Changes in the Power Station

AS was to be expected in an "off" electric railway year the power plant was not the scene of any sensational development during 1915. Nevertheless the year was one of substantial progress. A most notable event was the adoption of a standard boiler code by the American Society of Mechanical Engineers after years of work on the part of a special committee appointed to prepare it. The effort necessary to bring this proposition to a satisfactory conclusion and to harmonize conflicting interests was comparable with that now being exerted on the proposed national electrical safety code mentioned elsewhere. This code includes boiler design, construction and materials. It is therefore analogous to only a part of the electrical safety code.

Some progress has also been made in the direction of a more rational unit for rating boilers, at least to the extent of an increasing recognition of the inadequacy of the old nominal horsepower rating. There are two inconsistencies in present practice. In the first place it is ridiculous to rate a boiler in horsepower, because this rating, if anything but nominal, must involve the water rate of the engine or engines furnished with steam by the boiler. Second, the output of a boiler depends very largely upon the furnace. Hence a unit should be used which will permit the separation of the furnace from the boiler proper.

The committee on power generation of the A. E. R. E. A. emphasized last year the importance of more systematic accounting in this field and outlined a general plan for keeping records which should make the interchange of data more practicable. Obviously the more readily comparable the data from different power plants can be made the more rapid will be the advance in power generation economy. One result of interchanging data will be a better realization of the fact that the nature of the load is related to the cost of energy.

This journal has more than once directed attention to the high cost of peak-load power. Where power is purchased there is no difficulty in realizing this cost as the terms of the contracts specifically include it. It is more difficult to comprehend when a company is generating its own power.

One of the most significant events in the history of electric railway power generation occurred recently when the splendid Ninety-sixth Street power plant of the New York Railways in New York City was shut down because it could not compete with the remodeled Seventy-fourth Street plant of the Interborough Rapid Transit Company, which supplies power to the New York Railways. The latter plant now contains three steam turbine generators of 30,000 kw. each, rendering obsolete the great Corliss engines which once made the Seventy-fourth Street plant famous. Large power-generating systems, large individual plants and small plants as well are being made over to enable them to profit by the advances in machinery design. An instance of the "rejuvenation" of a small plant, that at Springfield, Ohio, was described in a recent issue of this paper. In this plant a novel form of condenser was employed, one in which the surface and jet types were combined. This invention suggests that the condenser still furnishes a fertile field for the ingenious designer.

The electrical end of the power plant has kept pace with the steam end, although the problems met by electrical designers are not of general interest. The manufacturers of electrical machinery are endeavoring to obtain consent to permit it to be run hotter, under certain conditions, than was formerly considered desirable. As it is the permissible rise in temperature which largely determines the weight of electrical apparatus, it is to the advantage of all concerned to have it operate at as high a temperature as is possible without involving excessive maintenance costs. As the radiating surface in electrical apparatus increases less rapidly than the volume, the difficulty of radiating heat becomes greater as the capacity of a unit is larger. Users appreciate this, but they wish their generators and transformers to have long life, hence are reluctant to permit greater temperature rises. The standards committee of the A. I. E. E. is taking a conservative position in the matter.

Electrification for Freight Service

FROM the commercial standpoint, it may be said that not even a good start has been made in exploiting the opportunities for profitable installations of electric operation on steam railroads. This condition of affairs is chargeable to many causes, of which the majority are, perhaps, indirect and more or less obscure. Among them, the "battle of systems" has played an important part in the past, but at the present time, when actual results have displaced estimated figures, the industry has settled down to a general acceptance of the belief that in most cases the proper choice of "system" is not open to question and that with the cases that are on the border line there is not enough difference between them to be worth much argument. On the other hand, there is no doubt but that the success of electric operation of city and interurban lines, which originally drew attention only to the electrification of steam railroad suburban service, brought about the prevalence of an idea that electricity was primarily a means for handling passenger trains, and this has made its use in any other service seem somewhat like a dangerous experiment.

