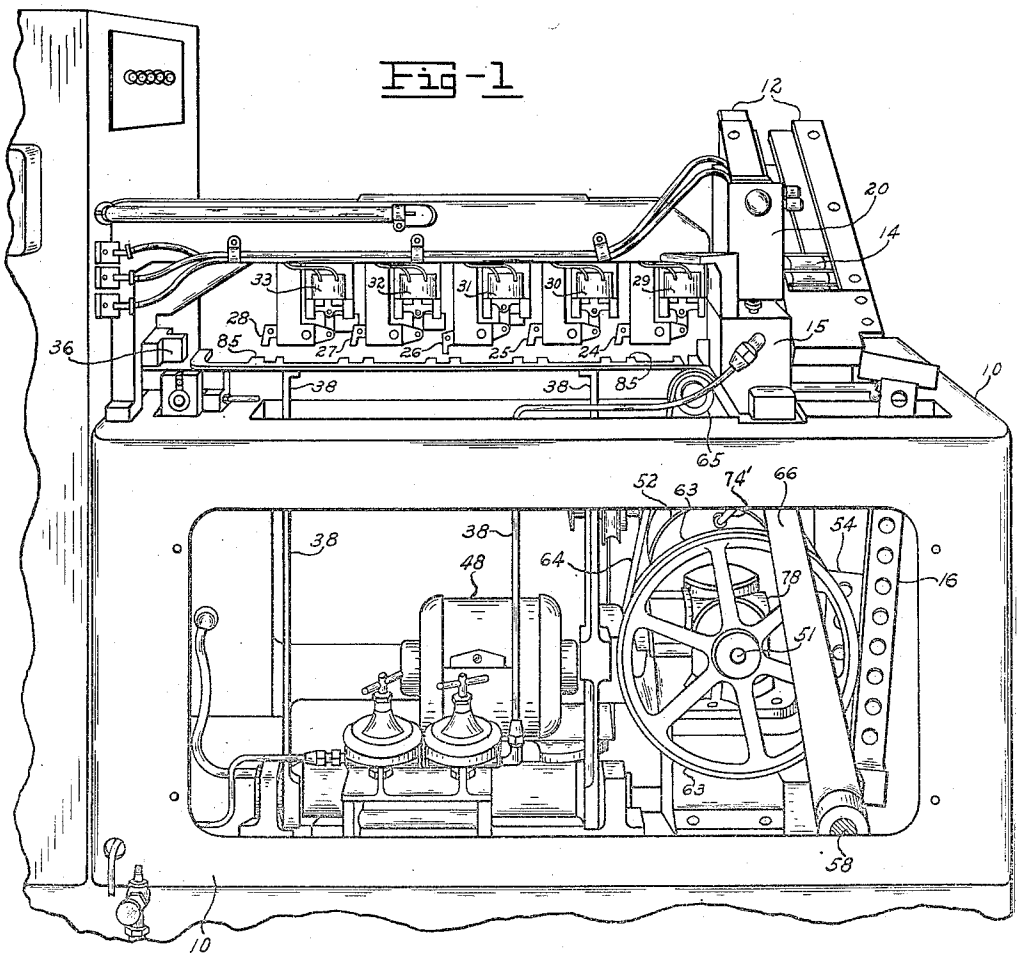
Aug. 4, 1953 W. F. ALLER ET AL 2,647,627

