Nov. 27, 1945. R. C. TIMM ET AL 2,390,012

INSPECTION MACHINE

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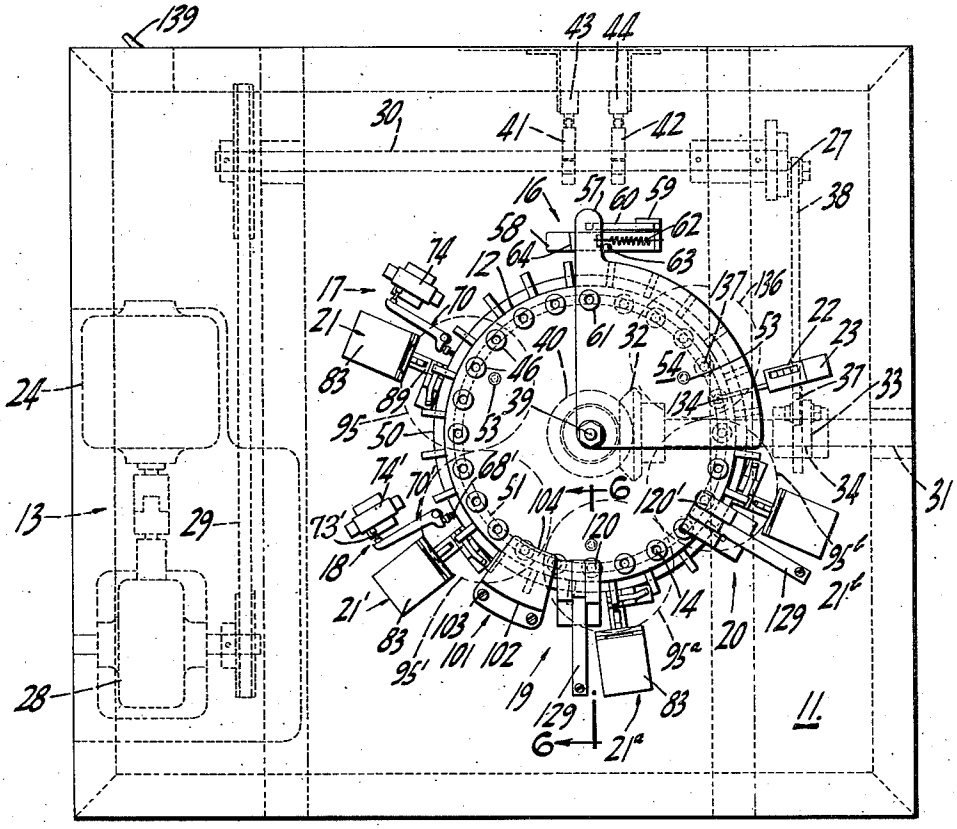


FIG. 1.

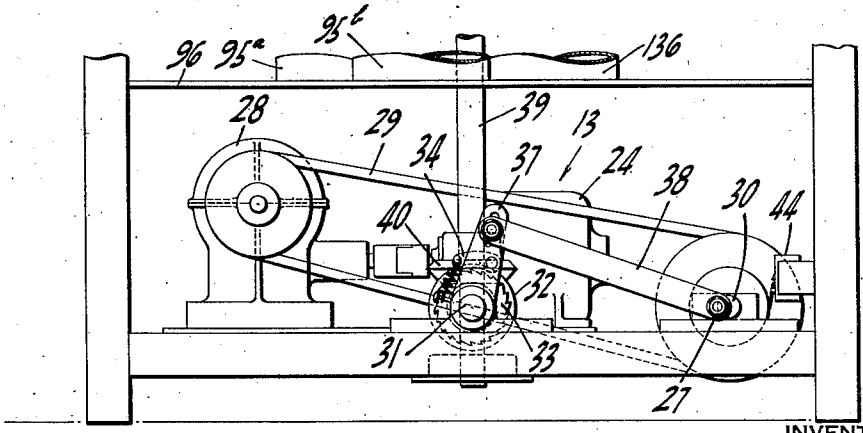


FIG. 2.

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FIG. 3.

