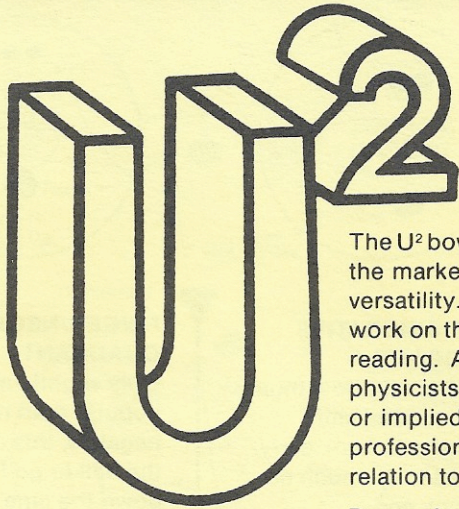


DRILL "BITS"

TECHNICAL INFORMATION FOR THE PROFESSIONAL BALL DRILLER

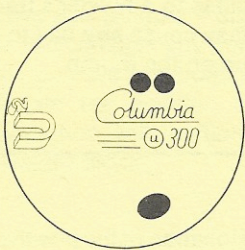


The U² bowling ball is one of the most versatile and easy to drill balls on the market. This information is intended to help you understand this versatility. Any technique that you have developed on other balls will work on the U². However, if you would like some suggestions, keep on reading. Although these methods have been tested and proven by physicists and professional bowlers, there is no guarantee, either real or implied, made by Columbia. They must be applied by a qualified professional who considers both the bowler and lane conditions in relation to each method.

Recognize that all illustrations, with the exception of finger and thumb weight, are shown for righthanders. They must be reversed for lefthanders.

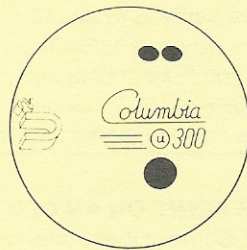
LABEL AREA

WEIGHT SHIFTS: Moving the grip slightly away from the main engraving (the heaviest part of the ball) creates "label weights." Finger and thumb shifts are commonly combined with positive or negative shifts to adjust skid, roll, and hook tendencies.



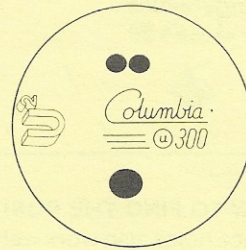
FINGER WEIGHT:

Moving the finger holes closer to the engraving creates finger weight. Finger weight causes the ball to go further down the lane before it hooks.



THUMB WEIGHT:

Moving the thumb hole closer to the engraving creates thumb weight. Thumb weight will cause the ball to hook sooner. Note that drilling thumb weight on a U² may remove more of the heavy core material than on other two-piece balls. This will result in less thumb weight than expected. To compensate, you may want to drill your finger holes deeper, or as an alternative, make a core-mounting pin shift to the thumb/positive quadrant.



POSITIVE WEIGHT:

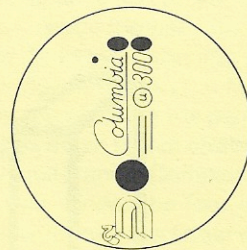
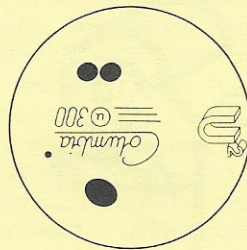
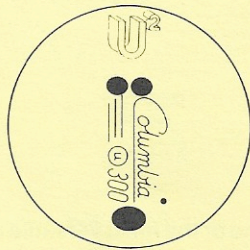
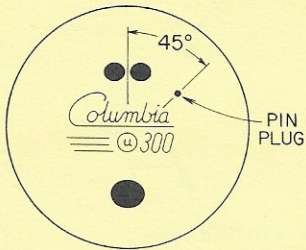
Moving the grip towards the left side of the ball creates positive side weight (opposite for lefthanders). Positive weight causes a ball to hook more when it makes its move to the pocket.



NEGATIVE WEIGHT:

Moving the grip towards the right side of the ball creates negative side weight (opposite for lefthanders). Negative weight causes a ball to hook less when it makes its move to the pocket.

CORE-MOUNTING PIN SHIFTS: The U² core is mounted on a pin inside the mold into which liquid urethane is poured that forms the shell, or outer surface of the ball. The hole that is left when the ball is removed from the mold is then filled. This can be seen very close to the center of the main engraving as a plug about 1/2-inch in diameter. To meet the demands of today's bowlers, Columbia has intentionally varied the position of this plug from ball to ball in relation to the center of the engraving. Rotating the plug into various quadrants of the ball is another way to drill in the label area while creating different ball reactions.



