April 13, 1926. 1,580,955

E. C. BURDICK

AUTOMATIC GAUGING MACHINE

Filed Feb. 25, 1925 9 Sheets-Sheet 1

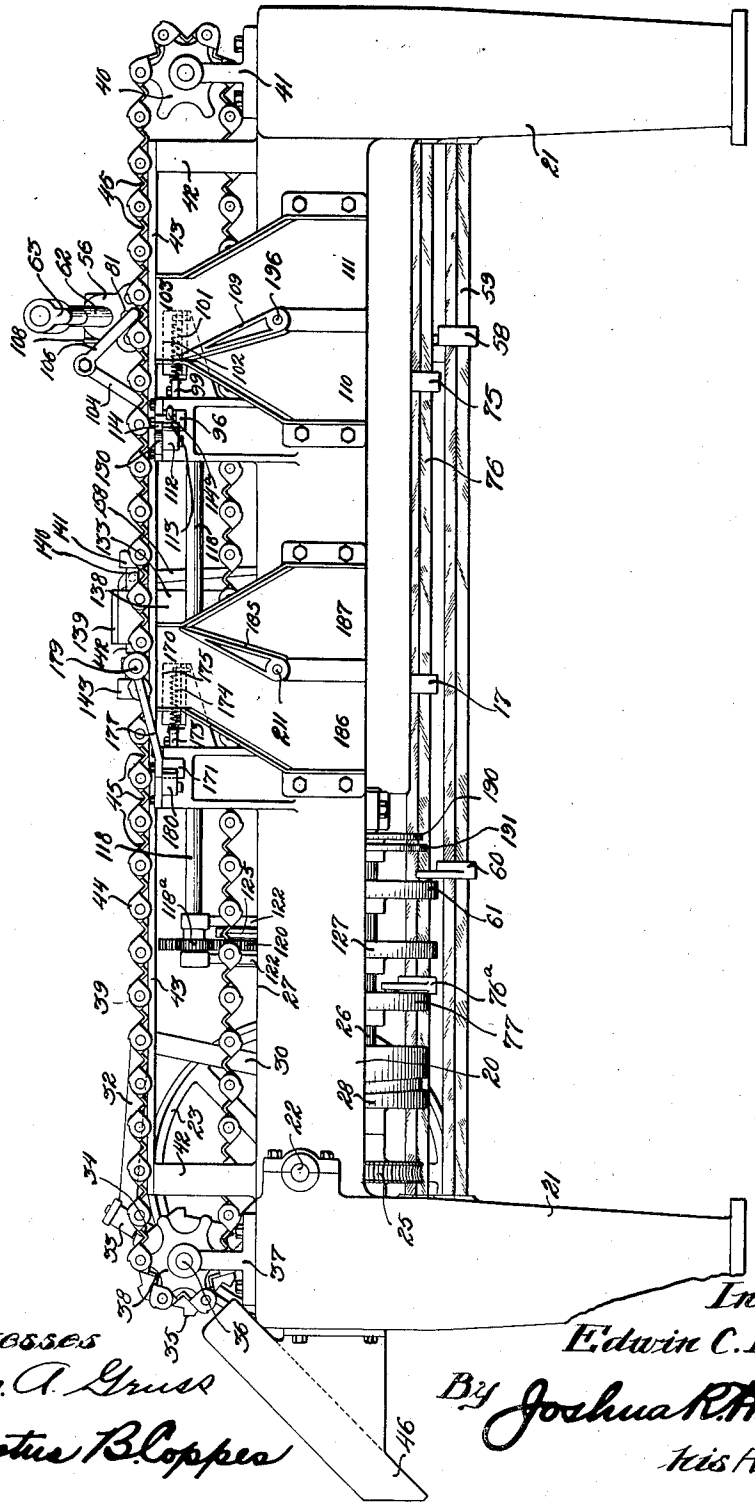

Fig. 1.

Witnesses
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By Joshua R. H. Potts
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AUTOMATIC GAUGING MACHINE

Filed Feb. 25, 1925 9 Sheets-Sheet 2

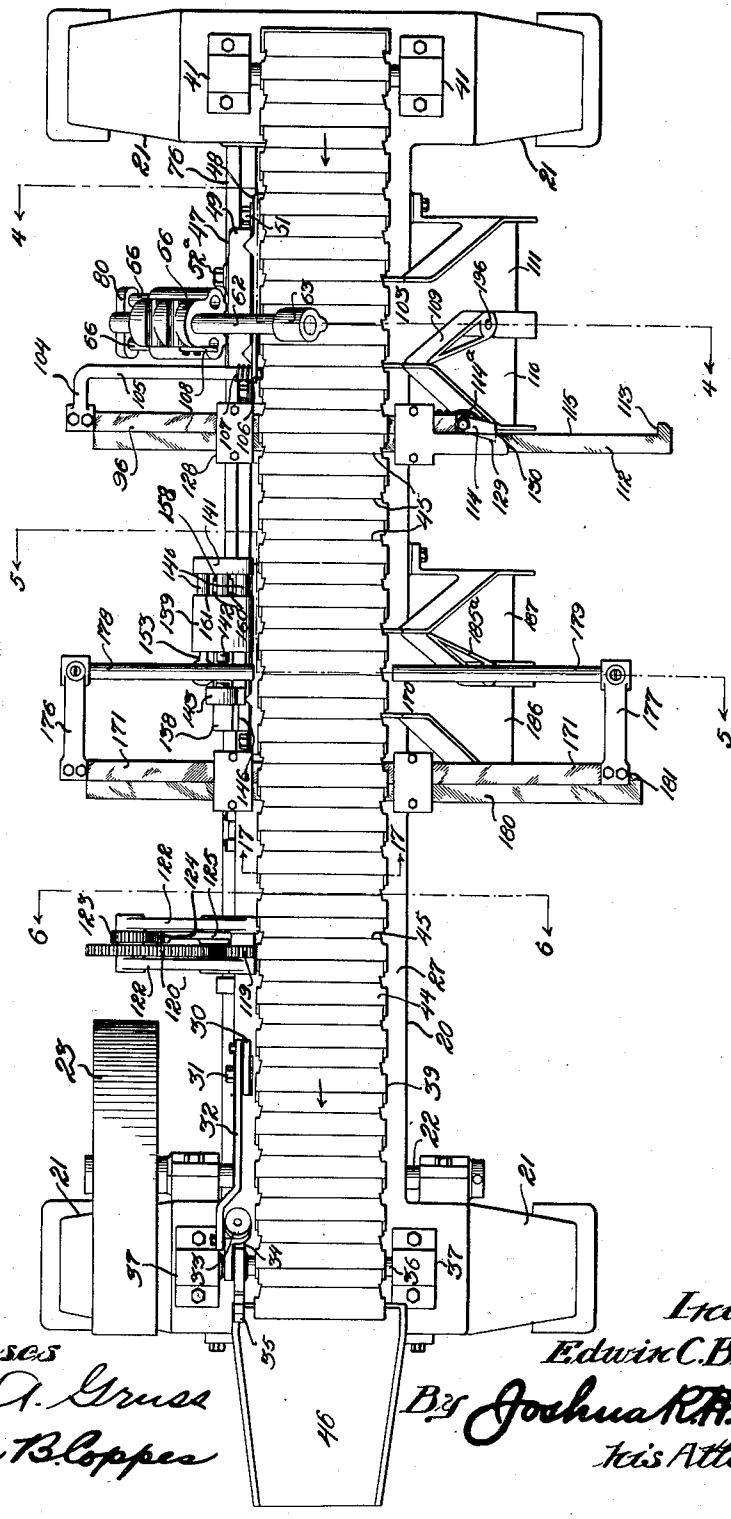

Fig. 2.