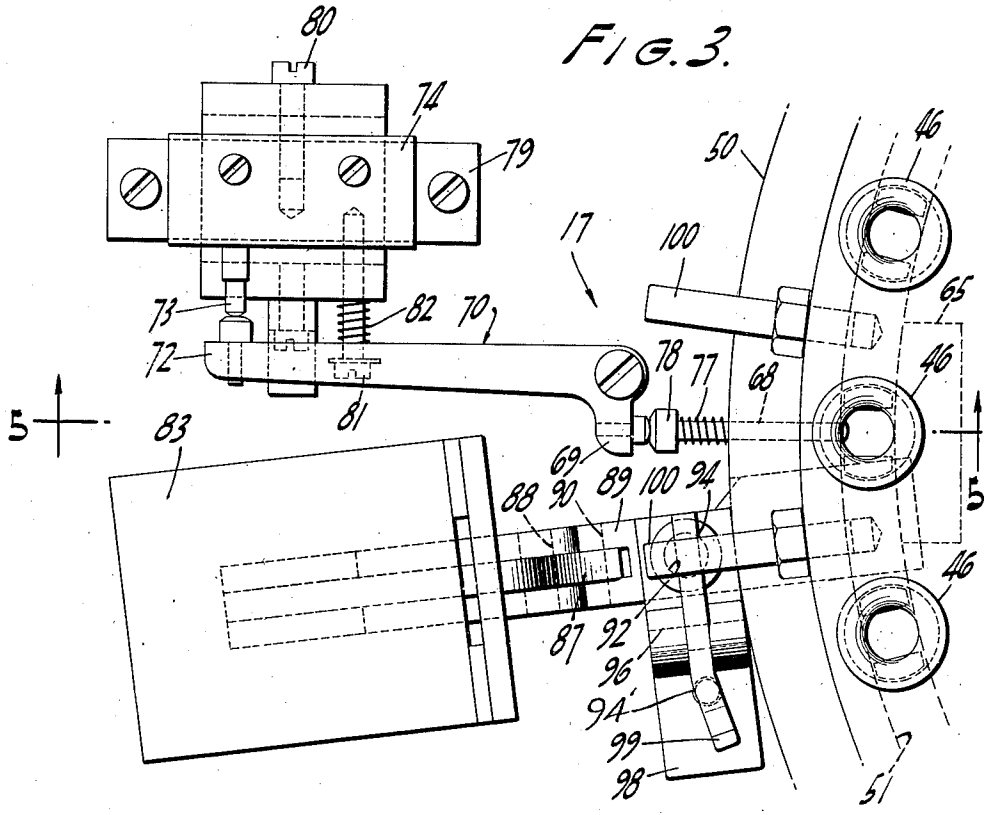
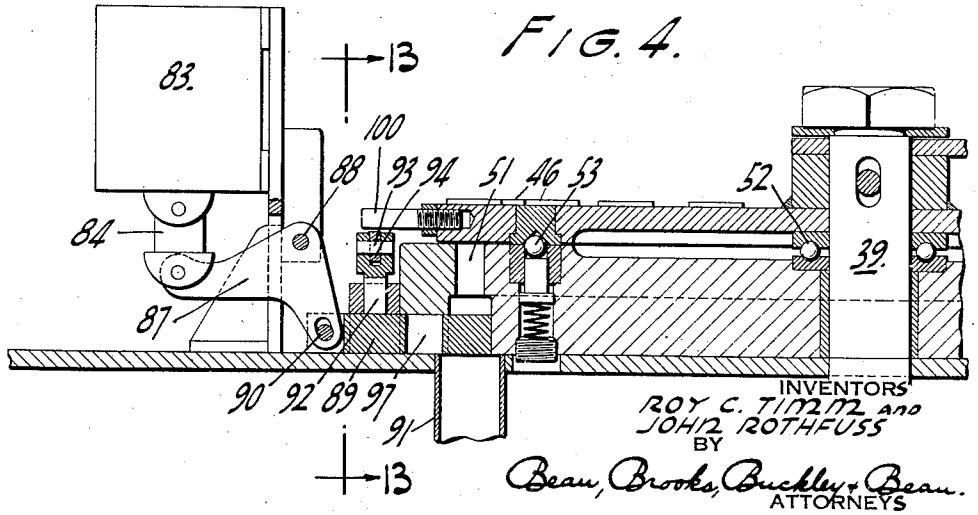


FIG. 4.



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FIG. 5.

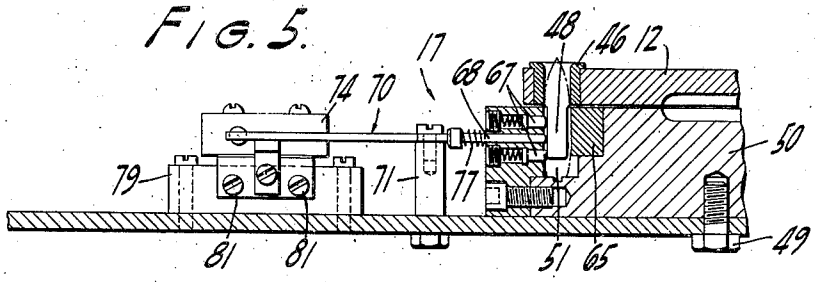


FIG. 6.

