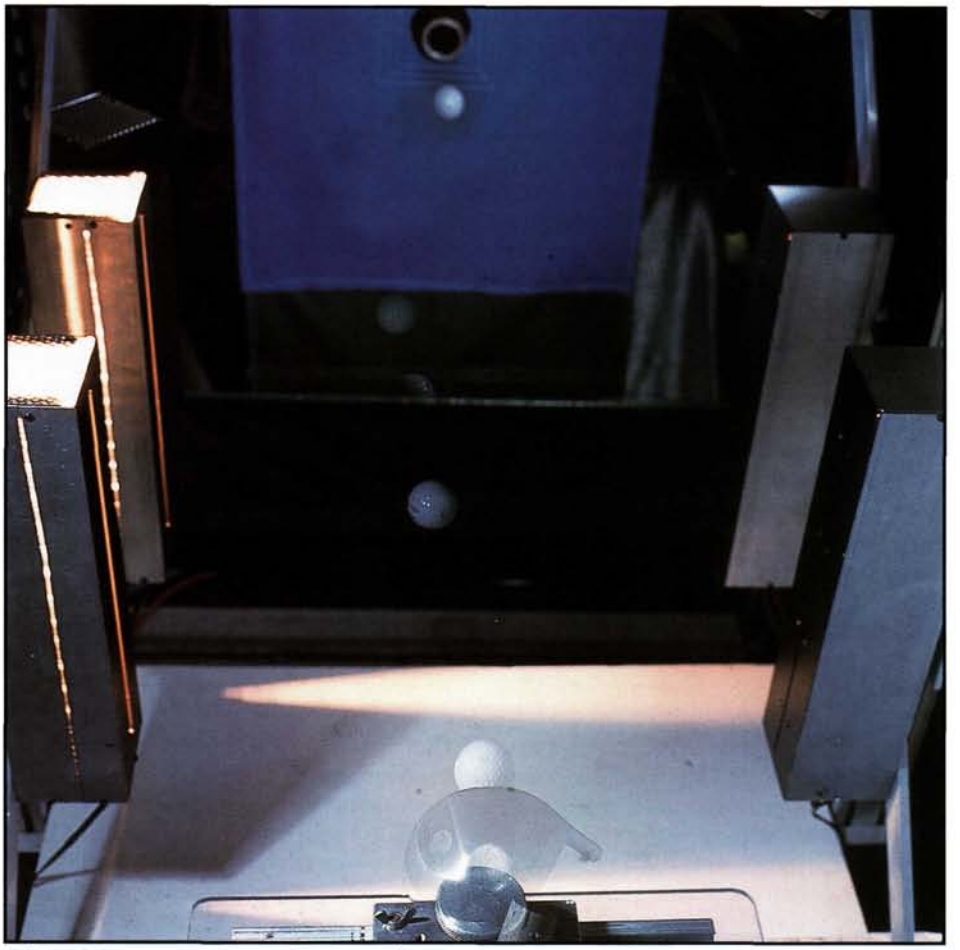
SPRING FEVER

Dick Rugge Q&A – The head of the USGA Test Center fields some frequently asked questions.



The USGA's test to determine its coefficient of restitution (COR) measures the rebound velocity of a golf ball fired at a clubhead.

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SINCE Dick Rugge first heard the words "spring-like effect" a few years ago, he has read and seen as much fact as fiction on one of the industry's hotly debated topics. Every golfer Rugge meets, it seems, has an opinion on the subject, and not all of it is based upon scientific research. Rugge, who in early 2000 became the USGA's senior technical director, recently sat down to discuss the physics and philosophy of the matter. An 11-year veteran of club development for a major equipment manufacturer, Rugge discussed how and why his Test Center staff examines clubs for spring-like effect, as well as why the game's two governing bodies are not in complete agreement on the matter. The questions included those posed most frequently to the USGA.

Q: What is spring-like effect?

A: I can best describe it by describing the test. We fire a golf ball at the face of a clubhead, and we measure the velocity of the ball just before it hits the clubhead. It strikes the clubhead and rebounds in the opposite direction. We measure the velocity again after it bounces off the clubhead. For example, if the ball started at 100 mph coming in, bounced off the head, and went back at 75 mph, we would say that club has a coefficient of restitution, or COR, of 75 divided by 100, or .75, or 75 percent.