GAUGING DEVICE

Filed Dec. 3, 1948 4 Sheets-Sheet 1

Fig-1



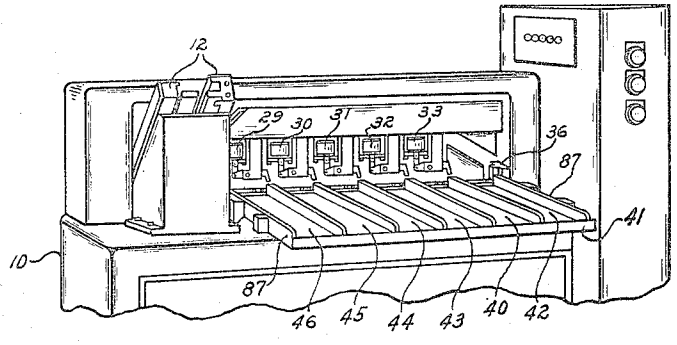


Fig-2

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GAUGING DEVICE

Filed Dec. 3, 1948 4 Sheets-Sheet 2

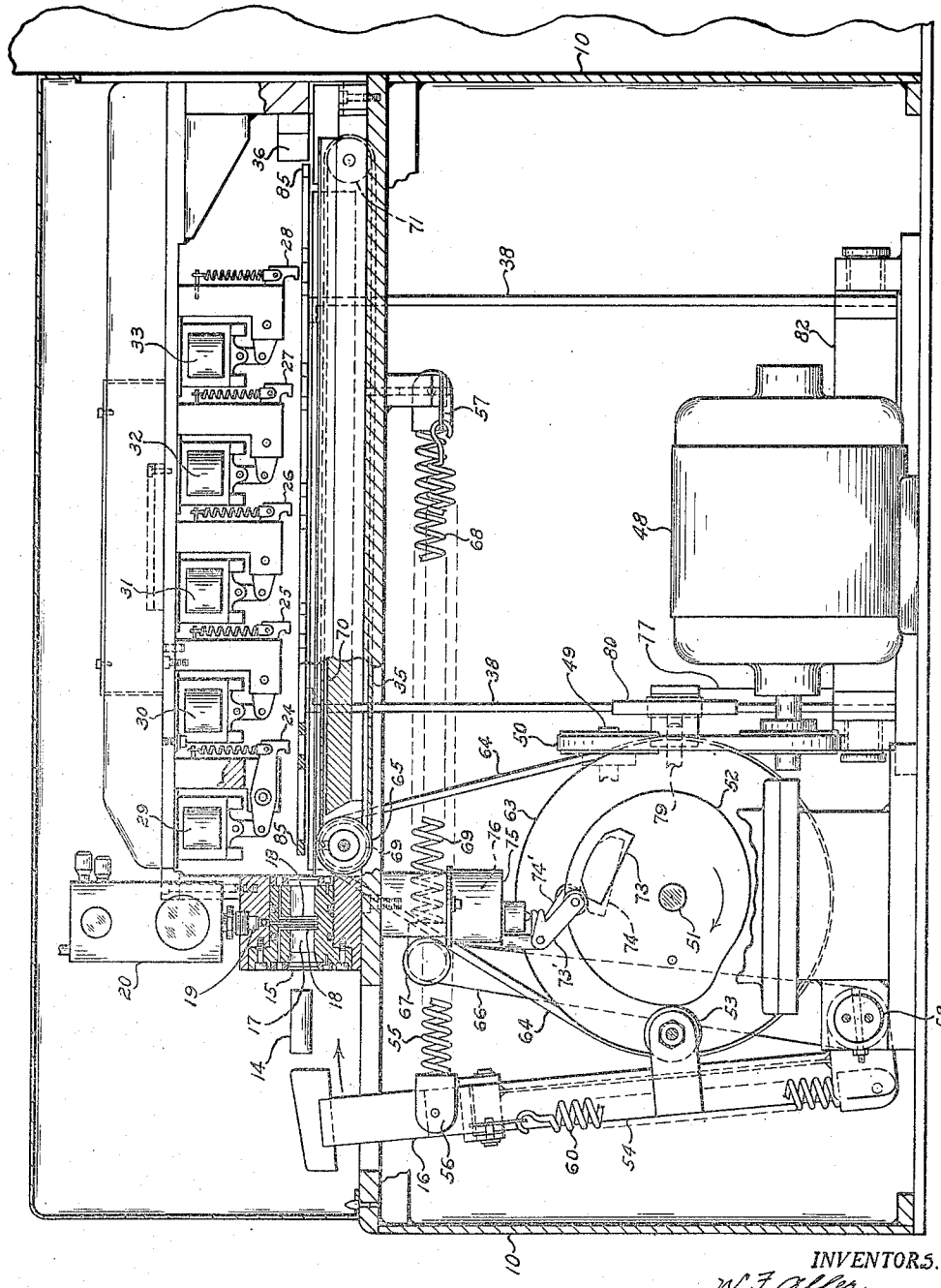


Fig-3

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GAUGING DEVICE

Filed Dec. 3, 1948 4 Sheets-Sheet 3

Fig-4

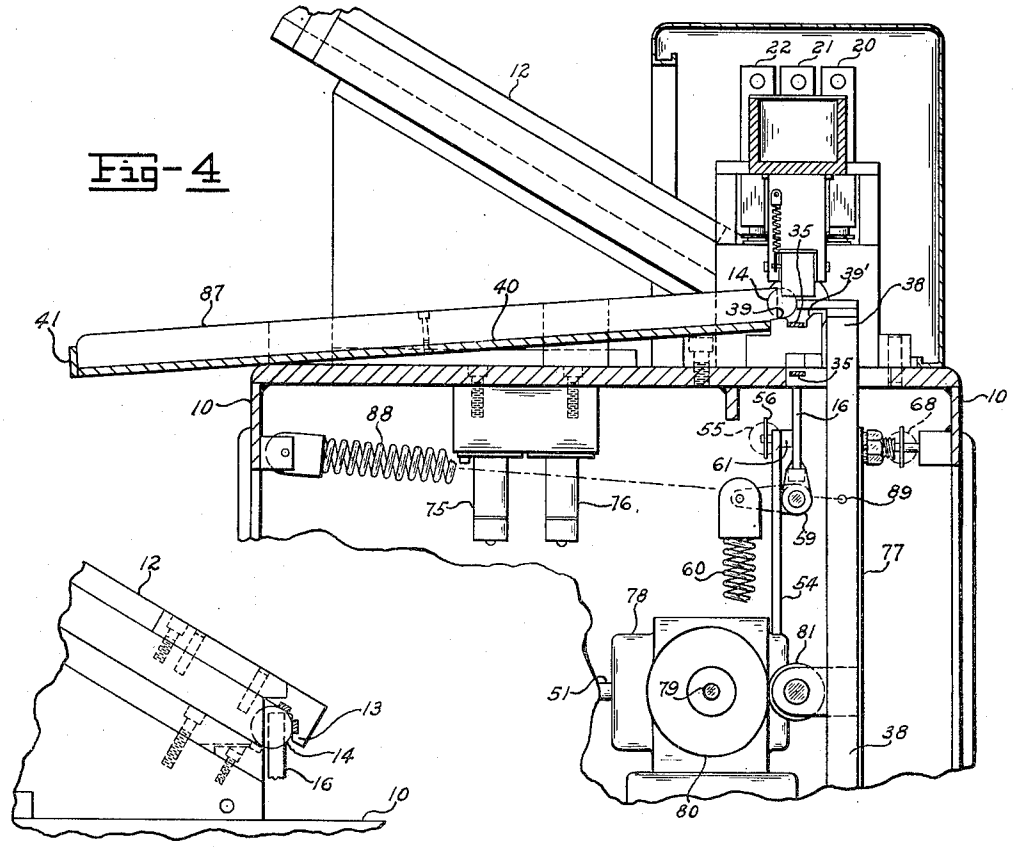


Fig-5

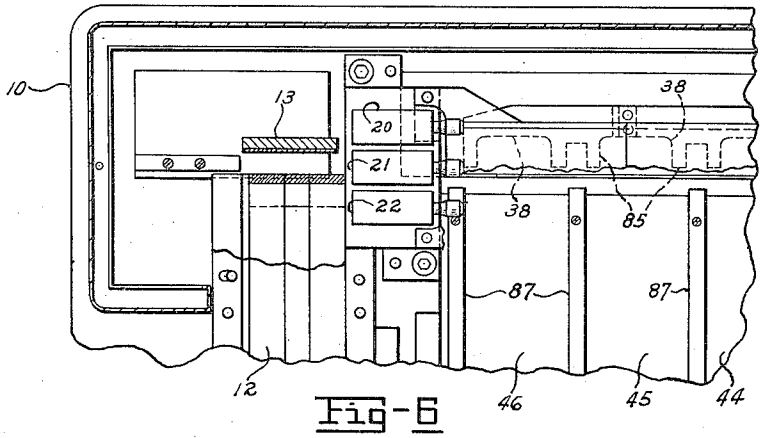


Fig-6

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GAUGING DEVICE

Filed Dec. 3, 1948 4 Sheets-Sheet 4

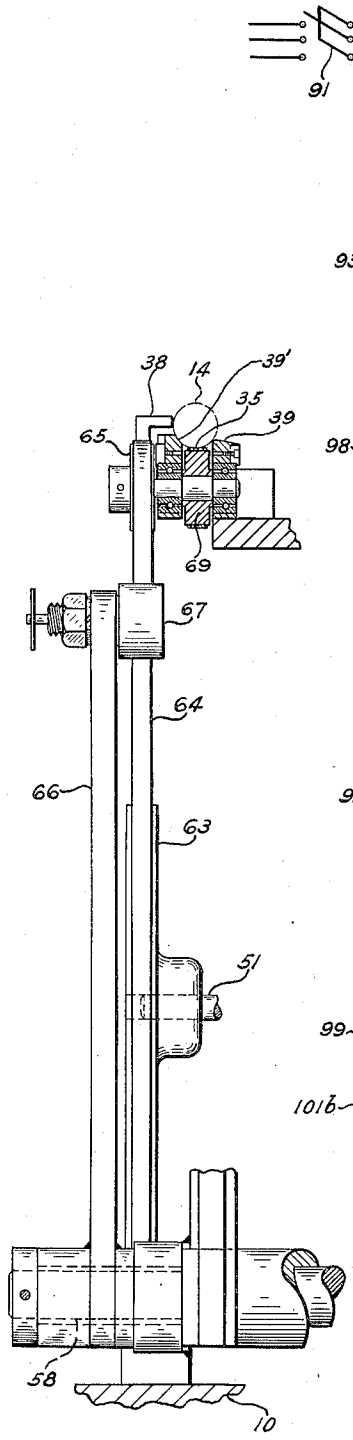


Fig-7

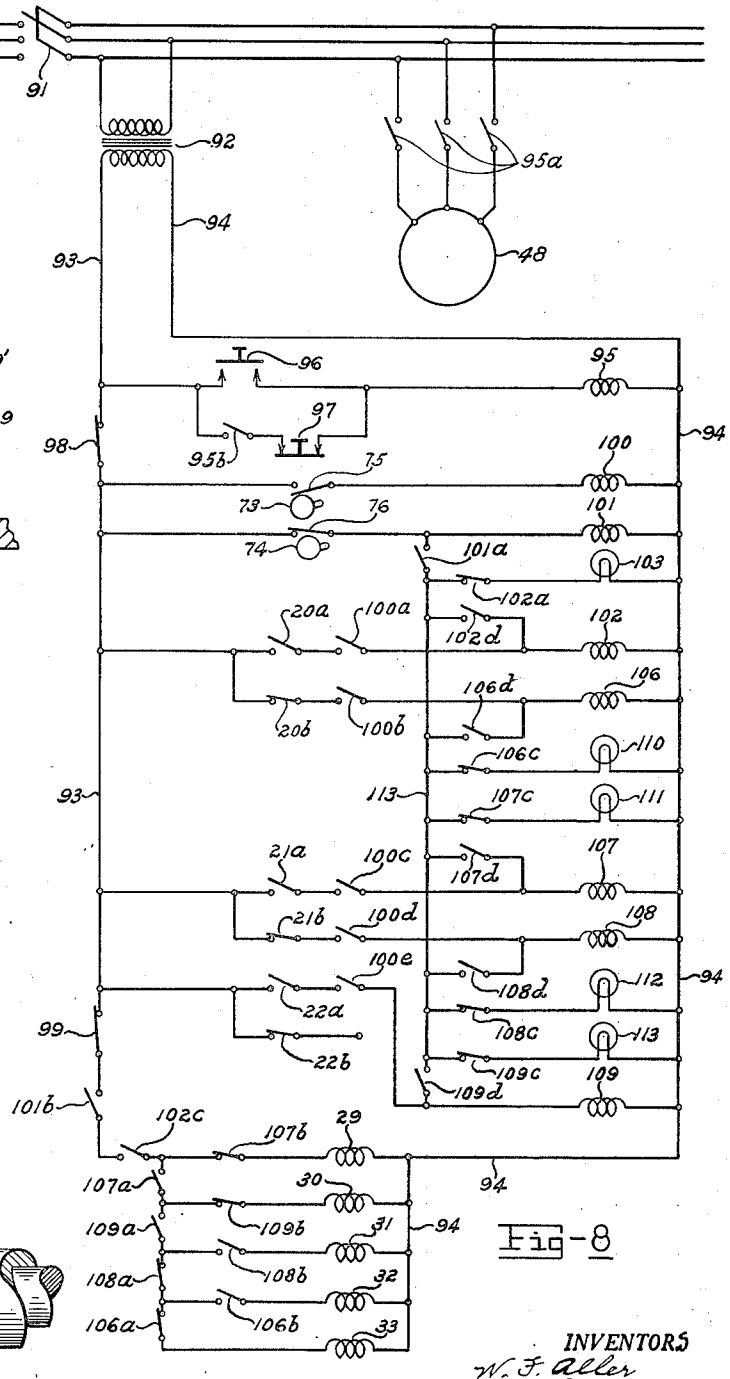


Fig-8

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UNITED STATES PATENT OFFICE

2,647,627

GAUGING DEVICE

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Application December 3, 1948, Serial No. 63,282

5 Claims. (Cl. 209—74)

1

This invention relates to gauging apparatus and more particularly to gauging apparatus adapted to gauge and select articles in accordance with a particular size or sizes.

