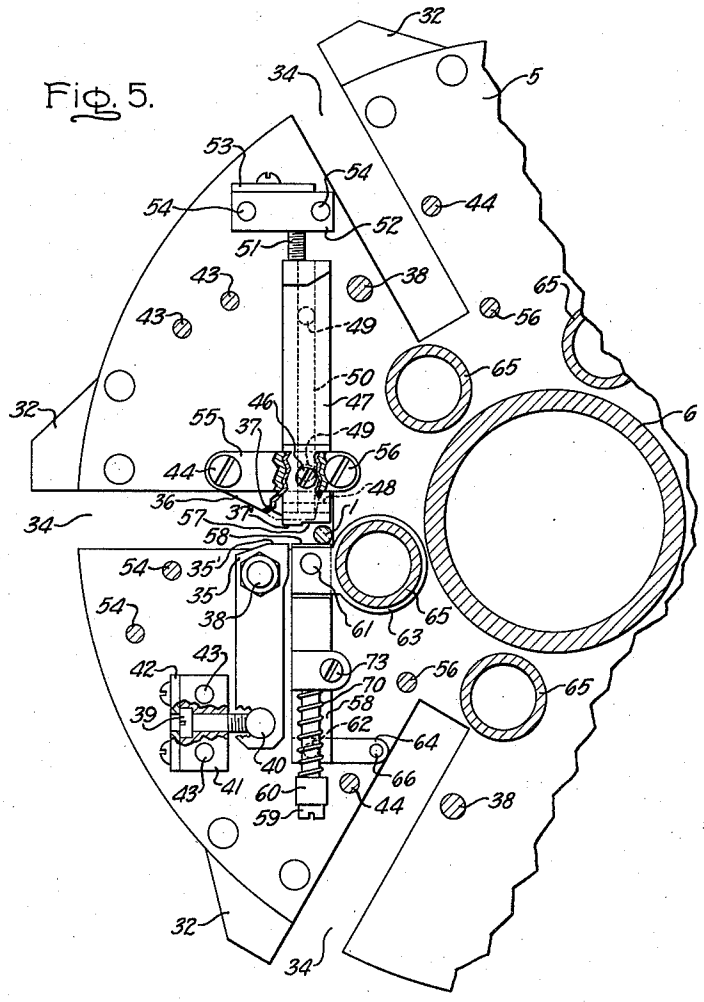
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Fig. 5.




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# UNITED STATES PATENT OFFICE

2,525,050

## GAUGING APPARATUS FOR LENGTHS OF TUBING OR ROD

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Application April 22, 1947, Serial No. 743,069

17 Claims. (Cl. 209—88)

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Our invention relates to apparatus for gauging lengths of glass rod or tubing. More particularly our invention relates to apparatus for automatically sorting out both over-size and under-size lengths of rod or tubing varying beyond the limits of an arbitrary predetermined size range and tapering rod or tubing varying more than an arbitrary predetermined amount from end to end.

Standard lengths of glass rod and tubing are quite apt to vary in size somewhat and may have a taper since the drawing process by which they are manufactured is extremely difficult to control in its entirety. Such off-size rod and tubing, on the other hand, cannot be used effectively in the manufacture of articles such as electric lamps by modern automatic apparatus since the use thereof results in the manufacture of substandard articles and the improper operation of modern high-speed manufacturing apparatus. In still other instances, the off-size rod and tubing interferes with the operation of automatic manufacturing apparatus to such an extent as to prevent the use of such apparatus altogether.

One object of our invention is to provide automatically operated apparatus for sorting a quantity of standard lengths of rod or tubing into one group within a desired size range and a second group either larger or smaller than said desired size range at a high rate of speed without breakage and in a generally satisfactory manner. To effect this object, our apparatus is constructed so that it can be operated effectively at a continuous rate and therefore at a high rate of speed without danger of breaking the rod or tubing. Our apparatus provides means of separating proper size rod and tubing from both larger and smaller size rod and tubing in a single gauging operation, thereby greatly reducing the handling thereof and contributing to the general satisfactory nature of said operation.

