pile and follows up this edge as the coal is removed. The conveyor is mounted on a pivoted frame moved by power and so arranged as to be wholly under the control of one man. The reloading conveyor carries the coal without transfer to the reloading tower, where it can be delivered either directly into cars or else screened and then delivered into cars. A unit of this system consists of two trimming conveyors and one reloading conveyor arranged midway between them. For large capacities the dumping tracks are arranged on one side of the plant and the reloading tracks on the other. By this arrangement it is possible to carry on simultaneously the operations of trimming and reloading without any interference of cars or choking of tracks.

In the coal-storage plants of this new system each machine is of sufficient capacity to handle 1,800 tons in ten hours. In the operation of the plant of this character the coal received from cars in a hopper located beneath the receiving track is fed through a chute to the conveyor of the trimming machine, which delivers it upon the ground or at the apex of the pile as it forms. The bottom of this trimming conveyor is a steel ribbon, usually twelve inches wide, which is wound upon a drum located at the foot of the truss and arranged to be drawn out in grooves fixed in the conveyor trough, so that its end, which is the only discharge point for the coal from the trimming machine, shall always be at the constantly rising and receding apex of the pile. The reloading machine is composed of a horizontal and an inclined portion, both working together so as to render the carrying of the coal continuous from any point on the horizontal portion to the upper end of the inclined portion, where a small pocket is provided into which the coal flows and from which it is discharged over screens into cars or vessels.

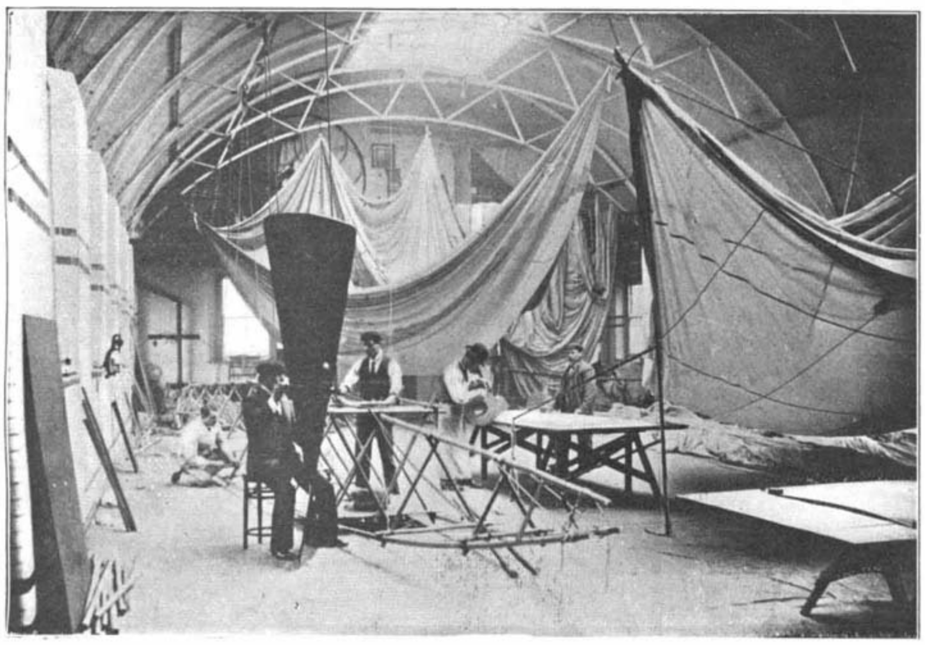
This system of coal-storage is employed in the 180,000-ton plant of the Philadelphia & Reading Railway Company at Port Richmond, Philadelphia. However, the Scranton plant erected for the Delaware, Lackawanna & Western Railroad Company has the largest trimmers and the longest reloader yet constructed under this system. Each of the two floors holds 50,000 tons in a pile 78 feet high and 310 feet in diameter, whereas the horizontal portion of the reloader is 300 feet in length. This plan of storing fuel is also adapted to use under cover in regions where heavy snowfall makes necessary the housing of all stored coal. For instance, the Lehigh Valley Coal Company has at West Superior, Wis., a plant which provides storage for 100,000 tons of anthracite coal in two circular steel buildings each 246 feet in diameter and 90 feet in height.

THE SPENCER AIRSHIP AND ITS THIRTY-MILE TRIP.

