Correspondence.

Flying Machines and Wind Resistance.

To the Editor of the SCIENTIFIC AMERICAN:

In a letter from Mr. George T. Tomlinson, published in your issue of June 9, under the title of "Flying Machines and Wind Resistance," I notice the following statement: "If an airship pitches more when running to the wind than when running away from it, it must be due to the fact (I do not know the authority) that the wind is in waves, still this should be felt just as well going with the wind."

According to the best information that I have seen on the subject, the observed pitching of airships and balloons is seldom very great. When pitching does occur, it must be due to the wind coming in puffs, as Mr. Tomlinson suggests. That such puffy winds are common is well known to all sailors. As the natural period of pitching for an airship is probably considerable, the puffs which would affect it most would not, unless of great intensity, be readily detected by an observer on an airship except by its pitching. They would not be felt directly as variations in the velocity of the ship through the air; hence Mr. Tomlinson's apparent uncertainty as to whether they really do occur.

The amount of pitching of any ship or floating body in a medium in which waves or "puffs" (as of wind) exist depends on its own natural period of vibration, rolling or pitching, which may be calculated from the dimensions of the body and the density of the medium. If the period of vibration and the interval between puffs are nearly the same, the pitching or rolling will be violent; if they differ considerably, it will be very slight. Hence anything which alters the interval between puffs as felt by the ship will affect its pitching. When an airship is running into the wind, the *effective* interval between puffs at the airship is:

$$(\text{Actual interval at a fixed point}) \times \frac{(\text{Velocity of wind}) - (\text{Velocity of ship})}{\text{Velocity of wind}}$$

When an airship is running before the wind, the effective interval is:

$$(\text{Actual interval at a fixed point}) \times \frac{(\text{Velocity of wind}) + (\text{Velocity of ship})}{\text{Velocity of wind}}$$

Hence, subtracting, we find that the difference between the effective interval running before the wind and that running into the wind is:

$$(\text{Actual interval at a fixed point}) \times \frac{2(\text{Velocity of ship})}{(\text{Velocity of wind})}.$$

(The velocity of wind and of the ship are those relative to a fixed point on the earth.) Obviously this difference may be considerable, and may, therefore, cause the ship to pitch most either when running into the wind or when running before the wind. As the interval between puffs is usually large compared with the period of pitching, the effective interval between puffs when the ship is running into the wind, being much less than that when the ship in running away from the wind, is most likely to coincide with the period of pitching of the ship, so then in general, airships pitch most when running into the wind. Similarly, most vessels pitch when running into a head sea, and captains are sometimes forced to alter their course in such circumstances in order to make repairs, get out anchors, or do other things which violent pitching renders difficult.

W. W. AMMEN.

U. S. Patent Office, Washington, D. C., June 16, 1906.

The Magic Sphere and the Gravitational Sense Organ.

To the Editor of the SCIENTIFIC AMERICAN:

In the current issue of your valuable paper you publish an article by Dr. Alfred Gradenwitz, entitled "The Magic Sphere." The author prefaces his discussion of the sphere by some very pertinent observations in regard to the sense of the vertical in connection with the power of vision.

You have seen fit to affix exceptions in a subsequent note, in which you discredit the idea of any gravitational sense organ, and also disagree with the author in his deduction that diametrical walking would be difficult on a rotating floor of the kind described.

I am not a scientist nor a mathematician, but I nevertheless am decidedly of the opinion that the author is correct in both these matters. First, in regard to the gravity sense organ, I have long been of the opinion that such a thing existed. This was first called to my notice in the following way:

