Sept. 9, 1969 D. P. BLAKER ET AL 3,465,619

BOWLING BALL HOLE GAUGING DEVICE AND DRILLING APPARATUS

Filed Aug. 16, 1966 3 Sheets-Sheet 1

Fig. 1

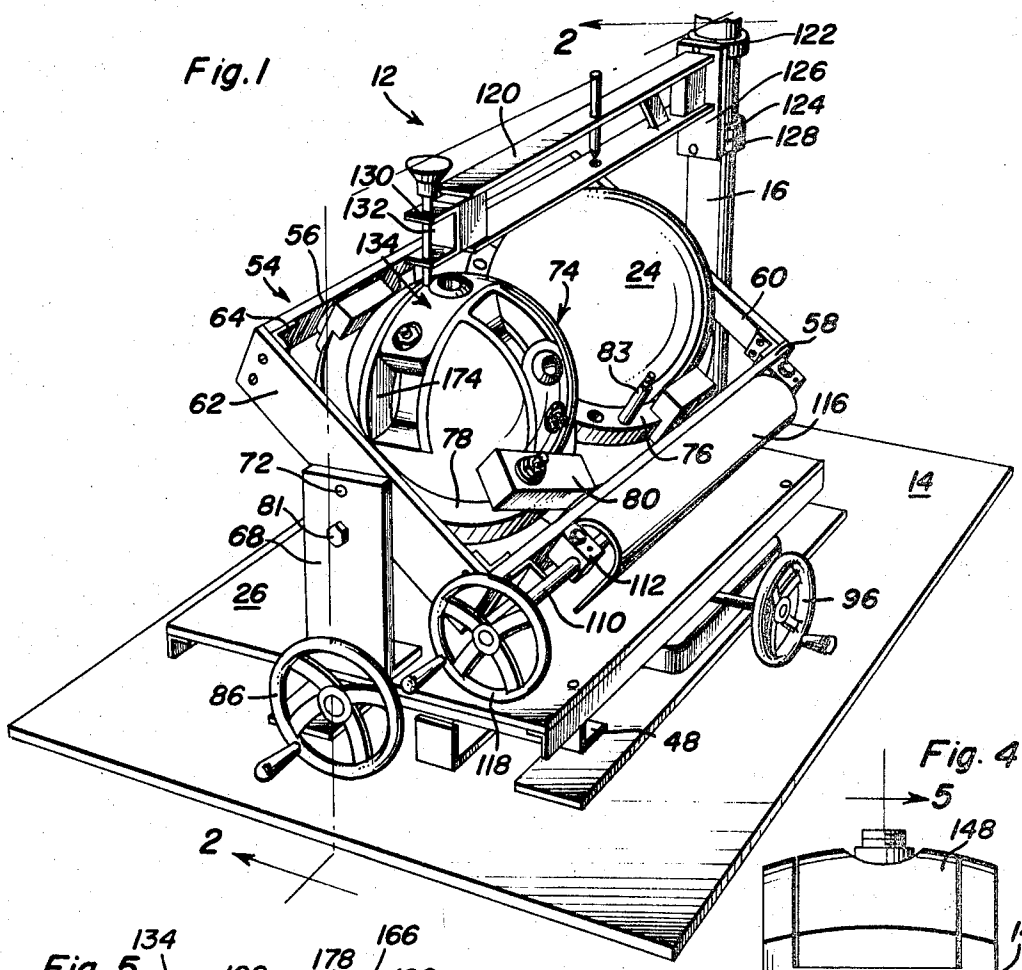


Fig. 5

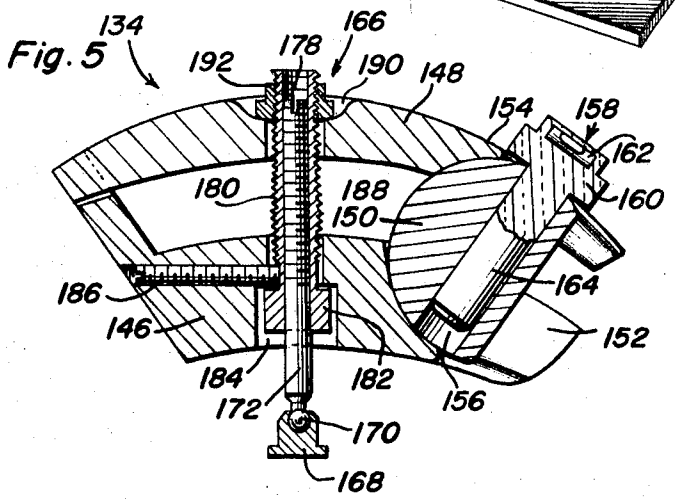
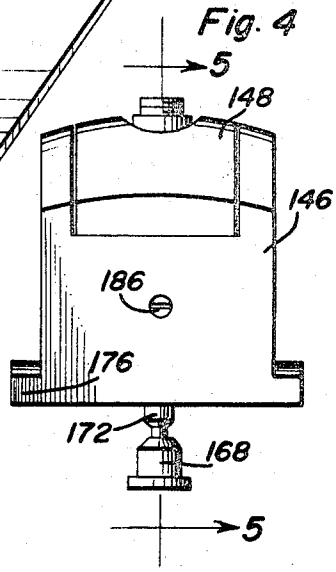