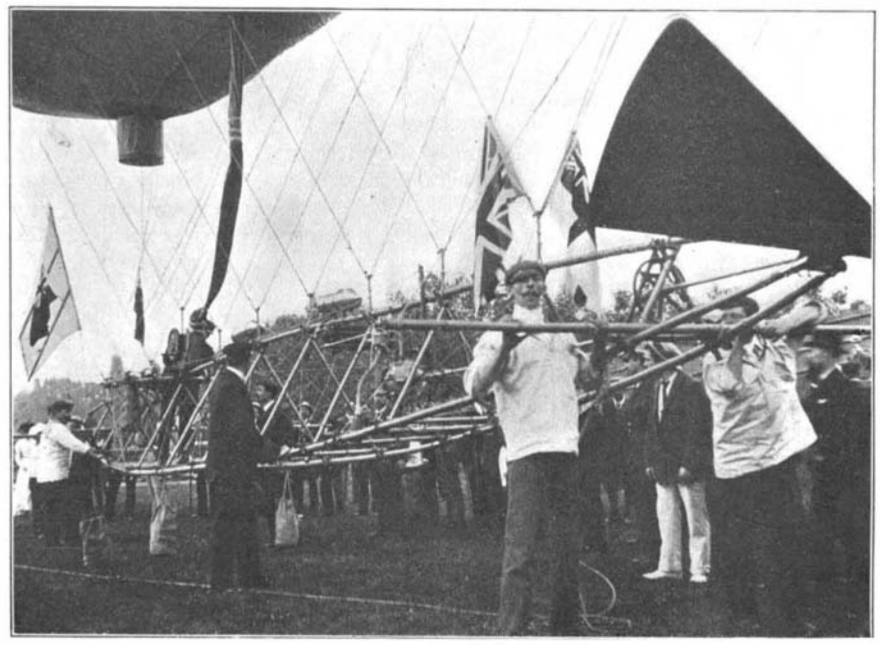
BY WILLIAM EDWARD WARD.

On September 19 London was surprised to see an airship hovering over its chimneys and spires. The air was apparently quite calm, and the ship steadily headed to the northwest, traveling about eight miles an hour. Months ago Londoners heard in a vague way, that an English-built airship was in existence, but the matter excited little interest at the time, and latterly was quite forgotten.

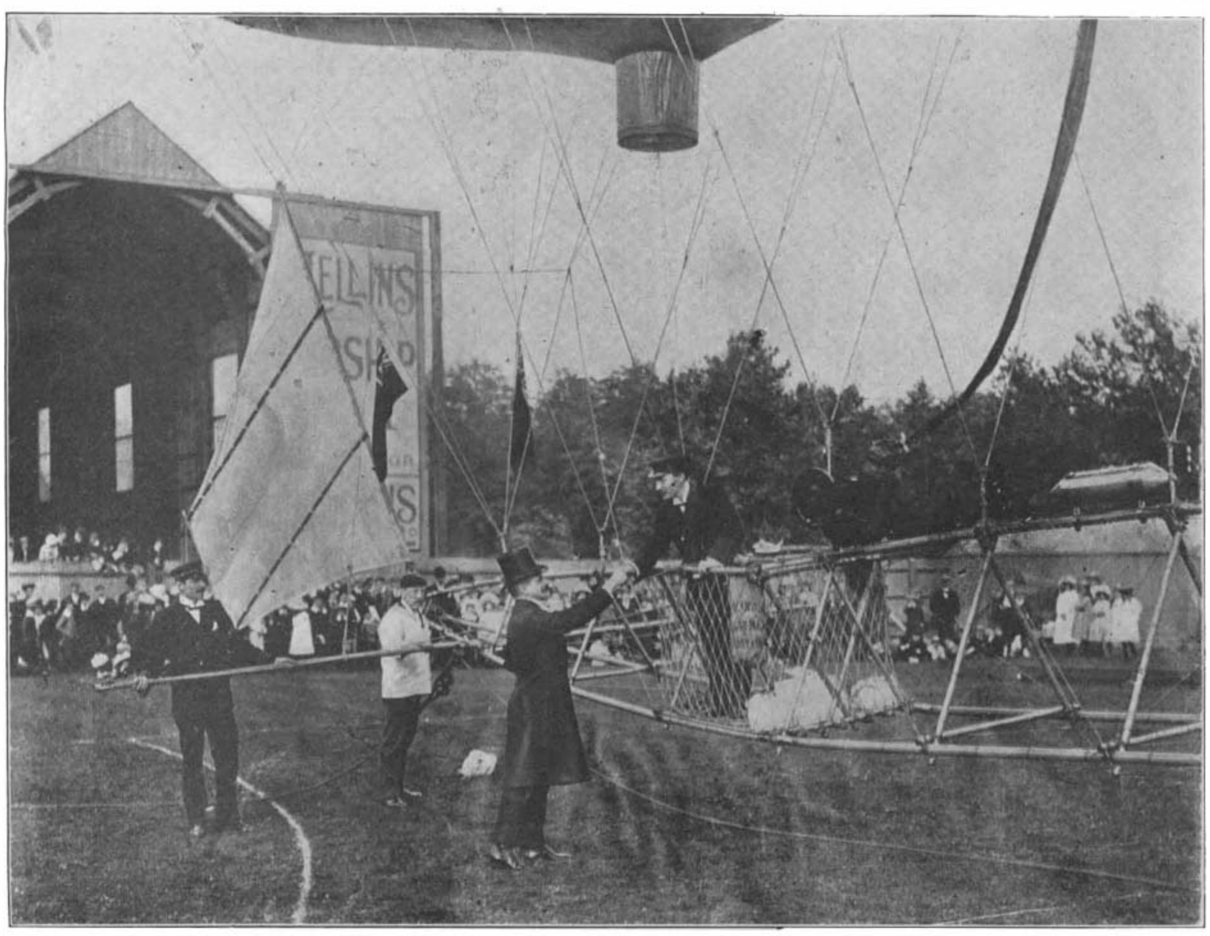
The new airship is the work of Spencer Brothers, a firm of aeronauts now in the third generation, built in their own factory. It was sailed by Stanley Spencer, the second of the three brothers. For three months the air-ship has been awaiting trial in its shed in a South London suburb; and on several occasions it has made experimental captive flights. On September 19 the unusual stillness of the air tempted the aeronaut on what proved a successful maiden trip. At the commencement of his journey he circled in a couple of "figure eights" and repeated the maneuver when over the west of London. For the rest he covered about twenty miles in a trifle over two hours, alighting without mishap just before dark.