One object of the invention is the provision of a gauging apparatus in which articles are supplied to a gauging station where a sizing operation is accomplished, the articles then being fed from the gauging station by means of a conveyor which transports the articles through a number of different stations and with provision for arresting the article at the proper station in accordance with its size and for removing the articles from the conveyor at the selected station.

Another object is the provision of a gauging apparatus of the character mentioned in which the gauging means automatically controls a series of different selecting devices so that the proper one is selected, each selecting device causing the operation of a stop means which stops the motion of the article while on the conveyor and during the continued travel of the conveyor.

Another object of the invention is the provision of a gauging apparatus of the character mentioned, having removing means that is operable in timed relation to the movement of a feed device that supplies the articles to the gauging station, such removing means being operable after the forward motion of the articles is stopped at the selected station, to move the articles from the conveyor.

Other objects and advantages of the invention will be apparent from the following description, the appended claims, and the accompanying drawing, in which

Fig. 1 is a perspective view of a gauging apparatus embodying the present invention;

Fig. 2 is a perspective view showing the upper portion of the gauging apparatus and illustrating the several segregating troughs or receivers;

Fig. 3 is a side elevation of the gauging apparatus with certain parts broken away or sectioned for purpose of illustration;

Fig. 4 is an end elevational view of the upper portion of the gauging apparatus;

Fig. 5 is a side elevation of the supply guide, shown on an enlarged scale;

Fig. 6 is a top plan view of the supply end of the gauging apparatus;

Fig. 7 is a detailed view showing the conveyor drive; and

Fig. 8 is a diagrammatic view showing the wiring diagram.