Fig. 4



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BOWLING BALL HOLE GAUGING DEVICE AND DRILLING APPARATUS

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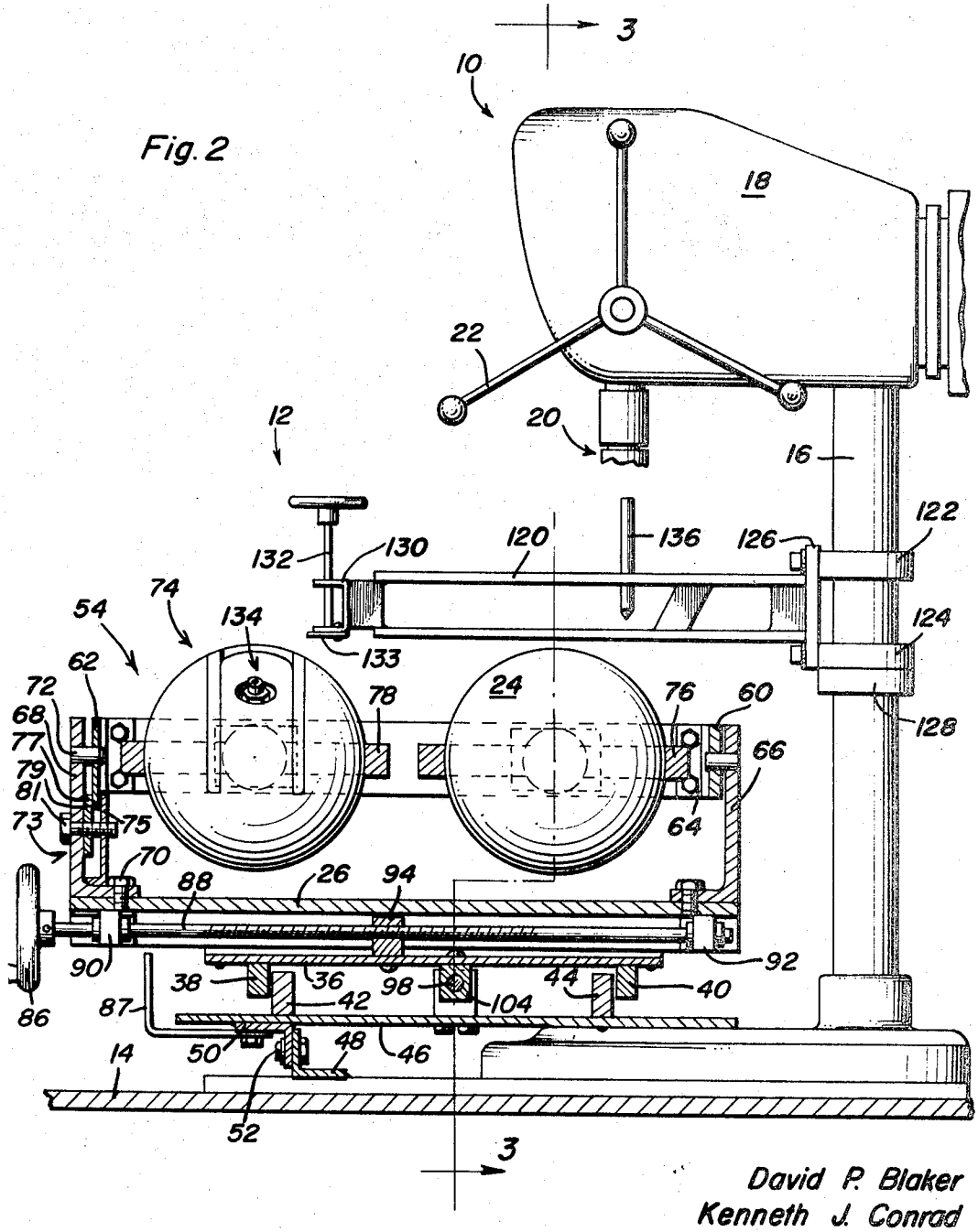
Fig. 2



