oscillation, and overcome a tendency of the machine to turn around on its center of gravity. They also give lateral stability; for when the machine tilts, the halves of the diedral angle of the aeroplanes which are down are more horizontal than those on the other side, and receive consequently greater air pressure, and the equilibrium of the flying machine is recovered.

Longitudinal equilibrium is gained by dividing the air current that passes the under surface of the aeroplanes. It is apparent that any upward or downward tendency of either the fore or aft aeroplanes is counterbalanced by the opposite effects on the other planes. The light connecting rod crossing the open space between the fore and aft aeroplanes forms the fulcrum upon which this force of the wind acts.

The inclosed triangular chamber formed by the diedral angles of the middle aeroplane with the upper aeroplanes gives direction to the air current passing through them, and imparts additional steadiness to the flying machine. The edges of the diedral angle aeroplanes not extending to the edges of the two upper aeroplanes, a further improvement in the stability is gained by leaving the same yielding and elastic under pressure.

The position of the aviator, as that of the motor, is below the aeroplanes. This brings the center of gravity below the center of pressure. By a simple arrangement of levers in connection with the lower front aeroplane, which also is a rudder acting horizontally, automatic equilibrium is imparted to the flying machine by the shifting of the position of the aviator caused by the tilting of the flying machine upward or downward. This pendulum motion of shifting the center of gravity with reference to the center of pressure can be enlarged at will, and made to correspond to the change in the center of pressure produced by the alteration in the angle of incidence or by greater speed, and assists the efforts of the horizontal rudder to correct the undue tendency to ascend or descend.

The machine is mounted on four wheels, the two front ones being capable of guidance. This arrangement permits alighting at an acute angle and rolling upon the ground until momentum is exhausted; or to gain headway by running along the ground before starting in flight.

My weight is 167 pounds. The weight of the flying machine without the motor is 165 pounds. The motor will weigh about 75 pounds. Giving a total weight of 307 pounds, or 1.6 square feet of surface for each pound of weight to be lifted. That this proportion of square feet of surface to pounds in weight is most desirable, was verified by many experiments with models and man-lifting kites.

Examples of this sort in nature are not very conclusive. The dragon-fly and the gnat, if their proportions were magnified until each weighed a pound, would have 25 and 50 square feet of surface respectively. The condor, the largest soaring bird, weighs 17 pounds and has less than 10 square feet of supporting area. The ratio of the wing surface of the swallow to its weight is about 3½ to 1. The giant petrel (*Procellaria gigantea*) a wonderful example of long-sustained flight, with at times absolutely motionless wings, has a ratio of 1.56 square feet of surface to each pound of weight, and is supposed to expend less than 5/100 of a horse-power of effort to keep itself afloat in the air.

At an angle of flight of ten degrees, the air reaction, according to the table compiled by Prof. S. P. Langley, from the result of exhaustive experiments, in which experiments he was aided by an appropriation from the United States government, is 30 per cent of the normal pressure of the air striking the plane at an angle of 90 degrees.

At a velocity of 30 miles an hour, or 2,640 feet per minute, the wind, according to Smeaton's formula, exerts a pressure on a plane at right angles to the current of 4.5 pounds to each square foot of surface. The supporting power of the flying machine running at 30 miles an hour will therefore be 491¼ times 4.5 times 0.30, or 662.85 pounds sustained. Inasmuch as the total weight to be lifted is less than half that figure, and as neither the drift nor the body, the edge of the wings, braces or other resistance will require that large margin of resistance, it is likely that a less speed or a smaller angle of incidence to horizontal progression will be sufficient.

There are two propellers of four blades each, 8 feet in diameter, and varying in width from 5 inches to 18 inches at the extreme edge. The skeleton structure of the propellers is of bamboo, and is covered with light oil canvas. The blades are in pairs, one behind the other, and connected together with diagonal struts and ties, so that in motion the members of one blade will be in compression and the other in tension.

While I have made application for letters patent for various parts of my flying machine, I have no desire to preclude anyone else experimenting along the same lines, and it is because I believe for the general advancement of the science that one should communicate results with others who may be interested in the same field, that I make public these experiments. It will be pleasant to record success at the trial, but progress in this science has so far been built upon failures. If, however, the flying machine should not fly, it will be no reason why this research should be abandoned, for success is often built on failures.

