automobile has been brought into use in this service, the motor which operates the air plant being also used to propel the machine when under way. Such is the capacity of a portable plant that three men can clean every portion of an ordinary ten-room house in a day of ten hours.

The types of apparatus for applying the air to the material vary, of course, according to the work to be performed. In the Nation-Christensen system, which has been installed in a number of large hotels and buildings, the carpet renovators are of various sizes, ranging from 12 to 36 inches in width. They consist of a steel framework which lies flat on the surface of the fabric. This is termed a hood, and contains an expanded nozzle connecting with the hose. In the bottom of the hood is a slot about 1-100 inch in width, through which the air passes in what might be termed a sheet. It is forced into the fabric at various pressures, according to the thickness of the latter and the amount of dirt which has accumulated. The usual pressure varies from 60 to 70 pounds to the square inch. This is sufficient to blow the dirt out of and from under the covering. It passes upward through two other slots into the hood, as it cannot escape outside of the machine on account of the weight on the surface. It is prevented from escaping into the air by a cloth bag which collects it but is loose enough to allow the air to pass through. The dirt settles into a pan especially designed to collect it. When filled, this can be readily removed by taking off the bag and emptied. To the renovator is attached a handle for moving it over the floor. The handle also acts as a conduit for the compressed air, the supply of which is regulated by an ordinary valve. The apparatus is usually pushed over the carpet and does its work so thoroughly that it will remove any kind of substance which can be driven out by air pressure. In several instances, flour was thrown upon a rug and trod in with the feet. When the renovator was applied it apparently collected every particle of the flour, none escaping into the air.

In treating lambrequins and other kinds of upholstery the hose is connected with a jointed steel tube long enough to extend to the upper portion of the apartment. The ordinary air blast is directed against the draperies and the dirt allowed to settle upon the floor and furniture. Obviously the draperies and upper portions of an apartment are the first cleaned, then the furniture and floor covering. For removing the dust from upholstered chairs, sofas, and other kinds of furniture, what might be called a hand renovator is employed. It is constructed on the same principle as the larger type with the slots for applying the air pressure and collecting the dust, and is pushed over the surface by hand. If the chair, for example, is stuffed with cotton or some other material more power is employed to force the air through this material as well. As already stated, even billiard table coverings are thoroughly cleaned of the chalk and dirt in the same way. In freeing such articles as pillows and mattresses a simple pneumatic needle is used, the air being injected with sufficient force to circulate among the feathers, straw or other stuffing and expel the dust which may have collected.

In England a vacuum-cleaner is used which depends upon a somewhat different principle. This apparatus consists essentially of a bronze suction pump driven by an electric motor. The suction pipe is connected by flexible tubing with a metal cone, which is provided with short rubber tubes disposed very much as are the bristles of a brush. Between this air brush and the pump is a hermetically sealed box which acts as a condenser of the dust gathered up. The air which is drawn in is discharged against a baffle plate so that the larger particles of dust are precipitated. The remaining portions are filtered by passing through filtering material, the clean air being then discharged into the atmosphere. The dust collected in the box can be removed by opening a valve in the bottom of the box. The apparatus which we have described is used in many English hotels and also on the steamships of the Cunard line.

Finish of the Endurance Test.

By the arrival at Pittsburg, Pa., on October 16, of five more machines from Cleveland, the total of survivors in the endurance run from New York to Pittsburg is increased to twenty-five. The contest was to have closed at midnight, but the extraordinary severity of the test warranted the recognition of the finish of the newcomers.

The examination of the surviving machines began October 16, and will be continued for several days, during which time the cars will remain officially "sealed" in the garage. Considering the ordeal through which they have gone, all the machines are in surprisingly good condition. Bent axles and broken springs seem to have been the main troubles to the running gears, while engines have been remarkably free from mishap. The Contest Committee made a hasty examination of the observers' reports October 16. They found that nine cars had reached all the night controls on time, or within a few minutes after closing time.

The scores indicate that the best record had been made by George Saules (two-cylinder Toledo), with a loss of only thirteen points from a total of 300.

WORK OF THE FISHERIES COMMISSION.

BY FREDERICK MOORE.

Of recent years the annual catch of salmon in the Pacific States and Alaska (which latter supplies half the pack of the world) has been over 100,000,000 pounds. In 1899 the quantity of salmon packed was 2,450,000 cases of 48-pound cans. The weight of the fish represented by this pack, together with the large quantities sold fresh, salted, and smoked, was about 175,000,000 pounds, in market value, $9,000,000.

