

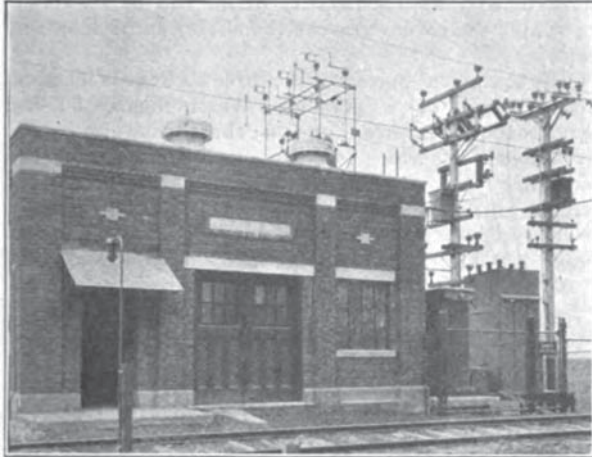
*Electric substations,
Automatic*

Substation Layout of an Ohio Railway

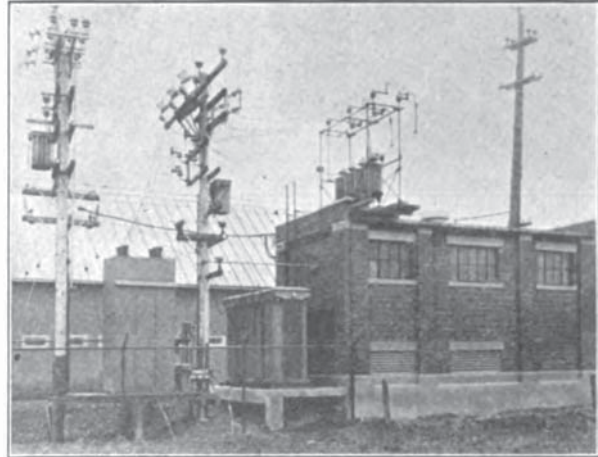
The Columbus, Delaware & Marion Electric Company Uses Three Automatic Substations on Its Interurban Lines, Operating in Conjunction with Two Manual Substations
—Some Details of Design and Construction Are Given

BY R. P. MEILY

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AUTOMATIC SUBSTATION AND WAITING ROOM AT RADNOR, LOCATED ON A 2 PER CENT GRADE. NOTE THE SIGNAL LIGHT OPERATED FROM WAITING ROOM BY PROSPECTIVE PASSENGER



REAR OF RADNOR SUBSTATION, SHOWING LOCATION OF TRANSFORMERS, SWITCHBOARD AND HIGH-TENSION EQUIPMENT AND THE ELECTROLYTIC LIGHTNING ARRESTERS ON THE ROOF

THE Columbus, Delaware & Marion Electric Company has recently completed the installation of three automatic railway substations which operate in conjunction with the manually operated station at the Scioto power plant and the Marion City substation.

This is a combined power and railway property with offices in Marion, Ohio. The main generating station is at Scioto, 8 miles south of Marion, on the Scioto River. This recently completed station has a capacity of 12,000 kw., and the layout contemplates an ultimate capacity of 24,500 kw.