## THE TEMPLE OF ABU SIMBEL.

The forgotten and half-obliterated civilization of ancient Egypt has given us few more splendid evidences of its departed magnificence than the ruins of the sanctuaries at Abu Simbel. These are counted among the most stupendous monuments of early Egyptian architecture, and even the gigantic edifices found in Egypt proper are hardly more interesting. Abu Simbel is located on the west bank of the Nile, between Korosko and Wady Halfa, in Nubia. The illustration herewith is of the entrance to the so-called Great Temple, which was dedicated primarily to the gods Ammon-Rē of Thebes and Rē-Harmachis of Heliopolis, though Ptah of Memphis and the deified Rameses II., who founded it nearly thirteen centuries before Christ, were also worshiped by its votaries. Burckhardt, in 1812, first called the attention of Egyptologists to this sanctuary. In subsequent years Belzoni, Lepsius, and Mariette repeatedly freed the temple from the sands of the shifting west desert and laid bare the wonders of the inner chambers. In 1892 Capt. Johnstone, R.E., restored the façade and built two walls to protect the temple from the encroaching sands.

The longer axis of the Great Temple runs almost due east and west, with the entrance at the eastern extremity, so that the rays of the rising sun penetrate even to the innermost sanctuary. The length of the rock-temple, hewn out of the living granite of the hillside, is 180 feet from the threshold of the entrance to the back of the innermost chamber. A flight of steps leads from the river to the fore-court carved out of the steeply sloping cliff. At the rear of this fore-court rises the imposing façade with its rows of graven captives, its hollow cornice and embellished balustrade. The entrance is at the center, flanked on the north and the south by pairs of colossal statues of Rameses II., the northern pair shown in the accompanying engraving. The temple proper consists of an eight-pillared, Great Hypostyle Hall, 58 feet by 54 feet, corresponding to the covered colonnades of the temples built in the open, a four-pillared Small Hypostyle Hall, 36 by 24 feet, a transverse chamber connected with the latter by three doors, and the inner sanctuary. Besides this, there are eight smaller chambers adjoining either the large or small hall, which were evidently used as storerooms for the temple utensils and furniture. The walls, the ceilings, and the square pillars are covered with reliefs, still vividly colored and of great historical value. They usually depict events of importance that occurred during the reign of Rameses II., but in some cases the intention of the artists appears to have been to secure decorative effects only.

Remarkable as the temple proper is, the real interest in the structure centers in the colossi of Rameses II. grouped about the entrance and hewn out of the cliff against which their backs are placed. Each of these gigantic figures, 65 feet in height, is larger than the world-famous colossi of Memnon, and despite the enormous scale on which they are executed, the workmanship is admirable. The pleasing, intelligent countenance and characteristic nose of the great Pharaoh are best preserved in the southernmost statue, though the northern pair shown in the photograph are little inferior. The second colossus has unfortunately been partially destroyed, and the head and shoulders, which have fallen from the rest of the body, lie upon the ground at its base. The supporting stonework under the cracked right arm of the first of the colossi in the photograph was placed in that position by one of the later kings of the 19th Dynasty, probably some ten or eleven centuries B. C.

Rameses II. is shown in the statues with the double crown of Upper and Lower Egypt. His hands rest upon his knees and from his neck depends a ring bearing his name. This is also carved upon the upper arm and between the legs. To the right and left of each colossus and in various other places are smaller figures of other members of the royal family. Upon the southern pair of statues are several Greek, Carian, and Phœnician inscriptions of considerable philological and historical interest, which were carved by soldiers of military expeditions which had penetrated as far as Abu Simbel during the centuries following the construction of the Great Temple.

It is almost impossible to describe the majesty and splendid dignity of these tremendous figures. To be truly appreciated they must be viewed under the dazzling glare of the Egyptian sun or the brilliant whiteness of the Egyptian moon. Even the human figure standing upon the hand of the statue as shown in the photograph helps us but dimly to comprehend with what infinite toil and patience the thousands of slaves and bondsmen, laboring with their primitive tools under the sting of the taskmasters' lashes, hewed these monster human likenesses from the living granite. And even though our understanding of the methods with which they wrought and the purposes for which they raised their edifices is but too often fragmentary, our admiration for these old Egyptian builders is boundless, and we can only regret that Time, the destroyer, made it impossible for us to complete the record.

