

CONVENTION ISSUE  
1908

# Electric Railway Journal

THE purpose of the annual Souvenir Issue of the ELECTRIC RAILWAY JOURNAL, which for a number of years has been published at the time of the convention of the American Street & Interurban Railway Association and its affiliated associations, the American Street & Interurban Railway Engineering Association, the American Street & Interurban Railway Accountants' Association and the American Street & Interurban Railway Claim Agents' Association, has been to give a rather exhaustive summary of the practice of electric railways along one or more special lines. In 1905 the four associations were reorganized on a joint basis, and it was decided that each association should confine itself to its own particular branch of electric railway work. The parent association, the American Street & Interurban Railway Association, continued for two years to consider all subjects pertaining to public relations, general policies, traffic and transportation matters and other operating problems not specifically covered by the work of the three affiliated associations. Last year, however, it became evident that the growing importance of traffic and transportation matters warranted the formation of a new affiliated association, which should be organized along the same lines as the three other associations previously mentioned, and should devote itself solely to matters relating to the traffic and transportation departments. The convention of 1908 is the first to be held by this new association.

In selecting the subjects to be considered in the Souvenir Issue each year a choice has been made of the topic which has seemed of the greatest interest at the time in electric railway development. During the year which has just passed the chief problems have been those of operation, and upon these the activities of most companies have been directed. It seemed most fitting, therefore, that the Souvenir Issue of the ELECTRIC RAILWAY JOURNAL in 1908 should be devoted to the subject of operating practice.

The subjects considered in this year's issue of the Souvenir include Employment and Training of Trainmen; Welfare Work, including descriptions of some typical club rooms, benefit associations and pension schemes; Train Dispatching Methods; Freight and Express Traffic; Passenger Traffic; Standards of Track Construction; Standards of Overhead Line Construction and Maintenance; the Design of Car Houses, and the Design and Equipment of Car Repair Shops. The aim has been to summarize the practice of typical city, suburban and interurban roads along these lines. In so far

as possible, the information has been gathered from roads in large and small cities, and in every section of the country, from Maine to the Pacific Coast, including some of the important cities in Canada, much of which is here presented for the first time. For the sake of completeness, some facts have been compiled from previous issues of the STREET RAILWAY JOURNAL and the ELECTRIC RAILWAY REVIEW, when recent inquiry has indicated that they are still properly descriptive of the practice in the different localities mentioned.

The form in which the matter is presented gives at once a concise but fairly complete summary of typical practice with many features of special and unusual interest. The information was gathered for the most part first hand through personal visits by the editors. About 20 city systems and as many more interurban roads were visited for this purpose. These companies were selected not with the idea of describing their methods as examples of the best practice, but with the primary purpose of including typical methods which would cover a wide range of local conditions and geographical locations. The publishers realize that the methods on many of the roads not mentioned are quite as interesting as on those discussed in the following pages, but limitations of space have prevented the publication of accounts of all. It was not even possible to include all the data on every subject considered which were received from the few roads visited by the editors.

In some instances information was obtained by correspondence. Thus it was thought the practice in train dispatching methods and employment of trainmen could not be properly presented with the limited amount of data obtained in person by the editors, and circular letters on these subjects were sent out. The letter on train dispatching methods was sent to 105 interurban roads and 70 answers were received. The circulars of inquiry on employment of trainmen were sent to 120 city and interurban roads, of which 91 sent replies in time to be used. In view of the well known experience of associations and others in attempting to secure information by correspondence and the usual paucity of replies, the results of the inquiry were very gratifying. The number of answers is a good indication of the interest manifested in these subjects by operating officers.

Acknowledgments are due to all those who assisted by furnishing the large amount of data required in the preparation of this issue.

# EMPLOYMENT OF TRAINMEN

ON the careful selection and training of applicants for the positions of motorman and conductor depends to a large extent the success or failure of the operation of any electric railway, for the men on the cars stand between the company and the public. The opening paragraph of the form letter of inquiry sent out to references given by applicants for employment by the Little Rock Railway & Electric Company expresses the company's view of the responsibility which rests on it in employing trainmen. "Mr. \_\_\_\_\_ has applied to this company for a position as \_\_\_\_\_ and refers to you for testimony as to his character. If appointed to this position, human life may depend on his judgment or be imperiled by his carelessness. He will, if appointed a conductor, have custody of the money of this company and will come in daily contact with the aged and feeble and with women and children who are entitled to the utmost courtesy and highest degree of care. This company feels seriously the responsibility of making such selections. There is too much at stake to accept applicants without the most careful inquiries."

More care is necessary in selecting applicants for positions in the train service on electric railways than in almost any other industry. The instruction period is necessarily short, and the men are put to work and given the care and responsibility of a car, after having had very little experience and only the rudiments of training in their duties. Few city systems have any facilities for putting the men through a long course of apprenticeship. A new man must be selected with the view of fitting him for his position in the shortest possible time. This condition is further complicated by the fact that new men must work without pay during the instruction period, and then must wait sometimes two or three months before being assigned a regular run on which they can earn a full day's wages. In view of these facts it is remarkable that the standard is so high on most roads. The usual requirements for employment on street and interurban railway systems are quite rigid and in general they are lived up to carefully. Occasionally, of course, when there is a shortage of men and it is absolutely necessary to have employees for the cars, the bars are let down and some men not quite up to the standard are employed. Occasionally such men turn out to be very satisfactory, but the requirements cannot ordinarily be made too rigid or followed too closely.

## REQUIREMENTS OF AGE

The requirements as to age vary somewhat, but on a large majority of the roads they are between a minimum of 21 years and a maximum of 45 years. On some roads these limits are stretched, as, for example, the Union Electric Company, of Dubuque, Ia., which has a minimum limit of 18 years and a maximum limit of 35 years. On a number of roads the minimum limit is as high as 25 years. The Toronto Railway Company places a minimum limit of 21 years for conductors but raises this to 25 years for motormen. This practice is also followed by the East St. Louis & Suburban, which has a minimum limit of 21 years for conductors and 24 years for motormen, and by the Inter-Urban Railway of Des Moines, Ia., which does not employ conductors under 25 or motormen under 27 years. The age limits of the Georgia Railway & Electric Company are 21 years to 40 years for conductors and 28 years to 40 years for motormen.

There is little if any difference between the practice of city and interurban roads in this respect. The motormen and conductors of city cars have just as much responsibility and the safety of the passengers and non-passengers depends as much on their care and alertness as in the case of the motormen and conductors on interurban cars.

## PHYSICAL REQUIREMENTS

Aside from the tests for vision and hearing, which are usually conducted by the company surgeon, the physical requirements for trainmen are seldom specifically defined. Applicants who do not appear to be in good general health or who have any serious visible deformity or evidences of injuries or poor health, are usually rejected in the preliminary examination by the officer in charge of the employment bureau. Many of the application blanks used require statements as to the general condition of the applicant's health, any deformities which he may have or any other physical defects which might impair his usefulness as a trainman. Answers to these questions frequently disqualify the applicant without going so far as subjecting him to a physical examination by the physician. Some roads, however, specifically define the general physical requirements of, and defects which disqualify, applicants for positions in the train service. The Indiana Union Traction Company, for example, gives the following physical disabilities which bar employment in interurban and city train service: "Loss of one eye, arm or leg, one thumb, more than two fingers, great toe, rupture, fits or fainting spells of any character, varicose veins, heart disease, syphilis, tuberculosis in any form and alcoholism." These are also the requirements of the Illinois Traction System and the Western Ohio Railway. The Birmingham Railway, Light & Power Company, in addition to the usual vision and hearing tests, requires applicants to be at least 5 ft. 8 in. tall, to be free from venereal disease, rupture or deformity, to show a good vaccination scar and to have heart, lungs and other organs in good condition. The Toronto Railway Company requires trainmen to be not less than 5 ft. 6 in. or more than 6 ft. 1 in. in height; conductors to weigh not less than 140 lb. and motormen not less than 150 lb. One of the common methods of determining, in a general way, the applicant's physical condition is to include on the application blank the question whether the applicant has ever been rejected as a risk by any life or accident insurance company. An affirmative answer to this question at once leads to a careful physical examination.

## GENERAL REQUIREMENTS

The class of men employed by electric railways depends largely on the local labor supply and demand, and to some extent on the ideas of the head of the transportation department. Most of the interurban roads prefer to recruit their men from among those who have been brought up in the country or in small towns where they have been subjected to clean and healthy surroundings and good moral influences. There is no doubt that this class of men make excellent employees. In many cities of the Middle West and the South large numbers of young men from the country drift into the cities looking for work, and many such men are to be found in the train service of the street railway companies of these cities. They have no difficulty in satisfying the company as to their characters, and they are usually in robust health with

no serious vices or demoralizing companions. In the larger cities the class of applicants for employment is usually not so desirable. They are drawn from every walk of life, and great care must be used in examining the references and looking into their character and habits. The "ringer," or old and experienced street railway man, who is in the business to beat the company and who poses under an assumed name and occupation, must always be guarded against in the large cities, whereas he seldom attempts to get work on smaller roads where the opportunity for stealing is less and the chances of detection greater.

Opinions differ as to the advisability of taking on experienced street railway men who for some good reason have left their positions in other cities. The Nashville Railway & Light Company, for example, makes it a rule not to employ any men who have ever had any experience on street railways, preferring to take untrained men and teach them the rudiments of their work. This company has a large number of old employees who have been in the service for many years and has comparatively few vacancies each year to fill. The new man is surrounded by experienced fellow employees and is constantly being taught what he should do and what he should not do. On many suburban roads, however, which put on a large number of extra crews in the summer months and reduce their forces in the winter months, the conditions are such that it is practically impossible to train new men in the short time between their employment and the beginning of heavy traffic. These roads prefer to employ only experienced men and sometimes offer special inducements in the way of wages and conditions of employment in order to get such men for the temporary summer service. The Boston & Worcester Street Railway is a road which has to meet such conditions. It requires all applicants to have at least six months' experience in electric railway work, and thus avoids the necessity of instruction in the elementary phases of the work. New men are broken in on the road by running with an instructor for three or four days to acquaint them with the special features of the division to which they will be assigned and the rules and details of the equipment which are special to this road. In the fall when traffic begins to decrease the company reduces its forces accordingly. Men are not discharged at the end of the season, but are given leave of absence for the winter. Their relative seniority is held for them until they return to the service of the company. The men are entitled to have this leave of absence applied to their term of service with the company and receive the same increases in pay for continuous service when laid off in this manner as if they worked all winter. Many of the men laid off in this way during the winter months regularly return in the spring, taking up some other business during the winter months. Two of the largest electric railway systems in the Far West, the Northern Electric Company and the Spokane & Inland Empire, make it a rule to employ only experienced railway men. The Spokane & Inland Empire recruits its forces largely from the experienced steam railroad men who are conversant with the general features of the rules and methods of handling trains. The Lackawanna & Wyoming Valley Traction Company, which uses steam railroad methods in dispatching and other features of its practice, makes previous steam railroad experience a requisite for employment.

#### ATTITUDE TOWARD UNION MEN

There are a number of electric railway companies in the United States which are so strongly opposed to labor unions that they make a special point of investigating an applicant's previous record of employment and reject any one who is in any way affiliated with a union of street railway employees

or other labor organization. All applicants are required to sign an agreement similar to the following, which is quoted from the application blank of the Birmingham Railway, Light & Power Company: "Will you agree not to join the Amalgamated Association of Street Railway Employees or any similar organization while in the employ of this company, or invite any one else in the employ of this company to do so, and will you agree that if any employee joins or agitates said association or like organization the company may discharge him without question?" In some States open discrimination of this kind is prohibited. Perhaps the most severe statute designed to prevent this form of discrimination is the so-called "black list" law passed about 18 months ago by the Texas Legislature. This law compels a company asking an applicant for references to furnish the applicant with copies of the replies of such references who may have been communicated with. This law has not been tested in the courts as yet. It cannot, however, prevent an applicant signing a document authorizing his former employers to give all information about his past record and waiving the right to request a copy thereof, and it is the practice of some of the railway companies to obtain such a waiver from applicants. The text of a waiver of this kind is as follows: "In order that the \_\_\_\_\_ Railway Company may be fully informed as to my personal character and qualifications for the position applied for, I refer to each of my former employers and authorize each of them to give all the information they may have as to my personal character and qualifications and the reason why I was discharged or quit service. Should I enter the service of this company pending the approval of my application and said application be not approved, I agree to be removed from the service at once and will not expect or ask to be informed of the nature or source of the replies received to inquiries regarding my previous record."

#### FORMS OF APPLICATION BLANKS

The forms of application for employment used by street and interurban railways vary widely in the number and nature of questions asked and the character of releases signed by the applicant. One of the simplest forms is that shown in Fig. 1, which is used by the Berkshire Street Railway Company. The forms used by some other roads contain as many as 50 different questions, not including those asked by the medical examiner, and completely cover the applicant's condition in life, personal habits, former record, etc. Most companies use a form approximately 8 in. x 14 in. printed on a single or double sheet with a space on the back for the proper office endorsements, which are folded outward to be readily visible when the application is filed away.

Where the various questions regarding the applicant's former record, habits, etc., are few in number and can be included on one page, space is often provided on the following pages for entering the surgeon's report of physical examination, certificates of character from applicant's references, endorsement of instructors and cashier's receipt for badge deposit. The advantage of this arrangement is that the entire record of the prospective employee is put on one sheet and can be readily filed or referred to at any time. There is also an advantage in having the applicant submit the complete form with answers filled out successively to the surgeon, his references and the superintendent who finally approves the application. Other roads prefer to have the surgeon's report and form letters of recommendation made on separate sheets.

The United Railroads of San Francisco has a very complete system of records and forms which is used by its employment bureau. The application blank is a four-page folder, 8 1/2 in. x 11 in. The first page contains 35 ques-

tions relating to the applicant's personal history, and on the second page are spaces for entering the names and addresses of four references and a cautionary paragraph as to the character of references which will be given most weight. The

On the back page is a space for office endorsement for filing.

After signing the application the applicant is given an order to the company surgeon for physical examination. This order, Fig. 2, is signed by the applicant at the time of making out his application, and the description at the bottom is filled in by the clerk who makes out the order. This prevents substitution of a healthy man for an unhealthy applicant during the physical examination. At the time of issuing this order the applicant is also given an order to a photographer to have taken four small photographs, 1 1/2 in. x 2 in., which are delivered to the employment office and become the property of the company. The applicant, however, pays the cost of having these taken. One of these photographs is attached to an identification card, Fig. 3, which is filled in with a description of the applicant and sent to all division superin-

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Berkshire Street Railway Co.,  
Pittsfield, Mass.

Gentlemen:—

I desire to make application for a position with your Company as .....

I have been employed by .....

(How long)

(What doing) .....

(Age) .. My family consists of ..

At present am employed by .....

My object in changing is .....

I can furnish references from .....

Yours truly,

Address: .....

Fig. 1—Application Blank—Berkshire Street Railway

third page contains an agreement or release to the company of the usual form with the addition of the following interesting clause:

"I decline to accept the benefit of the provisions of the act

UNITED RAILROADS OF SAN FRANCISCO—Hospital Dept. NO. \_\_\_\_\_

**ORDER FOR EXAMINATION**

To Dr. \_\_\_\_\_, Examiner at \_\_\_\_\_

The bearer \_\_\_\_\_, is an applicant for position as \_\_\_\_\_ Will you please examine him in manner directed in Company's instructions, advising me of result of such examination.

VIC. PRESIDENT AND GENERAL MANAGER

Signature of Party to be examined \_\_\_\_\_

Age \_\_\_\_\_ years \_\_\_\_\_ months, Nativity \_\_\_\_\_

Color of eyes \_\_\_\_\_ Color of hair \_\_\_\_\_ Complexion \_\_\_\_\_

Weight \_\_\_\_\_ Height \_\_\_\_\_

Fig. 2—Order for Physical Examination

**UNITED RAILROADS OF SAN FRANCISCO**  
Employment Department

Name \_\_\_\_\_

Affix photograph here.	Color Hair _____
	Color Eyes _____
	Complexion _____
	Height _____ ft. _____ ins.
	Weight _____ lbs.
	Married. Single. Widower.

Born \_\_\_\_\_ at \_\_\_\_\_

Present address \_\_\_\_\_

Previous address \_\_\_\_\_

Last Employer \_\_\_\_\_

Previous employer \_\_\_\_\_

R. R. experience \_\_\_\_\_

The Superintendent to whom this is sent will scrutinize carefully, and, if he recognizes the party described herein, will note the fact on the reverse hereof. If not, he will sign below; in either case returning to this office without delay.

Fig. 3—Applicant's Identification Card

of the California Statutes of 1893 providing for a day of rest from labor, and I request permission to work my full time each month, being satisfied with such relief from work as the company may allow."

tendents in order that they may identify the applicant if he has ever before worked for the company or is known to them in any way.

The Brooklyn Rapid Transit Company and the Coney

Island & Brooklyn Railroad require two photographs of applicants for their permanent files. The Louisville Railway Company requires applicants to have six photographs taken, one of which is pasted in one corner of the original application blank. Nearly all of the electric railway companies in the State of New York place at the head of the application blank a quotation from Section 570 of the Penal Code as follows: "A person who obtains employment or appointment to any office or place of trust by color of, or aid of any false or forged letter or certificate or recommendation, or of any false statement in writing as to his name, residence, previous employment or qualifications \* \* \* \* is guilty of a misdemeanor and is liable to imprisonment for not more than one year or a fine of not more than \$500, or both." In order to secure conviction of fraudulent applicants under this section of the Penal Code, all applicants are required to swear under oath before a notary that the answers made by them are true and correct.

This practice is also followed by some roads in other States, which have no specific statute under which a conviction could be secured, but which are thus able to protect themselves against perjury in swearing to false statements. The assistant superintendent of the Louisville Railway Company, who receives all applications for employment, is a duly authorized notary public and swears all applicants in person. The Scranton (Pa.) Railway Company is another road which requires sworn acknowledgment of the truth of all statements contained in employment applications.

Another means of warning applicants against making false statements is to include among the agreements concerning conditions of employment a clause to the effect that if, after employing the applicant, it is discovered by the company that any statement made by him is false in any particular, it will

employment, is, in some cases, very comprehensive. The simple and usual form of this agreement is about as follows: "I hereby make application for the position of \_\_\_\_\_, pledging myself if appointed to faithfully and honestly dis-

**UNITED RAILROADS OF SAN FRANCISCO**  
EMPLOYMENT DEPARTMENT

San Francisco, \_\_\_\_\_ 190\_\_

Mr. \_\_\_\_\_

The bearer, \_\_\_\_\_ has this day been appointed \_\_\_\_\_ You will please photograph him in accordance with the Company's instructions, sending four copies of the same to this office.

\_\_\_\_\_  
Superintendent of Employment.

NOTE.—This Company is in no wise to be responsible for or charged with the cost of the above mentioned photographs.

Fig. 4—Order for Photographs

charge the duties of the position to the best of my ability and to strictly comply with all rules and regulations now in existence or which hereafter may be created." In addition to this general agreement specific agreements are made concerning badge deposits, fidelity bonds, medical examinations, rates of wages, etc. The promise to faithfully discharge the duties of the position and follow the rules is often enlarged to include temperate use of liquor, if any, strict moral conduct, prompt payment of bills and other matters which the company cannot directly control. The Louisville Railway Company, for example, exacts a promise to abstain from all intoxicating drinks at all times. It is doubtful if the inclusion of such special pledges does any real good, as discipline can rarely be enforced for such breaches of faith.

One feature of the application blank of the Aurora, Elgin & Chicago, which is of interest, is the release from liability which is made part of the application. In the text of this release, which is as follows, it will be noticed that specific mention is made of the dangerous nature of the third-rail:

"I certify that I know that the railroad of the Aurora, Elgin & Chicago Railroad Company is operated by electricity with the use of an electric third-rail, electrical transmission lines and other electrical appliances of a dangerous character. I know that it is dangerous to touch, tamper with or work around such third-rail, transmission lines and electrical appliances, and agree that if I am employed by said railroad company, and as a consideration for my employment, I will and do assume all hazards connected with working at, on or around said electric third-rail, transmission lines and electrical appliances of said railroad, and release and relinquish said company from all claims of every kind and character to either my person or property which may be caused by the electric current."

On many application forms is printed a list of the offences which are cause for immediate dismissal, which prevents any misunderstanding on the part of applicants who might commit these offences later on.

The United Railways & Electric Company of Baltimore uses a formidable legal agreement or contract which is typical of its kind. The text in full follows:

THIS AGREEMENT Witnesseth, that..... the party of the first part, having made application to THE UNITED RAILWAYS AND ELECTRIC COMPANY OF BALTIMORE, party of the second part, to be employed as ..... upon its cars, and in consideration of such employment has agreed to make application to such corporation as may be selected by the said Company to become his bondsmen to the amount of five hundred dollars, said bond to be liable as set forth in the covenants contained in said bond; said party of the second part has agreed to employ him in said position, and to continue him in its

TOPEKA, KANSAS, \_\_\_\_\_, 19\_\_

DEAR SIR:

I have made application for a position in the train service of The Topeka Railway Company, Topeka, Kansas, and desire that you furnish said company with my full record while in your employ, together with my reason for leaving your service; also all information which you may have concerning me whether the same be of record or not; and I do hereby release you and the company you represent from all liability or damage whatsoever for or on account of furnishing the above-named company with such information.

I was in your employ as \_\_\_\_\_ at \_\_\_\_\_ from \_\_\_\_\_ to \_\_\_\_\_

(Signed) \_\_\_\_\_

Witness: \_\_\_\_\_

Fig. 5—Request for References and Release by Applicant Sent to Former Employers—Topeka Railway Company

be considered by the company cause for immediate discharge.

EMPLOYMENT CONTRACTS AND RELEASES

The form of general agreement and release from liability, which is frequently made a part of the application for em-

employment during its pleasure, and no longer, and to pay him on its regular pay day for his services in said position, the compensation which it shall determine, the same being so much per hour or per trip, according to the line where the same shall be made; such compensation to be fixed by the said Company, from time to time, by notices posted in the offices of its different lines, but the party of the first part shall not be entitled to pay except for the time he shall be actually engaged in running a car.

The party of the first part promises and agrees well, honestly and faithfully, to perform the duties of said position for the said THE UNITED RAILROADS AND ELECTRIC COMPANY OF BALTIMORE, so long as he shall be continued in that employment, and to obey and fully comply with all rules and regulations now existing, as well as those which may from time to time be prescribed by the Company for said position on its cars.

The party of the first part further agrees that if, for any reason, he shall be suspended from the employment of said Company, he shall not be entitled to any compensation during such suspension; and he further agrees that when his employment with said Company ceases, he will at once return to said Company any badge, buttons or other property of said Company in his possession, and that he will pay to said Company, during the time he shall retain possession of any such badge, or other property of said Company, after he has been discharged or suspended from its employment, or his employment in any way shall cease, the sum of twenty-five (25) cents for each day that the same, or any of them, are so retained by him, not as a penalty, but as liquidated damages; and he further agrees that any wages due him from the party of the second part, when his employment under this contract shall terminate, shall be retained by said party of the second part until all of said property is by him delivered to said Company.

And the said party of the first part further agrees to pay to said Company any damage which any car or other property of the Company shall sustain while such property shall be in his care, custody or control, or while the same may be in his charge, and also repay to the said Company any damages to the person or property of others, resulting directly or indirectly, by reason of his carelessness, neglect or misconduct or the violation of any of the rules of said Company, whether willful or otherwise, during the time he shall remain in the employ of said Company; and any wages which may be due to the party of the first part shall be applied by the party of the second part, so far as shall be necessary, in payment therefor, and said wages may be retained by said Company until any claims for damages shall be determined or adjusted.

And it is further agreed that any wages that may be due shall be retained by said Company until any sum owing by the said party of the first part on account of purchase of uniform, as required by the Company's rules, shall have been paid in full, and the balance, if any, paid over to the said party of the first part at the termination of his services as herein-after provided.

And it is further agreed that any Court costs, or Magistrate costs, which said Company may be called upon to pay (owing to any suit that may be brought by any one against said Company, such suit arising from damage to person or property owing to any negligence or neglect on the part of the party of the first part of this agreement), shall be deducted from said wages that may be due said party of the first part.

And upon the termination of said employment, either by the resignation by the said party of the first part of his said employment, or upon his discharge by the party of the second part, if, in the judgment of a majority of the Board of Investigation, that shall be appointed from time to time by the General Manager of said Company, said party of the first part, during his employment in said position, has not been guilty of any neglect, carelessness, dishonesty, misconduct, unfaithfulness, incompetency or dereliction of duty of any kind on his part in his said employment or duty in said position, and the Company shall have suffered no loss or damage to any property while in the charge, custody or control of the party of the first part, the judgment of which Board shall be final and conclusive, and shall have returned to the party of the second part all badges or other property intrusted by said Company to him, and shall have paid in full all sums due and owing to the said party of the first part on account of the purchase of a uniform, whether owing to the Company or to a contractor for supplying the same; then, and in such case, the said Company agrees to pay to said party of the first part any wages that may be due him.

IN WITNESS WHEREOF, the said party of the first part hath hereunto subscribed his name, and the said THE UNITED RAILROADS AND ELECTRIC COMPANY OF BALTIMORE, have caused these presents to be subscribed by their General Manager, this.....day of.....

One Thousand Nine Hundred and Eight.

.....[SEAL]

Signed and delivered in the presence of

THE UNITED RAILROADS & ELECTRIC CO. OF BALTIMORE.

By .....[SEAL]

General Manager.

INVESTIGATING REFERENCES

The practice in regard to the number and kind of references required and the methods of verifying them is no more uniform than other features of employment methods. From two to eight references as to character are required, and usually the applicant is also required to give the names of his previous employers for at least the year preceding his application. Some roads require a complete history of employment for five years previous and attempt to get into communication with all of the former employers named.

There are three methods in general use of verifying references, by mail, by personal interview and by requiring the applicant to take his application properly filled out and have his references affix their signature to it. Verification by mail is the commonest method, and, of course, the only one which can be used for out of town references. It gives considerable

opportunity for fraud, however, and such cases not infrequently arise; for example, the recent case of an old experi-

UNITED RAILROADS OF SAN FRANCISCO.

EMPLOYMENT BUREAU.

San Francisco, Cal., .....190...

Mr. ....

DEAR SIR:

Mr. .... of .....

has applied to this Company for a position as..... and refers to you for testimony as to his character. If appointed to this position, human life may depend upon his judgment, or be imperiled by his carelessness. He will, if appointed a conductor, have custody of the money of his employer, and will besides come in daily contact with the aged and feeble and with women and children, who are entitled to the utmost courtesy and the highest degree of care. Is the applicant, in your judgment, fit to occupy the above position? This Company feels seriously the responsibility of making such selections; there is too much at stake to accept applicants without the most careful inquiry, and therefore it adopts this means to assist it in securing the best men available.

Will you kindly give me, as early as possible, the information asked for in the following questions? Your answers will, I assure you, be considered entirely confidential and without prejudice to you.

Yours truly,

Vice-Pres. and Gen'l Mgr.

- 1. Was applicant ever in your service? If so, for how long? From ..... to.....
2. In what capacity?.....
3. Why did he leave your service?.....
4. How long have you known him?.....
5. Are you connected with him by relationship or otherwise? If so, in what way?.....
6. Are his habits sober and correct, and is his conduct such as to entitle him to our confidence?.....
7. Have you ever heard of his having been irregular or unsteady in his habits, or addicted to any bad habits?.....
8. Is he quick tempered?.....
9. Is he talkative or quiet?.....
10. Is he polite?..... 11. Is he a careful man?.....
12. Do you believe him thoroughly honest?.....
13. Has he ever been dismissed from any situation to your knowledge? If so, under what circumstances?.....
14. Has he ever, to your knowledge, been employed on any steam or street railroad in any position? If so, where?.....
15. Have you any reason to consider him incompetent to fill the position he seeks?.....
16. Has he any distinct traits of character not set out above?.....

PLEASE NOTE ANY REMARKS ON THE BACK OF THIS BLANK.

Signature..... Vocation.....
Address..... Dated.....

Fig. 6—Form Letter Sent to References

enced man who applied for a position in Louisville, Ky., under an assumed name and in the guise of a green hand.

UNITED RAILROADS OF SAN FRANCISCO.

SAN FRANCISCO,

DEAR SIR:

..... has applied to this Company for employment as..... and I have been informed that he has been in your employ. Would you kindly give me what information may be in your possession, concerning his record with you, and his character and habits? Your answer will be considered strictly confidential.

Below follows such information as may enable you to identify the applicant.

Very truly yours,

Vice-President and General Manager.

Full Name..... Age.....
Last Address..... Street,.....
Previous Address..... Street,.....
Born..... at..... Height.....ft.....in.
Weight.....lbs. Complexion..... Hair..... Eyes.....
Married..... Trade..... Appearance.....
Remarks: .....

Fig. 7—Form Letter Sent to Former Employers

He gave as references one man in Tampa, Fla., and another in Springfield, Ill., and satisfactory replies were received from

both. It was later discovered that the man was a fraud and both letters of recommendation had been written by accomplices who had been advised beforehand of the plan. The ideal method is practiced in Nashville, Tenn., where no applicant is accepted unless he brings in person to the office of the superintendent of transportation some citizen who is known to the superintendent and who will vouch for the honesty and good character of the applicant.

The employment bureau of the United Railroads of San Francisco has a complete follow-up system for investigating and recording references. When an applicant's references or former employers are located in San Francisco, they are called on in person by a special investigator. It has been found that a verbal inquiry of this kind often elicits facts which a person would hesitate to put in a letter. If the person from whom the inquiry is to be made lives out of town form letters are used, the text of which is reproduced in Fig. 6. The letter to former employers contains a complete physical description of the applicant which protects against fraud. The advices received from these inquiries are all entered on a single sheet, Fig. 8, which is filed with the application blank.

The Topeka Railway Company also uses form letters to both references and former employers. The latter letter is sent out with a request and release from liability signed by the applicant. The text of this document is also reproduced.

when the previous employer was another railway company.

PHYSICAL EXAMINATIONS

Physical examinations by competent physicians are required by nearly every street and interurban railway com-

*Applicant:* \_\_\_\_\_ *No.* \_\_\_\_\_

*Last Employer:* \_\_\_\_\_

*Address:* \_\_\_\_\_ *St.* \_\_\_\_\_

*Employed from* \_\_\_\_\_ 190\_\_ *to* \_\_\_\_\_ 190\_\_

*Advices:*—

---

*Previous Employer:* \_\_\_\_\_

*Address:* \_\_\_\_\_ *St.* \_\_\_\_\_

*Employed from* \_\_\_\_\_ 190\_\_ *to* \_\_\_\_\_ 190\_\_

*Advices:*—

---

*Reference:* \_\_\_\_\_

*Address:* \_\_\_\_\_ *St.* \_\_\_\_\_

*Advices:*—

---

*Reference:* \_\_\_\_\_

*Address:* \_\_\_\_\_ *St.* \_\_\_\_\_

*Advices:*—

---

*Remarks:* \_\_\_\_\_

INVESTIGATOR

Fig. 8—Summary of Investigation of References

pany, but some companies are more exacting than others in this respect. The interurban roads generally require a careful

**New Jersey & Hudson River Ry. & Fy. Co.**

*Edgewater,* \_\_\_\_\_ *190\_\_*

**MEDICAL EXAMINATION.**

*Name* \_\_\_\_\_

*Address* \_\_\_\_\_

*Height* \_\_\_\_\_ *Weight* \_\_\_\_\_

**VISION.** **COLOR.**

*Distance* \_\_\_\_\_ *Near* \_\_\_\_\_ *Distance* \_\_\_\_\_ *Near* \_\_\_\_\_

*Right Eye* \_\_\_\_\_

*Left Eye* \_\_\_\_\_

*Right Ear* \_\_\_\_\_

*Left Ear* \_\_\_\_\_

*Forced Inspiration* \_\_\_\_\_ *in.* } *Expansion* \_\_\_\_\_ *in*

“ *Expiration* \_\_\_\_\_ *in.* }

*General Strength* \_\_\_\_\_

*Does applicant appear older than age given* \_\_\_\_\_

*Rate of pulse sitting* \_\_\_\_\_ *Standing* \_\_\_\_\_

*Irregular* \_\_\_\_\_ *Intermittent* \_\_\_\_\_

*Is heart action uniform, free and steady* \_\_\_\_\_

*Are valvular sounds of heart normal* \_\_\_\_\_

*Have you any physical defects* \_\_\_\_\_

*Physical Condition in general* \_\_\_\_\_

\_\_\_\_\_

*I, the undersigned, do hereby certify that the applicant herein mentioned is physically qualified for active duty as* \_\_\_\_\_

M. D.

Fig. 9—Surgeon's Report of Examination—New Jersey & Hudson River

The Boston & Worcester Street Railway Company uses a signed request for information and release of this kind, only

**SURGEON'S CERTIFICATE OF EXAMINATION.**

Of \_\_\_\_\_

*Occupation* \_\_\_\_\_ *Age* \_\_\_\_\_

VISION	COLOR SENSE	HEARING
Right eye _____	Green _____	Right ear _____
Left eye _____	Red _____	Left ear _____
Combined _____	Purple _____	
Letters recorded when rejected.	Numbers recorded when rejected.	Whisper or acoumeter.

*What is rate of Pulse* \_\_\_\_\_ *of Respiration* \_\_\_\_\_

NAME	DATE

*What diseases has he suffered from?* \_\_\_\_\_

*Has he ever suffered from beria?* \_\_\_\_\_ *What form?* \_\_\_\_\_ *Is present condition* \_\_\_\_\_

*Has he ever suffered from injury?* \_\_\_\_\_ *If so what and when* \_\_\_\_\_

*Is he the subject of any deformity, from injury or otherwise?* \_\_\_\_\_ *If so,* \_\_\_\_\_

*note here and locate on skeleton blank herewith* \_\_\_\_\_

Heart	_____
Lungs	_____
Kidneys	_____
Joints	_____
Veins	_____
Feet and Legs	_____
Hands and Arms	_____
Spine	_____
Urinary Organs	_____

*Has he any present source of disability in* \_\_\_\_\_

(Applicants should be stripped for this examination. Note with care varicose veins, enlarged joints and anything tending to produce or prolong disability.)

*Does he use intoxicating liquors?* \_\_\_\_\_ *Is his appearance that of a temperate man?* \_\_\_\_\_ *Does he smoke cigarettes?* \_\_\_\_\_ *Has he had small pox* \_\_\_\_\_ *or been recently vaccinated?* \_\_\_\_\_

*His height is* \_\_\_\_\_ *feet* \_\_\_\_\_ *inches*; *weight* \_\_\_\_\_ *lbs*; *color of eyes* \_\_\_\_\_ *of hair* \_\_\_\_\_

*He is physically a* { *First class* \_\_\_\_\_  
*Average subject for position as* \_\_\_\_\_  
*Defective* \_\_\_\_\_

(Signature) \_\_\_\_\_ *Surgeon.*

*Examined* \_\_\_\_\_

*Date* \_\_\_\_\_ 190\_\_

*Signature of applicant to be taken at Surgeon's office.* \_\_\_\_\_

(Sign here) \_\_\_\_\_ *Applicant.*

**REMARKS:**

(Anything lacking in spaces above should be added here.)

Fig. 10—Surgeon's Report of Examination—Utica & Mohawk Valley

examination of vision, color sense and hearing, conducted along the lines now standard on steam roads, and in addi-

tion a thorough physical examination of all organs. Only men who are free from disease and in sound health are accepted. Particular attention is paid to heart action, respiration and condition of the kidneys and nervous system. Typical forms of surgeon's reports are reproduced in Figs. 9 and 10. It will be noted that the examination of the New Jersey & Hudson River emphasizes the condition of the ap-

possible in the test room, the conditions under which trainmen are required to distinguish signal lamp colors at night. The room is darkened and the applicant is required to call off the colors displayed by the examiner, who moves a disk containing from 10 to 15 various colored spectacles in front of the opening. The Aurora, Elgin & Chicago uses an ingenious lamp test for color sense devised by Dr. J. W. McDonald, chief surgeon of the company. A case containing 64 small lenses of various colors is used and behind each lense is mounted a small incandescent electric lamp. These lamps are connected to a keyboard worked by the examiner, who can turn on any light in the case for the applicant to name the color.

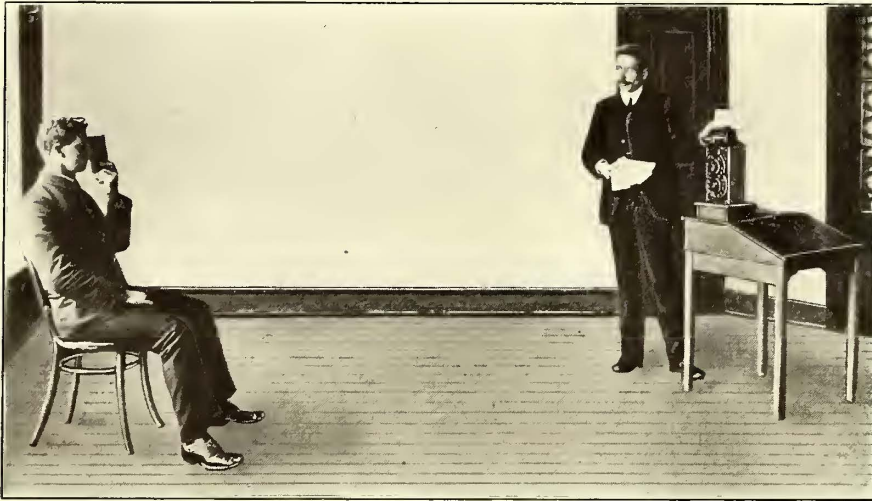


Fig. 11—Examining for Vision—Boston Elevated Railway

licant's heart action. This is considered most important because of the danger of collapse while a car is descending any of the steep hills on this road.

#### TESTS FOR VISION

The method of testing vision most commonly used is Snellen's system of lettered cards. The acuteness of vision is expressed as a fraction of which the numerator is 20, or standard distance, and the denominator the arbitrary number of the smallest line of type which can be read at 20 ft. Each eye is tested separately and both eyes together without glasses, and sometimes with a pair of special test glasses which accentuate any tendency toward near-sightedness. Normal vision is 20/20 and a vision of worse than 20/30 in both eyes is usually sufficient to disqualify an applicant.

