

## Correspondence.

## Air Resistance to Moving Bodies.

To the Editor of the SCIENTIFIC AMERICAN :

In concluding an editorial on air resistance to moving bodies, suggested by Murphy's bicycle riding feat, you offer for the special consideration of railroad managers this problem: If a body presenting three square feet of surface to air resistance, and moving at the rate of sixty miles per hour, requires seven horse power for its propulsion, what would be the resistance in horse power to a train moving at the same velocity, but presenting 400 to 600 square feet of surface? This is not at all difficult, as a mathematical problem, but to my mind it suggests another, which I confess is a "corker." If from 933 to 1,400 horse power is required to overcome the direct air resistance to a train moving sixty miles per hour, and this resistance is about equivalent to the utmost capacity of the locomotive, how are the inertia, frictional and other resistances overcome at this and much higher speeds? The men who formulated the extremely elastic formulæ on which such calculations are based should give their attention to this problem, in which event it is probable that we should soon hear of a solution equally interesting and valuable. But if they have any misgivings as to the accuracy of their calculations, it is suggested that they should not attempt to verify them by any experiments conducted on the pilot of a fast locomotive without first erecting thereon some very substantial fortifications against those delusive seven or more horse powers which otherwise they would be called upon personally to resist. If these gentlemen should unfortunately be afflicted with a physical corpulency to correspond with the inflated generosity of their imaginations, the dangers of the undertaking should certainly deter them from making, in other respects, such a promising experiment in the suffering interests of science.

The simple fact that the bicyclist Murphy was able to ride from 10 to 15 feet in the rear of the car or shield shows conclusively that a body of air enveloping the entire train is swept along with it, at about the same rate of speed, and that, therefore, small projections, window embrasures, and gaps between the cars, add little or nothing to the resistance.

If a bicycle rider, without a pacer, would have to exert seven horse power at sixty miles per hour, it would, at least, be safely within the limits of the accuracy of Mr. Adams' calculations to say that one horse power would be required at 30 miles per hour; but it is known that the best riders are unable to make a sustained effort of much over half a horse power, and if the double of this is demanded for air resistance alone, we must all admit that the rider who makes a record of 25 or 30 miles per hour is the most wonderful phenomenon that nature has ever produced.

W. F. CLEVELAND.

Moncton, N. B., Canada.

[The points raised by our correspondent are well made, and the reductio ad absurdum in the case of the horse power required to drive a bicycle at thirty or draw a train at sixty miles an hour is evident. We know that 1,400 horse power is not exerted by the locomotive in overcoming air resistance, and we know that a bicyclist cannot exert one horse power for more than a few seconds at a time, certainly not for two minutes; nevertheless, assuming that even the lowest tables of wind pressure are correct and working upon the 33,000 foot-pounds basis, as we did in the editorial referred to, these impossible results inevitably follow. As a matter of fact, there is a crying need to-day for careful investigation of the subject of wind pressure and air resistance, not so much to determine the disturbances of the atmosphere when agitated by moving bodies, as the exact pressures developed. The impossible results arrived at in working on our present basis of wind pressure prove that our tables are altogether too high; and if they are too high, we are putting tons of weight into our bridges, roofs and framed structures subject to wind stress, which represent simply a clumsy waste of material. The other point raised in this letter is taken up in our editorial column.—ED.]

## Air Resistance.

To the Editor of the SCIENTIFIC AMERICAN :

Your valuable paper of July 15 to hand yesterday, and contents of article headed "Murphy's Ride a Hint to the Railroads," noted.

It seems to me that you leave one factor out of all your calculations, namely, the suction or inrush of wind behind the train. You only credit the engine and car with one-half of their work. They not only cleared the way for Murphy; they created a 60-mile per hour wind behind him to carry him along. This new factor will cancel all your previous figures, as, according to them, Murphy had seven horse power of wind at his back.

That the frontage of engines, etc., offer some resistance to the air, there can be no doubt; but it is insignificant in comparison to the results of your figures. I will venture to say that if Murphy had taken his feet

off his pedals after he had attained his maximum speed he would have finished just as soon as he did.

