it more apt to contract disease. Let us preserve ourselves from fear, live an ordinary life, and hope that we shall avoid the appearance of this dangerous visitor.—*La Nature.*

Suture of Nerves.

The report that has just appeared to the effect that M. Tillaux has communicated to the Academy of Sciences the successful suture of nerve in two cases, and that in one case function has been restored in a nerve divided for a period of fifteen years, is, if confirmed, one of the most important facts we have had presented to us in our day. The physiologist, not less than the surgeon, will be led to important work by this event, and fresh fields of inquiry relative to nerve conduction may open new and unexpected advances in the theory as well as the practice of the medical art.

Our Petroleum Industry.

A retrospect of the past condition of the American petroleum industry, compared with its present state, discloses some interesting facts. The first American petroleum was exported in 1852. Charles Lockhart, of Pittsburg, sent nearly 600,000 gallons to Europe in that year, and sold it for $2,000 less than the cost of transport. In 1883 nearly 400,000,000 gallons were exported, for which $60,000,000 was returned to America. At the present day there are 20,000 producing oil wells in Pennsylvania, yielding 60,000 barrels of oil a day. It requires 5,000 miles of pipe line and 1,600 iron tanks of an average capacity of 25,000 barrels each to transport and store the oil and surplus stocks. There are now nearly 38,000,000 barrels stored in the oil region tanks.

Besides the 5,000 miles of pipe line in use in that region, there are in operation 1,200 miles of trunk pipe lines connecting the region with Cleveland, Pittsburg, Buffalo, and New York, and lines building to Philadelphia and Baltimore. In the line between Olean and New York 16,000 barrels of oil are transported daily. These are all the property of the Standard Oil Company, except one between Bradford and Williamsport, Pennsylvania. The Standard employs 100,000 men. The products of its refineries require the making of 25,000 oak barrels of 40 gallons each, and 100,000 tin cans holding 5 gallons each, every day. The money actually invested in petroleum production since 1860 is estimated to be more than $425,000,000, of which $200,000,000 was capital from New York city. Since 1880 more than $12,000,000 has been used in building iron tanks, and nearly as much in pipe lines, all by one corporation. The tanks cost on an average $8,000 each. A 35,000 barrel tank is 90 feet in diameter and 28 feet high. The lowest price ever brought by crude petroleum was 10 cents a barrel in 1861. In 1859, when there was only one well in existence, Colonel Drake's "Pioneer" at Titusville, the price was $24 a barrel. The value of crude petroleum delivered in London is now 6½d. per gallon (a fraction over 1*l.* or $5 per barrel, containing, on an average, 40 gallons).

AN ENGLISH WOLF.

Concerning the animal depicted in our engraving, which has aroused much interest among naturalists and others, Mr. A. D. Bartlett, the Superintendent of the Zoological Society's Gardens, Regent's Park, writes thus: "The prairie wolf now being exhibited in these gardens was presented by Mr. R. Payze, of Leytonstone, who says he bought the animal about a year ago. It was then a very small cub; it was one of three that had been taken in Epping Forest by some farm laborers, Mr. Payze believing at the time that it was a fox cub. Its subsequent growth, however, caused him to suspect that it was not a fox, and as it became troublesome on account of its destructive habits, notwithstanding that it had been reared perfectly tame, he decided to get rid of it, and accordingly presented it to this Society. Inquiry is now being instituted with a view to ascertain, if possible, the manner in which the parents had been introduced into that part of the country. It is said that, some years ago, some foreign cubs, supposed to be foxes, were turned out in the neighborhood of Epping Forest."—*London Graphic.*

A Sea Atmosphere for the Sick Room.

The solution to be used and diffused as spray consisted of solution of peroxide of hydrogen (10 volumes strength) containing 1 per cent of ozonic ether, iodine to saturation, and 2 50 per cent of sea salt. The solution placed in a steam or hand spray diffuser can be distributed in the finest spray in the sick room at the rate of two fluid ounces in a quarter of an hour. It communicates a pleasant sea odor, and is the best purifier of the air of the sick room I have ever used. It is a powerful disinfectant as well as deodorizer, acting briskly on ozonized test solutions and papers. Mr. Carl R. Schomberg has recently invented a large spray producer, which will diffuse the artificial sea air through a hospital ward.—*B. W. Richardson, M.D.*

FUMIGATING PASSENGERS FOR CHOLERA.

