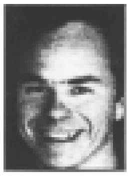
Bob Jewett



# Masse 102

## Execution of fancy shots can be enhanced with the proper equipment.

**In my last** column, I covered a system of aiming masse shots, suggested some basic techniques, and assigned some practice shots. Have you done your homework?

Outstanding! Let"s review a little and then discuss some equipment issues.

The aiming system described last time — the final direction of the cue ball is parallel to a line joining the resting spot of the cue ball and where the stick points on the cloth — applies to low-elevation English shots as well as more radical curves. On a typical side spin shot, the stick is elevated three degrees (about three inches from tip to butt) and the stick points to a spot on the cloth about two feet in front of the cue ball. However much off-center you hit the cue ball, that is how far from the initial path of the cue ball that the "aiming point" will be. and that determines directly how much angle the ball will curve through. For maximum side spin, you will hit about one-half inch off center, so the stick will be pointing at a spot on the cloth two feet ahead and half an inch over. That's almost one degree of curve, which is nearly a ball's width in a table length.

You may think you play with a level stick, but have a friend measure how far above the slate the center of your cue's bumper is when striking on the equator of the cue ball. Note that if draw is added to the side spin, the angle of the curve increases doubly. First, you will generally have more elevation to get the draw. Second, because the stick is lower on the cue ball, its line will reach the cloth sooner and the aiming point will be nearer the cue ball.

These general trends can be turned into a second system for aiming masse shots that's a little simpler than the one above. Note the angle you need to curve the ball through: first line your stick up along the final path you want the cue ball to take towards the object ball, then move your stick in line with the initial path of the cue ball that will allow it to clear the obstacle. The difference between these two directions we'll call the "curve angle." Now match your elevation angle to the curve angle — this part is by feel — and hit the cue ball with equal parts of draw and side. The angles are roughly equal; for a 45-degree curve, start with about 45 degrees of elevation, or maybe a little less.

Here's an alignment technique I learned from Tom Rossman when we were both taking a week-long course on masse and other fancy shots given by former European champion Hans de Jager. After you've planned your shot and you know the line the cue ball has to start along, hold your stick level along this line and carefully raise it. keeping it always in the same vertical plane. One of the main problems with elevated shots is maintaining the direction of the cue stick, and this is a good, methodical way of staying on the right line.

> **Most easy masse shots in games can be made with a standard cue. For serious practice and study, it should be shorter.**

So much for the theory and technique — on to equipment considerations.

Most easy masse shots in games can be made with your usual cue stick. For serious practice and study, you'll want to get a stick better suited to the shots. First, it should be shorter. My two masse cues are 47 and 50 inches long, which allows most of the weight to be well below the grip, increasing comfort and stability.

A standard weight will do for all but the slate-shattering shots, but get a 14mm ferrule. It will stand up better to the punishment and the larger tip will be easier on the cloth. Finally, you need a grip that will not slip. Bare varnish is pretty good, linen is bad but rubber is best.

The cloth has a huge influence on the action of the shots. On new. slippery cloth, it's easy to get great, sweeping arcs or to pull the cue ball back after sending it most of the way to the other end of the table. On old, dirty, sticky cloth the spin grabs too quickly and often the cue ball will fail to clear the obstacle before "breaking." Very dirty cloth will grab the bottom of the cue ball more strongly than the tip on some nearly vertical shots, and the action will be completely ruined. Usually a miscue will accompany such a result as the tip gives way before the cloth. Keep the cue ball and the cloth clean.

If you are stuck on old cloth, you can make it act more like new by waxing the cue ball. I use a paste wax. Roberto Rojas, the great Mexican fancy-shot artist, uses silicone to help his masse exhibitions, and he gets action that will make your eyes bug out and your brain boil.

For practice sessions, stay at the head end of the table. The cloth is generally cleaner there, and if you do nick the green, the divot will be less frequently bothersome than in the rack area.

Avoid practicing on slate seams — about $2^2$A diamonds from the ends on most tables — or you may crack the sealing plaster. For power shots, protect the cloth with a small pad under the cue ball. I use a small square of clear, hard plastic, which also helps the ball slip out from under the tip. As you improve, the miscues and table contact will be less frequent, and you can eliminate this prop.

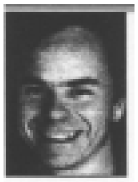
Can you hear the room owners' moans? I can. Here's a suggestion for them to make a little extra money from old cloth and help their players learn at the same time: When some tables are about to be recovered, advertise a masse clinic. Offer two hours of instruction and practice for about $20. Remember to use wax or silicone to get nice action on old cloth with old cue balls. The players will learn proper technique and have a little fun with the normally forbidden shot.

Then put up a sign: "No masse shots without instruction."

Next time we'll go over more shots — some practical and some just for fun.

*Bob Jewett has taught pool (including masse shots) since 1970, and is a partner in the San Francisco Billiard Academy, a BCA Master* ***Academy.***

Bob Jewett



# The Right Time To Masse

## Knowing when to hit the fancy shot is as important as executing it.

**The last two** columns covered theory, technique and equipment involved with masse shots. Now it's time to consider when to use your new skills.

In Diagrams 1 and 2, the game is 9-ball. In Diagram 1, you are slightly hooked on the 1 ball and the choice is between the masse shot and the kick shot. The masse is just like one you've been practicing, and the kick off the far side rail is quite likely to either scratch or sell out, so the masse is better. In the position shown, the 2 ball is ready for the run in case you do make the 1, which increases the payback for a good shot. If the 1 ball happens to be on the other side of the pocket, the kick is the better shot. If the cue ball is farther behind the blocking ball, you have to decide how confident you are in the curve shot.

In Diagram 2, there isn't even a good safety; a thin hit on the left side of the 1 is a likely scratch at A. There are two masse shots, though. A simple safety can be played by hitting about half-ball on the 1 ball with the stick pointed at about D. Use mostly right side, and enough elevation to hit the side rail at B with enough speed to continue to the end rail and then C.

The second shot is also likely to end in a safe, but has a chance to win. Play about the same angle and elevation with the cue stick, but use left-side spin and maybe a little draw with the intent to curve the cue ball back just enough to pocket the 9. The 1 ball must be struck full enough to drive it back across the table, so that it will be hidden by the 7-8 if the cue ball ends close to the 9. Adjust the separation between the cue ball and the 1 to see how that affects the shot.

There are some fun shots in Diagram 3. In shot A, the cue ball starts near the rail on the headstring. It must go around the ball on the spot to pocket the combination in the corner. The object of the B shot in Diagram 3 is to pocket both balls. The surprising part is that the far ball is pocketed first. Use a nearly vertical stick with left draw. If you cannot get good action at that distance, move the cue ball a little closer. The cue ball needs to start just a little off the rail so that it doesn't jump up under the nose of the rail and scoot out. Remember: both of these fancy shots are much easier if the cue ball or cloth is slippery.

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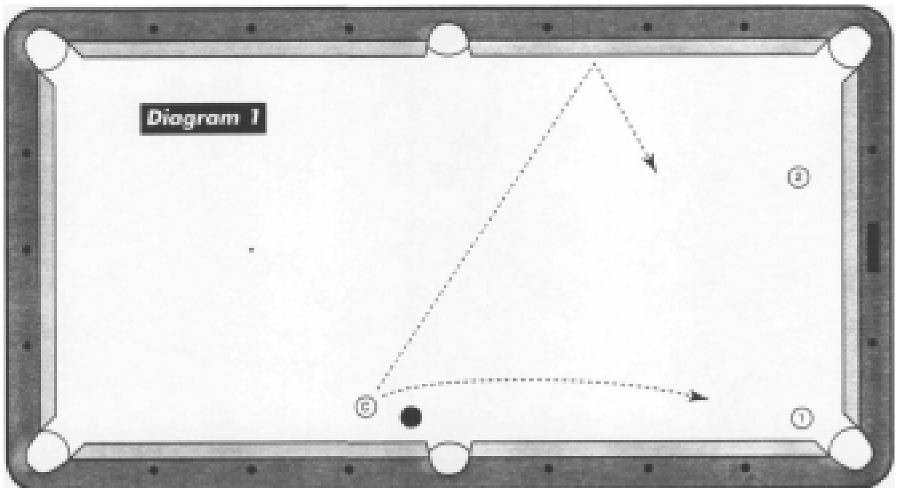


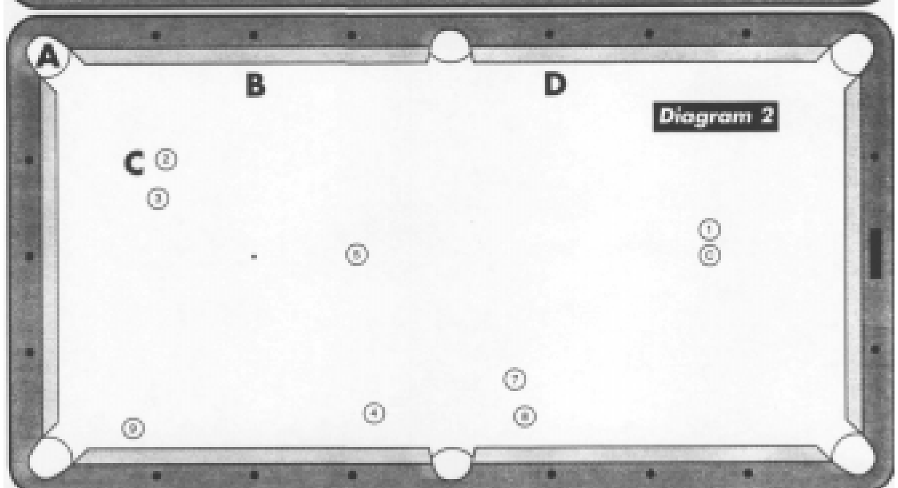


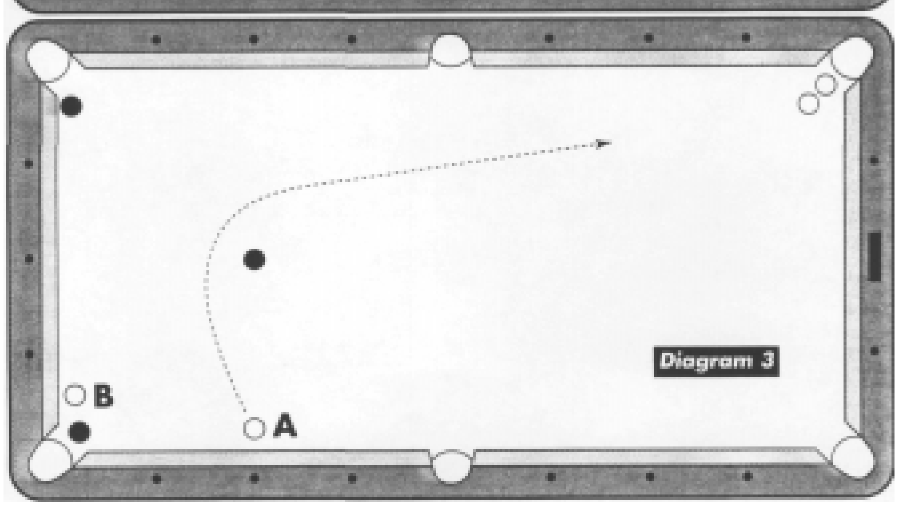

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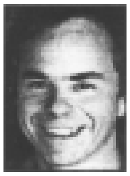


# Side Spin With a Kick

**Learn this type of applied English for when you need to use it.**

**A common piece** of advice heard around the pool hall is, "Over 80 percent of all shots can be played without side spin." While this may be true, some players take it to mean that they should avoid English as much as possible and, consequently, avoid learning how to spin the ball.