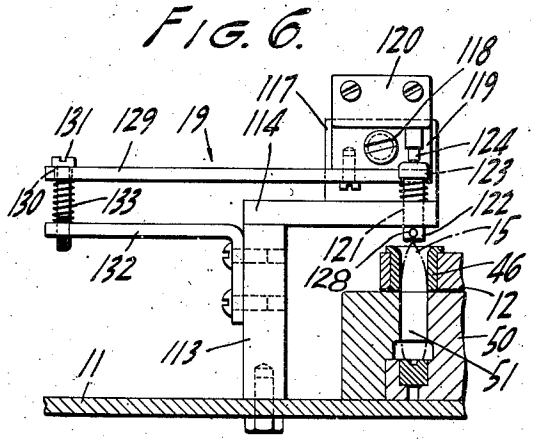


FIG. 7.

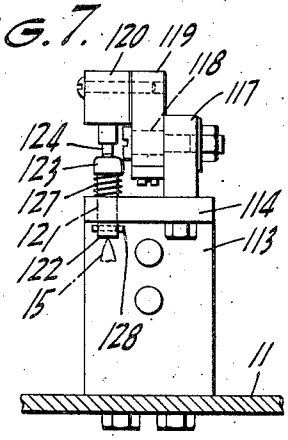


FIG. 9.

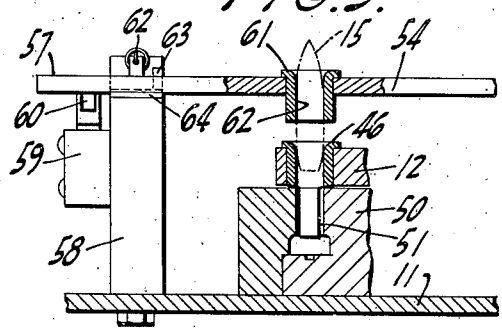


FIG. 8.

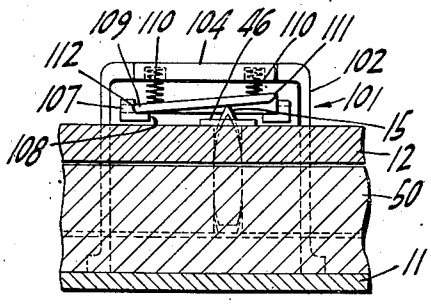
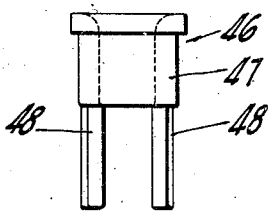


FIG. 10.



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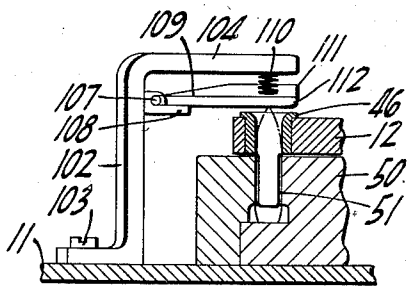


FIG. 11.

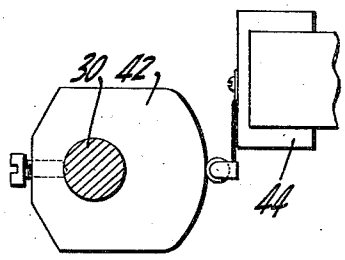


FIG. 12.

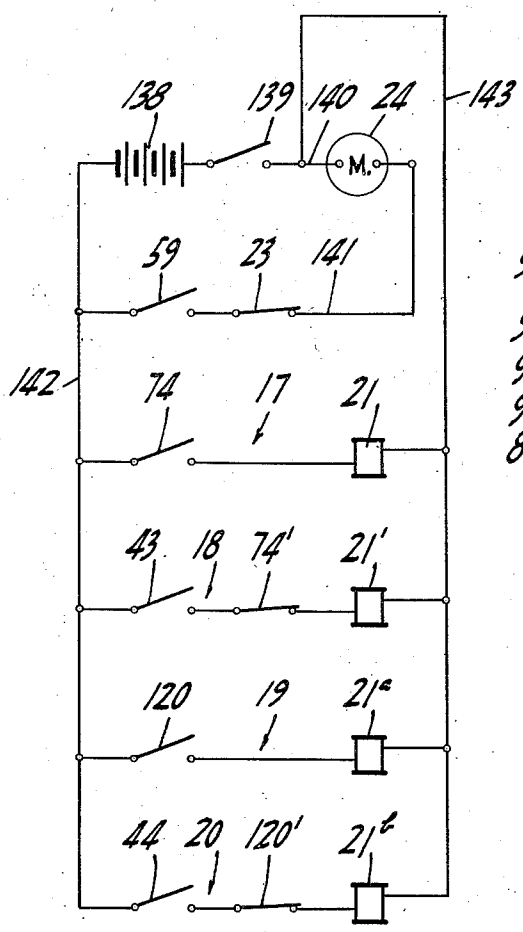


FIG. 14.