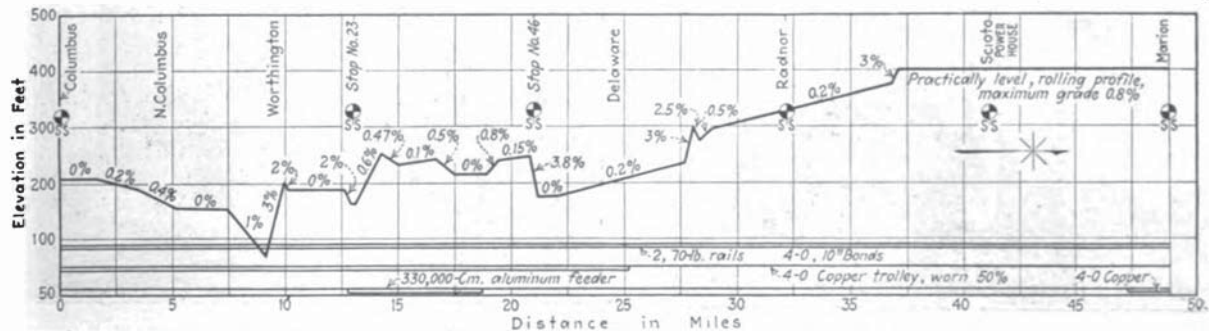
Alternating current is generated and distributed at 15,200 volts, three-phase, 60 cycles. A transmission line parallels the railway for both the power and railway loads, and alternating-current substations are located at Marion and Delaware, with numerous small secondary networks at intermediate points.

The railway lines serve a prosperous farming community with Columbus and Marion as terminals. Columbus has a population of 238,000, Marion 28,000 and Delaware, intermediately located, 12,000. City service is maintained in Marion and Delaware. In addition to the

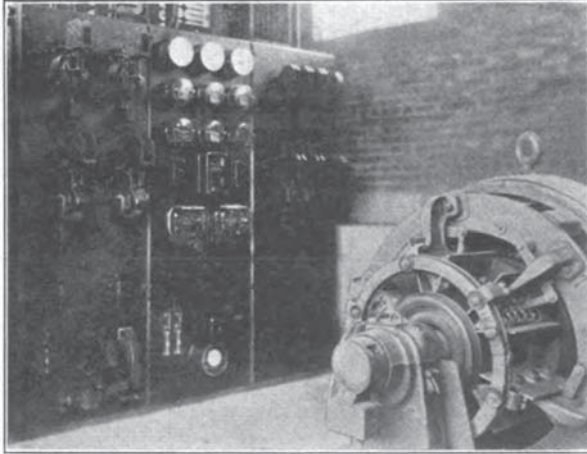
passenger service, both local and through freight business has been developed in spite of the competition due to parallel steam roads and an excellent public highway. The accompanying tabulation of data for the twelve months ended November, 1921, indicates the business handled, both passenger and freight, on the interurban and the city lines.

Most of the service in Delaware and Marion is handled by light-weight single-truck one-man cars. The interurban equipment consists of twenty cars weighing approximately 34 tons each. Hourly service is maintained out of Columbus and Marion, every other train each way being a "limited."

The right-of-way in general follows the Scioto River, resulting in a rolling grade, as indicated by the accompanying condensed profile. The most difficult grade is "Klingman's Hill," which is 2,000 ft. of 3.8 per cent grade. A standard-gage single track with numerous passing sidings has proved ample to handle the passenger and freight trains with a minimum of delay and layover. The run between terminals is 50 miles in length and is made in one hour and fifty-five minutes by



PROFILE, SUBSTATION LOCATIONS AND FEEDER LAYOUT ON THE COLUMBUS, DELAWARE & MARION LINES



INTERIOR OF COLUMBUS, DELAWARE & MARION AUTOMATIC SUBSTATION, SHOWING SWITCHBOARD AND CONVERTER

the limiteds and in two hours and twenty-five minutes by the locals. Five miles of this run is in Columbus proper and represents a half hour of the running time.

The portion of this mileage which is under automatic substation control includes all of the trackage south of the Scioto power plant, exclusive of the portion in Columbus, which is fed by the Columbus Railway & Light Company, over whose tracks the Columbus, Delaware & Marion operates. An interchange of power is effected near Stop No. 3, the trolley wire not being sectionalized for the present operation.

The map profile shows also the general layout with substation locations and copper distribution. In locating the stations, with regard to voltage regulation and copper economy, it was found that the locations thus determined could be made to serve as stops for the local trains. Accordingly it was decided to provide a waiting room in the same structure, by extending the building lengthwise to provide additional space 6 ft. x 12 ft. for this purpose.

