April 13, 1965 E. C. HANNA 3,178,002

APPARATUS FOR ORIENTING WORKPIECES

Filed Dec. 17, 1962 3 Sheets-Sheet 1

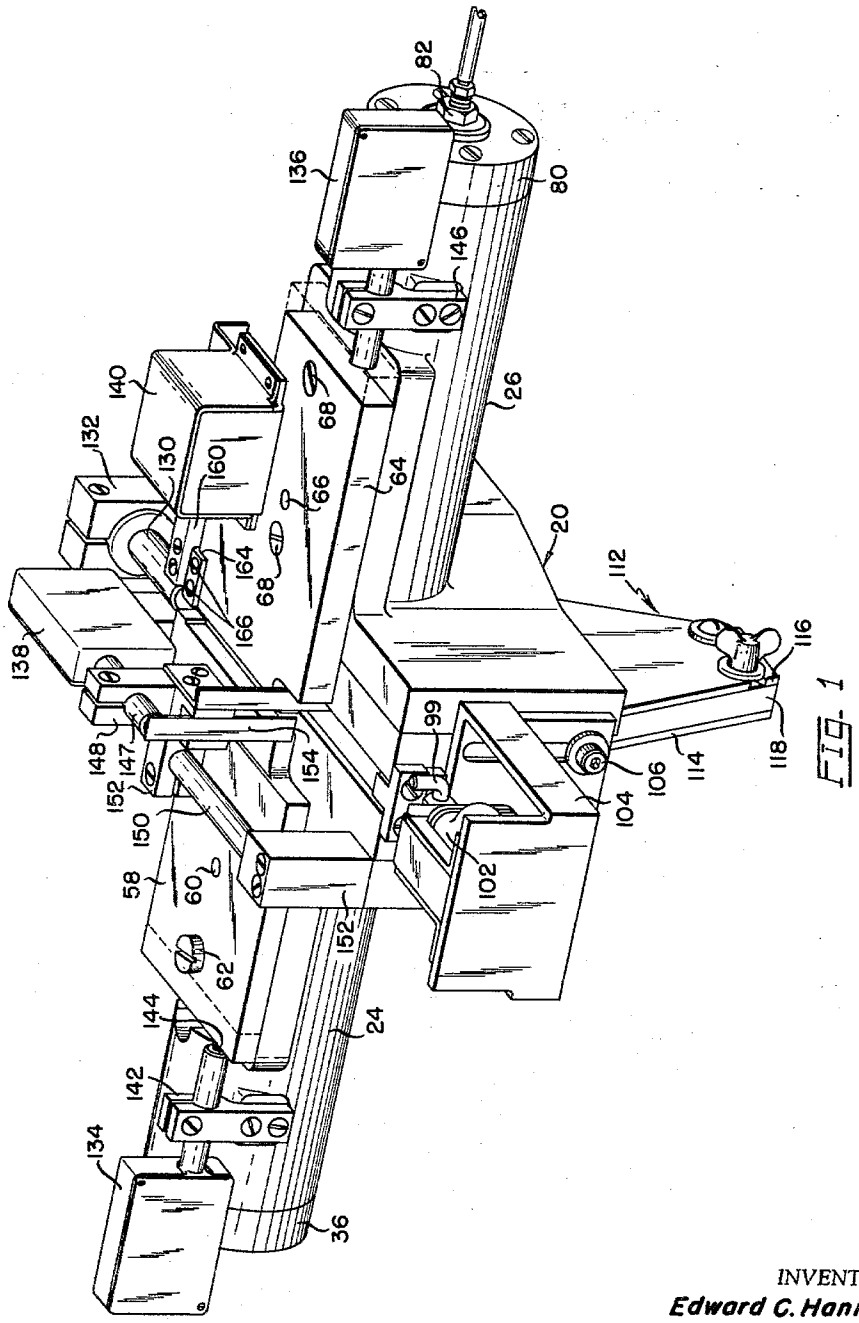


FIG. 1

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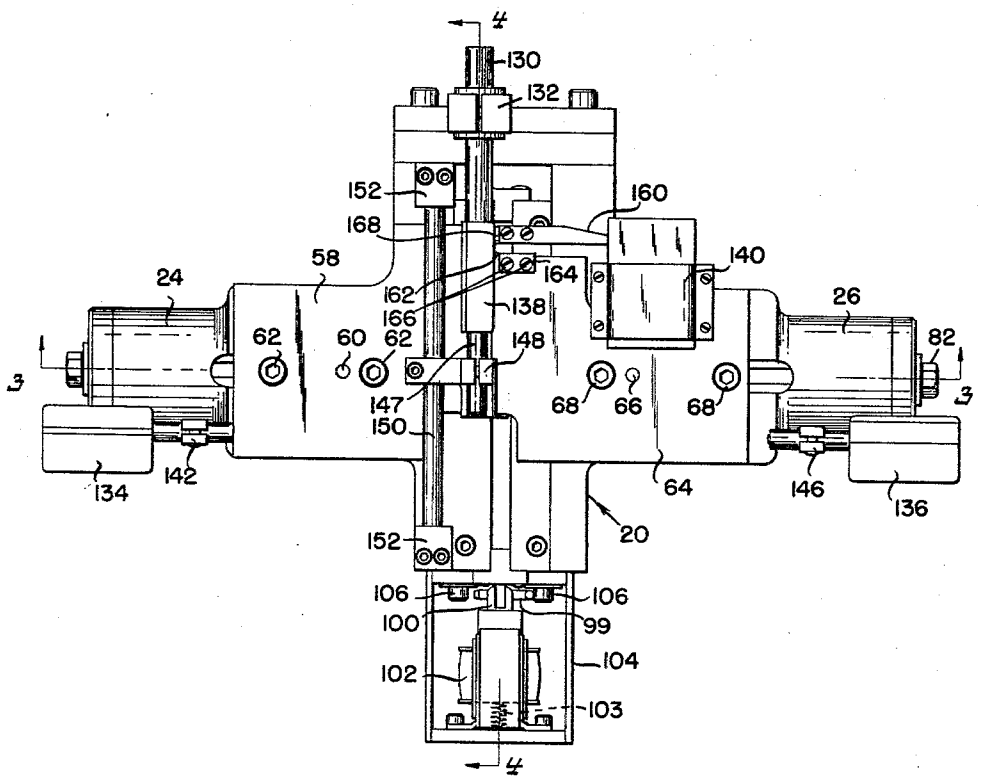