The flip side is that 20 percent of shots should be played with English, and you better be ready when they come up. This column simplifies the problem by mostly eliminating the object ball; the subject is kick shots. (Notes on word usage: "English," for purposes of this column, means side spin — left or right — and is separate from follow and draw, and a "kick shot" is any shot where the cue ball needs to go to a rail before hitting the object ball.)

**Diagram 1** shows a progressive practice drill that looks easy but is tough to master. The cue ball is shot straight across the table to contact each of the target balls. If the shot is successful, try for the next harder target, but if the shot fails, go for the next easier target on the next shot; you never try for the same target twice in a row. Mark your target with a coin to remember.

The shot in **Diagram 2** is about the same idea but the long way. This was first shown to me by Jimmy Lee — a great carom player and instructor — at Palace Billiards in San Francisco. Each diamond that the cue ball comes over in a table length is a "unit" of English. With practice, you will be able to dial in the exact spin you need to make a hit. Again, play the drill as progressive practice. Can you get to the side pocket? Be sure not to cheat by hitting over to the left on the far rail: maybe you will need to put an obstacle ball there.

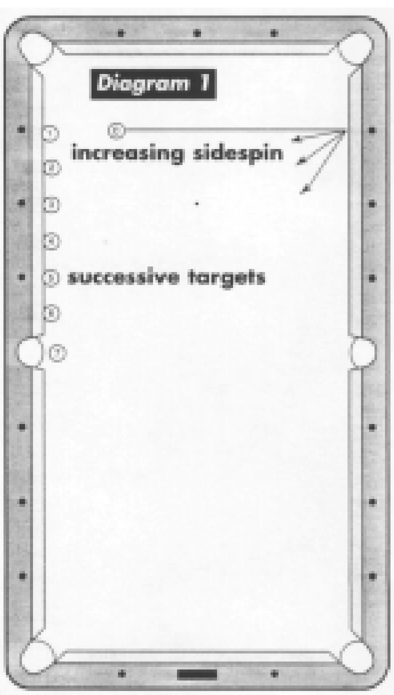
There are many variations on these two simple drills. Try playing the shots with just enough speed to reach the target, then shoot with force to separate balls by at least three diamonds at the end of the shot (similar to an attempted safety kick at 9-ball). For the softer shot, you will need to start with more spin since a larger fraction will be lost on the way to the rail. Don't neglect the other side spin — left or right. Both drills can be made easier by placing two or three balls on the rail as the target.

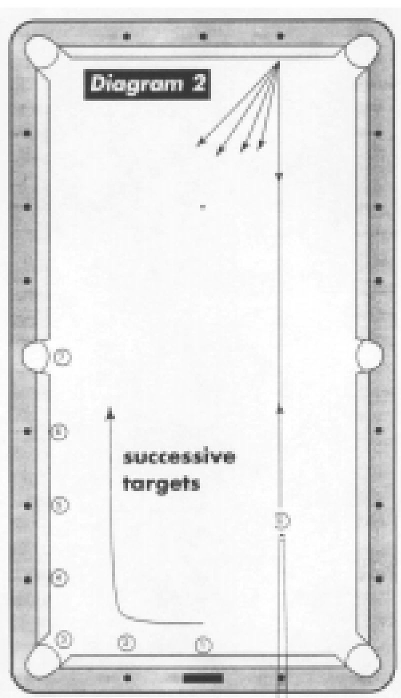
**Diagram 3** shows two additional variations. In shot A. the goal is to bring the cue ball nearly straight off the rail to pocket the duck, and to play from progressively farther up the table. This shot is a favorite demo of Grady Mathews, and is a surprisingly consistent way to kick, once you get the hang of it. Some draw gives a helpful curve off the rail. This shot can be varied by choosing a rail contact point farther up the table, but still with the goal of pocketing the duck. In Shot B, the idea is to shoot from a corner pocket to the far end rail and come back to that same corner pocket. How far out can you shoot and still get the cue ball to come back to the starting point? Experiment with center side spin, some draw or follow with the side spin and different speeds to find what works best.

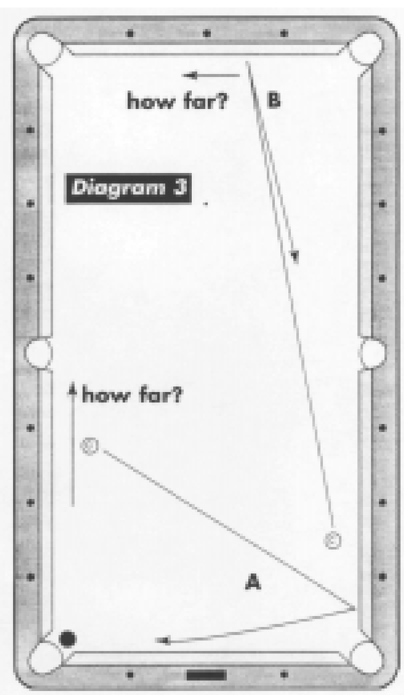
One remarkable result you may notice for the maximum English cases of these last two shots is that they can be a lot more consistent than the "easier" shots that require only a little side spin. This concept — that maximum english gives consistent results — is the basis of several banking systems. Of course, to succeed at these drills, you must first have the fundamentals of chalking, tip-to-ball contact and bridge down pat.

If you have any best-loved banking drills, please send them in for possible inclusion in a future column.

*Bob Jewett is a partner in the San Francisco Billiard Academy, a BCA Master Academy.*



Bob Jewett

TECHTALK

# Putting Proper Spin On It

## Learn the physics that dictate the English you apply to a cue ball.

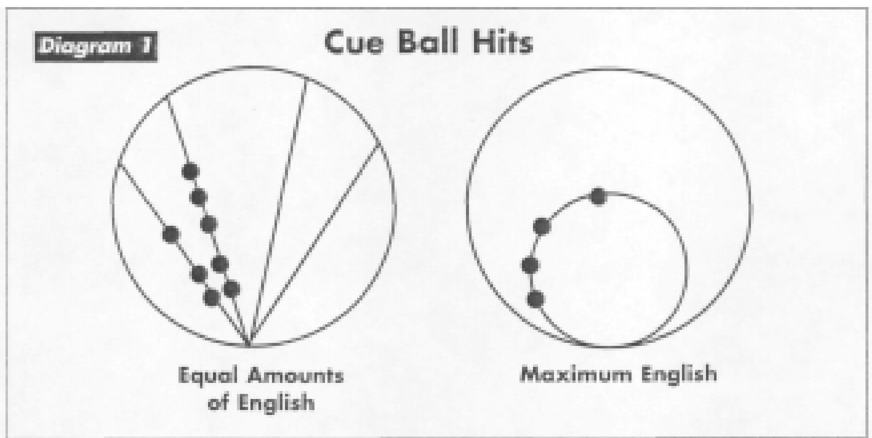
**If you practiced** the shots from *BD* May. you have developed a feel for how much a particular amount of side spin **will** take on the rail. This month, we'll go **over** some basic physics of the shot and see some new drills that will help you perfect **your** extreme spin shots.

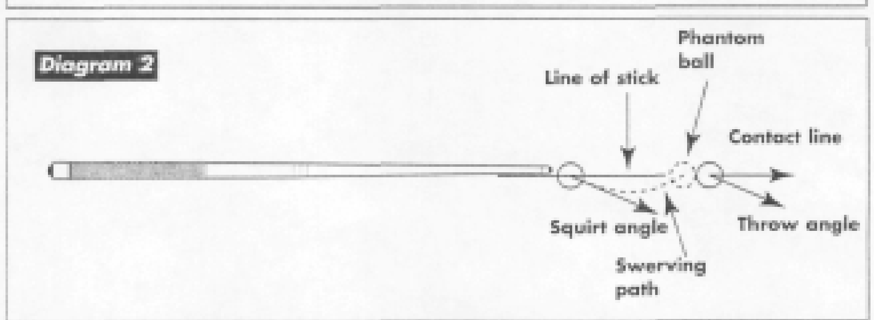
In **Diagram 1.** are two ideas from Ron Shepard's "Amateur Physics for the Amateur Pool Player." (If you don't already have a copy of this paper from the Internet, drop me a line, and I'll give you the electronic address.) On the left is a cue ball **with** "lines of equal English" shown. All of the points of tip contact on each straight line **will** produce the same amount of side spin relative to forward motion. This seems exactly wrong until you hear the one additional requirement: the spin is not used (or measured) until the cue ball is rolling smoothly on the table. Consider, for example, the points of contact near the cloth. Hitting the cue ball there will cause both left English and draw on the cue ball. As the ball moves away on the cloth, the draw **will** quickly dissipate due to the rubbing of the cloth, but the side spin will remain nearly constant. In effect, this multiplies the side spin. The amazing result is that the points for "constant side-spin-to-speed ratio when rolling smoothly" lie on a straight line. Where should you hit for maximum consistency if you want a particular amount of side? Well up on the ball is much better than down at the bottom, where the lines all converge and tip placement is critical for accurate control. Most players learn this subconsciously; now you know a little of the physics behind it.

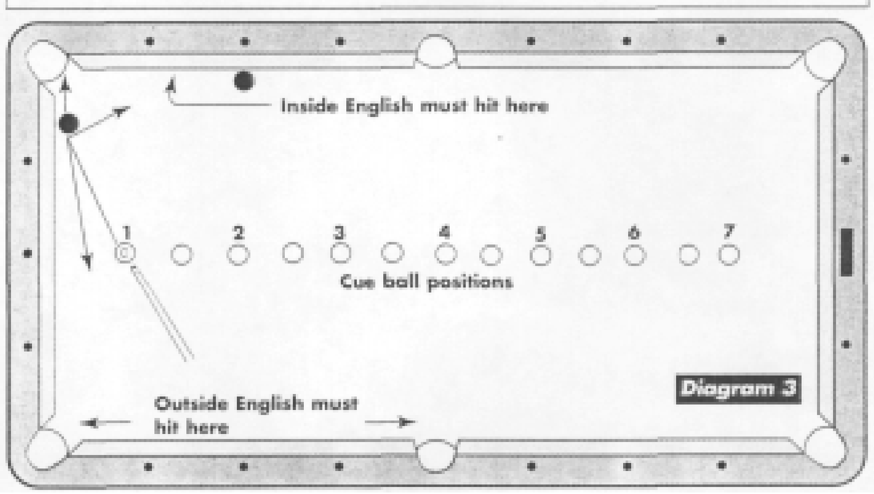
In the right view we answer the question. "For a given eccentricity of hit. what tip position gives the most side after normal rolling sets in?" The answer is again amazingly simple: on a small circle half as large as the cue ball, and resting on the same point. For very small amounts of English. hit nearly on the equator. For maximum effect, play the shot with roughly equal parts of side and draw. Although the addition of draw to the shot reduces the amount of side you can apply, the draw **more** than repays the loss by slowing down the cue ball and multiplying the spin effect.

OK. we are finally ready to hit an object ball while using English. Three major effects need to be remembered: squirt. swerve and throw. These have been discussed, but as a reminder, look at **Diagram 2.** which is a view from above for a shot **with** left English. When struck with side, the cue ball does not start straight ahead, but instead starts off at an angle — the squirt angle. This can be up to four degrees for extreme English and poorly designed cues. As the cue ball moves across the cloth, it curves or swerves back in. due **to** a minor masse effect. In theory, there would be no swerve back if you held the stick level, but you never do that because the rail and your knuckles won't let you.

