

THE MAGIC SPHERE.

The article on the Magic Sphere, published in our issue of June 16, has brought to the editor's desk several letters, some of whose writers agree with the author of the article in his explanation of the magic sphere's curious properties, and others who side with the views expressed by the editor in the brief note appended to the article. By far the most interesting of these letters is one received from the inventor of the Magic Sphere, Sir Hiram Maxim. He writes as follows:

To the Editor of the SCIENTIFIC AMERICAN:

I have read the article on the Magic Sphere by Dr. Alfred Gradenwitz, which appeared in your issue of June 16, and also your comments on the same.

It seems that you do not altogether agree with the doctor's reasoning. I would say, however, that I furnished him with all the data connected with this invention, and that I feel quite certain that we do have stored somewhere in our head what you have so aptly termed "the gravitational sense organ." The apparent position of objects is not influenced in any degree by the inclination of the body, as you seem to think. We cannot account for seeing things right side up, quite irrespective of the position that the body is in, except on the hypothesis that we do have "gravitational sense."

Suppose, for example, that a man should be strapped onto the face plate of a large lathe, and very slowly revolved; the man would always see things right side up, quite irrespective of the position of his body. If we placed a man in a room lighted from the inside, and sling this room to a long arm capable of being rotated around a large circle, and if a plumb line was hung from the ceiling, the plumb line would always occupy the same position in relation to the room, whether the room itself was revolving around a circle or not. If the centrifugal force was equal to the pull of gravity, the plumb line would appear perfectly vertical to the man, and the floor of the room dead level although its true inclination above the horizontal might be 45 deg., and this quite irrespective of the inclination of the man's body. If the man was strapped to the rotating face plate of a lathe, it would not change the appearance of things in the least; the combined pull of gravity and centrifugal force would be the same, quite independent of the position of his body.

In regard to your saying that there would be no difficulty in walking in a diametrical direction, I would say that when one is standing at the extreme edge of the floor, he is traveling, we will say, at the rate of about fifteen miles an hour, and his body is endowed with a certain amount of *vis inertiae* or momentum. Suppose now that he attempts to walk quickly to the center of the rotating floor; what is to become of this *vis inertiae*?

Suppose, for instance, that he is in the center of the floor, and attempts to reach the extreme edge quickly; the floor will certainly have a tendency to run away from him, and if he did not brace himself very strongly, he would topple over. However, if the movement is slow, very little difficulty would be experienced, whereas one could always walk in a circumferential direction, either way, without feeling any influence whatever from the rotating floor.

After carefully reading the article, I find that all the statements therein contained are in exact accordance with facts that have been demonstrated by actual experiments.

HIRAM S. MAXIM.

Thurlow Park, Norwood Road, West Norwood,
London, July 8, 1906.

If we understand Sir Hiram Maxim correctly, he contends that we owe our perception of the true position of surrounding objects to an unlocated gravita-

