July 25, 1961 G. R. ECKSTEIN 2,993,593

GAUGING AND SORTING MACHINE

Filed April 21, 1958 5 Sheets-Sheet 1

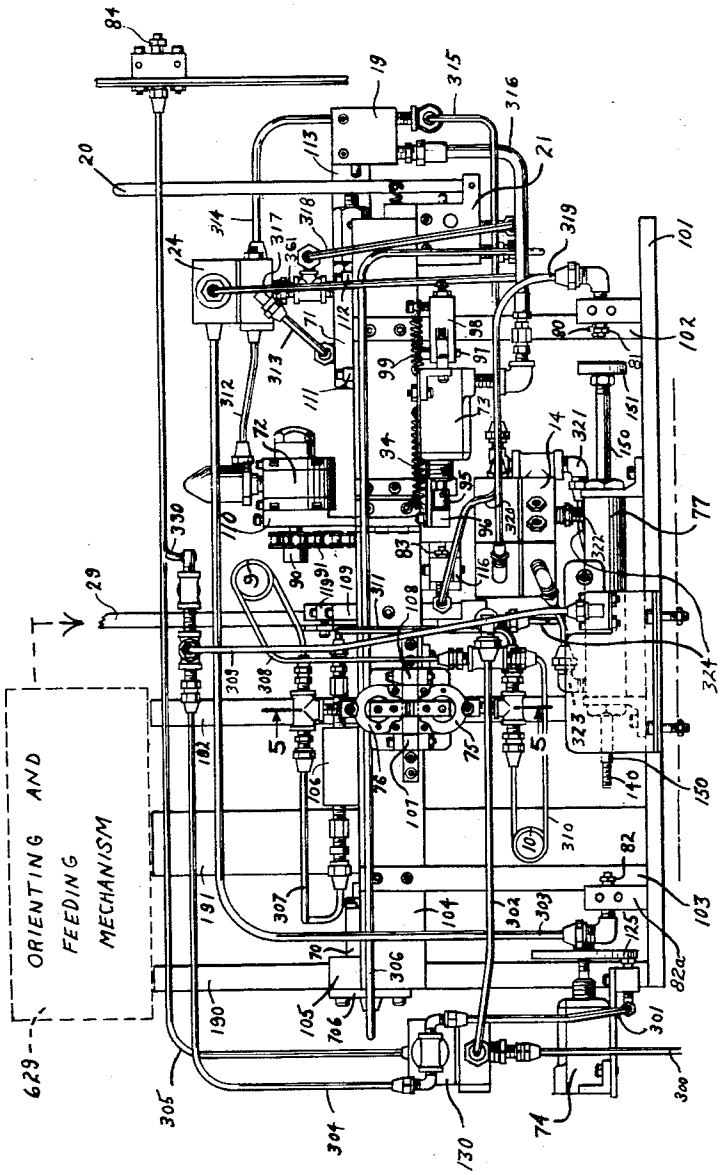


FIG. 1

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GAUGING AND SORTING MACHINE

Filed April 21, 1958 5 Sheets-Sheet 2

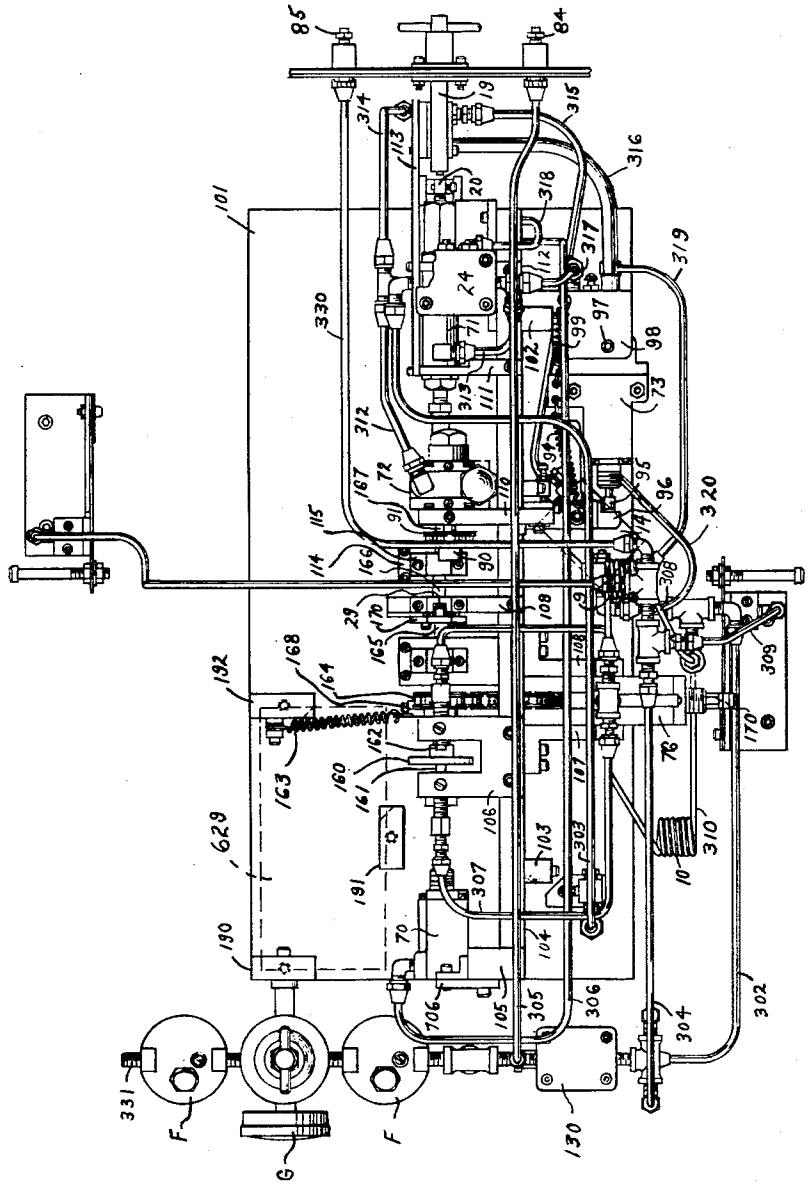


FIG. 2

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GAUGING AND SORTING MACHINE

Filed April 21, 1958 5 Sheets-Sheet 3

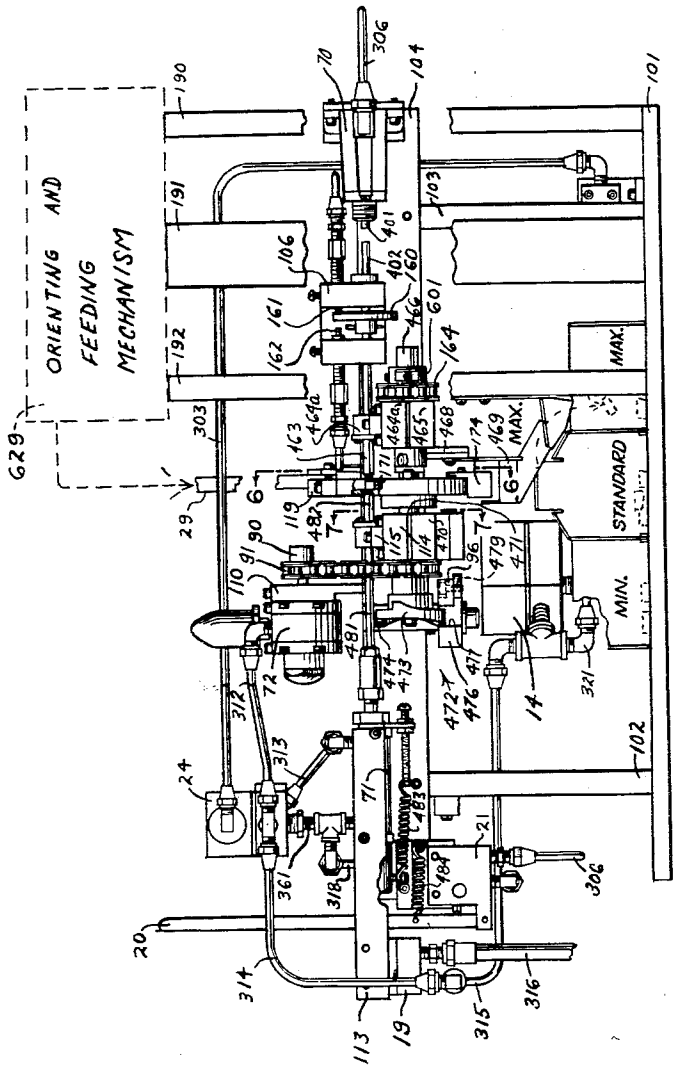