The third effect happens when the cue ball lands on the object ball: throw. The left spin



**will** pull the object ball to the right of the contact line, which is the line joining the centers of the two balls at the instant of contact. If you also have a cut angle, throw becomes considerably more complicated. If you use no side spin, there will be some throw just due to the cue ball's rubbing across the object ball and dragging it a little in the direction the cue ball is moving. If there is just the right amount of outside English — **left** when cutting a ball to the right — the cue ball **will** roll across the object ball without any rubbing, and the object ball will be driven along the contact line. With excess outside, it is possible to increase the cut angle beyond the contact line, and a little draw with the side will help you get this extreme spin.

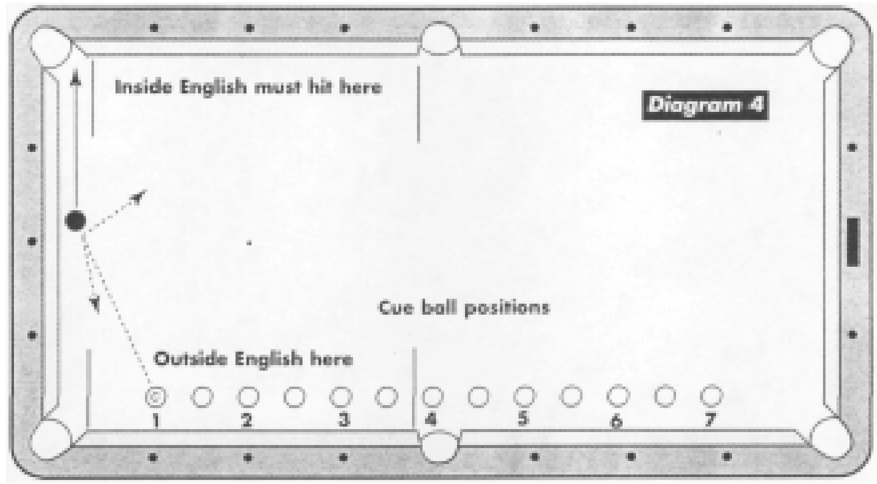



**Diagram** 3 is a spin drill. First consider the shot being played with inside or right spin. After pocketing the object ball, the cue ball is required to contact the side rail within two diamonds of the comer pocket. The extra object ball is at the second diamond as a sort of hurdle. Each time you make the shot, chose the next tougher cue ball position in half-diamond steps. If you fail to meet the requirements of the shot, play the next shot from the next easier position. The object ball is always returned to the marked position, which is half a diamond from the corner pocket and a thumb off the rail. Try moving the hurdle closer to the pocket and use the English multiplication trick to get the extreme angle required. Once you have inside English mastered, try the same drill but with outside English — left for this shot — so that the cue ball contacts the near side rail before the side pocket.

**Diagram 4** is a drill that requires considerably more accuracy in the hit on the object ball. The drill is similar to the drill above, but the object ball is two diamonds from the pocket and a ball off the rail. The location of the cue ball is even with the corresponding diamond, and just far enough off the rail to make a comfortable bridge on the bed of the table. If you can get to position 7 for both inside and outside English, while meeting the cue ball requirement, you will be far above average on the use of side spin.

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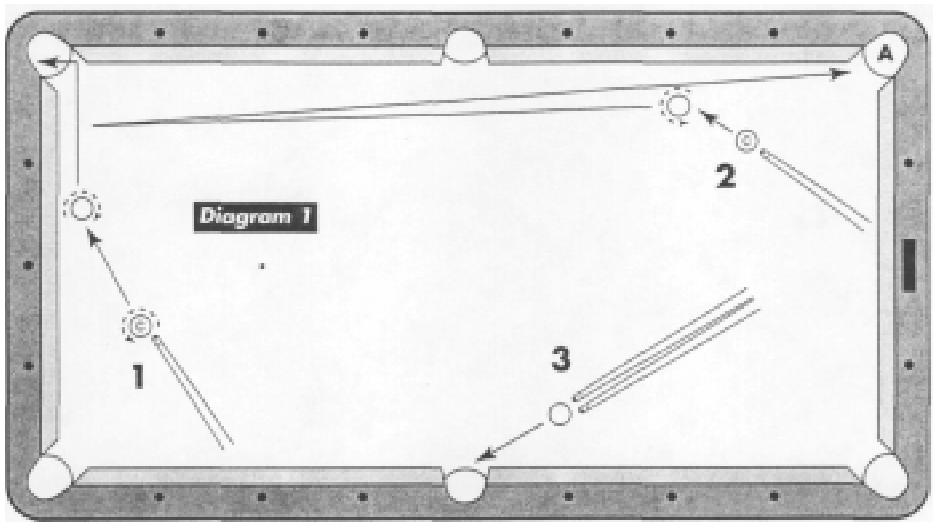
Bob Jewett

# Spin It In

## Does "get-in" English really exist?




**Is it possible** to help an object ball into the pocket by transferring side spin to it? An example is Shot 1 in Diagram 1 where inside (right) English on the cue ball becomes left on the object ball. When the object ball hits the far jaw of the corner pocket, the spin will help it enter the pocket, or so say the believers of "get-in" English. Some even say that "impossible" shots to the side pocket will go if helping English is used.

Is this effect real? If so, is there any shot using it that will quickly convince a skeptic? After working with the shot for a few hours, I'm sure that the answer to the second question is no; there is no obvious demonstration of the effect's usefulness. The first question remains: is there even a marginal benefit in using the technique?

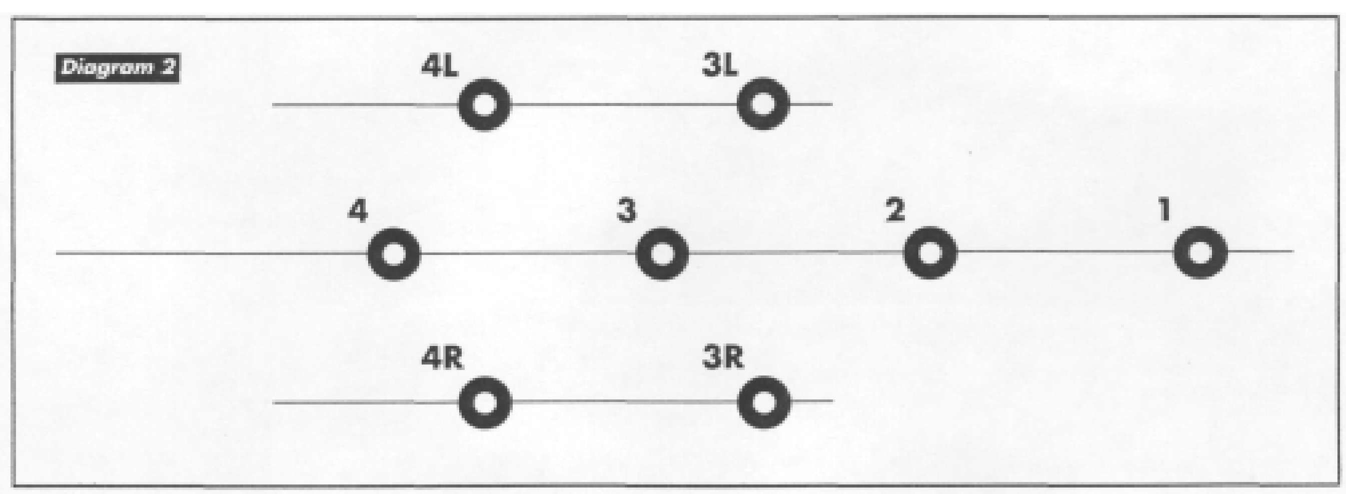
To get a basic feel for the size of the effect, first consider how much spin can be transferred to the object ball. In Shot 2, it is possible to shoot the object ball slightly away from the rail to bank off the short rail at the left and back into pocket A; this is an absolutely standard bank known to all one-pocket players. For a half-ball cut as shown, no added spin is needed on the cue ball; just the rubbing of the cut is enough to "twist" the ball back to the corner. Try it.

Now put the cue ball in the place of the object ball and shoot the cue ball along the same reverse-bank path and note how much side is needed. Using that same spin, aim towards the pocket and see if the spin makes the pocket larger or smaller as you use left and right. Can you detect a difference? (The cue ball is used here instead of an object ball because it is easier to direct to a particular part of the pocket with spin.) Try shooting the cue ball into the side pocket from unfavorable angles with that same small amount of side, as in Shot 3.

Let's try to measure the effect that may have been evident in the above primitive tests. Because the effect is clearly small, a very careful test setup is needed. If you're patient enough to carry out the following tests, please send your results to me. I'll arrange for a free one-year subscription for each of the three best submissions.

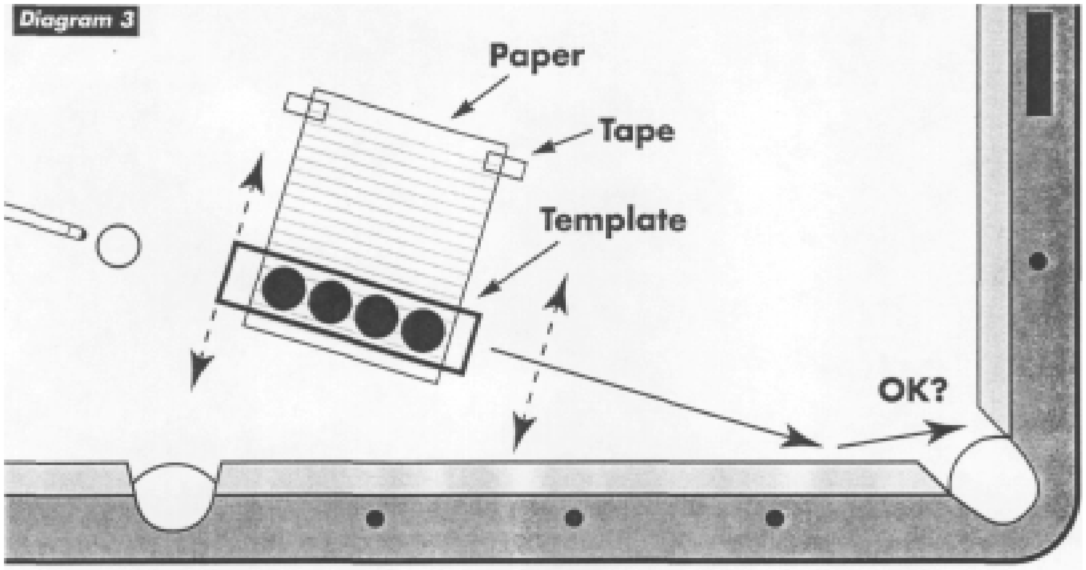
It's not easy to drive a ball precisely along a given line with a known amount of side spin. The following is a simple way that needs a minimum of equipment: a sheet of clear, hard plastic, self-adhesive paper reinforcements, lined notebook paper, tape, and a permanent marker.

The plastic sheet should be marked with a straight line down the center. Place paper reinforcements at 1-2-3-4 exactly in line and a couple of millimeters more than one ball apart. When balls are placed in the holes, the result is a four-ball perfectly straight combo. Now draw two lines to the sides as shown, one inch from the center line. Place reinforcements at 3L, 3R, 4L,



4R so that balls at 4L-3L-2-1 are all separated by two millimeters, and similarly for 4R-3R-2-1. (See **Diagram 2** for a basic outline.)

