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AWARDS TO AMERICAN EXHIBITORS AT PARIS.

The authorities of the Paris Exposition have made some amends for their delay in opening the gates to an incomplete World's Fair, by commendable promptness in the matter of making awards. The deliberations of 121 juries were conducted during the hottest months of the year, which added to the difficulty of passing upon eighty thousand entries in the time at their disposal. The question of the personnel of the juries, their organization and the value of the awards, while interesting subjects, need not concern us at the present time; but there is one phase of the matter which is remarkable: this is the high rank which the United States has taken both as regards entries and awards.

The total number of entries was 79,712, France naturally coming first with 31,946; then follows the United States with 6,674. Italy with 3,188. Russia with 3,113, Germany with 2,586, and Great Britain with 1,688 entries. Strange to say, the largest exhibitors next to the United States were countries of minor importance as regards the general interest of their exhibits; thus, Hungary had 3,304 entries, Portugal 3,381 and Mexico 3,419, while some countries, such as Jamaica, Port d'Espagne, Singapore and West Australia, had only one or two entries.

Disregarding the lower forms of award, such as "honorable mention," bronze medals and silver medals, let us consider the two highest premiums, the gold medals and the much-coveted "Grands Prix," which is the highest distinction that any exhibitor can obtain except, possibly, by securing a decoration. Our 6,674 entries have obtained for the exhibitors no less than 200 Grands Prix and 642 gold medals. The "entries per award," as regards the Grands Prix, were 33·3, and 10·4 as regards the gold medal. While we were out-percentaged by some of the other nations, at the same time the showing is a good one when the enormous number of our entries is considered, for we follow France very closely. Her entries per award were 27·3 for the Grand Prix and 5·7 for the gold medal. The United States exhibitors have distinguished themselves in every branch of art, education, and industry. In education we follow France, the jury having given us in this class 32 Grands Prix and 63 gold medals, which is a wonderful showing. In the fine arts it must be said that our success is not as great as that of Italy, Germany, and Great Britain, but otherwise we have received the largest number of awards, namely, 5 Grands Prix and 14 gold medals. In the liberal arts we have also taken high rank, being excelled only by France and Germany, all other countries following the United States. In the classes under this general head we took 17 Grands Prix and 41 gold medals. In machinery we are also excelled by France and Germany, taking 10 Grands Prix and 26 gold medals; in electricity the same conditions prevail, France and Germany exceeding us only in the number of awards, the United States taking 6 Grands Prix and 23 gold medals. In civil engineering and transportation we took 16 Grands Prix and 65 gold medals, and we are again excelled only by France and Germany, both of which have wonderful exhibits in this class. In agriculture, the United States did exceedingly well, taking 22 Grands Prix and 64 gold medals, but in this class we have to bow before Roumania and Russia, these countries having succeeded in each carrying away over a hundred prizes. In horticulture, forestry and sport, the United States did fairly well, as they also did in food products. In mining and metallurgy the United States ranks next to France, taking 18 Grands Prix and 42 gold medals, in this case distancing Germany by more than 38 prizes. In furniture and decoration we also take a prominent position, coming directly after France and Germany. We are excelled by quite a number of countries in textiles and clothing. In the chemical industries we obtained 7 Grands Prix and 26 gold medals, this number being excelled only by Germany and Russia. In social economy and hygiene we take a very high place, receiving 28 Grands Prix and 106 gold medals, coming next to France. In the army and navy we did not have as good a showing as France, Russia and Germany, but we lead Great Britain and other countries.

We have every reason to feel gratified with the remarkable showing, for it must be remembered that to exhibit in Paris necessitates the expenditure of considerable money for transportation of exhibits and maintenance. The majority of the United States exhibits had, of course, special representatives to give information relative to their display. It is much more difficult for an American firm to install a satisfactory exhibit than a British or German firm. If there is another international exposition in the course of the next ten or fifteen years, we may expect that the United States will take even a more prominent part than she has heretofore, as she is now doing in the export trade of the world.

POULSEN'S TELEGRAPHONE.

On another page will be found a full description by our Paris correspondent of an invention which has not only added to our store of electrical apparatus an instrument destined to take its place in our daily life, but also forcibly demonstrated that commonplace physical phenomena, so commonplace in fact that they are no longer remarked, when studied and fully grasped by a master mind, may be applied to ends little dreamt of. The invention in question is a phonograph which magnetically records the sounds converted into electric vibrations by a telephone.

In every college lecture room a simple experiment in magnetism is performed, which has been so often described that it should be familiar to everyone—an experiment which consists in writing with a magnetic pen upon a uniformly magnetized steel plate. At certain places the plate's magnetism is enfeebled, and at others strengthened; so that when the iron filings are distributed over the plate, the letters or words written by the magnetic pen immediately become visible. Upon this simple principle of variable magnetization, Poulsen's "Telegraphone" is based. Instead of a steel plate, a steel wire or ribbon is employed, which is passed between the poles of an electro-magnet and permanently, though ununiformly, magnetized by the variable electric currents generated by the vibrations produced in the diaphragm of a telephone transmitter by acoustic impulses. The record thus magnetically transcribed can be reproduced at a telephone receiver by causing the wire or ribbon to pass again between the electro-magnetic poles, so that variable electric currents are produced in the circuit to affect the diaphragm of the receiver.

Although the physical basis of the telegraphone has long been known, it is none the less astonishing to find that the differences of magnetism in the wire or ribbon are sufficiently pronounced, and that the magnetic and electric forces entering into consideration are intense enough to secure the result desired. Indeed, Poulsen was compelled to produce a working model in applying for his patent, in order to convince the skeptical authorities that his invention was based on physically sound principles.