I noticed, when seated below in a small sail yacht, that every time the boat came about, I seemed to see the walls of the cabin in a state of rotation around me. I repeatedly watched the phenomenon, and tried in vain to ascribe it to the working of any known sense or senses. This set me to thinking, and I soon took up the matter of the sense of the vertical, with similar results. This sense of sudden change of direction is closely correlated with the sense of the vertical, or of gravity, for an organ sensible of gravity would quite likely be sensible of change of motion, or inertia. It will be observed that no sense of rotation exists, *per se*, but it is only during the state of change that it can be perceived, and then only when the change is rapid. Just as the plumb-bob will remain in its former position if its support is suddenly rotated, and thereby indicate the change of direction, just so the organ or whatever it may be to which we owe this sense, operates under similar conditions. It does not seem credible to me, at any rate, that the impression of what constitutes an upright position is derived from external ocular observations. I once stood on the outermost edge of the overhanging rock that tops the outward-leaning wall of Glacier Point, which rises nearly half a mile from the floor of the Yosemite. I noticed then that all ocular means for determining a vertical were lacking. When viewing the earth from a height, slopes are not perceptible, and hills of considerable size are not recognizable. Therefore, with all objects removed to such a great distance, there remained to a person standing on the end of this rock only the sense of the vertical derived from gravity, to keep in an upright position. Indeed, how does this sense remain even when the sight is destroyed? If a person is revolved, or other means are used to put him in that dizzy condition where it is difficult to stand erect without staggering, and then the light is suddenly extinguished, the person is sure to fall, i.e., if the subject is really sufficiently disturbed to lose all sense of the vertical. To my mind, this is a strong argument for the gravitational sense organ. This is put out of working order by the treatment to which the subject is subjected, and the eyes are all that remain to guide him. Under these conditions, he sees objects about him rocking like a ship at sea, and attempting to follow the motion, he staggers. If the light be extinguished, he has no guide, and he falls.

In regard to the second point, viz., that diametrical walking would be difficult on a parabolic floor in a state of rotation, it is only a matter of figures to prove this to be correct. Let us suppose that the magic sphere in question is rotating at the rate of 14 revolutions per minute. Now, suppose an occupant, standing some distance from the center, approaches the axis at the leisurely rate of three miles per hour. At this rate he will shorten the diameter of the circle he is making about the axis by 8.8 feet in one second. This occasions a change of velocity of 6.4499 feet in a second. This acceleration is positive when the occupant moves centrifugally, and minus when he moves centripetally. Now, this acceleration is approximately one-fifth gravity, which is (for convenience) 32 feet per second. Therefore, if the speed of rotation be increased, a point may be reached where the occupant, in order to approach the axis at the moderate rate of three miles per hour, will have to exert a force equal to his own weight. This point would be attained at 69½ revolutions to the minute. Under these conditions the occupant would be obliged to lean far to the side in the direction of the rotation when walking centrifugally, and opposite to the direction of rotation when walking centripetally.

If I am laboring under any delusion in forming these conclusions, I should thank you for setting me right. As I said near the outset, I am neither a scientist nor a mathematician.

BENJ. S. DEAN.

Philadelphia, Pa., June 16, 1906.

Interesting Papers on Dynamic Flight.

Two interesting and valuable pamphlets on dynamic flight have just been published in this country. These are entitled "Resistance of Air and the Question of Flying" and "Flight Velocity." They are from the pen of Herr Arnold Samuelson, engineer, of Schwerin in Mecklenberg, Germany, and they give the results of his work, both experimental and speculative, in this line for the past thirty years. The first-mentioned pamphlet gives the author's experiments and theories, and in the second, which was written after he heard of Langley's experiments, he compares his own experiments with those of Prof. Langley, and points out wherein they agree and disagree. Samuelson disagrees with Langley in several important points, such as in claiming that the center of pressure of an aeroplane is always one-third of the way back from the front edge, no matter what the angle of incidence, and also that the pressure perpendicular to the plane is independent of the angle of inclination. He ends by stating that the aeroplane is not the proper form of dynamic flying machine after all, and by giving it as his opinion that the flapping wing idea is the only one that will succeed. He has constructed and experimented successfully with a model of this type, and he gives working drawings of it in the pamphlet on "Flight Velocity," besides stating his willingness to send gratis to anyone interested full directions for building a motor-propelled, man-carrying machine of this type. All of his aeroplane experiments were made with small models similar in form to Langley's, although very much smaller and propelled by elastic bands.

Automobile Notes.

