boxes of eggs, for ice. As soon as the crates arrive at each railroad station this space, as well as the top of the crate, is filled with ice. Recent experiments show that salmon eggs can be packed and transported a considerable distance when they are first taken.

During the earlier years of the Commission young fish and eggs were carried by messengers in the baggage cars, but as the work increased it was found that this method was inadequate and that other arrangements must be made to transport the large quantities the department was handling. After experimenting in the years of 1879 and 1880 with a special car, the Commission fitted out several and has now in operation six. While they differ slightly in construction and arrangement, they are essentially alike. The frame of the car is so braced as to permit of two large doors in the center, extending from floor to roof, which simplifies loading and unloading. Underneath, between the trucks, is a reservoir tank which holds 600 gallons of water. In one end of the car is an office, an ice-box of 1½ tons capacity, and a pressure tank with a capacity of 500 gallons of water. At the other end are the boiler room and kitchen. The tanks and cans used in transporting fish are carried in two compartments running along the side of the car between the office and boiler room. They are 30 feet long, 3 feet wide, 25 inches deep. In the middle of the car, over the compartments, are four berths and several lockers for the use of the crew. The office is fitted up with two berths, lockers, writing desk, and typewriter. In the boiler room are a 5-horsepower boiler, furnishing the necessary power; a circulating water pump, and an air and feed pump.

For the transportation of ordinary fry 10-gallon iron cans, tinned, are used, 24 inches high, 12 inches in diameter on the outside, with sloping shoulders and cover. The water is introduced by means of a rubber hose connected with the pressure tank, or simply with a dipper and bucket.

For the transportation of large fish, the cars are equipped with twenty-two tanks holding 52 gallons each. They are provided with an overflow which connects with a supply tank under the car and can be drained by means of a valve at the bottom. The supply of water is carried in the iron pressure tank located in the body of the car next the office. The water is circulated by means of a steam pump through galvanized-iron piping, which runs from the pump to the pressure tank, thence along the sides of the refrigerator to the transportation tanks, whence it flows by gravity to the tank below the floor. From here it is pumped into the supply tank for redistribution.

To provide sufficient air circulation, the air is driven by a pump to a 30-gallon reservoir in the top of the car, from which it is taken to the transportation tanks or cans through two lines of iron piping running along the sides and top of the car. There is one pet-cock in the pipe for each tank to be supplied with air, which goes into it through a hole 1-32 inch in diameter. The car has also a hatching outfit.

Besides the distribution through these special cars, a number of special messengers act independently. Each one is supplied with a number of 10-gallon cans, a dipper, a 5-gallon iron pail, a large tin funnel, with a perforated bottom; a thermometer, a piece of hose for use as a siphon, and a supply of ice.

The Commission has three vessels in use prosecuting the marine work, the steamers "Albatross" and "Fish Hawk" and the schooner "Grampus." The "Albatross" is fitted with appliances for deep-sea dredging and collecting work, and is used for surveying and exploring ocean bottoms and investigating marine life. The "Fish Hawk" is in reality a floating hatchery, and is engaged in hatching shad, lobsters, and mackerel, in collecting eggs and in distributing fry, besides making topographic surveys of fishing grounds, etc. The "Grampus" is used in general work, but mostly in the propagation and distribution of cod.

The cod is propagated artificially on a more extensive scale than any other marine fish. Up to and including the season of 1896-7 the number of cod fry liberated by the Commission on the east coast was 449,764,000. The output of fry in the last-named year was 98,000,000.

The work of the Fish Commission, if exploited in full, would consume several volumes. To tell in the briefest the story of how each fish is saved from extermination by the battle that the Commission wages is beyond our scope, and many of the individual descriptions would be to other than the fisherman and the fancier a practical repetition. And yet the artificial propagation and distribution of fish cannot be dealt with in general without sacrificing many of the interesting points. So the first fish foods of the world, in quantity, have been selected.