If we put a persimmon clubhead in that test, the ratio of the outgoing velocity to the starting velocity is about 78 percent. When we replace that club with the first generation of steel clubs, it's a tiny bit faster going out, about 78.5 percent. First-generation titanium clubs are about 79 percent, maybe 79.5. It's hard to notice a difference. But then titanium clubs started to evolve; they became larger and the face became thinner. What started out at 78 percent with wood, and 79 percent or so with first-generation titanium, went to 80, 81, 82 percent. So the ball's going out faster than it had with previous models.

The USGA developed this COR test and put a limit in of 83 percent. That has been the limit for more than two years. Since that limit was put in place, some clubs have come on the marketplace that have exceeded that limit. They've gone up to 84, 85, as much as 86 percent.

Q: Is it possible that further development will take those numbers even higher?

A: We've studied it with very good engineers we have working at the USGA, and consultants and physics and mechanical engineering professors from places like the Massachusetts Institute of Technology, Princeton University, and Lehigh University. They have studied this at length and have told us we can expect a limit of perhaps 88 percent.

So where we started out was 78 percent. Where we think it can end up is 88 percent. We drew a limit right smack in the middle, at 83, and clubs so far have gone to about 86.

Q: What does this mean in terms of additional yardage a player may get?

A: Let's assume a good PGA Tour player swinging that wooden club hits it 289 yards – a long poke. As he changes his club and increases his COR, let's say he goes to the USGA conforming limit of 83 percent. He'll get another 10 yards and that 289 will become 299. If he continues on with the highest COR club we've seen so far, that will be a 305-yard hit, and if he continues on with what we expect to be the maximum, it'll be about 309. So he will have gained 20 yards from the wood. We've drawn a line at 10 yards, and he can get another 10 on top of that.

Q: What does any of this mean to the average player?

A: A player who hits the ball 220 yards is going to get about three-quarters of the benefit. In other words, that player's going to see an increase of about seven or so yards at the conforming limit of 83 percent and about 15 yards at the ultimate.

Now that is if – and that's a big "if" there – the player happens to hit it right smack on the sweet spot, because that is where this effect occurs. What I mean by that is, within the half-inch diameter circle of the sweet spot is where this effect works. Outside of that, the above-the-limit COR goes away. So you've got to be able to swing it pretty hard, but more importantly, you've got to be able to put it on the sweet spot reliably and repeatedly.

Q: Some people have said the USGA is stifling innovation. Is that true?

A: No, not at all. Consider in the past 20 years some of the equipment innovations: metal woods, shafts of exotic materials, long putters, square grooves. Those help golfers of every ability. But spring-like effect doesn't do that; it generally helps the very best player most and rarely helps the lower-ability player.

I'll give you an example of a technology that has had just the desired impact. The perimeter-weighted iron helps the lower-skilled players far more than it helps elite players. Elite players really don't need it because they always hit the ball very close to the sweet spot. The benefit of the perimeter-weighted iron is that when you hit it off center, you get a better shot than you would have gotten without perimeter weighting. And that makes the game more enjoyable for those players who can't reliably put it on the center of the clubface. That's the kind of technology the USGA likes to see.

Q: Is excess spring-like effect possible because of the thinness of a clubface?

A: I'll give you the recipe to make a spring-like driver: Make it from titanium, make the clubhead broad, and make the clubface thin.

Why titanium? Because titanium is strong and light and allows you to make it big. But titanium is also springier; it has a higher elasticity than steel. Then you make a big face; by the same token that a long diving board is springier than a short one, the bigger face is springier than a small one. Think about a diving board that's a foot long versus one that's 15 feet long. You're going to get a lot more spring out of the 15-footer. And the third thing is, make the clubface thin. Thin gives more than thick does.