A few years ago, I followed a trolley car across the meadows between Rutherford and Jersey City, at a distance of some 20 to 30 feet. The car stopped unexpectedly (to me) to hail another car coming in an opposite direction. With all the back pressure I could exert I could not stop quick enough to avoid smashing my wheel, and I only saved myself by getting out from behind the car.

ROBERT MANCHLIN.

New Holland, Pa., July 15, 1899.

[Our correspondent is confusing a 60-mile per hour train with a 60-mile per hour wind. The pressure on a stationary square yard of surface exposed to a 60-mile wind is the same as the pressure on a square yard of surface moving at 60 miles per hour through still air. According to our correspondent's theories, if he took shelter from a 60-mile per hour wind behind a square yard of board fence, he would find a 60-mile wind (or suction as he terms it) blowing him against the fence on the lee side of it. As a matter of fact, the air on the lee side of the fence would be still or "dead" air, just as (according to Murphy) there was still or as he called it "dead" air behind the shield.—ED.]

## THE PARIS EXPOSITION MEDAL.

Our engravings give an admirable idea of the appearance of the new medal which will be given to the most deserving exhibitors at the great Exposition which will open its doors next year in Paris. The medal is of bronze,  $2\frac{1}{8}$  inches in diameter, and is the work of the French sculptor, M. Georges Lemaire. It consists of a female figure, modeled in considerable relief, holding in her right hand a branch, while with her left hand she sustains an airy bit of drapery. The wording is simply "L'Exposition de Paris," and the sun with conventionalized rays at her left has the figures "1900" imprinted across it. The figure is seated on the capital of a column which is almost hidden by the ample folds of the drapery, which are excellently



THE MEDAL OF THE PARIS EXPOSITION OF 1900.

handled. At her feet is a scroll, a palette, and a lyre, typifying the fine arts.

The reverse of the medal is made up of a cartouche which is to receive the name of the recipient of the medal. At one side and secured by a banderole is a sheaf, presumably of corn, typifying agriculture. Below, at the center, is an airship, at its right is a telegraph pole, and at the left a battleship bristling with fighting tops, conning towers, and turrets. The lower part of the composition is made up by the usual cog wheels, anvil, governor, etc., which have served, from time immemorial, for works of this kind. There is also a camera, telephone, a globe, books, and an alembic. The obverse of the medal is very handsome, but the reverse consists of a confused jumble of conventional representations of various arts, manufactures, and discoveries, and can hardly be called very successful. The medal will be warmly appreciated by its recipients, and we trust that the American exhibitors will take away their full share of them.

## The Arctic Club.

The Arctic Club of America is the name of a unique club which has headquarters in New York city. It was organized by the members of Dr. Cook's Arctic expedition of 1894 on the ill-fated ship "Portia," which was sunk so recently. The members of the expedition had been wrecked off the southwest coast of Greenland, their ship being the "Miranda," the sister ship of the "Portia," that ran upon the reefs off the coast of Greenland, the magnificent collections being lost. The party was rescued by a little Gloucester fishing schooner, and when they reached Halifax they embarked for New York on the "Portia." The members of the expedition met together on September 8, 1894, and organized the club, whose active members should consist of all persons upon the passenger list of the "Miranda" on her cruise. Prof. W. H. Brewer, of Yale University, was made president. It was decided that an annual dinner be given by the club. The first banquet took place December 7 of the same year. Since that time the scope of the club has been widened, and it now embraces among its members nearly every prominent Arctic explorer in the United States, and even Dr. Nansen is one of its honorary vice-presidents. The objects of the club are to promote a live interest

in Arctic matters and to disseminate accounts of the results of expeditions. The club has a banner of its own, which is now being borne toward the north pole by Lieut. Peary, Walter Wellman, and others, and the members of the club are living in hopes that their banner will soon float above the pole, the goal of all Arctic explorers.

## Automobile News.

A service of motor vehicles has been started between Rosas and Figueras, in Spain, a distance of twelve miles. The vehicles are of eight horse power and have a seating accommodation for nine passengers.