FINGER/POSITIVE QUADRANT:

If the core-mounting pin plug is not directly under the center of the main engraving, it will be located in the finger/positive quadrant of the ball for rightanders at about 1:30 on a clock face. Lefthanders should rotate the pin to about 10:30 for this same type of reaction. This causes the ball to go further down the lane and snap toward the pocket a little harder. This reaction is similar to the one created by moving the center of the main engraving on the finger/positive direction.

THUMB/POSITIVE QUADRANT:

This rotation of the label will cause a reaction similar to moving the center of engraving in the thumb/positive direction away from the center of grip. The ball will hook sooner, while still maintaining good hook on the back end. This position of the pin is recommended for full rollers as a way to increase hitting power and avoid rolling over finger holes.

THUMB/NEGATIVE QUADRANT:

Reacts similar to a thumb/negative label shift. The ball will hook early and not hook much on the back end.

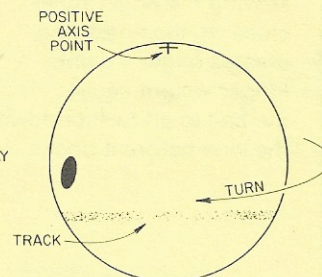
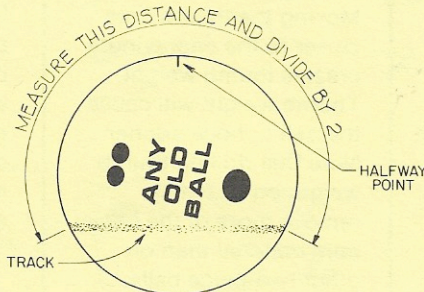
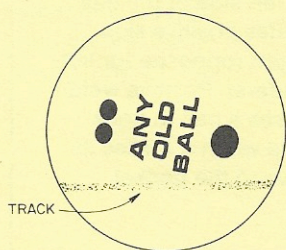
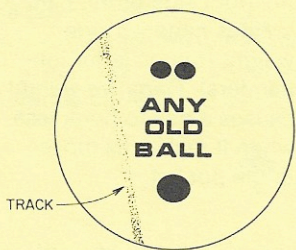
NOTE: This is not a popular drilling technique on *any* ball, particularly for high track bowlers, because the mass of the weight block is positioned very close to the bowler's track and may cause it to roll up on the thumb.

FINGER/NEGATIVE QUADRANT:

Only slightly more popular than thumb/negative, this causes the ball to go further down the lane before hooking, and still creates very little back end reaction. It can be useful when a bowler encounters a wet middle/dry outside condition. However, proceed at your own risk, because putting the mass of the weight block this close to a bowler's track may cause *any* ball to roll up on the thumb.

HOW TO FIND THE POSITIVE AXIS POINT ON AN OLD BALL

Popular methods that require balance holes also work well on the U². Some of these methods require location of the positive axis point and determination of the distance from the positive axis point to the bowler's grip. After finding these two items of information on an old ball, it is easy to transfer them to the U².



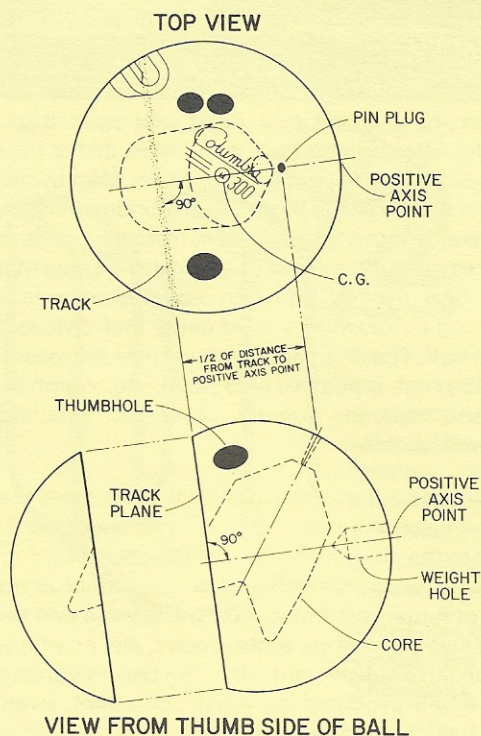
STEP 1: Map out the bowler's track on any old ball.

STEP 2: Turn the ball so that the track is parallel to the floor, on the bottom half of the ball.

STEP 3: Measure the distance from one side of the ball's track to the opposite side of the ball's track. Record the measure and divide by two. Draw a line through this point.

STEP 4: Turn the ball around 90 degrees and repeat Step 3. The halfway point where the lines intersect is your positive axis point.

