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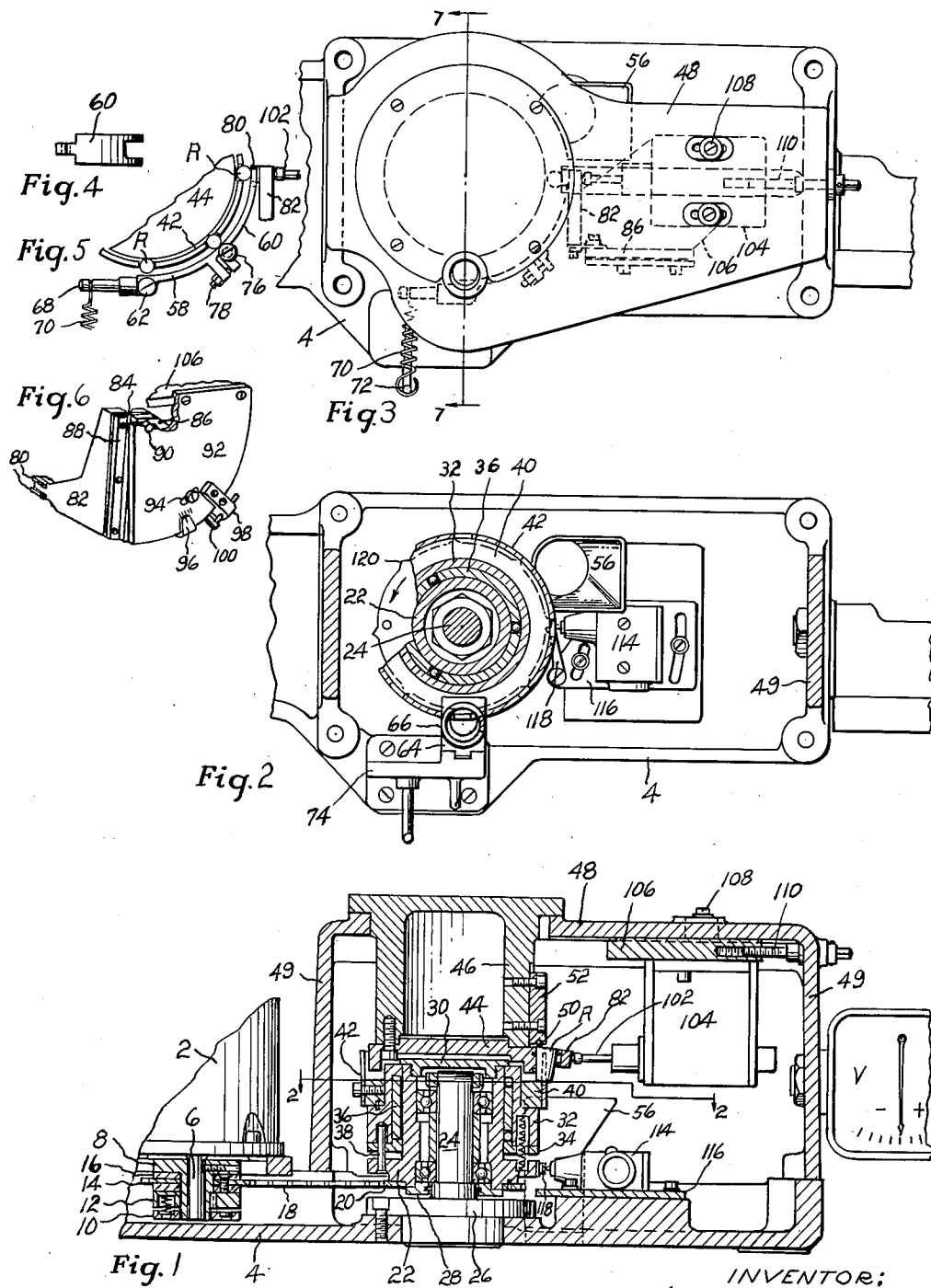
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2,634,859

GAUGING AND SEGREGATING OF ROLLERS

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2 SHEETS—SHEET 1

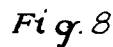
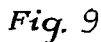


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2 SHEETS--SHEET 2



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GAUGING AND SEGREGATING
OF ROLLERS

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5 Claims. (Cl. 209—82)

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This invention relates to the gauging and segregating of rollers, especially tapered bearing rollers. An object of the invention is to provide a machine for gauging the diameters of tapered rollers at a uniform distance from their larger ends. Another object is to provide a machine for segregating such rollers into lots according to their diameters and to eliminate those which lack proper diameter. Another object is to provide an electronic gauging and segregating machine which will gauge the rollers while they are in motion and act with great rapidity.