FIG. 2

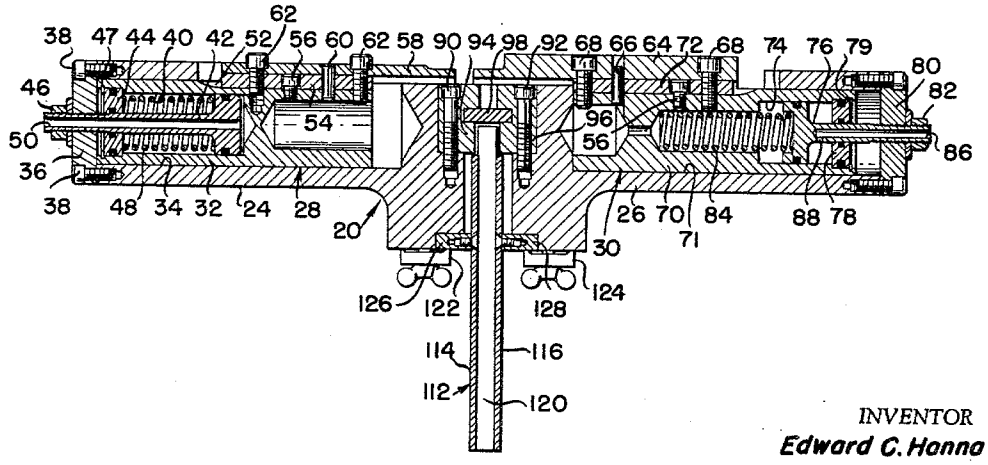


FIG. 3

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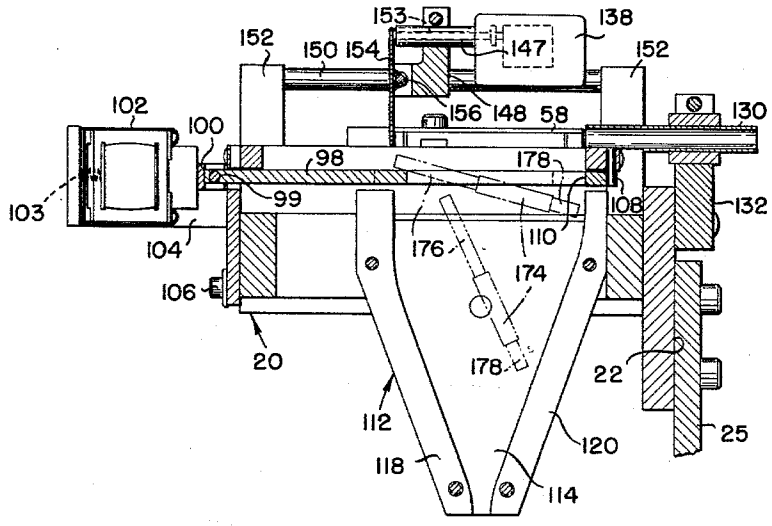


FIG. 4

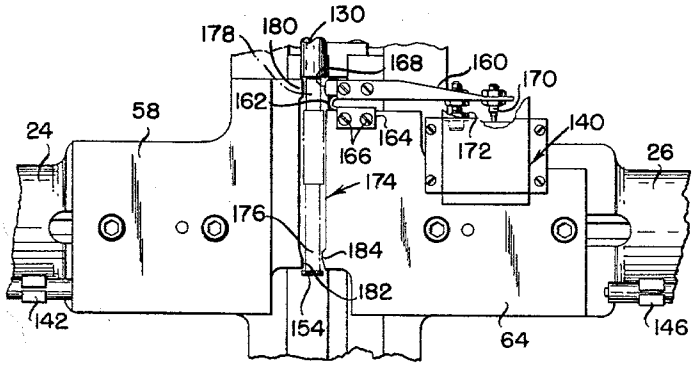


FIG. 5

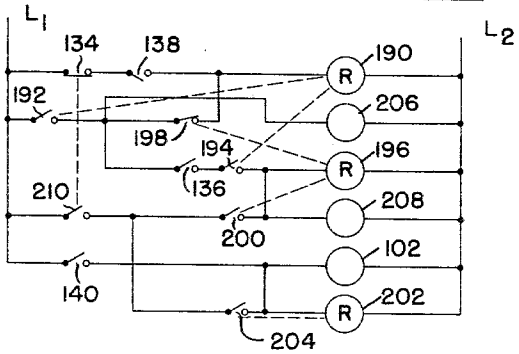


FIG. 6

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3,178,002

APPARATUS FOR ORIENTING WORKPIECES

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8 Claims. (Cl. 193—43)

This invention relates to apparatus for orienting workpieces and has particular utility in the orientation of elongated workpieces to assure the presentation of the proper end of the workpiece to automatic forming mechanism, for example, mechanism for threading the ends of the workpiece.

Quite frequently studs are produced with a coarse pitch thread on one end and a fine pitch thread on the opposite end. The blanks from which such studs are made include end portions extruded or otherwise formed to approximately the pitch diameter of the thread to be formed thereon. The slight difference in pitch diameter of the coarse and fine pitch threads is reflected in a slight difference in the diameters of the end portions of the work blank. In practice this difference in diameters may be as little as .003".

It is nevertheless essential that the end of the blank prepared for the coarse thread, for example, will always arrive between the coarse thread dies. Because of the very slight difference in diameters of the opposite ends of the workpiece, the orientation of a random group of such workpieces as they are fed to automatic threading apparatus could not be effected reliably with prior mechanisms.

With these considerations in mind, it is the principal purpose and object of the present invention to provide improved apparatus for orienting workpieces in which the orientation is effected in response to dimensional differences to which prior mechanisms were not reliably sensitive.