The New England Electrical Vehicle Transportation Company has made a beginning in the automobile business in Boston by putting five carriages in service. Within a month it is expected there will be thirty more.

It is expected that an automobile fête will be held at Pau, France, next February.

Sixty-seven motor cars started on July 16 to race around France, a distance of some fourteen hundred and fifty miles. It is expected that the trip will occupy nine days, with two intervals of a day each.

The first electric cart of the firemen of Paris is now running on the streets and has already begun its work of saving life and property. It is a handsome vehicle, with a seat in front for several firemen, and a horizontal steering wheel. Back of this is a "dos-a-dos" arrangement which will permit of seating several firemen. Between these seats is a box for hose. The batteries are carried underneath, and scaling ladders are carried at the side.

The Illinois Electric Vehicle Company will soon be in a position to begin operations. At first only a few vehicles will be operated, but the number will be increased as fast as they can be obtained from the manufacturers. The demand for electric carriages is so great that the manufacturing companies cannot furnish an adequate supply.

Some time in the fall electric automobile street sweeping machines will be used in Paris, and the old clumsy lust machines will be done away with. The motor is in front, while underneath and behind is a tank or water, and the sprinkling device in the rear and the sweepers, which can be raised out of contact with the pavement whenever desired. The new machine can be run back and forth over a street to sprinkle it, it will then return and sweep the dirt in piles and electrically-driven carts will carry away the dirt after it has been heaped in piles.

The French electric wagon Jeantaud recently made a trip of eighty-five miles in seven and a quarter hours, without recharging the battery.

## Test of the New Naval 4-inch Gun.

A new type of 4 inch, 50-caliber gun for the navy has just been tested at the Indian Head Proving Ground, giving excellent results. With a charge of 17 pounds of perforated grain navy smokeless powder, a muzzle velocity of 2,991 foot-seconds was obtained, with a muzzle energy of 2,049 foot-tons, with a chamber pressure of 16.95 tons per square inch. With a charge of 16½ pounds a muzzle velocity of 2,937 foot-seconds was obtained, with a muzzle energy of 1,972 foot-tons.

The gun was designed for 3,000 foot-seconds muzzle velocity within the limits of 17 tons pressure per square inch, and there is no doubt but that, with a powder of the proper grain, the requirements will be easily fulfilled. The weight of the new gun is 2.72 tons, while that of the old type 4-inch gun is 1.5 tons. The old type gun, with smokeless powder, has a muzzle velocity of 2,200 foot-seconds, and a muzzle energy of 1,108 foot-tons. The muzzle energy of the new gun is, therefore, 78 per cent greater than that of the old.

The old gun has a muzzle energy of 738 foot-tons per ton of gun; the new gun has a muzzle energy of 750 foot-tons per ton of gun. The old gun has 92 foot-tons muzzle energy per inch of shot's circumference, and the new gun has 170 foot-tons muzzle energy per inch of shot's circumference. The old gun has a muzzle energy of 335 foot-tons per pound of projectile, and the new gun has a muzzle energy of 62 foot-tons per pound of projectile.

A new type of mount for the heavy 4-inch gun was also tested and worked in a thoroughly satisfactory manner during the firing of the thirty-five rounds to which the gun was subjected.

The new monitors, in addition to their 12-inch turret guns, will each have an auxiliary battery of four of the new 4-inch guns.

The Ordnance Bureau of the navy is much gratified with the performance of the new gun, as the larger calibers of the new high powered gun now being manufactured for the battleships of the "Maine" class and the monitors are designed practically on the same lines as the 4-inch gun just tested. The next new gun to be tested will be one of 6-inch caliber, and it will be interesting to note its performance, as a new 6-inch gun manufactured by Vickers Sons & Maxim, of England, will soon be fired at Indian Head.

## Science Notes.

The British steamship "Holbein," which recently arrived at Liverpool, picked up Capt. William A. Andrews, known as the "lone navigator," who left Atlantic City on June 18 in a little vessel barely twelve feet in length, to attempt to cross the Atlantic. He was found in an exhausted condition on July 12, about 700 miles from the Irish coast.