To these ends and also to improve generally upon machines of this character, the invention consists in the various matters hereinafter described and claimed. In its broader aspects, the invention is not necessarily limited to the specific construction selected for illustrative purposes in the accompanying drawings in which:

Fig. 1 is a vertical sectional view through the center of Fig. 2.

Fig. 2 is a horizontal section on line 2—2 of Fig. 1.

Fig. 3 is a plan view.

Fig. 4 is a side view of an arcuate guide section.

Fig. 5 is a fragmental plan view of a sectional guide and associated parts.

Fig. 6 is a perspective view partly cut away of the feeler mechanism and its mounting.

Fig. 7 is a vertical sectional view chiefly on line 7—7 of Fig. 3.

Fig. 8 is a side view of a portion of the arcuate guide.

Fig. 9 is a diagram.

First outlining important functions, tapered rollers are fed downwardly, small end first, into pockets of a rotary carrier which carries them sidewise in sliding engagement with a portion of a fixed cylindrical gauging disc, the rollers being urged laterally against the disc by an arcuate spring-pressed guide. At the gauging position the larger end of each roller rides under a fixed diamond which determines the level of such end of the roller, the rotary carrier being resiliently supported to yield downwardly if necessary. At this position the periphery of the non-rotating bodily moving roller is engaged on its periphery, usually at two places, by a pair of feelers which control segregating mechanism in conjunction with a switch which is cam actuated as the carrier rotates. As each roller passes beyond gauging position, it is dropped through an exit funnel into a segregating chute having a plurality of gates which are actuated selec-

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tively by electronic control in accordance with the size and taper of the roller. The rollers are gauged at a uniform distance from their larger ends, which ends, in an antifriction bearing engage a guiding flange on a race ring.

Referring to Fig. 1, the motive power is supplied by a speed reducing motor 2 mounted on a plate adjustably fastened to a base 4. Fastened by a set screw to the motor shaft 6 is a flanged clutch hub 8 having a take-up nut 10 threaded thereon and provided with seats for coil springs engaging corresponding seats in a clutch plate 12 which is splined to the motor shaft. A driving sprocket 14 fastened between two discs 16 is frictionally driven due to the spring pressure exerted between the clutch plate 12 and the flanged hub 8.

A sprocket chain 18 drives a sprocket wheel 20 fastened to the bottom of a rotary sleeve 22 which is journaled by ball bearings on an upright stud 24 which has a flange 26 fastened to the base 4. A sealing cap 28 closes the bottom of the rotary sleeve and a flanged cap 30 is threaded in the top, the periphery of this cap projecting a little beyond the sleeve to act as a stop for an internal flange on an outer sleeve 32 which is urged upwardly by coil springs seated therein and seated at the bottom in a peripheral flange of the inner sleeve 22, the springs passing freely through openings in a cap 34 fastened to the outer sleeve. The outer sleeve has limited sliding movement vertically on anti-friction balls set in notches preferably 120° apart at opposite ends of a separator or spacer 36.

Besides having provision for a little yielding vertical movement, the outer sleeve 32 is compelled to rotate with the driven inner sleeve by a dowel pin 38 which is pressed in the flange of the inner sleeve and projects upwardly through holes in the cap 34 and into the outer sleeve. Fastened to a shoulder on the outer sleeve for rotation and vertical sliding therewith is a roller-supporting ring 40 which engages the smaller ends of the rollers R while the latter occupy pockets in a carrier 42 fastened to the outside of the supporting ring. The rollers slide around on a portion of the periphery of a fixed gauging disc 44 which is fastened to the bottom of a hollow cylinder 46 which is secured at its top to a bridge 48 having two supporting legs 49 secured to the base. The periphery of the gauging disc 44 provides a substantially upright surface of revolution, herein shown as convex and cylindrical for line contact with tapered rollers.