A quarter of a century ago Bell invented a device which aroused no little interest by reason of an exceptional simplicity which contrasted sharply with the manifold phenomena of motion which it was its function to reproduce. Indeed, there is probably no other apparatus in the entire field of technology which transmits such complex movements with such simple means. A small magnet, an iron core or two, a steel plate, wire coils, and two conductors, that was all which Bell used in transmitting the extremely intricate and swiftly changing acoustic vibrations of the human voice. A careful consideration of the telegraphone proves that its Danish inventor has devised an instrument which is almost as ideally simple as that of Bell.

With the invention of the telegraphone, Poulsen may incidentally have solved a problem which has presented unusual difficulties. What the relay is to the telegraph, his instrument may possibly be to the telephone. In telegraphy, as we all know, the very long conductors employed increase the resistance to such an extent that the electric current can be transmitted only to limited distances, for which reason a relay is used at the end of a circuit to serve as an automatic key for the next following circuit. The conditions are exactly similar in telephony. The longer the wire, the feebler will the current be at the terminals. For years it has been the self-imposed task of inventors to devise a telephone relay which would answer the purpose of the large telephone systems. Poulsen's apparatus seems designed to meet the requirements which can be exacted of a telephone relay.

But the telegraphone may play not merely the part of a relay; it may even perform functions similar to those of the duplex telegraph. For the last decade an apparatus has been used to send two, and even four or more messages over a single telegraph wire. In telephony, on the other hand, each conversation, as a general rule, must be transmitted by a separate circuit. In Germany, Sweden and England a device is used whereby it is possible to transmit three conversations over two circuits. The task of providing a duplex telephone is, therefore, nearing its accomplishment. The problem seems to have been completely solved by Poulsen's collaborator, Pederson, whose invention is described in the article already referred to.

Although we have not had an opportunity of examining Poulsen's telegraphone in this country, and although the account of our correspondent is based largely upon tests made at the Paris Exposition, we are, nevertheless, assured that the instrument has been used in the Danish telephone systems with no little success.

MECHANICAL STOKING IN THE UNITED STATES.

Among the signs of the times in the world of steam engineering is the wonderful growth during the past decade of mechanical stoking. Not merely is this scientific method of firing being adopted for isolated steam plants of moderate capacity, but it is safe to say that mechanical stoking has come to be regarded as a *sine qua non* in the equipment of a large modern power station. Just how extensive has been the growth of this industry may be judged from the fact that one firm alone in this city, who handle what is probably the most successful form of stoker in existence, are now installing at the power houses of the Metropolitan Street Railway Company of this city, mechanical stokers for a total of 66,000 horse power of boilers, while they are, furthermore, equipping over 225,000 horse power of boilers in various parts of the United States.

These figures are particularly striking when we bear in mind that the era of the rapid growth of the industry in this country has been confined almost exclusively to the decade which is now drawing to a close. As a matter of fact, at the commencement of this decade there were only three mechanical stokers manufactured in this country, and the activity which is now manifest in the invention and improvement of existing forms is due to the stimulus offered by the excellent results achieved by the Murphy, the Brighman, and the Roney types. The later forms are almost entirely improvements upon designs which had been patented either here or abroad previous to 1885.

Equally curious is the fact that although the application of this industry on a large scale in this country is of such recent date, mechanical stoking, as such, is as old as the steam engine itself. The earliest records of this subject show that the first mechanical stoker to be patented was one designed by the inventor of the steam engine himself, and it is to the credit of James Watt that the design, crude as it may have been, embodies the essential features of any good mechanical stoker. The coal was fed at the furnace door, and as it became coked was pushed back over two sets of horizontal grate bars. At the front of the furnace it became coked, and the gases from the coking fuel passed over the partially coked and live fuel in the middle and at the back of the grate, where they were completely consumed. Such, in principle at least, is the mechanical stoker of to-day.

The popularity of mechanical stoking is to be set down to the relative obvious advantages over stoking by hand. In the first place, the feeding of the fuel is constant and even. The fresh fuel being introduced only at the front of the furnace is very gradually coked, the liberated gases meeting with a supply of fresh air led in by special ducts to provide the necessary oxygen for combustion, and the bed of incandescent fuel over which the gases pass serves to raise their temperature to the ignition point and secure their perfect combustion. A further advantage is the ease with which a bed of fuel of uniform thickness may be maintained over the whole grate surface. Furthermore, there is the prevention of a serious loss of heat due to the necessarily frequent opening of the fire doors in hand firing, which not only reduces the temperature of the furnace by allowing streams of cold air to impinge on the tube sheets, but subjects the latter to serious strain, and is a fruitful source of leaking tube ends. Other advantages are the great saving in labor in plants which require more than one fireman in firing by hand, and the abatement of the smoke nuisance, due to the very perfect combustion. A further improvement, which is readily appreciated in the engine room, is the uniformity of the steam pressure, rendering the boiler better able to respond to heavy demands for steam. It is stated by an inventor who has had more to do with the modern development of mechanical stoking in this country than any other man, that a well designed stoker, as compared with a hand-fired furnace, will save ten per cent in the fuel, while one man operating a stoker will do as much as two men engaged in hand firing; this last estimate referring to the smaller plants. Where the boiler plant is of such a size as to warrant the installation of coal and ash handling machinery, the reduction of labor is estimated by the same authority to be about seventy-five per cent.

In view of the remarkable growth of the industry we are publishing in the SUPPLEMENT a series of illustrated articles, commencing with the issue of last week, in which some of the most representative forms of mechanical stokers will be fully illustrated and described.