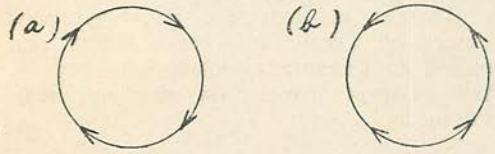
What Makes a Cricket Ball Curl in the Air?

By F. M. Gilbert, B.A.

"Whether any bowlers can impart this curl in the air to the ball at will is a moot point. . . . I have not been able to discover, any more than the bowlers themselves, why or how curl in the air takes place."—Ranjit Sinhji.

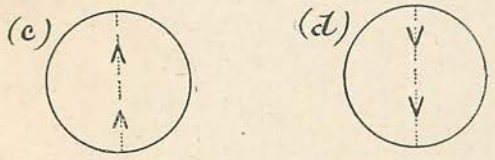
AS a contemporary with Ranjit Sinhji at Cambridge, the writer has read "The Jubilee Book of Cricket" with intense interest. Hoping to add something worth saying to the Prince's remarks about bowling, he is making an attempt to explain, in terms intelligible to a non-mathematical man, the effect of various spins on the flight of a cricket ball from the bowler's hand to the ground. Nearly all bowlers can make the ball "break" or "turn" as it pitches; and this result is well known to be caused by the friction between the spinning ball and the ground. But the effects of the friction between a spinning ball and the air surrounding it are not so well understood. Occasionally one meets a bowler able to make the ball curl by letting it go from his hand in a peculiar way, but he is *always* unable to understand the phenomenon or communicate his gift to others.

Let us imagine we are looking at the spinning ball from the point of view of the bowler's umpire. The first two spins we take are the ordinary breaking balls, (*a*) from the off, (*b*) from the leg.



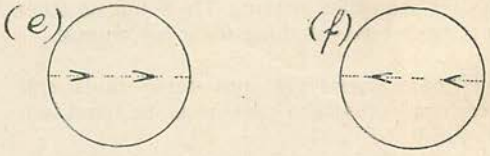
A mere mention of these will suffice for the present. If there be no wind, the atmospheric flight is practically the same as that of a ball without spin. In cases (*a*) and (*b*) the ball is turning, in the direction shown by the arrows, like a rifle bullet, round a horizontal axis pointing in the direct line of flight.

Now to consider the effects of the two spins in Figs. (*c*) and (*d*), where the ball is turning round a horizontal axis pointing at right angles to the line of the wicket.



Following Ranjit Sinhji's book, we will call these spins by the billiard terms, (*c*) TOP and (*d*) DRAG. In order to understand their effect upon the ball's flight, we must notice that the ball, in its course, is pushing away the highly compressible air from the front of it and is escaping from that behind. There is, therefore, more air-pressure in front of the ball than behind, so that the friction in front is stronger than that behind, and the latter will be overcome. This is the gist of the whole matter. The ball in Fig. (*c*) rolls up or CLIMBS, and in Fig. (*d*) rolls down or DIVES on the denser air in front, just as a cyclist's wheel propels him by turning on the road. So that a ball with "TOP" tends to CLIMB and pitch further from the bowler than it would have done had it been without spin. If anybody doubts this, let him watch the flight of a well-driven golf ball swept off the tee by the club-head just on the rise. Of course, DRAG has the reverse effect, making the ball dive and pitch shorter. The iron shot in golf illustrates this very well. It is hardly necessary to say that TOP makes the ball come more quickly from the pitch, while DRAG retards it.

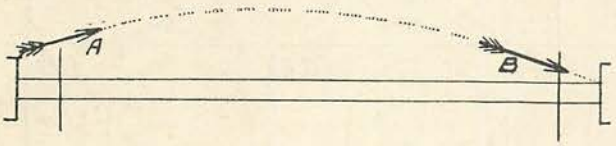
The next two spins are not mentioned by Ranjit Sinhji. They take place round a vertical axis and produce that sideways "curl" in the air for which Mr. King, the American, is noted.