Tape the lined paper to the table as shown in **Diagram** 3 with a slight angle to the rail. Place the plastic template with its center line along one of the paper lines, and place balls — preferably the 1-2-3-4 balls for consistency — in the holes for the straight — in combination.



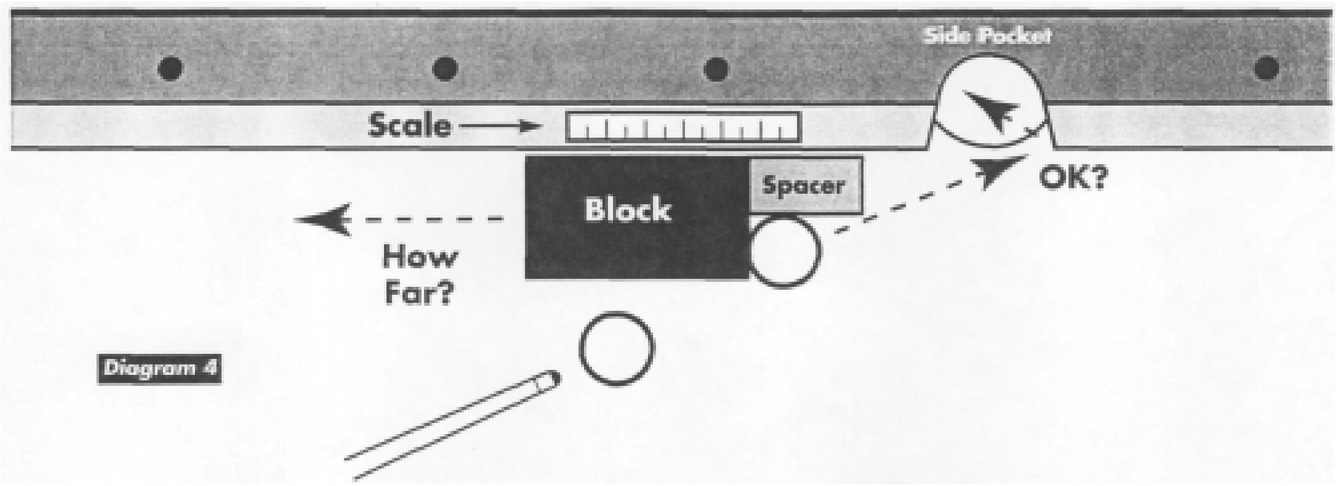

Shoot at medium speed, and move the template back and forth to find the extreme sides of the pocket. Be sure to keep the template parallel to the lines on the paper. The distance between the extreme positions of the template is the effective width of the pocket from this angle at the speed you used. Make a note of that width.

Next, place balls in the 4L-3L-2-1 holes, and repeat the experiment.

With this setup, the one ball will have "get-in" English from the transferred side from the cut angle. The two extreme points will likely be different from the first set. The number to record is again their separation. Repeat the test with the 4R-3R-2-1 spots, which will give the one ball "get-out" English.

To be really thorough, do this for several speeds and for pocket approaches from both the left and right. In all cases the "extreme point" is where the shot goes half the time, and its position should be measured to millimeter accuracy.

The effect for side-pocket shots could be measured similarly, but there is a faster test: the idea is to see if spin can improve the shallowest possible angle. You need two




blocks and a scale, as shown in **Diagram 4.** The ball is placed in an exact position by sliding the large block along the nose of the rail to a point on the scale, and placing the small block flat against the nose of the cushion. Repeatability should be within a small fraction of a millimeter. The exact dimensions aren't critical.

Once the object ball is precisely placed, remove the blocks, place the cue ball, and try to shoot the object ball into the side pocket.

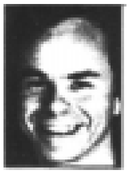
First, find the extreme location for straight — in with no side spin and various speeds. Carefully note the position on the scale. Now make the shot slightly more extreme and try various combinations of speed and side spin.

Is it possible to extend the range of side pocket angles? By how much and with what spin? For this shot, you need to report the distance off the rail (small block thickness) and improvement (or degradation for the wrong side) in how far up the rail the object ball is. You aren't looking for a 50-50 percentage; just find the limits of where the shot is barely possible.

Please send your write-ups to me in care of this magazine or by email to jewett@netcom.com. Neatness, completeness and promptness count. I'll summarize the results in a future column.

*Bob Jewett is the Secretary of the USBA, the governing body for carom billiards in the US.*

Bob Jewett



TECHTALK

# Complete Breakdown

**Cue sports simulators allow us to analyze the fleeting moments of pool.**

**Computer simulations of** physical systems are increasingly parts of our lives. The movie *Titanic,* video-arcade basketball games, and automobile design all benefit from this sort of virtual reality. (Automobile manufacturers doing crash testing of new designs use the most powerful supercomputers available to run cars into brick walls; it's cheaper in the CPU than on the test track.) Cue sports simulators such as Virtual Pool and Carom Simulator are now accurate enough that techniques and strategies useful on a real table can be learned from them.

This column describes a computer program that simulates a stick shooting a center-ball shot. We'll see that even such a simple case has interesting phenomena that the simulator, with its greatly expanded time scale, lets us examine in detail.

A fairly simple model is used for the stick itself, as shown in **Diagram 1.** (All diagrams are approximate.) The stick is divided into several hundred sections, and each is thought of as a small lump of mass connected to its two neighbors by springs. At first glance, this seems nothing like a real stick: the weights would sag down. To prevent this in the simulation program, the force of gravity is ignored, so the only force acting on each part of the stick is from its neighbors, and all the parts stay in line.

Each spring works very simply: in the resting position it does nothing, but if the two adjacent parts move closer, the spring pushes back with a force directly proportional to that compression. Similarly, if the two neighbors move apart, the spring will tend to pull them back together. The "stiffness" of the spring — how much push for how much compression — is set from the known properties of maple wood.

The taper of the stick is included by making the masses larger away from the tip. At the same time, the springs get stiffer because the larger cross section of wood is more resistant to compression.

The tip — or rather, the tip-to-ball interaction — is a little more complicated to simulate. While the parts of the stick are connected, the ball and tip only interact when the tip has moved into the space occupied by the ball; the tip doesn't grab the ball as it moves away. Also, the "spring" in this case is not the classical spring governed by Hooke's law, but instead increases in stiffness as the penetration increases.

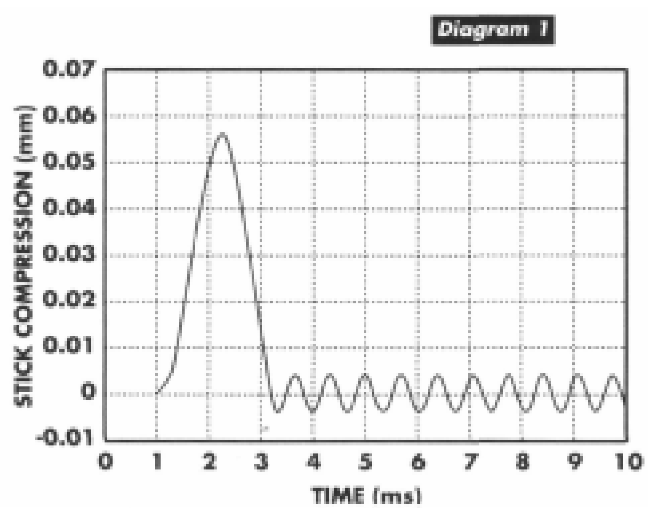
The ball is treated as a single six-ounce lump that is stationary at the start of the shot. While there may be some distortion or "ringing" of the ball due to the hit, modelling this would require dividing the ball into many small parts linked by springs — too complicated for this first look.

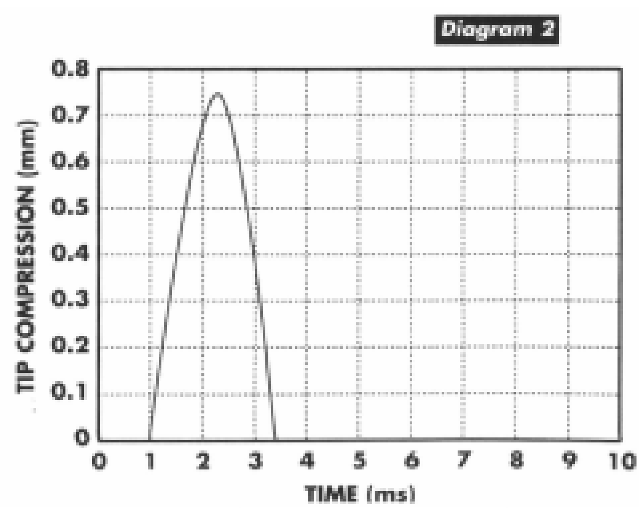
Now that we've reduced the ball and stick to masses and springs which interact by simple rules, how does the action proceed? The stick is positioned a short distance from the ball, and all its parts are given some initial speed. The "clock" is stepped forward by a tiny increment — typically one-millionth of a second — and the new positions of all the parts are calculated from the known velocities. If any of the springs is compressed or expanded, the velocity of neighboring parts will change a little. After the position and velocity of each part of the stick and the cue ball have been updated, the clock is advanced by another microsecond, and another cycle of calculation starts.

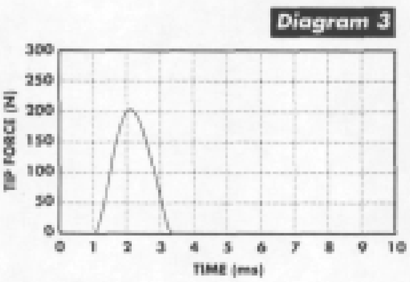
The following plots show what happens when a 20-ounce virtual stick travelling at one meter per second hits a cue ball. **In Diagram 2,** the tip compression is shown. Tip first meets ball at one millisecond on the time axis. The compression builds to three quarters of a millimeter, and then falls to zero as the ball is pushed away from the tip.

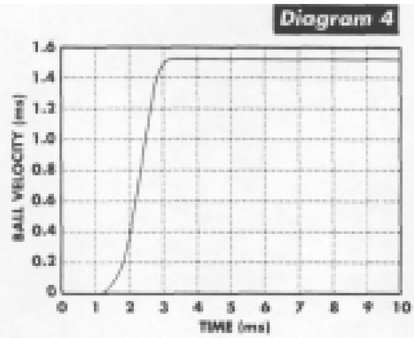
**Diagram 3** shows the force between the tip and the ball. The units are newtons — the calculation is all done in metric units — which are each about four and a half pounds of force, so the peak force for this moderate-speed shot is about 900 pounds. The shape of the force is a little different from that of the compression because the tip is a variable-rate spring, as mentioned above.

The ball velocity is shown in the next





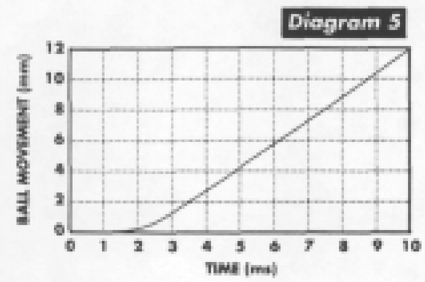




Diagram 4. Note how it builds up during the tip contact. An interesting point is that the final ball velocity — about 1.5 meters per second — is greater than the initial stick speed of one meter per second. This is expected from the simple physics of collisions between mismatched masses, and the value shown by the simulator is very close to the theoretical prediction.