At the gauging position, the gauging disc has

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a pair of "Carboloy" inserts substantially flush therewith. To locate the upper ends of all rollers at a fixed level at the gauging position, a diamond 50 is press-fitted in the bottom edge of a cam plate 52 which has a vertical tongue entering a groove in the cylinder 46, the cam plate being secured by screws to the cylinder 46 against a flat thereof. The lower edge of the cam plate has an inclined cam surface which overlies the large end of the roller as the latter rolls under it, this cam surface causing the roller to ride under the diamond 50 and, if the roller is longer than the minimum length, also forcing the supporting ring 40 and its supporting sleeve downwardly. All rollers thus have their larger ends located at the same gauging level and are gauged, as will appear, at the same distance from the larger ends.

Beyond the gauging position, the cam plate is relieved (Fig. 7) to let the ring 40 rise (if it has been depressed) to its original position as limited by contact of the outer sleeve 32 with the cap 30. As the roller leaves gauging position it immediately engages a fixed cam projection or ejector 54 which is fastened to the fixed gauging disc so that the gauged roller tilts over and drops into an exit funnel 56. Overturning of the roller is facilitated because it is supported by the ring 40 near its periphery and because the gauging disc is cylindrical and the roller tapered. Hence the roller axis is inclined to the vertical and its center of gravity well out beyond the point of support. Accordingly some means is needed to hold the roller in sliding contact with the gauging disc and cause it to slide as it is carried to gauging position from its loading zone which is herein shown as 90° from the gauging zone.

The holding means comprises an arcuate guide which is pivotally mounted and composed of two sections 58 and 60 adjustably and pivotally fastened together. Section 58 has a hub portion pivoted on a shouldered stud 62 on a loading block 64 which receives the rollers small end down from a flexible feed tube 66. An arm 68 on the hub portion is connected by a coil spring 70 to a bent anchor pin 72 fixed to a bracket 74 which carries the loading block 64. The arcuate guide sections are thus yieldably urged towards the gauging disc and press the rollers against it. The guide sections also react on the tapered surfaces of the rollers to urge them upwardly against the cam plate 52. Guide section 60 is mounted on section 58 by a pivot pin 76 but cannot swing outwardly independently because a lug on section 60 engages a stop screw 78 adjustably mounted in a lug on the section 58. Guide section 60 is forked at its free end to receive a pair of hardened roller-engaging projections which are bevelled at the ends to provide spaced feelers 80.

At the gauging position the periphery of the roller engages the feelers 80 which are carried by a lever 82 (Fig. 6) mounted on a vertical reed or leaf spring 84 fastened to the lever and to a tiltable plate 86 by vertical cleats 88 which are slightly bevelled adjacent to each other to allow a slight bending of the reed spring. The tiltable plate 86 is pivoted at 90 to a supporting plate 92 having an arcuate slot 94 for a clamping screw by which the plate 86 is held in its adjusted position as indicated by a pointer 96 mounted on plate 86 and co-operating with a scale on supporting plate 92. An angular bracket 98 on supporting plate 92 carries an adjusting screw engaging a pin 100 on the plate 86 to effect the adjustment. This adjustment sets the feelers 80

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at the proper inclination to conform to the tapered roller. The lever 82 engages the stem 102 of a gauging head 104 mounted on the bottom of a slide 106 clamped to the bridge 48 by screws 108 after adjustment by a screw 110. The plate 92 is fastened to the slide for adjusting movement therewith as required for rollers of different diameters.