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BOWLING BALL HOLE GAUGING DEVICE AND DRILLING APPARATUS

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Fig. 3

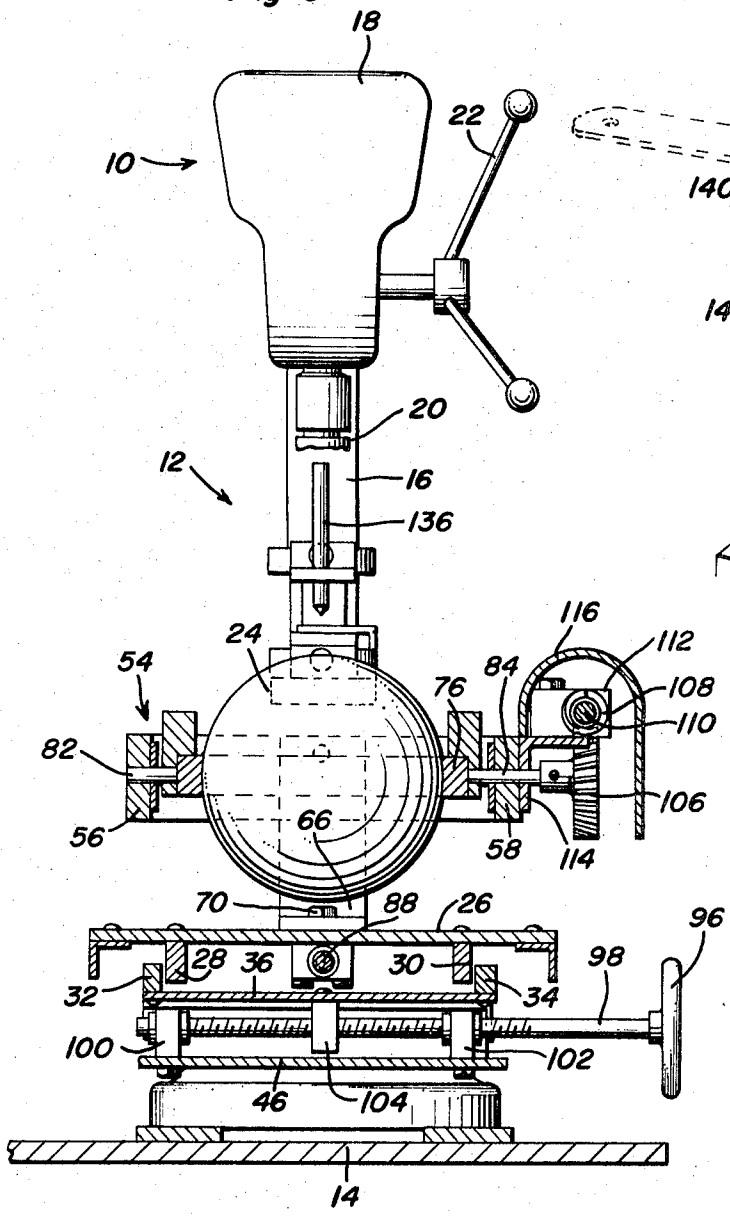
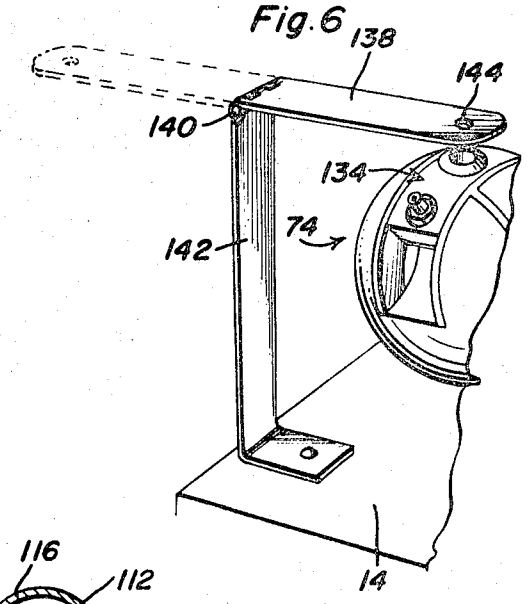