Shown in Diagram 5 is how much the ball has moved versus time. The major point to notice here is how far the ball has gone when it leaves the tip, which happens 3.3 milliseconds into the simulation: about two millimeters.

Very simple physics predicts a "tip departure" after a travel of pi times the amount of tip compression, so this is another indication that the program is giving reasonable answers.

As with most beginning simulations, the above leads to many new questions: How do different tapers react? If there is a lump of metal in the middle of the stick — AKA, a joint — does it change the hit? A harder tip is likely to cause more ringing. How hard is too hard? The answers to these questions, and others that you might send to me at jewett@billiardsdigest.com, will have to wait for a future column.

This simulation program does not include side spin. That is a much more complicated problem, because in order to simulate the resulting bending of the cue stick, it must be chopped up into small parts in at least two dimensions and preferably three, as opposed to a single dimension for the present program. Getting the details right — how bendable is typical joint and ferrule material? — is a large job. A study of squirt, which is perhaps the most interesting cue stick problem that is susceptible to simulation, will have to wait for a more complete program. While the information explained here doesn't have an immediate application on the table, it should help you understand what is really happening when you hit the ball. And, since you can't control time of contact, it should be one less thing to worry about while you shoot.

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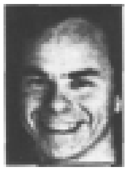
Bob Jewett



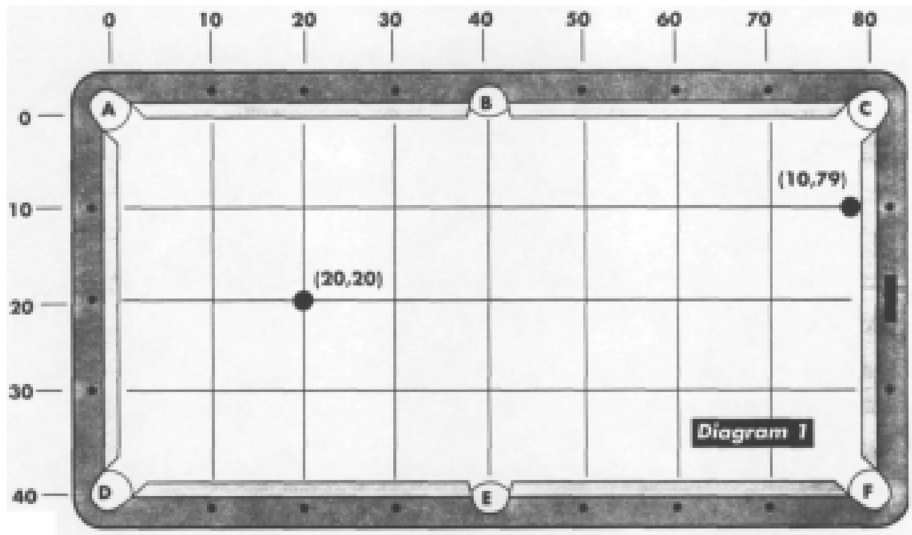
TECHTALK

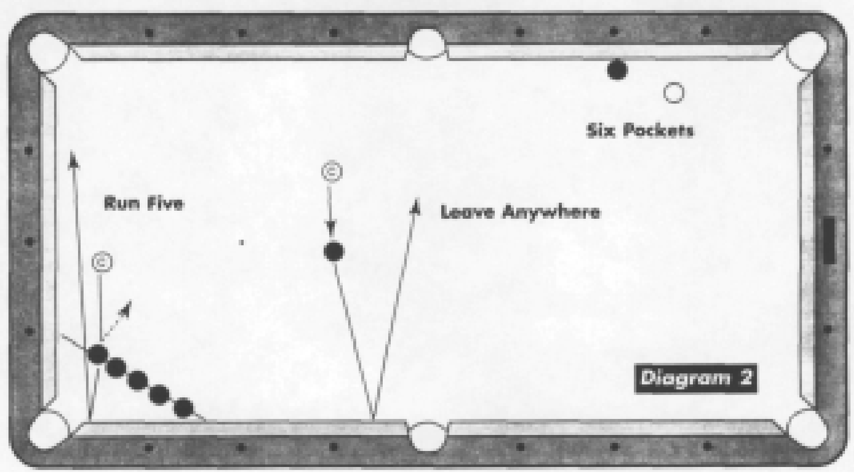
# 1.001 Banks

## These Practice Drills Feature Precise Aiming Points On the Rails

**Do you want** to bank balls better? Here are some practice drills that are guaranteed to improve this complex part of your game.

**Diagram 1** reveals a system that will help you categorize shots and can be used to record intricate shots without a diagram. Standing at the foot of the table, imagine a grid as shown. The position of any ball or rail contact can be precisely stated as the distances from the left rail and the foot rail in the units shown. Notice that there are ten units per diamond, so the ball on the foot spot is at location 20.20 and the one on the head rail occupies 10,79. The latter is not 80 units up the table because that would put the ball at the nose of the rail rather than half a ball away; it is the center of the ball that matters.




One-tenth of a diamond — one of our units of measure — is close to half a ball's width. Most shots will not need more precise specification, but you could use decimals if you are fanatical about accuracy. Half a ball is exactly 0.9 units on a 9-foot table.

The pockets get letters rather than numbers to avoid confusion. A-B-C run up the top side while D-E-F are on the bottom. Let's call the rails H. T, R and S for Head, Top, Right and Shoe. (If you have a better letter for the foot rail, speak up; B is taken.)

Here's the first problem: Can you bank (20,20) one rail off the head rail (H) to pocket A, with a ball at (10,79) as shown? You have the cue ball in hand. The blocking ball is very close to where you would like to land for a simple bank, so you will need to get some transferred side spin on the object ball, either by spinning the cue ball or by the cut angle. If you barely miss the obstacle, either side should work, using left english on the object ball when landing to the right and vice versa. If the balls and rail are stickier than average, you can place two balls side-by-side on the end rail and still make the shot either way. (I didn't believe this until I saw it done.)

That shot and this next one are very useful for one-pocket. Can you bank (20,20) off R and H to A? You may need to "twist" the ball a little on old cloth, but on slippery, new cloth, you can miss the shot long — hitting the S rail at (5,0). On very sticky cloth, the shot will always go short to rail T, and the shot is impossible. If I'm playing a lot of one-pocket on a table, I test to see how far to the left or right of the spot the object ball is when this shot is barely possible.

**Diagram** 2 shows three more drills. I learned "Six Pockets" from Eddie Taylor when he was giving free demonstrations at a BCA Trade Show. The idea is to bank the ball at (1,60) into each of the six pockets in as few tries as possible. The ball always goes back to that spot, and you keep trying each pocket until you make it, with cue ball in hand each time. This is an excellent drill for learning both frozen-ball banks and how the ball reacts on the second and third rails.

One trick to use is an impromptu "spot-on-the-wall" system. Suppose you want to bank to D with the balls as shown. Pick a spot at least six feet away along that line as your first target — perhaps a pocket on a neighboring table or the line between the mahogany paneling and the marble fireplace. If you miss, pick a new distant target until you are zeroed in. Once you have a good spot, try changing the speed — from barely hard enough to warp velocity — to see how the angle changes. For several of the pockets, there is more than one path; find the best.

The "Leave Anywhere" drill requires you to play position while banking. With the cue ball in hand, bank (20,30) into B. Simple enough? The rub is that you have to leave the cue ball within a "hand span" of a specific target — perhaps a penny — placed somewhere on the table. Select the spot **for** the target randomly around the table. Leaves in the lower half are much easier, since the cue ball doesn't have to cross the path of the object ball. You will definitely need to understand "cut-induced side-spin" for leaves in the upper half.

The "Run Five" drill teaches close position on bank shots. Place the object balls as shown, on a line between the two diamonds and with enough space between them to allow each shot. Bank all five balls into A. You get cue ball in hand only for the first shot; play the last four from your own leaves. How many times in ten tries can you run all five? If never, try four or three balls.

I'll leave you with a drill that will take several sessions to complete — a thousand and one different banks. The idea is to systematically pick ball positions, pockets and sets of rails such that you cover a wide variety of banks.

As an example, suppose you pick (20,20) as the ball position, and A as the pocket. How many different ways can you bank to that pocket? I can think of H (head rail only), R-H (mentioned earlier), S-T-H-R, R, T-R, and T-H-R. Any others?

If you're more impatient than methodical, pick one spot each practice session, and see how many ways you can bank into each of the pockets. If you're methodical, read on.

Prepare lined paper with three wide columns labeled A, B, and C for the pockets, and a narrow column at the left for a list of ball positions. The first nine lines are numbered (0,0), (5,0), (10,0), up to (40,0), which are positions along the foot rail half a diamond apart. The next nine lines are labeled (0,5), (5,5), (10,5), up to (40,5) which are similar positions, but half a diamond from the foot rail. Continue in nine groups of nine positions, so the last is (0,40), (5,40) ... (40,40) which is a line of positions between the side pockets.

Note that you don't have to include the D-E-F pockets, since for any shot to one of them, there is a mirror image shot to A-B-C that is already on the list, and you don't have to include ball positions in the top half of the table, since any shot up there has a twin on the lower half.

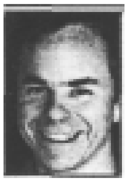
How many shots are there? There are 81 positions listed, but the four in the pockets, such as (0,0), should be excluded, leaving 77 object ball positions. For the two near pockets, A and B, I can usually find four shots to each, while for pocket C there is usually one additional cross-table shot, giving a total of 13 shots, on average, from each of the 77 ball positions. What is 13 times 77? A lot of practice possibilities.

You now have a blank form with 77 ball position lines and three pocket columns. Pick a column and line at random, place the ball on the table in the position, and choose a path to the pocket. Write the cushions in the chosen line and column — write small! — and try the shot until you feel that you understand it, even though you might not master it. Pick another line and column, and choose another set of cushions. If you happen to return to a pocket/position pair, choose a different set of cushions. If you fill up the sheet with all 1001 shots, send me a copy and I will arrange for a special certificate for you.

While the above describes many bank shots, it doesn't come close to all of them. Do you have a favorite set of bank drills? How about some good bank challenge/proposition shots? There's nothing like a little friendly competition to focus attention. A warning: If you hope to beat Eddie Taylor at the "Six Pockets" challenge, your average better be under 15 shots to make all six banks.