Witnesses
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AUTOMATIC GAUGING MACHINE

Filed Feb. 25, 1925 9 Sheets-Sheet 3

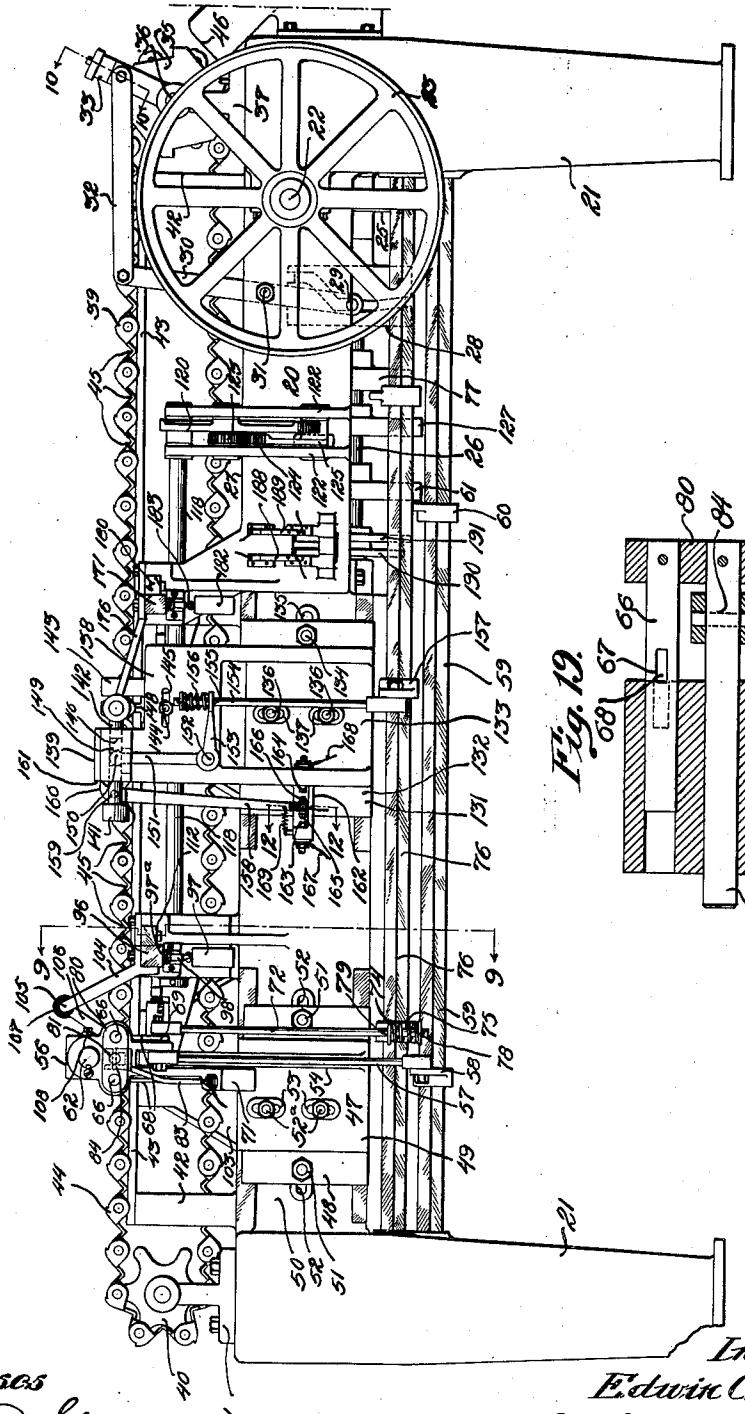

Fig. 3.

Fig. 19.

Witnesses
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AUTOMATIC GAUGING MACHINE

Filed Feb. 25, 1925 9 Sheets-Sheet 4

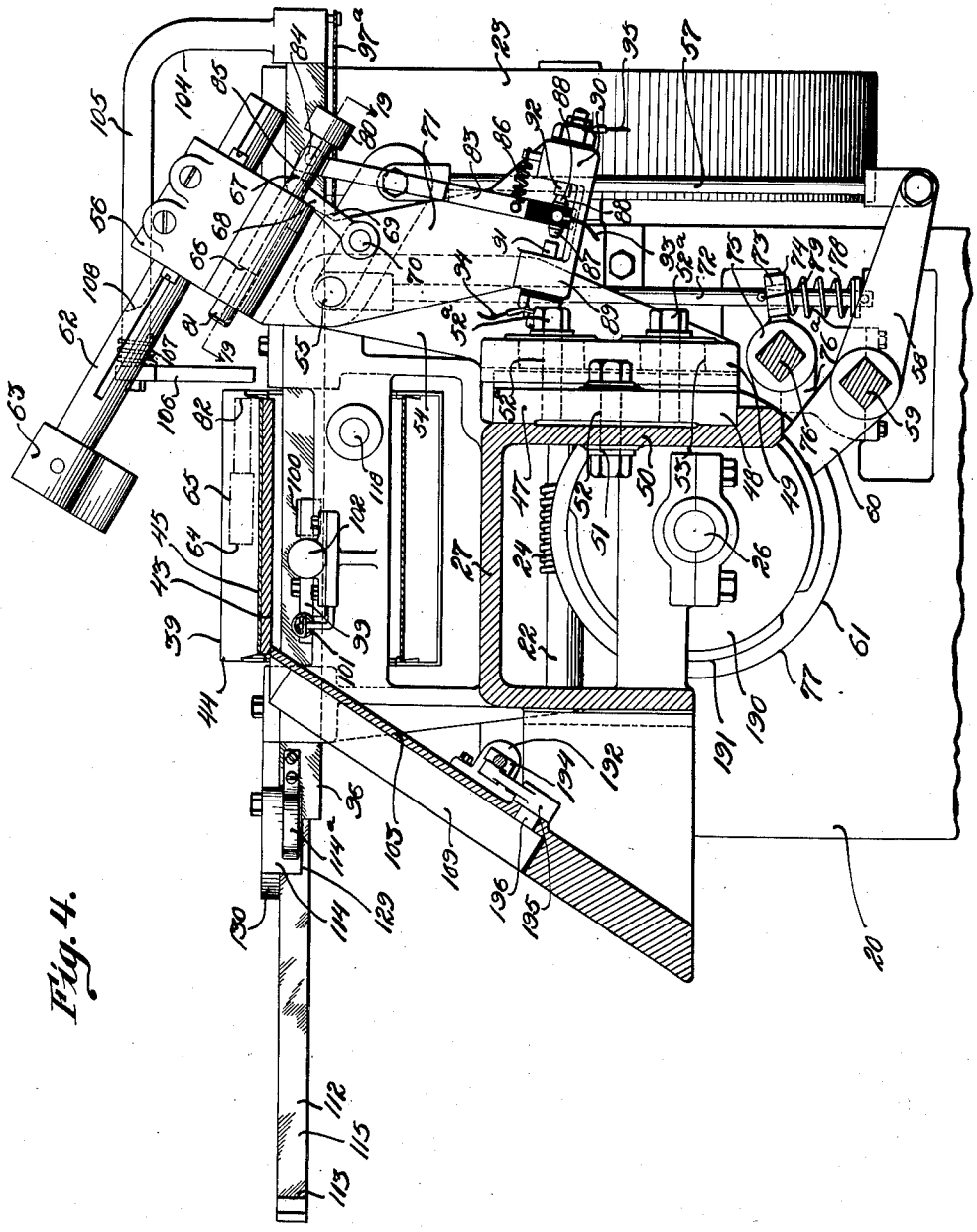

Fig. 4.

Witnesses
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AUTOMATIC GAUGING MACHINE