According to its species and size each salmon lays from a few hundred to thousands of eggs at each spawning. Although the lays are so multitudinous the time required for the hatch and development of a fish is, according to the temperature of the water in which he is, and his variety, from three to five years; the eggs are often largely destroyed; some are diseased and never hatch; some of the fish are taken off by disease, and many become the food of other fish. When in the rivers they are comparatively safe from enemies, but those in Alaskan waters are destroyed even there by otters, ospreys, and fishers, and are terribly slaughtered at the mouths of the rivers, when entering and leaving them, by seals and sea-lions. The enormous catch, therefore, were it not for the government propagation of the fish and the restocking of the rivers, would have by now exterminated salmon, or exhausted them for all commercial purposes, at least, in western waters. Since the work of propagating the fish began in 1873 on the McCloud River, it has grown to large proportions and engages the attention of all the coast States as well as the general government, and is now more extensive than ever before.

When salmon return from the sea each year to spawn they crowd up the rivers most persistently, and have been seen so far up the rivulets that form the head waters of the Sacramento that their bodies were exposed to the air. No matter how far the headwaters are from the ocean they will press forward until stopped by impassable obstructions or water too shallow for them to swim in. As they ascend the rivers they are caught at the government stations in gill nets, fyke nets, pounds, weirs, seines, wheels, and other devices. A species called the chinook is the principal salmon artificially propagated, and while the propagation at other stations throughout the country is about the same, the work on that specimen at the hatcheries on the McCloud River and Battle Creek (tributaries to the Sacramento) are taken for example. In 1899 the number of eggs of this variety alone collected by the commission was 48,043,000, of which about 43,775,000 were successfully hatched and planted. At these two stations the ascent of the fish is stopped by heavy wooden racks or barricades, below which their capture is effected by various means. After they are secured they are, for convenience in handling, placed in pens or live-boxes, the ripe or nearly ripe males and females being kept separate. When the eggs are taken in large quantities separate compartments are maintained for the ripe males, ripe females, nearly ripe females, and males partially spent that it may be necessary to use again.

The fish are usually stripped every day, as the eggs of the females confined in the pens are likely to be injured within the fish, which is a serious objection to keeping the parent in confinement any longer than is absolutely necessary. The spawning operations are conducted on a platform over the compartments containing the ripe fish, which are accessible through hinged covers set in the flooring. When taking the eggs one or two men stand ready with dip-nets to hand the females to the spawn-taker, and one or more perform the same office with the males. After the salmon are taken from the pens they are held suspended in the net until their violent struggles are over, after which they become quiet enough to handle and the eggs and milt can be expressed easily. All methods of taking salmon spawn are very much the same. Where there are plenty of assistants, and the salmon are of medium size, the most expeditious way is for the man who takes the spawn to hold the female in one hand and press out the eggs with the other, another in the meantime holding the tail of the fish. The male is handled in the same way. But on the Columbia River, where the salmon is larger and harder to manage, a "strait-jacket" is used. This is a sort of a trough made the average length of the salmon and hollowed out to fit its general shape. Across the lower end is a permanent cleat and across the upper a strap with a buckle. The fish is slid into the trough, the tail going down below the cleat, where it is securely held, and the head is buckled down with the strap. Under this control it cannot do itself nor anybody any harm and the eggs can be pressed out easily. The strait-jacket is indispensable with the very large salmon, and when operators are few.

One man presses the eggs from the female securely held in the spawning box into a pan held by another. As soon as the eggs are taken the male is drawn from the pen and the milt is pressed from him into the pan in the same way. Milt enough is taken to insure its coming in contact with each egg, after which the pan is gently tilted from side to side and the mass stirred with the fingers until thoroughly mixed. The pan is then filled about two-thirds full of water and left until the eggs separate, the time varying from one to one and a half hours according to the condition of the atmosphere. The average size of the eggs is about one-fourth inch.

The hatching apparatus generally employed on the Pacific Coast consists of a combination of troughs and baskets. The troughs are 16 feet long, 12 or 16 inches wide, and about 6 inches deep. These are divided into compartments just large enough to allow the baskets in which the eggs are placed to be lifted in and out. The egg receptacles are wire trays about 12 inches wide, 24 inches long, and deep enough to project an inch or two above the water (in order that the eggs might not wash out), which is 5 or 6 inches deep in the troughs in which they are placed. Into each of these baskets two gallons of eggs, equivalent to about 30,000, are poured at a time. The eggs suffer no injury whatever from being packed together in this manner, the water being supplied in a way that forces it through the mass, partly supporting as it circulates among the eggs from below. The meshes are too small to allow the eggs to pass through, though the long, slender fry may pass when the eggs are hatched. The eggs are kept in water averaging 54 deg. F. for about 35 days. The allowance of five days' difference in time of hatching for each degree of change in the water temperature is about what is necessary.

The eggs hatch very gradually at first, only a small portion of the fish coming out the first day; but the number increases daily until the climax is reached, when large numbers of young burst their shells together. At this time great care and vigilance are required. The vast numbers of shells clog up the guard-screens at the outlets of the troughs, which must be kept as clear as possible by thoroughly cleansing them quite often.