The work of the Commission is carried on at 25 stations or hatcheries, located at suitable places throughout the country. At Woods Holl and Gloucester, Mass., cod, mackerel, lobster, and other important species are propagated and the fry are deposited on the natural spawning grounds along the coast. At Battle Creek, Baird, and Hoopa Valley, in California, at Clackamas, in Oregon, and Little White Salmon River, in Washington, the eggs of the Pacific salmon are collected and hatched and the fry are planted on the spawning beds in the neighboring streams. The Atlantic and landlocked salmon are cultivated in Maine at Craig Brook and Glen Lake to restock the depleted streams and lakes of New England and northern New York. On the Great Lakes at Cape Vincent, N. Y., Put-in-Bay, Ohio, Alpena, Mich., and Duluth, Minn., the work is with whitefish and lake trout. Hatcheries in the interior at St. Johnsbury, Vt., Wytheville, Va., Northville, Mich., Manchester, Iowa, Bozeman, Mont., Neosho, Mo., Quincy, Ill., San Marcos, Tex., and Leadville, Col., maintain in the inland lakes and streams the supply of brook trout, rainbow trout, black bass, crappie and other fishes. During the spring on the Potomac, Delaware, and Susquehanna rivers shad are hatched and distributed in nearby streams along the coast.

Santos-Dumont's Airships to be Used by the French War Department.

Santos-Dumont lately offered to place his new airships at the disposition of the French government, so as to determine their value in military operations. The government has accepted his offer, and proposes to make a series of trials with the airships, which will be of the greatest interest. At the annual military review, which was held at Paris on the 14th of July, Santos-Dumont sailed over the maneuvering grounds with his small airship "No. 9," which was recently illustrated, and went through a series of evolutions showing the ease with which the balloon could be managed. This performance was admired by the military authorities and the thousands of spectators who were assembled at Longchamps. Not long after this occasion the Minister of War, Gen. André, received a letter from Santos-Dumont, offering to put his airships and personal co-operation at the service of France in case of war with any other nation, excepting those of North and South America. In reply to this offer he received a letter from Gen. André, which it will be of interest to give in full:

"In the course of the review of the 14th of July I had occasion to remark and admire the facility and surety with which you made the evolutions with your airship. It is impossible not to acknowledge the great step in advance which you have made in aerial navigation. It seems that owing to your efforts it can now be applied to practical ends, and especially to military operations. I consider, in fact, that the new airships can render very great services in time of war. I shall be therefore very happy to accept your offer to place your aerial fleet at the disposition of the government, and in its name I thank you for your kind offer. I have appointed Commandant Hirschauer, of the First Battalion of the Aerostatic Corps, to examine with you the dispositions which are to be taken in order to put the matter into execution. Lieut.-Col. Bordeaux will assist that officer in his examination, in order to keep me informed as to the results of your collaboration."

As a result of this correspondence Santos-Dumont received a visit from the two officers delegated by the Minister, in his new balloon shed at Neuilly. During two hours the officers remained with the aeronaut, examining the great airship "No. 10," which is now in construction, trying the new 60-horsepower petrol motor, starting and stopping the immense propeller, and carefully studying the balloon in all its details. The officers made such a favorable report after this examination that the minister decided to proceed with a practical test, which will be held in the near future. If the trials succeed, they will prove the value of the airship in military operations. The test will probably consist in making the trip in a single day from Paris to one of the fortified places on the frontier, either Nancy or Belfort. It will not be necessary, however, to make the whole trip in the airship. Santos-Dumont's project is to leave Paris by train early in the morning, carrying with him the balloon envelope, hydrogen tubes, and all the apparatus, then to stop at a short distance from the city which is chosen. A detachment of soldiers who are to accompany the officers delegated by the minister would then uncouple the car containing the balloon and its accessories, and dispose the airship for its flight, under the aeronaut's direction. Santos-Dumont considers that two hours will be sufficient for the preparation, and he will then make the attempt to pass above the city named for the experiment.