It is a further object of the present invention to provide improved apparatus for orienting workpieces which operates with sufficient speed to be compatible with the requirements of high speed work forming apparatus.

It is also an object of the present invention to provide improved workpiece orienting apparatus which is of rugged, relatively simple, mechanical construction and which has an extended trouble-free service life.

It is an additional object of the present invention to provide improved workpiece orienting apparatus which may be readily adapted to orient a wide variety of headless parts having a minimal distinction between their opposite ends.

In achieving these and other objects, the present invention provides apparatus for receiving a series of work blanks, for example, elongated cylindrical workpieces having end portions of slightly different size, means for moving these workpieces to a sensing or measuring station where the ends of the workpiece are "measured." The measuring or sensing apparatus includes means for magnifying the difference in size of the ends of the workpiece sufficiently to permit the actuation of apparatus for delivering the workpieces to a feed chute with a preselected end foremost.

Additional objects and advantages of the present invention will become apparent as the description proceeds in connection with the accompanying drawings in which:

FIGURE 1 is a perspective view of an embodiment of the workpiece orienting apparatus constructed in accordance with the present invention;

FIGURE 2 is a top plan view of the apparatus of FIGURE 1;

FIGURES 3 and 4 are vertical sections taken along lines 3—3 and 4—4, respectively, of FIGURE 2;

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FIGURE 5 is a fragmentary top plan view of a portion of the apparatus shown in FIGURE 2; and

FIGURE 6 is a circuit diagram of one form of automatic control apparatus for the mechanism.

Referring now more particularly to the drawings, the apparatus of the present invention is intended for use with a conventional feeder assembly, for example, a vibratory feeder. Accordingly, the base or frame assembly 20 which supports the principal operating components of the mechanism is provided with a flat rear surface 22 adapted to be secured by any suitable means to a support column 25 adjacent the feeder outlet.

The base assembly 20 is also provided with aligned lateral extensions 24 and 26 which support respective power cylinder assemblies 28 and 30. The assembly 28 includes a cylinder member 32 slidably received with a close clearance fit within a cylindrical bore 34 in the body extension 24, the outer end of the bore 34 being closed by a cap 36 detachably held in place by screws 38. The cylinder member 32 is provided with a blind cylindrical bore 40 which slidably receives a piston assembly 42, the piston rod portion of which extends through an inner cap member 44 and is ridigdly secured to the main cap 36 by a nut 46. Cap member 44 is held against a shoulder in bore 40 by a snap ring 47. Thus the piston assembly 42 is held immovable while the cylinder member 32 is urged to the left as viewed in FIGURE 3 by a compression spring 48 and is urged to the right by any suitable operating fluid which is supplied to and removed from the area at the right of the piston assembly 42 through a central bore 50 in the piston. The application of fluid pressure through the bore 50 is controlled by automatic means described below.

The upper surface of the cylinder member 32 is provided with an accurately mechined keyway 52 to which a key 54 is secured by a screw 56. An essentially flat caliper slide plate 58 is secured to the key 54 in accurate alignment therewith by a pin 60 and a pair of screws 62, each of which also extend into the cylinder member 32. The laterally projecting portions of the caliper slide 58 ride on flat machined surfaces formed on the upper portion of the lateral body extension 24.

A complementary caliper slide block 64 is similarly secured by a pin 66 and screws 68 to the cylinder member 70 of the power assembly 30, a key 72 again being provided to assure accurate alignment of the parts. The cylinder member 70 which is slidably received in a bore 71 in base extension 26, is bored as at 74 to slidably receive the head of a piston assembly 76. The rod portion of the piston assembly extends through an inner cap member 78 which is held in place by a snap ring 79, and outwardly through cap member 80 to which it is rigidly secured by a nut 82. The cylinder assembly 70 is urged to the left as viewed in FIGURE 3 by a compression spring 84 and is urged to the right by the application of fluid pressure through a bore 86 in the piston assembly 76, the bore 86 communicating with the space at the right of the piston head through an opening 88. Again the application and relief of fluid under pressure through the bore 86 is controlled by automatic means to be described below.

