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EFFECT OF FORCED DRAUGHT ON COAL CONSUMPTION.

Trials carried out last year of the system of induced draught which is installed on the steamship "Inchkeith" have shown that in this vessel the coal consumption, per indicated horse power, per hour, has been reduced to 0.99 pound. Briefly described, the installation is as follows: The furnace gas on leaving the smoke-box passes through air superheaters immediately over the tube sheet, and then to exhausting fans which discharge directly into the smokestack. The superheaters are heated by the gases on their way to the smokestack. With this method of draught, it is possible to use the open stokehold; and in the present instance the stokehold temperature during the trial was 74 degrees. The average temperature of the air on entering the furnace was 284 degrees, and the temperature of the waste gases at the smokebox and at the fan was, respectively, 650 degrees and 380 degrees. With a boiler pressure of 260 pounds to the square inch, the water evaporated per pound of coal from and at 212 degrees Fah. was 12.94 pounds. The "Inchkeith" is a vessel of 5,700 tons dead weight, and her engines develop ordinarily, when using Pocahontas coal, about 1,300 indicated horse power.

THE TWENTIETH CENTURY SAILING VESSEL.

It was thought that the day of the sailing vessel was past, the development of the tramp steamer to its present economy of fuel and large cargo capacity having apparently rendered successful competition by the sailing vessel impossible. During the past few years, however, two types of ships have been built in increasing numbers which bid fair to equal, if not exceed, the tramp steamer in cheapness of cost and operation, and at the dawn of the new century there are two vessels, one in each class, which are about to be constructed, that are more distinctive than any that preceded them. One, the contract for which has just been signed, is a huge, square-rigged sailing ship, having five masts, and a tonnage of 8,500, which is over 2,000 larger than that of any previous sailing vessel. The determination of the Germans to build a vessel of this size may be taken as evidence that the preceding "monster" sailing vessels owned by German firms have proved to be paying investments. The other type to which we refer is the multi-masted sailing schooner. The success of the six-masted schooner "George W. Wells," which is capable of carrying 5,000 tons of coal, has led the builder to predict that she will be followed by a seven-masted wooden schooner, with a carrying capacity of not less than 6,000 tons of coal. Such a vessel would be well on to 400 feet in length over all, and in her the cost of carrying a ton of coal would be brought even lower than in her predecessors. It is more than likely that as the century advances we shall see square-rigged and fore and-aft vessels designed for the carrying of cargoes in bulk which will rival in size all but the largest of the steamships of the century which has just closed.

PUPIN'S LONG DISTANCE TELEPHONY

In view of the great interest which has been aroused in Dr. Pupin's system of long-distance telephony by the announcement of the sale of his patents to the American Telephone and Telegraph Company, for the sum of about $500,000, we republish in the current issue of the SUPPLEMENT the illustrated article, descriptive of his system, which appeared in the SCIENTIFIC AMERICAN of June 2, 1900. The article referred to describes the line of investigation followed by Dr. Pupin, which consisted, first, in formulating a mathematical theory of the propagation of electrical waves in long wire conductors, and, second, in the construction of an experimental cable that should verify the theory and open the way for the construction of a cable suitable to commercial use.

The history of this investigation, which has involved five years of painstaking experiment, would make interesting reading. It is the weakening of the electrical current in an ordinary wire conductor that limits the distances over which such a wire can transmit a message. The loss of energy is due to the imperfect conductivity of the wire, and it is regulated by the inductance and capacity of the circuit. If a conductor has a high inductance, a given quantity of energy will be transmitted with less loss than over a conductor with a smaller amount of inductance—a fact that was well known to the English mathematical physicist Oliver Heaviside. It was known that the introduction into the circuit of inductance coils should theoretically give improved results; but, although such coils had been used, for want of an underlying mathematical theory to govern the experiments, they ended in failure.

Dr. Pupin set out to develop such a mathematical theory, and its main features were shown in a series of experiments in the vibrations of flexible cords, the same elements being present in the transmission of wave motion along a cord as in the transmission of electrical waves. If one end of a cord be fastened to one end of a tuning-fork, the other end to some fixed object, and the fork vibrated a wave motion results, whose amplitude will decrease as the distance from the tuning-fork (the source of vibration) increases, the energy being dissipated by the frictional resistances in its progress as the wave advances along the cord. This "attenuation" (to adopt the electrical term) is diminished if a string of greater density is employed, because a larger mass requires a smaller velocity in order to store up a given amount of kinetic energy, and a smaller velocity occasions a smaller frictional loss. Experiments with balls of wax attached to the string at certain regular, determined intervals, secured the desired result in preventing attenuation. The mathematical theory and law for the vibration of a cord under such conditions is exactly the same as that governing the distribution of the electric current over a wave conductor under the influence of similar forces. For kinetic or mass reaction, tensional reaction, and resistance reaction in the case of the cord are paralleled by electro-kinetic reaction, capacity reaction and ohmic resistance reaction in the case of the wave conductor. This being so, it is easily understood that if inductance coils are introduced along the wave conductor, at periodically occurring intervals, the efficiency of the transmission of electrical energy is increased.

