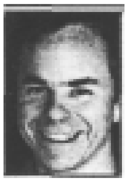
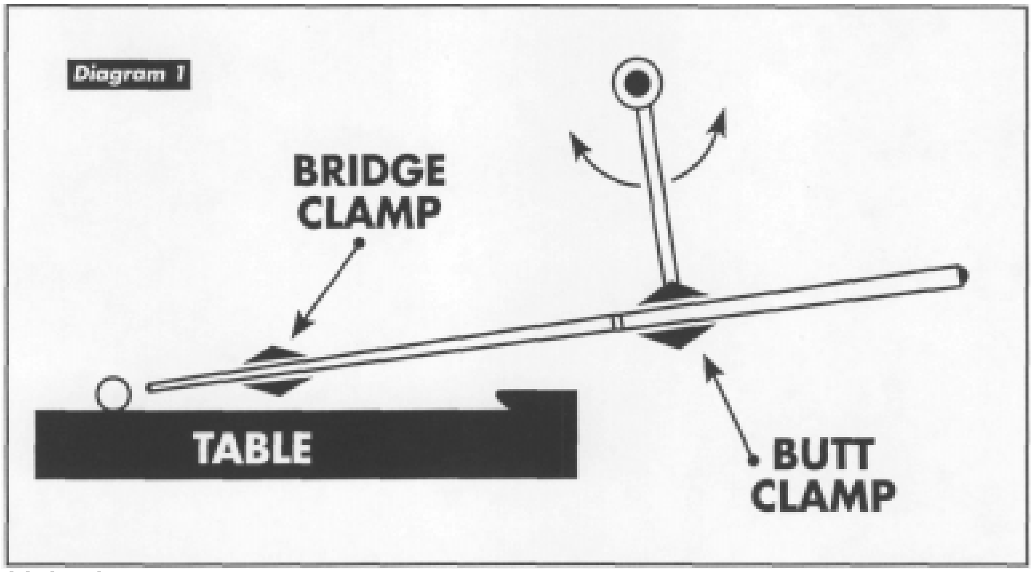
Bob Jewett



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.

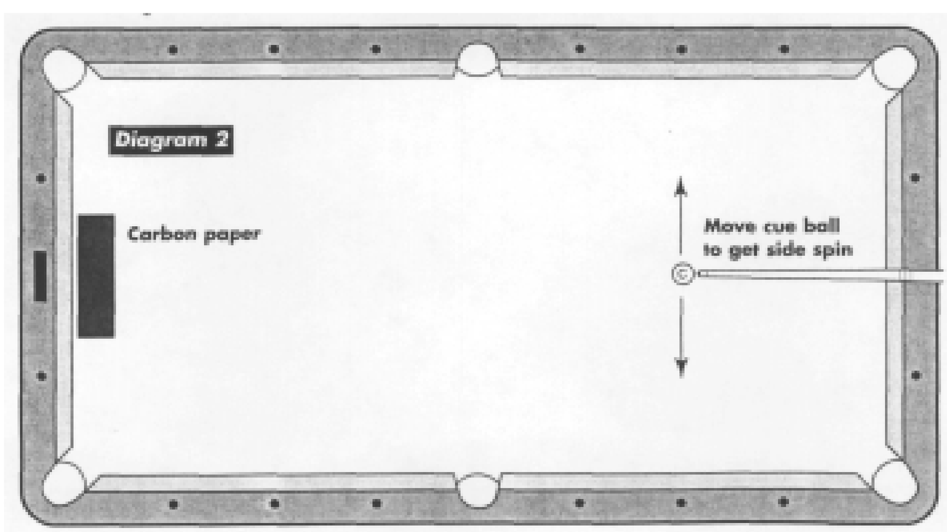
A bridge clamp, which is also attached to the frame, substitutes for the front hand. It is loose enough to permit the stick to slide through, just like a real bridge. The pivot arm is brought back to a measured height and released, and the stick comes down and through, hitting the cue ball in a very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

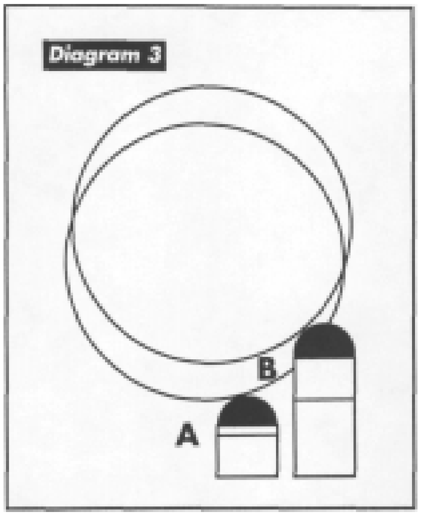
Once the robot is calibrated for a center-ball shot, the cue ball is moved a measured amount to the side. IW uses a sideways-sliding block that is removed prior to the shot, while MD uses a metal plate under the ball with a small hole for the ball to sit in. The plate is moved sideways with a calibrated 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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