With continued reference to FIGURE 3, the inner ends of the lateral base extensions 24 and 26 are spaced apart to provide an essentially open vertical throat through which the workpieces are delivered after orientation. Received in the upper end of the throat and held in place by screws 90 and 92 are a pair of guide blocks 94 and 96 which support a shuttle 98 for horizontal movement in a direction normal to the axes of the path of movement of the slide caliper blocks 58 and 64. The forward projecting end of the shuttle 98 is connected by a removable

pin 99 to the armature 100 of a solenoid assembly 102 carried by a bracket assembly 104 secured by screws 106 to the projecting forward portion of base assembly 20. The solenoid assembly 102, which is a commercially available item, includes an internal spring 103 which is effective when the solenoid is de-energized to urge the shuttle member 98 to the right as viewed in FIGURE 4 against stop 108 suitably secured to the base assembly 20. When the solenoid is energized, the shuttle 98 is moved to the left to dispose a central aperture 110 in the shuttle in the dotted line position shown in FIGURE 4.

As explained in detail below, the position of the shuttle determines the orientation of the workpieces as they fall vertically into a chute assembly 112 for delivery to the subsequent threading or other work forming mechanism. The chute assembly 112 comprises a pair of flat, V-shaped side plates 114 and 116 which are detachably secured to end strips 118 and 120, the upper ends of which are spaced apart a distance determined by the dimensions of the workpiece. To accomodate workpieces of different lengths, the end strips 118 and 120 may be replaced by other similar members having different dimensions.

The chute assembly 112 is mounted for easy detachment from the remainder of the assembly by clamps 122 and 124 which engage plates 126 and 128 projecting laterally outward from the sides of the chute assembly 112.

As shown in FIGURE 3 the adjacent edges of the caliper slide blocks 58 and 64 are spaced apart to provide a workpiece receiving throat which is laterally offset from the shuttle 98 and the upper end of the chute assembly 112. Workpieces are fed to this area by any suitable means such as a vibratory feeder through an inlet tube 130 adjustably positioned at the rear of the mechanism by a clamp assembly 132.

The operation of the device is controlled by four microswitch assemblies indicated generally at 134, 136, 138 and 140. Switch 134 is adjustably mounted by a suitable clamping mechanism 142 on the body extension 24 to position its actuating pin 144 in the path of the rear edge of the slide plate 58. The switch assembly 136, which controls the position of the complementary caliper slide block 64, is adjustably mounted by a suitable clamping mechanism 146 to dispose its actuating pin (not shown) in the path of the rear edge of the side block 64. Switch 136 is open except when the slide block 64 occupies its fully retracted position.

Plunger housing 147 of switch assembly 138 is adjustably carried by a clamp 148 which is in turn mounted for adjustment along a rod 150 supported at its opposite ends by blocks 152 which project upwardly from the base assembly 20. Switch 138, which is normally open, is closed by a pin 153 actuated by a lever 154 which is mounted for limited rocking movement on a pin 156 carried by the bracket 148. The lever 154, which normally occupies a substantially vertical position is rocked slightly in a clockwise direction as viewed in FIGURE 4 when the lower end of the lever 154 is contacted by the leading edge of a workpiece fed into the apparatus through the inlet tube 130. Since the pieces may be delivered with considerable force, the rocking movement of the lever 154 is limited by contact with fixed plunger housing 147 to protect the microswitch assembly 138 and to provide a solid surface against which the leading edges of the workpieces may abut.

As best shown in FIGURE 5, the microswitch assembly 140 is adjustably secured to the upper surface of the caliper slide 64. The switch 140 is normally open and is closed by a lever 160 which includes a U-shaped spring portion 162 and mounting portion 164 secured by screws 166 to the upper surface of the caliper slide block 64. As explained below, the lever 160 which normally occupies the position shown in FIGURE 5 is moved in a clockwise direction when a hardened anvil 168, carried by the inner end of the lever 160 is contacted by the larger of the two ends of the workpiece. It will be apparent that only a very small movement of the anvil 168 is required to displace the opposite end of lever 160 sufficiently to actuate the switch 140. The position of the anvil 168 can be adjusted with extreme accuracy to provide an extraordinarily high degree of sensitivity. Also the actuating plunger 170 carried by the free end of the lever 160 can be adjusted within very close limits to assure proper operation of the switch 140. To prevent damage to the switch, an adjustable abutment 172 is also provided on the lever 160 which abuts a suitable surface on the switch housing 140 or the caliper plate 64.