Another object of our invention is to provide automatic high speed apparatus for gauging lengths of rod and tubing at points spaced apart along said length and for sorting out proper-size and off-size lengths of rod or tubing according to the findings of either or both of the gauging operations. The spaced relation of the gauging mechanisms assures reliable operation of the gauging apparatus truly indicative of the size of the lengths of tubing or rod.

Still another object of our invention is to provide automatic gauging apparatus for separating lengths of rod or tubing tapering excessively in outside diameter. The separation function of such apparatus is dependent on the difference in the findings of gauging means engaging spaced portions along the extent of the lengths of rod or tubing and is dependent on said difference being greater than an arbitrary amount determined to be of unobjectionable nature in said lengths of rod or tubing. The apparatus for the separation of tapered lengths of rod or tubing can be combined with other gauging and sorting apparatus such as that hereinbefore referred to, to separate out tapered lengths within the acceptable size range of the selection thereof.

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Still further objects and advantages of our invention will appear from the following detailed description of a species thereof and from the drawing.

In the drawing, Fig. 1 is a side elevation, with mid-portions broken therefrom, of one species of gauging apparatus comprising our invention; Fig. 2 is a vertical section therethrough along line 2—2 of Fig. 1 in the direction indicated; Fig. 3 is a perspective view of a portion of one of the gauge discs or wheels and the gauging mechanisms mounted thereon; and Fig. 4 is a perspective view of the actuating means for the gauging mechanisms and the adjacent gauge disc; Fig. 5 is a sectional view similar to Fig. 2, but on a larger scale and taken on a different plane, and illustrating details of one of the gauge discs or wheels.

In general, the gauging is performed by passing the tubes (or rods) to be gauged into radial slots in a pair of spaced, rotatable gauging discs. Located within the slots are pairs of gauges for determining maximum and minimum size limits, the minimum limit gauges each comprising a movable member which is originally held in retracted position to pass a tube previously passed by the maximum gauge but which is thereafter moved forward to block or clamp the tube if it is within the limits of size. Upon rotation of the disc, an oversized tube which has been blocked by the maximum size gauge rolls out of the slot. Likewise, an undersized tube rolls out of the slot between the two gauges. However, a tube which is within the limits of size is prevented from rolling out of the slot by the minimum gauge which either blocks it off or actually grips it and later releases the tube upon retraction of the movable member of said minimum gauge. Additionally, one face of the minimum gauge in each disc is slightly undercut so that tubes of a predetermined minimum taper are retained, but the smaller end of an excessively tapered

tube is not retained by the associated minimum gauge, the movable member of which is tied to the corresponding movable member in the disc at the larger end of the tube so that it is prevented from gripping or blocking the smaller end of the tube.

In the arrangement shown in the drawing, Figs. 1 and 2 in particular, relatively long (48 inch) lengths of glass rod 1 are automatically introduced into the apparatus by the feed drums 3—3 which are located at spaced intervals along the shaft 4, and are gauged by the various limit gauge mechanisms on a carrier represented by the wheels or discs 5—5 which are located on end portions of shaft 6. In the course of operation of the apparatus, the gauging mechanism is turned from an upright position to an inverted position by the movements of the carrier so as to allow the force of gravity to advance said rod 1 into and then out of said gauging mechanism. The lengths of glass rod 1 which have been gauged to be within the desired size range are carried over the lip of the upper discharge chute 7 and dropped thereon whereas the lengths of glass rod 1 which are of different size and/or excessive taper are dropped on the lower discharge chute 8. The proper rotation of the shaft 4 and the hollow shaft 6 to cause synchronized movements of the drums 3—3 and the discs 5—5 is effected by the chains 9 and 10 which extend about the sprockets 11 and 12 on the shafts 4 and 6 respectively and which are driven at constant rates by means not shown.