During the ten years' experience with electrification problems, the field of freight service, and especially long-distance freight service, where the greatest economies seem to be made available, has been completely neglected. On the New Haven system, it is true, freight trains have been hauled electrically for some three

years, but because of the limited length of route, only 70 miles, in combination with a not inconsiderable proportion of the traffic diverted to branch lines at intermediate points, the service cannot by any means be classed as long distance. In consequence, the Chicago, Milwaukee & St. Paul electrification, which was placed in operation only last month, constitutes actually the first step toward a demonstration of what may be attained by the thorough exploitation of this opportunity.

Naturally, the return that will be made upon the first cost of this installation cannot be definitely determined until after a year or more of actual operation, but that the investment will be directly profitable can hardly be doubted. The work was undertaken solely upon grounds of economy in operation, and no indirect benefits such as smoke elimination, or increase of terminal capacity entered into the calculations.

Only two other projects undertaken primarily with the idea of obtaining direct profit appear in the history of trunk-line electrification. These are the Butte, Anaconda & Pacific and the Norfolk & Western installations, and although the service in both of these cases is really switching and transfer work on a grand scale, it is significant that both involve a traffic almost exclusively of freight and that both have shown a handsome direct profit on the investment. This is more than any of the previous installations for passenger service have been able to do, and the conclusion is inevitable that the future of electrification will be in the field of freight traffic.

Of course, this does not mean that passenger traffic must henceforth be handled by steam, because the difference between hauling an 800-ton passenger train and a 2400-ton freight train is, in the end, largely a question of gear ratio, or its electrical equivalent. But where there is an ample amount of freight to be moved, the arbitrary conditions set up by passenger service may be eliminated, or at least offset, and the valleys in the daily load curve may be filled, while at the same time the necessity for protecting train movements with idle locomotives is relatively reduced.

That which has gone before, therefore, seems really to have been less of a period of commercial development than an elaborate series of technical experiments, these being made possible by highly artificial conditions which compelled electrification regardless of economic considerations. Freight traffic, up to the present, has been lacking, and without its aid there has been little chance of making really profitable installations. Electrification, in fact, has only just begun to be commercialized, and until it has reached the stage where general recognition is given to its ability to show a definite and direct profit, there is no use in expecting it to progress faster than any other interesting but highly academic experiment. This point, however, seems now within reach. Indeed, results from the St. Paul electrification are not needed to show that freight can be profitably moved by electricity but only to show what extra profits may be attained by long-distance hauls. In the immediate future, therefore, numerous electrifications of favorably situated sections of track are inevitable, because capital will always be eventually available where definite returns are assured.

Getting Together on Power Distribution

TO an unusual degree the past year was one of conferences and reports on power transmission and distribution subjects. This is a field in which utilities must get together. Overhead lines of different utilities, telephone and telegraph companies, lighting and power companies and electric railways must not interfere with each other either as to safety or reliability of service. The same is true of lines placed underground, although here there is less danger of interference. Where the utility uses a ground return there is the stray current to be considered. These facts account for the activity which is manifested in joint committees of one kind and another. The electrical safety conferences, which are closely related to power transmission and distribution, are discussed in a separate article. The joint committee on overhead and underground line construction, in the formation of which the Engineering Association took an active part, has been meeting monthly during the past year and has brought together a representative group of experts. G. W. Palmer, Jr., has been vice-chairman of this committee. While some difficulty has been experienced in bringing out constructive criticism of existing specifications progress is being made along several of the following lines of work laid out more than a year ago: Underground and undergrade crossings; crossings of electric wires over electric railway tracks; crossings of trolley contact wires; overhead crossings of wires or cables of telegraph, telephone, signal and other circuits of similar character over steam railroad rights-of-way or track, or over lines of wire of the same classes; overhead crossings of electric light and power lines, and parallel lines.

In May a comprehensive report on crossing specifications, prepared by a joint committee representing several utilities in Pennsylvania, was presented to the Public Service Commission of that State. This was the outcome of an exhaustive study by electric railway and other engineers and, while not yet formally adopted, stands as a monument to co-operative effort. It forms a booklet of 165 pages.

Another concrete and commendable piece of work accomplished in 1916 was the set of specifications for 600-volt overhead line material which was compiled by the power distribution committee of the A. E. R. E. A. This is a compendium of good practice in its field and should be extended, as soon as possible, to take in higher-voltage and catenary construction. This committee also did constructive work in systematizing the designs of concrete and steel poles. An important step was taken in the direction of rationalizing the formu-