Filed Feb. 25, 1925 9 Sheets-Sheet 5

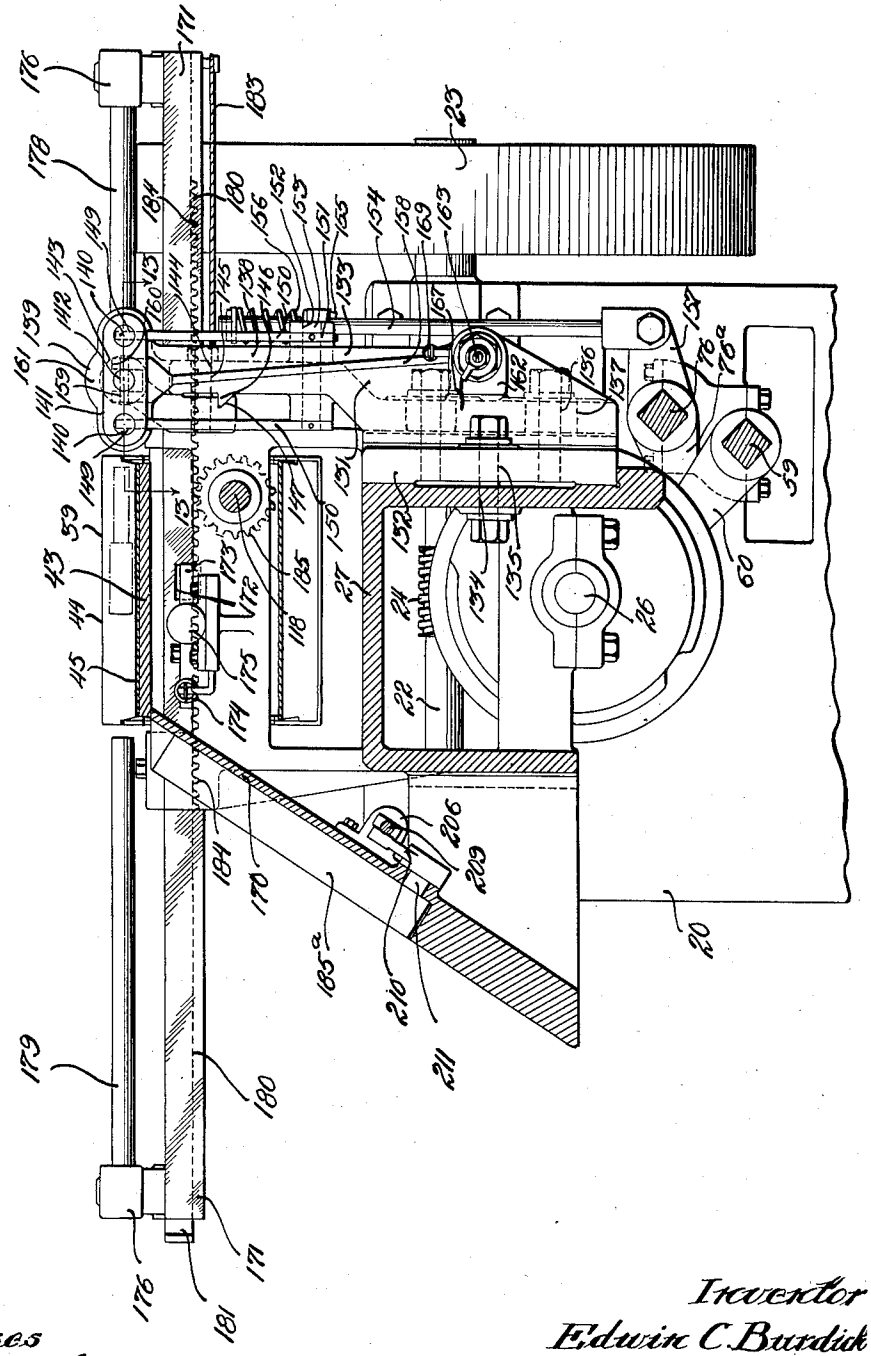

Fig. 5.

Witnesses
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AUTOMATIC GAUGING MACHINE

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Fig. 6.

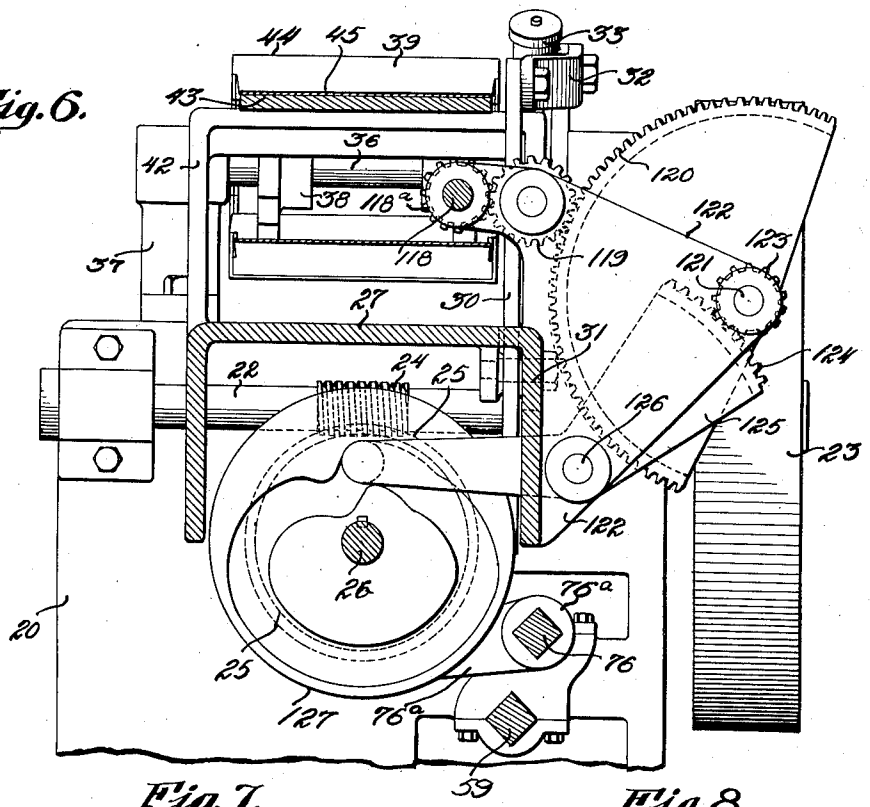


Fig. 7.

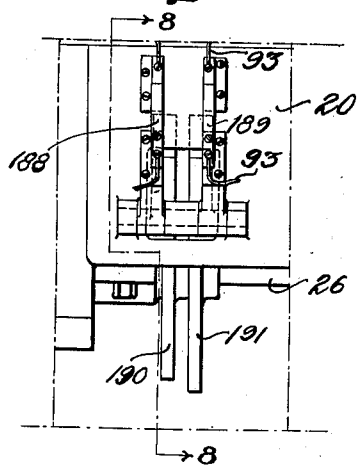
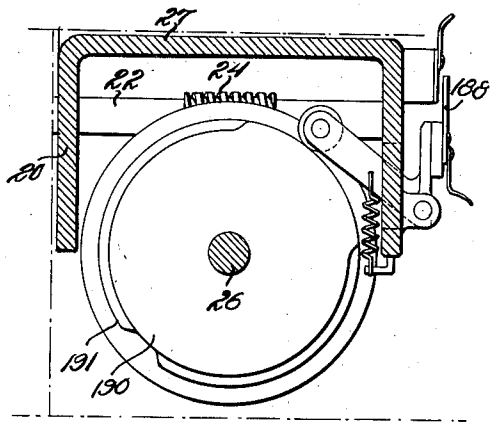


Fig. 8.



Witnesses
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AUTOMATIC GAUGING MACHINE