Those persons whom business takes to the infected districts of Southern France—for few are likely to resort thither for pleasure at the present time—will be glad to learn that the fumigation system at the Marseilles and Toulon railway stations has been abolished as useless and vexatious. This disagreeable ordeal was in full force at Avignon early in July, as is shown by this sketch by Mr. E. Prioleau Warren, A.R.I.B.A., who, with other unfortunates, was

CHOLERA FUMIGATING BOX.

exposed for a quarter of an hour to the fumes of strong carbolic acid.

In Geneva, according to another correspondent, Mr. Thomas Howie, still more stringent precautions are adopted. The suspected person is placed in a box about six feet high, and in which he stands upright, with only his head outside, a towel being wrapped round his neck. The process occupies from three to four minutes, and the disinfectants used are chloride of lime and carbolic acid. The top piece of the box is made to slide in, and is removed when the process is completed by simply pulling outward. While the sliding board is being removed, the towel comes in handily as a respirator.—*London Graphic.*

Manufacture of Aluminum.

Heretofore aluminum has always been made by treating its chloride with metallic sodium as a reducing agent. But the great trouble in handling this material, and its very high cost, have made such a process difficult and expensive—the price of aluminum at present being higher per ounce troy than silver. This has limited its uses and its manufacture in commercial quantities to the sole factory in Paris, France.

William Frishmuth, a German chemist, living in Philadelphia, and a pupil of Woehler, who discovered aluminum, has been working for twenty-eight years to solve the problem of making cheap aluminum in commercial quantities. Within the past few years, he has discovered and secured patents throughout most of the civilized world, for a process that now produces aluminum in a commercial way at one-third the cost of any other, with almost a certainty of being reduced to $1.25 per pound avoirdupois when worked in a large plant, with proper technical and practical management, ample capital, and perfected mechanical and chemical means.

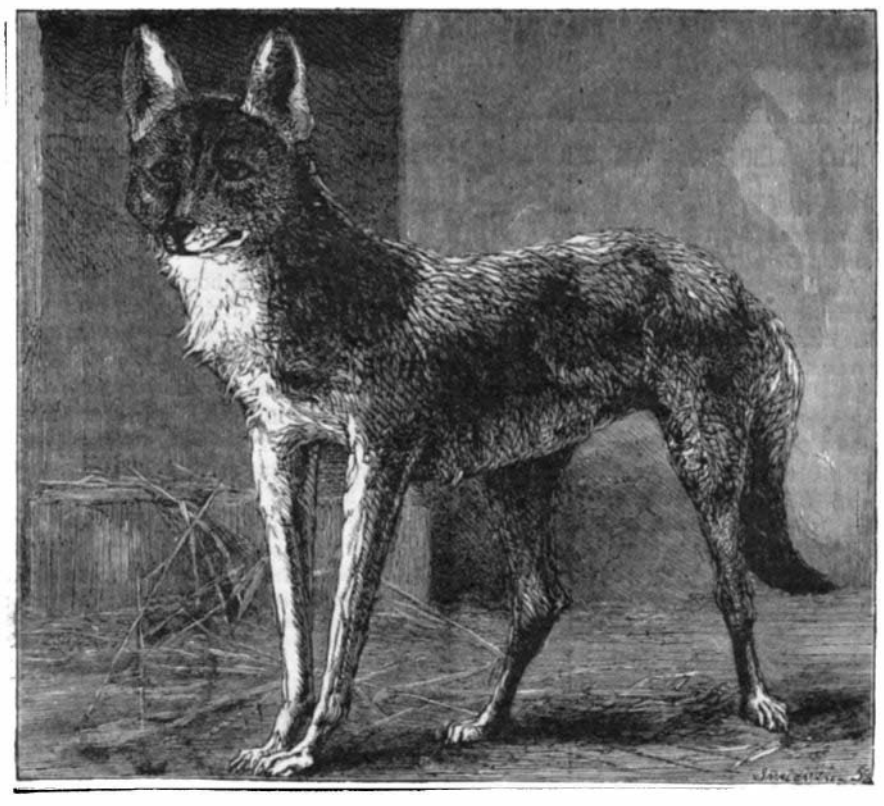
Instead of using metallic sodium as before mentioned, he uses a vapor, produced or generated in a suitable vessel from a mixture of sodium carbonate, or other suitable compound of sodium, and carbon or other reducing agent. And this sodium vapor, not metallic sodium, as used in the Deville process, is made to react in various ways upon the aluminous materials to produce aluminum. Therefore, the economy of the proved Frishmuth process is about as follows, estimated for illustration on a theoretical basis: The manufacture of 20 pounds of aluminum requires 115 pounds of sodium carbonate, at a cent a pound, or 50 pounds metallic sodium at from $2.50 to $3.50 a pound. Therefore, one pound of aluminum requires, by the Deville process, 2½ pounds metallic sodium, costing from $6.25 to $8.75; or by the Frishmuth process, 6 pounds sodium carbonate, costing say 6 cents. Practical operations are said to increase the quantities by the Deville process to from 3 to 4 pounds of metallic sodium, and by the Frishmuth process to say 12 pounds sodium carbonate.