While the apparatus of the present invention is adapted to be used for the orientation of a number of types of workpieces, the invention has achieved particular utility in connection with the orientation of workpieces of the type indicated at 174. This workpiece is of elongated cylindrical form having reduced end sections 176 and 178 of a slightly different diameter, the section 178 being slightly smaller than the section 176.

With continued reference to FIGURE 5 the caliper slide block 58 is provided with accurately machined anvils 180 and 182 adjacent its opposite edges. The surfaces of the anvils are coplanar and the plane in which they are disposed is exactly normal to the path of movement of the caliper slide block 58. The anvil 180 is opposite the anvil 168 on the lever 160 while the anvil 182 is generally opposite an anvil portion 184 on the caliper slide block 64. As in the case of the anvils 180 and 182 the anvils 168 and 184 are aligned exactly, the work contacting portions of these anvils being disposed in a plane precisely normal to the path of movement of the caliper slide block 64.

The operation of the mechanism will now be described, assuming that the parts initially occupy the position shown in FIGURES 3, 4, and 5. A workpiece fed to the apparatus through the tube 130 advances along the upper surface of the block 94 between the edges of the caliper slide blocks 58 and 64 until the leading edge of the workpiece abuts the lower end of the lever 154. The slight rocking of this lever closes the contacts of micro switch 138. As explained below the switch is connected electrically to cause a solenoid operated valve to admit air into the interior of cylinder 32 through the port 50 thus moving the caliper slide block 58 to the right. As a result of this movement the forward end of the work blank is seized between the forward anvils 182 and 184. It will be noted that the anvil portions 182 and 184 are offset axially of the workpieces so that the workpiece when engaged by these anvils is cocked slightly to bring the trailing end of the workpiece firmly against the anvil 180. The slight cocking of the workpiece is effected to prevent improper operation of the device which might otherwise be caused by eccentricity of the section 176 with respect to the section 178. The continued movement of the slide block 58 to the right also moves the slide block 64 as well as the workpiece to the right, the parts moving as a unit. The relation between the various anvil members is such that if the blank is fed to the apparatus with the smaller end leading, the larger end of the workpiece will displace the anvil 168 to rock the lever 160 in a clockwise direction as viewed in FIGURE 5 to close the switch 140. Closing of the switch 140 actuates the solenoid 102 which moves the shuttle 98 from the full line position shown in FIGURE 4 to the dotted line position. The timing of the mechanism is such that the shuttle is fully advanced before the slide block 64 has moved appreciably from the position shown in FIGURES 3 and 5.

The movement of the components to the right as viewed in FIGURE 3 is continued until the workpiece is held by the anvils over the shuttle 98 at which time the switch 136 is closed by contact with the rear edge of the caliper slide block 64. When switch 136 closes, the space within

cylinder 32 is vented permitting the caliper slide block 58 to return rapidly to its initial position under the influence of spring 48. Simultaneously, air is admitted through the port 86 to hold the cylinder assembly 70 in its position and thus hold the caliper slide block 64 stationary. When the blank is released by retraction of the slide block 58, it falls onto the shuttle 98. Because of the advancement of the shuttle 98 the trailing end of the workpiece will contact the end of the slot 110 causing the workpiece to fall into the chute assembly 112 with its opposite smaller end foremost. If a sample is fed to the apparatus with the larger end 176 leading, the action will be the same as that previously described except that the switch 140 will not be closed and the shuttle will remain in its inactive position as shown in FIGURE 4. Accordingly, when the workpiece is released by the withdrawal of the caliper plate 58 the larger end of the workpiece will contact the forward end of the slot 110 and the workpiece will again fall into the chute with its smaller end foremost.