FIG. 3

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GAUGING AND SORTING MACHINE

Filed April 21, 1958 5 Sheets-Sheet 4

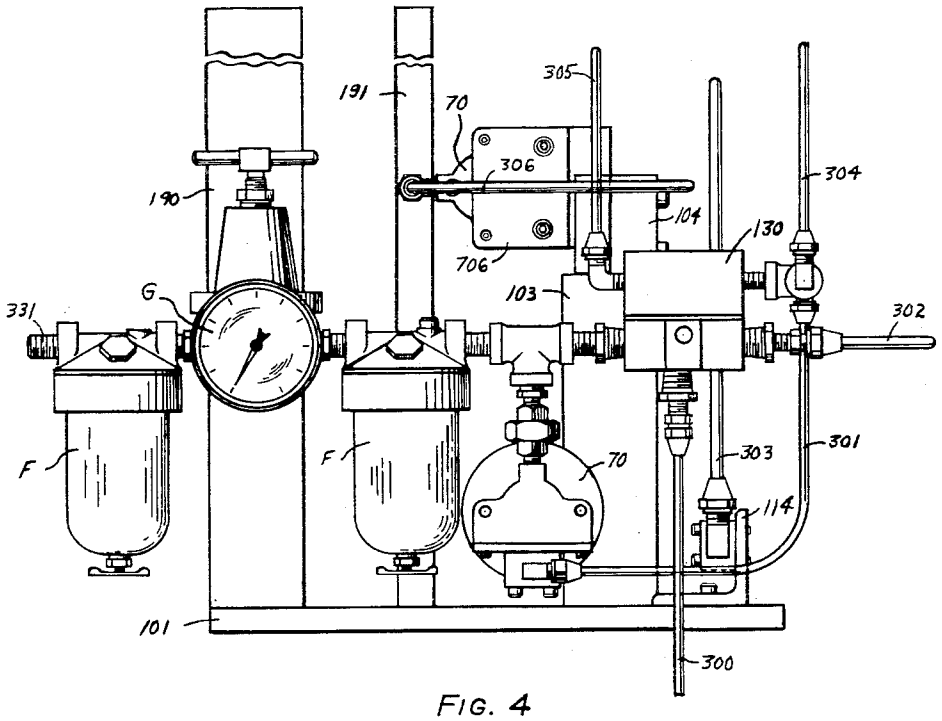


FIG. 4

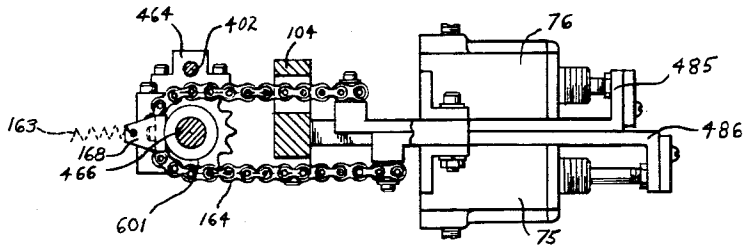


FIG. 5

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GAUGING AND SORTING MACHINE

Filed April 21, 1958 5 Sheets-Sheet 5

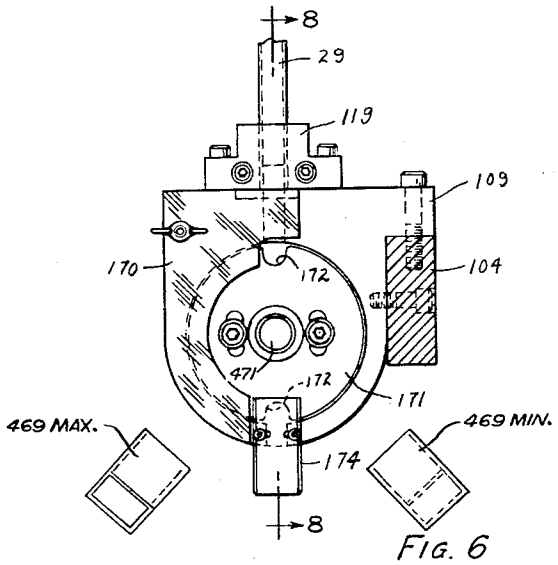


FIG. 6

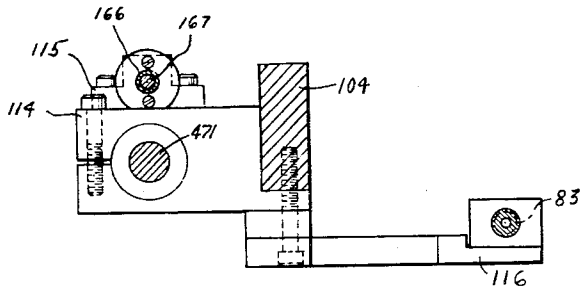


FIG. 7

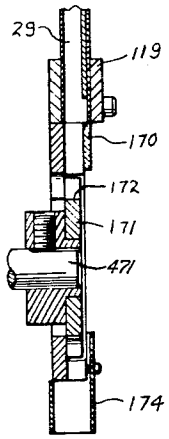


FIG. 8

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United States Patent Office 2,993,593 Patented July 25, 1961

2,993,593

GAUGING AND SORTING MACHINE

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Filed Apr. 21, 1958, Ser. No. 729,584
3 Claims. (Cl. 209—88)

This invention relates to improved automatic equipment for rapidly measuring a given dimension of small uniform articles and sorting the articles into groups according to variations in the measured dimension.

