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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RAILROADS IN SWEDEN TO USE ELECTRIC SYSTEM.

The Swedish government is thinking seriously of using electric traction on the State railroads, the current to be obtained from the numerous waterfalls which are found in that country. To this end Parliament has been asked to vote a large grant for the transformation of the system. Preliminary trials are to be carried out on a section of the Varta railroad, also on a portion of the line running from Stockholm to Jarfra. The current for this purpose will be furnished by the Stockholm central station and from a temporary plant which is to be installed at Tomtebodå. Four large electrical firms have already submitted plans for the trial of their systems, the Siemens-Schuckert, Allgemeine, Oerlikon, and English Westinghouse companies. While the movement is taking place in Sweden, the same question has come up in Switzerland, another country possessing large water power. A conference recently held at Berne, in which were represented the government and private railroad lines and also the leading engineers and electrical constructors, appointed a commission which is to make the preliminary investigations and draw up a series of propositions within one year. In Italy, where a number of electric railroads are working successfully, it is now proposed to use electric trains on the Milan-Venice railroad, using the third-rail system which is at present employed on the Milan-Varese line.

RECENT EXCAVATIONS AT CARTHAGE.

M. Gauckler, whose work in the excavations at Carthage is well known, has lately made an interesting discovery, having found one of the most important constructions of the Roman epoch. This is the theatre where Apuleius held his conferences, which is often mentioned by Tertullian and St. Augustine. It seems that the edifice was built at the beginning of the second century A. D., and was afterward destroyed by the Vandals. No exact indications have been given as to the site of the edifice, which was often confounded with the Odeon, recently uncovered near by, and it was supposed to have been entirely destroyed. The present excavations now elucidate this problem. The first trench which was opened in the supposed axis of the theatre proves that the structure is preserved in a fairly complete state, buried under 25 feet of earth, and that its dimensions are colossal. At the present time the excavators are approaching the stage and are beginning to discover the architectural decoration of the latter, with its capitals and cornices. Before long it is hoped to find statues and various ornaments analogous to those which were discovered in 1900 on the site of the Odeon. At present a very fine oval cameo upon agate has been brought to light. It represents the head of Pallas-Athene, bearing a helmet. The head is in white upon a background of pale yellow.

WAVE-OPERATED CLOCKS AT PARIS.

M. Bigourdan has been making experiments in Paris on a system of wave-operated clocks, and proves that such a system can be practically operated and would be of considerable value in a large city. Paris has already a system in which fifteen electric clocks in different parts of the city are connected with the Observatory. But the system is costly on account of laying the wires, and its use is limited. The wave method is cheaper and more practical. A main clock which operates an electric contact each second, works a relay which sends current into the primary of an induction coil provided with an oscillator. The secondary thus gives an oscillatory discharge for a very short time, which is regular for each second. By using a mast, the signals can be

sent to the receiving clocks. Two kinds of receivers are used. The simplest is a radio-telephone of the Popoff-Ducretet pattern, in which a beat is heard each second. The second is the receiver of an ordinary wireless telegraph receiver. Better signals are formed by using a chronograph band and pen to replace the ordinary Morse band. With this apparatus, which unrolls one centimeter of band per second, the time can be read within 0.02 seconds. The experiments were made at 1.2 miles distance, and this could easily be increased. To number the seconds the emissions would occur at the zero second of each minute, and an interruption could be made at intervals of 10 seconds. Such a system would be a great convenience for scientific and industrial establishments, watchmakers, and other places where correct time is needed.

THE GREAT SIZE OF THE ST. LOUIS EXPOSITION.

The American people are credited with a love for big things; and if the mere element of bigness were its strongest attraction, the great Exposition at St. Louis ought to be the most popular and successful of the many exhibitions of the kind to which the country has been treated during the past decade. Yet anyone who is present on the grounds, and takes careful note of the vast throngs which are to be found trying to make the round of the two square miles that are devoted to the Exposition, will be forced to the conviction that if the mere size of the Fair is an attraction, it is an attraction that is more of a sentimental than of a practical character; for it must be confessed that for the average visitor, with only limited time at his disposal, the Exposition of 1904 is altogether too big.

Judged from the merely spectacular side, the vast proportions on which this enterprise has been planned and carried out have served their purpose well; for a view of this wonderful congregation of buildings, taken, let us say, from the steps of the great Festival Hall, is certainly as magnificent, beautiful, and artistically impressive as anything that could well be imagined. But when, after giving himself up to the emotions that are aroused by this splendid panorama, the visitor sets himself resolutely to the work of inspecting the buildings and their exhibits, the conviction is soon borne in upon him that to gain anything more than a cursory glimpse would be a work calling for several weeks, if not months, of study. The problem is particularly serious, if he is desirous of following up only certain lines of exhibits, which may be, and probably are, scattered throughout several different buildings on the grounds. The exhibition palaces themselves are so immense, the distances between them so great, that it is impossible to follow out a line of investigation of this kind consecutively, day after day, without becoming practically exhausted.

Now we say this, not in any spirit of unkindly criticism, but merely to draw attention to the fact that in the endeavor to make an International Fair of this kind represent, by its vast proportions, the extent of the resources, the range of the industries, of the country which it represents, the limits of practical usefulness have been far exceeded. It must already have forced itself upon the sponsors of this exposition that future exhibitions of the kind must be restricted in their dimensions.