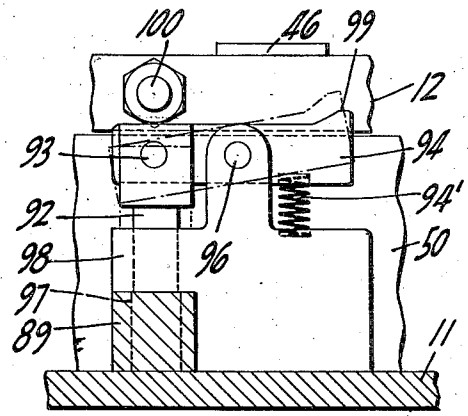


FIG. 13.

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Patented Nov. 27, 1945

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UNITED STATES PATENT OFFICE

2,390,012

INSPECTION MACHINE

Roy C. Timm, Buffalo, and John Rothfuss, Orchard Park, N. Y., assignors to Trico Products Corporation, Buffalo, N. Y.

Application November 28, 1942, Serial No. 467,252

9 Claims. (Cl. 209—88)

This invention relates to inspection machines and more particularly to the automatic type of such machines.

Its principal object is to eliminate the human factor in the inspection of mass production parts by providing efficient mechanical means whereby such parts are gauged in a practical manner to allowed tolerances and whereby those parts having any inaccuracies in their various tolerances are quickly and automatically detected and rejected. A further object is to provide a machine having in addition to the above characteristics the ability to sort the rejected parts into groups of similar inaccuracies, and a still further object to provide a machine to count the accepted parts to a predetermined number and then shut itself off. Other objects and advantages will be apparent from the following detailed description and claims.

In the drawings:

Fig. 1 is a top plan view of the invention;

Fig. 2 is a side elevational view of a driving means;

Fig. 3 is an enlarged fragmentary plan view of one of the inspection stations;

Fig. 4 is a sectional view of the rejection means thereof;

Fig. 5 is a sectional view of the inspection station taken along line 5—5 of Fig. 3;

Fig. 6 is a side elevational view of another inspection station partially in section, taken along line 6—6 of Fig. 1;

Fig. 7 is an end elevational view of the inspection station illustrated in Fig. 6;

Fig. 8 is a fragmentary sectional view of a part positioning means;

Fig. 9 is a fragmentary sectional view of the starting and feeding station;

Fig. 10 is a detailed elevational view of a part embracing element;

Fig. 11 is a side elevational view of the part positioning means;

Fig. 12 is a side elevational view of the interlocking switch means;

Fig. 13 is a view taken along line 13—13 of Fig. 4; and

Fig. 14 is a diagrammatic view of the electrical system of the machine.

The illustrated embodiment of the invention comprises a table 11 upon which is mounted a part carrier 12, herein illustrated as a disc, for receiving increments of rotative movements by a drive means 13. On the carrier 12 at selected intervals are a plurality of work piece holders herein illustrated in the form of openings 14 for embracing or supporting a work piece 15, such as a bullet core. Fixed to the table about and adjacent the periphery of the carrier is a starting and feeding station 16 and a plurality of inspection or gauging stations 17, 18, 19 and 20, each of said gauging stations having an automatic rejection device 21, 21', 21*a* and 21*b* respectively, associated therewith. The numeral 22 designates a counter for enumerating the accepted cores and 23 denotes an automatic switch for shutting off the machine at a predetermined number.

The general sequence of the machine's operation is as follows. A part, or bullet core, is fed into the carrier at the feeding station and is rotated by increments to the various inspection stations where they are gauged. Station 17 gauges for oversize diameter, station 18 for undersize diameter, station 19 for oversize length, and station 20 for undersize length. When a core successfully passes all these stations it is counted at station 22 and dropped through an opening in the table into its designated receptacle. If the core does not pass inspection at any one of the gauging stations the coacting rejection device associated with that particular station is automatically actuated and the core will fall through a trap door into a designated receptacle for that station. A more detailed description of this illustrated embodiment of the invention follows.