#### TESTS FOR COLOR SENSE

Color perception is tested either with skeins of various colored yarns or with colored lamps. Professor Holmgren's system of yarn tests requires three large skeins, one light green, one rose color and one red, and about 100 small skeins of variegated colors. These small skeins are all tagged with numbers and are spread out upon a table with the three large skeins. The applicant is required to select from the 100 small skeins all colors which in his eyes match the three large skeins regardless of light or dark shades. A person who is color blind can distinguish between light and dark shades, but cannot distinguish colors. Any serious mistakes in matching red with green or vice versa indicate lack of color sense and are cause for rejection.

The lamp test is sometimes used in place of the yarn test or in conjunction with it. It reproduces, as nearly as

as the denominator of a fraction, of which the numerator is 20, or standard. Thus, 20/15 would indicate defective hearing, while, on the other hand, 20/30 would indicate abnormally acute hearing. The same test is often conducted with a standard ratchet acoumeter, which is clicked a number of times, the applicant counting each sound which can be heard. A simpler test is to hold a stop-watch at arm's length and alternately stop and start it. The Ft. Wayne & Wabash Valley tests an applicant's hearing by watch ticks,



Fig. 12—Examining for Hearing—Boston Elevated Railway

whispering and by repeating over a telephone in a low tone letters and numbers. This test is made especially rigid, as all dispatching is done by telephone, and it is essential that an employee should be able to hear distinctly with the instrument.

The accompanying illustrations show the methods and apparatus used by the Boston Elevated in conducting color, vision and hearing tests. The results of these tests are re-





for city line students. The Indiana Union Traction Company, which operates the city lines in a number of the smaller cities which it reaches, makes a practice of promoting the best men from the city service to the interurban service, and less than 2 per cent fail to qualify. The Indianapolis Traction & Terminal Company reports the highest proportion of any of the city lines, 99 per cent for conductors and 97 per cent for motormen. A fair average for the city lines reporting is 85 per cent and for the interurban roads 90 per cent.

PHYSICAL EXAMINATIONS FOR OLD EMPLOYEES

Steam road train service employees almost without exception are required to pass periodical physical examinations, especially for defective eyesight, hearing and color sense. This practice is by no means general on electric roads, although many interurban lines, realizing the importance of keeping old employees up to the standard set for new men in this particular, have put such a rule into effect. The Spo-

new men in all of the essential features of their work. The length of the instruction period on 20 roads reporting is given in the table on page 795.

The system of the Memphis Street Railway for breaking in new employees presents some features of interest. The company employs a chief of conductors and a chief of motormen, who are practically foremen of the two classes of train service employees and who are held responsible for the proper performance of all the trainmen while on duty. Applicants are given a student's badge and turned over to one or the other of these chiefs who give them preliminary instructions and then send them out in care of an experienced trainman who acts as instructor. Each day the chief makes out an assignment slip, Fig. 17, which is signed and returned by the instructor at the end of the day with a statement of any deficiency on the part of the student. These daily assignments are entered on a summary sheet, Fig. 16, which is signed by the chief after he has given the student a thorough oral examination and has determined the student's fitness and pro-

THE MEMPHIS STREET RAILWAY COMPANY			
INSTRUCTION ORDER		STUDENT BADGE	
No. _____	MEMPHIS, TENN.		190 _____
ISSUED TO _____	MOTORMAN CONDUCTOR	BADGE No. _____	
Assigned to _____	Badge No. _____	Assigned to _____	Badge No. _____
Line _____	Date _____	Line _____	Date _____
Hour on _____	Hour off _____	Date _____	190 _____
O. K. _____		O. K. _____	
Assigned to _____	Badge No. _____	Assigned to _____	Badge No. _____
Line _____	Date _____	Line _____	Date _____
Hour on _____	Hour off _____	Date _____	190 _____
O. K. _____		O. K. _____	
Assigned to _____	Badge No. _____	Assigned to _____	Badge No. _____
Line _____	Date _____	Line _____	Date _____
Hour on _____	Hour off _____	Date _____	190 _____
O. K. _____		O. K. _____	
Examined and found O. K. _____	190 _____	Approved for Regulation Badge _____	190 _____

Fig. 16—Summary of Student's Practice

THE MEMPHIS STREET RAILWAY CO.			
STUDENT			
Badge _____	Date _____	190 _____	
Assigned to _____			
Badge _____	Line _____	Chief _____	
ON DUTY	OFF DUTY	CAR	DATE
.....M.	.....M.		
.....M.	.....M.		
.....M.	.....M.		
.....M.	.....M.		
Needs further instructions on _____			
Remarks _____			
Signed _____			
Badge No. _____			

Fig. 17—Student's Assignment Card

kane & Inland Empire requires all trainmen to pass a rigid physical examination once each year. The Fort Wayne & Wabash Valley requires an examination every two years, the Lackawanna & Wyoming Valley every three years, and the Utica & Mohawk Valley every five years. The Little Rock Railway & Electric Company is one of the two city companies reporting which require regular periodical examinations for old employees, its period being every three years. The Syracuse Rapid Transit Railway examines its old men every five years. The Milwaukee Electric Railway & Light Company does not subject its old men in either city or interurban service to these periodic examinations, but in promoting a man from city to interurban cars he is required to pass the same physical and mental examinations as a new man just entering the service.

BREAKING IN

The instruction period for trainmen is usually two weeks and rarely longer than three weeks. Many city lines find that a week or 10 days is sufficient time in which to train

new men in all of the essential features of their work. The superintendent also signs this sheet on issuing a regular badge to the student. The summary sheet and the daily assignment slips are filed permanently with the application blank, references and other papers relating to the student's record. A service record card, Fig. 19, is then made out, on which is kept a brief summary of the employee's conduct and efficiency from that time forth. All papers relating to employees' records are of such size as to be folded into a filing envelope 3 1/2 in. x 8 1/2 in. These envelopes are filed by badge numbers and contain, in addition to the application blank, references, assignment slips, summary and service record card, a card on which is entered a record of every accident in which the employee was in any way concerned, giving the date, class and cost to the company of each; an "off-duty" card, showing the reason for an employee being off duty for any cause; and the check reports of secret service inspectors both when the count is correct and when there are any discrepancies.

The Twin City Rapid Transit Company maintains its employment bureau at the Snelling Avenue shops and car house.

Students are required to spend not less than 14 days of 10 hours each breaking in. The first 70 hours are spent on one line with an instructing trainman learning the general rudiments of the work. This is followed by 10 to 15 hours on each of the other lines of the division to which the student is expected to be assigned. One day each week all students are required to report to the employment bureau for class instruction. An instructor takes the class over all the company's lines and lectures while the car is being operated. The students are required to practice punching sample transfers and they discuss with the instructor various phases of the operation of cars. On completing the course, students are given an oral and a written examination on the rule book, with especial stress laid on handling accidents and knowledge of car equipment. Part of this examination consists in requiring the student to properly punch transfers for any line intersecting with any other line running out of the division headquarters to which the student will be assigned.

Badge		Record		O. K.	
ACCIDENT RECORD					
DATE	NUMBER	CLASS	AMOUNT		
			PAID	SUIT	

Fig. 18—Accident Record Card

Badge	Record
Age	Employed
INVESTIGATION	
SERVICE RECORD	

Fig. 19—Service Record Card

WRITTEN EXAMINATION BOOKS

The Utica & Mohawk Valley requires all student trainmen to practice under the direction of an experienced man for from 15 to 18 days. Student motormen are then required to spend a day in the shop learning the details of the electrical equipment of the cars under the direction of the electrical engineer. Both conductors and motormen are then given an oral examination on the rules and 30 days later a written examination. This consists of answering 72 general questions, and 30 questions exclusively for motormen or 41 questions exclusively for conductors. These questions are

The Aurora, Elgin & Chicago uses a similar examination book containing 193 questions. A mark of 95 per cent is required to pass. New men are allowed 60 days for study before taking the examination, but are not given a regular assignment with full responsibility until they have successfully passed. Motormen, in addition to answering the 193 general questions, must answer 41 questions on the construction and handling of air-brake apparatus. There are no special questions for conductors. All examination papers, whether of passing grade or not, are filed with the employee's

other records. This system was tried last winter for the first time and will be continued each year for old employees as well as students.

The Lackawanna & Wyoming Valley is enabled to put all candidates for the train service through a thorough apprenticeship course. Student motormen, after spending four days in the shop and 10 days on the road, are assigned to one of the two switching crews employed. Road motormen are drawn from these crews, and at the present rate of vacancies new men have ample time to learn all the rules and become proficient in handling electrical equipment and brakes before being promoted to regular runs. Conductors are started as operators at dispatching booths, then promoted to brakemen and finally to conductor. All new men, before being promoted to road service in charge of a car, are required to pass a rigid examination on the rules conducted by the chief train dispatcher. School is held for old employees at irregular intervals and all those who attend are required to pass an examination on the rules discussed. After each case of discipline inflicted for non-observance of rules the employee is also examined by the superintendent or dispatcher to make sure that he is thoroughly familiar with the

OFF DUTY RECORD	
Badge Record O. K.'d	REMARKS, 1908
1	Family Sick
2	Family Sick
3	Family Sick
4	Family Sick
30	
31	
Total	
S.—Sick F.—Family Sick H.—Held Off E.—Excused O.—Other	

Fig. 20—Off-Duty Record Card

No.	Day	Date	1908		
Line					
Direction		Time on M.			
On		Off			
Car		Cond.			
Register Read—In—Out					
Tickets for Cash	Free	Total Paying	Registered	Short	Miscd
EXPLANATION					

Fig. 21—Incorrect Register Report

printed in book form on pages 8 1/2 in. x 11 in., not more than 11 questions being printed on each page with liberal spaces between for writing out the answers. The accompanying illustrations, Figs. 22 and 23, are reproductions of sample pages from this examination book, reduced about one half. If the student fails to pass a satisfactory examination on these questions, which is taken at 95 per cent, he is given time for further study and one more opportunity to pass. If he fails a second time he is discharged. Old employees are also required to take this written examination once each year with the same penalty for failure on second trial.

rules and that another infraction will not occur through ignorance.

The Denver City Tramway Company puts a student conductor or motorman out for instruction in charge of an old employee, who teaches him continuously for seven days, or longer if necessary. When he is qualified, in the opinion of his instructor, he is given a trial trip under the surveillance of one of the division superintendents, and if he performs his duties satisfactorily is sent up for a written examination on the rules and methods of car operation before being appointed. The company pays its instructors \$5 for break-

ing in an inexperienced man and \$2.50 for breaking in an experienced man. It is estimated that the annual amount of these fees, which represents the major part of the cost of hiring and training new employees, is less than one-tenth of 1 per cent of the gross earnings. All applicants are required to deposit \$5 when beginning their instruction and they forfeit this amount if they fail to qualify. On being appointed to the service they are required to deposit \$5 additional, making a total of \$10, which is held as a bond to cover the value of the company's property entrusted to them. This preliminary deposit of \$5 indemnifies the company for the instructor's fee in case the student leaves before actually entering the service of the company.

#### SCHOOL ROOMS

The Chicago City Railway Company has recently fitted up a school room for instructing trainmen at the headquarters

34. At junction points and crossings, in which direction are cars superior by direction?

35. What is the maximum rate of speed at which cars should be operated over special work, railroad crossings and switches?

36. After a blockade from any cause, how should cars be started with respect to each other?

37. To whom shall defects in car, track, wire or block signals, which need immediate attention, be reported?

38. When any fire department vehicle, patrol or ambulance is observed approaching, what must be done?

39. Should Conductors and Motormen endeavor to keep people from jumping on and off from moving cars?

40. If they attempt to get on or off car while it is in motion, what should be done?

41. When passengers are alighting from car, and a car is approaching in an opposite direction, what should be done?

42. Should passengers be allowed to ride on steps or buffers?

43. While a car is in commission, should both Motorman and Conductor leave it at one time?

44. When it is necessary for the Conductor to leave the car, what should he do?

45. Should passengers board the car during the absence of the Conductor, what will the Motorman do?

Fig. 22—Sample Page of General Questions—Utica & Mohawk Valley Examination Book

of its Second Division, Thirty-ninth Street and Wabash Avenue. It occupies a floor space 60 ft. x 65 ft. and contains an unusually complete equipment. At one end is a rostrum and desk for the instructor facing two rows of seats for students, and at the other end are two complete skeleton cars, consisting of the framework and running gear, with motors, electrical, hand and air-brake equipment, fare registers, trolley retrievers, etc. One of these is a skeleton of the older type of single-truck, two-motor car and the other is a double-truck, 1907 type motor car. On the walls are city maps showing all surface car and elevated lines, complete wiring diagrams of cars, sample car house "directory of runs," sample time tables, full set of accident report forms properly filled out as an object lesson of how to do it, full set of signing-in sheets, time cards, trip sheets and other forms used by the auditing department, also properly filled out, samples of properly punched transfers, and copies of all recent orders or

bulletins which relate to the conduct or duties of trainmen.

The class room work is informal, the object of the instructor being to supply information on any subject when questioned by the students. New men report to the school for preliminary instruction and explanation of their duties before being sent out on the road in care of an instructing trainman. This preliminary work requires about two hours. When not out on the road practising students are frequent visitors to the school room. The instructor is on duty from 8 a. m. to 6 p. m. and is always ready to answer any question or explain any points about the operation of any part of the car equipment which is not clear. The wheels of the skeleton cars are mounted free of the rails and the brakes are arranged to give a constant drag so that the exact performance of the motors of a car accelerating can be observed and the effect of brake applications studied.

When a student has finished with the road instructor he

210. Should passengers be allowed to bring on the car any article which is liable to damage the car, or property or clothes of passengers or injure their person?

211. Should the Conductor in any way assume responsibility for any package which a passenger may bring on the car?

212. Should trolley be removed from the wire at night at end of run or elsewhere before all passengers have left car?

213. When must the Conductor watch the trolley?

214. If the trolley should leave the wire, what should be done?

215. After trolley has been replaced upon the wire, what should be done before giving the Motorman the signal to go ahead?

216. Should Conductor request passengers to keep their hands off trolley-cord and bell-ropes?

217. What gate or door on rear platform on closed cars should be kept closed at all times?

218. On open cars, on which side should guard rod be kept down and chains hooked?

219. On closed cars, should the rear end doors be kept closed as much as possible in cold or stormy weather?

220. Should car always be kept well ventilated?

Fig. 23—Sample Page of Conductor's Questions—Utica & Mohawk Valley Examination Book

returns to the school room for a thorough examination by the school instructor. The motorman's examination requires about five hours, and includes among other points a test on the skeleton cars, on finding out why the motors will not start if the various fuses, switches, circuit-breakers, etc., are not properly regulated. He is required to cut out motors, make emergency stops and demonstrate how to feed the controller in ordinary service. The conductor's examination requires only about 2 1/2 hours and is principally confined to matters relating to collection of fares, issuing of transfers, care of passengers, emergency procedure and the like, but it also includes some questions on the care and manipulation of heating and lighting circuits, fare registers and trolley retrievers. As a preliminary to these examinations the student is given a book of 16 pages of closely printed questions without answers, which he is expected to study and be prepared to answer any of the questions contained therein. These questions have been se-

lected to cover the rule book and the operation of cars, and a student who can answer them all is well versed in his work.

The school room is used by old men, and these visits are encouraged. The instructor keeps a record of attendance of old employees in an alphabetical register book.

School rooms are used by most large street railway systems, and while they vary in equipment and methods, the school in Chicago described above is in a general way typical of them all.

TRAINMEN'S FIDELITY BONDS

The amount of deposit or fidelity bond required of conductors and motormen ranges from nothing to \$500, indicating a wide difference of opinion as to the necessity or value of such a guarantee of honest and faithful performance. Out of 80 replies received, 27 companies report no bond or deposit required for either conductor or motorman. Nineteen companies require only a nominal deposit from both classes of employees ranging from \$1 to \$5 to cover the value of badges, punches, rule books and other company property loaned to them. A substantial bond or deposit of from \$15

it. At the end of the year the balance remaining, after deducting any accrued indemnities, is turned over to the Employees' Mutual Benefit Association general fund. The Rhode Island Company, of Providence, requires conductors to furnish a surety bond of \$500 which must be signed by two real estate holders in the State of Rhode Island. A similar bond is required by the Omaha & Council Bluffs Street Railway Company. The Washington (D. C.) Railway & Electric Company bonds its conductors and motormen for \$500 through its Railway Employees' Relief Association. A premium of \$1.50 a year is charged and the profits accruing are turned into the general fund. This, in effect, is the same method as that employed by the Brooklyn Rapid Transit Company.

Several roads which require fidelity bonds carry the premiums on them free of cost to the employees. The Berkshire Street Railway and the Springfield (Mass.) Street Railway Companies do this. The East St. Louis & Suburban Railway Company requires conductors to pay the premium on a \$500 bond for the first year of their service, but after

NAME OF ROAD	Number References Required	How Verified	Per Cent. Rejected on Physical Exam'n	BREAKING IN		
				Shop or School Days	Road Days	Total Days
Birmingham Railway, Light & Power Co.	3	Mail	5	..	14	14
Boston Elevated Railway Co.	4 to 10	Mail	9	..	10	10
Boston & Worcester Street Railway	1 or more	Mail	..	3†	9	12
Denver City Tramway Co.	4 to 8	Mail	15	2 hours	7	7
Detroit United Railway Co.	3	Mail or personally	5	..	11	11‡
Fort Wayne & Wabash Valley Traction Co.	3	Mail or personally	33	2†	10	12
Indianapolis Traction & Terminal Co.	4	Mail	10	3	14	17
Indiana Union Traction Co.	3	Mail	4	5†	10	10 to 15
Lackawanna & Wyoming Valley Railroad Co.	3	Mail	8	4†	10	14
Little Rock Railway & Electric Co.	4	Mail or personally	3	6	12	18
Memphis Street Railway	4 to 6	Mail	..	3	10	13
Metropolitan Street Railway Co. (Kansas City, Mo.)	3	Mail	..	..	7	7
Milwaukee Electric Railway & Light Co.	5	Mail	20	..	10	10
Nashville Railway & Light Co.	1	Personally	1	2	8	10
Northern Electric Co. (Chico, Cal.)	1 to 5	Mail	15	..	7	7
Pacific Electric Railway (Los Angeles)	3	Mail	10	1	15	16
Springfield (Mass.) Street Railway Co.	5	Mail	1	..	14	14
Syracuse Rapid Transit Railway	2	Mail	3	3†	18	21*
Twin City Rapid Transit Co. (Minneapolis)	3	Mail	..	2	12	14
United Railways of Albany	2	Mail	18	7†	14	21

\*14 days on road for conductors.

†Motormen only, in shops.

‡30 days for interurban service.

Summary of Methods Used in Employment of Trainmen

to \$500 for conductors, but only a nominal deposit or none at all for motormen is required by 17 companies. Surety bonds or a deposit of \$15 or more for both motormen and conductors are required by 17 companies. The companies of each class reporting are about evenly divided between city and interurban lines.

The Milwaukee Electric Railway & Light Company requires of both motormen and conductors either a cash deposit of \$25 or a cash deposit of \$5 and a surety bond for \$100, for which the employee is required to pay the annual premium of \$1. The Metropolitan Street Railway Company, of Kansas City, requires a fidelity and liability bond of \$500 for both motormen and conductors, which covers property damage caused by the employee's negligence. In Brooklyn, the Brooklyn Rapid Transit Company bonds its conductors to the amount of \$100 through a fidelity fund which is appropriated annually from the earnings of the company. This fund represents the annual cost of premiums on fidelity bonds if taken out in a regular insurance company, and any breaches of trust which cause loss to the company are recouped from

that the company assumes the cost of carrying the bonds.

The Ottawa Electric Railway Company requires the applicant to furnish as references the names of two responsible citizens who will certify as to the applicant's character and agree to become security for him to the amount of \$50 each.

DISCIPLINING EMPLOYEES—BROWN SYSTEM

The old method of disciplining employees by summary dismissal, suspension without pay, or reprimand, is still practised on many roads, but it is giving way gradually to the fairer method of cumulative efficiency and deficiency records. Discipline by deficiency records is often referred to as the Brown system of discipline, because it was first used by George R. Brown while he was general superintendent of the Fall Brook Railroad. Mr. Brown's original system of records and penalties has been changed and modified in many of its details, but its essential principle is retained in all of the so-called merit and demerit systems which are in use at the present time on both steam and electric railways and in many industrial corporations. Mr. Brown's idea was

that the primary reason for discipline should be the improvement of the service and not the punishment and reprimand of the men or the giving of an object lesson to other men. He contended that suspension without investigation and without any fair measure of the degree of culpability is almost always unjust and is frequently administered in the spirit of anger. The basic idea of the Brown system is a record book in which a page is devoted to the personal record of every employee. The book itself is never shown, but any employee can get a copy of his own personal record at any time. In the book is written down on the proper page a brief statement of every irregularity for which a man is responsible. These records take the place of suspension, and are dreaded fully as much. The man is not laid off from his work, no one but himself suffers and he only in reputation at headquarters. When a man begins to accumulate a number of entries on his record he is called in and not reprimanded, but simply reminded that if his record continues to grow he will be considered a failure in the service and can expect nothing but discharge. His weaknesses are shown to him and he is given another chance. Another important feature of the Brown system as originally worked out is a bulletin which is

faithful service will be recognized and rewarded by uninterrupted employment and, on the other hand, that reward and promotion will not follow indifferent service.

#### MERIT AND DEMERIT SYSTEM

The Brown system makes no provision for rewarding specific meritorious acts nor does it give the employees a chance to wipe out past records and irregularities by long continued good behavior. In this one feature lies the principal difference between the Brown system and the more recently devised merit and demerit system of discipline. With the merit and demerit system, specific breaches of discipline and infractions of the rules are punished with a certain number of demerit marks entered against the record of the employee. A maximum number of demerits is set which when reached during a given period of time, makes the employee liable to discharge, subject, always, of course, to the discretion of the officers of the company. Similarly, the employee is entitled to a specific number of merit marks for especially commendable acts and a clean record for from three months to a year cancels a certain number of demerit marks which might have accrued previously. The usual practice where

BOSTON AND WORCESTER ST. RY. CO.	
General Office - South Framingham, Mass. _____	190_____
To Cond. M'man _____	No. _____
To _____	No. _____
You are hereby notified of a failure of conduct as stated on back and are cautioned to avoid its repetition. Sign promptly and return to Starter or Foreman in charge.	
_____ Asst. Gen'l Superintendent	
I have carefully read this report and understand it refers to Rule _____	
Paragraph _____	or General Order _____ or _____
_____ Cond. M'man No. _____	
_____ No. _____	
Full instructions concerning the above have been given by me to _____	
_____ No. _____	
Foreman - Starter	
When complete Foreman or Starter will return to Assistant General Superintendent.	

Fig. 24—Warning Card—Boston & Worcester

Memorandum Record Report.			
Badge _____	Date _____	1907	
Name _____	Car. No. _____	Time _____ M	
Place _____			
Inefficient. Speed, Signals, Switches. Not Reporting. Efficiency. Accidents, Responsible, Unavoidable, Preventing. Register.			
Passengers _____	Registered _____	Diff _____	Badges _____
Action taken _____			
Signed _____			

Fig. 25—Inspectors' Discipline Report—New Jersey & Hudson River

publicly posted and gives a record of every irregularity entered in the books. No names are given or other means of identifying the particular employee at fault. The bulletin simply describes the accident and irregularity and then comments on it briefly from the company's point of view and suggests how it was injurious to the interests of the company. Mr. Brown summarizes the objects of his method as follows:

First, to secure a higher state of efficiency.

Second, to avoid the loss of time and wages of employees which result in possible suffering on the part of those dependent upon the employee's earnings. There is also a grave chance of demoralization during enforced idleness.

Third, to avoid unnecessary severity in the dismissal of an employee or in requiring him to serve a suspension for a single offense that does not reflect upon his reputation, conduct or capacity for future usefulness.

Fourth, to remove the false but common impression in the minds of the employees that the amount lost by them in wages during their suspension is payment for the loss and trouble caused the company.

Fifth, to avoid frequent changes in the personnel of the company's force.

Sixth, to educate employees through the medium of the bulletin notes, which enable them to avoid the mistakes made by others.

Seventh, to insure a feeling of security and confidence that

such a system is used is to begin a new set of records once a year, starting each man with a clean sheet. In some cases, however, the record is made continuous and the best employees have to their credit a large excess of merit marks to wipe out any possible demerit marks which they might receive. This method of discipline is eminently fair and just to the company and to the employees alike, and in most cases where it has been tried it has proved markedly successful.

The system as worked out in Rochester, N. Y., is typical and will be described briefly here. A different scale of marks is provided for the city lines and for the interurban lines. For the city lines, 60 demerit marks after deducting any credit marks will result in dismissal. The scale of credit marks has been worked out in as much detail as the scale of demerit marks. The employee who has had no demerit marks against his name for six consecutive months is given 10 credit marks and for each succeeding six months is given 15 credit marks. The maximum number of credit marks for a specific meritorious act is five and the minimum is three. Certain infractions of the rules are not punished on the first offense, but a warning is given. Demerit marks then accumulate for the second and subsequent repetitions of this infraction. The demerit marks imposed vary from one for minor offenses to 40 for rear-end collisions. A list of 26 offenses has been made up

which are cause for immediate dismissal regardless of the working of the merit system. A written notice is sent to an employee on which the merit and demerit marks affecting him are recorded. This notice shows the number of credits or demerits entered for the specific offense and the balance standing against the employee's name on the record book. The receipt of this notice must be acknowledged in writing by the employee. Employees may appeal from the marking of the division superintendent, who has charge of the discipline records, to the general superintendent, who makes a complete investigation of the circumstances and affirms or modifies the marking of the division superintendent. Employees may also make application to the division superintendent for merit marks, stating the circumstances of the meritorious conduct which in their opinion entitles them to special commendation. If approved by the division superintendent, the proper number of credit marks are allowed. Bulletins are issued each month and posted at the different car houses showing the num-

nearly nine years, has introduced important modifications in the original plan. The system as put into effect in February, 1900, was an elaborate one. Schedules were prepared of 39 degrees of merits for motormen and 41 degrees of merits for conductors. On the demerit schedule, there were 62 degrees for conductors and 57 for motormen, and in the ledger in which these records were kept two pages were devoted to each man. On the left-hand page the merits and demerits were posted, while the right-hand page was devoted to explanatory notes. When a man had a clean record for a month, he was credited with 10 merit marks. The chief objection to the system was the time required for keeping it up. Again, it was found that a purely numerical system of discipline, with no penalty except final dismissal, was not entirely effective. In consequence, the company on Jan. 1, 1907, discontinued the system for one in which there are but eight entries as follows:

Inefficient performance.....	1 Demerit
Excessive speed or running by signals or switches....	1 Demerit
No reports on subjects required by the management....	1 Demerit
Efficient performance.....	1 Merit
Accidents for which the employee is responsible....	2 Merits
Unavoidable accidents in which the employee is involved.....	1 Demerit
Preventing accidents.....	2 Merits
Errors in registering fares.....	1 Demerit

The reports on which the marks are awarded are received from the outside inspectors and are submitted to the manager on the blanks, one of which is reproduced in Fig. 25. They are then filed with the other records of the employee under the man's name in a manila filing folio, 9 in. x 14 in. Every employee who has a clean record for a month is given 1 merit. The front of the filing folio contains blanks for summarizing the number of merits and demerits received each month, the cause of each, the action taken by the management, etc. Punishment is regulated to a considerable extent by the previous record of the man and usually consists in a reduction in his seniority standing. To avoid any misunderstanding on the part of the employees as to the intention of the company to rate a man in accordance with his standing with the company, the following clauses are printed on the application for employment which each applicant is obliged to fill out before taking service with the company:

- Do you know that your employment, retention or promotion will be based upon your relative standing, according to Competitive Civil Service Methods?
- Do you know that you will not be promoted according to the position of your name on the list, but according to the value of your services to the company, regardless of the time of your employment?

Most of the reports mentioned above are submitted by uniformed inspectors, who board the cars at frequent intervals and otherwise keep in close touch with the performance of the men. The arrangement of the company's lines is such as to permit this kind of inspection, as a large proportion of the passengers travel either to the ferry to New York, or through the junction at Hackensack. The daily car-miles run are 3500 to 3600; the car-hours average about 325, and six inspectors, working 10 hours a day, have no difficulty in inspecting 60 to 70 per cent of the gross receipts. The management is very careful about the selection of its men and most of the motormen employed have been honorably discharged from other lines. Owing to their experience, the management believes the most likely cause for accident on the part of the motorman is not ignorance, but neglect on his part to keep his mind on his work. Every man is told, therefore, that if he has business or social troubles when he reports for work, he is to apply to the dispatcher for relief from duty that day. This point is emphasized by the general manager in regular talks which he gives for two hours each month to the men when he goes over the rules with them. Attendance

<b>EIGHTEEN CREDITS.</b> Three motormen and two conductors—Clear record past year and neatness of person and car past six months.
<b>THIRTEEN CREDITS.</b> Seven motormen and three conductors—Clear record and neatness of person and car past six months.
<b>FIVE CREDITS.</b> Five motormen and four conductors—Tying up trolley wires. Two motormen and one conductor—Helping tie up trolley wires. Four conductors—Securing information valuable to claim department.
<b>THREE CREDITS.</b> Seven motormen and seven conductors—Neatness of person and car past six months. Two motormen—Watching broken trolley wires. Seventeen motormen and two conductors—Finding and turning in company's property. One motorman—Changing route of car and filling in gap. Two motormen and one conductor—Helping remove horse from track. One motorman and one conductor—Helping place car on track. One motorman and two conductors—Lighting switch lamp at Glen Haven Junction. One motorman—Coupling cars together, avoiding blockade. Two motormen—Splicing ground wire. One motorman and conductor—Helping remove wagon from track. One motorman—Helping crew get car to start when grounded. One motorman—Pushing crippled car to barn. One motorman—Repairing motor wire. One motorman—Connecting feed wire. One conductor—Removing obstruction from track.
<b>ONE DEMERIT.</b> Eleven motormen and 30 conductors—Failing to report for run on time. Six conductors—Turning car over to relief with fire out. Six conductors—Allowing fire to go out. Three conductors—Not having car properly ventilated. Two motormen—Not making junction stop. One motorman—Not sounding gong when passing streets. One motorman—Running into open switch.
<b>TWO DEMERITS.</b> One conductor—Not having car properly ventilated. Five motormen—Not having car properly signed. Twelve motormen—Running ahead of schedule time. One motorman—Running fast over special work.

**Rochester Merit and Demerit System—Sample Page of Monthly Bulletin**

ber of acts and the number of employees participating therein on account of which merits or demerits were given. No names, however, are divulged or other circumstances stated in such detail as would make it possible to identify any specific act.

The merit and demerit system in some modified form is used on 20 of the 80 companies from which replies were received. Among these roads may be mentioned:

- Fort Wayne & Wabash Valley Traction Company; Seattle Electric Company; Wheeling Traction Company; Capitol Traction Company; Tri-City Railway Company; Georgia Railway & Electric Company; Scranton Railway Company; Brooklyn Rapid Transit Company; Portland (Ore.) Railway, Light & Power Company.

**OTHER METHODS**

The practice of the New Jersey & Hudson River Railway & Ferry Company is particularly worthy of mention in this connection, because this road was one of the first to establish a merit and demerit system and, as a result of an experience of

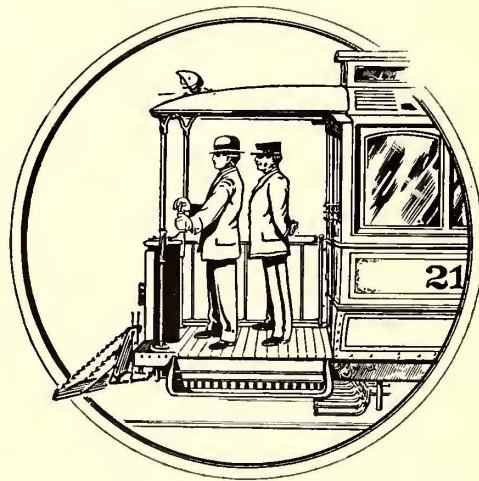
at these meetings is voluntary, but a record is kept of those present.

The Duluth Street Railway Company has worked out a merit and demerit system which has been found to be very satisfactory. The company has not altogether done away with suspension, but seldom suspends men for more than one day pending investigation. For the most part discipline is confined to giving demerits and rewards for clear records or meritorious acts are given in the shape of the first choice in selecting runs. The runs are assigned by choice in the order of the standing of the trainmen under the merit and demerit system. Seniority does not govern.

A common method of inflicting discipline for minor infractions of the rules is to assign the disobedient employee to the less desirable runs and place him on the extra list, sometimes at the top, and for more serious offenses at the foot, for a period of from 1 to 10 days. This is in effect partial suspension. In many cases, especially during the busy season, when every man available is needed, some trainmen would like suspension from duty. The assignment to undesirable

runs which require men to report as usual is found in most cases to be quite as efficient as actual suspension. It has, however, the element of humiliation to the trainman and publicly records the discipline which is one of the disadvantageous features overcome by the merit and demerit system.

When it becomes necessary to discharge an employee for a serious breach of discipline, many companies allow the offender the right of appeal to some officer higher in the organization than the one who inflicts the penalty. This policy is defended on the ground that the subordinate officer is sometimes liable to err on the side of the company and to mete out unjust punishment in a spirit of anger on slight provocation. On the other hand, if the superior officer too often reverses the verdict of his subordinates, the men lose respect for the entire organization and discipline becomes demoralized. If the responsibility of employing men is placed on a subordinate officer, it would seem fair to give him also the unrestricted right of discharging men who proved incompetent or unruly and to hold him to account for the efficiency and esprit du corps of the entire force under him.





# TRAINMEN'S CLUB ROOMS, BENEFIT ASSOCIATIONS, PENSION SCHEMES AND OTHER WELFARE WORK

THE social betterment of employees and the promotion of friendly relations between them and their superior officers has, in recent years, come to be an important part of electric railway management. Where a few years ago trainmen's clubs, benefit associations and other social and educational organizations were the exception rather than the rule, they are to-day to be found as an essential factor in the relations between employer and employee on nearly every important street railway system and on many of the interurban roads. Almost invariably where any welfare work of this kind has been carried on intelligently and tactfully it has been highly successful in cultivating a spirit of loyalty and esteem among the men and has more than repaid the money and effort spent in starting it. Opposition on the part of certain disturbing elements among the employees sometimes develops and threatens to disrupt the work, but usually the more intelligent class of men who realize the benefits which they themselves derive from clubs and relief associations and other betterment schemes, can be relied upon to give them their hearty support. In only one case reported has opposition to the establishment of trainmen's clubs or benefit associations developed to such an extent as to warrant abandoning the plan. In one large city in the Middle West the employees' association discouraged the street railway company in its effort to establish a benefit association, preferring to carry out the relief work independently of the company. Without the support of the men the company realized that welfare work would be of little or no real value and consequently abandoned any idea of undertaking it. This case is exceptional and it is possible that if the company had quietly endeavored to interest the men individually in the plan and made a point of explaining the advantages to them of club rooms and other features and that there was involved no obligation of any sort on their part, sufficient support would have been received to insure the success of the plan without antagonizing any element among the men.

## CLUB ROOMS

That the men use and appreciate club rooms where they have been established is beyond question. That the company benefits directly and indirectly has also been the general experience. Opinions differ somewhat as to the exact manner in which the companies benefit, but among the advantages which have been cited are the following:

Trainmen's clubs promote social intercourse among the men and assist in welding them together with bonds of friendly feeling toward each other which is an essential foundation for esprit du corps. They instill in the men a spirit of pride in the possession of a place all their own, which gradually grows to include pride in the company by which they are employed. Teaching the men to take care of their own club rooms teaches them to take care of the company's property entrusted to them. The men and officers have an opportunity to meet on some other ground than the "green carpet." A place is provided where the men can spend the time waiting for their runs among clean and moral surroundings. Where baths and barber shops are included as part of the club equipment, an improvement in the personal appearance and cleanliness of the men is always noticeable. These are some of the in-

direct benefits. The direct benefits vary largely, of course, with local conditions. There are usually enough men using the club rooms at any hour of the day to supply an extra crew in an emergency and where night schools and similar educational work are carried on in connection with the clubs, the company is the direct beneficiary. If the car houses are located at isolated points the club rooms afford an incentive for the men to report a little ahead of time, a condition which often aids materially in getting cars out on time.

## Y. M. C. A. STREET RAILWAY BRANCHES

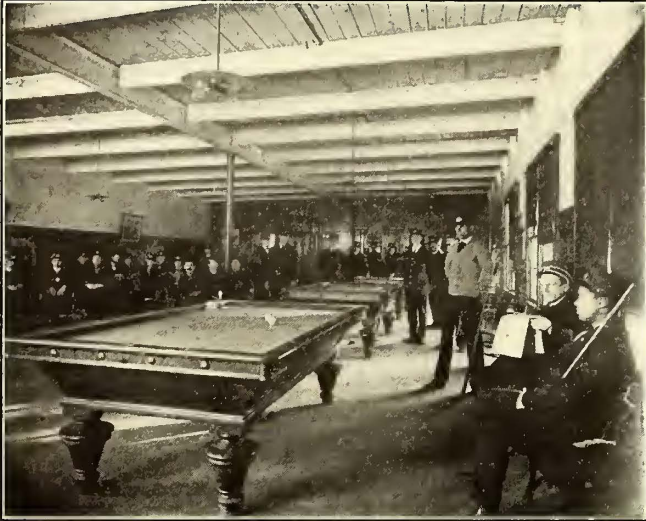
Before describing some of the typical club rooms of street railway employees a brief reference should be made to the work of the Young Men's Christian Association through its street railway branches in Rochester, N. Y.; Memphis, Tenn.; Nashville, Tenn.; Richmond, Va., and Birmingham, Ala. In other cities the methods of the Y. M. C. A. have frequently been followed in conducting trainmen's clubs without, however, actual affiliation with that organization. In the cities mentioned the clubs are conducted as Y. M. C. A. branches, are under the direction of a paid secretary and embody all of the moral and religious influences that have been so successfully made a part of the work of the general association.