More particularly the equipment of the present invention is intended for use in the measuring and sorting of primer elements used in the manufacture of firearm ammunition, and must meet rigid requirements as to safety while maintaining a practical speed level in doing the work.

It is an object of this invention to provide an improved machine for automatically gauging and sorting small cylindrical articles, such as fream ammunition primers, in such a way that all articles falling within the allowable limits as to the measured dimension are placed in one group, all articles having the measured dimension greater than the allowable limit are placed in another group, and those of measured dimension less than the allowable limit placed in yet another group.

It is another object of this invention to carry out the gauging and sorting operation at a rapid rate while maintaining a high degree of safety.

These and other objects will be apparent from a consideration of the following specification together with the accompanying drawings in which:

FIGURE 1 is a front elevation of a machine embodying features of the present machine.

FIGURE 2 is a top or plan view of the machine of FIGURE 1.

FIGURE 3 is a back view of the machine of FIGURE 1.

FIGURE 4 is an end view of the machine of FIGURE 1.

FIGURE 5 is a partial sectional view taken at line 5—5 of FIGURE 1.

FIGURE 6 is a partial sectional view taken at line 6—6 of FIGURE 3.

FIGURE 7 is a partial sectional view taken at line 7—7 of FIGURE 3.

FIGURE 8 is a partial sectional view taken at line 8—8 of FIGURE 6.

Generally and basically, in the machine of the present invention, the articles are moved from a feeding and orientating device to a gauging position in the machine. At the gauging position the desired dimension of the article is measured between two opposed axially movable probe rods. The measuring movement of one of the probe rods acts to position a deflecting member so that upon realease of the article from the gauging position it is diverted by the deflecting member into the proper receptacle according to whether its measured dimension was: too large, too small, or within satisfactory limits. Of course it will be understood that more than three categories could be established if desired.

The structure of the machine will now be described in detail, with reference to the drawings.

The base or supporing frame structure of the machine comprises a horizontal base plate **101** to which are secured vertical support members **102**, **103**, **190**, **191** and **192**. The vertical support members **190**, **191** and **192** provide support for a conventional orienting and feeding device **629** from which the articles or primers are fed to the gauging and sorting machine through guide channel **29**.

Vertical support members **102** and **103** are connected at their upper extremeties by a horizontal longitudinal cross bar member **104** upon which are secured a number of transverse support brackets such as **105**, **106**, **706**, **107**, **108**, **109**, **110**, **111**, **112**, **114**, **470** and **464** and **465**. These transverse brackets in turn support the majority of the component units of the machine.

In the interests of safety, the machine is operated by air pressure and utilizes a number of conventional and well known component units arranged in what is believed to be a novel and useful combination.

The major component units will first be described as to their positions and cooperation with other elements of the machine and later discussed in connection in the air circuit system.

Longitudinally mounted on a bracket at one end of base plate **101** is a reciprocating air piston motor unit **74** of conventional design. This unit **74** functions to terminate operation of the machine in the event that the air supply to the machine drops below a predetermined minimum pressure.

Longitudinally mounted on one end of horizontal cross bar member **104** by brackets **105** and **706** is another reciprocating air piston motor unit **70** of conventional design. This unit **70** actuates the control probe rod **402** for the gauging operation in a manner to be described later.

Longitudinally mounted at the other end of horizontal longitudinal cross bar member **104** by brackets **111** and **112** is another reciprocating air piston motor unit **71**. This unit **71** actuates the reference position probe rod **481** for the gauging operation in a manner to be described later.

Transversely mounted on an intermediate portion of horizontal longitudinal cross bar member **104** by brackets **107** and **108** are two superimposed parallel reciprocating air piston motor units **75** and **76**. These units **75** and **76** actuate the movable deflecting sector **468** to which there are attached the deflector chutes **469** Max. and **469** Min. which divert the gauged primers into the proper receptacle according to size in a manner to be later described.

Pivotally mounted for movement about a vertical axis on bracket **98** is yet another reciprocating air piston motor unit **73**. This unit **73** intermittently actuates the 180° degree clutch device indicated at **472** in a manner to be described later.

Mounted with its axis of rotation parallel to the horizontal longitudinal cross bar member **104** and secured thereto at an intermediate portion thereof by bracket **110** is a rotary air motor unit **72**. This unit **72** drives the 180° intermittent clutch device indicated at **472** at intervals which are controlled by operation of reciprocating air piston motor unit **73** in a manner to be described later.