The drive means 13 is located beneath the table 11 and comprises a motor 24 for rotatively driving an eccentric 27 through a speed reducer 28, belt drive 29 and a horizontal countershaft 30. A second horizontal countershaft 31 laterally spaced from the first has a bevel gear 32 fixed to its inner end and is intermittently driven by a ratchet 33 mounted thereon and a pawl 34 pivotally carried by a finger 37 which is connected to the eccentric 27 for oscillatory reciprocation by a connecting rod 38. Extending upwardly through the table 11 and having a driving connection with carrier 12 is a central vertical shaft 39 which receives the intermittent motion of the gear 32 through an intermeshed bevel gear 40. The countershaft 30 has fixed thereon a pair of cams 41 and 42 for actuating a pair of interlocking micro-switches 43 and 44, respectively, the function of which will be described later.

The openings 14 in the carrier 12 have fitted therein part embracing elements 46 of hardened metal, comprising a tubular seat portion 47 and a pair of depending part embracing fingers 48. Beneath the carrier 12 and fixed to the table 11 by bolts 49 and of complementary disc shape is a platform 50 having a circular channel or guide-

way 51 into which the fingers 48 depend. An anti-friction bearing 52 mounted on the platform 50 about the shaft 39 supports the carrier 12 slightly spaced above the platform to allow free rotation thereof. However, to assure positive positioning of the carrier at each station, a plurality of spring and ball detent means 53 are provided.

The starting and feeding station comprises a quadrant shaped member 54 pivotally connected to the shaft 39 having a finger 57 extending radially therefrom and resting upon a supporting pedestal 58. The quadrant shape of this member provides a covering for a part of the carrier 12 to protect the operator from being injured by moving parts. On the side of the pedestal 58 is fastened a normally open micro-switch 59 having its actuating lever 60 extending beneath and actuated by the finger 57 when the finger is in the position shown in Fig. 1. A guiding sleeve 61 having an opening 62 is fitted into the part 54 in a position to register with one of the parts 46 when the carrier is held at rest by the detent means 53. It is through this sleeve that the cores 15 are fed into the parts 46 to be advanced by the carrier 12 to the various gauging stations. By making the opening 62 of this sleeve to a definite tolerance it acts as a preliminary oversize diameter gauging station and by making the distance from the bottom of the guideway 51 to the bottom of the sleeve a predetermined length it acts as a pregauging means for oversize length. When a core is of a size to pass through this preliminary gauging station but is too large to be completely received by the part 46 it serves as a means to lock the member 54 with the carrier 12 as shown by the broken line position of the core in Fig. 9. When this occurs the next increment of movement of the carrier 12 will rotate the member 54 about the shaft 39 and away from contact with the switch actuating lever 60 thereby releasing the lever which breaks the circuit and shuts off the motor 24 for stopping the machine. If the core is longer than the distance between the bottom of the guideway and bottom of the sleeve it will likewise interlock the carrier with the finger and shut off the machine on the next increment of movement. A tension spring 62 normally holds the finger 57 in position against a stop 63 on the pedestal whereby sleeve 61 is held in its operative registry with the parts 46. When the finger is rotated as described above it drops behind an abutment 64 on top of the pedestal which holds it against the spring tension. When the carrier is cleared of the locked condition a slight upward push by the operator will permit the finger to snap back to its operative position against the stop 63 actuating the switch 59 and starting the carrier moving again. At the termination of each increment of rotation a new core is dropped into the carrier through the sleeve 61.

When the core is the correct size to be received by the part 46 of the carrier 12 it is moved around to the first inspection station 17 for gauging oversize diameters. On its arrival a pair of spring pressed plungers 67 (Fig. 5) acting between the fingers 48 of the part 46 engages the core to position it firmly against a hardened insert 65 in the back wall of the channel 51. The gauging operation is accomplished by means of a plunger 68 located in this embodiment between the pair of spring pressed plungers 67 and having its inner tip extending into the channel 51 a sufficient distance to allow a core of the maximum allowed tolerance to pass between the tip and the hardened insert without actuating it. Should the core be oversize, the plunger would be pushed outwardly against a short arm 69 of an amplifying bell crank lever 70 which is pivotally mounted on a pedestal 71. The long arm 72 of the lever 70 would increase or amplify the movement of the plunger a sufficient amount to actuate the contactor 73 of a micro-switch 74 which is normally open. The plunger 68 is normally held out against the short arm of the lever by a light compression spring 77 positioned around the plunger between a head 78 on its outer end and the outer periphery of the platform 50. To vary the maximum allowed tolerance of the part to be gauged the micro-switch is slidably mounted on a block 79 by means of adjusting screws 80, 81. By backing off screw 80 the switch is urged away from the long arm 72 of the lever 70 by springs 82 on the screws 81 allowing the light spring 77 to move the tip of the plunger outwardly of the channel until the long arm 72 again contacts the switch contactor 73 thereby increasing the allowed maximum tolerance. To decrease this tolerance the reverse procedure is followed. Screw 80 is turned inwardly pressing the switch 74 against the tension of springs 82 and the switch contactor 73 against the long arm 72. This rotates the lever 70 counterclockwise against the plunger 68 thereby pressing it inwardly of the channel 51 against spring 77 thereby decreasing the allowed tolerance.