*Bob Jewett is a BCA Certified Instructor and a partner in the San Francisco Billiard Academy, which offers all levels of cue sport instruction.*

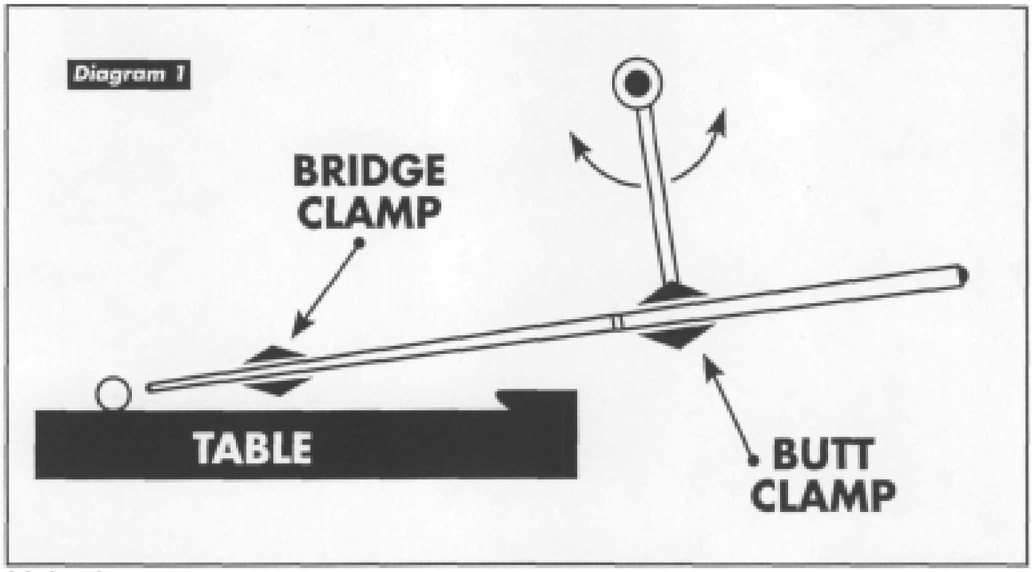
Bob Jewett



TECHTALK

# Battle of the Robots

## The mechanics behind Predator's and Meucci's dueling devices.




**For weeks before the** BCA Trade Show, the Internet was abuzz with the news: there would be not one but two cue-wielding robots in Orlando to do battle. Predator was going to bring "Iron Willie," the original mechanical Mosconi, and Bob Meucci was bringing his new-and-improved "Myth Destroyer."

For some, the actual showdown was anticlimactic — neither machine was up to running a rack of 9-ball, or even pocketing a ball by itself — but for technical types such as myself, seeing real, physical measurements in progress on pool tables was a delight. The results may destroy some people's myths. Both IW and MD seem quite capable of measuring important aspects of sticks, and both manufacturers seem to be making improvements based on this testing.

The two robots are built along the same general plan, which is shown in Diagrams 1 and 2. A frame — which is not shown — supports a pivot from which hangs an arm-like rod with a butt clamp (grip hand) at the bottom.

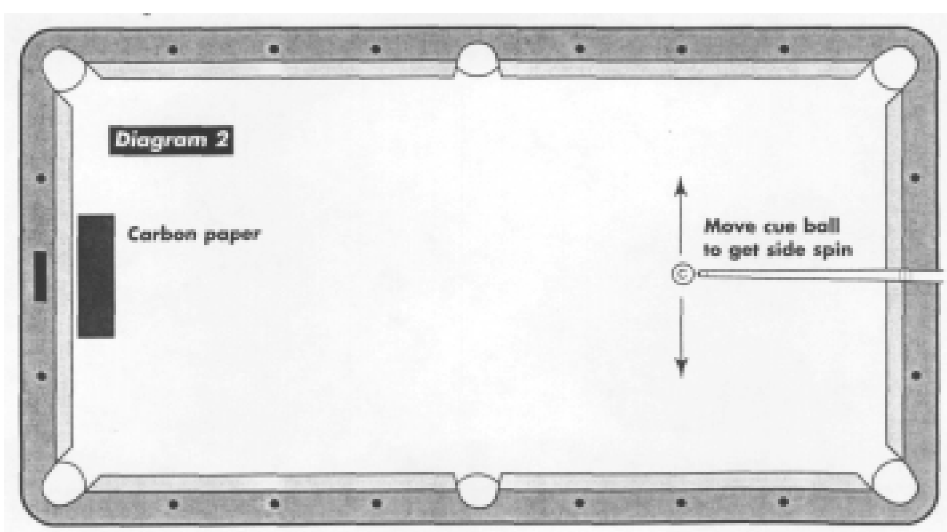
A bridge clamp, which is also attached to the frame, substitutes for the front hand. It is loose enough to permit the stick to slide through, just like a real bridge. The pivot arm is brought back to a measured height and released, and the stick comes down and through, hitting the cue ball in a very repeatable way.

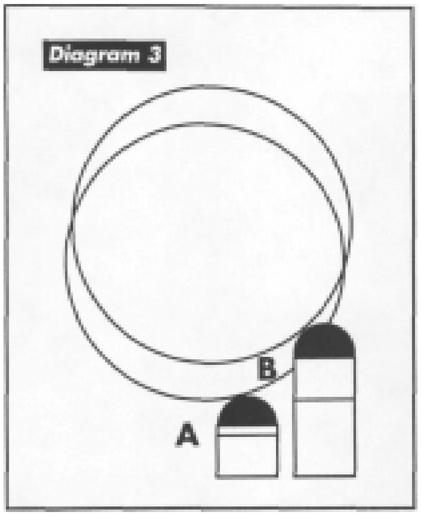
Once the robot is calibrated for a center-ball shot, the cue ball is moved a measured amount to the side. IW uses a sideways-sliding block that is removed prior to the shot, while MD uses a metal plate under the ball with a small hole for the ball to sit in. The plate is moved sideways with a calibrated screw drive. To record the path of the ball — or, rather, its position after about six diamonds of travel — a strip of pressure-sensitive paper is held vertically against a block on the left end rail in diagram 2.

Many people would guess that when the cue ball is moved to the left a quarter-inch to get some right English, it will land a quarter-inch farther to the left than for a no-English shot. This is the simple — and horribly wrong — parallel aiming system. What both machines show is that the cue ball lands on the block about an inch to the left of the point that the simple theory predicts.

This deviation from the parallel line is known as squirt, and has been discussed in this magazine several times before. My August 1994 and June 1997 columns have manual tests, if you want to do your own experiments. (Some people refer to this phenomenon as "deflection," but there are many kinds of deflection, and squirt is important enough to deserve its own name.)

MD has another ball-positioner about halfway between the cue ball and the recording block to allow something like a normal shot to be demonstrated.






The object ball is moved to the side the same amount as the cue ball, so if parallel aiming worked, the object ball would be driven nearly straight ahead. Instead, what is observed is that the object ball lands on the carbon paper about six inches off-center for less than half a tip of English, and that's for a good stick.

As an engineer, I have a couple of quibbles with both machines. (Please note: they both do their job — we engineers just like to fiddle.) The first is that the stick is necessarily elevated on the shot because it passes over the rail, as shown in diagram 1. This will cause some curve in the path of the cue ball for side-spin shots, and will make the results for different speeds ambiguous. The second is that the resulting number — inches on a piece of paper for a given amount of spin at the particular speed used — is hard to translate into a single, reproducible number that characterizes the stick. I think you will be hearing more from both manufacturers on this topic soon.

A separate, very interesting technical item at the Show was a videotape that Bob Meucci made of a stick hitting a ball. The special system caught 4,000 frames per second, which is about 100 times faster than the slo-mo you see on regular TV. In the case of a side-spin shot, there were only four frames showing the tip on the ball, so the contact time was only one-thousandth of a second. This result matches previous reports by the University of Wisconsin, Milwaukee and the simulations I reported last July.

The new and very interesting thing that was visible on the tape was what the tip and ferrule do during the hit. This is shown in slightly exaggerated scale in **Diagram 3,** where the first (A) and last (B) of the four contact-time frames are shown. The tip and ferrule move to the side while the tip maintains contact at one point. There is no visible bending of the part of the stick in the frame, but there must be some bend farther back. Bob Meucci has said that he will be making the tape available to those who would like to see this for themselves. If you want to rent a high-speed camera for your own experiments, it's about $2,500 a week.

What will all of this high-tech experimenting do for you? The robots are already being used to design more accurate shafts by investigating the influence on play of such things as tip curvature, weight distribution, flexibility, and joint construction. While a lot of this testing is now by cut-and-try, the high-speed video promises to show what's happening during the very short time you can actually influence the shot — while the tip is on the ball. As basic understanding of stick dynamics increases, expect to see cues that give more consistent hits.

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Bob Jewett

# Peeling the Onion

**Study all the layers of shot opportunities on the table before you shoot.**

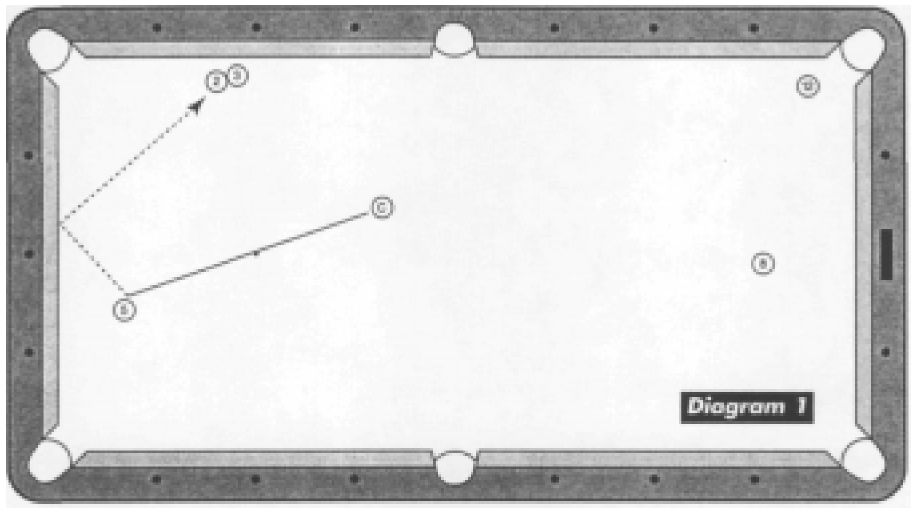


Diagram 1

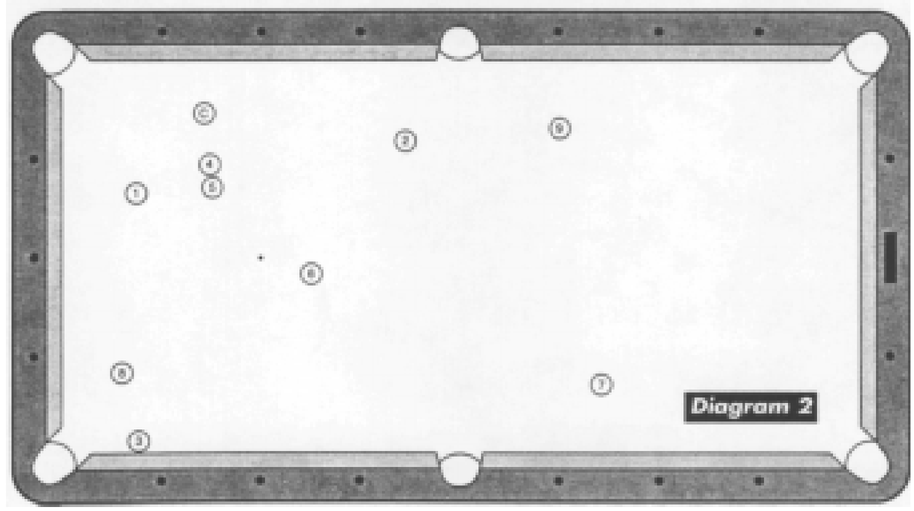


Diagram 2

**Some problems are** like onions. You start by seeing the first layer of the problem. Peel it away and there is a second layer. Once that layer is removed, there is a third, and so on. A good pool-shot problem will take you though a large part of your table savvy if you're willing to take the time to study all the layers. The two examples below you have seen before in these pages (Diagram 1 appeared in the June '98 "Solids & Stripes," and Diagram 2 appeared in George Fels' "Your Shot" column in April '98). You probably scanned each quickly, nodded at the offered solution, and passed on. Let's look deeper.