Fig. 6



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BOWLING BALL HOLE GAUGING DEVICE AND DRILLING APPARATUS

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Continuation-in-part of application Ser. No. 352,450, Mar. 17, 1964. This application Aug. 16, 1966, Ser. No. 572,708

Int. Cl. B23b *41/00, 49/00*

U.S. Cl. 77—5 15 Claims

ABSTRACT OF THE DISCLOSURE

A fitting ball adjusted to certain fingerstall positions is clamped in a gimbal assembly also holding a blank ball to be drilled. Both balls are simultaneously orientated by planar movement of a platen in perpendicular directions, pivotal movement of a frame on the platen and pivotal movement of the two ball holding gimbals relative to the frame in order to align a fingerstall on the fitting ball with a pin or the like mounted in fixed parallel spaced relation to the path of movement of the drilling tool.

This application is a continuation-in-part of our prior copending application U.S. Ser. No. 352,450, filed Mar. 17, 1964 now Patent No. 3,271,870 and relates to apparatus for fitting and drilling a bowling ball to suit the handgrip of individual bowlers.

An important object of the present invention is to provide in combination with a conventional type of drill press or drilling machine, a locating apparatus for drilling the finger-receiving holes in a bowling ball in accordance with locations established on a dummy or fitting ball. Thus, the locating apparatus enables an operator to rapidly and accurately orientate and position a bowling ball below the drill chuck of a drill press by simultaneously orientating and positioning the fitting ball below a locating arm mounted by the drill press for this purpose.

In accordance with the foregoing object, the locating apparatus of the present invention includes a supporting platen mounted for movement in a plane parallel to the base of the drilling machine or perpendicular to the upright column supporting the drilling head whereby both the fitting ball and the bowling ball to be drilled may be adjustably positioned relative to the supporting column or drilling head. Both of the balls are mounted on the supporting platen by a gimbal type holder assembly so that the balls may be orientated about perpendicular intersecting axes. The gimbal assembly includes therefore a pair of ball clamping rings or gimbals and means for insuring that both of the balls are simultaneously orientated in the same direction and by the same amount. According to the present invention, the means for simultaneously orientating the gimbals comprises worm gearing as compared to the linkage utilized in the locating apparatus disclosed in the prior copending parent application aforementioned. Accordingly, the fingerstalls on the fitting ball may be orientated relative to a locating arm so that when the fitting ball is aligned therewith, the ball to be drilled will then be precisely aligned with a drill bit received in the drill chuck of the drilling machine.

Another object of the present invention therefore, is to provide a fitting ball having adjustably positioned fingerstall assemblies arranged to be aligned with the aforementioned locating arm of the locating apparatus. The fingerstall assemblies are similar to but embody certain improvements over the fingerstall assemblies disclosed

and claimed in the aforementioned prior copending application. Further, a level indicating target device is associated with the fingerstall assemblies in connection with one form of locating apparatus.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a perspective view showing the locating apparatus of the present invention.

FIGURE 2 is a side sectional view taken substantially through a plane indicated by section line 2—2 of FIGURE 1 showing the locating apparatus in combination with a drilling machine.

FIGURE 3 is a sectional view taken substantially through a plane indicated by section line 3—3 in FIGURE 2.

FIGURE 4 is a front elevational view of the improved fingerstall assembly associated with the present invention.

FIGURE 5 is a sectional view taken substantially through a plane indicated by section line 5—5 in FIGURE 4.

FIGURE 6 is a partial perspective view showing a modification of the locating apparatus illustrated in FIGURES 1 through 3.

Referring now to the drawings in detail, FIGURES 1, 2 and 3 illustrate a conventional-type of drilling machine or drill press generally denoted by reference numeral **10** with which the locating apparatus of the present invention may be associated, the locating apparatus being generally referred to by reference numeral **12**. As explained in parent application aforementioned, the workpiece to be drilled by the drilling tool is a blank ball **24** held in the locating apparatus. The drill press includes a supporting base **14** on which the locating apparatus **12** may be mounted, a supporting column **16** and a drilling head **18** mounted by the column in spaced relation above the base. Associated with the drilling head, is a drill chuck **20** adapted to be displaced vertically in opposite directions by means of the feed control **22** in a manner well known in order to lower or raise a rotating drill bit relative to a workpiece mounted on the base.