Filed Feb. 25, 1925 9 Sheets-Sheet 7

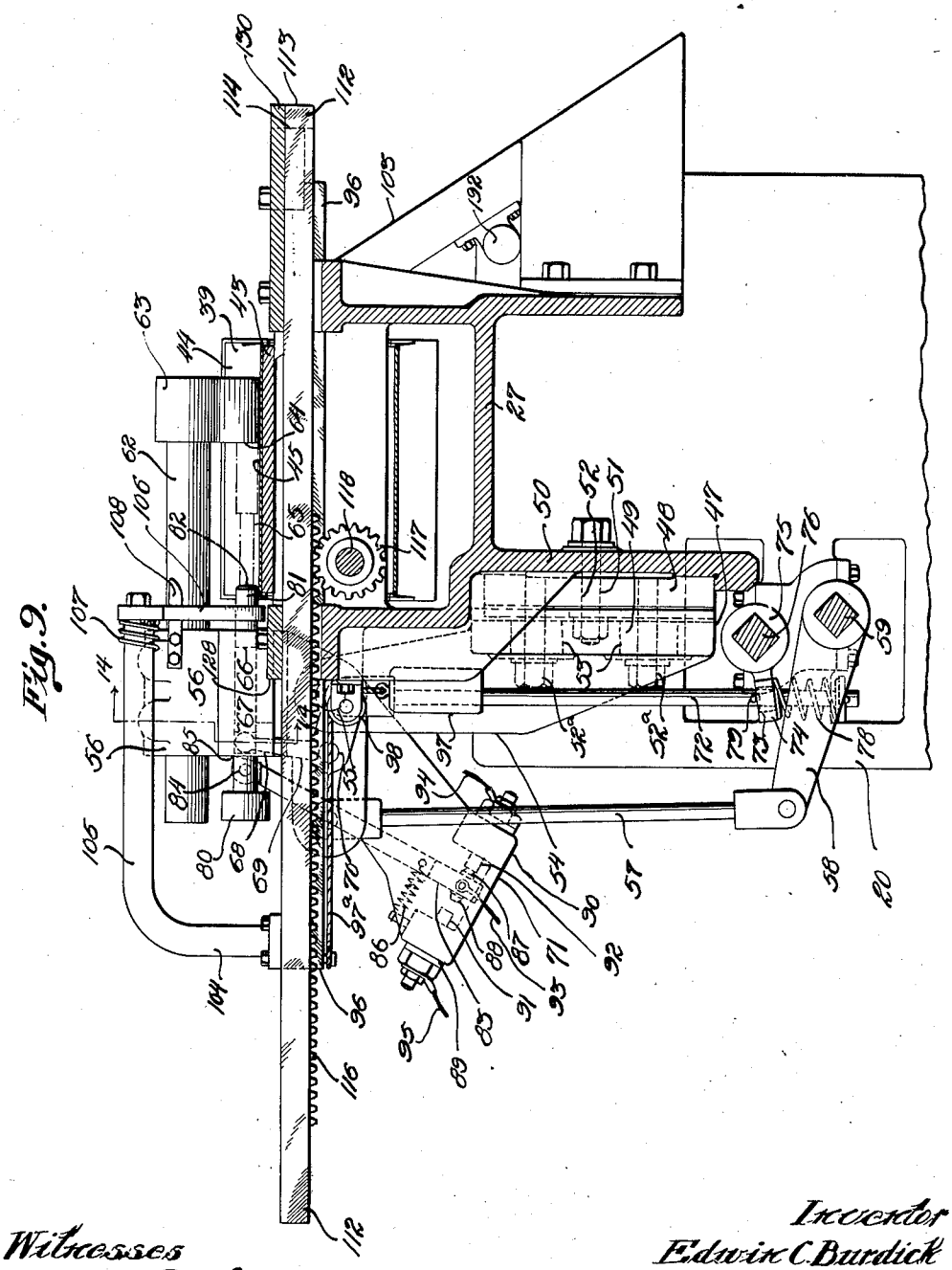

Fig. 9.

Witnesses
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April 13 , 1926. 1,580,955

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AUTOMATIC GAUGING MACHINE

Filed Feb. 25, 1925 9 Sheets-Sheet 8

Fig.10.

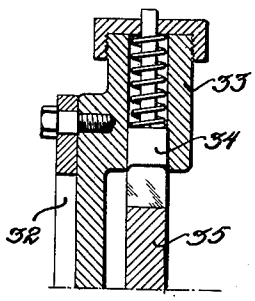


Fig.11.

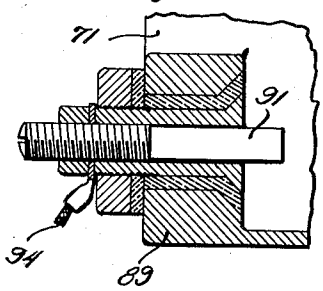


Fig.12.

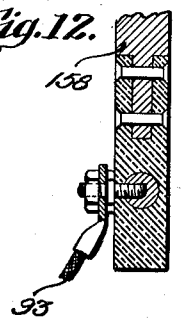


Fig.13.

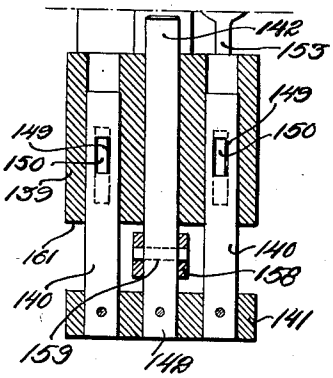


Fig.14.

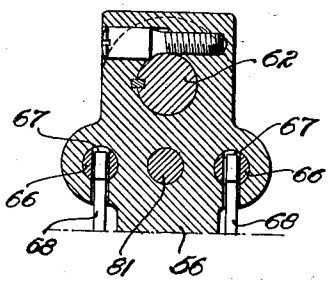


Fig.15.

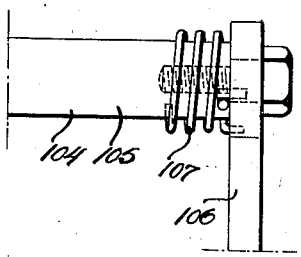


Fig.16.

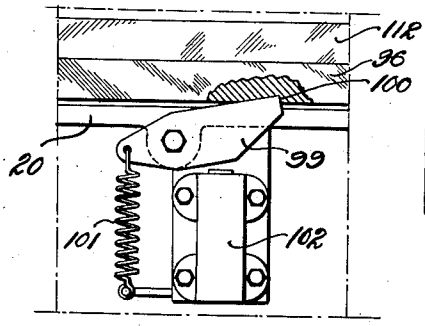
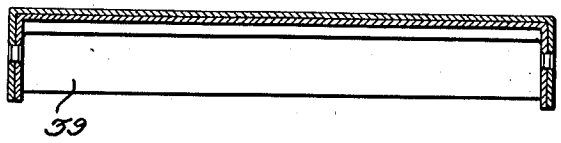


Fig.17.



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AUTOMATIC GAUGING MACHINE

Filed Feb. 25, 1925 9 Sheets-Sheet 9

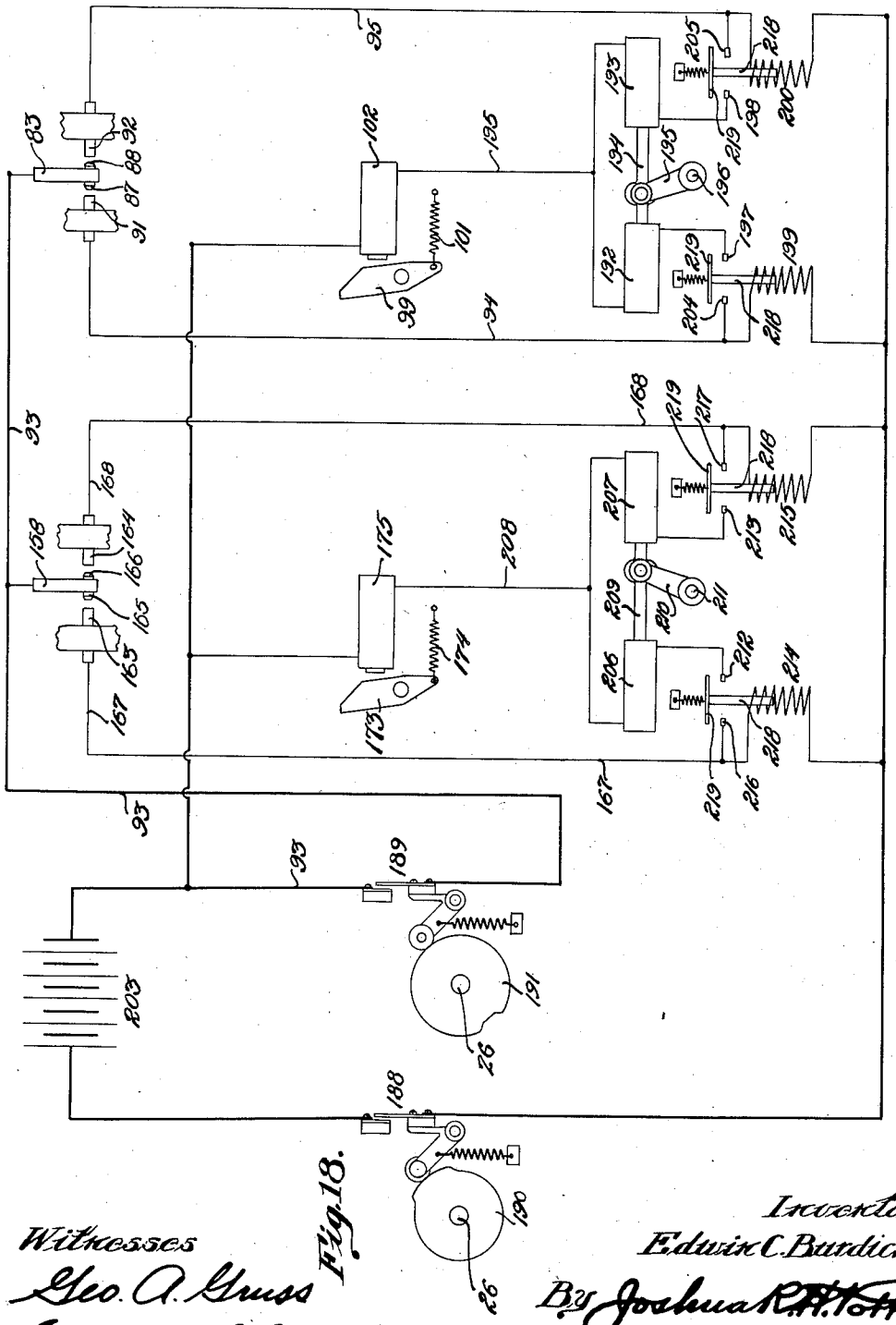

Fig. 18.