The next step was from theory to an experimental investigation, in the course of which Dr. Pupin constructed three separate experimental cables before he brought the results into agreement with the theory. The first cable was 235 miles, the second 500 miles, and the third and successful cable 250 miles in length. In the last cable double coils, 6 inches in diameter by 5 inches high, with 1,160 turns, but having no iron cores, were used, and with this apparatus it was found that if these inductance coils were placed at intervals of about one-sixteenth of the wave length of 17 miles, the non-uniform conductor was like a uniform conductor to within two-thirds of one per cent. It was found, indeed, that if the coils are properly placed, 2½ per cent of the current generated at the transmitting end reaches the receiving end of the cable; but if the coils are cut out, and the cable is used in the ordinary way, then only one two-hundred-and-fifty-thousandth part of the current sent in at the transmitting end reaches the receiving end. The insertion of the coils enables the cable to transmit six thousand times as much current.

The work done by Dr. Pupin since the publication of the article above referred to consisted in an investigation of the question of the best form of coil for commercial purposes. The coils used on the experimental cable, although they are effective for an air line, and have, indeed, been used on a Bell telephone air line of 700 miles, are too large for submarine or underground cables; and for the latter purpose Dr. Pupin has produced an inductance coil with an iron core which provides a large magnetic mass and enables the size of each conductor to be reduced to the external dimensions of about 2 inches by 2 inches by 3 inches. For submarine cables these coils would be placed at intervals of an eighth of a mile, and for land cables at intervals of 2 miles. The introduction of the iron core in the inductance coils, by considerably reducing the bulk of the coils, has rendered their installation thoroughly amenable to the arbitrary constructional requirements for long distance cables, particularly in submarine work; for the whole device can now readily be included within the sheathing of the cable. We are informed by Dr. Pupin that the extreme distance over which the present system of telephony will be fully available is 3,000 miles.

THE KRESS AIRSHIP.

Herr Wilhelm Kress has completed his model of an airship, and he is now working on a large vessel. In brief his system consists in an aeroplane operated by a light benzine engine. Great wings of silk or hemp are extended by means of steel ribs, resembling the spokes of a bicycle wheel. These would in themselves act as parachutes and allow the car beneath to descend gently. This car rests on runners like those of a sled which would enable it to glide on ice, snow or glass, and it is arranged so that it can also rest on water. The machine is to be raised and moved by two propellers similar to a ship's screws. These, while propelling the vessel, will make the wings or sails face the air. With these latter, or part of them, directed upward, a power will come into action which will first support the weight of the boat and then raise it in the air as it grows stronger. The screws are to be actuated by a benzine motor of 20 horse power of great lightness. The first experiments with the full-sized airship will be made in the spring on the Lake of Neusiedel, on the Hungarian frontier.

THE INTERNATIONAL CONVENTION FOR THE PROTECTION OF INDUSTRIAL PROPERTY.

The Convention for the Protection of Industrial Property was drafted at a conference held in 1880 at Paris, France, and it was signed in the same city, March 20, 1883, and the United States accepted it in 1887. The Convention, to which every first-class power in Europe, except Russia and Turkey, has now adhered or given notice of such intention, relates on the one hand to patents for inventions, industrial models, and designs, and on the other to trade marks, trade names, and indications of origin. The Convention provided for periodical conferences for revision. The first conference was held in Rome in 1886, and was without substantial effect, the propositions not receiving unanimous ratification. The next conference was held in Madrid in 1890, where some agreements relative to trade marks, to which the United States is not a party, were entered into. The next conference was that of Brussels in 1897, and the meeting held in December, 1900, was the adjourned meeting. This last session will take rank with that which framed the Convention, if the Act (amendatory of the original article) which has just been signed by the delegates accredited to it, is finally ratified by those countries whose laws, like those of the United States, require ratification before they take effect. We have already referred to the original Convention on several occasions, and the conference at Brussels has remedied several defects which were thought to exist in the patent laws of many of the countries in the Convention. In brief, the following results were arrived at: First: Concerning the independence of the patents in the different countries, it is well known that the validity of patents has been endangered in many cases by the fact that in some countries a patent lapses if, for any cause, the patent lapses in another country, as, for example, for the non-payment of fees. This is a hardship, and compels the owner of the patent, in more than one country, to look not only to keeping the patent in his own country alive, but also those in other countries. Second: The Convention has also extended the time of filing applications from six or seven months to a uniform period of one year, and the shorter period for four months for industrial designs, models, and trade marks. Third: The conference agreed that the Convention should be amended so that American inventors who had taken out patents abroad need not work their inventions in those countries which are members of the Convention for a period of three years after the application for the patent. This feature, if adopted, will enable our inventors to develop their business in the United States before working their inventions abroad, thus in many cases saving a considerable sum.

As to trade marks, there was a great deal of discussion on the amendment of Article VI., which requires the registration of marks good in the country of origin in all the other countries. This met with such opposition that the article was left untouched. The period of delay for trade marks similar to that of patents was made uniform, being four months, instead of three and four months, as at present. This is of little interest to citizens of this country, as it refers to trade mark laws which are not similar to our own, and under which it is expected that trade marks should be registered before use instead of after, as in this country. The provisions of the Convention against false indications of origin are extended to agricultural products, thus protecting our fruits. A new article was inserted granting the same protection against unfair competition to citizens of the United States as is granted to citizens or subjects of any other of the countries of the Convention. This inclusion within the Convention of protection to agriculturists and of the doctrine of unfair competition may be regarded as a distinct advance.

The personnel of the Convention was of the highest character. The delegates, of whom forty-five were in attendance at one time, were the ministers of the several members of the Union, supported by the heads of the offices of the different countries which are con-