The aeronaut has recently returned from a trip which he took to Brazil on the advice of his physician, as he was suffering from overwork. On reaching Paris he expects to complete the "No. 10" as soon as possible, in order to make the above trials. The new airship for the St. Louis contest is already in construction, and will be described shortly. One very gratifying result of the aeronaut's trip to South America is that the Brazilian Congress will very probably vote a prize of $100,000 for an international aerostatic contest, which is to take place near Rio Janeiro from May to December, 1905.

Correspondence.

Utility of the Scientific American.

To the Editor of the SCIENTIFIC AMERICAN:

We at present receive regularly the SCIENTIFIC AMERICAN, and use it as a newspaper of arts and sciences, and also select the more permanently valuable articles and cuts, filing them in what we call our "Industrial Library," from which they are drawn to be used as illustrative matter in class work, or by pupils interested in one or another subject.

We would be glad to learn of any other ways to use the paper educationally. ARTHUR W. RICHARDS.

The Ethical Culture School, New York City.

[Mr. Richards is perhaps utilizing the material in the best possible way. In too many schools, however, copies of the SCIENTIFIC AMERICAN are not preserved. In our judgment two copies of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT should be subscribed for. Bind one copy of each for reference, and cut up the remaining copy, classifying the subjects carefully. Mount the illustrations and text on stout manila paper with paste. In a few years such a collection will prove of the utmost value. The usefulness of such a plan is not confined to schools. We would like to hear from our readers relative to this matter. —ED.]

Static Electricity in the Separation of Metals.

To the Editor of the SCIENTIFIC AMERICAN:

Being a frequent reader of your valuable paper, I notice under the head of Electrical Notes in your issue of September 12, page 187, a published communication of Mr. D. Negreano made to the Paris Academy of Science, in which is described a process for separating metallic powders from inert matters by the use of static electricity. We wish to call to your attention the fact that several patents were granted to inventors in this country several years ago in which the principle described in Mr. Negreano's communication is utilized. Two patents granted to Mr. W. L. Steele and the writer, issued March 26, 1901, Nos. 670,440 and 670,441, use static electricity in the separation of metals or conductive particles in a pulverulent mass from the silicious or non-conducting particles of the same, by exposing such a mass on a suitable conveyer which is electrostatically charged from a Wimshurst machine, and supporting above the conveyer a metallic screen that is either connected to the ground or the opposite pole of the Wimshurst machine.

In the operation of this process the entire mass of pulverulent material is attracted to the screen; but the metals or conducting particles, by reason of their superior conductivity, quickly lose their static charge in the immediate vicinity of the screen, while the non-conducting particles pass through it, and are disposed of by a suitable air blast or other mechanical means.

This process has successfully operated on ores in separating metallic values from the gangue.

H. M. SUTTON.

Dallas, Texas, September 29, 1903.

Bertelli's Studies of Bird Flight.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the very interesting and instructive article, "The Flight of Birds Mechanically Studied," in the October 10 issue of the SCIENTIFIC AMERICAN, the writer alludes to the fact of the results being seemingly paradoxical, but if it be remembered that any current of air (as in the St. Louis cyclone of some years ago, and at the so-called Flatiron Building, New York, the walls and glass were blown outward, as explained by the undersigned at the time of those occurrences) produces a partial vacuum along its path toward which the surrounding air rushes in to fill the void, the phenomenon illustrated in the cuts will easily be understood and admitted.

May be, also, the learned professors who are engaged in this experimental work, will allow me to call their attention to the conclusion I arrived at some five years ago, as set forth in a correspondence of mine published in La Presse, Montreal, to wit, that in soaring, the bird's wings, concave underneath, act as a parachute, and that the great heat from the bird's lungs and body, as any one can see for himself by applying his hand to the breast of the bird, must again rarefy the air beneath the wings, and thus cause the underlying atmosphere to have a reactive and upward tendency, and thus also, so far, diminutive of the bird's tendency to fall.

The competition between the various aerostats which is to take place at the forthcoming exhibition at St. Louis, when the many forms of aerial vehicles are to be submitted to practical trial, cannot but render this exhibition the most interesting and instructive the world has ever seen, and cause thousands to go there who, but for such an exhibit, would have stayed at home. C. B.

Quebec, October 13, 1903.