A typical control circuit for effective automatic operation of the apparatus thus far described is shown in FIGURE 6. In addition to the elements previously described the circuit includes a relay 190 having a pair of normally open contacts 192 and 194, a relay 196 having a normally closed contact 198 and a normally open contact 200 and a relay 202, having normally open contacts 204. This circuit also includes a solenoid 206 which, when energized, supplies fluid to advance the caliper slide 58 and when deenergized, relieves the fluid pressure to permit the slide to retract and a solenoid 208, which, when energized, supplies fluid to hold the complementary caliper slide block 64 in its retracted position and when deenergized permits the slide block to return to the position shown in FIGURE 3.

The circuit as shown in FIGURE 6 in its at rest position, i.e., with the apparatus occupying the position shown in FIGURE 3 and just before a workpiece is fed to the apparatus. When a workpiece is fed to the apparatus it closes microswitch 138 energizing relay 190 to close contacts 192 and 194. This action energizes solenoid 206 to advance the caliper slide 58 and completes the holding circuit around the contacts 134 which open as soon as the slide block 58 leaves its fully retracted position. At the same time normally open contacts 210 which are included in the microswitch 134 are closed.

If the smaller end of the workpiece is positioned opposite the anvil 168 the caliper slide blocks 58 and 64 move to the right together until the slide block 64 reaches its limit position at which time switch 136 is closed which completes the circuit through the previously closed relay contacts 192 and 194 to energize relay 196 opening contact 198 and closing contact 200. When contacts 198 are opened, relay 190 is deenergized opening contacts 192 and 194 and deenergizing solenoid 206 permitting the caliper slide block 58 to retract. Slide block 64 is held in its retracted position because of the energization of solenoid 208 through now closed contacts 210 and 200. When the slide block 58 returns to its fully retracted position switch contacts 134 are closed and contacts 210 are opened deenergizing relay 196 and solenoid 208 to permit slide block 68 to return to the position shown in FIGURE 3.

If the workpiece is reversed end for end and the larger end is positioned opposite the anvil 168 the limit switch 140 will be closed as soon as the slide block 58 has been advanced sufficiently. The closing of switch 140 energizes the solenoid 102 to advance the shuttle to the dotted line position shown in FIGURE 4. The shuttle will be held in this advanced position until the slide block 58 is fully retracted and the switch contacts 210 are thereby opened to deenergize the solenoid 102 and the holding circuit relay 202.

The apparatus this far described may readily be adapted for the handling of longer or shorter workpieces by the substitution of a shuttle having a longer or shorter recess

110 and a work chute having a wider or narrower top opening. Both of these parts are mounted for easy removal and replacement. The replacement of these parts must also be accompanied, of course, by a proper repositioning of the bracket 148 carrying the microswitch 138 and the actuating lever 154.

It will be noted that it is not necessary to provide independent mechanism for interrupting the feed of workpieces, since the edge of the caliper slide block 58 blocks off the exit end of the tube 130 at all times except when the mechanism is in position to receive a new workpiece.

Actual tests have established that the mechanism described above will orient stud blanks reliably at a rate of from 60 to 110 per minute, depending upon the length of the blank.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. Apparatus for orienting and feeding a series of workpieces, the ends of which are of different size to dispose a pre-selected end of said workpieces away from the direction of feed, comprising, means for receiving a workpiece in random orientation; sensing means for determining the orientation of said workpiece; a delivery chute through which workpieces pass by gravity; means for moving said workpiece to a position over said chute, and releasing said workpiece; and means responsive to said sensing means operable to delay the fall of only said preselected end of said workpiece while permitting the opposite end of said workpiece to fall freely into said chute whereby said workpiece is positioned in said chute with its preselected end facing away from the direction of passage through said chute.

2. Apparatus for orienting and feeding a series of workpieces, the ends of which are of different size, to dispose a preselected end of said workpieces away from the direction of feed; comprising a pair of slides adapted to receive a workpiece between them, a delivery chute through which workpieces pass by gravity, means for moving said slides into pressure contact with said workpieces and thereafter moving said slides to position said workpiece over said chute, a gauge on one of said slides movable in response to engagement with said preselected end of said workpiece, means for retracting one of said slides to release said workpiece, and means responsive to the movement of said gauge operable to delay the fall of said preselected end of said workpiece whereby said workpiece is positioned in said chute with its preselected end facing away from the direction of passage through said chute.