The gauging head 104 and amplifier 112 (Fig. 9) with its meter V may be of standard commercial construction and it controls the segregating mechanism in conjunction with an electric circuit which is periodically opened by a normally closed microswitch 114 fastened to a base plate 116 having arcuate slots curved about the center of the carrier so as to be angularly adjusted on a pad of the base 4. The stem of the microswitch is engaged and actuated by an arm 118 pivoted on the bracket 116, the free end of the arm being in the path of a series of cam projections 120 equally spaced about the flange on the rotary sleeve 22. Eight cam projections 45° apart are herein indicated. The roller carrier 42 has the same number of equally spaced roller pockets, each pocket being arranged to reach gauging position and actuate the gauge circuit very shortly after the corresponding cam projection 120 has actuated the arm 118 and the microswitch. Thus electrical impulses can be made to occur as each roller is gauged and this will control a segregating mechanism. Whenever a roller reaches gauging position, a preceding gauged roller will have already been ejected into the exit chute 56 which is less than 45° from the gauging position. The carrier does not stop but rotates steadily and gauging occurs while the roller is sliding. When a gauged roller has been dropped into the exit funnel 56, it enters a vertical segregating chute 121 (Fig. 9) having a series of pivoted gates or deflectors, the two lowest ones only being shown.

The measuring unit includes the electronic gauge 104 which operates in response to the extent of displacement of the gauging work spindle 102 for regulating the direct current output voltage in lines 122 that connect to an electronic amplifier 112 energized by a suitable alternating current source. The direct current voltage output of the amplifier 112, which is carried by the lines 126 and 124 respectively connected to the positive and negative amplifier terminals, varies proportionately under control of the voltage changes in lines 122. The meter V on the amplifier 112 responds to changes in output voltage of this amplifier. Two independent and constant direct current voltage sources, herein shown as alternating current energized rectifiers A and B, are also provided for supplying required voltages to a series of similarly connected grid-controlled electronic tubes which control the opening of self-closing gates in the work sorting mechanism, two of these tubes being shown at 15 and 16 and respectively controlling the gates 15 and 16 which are last in a series of sixteen. The electronic tubes used in the present circuits are preferably of the type commonly referred to as "Thyratron" wherein current flow once started in the plate circuit continues irrespective of changes in grid bias voltages and until circuit is broken by the opening of the switch 114 by one of the cam projections 120. These electronic tubes will respond instantaneously when the critical grid bias is reached and even before the pointer of the meter V comes to rest at a correct measuring position. Hence,

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work pieces, as the rollers R, in a fast travelling production line may be rapidly and successively passed through gauging position and sorted by the gauge-controlled mechanism in accordance with their work sizes.

Each electronic tube has a suitably heated filament F, a cathode C, a plate P, and a control grid G whose impressed voltage regulates the electron flow between the cathode and the plate to control current flow in the plate circuit. The positive terminal of the rectifier A connects through a line 130 and through each of the coils of normally de-energized relays, as relays 15 and 16 to the plates P of the successive electronic tubes. The negative terminal of the rectifier A connects through a line 124, grounded at 128, to the negative terminal of the amplifier 112 and through the switch 114 (controlled by the cam projections 120) and through a line 132 to the cathodes C of all of the electronic tubes. A series of voltage dividers, as 135, for preadjusting the negative grid bias to each tube, is connected in parallel between the lines 126 and 134; line 126 being connected to the positive terminals of the rectifier B and of the amplifier 112, and line 134 connecting with the negative terminal of the rectifier B. The voltage adjusting members of the voltage dividers are respectively connected by leads, as 136, to the grids of the successive electronic tubes.

In the usual electronic tube, when a predetermined positive potential is impressed from the plate to the cathode, current flow in the plate circuit will be started when a voltage at or above a required critical negative voltage is applied to the control grid. The voltage between the lines 126 and 134 is maintained constant and preferably higher than the maximum voltage across the lines 124 and 126 so that the line 134 will always have a negative potential with respect to the line 124. The positive voltage across the lines 124 and 126 which varies in accordance with the gauged work size, additively affects all of the minus grid voltages and is used to control the selective operation of the electronic tubes which in turn respectively control the closing of the normally de-energized plate circuit relays, as relays 15 and 16. Each relay has a movable armature engaging a contact 140 when the relay is deenergized, as shown by relay 16, and engaging a contact 141 when the relay is energized, as illustrated by relay 15.