Referring more particularly to the drawing in which the same reference numerals are used in

2

the different views to designate like parts, the gauging apparatus as herein shown comprises a frame structure 10 the lower portion of which contains the essential drive mechanism while the upper portion provides a support for the feeding means, the supplying means, the article conveyor and the segregating means. In the particular form of construction illustrated, the gauging apparatus is designed to gauge the diameter of parts or rods such as piston pins for example, and select the pins in accordance with their diameters into four different groups in the acceptable size range, one additional group for oversize rejects and one additional group for undersize rejects.

The piston pins are placed by the operator in an inclined guide 12 and roll down the guide until they are stopped by the lip 13, see Fig. 5. The lowermost piston pin is then in line with the gauging station generally designated by the reference numeral 15. The pin is then supplied to the gauging station by means of an automatically operable feed arm 16 which moves from a normal position as shown in Fig. 3 to advance the piston pin endwise into the chamber 17 of the gauging station. During the forward stroke of the feed arm 16 the upper end of the feed arm blocks the downward travel of the next higher piston pin in the guide 12 but permits that piston pin to move down into a position ready for forward feeding as soon as the feed arm 16 is returned to its normal position illustrated.

When the article or piston pin 14 is in the chamber 17 its diameter is gauged, preferably as herein shown by means of a series of gauging switches of the type, for example, as disclosed in the prior application of Aller, Serial No. 660,902, filed April 10, 1946, now abandoned. Said switches are arranged in pairs with each pair controlled by a curved pressure responsive tube, the several tubes being in common communication with a gauging orifice through which there may be a leakage of fluid supplied under pressure, with the amount of leakage dependent on the distance between the gauging orifice and the workpiece. In the form illustrated, the gauging orifice consists of two annular rings 18 separated by an intermediate groove which is in communication with a manifold passage 19 leading to the several pressure responsive tubes that control the switches, so that an average diameter measurement of the object is obtained. The switches are arranged to be closed or opened at different pressures existing in the manifold passage 19 in accordance with the particular size range to be se-

lected. As will be presently described, the three pairs of switches employed in the three gauging heads 20, 21 and 22, see Figs. 3 and 6, are arranged to automatically control the operation of any one of the five selecting stops 24, 25, 26, 27 and 28 through their respective solenoids 29, 30, 31, 32 and 33, suitable holding circuits being provided so that the proper stop selected by the gauging operation will be held in its lowered stopping position for a predetermined time after the article is pushed out of the gauging station by the next succeeding article that is supplied to the gauging station.

As the gauged article is moved out of the gauging station it is received on a belt conveyor 35, see Figs. 3, 4 and 7, and carried rapidly along on the conveyor until it is stopped by any one of the stops 24, 25, 26, 27 and 28, and if none of the stops are depressed to stopping position, it moves on until it reaches a fixed stop or bumper 36. The speed of the conveyor is such that a gauged article may be carried from the gauging station to the bumper 36 and be pushed off of the belt laterally before the gauging operation takes place on the next article supplied to the gauging station. It will be understood that when one of the stops is depressed, stop 28 being so illustrated, it will stop the article during the continued forward movement of the conveyor belt, and at the proper time a push bar 38, see Figs. 1, 3, 4 and 6, will be moved in a counterclockwise direction as viewed in Fig. 4 and into the position shown in that figure to push the article up over the guide rail 39 so that it may roll down the gradually inclined receiving trough 40 until it is stopped by the end rail 41 or until it is stopped by another article already against the rail 41. It will be noted that the inclination of the trough 40 is quite gradual so that a gauged piston pin does not severely jar itself or another gauged pin when it comes to rest. The several receiving troughs are open at the top so the operator can pick off a group of gauged pins before the trough is filled and can see from which station he takes them in order to note their size. For example, the piston pins in the trough portion 40 may be oversize rejects. Those in trough portion 42 may be undersize rejects. Those in trough portion 43 may have a size between 1.001 inches and 1.002 inches. Those in trough portion 44 may have a size between 1.000 and 1.001 inches. Those in trough portion 45 may have a size between .999 and 1.000 inch, and those in trough portion 46 may have a size between .998 and .999 inch.

The conveyor, feeding means, gauging means and the push bar 38 are timed together by driving mechanism and cams as will now be described. A motor 48 is arranged in the lower portion of the frame 10 and drives a shaft 49 through a belt 50, shaft 49 being connected in any suitable manner and through suitable speed reducing gearing to a transversely extending timing shaft 51, see Figs. 1 and 3. On this shaft is a feed cam 52 controlling a roller 53 on an arm 54 the upper end of which is connected to the feed arm 16. A spring 55 anchored at one end to a clip 56 on the feed arm 16 and at the other end to an anchorage 57 on the frame serves to yieldingly urge the feed arm in a clockwise direction, as viewed in Fig. 3, and move the arm when the cam permits so that the actual feed impulse on the articles is by means of the spring 55 under the control of the cam 52. The arm 54 is pivotably movable about a shaft 58. The feed arm 16 instead of being rigidly connected to the upper end of arm 54, is connected in such a manner that it can be manually moved with respect to the arm 54 in a direction transverse of its normal feeding movements so that during the setup operation of the apparatus it would be possible to retract an article from the gauging station merely by laterally swinging the upper end of the feed mechanism. The connection between the feed arm 16 and the arm 54 comprises a pivot connection 59, a spring 60, and a stop 61, with the spring 60 holding the feed arm 16 against the stop. In normal operation the parts 16 and 54 operate as if they were rigidly connected together.