Witnesses
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his Attorneys

Patented Apr. 13, 1926. 1,580,955

UNITED STATES PATENT OFFICE.

EDWIN CLARK BURDICK, OF PHILADELPHIA, PENNSYLVANIA.

AUTOMATIC GAUGING MACHINE.

Application filed February 25, 1925. Serial No. 11,888.

To all whom it may concern:

Be it known that I, EDWIN C. BURDICK, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Automatic Gauging Machines, of which the following is a specification.

The system known as "interchangeable maunfacturing" is the principle which is the foundation of the present day manufacturing in quantity production, especially of metal parts. Under the old system of "fit and try", parts when machined were left with a little extra metal on them to be fitted by the assembler when putting the machine together. This made the assembling a slow and consequently expensive operation and also made it difficult to supply repair parts if the machine broke down. This old method is still in use to a large extent in foreign countries but in America the system of interchangeable manufacturing has been developed by which parts are machined in the first place to fit the corresponding parts without further fitting during the assembling process so that assembling is only a matter of putting the parts in place and fastening them. This system cheapens and expedites assembling and makes it possible to repair parts for a machine which is located at a distance from the factory in which the parts are made.

The limit system is the basis of interchangeable manufacture since no two pieces can be made actually alike for the reason that no matter how nearly alike the parts are if instruments which are accurate enough are used there can always be found a difference in the size of the parts even if it is infinitesimal. The best that can be done is to establish what is known as "limits of tolerance" or in other words the amount of variation from the desired size which is allowable on each dimension of a part so as to make it function properly with the corresponding parts in the machine. For example a high and low limit is set for every dimension of a part. In a shop working under the limit system, the workman and inspectors are usually supplied with a rigid gauge for every dimension of the part they are working on. Each gauge usually indicates the plus and the minus limits of some dimension and that dimension on all parts must be kept within those limits.

During recent years, inspecting methods have been greatly improved but the process of inspection is comparatively slow. Various forms of designs of machines have been invented which are capable of gauging some dimensions on a certain part.

One object of my invention is to provide an automatic gauging machine which will be adapted for general use and which will take its place as a machine tool in the equipment of the modern shop and can be properly adjusted to gauge any set of dimensions on any part that is within the compass of operation of the machine.

Another object is to make my improved machine of a comparatively simple and durable construction which will accurately inspect various parts of articles and which will be capable of automatically ejecting parts which are smaller than the allowed minimum size or larger than the allowed maximum size and will convey the parts or articles which are of sizes within the "limits of tolerance" to a position separate from the rejected parts.

Another object of my invention is to so construct my improved machine that the parts or articles can be gauged both for widths and diameters and for lengths by a succession of movements from one end of the machine to the other.

These objects, and other advantageous ends which will be described hereinafter, I attain in the following manner, reference being had to the accompanying drawings in which—

Figure 1 is an elevation of one side of a gauging machine made in accordance with my invention,

Figure 2 is a top plan view of the machine shown in Figure 1,

Figure 3 is an elevation of the opposite side of said machine,

Figure 4 is an enlarged fragmentary transverse sectional elevation taken on the line 4—4 of Figure 2,

Figure 5 is an enlarged fragmentary transverse sectional elevation taken on the line 5—5 of Figure 2,

Figure 6 is an enlarged fragmentary transverse sectional elevation taken on the line 6—6 of Figure 2,

Figure 7 is a fragmentary elevation showing the cam operated switches which form a part of my invention and illustrated on a slightly enlarged scale from that shown in Figure 3,

Figure 8 is a section taken on the line 8—8 of Figure 7,

Figure 9 is an enlarged fragmentary transverse sectional elevation taken on the line 9—9 of Figure 3 showing certain of the parts in their positions which they occupy when gauging the length,

Figure 10 is an enlarged fragmentary section taken on the line 10—10 of Figure 3,

Figure 11 is a fragmentary sectional view showing the adjusting means for one of the gauging contact pins,

Figure 12 is an enlarged fragmentary section taken on the line 12—12 of Figure 3,

Figure 13 is an enlarged fragmentary section taken on the line 13—13 of Figure 5,

Figure 14 is a section taken on the line 14—14 of Figure 9,

Figure 15 is a fragmentary end elevation of certain of the parts shown in Figure 9 and illustrated on an enlarged scale; said parts operating to push an article from the conveyor if the article is of improper length.

Figure 16 is a fragmentary plan view partly in section illustrating an armature latch which forms a part of my invention and which is controlled in its movement by an electro-magnet in the construction as illustrated; said latch serving to hold the pusher rod against action under certain conditions during the operation of the machine,

Figure 17 is an enlarged transverse section of the conveyor belt or chain; said section being taken on the line 17—17 of Figure 2,

Figure 18 is a diagrammatic view of certain of the parts together with the elements which electrically control them, and

Figure 19 is a section taken on the line 19—19 of Figure 4.

Referring to the drawings, 20 represents an elongated frame which is preferably supported on legs 21. A drive shaft 22 is supported transversely on the frame 20 and has thereon a driving pulley 23. The shaft 22 has a worm 24 thereon (see Figure 6) which drives a worm wheel 25 secured to a cam shaft 26. This cam shaft extends in the direction of the length of the frame below the top 27 thereof and has a cam 28 thereon in which fits a pin 29 on the end of a lever 30; said lever between its ends being pivoted on a rod 31 which is mounted in the frame 20 as shown in Figure 3. This lever at its top is connected by a link 32; said link being in turn connected to a pawl housing 33 which contains a spring-pressed pawl 34 for engagement with a ratchet wheel 35 as shown in Figures 3 and 10.

The pawl housing 33 is freely pivoted on the shaft 36 which extends transversely and is mounted in bearings 37 which are secured to the frame 20. The ratchet wheel 35 is secured to the shaft 36 and the shaft 36 has a sprocket wheel 38 secured thereto over which passes one end of a chain conveyor belt 39. The conveyor belt 39 extends lengthwise above the top 27 of the frame and at its opposite end passes over an idler sprocket 40 which is mounted on bearings 41 supported by the frame 20. The frame 20 has posts 42 which at their tops support a bed plate 43 which is positioned directly below the upper run 44 of the conveyor belt 39 so that said bed plate 43 serves to support the upper run of the conveyor belt during intermittent movement thereof which is imparted by the mechanism above described.

I have illustrated the belt 39 composed of links pivoted together and in which the links between their pivots have transversely extending grooved or trough portions 45 in which articles to be gauged can be positioned from a location adjacent the right hand end of the frame viewed from Figure 1. The opposite end of the frame is provided with a chute 46 down which the gauged articles which are of proper size will be dropped from the belt as the belt passes over the sprocket 38. Articles which have been gauged and found of improper size will be pushed transversely off the belt into receptacles placed for that purpose by mechanism hereinafter described.

A bracket 47 includes two parts 48 and 49 as shown in Figure 4. The part 48 is secured to the side 50 of the frame by a bolt 51 which extends through a horizontally extending slot 52 in the side 50 of the frame so that said part 48 is capable of longitudinal adjustment in a horizontal direction. Bolts 52^a extend through vertical slots 53 in the part 49 of the bracket and fit within tapped holes in the part 48 as clearly shown in Figures 3 and 4. It will thus be noted that the bracket 47 has vertical and horizontal adjustment with respect to the frame and conveyor belt.

The part 49 of the bracket has an upwardly extending arm 54 through which passes a pivot pin 55 and upon this pivot pin is pivotally mounted a gauging head 56. A link 57 at its upper end is pivotally connected to the gauging head at one side of the pivot pin 55 and said link at its lower end is connected to a crank 58 which is adjustably secured to an angular shaft 59. This crank 58 includes a part 60 which may be made of a separate piece and adjustably secured to the shaft 59; said part 60 being actuated by a cam 61 on the cam shaft 26 and is adapted to impart a rocking movement to the shaft 59 and consequently a raising and lowering movement to the link

57 so as to swing the gauging head 56 on its pivot pin 55.