Building Spencer's Airship.



The Car Seen from the Front. Photographed Before the Start.



Spencer Starting on His Trip. The Aeronaut is Shaking Hands with Lachambre, Builder of the Santos-Dumont Ships.

The Ascent from the Grounds at Crystal Palace, London.

THE THIRTY MILE AIRSHIP FLIGHT OF STANLEY SPENCER.

The balloon follows the torpedo-shaped construction made familiar by Santos-Dumont, but has more blunted ends. Consequently it has not the graceful lines of its French predecessor. The frame, which bears the aeronaut and the machinery, is constructed of bamboo held taut by piano wire. As seen in the air, it bears some resemblance, in its proportions, to a skeleton canoe. Three long strips of bamboo run the length of the frame, and are kept in position by struts bound triangularly, the base of the triangle being horizontal. The frame is slung from the bag by fine ropes. The principal feature of the construction is the position of the propeller, which is placed at the bow of the ship instead of, as is usual, at the stern. The inventor considers that the effect of this innovation will be to enable the ship to hold a more even course.

The motive power is supplied by a small petroleum motor swung in the forward end of the frame and firmly bound in position by piano wire. A small cylinder to feed the engine's water jacket is fastened just over the engine. Directly below the engine is the condenser. The fuel tank is fixed to the upper bamboo, but further aft to shield it from the motor flames. A thin rod of steel—the engine's shaft—runs forward to a gear wheel, the axis of which is the propeller shaft.

Toward the stern of the balloon is the aeronaut's stand, inclosed in netting. Behind him is the rudder, a large quadrilateral sail suspended by ropes between the ends of the balloon and the frame. The construction places all the mechanism—except the rudder—directly in front of the navigator, an obvious advantage in cases of sudden emergency.

All the working parts are under absolute control from the car. Two cords guide the rudder. The propeller is started or stopped by a friction clutch, operated by a lever; another lever controls the speed of the engine; and an electric switch regulates the ignition devices.

The envelope is of English silk, heavily varnished, and when inflated is 75 feet long. Its capacity is 20,000 cubic feet. The safety valve is placed directly over the car and may be opened by a cord. It is, however, constructed to work automatically; it worked successfully on the trial trip. Sand ballast is carried on the aeronaut's stand; and to decrease the buoyancy of the balloon, air may be forced into it by a small hand blower placed just in front of the stand.

The weight, with netting and gear for supporting the keel, or *nacelle*, is 290 pounds. The keel, or *nacelle*, which in outline approaches that of a well-formed tipcat, is made entirely in skeleton of bamboo, trussed triangularly, and rigidly stayed throughout with steel wire stays. When suspended it is carried 10 feet below the bag. The motor, which is carried on the forward half of the keel, being placed 20 feet from the escape valve.

The engine—a 6.8 horse power Simms petrol motor, with Simms-Bosch ignition—serves to drive the propeller.

