Correspondence.

Air Resistance to Moving Bodies.

To the Editor of the SCIENTIFIC AMERICAN:

The newspaper reports of Mr. Adams' experiments with air-splitting trains, and the ill-considered theories which he has taken the trouble to publish, lead one to wonder why he adopted such an expensive and cumbersome plan of proving the fallacy of these theories, which even the highly colored accounts referred to establish beyond dispute. The speeds claimed were not extraordinary, taking the capacity of the engine and the weight of the train into account, except when descending the grades, and even the maximum speed of 102 miles per hour has been equaled, with a heavier train, on one of the level roads between Philadelphia and Atlantic City.

If air resistance is such a dominant factor in the consumption of the power of the engine, why did not Mr. Adams' train run faster on the grades? Either this resistance does not exist, or else Mr. Adams' housings did not remove it. We are all familiar with the remarkable run, made on one of the Chicago and Buffalo roads, a few months ago, when a very commonplace locomotive, with a heavier train, on about an equal grade, out-raced Mr. Adams' train by several miles per hour. The exact figures cannot at present be given, but the statement is approximately correct. It is also a well-established fact that the drawbar pull or traction effort of the engine does not increase on level roads with the higher speeds, except under accelerative stresses, which, of course, are at all times proportionate to the inertia of the train and the increase in speed. On the contrary, it has been shown by tests, published in The London Engineer, that at certain uniform speeds, above fifty miles per hour, the tractive power demanded is even less than at lower speeds. What becomes of Mr. Adams' theories if this is true? It was clearly shown that the horse power developed was considerably less at these high speeds, back-pressure and "wire-drawn" admission being the chief obstructions to the attainment of higher cylinder power. After a certain speed is reached the horse power of the engine cannot be increased, and frequently cannot be maintained, owing to these difficulties of admission and exhaust, together with a limited boiler capacity; and this is the mysterious resistance that has switched Mr. Adams off on the wrong track.

A heavy head wind is not a serious obstruction to the attainment of high speeds, in spite of the greater atmospheric density induced thereby, but side winds are fruitful causes of late trains, which show beyond question that friction and not air resistance is the arch enemy of high speed. In still weather a large body of air is swept along with the train, but, moving at lower velocities as the distance therefrom increases, shows conclusively, although it is a self-evident truth, that each stratum of air passes over the next, with much less friction, than the innermost stratum would sweep over the walls of a train however smooth or unbroken, and that this stratum, therefore, although a thin one, has practically the same velocity as the train. Anyone who has not learned this by observation, may do so by holding the hand close to the outside wall of a fast train, below one of the windows. It is surpassingly strange that such evidence as this should be ignored by a student who makes a specialty of this interesting subject. W. F. CLEVELAND.

Penetang, Ontario, Canada.

Ethnology at the Pan-American Exposition.

BY DR. A. L. BENEDICT.

The Exposition has provided a circular building 128 feet in diameter, and has also arranged for a "Six Nation" Indian Exhibit on the grounds, with a representation of the typic "Long House" of the Iroquois and an attendance of some sixty Indians, who will be engaged in such industries as basket-making, woodwork, etc. As these Indians are pagans and have preserved to a great degree their ancient customs, they will celebrate in appropriate seasons their various thanksgiving festivals, dances, and other rites.

Every precaution will be taken to protect exhibits against fire or theft and loss in packing and unpacking. It is expected, therefore, that a large amount of valuable archæological material will be placed at the disposal of this department by museums and individual collectors. In fact, it is not too early to assure the public that the promises of such institutions as the American Museum of Natural History, the Peabody Museum, University of Pennsylvania, University of Chicago, and the Buffalo Society of Natural Sciences, as well as the friendly co-operation of the ministers of the South American republics, guarantee the success of this department. At the same time, there is always room for more, and as the aim of this department is not so much to get together a large miscellaneous collection of relics as to afford a means of popular instruction in American archæology, it is desired that students from all parts of the country shall send on exhibits or memoranda descriptive of results obtained in their special fields of labor. For example, one exhibit will show the animals domesticated by the aborigines of the Western Continent, and will explain why the lack of large, useful animals capable of domestication hampered the development of civilization in the New World.