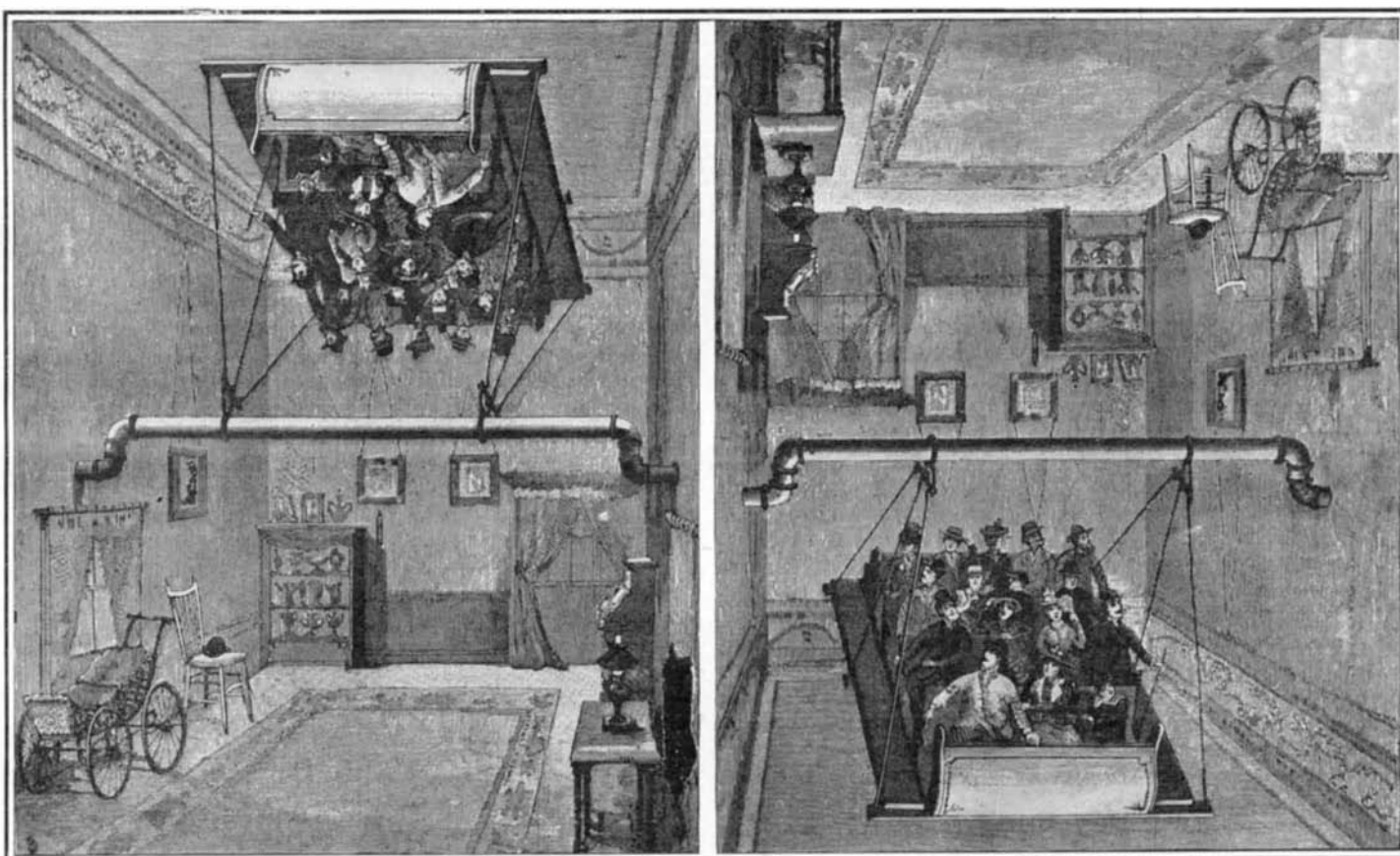
tional sense organ, and that the presence of such an organ is demonstrated by subjecting the human body to the action of centrifugal force in order to counteract the effect of gravitation. In other words, if we can counteract the force of gravity, the organ will be deprived of its stimulus, and its existence will thus be proved.

We still adhere to the view which we expressed in the brief editorial note appended to the article, in which the principle of Sir Hiram Maxim's magic sphere was explained and illustrated. In that note we stated that we refer external objects to ourselves, and that we thus gage their relative positions. If we deprive the eye of the means of making this comparison by inclosing ourselves in a room which, as Sir Hiram suggests in his letter, is slung "to a long arm capable of being rotated around a large circle," we shall no longer be able to institute that comparison with objects outside of the room which would ordinarily inform us of their position and ours. Assuming that the room in question were provided with spacious windows, through which trees and houses could be seen, it is certain that no one would be deceived. That this is so is proved by Sir Hiram's flying machine apparatus, which constitutes one of the attractions of every American seaside resort. That apparatus consists essentially of a post, to the top of which rods are hinged, each carrying at its outer end an open boat fashioned to resemble an airship. When the post is turned, the boats revolve in a circle and are flung out to an angle of about 45 deg. with the vertical. The occupants of these open boats are influenced by

no matter where he stands on the floor, will without effort assume a position normal to the curve of the floor at that point.