By reference to the plan view of the station it will be seen that the only openings between the station and the waiting room are two louvers. The louvers are 2 ft. x 4 ft., one being placed near the floor and the other near the ceiling. By means of these openings an air circulation is obtained, the heat given off by the machine passing into the waiting room through the top louver and

back into the station through the lower one. The absence of other openings, except the small open doorway, causes the temperature of the waiting room to be several degrees higher than the outside air, by means of this natural circulation. The small difference in temperature is quite apparent, and the idea has worked out very well.

It will also be noted that louvers have been placed in the back of the building. These are for the purpose of providing better circulation in summer. They are provided with sheet-iron box covers located inside and so constructed that the quantity of air can be regulated. In winter the covers prevent the sifting in of snow and rain.

The equipment in each of the three stations is identical and consists of a standard Westinghouse 500-kw. synchronous converter and a three-panel automatic switchboard on which is mounted all the metering and switching equipment except the alternating-current oil circuit breaker. The direct-current lightning arrester is also inside the building and is mounted on a wall bracket at the right of the board, as shown in plan.

All of the high-tension alternating-current equipment was placed out of doors. This not only reduced the fire and other risks to a minimum but lessened the cost and size of the building.

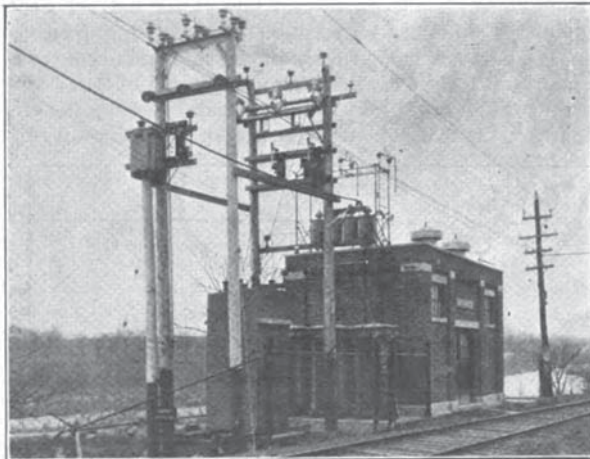
The transformers were swung from a flat car directly into position with the company's locomotive crane, as

OPERATING DATA FOR FISCAL YEAR ENDED NOVEMBER, 1921, COLUMBUS, MARION & DELAWARE ELECTRIC COMPANY

<i>Main Line</i>	
Passenger car-miles	818,042
Freight car-miles	152,166
Passengers, revenue	2,069,208
Passengers, transfer	247,473
<i>Delaware City</i>	
Car-miles	195,861
Passengers	486,500
<i>Marion City</i>	
Car-miles	451,902
Passengers	2,667,535

was the switch house. Should a transformer failure occur, the transformer can be replaced with a spare with a minimum of time and labor. The transformers rest on rails laid on a concrete platform, built as a continuation of the station floor.

The switch house is a sheet-iron cabinet which protects the automatic oil circuit breaker and the alternating-current metering equipment. The front and back of



ANOTHER TYPE OF AUTOMATIC SUBSTATION WITH WAITING ROOM ENTRANCE AT SIDE, LOCATED AT STRATFORD



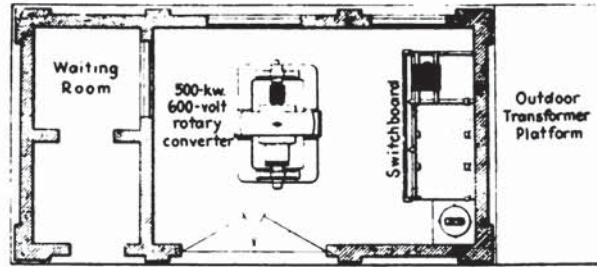
ANOTHER VIEW OF STRATFORD STATION SHOWING WAITING ROOM ENTRANCE AND SIGNAL FOR CAR

this house are hinged and can readily be thrown open for inspection.