The Young Men's Christian Association began its work among steam railway employees 36 years ago. It has built or helped build and maintain 170 buildings for its several branches, besides furnishing quarters in buildings not owned for 67 other branches. These 170 buildings, of which 120 are owned outright by the Association and 50 are owned by the railway companies, represent a total investment of more than \$3,600,000. The street railway department of the Y. M. C. A. is only about six years old. In the spring of 1902, the Rochester Railway Company decided to establish club rooms for its employees to be maintained and directed by the company. At a very large cost the company fitted up one of its car houses with rooms for games, reading, bathing and bowling alleys. The secretary of the Rochester central branch of the Y. M. C. A. became interested in this welfare work and conceived the idea of organizing a street railway branch of the Y. M. C. A. Together with one of the international secretaries of the steam railway department he called on the Rochester Railway Company and placed before the management a statement of the work which the railway department of the Y. M. C. A. had accomplished among steam railway employees and asked to be allowed to organize a street railway branch on similar lines. The company approved the plan, and in a short time an Association was organized and occupied the commodious quarters already provided.

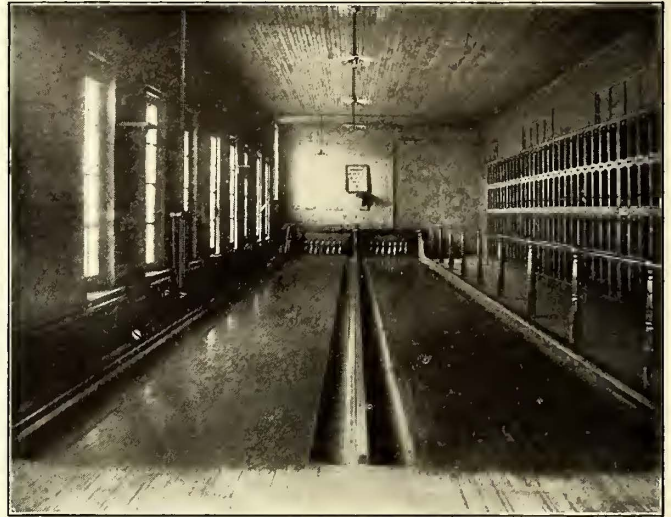
The first branch of the Y. M. C. A. in Rochester proved so successful that the company decided to extend its work in this direction by establishing a second branch in the car house of the Eastern Division at Federal Street. The company is now planning to open a third branch at its Portland Avenue car house. The work of fitting up the club rooms at this car house is well under way, and it is expected that they will be ready for use in a short time. The accompanying illustrations, from photographs, show the equipment of the

rooms in both the Eastern and Western Division branches. The Western Division rooms include a library, containing a large number of the best books and current files of magazines and technical publications, a pool and billiard room, containing three pool tables and one billiard table, two bowling alleys, a barber shop, bathrooms, and a dormitory containing 16 beds. The pool and billiard room is used as a gen-

contain one or two single beds, chairs and a bureau. The barber shop is equipped with two chairs and all of the latest and most sanitary devices. The usual prices are charged for shaving and hair cutting. The dining room has a seating capacity of between 35 and 40 at the tables, and a course dinner is served at noon for which the small sum of 20 cents is charged. A large assortment of short order dishes is



Rochester Y. M. C. A.—Game Room

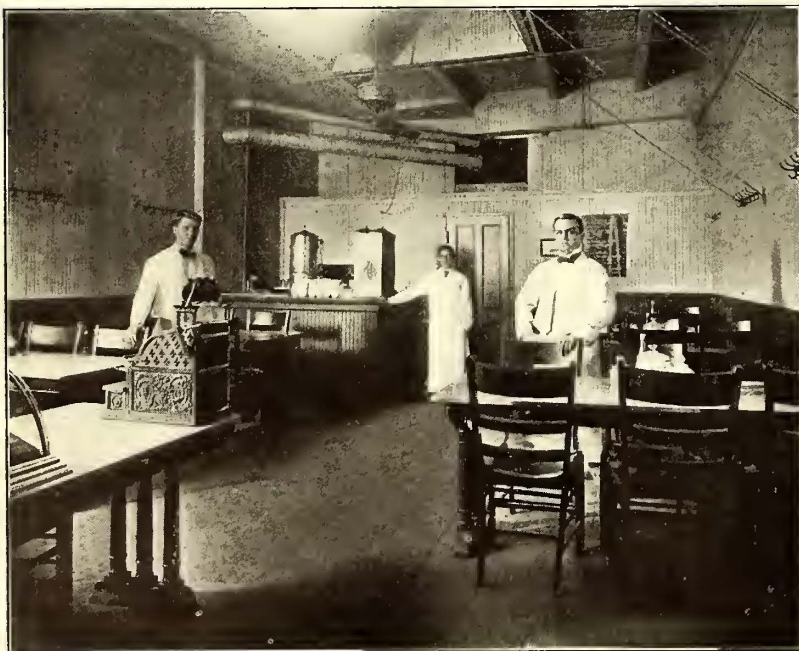


Rochester Y. M. C. A.—Bowling Alleys

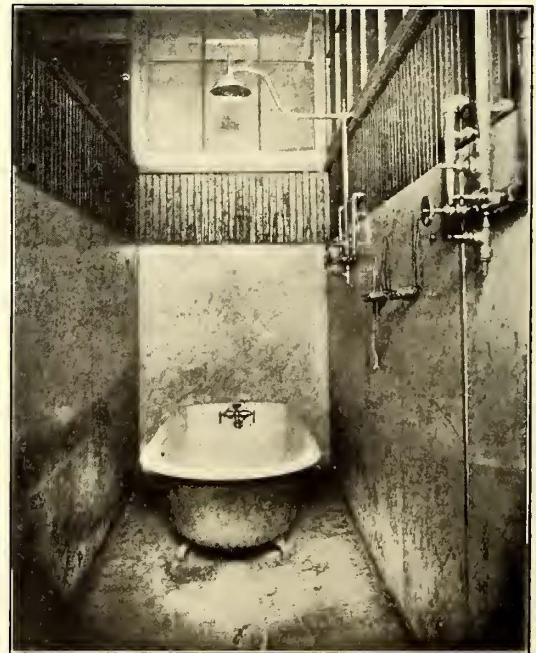
eral recreation room and contains, in addition to the four large tables, a piano, and a number of smaller tables with chairs for playing games of checkers and chess. There are two regulation bowling alleys with a full equipment of pins and balls. In this room are the trainmen's lockers, shown in the right of the illustration. The charge made for the use of the

served at other hours. The lunch room is always open. The equipment of the bath rooms is very complete. They are lined with marble and have shower and tub baths. A charge of 5 cents is made for taking a bath, and this includes clean towels and soap.

The Eastern Division branch equipment consists of a



Rochester Y. M. C. A.—Lunch Room



Rochester Y. M. C. A.—Bath Room

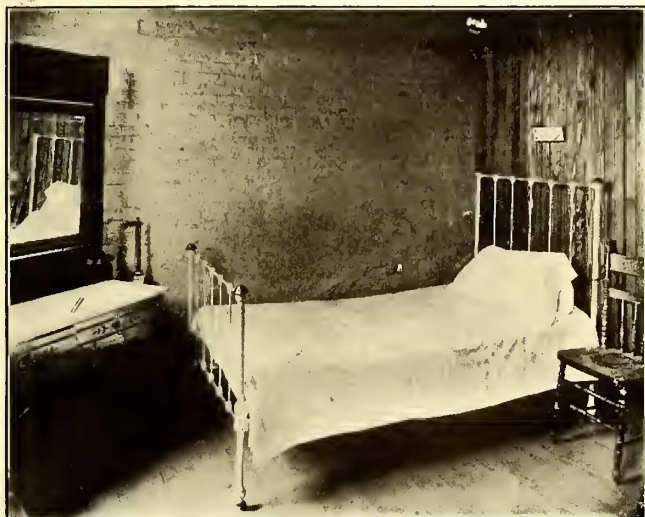
pool tables is only 2 cents per cue. A charge of 5 cents per man per game is made for the use of the bowling alleys; games of checkers and chess are free. The dormitory of the Western Division branch contains 16 beds in single and double rooms. A charge of 15 cents per night is made for the use of these rooms, and they are usually well patronized. The rooms are steam heated and lighted with electricity, and

library, recreation room containing pool and game tables, barber shop and bath rooms. The company is contemplating putting in a dining room at this car house which will be run on the same plan as the restaurant in the Western Division car house.

The Rochester Railway Company gives the use of these club rooms to all of its employees without cost of any kind,

and in this respect the rooms are conducted along the same lines as in other cities which have no affiliation with the Y. M. C. A. The rooms are under the direction and supervision of a paid secretary of the Y. M. C. A., however, and the company encourages the religious and moral influence of the Association in every possible way. It is contemplating reorganizing the clubs and charging the employees nominal

readily called when needed; second, that the moral tone which pervades the club rooms has an uplifting influence on the men and tends to inculcate principles of honesty and courtesy; and third, that the sociable character of the club rooms tends to make the men congregate there instead of in the saloons near the car houses. A short time ago one employee went to the secretary of the Y. M. C. A. in Rochester



Rochester Y. M. C. A.—Bed Room



Rochester Y. M. C. A.—Secretary's Office

dues which will entitle them to full membership in the Y. M. C. A. The company contributes a fixed sum of \$1,500 for the secretary's salary, maintains the rooms and contributes funds from time to time for other purposes. The secretary has two paid assistants, whose salaries are met from the revenues derived from the use of the games and the restaurant.

and said that through the influence of the club rooms he had given up the use of liquor and had saved money during the last two years, and that he knew that he was a much better man in every way.

In 1904 the Virginia Passenger & Power Company, of Richmond, Va., was approached by H. O. Williams, one



Rochester Y. M. C. A.—Barber Shop



Rochester Y. M. C. A.—Reading Room

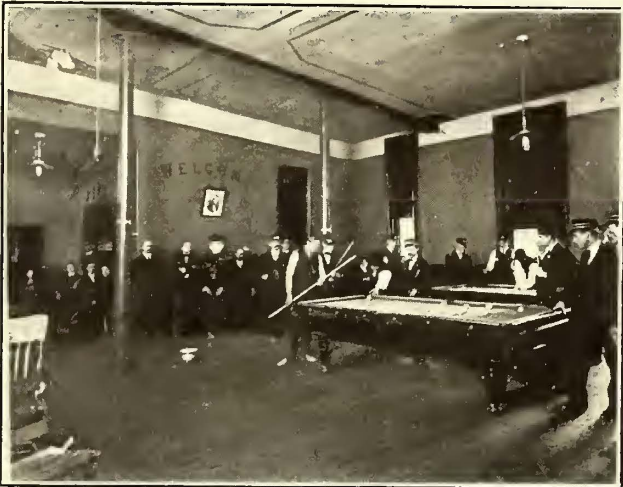
The rooms are used by 95 per cent of the employees. With the exception of the lunch rooms, which are open 24 hours a day, the other departments at both clubs are open only from 7 a. m. to 11 p. m.

The Rochester Railway Company states that the principal value which it has derived from the club rooms is, first, that the men make the club rooms their headquarters and can be

of the international secretaries of the railway department of the Y. M. C. A., and a plan was laid before it for establishing a street railway branch in that city. The good work already accomplished in Rochester proved a strong argument, and the street railway company was induced to appropriate \$15,000 for a building and its equipment. This building is equipped with a large library, pool tables and tables for

other games, reading and writing rooms, a rest room, shower baths, a barber shop, a phonograph, music box and piano and a large auditorium for social and religious gatherings. In the last four years this branch of the Association has grown rapidly and at the present time it has 707 members. Smaller branches

tables, current files of a number of magazines, technical publications and weekly and daily papers. A few figures with reference to the work of this branch of the Association are of interest. The present membership is 476. During the past 12 months 8269 baths have been taken by the men,



Nashville Y. M. C. A.—Billiard Room



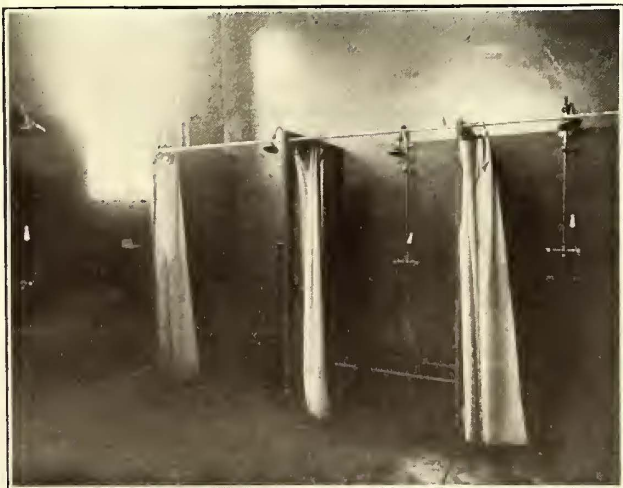
Nashville Y. M. C. A.—Restaurant

have been established in the outlying villages of Petersburg and Manchester, at the main power house and in a rented building on Broad Street, Richmond. These serve the men who are not able to reach the main building.

On Aug. 26, 1905, the third street railway branch of the Y. M. C. A. was opened in Memphis, Tenn. The Memphis Street Railway Company appropriated \$1,800 for furnishing quarters for the Association on the ground floor of its main car house and shop building. This branch started with a membership of 300. In two years it increased its membership to 475, and at the present time 85 per cent of the white employees of the company are members. The original quarters have been outgrown, and it is probable that provision will have to be made in the future for more room. The company has contributed the use of the space occupied by the Association rooms, light, heat, hot and cold water and \$100 a month toward the salaries of the secretary and assistant

and 21,644 games of pool and 7563 games of checkers have been played in the rooms. The secretary estimates that 463 books and 12,775 magazines were read by the members during the year. The number of letters written in the Association rooms is estimated at 15,595 and the number of letters delivered to members at 7382. Eighty-one social and religious meetings were held for members and the secretary made 54 visits to the sick. The sum of \$404.25 was raised among the members by voluntary contribution for the relief of the sick. The total attendance at the department for the year was 176,538, a daily average of 484. The rooms are open from 9 a. m. to 10 p. m. Any white employee is eligible for membership and the annual dues are \$3.

In May, 1906, the Birmingham (Ala.) Railway, Light & Power Company organized a street railway branch of the Y. M. C. A. among its employees, after having carefully investigated the work of the branches in Rochester, Richmond



Nashville Y. M. C. A.—Shower Baths



Nashville Y. M. C. A.—Barber Shop

secretary. The rooms occupied by the Association contain two pool tables, a number of small game tables, a good organ with 100 song books and a number of bibles, a library of 952 volumes, many of which deal with electrical and other engineering subjects of interest to street railway men, writing

and Memphis. The second floor of the shop building which adjoins the main car house was turned over to the Association, and the company contributed a sum sufficient to completely equip and furnish the rooms. The quarters consist of a reading room, game room containing pool tables, card and game

tables, lunch room, bath room containing shower and tub baths and two large dormitories or sleeping rooms. The ac-

The restaurant is equipped with a range, coffee urn and other facilities for preparing any kind of food. It is run on



Nashville Y. M. C. A.—Reading Room



Birmingham Y. M. C. A.—Reading Room

companied illustrations show the equipment of some of these rooms. The dormitories contain about 50 beds and a charge of 10 cents per night is made for the use of these beds.

a cost basis and no attempt is made to conduct it at a profit. Good meals can be obtained for from 15 to 25 cents. The equipment of the restaurant includes tables and chairs, in addition to stools in front of the lunch counter along one side of the room. The company pays the salary of the Association secretary and furnishes heat, gas for cooking, electricity, water and ice, free of charge. The dues are the same as in other cities, \$3 per year. On account of the fact that sleeping quarters are provided at this branch, the rooms are open at all hours, although the secretary is in attendance only during the day.



Birmingham Y. M. C. A.—Restaurant

These rooms are in constant use by trainmen who have late runs or who are required to report early in the morning. A number of employees sleep here every night, having no other

The street railway branch of the Nashville Railway & Light Company was organized Jan. 1, 1908. Its rooms, which were provided by the railway company, were opened on June 15, 1908. The company purchased a large office building adjoining its central transfer station in the center of the city and remodeled the second floor for the Y. M. C. A. quarters. The equipment includes tub and shower baths, a barber shop, reading room and library, writing room, game room, restaurant and rest room. In the reading room 27 magazines and other periodicals are kept on file. The library has been started with about 100 volumes, and a substantial fund is now being raised with which books of the best fiction, history and biography and technical works on the construction and operation of street railway systems will be purchased. In the writing room free stationery is provided. The rest room is a large, airy room, isolated from the other rooms and containing comfortable chairs and reclining lounges. The restaurant is in charge of a competent chef and meals are served at all hours at practically cost price. The religious work of this branch is especially active. Services are held every Sunday morning at 11:15, which are regularly attended by from 20 to 40 members. Bible classes are conducted every Thursday evening, and from time to time noon prayer meetings are held by the secretary in the shops and car houses. The dues are \$3 and about 80 per cent of the employees are members. The company pays

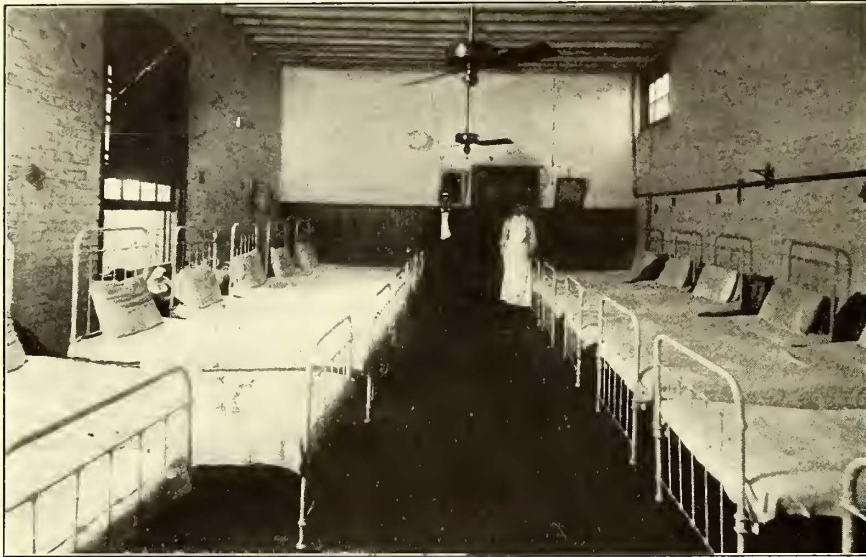


Birmingham Y. M. C. A.—Dormitory

boarding place. The charge for the use of the beds is merely nominal and barely covers the cost of laundry and attendance.

the salary of the secretary, furnishes free the building, light, heat and water, and, in addition, guarantees to make up any deficit which may accrue.

in separate buildings near the car house or in rented quarters in the downtown section. The trainmen's club rooms in Brooklyn are especially well equipped. The Brooklyn Rapid Transit Company has provided 11 club rooms at terminal depots and in addition erected, in 1903, a large building adjoining the East New York shops and terminal, which is used exclusively for an employees' club house. The building is of frame construction except the front walls, which are of brick. It covers an area 60 ft. x 170 ft. and is three stories high in front and two stories in the rear. On the ground floor are four regulation bowling alleys and a large locker room with lavatories, tubs and shower baths. On the second floor, in front, is the office of the secretary, who has charge of the club rooms all over the system, a library and reading room. Back of this is a billiard room and game room extending the entire width of the building. Adjoining the billiard room and separated from it by folding partitions is the gymnasium. An instruction room is beyond the gymnasium and is separated from it by another set of folding

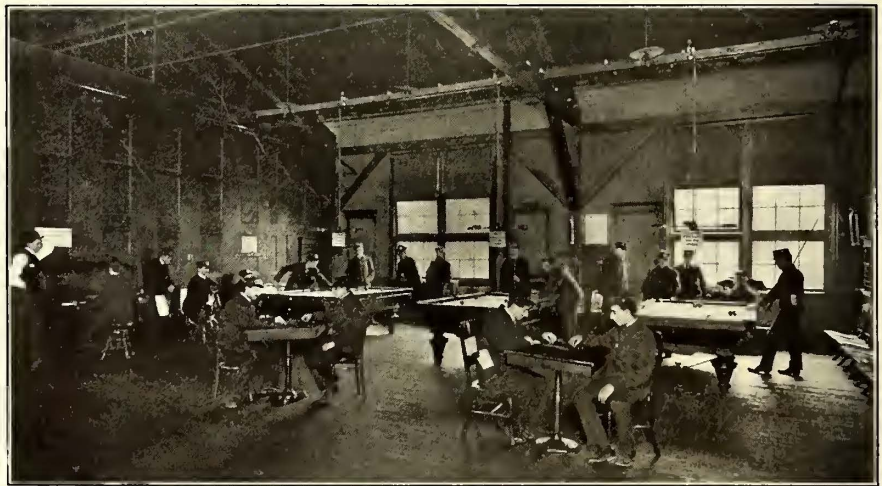


Birmingham Y. M. C. A.—Dormitory

One rule only governs all those who come within the quarters of the Association branches. This rule, which is prominently displayed on the walls, reads as follows: "Ladies may not be present; gentlemen are. Act accordingly or move on." The Association aims to teach the men to have a high opinion of right and truth, manly respect for the rights of the public and of the company, and always to practice the theory of a square deal. Some years ago one of the higher officers of the Rochester Railway Company, in addressing the Eleventh International Convention of the Railroad Branch of the Y. M. C. A., at Topeka, Kan., said:

"I heartily endorse the work of the Y. M. C. A. and earnestly recommend to the companies and the managers of street railways the necessity of their joining in this work. From a financial standpoint, I am quite sure that it will pay them, for we all want moral and religious men and I know of no better means of bringing this about than to organize a branch of this Association, provided the company will give it the proper support. The moral standard of our men is, conservatively speaking, at least 50 per cent. better than it was nine months ago, before the work was inaugurated."

partitions is the gymnasium. An instruction room is beyond the gymnasium and is separated from it by another set of folding



East New York Club House—Game Room

partitions. Along one end of the instruction room is a platform or stage, 8 ft. x 30 ft. The instruction room, gymnasium



East New York Club House—Reading Room

The usual location of trainmen's club rooms is at terminal car houses, but in some cities club rooms have been provided



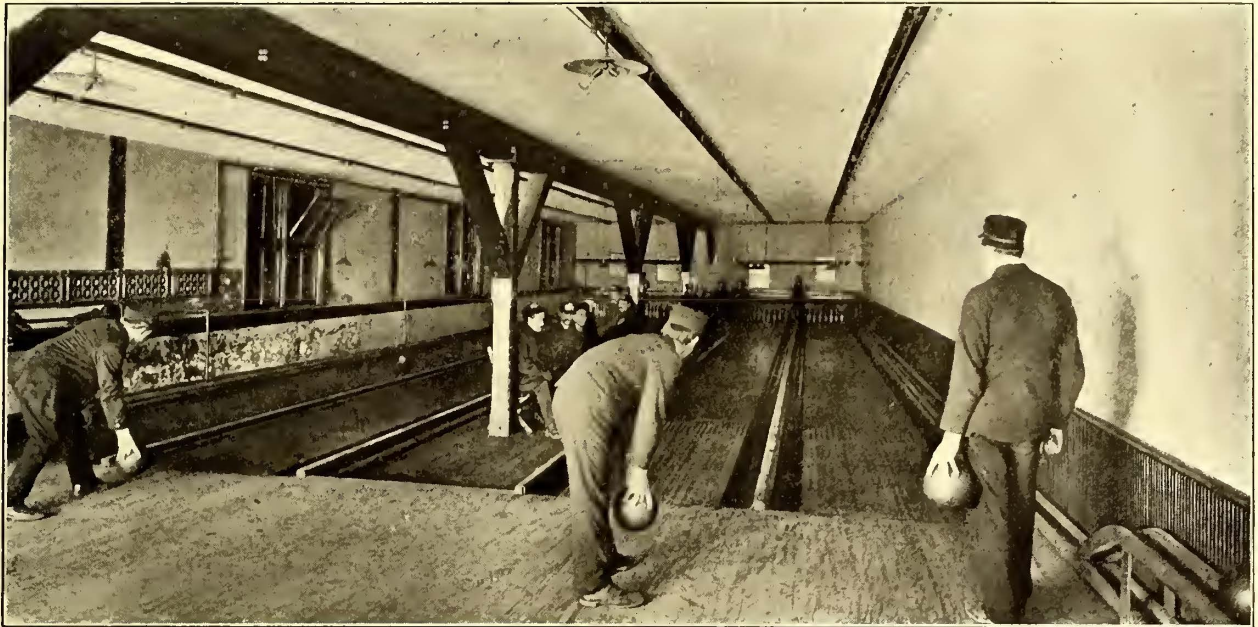
East New York Club House—Locker Room

and billiard room can be thrown together by folding back the separating partitions and when so arranged the entire room

can be used as an auditorium seating more than 1000 persons.

The building, which cost nearly \$40,000, was donated for the use of its employees by the company. In addition the company furnishes light and heat. The club is directed by the secretary of the Employees' Benefit Association, but it is open to all employees regardless of membership in that asso-

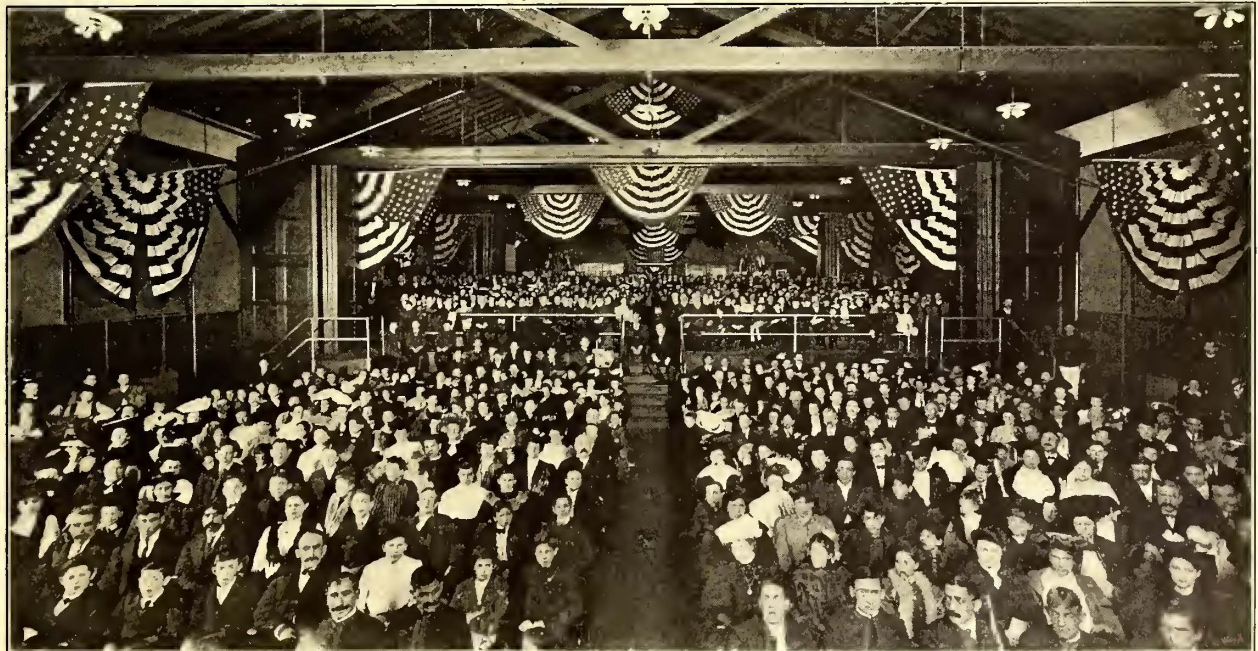
for food are as low as can be made with a nominal profit, which goes into the treasury of the club fund. The restaurant at the East New York club house has been in operation about a year and a half. The restaurant and kitchen are located on the ground floor in the space formerly occupied by the reading room. The dining room



East New York Club House—Bowling Alleys

ciation. This club house, like all of the other club houses in Brooklyn, is self-supporting, revenues being obtained by nominal charges for playing pool, billiards, bowling, etc. The various clubs had a total balance at the end of December, 1907, of \$12,596, which is available for purchasing new equipment and maintaining that already owned.

has an equipment of chairs and tables seating 150 persons at one time and there is also a special lunch counter 22 ft. long, where sandwiches and other similar dishes are served. Between 11 a. m. and 2 p. m. a regular dinner of five courses is served for 25 cents. The dining room is convenient of access to the East New York shops, the elevated structure



East New York Club House—Auditorium

The other club rooms of the Brooklyn Rapid Transit Company are equally as comfortable and as well equipped on a somewhat smaller scale as the main club house in East New York. Some of them are kept open the entire 24 hours of the day, while others are closed after midnight. At five of these clubs lunch rooms are maintained where the charges

and the street and a large number of the employees patronize the restaurant at noon. All of the table linen and the silver is marked with the emblem of the Employees' Benefit Association.

Outside interests of the Employees' Benefit Association of the Brooklyn Rapid Transit Company are numerous and

varied. Aside from the benefit association fund, which is used for no other purposes than for sick and death benefits,

dancing, and also has an equipment of folding chairs which are used for vaudeville performances and other entertainments on the stage. The club room and reading room are open, without charge to all employees of the company, including the shop men, and track and line employees, as well as the trainmen. The railway company furnishes the building as well as the light, heat and janitor's service free. While the club rooms are open to all employees, the furnishings are the sole property of the Employees' Club, the membership dues of which are 25 cents a month. All expenses of the special entertainments and the purchase of furnishings for the club rooms are met out of the fund obtained from these membership dues. Non-members have no rights or privileges in the club to the exclusion of members, nor are they admitted free to the periodical entertainments given by the club, which include dances, lectures and vaudeville performances. The barber shop is run by a barber, who has a concession from the company for this

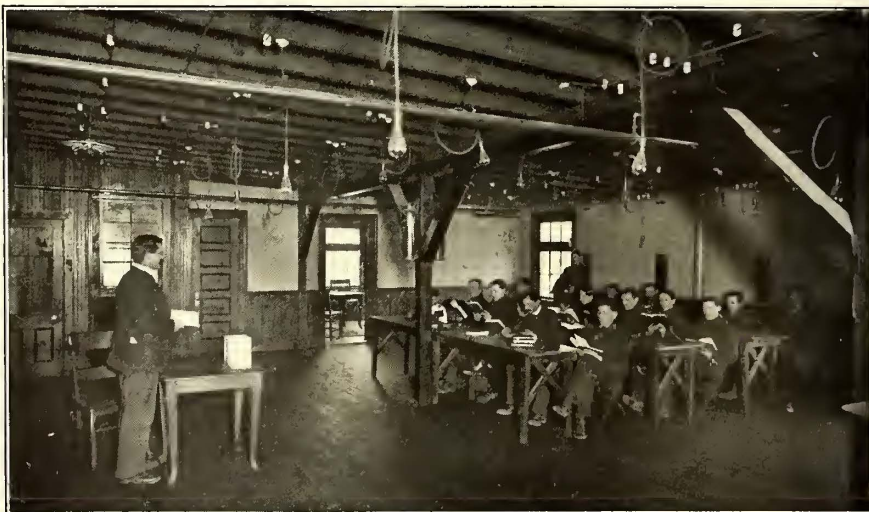


East New York Club House—Gymnasium

and the club house fund, which is used only for the upkeep of the various club houses, the association has what is called a "Special Luna Park and Rockaway Fund." Under an arrangement with the proprietors of Luna Park, which is one of the largest amusement centers in Coney Island, the employees of the Brooklyn Rapid Transit Company are allowed to sell a combination ticket giving \$1 worth of attractions for 50 cents wherever they can do so. The proprietors allow the employees a liberal percentage on the sales of these tickets, and the profit is applied to this special fund. During 1907 nearly \$7,000 was realized from the sales of these tickets. This money is used for charitable purposes among destitute members and also provides free educational classes during the winter months, in the East New York club house. The expenses of semi-monthly vaudeville entertainments which are held from October to April each year in the auditorium in the East New York club house are also met from this fund. These entertainments are free to members of the association and their families. Once each year the employees have an outing at Rockaway Beach. The employees are charged 60 cents per ticket for the excursion, which includes their railroad transportation and dinner at Rockaway Beach. The railroad company donates the train service and the amount received from the sale of the tickets over and above the expenses of the day is applied to this special fund as well.

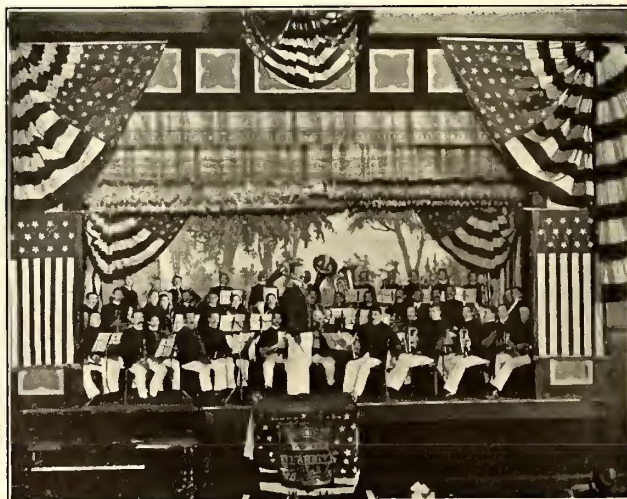
Employees' clubs with headquarters in the various terminals of the Chicago City Railway have been in existence for a number of years. The two newest car houses of this company, at Seventy-seventh Street and Vincennes Road and at Cottage Grove Avenue and Thirty-ninth Street, were designed to provide commodious and attractive quarters for the employees' clubs of these two divisions. At the Cottage Grove car house the club quarters consist of a billiard, lounging and game room, 81 ft. x 46 ft., with a stage at one end; a cloak and reading room, 14 ft. 6 in. x 22 ft.; a large toilet room and a barber shop containing two chairs and a bootblack stand. The main club room contains a billiard and two pool tables, a number of game tables and some light gymnasium apparatus. It has a hardwood floor, so that it can be used for

entertainments given by the club, which include dances, lectures and vaudeville performances. The barber shop is run by a barber, who has a concession from the company for this



East New York Club House—Class Room

privilege. The company furnishes the room and light and heat and charges the concessionaire nothing for the privilege, placing



Brooklyn Rapid Transit Employees' Band

on him only the restriction that not more than 10 cents be charged for shaving. The club is managed entirely by the



men, who elect their own officers. The division superintendent, whose offices are in the same building adjoining the club rooms, of course, maintains a supervision over the men, but seldom, if ever, has occasion to exercise his authority. Out of the total of nearly 800 trainmen who make this car house their headquarters the Employees' Club has a membership of over 500 and is rapidly growing. The club rooms are open from 5 a. m. to 1 a. m., including Sundays.

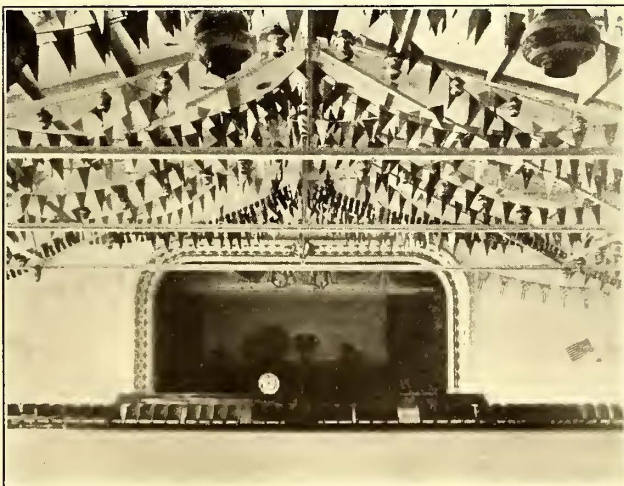
The Roanoke (Va.) Railway & Electric Company has begun the construction of a general office building in the center of the business district of Roanoke at the corner of Campbell Avenue and Randolph Street, in which provision has been made for elaborate trainmen's club rooms. The accompanying illustration from the architect's drawing shows the handsome exterior of the new building. The offices and waiting room are on the first floor and the entire second floor is used for the club rooms, which consist of a library and reading room, pool room, writing room and bathroom. The third floor will be used as a storeroom.

One of the most elaborate club houses for street railway employees, which is run entirely by the company, is that of the United Railways of St. Louis. In November, 1907, the company purchased a large old-fashioned brick residence, situated about two blocks from the company's main offices and shops. The building was remodeled and in the rear an auditorium seating 2000 people was built. This addition is 100 ft. square, and with the exception of the brick work was erected by the employees of the company. The roof



United Railways of St. Louis—Employees' Club House

is supported by steel trusses and the floor is entirely clear of posts and other obstructions. It is laid with hard maple on cement and is used for dances and receptions. On the



United Railways of St. Louis—Auditorium in Club House ground floor of the original building a reading room and a reception room have been fitted up in front and a number of tubs and shower baths have been put in the rear. On the

second floor is a billiard and pool room and a room for other games. One-half of the third floor is set apart as a billiard room for the department heads exclusively. The women and



Roanoke (Va.) Office and Club Building

girls employed in the office of the company are eligible for membership and accommodations have been provided for them in the way of toilet and check rooms, basket ball and other amusements. Three basket ball teams have been organized among the girls employed, and they play regular games between themselves and outside teams. The auditorium has a stage 33 ft. wide by 30 ft. deep, with dressing rooms, scenery and all the equipment of a regular theater. The stage is separated from the auditorium by a heavy fireproof brick wall and a thick asbestos fireproof drop-curtain. The hall has an equipment of 1600 opera chairs and special means are provided for quickly clearing the floor and storing the chairs in the basement when it is desired to use the floor for dancing after entertainments. The hall is brilliantly lighted by 3500 incandescent lights and when decorated for special occasions, presents a remarkable picture. Any white employee of the company is eligible to use the club rooms without restrictions and without cost between the hours of 7 a. m. and midnight. The entire cost of running the club is assumed by the railway company and its operation is under the personal supervision of the general manager. The division superintendent is directly responsible for keeping order in the club house and supervising its care and maintenance. No barber shop or restaurant has been provided because it was not desired that any employee should be charged for anything in the club house. Some time ago the company fitted up a lunch car, which was stationed near the shops, and which served food to employees at exact cost, and gave excellent service. The car was not well patronized and is now no longer used.