In the present embodiment, sixteen electronic circuits are used to selectively control the sorting of sixteen different sizes of work pieces. However, any desired number of similarly operated electronic circuits may be used for selective control. To simplify illustration, the first fourteen tubes of the series and their controlling circuits are not shown since they are the same as that shown for the electronic tube 15. Each tube in the series of sixteen controls a solenoid actuated gate, the last two gates 15 and 16 being shown. The last gate 16 deflects from the chute 121 all work pieces that are larger than a maximum acceptable size. The preceding gate 15 deflects articles of the maximum acceptable size. The fourteenth gate will deflect acceptable work pieces one grade smaller and so on, the first gate deflecting work pieces of minimum acceptable size. Work pieces smaller than the minimum acceptable size pass through the chute 121, no gate opening to deflect them.

For initial adjustment, two master work pieces of predetermined maximum and minimum ac-

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ceptable sizes are successively placed in gauging position and the resultant high and low readings of the meter are taken. The electronic gauge 104 and the amplifier 112 are constructed to produce linear voltage changes across the lines 126 and 124 in response to uniform increments of axial displacement of the gauging spindle 102. Hence, the size of any work piece located in gauging position may be indicated by the measuring position of the pointer on the meter V. While the smaller of these master work pieces is being gauged, the voltage divider connected in the grid circuit of the first electronic tube of the series is adjusted to produce that critical grid bias voltage at which the first plate circuit relay will be energized and the first gate will be opened. Work pieces smaller than this minimum acceptable size will not cause the first gate to be opened and will pass on through and out of the chute since the negative grid bias voltage will be too great to result in current flow in the plate circuit of this first electronic tube. Similarly, during gauging of the work piece of maximum acceptable size, the voltage divider in the grid circuit of the tube 15 is adjusted to produce that critical grid bias which will result in the opening of the gate 15. The voltage dividers associated with the grid circuits of the second through the fourteenth tubes are respectively adjusted in accordance with predetermined work sizes as indicated on the meter V to selectively control the opening of the corresponding gates in accordance with the required predetermined intermediate work piece sizes. The voltage divider 135 is adjusted so that the gate 16 will open and receive all work pieces of sizes greater than the maximum acceptable size.

Let it be assumed that current flow will be initiated in the plate circuit of each electronic tube only when its negative grid bias equals or is less than a critical negative bias of minus $2\frac{1}{2}$ volts. Since this minus grid bias voltage is additively affected in all of the voltage dividers in accordance with the sixteen different predetermined work sizes, the electronic gauge 104 is preadjusted to control sixteen corresponding plus voltage increments of $2\frac{1}{2}$ volts each, causing the voltage range across the lines 124 and 126 to extend from plus $2\frac{1}{2}$ volts when a work piece of the minimum acceptable size is being gauged, to plus 40 volts when a work piece over maximum acceptable size is being gauged.

When a work piece of the minimum acceptable size is placed in gauging position and the voltage divider associated with the first electronic tube of the series is adjusted to the critical negative grid bias, the first tube will start current flow in its plate circuit energizing the first relay of the series which in turn causes the first gate of the series to be opened for subsequently diverting this gauged work piece from the chute 121 into a suitable bin for receiving similar work pieces of minimum acceptable size. The potential across the lines 124, 126 will now be plus $2\frac{1}{2}$ volts and the voltage divider for this first electronic tube will be set at minus 5 volts to provide the required critical negative grid bias of minus $2\frac{1}{2}$ volts. The grid biases to all of the succeeding fifteen tubes in the series are now insufficient to permit current flow in their plate circuits, and each of the relays controlled by these fifteen tubes will now be in their normally de-energized positions, as indicated by the relay 16. The first gate, which is not illustrated, will now be opened (in the same manner as illustrated for the gate 15

whose armature is shown moved to engage contact 141 leading through the line 143 to the solenoid of gate 15) and current from the A. C. source will flow through line 124, switch 114, line 142, contact 140, line 145 and through the preceding deenergized relay armatures and their contacts 140 to the first gate-controlling solenoid which is common with the other gate solenoids is connected through the line 144 to the A. C. source. Each selectively opened gate remains open after the work piece has left gauging position and until one of the cam projections 120 opens the switch 114 to break the cathode-plate circuit to all of the tubes just prior to the next gauging operation.

When a work piece one grade larger in size than the minimum acceptable workpiece size is in gauging position and the voltage divider for the second electronic tube is adjusted to critical negative bias, the potential across the lines 124, 126 will be plus 5 volts and this voltage divider will be set at minus $7\frac{1}{2}$ volts to again produce the critical grid bias of minus $2\frac{1}{2}$ volts so that the second gate in the series will be opened.