A rod 62 is slidably secured to the gauging head 56 and has at one end a gauging anvil 63 which owing to the adjustable connection between the rod 62 and the gauging head 56, can be moved into various positions spaced from the gauging head 56. This gauging anvil 63 is adapted, when the gauging head is rocked from the position shown in Figure 4 to the position shown in Figure 9, to move adjacent the end 64 of an article 65 to be gauged for length so that said anvil will form an abutment for the end 64 of said article as clearly shown in Figure 9; said article being illustrated in dot-and-dash lines. The head 56 has two guiding pins 66 slidable therein as shown in Figures 4 and 14; said guiding pins having slots 67 therein into which project the tines 68 of a fork 69. This fork is secured to a pin 70 which is pivotally mounted in a depending leg 71 of the gauging head 56. The fork 69 forms one part of a bell crank lever to which is attached a connecting rod 72. The connecting rod 72 extends through a hole 73 in a projection 74 of a crank lever 75 which is adjustably secured to a second angular shaft 76. The crank lever 75 includes a portion 76^a which in the present instance is made separate from the part 74 and is adapted to be actuated by a cam 77 on the cam shaft 26. The connecting rod 72 supports a cushion spring 78 below the projection 74 and a pin 79 above the projection 74. Thus during the rotation of the cam shaft the connecting rod 72 will be raised and lowered and the fork 69 will be moved to reciprocate the pins 66 within the gauging head 56. The pins 66 are connected by a cross bar 80 as shown in Figures 2 and 19. A gauging finger 81 is slidably mounted in the sliding head 56 between the pins 66 and is secured to the cross bar 80. This gauging finger may consist of a pin and has one end projecting out of the gauging head and opposed to the gauging anvil 63. This gauging finger is adapted during the gauging of the lengths of the articles 65 to abut the ends 82 of said articles when the gauging head is swung into the position shown in Figure 9 and the connecting rod 79 is lowered by the mechanism previously described.

It will be understood from the mechanism previously described that the conveyor belt will receive an intermittent movement; the arrangement being such that the troughs of the conveyor belt will be successively stopped when in front of the gauging head 56.

A contact lever 83 has an upper end portion which is pivotally connected at 84 to the rod constituting the gauging finger 81 at a position to the rear of the gauging head 56. This upper end portion of the contact lever terminates in a fulcrum point 85 adapted under certain conditions when the fork 69 moves the pins 66 and the finger 81 in the direction of the anvil 63 to cause the contact lever 83 to move against the action of a spring 86. The lower end of the contact lever 83 has two electric contacts 87 and 88 projecting from its opposite sides as clearly shown in Figure 4. The legs 71 of the guiding head 56 has two outwardly projecting lugs 89 and 90 in which are adjustably mounted gauging contact pins 91 and 92; said pins being insulated from the lugs and having ends opposed respectively to the contacts 87 and 88. The contacts 87 and 88 have a common electrical connection in the form of a wire 93 and the gauging contact pins 91 and 92 are respectively connected by wires 94 and 95; said wires 93, 94 and 95 being more clearly illustrated in Figure 18 in circuit with certain electrical devices hereinafter more fully described. It will be understood however that if, upon movement of the gauging finger 81 into contact with the end 82 of the article 65 when the end 64 of said article is in engagement with the gauging anvil 63, the fulcrum point 85 does not touch the gauging head 56, then the spring 86 will hold the contact 88 in engagement with the gauging contact pin 92. On the other hand, if upon said movement of the finger 81 the fulcrum point 85 engages the head 56 only to move the lever 83 a short distance, then the contacts 87 and 88 will be out of engagement with both the gauging contact pins 91 and 92. If, however, the finger 81 is moved to such extent as to cause a greater swinging of the contact lever 83 due to engagement of the fulcrum 85 with the gauging head 56, then the contact lever 83 will be swung to such extent that its contact 87 will engage the gauging contact pin 91. Due to this construction and arrangement of parts and considering that the gauging finger 81 and its operative parts are initially set with respect to the anvil 63 so that when the finger 81 moves into contact with the end 82 of the article 65 when the end 64 of said article is in engagement with the anvil 63 and so that this movement of the finger 81 will effect the movement of the lever 83 so that the contacts 87 and 88 will occupy a neutral position out of engagement with both the gauging contact pins 91 and 92 then there will be no electrical action to cause the ejection of the article 65 since this test will show that the article is of proper length and said article during the next movement of the conveyor belt will be moved to a position beyond the line of gauging action of the anvil 63 and finger 81 toward the gauging means for width or diameter hereinafter described.

If upon test of the length of the article by the anvil 63 and gauging finger 81 either

the contact 87 engages the pin 91 or the contact 88 engages the pin 92, the article which is either under size or over size will be pushed laterally off the conveyor belt by mechanism now to be described. A bar 96 is slidably mounted transversely on the frame 20 below the upper run of the conveyor belt and this bar is adapted to be slid lengthwise by means of a weight 97 as shown in Figure 9; said weight being connected to the bar 96 by means of a flexible cable 97[a] which passes over a pulley 98. This sliding movement of the bar 96 however is normally resisted by an armature latch 99 as clearly shown in Figure 16; said armature latch being held in a notch 100 in the bar 96 by means of a spring 101. This latch 99 under certain conditions will be withdrawn from the notch 100 by an electro-magnet 102 when the latter is electrically energized such for example as when either the contact 87 engages the contact pin 91 or the contact 88 engages the contact pin 92 which action will complete an electric circuit through the magnet 102 and cause its core to be magnetized to swing the latch 99 out of the notch 100. It may be here stated that when the latch is thus moved out of the notch 100, the bar 96 will be moved by the weight 97 and this movement will push the rejected article transversely off the conveyor belt into a chute 103 at the side of the frame by the means now to be described.

A standard 104 is secured to the bar 96 and has an overhanging portion 105 to which is pivotally connected a pushing finger 106; said pushing finger having its lower end movable into alignment with the trough of the conveyor immediately in line with the anvil 63 and gauging finger 81, by a coiled torsion spring 107 when the gauging head is swung to raise the anvil and pin 81 after the gauging action; it being noted that the gauging head has a cam projection 108 adapted to engage the pushing finger 106 when the head is again swung to lower the anvil and pin 81 so that the pushing finger will be moved against the action of the spring 107 out of the path of movement of the gauging finger 81 during the gauging action. It will thus be understood that during the sliding movement of the bar 96 by the action of the weight 97 that the pushing finger 106 will engage the end 82 of the article 65 and the latter will be pushed off of the conveyor belt into the chute 103; there being a gate 109 pivotally mounted below the top of the chute 103 which is capable of being swung in opposite directions by the mechanism hereinafter described and which is rendered selectively operative according to the direction of movement of the contact lever 83 so that said articles will be deflected into either of the divisional chutes 110 and 111.

A rack 112 is slidably mounted along the side of the bar 96 as shown in Figures 2 and 9; said rack having a shouldered end 113 which, when the pushing finger 106 is in position ready to push an article transversely of the conveyor belt, is directly adjacent the end of a pawl 114 which is pivotally connected to the bar 96 and which is pressed by a spring 114[a] so as to slidably engage the surface 115 of the rack 112. The rack 112 has teeth 116 which mesh with a gear wheel 117 secured to a shaft 118. A gear wheel 118[a] on the shaft 118, as clearly shown in Figure 6, meshes with an intermediate gear wheel 119 which in turn meshes with a segmental gear 120 of comparatively large radius and which is mounted on a shaft 121; said shaft 121 and the shafts for the wheels 118[a] and 119 having bearings in a bracket 122 which projects from the frame 20. The shaft 121 has a pinion 123 secured thereto which meshes with a toothed portion 124 of a lever 125; said lever being pivotally mounted at 121 and having a portion operative by a cam 127 on the cam shaft 26; said cam being operative to impart an oscillating movement to the lever 125 and this oscillating movement through the gear train above described will impart a reciprocating movement to the rack 112. Thus considering that the armature pawl has been withdrawn from the bar 96 and that the rack 112 moves outwardly, the bar 96 will follow the movement of the rack 112 and the article will be ejected. This movement of the bar 96 is stopped due to the engagement of the lower part of the standard 104 with the surface 128 but the rack 112 moves to a greater extent to accommodate an action of the means for gauging the width and diameter of the article hereinafter described; it being sufficient here to state that during the continued outward movement of the rack 112, a notch 129 therein will be brought into register with the pawl 114 and the latter will spring into the notch and during the return movement of the rack the bar 96 will be slid rearwardly due to the engagement of the pawl 114 in the notch 129. During this rear movement the weight 97 will be raised and the armature pawl 99 will be moved into the notch 100 by the spring 101 at practically the same time the pawl 114 will be moved out of the notch 129 by the engagement of the pawl 114 with a fixed cam projection 130. In this manner the pushing finger will be returned to its normal position and during the next gauging movement the cam projection 108 on the gauging head 56 will move the pushing finger 106 into its position so as not to interfere with the gauging action.