While the United Railways Company has no formal benefit association, the company maintains a medical department which supplies free medical attendance to all employees. In addition to this, the company has an annual picnic given for the employees and their families, at which time the entertainment and food are supplied free by the company. Among the outside organizations of the employees of this company is the baseball league, consisting of nine teams from the different departments. These teams play a regular schedule through the summer months for three prize cups,

contributed by the company and valued at \$100, \$50 and \$25 respectively. A band of 62 pieces has been organized among the employees, for which the company furnishes free the uniforms, music and instruments and a conductor who is paid a salary of \$100 a month. This band gives concerts twice a month in the auditorium. A moving picture machine with frequent changes of films is part of the equipment of the auditorium and free performances are given at frequent intervals through the winter months for the employees and their families.



Springfield (Ill.)—Game Room of Employees' Club

The Springfield (Ill.) Consolidated Railway, in building its new car house and shop, completed this year, made provision for employees' club rooms on the second floor over the offices. The rooms have not yet been completely furnished, but will eventually contain a library, game and pool tables and plenty of comfortable chairs. There are no charges and no restrictions placed on the use of these rooms by all employees.

Probably one of the best appointed club houses in the



Grand Rapids Railway—Library

United States is that of the employees of the Grand Rapids Railway Company at the new central car house of that company on Wealthy Avenue. Down stairs and just back of the general offices is a lunch room and opening off it the reading room. In the second story, immediately over the offices, is the club room, 20 ft. x 40 ft., a toilet room with shower baths and six sleeping rooms which contain two single beds each. The lunch room is fitted with a lunch counter, a coffee urn and range, and light meals may be obtained here prac-

tically at cost. The lunch counter is especially popular with the night men who come in late and who would have difficulty in getting food at such a late hour in the part of the city in which the barn is located. The reading room is furnished in Mission style, with a number of tables and comfortable chairs. The walls are hung with well chosen pictures and in the library are a number of the best books, together with current magazines and technical periodicals. The billiard room on the second floor is also furnished in Mission style and is tastefully decorated, the accompanying illustration



Grand Rapids Railway—Billiard Room

giving an idea of its appearance. The walls are finished with a board wainscot about 4 ft. high, and above this is a plate shelf. The walls are hung with a number of cheerful but artistic pictures. The six bed rooms are furnished with white iron beds, bureaus, rugs, pictures and curtains, presenting a most attractive appearance. All of the privileges of the club are accorded to any trainmen employed by the company. The rooms are kept open all night and are usually well filled.



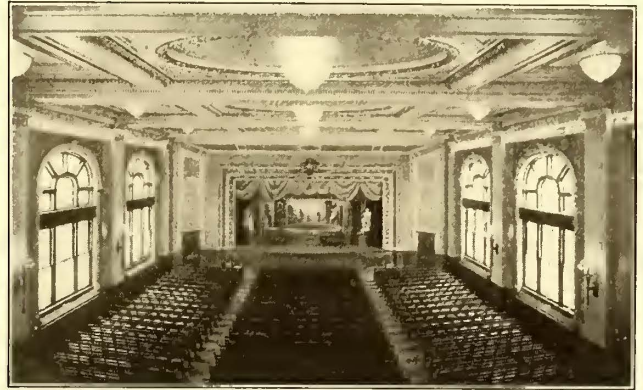
Grand Rapids Railway—Lunch Room

The Interurban Club, of Springfield, Ill., composed of the employees of the Illinois Traction System, is a unique organization in some ways. The club is run independently of the company and was organized by employees making their headquarters Springfield, with the object of promoting a closer feeling of fellowship between themselves as well as to provide a place where they might meet and spend their time pleasantly and profitably. The club maintains four rooms which it rents in an office building near the interurban station. These rooms

consist of a parlor, reception room, billiard room, game and card room, and are nicely furnished in Mission style. The parlor contains a piano and music box and the reception room has a large library of books and magazines. The dues are \$1 per month, and the payment of each month's dues is recorded on the back of a membership card, which thus indicates whether the member is in good standing. Branch clubs have been, or will be, established in Decatur, Champaign, Danville, East St. Louis and other cities reached by the Illinois Traction System, and members of any of these clubs will, on presentation of their membership cards, be accorded the privileges of any of the other clubs. Most of the officers of the company are members of the club, which also includes in its membership a large number of the trainmen running into Springfield.

When The Milwaukee Railway & Light Company designed its fine Public Service Building and interurban terminal station in Milwaukee, it made provision for elaborate and commodious rooms for its employees. The ground floor of this building, which is adjacent to the passenger station of the Chicago, Milwaukee & St. Paul Railway and only one block from the main business street of the city, is used as an interurban terminal station and as a depot for a number of the city street car lines. The building has a storage capacity for 80 cars on the ground floor and on the second, third and fourth floors are located the general offices of the company, so that a large part of the office and train service forces have convenient access to the club quarters which have been provided. The club rooms are on the second floor of the building; an auditorium, occupying one wing, has a floor space 65 ft. x 155 ft., and in the adjoining wing and connected with the auditorium across the intervening court by two bridges, are the library and billiard room, restaurant, card room, barber shop and toilet room. The auditorium has a seating capacity of 1100 persons and the chairs are removable so that the floor can be cleared for dancing. On each

mental stairway leading to a mezzanine floor. The kitchen is equipped with gas and electric ranges and all of the necessary cooking utensils for preparing elaborate meals. The main dining room for employees is at one side of the kitchen, and on the other side is a smaller private dining room for officers and heads of departments. These departments have not yet been put into use. The billiard and pool room has a stone floor and is furnished with six tables made of curly birch to match the handsome interior decorations of the room.



Milwaukee Public Service Building—Auditorium

A nominal charge is made for the use of the billiard tables and the bowling alleys in the basement of the building. Space has been provided for a barber shop and bathrooms in connection with the club rooms, but the fittings have not been installed. The rooms are open from 10 a. m. to midnight and are in constant use during these hours. There are no membership dues or any kind of expense, the maintenance and operation of the club rooms being borne by the company. In connection with the club, the company supports a large band, for which it furnishes instruments, music and a paid instructor.

The Electric Railway Club, of Utica, N. Y., composed of the employees of the Utica & Mohawk Valley Railway Company and the Oneida Railway Company, has leased rooms in one of the upper floors in a downtown lodge building in Utica. The rooms have been furnished with a library of books and magazines, pool and billiard tables and card and game tables and some light gymnasium apparatus, together with baths and toilet facilities. While the club is not financially connected with the mutual benefit association of the two companies, one of the conditions of membership is that the applicant shall be a member of the benefit association or shall have made application for membership. Those employees who, in good faith, make application to the association for membership and who have been rejected on account of physical disqualifications, are still eligible for membership in the Electric Railway Club. The club is purely social, but the company feels that it has such a value in bringing the employees into closer relations with each other and in promoting a feeling of good will between the officers and men, that it pays the major part of the cost of maintaining the club. It contributes a fixed sum of about \$1,850 a year, which covers the cost of renting the rooms, light, heat and janitor's services, and also makes a further contribution of \$1 for every \$1 in dues collected from the members. The annual dues of the club are only \$1, payable quarterly. About 85 per cent of the employees of these two companies in Utica and the vicinity are members of this club. Similar clubs are in existence at other terminals of the two companies. The club rooms are open from 9 a. m. to 11:30 p. m., and are well patronized by the men. About half of the members



Grand Rapids Railway—Sleeping Room

side of the main entrance to the auditorium are small rooms which may be used as reception and committee rooms. The stage at the end of the auditorium is 65 ft. wide and 30 ft. deep. It is completely equipped with scenery and stage fittings so that any kind of an entertainment can be given. The library and reading room in the adjoining section of the building is furnished with a number of tables and comfortable chairs, and all of the books are kept in steel book racks arranged in two tiers. The upper tier is reached by an orna-

use the club from three to four times a week. The club is managed entirely by the men.

The United Railways & Electric Company, of Baltimore, in planning all of its seven new car houses and in remodeling an eighth, has made liberal provision for trainmen's club rooms in each. In the new car houses, a large assembly room containing pool tables, game and reading tables and a number of comfortable chairs has been built in the rear of the division offices and toilet and locker rooms. This assembly room is intended for recreation purposes only, a general room where motormen and conductors can make out reports and attend to any other business being provided, adjoining the cashier's and dispatcher's offices in front. At the remodeled Light Street car house a separate brick building for trainmen's quarters was erected on an adjoining lot. The entire second floor of this building, 71 ft. x 29 ft., is devoted to an assembly room similar to those in the new car houses. In addition to these rooms at car houses, the company has secured the two lower floors of an office building 35 ft. x 100 ft. at the corner of Franklin and Howard Streets, in the heart of the shopping and business district. The lower floor is used as a waiting room for suburban passengers, a parcel check room and the company's lost and found department. The second floor is divided into two large club rooms for employees and a small office for the use of division superintendents. One of the club rooms contains two pool tables and the other is equipped with checker and other game tables, and at one end a reading table and library of magazines and books. This central club room affords a convenient lounging room for the men when off duty downtown, and has proved to be a big success from the standpoint of attendance. Conductors and motormen are given tickets which admit them to this central club room when not in uniform, so that there is no danger of the privileges of the club being abused. This room and the rooms at car houses are furnished and maintained by the company at no expense to the men and are open to all trainmen. No charge is made for the use of the pool tables, and practically the only restriction which is placed on the use of the rooms is that no card playing of any kind is allowed.

#### EMPLOYEES' MUTUAL BENEFIT AND RELIEF ASSOCIATIONS

Closely associated with the movement toward providing comfortable and attractive quarters for the use of employees during their hours off duty is the organization of mutual benefit and relief associations, which insure the members for small amounts in case of sickness, injury or death. The object of these associations is twofold—to promote a friendly and fraternal spirit among employees and to provide relief benefits at a low annual cost. In some cases, as in Brooklyn, the employees' benefit association is conducted as a club, in every sense of the word, its members having the use of the commodious club rooms provided by the Brooklyn Rapid Transit Company in most of the terminal car houses. In other cases, as for example, the Northwestern Mutual Benefit Association, made up of employees of the Terre Haute, Indianapolis & Eastern, the organization has no connection whatever with the employing company, has no social features and receives no financial support of any kind from the company. Usually, however, the railway company interests itself in the affairs of the organization to the extent of aiding it when necessary in a financial way and having a voice in the conduct of its affairs through one or more representatives on the board of managers.

Relief associations have been in existence among the employees of several of the companies in the larger Eastern cities for 15 years or longer, but not until recently have they become

common on the smaller roads. The following paragraphs summarize the methods employed on a number of the roads visited:

#### LOUISVILLE

One of the earliest of these associations to be organized in the Middle West is the Louisville Railway Relief Association. This association was organized and duly incorporated under the laws of the State of Kentucky on Feb. 10, 1900. The following paragraph, taken from the articles of incorporation, states the object for which it was formed: "We (the 11 incorporators) associate ourselves together for the purpose of incorporating a benevolent charitable association to be known and called the Louisville Railway Relief Association. The object of said association is for the benefit and protection of its members from funds collected from its members, by assisting members who, by sickness or other disability, may become incapacitated from attending to their occupation or business, and by the payment of death benefits to deceased member's next of kin or to such other person or persons as may be designated in an application for membership." The articles of incorporation also specify that the highest amount of indebtedness that shall be contracted by the corporation is \$1,000; that the corporation shall have the power to sue and be sued in its corporate name and to hold any property which may come to it by donation or devise or in any other manner. The private property of the members of the corporation is exempt from the corporate indebtedness. The life of the corporation is 25 years from the time it commences business.

Any white employee in any department of the Louisville Railway Company who is over 16 years of age and under 45 years of age is eligible for membership, provided, however, that the employee's wages are at least \$1.50 per day. Membership ceases when the member for any cause ceases to remain an employee of the Louisville Railway Company. The monthly dues of each member are 50 cents. Under the constitution, special assessments on the members can only be ordered when there is less than \$500 on hand to meet the obligations of the association, and such special assessments cannot exceed 50 cents in any one month. Members are allowed 30 days in which to pay any extra assessment without forfeiture of any of their rights to benefits.

The association is governed by a president, vice-president, recording secretary, financial secretary, treasurer and a board of managers consisting of 18 members of the association, selected as follows: Seven members from Division 1; six members from Division 2 and five members from Division 3. The board of managers is charged with the general supervision of the association and the members of the board from each division constitute the visiting committee for that division. These visiting committees are required to visit their sick or disabled members within 48 hours after receiving notice of any sickness or disability, and at least once a week thereafter. They have power to order warrants for relief payments which, however, must be properly attested by the recording secretary and the medical examiner. The limits of the visiting committee are confined to within a radius of 5 miles from the center of the city. Sick or disabled members residing beyond the visiting limits and desirous of claiming weekly benefits, must present to the board of managers within two weeks after the sickness or disability shall arise a written application, together with a certificate from the attending physician, stating the time of attendance and the nature of the disease or disability. Such applications must be sworn to before a notary public and approved by the association's physician.

The benefit paid by the association for sickness or injury wholly preventing the member from following his regular occupation, is the sum of 90 cents per day for every day after the first seven days. If the sickness and disability continues for six months, this payment is reduced to 50 cents per day. If the member's disability is local and apparently permanent, but his general health such as not to disqualify him from following some occupation, he ceases to become entitled to continued benefits. Any member who is receiving sick benefits is absolutely forbidden to frequent saloons or be seen in or about them or to use liquor in any form unless prescribed by the medical examiner of the association or by the attending physician. Any member who violates these provisions or feigns sickness in order to fraudulently obtain benefits is liable to expulsion. Benefits are not paid for disability arising from sickness contracted or injuries received while engaged

Davis, one of the directors of the Louisville Railway Company, and \$148.77 received as interest on the funds of the association deposited in the bank. The balance on hand on Jan. 1, 1907, was \$6,519.31, which is a good indication of the prosperous condition of the association after seven years of existence. The largest amount paid out to any member for sick benefits was \$147.60; the smallest payment was 90 cents. During the year, \$450 in death benefits was paid on the death of three members; \$150 was paid on the death of the wives of three members and \$400 was paid on the death of 16 children of members under 14 years of age.

BIRMINGHAM

The benefit association of the Birmingham (Ala.) Railway, Light & Power Company is conducted along slightly different lines and is more comprehensive in the character of the benefits paid. Any white male employeé of the Birmingham Railway, Light & Power Company between the ages of 21 and 50 is eligible, provided he is able to pass a medical examination corresponding to that required by the company for motormen and conductors. These requirements are a minimum height of 5 ft. 8 in., ability to read 1/2-in. letters with each eye at a distance of 10 ft., and ability to hear a standard watch tick at arm's length with each ear, freedom from chronic or venereal diseases and deformities, good condition of all organs, satisfactory vaccination scar and freedom from color blindness.

For the several benefits paid by the association, each member is required to pay \$1 per month in advance on the first day of each month. This entitles the member to a certificate of membership. The member paying proportionate dues may carry two or three certificates, entitling him to two or three times the benefits of the single certificates. In addition, any member who so desires, by a regular payment of 15 cents per month, may secure a benefit of \$50 on the death of his wife, and by the regular additional monthly payment of 10 cents may secure a benefit of \$15 on the death of any one of his children. The following benefits are paid to the holders of each certificate, provided, however, that death or disability is not due to intemperate or immoral conduct:

(a) Sickness or Accident Benefit.—For disability by reason of sickness or accident exceeding five days, a benefit of \$1 per day. This benefit ceases after 60 days' continuous disability, and the limit of benefits to which any member is entitled by reason of sickness or accident is \$100 in one calendar year. New members are not entitled to secure accident benefits until two months after their application has been accepted.

(b) Death Benefits.—Death benefits are paid on an increasing scale as follows: If a member dies during his first year of membership the benefit is \$100; second year, \$200; third year, \$300; fourth year, \$400; fifth year and thereafter, \$500.

(c) In case of an accident, by reason of which a member suffers the total loss of sight, the loss of both feet, the loss of both hands, or the loss of one hand and one foot, a payment of \$1,000 is made, and for the loss of one hand or one foot, a payment of \$333.33 is made. For the loss of sight of one eye, \$200 is paid.

In addition to these benefits, members are entitled to the attendance upon themselves of the physicians of the association at the following rates: Office and hospital visits, 25 cents; residence calls, for the first three visits, 50 cents; residence calls after the first three, 25 cents. Members are also entitled to free use of beds for themselves at the hospitals designated by the association.

**APPLICATION FOR MEMBERSHIP**  
**CLASS A**

LOUISVILLE, KY., \_\_\_\_\_ 190\_\_

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Sec. I.—I, \_\_\_\_\_, hereby petition the LOUISVILLE RAILWAY RELIEF ASSOCIATION for membership. I pledge myself to comply in every way with the Constitution and By-Laws. I am a believer in the Supreme Being. My age is \_\_\_\_\_ years. Date of birth \_\_\_\_\_ 18\_\_ .. Occupation \_\_\_\_\_

Report \_\_\_\_\_ Residence No. \_\_\_\_\_  
Street \_\_\_\_\_

Sec. II.—I am, my wife is, and my children, under fourteen years of age, are of sound bodily health.

Note.—(Words in this section relating to wife and children do not, of course, apply when the applicant is unmarried.)

Sec. III.—I direct, 1. That my benefit be paid to \_\_\_\_\_  
\_\_\_\_\_  
(Name or Names) (Relationship to Applicant)  
\_\_\_\_\_  
(Residence)

2. That the benefit be paid to me in case of the death of my wife or any of my children under fourteen years of age.  
\_\_\_\_\_  
(Full Signature of Applicant)

---

We, the Investigating Committee on the application of Mr \_\_\_\_\_  
\_\_\_\_\_ for membership under Class \_\_\_\_\_  
A. report \_\_\_\_\_ favorably.  
\_\_\_\_\_  
(Committee)

NOTE—USE INK IN FILLING OUT THIS FORM

Application Blank—Louisville Railway Relief Association

in unlawful acts or death resulting from immoral or intemperate use of stimulants and narcotics or death by the hand of justice.

On the death of a member, the sum of \$150 is paid to the beneficiary named in the application for membership. The sum of \$50 is paid to members in the event of the death of their wives and \$25 on the death of any member's child under the age of 14 years.

The association now has a membership of about 600. During the year ending Jan. 1, 1907, which is the last report available, the sum of \$1,925.10 was paid out to members in sick benefits, the sum of \$1,000 was paid for death benefits and \$419.64 was paid out for general expenses, making a total of \$3,334.74. Total receipts were \$4,465.27, which included a donation of \$1,000 from A. H.

When a member retires from the service of the company, after 20 years' membership in the association, he will be entitled to one of the following benefits, which he may choose: \$500 in cash or an annuity of \$72, payable in monthly installments of \$6 each for the remainder of his life. Charter members of the association who may retire from the service of the company before 20 years' membership in the association, but after 20 years' service with the company, will receive one of the above benefits out of a special fund provided by the company. Charter members who retire at the age of 50 years, after a service of less than 20 years but more than 10 years with the company, will receive of the annuity benefit a proportion based on the ratio of their term of service to the full 20-year term of service.

The association is governed by a board of seven directors. Two directors are chosen each year by ballot from among the members, serving three years, but the seventh director is appointed by the president of the Birmingham Railway, Light & Power Company, which is thus represented by one member on the board.

The association has been so conducted that it has been entirely self-supporting. The only contribution which the company makes toward its support is furnishing the service of its clerical force in keeping the books and accounts of the association free of charge. The annual dues of \$12 are higher than those ordinarily charged by similar organizations, and in order to prevent any injustice to members who for any reason terminate their service with the company, the constitution provides for a graded rebate of the dues as follows: When membership in the association terminates for any reason except death, all money which has been paid in by the retired member during his term of membership, less the benefits which he has drawn from time to time, and less the amount which would have been charged by standard insurance companies for life, accident and health insurance premiums, during his term of membership, will be deposited in a savings bank subject to his order after one year. If a member fails to draw such sum within one year after the date on which it is payable the money is returned to the treasury of the association. The constitution contains the accompanying schedule of life insurance premiums which are deducted.

For accident and health insurance, a deduction at the rate of \$9 per year is made. As will be seen from the table, a member 21 years of age at the time of his enrollment who retires at the end of the first year, will have deducted from the \$12 paid in as dues the sum of \$1.60 for life insurance and \$9 for accident and health insurance, making a total rebate of \$1.40. A member 50 years old at the time of his enrollment is entitled to no rebate whatever, according to the schedule.

#### SPRINGFIELD, ILL.

The Springfield Consolidated Railway Relief Association, of Springfield, Ill., was organized in March, 1905, and has a constitution very similar to that of the Louisville Relief Association. Any employee of the company between the ages of 16 and 45 whose wages are at least \$40 per month is eligible for membership. The board of directors consists of four officers and six additional members elected by the association, of whom three must be trainmen and one employed in the track department. The president of the association has power to appoint a visiting committee of four members. The city is divided into four districts and each member of this visiting committee is assigned one of these districts. He must visit any sick or disabled member who resides in his district within 48 hours after receiving notice from the secretary, and must approve all the warrants for relief. An initiation

fee of \$1 is charged any new member and the monthly dues are 50 cents.

The sum of \$1 per day is paid to members who are wholly unable to follow their occupation on account of sickness or injuries. No benefits are paid for disability of less than seven days. After 26 weeks of total disability all payments cease. Death benefits are paid as follows: On the death of any member of the association in good financial standing, \$75 is paid to the beneficiaries named in the application for membership. The sum of \$50 is paid to any member on the death of his wife, provided the member at the time of making the application for membership in the association presents a certificate from a reputable physician, stating that his wife is not at that time afflicted with Bright's disease or any other incurable form of kidney trouble or tuberculosis.

At the time of the organization of the relief association of the Springfield Consolidated Railway Company the company guaranteed the payment of benefits by the association until

Age at Time of Enrollment in Association	For Membership of				
	1 Year	2 Years	3 Years	4 Years	5 Years
21 years.....	\$1.60	\$3.20	\$4.80	\$6.40	\$8.00
22 ".....	1.65	3.30	4.95	6.60	8.25
23 ".....	1.70	3.40	5.10	6.80	8.50
24 ".....	1.75	3.50	5.25	7.00	8.75
25 ".....	1.80	3.60	5.40	7.20	9.00
26 ".....	1.80	3.60	5.40	7.30	9.10
27 ".....	1.85	3.70	5.55	7.40	9.25
28 ".....	1.90	3.80	5.70	7.60	9.50
29 ".....	1.95	3.90	5.85	7.80	9.75
30 ".....	2.00	4.00	6.00	8.00	10.00
31 ".....	2.05	4.10	6.15	8.20	10.25
32 ".....	2.10	4.20	6.30	8.40	10.50
33 ".....	2.15	4.30	6.45	8.60	10.75
34 ".....	2.20	4.40	6.60	8.80	11.00
35 ".....	2.25	4.50	6.75	9.00	11.25
36 ".....	2.30	4.60	6.90	9.20	11.50
37 ".....	2.35	4.70	7.05	9.40	11.75
38 ".....	2.40	4.80	7.20	9.60	12.00
39 ".....	2.45	4.90	7.35	9.80	12.25
40 ".....	2.50	5.00	7.50	10.00	12.51
41 ".....	2.55	5.10	7.65	10.20	12.75
42 ".....	2.60	5.20	7.80	10.40	13.00
43 ".....	2.65	5.30	7.95	10.60	13.25
44 ".....	2.70	5.40	8.10	10.80	13.50
45 ".....	2.75	5.50	8.25	11.00	13.75
46 ".....	2.80	5.60	8.40	11.20	14.00
47 ".....	2.85	5.70	8.55	11.40	14.25
48 ".....	2.90	5.80	8.70	11.60	14.50
49 ".....	2.95	5.90	8.85	11.80	14.75
50 ".....	3.00	6.00	9.00	12.00	15.00

Table of Life Insurance Premiums—Birmingham Relief Association

such time as sufficient funds were accumulated to meet any demand for benefit payments. The company has continued to contribute to the treasury of the association the sum of \$25 a month.

#### INDIANAPOLIS & CINCINNATI TRACTION COMPANY

The employees of the Indianapolis & Cincinnati Traction Company organized a voluntary relief association on Jan. 16, 1906. This is known as the Red Line Relief Association, and now has about 60 members. Nearly all trainmen are members, but comparatively few shopmen and trackmen have joined. No especial solicitation has been made to get new members, but the association has been prosperous and self-supporting from the beginning. Any regular employee of the Indianapolis & Cincinnati Traction Company is eligible, but his written application must be accompanied by a certificate from some reputable physician to the effect that the applicant is in good health. The officers of the association consist of a president, vice-president, secretary, treasurer and a board of six directors, one each being chosen from the track

department, line department, car service department, shop department, office department and power station department. Applications for membership must be made to the director of the department in which the applicant is employed, accompanied by an initiation fee of \$1. The names of applicants are posted on the bulletin board for 10 days, and if at the end of that time no objection is made by any member of the association the application is accepted.

The dues are 50 cents per month and in return the members receive disability benefits at the rate of \$6 per week. No payment is made, however, for disability covering a period of less than six consecutive days and more than 20 consecutive weeks. A benefit of \$75 is paid to beneficiaries named in the application for membership on the death of any member in good standing. Where no person is designated in the application as a beneficiary, the association applies the amount of the benefit to the payment of funeral expenses. If, as a result of sickness or accident, a member is unable to return to his regular employment, the sum of \$50 is paid

in the train service are obliged to become association members as one of the conditions of accepting employment with the railroad company. The association has a social and educational side as well as being a charitable and benevolent institution. The Brooklyn Rapid Transit Company has provided and furnished club rooms at 11 depots. These club rooms are open to all employees in the train service, whether members of the benefit association or not, but they are run as an adjunct to the benefit association primarily and are under the supervision of the secretary of the association. Any male employee in any branch of the service between the ages of 21 and 50 is eligible to membership. The initiation fee is \$1 and the dues are 50 cents per month. This amount is deducted from the pay check of each employee, so that there is no difficulty in collecting dues each month. The medical examination of applicants for employment is relied upon to protect the association against the acceptance, as members, of persons who are in poor health.

The benefits paid are as follows: A death benefit of \$150

NAME OF ROAD	AGE LIMITS FOR MEMBERS		Initiation Fee	Annual Dues	WEEKLY BENEFITS FOR SICKNESS OR ACCIDENT			DEATH BENEFITS			REMARKS	
	Min.	Max.			Rate per Week	Limit of Time	Total Allowed in 1 Year	Members	Wives	Children		
Birm'gham Ry., Lt. & Pr.Co.	21	50	None	\$15.00	\$7.00	60 days	\$100	\$100 to \$500	\$50	\$15	Accident insurance also.	
Boston Elevated.....	18	45	None	6.00	7.00	10 wks.	70	None	None	None	Note.—\$1 for each member.	
			None	6.00	5.00	12 wks.	84	None	None	None		
Brooklyn Rapid Transit.....	21	50	\$1.00	6.00	7.00	90 days	90	150	None	None	Free medical attendance also.	
Ft. Wayne & Wabash Valley..	16	45	None	6.00	3.50	120 days	60	100	None	None	Weekly accident benefit, \$5.25.	
Indianapolis & Cincinnati..	..	..	1.00	6.00	6.00	26 wks.	..	75	None	None	\$75 for total disability.	
Little Rock Ry. & Elec. Co.	..	..	None	6.00	6.00	6 wks.	..	100	None	None	\$100 for total disability.	
Louisville Ry. Co.....	16	45	None	6.00	6.30	6 mos.	..	150	50	25	Benefit reduced to \$3.50 after 6 months.	
Met. St. Ry. Co., Kansas City	21	None	1.00	12.60	10.50	80 days	120	See Note	50	35	Note.—Extra assessment, netting about \$750.	
Nashville Ry. & Light Co....	..	..	0.25	5.20	5.00	8 wks.	40	None	None	None		
Terre Haute, Ind. & East.....	..	..	None	12.00	12.00	26 wks.	..	100	None	None	None	Three classes of members.
				9.60	10.00							
				7.20	8.00							
Springfield (Ill.) Cons. Ry..	16	45	1.00	6.00	7.00	26 wks.	..	75	50	None		
Springfield (Mass.) St. Ry. Co.	21	..	None	6.00	7.00	60 days	60	None	None	None		
Syracuse Rapid Transit .....	..	..	None	6.00	7.00	90 days	90	150	None	None		
Utica & Mohawk Valley.....	21	45	1.00	6.00	7.00	90 days	90	300	None	None	\$1 fee for medical examination.	
Rhode Island Co., Prov., R. I.	..	35	None	5.20	4.00	None	208	500	None	None	Dues based on wages receiv'd	
			None	7.80	6.00	None	312	750	None	None		
			None	10.40	8.00	None	416	1000	None	None		Disability benefits continue to 70 yrs. of age, when pension begins.

Electric Railway Employees' Mutual Benefit and Relief Associations

to such member as full settlement of claims on the association on account of that disability. If the accident or sickness results in death, the sum of \$75 is paid in full settlement. No member is entitled to benefits whose sickness or disability or death is the direct result of debauchery, illegal practices or self-inflicted injuries. The Indianapolis & Cincinnati Traction Company contributed \$1 for every charter member of the association at the time of its organization, but has made no contribution since. No special assessments have been levied on members since the association started.

BROOKLYN

The Employees' Benefit Association of the Brooklyn Rapid Transit Company is probably the largest organization of its kind in the country among street railway employees. On Dec. 31, 1907, this association had a membership of 6500. It was organized in May, 1902, and previous to July 1, 1904, the membership was not obligatory, nor is it now among employees who were in the company's service prior to that time. Since July 1, 1904, however, all new employees

to beneficiaries of deceased members and a disability benefit of \$1 per day paid for complete disability by reason of sickness or injury. Disability benefits are limited to \$90 in any one year. Membership in the association brings with it free medical attendance by the association's physician and a considerable reduction in the price of medicines purchased from certain druggists throughout the city with whom the association has agreements.

The railroad company has a deciding voice in the management of the affairs of the association. The officers of the organization are a president, who is always the head of the operating department of the railroad company; a vice-president, selected from among the members; a treasurer, who is always the secretary and treasurer of the railroad company, and a board of six trustees. Three of these trustees are appointed annually by the president of the railroad company and the remaining three are selected annually by the members. The secretary is appointed by the board of trustees, which also selects the association's physician and assistant physician. The association physician is paid a salary at the

rate of 90 cents per year per member, and both he and his assistant are required to give their immediate attention to members whenever called upon.

The association is in a very prosperous condition. During the year ending Dec. 31, 1907, it paid out for sick benefits \$25,300; for death benefits, \$10,245; for medical service and salaries, \$10,344.38; for miscellaneous expenses, \$3,041.40, making a total of \$48,930.78. The receipts for the year, including a balance from the previous year carried over, were \$70,146.38. These receipts were made up of initiation fees and dues, together with a large donation from the company. This donation, which is the annual contribution to the treasury of the association by the company, consists of the interest received on badge deposit money, receipts from the sale of unclaimed lost property and the balance of the conductors' fidelity fund. The Brooklyn Rapid Transit Company does its own bonding of conductors, and the unexpended balance of the fund appropriated for this purpose is annually turned over to the benefit association.

#### BOSTON

The Boston Elevated Railway Company fosters three mutual benefit associations among the employees of its elevated and surface divisions. The oldest of these is the Metropolitan Mutual Aid Association, organized in 1882. This is the largest as well as the oldest organization of the three. Membership in it is open to male employees of the company between the ages of 18 and 45 who have been certified as to the condition of their health by the medical examiner of the company. The yearly dues are \$6, payable in monthly installments of 50 cents each. The sum of \$7 per week is paid to members wholly disabled by sickness or injury for more than one week. No member is allowed to receive more than \$70 in sick benefits in any consecutive 12 months. A death benefit of \$1,000 is paid unless the membership in the association falls below 1000, in which case the beneficiaries receive as many dollars as there are members in good standing. The railway company contributes the actual cost of the clerical work necessary to keep the books of the organization and pays its current running expenses, which are quite small.

The second of these associations is the Boston Elevated Mutual Aid Association, organized in 1907. It is a sick benefit association solely, having no death benefit feature. Its dues are 50 cents per month and it pays a benefit of \$7 a week for sickness, with a limit of \$84 in any consecutive 12 months. The third of these associations is the Mutual Benefit Association of Division 3, which was organized among the employees of the Third Division of the system. It pays a sick benefit of \$5 per week and a death benefit of as many dollars as there are members in good standing. Its dues are also 50 cents per month.

#### TERRE HAUTE, INDIANAPOLIS & EASTERN

In 1904, the employees of the Indianapolis & Northwestern Traction Company organized the Northwestern Mutual Relief Association. After the consolidation of this railway with several other interurban lines into the system now known as the Terre Haute, Indianapolis & Eastern, the by-laws of the association were amended so as to include the employees of all the branches of the Terre Haute, Indianapolis & Eastern system. Any employee in good physical condition is eligible for membership. There are three classes of membership, based on the amount of dues paid per month, and the amount of weekly benefit to which each member is entitled in case of disability is proportional to the dues which he pays. Members paying \$1 per month receive \$12 per

week benefits, members paying 80 cents per month receive \$10 per week benefits and members paying 60 cents per month receive \$8 per week benefits. No member, however, is allowed to draw benefits as great as his weekly salary as shown upon the payrolls of the company. The association also pays a death benefit of \$100. All of the officers of the association are chosen by vote of the members and the association is entirely independent of the railroad company in its support and management. It has never received a donation from any source except such money as has been derived from entertainments given by the members for the purpose of raising extra funds.

#### KANSAS CITY

The Fraternal Aid and Protective Association of the Street Railway Employees of Kansas City is an organization similar to the benefit association of the Brooklyn Rapid Transit Company in that it has a social and educational side combined with the benevolent features. The following is quoted from Article 2 of the constitution and sets forth the purposes of the association: "The purposes of this association are to aid its members while they are disabled by reason of sickness or injury and at their death to contribute aid to their beneficiaries; to promote the interests and elevate the standard of street railway employees; to provide and maintain a place of meeting for the use of members and their families; to encourage and promote a spirit of friendliness and good-fellowship among its members; to educate its members to a higher standard of efficiency; to study, investigate, discuss, debate and encourage its members in the study, investigation and discussion of matters and questions pertaining to street railway operation; to inculcate just and equitable principles of dealing in all matters pertaining to the welfare of this association or its members."

Membership in this association is open only to employees of the train service of the Metropolitan Street Railway and allied companies. No maximum limit of age is placed, but the minimum age limit is 21 years.

The Metropolitan Street Railway Company has equipped comfortable club rooms in the main office building, which are open to members and non-members alike, but the secretary of the benefit association is in charge. Aside from furnishing such a meeting place, the company does not contribute directly to the financial support of the association.

The regular dues are 80 cents per month with a membership fee of \$1, and an additional fee of 15 cents per month if an employee wishes to insure his wife against death. Upon the payment of 10 cents per month for each of his children, a member may also insure them against death. Members are also assessed 50 cents on the death of each member and the entire amount raised by such assessments is paid as a death benefit. At the present time this would be about \$750, as the association has about 1500 members.

The sick benefits for members are \$1.50 per day for each day of total disability after the first five days and for a period not exceeding 80 days. No member is entitled to receive more than \$120 in any one year in sick benefits. The amount paid for the death of a child is \$35, and for the death of a member's wife, \$50.

The president and vice-president of the benefit association are selected from among the higher officers of the Metropolitan Street Railway Company. The affairs of the association are managed by a board of 12 directors selected from among the train service men.

The by-laws of the association contain one or two somewhat unusual provisions. Article 18, for example, reads as follows: "No political or religious question of any kind that



will conflict with the interests of the Metropolitan Street Railway shall be discussed at any of the meetings of the association." Article 10 states that "the president shall appoint a committee of six, to be chosen from the members, to act as pall-bearers, to wear full uniform and attend all funerals of members in Kansas City unless the beneficiaries wish otherwise."

#### FORT WAYNE & WABASH VALLEY

The Employees' Mutual Benefit Association of the Fort Wayne & Wabash Valley is one of the newest organizations of this kind, having been started on Oct. 1, 1907. Its constitution was drawn up by a committee of the officers' association of the company after a careful study of all of the street railway and steam road employees' benefit associations in the country. The association is governed by a board of seven trustees, the chairman of which is the general manager of the company. Three trustees are appointed by him from among the members of the officers' association; the other three are elected by the employees. This board is soon to be increased to 11 members in order to give the employees of each department a representative on it.

The dues are 50 cents a month, and all employees of the company between the ages of 16 and 45 years who are in good physical condition are eligible for membership. When a member is disabled by injuries received in an accident he receives 75 cents a day after the first seven days, but if the disability is caused by sickness the benefit is only 50 cents a day. Payment of sick or accident benefits is limited to 120 days in any one year. The death benefit is \$100.

The association started with 340 members and now has over 500 employees enrolled. In the first eight months of its existence it paid out more than \$900 in sick, accident and death benefits. The company contributed a generous sum on the organization of the association and signified its intention of making further contributions whenever necessary. It also contributes the services of the clerical force in the auditor's office to keep the books and records of the association and pays the wages of employees relieved from duty to attend the meetings or other business connected with the association's affairs. In connection with the association the company has provided club rooms for the members at four division points.

The employees of the Nashville Railway & Light Company have a small sick benefit association which is conducted without much formality. All white employees in good health are eligible, and an initiation fee of 25 cents is charged each member. The dues are 10 cents per week and \$5 a week is paid in benefits for a period not longer than eight weeks. The company's paymaster is the treasurer of the organization, and has authority to deduct the weekly dues from the pay envelopes of the members.

#### OTHER CITIES

There are a number of other benefit associations in other cities more or less like those already described. The details of these are given in the accompanying table.