LEVERAGE WEIGHT

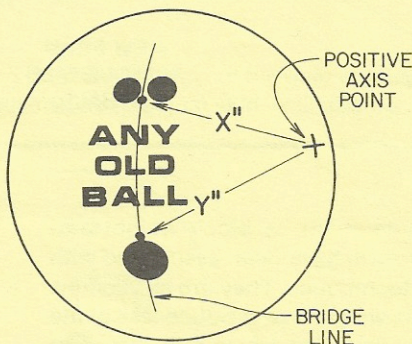


It is preferable to start with a ball with 2.5 ounces or more of top weight when drilling leverage weight. Maximum leverage weighting of a U² is created by placing the core-mounting pin plug at the leverage point. This is the point halfway between the **track** (not the grip) and the positive axis point where the pin plug is on a line that crosses through the center of the palm and the positive axis point. This positions the core at almost a 45 degree angle to the track plane, causing a whipping motion around the axis, thus the name leverage. The heaviest part of the ball prior to drilling is sometimes referred to as the static center or the center of gravity (CG). To ensure that the CG is affecting the ball in the same way as the pin plug, position it on the same line as the pin plug.

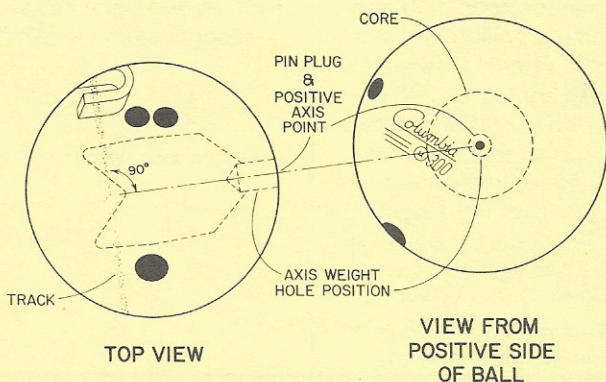
To avoid losing any of the leverage created by this maximum leverage position, drill your weight hole through the positive axis point, leaving just under one ounce of positive side weight. Maximum leverage weight will cause the sharpest break of any drilling method. Because of this, it is the most difficult to control. To reduce this break, you may want to drill your balance hole deeper to remove some of the side weight. If a bowler does not have a consistent release, try to steer him away from leverage weight.

HOW TO TRANSFER OLD BALL INFORMATION ONTO A NEW U² FOR AXIS WEIGHT OR AXIS BALANCE

Measure the distance from the positive axis point on the old ball to where the span line crosses the fingers and from the positive axis point to the thumb hole (See illustration: X = distance from fingers to positive axis point; Y = distance from thumb to positive axis point). Now you can pick any point on an undrilled U² that you wish to put on the positive axis point and span these distances in any direction to locate the position of gripping holes. This method, called triangulation, will position the grip at the correct angle in relation to the weight block.



AXIS WEIGHT

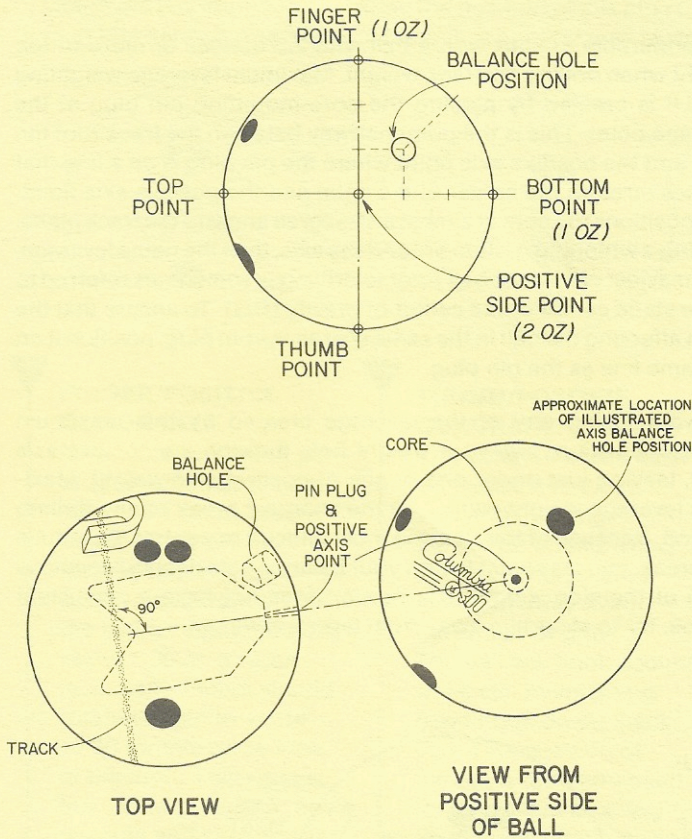


In order to drill axis weight or axis balance, it is preferable to start with a ball that has top weight of 2.5 ounces or less.