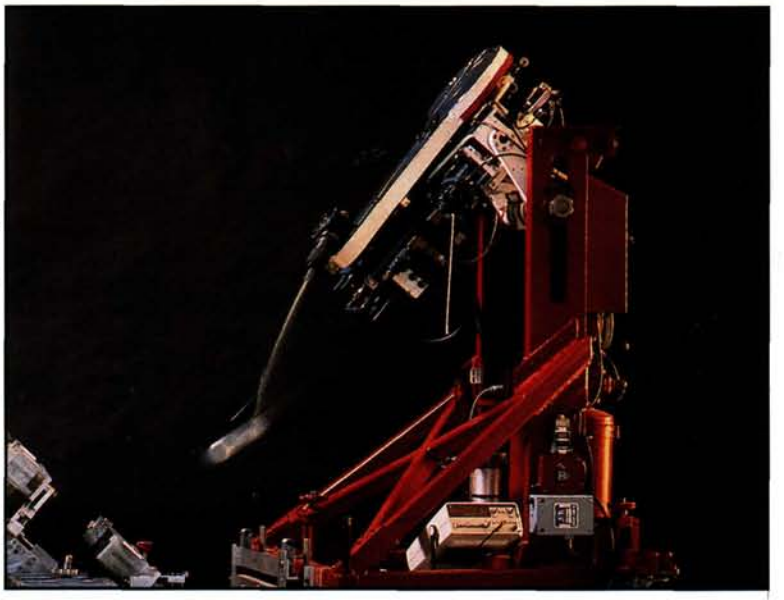
Q: How thin are we talking about for these clubfaces?

A: They're a little bit more than a tenth of an inch, or less than the thickness of a compact disc.

Q: Why does the USGA believe that regulating this effect is so important?

A: Golf is meant to be a broad and deep challenge for a golfer, and we want to make sure equipment doesn't alter the balance it should have with skill in such a way that the challenges become less in the game. We have to do something before it happens rather than after it happens. Our mission is to protect the game.

There are two examples I'll cite – two sports that have been longtime competitors for participants with golf.



Iron Byron, the mechanical golfer, reproduces a golfer's swing. It can be used for both indoor and outdoor testing.

One is bowling. If we went back 30 years, we would find a couple of interesting things. There were about 9.5 million serious bowlers, as defined as people who belonged to bowling leagues and bowled every week. There were about 900 perfect games rolled in the United States in 1969. During the ensuing decades, there have been a lot of technical changes made to bowling equipment, to balls and the lanes themselves. Bowling ball ads today look like golf club ads. They talk about moment of inertia and the use of titanium, believe it or not, and having different surface treatments that grab the lanes better, all for the purpose of allowing for control and supposedly to give the bowler more enjoyment of the game. Well, they've made the game more "enjoyable" in a couple of ways. Those 900 perfect games in 1969? In 1999, the number had swelled to 35,000. Many lanes never saw one in a year and now it just happens all the time. And by the way, those 9.5 million serious bowlers have shrunk to about 3 million.

Another example: tennis. In 1975, the high-water mark of tennis participation in the U.S. reached about 34 million players. About the same time, the oversize racket was brought to the U.S. to make the game more enjoyable and easier to play and more fun and all those kinds of things. From 1975 to 1985, one decade later, the elite game of tennis had markedly changed. It became a power game. The finesse that had been present before was largely gone, and it wasn't so interesting to people anymore. And that 34 million had shrunk to about 13 million – interestingly enough, about the same ratio as bowling. And according to people at the United States Tennis Association, the hardcore tennis players stayed. The ones lost were the marginal players, the ones the game was trying to turn into hardcore players. They disappeared.

Now I can't say for sure it was the oversize tennis racket that drove them all away, but it sure didn't keep them in the game. I think it's our responsibility not to allow unchecked technology experiments, like they had in bowling and tennis, to come into golf. To be true to our mission of protection, we can't take these kinds of chances, especially when other sports have shown that an easier game resulting from equipment "advances" is not the road to more participation.

Q: Why have the USGA and the Royal & Ancient Golf Club, the two

governing bodies, taken different positions on the need to test for excess spring-like effect?

A: The USGA and the R&A have taken different positions based not on science, but on philosophy. The R&A looked at the same data and said, "Well, the highest COR clubs today gain only about six yards on top of the USGA limit." The USGA looked at the same data a little differently. The USGA said, "Wow, that's six yards and that's already on top of 10 we allowed by setting the limit at 83 percent. So that's 16 yards. That's a bunch."