In addition to the roads mentioned in the table, the following companies, among others, have some form of benefit association for their employees: Cincinnati Traction Company; San Bernardino Valley Traction Company; Portland (Ore.) Railway, Light & Power Company; Capital Traction Company (Washington, D. C.); Central Pennsylvania Traction Company; Washington (D. C.) Railway & Electric Company; Syracuse Rapid Transit Company; Montreal Street Railway Company; Pittsburg Railways Company; Auburn & Syracuse; Metropolitan Street Railway Company, of New York.

The Union Electric Company, of Dubuque, Ia., does not have a benefit association among its employees, but one of the conditions of employment is that applicants agree to carry an accident insurance policy for a reasonable amount, in order to protect themselves and their families against accidents caused by or through the negligence of the employer, employee, or otherwise during the time they are in the service of the company.

#### PENSIONS FOR OLD EMPLOYEES

The plan of pensioning superannuated and disabled employees has been adopted by only a few electric railway companies in this country, although it is quite general abroad. An account of the methods employed is added here in the chapter on Welfare Work for the sake of completeness.

There are two plans for establishing pension systems. One is for the company to bear the entire cost and to retain the right at any time, if circumstances warrant, to cease payment of the pensions. The other plan is to incorporate the pension scheme as one of the features of the employees' mutual benefit association. The former is in many ways to be preferred, because when a man leaves the service of a company he loses all rights which he may have had to participate in the pension plan. He has paid nothing for its support and has no equity in the pension fund or any cause for claims against it. The provisions of the pension schemes of a number of street railways in the United States are given below.

The Union Railroad Company, of Providence, R. I., now the Rhode Island Company, was the first road in the United States to inaugurate a regular pension scheme for its old employees, in October, 1901. At the present time seven men are on the pension list. The pension scheme supplements the work of the employees' mutual benefit association, started about the same time. Pensions begin at age 70, and are based on a graded percentage of wages received for the 10 years before retirement. If the employment has continued for more than 35 years, the pension is 2 per cent of the average weekly wages for each year of such employment, the total, however, not to exceed 100 per cent. If between 30 and 35 years, 1 3/4 per cent; if between 25 and 30 years, 1 1/2 per cent; if between 20 and 25 years, 1 1/4 per cent, and if less than 20 years, 1 per cent. Under this plan, if an employee has served 35 years and had average weekly wages of \$15, his pension on reaching the age of 70 years is 70 per cent of \$15, or \$10.50 per week, which is equivalent to \$546 per annum. The entire cost of these pensions is borne by the company. The weekly payments for total disability provided for under the mutual benefit plan continue until the age of 70 years is reached, if the disability is permanent, and then the pension payment is begun. Employees having wives dependent on them and receiving pensions may carry \$1,000 life insurance by having 20 cents each week deducted from the pension.

The second pension scheme for street railway employees to be put into effect was that begun by President Vreeland, of the Metropolitan Street Railway Company, of New York, in 1902, and it is still in force in spite of the financial and other difficulties in which the Metropolitan has been involved in recent years. This pension scheme was the culmination of the welfare work among employees which was so strongly encouraged and supported by Mr. Vreeland during his connection with the company. The plan provides for voluntary and involuntary retirement of all employees between the ages of 65 and 70 whose annual maximum wages have not exceeded \$1,200 per annum, and who have had 25 years or more of service with the Metropolitan Street Railway or any

of its constituent companies. Employees to receive pensions are divided into two classes: First—All employees who have reached the age of 70 years, who have been continuously in such service for 25 years or more preceding such date of maturity; and, Second—All employees from 65 to 69 years, who have been 25 years or more in such service, who, in the opinion of the trustees of the pension fund, have become physically disqualified for active service. All employees of 70 years of age are considered to have attained a maximum age allowed for active service and are retired by age limit, while those whose ages are between 65 and 70 may be retired on pension if found on examination to be physically incapable.

The pension allowance is based on the following scale:

(a) If service has been continuous for 35 years or more, 40 per cent of the average annual wages for the previous 10 years.

(b) If the service has been continuous for 30 years, 30 per cent.

(c) If the service has been continuous for 25 years, 25 per cent.

The fund from which these payments are made is contributed annually by the company and no expenses of any kind are placed upon the trainmen who are the beneficiaries. The only restriction of any kind placed on the payment of pensions is that the beneficiary must be a member of the Metropolitan Street Railway Association, which is the mutual benefit association of the company's employees.

The Boston Elevated established a pension scheme in 1903. Any car service employee who, in the judgment of the management, has satisfactorily performed his duties in the service of the company continuously for 25 years, or who has reached the age of 60 and been continuously employed by the company for at least 15 years, may be retired from the service of the company at his own or the company's option. A retired employee receives a sum not exceeding \$25 per month during the rest of his life. This pension system is entirely independent of the benefit associations organized among the employees and the entire cost is borne by the company.

On the Louisville Railway Company pensions ranging from \$16 to \$18 per month are paid to about a dozen old employees. Two years ago the directors of the company appointed a committee of three of their number with the authority to retire any long-service employees who had then reached the age of 60 years. The selection of the beneficiaries and the amount of the pension paid rests entirely with this committee of three directors. The company has never made any formal announcement of its intentions in this direction and the pension scheme is not based on any specific requirements of age or length of service.

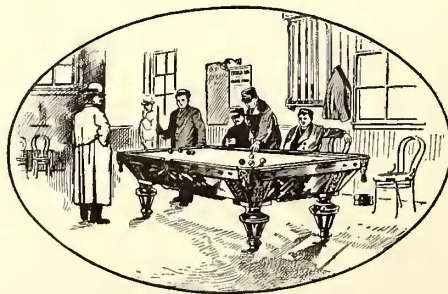
One of the provisions in the constitution of the Birmingham Railway, Light & Power Company Benefit Association is for the payment of an annuity to members of the association after 20 years of membership. The amount of this en-

dowment or annuity is \$500 in cash or \$72 a year for the remainder of a member's life. The association has only been organized about three years so no employees have yet come under this provision. The railway company, however, has agreed to provide a special fund for the payment of these endowments to charter members of the association, who may retire from the service of the company before 20 years' membership in the association, but after 20 years' service with the company.

In Brooklyn, there are about 20 old employees of the Brooklyn Rapid Transit Company to whom gratuities of \$20 are paid monthly by the company. There is no formal agreement or specific pension scheme, but the men are cared for from month to month. It is the practice of the company to care for men who have grown old in the service by placing them in positions where the work is easy, such as watchmen, gate tenders, door tenders, hall men, etc.

On Jan. 1, 1907, the Washington (D. C.) Railway & Electric Company established a new pension system, in which employees who have attained the age of 70 years and those who have worked continuously for 20 years or more, in the service of the company, and who have become physically disqualified by reason of injuries received in the service will be benefited. Employees participating in the pension benefits must be members of the Washington Railway Relief Association. The allowances to retired employees are as follows: If the service with the company has been continuous for 35 years, the sum of 40 per cent per annum in equal monthly installments on the average annual wages for the 10 years preceding the retirement; if the service has been continuous for 30 and less than 35 years, 30 per cent per annum; if the service has been continuous for 25 years and less than 30 years, 25 per cent per annum; if the service has been continuous for 20 years and less than 25 years, 20 per cent per annum. The railway company has appropriated the sum of \$5,000 annually to defray the expenses incurred in paying these pensions. Pension allowances may be revoked by the pension board appointed by the president of the railway company upon conclusive proof that the recipient has been guilty of misconduct, of which the board is the judge.

The Denver City Tramway Company established a pension system in 1903, under which old employees who have been retired after reaching an age of 65 years and after having had 25 years of continuous service with the company, receive pensions ranging from \$15 to \$25 a month. Uniformed employees in regular train service receive \$25 a month on retirement. Employees in other branches of the service who have received average monthly wages of \$80 or more for 10 years preceding retirement also receive pensions of \$25 a month. Employees receiving average monthly wages of \$60 to \$80 get \$20 a month, and employees whose wages were less than \$60 get \$15 a month. At the present time only two old employees are on the pension list.



# TRAIN DISPATCHING METHODS AND FORMS OF TRAIN ORDERS

THE safe and prompt movement of cars is the first consideration of the operating department of an electric railway, whether it be city, suburban or interurban. Normal operation can be sufficiently well covered by the timetable and a few simple rules, but when there are delays or heavy travel requiring extra cars to be run, an elaborate system of directing the movements of cars from point to point under the direction of one responsible head becomes necessary. The degree of elaboration with which the details of such a system needs to be worked out depends largely on local conditions. A few safeguards are sufficient in one situation; all of the safeguards considered necessary by steam roads, as outlined in the Standard Code of the American Railway Association, are not thought sufficiently complete by other companies and are supplemented by additional rules and precautions.

## CITY LINES

City lines, of course, present the simplest methods of train dispatching, for cars are run at comparatively slow speeds, and turnouts in single track are usually spaced so closely together that no long delays are occasioned by failure to make scheduled meeting points on time. An inspector at the busy downtown junctions, who directs the movements of cars past one point, is frequently the only dispatching system employed and is all that is required to handle cars safely and on schedule time. On the other hand, where traffic is very heavy, as in the congested districts of large cities, a central dispatching system, intended more to preserve the proper intervals between cars than for any other purpose, has been found of great value. Such a system has been completely developed in Denver. Similar large telephone systems have been installed in Eastern cities, but primarily for intercommunication.

## SUBURBAN LINES

Suburban roads are an intermediate development between the high-speed interurban roads and the city roads. The speed is not so high as on the interurban roads, but at the same time is great enough to require precautions not necessary on city lines. Turnouts on single track are farther apart and there are more chances for long delays. The density of traffic is often as great as on city lines during the summer and in many places during the commuting hours. The principal field of development in dispatching systems for such roads has been some form of block signals at turnouts, operated either manually by the train crew or automatically by the passage of the trolley wheel under a contact switch. The telephone, as a supplementary aid in moving trains over the road, is used to some extent by suburban roads, but not often with the adjunct of written train orders, which require some time in transmission and delivery.

## INTERURBAN LINES

High-speed interurban roads require the most safeguards and have naturally developed the most complex systems of train dispatching. Most of these are based on the general method outlined in the Standard Code of the American Railway Association, but considerably modified to meet the conditions peculiar to electric railway operation, and particularly the use of telephones in transmitting orders from dispatcher

to train crew. With few exceptions the telephone is universally used for train dispatching on interurban electric roads throughout the country. Most of the interurban mileage is single track and automatic block signals have not yet been adopted to any great extent for long stretches, although they have proved valuable at many points of special danger or congestion. A few double-track roads have installed automatic block signals, using track circuits, but the expense of equipping a road with signals of this type close enough together to permit handling cars at short intervals is so great that the benefits derived in the way of safety and expediting the movement of cars are hardly enough to warrant the investment. Train order signals operated automatically from the dispatcher's office and designed to stop a car for the purpose of getting into communication with the crew are, however, being installed in large numbers, as they have proved a valuable adjunct to the ordinary dispatching system.

## ADHERENCE TO STANDARD CODES

There are five standard codes of train rules in existence which include instructions for issuing, receiving and carrying out written train orders. The rule books of nearly all of the interurban roads in the country which operate high-speed cars contain instructions regarding train orders, which are either copied verbatim from one of these five standard codes or are modeled closely along the same lines. The changes made are usually the omission of certain clauses which do not apply on account of local conditions or the addition of others to cover special cases. These five standard codes are those adopted by the American Railway Association (steam), American Street & Interurban Railway Association, Central Electric Railway Association, Street Railway Association of the State of New York and the Indiana State Railroad Commission.

## AMERICAN RAILWAY ASSOCIATION CODE

The American Railway Association (steam) code is the oldest of these and covers the contingencies of railroad operation in a complete way. But it is not altogether perfect, and from the standpoint of the electric roads does not in its entirety meet the conditions of interurban operation as satisfactorily as some of the other codes based on it in a general way but considerably modified. The principal objection urged against the method of train dispatching outlined in it is that it is too cumbersome, and hence does not readily adapt itself to the quick movement of frequent trains which prevails on interurban roads. It assumes the presence of an operator at train order stations, who acts as an intermediary between the dispatcher and the train crews. Ordinarily the exigencies of traffic require means whereby every siding becomes a train order station, and this the telephone provides for. With train crews in direct communication by telephone with the dispatcher, many of the clauses in the American Railway Association code become meaningless and of no practical use to many roads. There are, however, a number of electric roads which cling to the provisions of this code as regards train orders, and see no reason for departing from it in any essential respect. Among these may be noted the Toledo & Indiana Railway Company, Scioto Valley Traction Com-

pany, Toledo & Western Railroad Company, Waterloo, Cedar Falls & Northern Railway Company, Inter-Urban Railway of Des Moines, Ia., Philadelphia & Western Railway Company, Quebec Railway, Light & Power Company, Spokane & Inland Empire Railroad Company, Northern Electric Railway Company, of Sacramento, Cal., and the Albany & Hudson Railroad Company.

NEW YORK STREET RAILWAY ASSOCIATION CODE

The code of the New York Street Railway Association adopted in September, 1907, is very nearly like that of the

phone in transmitting train orders and provide a different procedure when train orders are delivered at stations where agents or operators are on duty and at sidings where there is no operator. The Utica & Mohawk Valley Railway Company, Northern Texas Traction Company, DeKalb-Sycamore & Interurban Traction Company and the New Jersey & Hudson River Railway & Ferry Company are among the roads which use this code and the method of train dispatching outlined by it.

CENTRAL ELECTRIC RAILWAY ASSOCIATION AND INDIANA COMMISSION CODES

The rules of the Central Electric Railway Association, which, so far as train dispatching is concerned, are almost identical with those approved by the Indiana State Railroad Commission, have been adopted by most of the roads in the Middle West. The following is a representative list of roads in Indiana, Ohio and Michigan which employ the method outlined by these two codes: Fort Wayne & Wabash Valley Traction Company; Cleveland, Southwestern & Columbus Railway Company; Terre Haute, Indianapolis & Eastern Traction Company; Indianapolis & Cincinnati Traction Company; Evansville & Southern Indiana Traction Company; Toledo Urban & Interurban Railroad Company; Louisville & Northern Railway & Lighting Company; Detroit United Railway System; Kokomo, Marion & Western Traction Company; Michigan United Railways Company; Western Ohio Railway Company; Pittsburg & Butler Street Railway Company.

The principal point which distinguishes the practice laid down by these rules from the practice elsewhere is that in all cases one member of the train crew calls the dispatcher and writes the order as received over the telephone. The other member of the crew is then required to repeat the order as

Fig. 1—Standard Form "31" Train Order Blank

American Railway Association as regards the rules relating to train orders. A number of roads in the State of New York have adopted these rules, among them being the International Railway Company, of Buffalo, on its interurban divisions, the Fonda, Johnstown & Gloversville, the Oneonta & Mohawk Valley Railroad Company, the Rochester & Sodus Bay Railway Company and the Rochester & Eastern Rapid Railway Company. The only essential difference between the rules given in the American Railway Association code and in the New York Street Railway Association code is the inclusion of a rule, 217A, in the New York code, providing for train crews receiving orders by telephone at remote sidings direct from the dispatcher. This rule reads as follows:

"217A. When necessary for train crews to receive train orders by telephone, the conductors must receive and make a written record of the order. The motorman must repeat it back from the record made by the conductor. The order must not be acted upon until 'complete' is given by the train dispatcher to motorman and acknowledged by the conductor."

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION CODE

The American Street & Interurban Railway Association rules for train dispatching have not been widely adopted, although they more nearly fulfil the requirements of electric roads in many important respects than the rules of the American Railway Association. They assume the use of the tele-

Fig. 2—Standard Form "19" Train Order Blank

written to the dispatcher, and both must sign it before the "complete" is given and the order is in force. At stations where operators are on duty the sole function of the operator is to set the train order signal to stop on receiving instructions from the dispatcher, and the train crew, on arriving, call the dispatcher and receive their orders in the same way as at an outlying siding without involving the operator in any way.

MISCELLANEOUS CODES

There are, of course, a number of roads which do not use any of the codes previously mentioned, but have their own

specially worded rules and individual methods of train dispatching. These roads are mostly confined to the New England States and the far West. The New England roads which are included in this class operate interurban lines which more nearly resemble suburban roads, running as they do for long distances through thickly populated districts at moderate speeds. On the Boston & Worcester, for example, regular trains are run on a 15-minute headway and extras are frequently run in between regular trains. The double order system of train dispatching, as laid down in all of the standard codes, would hardly be practicable to use under such conditions, as too much time is required to receive and complete an order under this system. With a 15-minute headway the delays incident to communicating with the dispatcher after the manner prescribed in any of the standard codes would soon result in every train on the road being off schedule.

**USE OF THE TELEGRAPH FOR TRAIN DISPATCHING**

While the telephone is almost universally used in transmitting train orders on interurban electric roads, some few companies still cling to the telegraph, using the telephone occasionally in emergencies. The use of the telegraph is confined in most cases to those roads which follow the procedure of the American Railway Association Standard Code, which is based on the assumption of having an operator act as an agent between the train dispatcher and the train crews in the transmittal of orders.

The Quebec Railway, Light & Power Company has 11 telegraph stations on its Montmorency division, 25 miles long, and has no telephone line. The Toledo & Western Railroad Company; the Waterloo, Cedar Falls & Northern Railroad; the Northern Electric Railway Company, of Sacramento, Cal.; the International Railway Company, of Buffalo, and the Spokane & Inland Empire Railroad Company all use the telegraph in transmitting orders to stations

free and prompt use of the line for dispatching purposes. Many of the more important interurban roads have therefore installed an entirely separate line for the dispatcher's use, connected to all stations, substations and jack boxes or booths at sidings. The general line, which connects the ticket offices, substations and power house, can be used in an emergency when the dispatcher's line fails. Twenty-two out of 35 roads from which answers were received state that they use a separate

**SCHENECTADY RAILWAY COMPANY**

Train Order No. .... Superintendent's Office ..... 190...

To ..... of ..... at .....

CONDUCTOR	MOTORMAN

Fig. 4—Train Order Blank—Schenectady Railway Company

line exclusively for dispatching. The other 13 roads, most of which are comparatively short or which use the telegraph as well as the telephone, use only one general line for all company business. One of these, the Pittsburg & Butler Street Railway Company, is fortunate in having parallel long-distance telephone lines which are connected to all stations and which can be used in case the company's private line fails.

**TELEPHONE EQUIPMENT AND CONNECTIONS**

Three forms of telephone instruments are in general use, wall sets permanently mounted in stations and in locked booths at sidings, portable telephones carried on every car, and stationary telephones permanently mounted in the front vestibules of cars. The portable sets are hung in the front vestibule and are commonly used without taking them down. It is convenient, however, to have them removable in case a car breaks down at some distance from a jack box, and it is necessary to call for assistance or to notify the dispatcher in order to protect the car. Some roads have telephones in booths and also provide portable sets on cars as a double convenience. Out of 37 roads from which answers were received, 20 reported that they used only fixed telephones in booths at sidings and stations and did not equip their cars with telephones or their line with jack boxes. The Waterloo, Cedar Falls & Northern originally had its cars equipped with telephones and placed jack boxes every 2 miles. The car telephones were later taken out and the jack boxes abandoned. On the Cleveland, Southwestern & Columbus, only work cars are equipped with portable telephones and poles for making connection with the telephone line overhead. No jack boxes are provided.

Eight roads report that they use no booths at sidings, but have all cars equipped with telephones. Nine roads reporting have both telephones on cars and booths at sidings. The location of telephone jack boxes at sidings and their spacing between sidings vary widely on different roads. On the Rochester & Sodus Bay a single box is provided in the center of the siding and none at all between sidings. The Rochester, Syracuse & Eastern, which is double tracked, locates a box on every 25th pole, or at intervals of about 2000 ft.

**THE TOLEDO & INDIANA RAILWAY**

**TRAIN ORDER BLANK**

Order No. .... Date ..... 190 ...

At ..... to C. & M. of .....

Conductor	Train	O.K'd by	Time

Dispatcher. ....

Fig. 3—Train Order Blank—Toledo & Indiana

where operators are on duty, but also have telephone lines which can be used by train crews at sidings or at stations when the operator is not on duty.

**USE OF TELEPHONES FOR TRAIN DISPATCHING**

On a line of any considerable length there is usually enough telephone communication between departments to keep a single private telephone circuit so busy as to interfere with the

The Rochester & Eastern Rapid Railway places boxes in the center of short sidings, and at each end opposite the switchstands of long sidings. Cars are equipped with a bamboo pole, by means of which the telephone line can be reached at

kinds of blanks for this purpose. A "31" order is given to the operator but is not made complete until the operator has repeated the order back, has secured the signature of the conductor and engineman of the train to which it is addressed

and repeated their signatures with his own back to the dispatcher. This is a precaution whereby the dispatcher has positive assurance that the order has been delivered to the train crew. Form 31, accordingly, has spaces provided for the address at the top, a blank space for the order itself and spaces below for the signatures of the conductor, engineman, operator and dispatcher's "complete." A "19" order is made "complete" without the signatures of the conductor or engineman of the train addressed, and is a more convenient, but not so safe, method of transmitting orders. Form 19, on which such an order is received, contains no spaces for the train crew's signatures, and in this respect only differs from Form 31. As already mentioned, the New York Street Railway Association code

**PHILADELPHIA & WESTERN RAILWAY COMPANY**

General Superintendent's Office .....190

Train Order No. .... To C. and M. or E. of Train.....

Engine No. .... Car No..... At.....

Received by ..... Repeated by .....

Made ..... at ..... M ..... General Superintendent.

CONDUCTOR AND MOTORMAN (OR ENGINEMAN) MUST EACH HAVE A COPY OF THIS ORDER

Fig. 5—Form "31" Train Order Blank—Philadelphia & Western

any point in emergency, and no jack boxes are provided between sidings. The Utica & Mohawk Valley Railway, also a double-track line, has jack boxes mounted every half-mile. On the Fort Wayne & Wabash Valley jack boxes are mounted on poles 500 ft. away from the siding in each direction. Between sidings they are spaced half a mile apart. The Evansville & Southern Indiana Traction Company has a jack box located at each switchstand but none between sidings, as cars are equipped with poles with which the telephone line can be reached. Some of the other distances between jack boxes reported are: British Columbia Electric Railway, 1200 ft.; Boston & Northern, 1 1/2 miles; Pittsburg & Butler Street Railway, 500 ft.; New Jersey & Hudson River Railway & Ferry Company, 1000 ft.

is substantially the same as that of the American Railway Association, and specifies the same form for recording "31" and "19" orders. A standard "31" order form as used by the Albany & Hudson is shown in Fig. 1, and a standard "19" order form as used by the

FORMS OF TRAIN ORDERS

The printed train order blanks on which trainmen or operators record orders received from the train dispatcher reveal a wide variation in form and text. A few typical ones are reproduced herewith. Each of the five standard codes already referred to prescribes a standard form for train order blanks, but, with few exceptions, these standard forms have not been closely followed, even where the other parts of the codes are used without change.

The American Railway Association distinguishes between "Form 31" orders and "Form 19" orders and provides two

**The Cleveland, Southwestern & Columbus R'y Co.**

Train Order No..... 190 .....

To Conductor and Motorman:

Train No.....Car No.....At.....

**A** Meet Train No.....Car No.....At.....

**B** Meet Train No.....Car No.....At.....

**C** Meet Train No.....Car No.....At.....

**D** Meet Train No.....Car No.....At.....

.....

**E** Report at.....

**F** Proceed to.....against Train No.....and report.

**C** Run as.....Section Train No.....from.....to.....

**H** Train No.....is annulled between.....and.....

**I** Car No.....at.....will run extra from.....

.....

Complete at .....M .....Dispatcher.

.....Motorman.....Conductor.

Fig. 6—Central Electric Railway Association Standard Train Order Blank

International Railway Company, of Buffalo, on its interurban divisions where telegraph stations are maintained is shown in Fig. 2. These forms are printed on thin tissue paper bound in pads of 300 leaves. Form 31, Fig. 1, is 6 3/4 in. x 9 1/4 in.; Form 19, Fig. 2, is 6 3/4 in. x 6 in. As many as nine duplicate copies can be made at one writing with double carbon paper placed between the tissue sheets.

A plain form of train order blank used by the Schenectady Railway Company for work trains and extras only is shown in Fig. 4. This is a "31" order blank requiring the signatures of motorman and conductor, and their acknowledgment of its receipt by placing their signature at the bottom. It is

<b>LOUISVILLE &amp; NORTHERN RAILWAY &amp; LIGHTING CO.</b>			
Order No. _____	Date _____	190__	
To M. & C. Train No. _____	Ex. No. _____	At _____	Sliding _____
Meet Train No. _____	Extra No. _____	At _____	Sliding _____
Meet Train No. _____	Extra No. _____	At _____	Sliding _____
Meet Train No. _____	Extra No. _____	At _____	Sliding _____
and report at _____			Sliding _____
Run Extra to _____ and Report _____			
Run as _____ Section to Train No. _____ From _____			
To _____			
Carry Signals for _____ Section From _____ To _____			
Time _____ M. Order Taken By _____			
Order Read By _____			
Change of Crews and Order Completed by _____			Motorman _____
17506			Conductor _____

Fig. 7—Manifold Train Order Blank—Louisville & Northern

delivered in person by the superintendent to the crew. No train orders are issued to regular trains on this road, which is doubled-tracked throughout.

Fig. 3 shows the blank form used by the Toledo & Indiana Railway. It is filled out by the conductor and repeated by

<b>B. C. Electric Railway Co., Ltd.</b>	
Running Orders.	
Conductor .....	CAR No.....
Motorman .....	
Leave Westminster at .....M	
Cross.....Cars at Orphanage	
Cross.....Cars at Burnaby	
Cross.....Cars at Central Park	
and report for orders. <b>Be cautious—RUN NO CHANCES</b>	
Cross.....Cars at Park Drive	
Received,	.....Dispatcher.

Fig. 9—Running Order Blank—British Columbia Electric Railway

him, and is in effect therefore a "31" order. Ruled lines are provided which, it is claimed, prevent confusion in reading carelessly written orders.

Fig. 5 shows the "31" train order form used by the Philadelphia & Western Railway. This may be received by an

agent, but must be repeated and made "correct" by the conductor, who must sign it.

The standard form of train order given in the code of the Central Electric Railway Association is shown in Fig. 6. The usual instructions to train crews are printed in blank, to be filled in on receipt of orders. The standard form given in the new code approved by the Indiana State Railroad Commission does not contain the printed lines F, G, H and I, shown in Fig. 6, but instead has three skeleton lines for entering orders to report and two skeleton lines for entering changes in meeting points previously ordered.

Fig. 7 shows the manifold skeleton train order blank used by the Louisville & Northern, which in general resembles the standard form of the Central Electric Railway Association. The simplest form of train order blank is that shown in Fig. 8, which is used by the Boston & Worcester Street Railway Company.

The British Columbia Electric Railway Company, which operates a 13-mile interurban road between Westminster and Vancouver, issues to train crews what are termed running

<b>Boston &amp; Worcester St. Ry. Co.</b>	
Train Order No. _____	
Date _____ 190__	Correct at _____ M.
_____	
_____	
_____	
_____	
_____	
No 44206	
_____ Motorman.	
_____ Conductor. Dispatcher.	

Fig. 8—Train Order Blank—Boston & Worcester

orders on the triplicate blank form shown in Fig. 9. There are four meeting points and the orders give the number of cars to be passed at each point. This is train dispatching reduced to its simplest form.

CLEARANCE CARDS

Train clearance cards are used on some roads as an additional precaution that train orders are not overlooked. These cards are issued at regular train order stations by the operator on duty. The clearance card of the Rochester & Eastern Rapid Railway, shown in Fig. 10, is issued to every train on leaving the stations printed on the bottom margin. In effect this provides a block system between stations. The clearance card of the Michigan United Railways Company is used for another purpose. When orders are received at a train order station for a train which has not arrived the operator must display the train order signal in the stop position. If a train for which there are no orders arrives ahead of the train for which orders have been received, it must not pass the stop signal without a clearance card, as shown.

CAUTION CARDS

Caution cards are used on the Albany & Hudson whenever circumstances require an extra degree of caution. The

card is a reminder to the motorman of the following car that another car is ahead and may be encountered anywhere. These cards are not often used.

RECEIVING TRAIN ORDERS

The codes of both the American Railway Association and

**ROCHESTER AND EASTERN RAPID RAILWAY CO.**  
TRAIN CLEARANCE ORDER.

Order No. \_\_\_\_\_ Station \_\_\_\_\_ Date \_\_\_\_\_ 190 \_\_\_\_\_

To Conductor and Motorman of Train No. \_\_\_\_\_ Car No. \_\_\_\_\_

Have no orders for you.

Received by \_\_\_\_\_ Time \_\_\_\_\_ { Train \_\_\_\_\_  
Operator. Conductor. Time \_\_\_\_\_

O. Ked by \_\_\_\_\_ Dispatcher.

This order must always be obtained by all train crews at following stations: ROCHESTER, PITTSFORD, VICTOR, CANANDAIGUA, GATES SUB-STATION and GENEVA.

Fig. 10—Train Clearance Order Form

the American Street & Interurban Railway Association have been criticised because they do not specifically provide that an order received by one member of the train crew shall be

**Michigan United Railways Company**  
CLEARANCE CARD

..... M. .... 190 .....

Conductor and Motorman.....

I have no ..... orders for your train

**Signals are out for**.....

This does not interfere with or countermand any orders you may have received.

..... Agent.

Conductor and motorman must each have a copy and see that their train is properly designated in the above form.

Fig. 11—Clearance Card

repeated back to the dispatcher by the other member of the crew, as do the codes of the New York Street Railway Association, the Central Electric Railway Association and that

**Albany & Hudson Railroad Co.**  
CAUTION CARD.

..... Station..... 190..... M.

To Motorman of.....

Train No. .... } left this Station at..... M.  
Extra..... }

**PROCEED WITH CAUTION**

This does not interfere with or countermand any orders you may have received.

..... Operator.

NOTE--The Motorman receiving this card, duly dated timed and signed, will run with train under control, to the next Station at which there is an operator on duty, and on completion of the day's work will send this card to Office of Train Master.

Fig. 12—Caution Card

approved by the Indiana State Railroad Commission. That this omission is not considered vitally important is shown by the replies received from 30 roads. Of this number, repre-

sented practically every operating condition, 18 do not require the second member of the crew to communicate in any way with the dispatcher in receiving a train order. The other 12 roads require the second member of the crew to repeat the order as written by the first member before the "complete" is given. Four of these roads handle a large part of their orders through station agents, and in such cases the conductor alone repeats the order as received by the agent.

Where the order is received by one member of the crew and repeated back by the other member the responsibility is constructively and actually divided. Where only one member of the crew handles the order, either from an agent or from the dispatcher, the rules generally require the order to be read and thoroughly understood by the other member, and thus the responsibility is placed equally on both. The one who first receives the order, however, is likely to be more impressed with its importance, and it is of interest, therefore, to note the number of roads which delegate this duty to the conductor and those which require the motorman to take the

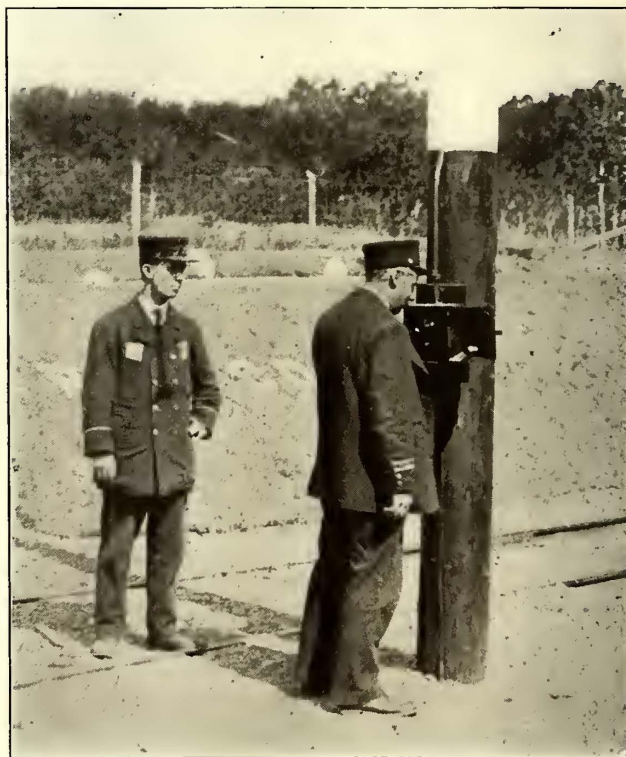


Fig. 13—Dispatching Telephone Box—Milwaukee Electric Railway & Light Company

orders. Thirteen roads require the conductor to receive orders from the dispatcher or agent and get the "complete." Five reverse this and require the motorman to take orders and transmit them to the conductor.

REPORTING TO DISPATCHER

The frequency with which train crews are required to report to the dispatcher during a run from terminal to terminal varies, of course, with local conditions. The Berkshire Street Railway, for example, requires all interurban crews to report at each siding, and it is the practice on many roads to require the crew of the first car arriving at a regular or special meeting point to call the dispatcher for orders relating to either or both cars making the meet. In this connection the practice of the Iowa & Illinois Railway is interesting. This is a high-speed interurban road, 36 miles long, between Davenport and Clinton, Ia. The run from terminal to terminal is made in 1 hr. 30 min., and during the day cars



leave each end every hour. This schedule requires two meets with regular passenger cars on each trip, and in addition one or more meets with express cars which are run as regular trains. Under the rules of this road, train crews are not required to obtain clearance orders or to report at any particular sidings or stations. The departure of trains from the terminals is promptly reported to the dispatcher by the station agent, as is the time of passing a substation, which is a regular meeting point. These reports, together with his own record of time of passing his office, about midway between terminals, enable the dispatcher to keep a close check on train movements without having the train crews report. The company claims that with frequent and regular train movements there is no necessity for regular trains to report unless they lose time and fail to meet regular cars at regular meeting points. The absence of requests for orders from trainmen permits the dispatcher to operate extra trains and work trains with safety under proper time limitations. With this system issu-

ing a train order is an unusual rather than a usual occurrence, consequently, it is claimed, a train order when issued has more significance to a train crew receiving it than it would have if orders of one kind or another were being received on an average of, say, every 30 or 45 minutes during the run from terminal to terminal. Receiving clearance cards and train orders so frequently soon robs them of any importance in the minds of the trainmen, and as a result they are sometimes forgotten or disregarded. Disobeying or forgetting orders is what causes most accidents.

Another peculiar feature of the practice of this road in the movement of trains is the method of holding back a train which has lost time. When a train becomes seven minutes or more late, it loses its rights and is held back, as an extra would be, in favor of regular trains. Another car is substituted at terminals on its return trip when necessary. This prevents every car on the road from losing time waiting at regular meeting points for the single delayed car.



# FREIGHT AND EXPRESS TRAFFIC

INTERURBAN railways have realized during the last three or four years that freight and express traffic can be handled at a profit, and that its development opens up possibilities of largely increasing gross earnings without interfering seriously with the passenger service and without an excessively large increase in investment in special plant and equipment. The growth of this class of traffic on electric railways generally throughout the country has been little short of phenomenal and, with few exceptions, has far exceeded the expectations of the companies when the service was first inaugurated in a small way. A few years ago package freight was carried by some of the interurban roads more as an accommodation to merchants along their lines than as a money making branch of the business. None of the pioneer roads were built or financed on the basis of combined passenger and freight traffic, but most of the newer lines have made provision at the start for handling freight as well as passengers, and the estimated revenue from this source has played no small part as an argument for selling the company's securities.

Interurban roads are well adapted for handling less than carload lots of small package freight, but many companies have gone farther than this and are prepared to carry any kind of bulk freight, coal, stone, brick, lumber, grain or live stock, in their own cars at regular steam road rates. On account of the short average haul the revenue per ton per mile from this class of traffic is higher than the average revenue of the steam roads on merchandise and other high-class freight on longer hauls. Carload business, however, involves an investment in equipment and tracks which is out of proportion to the occasional revenue derived on most roads. This equipment on most roads cannot be kept in service continuously as can the motor and trailer package freight cars which contribute the bulk of the revenue.

## COST OF OPERATION OF FREIGHT DEPARTMENT

The cost of operating freight cars has only been estimated roughly by most electric roads, for the service is so comparatively new that the accounting systems have not always been modified so as to segregate the various operating expenses into charges against the freight and passenger departments. Expenses on account of freight service have been estimated at between 30 per cent and 100 per cent of the gross freight revenue. Some of these estimates include proportionate charges for taxes and interest on funded debt, while others do not. Some are based on arbitrary divisions of maintenance costs, general superintendance, etc., plus actual wages of trainmen, maintenance of freight cars and power consumption. These estimates are obviously crude approximations, and there is need for more accurate methods of analyzing the expenses of the freight department. Perhaps the most accurate estimates so far made are those contained in the report of the committee on freight and express of the Street Railway Association of the State of New York at the Niagara Falls meeting last July. This report presented statistics of nine companies in New York which do a freight and express business. The lowest ratio of operating expenses to gross income was that of the Rochester & Eastern Rapid Railway, which showed 31 per cent on a gross of \$20,792 for 10 months. This company maintains a wagon collection and delivery, partly with its own teams and partly by contract with truckmen, this

service costing \$1,900. The Syracuse Rapid Transit Company, which does a suburban business only, showed an actual loss, its ratio being 100.72 per cent on the small gross earnings of \$4,596 for 10 months. The average for the nine roads reporting, which include the Auburn & Syracuse, Hudson Valley, International Railway, Rochester & Eastern Rapid Railway, Rochester & Sodus Bay, Electric Express Company of Schenectady, Syracuse Rapid Transit Company, United Traction Company of Albany and the Utica & Mohawk Valley, was 70.74 per cent on 10 months' gross of \$350,148. The cost of conducting transportation for all of these companies was \$176,235, and general expenses were \$63,278, while maintenance was charged \$8,189, which is less than 1.5 cents per car-mile.