The propeller itself is the design of Sir Hiram Maxim, who is an enthusiastic follower of aeronautics. It is double-bladed, built of thin strips of carefully selected pine, weighs 28 pounds, is nearly nine feet long over all, and a full four feet at its broadest part.

The drive is communicated to the screw from the engine shaft by means of doubly universally-jointed propeller shaft, steadied in its center by an adjustable ball bearing slung by four wires from the angles of the keel frame. The engine shaft carries a steel pinion, which meshes with a gun-metal spur wheel ten times the diameter of the pinion, this spur wheel being carried on a shaft attached to the rearward universal joint of the propeller shaft. Thus the propeller revolves at one-tenth of the speed of the engine shaft, the normal rate of which is 1,500 revolutions per minute. The usual coned friction clutch forms part of the engine flywheel, and a free-wheel clutch with starting band is also fitted to the engine shaft. Cords from the clutch and starting clutch mechanism are led back to the aeronaut's car, which consists of a platform on bamboo supports situated in the center of the rear half of the keel. The engine can therefore be started and disconnected from the propeller shaft, and by similar means the sparking is advanced or retarded by the aeronaut at will. At the stern of the keel is placed the rudder, with lines to the car, from which also depends the balancing trail rope. Just forward of the car, on the top of the keel frame, is placed a blower, connected by silken pipe with the interior of the gas bag, and which can be operated by the aeronaut when it is necessary to control the distension and equilibrium of the balloon.

To avoid the danger of explosion when the valve is opened and hydrogen emitted, the motor's exhaust pipe is incased in wire gauze, somewhat after the fashion of a miner's safety lamp.

With a capacity of 20,000 feet, the Spencer airship is about three-quarters the size of the Santos-Dumont No. 6. When fully inflated with hydrogen (at a cost of $250) it has a gross lifting power of 1,000 pounds. The envelope weighs 360 pounds, and the car with all the machinery weighs 300 pounds. This leaves a margin of 340 pounds to be divided between the aeronaut and the net lifting power.

I saw Mr. Spencer almost immediately after his trip, and found him enthusiastic that the construction of his ship was on right lines. He has commenced building a much larger one, of which the only particulars as yet obtainable are that it will carry four or five persons, and will embody all the principles of his No. 1.

London, England.

A Communication from Leo Stevens.

The Editor of this journal has received from Leo Stevens a brief account of his recent ascent at Manhattan Beach, which was commented upon in the Scientific American. Mr. Stevens assures us that the Santos-Dumont balloon steered by Mr. Boyce traveled directly northeast and landed about a mile and a half from the starting point. Mr. Stevens states that he was traveling above this ship on the same line, that when reaching Sheepshead Bay he turned two complete circles and that he then ventured on the trail of the Santos-Dumont. After Mr. Boyce had pulled his emergency cord Mr. Stevens states that he started on his way back against the wind, and that when directly over the Brighton Beach race track, he turned again, sailing directly to Coney Island. On his way back to Manhattan Beach he lost his sparking plug and had to descend in a network of wire. Mr. Stevens claims that the actual distance which he covered was about seven miles.

Mining Water for Coal.

The straits to which New York city has been put by reason of the coal strike have given birth to a most curious occupation. When coal began selling at $10 a ton a Bridgeport wrecking company decided that it was about time to begin the work of mining Long Island Sound. According to the New York Tribune, the method of water mining is quite simple.

The wreck of a coal barge is first located by means of the Lake submarine boat, described some time ago in the columns of the Scientific American. Two boats—"wreck-finders" as they are called—are run out to the territory where the coal wrecks are supposed to be. In each boat about a mile of inch rope is contained. As the boats run alongside each other the ends of the ropes of each boat are spliced, making a continuous rope two miles long, and thereby lashing the two boats together. The wreck-finders then travel in opposite directions for about half a mile and thereupon run parallel to each other. The rope is paid out through a ring in the end of an iron pole projecting over the stern. After sufficient rope has been reeled off, two 300-pound weights are run down the rope from the sterns of each boat. Rapidly sinking to the bottom, these weights hold the rope a short distance from the ground, so that it forms a sweep half a mile long and is bound to catch anything that may come in its way. When the sweep rope catches the boats are stopped, the drums reversed and the rope wound up. The boats travel toward each other until they are almost over the point where the sweep rope is caught. A sounding is taken, and the lead carefully examined for traces of coal. Sometimes the lead tells nothing. A harpoon is then sent down the rope. If it sticks there is probably wood to be found far down in the water. If the harpoon is pulled up with its end blunted, iron or rock may be expected. A diver is now sent down to explore the find. He estimates the quantity and quality of the coal discovered, and decides whether it should be taken out by buckets or by suction pump. Sometimes the diver fastens a floating buoy to the wreck, and the sweep boats proceed on their way, looking for more coal cargoes that have sunk.