3. Apparatus for orienting and feeding a series of workpieces, the ends of which are of different size, to dispose a preselected end of said workpieces away from the direction of feed; comprising a pair of slides adapted to receive a workpiece between them, a delivery chute through which workpieces pass by gravity, a pair of anvils on each of said slides adapted to engage the opposite ends of said workpiece, one of said anvils being mounted for movement on one of said slides in response to engagement with one end of said workpiece, means for moving said anvils into pressure contact with the opposite ends of said workpiece and for moving said workpiece bodily into a position over said chute and releasing said workpiece, and means responsive to the position of said one anvil operable to delay the fall of said preselected end of said workpiece whereby said workpiece is positioned in said chute with its preselected end facing away from the direction of passage through said chute.

4. Apparatus for orienting and feeding a series of workpieces, the ends of which are of different size, to dispose a preselected end of said workpiece away from the direction of feed comprising; means for receiving a workpiece in random orientation, sensing means for determining the orientation of said workpiece, a delivery chute to which workpieces pass by gravity, means for moving said workpiece to a position over said chute and releasing said workpiece into said chute, a shuttle movably mounted in the upper end of said chute, said shuttle having surfaces operable in a first position to delay the fall of one end of said workpiece, and operable in the second position to delay the fall of the opposite end of said workpiece, and means responsive to said sensing means to position said shuttle to intercept the preselected end of said workpiece whereby said workpiece is positioned in said chute with its preselected end facing away from the direction of passage through said chute.

5. Apparatus for orienting and feeding a series of workpieces, the ends of which are of different size, to dispose all of said workpieces in the same endwise orientation, comprising means for receiving a workpiece in random orientation, sensing means for determining the orientation of said workpiece, a delivery chute through which workpieces pass by gravity, means for moving said workpiece to a position over said chute and releasing said workpiece, orienting means, stationary when said workpiece has entered said receiving means in proper endwise orientation, to permit said workpiece to pass into said chute in proper endwise orientation, and means responsive to said sensing means to move said orienting means when said workpiece has entered said receiving means in reverse endwise orientation, to cause said workpiece to pass into said chute in proper endwise orientation.

6. Apparatus for orienting and feeding a series of workpieces, the ends of which are of different size, to dispose all of said workpieces in the same endwise orientation, comprising a pair of relatively movable slides, means for moving said slides apart to permit a workpiece to be fed endwise between them, a delivery chute through which workpieces pass by gravity, means for moving said slides together to seize said workpiece between them and thereafter move said workpiece to a position over said chute, sensing means on one of said slides movable when said workpiece is seized and said workpiece has entered the space between said slides in improper orientation, means for retracting one of said slides to release said workpiece, and means responsive to the movement of said sensing means to cause said workpiece to pass into said chute in proper orientation.

7. Apparatus for orienting and feeding a series of articles, the ends of which are of different size, to dispose all of said articles in the same endwise orientation, comprising a pair of slides disposed on opposite sides of a receiving station to receive an article therebetween, fluid power means responsive to the presence of said article in said receiving station to move one of said slides toward said article and the other of said slides to seize said article between said slides and thereafter to move said article to a discharge station, a delivery chute disposed beneath said discharge station, sensing means on one of said slides movable in response to the presence of said article seized between said slides when said article is in improper endwise orientation, means operable when said slides arrive at said discharge station to retract said one of said slides to release said article, and means responsive to movement of said sensing means for causing said article to fall into said chute in proper endwise orientation.

8. Apparatus for orienting and feeding a series of articles distinguishable with respect to the ends thereof, comprising means for receiving an article in random orientation, a delivery chute through which articles pass by gravity, gripping means for moving said article to a position over said chute and releasing said article, orienting means operable in a first position to pass a properly oriented article into said chute, sensing means carried by said gripping means movable in response to the presence of an article in improper orientation, and means for moving said orienting means in response to movement of said sensing means to cause said articles to move into said chute in proper orientation.

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