It will thus be understood that the anvil 63, gauging finger 81 and their operative parts together with the means for ejecting

the article of improper size constitutes a length gauging unit and that any of the articles which withstand the test for length by said unit will remain upon the conveyor belt and will be conveyed to a gauging unit to test their diameter or width. I have illustrated this diameter testing unit which includes a bracket 131 having two parts 132 and 133 as clearly shown in Figures 3 and 5. The part 132 is secured to the side of the frame 20 by means of bolts 134 which extend through horizontal slots 135 in the side of the frame so that said part 132 will have an adjustment in the direction of the length of the frame. The part 133 is secured to the part 132 by means of bolts 136 which pass through vertical slots 137 in the part 133 and into tapped holes in the part 132. The part 133 has an upwardly extending portion 138 having at its top a gauging head 139 which is located at one side of the conveyor belt and as shown in Figure 13 this head 139 has two guiding pins 140 slidable therein which are connected by a cross bar 141.

A gauging finger 142 is slidable within the head 139 parallel with the guiding pins 140 and are substantially parallel with the length of the conveyor belt. An anvil block 143 is adjustably secured to the part 138 by a bolt 144 which extends through a slot 145 in the part 138 and into a tapped hole in the anvil block; there being a guiding ledge 146 provided on the part 138 which fits in an undercut groove 147 in the anvil block so that the anvil block may be adjusted toward or from the gauging head 139. The space between the outer end of the pin 142 and the anvil block 143 permits an article to be pushed from the conveyor belt into said space by mechanism hereinafter described and I preferably provide a support 148, as shown in Figure 3, for the article when positioned between the anvil block 143 and the pin 142. The guiding pins 140 have slots 149 into which project the tines 150 of a fork 151 which is secured to a rock shaft 152. An arm 153 is also secured to said shaft 152 and together with the fork 151 forms a bell crank lever. The arm 153 has a hole through which an upright connecting rod 154 slidably extends; said connecting rod having a pin 155 under the arm and a spring 156 above the arm; said spring abutting a part on the upper end of the rod 154 so that if the rod 154 is moved downwardly the rod 153 will be moved downwardly so as to actuate the block to cause the pins 140 and 142 to slide in the head 139 so that the pin 142 will move toward the anvil block 143. The lower end of the connecting rod 154 is pivotally connected to an arm 157 on the shaft 76 so that during the oscillation of said shaft 76, the pins 140 and 142 will be actuated so as to reciprocate in the head 139.

A contact-carrying lever 158, which is substantially similar to the contact lever 83 above described, is pivotally connected at 159 to the pin 142 as clearly shown in Figures 3, 5 and 13. The upper end of the lever 158 has a fulcruming point 160 adapted to engage the surface 161 of the gauging head 139.

The part 133 of the bracket 131 has a projection 162 in which is adjustably secured a gauge contact pin 163 and opposed to the pin 163 is another gauge contact pin 164 which is adjustably secured so as to oppose the pin 163; said pins 163 and 164 being spaced apart as clearly shown in Figure 3. The lower end of the lever 158 has two electric contacts 165 and 166 which are respectively opposed to the pins 163 and 164. Both of the contacts 165 and 166 are in electrical connection with the wire 93 previously mentioned. The contact pin 163 has an electric wire 167 while the contact pin 164 is connected with the electric wire 168.

A spring 169 is connected to the contact lever 158 and to a fixed part on the portion 162 of the bracket; said spring 169 normally tending to move the lever so that the contact 165 will engage the pin 163. It will thus be noted that considering that an article has been pushed from the conveyor belt between the anvil block and the pin 142 and that the fork 151 has been actuated so as to move the pin 142 into engagement with the article to hold the article against the anvil block, if this movement causes the contact 166 to engage the pin 164 or if the movement is not sufficient to bring the fulcrum point 160 into engagement with the surface 161 of the head 139 so that the spring 169 will move the lever to cause the contact 165 to engage the pin 163, the pushing means, hereinafter described, will push the article transversely off the conveyor belt into a chute 170. If, however, the fulcrum point 160 engages the surface 161 and the pin 142 moves to the extent prescribed for the arcuate measurement of the diameter, the contacts 165 and 166 will be moved out of engagement with both of the pins 163 and 164 so that the mechanism will not operate to eject the article from the conveyor belt but on the contrary on the next movement of the belt the article will be conveyed forwardly as having the proper width or diameter.

In order to eject the articles when the articles do not measure up to the proper diameter, I provide the following mechanism: A bar 171 similar to the bar 96 is slidably mounted transversely of the frame and includes a notch 172 into which engages an

armature latch 173; said armature latch being connected by a spring 174 for the purpose of holding the latch in the notch; said latch being adapted to be withdrawn from the notch 172 by an electro-magnet 175 when the latter becomes energized in a manner hereinafter described. The bar 171 adjacent opposite ends has arms 176 and 177; said arms respectively supporting pushing rods 178 and 179. These pushing rods are adjustably secured within the arms 176 and 177 so that they can be moved and secured in various positions to accommodate various lengths of articles and are operative to move the articles into and out of gauging position with respect to the anvil 143 and the pin 142.

A rack 180 is slidably mounted in the frame 20 alongside of the bar 171 and is of substantially similar construction as the rack 112. The rack 180 has a shouldered end 181 adapted to be engaged by the outer end of the bar 171; it being noted that said bar 171 is moved outwardly by means of a weight 182 which is connected to the bar 171 by a cable 183 as shown in Figure 3. In other words, the bar 171 is moved by the weight 182 in the same manner as the bar 96 is moved by the weight 97. The rack 180 has teeth 184 which mesh with a gear wheel 185 on the shaft 118 so that the rack 180 will be given the same reciprocating movement as the rack 112 and during the operation when the electro-magnet 175 is energized to withdraw the armature latch 173 from the notch 172 of the bar 171, the bar will take the movement of the rack 180 and will follow against the shoulder 181 during which time the pushing rod 178 will push the article from between the anvil block 143 and gauging pin 142 when the latter is retracted; said pushing movement of the article continuing across the belt so that the article will drop into the chute 170. The chute 170 has a gate 185[a] of similar construction to the gate 109; said gate being movable by electrically controlled means hereinafter described so as to cause the articles, as they are pushed off the belt into the chute, to be deflected into either of the divisional passages 186 or 187, for example the articles which are below the minimum diameter or width will be deflected down the passage 186 while the articles which are above the maximum diameter or width will be deflected down the passage 187. Suitable receptacles (not illustrated) can be set below the divisional passages 186 and 187 and 110 and 111 of the chutes 170 and 103 to receive the articles which are outside of the limits of tolerance for the articles being gauged.

It will be noted that after the rack 180 serves to return the bar 171 to its neutral position as shown in Figure 2 and during the testing operation, the rack 180 will move the bar 171 so that the pushing rod 179 pushes an article from the aligned trough of the belt between the anvil block 143 and the pin 142 to be gauged. If the article is of proper diameter the bar 171 during the next outward movement of the rack 180 will move the article through the medium of the pushing rod 178 onto the belt and since there is no electric energizing of the electro-magnet, the latter will move into the notch 172 and the article will remain on the belt and be conveyed to the chute 46 at the end of the frame.

As means for electrically actuating the armature latches 99 and 173 and for selectively moving the gates 109 and 185[a], I provide two electric switches 188 and 189 which are adapted to be opened by cams 190 and 191 on the cam shaft 26 as clearly shown in Figures 3, 7, 8 and 18.

As shown diagrammatically in Figure 18, two solenoids 192 and 193 which have a common core 194 are in electric circuit through the medium of the wire 195 with the electro-magnet 102; said core 194 being connected by an arm 195 to the shaft 196 to which the gate 109 is secured. The other poles of the solenoids 192 and 193 are in connection with contacts 197 and 198 of relays 199 and 200. The coils of the relay 199 are in electric connection through the medium of the wires 94 and 95 with the contact pins 91 and 92. The coils of the relays 199 and 200 are also in connection with the battery or electric generator 203 through the medium of the switch 188. The opposite pole of the generator 203 is in connection with the lever 83 through the medium of the switch 189; said electro-magnet 182 also being in electric connection with the wire 93 between the switch 189 and the generator 203. The relays 199 and 200 also include contacts 204 and 205 which are electrically connected to the wires 94 and 95.