Arranged on the timing shaft 51 is a pulley wheel 63 driving a belt 64 which extends around pulley 65, see Figs. 3 and 7. A tensioning arm 66, pivoted on the shaft 58, has a tensioning roller 67 engaging the belt and holding it under the proper tension, the tensioning arm 66 being urged in a clockwise direction, as viewed in Fig. 3, by means of a spring 68. The pulley 65, which is driven by the belt 64, is fixed to the conveyor driving pulley 69 and serves to drive the belt in timed relation with the rotation of the timing shaft 51 so that the belt will travel through all of the selecting stations in the interval between the time it receives an article from the gauging station and the time of the next succeeding gauging operation. Below the belt, and preferably spaced only a small fractional part of an inch from the belt, is a belt supporting frame 70 which prevents the belt from sagging when it is carrying an article. The belt is returned over a return pulley 71 carried by the frame structure.

The feed cam 52 is provided with timing cams 73 and 74. Timing cam 73 controls an arm 73' which operates a normally open gauging switch 75. A normally closed holding switch 76 is controlled by an arm 74' operated in turn by cam 74. The gauging switch is adapted to be temporarily closed by cam 73 after an article is supplied to the gauging station and then before that switch opens again holding circuits are completed by opening the normally closed switch 76 to maintain the condition of the various gauging circuits.

The main timing shaft 51, as shown in Fig. 4, is connected through suitable drive mechanism in a housing 78 with an auxiliary timing shaft 79 driving an ejection cam 80 engaged by a roller 81 on a bar 77 connected to the push bar 38. Actually there are two of these bars 77, as shown in Fig. 3, connected together by a tie bar 82 at their lower ends where they are pivotably supported. The upper ends of the bars 77 are connected to the push bar 38. The push bar 38 is thus moved laterally at the proper time in the sequence of operation after a sufficient time has elapsed for the article to travel all the way down to the bumper 36 after leaving the gauging station. Regardless of where the articles might have been stopped by the several stops 24 to 28, or stopped by the bumper 36, the push bar 38 will act to move the articles from the belt conveyor 35 and over the top of the guide rail 39 that extends along the side of the belt and acts as a retainer to keep the article on the belt during its forward travel. A similar retaining projection 39' extends along the other side of the belt as shown in Fig. 4. The push bar 38 is provided with fingers or projections 85 adapted for contact with opposite ends of the piston pin and serve to keep the piston pin axis parallel to itself as it moves from the belt and down the inclined guideway in the selected position. The several stations of the guideway are defined and separated from one another by means of retaining bars 87, see Figs. 2 and 4. It should

also be noted that the cam 80 properly times the operation of the feed bar but the actual movement of the feed bar towards pushoff position is accomplished by a spring 88, see Fig. 4, connected to one of the bars 77 as indicated at 89. If by any chance an article should not be exactly in line with one of the selecting troughs, or if there should be an obstruction to the articles at the time the feed bar operates, the spring 88 may yield without injury to the part.

The sequence of operation will be explained in so far as the electrical circuits are concerned in reference to Fig. 8. In this figure the coils or relays which operate switches are designated by numbers, and the switches they control are designated by the same reference numeral followed by a suffix letter. In this figure the parts are shown in their normal deenergized condition. 75 designates the normally open cam operated switch which when closed by the cam 73 initiates a gauging operation. Shortly before this switch closes, the normally closed cam operated switch 76 is opened to drop out the holding operation from a previous cycle. After the gauging switch 75 closes and conditions the various gauging circuits the holding switch 76 is closed again by cam 74 which permits arm 74' to drop and the circuits are held until shortly before a succeeding gauging operation is initiated. The proper circuits are held during the time the gauged piston pin leaves the gauging station and travel along through the several selecting stations and is pushed off the belt conveyor when it reaches the proper selecting station.

Current is supplied from a suitable source through the power switch 91 to a transformer 92 to energize the leads 93 and 94. The power switch 91 is also connected through switches 95*a* to the motor 48. The switches 95*a* are normally open but are closed when a relay coil 95 is energized by closing the start switch 96. Coil 95, when energized, closes the switch 95*b* and current flows through switch 95*b* and normally closed stop switch 97, and maintains the energization of coil 95 so that the start switch can then be released. Manually operable switches 98 and 99 are closed by the operator. These switches are provided for setup purposes and stay closed during automatic gauging operation.