The other part of that philosophical difference is that the R&A looks at the clubs that have been made so far and said, "Well, that's about as much as they're going to get. They're not going to go to 88 percent as the USGA said they might."

Driven primarily by my years of working at a major club manufacturer with multi-million-dollar research-and-development budgets and 50 engineers working away, I tend to think the manufacturers will continue to exceed the results with their second, third, and fourth models. I have a more optimistic view of their abilities than the R&A does. I don't think they are finished. I think they're just beginning. The R&A thinks the future is already here.

Q: What supports your view?

A: My experience in the business. You find something, get a first try at it, then keep working at it. You don't stop until you really have nothing more in the well. And I think they have something more in the well.

COR is not the crux of club design. To my way of thinking, it's one small part. There are many opportunities to make clubs that are more enjoyable to play, that work better for any specific golfer. To focus so much on this one issue is not in keeping with the history of golf. The history of golf proves that new development comes from all angles, and I would say the recent merchandise show in Orlando showed that. There wasn't much of a focus on high-COR clubs, if any at all, yet we saw some new, interesting developments in shafts, grips, and clubheads, all within the Rules.

Q: The way clubs are developed for the marketplace has changed drastically in recent years. How would you characterize the changes in this era of clubmaking?

A: Certainly it has been a more engineering-driven era in the past 10 or 15 years, which is the era I've been involved in golf. And that's driven by a couple of things: significantly more investment from publicly owned companies, a lot of aerospace engineers who like to play golf, and the advent of using computerized tools, analysis, cad-cam equipment – virtual designing on the computer – bringing those tools from other industries into golf. People have seen that you can make improvements.

"Equipment innovations of the past 20 years have helped golfers of every ability. But spring-like effect doesn't do that; it generally helps the very best player most and rarely helps the lower-ability player."

The USGA Research and Test Center tests more than 20,000 golf balls each year.

The game has a history 500 years long or more, and that's 500 years of not just playing, but also tinkering with clubs. And that tinkering continues. It's an important part of the history and the future of golf. Only the tinkering that's done today isn't done in somebody's workshop. It's done in front of cad-cam computers by Ph.D.'s, and that accelerates the pace of tinkering. It also allows them to weed out the bad ideas from the good ones much more easily, quickly, and inexpensively. But there's nothing like the good ol' creativity that comes springing forth from the human mind, and that will continue forever.

Q: Are all of these equipment advances possible because the clubs are made of metal and not wood?

A: The whole reason metal clubs came to replace wood clubs was because they had a more forgiving characteristic. They were tolerant of off-center hits, and that's simply because their moment of inertia, which is a body's resistance to twisting, is higher than wood clubs. The weight is located further away from the center. And the same thing is true when drivers became larger in the early '90s, and continue to grow larger, with titanium.

It was a story of the two Ps: physics and psychology. The physics is a higher moment of inertia, allowing for more forgiveness on off-center hits. The psychology is looking down at a small, old driver head, and one of the thoughts going through a player's mind before hitting that would be, "Don't whiff." With a big driver of today, that thought is no longer there. There's a much more relaxed sense, and people know that a relaxed golfer is generally a better golfer.

Q: The Rules of Golf would infer that no spring-like effect is allowed. By drawing a line at 83 percent, is the USGA saying that some spring-like effect is allowed, but only up to a certain point?

A: Let me give you the exact wording from Appendix II in the Rules: "The material and construction of, or any treatment to, the face or clubhead shall not have the effect at impact of a spring."

What we have is a pragmatic application of an extreme Rule, and I'll give you another example of that. We say in the Rules that a shaft must be straight. I guarantee you that if we make a fine enough measurement, no shaft ever manufactured or made in the history of the world, or the world to be, would be straight. So we make a pragmatic application of a severe Rule. That's throughout the Rules book. That's what we did here.

DICK RUGGE, *USGA senior technical director, coordinates the USGA Test Center activities from Far Hills, N.J.*

More information on the USGA's Test Center, including how it conducts conformity tests, can be found on the USGA's website at www.usga.org/test_center.