Dr. Lambert Lack of London has for a long time been investigating the origin of cancer. His theory is that cancer is not a germ disease, but is due to specific injury to the basement membrane of the mucous membranes and allied structures. Dr. Lack promises that he will communicate full details of his investigations to the medical press in a short time.

A short time ago the "Captain Cook Reserve" at Kurnell, on the shore of Botany Bay, New South Wales, Australia, was formally opened. The reserve is the ground which marks the spot where Capt. Cook, the great navigator, landed one hundred and twenty-nine years ago. The park was inaugurated with appropriate ceremonies, and H. M. S. "Goldfinch," which lay in the harbor, fired a salute.

The opal mines in Mexico and the United States have been about exhausted, no gems of much value being extracted from them, though at one time large sums were made out of these mines. Opals occur in veins in the same manner as silver or gold. Those coming from below the level of water in a mine are not considered desirable. They may lose their color or crack after being exposed to the sunlight, so as soon as a mine reaches water level, it is abandoned.

Henry G. Bryant, of Philadelphia, the well-known explorer and mountain climber who led a search party for Lieut. Peary a few years ago, and who has now in view the ascension of Mount St. Elias in Alaska, has left Banff for Mount Assiniboine to make preparations for the ascent of the peak. He has been considering the ascent of the great peak of Assiniboine for some time. He will be accompanied by Swiss guides from Interlaken, who have been recently introduced at the Selkirk glacier and other mountain points for the benefit of Alpine clubs.

After September 1, the sirups used in soda water in New York city will be subjected to the careful scrutiny of the Health Department, and not only will the small vendors who peddle from their carts come under the jurisdiction of the department, but the large drug stores which dispense soda water from pretentious fountains will also be under their supervision. The act is aimed particularly at imitations of lemon and orange juices, which are very injurious. Imitation pineapple made from ethers is also unwholesome. The selling of adulterated sirups is now a misdemeanor in the State and is punishable by fine or imprisonment.

Rome and the surrounding country was visited by a severe earthquake on July 19. Considerable damage was done in the central part of the city and a number of churches were injured. Several blocks of stone fell from the Coliseum, and the columns of the Forum rocked, but remained intact. Otherwise the antiquities were not seriously injured. In the Alban Hills the shock was very severe. The villa of the Pope at Castle Gandolfo was seriously damaged, and the town of Frascati was injured worst of all. The shock it is believed can be attributed to the same causes which made Mount Etna begin an eruption the day before.

The colored screens used in orthochromatic photography are far from being identical among themselves, especially when they consist of a small glass cell filled with colored liquid. It thus becomes necessary to verify them each time before using, a process which is quite difficult. In order to facilitate this comparison, M. Villain has had the idea to utilize an apparatus which is very simple, known to chemists and color makers as the colorimeter of Houton-Labillardière. This colorimeter consists of a rectangular box of which one of the sides has two openings preferably rectangular, while opposite to them on the other side of the box is a larger rectangular opening, through which the first two are visible. Behind each of the two openings is placed a glass tube, about 15 mm. in diameter and 15 cm. long, open at the top, into which are poured the liquids to be compared. Screens of glass or gelatine may take the place of the tubes. By looking through the large aperture at the two screens, it is easy to detect any difference of color. The construction of this small apparatus is very simple as well as cheap, but it may be still further simplified, and one may in fact transform his own camera into a colorimeter with little trouble. It is only necessary to take off the lens and to replace the frame containing the ground glass by a thin piece of wood or even thick cardboard slid into the back of the camera. In this are cut two openings, as above, and the tubes or screens are fixed to the back in any convenient manner. The two screens to be compared being thus in place, they are observed through the opening left by the removal of the lens, the head being covered by the cloth. In this way a very small difference of color may be easily detected.

## Engineering Notes.

The Lachine Rapids Hydraulic and Land Company is contemplating many additional improvements. An additional wing dam 1,000 feet long will be constructed to avoid the frazil ice. The company will also build about 1,000 feet of crib work. A steam plant is also to be installed to provide for emergencies.