Both Deville and Frishmuth have to use the double chloride of aluminum and sodium, although Frishmuth has a patent for his successful use of the double fluoride of aluminum and sodium in making aluminum. This is another great item of cost in making this metal. But Frishmuth has made improvements in making the double chloride of aluminum and sodium that reduce its cost to a few cents a pound, and consequently that of the metal. As this double chloride is the cheapest of a few known chemical substances used in making aluminum cheaply and in commercial quantities by chemical or electrical processes, the saving in cost, through such discovery by Frishmuth, in making this metal, will be very great, and almost as much as by the use of his sodium mixture in place of metallic sodium.

On account of the use of sodium and chloride, the wear and tear on retorts, crucibles, and apparatus is usually great. But in the apparatus now used in Philadelphia, designed by Frishmuth, this item of cost is much reduced, and will be further reduced when heated by Wilson producer gas instead of coke.

The metal is superior in quality to the French, being purer and whiter. Its specific gravity is 2·73. It has been tested in New York, London, and Paris, in a commercial way, and can be sold at the market price. All manufacture has been in the experimental and developing way, and Frishmuth has sold metal thus made to the extent of many thousands of ounces. Recently he made in a few days several ingots of 40 ounces Troy each, the quality of which was severely tested.

The use of the metal will increase as the price decreases, and when sold eventually, say, at 30 cents an ounce, the consumption here and in Europe should be 120,000 ounces troy a day. It has greatest value as an alloy, especially with silver and copper, as it gives a nontarnishing and noncorrosive quality to such metals, and greatly increases the tensile strength. Aluminum bronze is made by alloying 10 pounds of aluminum with 90 pounds of copper, and has a tensile strength of three tons per square inch more than Bessemer steel. Frishmuth has invented a solder for aluminum that welds the metal with itself or with copper, tin, lead, and iron. The color is the same as the metal. This will greatly increase the use of the metal, and is of great benefit to the arts and industries.



A PRAIRIE WOLF, CAUGHT IN EPPING FOREST.

Hay Fever.

This is the period for hay fever, a malady from which many suffer, and which admits of few methods of relief not embodying change of altitude or climate. Dr. W. T. Phillips, of Andover, recommends belladonna—one and one-fourth minims of the succus every hour until relieved (30 m. to 3 ounces of water, teaspoonful dose) Dr. G. E. Dobbson, in the *Lancet*, has had satisfactory success by the inhalation of the vapor of camphor and steam, made to come in contact with the outer surface of the face about the nose by means of a paper cone, placed with the large end downward in a vessel containing hot water and a drachm of coarsely powdered or shredded camphor. He asserts most positively that if this procedure is continued for 20 minutes, and repeated 3 or 4 times in as many hours, great and usually permanent relief follows.

CAPT. WILLIAM LUND, of the Hawaiian brig Dora, lately presented to the Academy of Sciences, San Francisco, a collection of water snakes found ten miles at sea; also a live *Yllama*, 12 feet long, or species of boa constrictor, found by him on Tres Marias Island.

Brief History of Electric and Magnetic Locomotion.

BY E. M. BENTLEY.

The electric motor was invented over fifty years ago, and has been in extensive use ever since. The first inventor is a matter of some dispute, but the invention follows very naturally from the investigations in electro-magnetism made by Professor Henry about 1830.

Probably the first motor giving direct rotary motion was made by Sturgeon in 1832. A number of others soon followed, but the one attracting the most attention, and on which great hopes were based, was invented by Thomas Davenport, of Brandon, Vt., and was fully described in the *American Journal of Science and Arts* for April, 1837. Of his experiments it was said, "One of the machines with a motive wheel only seven inches in diameter has been attached to a turning lathe, and moves it with astonishing strength compared with the small size of the propelling engine."