After the eggs are all hatched and the young fish are safely out of the trays and in the bottom of the troughs their dangers are few, and they require comparatively little care. Almost the only thing to be guarded against now is suffocation. Even where there is an abundance of water and room, with a good circulation, they often crowd together in heaps or dig under one another until some of them die from want of running water, which is not an inch away from them. The only remedy in such cases is to thin them out.

At hatching the young salmon is about an inch long, and has hanging under him a comparatively enormous sack, the "yolk-sac." For a month he eats nothing, living on the essence of vitality stored in the sac. When the yolk-sac has nearly all been absorbed the fish rise from the bottom of the trough, where they have previously remained, and begin to swim. They are now almost ready for food and must be liberated into the streams for which they are intended, or artificial food must be provided them. As a rule the fry are planted at this time. This is regarded as the best practice, and moreover the amount of space required renders the rearing of fry impracticable. They have, however, been successfully retained in troughs from the time they begin to feed, in February, until the middle of May, when on account of the rising temperature of the water they have to be liberated.

For the first few days salmon eggs are very hardy, and at this time they are thoroughly picked over and the dead ones removed, as far as possible, before the delicate stage during the formation of the spinal column comes on, so that in the critical period they may be left in perfect quiet. As soon as the spinal column and the head show plainly the eggs are hardy enough to ship, but when there is time enough a wait of a day or two until the eye-spot is distinctly visible, after which the eggs will stand handling and may be safely shipped if properly packed, is generally allowed.

The packing box used in shipping eggs is made of half-inch pine, 2 feet square and 1 foot deep. At the bottom is placed a thick layer of moss, then a layer of mosquito netting, then a layer of eggs, then mosquito netting again, then successive layers of moss, netting, eggs, netting, and so on to the middle of the box. Here a firm wooden partition is fastened in and the packing continued as before. The cover is then laid on top, and when two boxes are ready they are placed in a wooden crate, made large enough to allow a space of 3 inches on all sides of the boxes. This space is filled with hay to protect the eggs from changes of temperature, and the cover being put on the eggs are ready to ship. In the middle of the crate an open space about 4 inches in depth is left, between the two

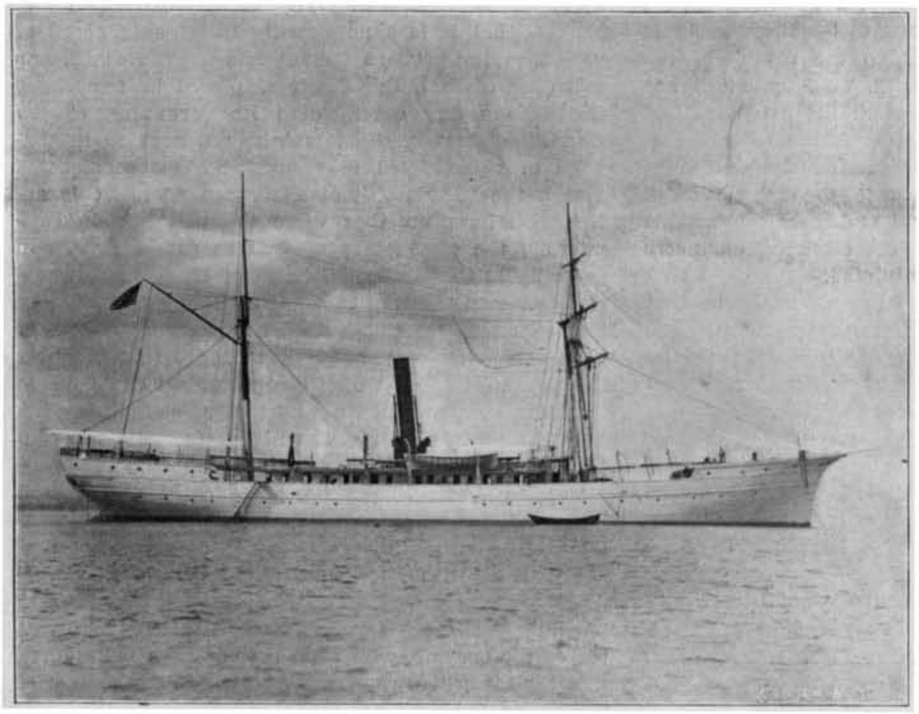
SCIENTIFIC AMERICAN

(Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1903, by Munn & Co.)

Vol. LXXXIX.—No. 17.
ESTABLISHED 1845.