## GROSS EARNINGS FROM FREIGHT

The ratio of gross earnings from freight to total gross earnings on interurban roads has not yet approached the average of steam roads, nor is it probable that it will in years to come, at least not until belt lines on private rights of way are built around cities and towns and freight traffic removed from the streets. The average ratio of freight revenue to total revenue on steam roads is between 60 and 70 per cent. The highest ratio of the electric lines reporting is 20 per cent, on the Grand Rapids, Holland & Chicago. This company operates a double-track road between Grand Rapids and Holland on Lake Michigan, traversing a rich fruit and agricultural country. A line of steamers runs between Holland and Chicago, and during the summer months large daily shipments of produce and garden truck are made to Chicago, the electric line having direct tracks to the boat wharves. The daily freight receipts from this source during the season are in excess of \$250 and the annual receipts are about \$50,000. The Illinois Traction System, which operated last year 325 miles, had freight earnings of \$191,000. This is about 6 per cent of the gross earnings, but freight traffic has been increasing at the rate of 65 per cent over last year and promises to continue to grow. The estimated net earnings last year from this source were \$102,012, which gives an operating ratio of 46 per cent. The Indiana Union Traction Company, operating a slightly smaller mileage, now has freight earnings of \$150,000, which is 7 per cent of the gross. The average ratio of freight earnings to gross earnings for 20 roads reporting is between 5 per cent and 10 per cent.

## FREIGHT RATES

The rates charged by interurban roads are far from being uniform and comparisons are difficult to make. Much the largest part of the freight traffic is single package shipments with a short haul, seldom averaging over 20 miles. Where wagon collection and delivery is maintained, as on a number of the roads in the Eastern States, the total charges of these roads are equal to or only slightly less than those charged by regular express companies for the same service. In the Middle West, wagon collection and delivery has not found general favor, and the service given, as far as collection and delivery are concerned, is the same as that of the steam roads. The rates are generally as nearly as practicable the same as those charged by competing steam roads between the same points. In Illinois, local freight rates are regulated by a maximum tariff issued by the Illinois Railroad & Ware-

house Commission, which contains graded distance tariffs for five classifications of less than carload freight. The commission has specified all of the important steam roads operating within the State as Class A roads and all other steam and electric railways are included under Class B. Roads in Class B are permitted to charge 10 per cent excess over the maximum rates allowed to be charged by Class A roads. Some of the electric lines take advantage of this 10 per cent excess in their tariffs, but the Illinois Traction System, which is the largest interurban electric railway system in Illinois and comes into direct competition with parallel steam roads of Class A for practically its entire length, bases its tariff on Class A rates, and furthermore bills freight at the short line mileage of the steam roads. Its minimum short haul rate is 17.5 cents per 100 lb. on first-class freight for a nine-mile haul. The fifth-class rate for the same distance is 8 cents.

The average rate per ton per mile, which is the basis of all comparisons of rates, is kept by but few roads. To arrive at this figure requires an analysis of every way bill to determine the product of weight by distance. The freight accounting methods on most roads have not progressed thus far, and the only figures which might be obtained for comparison are the published tariffs for similar commodities for

low-grade to high-grade freight was, of course, much lower than on the steam roads, and this accounts for the high average revenue per ton per mile. The cost of transporting freight for short distances is greater per mile than for long distances, due to the fixed cost of handling at terminals which must be pro-rated over the entire haul, but there can be no doubt that an average ton-mile rate of 4.25 cents for miscellaneous traffic of all kinds is a profitable one for this road.

#### FREIGHT AND EXPRESS ROLLING STOCK

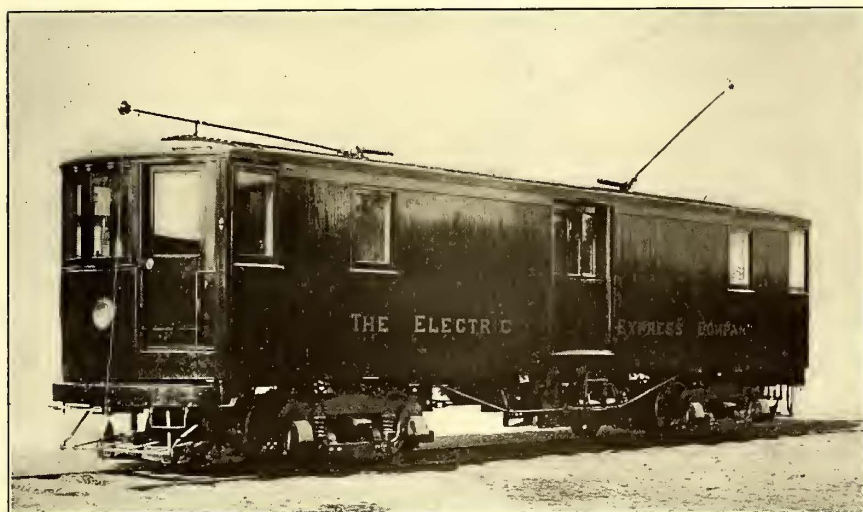
The rolling stock used for freight service on electric roads is built primarily for hard service, but more attention is given to exterior finish and appearance than in standard steam freight cars. Many city ordinances prohibit companies from running over city streets any but so-called "standard express cars," which are closed box cars with side doors and glazed windows.

These cars are usually finished outside in conformity with the standard body color of passenger cars and do not present an objectionable appearance. Motor and trailer cars are generally similar in size and construction, except that trailer cars do not have vestibules in the ends.

A typical motor express car of the latest type is shown herewith. The car has just been completed by the Wason Manufacturing Company for the Electric Express Company, of Massachusetts. It is 45 ft. long over all and is mounted on two type "C-60" Standard trucks. The exterior is finished according to Pullman standard. It is equipped with Allis-Chalmers air brakes and wheel hand brakes in each end. The electrical equipment consists of four General Electric 40-hp 80-A4 motors, geared for a maximum speed of 33 m.p.h. The car is heated with Consolidated electric heaters, so as to prevent damage to perishable goods in cold weather.

Only a few roads have invested in standard steam freight equipment except perhaps a few flat and gondola cars used chiefly in construction work and ballast-

ing. The interurban roads of the Far West and a few of the longer lines in the Middle Western States have purchased large numbers of such cars equipped with air brakes and automatic couplers. They have a capacity of 40,000 lb. to 60,000 lb. and can be hauled in steam trains interchangeably with other cars. The Spokane & Inland Empire with 200 miles of line has over 500 such cars. The Illinois Traction System owns 360 coal cars and 40 flat cars, and last year hauled 150,000 tons of coal in them over its own lines from mines which it reaches to the larger cities. This company also owns 15 electric locomotives having a tractive effort of 16,800 lb., which are used to haul these cars in trains of from four to eight cars. Its high-class freight is handled in standard express cars, of which it has 15 equipped with motors and 40 trailers. Four of these trailers are refrigerator cars and are used for carrying fresh meat, beer, ice, fruit and other perishable freight. The express cars have a capacity of 50,000 lb. The motor cars have multiple unit control and may be used in trains. Ordinarily one motor car hauls from one to three trailer cars. These express cars are not equipped with automatic couplers, and are not used for hauling standard freight cars except in emergencies.



Electric Express Company—Motor Express Car

similar distances. The committee report of the Street Railway Association of the State of New York contains a summary of this kind which was tabulated from the tariffs of 14 roads operating in the State of New York. This shows average ton-mile rates for five commodities as high as 96 cents for hauls between 1 and 5 miles and as low as 25.6 cents for the same distance and same commodities. The lowest rates are 8 cents for a haul of from 5 to 10 miles. Average ton-mile rates for all lengths of haul vary from 48 cents to 12.6 cents, and an average of the averages for the 14 roads is 24.1 cents. The steam road tariffs for the same commodities used in compiling the figures for electric roads average 18 cents for hauls from 1 to 10 miles, 5.6 cents for 50 miles, 3.8 cents for 100 miles and 2 cents for 200 miles. It will be seen from this that even on the basis of the same length of haul the electric roads included in the summary obtain much higher rates than the steam roads. One of the large interurban roads in the Middle West which handles much low-grade freight in carload lots at correspondingly low rates and which has a comparatively long haul for much of its high-class freight, averages 4.25 cents per ton-mile, which is more than four times as great as the average revenue of steam roads of corresponding mileage. The proportion of

The motor express cars used on most roads are equipped with two motors of moderate capacity, but where freight is handled in the daytime it is sometimes necessary to run an express car on a limited train schedule. The Indiana Union Traction Company has a number of motor express cars equipped with four motors and geared to a speed of 55 m.p.h. These cars can equal or exceed the running time of the fastest limiteds, and enable the company to provide a fast

fused after 2:30 p. m., which is too early for afternoon deliveries from the wholesale houses. To overcome this a trail car loaded with transfer freight only is attached to the regular passenger car leaving Davenport at 3 p. m., and is hauled through to Clinton 36 miles in time for the steam road connections. The local motor express car follows 30 minutes later and makes all stops, loading and unloading freight and arriving in Clinton one hour after the trail car.

This schedule saves one trip and makes it possible to handle all of the through and local business with only one motor express car.

The Western Ohio has a somewhat similar condition to meet. All freight between Toledo and Dayton received in the afternoon for delivery the following morning is hauled to the distributing depot at Wapakoneta, where it is sorted and loaded on north and south bound cars, which leave early in the morning, making deliveries. Freight from Dayton is loaded in a trail car, which is attached to the last passenger train leaving Dayton in the evening north bound. This car is hauled through to Wapakoneta and cut off at the distributing depot, where its contents are sorted and reloaded for delivery the next morning. This arrangement saves motor freight car-mileage and other expenses.



Pacific Electric Railway—Freight Locomotive

day freight service without interfering with the passenger service.

#### OPERATION OF TRAIL CARS

Where trail cars are used they are ordinarily hauled behind motor express cars, but in the case of one or two roads reporting, trailers are hauled behind regular passenger cars.

#### CARRYING FREIGHT ON PASSENGER CARS

Where the volume of freight does not warrant running a special freight car, a number of roads carry it in the baggage compartment of passenger cars. The Illinois Traction System and the Indiana Union Traction Company do this on some of their branch lines. Those companies which have



Motor Freight Car and Train in Birmingham, Ala.

The Iowa & Illinois does a large transfer business between Davenport, Ia., and points on the Chicago & Northwestern Railway via Clinton, its northern terminal. In order to make the connection at Clinton by 5 p. m. it is necessary to have a car leave Davenport at 3 p. m., reaching Clinton at 4:30 p. m. The local motor express car requires two hours to make the run, and if the transfer freight was loaded on it, both local freight and transfer freight would have to be re-

made contracts with old line express companies usually carry express matter on regular passenger cars which have a baggage compartment. This practice, however, has the disadvantage of incurring chances of delay to passenger cars when an unusual amount of freight has to be loaded or unloaded at way stations. It also burdens the trainmen with the freight messenger's work and takes their time and attention from their own more important duties.

## HOURS OF FREIGHT TRAFFIC

When neither the passenger nor freight traffic is very heavy, freight cars can be run during the daytime without seriously interfering with the movement of passenger cars, but on the other hand, where passenger traffic is extremely heavy the operation of freight cars on more or less irregular schedules causes such frequent delays that as much of the freight traffic as possible is handled at night. On the Illinois Traction System, for example, the passenger schedule calls for 15 limited trains each way a day between Springfield and East St. Louis and a number of local trains also. It is necessary to handle most of the freight between these two points after 9 p. m. The residents along streets in cities which are used by interurban roads also raise objections to the running of frequent freight cars during the daytime, especially if such cars are run in trains. The Pacific Electric Railway is permitted by its city franchise in Los Angeles to run single express cars during the day, but standard freight cars in trains can be moved through the streets only at night. The Northern Electric Railway, which uses nothing but standard freight cars hauled by electric locomotives, moves all of its freight through cities during the night.

The requirements of shippers and consignees, however, are usually the controlling factors in determining the schedule of freight and express cars. The outbound shipments of freight from large terminal cities consist mostly of merchandise consigned to merchants in the smaller outlying towns. Rush orders for delivery the same day require a service during the

or more cars during the day to handle rush shipments when necessary. Inbound freight to such cities consists of produce, milk, empty cases, etc., which are wanted early in the morning, and most of this freight is handled between 6 a. m. and 10 a. m. Inbound cars leave the outlying terminals between 4 a. m. and 6 a. m. collecting freight on the way.

The freight business of the Illinois Traction System out of East St. Louis presents some novel features. This com-



Louisville Interurban Station—Freight Platform

pany runs a through car every night from East St. Louis to Danville, Ill., 225 miles, and also one to Peoria, 175 miles. Freight received up to 6 p. m. at the transfer freight house in St. Louis is loaded on these cars, which leave East St. Louis at 9 p. m., arriving at Springfield at 12:40 a. m., Danville 7:30 a. m. and Peoria at 7:30 a. m. Danville and Peoria have always been in the Chicago territory, but with this serv-



Pacific Electric Railway—Standard Concrete Freight and Passenger Station

daytime which will insure delivery before the close of business, but these shipments constitute but a small part of the total for which delivery on the morning of the day following receipt of the order is usually sufficiently quick. Indianapolis, Ind., which is the largest interurban center in the country, is typical of this class of terminal cities. From 80 per cent to 90 per cent of the outbound freight leaves the freight houses between 6 p. m. and 9 p. m. All of the roads run one

ice, shipments made from St. Louis are received from 24 to 48 hours earlier than from Chicago. These are the longest interurban freight runs in the country.

Summarizing the practice in the matter of freight schedules, of the 23 roads from which replies were obtained, 11 run freight cars mostly during the day and only occasionally at night, while the other 12 roads run cars during the day and night. On five of these roads, the Terre Haute, Indianapolis

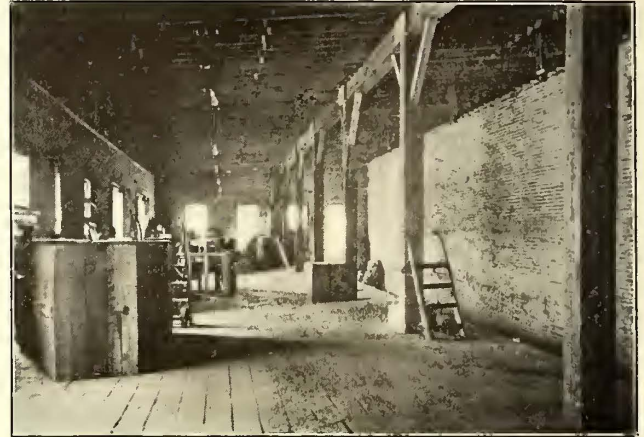
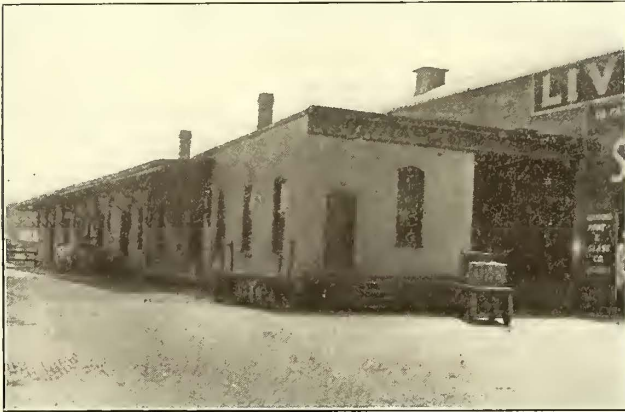
& Eastern, Utica & Mohawk Valley, Northern Electric, Pacific Electric and Illinois Traction System, most of the freight is handled at night, the day service being confined largely to short haul local freight.

#### WAGON COLLECTION AND DELIVERY

Wagon collection and delivery service is given on all or part of the freight handled by 10 of the 23 companies visited. With the exception of the Lake Shore Electric and the Cleveland, Southwestern & Columbus, over which the Electric

less than 35 miles. In general, its rates are about equal to those charged by the regular express companies. It does a large interline business with the boat lines on Lake Erie and with some of the connecting electric roads.

The Utica & Mohawk Valley does an express business only, its expenses for cartage aggregating nearly 25 per cent of the total operating expenses. Its rates are about the same as those charged by the regular express companies. Its gross income from this source last year was \$66,000 and its operating expenses estimated at 80 per cent.



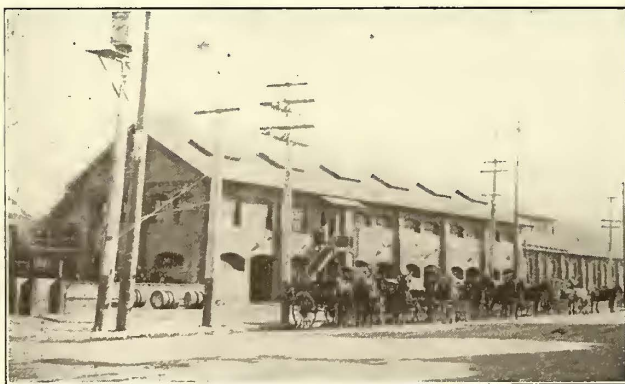
Rockford & Interurban—Freight House at Rockford, Ill.

Package Company operates, the Utica & Mohawk Valley is the only company visited which collects and delivers all freight and express matter. The Electric Package Company of Cleveland is not a corporation but an association of the four interurban roads entering Cleveland, Ohio, formed to take entire charge of the freight and express business of these companies as well as baggage. Each road furnishes its own train crews, power and freight equipment, and the Electric Package Company furnishes the train messengers and delivery trucks in the various cities and towns in Northern Ohio reached by these roads. The association is managed by a committee of representatives of the roads and is operated

The Detroit United has made a contract with a trucking company in Detroit for delivery and collection of freight when desired by the shipper or consignee. The charge for this service varies with the character of the shipment and the distance hauled, but averages about 2 cents per 100 lb.

The Indiana Union Traction Company makes no charge for transfer of shipments at junction points, where the freight houses of its own and the connecting line are some distance away from each other. It does not, however, attempt to collect or deliver freight in cities and towns.

The Birmingham Railway, Light & Power Company maintains wagon delivery service at only two of its stations,



Pacific Electric Railway—Los Angeles Freight House



Freight House and Team Tracks in Birmingham

by a superintendent. The company receives 10 cents for handling each piece of baggage, which, however, is not delivered in cities, and its rates on produce, merchandise, milk and other package freight are correspondingly higher than steam road rates on account of its delivery service. The gross express earnings last year on the Cleveland, Southwestern & Columbus, one of the member companies, were \$50,000, and the earnings of the other companies in the association are proportionately as large. The minimum rates of the Package Company are 30 cents per 100 lb. for distances of

for which no extra charge is made. Its rates in general are about the same as those of the steam roads. The Southern standard commodity classification is used, and the rates are the same from any point on the system to any other point.

The freight and express business of the Springfield (Mass.) Street Railway Company is handled by a subsidiary company of the New England Investment & Securities Company, known as the Electric Express Company, which operates on all lines in Massachusetts controlled by the New York, New Haven & Hartford Railroad. This company uses a single one-

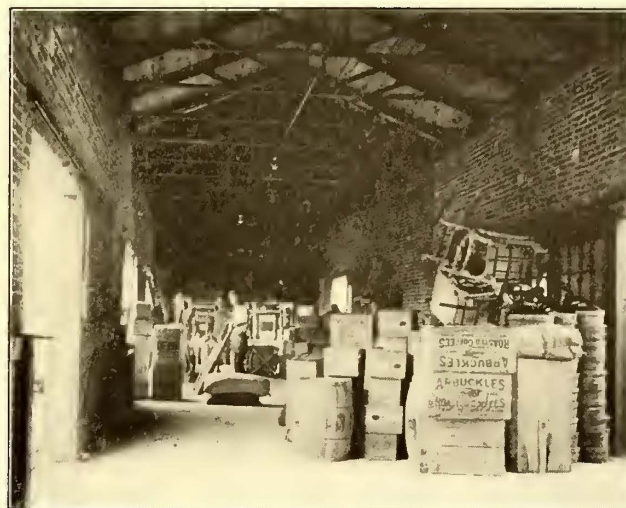
horse wagon in Springfield for collecting light express matter, for which a small extra charge is made. This wagon also does some delivering when through delivery charges are paid.

The Illinois Traction system is compelled to provide a wagon transfer on all shipments into and out of St. Louis, pending the completion of its bridge and entrance into that city. At the present time its terminal is in East St. Louis, across the Mississippi River, and freight is hauled on trucks, either over the Eads bridge or by ferry from the freight warehouse of the transfer company in St. Louis. An average

other shipper, the goods being consigned to the company's agents. The Pacific Express Company operates on the Western Ohio. In the Far West the Wells-Fargo Express Company has a virtual monopoly of the express business on the steam roads, and has also made contracts with some of the electric interurban roads, including the Pacific Electric and the Northern Electric. On the Lackawanna & Wyoming Valley the Adams Express Company operates. The Albany & Hudson has a contract with the American Express Company.



Birmingham Railway, Light & Power Company—Freight Depot at Ensley, Ala.



Toledo Urban & Interurban—Interior of Freight House in Toledo

charge of 5 cents per 100 lb. is made by the transfer company for this service, but this charge is absorbed in the published rates from St. Louis. Six to eight two- and three-horse trucks with a capacity of 10,000 lb. to 15,000 lb. are used for this transfer service. Single shipments from one consignor in St. Louis exceeding 10,000 lb. in weight are loaded direct from the consignor's warehouse without extra charge by the transfer company, thus saving cartage to the transfer freight house.

The contracts which are made with electric roads by the express companies are generally similar to the contracts made with the steam roads, except in cases where the railway company maintains an express business of its own, which it is obliged to protect by restricting the right of the express company to do strictly local business on its lines. Railways which handle freight at close to steam road rates have nothing to fear from the competition of an express company operating over their lines, as the difference in rates is so great as to



Toledo Urban & Interurban—Freight House in Toledo

#### CONTRACTS WITH EXPRESS COMPANIES

The old line express companies have recently extended their operations to include many of the longer interurban roads as well as the steam roads. The United States Express Company has been most active in this field, and now operates over the Illinois Traction System, the Ft. Wayne & Wabash Valley, the Ohio Electric and a number of other roads in the Middle West. It has no contract with the Terre Haute, Indianapolis & Eastern, but ships large quantities of express matter on the cars of that company on the same basis as any

preclude the possibility of suffering a loss. The express companies ordinarily agree to divide the gross revenue on a basis of from 40 per cent to 50 per cent for the railway company and guarantee a fixed monthly payment. In return, the railway company furnishes the necessary cars or space in regular passenger cars and storage facilities at stations for express matter. With this form of contract the railway company earns as much, or sometimes even more, on express shipments as it would if it carried the shipments at its regular freight rates, which are usually one-third to one-half of the express

companies' rates. The volume of express business is seldom large enough to require a special car to be run, although on the Illinois Traction System this is done. One of the company's standard motor freight cars is used and the express company furnishes a special messenger. This car makes a daily round trip between East St. Louis and Danville, 225 miles, and handles the majority of the express matter carried between those points. The local passenger cars pick up and deliver packages at the smaller towns and country stops, as the through car runs on a limited schedule and stops only in the larger cities. The station agents of the railway company act as agents for the express company also, receiving a commission on the gross revenue derived from their station in addition to their regular salary as agents.

The Detroit United has a contract with the express company which operates over its lines under which it receives a flat rate per 100 lb. carried, with a fixed guarantee per month. The Grand Rapids, Holland & Chicago and the Birmingham Railway, Light & Power Company have a similar form of contract.

MAIL CONTRACTS

United States mail is carried on nearly all of the interurban roads and by many of the city lines. The interurban roads do not, as a rule, run special cars for this purpose, their contracts usually covering only the transportation of sealed pouches between towns. These are carried on regular passenger cars. The Spokane & Inland Empire runs some regular mail cars on which only mail is carried, and the Pacific Electric has in service some combination cars with a postal compartment in one end.

The rates received from the Government on mail are not high enough to make this class of business particularly profitable, although the cost of handling mail is small, as the trainmen are entrusted with the mail sacks and receive no extra compensation for their services. The frequent service offered by the interurban roads is a great convenience in handling mail from town to town, and the companies have no difficulty in getting the contracts if they want them, at rates at least equal to those charged by the steam roads. Carrying the mail adds some prestige, and is a protection against interference with service during strikes or other disturbances.

CARRYING MAIL ON CITY LINES

Among the city lines which operate separate cars for the collection and delivery of mail are the Chicago City Railway Company, Chicago Railways Company, Philadelphia Rapid Transit Company, Springfield (Mass.) Street Railway Company, Third Avenue (New York) Railroad Company, Pittsburgh Railways Company, United Railroads of San Francisco, United Railways of St. Louis, Boston Elevated Railway, Detroit United Railway, Municipal Traction Company of Cleveland and the Capitol Traction Company of Washington, D. C. These companies furnish the cars and car crews, but the mail is in charge of a regular postal clerk who is responsible for it.

MILK TRAFFIC

Carrying milk in cans from the country districts to the cities is a traffic for which the interurban roads are peculiarly adapted by reason of their location and the kind of service which they can give. With three exceptions, the 23 roads visited carry large quantities of milk in cans, the revenue from this source being from \$500 to \$48,000 annually. The Western Ohio turns all of this business over to the Pacific Express Company which operates on its lines. The rates on milk show wide variations on different roads. In many cases

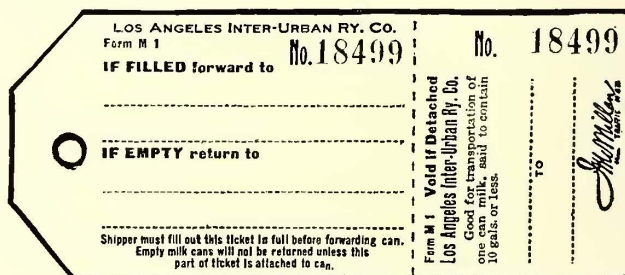
they are apparently based on what the traffic will bear and not on what the service costs. The Auburn & Syracuse is one of the few roads which puts milk on the same basis as any other commodity. It carries milk at first-class rates on a straight distance tariff.

The Electric Express Company, which operates on the trolley lines of the New York, New Haven & Hartford in Massachusetts, has a graded tariff for milk, which is shown in the table below:

Daily Quantities	Less than 20 Miles	20 to 49 Miles	50 to 99 Miles	100 Miles or More, Cents
1-20 cans	Cents per Can	Cents per Can	Cents per Can	per Can
21-30 "	5	6	7	8
31-40 "	4 3-4	5 3-4	6 3-4	7 3-4
41-50 "	4 1-2	5 1-2	6 1-2	7 1-2
51-75 "	4 1-4	5 1-4	6 1-4	7 1-4
76-99 "	4	5	6	7
100 or over	3 1-2	4 1-2	5 1-2	6 1-2
	3	4	5	6

All cans are figured at 8.5 qts. capacity, or a trifle more than 2 gal. Empty cans are returned free, but icing of milk in transit is charged for extra. This company handles into Springfield, Mass., alone, more than 10,000 cans a year, from which it derives a revenue of \$3,600.

The Birmingham Railway, Light & Power Company makes a flat rate of 2 cents per gallon for any distance, with a minimum of 5 gal., or 10 cents for each can. The Albany & Hudson makes a flat rate of 12 1/2 cents for a 10-gal. can or less from any point to Albany, which includes the return of the empty can. This company has a maximum one-way haul of 35 miles.



Pacific Electric Railway—Milk Ticket

The Cleveland, Southwestern & Columbus does a large milk business, its revenue from this source amounting to \$48,000, or \$3,000 in excess of the revenue from all other freight and express. Its regular freight and express business is handled by the Electric Package Company, but it conducts its own milk business and appropriates the entire revenue. Its rates are 7 1/2 cents, 10 cents and 12 1/2 cents per 10 gal. can, according to the distance carried, but an extra charge is made for returning the cans. Last year this company carried 292,000 cans into Cleveland.

The Indiana Union Traction Company bases its rates on distance with a minimum of 1 1/2 cents a gallon for distances of less than 30 miles. The rate for 100 miles is only 2 1/2 cents a gallon as against a rate of 3 cents a gallon for any distance on the Ft. Wayne & Wabash Valley, a connecting road. This indicates the variation in practice to be found in all parts of the country.

NEWSPAPER TRAFFIC

The same variation in rates which is characteristic of milk traffic is found in the charges made for carrying newspapers in bundles, which is a small but profitable branch of the freight and express business on many interurban lines. In the Middle West, where the average haul is between 25 and 50 miles, the rate generally charged is 50 cents per 100 lb. with a minimum of 5 cents per bundle. This is the rate on



the Terre Haute, Indianapolis & Eastern, the Indiana Union Traction Company, the Ft. Wayne & Wabash Valley and the Indianapolis & Cincinnati. The Terre Haute, Indianapolis & Eastern sells to the newspaper publishers books of coupons from 5 cents to 25 cents in value, which have mucilage backs and are pasted on the bundles before delivery to the cars. The trainmen throw off the bundles, but the company does not assume any liability for wrong delivery or non-delivery. One local car on the Richmond Division leaving Indianapolis at 4 p. m. carries a newspaper messenger, who rides in the baggage compartment and while the car is running throws off single papers to subscribers who live on the line or who make arrangements to have their papers thrown off at a certain point.

The Pacific Electric Company uses newspaper tickets of the form shown in the accompanying engraving. These tickets are printed in denominations of from 5 to 100 and each ticket is good for the transportation of the number of papers printed in large type on its face for any distance. The tickets are printed and bound in book form and the back of the large section is mucilage to be attached to the cover on the bundle. The conductor's small coupon is not pasted down and is detached by the conductor when the papers are thrown off. Conductors are required to turn in these coupons at the end of each trip with their cash and other tickets so that a complete check is kept on the newspaper bundles handled by each car. The tickets are sold on the basis of 1,000 papers for \$1.



Pacific Electric Railway—Newspaper Ticket

The newspaper rates charged by the interurban companies in New York are comparatively low. The Utica & Mohawk Valley and the Syracuse Rapid Transit Company charge only 10 cents per 100 lb., while the Auburn & Syracuse charges 25 cents per 100 lb. The Hudson Valley Railway carries papers as package freight at regular rates, while the Albany & Hudson turns all this business over to the American Express Company which operates over its lines. The rate of the Electric Express Company in Massachusetts is 50 cents per 100 lb. for any distance.

The Louisville Railway Company makes no charge whatever for carrying papers, in this way reciprocating the good will of the newspaper publishers.

SOLICITING FREIGHT TRAFFIC

The success of the freight department depends to a large extent on the energy and personality of the traffic solicitors employed. New business does not come in without expending some effort to get it, and where a steam road competes for freight it is not always easy to overcome the advantage of the large organization and long experience of its traffic department. The head of the freight traffic department of an interurban road is often also the head of the passenger traffic department, or even is burdened with the entire management of the transportation department. He seldom has time to

get out of the office to visit and cultivate the friendship and confidence of large shippers, adjust complaints, and in other ways lay the foundation for future growth of the freight business. One or more good outside solicitors, who do nothing else but visit shippers and advertise the service by personal interviews, can secure business which can be obtained in no other way. Most of the large interurban roads in the Middle West employ such men, and the steady growth of the freight traffic attests the value of their services.

ORGANIZATION OF FREIGHT TRAFFIC DEPARTMENT

The Illinois Traction System has the largest organization of this kind of any road visited. The freight and passenger traffic department is headed by a general traffic manager with offices in Springfield, which is about the geographical center of the system. District traffic managers are located at Champaign, Peoria, Bloomington, East St. Louis and two at Springfield. These district managers have general supervision over the freight and passenger business of their respective territories and do some outside soliciting as well. One or two freight solicitors who devote all their time to visiting the merchants and shippers on the company's lines and induce them to ship or order their shipments routed over the electric line are employed in each district office. That this organization is effective in getting business is shown by the increase in traffic over last year of 65 per cent. This increase has been maintained in spite of the business depression and other local causes tending to reduce rather than increase the normal amounts of shipments moving.

The Terre Haute, Indianapolis & Eastern has a general passenger and freight agent, who is assisted by a district agent located at Indianapolis. Two, and, at times, three outside solicitors are employed. A similar organization is maintained by the Indiana Union Traction Company which has two division agents. The Detroit United employs two outside solicitors and the Western Ohio one. The Electric Package Company of Cleveland employs a number of so-called route agents, who solicit business on all of the lines over which the company operates. The Pacific Electric has an outside solicitor who is given the title of traveling freight agent.

COMMISSIONS FOR LOCAL AGENTS

A plan which is in use on a few roads for increasing the efficiency of agents in small towns as traffic solicitors is to put them on a commission basis or pay them a small commission on all business originating from their station in addition to their regular salary. This is the practice of the Detroit United; Indianapolis & Cincinnati; Indiana Union Traction Company; Birmingham Railway, Light & Power Company; Electric Express Company and the Lake Shore Electric. The Terre Haute, Indianapolis & Eastern and the Western Ohio pay some agents in small towns a commission on both freight and passenger receipts. The Ft. Wayne & Wabash Valley pays its agents straight salaries, but depends on them almost entirely for soliciting business in their towns, having no regularly organized traffic department.

ROUTING CARDS

Another plan which has been productive of good results where tried, is to distribute routing cards among merchants and buyers, with the request that they be attached to orders sent in to jobbers in terminal cities. One of these cards is shown on the following page. The Western Ohio, whose card is reproduced, makes a practice of obtaining signatures to these cards from small merchants in the cities and towns on its lines. The company's general freight agent, about once a month, takes a package of these signed slips and calls on the

wholesale dealers in Lima, Toledo, Dayton or Cincinnati to whom they are addressed. The signatures from customers obtain for the company's agent an interview with the wholesale dealer, during which arguments can be presented in favor of shipping all the merchandise possible over the electric road in preference to the competing steam road. This company's experience has been that routing cards are of little value when simply attached to orders, as shippers seldom pay any attention to such instructions if not insisted upon by the consignee.

The Illinois Traction System uses these cards but in a slightly different way. They are put up in pads and distributed to agents, solicitors and trainmen on both express and passenger cars. They are placed with merchants, farmers and other persons who ride over the company's lines and good results have been obtained from their use. Among other roads which reported using such cards are the Lake Shore Electric; Electric Express Company; Spokane & Inland Empire; Grand Rapids, Holland & Chicago; Pacific Electric; Indiana Union Traction Company; Ft. Wayne & Wabash Valley; Detroit United and Cleveland, Southwestern & Columbus.

Freight solicitors for electric roads have a number of strong arguments to bring to bear on shippers and consignees in order to divert business from the steam roads. The most important, of course, is quick delivery. The package

<b>LIMA ROUTE</b>	190.....
.....	
<i>Please mark and ship our freight via</i>	
.....	
<b>THE WESTERN OHIO RAILWAY</b>	
.....	
<i>regardless of previous instructions.</i>	
.....	

Western Ohio Railway—Routing Card

freight service of the average electric railway is 50 per cent quicker than that of the steam roads, and in many cases an even greater saving in time can be shown. The leaving and arriving time of express cars is usually arranged to best meet the convenience of shippers in delivering rush or late orders, and of the consignee in receiving his shipment on the same or following day in time to effect a sale before the close of business. The freight terminals of the electric roads in cities are usually more conveniently located for receiving and delivering shipments than the steam road freight depots. On account of the quick service there is seldom any congestion in the freight depots, and consequently less chance for loss and damage to shipments held over in the house. With these strong arguments in favor of the electric road the question of rates plays little or no part. None of the roads visited reported lower rates to be a factor in soliciting business.

#### INTERCHANGE OF FREIGHT TRAFFIC WITH STEAM ROADS

The passenger and freight traffic of electric railways has not been built up entirely at the expense of competing steam roads, but the latter have undoubtedly felt the effect of the diversion of no inconsiderable part of their former revenue. For this reason they have not as a rule been willing to voluntarily enter into traffic agreements which might prove more

profitable in the long run to the electric roads than to themselves. Such traffic agreements open up to the electric lines the entire transportation network of the continent, while they increase the joint territory of the steam roads only by a small amount. The electric road with its possibilities for originating traffic would receive as the originating road a disproportionate share of the joint rate. These considerations have been largely responsible for the steam roads refusing to arrange joint traffic agreements with connecting electric lines. The non-interchangeability of equipment has also been a deterring factor.

Of the 21 roads from which answers were received only six have joint freight traffic arrangements with connecting steam roads. Two of these, the Pacific Electric and the Spokane & Inland Empire, are in the Far West where competition of parallel electric lines has not been keen. Two others, the Albany & Hudson and Lackawanna & Wyoming Valley, are in the East, and the fifth, the Birmingham Railway, Light & Power Company, is in the South. Only one interurban road in the Middle West which was visited has such an arrangement, although a few other roads, which were not visited, interchange freight with steam roads. The Aurora, Elgin & Chicago, which is referred to, has an arrangement for the interchange of car load freight with a number of connecting steam roads, under which freight cars consigned to its line are billed to the junction point and then handled by the electric road on an arbitrary switching charge. It also has a traffic agreement with the Illinois Central under which it issues joint tariffs. A division of revenue has been agreed upon which differs from that used by two connecting steam roads, being especially adapted to the class of freight commonly interchanged.

The Spokane & Inland Empire interchanges freight with all of the steam roads entering Spokane under a joint tariff arrangement exactly similar to those drawn up between two steam roads. The cars of the electric road, however, are never allowed to leave its own rails except in cases of emergency. All equipment for foreign shipments is furnished by the connecting steam roads.

The Albany & Hudson handles cars of connecting steam roads over its line on the basis of local rates. Shipments are billed to the junction point at the local rate from origin to junction, and then the local rate of the Albany & Hudson is added from the junction joint to destination.

#### INTERCHANGE OF FREIGHT WITH ELECTRIC ROADS

The organization of the Central Electric Traffic Association promises to extend very largely the practice of interchanging freight between connecting electric roads in the Middle West. Most of the roads entering Indianapolis now interchange freight in less than carload lots, billing it through and transferring it from car to car at the junction point. The division of revenue is usually made on a straight mileage basis, the proportion of the through rate for each road being determined by its haul. The Central Electric Traffic Association proposes to attempt to standardize the practice in this regard, to issue in the name of the association joint tariffs from any point on one road to any point on any other road based on the sum of the minimum local rates of each connecting road, and to bring about a uniform method of division of revenue based on pro rates per rate.