Longitudinally mounted on an intermediate portion of base plate **101** is a timer air cylinder **77** with a reciprocating piston **150** at one end of which is secured a disk member **151**. This piston **150** and cylinder times and controls the operating cycle of the machine in a manner later described.

Vertical guide channel **29** is secured at its lower end to bracket **119** in alignment with a vertical feed passage in bracket **109** which is transversely fixed to horizontal longitudinal cross bar member **104**. Bracket **109** is provided with a shallow cylindrical cavity, the axis of which is parallel to longitudinal cross bar member **104**. This cavity intersects the vertical feed passage. A pocketed wheel **171** is rotatably fitted into the cylindrical cavity in bracket **109**. The wheel **171** is provided with two diametrically opposed pockets **172** in its periphery. These pockets are of a size to hold the primers and pass di-

rectly beneath the vertical feed passage in bracket **109** to receive individual primers therefrom when aligned therewith. Pocketed wheel **171** is secured by bolts to a radial flange member on shaft **471**. Shaft **471** is rotatably supported in transverse brackets **114** and **470** which are supported on longitudinal cross bar member **104**. Shaft **471** is positioned parallel to cross bar member **104** and provided at its other end with a chain drive sprocket and the 180° intermittent clutch drive mechanism indicated at **472**. Shaft **471** is connected to be driven by rotary air motor unit **72** through the motor drive sprocket, the drive chain **91** and the drive sprocket on the shaft itself. The rotary air motor unit continuously exerts a torque to rotate shaft **471**, but can so rotate the shaft and pocketed wheel **171** only when the 180° intermittent clutch device mechanism **472** is actuated. The 180° intermittent clutch drive mechanism **472** comprises a wheel element **473** mounted on the extremity of shaft **471**. The wheel element **473** is provided on its side surface with two diametrically opposed steps, one of which is indicated at reference numeral **474**. The two steps are joined by inclined cam portions. Ordinarily the wheel element **473** is prevented from being rotated by rotary air motor **72** by the interengagement of one of the steps on the side surface of wheel element **473** and a blocking abutment **477** on a pivotally mounted element **476** which is mounted for limited movement about a vertical axis on pin **480**. A transverse lever arm member **96** is rigidly secured to pivotally mounted element **476**. Lever arm **96** extends transversely of and beneath longitudinal cross bar member **104**. As can be seen in FIGURES 1 and 2, lever arm **96** and pivotally mounted element **476** to which it is rigidly secured are biased by spring **94** into movement blocking position with respect to the steps such as **474** on wheel element **473** to prevent rotation of shaft **471** and pocketed wheel **171** carried thereon. The extremity of lever arm **96** is positioned in alignment with the actuating piston element **95** of reciprocating air piston motor unit **73** which is pivotally mounted at **97** on bracket **98**. It will be understood that actuation of the air piston motor unit **73** will cause the piston element **95** to engage the lever arm **96** to pivot the abutment **477** out of engagement with the step in wheel member **473** to permit a 180° rotation of shaft **471** and the pocketed wheel **171**. This 180° rotation of pocketed wheel **171** will move the pocket at the top of the wheel to the bottom position and carry a primer contained therein into position where it will drop through vertical guide **174** and be deflected by the movable deflector sector **468** and the selected one of the deflector chutes **469** into the proper receptacle in accordance with the measured size of the primer. The position at the top of the pocketed wheel **171** is the primer gauging or measuring position into which the primers are fed via channel **29** and the vertical feed passage in bracket **119**. In this position the primer in the pocket of the wheel is engaged between the axially movable reference position rod **481** and opposed axially movable control rod **402**. The reference position rod **481** engages the primer slightly before it is engaged by the control rod and establishes the reference point or position from which the measurement is made. The thrust of the control rod is adjusted to be slightly less than that of the reference position rod. Reference position rod **481** is slidably supported in sleeve member **482** and bracket **115** for movement perpendicular to the plane of wheel member **171** and parallel to shaft **471**. Sleeve member **482** acts as a stripper device to prevent the measured object from sticking to the rod. One end of the reference position rod is secured to the piston element of reciprocating air piston unit **71** so that its movements are controlled thereby.