Diagram 1 is an 8-ball situation. With no good shot at your solids, and a plum waiting for your opponent, an aggressive safety is needed. One way is shown. Before reading on, answer these questions: What do you like about the shot? What do you dislike? How much accuracy in angle, spin and speed is needed? Is there a better shot?

The shot has a chance to break up your cluster and to leave your opponent behind the parts. Done well, it will win the game for you, but there are several dangers. What if you land on the near side of the 2 ball? Game over! You also lose if you land on the other side of the 2 ball after two rails with too much speed — the cue ball slides between the balls and the rail and into the clear for your opponent. The angle shown looks like it needs some side spin. Try the shot five times. What's your percentage? Finally, for us short players, the shot is a stretch on a full-sized table; I'd look for something else.

Can you see enough of the 2 ball to play directly at it softly? If so, you can put the cue ball exactly where the two is while banking the 2 just off the rail. Don't shoot so softly that the 2 is left in the path of the three — your opponent will be kicking at the 12 and is likely to leave the cue ball up there. A good spot for the 2 is halfway between the 3 and the 5. That should complicate your opponent's kick.

A danger with this second alternative is that the cue might hit the 3 first. The 3 might then bank back out far enough for the snooker, but not very likely. Favor contact on the left side of the 2, but not so far over that you get the kiss. Try this shot five times also.

Another aspect of shots like this is the "safe shade" that your blocker balls, in this case just the 3, provide. If only the 12 and the 3 are on the table, where is the safe region to leave the cue ball?

Imagine the 12 is the sun, and look where the shade of the 3 lands. If you can leave the cue ball touching that shade — or better, in full shade — your opponent has a kick, jump or masse next. (This is a simple example; Diagram 2 will be a little more complex.) The most important thing to note here is that the area between the 3 and the side rail about two-and-a-half balls wide is all shady. Is there an easy way to get there that uses the long shape to ease the precision speed requirement? (A similar technique is used to play position — play along rather than across the best line for the next shot.)

Play to hit half of the 2 ball on the left side, allowing the cue ball to roll smoothly on the cloth. There is no scratch possible unless the hit is way off, and the natural angle is off the end rail and into the shade, with just a touch of right side. See if you can't do five good safes in a row. Can you leave the 2 ball by the other corner pocket at the same time?

The importance of understanding the half-ball angle cannot be stressed too much. If you are still unsure of why it's essential for good position and safety play, see the chapter about it in Robert Byrne's "Advanced Book of Pool and Billiards," or take an hour's lesson on it from an instructor. After studying it, you can see how an apparently simple safe can take us into manifold considerations. A word of advice: If we're in a match and you start to analyze each shot this deeply, I'll have the ref put the shot clock on you. The practice table is the place to work out all these details and learn to recognize the tricks and traps. When in a match, you apply that learning.

Diagram 2 is a shot from a game of 9-ball. What would you shoot? What problems are there with that shot? How would the problems change if if the balls were rearranged some? There is no good shot for the 1, so again an aggressive safety is indicated. The 4 is not quite pocketable. If you bank the 1 to the other end of the table, and draw to land the cue ball softly on the 4, you have a good chance to run out with ball-in-hand.

What happens if the 1 falls into the side pocket off one rail — it is close — or the corner pocket off two rails? The planned safety is also safe on the 2 ball. (Exchange the positions of the 2 and 8 balls, and pocketing the 1 on a fluke bank becomes a game-winning bonus.)

Are you familiar with the two-rail banking rule-of-thumb that applies to the 1 ball? If the 1 is sent along roughly a 45-degree angle between the long rail and the short rail — for example, if it is hit full on this shot— it will go close to the upper right corner. If you haven't tried this shot before, take a few minutes right now. Note how speed, distance from the rail, and distance along the end rail modify the 45-degree rule.

Let's go back to the "shade" idea, to see whether banking the 1 on two rails is a good shot. Considering the 9-2-4-5 as shade balls, what region near the present 1 ball is safe for a "sun" ball between the upper right corner and the name plate? Of course, this depends on exactly where the 1 ball stops if it is missed, but it looks like the upper left corner is a very shady part of the table, especially due to the 9.

Here's the proposed shot: bank the 1 two rails to the corner, while drawing the cue ball back to where the 2 is at least visible, if not a good shot. Nudging the top side of the 4 would be a nice feature, but that would require excellent control. This shot is worth ten tries to get a feel for all the aspects.

Whenever you are driving the object ball to a safety, another thing to consider is how well you'll be set up to try to get your opponent on a second foul and then win with a third foul. If you can send the object ball next to another object ball, or even better, a cluster of balls, a second safety is made much easier, often nothing but a stop shot at a slight angle to leave your opponent frozen to the other ball. In the case of playing towards a cluster, you may even set yourself up for an easy cluster break if the ball itself doesn't do the job. Another advantage of this tactic is that those extra balls cut off some of the banking paths to the object ball.

One last layer: suppose the 9 is on the far end rail near either pocket, and there seems to be no chance to pocket the 1 on a bank and still get safe. Then strive to leave the 1 ball on the same end rail for an early win by combination.

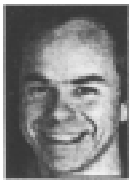
Both seeing and executing the suggestions above require practice. See the August issue for a structured way to practice banks. Soft, precise draw, like that required for Diagram 2, can be learned on the pool table, but if you try straight caroms, you'll quickly learn speed control of both balls on soft draw shots. The half-ball angle can again be practiced on a pool table, but if you have access to a snooker table, try the great game of English billiards for the best half-ball training available.

Remember — Do your onion peeling on the practice table and your opponent will be the one weeping in the match.

*Bob Jewett is an advanced level BCA instructor with the San Francisco Billiard Academy — one of seven BCA master academies.*

TECHTALK

Bob Jewett

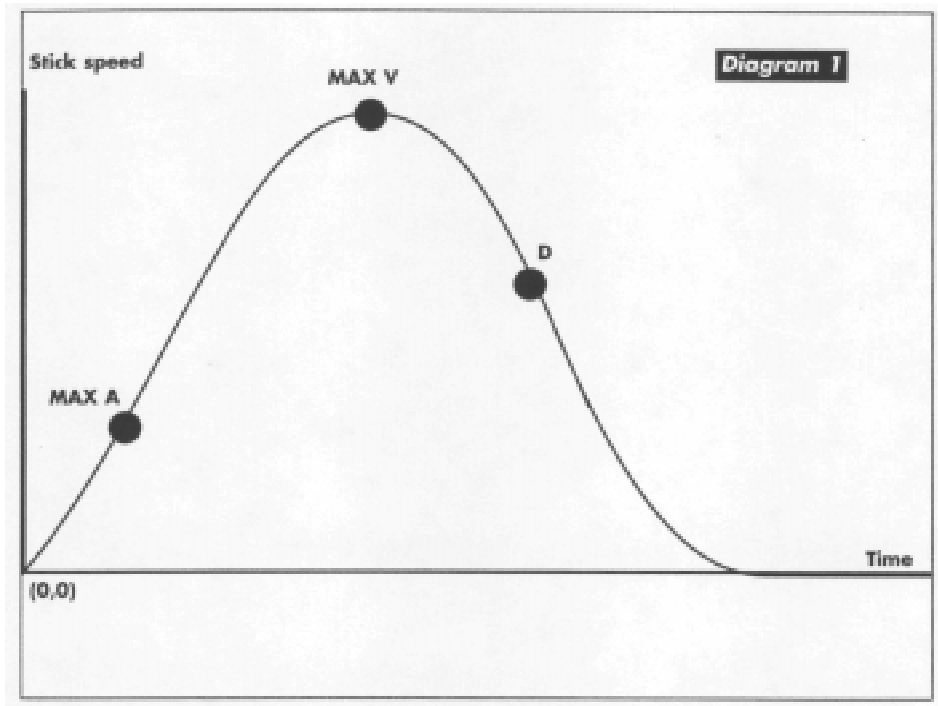


# Hitting the Peaks

**When you hit the ball can determine how you hit the ball.**

**Have you ever** thought about when in the timing of the stroke is the best instant to hit the cue ball? Should it be while accelerating or decelerating the cue stick? Common advice is to be accelerating when you hit the ball. We'll see below why that's not such good advice.

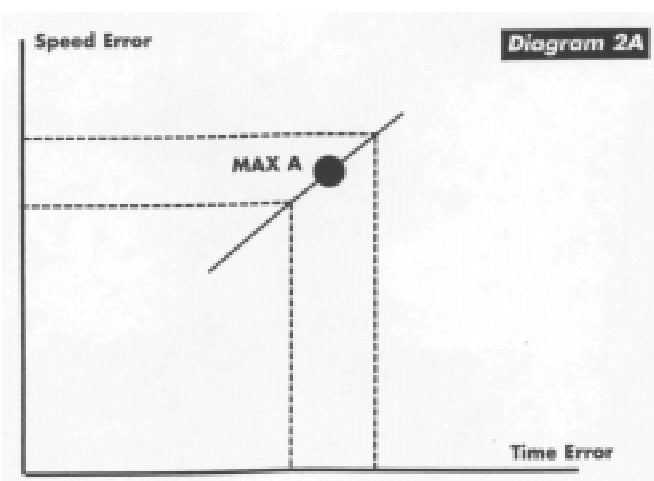
In Diagram 1 is a plot of stick speed versus time during the forward part of the stroke. (Left out is the sudden slowing of the stick when the ball is struck.) The speed builds up from zero (that's the pause or stop at the end of the final backstroke), rises rapidly, hits a peak speed, and then drops to zero as the stick stops at the forward-most position. As drawn, this stroke is as smooth as it gets and is identical to the motion of a perfect pendulum. When on this stroke would you want to hit the ball? That is, how would you adjust your timing for most power, consistency or control? The answer is probably not what you think.

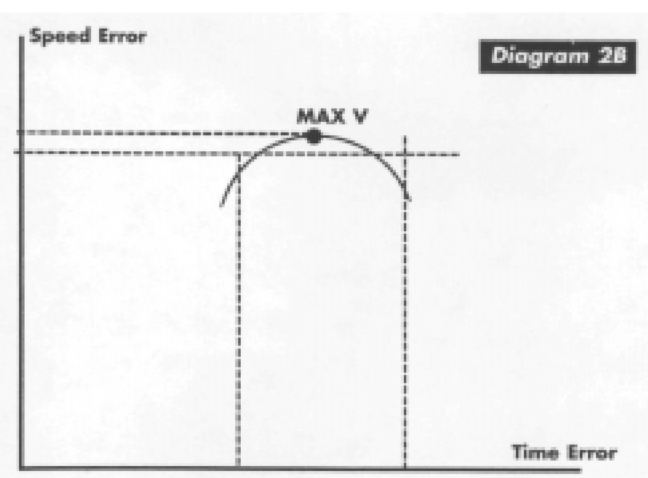



"MAX A" on the diagram marks the point of maximum acceleration. This is where the speed of the stick is increasing most rapidly. "MAX V" is another possible choice. It marks the point in the stroke of peak velocity. Since the peak is flat on top — that's the nature of such peaks in a smooth stroke — there is zero acceleration there. Point "D" is another choice. This is some time after the peak where the stick is starting to slow down.

The common advice would have you hit the ball at "MAX A". A major problem at that point is that if your timing is a little early or late, your speed will be off by quite a bit. (See Diagram 2A.) That's because the slope of the curve is so steep there. A similar problem occurs at "D", but the slope might be a little less.