Two types of pole structure were used in the line construction. The four-pole type is preferred, as the "disconnects," choke coils, operating transformer, etc., are less crowded than with the two-pole type. More room is available for guying the poles, also, and the general appearance is more pleasing.

The small transformer shown on the switch-house platform is the potential transformer for the alternating-current metering apparatus. The operating transformer is mounted on the pole structure. Electrolytic lightning arresters, which require charging once a week, are mounted on the substation roof. A high wire fence protects the outside equipment and prevents possible injury to passers-by.

Another feature which may be mentioned is the signal lamp operated by a passenger waiting for a local car. The circuit is controlled by a push-button in the waiting room and lights a blue lamp notifying the motorman to stop for passengers. Another is a small lamp mounted over the substation window. This lamp is lighted when the station is in operation. In the event the station



PLAN OF TYPICAL AUTOMATIC SUBSTATION WITH WAITING ROOM IN ONE END

failed to start, the motorman of a passing car would notify the train dispatcher by means of a telephone located in the waiting room.

From the operating point of view these stations have proved highly successful in maintaining an over-all efficiency of approximately 85 per cent. A careful inspection of each station is made once each week, at which time the lightning arresters are charged. The stations were designed and erected by the Columbus, Delaware & Marion Electric Company.

How Accidents to Employees Are Being Reduced on Chicago "L"

Influence of Officers and Management an Important Part in Results Obtained—
How Employees' Observations of Accident Breeding Conditions Are Habitually Turned to Corrective Measures Is Told

BY B. J. FALLON

General Manager Chicago Elevated Railroads

*Elevated railroads
safety
direct cost
measures*

WITH the reorganization of the safety work on the Chicago Elevated Railroads in January, 1920, a safety department was instituted and a safety engineer placed in charge of the work. The company had been doing safety work for a number of years, and in the reorganization it was the idea of President Britton I. Budd that the work of accident prevention should be intensified and that it should be in charge of one man whose sole duty would be to carry on a comprehensive safety campaign 365 days a year.

The foundation of the Chicago Elevated Railroads' plan for accident prevention is the development of the powers of observation of the employees of the company to such a point that their attention is immediately attracted by any condition or practice that is hazardous or likely to become so. By this plan it becomes a habit for them to be constantly on the alert for these conditions and either to take steps to correct the condition or to report it to the proper authorities and to see that the condition or practice is corrected before an accident happens.

The employees are impressed with the idea that their co-operation is sought to prevent accidents to themselves and to others by keeping safety always in mind. They are brought to realize that the prevention of accidents is alike a moral, a humane and a public duty owed by all.

A system of employees' safety committees was installed in 1920, and we have at present fourteen of these committees holding meetings twice a month for the consideration of safety suggestions and accident

prevention in their several departments. These committees are selected from the rank and file of the men and none of the supervisory force is a member of any of these fourteen committees nor does any member of this force, other than the safety engineer, meet with these committees.

There are five division safety committees, one on each of the divisions of the elevated lines, made up of the superintendent, master mechanic, general foreman, electrical foreman and the claim adjuster for the division. These committees hold meetings twice a month on the days following the meetings of the employees' safety committees. A central committee of five members, the assistant general superintendent of transportation, the engineer maintenance of way, the superintendent of shops and equipment, the electrical engineer and the safety engineer, hold meetings monthly or oftener if necessary.

Safety suggestion cards are provided and placed in all shops and at all terminals for the use of employees in making suggestions. These cards are sent to the chairman of the employees' safety committee of the department that is directly concerned in the proposed change and this committee acts on these suggestions at its meeting, either approving or disapproving each suggestion and giving the reasons for the action taken. The suggestion then goes to the division safety committee at its next meeting and is acted on in the same manner.

In this latter committee are the heads of the several departments on the particular division and in all cases