# Correspondence.

### Where Did the Photographer Stand?

To the Editor of the SCIENTIFIC AMERICAN:

The article in your issue of June 10, 1905, entitled "Where Was the Camera Set Up?" by Prof. William F. Rigge, has been of special interest to me.

I wish to thank the professor for his novel solution of a somewhat difficult problem; and at the same time I take the liberty of calling his attention to the fact that his last statement appears to be somewhat erroneous.

Were the picture plane parallel with the front of the observatory, the mortar lines in the front of the transit room would have retained their normal position in the photograph, but as near as I can tell from the reduced cut, accompanying the article, they vanish at a point on the horizon 347 feet to the right of O. This is the vanishing point of east-and-west lines, or *V R*. If a transit is set up at this point and trained on the optical center of the camera, the line will be found to be due east and west, or at right angles with the line from the camera to point O. Then train the transit on O, and the angle will be found to be very nearly 10 deg. 45 min. and the course will be N. 89 deg. 15 min. W., showing that the plate in the camera formed an angle of about 10 deg. 45 min. with the front of the observatory, instead of about 8 deg., as stated, and the entire front of the building would measure 4 and 9/16 inches instead of 4⅛ inches, as it does in the cut, showing that the lines are reduced a little more than 10 per cent. The angle of the picture plane with the front of the building also accounts for the apparent shortening of the wall space at the left of the door to the equatorial room, which, were they parallel, would show a trifle larger than that between the door and angle at the right.

Pittston, Pa., June 13, 1905. B. F. CRAWFORD.

### The Intelligence of a Cat.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with much interest the letters in the SCIENTIFIC AMERICAN describing how cats opened doors by climbing to the old-fashioned thumb catch and pulling it down with their paws. In confirmation of the evident reasoning powers of cats, I want to relate to you what a cat did that I owned a few years ago.

One night my wife and I were awakened by the door bell ringing. My wife got out of bed and answered the call by asking, "Who's there?" Not receiving a response, she opened the door and in bounded the cat with a "Meouw," as much as to say, "Thank you for letting me in." We could hardly credit the belief that the cat had rung the door bell, but we were convinced of this fact later on. A neighbor called our attention to it soon after by saying that she had seen our cat ring the door bell that afternoon by standing on his hind legs and with his front paws busily engaged in pulling the handle up and down until it rang.

Whenever he wanted to get in the house in the night time he would ring the bell, much to our disgust, so I thought I would lock him up in an old hen coop after supper. This worked well for a few nights, until he got wise to the fact, and then he made himself conspicuous by his absence, and all the calling I could do would not bring him in sight, although he was very much attached to me. Later on, however, after we had gotten sound asleep, the door bell would ring again and I would let him in.

I have owned a number of very smart cats, but this one exhibited greater reasoning powers than any cat I ever saw, but like the good boys and girls in story books, he died young, giving up the ghost soon after he was a year old. C. DE VOS.

Coopersville, Mich., July 5, 1905.

### American Homes and Gardens.

To the Editor of the SCIENTIFIC AMERICAN:

Please accept our most sincere congratulations upon your new departure in the field of literature and magazine publication.

A better title than "American Homes and Gardens" could never have been chosen, and the table of contents, *per se*, gives assurance of unfailing interest from beginning to end.

The success of such an enterprise under the auspices of the SCIENTIFIC AMERICAN is a foregone conclusion. The word "American" appeals to everyone who is inspired with love of country and patriotic pride and the word "Homes" is as broad and dear in its signification as the very globe upon which we live. "Gardens," too, conveys the true idea of what the surroundings should be, of beautiful grounds, large or small, as the case may be, which should constitute the real foundation that nature itself has provided for homes everywhere.

Not the "cooped-up" flat for the average, nor the costly apartment house for the rich, nor the squalid tenement for the poor, but "American Homes and Gardens" for all; let the cost be what it may, regulated by the income or financial ability, yet with every possible comfort, every convenience, and the best decoration.