The closing of switch 74 by an oversize core actuates an indicator or other device such as a solenoid 83 of the rejection station 21 associated with station 17. Actuation of this solenoid causes its plunger 84 to be drawn upwardly thereby rotating a bell crank 87 clockwise about its pivot 88 to withdraw a gate 89 pivotally connected thereto at 90, from the channel 51 and allowing the oversize core on the next increment of movement to drop through a chute 91 to a receiver 95 located on a platform 96 positioned beneath the table 11.

To hold the gate 89 open until the rejected core drops through it, a latch pin 92 freely pivoted at 93 to a rocker arm 94 is positioned to drop into an opening 97 in the gate 89 when the latter is withdrawn from the channel. The rocker arm 94 is pivotally mounted at 96 on a block 98 fastened to the table 11 adjacent the periphery of the carrier 12 and is provided at its outer end with an upstanding cam surface 99. A coil spring 94' normally urges the pin 92 downwardly and the cam surface upwardly into the path of fingers 100 extending radially from the carrier 12 which on the next increment of movement will contact the sam surface 99 thereby depressing the outer end of the rocker arm and raise the pin from the opening to release the gate for closing under the urge of the solenoid spring (not shown). If the core is within the allowed maximum tolerance it will pass by station 17 without actuating the trap door 89 but continue over it to the next inspection station 18.

Station 18 is for gauging cores of undersize diameter and is similar in construction to the previous station 17 with the exceptions that the micro-switch 74' is normally closed and the plunger 68' is set so that the distance between the back of the channel and the tip of the plunger is equal to the minimum allowed tolerance. A rejection station 21' exactly the same as that previously described is associated with this station for rejecting undersize cores. Connected in series with the micro-switch 74' is the previously mentioned interlocking micro-switch 43 which latter is normally open. When the core reaches

station 18 it is within the allowed maximum tolerance but it may or may not be within the allowed minimum tolerance. Considering first, that the core is within minimum tolerance the plunger 68' is actuated and through the amplifying bell crank 70' and switch contactor 73' opens the switch 74'. At the same time cam 41 on countershaft 30 closes the interlocking switch 43 but because switch 74' is now open the associated rejection station 21' is not actuated and the core moves over the trap door to the next station. On the other hand if the core is undersize it would not actuate the plunger 68' thereby leaving the switch 74' closed and as the interlocking switch 43 is in series with switch 74' and has been closed by the cam 41 when the core reaches this station, the associated rejection station 21' is actuated, thereby opening the trap door, and the core drops through a chute (similar to chute 91) on the next increment of movement to the associated receiver 95'.

Interposed between stations 18 and 19 is a device 101 for assuring positive seating of the core on the channel floor in preparation for length gauging at stations 19 and 20. This seating device comprises a vertical standard 102 fastened to the table 11 by screws 103, and an inturned bracket part 104 overhanging the embracing elements 46 as they pass therebeneath. Pivotally mounted at 107 on the standard 102 and supported by lugs 108 in a substantially horizontal plane between the bracket part 104 and the immediately underlying element 46 is a plate 109 held in its lowermost position against the lugs 108 by compression springs 110. The outer active portion of this plate is formed or disposed at an incline so that its leading edge 111 will be of sufficient height above the channel floor to allow the introduction of a core of more than the desired maximum length while the trailing edge 112 will be of sufficient height above the channel floor to press cores of less than the desired minimum length firmly thereagainst. As viewed in Fig. 8 a core is shown beneath the plate 109 in full lines as being unseated from the channel floor. As the carrier is rotated, to the left in this view, the core will be pressed downwardly by the underside of plate 109 until it is seated on the channel floor. Then if the core is longer than the distance between the trailing edge 112 and the channel floor the plate will pivot upwardly against the springs 110 allowing the core to pass beneath it to station 19.