When gauging a work piece of maximum acceptable size, which in the present instance is fourteen graded sizes larger than the minimum acceptable size, the potential across the lines 124, 126 will be increased from plus $2\frac{1}{2}$ volts by fourteen $2\frac{1}{2}$ volt increments to provide the plus voltage of $37\frac{1}{2}$ volts, and the setting of the voltage divider for the tube 15 will be minus 40 volts to produce the resultant critical grid bias of minus $2\frac{1}{2}$ volts so that the relay 15 will operate as shown to direct current through the line 143 and control the opening of the gate 15.

Similarly, when a work piece of greater than maximum size is gauged, the potential across the lines 124, 126 will be plus 40 volts and the voltage divider 135 will be set at minus $42\frac{1}{2}$ volts so that the tube 16 will control the energizing of the relay 16 and the resultant opening of the gate 16 which will subsequently divert this oversized work piece from the chute 121 into a suitable bin for similar oversized work pieces.

When the negative grid bias as controlled by the work piece size equals or is less than the critical minus voltage that results in the energizing of one of the electronic tubes, as tube 15, the grid biases for all of the preceding tubes, as the first fourteen tubes, are at voltages which would normally cause current flow in all of the plate circuit relays associated with these preceding tubes. However, the energized relay (assuming it is relay 15 which is moved against the contact 141) breaks circuit to the preceding relays at this time so that only the selected gate, as gate 15, is held open to divert the gauged work piece from the chute into the desired bin.

I claim:

1. In apparatus of the character indicated, a gauging member having a substantially upright, convex surface for sliding contact by the periphery of advancing rollers, a carrier having pockets to receive the rollers in succession, means for continuously rotating the carrier to traverse the rollers around the outside of the convex surface past a gauging position, means arching around the convex surface for holding the rollers against the surface and compelling them to slide as the carrier rotates, a work engaging feeler at the gauging position and actuated in accordance with the size of the roller, and means beyond the gaug-

ing position to expel the gauged rollers from the pockets of the carrier.

2. In apparatus of the character indicated, a member having a substantially upright, cylindrical gauging surface for sliding contact by the peripheries of tapered rollers, a carrier to traverse the rollers around the outside of the gauging surface past a gauging position, a spring-pressed guide arching around the gauging surface and pressing the tapered rollers against the gauging surface to compel them to slide and to urge them upwardly, a gauging member in opposition to the gauging surface at the gauging position and having a pair of feelers spaced apart to engage separated points along the length of the sliding rollers, and a gauge controlled by the feeler to detect unacceptable size in the rollers.

3. In apparatus of the character indicated, a member having a substantially upright, cylindrical gauging surface for sliding contact by the peripheries of tapered rollers, a carrier to traverse the rollers along the gauging surface past a gauging position, means for engaging an end of each sliding roller at the gauging position to locate the roller endwise with one end in a predetermined position, a spring pressed guide arching around the gauging surface and pressing the tapered rollers against the gauging surface to urge them upwardly against the endwise locating means, a gauging member having a pair of feelers to engage each roller at separated points along its length, and a gauge controlled by the feeler to detect unacceptable size in the rollers.

4. In apparatus of the character indicated, a member having a substantially upright, convex gauging surface for sliding contact by the periphery of advancing rollers, a carrier to traverse the rollers in succession around the outside of the convex surface and past a gauging position, means to space the rollers and hold them with their axes in a plane perpendicular to the gauging surface, a member having a pair of feelers spaced apart to engage the advancing rollers at two points in said plane, means to locate the ends of the rollers at a definite distance from the feelers, and gauging means actuated by the feelers to detect rollers which have unacceptable diameter.

5. In apparatus of the character indicated, a gauging surface, means for sliding tapered rollers along the gauging surface past a gauging position, a pivotally supported tiltable plate, an arm movably mounted on the plate and having a pair of spaced feelers to engage the rollers at spaced points along their length, adjustable mechanism including a feeding screw and a clamping screw for tilting the plate to place the feelers in a line making a predetermined angle to the gauging surface at the gauging position, and a gauge actuated by the movable arm.

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