Scientific knowledge of new methods and plans for construction, hints for the exterior and interior illustrations, charming in reality and helpful in suggestion, besides articles upon current topics of the most comprehensive character, as perfectly described in your editorial, present an almost unlimited province for thought, investigation, and practical enterprise.

Years ago, we wondered why the Building Monthly did not develop into such a magazine, which now gives every promise of realization in fact of all that the projectors have formulated theoretically.

MRS. EDWARD P. FOSTER.

Cincinnati, Ohio, July 3, 1905.

### THE SIXTH INTERNATIONAL AUTOMOBILE RACE FOR THE BENNETT TROPHY.

On July 5, for the fourth time, the Bennett trophy was won by a French machine. Not only this, but, what is more notable still, by a machine almost identical in construction to that which won it last year, and driven by the same successful chauffeur, Leon Théry. The race this year was over the same course that the French eliminating trials were held upon three weeks before—a circular course 85.35 miles in length, known as the Auvergne circuit. The course had more sharp turns, steep pitches, and narrow stretches than any on which the race has been run heretofore, and that an average speed of over 47½ miles an hour was maintained by the winner in traversing it four times speaks well for his driving and for the car. That familiarity with the course has considerable to do with winning a race is shown by the fact that in this, the second race he has won upon it, Théry increased his average from 45½ to 47.63 miles an hour.

Eighteen machines were entered in the race this year, the following six countries being represented: England by two horizontal-cylinder Wolseley machines and a Napier; France by two Richard-Brazier cars and a De Dietrich; Germany by three Mercedes; Austria, ditto; Italy, three Fiats; and America, two Pope-Toledos and a Locomobile. With the exception of the Wolseley machines, all had four-cylinder vertical gasoline engines capable of developing something like 100 horse-power. The two Pope-Toledo machines were the lowest-powered of the lot, they being only 50 horse-power each.

The start was made at Laschamps at 6 A. M., Théry on his Richard-Brazier being the first to get away. The other cars followed at five-minute intervals, the 140-horse-power Locomobile driven by Tracy being the last machine to be dispatched (at 7.25 A. M.). Only 15 minutes later Théry reappeared, he having made the first round in 1 h. 41 m. Car No. 6—Lancia's Fiat—made the fastest time on its first round, viz., 1 h. 35 m., which is equivalent to a speed of 53.9 miles an hour. The machine dropped out in the second round, however, owing to a stone hitting the radiator and breaking it, so that the water leaked out. After this accident to the Italian car, Théry had no formidable rival. His machine ran like clockwork, and owing to its being equipped with improved Michelin tires, the tire trouble which he experienced was comparatively slight and new tires were quickly obtained. That any tires can be built to stand the strain of taking such sharp corners as that shown in one of our illustrations at speed, seems marvelous; but when such corners have to be rounded every few minutes in the course of a seven hours' run, much depends on the judgment and skill of the driver as to whether the tires will last. Let him not slacken his pace properly in making the turn and the result is almost certain to be a burst tire. Even Théry is said to have had the shoes of his car replaced twice, besides having to repair several punctures on the road. Upon pulling up at a tire station, four men quickly jacked up the machine, while others removed the old tires and put on new ones, which were almost instantly inflated by compressed air stored in reservoirs for the purpose. Only 5½ minutes were required in which to change all four tires. The race may be said to have been a race of tires; and it is at any rate partly owing to the extensive preparations for their renewal that the victory went to a French car.

On a course of this nature, one would naturally expect the machines having the greatest horse-power to make the fastest time, on account of their more rapid acceleration. Such is not always the case, however; and a long-distance automobile road race bears a resemblance to the fabled race of the hare and the tortoise, in that the ability to go and keep going, even if the speed is not of the highest, often gains a machine a prominent place. A case in point is that of the 50-horse-power Pope-Toledo driven by Lytle. A stone flew up and struck the main oil pipe of this machine in the early part of the race, but the mechanic managed to hold the pipe together, and the race was finished in this manner, the car obtaining twelfth place, although the engine received scarcely any oil. The Locomobile racer broke a chain in the first round, and later developed trouble with the clutch-shifting collar, such that it was obliged to drop out of the race on the second round. It may be recalled that Lytle is the driver who finished in the Vanderbilt race last year after many mishaps. In both events he has shown great perseverance and, although driving a low-powered car, has managed to finish in spite of all difficulties. He is to be rewarded, we understand, by being placed at the wheel of a powerful six-cylinder Pope-Toledo racer now building for the Vanderbilt race on Long Island on October 14.