Inspection station 19 (Figs. 6 and 7) is for gauging oversize length cores and comprises a vertical standard or pedestal 113 having a horizontal bracket part 114 overhanging the carrier 12 and the adjacent elements 46. Fixed to the part 114 is a second pedestal 117 having pivotally mounted thereon at 118 a block 119 carrying a micro-switch 120. Also mounted on the part 114 and located directly over an element 46 when the latter is at rest is a plunger 121 having its lower end 122 at a height above the channel floor equal to the desired maximum allowed length, and its headed upper end 123 held in contact with switch contactor 124 by a light compression spring 127 positioned around the plunger 121 between its headed upper end 123 and part 114. To prevent the plunger from becoming accidently displaced from part 114 a pin 128 is provided. A means for varying the allowed maximum length tolerances is provided by the elongated adjusting lever 129 which is fastened at one of its ends to the underside of the pivotally mounted block 119. The other end has an opening 130 through which an adjusting screw 131 passes and screws into an underlying co-extensive arm 132 rigidly mounted on the pedestal 113. A spring 133 holds the lever 129 upwardly against the head of the screw 131. To vary the allowed tolerance of the maximum length of the core the adjusting screw 131 is turned inwardly or outwardly of the part 132 thereby rotating the block 119 about its pivot 118 in a counterclockwise or clockwise direction as viewed in Fig. 6. Rotation of block 119 carrying switch 120 moves the contactor 124 upwardly or downwardly thereby allowing the spring to raise the plunger to increase the distance between its tip 122 and the bottom of the channel or forcing plunger 121 downwardly to decrease the said distance.

Actuation of the plunger 121 by an overlength core operates the associated rejection station 21*a*, which is exactly similar to the previously described rejection stations 21 and 21' and allows the core to drop through the trap door to the associated receiver 95*a*. If the core is within the maximum tolerance the trap door remains closed and the core passes over it to the next inspection station 20.

Inspection station 20 is for gauging undersized length cores and is exactly similar in construction to the previously described station 19 except that the distance between the tip 122 of the plunger 121 and the floor of the channel is set for the minimum allowed tolerance and the micro-switch 120' is normally closed. To vary this tolerance the same procedure as described for the above station 19 is followed. In its operation this station is similar to the operation of station 18. Connected in series with micro-switch 120' is the previously mentioned normally open interlocking micro-switch 44 for operating the associate rejection station 21*b*. During the time the core is at this station the cam 42 holds the switch 44 closed. When the core reaches this station it is within the maximum allowed tolerance but may or may not be within the allowed minimum tolerance. If the core is within this desired tolerance a plunger (similar to plunger 121) is actuated thereby opening switch 120' and preventing the rejection station from operating. If the core is less than the minimum allowed tolerance it will not actuate the switch 120' but allow it to remain closed. As the interlocking switch 44 is closed when the core is at this station, they are now both interlockingly closed thereby operating the rejection station 21*b* to open the trap door and the core drops through chute 91 on the next increment of movement to an associated receiver 95*b* for that station.

When a core has passed all of the inspection stations successfully, further rotation of the carrier brings it into actuating contact with one end of a lever 134 of the counter 22. The other end of the lever 134 actuates the counting mechanism, of the counter 22, to register each accepted part. The counter 22 may be set to open the switch 23 at a predetermined number of accepted parts thereby shutting off the machine. Further rotation of the carrier brings the accepted core into registry with an opening 137, in the platform 50, through which it drops into an associated receptacle 136 for accepted cores.

Referring to the wiring diagram illustrated in Fig. 14 one side of the motor 24 is connected to a source of electrical energy 138 through a manual switch 139 by conductor 140, the other

side of the motor being connected to the source of energy through micro-switches 23 and 59 by connectors 141 and 142. Stations 17 and 19 are connected to the source of energy 138 respectively through their switches 74, 120, and their solenoids 21, 21a by conductors 142 and 143. Stations 18 and 20 are connected to the source of energy 138 respectively through their switches 74', 120', their interlocking switches 43, 44 and their solenoids 21', 21b by connectors 142 and 143.

In the foregoing description the inspection of one core has been followed through the various inspection stations to its final counting and acceptance. However it should be understood that at each increment of rotative movement of the carrier, another part or core is placed therein, through the starting station, to follow the previous one through the various inspection stations. Thus it can be seen that all of the various stations are each performing its gauging function at the same time but on different pieces.

This series of inspection stations has been illustrated and described by way of example. However, it should be understood by varying the number of stations and the positions of the switch actuators, that numerous other gaugings may be made by simple changes in the carrier and that a variety of parts may be inspected. Thus it can be understood that the applicants do not wish to be restricted by the above specific description but only by the scope of the appended claims.