The motor being in operation, a piston pin is applied to the gauging station by the feed bar and during the retracting movements of the feed bar, the cam operated switch 75 closes to initiate a gauging cycle. This switch thus energizes a coil 100 which closes switches 100*a*, 100*b*, 100*c*, 100*d* and 100*e*. Before the gauging switch opens again the cam operated switch 76 closes, as previously mentioned and circuits are held, as follows. Closed switch 76 energizes coil 101 and thus closes the normally open switches 101*a* and 101*b*. Assume now that the part is an undersize reject. Such a part travels down to the bumper and is not stopped by any of the stops 24 to 28 respectively and none of the relays 29 to 33 are energized. An undersize reject will not cause any of the normally open undersize switches of the several switch heads to close. These undersize switches of the three gauge heads 20, 21 and 22 are shown in Fig. 8 at 20*a*, 21*a* and 22*a*. The corresponding oversize switches controlled by the several gauging heads are indicated at 20*b*, 21*b* and 22*b*. With all of the switches 20*a*, 21*a* and 22*a* open, no current will flow through the coil 102, and switch 102*c* remains open preventing any of the circuits of the solenoids 29 to 33 being energized. The part will thus not be stopped until it reaches the bumper at the end of the line of travel. Since coil 102 is deenergized, switch 102*d* remains open. This switch is a holding switch that would complete a holding circuit for coil 102 if that coil were energized, from line 94, coil 102, switch 102*d*, line 113, switch 101*a*, and switch 76 to line 93.

Suppose now that the part is an oversize reject. It is stopped by energizing relay 33 and moving the stop 38 downwardly. This solenoid 33 is energized through the line 94, switches 106*a*, 108*a*, 109*a*, 107*a*, 102*c*, 101*b*, 99 to the line 93. With 106*a* remains closed since its controlling coil 106 is not energized because switch 20*b* is now open. This switch is only closed when the part is under the size for which it is set to operate. Similarly switches 21*b* and 22*b* are open and the coil 108 is not energized so that switch 108*a* remains closed. Switches 109*a* and 107*a* are closed by energization of coils 109 and 107 since the switches 22*a* and 21*a* are closed due to the part being oversize. Switch 102*c* at this time is closed since the switch 20*a* is closed and switch 101*b* is closed since the cam operated switch 76 is closed during the holding operation.

If the part has a size that would place it in the range, in the particular example chosen for illustration, of 1.001 inches to 1.002 inches it would be stopped by stop 27 depressed by energizing solenoid 32. Under these conditions switch 106*b* is closed by energizing coil 106 through the closed switch 20*b* which only opens when the part is greater than 1.002 inches in diameter. Switch 108*a* remains closed, switch 21*b* being now open since the part is greater than 1.001 inches in diameter. Switches 21*a* and 22*a* being closed, coils 107 and 109 are energized and switches 107*a* and 109*a* are closed, switch 102*c* being closed due to the fact that switch 20*a* is closed. Switch 101*b* is closed since coil 101 is energized so it will be seen that a circuit is completed from the line 93 through the switches 101*b*, 102*c*, 107*a*, 109*a*, 108*a*, and 106*b* through the solenoid 32. Solenoids 31, 30 and 29 are not energized since switches 108*b*, 109*b* and 107*b* are open.

Solenoid 31 is energized when switches 108*b*, 109*a*, 107*a*, 102*c* and 101*b* are closed. This condition exists when coil 108 is energized by closed switch 21*b*, coil 109 being energized by closed switch 22*a* and coil 107 being energized by closed switch 21*a* with coil 102 being energized by closed switch 20*a*.

Solenoid 30 will be energized when switch 109*b* stays closed, due to deenergization of coil 109, by opening switch 22*a*. Switch 107*a* will be closed since switch 21*a* is closed and relay coil 107 is energized. Switch 102*c* will be closed and switch 101*b* will be closed as previously described.

Solenoid 29 will be energized when the switch 107*b* stays closed, due to deenergization of coil 107, by opening switch 21*a*. Switch 107*a* at this time is open so that no current flows to the other solenoids 30 and 33.

Reference numerals 103, 110, 111, 112 and 113 designate lamps controlled respectively by switches 102*a*, 108*c*, 107*c*, 108*c*, and 109*c*, used in setting up the apparatus for any desired size range of selection.

Switch 102*d*, as previously mentioned, is a holding switch for coil 102, and in a similar manner holding switches 106*d*, 107*d*, 108*d* and 109*d* are provided for the coils 106, 107, 108 and 109 respectively.

It will be understood that while certain sizes

have been mentioned in this description and the apparatus has been described as adapted for the selection of the parts in four different acceptable size ranges, one oversize reject, and one undersize reject, the apparatus may be constructed to provide as many different selections as desired by providing the requisite number of pressure controlled switches with each switch arranged to select within a desired size range. In the particular form illustrated, the normally closed oversize switch 22b of the gauging head 22 is not effective.