As the race progressed, it was seen that Théry was in the lead, and he was anxiously awaited at the starting point at each successive lap. He finally came around for the fourth time at 1.10 P. M., having won the race in 7 hours and 10 minutes. Cagno, on a 120-horse-power Fiat, got second place in 7:26, and Nazzaro, on another Fiat, third in 7:27. Fourth place went to Callois on the second Richard-Brazier, his time being 7 hours and 29 minutes. Earp, on an 80-horse-power Napier machine, was fifth in 8 h. 30 min., while an Austrian Mercedes driven by Braun came in sixth. None of the other Mercedes machines made a favorable showing. Next to the French the Italians did the best. That their running was very uniform is shown by their finishing only one minute apart. It is significant that the first four cars to finish within 19 minutes were equipped with Truffault-Hartford shock absorbers.

### SOME NEW AUTOMOBILE TRACK RECORDS.

In America track racing is more in vogue this year than ever before, and meets in the vicinity of New York are being held almost weekly throughout the season. At one of these, held on July 3 and 4, a new mile record of 48 4-5 seconds was made by a White steam racer, and a new Christie machine with a motor incorporated in both front and rear axles made its appearance. One of the photos (page 49) shows the rear motor of this peculiar car. The front driving equipment was described in our last Automobile Number. Mr. Christie has built a motor in at the rear of his car in a similar manner, and with the two he gets about 120 horse-power on a straight course, although on a track the car has nearer 100 horse-power available. The rear engine has four 5 x 5¾ cylinders, while the front one has four 6¼ x 6¾. The car has 28-inch wheels in the rear, and 30-inch wheels in the front. The contact boxes of the two motors are connected, so as to advance the spark uniformly for each, but this is the only connection between the two. The front motor is started with a crank as heretofore, but the rear one is set going after the car is in motion, by letting in the clutches. When making the turns on the track, the rear motor is shut off by pressing a button in the steering wheel, which cuts off the ignition current. The cone clutches on the outer face of the motor flywheel are fitted with band brakes on their outside. It was due to the expansion of these clutches from heat developed by a sudden application of the brakes, and the consequent failure of the clutches to hold, that Mr. Christie lost the final heat of the match race between the Chicago Automobile Club and the Automobile Club of America for the Thomas trophy, on July 4. One of the photos shows Webb Jay on the White "Rocket" passing Christie on the last turn, and winning the 5.56-mile race in 5:28 1-5. Christie's time in the previous heat (which he won by 150 yards, although making the last mile on a flat tire) was 5:14 4-5, and his fastest mile 50 1-5 seconds. Another photograph which we reproduce shows Jay making the new track record and going at the rate of 73.77 miles an hour. This is the first time a steam machine of the heavy-weight type has made a world's record on the track, and it is interesting to note that the White racer is built on the same lines as the regular touring car, and is fitted with the same size compound engine, although a larger generator is used, and a pressure of 600 pounds per square inch is carried, or double that used in the ordinary White machine. The racer has a shaft drive with a disconnecting clutch, so that the engine can be run and warmed while the machine is at rest. The frame is hung below the axles, and clears the ground by but 4 inches, which accounts for the great cloud of dust raised by the suction. The weight of the machine is 1,700 pounds.

A new record for middle-weight cars was made by a 24-horse-power Fiat machine, that was specially constructed for track racing. This was a mile in 55 4-5 seconds.

These records were made on the Morris Park race track, which is a long track with a wide unbanked turn at one end and a short, insufficiently-banked curve at the other. A complete circuit of the course equals 1.39 miles. There were several accidents, owing to cars running through the fence at the sharp turn, but fortunately the drivers escaped serious injury.