Through the co-operation of the Department of Agriculture and Horticulture exhibits will be made of the plants cultivated in both North and South America before the discovery.

Often the placard is of as great value as the specimen, and one of the features of the exhibit will be cases describing in brief various types of stone age implements and the method of manufactering them. Any student of American archæology, who has elaborated some special phase of the subject and wishes to place his work before the public may send on manuscript, and placards will be made from it, with due credit to the investigator. While such placards should be illustrated by actual specimens, it is not necessary that the specimens should occupy a great amount of space, and in many instances we may be able to supply needed illustrations if proper descriptions are sent. One point, however, we would like to have made perfectly clear, namely, that mercenary collectors will not find the Pan-American Exposition a source of revenue, although there would be no objection to a modest advertisement placed in a case of relics which are otherwise of scientific value.

FIRST-CLASS BATTLESHIP "KENTUCKY."

With the departure of the first class battleship "Kentucky" to join the North Atlantic Squadron, the United States Navy is strengthened by the addition of the second of a pair of battleships which, because of certain novelties in construction, have attracted, perhaps, more attention than any other vessels in our navy. The "Kearsarge" and the "Kentucky" were authorized on March 2, 1895, and the contract for the construction of both vessels was secured by the Newport News Shipbuilding Company, these being the first battleships to be undertaken by that now famous yard.

At about the time that they were authorized Lieut. Strauss, of the navy, had proposed that, with a view to securing the greatest possible amount of all-round fire, the 8-inch guns of the intermediate battery should be superposed above the turrets containing the main battery of 13-inch guns. The idea commended itself to Admiral Sampson, who was at that time Chief of the Bureau of Ordnance, and after a considerable amount of discussion it was decided to give the proposed system a trial upon the two new battleships, which at that time were known as Nos. 5 and 6. The design of the Bureau of Ordnance was taken in hand by the Construction Department and the details of the installation of the guns in the double turrets were very skillfully worked out by Naval Constructor Woodward. Advantage was taken of the rapid improvements which had been made in the electrical arts to provide a complete electrical equipment for the operation of both the turrets and the guns. The keels of both vessels were laid on adjoining slips on January 30, 1896, and 21 months later, March 24, 1898, both vessels were launched with imposing ceremonies; this being the first instance, we believe, of a double launching of battleships in the history of our modern navy. The "Kearsarge" was the first of the two vessels to be completed, the delay, both in her case and in the case of the sister ship, being due largely to the incomplete state of the armament. The two vessels are practically identical, and a description of one will, therefore, apply very closely to the other.

The "Kentucky" is 368 feet on the waterline, has a beam of 72 feet 2½ inches, and when the ship is fully equipped, ready for sea, with all stores on board and a normal coal supply of 410 tons, her maximum draught will be 25 feet 1 inch, and her displacement 11,525 tons. This is an unusually moderate draught for a battleship of over 11,000 tons displacement, and it is gratifying to know that these ships and the later vessels of the "Maine," the "Alabama," and the "Georgia" classes are to be restricted to the same draught. The later battleships of foreign navies exceed these vessels in draught by from 1 to 3½ feet; thus, the "Kaiser Friedrich," of the German Navy, draws about 26 feet, the French "Jaureguiberry" 27 feet 9 inches, the Italian "Re Umberto." 28 feet 6 inches, and the British "Majestic," 27 feet 6 inches, while the "Italia," of the Italian Navy, draws 31 feet 6 inches; although it is scarcely fair to include this vessel, which was launched in 1880, in the present comparison. The advantage of a moderate draught can scarcely be overestimated, and in naval operations that are conducted in shoal waters, it may easily prove to be the decisive factor. Were our own shore the object of attack and the exigencies of the campaign demanded that we should act on the defensive, it would be possible for our ships to retire into harbors and channels, into which the attacking ships, because of their greater draught, could not enter; and if we should be carrying on a campaign in foreign waters, it would be possible for our heavily armored battleships to enter bays and harbors and pass through straits which would be closed against the deeper armored ships of the enemy.

