

PELLER 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 fly-wheel, 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



Taking the Hurdles Between the Lions and Tigers.

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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.

A wild adult animal is of no use whatever to the trainer, but a young forest-bred beast can be trained as well as those born in captivity. So well are the animals in the group mentioned above trained that they will come out into the arena, one at a time, at the crack of the whip, and take up their positions on the stools or pyramids. According to Mr. Hagenbeck, anyone may become a wild beast trainer, provided he is prepared to give the necessary time, and is endowed with patience, tact, and good judgment. He must have a love for animals and never treat them harshly. The great worry in getting mixed groups together is to get the beasts to agree. If an animal is not liked by its fellows, another one must be secured. Keeping it would only mean continual fighting, and it is often necessary during the early stages of the training to keep men in the cages all night to prevent the beasts from quarreling.

It is interesting here to note that \$50,000 has frequently been refused for these groups of trained beasts. Mr. Hagenbeck told me that they often cost him that to get together and train. A tiger, for instance, valued at say \$500 would be worth ten times that amount after a couple of years of training. Curiously enough, Mr. Hagenbeck does not look to receive a large profit from the training side of his business, but rather regards it as a good advertising medium. His principal income is derived from the selling of all kinds of rare and wild animals to public zoos, menageries and private parks. For this purpose he keeps a large stock of animals on hand.

At the time of my visit he had the following animals in his depot: Sixteen lions, eight Bengal tigers, seventeen pumas, black panthers and jaguars, twenty-one bears, hyenas and wolves, eleven elephants, eighteen wild pigs of different sorts, twenty-seven camels, six dromedaries, eight various llamas, six zebras, three wild asses, four Mongolian wild horses, eight American bison-buffalo, eighteen yaks and various antelopes, thirty-three deer of different varieties, nine various wild sheep and goats, twelve ostriches, sixty-one cranes and storks, one hundred and seventy-two swan, geese and ducks, lots of monkeys, reptiles, pheasants, vultures, eagles and different varieties of small animals.

This of course, gives the trainers at Hamburg a varied and large stock to pick from, and explains the reason why no menagerie the world over can hope to turn out such interesting tableaux. All the principal groups of trained wild animals which have been exhibited in Europe, America, India and Australia were first trained in Hamburg. In addition to the three groups in America, there is another performing at Blackpool, England, and another at Nice, on the Riviera. The former is made up of twenty-one animals, between three and four years of age, and the other of sixteen animals.

Mr. Hagenbeck has won considerable fame as an animal importer, and now claims the distinction of being the largest dealer in wild animals and curious beasts in the world. He has made some decided hits at different times in securing specimens of the

rarer animals. Thirty years ago he obtained an African rhinoceros for the London Zoological Society, which was the first rhinoceros seen in Europe since the days of the Roman Amphitheater. Seven years ago he imported a Siberian tiger, and four years ago a Persian tiger. Four years ago, too, he landed in Hamburg two lions from Balkash Lake, in Central Siberia, and a couple of tigers from Russia Turkestan. These beasts created quite a sensation in zoo-

and a tiger. The peculiarity of this beast is that it has a tiger's body and a lion's head. It weighs nearly five hundredweight, and measures ten feet from the tip of his tail to the tip of his nose, and stands about four feet high up to the top of his shoulder. There are five other similar animals at Hamburg. Mr. Hagenbeck has also crossed zebras with horses, at the advice of Prof. Hewitt, of Edinburgh, Scotland. He recently helped the Duke of Bedford to cross Persian fallow deer with ordinary European deer, so that a bigger and stronger deer could be obtained. The whole idea of this crossing, of course, is to secure a better blood and a stronger breed. In this way he has secured a better breed of pheasants, by crossing pheasants from Central Asia with the European variety. They are larger and heavier birds, stronger on the wing and prettily marked. In conclusion I would add that the great dealer is now busy building a zoo at Stellingen, a suburb of Hamburg, which, when completed, will be the most singular garden of its kind. It will be unique in the manner in which it is laid out. It is to be opened next May.
London, England.