During the gauging cycle and as soon as the holding switch 76 is closed, the several circuits as previously described are completed and are held after the workpiece leaves the gauging station the holding switch 76 opening again to de-energize the coil 101 temporarily just before the next gauging cycle takes place. The circuits are thus maintained during the time the article gauged is being pushed out of the gauging station and is moved along on the conveyor until it is stopped by the selecting stop or until it meets the bumper in its forward line of travel. After sufficient time for the workpiece to reach the bumper if none of the stops are projected, then the push off bar moves to eject the part from the conveyor.

It will be now apparent that the apparatus is capable of very accurately gauging the parts supplied to the gauging station automatically one after the other and that the rate of the gauging operation may be very rapid so that a large number of parts may be handled at any given time. Following the gauging operation the parts are carried resting on the conveyor so that they may be stopped at the proper location opposite the proper inclined trough although this does not require stopping the conveyor itself, which continues to move. This affords a very simple but effective transporting device. Having reached a selected station by the projection of the proper stop, the gauged part at the proper time in the cycle of operation is moved laterally from the conveyor while maintaining its axes parallel to itself so it can roll down the proper trough. In so moving, the part does not drop or slam against another part, the inclined troughs arranging the parts with their axes parallel and in a very convenient position so that the operator can most readily pick up a number of parts from any selecting station and place them in the proper receptacle knowing that each part in the group he takes from any one selecting station is within the tolerance for which that particular station has been set up.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. Gauging apparatus comprising a gauging station having an article gauging means, feeding means for supplying articles one at a time to the gauging station, a conveyor belt for receiving articles pushed from the gauging station by a supplied article, means for driving the conveyor continuously, a series of selecting stations selectively operable by said gauging means for stopping the travel of the article during the continued travel of the conveyor retaining means extending along opposite sides of the conveyor belt, removing means operable in timed relation with the feeding means and movable laterally of the line of advance of the articles on the belt for pushing the articles off the upper side of the conveying portion of the belt and past said retaining means, and tracks having a gradual downward incline from said conveyor along which the articles can travel by gravity.

2. Gauging apparatus comprising a gauging station having gauging means responsive to a dimension of an article, feeding means for supplying articles to the gauging station, drive means for moving said feeding means step by step, a conveyor for receiving articles from the gauging station and transporting the articles thereupon through a series of selecting stations, means for driving said conveyor to carry an article from the gauging station through the selecting stations during the time required between successive steps of said feeding means, stop means at the selecting stations selectively operable by said gauging means into the path of movement of the articles to stop the travel of an article on the conveyor during the continued travel of the conveyor, a push bar extending along the several selecting stations, and driving means for driving said bar to remove the articles from the conveyor at the station selected by the stop means, means for operating said driving means in timed relation to the feeding means, said driving means including a cam for withdrawing the bar and a spring means opposing the cam and operable to impositively move the bar to article removing position.

3. Gauging apparatus comprising a gauging station having a generally cylindrical cavity into which cylindrical articles may be supplied one at a time, feeding means for supplying articles step by step into said cavity, a conveyor belt extending substantially horizontally from the lower side of said cavity for receiving thereupon articles pushed from the cavity by another article supplied to the cavity, a series of selecting stations along the length of said belt, stop means at the selecting stations operable into the path of movement of the articles, switch means for controlling said stop means, gauging means at the gauging station for selectively controlling said switch means, a push bar for pushing the atricles from the conveyor at the station selected by the stop means, and means for operating said push bar in timed relation to the feeding means.

4. Gauging apparatus comprising a gauging station, gauging means at the gauging station responsive to a dimension of an article, a conveyor for receiving articles from the gauging station and transporting the gauged articles thereupon, means for driving the conveyor continuously at a predetermined speed, a series of selecting stations in the path of travel of the gauged articles, a common pushing means common to all said selecting stations for pushing an article from the conveyor at any of said stations, means synchronizing the operation of said pushing means with time of supply of the gauged article to the conveyor, and a series of selecting means one at each selecting station selectively responsive to the operation of the gauging means for automatically stopping an article at a selected selecting station during the continued travel of the conveyor.

5. Gauging apparatus comprising a gauging station having gauging means, a conveyor belt for receiving articles from the gauging station and transporting the gauged articles on the uppermost surface thereof, means for driving the con-

veyor continuously at a predetermined speed, a series of selecting stations along the path of travel of the gauged articles, timing means operably connected to said gauging means and said drive means for moving the conveying surface through all the selecting stations in the interval between successive operations of the gauging means, removing means for removing the articles from the conveyor, means synchronizing the operation of said removing means with the time of supply of the gauged article to the conveyor, a series of selecting means including positive stop means, one at each selecting station, means supporting said positive stop means for movement into and out of the path of travel of the article, means connecting said series of selecting means to the gauging means for selective control thereby for automatically stopping an article on the moving conveyor belt surface and at a selected

selecting station during the continued travel of the conveyor.

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