The lengths of glass rod 1 which are to be gauged are rested upon the rails 13, 14 and 15 which are mounted at spaced intervals along the rod 16 extending between opposite sides of the frame 17 of the apparatus and roll against the notched periphery of the feed drums 3—3 because of the inclination of said rails 13, 14 and 15. The pegs 18—18 on the rails 13 and 15 keep the ends of the immediate length of rod 1 in place and prevent said lengths of rod 1 from shifting to an angular relation to the feed drums 3—3 to thereby assure proper contact with the periphery of both said drums 3—3. The rotation of the feed drums 3—3 is in a clockwise (Fig. 2) direction and advances succeeding notches 19, which are only large enough to hold one rod, into engagement with the rods 1 which roll into said notches 19 and which are then picked up and advanced thereby. Portions 20 of the edges of the drums 3 preceding each of the notches 19 are relieved to allow ready entrance of the rods into the notches 19 and provide cam surfaces which cause the rods 1 to be unloaded if not properly seated in the notches 19 of both feed drums 3—3. The improper feeding condition exists when only one feed drum 3 becomes properly engaged with the rod 1 so that the rotation of said feed drum 3 gradually pulls said rod to an angular position whereby a portion thereof is lifted from the notch and into engagement with the cam surface 20. The resulting outward pressure of the cam surface 20 forces the rod 1 from the relatively short portion of the notch 19 in the feed drum 3 which it engages at such time, causing the rod to fall back into the general supply thereof on the rails 13, 14, 15.

Additional support is provided the lengths of rod 1 being fed by the drums 3—3 by the plane discs 21—21 which are mounted on the hubs 22—22 carried by the shaft 4. The pairs of hubs 23—23 provide the means of attaching the feed drums 3—3 to the shaft 4 which is mounted in



the bearing blocks 24—24 carried by the angle members 25—25 of the frame 17. The rotation of the feed drums 3—3 advances the lengths of rod 1 to the top of the feed drums 3—3, after which the rods are retained in the notches 19 by the guides 26—26 which are mounted on the support bars 27 and 28 of the frame 17. After further rotation (almost 180 degrees) of shaft 4, said lengths of rod are advanced beyond the furthest extent of the guides 26—26 where they drop out of the notches 19 of the drums 3—3 and fall onto the horizontal shoulders 29 on the still lower extremities of the guides 26—26.

The rod 1 is now in position to be picked up by one of the cooperating pairs of gauging mechanisms on the spaced discs or wheels 5—5 as the rates of rotation of the feed drums 3—3 and gauge discs 5—5 are such that a single length of rod 1 is caused to drop on the shoulder 29 just prior to the advance of the gauging mechanisms into operative relation thereto. Counterclockwise rotation (Fig. 2) of the gauge discs 5—5, which function as the carrier for the gauging mechanisms, is produced by the shaft 6 which is journalled in the bearing blocks 30—30 carried by the angle members 31—31 of the frame 17, and carry said gauging mechanisms into operative relation to the rod 1 by advancing corresponding peripherial teeth 32 on said gauge discs 5—5 against opposite end portions of said length of rod 1. Further rotation of the discs 5—5 causes the teeth 32 at the back edges of the slots 34 to push the rod 1 over onto the inclined edges 33 of the guides 26 where it rolls therealong and gradually descends into the slots or passages 34 in the said discs 5—5 and into engagement with other portions of the gauging mechanisms associated therewith. As shown in Fig. 2, the edges 33 of the guides 26 are inclined downwardly from the forward edge of the shoulders 29 in the direction of and across the path of movement of the disc slots 34 and at an angle to the horizontal appreciably less than that of the radial line passing through the center of rotation of the discs 5 and extending to the forward edge of the shoulders 29. The inclined edges 33 therefore cooperate with the front or leading sides of successive disc slots 34 to form a wedge-shaped tube support cradle which gradually deepens inwardly of the respective slot 34, as the disc 5 rotates, to thereby restrain the tube 1 in its descent into the slot. This manner of introducing the length of rod 1 into engagement with the gauging mechanism provides a means of controlling the pressure of engagement therebetween and eliminates any shock which would be caused by the rod falling into engagement with said gauging mechanism, and the possibility of its becoming wedged therein.