If he stand at the center, he will be normal to the earth. If he move out say three feet from the center, he steps onto a portion of the floor that is moving in a circular direction, say from right to left, at a certain rate of speed. In his new position two new forces will act upon him; first, a centrifugal force, pulling him to the outside of the floor; second a circumferential force, acting from right to left to knock his feet from under him. The former, or centrifugal force, is provided for by the inclination of the floor, which is such as to throw his body toward the center sufficiently for this purpose. This is done independently of himself, and as far as his consciousness is concerned, is involuntary. The circumferential force he must counteract by a voluntary inclination of his body in the direction in which the floor is rotating. So far as the effort expended in walking up or down the parabolic floor is concerned, we still adhere to our original statement. We may consider the problem from three points of view: (1) When the centrifugal force is greater than the force of gravitation; (2) when the centrifugal force is equal to the force of gravitation; and (3) when the centrifugal force is less than the force of gravitation. In the first case a man will obviously be pulled out from the center to the circumference if he does not resist; in the second, he will be practically in the situation of a man walking on a level floor, as in the magic sphere; in the third, he will have to climb a hill, in other words, he will have to perform

more work than in the first two cases. In all three situations he will perform an amount of work which, if we elaborate the well-known formula, is dependent upon his weight (the mass), upon the degree of curvature, and upon the speed of rotation, which last two determine his velocity. In all three cases he will seek instinctively to adjust himself to the mechanical requirements of his situation. The line passing from his head through his body represents the resultant of a combination



THE CAR IS STATIONARY, BUT THE ROOM IS ROTATABLE, AND ITS FURNITURE AND HANGINGS ARE FIRMLY SECURED. WHEN THE ROOM IS TURNED THE OCCUPANTS OF THE CAR IMAGINE THEY ARE CIRCLING IN THE AIR.

centrifugal force; yet they still persist in seeing objects in their true positions, and are fully cognizant of their own inclinations. Why? Simply because they can compare themselves with the outer world.

If the gravitational sense organ existed, it should manifestly perform its functions in a windowless room when the body is not subjected to centrifugal force; in other words, when the supposed gravitational sense organ is unaffected. Several years ago we published in the SCIENTIFIC AMERICAN an illustration of an illusion apparatus which answers these conditions, and we reprint it as an argument against the existence of a sense of gravity. The apparatus comprises a room journaled on a horizontal shaft from which a car is suspended. Every movable object of furniture in the room is nailed down. When the room is turned on the horizontal shaft, the occupants of the car imagine that they are circling through the air, although in reality they are stationary. In order to heighten the illusory effect, the car was first pushed by an attendant, so that it was made to swing gently. The attendant then left the room. By causing the room to rock on its shaft, the car seemed to swing from side to side in ever-increasing curves, until finally, when the room was completely rotated, it seemed to its occupants to describe complete circles. So successful was the illusion in actual practice that men and women would anxiously clutch the sides of the car when the floor of the room was above them.

It is unfortunate that the expression "difficulty of walking" should have been brought into this discussion; for the curve of the floor has been so designed with reference to the speed of rotation, that a person,

of forces formed by gravitation and the centrifugal force of the rotating floor and the circumferential accelerating force. In other words, he is under the influence of a force acting normally to the floor, just as he is in ordinary circumstances. If in Sir Hiram's case he attempted to walk toward the center of the floor without thus adjusting his position, we concede that it would be hard for him to walk. Similarly he would find his progress from the center toward the outer edge facilitated by centrifugal force. It is inconceivable, however, that any man would select the most cumbersome method of moving inwardly. He would instinctively tilt himself forward, just as he does when standing in a train rounding a curve.

The Current Supplement.

The current SUPPLEMENT, No. 1597, opens with an article on the Concrete Railroad Bridge at Danville, Ill. The article is illustrated with photographs of the bridge in course of construction. Attempts at smoke abatement are almost as old as the art of burning fuel itself. Mr. Wm. H. Bryan discusses its various phases. A new duplex four-cycle gasoline motor is described and illustrated in an article by the Paris correspondent of the SCIENTIFIC AMERICAN. Prof. J. S. Shearer writes on some properties of matter at low temperatures. Coke Oven Gas is the subject of an article by C. G. Atwater. Friedrich Guenther asks: "Is the Age of Bronze a Myth?" and shows that it is. A very valuable paper on amalgams is published. Lieut. White gives an account of the naval battle at Tsushima. Another installment on "Tinning" appears. Prof. William H. Hallock tells how tides are predicted.