We also find the following financial appeal, which to the stock sellers of the present day must seem an example of untutored simplicity: "For the purpose of raising funds to carry on experiments, etc., a joint stock association has been formed in New York, of which Mr. Edwin Williams, No. 76 Cedar Street, is agent. By this arrangement, the principal interests of the patent for the United States and Europe being placed in a stock of three thousand shares, the proprietors offer an opportunity to public spirited individuals to become associated with them in the enterprise, which it is hoped for the benefit of mankind may be successful."

Another electric motor attracting wide attention about that time was invented by Prof. Charles G. Page, of Washington, D. C. An account of this motor and its application to locomotive purposes was given in a lecture delivered by the inventor in New York, and printed in the SCIENTIFIC AMERICAN of November 15, 1851. At that early date electric motors were successfully applied to locomotion, both on land and water. In April, 1837, Sturgeon announced his having succeeded in propelling a boat, and also a locomotive carriage, by electro magnetism—see "Sturgeon's Annals of Electricity," vol. i., page 250. In the same publication for October, 1840, are given a cut and description of the electric locomotive of Uriah Clark, of Leicester, England, which was run for two months on a circular track at the Leicester Exhibition of that year. Davenport, whose motor was mentioned above, ran a locomotive in 1842 on a railway near Glasgow. This locomotive, which is described in the lecture by Professor Page, above cited, weighed five tons, and developed one horse power, attaining a speed of four miles an hour. In this country, about the same time, Professor Page obtained an appropriation from Congress to aid in experiments on this subject, and constructed a locomotive which traveled from Washington to Bladensburg on the Baltimore and Ohio Railroad.

In electric locomotion by water, the most successful inventor was Professor Jacobi, who, in 1839, propelled a boat by electricity on the Neva.

The following very interesting letter from Jacobi to Faraday is found in the *Mechanics' Journal*, 1839, vol. xxxii., page 64:

"During the past autumn, and at a season already too far advanced, I made, as you perhaps have learned from the gazettes, the first experiments in navigation on the Neva, with a ten oared shallop furnished with paddle wheels, which were put into motion by an electro-magnetic engine. Although we journeyed during entire days, and usually with ten or twelve persons on board, I was not well satisfied with this first trial; for there were so many faults of construction and want of insulation in machines and batteries, which could not be repaired on the spot, that I was terribly annoyed. All these repairs and important changes being accomplished, the experiments will shortly be recommenced. If Heaven preserve my health, which is a little affected by continual labors, I hope that within a year from this time I shall have equipped an electro-magnetic vessel of from forty to fifty horse power."

In all the inventions I have described the source of electricity was a galvanic battery carried by the locomotive itself; but others used a stationary generator, and conducted the electricity to the propelling motor by means of conductors laid along the track or by the rails themselves. Mr. Pinkers, an Englishman, invented, in 1840, an electric railway of this description; from his stationary source of supply the current was led to his moving locomotive by two copper conductors, which were fastened to a beam of insulating material laid between the rails; two sliding blocks of copper depended from the locomotive and rested in contact with the two conductors respectively, and from thence to the two blocks the current passed to the propelling motor on the train. Mr. Pinkers' electric railway is fully described in his English patent, No. 8,644, of 1840. A railway of this kind is described in the *Mechanics' Magazine* for 1847, vol. xlvii., page 559. It was invented by Messrs. Lilly & Colton, of Pittsburg, Pa. In the description it is said: "The power is applied, not to the locomotive, but to the track, and herein consists the novelty of the invention or discovery. Two currents of electricity, positive and negative, are applied to the rails, and from thence communicate with the engine. The latter is provided with two magnets, which, by a process of attraction and repulsion, drive the car over the track. Heretofore the propelling power has been used on the car itself; in this instance, however, the power is in the rails, and an engineer may remain in one town and with his battery send a locomotive and train to any distance required." Of a later date is the railway of Bellet and De Rouvre, described in an English patent of 1864, No. 2,681, in which two wires are stretched beneath the car to convey the current to the locomotive; also that of Hallez de Arros, of Nancy, France, in 1873, in which the inventor in his patent says, after describing his locomotive: "The battery or source of electrical power may be mounted on the carriage, as above described, or it might be fixed in position and the electrical current might be transmitted by conductors laid along the rails, or by the rails themselves."