The course of movement of the length of rod 1 within the slot 34 of each disc 5—5 is the same and carries the rod 1 between converging opposed faces of the gauge finger 35 and the stationary guide 36 (Figs. 2 and 3). If the rod 1 is not larger than the size range being selected, it continues to move and passes between a flat gauge surface 35' of the gauge finger 35 and the flat gauge surface 37' of gauge block 37. However, should said rod 1 be of a size larger than the maximum limit of the size range being selected, it will come to rest on the gauge finger 35 and the gauge block 37. Abnormally large rods 1 move even less and come to rest on the converging faces of the gauge finger 35 and the stationary guide 36. The gauge finger 35 is

pivotally mounted on an end portion of the bolt 38 (Fig. 3) extending from the wheel 5 and is retained in its necessarily exact position by the screw 39 which is threaded into the pin 40 extending therefrom and which is held in place by the block 41 and cover plate 42. In instances when the mechanism is to be adjusted to change the maximum limit of the size range being selected, the screw 39 is rotated by means of a tool inserted into engagement with the head thereof through an opening in the cover plate 42 and is threaded in or out of the pin 40 so that the gauge finger 35 is rocked and separates or moves nearer the gauge block 37. The block 41 remains in a fixed relation to the disc 5 at all times since it is fastened thereto by the screws 43—43.

The guide 36, which functions as a means of directing the length of rod 1 against the gauge finger 35 and (where the size of the rod 1 permits) over the end of the gauge block 37, is pivotally mounted (as can be seen from various parts of Fig. 3) between the head of the screw 44 extending from the disc 5 and the sleeve 45 about a mid-portion of the said screw 44 and is positioned against pivotal movement thereon by the head of the screw 46 which extends above said gauge block 37 into an opening in the guide 36, as shown at the top of Fig. 3. The gauge block 37 is normally a fixed member since it is fastened to the bar 47 by screw 46 and key 48, and said bar 47, in turn, is held in place by the studs 49—49 (see mechanism in forward part of Fig. 3) which extends into a longitudinal slot 50 therein, and by the screw 51 which extends from the block 52. The head of the screw 51 is held between the cover plate 53 and the block 52 which is fastened to the disc 5 by the screws 54—54 and can be turned by a tool inserted through an opening in the cover plate 53. The spacing between the gauge surface 37' of gauge block 37 and the flat gauge surface 35' of gauge finger 35, which determines the maximum limit of the size range selected by the mechanism, is also subject to adjustment by repositioning the gauge block 37 and bar 47 which adjustment is made by manually rotating the screw 51. The position of the gauge block 37 also determines, in a manner hereinafter described, the minimum limit of the size range selected and therefore is only adjusted when both the maximum and minimum limits are to be re-established. During the adjustment of gauge block 37, the guide 36, gauge block 37 and the end of the bar 47 move as a unit below the strap 55 held by screws 44 and 56.

Rods 1 of a size such as to pass between gauge finger 35 and gauge block 37 also pass freely between a further extent of the gauge surface 37' of gauge block 37 and the gauge surface provided by the end of the movable gauge finger 58 and thence between the undercut or offset flat gauge surface 57 of the gauge block 37 and a further extent of the gauge surface of the movable gauge finger 58. Finally the rod 1 comes to rest on the base of the slot 34 in the disc 5 with its maximum diameter still located between the offset flat surface 57 of the gauge bock 37 and the gauge surface of the movable gauge finger 58.

As further rotation of the discs 5—5 progresses the movable gauge fingers 58 of the two gauging mechanisms contacting the length of rod 1 are advanced toward the opposed gauge blocks 37 to an extent determined by the pinching of the rod 1 or the engagement of the head of stop screws 59 of each mechanism with the stationary blocks 60. In the latter movement the spacings of the gauge fingers 58 and the gauge blocks 37, as determined by the spacings of the ends of gauge fingers 58 and gauge surfaces 37' of gauge blocks 37, are reduced to the minimum limit of the size range of the length of rod 1 being selected. Each movable gauging finger 58 is mounted on the pins 61 and 62 which extend from the arms 63 and 64 (see various parts of Fig. 3) respectively which, in turn, are mounted on the hollow shaft 65 and the stud 66, respectively, supported by the disc 5. At the time of the movement of the finger 58, the rotation of the disc 5 and the corresponding movement of shaft 65 carries the rollers 67 (Fig. 4) on the arm 68 on the end of said shaft 65 adjacent one side of the apparatus around beyond the thick or high portion of the stationary cam 69 so that rotation of shaft 65 and arm 63 and movement of the finger 58 toward gauge block 37 can be brought about by the expansion force of the spring 70 which is located between a protruding portion of the finger 58 and a block 60 attached to disc 5. The limit of the movement is reached when the head of the screw 59 which is threaded into the protruding portion of the finger 58 seats against the block 60. Corresponding gauging mechanisms on the discs 5—5 are similarly attached to the hollow shaft 65 and are operated together under control of means engaging the single cam 69 on the left end (Fig. 1) of shaft 6 which cam 69 is kept from rotating therewith through an anchorage made to a portion of the frame 17 by the arm 71 and stud 72. The position taken by the movable gauge finger 58 can be changed to alter the space between it and gauge block 37, which corresponds to the minimum limit of the size range of the length of rod 1 selected, by manually rotating the screw 59. The screw 73 permits a portion of the gauge finger 58 which is slit to be clamped tightly around the screw 59 to lock it in place.