A number of roads in this territory which have through traffic arrangements divide the revenue on a mileage group basis. The accompanying table shows the division percentages agreed to by three connecting roads, the Western Ohio, Lima & Toledo division of the Ohio Electric Railway, and the Ft. Wayne & Wabash Valley. Shipments originating

on the Western Ohio and consigned to points on the Ft. Wayne & Wabash Valley are routed as follows: Western Ohio, north or south to Lima; Ohio Electric, from Lima to Ft. Wayne; Ft. Wayne & Wabash Valley, from Ft.

THE WESTERN OHIO RAILWAY CO.

PERCENTAGES APPLYING BETWEEN POINTS ON THE WESTERN OHIO RAILWAY AND FT. WAYNE & WABASH VALLEY TRACTION CO. VIA LIMA AND FT. WAYNE

FT. W. & W. V. POINTS	Roads	W. O. STATIONS NORTH OF LIMA TO FINDLAY, INC.		W. O. STATIONS SOUTH OF LIMA TO PIQUA, CELINA AND MINSTER, INC.	
		Miles	Per Cent.	Miles	Per Cent.
West of Ft. Wayne to Wabash, inclusive. . . .	W. O. . . . .	33	23	49	31
	L. & T. . . . .	65	45	65	41
	Ft.W.&W.V. . . . .	45	32	45	28
West of Wabash to Logansport, inclusive. . . .	W. O. . . . .	33	*20	49	26
	L. & T. . . . .	65	37	65	34
	Ft.W.&W.V. . . . .	76	43	76	40
West of Logansport to Lafayette, inclusive. . . .	W. O. . . . .	33	*20	49	21
	L. & T. . . . .	65	30	65	29
	Ft.W.&W.V. . . . .	114	50	114	50
South of Ft. Wayne to Bluffton, Ind., inclusive. . . . .	W. O. . . . .	33	27	49	34
	L. & T. . . . .	65	53	65	46
	Ft.W.&W.V. . . . .	25	20	*25	20

\*Minimum.

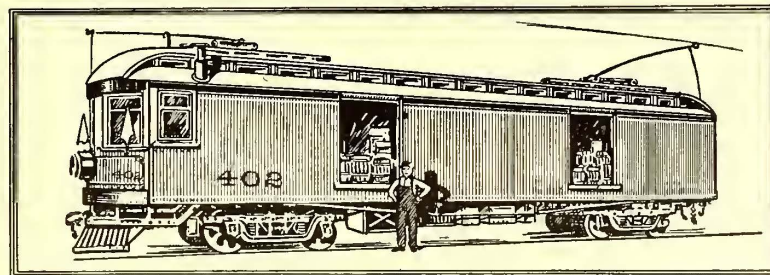
Wayne to destination. The haul on the Western Ohio is averaged at 33 miles for the group of stations between Lima and Findlay, and 49 miles for the group between Lima and Piqua, Celina or Minster. The haul on

the Ohio Electric is the same in all cases, 65 miles from Lima to Ft. Wayne. The haul on the Ft. Wayne & Wabash Valley is again averaged for stations between Ft. Wayne and Wabash at 45 miles, Wabash to Logansport 76 miles, etc. The revenue is divided on percentages represented by the average haul in any group. Thus on a shipment from Findlay to Wabash the Western Ohio receives 23 per cent of the through rate, the Ohio Electric 45 per cent and the Ft. Wayne & Wabash Valley 32 per cent. This method simplifies the work of the accounting department in auditing through way bills for joint settlement and is probably sufficiently accurate.

The Grand Rapids, Holland & Chicago interchanges freight with other electric lines only occasionally and divides the revenue on an arbitrary basis of 50 per cent to each road. The Detroit United also has interchange agreements with connecting lines which are based on a purely arbitrary division of revenue.

INTERCHANGE OF FREIGHT EQUIPMENT

The Fort Wayne & Wabash Valley and the Indiana Union Traction Company have an arrangement for interchanging freight equipment for carload shipments, as do the Western Ohio, Ohio Electric, and the Dayton & Troy. With these exceptions, however, none of the roads visited has made a practice of interchanging freight cars with connecting lines. Through shipments of this kind are loaded in trailers which are turned over to the connecting line at the junction without unloading.



# PASSENGER TICKETS AND FARES

IT is to the interest of interurban railway companies, for a number of reasons, to collect as large a part of the passenger revenue as possible before passengers board the cars. Even on short suburban lines where the zone fare system is in effect, tickets of some form are usually provided for the convenience of passengers and the protection of the company. The use of tickets facilitates the collection of fares on cars, is a convenience to passengers who are enabled to purchase their transportation in advance, is a protection against theft of cash fares by dishonest conductors and assists the auditing department in the compilation of traffic statistics and accounts.

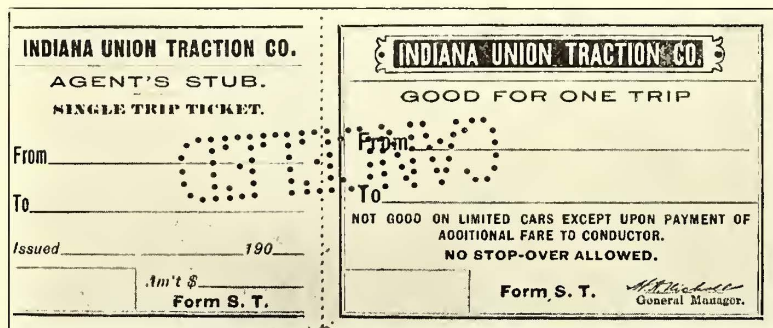


Fig. 1—Skeleton Single-Trip Ticket

## PROPORTION OF TICKET SALES

One of the subjects in connection with passenger fares and tickets on which data were secured from the several interurban roads visited was the percentage of total passenger revenue derived from the sale of tickets and the percentage of cash fares paid. The percentages of ticket sales range from 15 per cent to 90 per cent. The character of the traffic, whether largely local, or having a preponderance of trips from town to town, the convenient location of ticket offices in cities and towns and the reductions offered on ticket fares over cash fares, all affect this ratio. On the four divisions of the Detroit United interurban lines the percentages of ticket sales are as follows: Detroit, Utica & Romeo, 16 per cent; Rapid Railway System, 23 per cent; Detroit, Monroe & Toledo Short Line, 52 per cent; Detroit, Jackson & Chicago, 31 per cent. The Ft. Wayne & Wabash Valley obtains from ticket sales 54 per cent of its revenue. The Boston & Worcester also has a low ratio of 40 per cent. The highest ratios reported were the Lackawanna & Wyoming Valley, 90 per cent; Spokane & Inland Empire, 90 per cent; Rochester, Syracuse & Eastern, 90 per cent; Oneida Railway Company, 87 per cent. The average of six of the largest interurban roads in the Middle West is 72 per cent.

## CASH FARE EXCESS RATES

One method of discouraging payment of cash fares on cars from points where tickets are sold is to charge cash fares from such points in excess of the one-way ticket rates. This practice has been borrowed from the steam roads, which have found it a successful means of preventing, to a large extent, the boarding of cars by passengers without buying tickets at

stations. The Western Ohio Railway on July 1, 1908, issued an order that a uniform excess fare of 10 cents over one-way local ticket rates would be charged all passengers not holding tickets who board cars in towns where ticket offices are maintained, during such hours as the ticket offices are open. This rule does not apply, however, in the case of passengers boarding cars inside the limits of cities or towns where the company's cars make more than one stop at the ticket office. No rebate is allowed on this excess fare. The Northern Electric Company, of Chico, Cal., charges 10 cents excess for fares paid on cars, but this excess is returned to passengers on the presentation of the cash fare receipt issued

by the conductor to the ticket agent at the destination. The Lackawanna & Wyoming Valley charges 5 cents excess, which is also returned on presentation of the cash fare receipt. The Albany & Hudson Railway also charges 5 cents excess with a rebate of 5 cents. The Grand Rapids, Holland & Chicago Railway has its cash fare rates between towns fixed by its local franchises. Its established ticket rates, however, between towns are 5 cents less than the cash fare rates and a 10 per cent reduction is given on round trips. The unique ticket system of the Indianapolis & Cincinnati Traction Company, which will be described later, provides for the sale of tickets of all denomi-

nations at a uniform reduction of 10 per cent on their face value. Its published tariffs are based on cash fares and the face value of the tickets is equivalent to cash. This, in effect, provides for a 10 per cent reduction on tickets over cash fare rates. The Oneida Railway charges a cash fare excess of from 5 to 10 cents, depending upon the amount of fare paid. It makes no rebate.

## FORMS OF TICKETS

The forms of tickets used by interurban railways show wide variation. Some companies have adopted, practically entire, the standard forms of tickets used by steam roads, including one way and round trip card tickets, coupon interline tickets, mileage strips and ticket books for commutation

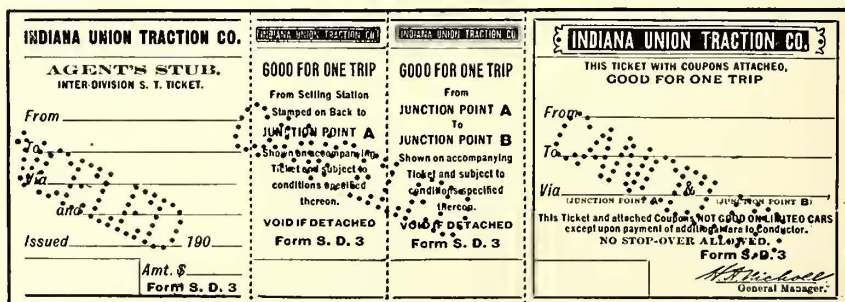


Fig. 2—Skeleton Interdivision Single-Trip Ticket

and special school and other reduced rates of transportation. The Indiana Union Traction Company uses a complete set of such tickets and forms, some of which are reproduced herewith. Fig. 1 shows a skeleton one-way trip ticket with agent's stub attached. Fig. 2 shows a skeleton interdivision single-trip ticket with agent's stub attached. Fig. 3 shows the standard coupon interline ticket sold from points on the Indiana Union Traction Company's lines to points on the Fort

Wayne & Wabash Valley Traction Company. This ticket has three coupons, the audit stub, a coupon lifted by the Indiana Union Traction Company conductor, and the coupon with the contract stub retained by the conductor of the Fort Wayne & Wabash Valley Traction Company. Fig. 4 shows a similar ticket in skeleton form which can be made out for passengers destined to points on any line with which the com-

Cincinnati & Louisville Railroad. This is the form of ticket which is now being used for through traffic between Indianapolis and Chicago. The Indiana Union Traction Company turns over its through passengers to Chicago to the Chicago, Cincinnati & Louisville Railway at Peru. It has an arrangement whereby its agents sell space in Pullman cars, and special night train service has been put on between Indianapolis and Peru, making connections with the sleeping car leaving Peru at 2 a. m. and arriving in Chicago at 6:30 a. m.

A round trip card ticket is shown in Fig. 7. The going coupon is printed in one color and the returning coupon in another color so as to make it easy for the conductor to distinguish between the two in lifting the going coupon. It will be noted that the contract on the return coupon of this ticket makes no provision for the expiration of the transportation within time limits. This clause is sometimes included.

The Auburn & Syracuse issues a one-way card ticket with auditor's stub attached, shown in Fig. 9. The stub bears the same consecutive number as the ticket and is detached by the agent when the ticket is sold. It also bears identification letters, indicating the destination and from what station sold.

The Illinois Traction System and the Detroit United Railways, among others, use duplex agents tickets which are similar to the duplex cash fare receipts commonly used. The passenger's stub and the auditor's stub have printed on them the names of the principal stations, and the agent punches in one column the station from and in the other column the station to. The date of sale and station from which sold is stamped on the back of each stub. This gives a complete audit check and saves a large investment in special ticket forms for each selling office.

The Boston & Worcester uses special forms of tickets on account of its zone system of fares. Fig. 8 shows part of a round trip ticket between Westboro and Chestnut Hill. Each of the coupons is good for a ride within one 5-cent zone and one coupon is lifted by the conductor when passing from one zone to another. This ticket, which has in all 14 coupons representing 70 cents in fares, is sold for 65 cents, or 5 cents less than the face value of the several coupons. Similar coupon tickets of this type are issued in book form, two or more coupons forming one page of the book. These books are sold at considerable reductions over the cash fares represented by the coupons contained therein.

The ticket system of the Indianapolis & Cincinnati Traction Company, which has been in use about a year, is based upon the principle that a ticket sold by the company should be honored for passage between any points where the published tariffs are equal to the price paid for the ticket. In other words, a 20-cent ticket should be good between any two stations where the published tariff is 20 cents. Small card tickets are used bearing, in prominent figures, the face value of the ticket instead of the names of the stations to and from. These tickets are issued in denominations of from 5 cents to \$1.10, which is the maximum limited train fare on this line, and can be bought at any station in any denominations and in unlimited numbers. Tickets are sold at the uniform reduction of 10 per cent on their face value and the discounts are figured to even cents. Two 5-cent tickets printed on one card can be purchased for 9 cents, so that the passenger paying a low fare saves as large a percentage as the passenger buying a ticket of the largest denomination, or \$1.10, the price of which is 99 cents. No difficulty is experienced by the company in making the change to even pennies at ticket offices, and a large saving in investment in tickets has been made. Only 23 forms of tickets are required, as

Fig. 3—Interline One-Way Coupon Ticket

Fig. 4—Skeleton Interline One-Way Coupon Ticket

pany has traffic agreements. Fig. 6 shows a skeleton interline ticket used in connection with the Toledo, St. Louis & Western Railroad between towns on the Indiana Union Traction Company's lines and Toledo, which must be validated by the agent of the Toledo, St. Louis & Western in Toledo in order to make it good returning. Fig. 5 shows a skeleton interline coupon ticket issued in connection with the Chicago,

against more than 2000 before the introduction of this system.

CASH FARE RECEIPTS

The forms of cash fare receipts used by interurban roads do not show such wide variations as the forms of tickets used. In general, three forms of cash fare receipts are used: Duplex punched receipts for single-trip cash fares paid; duplex punched cash fare receipts for round-trip fares, the duplex stub issued to the passenger being good for the return trip, and single sheet double indication fare receipts, torn in such a way as to leave

A typical duplex fare receipt is shown in Fig. 10. This receipt contains spaces for indicating the station to and the station from, the month and the day of the month, the amount of the cash fare paid, and whether paid for express charges or for excess baggage charges.

Fig. 11 shows a simple cash fare receipt used by the Aurora, Elgin & Chicago Railroad. This receipt, when printed on yellow paper, is used on southbound cars, and when printed on blue paper is used on northbound cars. Fig. 12 shows another form of cash fare receipt used by this company which is torn with a special notched straight edge. The lower half is retained by the conductor and the upper half issued to the passenger. Fig. 19 shows a round trip duplex fare receipt issued by the Iowa & Illinois Railway Company. This company issues this form of tickets printed in two colors. Those printed on pink paper with blue type

Fig. 5—C. C. & L. Interline One-Way Coupon Ticket

Fig. 6—Upper and Lower Halves of Special T, St. L. & W. Interline Excursion Ticket

Fig. 8—Part of Coupon Strip Ticket—Boston & Worcester

one stub for the passenger and one for the conductor, both indicating the amount paid and the stations between which the fare is collected.

are issued on northbound cars and the return stub is good only on southbound cars. The round trip duplex tickets issued on southbound cars and good returning on northbound

cars are printed with red letters on white paper. This color scheme of paper and type to distinguish between north and southbound passage characterizes all forms of tickets used by this company.

Fig. 14 shows the continuous train check used by the Indiana Union Traction Company which is of the same form as the duplex cash fare receipt used by this road. This continuous check is issued by the conductor in place of a ticket taken up or cash fare paid to a point beyond the run of his train. The conductor punches the station to and from as

the return coupon is left attached to and returned to the auditor with the auditor's stub.

HAT CHECKS

On roads where traffic is heavy and where there are mixed local and through passengers, it is difficult for the conductor to identify every passenger who has paid his fare without issuing some form of receipt. Some companies have adopted for this purpose plain hat checks. These afford only a small degree of protection against passengers deceiving the con-

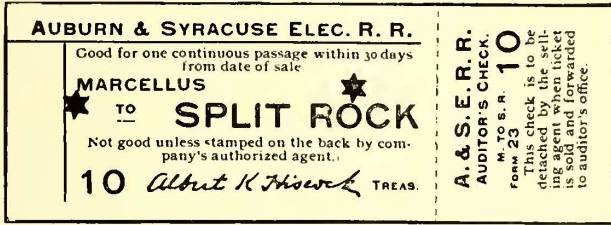


Fig. 9—One-Way Card Ticket with Audit Stub

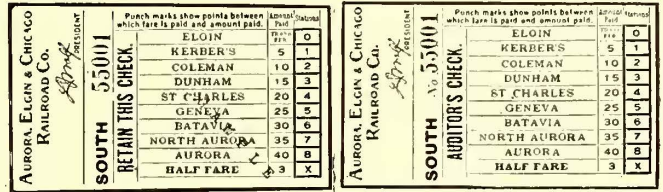


Fig. 11—Two Halves of Duplex Cash Fare Receipt—Aurora, Elgin & Chicago

shown on the ticket lifted, and also the junction point where the passenger makes the connection for his destination. The ticket, in place of which the continuing check is issued, is attached to the audit stub and turned in with the train report. On reaching the junction point, the passenger's continuing check, when presented to the conductor of the connecting car, is taken up in place of the original ticket purchased and entitles the passenger to continue on to his destination.

ductor, however, and on a number of roads special forms of hat checks have been devised.

The Springfield Street Railway Company issues a duplex hat check which serves both as a cash fare receipt and as a method of identification for the conductor that the fare has been paid. One half of this receipt is shown in Fig. 15. It is printed on stiff yellow card and spaces are provided for indicating stations to and from, the amount of fare paid and the date.

The Pacific Electric Railway Company issues a triplex

<b>FT. WAYNE &amp; WABASH VALLEY TRACTION CO.</b> <b>AUDITOR'S STUB</b> For Fare paid From and To Stations Punched Conductors will turn in all Duplicates of Cash Fare Receipts Issued as per Trip		TO FROM 1 FL. WAYNE 2 Abolite 3 Rockdale 4 Wardsville 5 Huntington 6 Miami Park 7 Andrews 8 LaGrange 9 Wabash 10 Boyd Park 11 Peru 12 Lewisburg 13 Country Club 14 Logan Sport 15 Longchiff 16 Claymets 17 Barrows 18 Rockfield 19 Delphi 20 Colburn 21 Buck Creek 22 Springvale 23 La Fayette 24 Ferguson 25 Youer 26 Greenwood 27 Kingsland 28 Huntington	No. 65080 EXPRESS 250 245 240 230 220 210 205 200 195 190 185 180 175 170 165 160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5	JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEP. OCT. NOV. DEC. For Fare paid From and To Stations Punched RETAIN THIS AS EVIDENCE OF FARE PAID <b>FT. WAYNE &amp; WABASH VALLEY TRACTION CO.</b> CASH FARE RECEIPT
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Fig. 10—Typical Duplex Cash Fare Receipt

AURORA ELGIN BATAVIA CHICAGO BOSWORTH WAGNER ROAD ST. CHARLES ROAD FERRY ROAD WHEATON WILMINGTON WAREHAVILLE GENEVA ROAD PLEASANT HILL PLEASANT HILL WHEATON GLEN ELLYN LOMBARD CANFIELD ROAD SO. ELMHURST WOLF ROAD BELLEWOOD MAYWOOD	A 836963 THE AURORA, ELGIN & CHICAGO R. R. CO. Large figure in top corner denotes amount of fare paid. Retain this receipt until called for by inspector. L. J. WOLF, Pres. ATTOURNEY, ALLEN & CO. CHURCH ROAD, WAGNER ROAD, BOSWORTH EOLA JUNCTION ST. CHARLES ROAD FERRY ROAD WAYNE WILLIAMS ROAD INGALLSON WAREHAVILLE GENEVA ROAD WHEATON GOLF CLUB PLEASANT HILL WHEATON GLEN ELLYN LOMBARD CANFIELD ROAD SO. ELMHURST WOLF ROAD BELLEWOOD MAYWOOD HARLEM OAK PARK 524 AVE., CHICAGO CHICAGO
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Fig. 12—Cash Fare Receipt—Aurora, Elgin & Chicago

cash fare receipt which is shown in Fig. 13. This check contains three coupons. The going coupon is a cash fare receipt for a continuous trip on the car on which the fare is paid. The return coupon is issued when a round trip fare is paid, and it is handed to the passenger, together with the going coupon. The auditor's stub, which forms the central portion of the ticket, must be turned in at the end of the day whether the receipt is issued in payment of a one-way fare or a round trip. If the ticket is issued for a one-way fare only,

The Boston & Worcester issues on its main lines a form of hat check shown in Fig. 16. These checks are issued to all through passengers when single coupon through tickets are presented. The hat checks are dated by punching at the office of the company each morning, and all used or unused checks are turned in at the end of the day. Each check has attached to it a conductor's stub which bears the same consecutive number as the check, and conductors are required to account for all stubs and checks issued by them

Fig. 13—Triplex One-Way and Round Trip Cash Fare Receipt—Pacific Electric Railway

Fig. 16—Hat Check with Audit Stub

Fig. 14—Duplex Continuous Train Check

Fig. 15—Half of Duplex Hat Check Fare Receipt

Fig. 17—Cipher Hat Check

Fig. 18—Sample Cash Fare Ticket Receipts—Twin City Rapid Transit Company

Fig. 19—Round-Trip Duplex Cash Fare Receipt



during the day. On westbound trains, the hat checks used are printed on pink paper, and on the eastbound trains they are printed on blue paper.

The Fort Wayne & Wabash Valley Traction Company issues a hat check on which are printed four rows of numbers and letters. In issuing these checks, each number represents a station eastbound or westbound, as the case may be. The indications of these numbers and letters are changed at frequent intervals and are arranged according to a secret code which is known only to the conductors and auditing department. For example, the figure 4 may indicate Logansport, eastbound, one week, and Huntington, westbound, the following week. This plan makes it practically impossible for passengers to defraud the conductors by displaying a hat check which was not issued to them.

The Indianapolis & Cincinnati Traction Company issues duplex fare receipts to every passenger, regardless of whether the fare was paid in cash or by ticket or pass. This receipt is punched in the same manner as an ordinary duplex cash fare receipt, with some additional punching designed to give the auditor's office a large amount of detail information about the traffic returns. It is reproduced in Fig. 20.

The Twin City Rapid Transit Company on its suburban line to Lake Minnetonka uses a simple form of cash fare receipt or hat check consisting of small tickets 1 in. x 2 in., issued in different denominations of from 5 cents to 25 cents, printed on different colored papers and bearing in prominent

RATES OF FARE

The basic rates for one-way local fares on interurban roads vary from 1 1/4 cents per mile to 2 1/2 cents, and in general are fractionally lower than the rates of competing steam roads between the same points. In States which have enacted 2-

**THE INDIANAPOLIS & CINCINNATI TRACTION COMPANY.**  
**FARE RECEIPT.**  
 The Passenger must retain this and produce it whenever called for by Conductor or Inspector. The Conductor will issue **One and Only One Receipt** to each passenger as the fare is taken. He will punch the stations or groups of stations between which the passenger is to ride, the amount of cash paid and the cash fare value of each ticket (cash to be punched in right and tickets in left column). No cash fare value will be punched for Passes or Press Transportation. If more than one ticket of the same value is used, the conductor will punch as many times as there are tickets of that value, the first punch mark to be in the space where the value is shown and the remaining marks to be opposite, to the left. In every case the cash fare value of each ticket should be indicated by **one** punch mark. In case of detached coupon tickets or similar tickets, each undetached strip will count as one ticket. If the fare paid is ticket or cash for a child (between 6 and 12), a Student Ticket, a Pass, Press Transportation, or if the amount collected is in payment of transportation of property, when no baggage check is given, the fact will be noted by punching the proper space in addition to punching the receipt as above set out.

8722

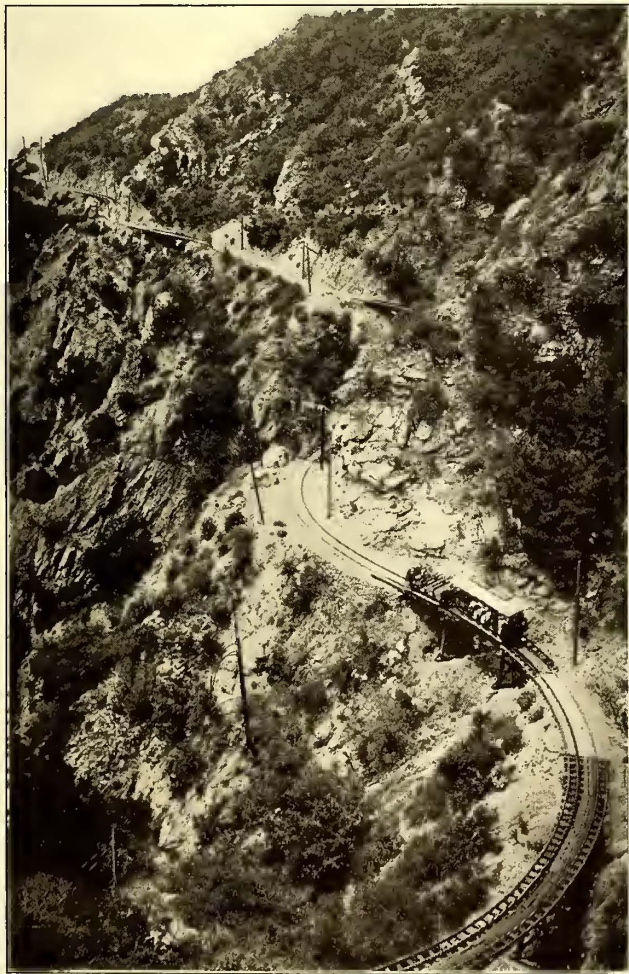
Stations	From	To	Cash	Ticket
01	From	05	05	05
02	From	10	10	10
03	From	15	15	15
04	From	20	20	20
05	From	25	25	25
06	From	30	30	30
07	From	35	35	35
08	From	40	40	40
09	From	45	45	45
10	From	50	50	50
11	From	55	55	55
12	From	60	60	60
13	From	65	65	65
14	From	70	70	70
15	From	75	75	75
16	From	80	80	80
17	From	85	85	85
18	From	90	90	90
19	From	95	95	95
20	From	1.00	1.00	1.00
21	From	1.05	1.05	1.05
22	From	1.10	1.10	1.10
23	From	1.15	1.15	1.15
24	From	1.20	1.20	1.20
25	From	1.25	1.25	1.25
26	From	1.30	1.30	1.30
27	From	1.35	1.35	1.35
28	From	1.40	1.40	1.40
29	From	1.45	1.45	1.45
30	From	1.50	1.50	1.50
31	From	1.55	1.55	1.55
32	From	1.60	1.60	1.60
33	From	1.65	1.65	1.65
34	From	1.70	1.70	1.70
35	From	1.75	1.75	1.75
36	From	1.80	1.80	1.80
37	From	1.85	1.85	1.85
38	From	1.90	1.90	1.90
39	From	1.95	1.95	1.95
40	From	2.00	2.00	2.00
41	From	2.05	2.05	2.05
42	From	2.10	2.10	2.10
43	From	2.15	2.15	2.15
44	From	2.20	2.20	2.20
45	From	2.25	2.25	2.25
46	From	2.30	2.30	2.30
47	From	2.35	2.35	2.35
48	From	2.40	2.40	2.40
49	From	2.45	2.45	2.45
50	From	2.50	2.50	2.50
51	From	2.55	2.55	2.55
52	From	2.60	2.60	2.60
53	From	2.65	2.65	2.65
54	From	2.70	2.70	2.70
55	From	2.75	2.75	2.75
56	From	2.80	2.80	2.80
57	From	2.85	2.85	2.85
58	From	2.90	2.90	2.90
59	From	2.95	2.95	2.95
60	From	3.00	3.00	3.00
61	From	3.05	3.05	3.05
62	From	3.10	3.10	3.10
63	From	3.15	3.15	3.15
64	From	3.20	3.20	3.20
65	From	3.25	3.25	3.25
66	From	3.30	3.30	3.30
67	From	3.35	3.35	3.35
68	From	3.40	3.40	3.40
69	From	3.45	3.45	3.45
70	From	3.50	3.50	3.50
71	From	3.55	3.55	3.55
72	From	3.60	3.60	3.60
73	From	3.65	3.65	3.65
74	From	3.70	3.70	3.70
75	From	3.75	3.75	3.75
76	From	3.80	3.80	3.80
77	From	3.85	3.85	3.85
78	From	3.90	3.90	3.90
79	From	3.95	3.95	3.95
80	From	4.00	4.00	4.00
81	From	4.05	4.05	4.05
82	From	4.10	4.10	4.10
83	From	4.15	4.15	4.15
84	From	4.20	4.20	4.20
85	From	4.25	4.25	4.25
86	From	4.30	4.30	4.30
87	From	4.35	4.35	4.35
88	From	4.40	4.40	4.40
89	From	4.45	4.45	4.45
90	From	4.50	4.50	4.50
91	From	4.55	4.55	4.55
92	From	4.60	4.60	4.60
93	From	4.65	4.65	4.65
94	From	4.70	4.70	4.70
95	From	4.75	4.75	4.75
96	From	4.80	4.80	4.80
97	From	4.85	4.85	4.85
98	From	4.90	4.90	4.90
99	From	4.95	4.95	4.95
100	From	5.00	5.00	5.00

**THE INDIANAPOLIS & CINCINNATI TRACTION COMPANY.**  
**FARE RECEIPT.**  
**AUDIT CHECK.**  
 At the end of each train, on each division, conductor will make a neat bundle of Audit Checks, in the order issued, and forward them to the Accounting Department, with his train report. Mutilated receipts will be punched in the space marked "Mutilated" and sent in with train report in bundle separate from properly punched Audit Checks. Mutilated receipts must not have the Passengers Checks detached. Conductors will exercise care not to crumple or fold Audit Checks. It will be more satisfactory not to tear Audit Checks off until several receipts have been issued. Receipts must be issued in order of the numbers. Conductor will write on each bundle date, train number and his name.

8722

Stations	From	To	Cash	Ticket
01	From	05	05	05
02	From	10	10	10
03	From	15	15	15
04	From	20	20	20
05	From	25	25	25
06	From	30	30	30
07	From	35	35	35
08	From	40	40	40
09	From	45	45	45
10	From	50	50	50
11	From	55	55	55
12	From	60	60	60
13	From	65	65	65
14	From	70	70	70
15	From	75	75	75
16	From	80	80	80
17	From	85	85	85
18	From	90	90	90
19	From	95	95	95
20	From	1.00	1.00	1.00
21	From	1.05	1.05	1.05
22	From	1.10	1.10	1.10
23	From	1.15	1.15	1.15
24	From	1.20	1.20	1.20
25	From	1.25	1.25	1.25
26	From	1.30	1.30	1.30
27	From	1.35	1.35	1.35
28	From	1.40	1.40	1.40
29	From	1.45	1.45	1.45
30	From	1.50	1.50	1.50
31	From	1.55	1.55	1.55
32	From	1.60	1.60	1.60
33	From	1.65	1.65	1.65
34	From	1.70	1.70	1.70
35	From	1.75	1.75	1.75
36	From	1.80	1.80	1.80
37	From	1.85	1.85	1.85
38	From	1.90	1.90	1.90
39	From	1.95	1.95	1.95
40	From	2.00	2.00	2.00
41	From	2.05	2.05	2.05
42	From	2.10	2.10	2.10
43	From	2.15	2.15	2.15
44	From	2.20	2.20	2.20
45	From	2.25	2.25	2.25
46	From	2.30	2.30	2.30
47	From	2.35	2.35	2.35
48	From	2.40	2.40	2.40
49	From	2.45	2.45	2.45
50	From	2.50	2.50	2.50
51	From	2.55	2.55	2.55
52	From	2.60	2.60	2.60
53	From	2.65	2.65	2.65
54	From	2.70	2.70	2.70
55	From	2.75	2.75	2.75
56	From	2.80	2.80	2.80
57	From	2.85	2.85	2.85
58	From	2.90	2.90	2.90
59	From	2.95	2.95	2.95
60	From	3.00	3.00	3.00
61	From	3.05	3.05	3.05
62	From	3.10	3.10	3.10
63	From	3.15	3.15	3.15
64	From	3.20	3.20	3.20
65	From	3.25	3.25	3.25
66	From	3.30	3.30	3.30
67	From	3.35	3.35	3.35
68	From	3.40	3.40	3.40
69	From	3.45	3.45	3.45
70	From	3.50	3.50	3.50
71	From	3.55	3.55	3.55
72	From	3.60	3.60	3.60
73	From	3.65	3.65	3.65
74	From	3.70	3.70	3.70
75	From	3.75	3.75	3.75
76	From	3.80	3.80	3.80
77	From	3.85	3.85	3.85
78	From	3.90	3.90	3.90
79	From	3.95	3.95	3.95
80	From	4.00	4.00	4.00
81	From	4.05	4.05	4.05
82	From	4.10	4.10	4.10
83	From	4.15	4.15	4.15
84	From	4.20	4.20	4.20
85	From	4.25	4.25	4.25
86	From	4.30	4.30	4.30
87	From	4.35	4.35	4.35
88	From	4.40	4.40	4.40
89	From	4.45	4.45	4.45
90	From	4.50	4.50	4.50
91	From	4.55	4.55	4.55
92	From	4.60	4.60	4.60
93	From	4.65	4.65	4.65
94	From	4.70	4.70	4.70
95	From	4.75	4.75	4.75
96	From	4.80	4.80	4.80
97	From	4.85	4.85	4.85
98	From	4.90	4.90	4.90
99	From	4.95	4.95	4.95
100	From	5.00	5.00	5.00

Fig. 20—Duplex Cash and Ticket Fare Receipt



Pacific Electric—Scenic Route

type figures showing the amount of fare paid and the point from and to. These packets of tickets are carried in a holder and are issued for each fare paid. The conductor also rings up the fares as collected.

cents a mile fare laws, including Indiana, Ohio and Illinois, the basic rates are, of course, not over the legal limit, but in the Far West, where steam road rates have always been high, basic rates of 2 1/2 cents and even higher are in force. The Spokane & Inland Empire has a rate of 2 1/2 cents per mile on its Spokane & Inland division. On the Coeur d'Alene division of this company, however, the basic rate is reduced to 2 cents a mile. This company makes no extra charge for riding in the coaches of limited trains, but it runs chair cars on these trains for which an extra charge of 25 cents a seat between terminals is made. On round trip tickets it makes a reduction of 5 per cent. It sells a book containing coupons representing \$20 worth of one-way fares for \$16 and also books of commutation and school tickets at the rate of 1 1/4 cents per mile.

The Pacific Electric, on some of its scenic routes, charges as high as 8 cents per mile. The reason for this apparently excessive charge can be appreciated when the cost of construction and operation of these lines is taken into account. The accompanying illustration shows a section of the Alpine division of this company, which reaches the top of Mt. Lowe, 21.3 miles back from Los Angeles. The one-way fare for this distance is \$1.75 and the round-trip fare is \$2.50. The rates on some of the other lines of this company, as for example between Los Angeles and Pasadena, are as low as 1 1/4 cents per mile.

The 5-cent fare zones of the Boston & Worcester, of which there are nine on the main line, average 3 miles in length, which gives a basic rate of 1 2/3 cents per mile, or only slightly less than the average of the longer interurban lines of the Middle West.

tickets, good only in one town, between the hours of 5:30 a. m. and 7 a. m., 11:30 a. m. and 1 p. m. and 5:30 p. m. and 6:30 p. m., are sold in books of 30 for \$1. These tickets are not good on Sundays and holidays and transfers are not issued on them.

The Ft. Wayne & Wabash Valley uses 2 cents a mile as



Aurora, Elgin & Chicago—Interior of Parlor-Buffet Car

its basic rate in fixing its local one-way fares, keeping them just below the limit allowed by law in Indiana. An excess fare of 5 cents is charged on limited trains between county seats which average about 20 miles apart. In order to meet the twin-ticket competition of the parallel steam road a reduction of 25 per cent is made on round trip tickets. Commutation tickets average about 1 cent per mile. This company

tion on round trip tickets is only 10 per cent on twice the one-way rate. Commutation tickets are sold at the rate of one fare plus 10 per cent for the round trip, or 45 per cent reduction. This company is also a member of the Central Electric Traffic Association and honors the new interchangeable mileage ticket sold for 1 3/4 cents per mile.

The basic rates of the Lake Shore Electric are 1.8 cents for local one-way fares, 10 per cent reduction on round trips and 1 1/4 cents for commutation tickets. Its mileage book sells at 1.6 cents per mile. No excess is charged on limited trains.