The defensive qualities of the "Kentucky" are of a very high order. In the first place, the whole of her armor has been treated by the Harvey process, and although ton for ton, it is inferior to the Krupp armor, its greater thickness will put the "Kentucky" on fairly equal terms, as regards protection, with the latest battleships of foreign construction. The waterline armor extends from abaft the after superposed turrets forward to the bow, and the absence of vertical waterline armor from the after turret to the stern is compensated for by giving the curved protective deck in this locality a thickness of 5 inches. The belt extends from 3 feet above to a depth of 4½ feet below the waterline. Amidships this belt is 16½ inches thick on its upper edge and tapers vertically to a thickness of 9½ inches on its lower edge. It also diminishes in thickness gradually from amidships to either end, the thickness of the bow being about 4 inches. Massive bulkheads also extend across the ship abreast of the barbettes to a junction with the side armor, thus presenting a complete wall of vertical armor around the engine rooms, magazines, and boilers. Above this belt is a flat deck of Harveyized steel which is 2¾ inches in thickness. Forward of the turrets this deck is of a turtle-back form and 3 inches in thickness. It curves down gradually toward the ram bow and is worked into the structure of the ram, serving to greatly stiffen the latter and to assist in transmitting the shock of ramming throughout the whole structure of the vessel. Barbettes of 15-inch steel are built up from the protective deck to a height of 3 or 4 feet above the main deck, and above these are carried the superposed turrets, the turning gear and ammunition hoists of the turrets being protected by the barbette armor. The greatest thickness of the armor on the lower half of the turrets is 17 inches, and on the upper half, containing the 8-inch guns, the armor is 11 inches in thickness. The space amidships between the superposed turrets is occupied by a powerful secondary battery of fourteen 5-inch rapid-fire guns, which are carried seven on each broadside. The whole of this battery is inclosed by a wall of 5½-inch armor, which not only protects the guns from direct attack on the broadside, but also extends obliquely across the ship and prevents the enemy from raking the battery from an end-on position. Mounted on the superstructure deck above the secondary battery are a dozen 6-pounders, eight of which are mounted in broadside, while the other four are mounted so that they can fire on the broadside or dead ahead or dead astern. On the berth deck are eight other 6-pounders, four of which are mounted in the bow and four astern.

The electrical installment of the "Kentucky" is more complete than has been supplied on any previous battleship, except, of course, her sister ship the "Kearsarge." Two 50 horse power motors are installed in each turret for turning the same; 20-horse power motors operate the ammunition hoists to the 13-inch guns and 6-horse power motors perform the same service for the 8-inch rifles. There are also special electrical motors for elevating the guns, working the rammers and blowing the gases out of the bores of the 8-inch and 13-inch guns. In addition to the plant connected with the turrets, electric power is utilized in the operation of 10 endless-chain, ammunition hoists for the 5-inch and 6-pounder guns. There are also six electric deck winches, and the four big boat cranes, which project above the superstructure, are also operated by electric motors. The ventilating of the ship is performed by thirteen electrically-driven ventilating fans.

The view on our first page, showing the "Kentucky" under way, gives an excellent idea of the very shapely appearance of this handsome vessel. Whatever may be said of the advantages or disadvantages of the double-turret system, it cannot be denied that, on the score of appearance, there is a decided gain. The concentration of the heavy guns at either end of the ship and the long line of the 5-inch rapid-fire battery, with the 6-pounders above it amidships, has a look of simplicity and convenience. If one could suggest a feature that would add to her beauty, it would be the raising of the free-board from the bow to the foremast by the height of one deck, as in the case of the ships of the "Alabama" and "Maine" classes.

The official trial trip of the "Kentucky" took place on November 24, 1899, over a measured 33 sea-mile course between Cape Ann and Cape Porpoise. The vessel was run over the course twice and the mean speed for the two runs with tidal connections was 16·9 knots per hour; the horse power developed by the main engines being 11,081·9, and by the auxiliaries in use 236·5. The coal consumption worked out at 2·63 pounds per horse power per hour.

The Library of the Temple at Nippur.

Dr. H. V. Hilprecht, of the University of Pennsylvania expedition into Nippur, has arrived at Constantinople after having discovered the library at the Great Temple, and over 17,000 tablets dealing with literary and historical matters. None of them are of a later date than 2280 B. C. The remains of the library will require five years to excavate. There is every indication that the discoveries will give us a complete record of the ancient civilization.