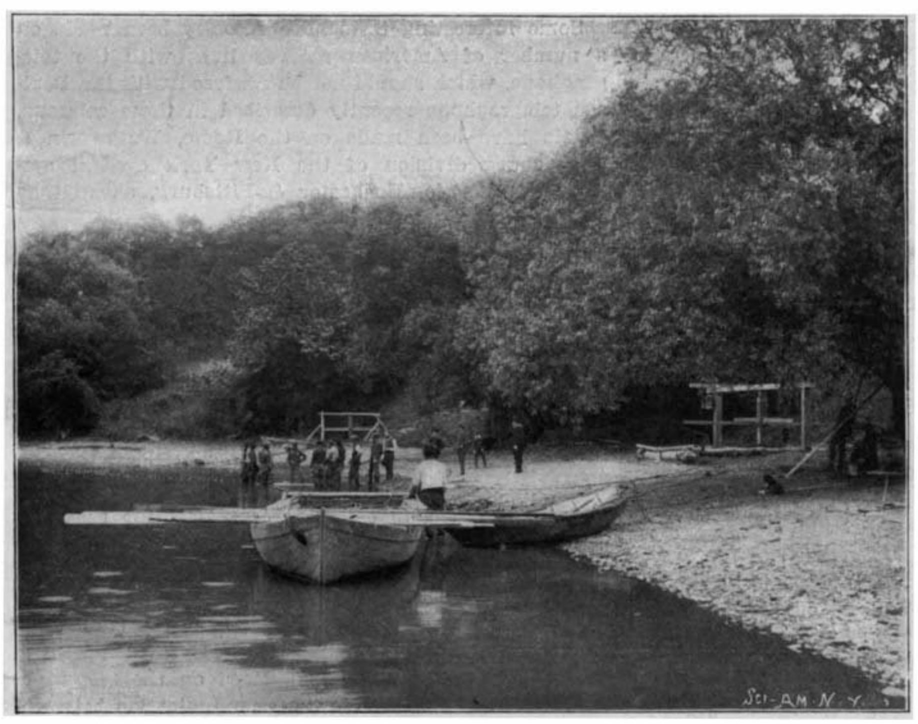
NEW YORK, OCTOBER 24, 1903.

[8 CENTS A COPY
$3.00 A YEAR.]



The Fish Commission Ship "Albatross."

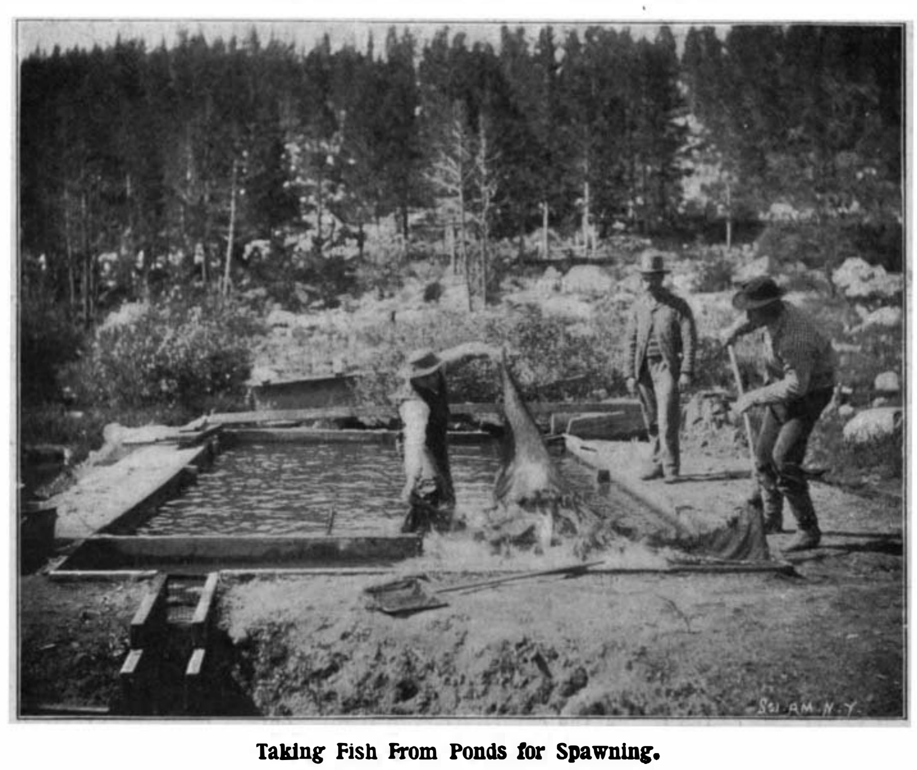
Loading Cans of Shad Fry on Launch.



Landing Shad Seine, Potomac River.

Hauling Shad Seines on the Potomac River.

Sorting and Spawning Trout, Northville, Mich.



Taking Fish From Ponds for Spawning.

THE WORK OF THE UNITED STATES COMMISSION OF FISH AND FISHERIES.—[See page 290.]

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.