Still further rotation of the discs 5—5 carries the slots 34 therein holding the length of rod 1 followed by this decsription around into a lower quadrant thereby inverting said slots 34 so that over-size rods 1 resting on gauge finger 35 and either guide 36 or gauge block 37, and the under-size rods 1 smaller than the spacing between movable gauge finger 58 and gauge block 37, move toward the open end of the slot 34. The rotation of the discs 5—5 carries the rod 1 in the slots 34 to a position opposite the guide plates 74—74 which are attached to vertical angle members 75 mounted on the cross member 76 of the frame 17 and which are spaced from the axis of rotation of the discs 5—5 sufficiently to allow an oversize and under-size rod 1 to fall away from the gauging mechanisms.

A length of rod 1 which is within the size range being selected is gripped between the movable gauge fingers 58 and the gauge blocks 37 but very probably varies in size from end to end so as to be gripped between only the movable gauge finger 58 and gauge block 37 of one of the gauge mechainsms. If the length of rod 1 is tapered to such an extent that the small end passes between the more limited space between the gauge surface 37' of gauge block 37 and the gauge surface of the movable gauge finger 58 said small end has excessive taper and passes between the further extent of gauge surface 37' of gauge block 37 and the gauge finger 35 and then through the slot 34 to finally come to rest on one of the guide plates 74. The gauge fingers 58 of the cooperating gauging mechanism take corresponding positions because of the interconnection therebetween made by shaft 65 and therefore

allow the small end of the rod 1 to fall onto one of the guide plates 74 whenever the small end is undersize an amount equal to the difference between the gauge surfaces 57 and 37' of the gauge block 37. For instance, the flat gauge surface 57 of the gauge block 37 may be .003 inch below the main gauge surface 37' thereof so that the small end of tapered rod 1 must accordingly be more than .003 inch small to fall free of the gauging mechanism. A proper size length of rod is either pinched or, if at the lower limit of the size range and smaller than the spacing between gauge finger 58 and the gauge surface 57 of gauge block 37, is blocked by the gauge surface 37' of gauge block 37 from movement outwardly past the gauging mechanisms and carried along therewith.