A Group Trained After Eighteen Months of Teaching.

logical circles, as they were the first species of their kind ever seen in Europe. Last October his depot was enriched by a stud of twenty-eight wild horses from Mongolia. They were caught, as foals, in a district some twelve days' march beyond Peking, and after much trouble shipped to Hamburg, at a cost, all told, of over \$25,000. They were quickly snatched up by the leading zoos, many of them being sold at \$2,500 apiece.

Mr. Hagenbeck has conducted some interesting experiments recently in the cross-breeding of animals. Mention was made above of a cross-breed of a lion

missioner of Street Cleaning of New York city, had determined to carry out a series of experiments for the purpose of ascertaining the bacteriological condition of the air of New York city. The first results of the experiments have been given to the public. To one who is not a bacteriologist, the conditions which have been found to prevail are startling.

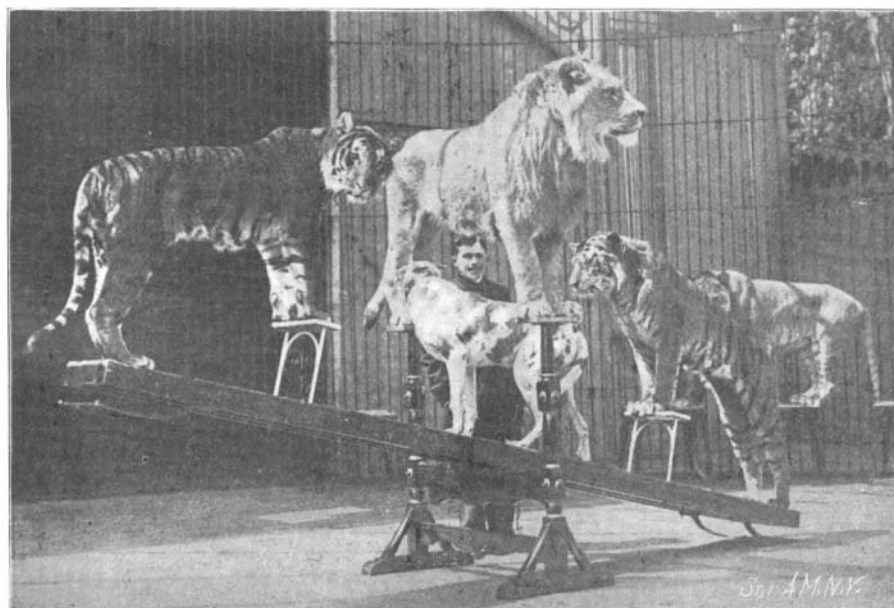
At various points, selected to give strong contrasts, gelatine-coated plates were exposed for one-half hour at curb level and six feet above the curb. The microorganisms thus collected were transferred to the usual culture medium and allowed to propagate. Exactly what the germ colonies contain has not been definitely ascertained; that they carry enormous numbers of disease germs goes without saying. But it has at least been established that the air near the curb level is much more heavily laden with what is grimly called "rich bacterial flora" than that six feet or more above the sidewalk. It is therefore evident that unclean streets are most unsafe playgrounds for children.

For those who consider municipal cleanliness rather more costly than the end attained would seem to warrant, we recommend the useful object lesson that a plate exposed for one-half hour in clean, residential streets with well-swept asphalt pavements shows five isolated pinhead colonies after an enlargement of 700 diameters; while one exposed for the same length of time under precisely the same conditions of hour and weather, in an East Side street flanked with crowded tenements—from the windows of which tons of refuse are daily thrown—shows nearly 10,000 colonies, some as large as a thumbnail.

A more striking argument in favor of clean streets could hardly be found.



A Trained Walrus.



On the See-Saw.



Dinner Time at the Training Quarters.

THE SCIENTIFIC TRAINING OF WILD ANIMALS.