Science Notes.

According to The Sanitary Record, meats frozen and kept in cold storage for long periods do not undergo organic changes in the ordinary sense, but they certainly do deteriorate in some intangible way. After a certain time frozen meat loses some life-principle essential to its nourishing quality.

The British Association celebrate their seventieth annual meeting at Bradford commencing September 3. The president this year is Sir William Turner, who is probably the most distinguished anatomist of the day, and he will doubtless deliver an address bearing upon a branch of this science. Other lectures will include one upon "Animal Electricity," by Prof. F. Gotch; "Range Finders," by Prof. W. Stroud; and one for the benefit of artisans, by Prof. Silvanus Thompson. The proceedings will be enlivened by the various entertainments which always characterize this annual gathering of scientists.

During the celebration of divine service at St. Botolph's Church, Boston (England), while a storm was raging, the lofty tower was struck by lightning, and a large pinnacle was torn from its place, crashed through the roof of the building, and alighted on the floor 300 feet below, where it was shivered to pieces. The congregation rose to their feet and rushed to the doors in terror. The clergy remained at their posts and by dint of much persuasion at last restored order so that a panic was averted. Fortunately, no one was injured, either in the rush for the doors, or by the flying fragments of the broken pinnacle.

The American walnut, which has long been such a favorite wood in England, has met a powerful rival which threatens to supersede it in the English markets. This is the Cape laurel wood, a report upon which has recently been prepared under the authority of the Imperial Institute of London. This new wood is very hard to saw, but planes easily and turns well, while the polish that may be imparted to its surface is extremely brilliant. It is of a fine rose color, and possesses a pretty figure. There is one very prominent peculiarity in this wood that causes the workmen to sneeze violently and continuously while operating it, even with the saw.

Edward Hale, the well-known English cyclist, has recently completed a unique cycling performance, viz., the riding of 100 miles per day for a year, Sundays excepted, upon an Acatene chainless cycle. The distance he has covered is 32,479 miles upon the high roads in all parts of the country. Hale was as sound in health after he had completed his performance as he was when he first set out, the only difference being a decrease of seven pounds in his weight and a slight enlargement of the heart, which is generally the resultant effect of a course of violent gymnastics. The cycle has stood the trial well. The bevel gear has given no trouble whatever, and has stood thoroughly, the repairs to the cycle only comprising renewals of the bearings and the tires.

A school of tropical diseases, similar to those already in existence in London and Liverpool, is about to be opened at Hamburg, in Germany. Dr. Nocht, the port medical officer of Hamburg, has been visiting the English schools for the purpose of studying the work in each establishment, since the Hamburg school will work in co-operation with the two English schools. Dr. Nocht has had an interview with Mr. Chamberlain, the English Colonial Secretary, who is intensely interested in the subject. In fact, it was mainly due to the indefatigable efforts of the Colonial Secretary, in conjunction with some West African traders in Liverpool, that the schools were founded in England. It is contended that once the malaria is suppressed in West Africa the country will become a second India.

Prof. W. Ramsay and Dr. Travers have been exhibiting to the Fellows of the Royal Society in London a beautiful collection of vacuum tubes charged respectively with samples of the various new gases which they have succeeded in obtaining from our atmosphere. The gases, five in number, are as follows:

Helium	with an atomic weight of			4.
Neon	"	"	"	20.
Argon	"	"	"	40.
Krypton	"	"	"	80.
Xenon	"	"	"	128.

When the electric spark is passed through the tubes some very beautiful color effects, remarkably rich and pure, are obtained. Especially noticeable in effect is that obtained in passing the spark through neon, when a magnificent crimson glow is yielded. The scientists also exhibited the apparatus by which they succeeded in separating these gases from the atmosphere and from one another. The process consists of fractional distillation. A vacuum vessel is filled with liquid air, and into this is dipped a narrower tube which is sealed at the bottom, but is connected at its upper end with a mercury aspirator. Impure argon is then liquefied in this narrow tube, after which, by operating the aspirator, the more volatile impurities distil over first, and can be collected for further examination or purification. Xenon is the heaviest simple gas which has yet been discovered, its density being 64, or about 4½ times that of the air we breathe.