The rotation of the discs 5—5 finally progresses to a position where the rod 1 passes beyond the ends of the guide plates 74—74 and, if of improper size and resting thereon, falls from the open ends of said slots 34 to the chute 8. During the above interval the free end of a tapered length of rod 1 resting on one of the guide plates 74 passes under the relatively flat taper pointed front edge 7' (Figs. 1 and 2) of the lip of the chute 7 so that the opposite end retained by one of the gauging mechanisms is pulled therefrom and falls into the chute 8 with the other off-size lengths of rod 1. A proper size length of rod 1 passes over the lip of the chute 7 and immediately reaches a discharge position where it is released by the gauging mechanisms so as to fall on said chute 7. The release of the proper size length of rod 1 is effected by the passage of the roller 67 of the actuating means for the respective gauging mechanisms onto a higher portion of the cam 69 which movement turns the arm 68, shaft 65, and the arms 63—63 of the mechanisms so that gauge finger 58 is moved farther away from the gauge block 37. The chutes 7 and 8 are inclined oppositely and cause the proper- and off-size lengths of rod to pass from the back and front of the apparatus respectively. If a length of rod 1 be retained by the gauging mechanisms due to improper operation as by the wedging action of a small piece of broken glass, said length of rod 1 is carried against the angular face of the plates 77 and forced from the slots 34 by the further rotation of the discs 5—5. The plates 77 are mounted in line with the guides 26 on bars 78 extending therefrom.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. Apparatus for sorting tubes or rods as to diameter comprising a movable carrier member having means defining a passage open at a surface of the carrier member and adapted to receive the tubes or rods, maximum gauge means on said member in cooperative relation to said passage providing fixed, opposed surfaces which constrict said passage to a predetermined maximum width, and minimum gauge means on said member providing opposed surfaces at a point farther along said passage which constrict the passage to a predetermined minimum width, one of the said surfaces of said minimum gauge member being provided by a movable finger member mounted for movement toward the cooperating opposed surface from a normally retracted position to a gauging position, means for moving said carrier member from a tube-receiving position wherein the said passage is upwardly directed to a tube-discharging position wherein the said passage is downwardly directed, and means for effecting movement of said movable finger member from its retracted position toward its gauging position while the said passage is upwardly directed and for effecting retraction of said finger member at a predetermined point in the travel of said carrier member when the said passage is downwardly directed.

2. Apparatus as set forth in claim 1 wherein the movement of said finger member from its retracted position to its gauging position is effected under spring pressure.

3. Apparatus for sorting tubes or rods as to diameter comprising a pair of laterally spaced movable carrier members each having means defining a passage open at a surface of the carrier member and adapted to receive one end of a tube or rod, maximum gauge means on each of said members in cooperative relation to said passage providing fixed, opposed surfaces which constrict said passage to a predetermined maximum width, and minimum gauge means on each of said members providing opposed surfaces at a point farther along said passage which constrict the passage to a predetermined minimum width, one of the said surfaces of each of said minimum gauge members being provided by a movable finger member mounted for movement toward the cooperating opposed surface from a normally retracted position to a gauging position, means fixedly interconnecting the movable finger members in the two carrier members whereby they move in unison, means for moving said carrier members in unison from a tube-receiving position wherein their said passages are upwardly directed to a tube-discharging position wherein their said passages are downwardly directed, and means for effecting movement of said movable finger members from their retracted positions toward their gauging positions while the said passages are upwardly directed and for effecting retraction of said finger members at a predetermined point in the travel of said carrier members when the said passages are downwardly directed.

4. Apparatus as set forth in claim 3 wherein the surface of each of the said minimum gauge members other than the surface provided by the said movable finger is provided with an offset portion to provide thereat a slightly larger gap between the minimum gauge surfaces whereby to render the said minimum gauges ineffective to trap the smaller end of a tapered tube.

5. Apparatus for sorting tubes or rods as to diameter comprising a carrier member rotatable about a horizontal axis and having means defining a passage open at the periphery of the carrier member and adapted to receive the tubes or rods, a pair of relatively fixed and opposed gauge fingers mounted on said carrier at opposite sides of said passage to constrict said passage to a predetermined maximum width, a third gauge finger movably mounted under one of said pair of fingers in opposed relation to a portion of the second finger of said pair of fingers to define therebetween a gauge of predetermined minimum width, and means to effect movement of said third finger from a retracted position to a gauging position during rotation of said carrier.

6. Apparatus as set forth in claim 5 wherein the said pair of gauge fingers are individually adjustable whereby to vary both the maximum and minimum settings of the gauges.

7. Apparatus as set forth in claim 5 wherein the movement of said third gauge finger from its retracted position to its gauging position is effected under spring pressure.

8. In a tube or rod gauging apparatus of the class described, a rotatable disc-like carrier mounted on a horizontal axis and having a tube-receiving slot extending inwardly thereof from its periphery, maximum gauge means on said carrier contiguous with said slot and providing fixed, opposed surfaces which constrict said slot to a predetermined maximum width, and minimum gauge means on said carrier farther inward of said slot providing opposed surfaces which are adapted to constrict said slot to a predetermined minimum width, said minimum gauge means comprising a movable finger member which constitutes one of the said surfaces thereof and which traps the tube in the slot only if the tube is of a diameter at least equal to said minimum width, means for rotating said carrier from a tube-receiving position wherein the said slot is upwardly directed to a tube-discharging position wherein said slot is downwardly directed, and means for effecting movement of said finger member from a retracted position to a gauging position while the said slot is upwardly directed and for effecting retraction of said finger member at a predetermined point in the rotation of said carrier when the said slot is downwardly directed.