Now comes the turn of the lighters. By means of derricks or suction pumps the coal is raised to the surface. Not infrequently a coal wreck is found where the lighter can be pumped full of coal in half a day. Indeed, a wreck that will not fill the hold of the lighter in a day is not considered much of a find. A hundred tons of coal recovered in this way is deemed a fair day's work. When it is considered that a number of coal barges are sunk during every heavy storm on Long Island Sound, it will be readily seen that the business is profitable even in times when there is no coal famine.

The island of Guam was recently visited by many earthquakes. Some of the shocks were violent; indeed, so violent that the government buildings have been badly damaged. A tidal wave destroyed a large part of the crops and caused much suffering among the islanders. Commander Seaton Schroeder has telegraphed that the total damage amounted to $45,000 to government property.

THE SCIENTIFIC TRAINING OF WILD ANIMALS.

BY HAROLD J. SHEPSTONE.

There is no disputing the fact that the training of wild beasts has developed into a science, and no man has given the subject such serious consideration as Mr. Carl Hagenbeck, the world-famous animal dealer, of Hamburg. When in that city recently I called at his interesting animal emporium, for it is nothing else, and sought to discover the methods adopted at this unique training establishment.

At the time of my visit a group of twelve seals were undergoing stage tuition in a large cage, in the open ground, while in another a tiger was being taught to ride an elephant. The seals were being taught their tricks by an Englishman, and I was assured that they had made excellent progress during the seven months they had been under instruction. One of the larger ones, which the trainer affectionately patted on the head every now and again, could already take a small ball in his mouth, bounce it on the floor, catch it on his nose, and waddle with it, balanced in the air, onto his perch. In the other cage, which was under cover, the tiger displayed no small amount of intelligence, and seemed to perfectly understand what was wanted of him. If anything, the elephant was the more nervous of the two.

During the last thirty years Mr. Hagenbeck told me he had trained over seven hundred large animals; such as lions, tigers, bears and elephants, while most of the lion-tamers of Europe and America have passed through his hands. His methods are unique; he believes in individual training, and to him a new lion is a beast endowed with distinct characteristics, and therefore demands separate study and attention. "Like everything else," said Mr. Hagenbeck, "the business of animal training has considerably advanced during the last quarter of a century; and whereas it was considered wonderful for an animal, say a lion, to perform certain tricks, it is now almost essential for the would-be trainer to go through a series of evolutions with quite a number of different animals. It is not difficult to see that to train one animal is an entirely different matter from training a group of say twenty different beasts. I was the first to conceive the idea of training various animals to perform together.

"The first group of various wild animals which I succeeded in training to perform in the arena together, after many weary months, was exhibited at the Crystal Palace, London, in 1891. Their performances caused a sensation at the time, and thousands came daily to see them. After a few months the animals became very sick, so I took them back to Hamburg. Within six weeks after my return they all died. I found it extremely difficult to get good meat on which to feed them while in London. Such animals as lions and tigers like meat soon after the bullock or sheep is slaughtered. It was a great loss to me, for they had not been exhibited long before two American gentlemen offered me $50,000 for the group. I soon got another group ready, however, which I took over to Chicago, to the World's Fair, and they proved a great success.

"I have been busy lately making very extensive arrangements for exhibiting my trained animals in America. I have already sent one group over consisting of sixteen various animals, while by the middle of September another consignment will leave Hamburg for New York, containing a sufficient number of trained beasts to make up three distinct groups. These will travel all over the United States, performing at all the principal cities, and I am sure they will excite no little interest." They will be managed by a concern known as the Hagenbeck Trained Animal Company, an organization composed of four gentlemen, including Mr. Hagenbeck.

The most interesting of these groups, probably, is that made up of two large Nubian lions, one large cross-breed of a lion and a tiger—an entirely new and decidedly interesting beast, of which more anon—three Bengal tigers, two large Indian leopards, two South American pumas, two large polar bears, and four boarhounds. Incredible as it may sound, Mr. Hagenbeck assured me that it took four years to train this one set of animals. Although the group is made up of only sixteen beasts, over sixty were purchased and partially trained before the desired number was obtained. The others were useless from a performing point of view. This is where Mr. Hagenbeck scores over his competitors. Being a dealer in wild animals, as well as a trainer, those beasts that are unfit for the stage are sold to zoological gardens and menageries.

Taking the Hurdles Between the Lions and Tigers.
THE SCIENTIFIC TRAINING OF WILD ANIMALS.