The explanation is of the same nature as before. Take the spin represented in Fig. (*e*). Every small portion of the surface of the ball is moving horizontally, so the ball has no tendency either to climb or dive. The air-friction on the front of the ball makes it roll from "off" to "leg." We will call this spin OFF-CURL. Of course, the smaller friction on the back of

the ball has the opposite tendency, thus lessening the effect, but not destroying it. Naturally, the reverse spin, Fig. (*f*), produces a curl in the other direction, from the leg side to the off. We will call it "LEG-CURL." A right-hand bowler with a low delivery often has this spin.

The OFF-CURL, Fig. (*e*), ought to be one of the easiest spins for a right-hand bowler with a high delivery. It is just possible that what Ranjit Sinhji calls the "action break" of a



fast bowler may really be this curl from the off to leg; for it may be noticed that a curling ball may pitch out of the direct line between the bowler and the stumps, and yet hit the wicket, even when the ground is too smooth and hard to take a slow bowler's finger break. Perhaps a bird's-eye view will make the matter plain.

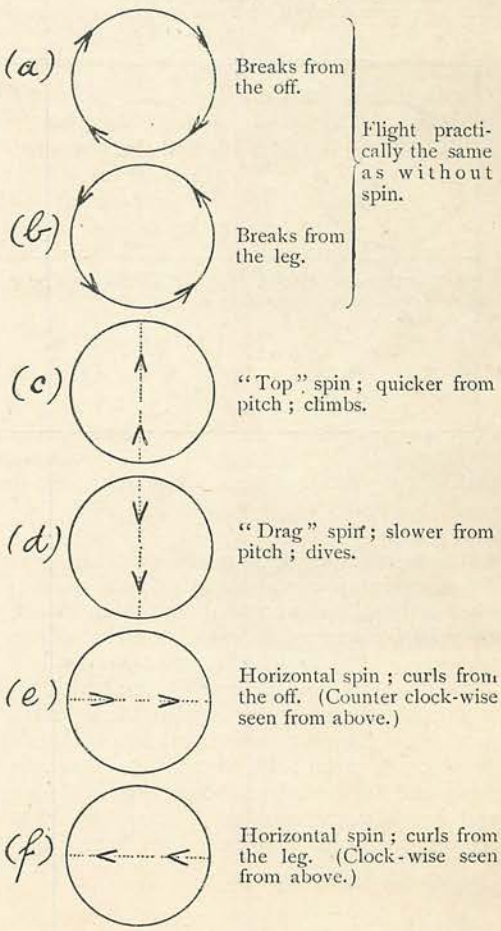
The ball leaves the bowler's hand at A, in a direction which would take it well away to the off were it not curling. After pitching at B, the ball may go straight for the stumps, without "breaking" a hair's breadth. This effect is evidently independent of ground-friction. It is more easily produced by a fast bowler than by a slow one, owing to the air resistance being approximately proportional to the SQUARE of the ball's velocity. For example, supposing that Richardson bowls three times as fast as Briggs, he has about nine times as much air-friction to help him in making the ball curl. If this is at first sight not quite clear, it becomes evident by remembering that his ball not only impinges on three times as many air particles in the same time, but pushes each one away with three times the force. And as his ball goes from wicket to wicket in one-third of the time, it will curl three times as much, provided that it has the same spin.