In the railway invented by Mr. W. H. Knight and myself, which has recently gone into practical operation in Cleveland, in connection with the Brush system, we make no extravagant claims to be the first persons to whom the idea of electric locomotion has come, but we do claim that we have taken up only devices which are free as air to every inventor, and by inventions of the utmost importance have rendered electric railways a practical success.

Water Power for Cities.

In London the plan of distributing water power in pipes for manufacturing purposes, running lathes, elevators, etc., is now in successful operation. The franchise is owned by the General Hydraulic Power Company. The water is taken from the Thames, filtered through sponge filters, then forced through the pipes by steam power. There is a pressure of 700 pounds to the inch in the mains. The mains, which now measure in the aggregate seven or eight miles, are cast iron pipes 6 inches in diameter. They are cast in 9 foot lengths, and are tested to 2,500 pounds per square inch at the works. The joints are turned and bored spigots and sockets, and are made tight with gutta percha rings, the necessary pressure being obtained by two 1¼ inch bolts passing through lugs on each pipe. As each section is laid, the water is admitted to test the joints; and after that, if they are tight, very little more trouble is experienced. Stop valves are inserted every 400 or 500 yards, and by their aid the position of a leak can be located within that distance, after which it is easily found.

The financial success of the company is no longer a matter of doubt. Since January 1 of the present year the amount of water delivered has increased 40 per cent, and would be much greater if all the intended consumers had their machinery in place. The charges for power are based upon a minimum payment of 25s. per quarter for each machine, and a sliding scale for the water, which is measured by meter as it is exhausted. The following is the scale of prices:

	Per Machine. £ s. d.
Under 3,000 gals. per quarter	1 5 0
	Per 1000 gals.
Above 3,000 " not exceeding 5,000 gals.	0 8 0
" 5,000 " " " 10,000 "	0 7 0
" 10,000 " " " 20,000 "	0 6 0
" 20,000 " " " 50,000 "	0 5 0
" 50,000 " " " 100,000 "	0 4 0
" 100,000 " " " 200,000 "	0 3 0
" 200,000 by special terms.	

In many cases the cost of lifting by the company's power is as low as one halfpenny per ton lifted 50 feet high.

The Philadelphia Electrical Exhibition.

The arrangements seem to be in a promising state of forwardness for the prompt opening of this exhibition as designed, on Sept. 2. The main building has been completed, and the former Pennsylvania passenger depot is to be used as an annex. Twelve engines, of the combined capacity of 1,800 horse power, will run the dynamos which will brilliantly illuminate the buildings and grounds. There will be 5,600 incandescent lights, Edison furnishing one dynamo larger than any heretofore constructed, and capable of producing electricity to supply 2,000 lights. A part of the exterior illumination will be furnished by a monster arc light of 100,000 candle power. A conspicuous feature is to be an electrical fountain, the water jets and spray from which are to be gorgeously illuminated by rays of colored electric light thrown from invisible points, and controlled by cunningly devised optical apparatus.

It is expected that there will be in all about three hundred exhibitors, the great electric light companies being very completely represented. In the schedule prepared there are five classes of apparatus for the *production* of electricity. Electric *conductors* alone require seven classes, and each of these classes will have many exhibits. The most delicate and beautiful apparatus for making *measurements* of electricity and its different properties will be shown under four classes. The *practical* application of electricity covers two sections, one embracing apparatus requiring electric currents of low power, and the other currents of high power. Under the former section come electric telegraphs, telephones, microphones, etc., fire and burglar alarms, annunciators, electric clocks and time telegraphs, electric registering and signal apparatus, applications of electricity to dentistry, to warfare, to mining and blasting, to spinning and weaving, to traps and snares, to pneumatic apparatus, to musical instruments, to writing and printing, to conjuring apparatus and to toys. Currents of high power will be shown as used in electric illumination, in electro-metallurgy, and other chemical applications, in storage batteries, in the transmission of power to electric motors, and in magnetic brakes. Other sections of the exhibition will be devoted to atmospheric electricity, terrestrial magnetism, etc., historical apparatus, and books on the general subject.