Four engineers have been selected to prepare plans for the construction of the memorial bridge across the Potomac River at Washington, from the Naval Observatory grounds to the Arlington estate. The men selected are George S. Morison, Leffert L. Buck, William H. Burr and William R. Hutton. They are all engineers who have done important work in this line.

The Knapp roller boat, which we have already described, set out from Toronto a short time ago. The roller boat would not roll, and according to The Canadian Engineer became unmanageable, even in a moderate wind. Five days after leaving Toronto the "roller" was reported as being tied to a tree about two miles west of Bowmanville, Ontario, having rolled forty-one miles in five days.

It is announced that a contract has been made between the Carnegie Steel Company, Limited, and the Schoen Pressed Steel Car Company, at Pittsburg, which will run for ten years. During this time the Carnegie Company is to furnish the Car Company with 1,000 tons of steel plate daily. The yearly contract will amount to \$6,000,000. It is said that this is the largest single contract ever made in this country.

The power of the Mannlicher rifle was recently demonstrated in an accident near Prague. Two gendarmes entered a room in an inn and closed the door, putting their rifles in the corner. One rifle fell and discharged itself, the bullet going through the door into the next room, where a party was dancing, passed through the body of a musician, killing him, and then through the bodies of five other men, all of whom were dangerously wounded.

On the new street cars between St. Paul and Stillwater there will be air brakes and whistles, the air being supplied by a small motor which operates an air pump. The whistles will be used in the country, where a high rate of speed is maintained. Each car is also to be provided with a telephone and fifty feet of wire. Each half mile there will be a place where this telephone can be attached, so that the conductor can communicate with the power house or car barn.

An interesting gyroscopic device, termed the "oscillometer," has been put on the market by a Milanese firm. It consists of a small electric motor mounted in gimballs like a ship's compass, with its armature running in a vertical position at a very high rate of speed; the frame of the instrument being attached to the vessel follows any change in direction. As the ship rolls, the armature maintains its original position, while the frame, of course, follows the motion of the ship. As the motor armature continues to revolve always in the original plane, any change in the direction of the vessel is at once indicated. Suitable scales and pointers are provided, so that the amount of movement can be accurately determined.

A story is now going the rounds to the effect that the Chinese government will soon make a contract for tearing down the Great Wall, which is 1,300 miles long. It is very unlikely that any attempt to do this will be made, because the expense of taking down such a wall, even with the cheapest labor, would amount to an almost impossible figure. The reservoir at Forty-second Street and Fifth Avenue, New York city, may be compared to the wall of China in certain ways. It is estimated that it will cost over \$100,000 to remove the reservoir, and when its very small size is considered, it will be seen that to pull down 1,300 miles of wall would cost a billion or more dollars. It is probable that the wall may, however, be utilized as a quarry for those in search of building materials.

The Compagnie Générale des Omnibus de Paris is installing on the cars of their Louvre-Saint-Cloud line a low pressure acetylene lighting system. The vehicles while built under the form of an omnibus are really street cars, for they run on tracks and are provided with an "imperial" or second story. The material which generates the gas is not ordinary calcium carbide, but is what is called "acetylithe," which has been devised by Létang and Serpollet. This substance is calcium carbide which has been treated with glucose after an immersion of several weeks in petroleum; this prevents an over-production of gas. The generator is placed on the platform of the car, under the stairs which lead into the imperial, and is of a new form, and is simple and effective. The gas after being generated is dried and the impurities are removed. Lead pipes conduct the gas to the burners, which are inclosed in globes somewhat similar to those used for the Pintsch light; there are two in the car proper, one on the imperial and one on the platform, as well as a small signal light of five candle power. The total expense for the five lights is about four cents per hour, which is much cheaper than an equivalent amount of electric light.

## Electrical Notes.

Stockholm, Sweden, has probably the largest number of telephones for its population of any city in Europe. There are 23,000 telephones to less than 300,000 inhabitants.