The difficulties of adequately seeing the Fair and inspecting in detail the various exhibits, might have been largely reduced if the Intramural Railway System had covered at least four times as much ground as it already does. At present, as actually built, in making the outside circuit of the grounds it covers a total distance of about eight miles; and when we remember that the Exposition grounds, which are in the form of a parallelogram, measure one mile in width by one and three-quarters miles in length, it can be understood that the distances across the main group of buildings, encircled by this road, are necessarily very great. Had intersecting lines of track been run in gridiron fashion through the main plazas and causeways, the problem of transportation would have been greatly simplified. Nor would the presence of these tracks have marred the landscape and architectural effects. So vast are the various plazas and courts, that the presence of the trains would scarcely have been noticed.

To give some idea of the great scale upon which the place is laid out, let us consider one single building, the Palace of Agriculture. The plan of this structure is a parallelogram, which extends in width for five hundred feet and in length for sixteen hundred feet. It contains eight or nine corridors, each sixteen hundred feet in length, crowded each of them on both sides with exhibits, and it is intersected throughout its full length with numerous transverse corridors. This means that anyone wishing to cover the whole field of exhibits within this single building, would have to walk at least three or four miles. The other industrial palaces, though not so large as this, are every one of them of great proportions. Thus the United States Government Building is 250 feet wide by 800 feet long; the Palace of Mines and Metallurgy

is over twice that width and of about the same length. Then we have the Palace of Manufactures, 1,200 feet in length by 525 feet in width; the Palace of Varied Industries of the same dimensions; and the Palace of Transportation of the same width, but 1,300 feet in length. And so it runs, each of these buildings containing a covered acreage that would represent a large proportion of the total area that was under roof at the Centennial Exposition at Philadelphia.

To those people for whom the theories of Bellamy have an attraction, the problem of attempting to house 5,000 people in a single hotel within the grounds will present a decidedly interesting study. Of course, nothing of the kind, or even approaching it, has ever before been attempted; and considering the ambitious scale on which the hotel is being run, probably the guests are securing about all they can reasonably ask for. But here again the distances to be traversed become a serious problem, as may be judged from the fact that the writer, on starting out for the day, found that a rainstorm was threatening, and in returning to his room for an umbrella had to cover nearly half a mile of walking before he was back at the main entrance.

However, it must, in all fairness to the management of the fair, be admitted that having once planned it upon such a stupendous scale, they have carried out their work with commendable success. And to those who come to the Exposition with time to study its marvelous assemblage of exhibits, leisurely and with patience, it will yield a fund of information and a marvelous range of sights and sounds and impressions that must prove for many a year to come a subject for pleasant and profitable recollection. The number of Americans that have the means and leisure for foreign travel is at best but a small percentage of our population; and every one of this great majority should, if he be able, avail himself of this opportunity to study this "pocket edition" of the great world in which we live.

NEED OF COTTON-PICKING MACHINES.

The high price of cotton in the past year, with little promise of a return to former low prices, has stimulated unusual inquiry into the causes, and made the question of cotton planting, picking, and manufacturing of paramount importance. The part that machinery has played in the development of our cotton industries in this country has greatly affected conditions that existed half a century ago; but to some extent it has still left untouched the most expensive department of the cotton industry. While machinery has been successfully invented for harvesting and planting nearly all of our other agricultural crops of importance, such as corn, wheat, rye, and many of our fruits and vegetables, the gathering or picking of cotton is still done by hand in the most expensive way.

The harvesting of the cotton crop represents the largest item in the cost of production, and consequently the demand for adequate machinery for doing the picking increases each year in proportion to the advance in prices and the steady increase in consumption. The labor item for harvesting cotton is so large that it would seem reasonable to justify the economic need of slaves as in the old days before the war. The early cotton planters claimed that cotton could not be made a profitable industry without slaves, and to some extent their view was a correct one. Unless machinery could be invented to take the place of the cheap slave labor in the cotton fields, cotton growing either could not prove profitable or the consumers would have to pay higher prices for the commodity.

The latter condition has resulted, and it is doubtful if prices for cotton will ever go down to their former low level until some successful cotton-picking machinery has been invented. In picking and harvesting upland cotton about twenty per cent of the entire cost of production is used up in this one item, while it takes even more for harvesting sea-island cotton. In the harvesting season of cotton in the South, the difficulty of getting sufficient pickers is the one great reason why the acreage is not extended. It is comparatively easy for a cotton grower to raise a good acreage of cotton, but when he comes to consider the question of harvesting it, he stops to consider whether it is wise to increase his responsibilities. Thus a farmer with modern machinery for plowing, harrowing, planting, and cultivating can raise thirty acres of cotton without depending upon hired help; but in the harvesting season he would have to employ four men at least to pick the crop during the harvesting months of fall and early winter. It is often necessary that the crop be picked within a month to secure the best results, and in that event the picking force would have to be more than doubled.

Cotton picking to-day is much what it was a century ago. There has been no gain or improvement in the method. The slave darky of ante-bellum days could pick as many pounds of cotton as the free darky of to-day. A fair average day's work for a picker is about 100 pounds of seed cotton. Allowing 130 days for the harvesting season, each picker working steadily would thus gather 13,000 pounds of seed cotton as his share