Electrical Notes.

The introduction of the trolley in the French Riviera has resulted in injury to the telephone lines, which are of the grounded pattern.

It is proposed to erect an electric light plant at Simla, the summer capital of India. It is in the foothills of the Himalayas, and water power is abundant. Kerosene is used at the present time.

To measure comparative sound intensities, M. F. Larroque uses an electro-magnetic transmitter and receiver, the latter containing a core of iron filings. The sound is reduced to silence by suitably withdrawing a portion of the core, and the silencing points of two sounds are compared.

A novel type of trolley is used on the Dublin United Tramways. It is of the swivelling arm type, placed at the side of the car so as to be out of the way of the passengers, who ride on the top of the cars. The trolley-wheel is small and is contained in a casting. There is a kind of double swivel joint which assists in keeping the trolley on the wire.

A group of apartment houses in Utica, N. Y., is provided throughout with electrical cooking utensils, consisting of three round platters, or 'stoves," an oven, and a broiler. When not needed they can be stowed away, leaving no outward trace of the use to which the room is put. The air is not vitiated, and the apartment is kept much cooler. The same apartments are provided with electric curling-tongs heaters, which are much appreciated.

During a violent thunder storm in the north of England a flash of lightning struck a pasture field, and plowed a trench, varying from 3 feet to 3 feet 6 inches deep, and about 7 inches wide, across the field for a distance of about 12 feet. The solid clay was scattered in all directions, one clod being hurled as much as 60 feet away from the spot. The turf was torn up as cleanly as if it had been removed by the aid of a sharp implement. One length of turf, measuring about 6 feet in length and 9 inches in width, was cut up and thrown over a fence into another field.

Experiments are being conducted in Budapest with high-pressure rotary current for working an electric railway on a system introduced by Ganz and Company, says The Engineer. It is stated that, despite the high working pressure of 3,000 volts which is used, the system ensures complete safety even in its application to main line working. Experimentally, the system is to be introduced on the Valtelina stretch of the Italian State Railway, which has a length of almost sixty-six miles. The length of the cars which are worked by the new system amounts to 60 feet, while the speed attained is about thirty-seven miles per hour.

Inquiry was recently made by the German Government, says The Chicago Tribune, into the effect of lightning upon trees. Observations were made by overseers of foresting stations scattered over an area of 50,000 acres in the district of Lippe. The forests comprised 70 per cent of beech trees, 13 per cent of pines, 11 per cent of oaks, and 6 per cent of firs. Of 275 trees struck by lightning, 58 per cent were oak, 21 per cent fir, 8 per cent beech, and 7 per cent pine. These figures show the extreme susceptibility of the oak to lightning stroke, and the large and disproportionate percentage of its attack upon the fir. The beech appears to be almost immune from lightning stroke. While 70 per cent of the forest trees were beeches, they received only 8 per cent of the strokes, or about one-ninth of their proportionate share. It has often been asserted in England that the beech was never struck by lightning. While the German observations disprove this broad assertion, they amply justify the common belief in the rarity of the occurrence.

Mr. L. B. Miller, of London, has patented an invention for the purpose of decohering rapidly in connection with wireless telegraphy. To attain this end, the inventor attaches the coherer to the light armature of a small and very quick-acting electro-magnet. The latter is thrown into action by the relay, the sudden jerk forward of the armature serving to decohere the filings. The speed of decohering may be greatly increased if the movement of the armature away from a stop is made to break the coherer circuit. When this is done, it is possible to more delicately adjust the relay, and then when the shunt circuit through the relay is opened the received wave can only pass through the coherer. The inventor states that the coherer filings should be of a metal or alloy, that cannot be magnetized owing to the proximity of the electro-magnet. The coherer is constructed so that it can be exhausted and sealed with little possibility of its sensitiveness being impaired by the hot blast of the glass blower, by fusing into the bottom of a glass tube the two platinum wires attached to the lower metal electrodes, insulated from one another, and afterward cleaning the acting surface from the open end of the tube, inserting filings and a plug or screw, and finally exhausting and sealing up the open end. To obviate self-induction a Morse local inker can be attached in parallel to the decohering magnet, or an electro-chemical recorder may be employed for this purpose.