The control or measuring rod **402** is slidably supported for limited free movement in sleeve stripper element **463**, bracket **464***a*, and the projecting arms of U-shaped bracket **106**. A disc element **160** is fixed to control rod **402** between the arms of U-shaped bracket **106** and limits the axial movement of the rod. One end of control rod is positioned adjacent to and in axial alignment with actuating piston element **401** of reciprocating air piston motor unit **70**. Mounted in opposing aligned positions on the inner surfaces of the projecting arms of U-shaped bracket **106** are two identical air escape orifices **161** and **162**. Air escaping equally from these orifices is directed against opposite sides of the disc **160**. Air escape orifices are connected to the air lines controlling the movement of transversely mounted reciprocating air piston motors **75** and **76**. Air piston motors act in opposition to control the angular position of deflector sector **468** and the chutes **469** carried thereby, which assembly is mounted on shaft **466** which is itself journalled in transverse brackets **464** and **465**. Shaft **466**, on which the deflector means is rigidly secured, is provided with a drive sprocket **601**. A drive chain **164** extends around drive sprocket **601**, one end thereof being connected to the actuating piston element of reciprocating air piston motor unit **76**, and the other end thereof being connected to the actuating piston element of companion reciprocating air piston motor unit **75**. When reciprocating air piston motor unit **70** is actuated, its piston **401** engages the end of control rod **402** and moves it against the primer to be gauged, which is of course backed up by the reference position rod **481**. The extent of movement of control **402** is dependent upon the dimension of the primer being measured, and according to this dimension therefore, the disc **160** will assume a given position between air escape orifices **161** and **162**. It will be understood that movement toward one of the orifices will result in a blocking of that orifice and a rise in pressure the air line connected thereto, under such a condition of course, the opposing air escape orifice is opened somewhat with a consequent pressure drop in its air line. This produces a differential in the air pressure supplied to opposed reciprocating air piston motor units **75** and **76** so that the drive sprocket **601** to which each is connected by drive chain **164** is rotated an amount which will angularly position the primer deflecting means **468**, **469** to divert the measured primer into the proper receptacle according to size upon the 180° rotation of the pocketed wheel **171**. If the measured primer is of the correct size, the disc **160** on control rod **402** will remain in a position equidistant between the air escape orifices **161** and **162** giving an equal blocking effect and equal air pressure in the air line to each. This equal air pressure will exist therefore in the air lines leading to the opposed reciprocating air piston motor units **75** and **76** so that no angular motion of the deflecting sector **468** from its central position will occur, allowing the measured primer to drop, as shown in FIG. 6, straight through vertical guide **174** from the bottom pocket position in wheel **171** into the proper receptacle which is directly beneath. A spring **163**, acting between an arm **168** fixed to sprocket **601** and vertical support member **192**, acts to oppose the unbalance of air motors **75** and **76** and to always return them to a centered position. Unbalance of the air motors **75** and **76** will result when the position of the control rod indicates a primer outside dimensional specifications and will result in shifting the sector **468** to position either chute **469** Max. or **469** Min. beneath the vertical guide **174**, as shown in FIG. 3, where chute **469** Max. is in deflecting position, to discharge into the container marked Max. Chute **469** Min. extends to the left from the sector **468** and, when it is in position beneath the guide **174**, delivers primers to the container marked Min.

Having thus described the major component units of the machine in detail, the remaining component units of the machine which cooperate therewith will now be discussed.

A bleeder valve **82** is mounted on a bracket **82***a* on base plate **101** in alignment with one end of the piston of the timer cylinder **77**. Engagement of bleeder valve **82** by end **140** of the timer cylinder piston causes the

air pressure to drop in conduit 303 which is connected to the pilot section of pilot operated valve unit 24.

Two bleeder valves 80 and 81 are mounted on base plate 101 in alignment with the disc 151 on the other end of timer cylinder piston 150.

Engagement of bleeder valve 80 by the disc 150 bleeds the air from line 317 which is connected to the pilot section of pilot operated valve unit 24.

Engagement of bleeder valve 81 by the disc 150 bleeds the air to reduce the pressure in line 319 which is connected to the pilot section of another pilot operated valve 14.

A bleeder valve 83 is mounted on transverse bracket 116 which is supported on longitudinal support member 104. Bleeder valve 83 is aligned with the piston 95 of reciprocating air piston motor unit 73 and when engaged thereby bleeds the air to reduce the pressure in conduit 320 which is connected to the pilot section of pilot operated valve unit 24.

Pilot operated valve unit 14 controls the timer cylinder piston 150 and is connected to time cylinder 77 by conduits 322 and 323.

Pilot operated valve unit 24 controls reciprocating air piston motor unit 71 and is connected thereto by conduits 313 and 361. Pilot operated valve unit 24 also controls the flow of air to poppet valve unit 21, being connected thereto by conduit 318. Poppet valve unit 21 is actuated by engagement of lever 20 with its control element. Engagement of lever 20 with the control element of poppet valve unit 21 causes pressure air to be directed to reciprocating air piston motor unit 70 through conduit 306.

Lever 20 is spring urged into engagement with the outer end of the piston of reciprocating air motor unit 71.