The Hudson River Power Transmission Company has received permission to erect poles and string wires along the Erie Canal for a distance of twenty miles from Mechanicsville, where the power is generated, to Albany.

The freight traffic of the Detroit, Ypsilanti and Ann Arbor electric railway promises to be a profitable branch of the business of that line. Every day two shipments are made from its office depot on Griswold Street, in Detroit, says The Tribune of that city, and two shipments are received back at the same place. The receipts from inbound freight average \$10, and for outbound freight about \$25 a day, and it is expected that the total receipts will be increased to more than \$100 a day by June, 1900. Ann Arbor takes about half of the freight and Ypsilanti is next in volume, but shipments to Wayne are daily increasing. A good deal of the freight consists of vegetables and groceries, although trunks and all light articles usually carried in express cars on steam railroads are also taken. -- Western Electrician.

It is stated that the electric locomotive destined for the Jungfrau mountain railway is the most powerful rack-wheel machine hitherto constructed. It is designed to haul the trains over the steepest portion of the track. The motors are placed under the passenger cars, whereby greater adhesion between the driving wheels and rails is obtained. The car truck is provided with two bearing axles and two driving axles, which latter are situated between the former. Two motors, each of 125 horse power, at 800 revolutions per minute, actuate the toothed wheels through the medium of duplicate gearing. If required, these motors are capable of working up to 300 horse power. The driving current is conveyed overhead at a tension of 500 volts. The pivots of the toothed wheels are of aluminum bronze, the teeth being of cast steel. Three methods of braking are provided for; an electric brake arranged to work on the driving shaft, a hand brake, and a third brake which grips the rails by means of cheek pieces. The locomotive was constructed by Messrs. Brown, Boveri & Co.—English Electrical Review.

Mrs. Ayrton, the wife of the electrician, recently created quite a sensation by reading a paper on the hissing of the electric arc. The paper was an important one and has been highly commended by electricians. She appears to have demonstrated, according to The Electrical World, that an arc hisses as soon as its cup overflows, that is, as soon as the crater in the positive carbon breaks its walls and the arc commences to ascend the side of the positive carbon. So long as the crater is kept within the sides of the carbon, or at the end of the positive carbon, the arc is silent, but the moment the crater expands so as to leave the end and cut into the side wall, the hissing promptly commences. The cause of this remarkable disturbance appears to be a rhythmical disturbance due to combustion. In the hissing arc air is able to gain more or less complete access to the highly heated surface of the crater and this is accompanied by a direct combustion of the carbon at the crater's surface, with semi-rhythmical rapid alternate heating and cooling. The paper is worthy of study, as showing how a subtle and apparently complex phenomenon may be explained and elucidated by systematic research.

In Manila the central station plant is near the center of the city. The Pasig River, which runs through the city, divides the old from the new town, and the current is carried across the river by three bridges on steel poles, the lines being tapped to supply lights to each bridge. There are 450 steel and 1,400 wooden poles, and the lines are carried in oil-filled porcelain insulators. The Manila Electric Light Company has a contract to light the streets for 20 years, 16 of which are still to run. General Otis has taken over the responsibilities of the contract, says Industries and Iron, of London, and is paying the electric-lighting bills for the streets. The original contract provided for 140 2,000 candle power arc lamps and 1,000 20 candle power series incandescent lamps at \$60,250 a year. The arcs are 50-volt lamps, 20 in series, on a 1,000-volt circuit. The number of street lights has greatly increased. On wide streets the steel poles are in the middle, and it is provided that the lights should be switched in 20 minutes after sunset and off 20 minutes before sunrise. There are about 6,000 incandescent 16 candle power lamps, running on 100-volt alternating current circuits. The charge is \$1.50 (Mexican) a month for a 16 candle power lamp, burning half the night, and \$2 for an all-night lamp. The central station is equipped with six compound condensing engines of 300 horse power each, 10 alternating current generators of 2,000 volts, of 60 kilowatts capacity each, and four 65-light 2,000 candle power arc dynamos, running at 3,250 volts each. The capacity of the station is 12,000 incandescent lamps and 260 arc lamps.