9. Apparatus as set forth in claim 8 including means adjacent said carrier for causing a gradual descent of the tube into said slot during rotation of the carrier.

10. Apparatus as set forth in claim 8 including means defining a surface adjacent the face of said carrier and inclined across the path of movement of the said slot in a position to restrain the tube in its descent into said slot.

11. In a tube or rod gauging apparatus of the class described, a rotatable disc-like carrier mounted on a horizontal axis and having a tube-receiving slot extending inwardly thereof from its periphery, maximum and minimum limit gauge means on said carrier contiguous with said slot, a tooth member projecting outwardly from the periphery of said carrier at the back edge of said slot, and tube guide means having a horizontal shoulder portion adjacent the periphery of said carrier at the top thereof and adapted to support a tube in position to be engaged by said tooth and pulled into said slot upon rotation of said carrier, said guide means further including a surface inclined downwardly from said shoulder in the direction of and across the path of movement of said slot and at an angle to the horizontal appreciably less than that of the radial line passing through the center of rotation of said carrier and extending to the forward edge of said shoulder portion whereby to form with the leading side of said slot a tube support cradle which gradually deepens inwardly of said slot during the rotation of said carrier to thereby restrain the tube in its descent into said slot toward the said gauge means.

12. Apparatus as set forth in claim 8 including stationary guide means providing a tube-receiving surface extending adjacent a lower quadrant of the carrier and adjacent the path of movement of the said slot to temporarily retain in the slot a tube which is either over- or undersize and is therefore not trapped in the slot by said finger member of said minimum gauge means.

13. Apparatus as set forth in claim 8 including ejector means located adjacent said carrier at a point reached by the slot therein just subsequent to the point at which retraction of said minimum gauge finger member is effected, said ejector means being further located in the path of travel of a tube carried in said slot to insure ejection of the tube from said slot.

14. Apparatus as set forth in claim 8 wherein the means for effecting movement of said finger member comprises a stationary cam mounted adjacent the axis of rotation of said carrier, and means mounted on the carrier in position to engage the said cam and effect the said movement and retraction of said finger member.

15. In a tube or rod gauging apparatus of the class described, a pair of laterally spaced disc-like carriers mounted on a horizontal axis and each having a tube-receiving slot extending inwardly thereof from its periphery for receiving the ends of a tube, maximum gauge means on each of said carriers contiguous with said slot and providing fixed opposed surfaces which constrict said slot to a predetermined maximum width, and minimum gauge means on each of said carriers farther inward of said slot providing opposed surfaces which are adapted to constrict said slot to a predetermined minimum width, each of said minimum gauge means comprising a movable finger member which constitutes one of the said surfaces thereof and which traps the tube in the slot only if the tube is of a diameter at least equal to said minimum width, means fixedly interconnecting the movable finger members in the two carriers whereby they move in unison, means for rotating said carriers in unison from a tube-receiving position wherein the slots are upwardly directed to a tube-discharging position wherein said slots are downwardly directed, and means for effecting movement of said finger members from a retracted position to a gauging position while the said slots are upwardly directed and for effecting retraction of said finger members at a predetermined point in the rotation of said carriers when the said slots are downwardly directed.

16. Apparatus as set forth in claim 15 wherein the movement of said minimum gauge finger members from their retracted position to their gauging position is effected under spring pressure.

17. Apparatus as set forth in claim 15 wherein the movement of said minimum gauge finger members from their retracted position to their gauging position is effected under spring pressure, and wherein a portion of each surface of the minimum gauge means other than the surface provided by the movable finger member is offset to provide thereat a slightly larger gap between the minimum gauge surfaces whereby to render the said minimum gauges ineffective to trap the smaller end of a tapered tube.

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