A second poppet valve assembly 19 is mounted on longitudinal bracket 113 with its control element aligned with lever 20 to be actuated thereby. Actuation of poppet valve unit by lever 20 causes pressure air to be directed to reciprocating air piston motor unit 73.

Air escape orifice 161 is connected to reciprocating air piston unit 76 via conduit 307 and air escape orifice 162 is connected to reciprocating air piston unit 75 via conduit 311.

Pressure air is led from a source not shown into conduit 331, air filter F, pressure gauge G, air filter F, low pressure cutoff device, and safety device 130, to main inlet conduit 302. From conduit 302 pressure air is supplied to reciprocating air piston motor units 75 and 76 and their respective air escape orifices 162 and 161 via conduits 310 and 308. Units 9 and 10 are air flow resistance units in conduits 308 and 310 respectively. Pressure air from inlet conduit 302 is supplied to pilot operated valve unit 14 via conduit 324, and is supplied to poppet valve unit 19, pilot operated valve unit 24, and rotary air motor unit 72 by conduits 315, 314 and 312 respectively.

Unit 130 is a pilot operated valve unit which is controlled by remote operated bleeder valve unit 84 and other units such as the orienting and feeding unit 629 to cut the air supply off to the machine if desired or if the orienting and feeding unit exhausts its supply of primers to be acted upon. Reciprocating air piston motor unit 74 acts to cut the machine air supply in the event the air pressure falls below a predetermined minimum.

The reciprocating air piston motor units 70, 73 and 74 are of the spring return type which return to an initial position when the actuating air pressure is removed therefrom. Units 75 and 76 are not spring returned cylinders, although the spring 163 tends to return the assembly to a centered position.

The operation of the machine will now be described. It will be assumed that a supply of the articles to be gauged and sorted is available and being fed to the gauging position through guide channel 29 and that the machine is operating with the timer cylinder disc 151 moving to the right in FIGURE 1 to engage the bleeder valves 80 and 81. Actuation of bleeder valves 80 and 81 allows the air to escape through them to reduce the pressure in conduits 317 and 319. Reduction of air pressure in conduit 319 actuates pilot operated valve unit 14 to direct pressure air into conduit 322 to reverse the motion of timer cylinder piston 150 and its disc 151. Reduction of air pressure in conduit 317 actuates pilot operated valve unit 24 to direct pressure in, first through conduit 361 to cause reciprocating air piston motor unit 71 to advance the reference position rod 481 and second, through conduit 318 to apply the pressure air to poppet valve unit 21. As the piston of unit 71 advances, it allows lever 20 engaged therewith also to advance under the urging of its spring. As lever 20 advances (counter clockwise in FIGURE 1) it actuates poppet valve unit 21 which directs pressure air through conduit 306 to operate reciprocating air piston motor unit 70 which engages and advances the control rod 402 from the opposite direction.

The reference position rod 481 actuated by unit 71 engages the primer from one side of the pocket 172 in the wheel member 171 and the control rod 402 engages the primer from the other side. As previously mentioned the actuating force of control rod 402 is less than that of reference rod 481. Acordingly them ovement of control rod 402 will be limited by the thickness of the primer to control the position of the disc 160 which controls the air pressure actuating motor units 75 and 76 by means of the air escape orifices 161 and 162 to position the deflecting sector 468 and chutes 469 to divert the measured primer into the proper receptacle after the wheel member 171 has been rotated 180° to allow the measured primer to drop from the pocket at its lowermost position.

By the time the measuring or gauging operation has been completed by the opposed rod members the piston 150 of the timer cylinder 77 has reached the limit of its movement to the left (FIGURE 1) and strikes bleeder valve 82. This causes the pressure to drop in conduit 303 which reverses pilot operated valve unit 24 which cuts off the pressure air to air motor unit 70 via conduits 318 and 306. The air motor unit 70 returns under spring pressure to its initial position. Reversal of pilot operated valve 24 also cuts off pressure air to conduit 361 and diverts pressure air to conduit 313 to reverse motor unit 71 and withdraw the reference position rod 481. As the piston element of air motor unit 71 returns to the right (FIGURE 1) it forces lever 20 to move in a clockwise direction until it actuates poppet valve unit 19 to direct pressure air through conduit 316 to actuate reciprocating air piston motor unit 73 and extend its piston element 95. Movement of piston 95 causes it to engage the end of lever arm 96 to pivot the same together with element 476 to which it is attached so that abutment 477 is moved out of the way of the step in wheel element 473 to allow rotary air motor 72 to rotate shaft 471 and the pocketed wheel through 180°. This allows the measured article or primer to drop through vertical guide 174 and be diverted into the proper receptacle by angularly positioned deflecting means 468, 469. The spring 94 causes arm 96 to relatch the wheel element 473 after 180° of movement.