The locating apparatus includes a relatively flat platen **26** which is generally parallel to the base **14** and mounted for movement in a plane perpendicular to the vertical axis of the supporting column **16** and the vertical axis along which the drill bit and drill chuck are fed. Toward this end, the platen **26** is provided with a pair of guide bars **28** and **30** which extend downwardly therefrom as more clearly seen in FIGURE 3 so as to guide movement of the platen in one direction in its plane of movement. The guide bars **28** and **30** are therefore slidably engaged by guide rails **32** and **34** which project upwardly from the plate **36** to which they are connected. The plate **36** on the other hand is guided for movement in a direction perpendicular to the direction in which it guides movement of the platen **26**. Toward this end, guide bars **38** and **40** are connected to and depend from the plate **36** as more clearly seen in FIGURE 2 in sliding engagement with the guide rails **42** and **44** connected to and projecting upwardly from the mounting plate **46**. The mounting plate **46** is rigidly fastened to the base **14** by suitable means including for example the angle bracket **48** welded to the base and angle bracket **50** welded to the mounting plate, the brackets being interconnected by fastener assemblies **52**.

The platen **26** constitutes a carriage which supports a gimbal assembly generally referred to by reference numeral **54**. The gimbal assembly includes a rectangular

frame consisting of parallel spaced side bars **56** and **58** spaced by the end bars **60** and **62**, the bars being interconnected at the corners by angle elements **64** or any other suitable fastening means. The rectangular frame is pivotally mounted about an axis parallel to the plane of movement of the platen **26** by means of a pair of pivotal brackets **66** and **68** projecting upwardly from opposite longitudinal ends of the platen and secured thereto by the fasteners **70**. The longitudinal axis about which the rectangular frame is pivoted, extends through a pair of stub shafts **72** projecting from the end bars **60** and **62** of the rectangular frame and received within apertures formed in the pivot brackets **66** and **68** as more clearly seen in FIGURE 2. The rectangular frame may thereby be angularly positioned as desired by the operator and held in an adjusted position by locking assembly **73** in order to simultaneously orientate the bowling ball **24** to be drilled and a dummy or master fitting ball **74**. The locking assembly as shown in FIGURE 2 includes the clamping plates **75** and **77** engageable with a downwardly extending extension **79** of the end bar **62**, the clamping plate **75** being threadedly mounted on the locking screw **81** having a head projecting from the bracket **68** through the plate **77**.

The balls **24** and **74** are respectively clamped within gimbal holder rings **76** and **78** by means of clamps **80** received on the studs **83** firmly holding each ball within its gimbal ring centrally aligned with a rotational axis for the gimbal ring extending through the shaft sections **82** and **84** respectively journalled within apertures formed in the side bars **56** and **58** of the rectangular frame. Thus, the gimbal rings **76** and **78** are capable of being angularly orientated with the balls clamped therein about perpendicular intersecting axes associated with the gimbal assembly **54**.

The locating apparatus is provided with facilities for carefully positioning and orientating the balls **24** and **74** relative to the column **16** of the drill press. The platen **26** is therefore longitudinally positioned in one direction within its plane of movement by means of the positioning hand wheel **86** connected to one end of a screw shaft **88** which is rotatably journalled within spaced journal assemblies **90** and **92** connected to and depending from opposite longitudinal ends of the platen **26** as more clearly seen in FIGURE 2. A nut element **94** is secured to the plate **36** in alignment between the journal assemblies **90** and **92** and threadably receives the screw shaft **88** so that in response to rotation of the screw shaft by the hand wheel **86**, movement will be imparted to the platen **26** along the axis of the screw shaft. A position guide **87** is fixed to the base for indicating the approximate position to which the platen should be adjusted by alignment of the guide with bracket **68**. The platen may also be laterally positioned in the plane of movement by means of the positioning hand wheel **96** connected to one end of a screw shaft **98** which is rotatably journalled by spaced journal assemblies **100** and **102** fixed to the stationary mounting plate **46** as more clearly shown in FIGURE 3. A nut element **104** is secured to the plate **36** and depends therefrom in alignment between the journal assemblis **100** and **102**. The screw shaft **98** is threaded through the nut element **104** so that upon rotation of the screw element, movement will be imparted to the plate **36** carrying the platen **26** therewith in a lateral direction. It will therefore be apparent that the gimbal assembly **54** may be positioned by means of the screw operating hand wheels **86** and **96** at any desired location within limits in the plane of movement. Once the gimbal assembly and the balls mounted therein are so positioned, the balls may be angularly orientated by angular displacement of the rectangular frame about its longitudinal axis and by simultaneous angular displacement of the gimbal rings **76** and **78** about their respective axes intersecting the longitudinal axis of the rectangular frame.