With the running off of the Grand Prix race in France on June 26 and 27, the first great road race of the year was successfully completed. This race, which was substituted for the Bennett Cup race by the French constructors in order to allow a greater number of French cars to compete, was run on two successive days over a triangular course some 60 miles in length, the total distance being about 750 miles. Out of 32 starters but 16 finished the first day's race, and 11 the second. Szisz on a 105-horse-power light-weight Renault machine was the winner, his total time being 12 hours, 14 minutes, and 7 seconds, corresponding to an average speed of over 63 miles an hour. Nazzaro, on a 135-horse-power Italian Fiat, was second in 12:45:25; and Albert Clement, on a 125-horse-power Clement-Bayard machine, third in 12:49:46. Barillier, on a 105-horse-power Brazier, was fourth in 13 hours and 53 minutes, Lancia on a Fiat fifth in 14:22:11, and Heath, on a 130-horse-power Panhard, sixth in 14:47:45. Three Brazier machines formed the only team that finished, these gaining fourth, seventh, and ninth places respectively. Two 125-horse-power German Mercedes cars were the last to finish, the best time of the two being 16:18:42, made by Alex. Burton's machine. The success of the winner is said to be largely due to a new detachable rim, by means of which a punctured tire is removed complete with the rim and a new, fully-inflated tire is quickly slipped on. Szisz is said to have changed tires no less than nineteen times during the race, and to have been able to change a tire in four minutes instead of requiring fifteen or twenty.

The American Automobile Association's tour for the Glidden Trophy, which starts from Buffalo on July 12 and ends at Mt. Washington, N. H., on the 28th, is to be one of the simplest reliability runs that have ever been held in this country. The cars will be run on a schedule, and checkers will be located about 25 miles apart, for the purpose of keeping tab on the contestants. The latter will be given the time at which they must pass the checkers and arrive at the finish. One point will be deducted for every minute they are behind time, and two points for every minute they are ahead. An average speed of from 15 to 17 miles an hour will probably be required. All repairs, adjustments, filling of tanks, etc., must be made each morning after the car has been officially started, though an allowance of 10 or 15 minutes will doubtless be made for this. The winner of the trophy will be the car which loses the least number of points from being behind or ahead of time from any cause whatsoever. The route of the tour extends through one of the most picturesque sections of the United States and Canada. Three days will be consumed in making the run from Buffalo to Saratoga, with stops at Auburn and Utica. Sunday, July 22, will be spent in Saratoga. The next day's run will be to Elizabethtown, in the heart of the Adirondacks. July 19 will be spent in Montreal, July 22 and 23 in Quebec, and July 27 at the Rangeley Lakes in Maine. These days for resting and sight-seeing will no doubt be greatly appreciated by all who participate in the tour. Elaborate preparations have been made for the successful conducting of this event. Accommodations have been provided by the committee for the accommodation of 400 people at the different stopping points. In some places tents will be used, and at Three Rivers, in Canada, one of the St. Lawrence steamers will accommodate the tourists over night. One and a half tons of confetti will be used by the pilot car in marking the route. From present indications, about fifty cars will be entered. Most of these are four-cylinder touring cars of 24 horse-power or over. Although there was a protest at the idea of not admitting light cars to the contest, which resulted finally in the admission of the same, very few of the entrants have cars of this class.

The Current Supplement.

The current SUPPLEMENT, No. 1592, opens with an excellent article by the English correspondent of the SCIENTIFIC AMERICAN, describing the difficult feat of transporting by rail the huge stern frame and brackets which now form part of the Cunarder "Lusitania." Excellent illustrations accompany his text. Dugald Clerk continues his illuminating exposition of internal combustion motors. The æsthetic versus the economical value of Niagara Falls is discussed. The grains used for breakfast foods are made the subject of a short but interesting article. Now that the law has been passed which renders it possible to make alcohol for industrial purposes tax free, we hope to publish, from time to time, exhaustive articles on the manufacture of industrial alcohol and the methods by which it is denaturized. The first of these articles appears in the SUPPLEMENT, and is entitled "Alcohol from Sawdust." It describes very fully the results which have been obtained in Germany with an experimental plant producing alcohol in this way. Wellman's huge Polar airship is also described.