The Franklin Institute, which is carrying out the exhibition, has decided that no awards or premiums shall be given, but in place thereof a report to the Institute will be prepared by a Board of Examiners, which report will be as full as the time and opportunity will permit. Exhibitors are requested to give, at the time of the opening of the exhibition, detailed descriptions of their exhibits, addressed to the Board of Examiners, describing the merits of each exhibit as understood by the exhibitor. If any of the exhibitors desire expert examination or competitive tests of their displays, such tests will be conducted by the Institute to the extent practicable in the time, provided the cost of the materials and instruments used be borne by the exhibitors desiring the test. The Institute reserves the right to enter into such other scientific work touching the exhibition (not requested by the exhibitors) as in its judgment may tend to the advancement of science. The examiners shall be appointed by the Board of Managers, and shall be men of acknowledged integrity, skill, and experience in the class of goods assigned to them. All parties making application for tests thereby bind themselves to acquiesce, without appeal, in the results of the tests.

The English Government has taken official action, and has detailed Lieutenant Chisholm Batten, of the Royal Navy, to attend, and, after a careful study of all its features and developments, to make a report to his government. The Royal Society of England will be represented by John Hopkinson, M.D., F.R.S.; V. H. Preece, C.E., F.R.S.; Lord Rayleigh, D.C.L., F.R.S.; and Prof. Sir William Thomson, LL.D., F.R.S.; and the French Academy will send a representative, as will also France and the other Continental Governments; the Canadian Royal Society and the Republic of Mexico, and nearly every one of the North and South American Governments will send commissioners.

The United States Government has not been backward in lending its aid to the exhibition, and has appropriated $7,500 for the expenses of a Commission to provide for an international conference of electricians to be held during the continuation of the exhibition. The Commission was authorized to invite scientific men, native and foreign, to participate in its labors, and power was given it to determine the scope and character of its work. The members are to serve without compensation. In accordance with this act the President named eleven Commissioners as follows: Professor H. A. Rowland, Johns Hopkins University; John Trowbridge, of Harvard College; George F. Barker, University of Pennsylvania; M. B. Snyder, High School Observatory, Philadelphia; J. Willard Gibbs, Yale College; Simon Newcomb, *Nautical Almanac;* Edwin J. Houston, Philadelphia Central High School; Charles A. Young, Princeton College; Dr. W. H. Wahl, Franklin Institute, Philadelphia; F. C. Vandyck, of Rutgers College; and C. F. Brackett, of Princeton. This Commission has chosen Prof. H. A. Rowland, of Johns Hopkins University, President; Professor M. B. Snyder, of Philadelphia, Recording Secretary; Professor G. F. Barker, Corresponding Secretary; and the following Executive Committee: Professors Rowland, Snyder, Barker, Dr. W. H. Wahl, and Professor Simon Newcomb.

During the progress of the exhibition there will be held in Philadelphia meetings of the American Association for the Advancement of Science and the American Institute of Mining Engineers, and it is known that many members of the British Association, holding its meeting this year in Montreal, will be present as guests of American scientists. The topics to be discussed in the electrical conference are informally announced as follows: The sources of electrical energy; the theoretical conditions necessary to the most efficient construction of the dynamo-electric machine for the various purposes of practical work, the electrical transmission of energy; the systems of arc and incandescent lighting; the theory of the electric arc, storage batteries, electro-metallurgy; lighthouses for the coast; applications of electricity to military and mining engineering; lightning protection; induction in telephone lines, and the problem of long distance telephoning; the question of underground wires; atmospheric electricity; earth currents and terrestrial magnetism; photometry and standards for photometric measurements, the ratio of the electro-magnetic to the electrostatic system of units and the electro-magnetic theory of light, and, finally, on account of the pressing necessity for accurate and uniform electrical measurements, it is probable that the question of establishing a National Bureau of Physical Standards will receive proper attention.

Three grand receptions will be given during the time of the exhibition, one at the Academy of Music on Sept. 5, one at the Academy of Fine Arts, and a third at Haverford College.

Poisonous Postal Notes.

The Post Office Department is issuing a new style of postal note. It is of the same size as the old one, but differs in color and in the method of indicating the number of dollars to be paid. The old one was made of bright yellow paper, with a broad design on the back printed in green. The amount to be paid was indicated by punching figures in the margin. The new one is made of paper of a faded lilac color, and is printed in black on the face and blue on the back. The number of dollars is indicated by the number of stubs attached to it after it is torn from the book.

The chief reason for making the change was the poisonous character of the ink on the back of the old notes.