Engineering Notes.

The "Pom-Pom" gun, which has played such a prominent part in the South African war on the sides of both belligerents, has not proved a very great success with the British forces. Owing to the rough nature of the country over which the guns were dragged, and the pace at which the army traveled, the guns were thrown out of gear. Several experiments were tried to overcome this difficulty, but without success. This is said to be the reason why the Boers carried their guns about in the ambulance wagons, since, as these latter were fitted with springs, the guns were not thrown out of adjustment.

The Paris Underground Railway was opened on July 21st, and it carried thirty thousand persons between Porte Maillot and Vincennes. There was a considerable difference in temperature noticeable on leaving the street, the tunnel being rather chilly. Paris has heretofore been the most backward city in the world, as regards transportation facilities, and the new line is only an earnest of the vast improvements. The journey on the recently completed line requires only half an hour, while by the ordinary tramway one hour is consumed. The fares are five cents for first-class passengers and three cents for second-class passengers, and the trains are run on ten minutes' headway. When the entire underground system is completed there will be thirty-nine miles of railway, and the cost will be $40,000,000.

The new Elbe and Trave Canal has been completed at a cost of $5,831,000. It was formally opened by the German Emperor on July 16. The length of the new canal, which is the second to join the North Sea and the Baltic, following the Kaiser Wilhelm Ship Canal, or Kiel Canal, which was finished five years ago, is about 41 miles. The available breadth of the new canal is 72 feet. The breadth of the lock gates is 46 feet, the length of the locks 87 yards, and the depth of the locks 8 feet and 2 inches. The canal is crossed by twenty-nine bridges, which were built at a cost of $1,000,000. The span of the bridges is in all cases not less than 30 yards and their height above water level 15 feet. There are seven locks, five being between Lubeck and the Möllner See—the highest point of the canal—and between Möllner See and Lauenburg-on-the-Elbe.

The English War Office is experimenting with a new magazine rifle. It is the invention of an Australian, and it possesses several advantages over the Lee-Metford arm, which is at present employed in the British army. The automatic feed of the cartridges from the magazine into the breech is a striking feature. It was tried at Bisley in the recent competitions and fired thirty shots in the minute, with twenty-eight hits, of which seventeen were bull's-eyes. The rifle is said to be vastly superior to either the Lee-Metford or the Mauser in strength, efficiency, and simplicity of construction, while it is 35 per cent cheaper to manufacture, and is 1¼ pounds lighter than the present Lee-Metford rifle. It has been strongly recommended by Lord Charles Beresford, and there is little doubt that it will be introduced into the British army at the end of the South African campaign.

The new Central London Electric Railway, which was opened to public traffic a few weeks ago, has proved a prodigious success. During the first four days it was opened no less than 353,000 people availed themselves of this new means of rapid transit, to the detriment of the omnibuses. So startling has been the enthusiastic reception of the innovation, that the Underground Railway, after many years' controversy and spasmodic experiments, have finally determined to convert the whole of their system to electric traction with all possible dispatch. This resolution has probably been accelerated by the significant fact that in the new Electric Railway they have a powerful rival, which is both quicker, cheaper, and cleaner than their own antiquated method of locomotion. At the recent meeting of the Underground Railway Company, the chairman announced that without any further delay electric traction should be installed upon the outlying portions of their system, since their own experiments between Earl's Court and Kensington with an electrically propelled train had convinced them that an electric locomotive could haul a greater weight than the ordinary steam locomotive, that it was more economical, and that the atmosphere of the tunnels was maintained in a much purer condition. Of course, the great difficulty that presents itself in connection with the electric conversion of the Underground Railway is the question of the intercommunication of the other great trunk railways of the country. The leading railways have not one central depot in London in which all the railways converge, but rely for communication between the various termini upon the Underground Railway system, and as they have full running powers over portions of the latter's system, it is not probable that they will introduce electric locomotives especially for this intercommunicative traffic. Therefore, it will probably be impossible to banish the steam locomotive entirely from the Underground Railway.