Axis weight is created by locating the core-mounting pin plug on the bowler's positive axis point. Then span back your predetermined distances to finger and thumb hole positions. Again, a weight hole must be drilled to conform to ABC/WIBC specifications. The most common positioning of this weight hole is directly into the positive axis point.

Axis weight is intended to produce an even arc from release to impact. To create the greatest arc, leave just under one ounce of positive side weight. To reduce the arc, drill your weight hole deeper. This most common method of positioning the weight hole builds some wobble into the ball because of the resultant bottom weight. This might be thought of as a lever created by center of gravity placement as opposed to the previously described leverage weight created by weight block placement. However, it will not affect the ball's roll nearly as much as leverage weight.

AXIS BALANCE



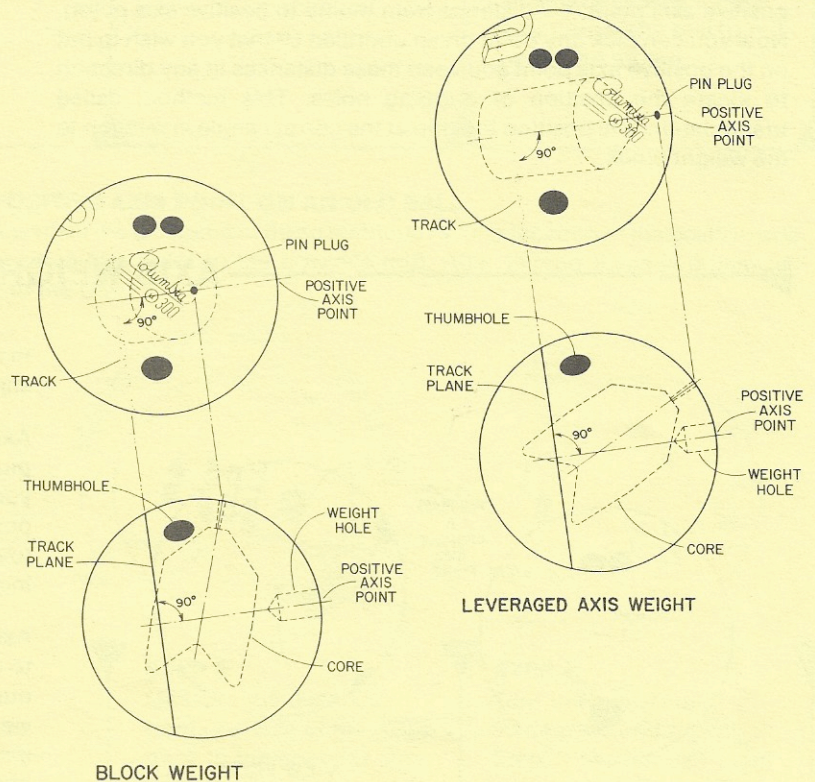
Axis balance will prevent the bottom weight and resultant wobble created by axis weight. Again, position the core-mounting pin plug on the positive axis point and span back to your grip location. After drilling your grip holes, divide the ball into eight equal sections with your quarter scale. Start by continuing a line from the center of the thumb to the bridge between your fingers all the way around the ball. Now, from the center of the palm, go all the way around the ball at a 90 degree angle to that circle. The ball is now divided into four equal quadrants. Complete the sectioning by drawing a third circle that divides the four quadrants in half. The intersecting points now represent a finger point, a thumb point, a positive side point, etc. Weigh the ball on your scale and mark the quantity of weight remaining at the three applicable points.

These three points form a triangle that encloses the section of the ball where you will want to drill your balance hole. Locate the hole closest to the point with the most weight remaining. For instance, if there are two ounces of positive, one ounce of bottom, and one ounce of finger remaining, you will want to drill twice as close to the positive point as the bottom point, etc. As with axis weight, the more positive side weight left in the ball, the greater the arc. Axis balance will produce the most consistent, even rolling, even arcing ball of any drilling method.

Many other names, such as block weight and leveraged axis weight, have been associated with different drilling techniques. They are all versions of leverage or axis weight that produce less of the above described effect and are, in fact, less than maximum leverage weight. They are accomplished by positioning the core mounting pin plug, and thus the core, at any angle to the track plane other than straight over the label, maximum leverage or axis positioning.

If a bowler prefers one of these other methods, do not hesitate to drill it. As mentioned before, the U² is a ball that can be drilled using any of the methods currently in use.

For the serious driller who wants to drill any method discussed here with the greatest degree of accuracy and confidence, investigate a product called CompuBalance. It can make your life easier and add profit to your pro shop.



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