### PEARY'S ARCTIC SHIP, THE "ROOSEVELT."

The new Arctic ship "Roosevelt," which has been built by the Peary Arctic Club to enable Commander Peary to make another attempt to reach the North Pole, is now at New York, taking on stores and equipment for the trip. She is 160 feet long on the load waterline; 184 feet in length over all; with a beam at the waterline of 32 feet, and over the guard-strake of 35 feet 6 inches. She has a depth of 16 feet 6 inches, and at full load has a displacement of about 1,500 tons. The form of the ship and its construction have been designed to meet the severe conditions of the service for which she is built. Her cross section and her diagonals show a model that is very round below the waterline, and indeed, from the guard-strake her sections narrow down to a broad easy bilge, to which there is a very sharp dead rise from the keel. This form is chosen to enable the ship to rise when she is being nipped by the ice, pressure upon her wedge-shaped hull tending to lift her bodily upward. In construction she is certainly the strongest wooden ship, or ship of any kind, ever built; for in addition to her heavy frames, and triple planking and sheathing, she is strutted and trussed from end to end with massive horizontal and diagonal timbers. The stem, sternpost, keel, keelsons, frames, planksheer, and garboard strake are all of selected white oak, all bolted and drift-bolted with more than usual thoroughness. The frames are molded to 16 inches at the heel and 10 inches at the head, and they are placed only 2 feet apart from center to center. To give longitudinal strength, a lattice-work of diagonal straps of steel is laid for the full length of the ship, the distance from strap to strap being about 6 feet. The straps are rabbeted down flush into the outside face of the frames. The skin of the ship consists of two courses of 5-inch planking, the inner course of yellow pine and the outer of white oak. Between the two courses is laid a sheathing of tarred canvas. On the inside the frames are covered with 3-inch white oak ceiling, and it can be seen at once that these four layers of planking and waterproof material will render the ship not only water-tight and stiff, but warm in cold weather. The beams of the main deck are spaced 4 feet apart center to center, and the lower beams are immediately below the deck beams. A system of diagonal struts is worked in between the beams, the whole being thoroughly tied with through-bolts. The system of trussing is completed by a central line of tie-rod stanchions, the tie-rods running down inside the wrought-iron piping. These stanchions are constructed so that they can be tightened up at any time in the same way as the truss rods of the old wooden Howe truss bridges were, that did such good service on our early railroads.

The "Roosevelt" is protected against the grinding of passing ice by special protection at the bow, stern, and waterline. At the bow, an extra thickness of 2½-inch greenheart ice sheathing is worked on from the stem well back onto the body of the ship, and extending to the keel. A belt of the same sheathing, 5 feet wide, reaches at the waterline from stem to stern. The stem and forefoot are protected by a heavy steel strap extending down the cutwater and for a considerable distance aft below the keel. The stern, which is built of white oak, is of great massiveness, and has a similar protection of ¾-inch steel plating and 1-inch strap worked on. It extends from the keel over to the sternpost, and gives great strength to this part of the structure.

The vessel is provided with two deckhouses; the forward one is portable, and it has been made of sufficient size to accommodate Commander Peary and the officers of the ship. When the "Roosevelt" has been pushed as far north as it is possible to drive her, the plan is to carry the house ashore to serve as winter quarters. The crew are housed in the forward deckhouse, and Commander Peary and his staff have their quarters in the after deckhouse. The ship is heated by steam and lighted both by electricity and oil lamps. The motive power consists of a single, inverted, compound engine, driving a 10-foot four-bladed propeller. Steam is supplied by two water-tube boilers, and, under trial, the "Roosevelt" made about 12 knots. She is expected to have a sustained sea speed of about 11 knots an hour. She will be driven north at about 7 or 8 knots to save fuel. The coal capacity is 500 tons. The ship has a peculiar-looking rig, but one that is designed for the special work she has to do. She is rigged as a three-masted fore-and-aft schooner, and spreads sufficient canvas to enable her to make a fair speed under sail alone.

Two of our photographs show the construction by which it is possible to unship the rudder and the propeller blades while the vessel is at sea. For the rudder a large open well reaching through to the main deck is provided, of sufficient size to enable the massive rudder to be drawn up and hoisted on deck. To do away with the necessity of sending a diver down to release the gudgeons, the latter work in a vertical groove worked into the after end of the sternpost. The pintles are attached to the rudder post by heavy