Consider the speed error caused by a timing error for an attempted hit at "MAX V" as shown in Diagram 2B. Because the peak is smoothly rounded, even a much larger mistake in when



you hit the ball would result in less error in the speed at impact.

Another factor is how efficient the shot is. That is, for each timing, how much energy from the stick gets into the ball?

The speed of the cue ball will increase directly with the speed the cue stick has at the time of impact. The speed of the stick at MAX A is only half the speed at MAX V, so the latter would propel the ball twice as fast. This amounts to four times as much energy in the cue ball, since energy goes up as the square of the velocity. Point D would also waste energy compared to MAX V.

From this fairly simple argument, it seems that for both best power and best speed control, you should strive to hit the ball when the stick is going at peak speed. How can you train yourself to do this?

My belief is that good players have already learned this timing instinctively while their games were forming, so the following suggestions will be of more help to beginners and anyone who is having a hard time with speed control.

First, try practicing your stroke with no cue ball on the table and your eyes closed. Feel your back stroke — put a small pause at the end — then feel the timing of your forward stroke: the accelerating part, the peak, and the stop. Do you also feel a jerk back at the end? I hope not. Keep it a simple, smooth forward motion.

Second, try for the same feeling with a ball. Your eyes may need to be open for this part. Does it feel like you hit the ball at the peak? It may help to say to yourself, "Just let the stick do the work. Don't try to force it."

The last suggestion to optimize your timing is to play the cue ball four table lengths up and down the middle of the table — this is a fairly powerful stroke — but try to do it with a minimum of effort. When you can get that distance consistently with ease, you know your timing is right.

Can you get more speed on the cue ball with a firm or loose grip? Probably not. As noted in the July issue, the contact is very brief, about 1/1,000 of a second, and that is not time enough for the relatively soft flesh of your hand to react to apply any extra force through the tip.

Why is the "hit while accelerating" advice so common? I think partly because many people confuse acceleration and speed. Without thinking, they would pick MAX V as being the point of maximum acceleration, when in fact the cue is just coasting then and the acceleration is zero. And I think the advice works for those players who jerk prematurely to a stop — they are the "D" players. Getting them to accelerate for a little longer gets them to hit at the peak.

After you try the exercises above, let me know if you are playing with less effort and more accuracy, either electronically at jewett@netcom.com, or in care of this magazine if you are still un-networked.

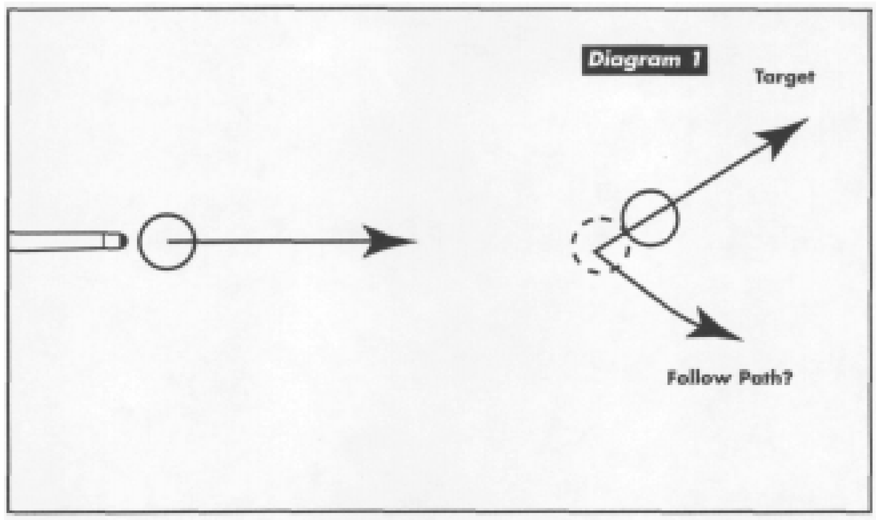
*Bob Jewett is an advanced level BCA instructor with the San Francisco Billiard Academy — one of seven BCA master academies.*

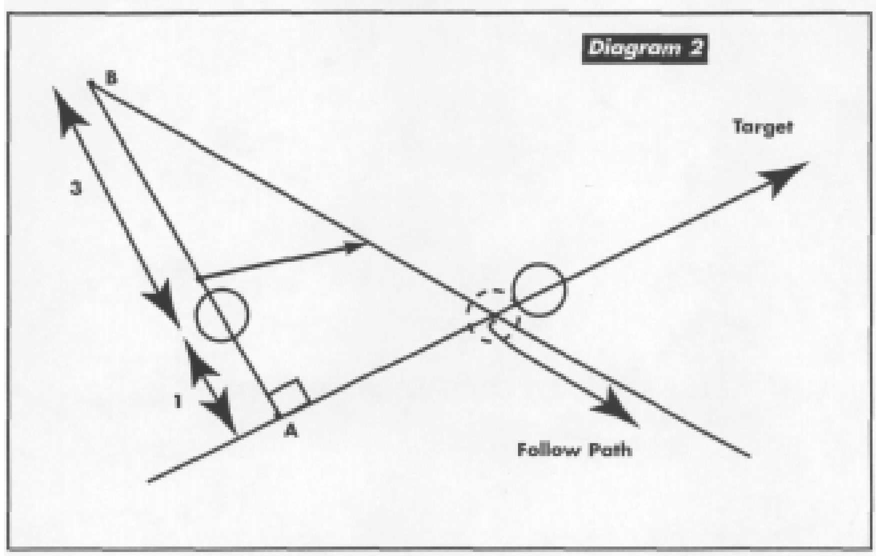
Bob Jewett

TECHTALK

# Cut to the Chase

**These principles can help you find hard shot angles.**




**In my column** from *BD* December 1995, I gave a system to determine where the cue ball would follow to for nearly full shots. Recently, a student of mine, Jeff Kletsky, digested this for a while, and pointed out the geometry on which the following more complete system is based. It allows you to find the angle of the cue ball for a follow shot for any cut angle.

The problem is shown in **Diagram 1.** You are going to cut the object ball to the left, and the cue ball is going to follow somewhere to the right. Your aiming experience will put the object ball in the pocket (the target), but where will the cue ball go?

**Diagram 2** shows how to determine the path of the follow. First extend the object ball path (the target line) back to the vicinity of the cue ball. This can be done by laying your cue stick on the table with it pointing through the object ball to the pocket.

Now here comes the hard part. Imagine a line perpendicular to that first line, and going through the cue ball. In the diagram, it is the line from A to B. Find the point B on that path that is three times as far from the cue ball as point A. One easy way to do this is to place your finger at a spot on the AB line that is just as far from the cue ball as the target line, and then move your finger to a second spot that is twice as far from the stick.

You now have point B determined. Look from B to the center of the ghost ball. (Remember, the ghost or phantom ball is where the cue ball will be when it hits the object ball.) The cue ball will go parallel to that line.

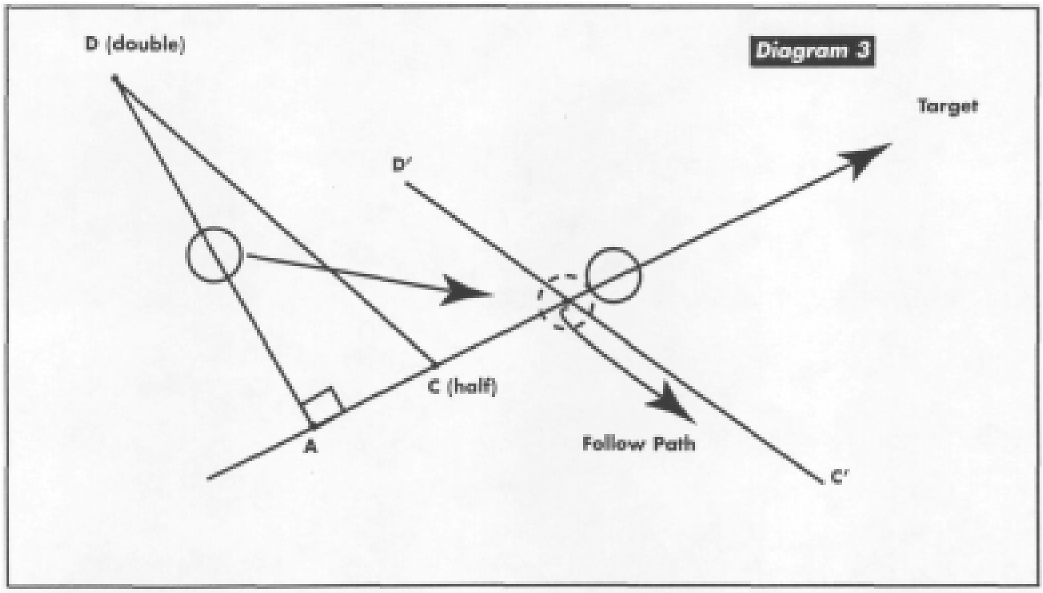
In the diagram, you can see that there is an initial curved part of the cue ball path. The size of that will depend on the speed of the shot, and will be larger on slippery cloth. This takes practice to estimate; start by assuming that on medium shots, the edge of the cue ball will travel along the line; that is, the cue ball will "offset" half a ball to the side while the follow takes.

A very important requirement for this shot to work is that the cue ball must be rolling smoothly on the cloth when it hits the object ball. Since that is what it wants to do, this is an easy requirement to meet. A beginner's mistake is to shoot so hard that the cue ball has not enough time to acquire natural roll before getting to the object ball. You can help the process by starting the cue ball with natural roll. This requires something like a full tip of follow, so that you hit the cue ball 12 millimeters above center.

Another possible source of error is the weight of the cue ball. If you are on a coin-op table that has a heavy cue ball, the path will be somewhat more forward than this system gives. In order to make a correction, just use a distance smaller than the "three times" between the cue ball and point B. Some tables have light cue balls, which are smaller due to years of wear. In that case, you may have to go out more along the AB line to find the path. Here is a good routine to find the follow path: Place your cue stick along the target line as mentioned earlier, with the tip at the center of the ghost ball. Using your other hand, find point B. Now, leaving the tip in place, pivot the stick around until it is over point B. The stick will now be pointing along a line parallel to the follow path of the cue ball. Move the stick over, parallel to itself, a little — the amount depends on how hard you plan to shoot — and you know just where the cue ball is going.

Bob Jewett

In theory, left and right English on the cue ball should have little effect on the follow path. Do the experiment to see how large the effect is.




For shots that are quite thin, point B ends up being off the table or maybe in the next county. **Diagram 3** shows an alternate method to arrive at the same line that works better for thin cuts. Starting from the target line as before, go to point D (double the distance from A to the cue ball) and then find the point C which is half way between the ghost ball and A. The line DC is parallel to the follow path. If your cue stick is along DC, move it parallel to itself until it is along D'C'. For very thin cuts, it is useful to note that the line from the cue ball to a point half way between A and C is also parallel to the follow path.

A final caution: The physics underlying this system actually gives a factor of 2.5 rather than the 3 used in Diagram 2. In practice, 3 seems to work better because it compensates to some degree for the follow that the cue ball loses when it hits the object ball, and for the offset to the side due to the curved path. Also, the 3 is easier to estimate. If you find the cue ball's path is consistently ahead of the line calculated, try 2.5 instead of 3.

This system can take much of the guesswork out of planning follow shots. It is fairly simple to use, and applies over the full range of cut angles. With a little practice, it can be an important addition to your game.

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