What is claimed is:

1. A mass production parts inspection machine comprising a table, a platform fixed thereon having a guideway in its upper face, a carrier pivotally mounted over the platform and having a plurality of part embracing members fixed therein adjacent the periphery thereof, each of said part embracing members having fingers depending into said guideway for steadying its embraced part, means for pregauging the parts to be inspected and presenting the same successively into the part embracing members whereby each part may depend into the guideway, a plurality of gauging stations comprising oversize and undersize diameter gauging stations having gauging means extending into the said annular groove, oversize and undersize length gauging stations having gauging means overlying the part embracing member, means between the diameter and the length gauging stations for favorably positioning said parts for their length inspection, and means for rotating said carrier whereby the parts may be presented to each of said stations.

2. An inspection machine for elongated parts comprising a table, a fixed platform having a guideway in its upper face with opposed walls, a carrier movably mounted over the platform and having a plurality of part embracing members fixed therein adjacent the periphery thereof, each of said part embracing members having spaced fingers depending between the opposed walls of said guideway for steadying and supporting its embraced part fore and aft in an upended position, means for feeding the parts to be inspected successively into the part embracing members whereby each part may depend into the guideway between the fingers, a diameter gauging station having gauging means extending into the guideway to contact the part exposed between the fingers for gauging the same, and means for moving said carrier whereby the parts may be presented successively to such station.

3. An inspection machine comprising a movable carrier having a plurality of article supporting seats, inspection means arranged adjacent the path of movement of the carrier for acting upon the articles as successively presented thereto by the carrier, means operable to intermittently move the carrier for so successively presenting the supported articles to the inspection means, means for arresting the carrier moving means, means for selectively feeding the articles to their seats on the carrier, said selective means being mounted for limited movement by the carrier by and during the failure of the selective means feeding its article fully to the carrier, and means operable by the carrier imparted movement of the selective means for actuating said arresting means.

4. A parts inspection machine comprising a movable carrier having part receiving openings therein, means for operating the carrier including a shutoff device, a movable member overhanging said carrier having an opening adapted to register with an underlying carrier opening through which a part is fed into such registering carrier opening, said member adapted to suspend an oversize part in a position from which it extends into the registering opening of the carrier for coupling said member to the latter for being driven thereby, and means operable by and during the carrier imparted movement of the movable member for actuating the shutoff device.

5. A parts inspection machine comprising a movable carrier having part receiving portions for supporting elongated parts upright on end to be inspected, means for moving the carrier, a diameter inspection station comprising gauging means for actuation by the upright part as it is presented to the inspection station by the carrier, a length inspection station comprising gauging means and an actuator for the latter overhanging the part receiving portions for actuation by the upright part during movement of the latter therebeneath for gauging the length of the part, and means interposed between the two inspection stations operable to axially shift any misplaced part for favorably positioning the part for its length inspection.

6. An inspection machine for elongated parts comprising a stationary guideway having opposed walls between which the parts are disposed on end in an upright position, a movable carrier having part receiving portions overhanging said guideway for supporting the parts to be inspected whereby the parts will be guided by the guideway during movement of the carrier, a diameter inspection station comprising gauging means for actuation by the part as it is presented to the inspection station by the carrier, said carrier portions having fore and aft steadying fingers depending into the guideway for supporting the part on end during gauging operation, and means for moving said carrier.

7. A parts inspection machine comprising a stationary guideway, a movable carrier having part receiving portions overhanging said guideway for supporting the parts to be inspected whereby the parts will be guided by the guideway during movement of the carrier, a length inspection station comprising gauging means overhanging the part receiving portions for actuation by the part during movement of said carrier, means for pregauging the thickness of the

parts presented to the carrier, said pregauging means adapted to be coupled to the carrier by an oversize part for moveemnt thereby, and means for operating the carrier including a shut-off device, said pregauging means operating to actuate the shut-off device by and during the carrier imparted movement.

8. A machine for inspecting parts, comprising a platform having a guideway with opposed side walls and a part supporting bottom wall, a carrier overlying the guideway and movable in the direction of extent thereof, said carrier having a seat through which a part may be guided to rest on end in the guideway, said seat having fingers depending into the guideway fore and aft of the part to support the latter upright therein while the carrier is in motion, and a gauging station having a part engaging plunger mounted in a side wall of the guideway for gauging contact with the part between the fingers.

9. A machine for inspecting parts, comprising a platform having a guideway with opposed side walls and a part supporting bottom wall, a carrier overlying the guideway and movable in the direction of extent thereof, said carrier having a seat through which a part may be guided to rest on end in the guideway, said seat having fingers depending into the guideways fore and aft of the part to support the latter upright therein while the carrier is in motion, a gauging station having a part engaging plunger mounted in a side wall of the guideway for gauging contact with the part between the fingers, means for operating the carrier to bring the part to rest opposite the plunger for such gauging contact therewith, and means adjacent the plunger for engaging the part at points above and below the plunger to poise the part for such gauging contact when so arrested.

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