In order to simultaneously orientate both of the balls **24** and **74** in the same direction and by the same amount about their respective axes disposed in parallel spaced relation to each other, each shaft section **84** associated with the gimbal rings is connected at a projecting end to a worm wheel **106** as more clearly seen in FIGURE 3. The worm wheels **106** associated with the shaft sections are meshed with a pair of worm gears **108** secured to a common adjustment shaft **110** through which the worm gears and worm wheels are simultaneously rotated in the same direction and by the same amount. The adjustment shaft **110** is journalled by spaced journal brackets **112** secured to the horizontal leg of an elongated angle bar **114** fastened to the side bar **58** of the rectangular frame. Also secured to the side bar **58**, is a dust shield **116** protectively enclosing the self-locking worm gearing through which the adjustment shaft **110** is drivingly connected to the gimbal orientating shaft sections **84**. A gimbal orientating hand wheel **118** is connected to one end of the adjustment shaft **110** as shown in FIGURE 1 for manipulation by the operator.

It will now be apparent that through use of the positioning hand wheels **86** and **96** and the orientating hand wheel **118**, the operator may position the ball **24** to be drilled in alignment below the drill chuck **20** of the drill press and then orientate the ball for drilling finger-receiving holes therein. The dummy ball **74** is therefore utilized in order to determine both the location of the gimbal assembly and the orientation of the ball **24** therein for drilling the finger-receiving holes. In one form of the invention, an elongated locating arm assembly **120** is mounted for angular displacement about the vertical axis extending through the column **16** by means of the spaced mounting rings **122** and **124** encircling the column and attached to the mounting plate **126** connected to one end of the locating arm assembly. A support collar **128** is fixedly secured to the column **16** below the mounting ring **124** so as to support the locating arm in vertically spaced relation above the gimbal assembly **54** and more closely spaced above the balls **24** and **74**. The end of the locating arm assembly remote from the column **16** is provided with a bracket **130** slidably supporting an alignment pilot pin **132** which is adapted to be received within a finger-receiving insert associated with one of the adjustable fingerstall assemblies **134** of the dummy or fitting ball **74**. The pin **132** is held in its upper position by means of a holding arm **133** pivoted below the bracket **130**, which is swung out of the way when using the alignment pin. With the longitudinal axis of the locating arm **120** intersecting the vertical axis along which the drill bit extends from the drill chuck **20**, the ball **24** to be drilled will be properly aligned with the drill bit when the alignment pin **132** is received within the bore of a finger insert in the fitting ball **74**. In order to properly align the locating arm assembly **120** below the drill chuck **20**, a locating pin **136** is mounted on the locating arm assembly spaced from the alignment pin **132** and extending vertically in intersecting relation to the longitudinal axis of the locating arm assembly. The locating pin **136** is also fixedly spaced from the axis of the column **16** by the proper radial distance so that it may be received within the drill chuck **20** when the locating arm **120** is swung to its proper position in alignment therebelow. The locating arm **120** may then be held in this position by engagement of the positioning pin **136** within the drill chuck. Also, the spacing between the positioning pin **136** and the alignment pin **132** is equal to the center to center distance between the gimbal rings **76** and **78** or the balls **24** and **74** clamped therein, in order to properly locate the ball **24** when the ball **74** receives the alignment pin **132**.

An alternative method for locating the fitting ball **74** at a reference location corresponding to the drilling location for the bowling ball **24**, is illustrated in FIGURE 6. In accordance with this alternative method, the locating arm assembly **120** aforementioned is replaced by a locating arm **138** pivotally connected by the hinge **140** to a

support bracket **142** secured to the base **14** in fixed spaced relation to the column **16** and in laterally spaced relation thereto. Accordingly, the locating arm **138** may be swung into the solid line position shown in FIGURE 6 in order to establish a reference location at its target sighting aperture **144** adapted to be aligned with the finger insert of the adjustable fingerstall assembly **134** in the fitting ball **74**. The fitting ball must therefore be angularly oriented to a position wherein the axis of the finger insert bore is perefectly vertical or parallel to the vertical rotating axis of the drill bit in order to correspondingly orientate the bowling ball **24** to be drilled. Thus, in connection with the modification shown in FIGURE 6, a level indicating target device **158** is provided as shown in FIGURE 5.