Movement of piston 95 continues after it has actuated pivoted lever 96 until it engages bleeder valve 83. Engagement of bleeder valve 83 by piston 95 causes the pressure to drop in conduit 320 to actuate or reverse the pilot operated valve unit 14 which cuts off pressure air to conduit 322 and diverts pressure air into conduit 323 to cause timer cylinder piston 150 to move again to the right where it will again engage bleeder valves 80 and 81 to repeat the cycle.

It has been found that the machine will function satisfactorily to gauge and sort primers at a rate of from 60 to 100 per minute, selecting primers with a zone tolerance of 0.010".

The machine can be started and stopped by manipulation of handle or lever 20. With the air pressure ap-

plied to the machine, operation is commenced by pushing the lever toward poppet valve unit **19** and releasing it. The handle is moved back and forth during machine operation. To stop the machine, pressure is applied to lever **20** to prevent it from actuating poppet valve **19** and then the arm is released. The cancellation of inertia effects from unit **71** is sufficient to stop poppet valve unit **19** from being actuated and operation is stopped.

As mentioned in the previous discussion, the reciprocating air piston motors, the rotary air motor, the pilot operated valve units, the poppet valve units, and bleeder valve units are all conventional and well known units, examples of which are disclosed in prior patents and publications.

While in accordance with the provisions of the Patent Statutes, I have illustrated and described the best form of the invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of apparatus disclosed without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. An automatic pressure fluid operated machine for individually gauging and sorting a plurality of primers, comprising a frame, a wheel member provided with a primer receiving pocket therein and rotatably mounted in said frame for movement between a primer-receiving position and a primer-releasing position, guide means on said frame for directing primers one at a time into said pocket, first air motor means for moving said wheel from said primer-receiving position to said primer-releasing position, two opposed axially aligned rods, slidably mounted in said frame for movement into engagement with a primer in said pocket to measure a dimension of the same when in said primer-receiving position, second air motor means on said frame for moving said opposed rods, a movable deflector cooperating with said wheel member when in said primer-releasing position for diverting a released measured primer into the proper one of three containers according to the measured size of said primers, third air motor for positioning said movable deflector means and controlled and actuated by means responsive to relative movement of said opposed rods, and a control means for operating said first air motor means, said second air motor means, and said third air motor means in a continuous predetermined sequence of operations.

2. Automatic apparatus for gauging, and sorting ammunition primers into groups according to the gauged dimension comprising in combination, a frame, a wheel element rotatably mounted in said frame, said wheel element provided with a primer supporting pocket, rotary pneumatic drive means on said frame operatively connected to said wheel element to move the same between a primer supporting and gauging position and a primer releasing position, means for feeding a series of primers into said pocket, a first rod element mounted for reciprocating movement in said frame between an extended position in cooperation with said primer supporting pocket when in said primer gauging position, and a retracted position, a second rod element mounted for reciprocating movement in said frame axially opposed to said first rod element and movable between a first retracted position and a primer engaging position in cooperation with said primer supporting pocket when in said primer gauging position, pneumatic means on said frame for moving said first rod element between its first and second positions, pneumatic means on said frame for moving said second rod element between its first and second positions, a swinging primer directing member mounted for movement on said frame and positioned to cooperate with said pocket of said wheel element in its primer releasing position to direct a released gauged primer into the proper one of a plurality of groups according to the gauged dimension, pneumatic means for moving said primer directing member, pneumatic means on said frame responsive to movement of said second rod element for controlling the movement of said means for moving said swinging primer directing member, and pneumatic means cooperating with and actuating the first rod element moving means, the second rod element moving means, said means for moving said primer directing member, and said drive means for said wheel element continuously in predetermined timed sequence.

3. An automatic pressure fluid operated machine for individually gauging and sorting articles in accordance with a significant dimension thereof, comprising a frame, a wheel member provided with an article receiving pocket and rotatably mounted in said frame for movement between an article receiving position and an article releasing position, guide means on said frame for directing articles one at a time into said pocket, first air motor means for moving said wheel from said article receiving position to said article releasing position, two opposed axially aligned rods slidably mounted in said frame for movement into engagement with an article in said pocket to measure a significant dimension of said article when the wheel is in article receiving position, second air motor means on said frame for moving said opposed rods, a movable deflector cooperating with said wheel member when in said article releasing position for diverting a released measured article into the proper one of three containers according to the measured significant dimension of said article, third air motor means for positioning said movable deflector and controlled and actuated by means responsive to relative movement of said opposed rods, and a control means for operating said first air motor means, said second air motor means, and said third air motor means in a continuous predetermined sequence of operations.

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