In similar manner the electrode magnet 175 is in electrical connection with two solenoids 206 and 207 by means of a wire 208. These solenoids have a common core 209 to which is connected an arm 210 on the shaft 211 to which the gate 185[a] is secured. The solenoids 206 and 207 are respectively connected to contacts 212 and 213 of relays 214 and 215. The coils of the relays 214 and 215 are connected to the wires 167 and 168 which lead to the contact pins 163 and 164. Contacts 216 and 217 of the relays 214 and 215 are in electrical connection with the wires 167 and 168 respectively. It will be understood that when any of the coils of the relays are energized its core 218 will be retracted so that the transverse portion 219 will electrically connect the contacts of the relay. For example if the coil of the relay 199 is energized its core 218 will be retracted and the part 219 will bridge the con-

tacts 204 and 197 and thus complete a circuit through the solenoid 192 to cause it to retract its part of the core 194 and swing the arm 195 to rock the shaft 196 and consequently rock the gate 109 into the position shown in Figure 2.

Considering that during the testing action, the cam 190 rotates to permit the switch 188 to close and either of the levers 83 or 158 is moved to engage therein adjacent contacting pins, after the cam 191 moves to permit the switch 189 to close, then a circuit will be completed to energize the respective relays which are in connection with the contacting portion between the contact levers and the contact points. This will cause the core of the energized relay to be retracted so as to complete a circuit between its contacts through the respective solenoid and through the electro-magnet which is in circuit therewith. The energizing of the solenoid will then move its core to swing the respective gate and the armature latch of the energized electro-magnet will be swung into its retracted position releasing its pushing bar so that the article will be pushed from the conveyor belt as previously described. It is obvious that if the contact lever of each gauging unit occupies a neutral position that its associated electro-magnet will not be energized nor will either of the solenoids which are in connection with said unit, be energized. Thus there will be no action imparted to the respective gate. In other words, the various contact pins are in connection with the respective relays and when the associated contact lever is moved into engagement with the contact pins, the relays will be energized when the switch 189 momentarily closes; such time being sufficient to permit the parts 219 to engage the contacts, after which a circuit will be established by the switch 188 which remains closed for a longer period in view of the character of the cam as illustrated.

It will be understood that the articles can be pushed to various extents between the anvil block and the pin 142 by adjusting the pushing rods 178 and 179 so that any desired portion of the articles can be gauged for diameter or width. Furthermore while I have illustrated only one gauging unit for length and one gauging unit for width and diameter, various numbers of units can be employed according to the length of the machine and the requirements of the gauging operations. Thus the gauging units can be duplicated and any number thereof can be arranged and operate during the continuous passage of the articles from one end of the machine toward the other.

While I have described my invention as taking a particular form, it will be understood that the various parts of my invention may be changed without departing from the spirit thereof, and hence I do not limit myself to the precise construction set forth, but consider that I am at liberty to make such changes and alterations as fairly come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a gauging machine, a conveyor for moving articles to be gauged; gauging means operative to move toward said articles; and ejecting means movable to various positions dependent upon the extent of movement of said gauging means and operative to effect movement of the gauged articles of improper size to one of a number of locations off of said conveyor and independently of the movement thereof, said gauging means when movable into a neutral position, determining the proper size of the articles, being effective to allow said conveyor to move said latter mentioned articles to another location; substantially as described.

2. In a gauging machine, a conveyor for the articles to be gauged; a movable deflecting member; gauging means movable toward said articles; means movable into various positions due to the movement of said gauging means; ejecting means having a movement controlled by the movement of said second means, when moved into certain of said positions, to eject said articles; and means for moving said deflecting means into various positions and rendered selective by the position into which said second means occupies whereby the ejected articles will be separated into a number of classes, said second means, when the gauging means is moved into engagement with said articles and remains within the limits for proper size of said articles, being movable into a neutral position rendering inoperative said ejecting means and permitting said conveyor to move said proper size articles to another location; substantially as described.

3. In a gauging machine, a conveyor for articles to be gauged; a supporting structure; a gauging member movably mounted with respect to the supporting structure; ejecting means for articles of improper size; a contact lever movably connected to said gauging member; and a contact member operative, when engaged by said lever, to effect operation of said ejecting means, said gauging member, due to the extent of its movement toward said articles, being operative to effect movement of said lever into or out of engagement with said contact member; substantially as described.

4. In a gauging machine, a conveyor for articles to be gauged; a supporting structure; a gauging member movably mounted with respect to the supporting structure;

ejecting means for articles of improper size; a contact lever movably connected to said gauging member; and a contact member operative, when engaged by said lever, to effect operation of said ejecting means, said lever having a portion for fulcruming engagement with said supporting structure whereby if the gauging means moves to cause the fulcruming portion to engage the supporting structure, the lever will be moved out of engagement with the contact member; substantially as described.

5. In a gauging machine, a conveyor for articles to be gauged; a supporting structure; a gauging member movably mounted with respect to the supporting structure; ejecting means for articles of improper size; a contact lever movably connected to said gauging member; a movable deflecting member; contact members spaced apart; means operatively connected to said contact members whereby when said lever engages either of said contact members, the ejecting means will be actuated; and means operatively connected to said contact members and to said deflecting member to selectively move the latter to deflect the ejected articles in opposite directions, said gauging member due to the extent of movement toward said articles being operative to effect movement of said lever into or out of engagement with either of said contact members or into a neutral position therebetween; substantially as described.

6. In a gauging machine, a movable gauging member; contacts spaced apart; a lever movable by said member into and out of engagement with said contacts; ejecting means operatively connected to said contacts and rendered operative when said lever engages either of said contacts; and a deflecting member operatively connected to said contacts to be selectively moved to deflect in different directions the ejected articles; substantially as described.

7. In a gauging machine, a conveyor for articles to be gauged; gauging means movable to gauge the articles on said conveyor; and means for ejecting articles of improper size, after being gauged by said gauging means, said ejecting means having a portion normally in line with said articles when positioned to be gauged and being movable out of said line during the gauging action; substantially as described.

8. In a gauging machine, a conveyor for articles to be gauged; gauging means movable to gauge the articles on said conveyor; and means for ejecting articles of improper size, after being gauged by said gauging means, said ejecting means having a portion normally in line with said articles when positioned to be gauged and being movable by a portion of said gauging means out of said line during the gauging action; substantially as described.

9. In a gauging machine, a conveyor for articles to be gauged; gauging means for said articles; means for ejecting articles of improper size from said conveyor after having been gauged by said gauging means, said ejecting means including a bar automatically movable in one direction; and a rack operative to control the movement of said bar in said direction and to return it to its normal position; substantially as described.

10. In a gauging machine, a conveyor for articles to be gauged; gauging means for said articles; means for ejecting articles of improper size from said conveyor after having been gauged by said gauging means, said ejecting means including a bar automatically movable in one direction; an electro-magnet; an armature latch for holding engagement with said bar and movable out of holding engagement when the electro-magnet is energized whereby the bar will be automatically moved in said direction; and means for returning said bar to its normal position; substantially as described.

11. In a gauging machine, a conveyor for articles to be gauged; gauging means located to the side of said conveyor and having gauging portions spaced apart and movable with respect to each other to vary the distance therebetween; means for pushing said articles off said conveyor into said space between the gauging portions to be gauged; and means for returning said articles upon said conveyor after the gauging operation; substantially as described.

12. In a gauging machine, a conveyor for articles to be gauged; gauging means located to the side of said conveyor and having gauging portions spaced apart and movable with respect to each other to vary the distance therebetween; means for pushing said articles off said conveyor into said space between the gauging portions to be gauged; and means for returning said articles upon said conveyor after the gauging operation, said latter means being selectively movable to a greater extent to eject said articles from said conveyor; substantially as described.

13. In a gauging machine, a supporting frame; a conveyor for the articles to be gauged; gauging means; and a bracket for said gauging means, said bracket being made in two parts, one part adjustably secured to the frame so as to be moved in one direction, the other part being adjustably secured to said first part so as to be moved in another direction whereby the gauging means can be varied with respect to said conveyor; substantially as described.

14. In a gauging machine, a conveyor; means for ejecting articles from said conveyor and including a bar; an actuating

member movable adjacent said bar and having a notch and a shoulder, said bar being automatically movable in one direction independently of said actuating member and having a pawl thereon, said actuating member being movable in an opposite direction to a greater extent than the movement of said bar and permitting said latch to engage said notch whereby said actuating member on a return movement will return the bar to its normal position; and means for automatically disengaging said pawl from the notch during said latter movement; substantially as described.

In testimony whereof I have signed my name to this specification.

EDWIN CLARK BURDICK.