Referring now to FIGURES 4 and 5, it will be observed that each fingerstall assembly **134** is provided with a seating element **146** and a clamp member **148** similar to the seating elements and clamp members associated with the fingerstall assemblies disclosed and claimed in the prior copending application aforementioned. A finger receiving insert **150** is also associated with the fingerstall assembly and clamped between the bearing surface portions **152** and **154** of the seating element and clamp member, the insert being provided with a finger-receiving bore **156** within which the level indicating target device **158** may be mounted. The target device **158** includes therefore, an exposed mounting base **160** which mounts a level indicating bubble portion **162** within which a levelling bubble will indicate the vertical positioning of the shank portion **164** when the bore of the finger-receiving insert **150** is properly orientated in the locating apparatus. The target device **158** may of course be removed from the finger insert and replaced by an alignment bushing when utilizing the locating arm assembly **120** as described in connection with FIGURES 1 through 3.

The dummy ball **74** is fitted to the natural handgrip of an individual bowler by means of the fingerstall assemblies adjustably mounted therein as explained in detail in the aforementioned prior copending application. Each fingerstall assembly is then locked in its adjusted position and the finger insert clamped in its orientated position at the same time by means of a screw clamping assembly of an improved type generally referred to by reference numeral **166** as more clearly shown in FIGURE 5. The screw clamping assembly includes a ball engaging element **168** connected by a ball and socket connection **170** to an externally threaded screw shank **172**. The ball engaging element **168** is axially displaced by the screw shank **172** into engagement with the bottom of an adjustment slot **174** formed in the fitting ball tending to displace the seating element **146** from the fixed path of movement to which it is constrained by the guide projections **176** projecting laterally therefrom as shown in FIGURE 4. Thus, the seating element **146** is locked by a binding action in its adjusted position. The end **178** of the screw shank **172** is slotted for reception of a screwdriver and is threadedly received within an externally threaded, hollow screw element **180** open at opposite axial ends so as to both expose the slotted end **178** of the screw shank **172** as well as to accommodate the projection of the screw shank therefrom. The hollow screw element is provided with a head portion **182** received within a socket cavity **184** formed in the seating element against which the head portion **182** bears. The screw element **180** may also be held in axially fixed position within the seating element by means of a setscrew element **186**. The hollow screw element **180** also extends loosely through an aperture **188** formed in the clamp member **148** and projects from the clamp element centrally through a recess **190** in its top arcuate surface. A clamping nut **192** is threadedly mounted on the screw element **180** and bears against the clamp member **148** within the recess **190** in order to clamp the finger-receiving insert **150** between the clamp member **148** and the seating element **146**.

From the foregoing description, the utility and construction of the apparatus and elements associated with the present invention, will be apparent. It will be appreciated therefore, that by virtue of the present invention both the gauging and drilling of finger holes in bowling balls may be rapidly and accurately effected to suit individual bowlers. By use of the adjustable fingerstall assemblies **134**, the locations and orientations of finger-receiving bores may be established in the fitting ball **74** by the clamping of the finger inserts **150** in adjusted and orientated positions determined by the bowler's grip. The fitting ball **74** as well as a bowling ball **24** to be drilled may then be clamped within the respective gimbal rings of the locating apparatus **12** utilizing either the locating arm **120** as shown in FIGURES 1 through 3 or locating arm **138**, as shown in FIGURE 6. The reference location for the fitting ball and its angular orientation is then established either by reception of the alignment pin **132** within the finger bore **156** of the insert **150** after the positioning pin **136** is clamped within the drill chuck **20** or by sighting the level indicating target device **158** through the aperture **144** in the locating arm **138** following the orientation of the dummy ball **174** to a position levelling the bubble within the target device. The bowling ball **24** will then be in a proper position below the drill chuck of the drill press so that after the locating arm is swung out of the way and a drill bit inserted within the drill chuck the drilling machine may be operated to form a finger-receiving hole within the bowling ball. The balls may then be reorientated in order to drill the other finger receiving holes utilizing the same locating procedure. Positioning of the balls is of course effected by means of the screw operating hand wheels **86** and **96** while orientation of the balls is effected by displacement of the rectangular frame and simultaneous displacement of the gimbal rings through the hand wheel **118**.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In combination with a base, and a drill mounted for vertical movement, apparatus for drilling holes in bowling balls comprising, a supporting platen mounted by the base for movement in a plane perpendicular to the path of movement of the drill, a frame rotatably mounted by the platen about a first axis parallel to said plane, a pair of ball clamping gimbals rotatably mounted by said frame about parallel spaced axes intersecting said first axis, means connected to said platen for adjustable positioning thereof, orientating means connected to said pair of gimbals for simultaneous angular adjustment thereof about said pair of parallel spaced axes, and locating means for adjustably positioning one of the gimbals at a reference location to align a bowling ball clamped in the other of the gimbals with the drill.