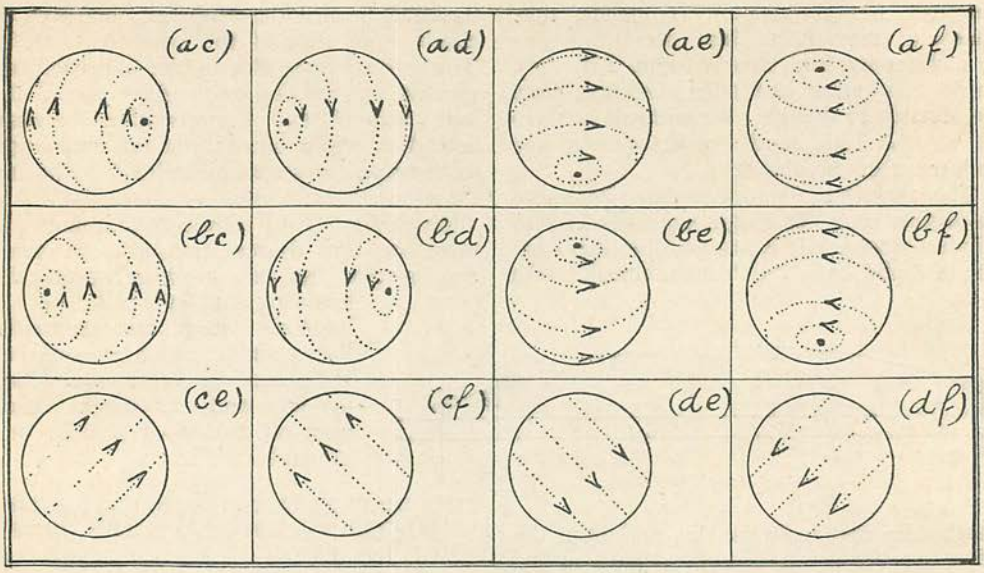
Up to this point we have been considering a windless atmosphere; but a thoughtful bowler must not forget the wind. A ball curling from the off, Fig. (*e*), has both curl and pace increased by a cross wind from off to leg, because the wind-pressure is applied to the off side of the ball, so that the spin helps it on in the line of flight. And it will not be out of place to mention that a ball travelling against the wind will curl, dive, or climb more than if the wind be with it. This is once more due to the increased air-pressure and friction on the front part of the ball, without any corresponding increase behind it. So a bowler who can curl ought to be helped rather than hindered by having the wind against him.

As every ball bowled combines in more or less degree each of the three simple spins and their separate effects, the following tables may be of interest. Look at the spin, Fig. (*af*), for example. It causes a curl from leg to off, and a break back from off to leg—a terrible ball to play!

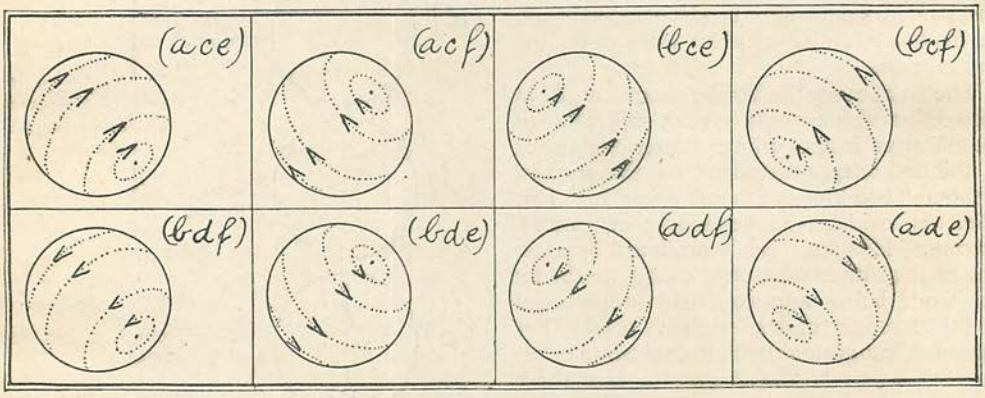
THE DIFFERENT SPINS SEEN BY THE BOWLER'S UMPIRE, AT THE LEVEL OF HIS EYE.

I.—THE SIX SIMPLE SPINS.





2.—THE TWELVE DOUBLE SPINS.
Each is compounded of two simple spins and combines the effect of both. Thus (*af*) on referring to the simple spins, curls from leg and breaks from the off.



3.—THE EIGHT TREBLE SPINS.
Each is compounded of three simple spins, and combines the effect of all three. Thus (*adf*) curls from leg, dives and breaks from the off.

These remarks may be summarized in the following simple statement: The ground-bias, or break, is in the direction in which the spin is carrying the *top* of the ball. The air-bias, or curl, is in the direction in which the spin is carrying the *back* of the ball.

One point more may be mentioned, lest it should be thought that too much has been proved. It would be natural to ask why every ball bowled does not swerve in the air and break if the spin on it is treble. The answer is simple—it does. But these effects are purely matters of degree. If the flight be slow and the spin weak the curl is probably microscopic, though the break may be perceptible. But even an inexperienced eye will detect the curl on a ball hit round with a horizontal bat to square-leg, or driven with a slicing stroke over cover-point's head. So the bowler's spin must be strong and his pace good, otherwise the soft, gentle, velvety friction of the air, though acting constantly throughout the whole flight of the ball, will not cause a noticeable curl.