2. The combination of claim **1** including a fitting ball clamped in said one of the gimbals having an adjustably mounted fingerstall therein adapted to be aligned with said locating means.

3. The combination of claim **2** wherein said locating means comprises a locating arm rotatably mounted by the column above the frame, an alignment pin mounted by the locating arm for reception within the fingerstall of the fitting ball and a positioning pin mounted by the locating arm in spaced relation to the alignment pin and adapted to be engaged by the drill chuck to position the arm below the drilling head.

4. The combination of claim **1** including a fitting ball clamped in said one of the gimbals having an adjustably mounted fingerstall therein and a level indicating target device received in said fingerstall adapted to be aligned with said locating means.

5. The combination of claim 4 wherein said locating means comprises, a locating arm having a target aligning aperture therein, and means pivotally mounting the locating arm on the base for angular displacement of the arm to a position aligning the aperture with the reference location.

6. The combination of claim 1 wherein said locating means comprises a locating arm rotatably mounted by the column above the frame, an alignment pin mounted by the locating arm and a positioning pin mounted by the locating arm in spaced relation to the alignment pin and adapted to be engaged by the drill chuck to position the arm below the drilling head.

7. The combination of claim 1 wherein said locating means comprises, a locating arm having a target aligning aperture therein, and means pivotally mounting the locating arm on the base for angular displacement of the arm to a position aligning the aperture with the reference location.

8. In combination with a drill mounted for vertical movement, apparatus for drilling holes in bowling balls comprising, a base, a supporting platen mounted by the base for movement in a plane perpendicular to the path of said vertical movement, a pair of ball clamping elements, gimbal means adjustably mounting said ball clamping elements on the supporting platen, positioning means connected to the platen and the gimbal means for simultaneously orientating the ball clamping elements, a fitting ball received in one of the ball clamping elements and locating means for establishing a reference location to which the fitting ball is displaced by the positioning means aligning a bowling ball within the other of the clamping elements with the drill.

9. The combination of claim 8 wherein said locating means comprises a locating arm rotatably mounted by the column above the frame, an alignment pin mounted by the locating arm for reception within the fitting ball and a positioning pin mounted by the locating arm in spaced relation to the alignment pin and adapted to be engaged by the drill chuck to position the arm below the drilling head.

10. The combination of claim 8 including a level indicating target device mounted by the fitting ball adapted to be aligned with said locating means.

11. The combination of claim 10 wherein said locating means comprises, a locating arm having a target aligning aperture therein, and means pivotally mounting the locating arm on the base for angular displacement of the arm to a position aligning the aperture with the reference location.

12. The combination of claim 8 wherein said locating means comprises, a locating arm having a target aligning aperture therein, and means pivotally mounting the locating arm on the base for angular displacement of the arm to a position aligning the aperture with the reference location.

13. The combination of claim 1 wherein said orientating means comprises, a pair of gear elements respectively connected to said pair of gimbals and a common gear member enmeshed with both of said gear elements for simultaneous displacement of the gimbals.

14. In a machine for drilling holes in a blank ball in accordance with the positions and pitch angles of holes in a master ball, the combination of, a base, a drilling tool supported for movement along a predetermined path, a pin, means on said base for supporting said pin for movement along a second path parallel to said predetermined path, a first holder disposed along said predetermined path to support the blank ball for engagement with the drilling tool, a second holder disposed along said second path to support the master ball for engagement with the pin, a carriage mounted on said base for movement in a first direction perpendicular to said paths, a frame supported on said carriage for movement in a second direction perpendicular to said first direction, said frame being pivoted on said carriage for rocking movement relative to the base about a predetermined axis perpendicular to said paths, and said holders being pivoted in side-by-side relation on said frame for rocking movement relative to the frame about parallel axes perpendicular to said predetermined axis, means operatively connecting said holders for rocking in unison about parallel axes, and means for bringing the pin into one hole of the master ball and thereby position the blank ball relative to said predetermined path in accordance with the positioning of the master ball relative to said second path for duplication of the holes in the blank ball.

15. The combination of claim 14 including means for locking the second holder in place with the axis of the one hole in the master ball aligned with said second path.

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FRANCIS S. HUSAR, Primary Examiner

U.S. Cl. X.R

33—174; 77—62, 63