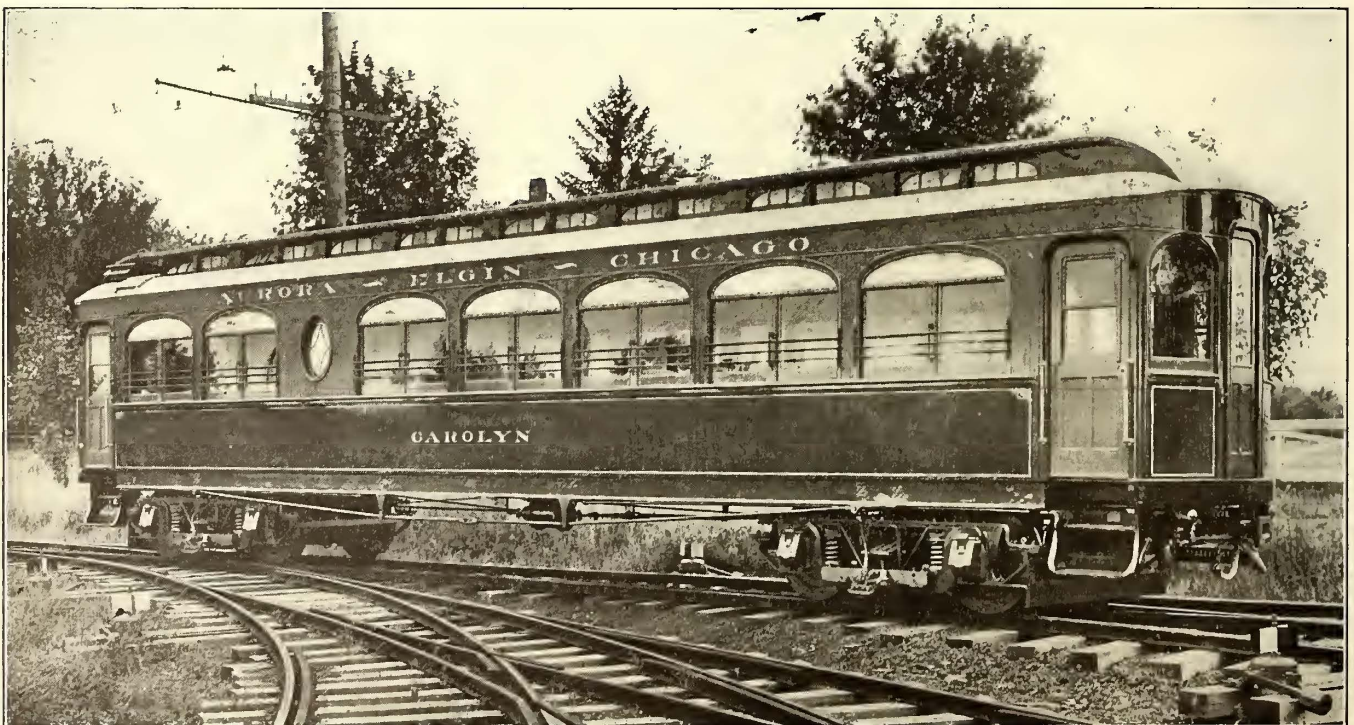
The Cleveland, Southwestern & Columbus uses 2 cents as its basic rate and allows the small reduction of 8 per cent on round trip tickets. Commutation rates are 1 and 1 1/4 cents and mileage 1 1/2 cents.

The Detroit United is limited by its local franchise agreements in fixing fares, and has the low average of 1 1/4 cents for local one-way fares. In addition to this low basic rate it allows 12 per cent reduction on round trip tickets and sells mileage for 1 cent a mile. No excess is charged on limited trains.

The Indiana Union Traction Company bases its local fares on a rate of 1 3/4 cents per mile, adding an excess fare of 1/4 cent per mile for limited cars. A reduction of 10 per cent on the local one-way fares is given on round trip tickets.

On the Terre Haute, Indianapolis & Eastern the average of one-way local fares is 1.7 cents per mile, and the average of round trip fares is 1.6 cents. The excess charged on limited trains is 5 cents for each 20 miles or fraction thereof.

The Aurora, Elgin & Chicago charges no excess fares on limited trains, but in several of these trains between Chicago



Aurora, Elgin & Chicago—Parlor-Buffet Car

formerly sold mileage for 1 1/2 cents per mile, but has subscribed to the mileage book agreement of the Central Electric Traffic Association, which makes the interchangeable mileage book rate 1 3/4 cents per mile.

The Western Ohio uses 2 cents as its basic local rate and makes no extra charge for riding on limited trains. Its reduc-

tion on round trip tickets is only 10 per cent on twice the one-way rate. Commutation tickets are sold at the rate of one fare plus 10 per cent for the round trip, or 45 per cent reduction. This company is also a member of the Central Electric Traffic Association and honors the new interchangeable mileage ticket sold for 1 3/4 cents per mile.

The basic rates of the interurban companies operating in New York and Pennsylvania are generally lower than those used by the interurban roads in the Middle West. The Utica & Mohawk Valley, the Auburn & Syracuse and the Oneida Railway all use 1 1/2 cents as a basis for one-way local fares, as does also the Lackawanna & Wyoming Valley. The Rochester, Syracuse & Eastern and the Albany & Hudson, however, use 2 cents. None of these roads charges excess fare on any trains. The interchangeable mileage book used by the companies named which operate in the State of New York contains coupons for 500 miles and is sold for \$6.25. The Lackawanna & Wyoming Valley sells a mileage book at the same rate. The Auburn & Syracuse and the Rochester, Syracuse & Eastern sell commutation tickets at rates as low as 2/3 cent per mile.

#### REGISTERING FARES

The practice of interurban roads in registering tickets and cash fares presents some features of interest. Eight out of 18 companies use an indicating and recording register and ring up all cash and ticket fares collected, including mileage. Seven companies use a register for city fares only. The Western Ohio uses an indicating and recording register on its local cars, but on its limited cars uses no register of any kind. The Terre Haute, Indianapolis & Eastern uses registers on some divisions, but on other divisions has its conductors make up their trip reports from tickets collected and the stubs of the duplex cash fare receipts issued.

The Boston & Worcester uses two single registers in each car. On branch lines one register is used for recording cash fares collected in each zone and the other register is used for recording tickets and transfers received. On the main line one register is used for recording all through tickets reading between Boston and Worcester to the value of 45 cents, and the other register records cash and ticket local fares between intermediate zones.

#### INTERCHANGE OF PASSENGER TRAFFIC WITH STEAM ROADS

Only three of the interurban roads from which data on passenger traffic were obtained reported that they had interchange agreements covering passenger business with connecting steam roads. These were the Lake Shore Electric, the Indiana Union Traction Company and the Spokane & Inland Empire. The Indiana Union Traction has a joint passenger traffic agreement with the Chicago, Cincinnati & Louisville Railroad which is identical in its provision with the agreements drawn up between two connecting steam roads. Joint tariffs are published naming rates from any point on the Indiana Union Traction Company's lines to any point on the Chicago, Cincinnati & Louisville, and each company binds itself to divert all possible interline traffic to the lines of the other. The lines of the two companies cross each other at Peru, Marion and Muncie, and passenger traffic is interchanged at all of these points. The form of interline coupon ticket sold by the Indiana Union Traction Company in connection with the Chicago, Cincinnati & Louisville is shown on page 836.

This company also has an agreement with the Toledo, St. Louis & Western for interchange of passenger traffic, but only to the extent of honoring tickets sold at regular rates, the division of revenue being based on the proportion which the local rate of each road bears to the total price of the ticket. This practice is followed in occasional instances by a number of other interurban lines in this territory which connect with steam roads not members of the Central Passenger Association.

The Spokane & Inland Empire has joint passenger traffic arrangements with all of the steam roads entering Spokane. Its agreements are similar in every respect to those in effect between the several steam roads in that territory and provide for reciprocal interchange between all points on its own and connecting lines.

Interchange of passenger traffic between connecting electric roads is quite general in the Middle West and in Central New York. The member roads of the Central Electric Traffic Association have in use an interchangeable mileage book and most of them have interchange agreements with each other covering the sale of interline coupon tickets, the revenue from which is decided either on a straight mileage proportion or is prorated from the local rates of each road. In the case of most of the interurban roads in the State of New York which interchange passenger traffic, the through rate is made up of the sum of the local rates of each company and the revenue is divided so that each company receives its regular local fare. The joint passenger tariffs of the Detroit United Railways and its connecting lines are divided on a purely arbitrary basis determined by the companies interested.

#### INTERCHANGE OF PASSENGER EQUIPMENT

The Fort Wayne & Wabash Valley and the Indiana Union Traction Company have an agreement covering the interchange of limited passenger cars on the through runs from Fort Wayne to Indianapolis. Each company furnishes its share of the equipment required for this service and the crews are changed off at the junction point. A similar arrangement is in effect on the through service of the Toledo Urban & Interurban System, the Western Ohio and the Dayton & Troy. Special through excursion traffic is occasionally handled by interchanging equipment between other roads than those mentioned, but the practice is not general.

#### TICKETS AND FARES ON CITY LINES

The standard practice on the city street railway systems in the United States is to charge 5 cents as a cash fare for a continuous ride within the corporate limits of any city or town regardless of the length of ride. A few companies in Massachusetts charge 6 cents. The local system in Cleveland is now leased by the Municipal Traction Company, which is allowed by ordinance to charge 5 cents per ride, but is operated at present, as an experiment, on a 3-cent cash fare basis. In order to effect a reduction in operating expenses somewhat commensurate with the decline in revenues which this step has produced, this company has made many changes in routing and has decreased the total car-miles run.

Many city systems, by the sale of tickets or tokens at reduced prices when bought in quantities reduce the rate to as low as 4 cents. The Indianapolis Traction & Terminal Company and the Milwaukee Electric Railway & Light Company, for example, sell six tickets for 25 cents and 25 tickets for \$1. Conductors are supplied with strips of both kinds of tickets. The Springfield (Ill.) Consolidated Railway sells six tickets for 25 cents on cars and books of 25 tickets for \$1 are sold at the company's general office. These ticket books are purchased in moderately large quantities by merchants and others who sell them to customers at cost as an inducement for trade. In Indianapolis 85 per cent of the gross passenger revenue is derived from ticket sales, the sales of 25-cent strips being largely in excess of the sales of the \$1 strips. In Milwaukee the percentage of ticket sales is almost as large, being approximately 80 per cent. Ticket sales in Springfield, Ill., aggregate 25 per cent of the total revenue.

The Albany & Hudson sells 24 tickets for \$1, good on the city lines in Hudson, but the sales are very small. In

Spokane, Wash., the Spokane & Inland Empire, which operates the city lines, sells 22 tickets for \$1 and school tickets for 2 1/2 cents each. Only about 6 per cent of the city line revenue is derived from this source. In Auburn, N. Y., the Auburn & Syracuse also sells 22 tickets for \$1, the receipts being about 5 per cent of the total.

The Utica & Mohawk Valley issues a book of 20 tickets which is sold for \$1 and is merely a convenience to passengers. About 4 per cent of its revenue is obtained from the sale of these books. The Syracuse Rapid Transit Railway also sells 20 tickets for \$1. The Springfield (Mass.) Street Railway sells a 100-ride ticket for \$5 and a 20-ride ticket for \$1. The proceeds from the sale of these tickets represent only 6 per cent of the total passenger revenue.

The Philadelphia Rapid Transit Company sells six tickets for 25 cents and also sells exchange tickets for 8 cents, good for continuing trips from cars of one division to cars of another division between which free transfers are not issued. In 1907, 54 per cent of the gross passenger revenue was derived from the sale of the 4 1/6-cent tickets and 14 per cent from the sale of exchange tickets.

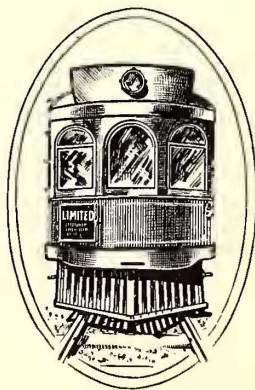
#### TRANSFER TRAFFIC

Statistics of transfer travel were obtained from a number of cities. The highest percentage of transfer passengers to total passengers carried reported from any city visited was 50 per cent in Nashville. The conditions in that city are peculiar in that all cars run into a central transfer station, which is a little out of the business center of the city. A large part of the transfer passengers are passengers from the lines which do not pass through the business district in entering the transfer station. They transfer to continue their trip to the business

district and only ride two or three blocks. In New York City, where the transfer situation has reached an acute stage, the roads show a ratio of 36.1 per cent. The ratios in some other cities from which replies were received are as follows: Auburn, N. Y., 12 per cent; Detroit, Mich., 30 per cent; Indianapolis, Ind., 23 per cent; Kansas City, Mo., 43 per cent; Louisville, Ky., 30 per cent; Milwaukee, Wis., 28 per cent; Minneapolis, 23 per cent; Philadelphia, Pa., 16 per cent; Springfield, Ill., 20 per cent; Syracuse, N. Y., 25 per cent; Spokane, Wash., 10 per cent; Springfield, Mass., 14 per cent, and Utica, N. Y., 25 per cent. These figures convey only a general idea of the extent of transfer travel in cities of large and small size. The local traffic conditions and restrictions placed on the issuing of transfers are different in every city, and comparisons are of small value without going into details of traffic, which would be out of place here.

#### REGISTERING TRANSFERS

The practice in regard to registering transfers on cars was also investigated in this connection. Eleven of the 17 companies reporting register all transfers collected as well as tickets and cash fares, while six companies do not register transfers. The companies which register transfers and also sell tickets usually register cash fares on one dial and all tickets on another dial. Among the larger city systems which register transfers may be mentioned the Indianapolis Traction & Terminal Company, Detroit United Railways, Twin City Rapid Transit Company and the United Railways of St. Louis. The Brooklyn Rapid Transit Company registers transfers, while its neighbor, the New York City Railway Company, does not.



# STANDARDS OF TRACK CONSTRUCTION

In the effort to design a satisfactory and durable track construction for paved streets a large number of methods have been tried. The illustrations on the following pages and the accompanying brief descriptions of methods and materials used summarize the standard practice in a number of cities visited. While T-rail is being used in increasing quantities, especially for tracks over which interurban cars are operated, a number of large city systems are laying heavy girder rail. A recent section has a groove deep enough to accommodate an M. C. B. wheel flange. A number of designs of both types are shown.

## INDIANAPOLIS

Two types of construction used in Indianapolis, Ind., are

structure. The rails are 91-lb. Lorain Steel Company's section No. 375, and are laid on the ties with special brace tie plates. Between each pair of ties two of these tie plates are attached to the flange of the rail, and 3/4-in. anchor bolts 10 in. long are placed in the three spike holes with washers. These bolts are bedded in the continuous supporting beam and hold the rail down firmly on the concrete. No tie rods are used. The brick paving is laid on a 3-in. sand cushion. A flange groove is formed by dropping the brick next to the inside of the rail, 1 1/4 in. and placing next to it a beveled stretcher brick. This construction requires 528 ties and 1036 cubic yards of concrete per mile of single track.

The construction shown in Fig. 1 spaces the ties every

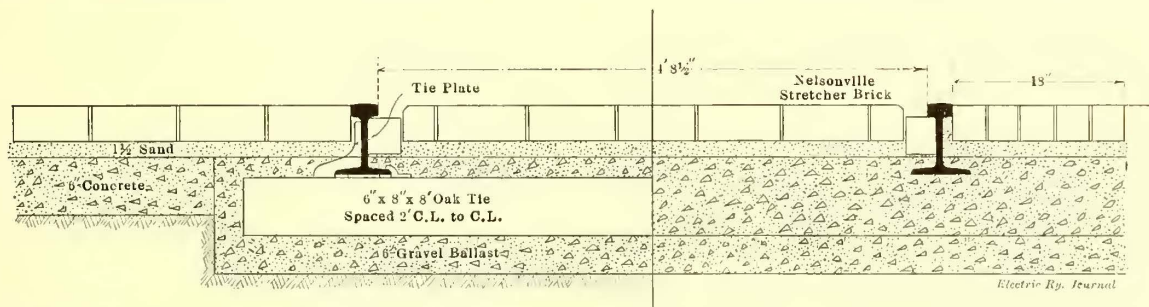


Fig. 1—Indianapolis Traction & Terminal Company—Standard Construction on Gravel Ballast in Brick Pavement

shown in Figs. 1 and 2. The concrete beam construction shown in Fig. 2 is employed on Illinois Street, from Ohio to Washington Streets. The 6-in. x 8-in. x 8-ft. white oak ties are spaced every 10 ft., and a continuous beam of con-

crete 10 in. deep is carried under each rail. The ties are also bedded in lateral beams of concrete 16 in. deep and 24 in. wide, and a slab of concrete 6 in. thick is carried across between the longitudinal beams, the whole forming a monolithic

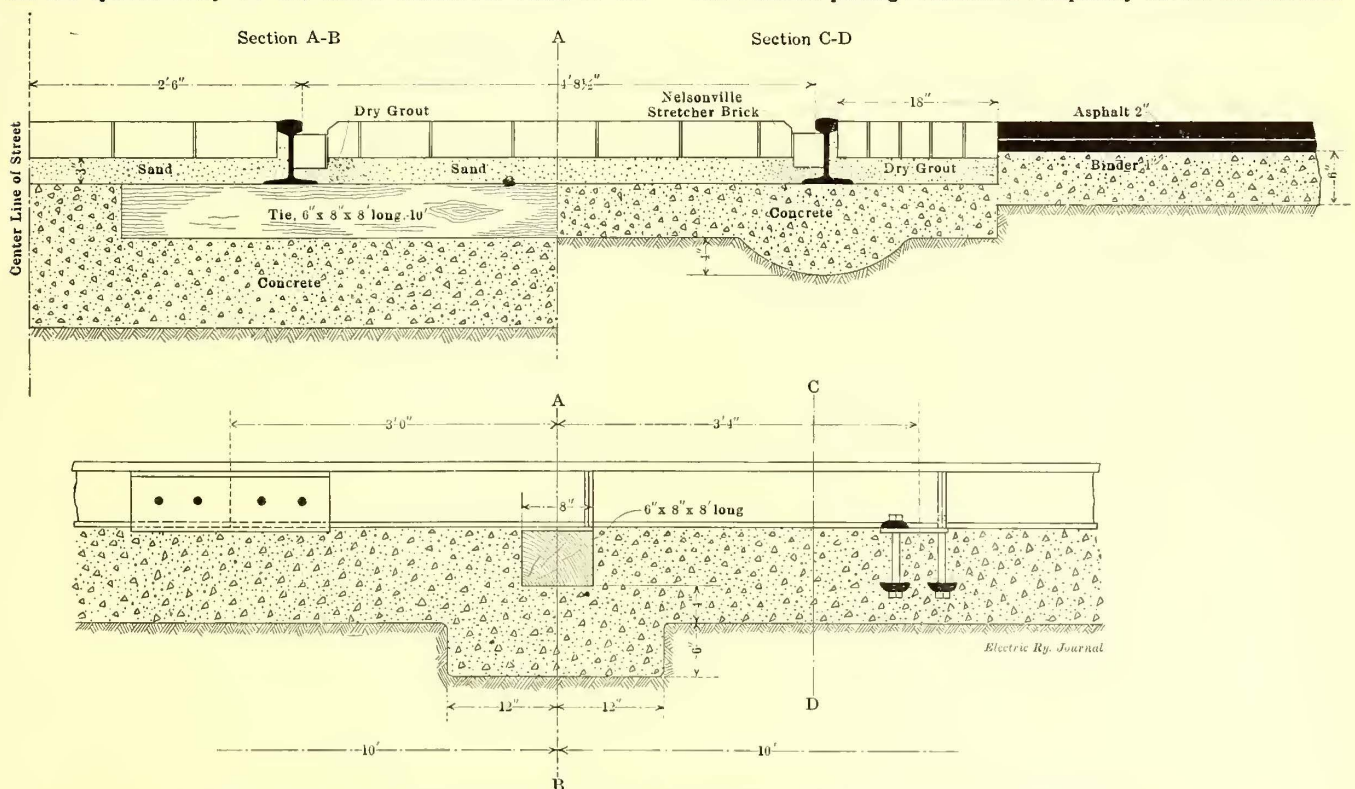


Fig. 2—Indianapolis Traction & Terminal Company—Concrete Beam Construction

crete 10 in. deep is carried under each rail. The ties are also bedded in lateral beams of concrete 16 in. deep and 24 in. wide, and a slab of concrete 6 in. thick is carried across between the longitudinal beams, the whole forming a monolithic

the flanges of the rails, reducing the thickness of the sand cushion under the paving to 1 1/2 in. This construction requires 1336 cubic yards of concrete per mile of single track.

The Indianapolis Traction & Terminal Company uses

Continuous rail joints and hardened center special work. All rail joints are staggered on both straight and curved track. It uses the proportions of 1 cement, 3 sand and 6 gravel for concrete foundations and both hand and machine mixing.

under the ties. The main body of the concrete foundation is put in over the tops of the ties, but a space is left under the rails for grouting up after the concrete has set, in order to insure a firm and continuous bearing on the concrete. The

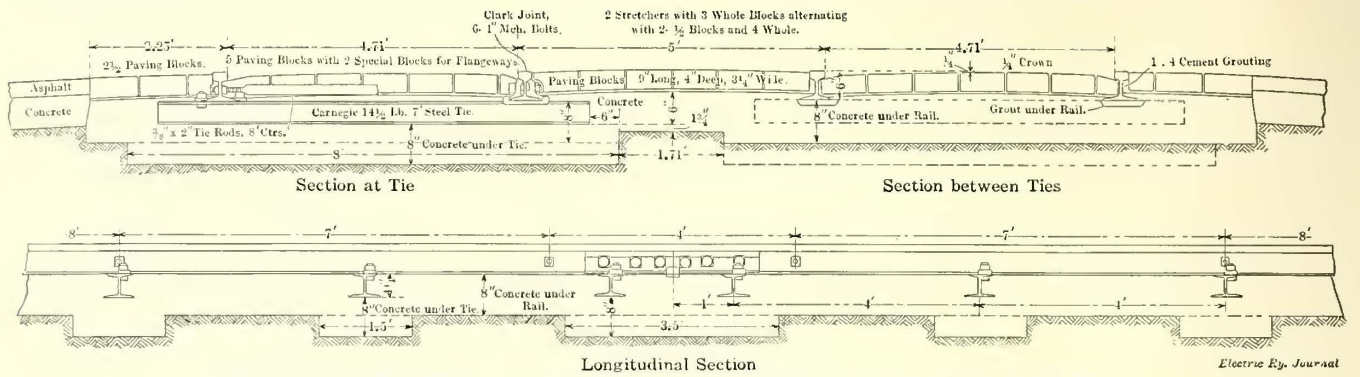


Fig. 3—Utica & Mohawk Valley—Standard T-Rail Construction with Steel Ties

UTICA, N. Y.

The Utica & Mohawk Valley for its reconstructed track in the paved streets of Utica has used two types of construction, one of which employs 9-in., 95-lb. girder rails, and the other employs 100-lb. A. S. C. E. T-rail. Both sections of

brick pavement, 4 in. thick, is laid on 1/2 in. of sand and is crowned slightly between the rails. Special flangeway bricks are used, forming a triangular groove 3 in. wide and 1 1/4 in. deep below the head of the rail. Clark rail joints are used, and in all cases are staggered except one stretch of new

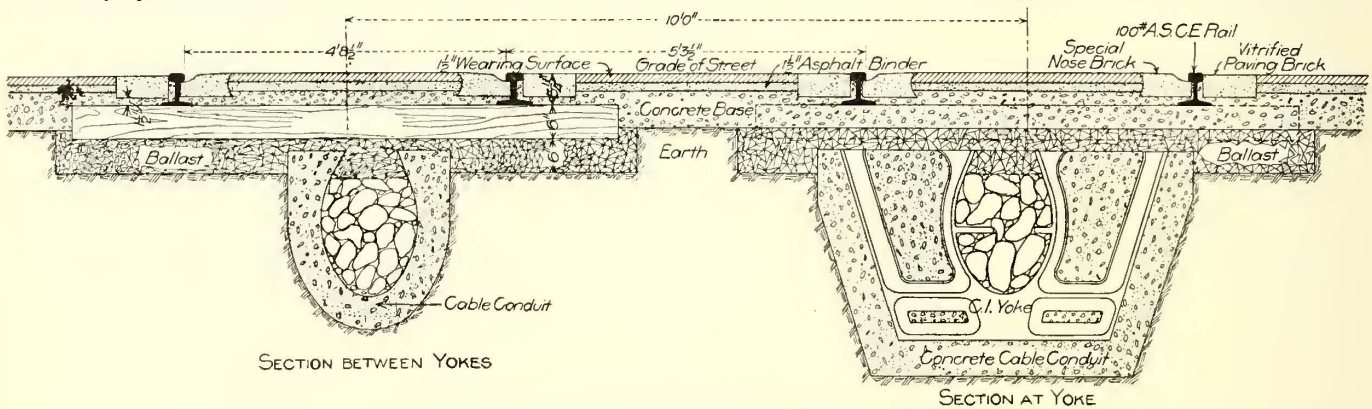


Fig. 4—Reconstructed Cable Track in Kansas City

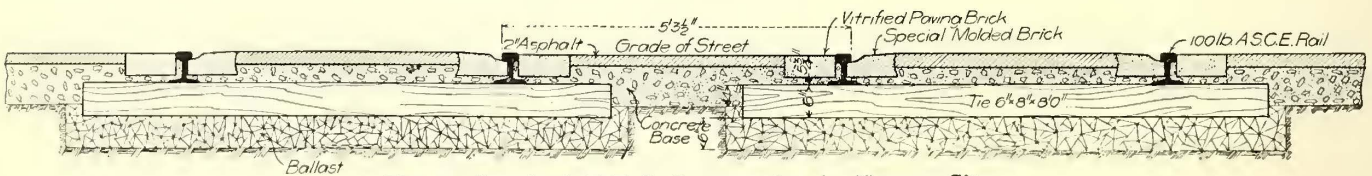


Fig. 5—Standard T-Rail Construction in Kansas City

rail are laid on Carnegie steel ties. Fig. 3 shows the latest construction, using 100-lb. T-rail. The 4 1/4-in., 14 1/2-lb. steel ties are spaced 4 ft. center to center, except at joints, where two ties are bunched to 2-ft. centers. Tie rods 2 in. x

9-in. girder rail, which has been laid with joints opposite.

KANSAS CITY

The Metropolitan Street Railway Company, of Kansas

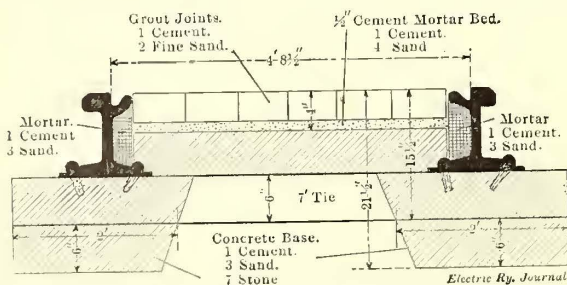


Fig. 6—Boston Elevated Railway—Concrete Beam Construction for Heavy Traffic

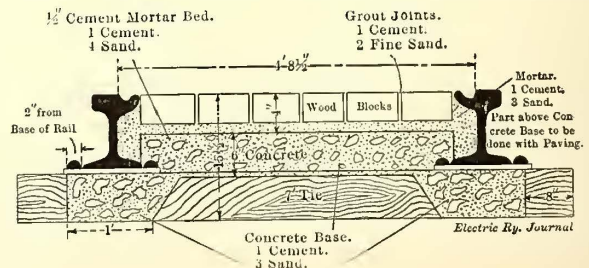


Fig. 7—Boston Elevated Railway—Concrete Beam Construction for Moderate Traffic

3/8 in. are spaced 8 ft. apart over alternate ties. In preparing the subgrade for concreting, cross trenches 18 in. wide and 4 in. deep are dug under each tie so as to give a uniform depth of 8 in. of concrete under the rails and also

City, Mo., uses 80-lb. and 100-lb. A. S. C. E. T-rail sections, the construction being shown in Figs. 4 and 5. In reconstructing old cable track the cable conduit and cast-iron yokes are leveled off 13 3/4 in. below the surface of the pavement

and the cable trough is filled with boulders and broken stone. Broken stone ballast is deposited to a depth of 8 in. in the trench and the ties are bedded in this ballast to a depth of 2 in. The rails are then laid down and fastened

bedded in 8 in. of gravel ballast, leaving 2 in. of ballast under them. The top filling is 8 in. of loam which is sodded. Tie rods 1-in. in diameter are spaced every 5 ft.

Fig. 8 shows the standard girder rail construction used

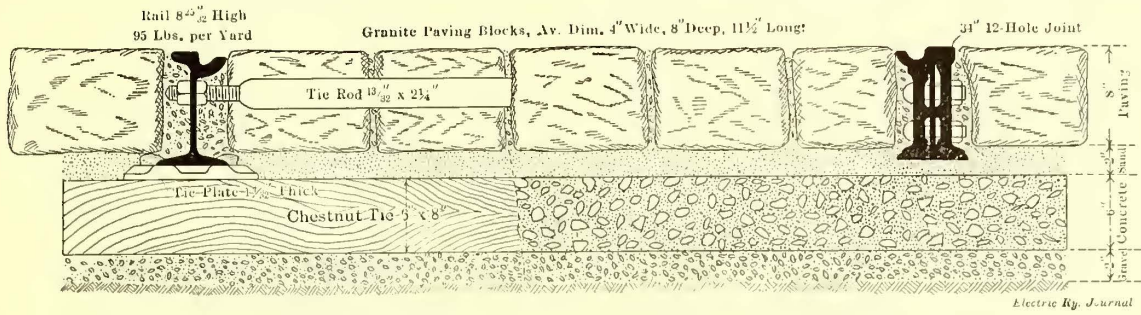


Fig. 8—Boston Elevated Railway—Gravel Ballast Construction in Paved Streets

and the track tamped to surface and aligned. Concrete is deposited on top of the ballast to a depth of 5 1/2 in., completely embedding the ties. For asphalt paving a row of paving bricks is set in this concrete bed along the outer edge

in paved streets. A 2-in. bed of gravel is placed on the sub-grade on which the 6-in. x 8-in. chestnut ties are laid, 2 ft. 6 in., center to center. The ties are embedded in 6 in. of concrete laid on top of the gravel and brought up flush with

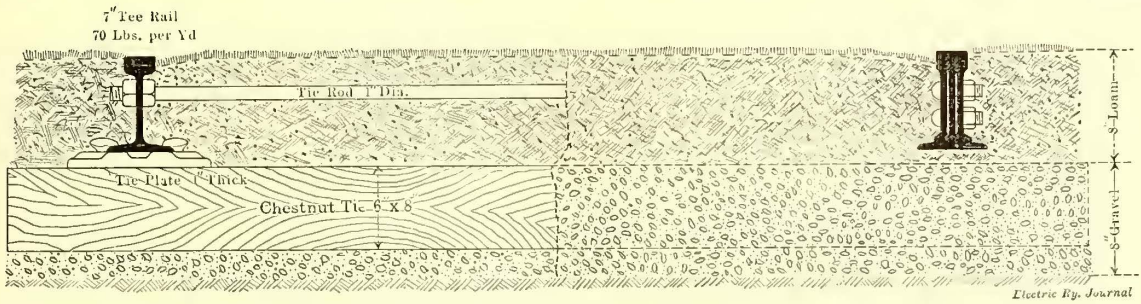


Fig. 9—Boston Elevated Railway—High T-Rail Construction in Parked Streets

of the rail head and a row of special molded nose bricks along the gage line. The paving consists of a 1 1/2-in. layer of asphalt binder and a 1 1/2-in. top layer of asphalt wearing surface. No tie rods are used in this construction. The con-

struction for new track is the same as for reconstructed cable track above the ballast. This company uses "100 per cent" rail joints staggered in all cases. The concrete used in the track foundation is hand mixed in the proportions of 1 cement, 3 1/2 sand and 6 stone. Manganese steel special work is being used in new construction.

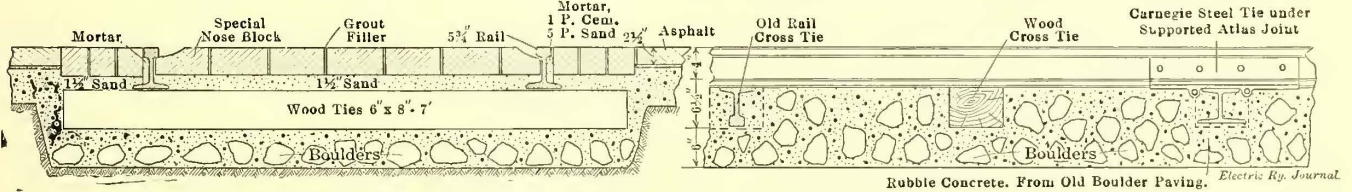


Fig. 10—Ft. Wayne & Wabash Valley—Standard Rubble Concrete Foundation Construction

struction for new track is the same as for reconstructed cable track above the ballast. This company uses "100 per cent" rail joints staggered in all cases. The concrete used in the track foundation is hand mixed in the proportions of 1 cement, 3 1/2 sand and 6 stone. Manganese steel special work is being used in new construction.

them above the top of the concrete bed which surrounds the ties. This construction permits the use of 8-in. granite paving blocks, which are laid flush with the tread of the rail.

Figs. 6 and 7 show two forms of concrete beam construction for extra heavy and moderately heavy traffic. Fig.

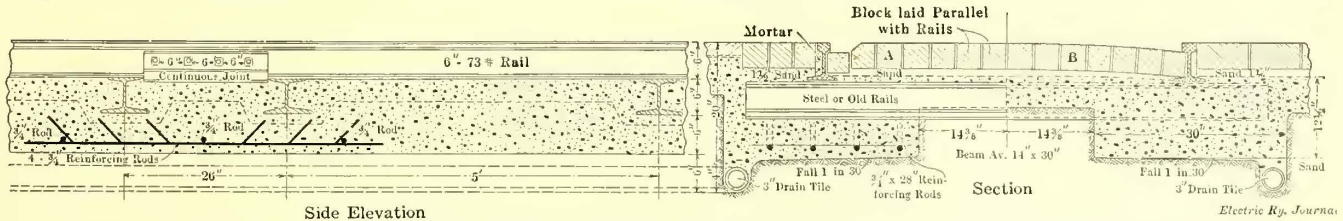


Fig. 11—Ft. Wayne & Wabash Valley—Proposed Standard Reinforced Concrete Construction with Steel Ties

BOSTON

The track construction for the surface lines of the Boston Elevated Railway Company is shown in Figs. 6-9. Fig. 9 is the standard construction in parked streets. A 7-in. 70-lb. T-rail is used, laid with 1-in. tie plates on 6-in. x 8-in. chestnut ties, spaced 2 ft. apart center to center. The ties are

6 is the construction used in Washington Street between Milk and Essex Streets. The ties are chestnut, 6 in. x 8 in. x 7 ft. spaced 2 ft. 6 in. center to center. The foundation consists of two continuous concrete beams 12 in. deep, 20 in. wide at the bottom and 28 in. wide at the top. The ties are embedded in these beams flush with the top surface.

This work is done in advance of the street paving, and the surface between the rails is leveled off and thoroughly tamped. The rails, which are 9 in. high and weigh 125 lb. per yd., are laid on 1/2-in. tie plates, and the cavity along the inner side of the web under the head is filled with a cement mortar, consisting of one part cement and three parts sand. The

with boulders, and in the reconstruction these stones were utilized in making rubble concrete for the foundation. At least 33 per cent of the whole mass is boulders. This effected a saving in the cost of the concrete of about 45 per cent. The proportions of the concrete mixture used by this company are 1 cement, 5 sand and fine gravel and 4 stone.

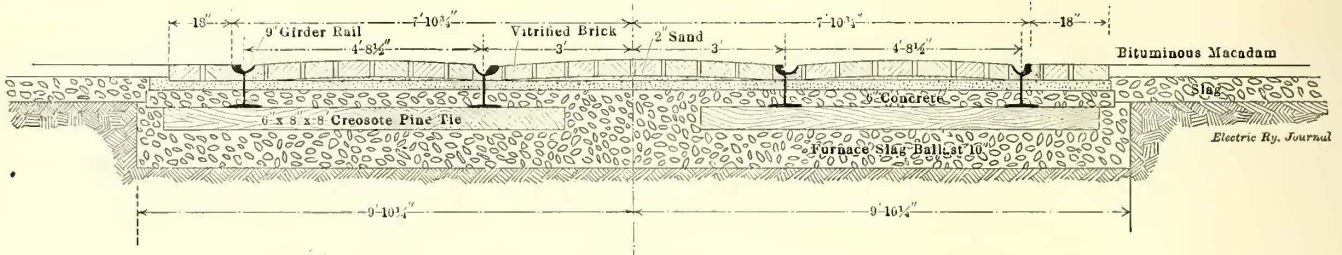


Fig. 12—Slag Ballast Construction for Paved Streets in Birmingham, Alabama

5 1/2-in. concrete paving foundation between rails is laid on top of the ties at the time the roadway foundation is put down, and is covered with a 1:4 cement mortar bed 1/2 in. thick on which the wood paving blocks are placed and grouted between joints. Fig. 7 shows a somewhat similar construc-

BIRMINGHAM, ALA.

The Birmingham Railway, Light & Power Company makes use of blast furnace slag in place of gravel or broken stone for track foundations and in concrete. In paved streets it uses a 9-in. girder rail weighing 89 lb. per yard, but in

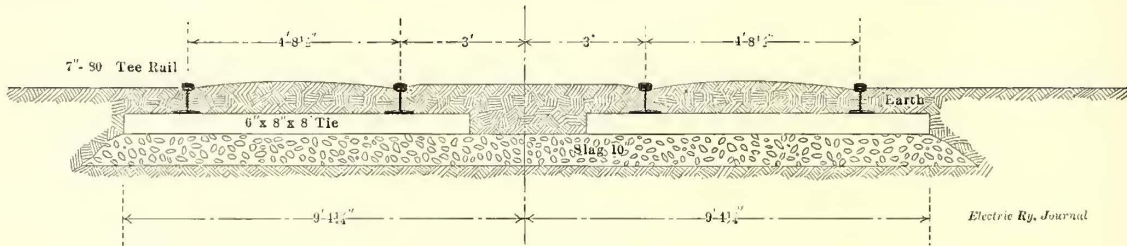


Fig. 13—Slab Ballast Construction for Unpaved Streets in Birmingham, Alabama

tion for lighter traffic using a 95-lb. grooved rail. In the second section of this issue is shown the latest standard construction in parked streets.

The Weber and Continuous types of rail joints are used in Boston, and all joints are spaced opposite except on curves of less than 1000 ft. radius. The concrete used in track

unpaved streets it uses a 7-in. 80-lb. T-rail. The foundation consists of 10 in. of broken slag under the ties. All ties are 6 in. x 8 in. x 8 ft. of loblolly or other pine treated with creosote by the vacuum process. The ties are impregnated with 10 lb. of creosote per cubic foot. Above the ties, 6 in. of concrete, mixed in the proportion of 1 cement, 2

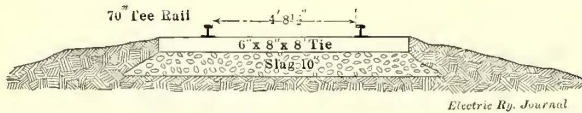


Fig. 14—Private Right of Way Construction in Birmingham, Alabama

foundations is mixed in the proportions of 1 cement, 3 sand and 7 stone.

FT. WAYNE & WABASH VALLEY

The Ft. Wayne & Wabash Valley Traction Company operates the city lines in Ft. Wayne, Logansport and Lafayette, Ind., and has to maintain track in paved streets in a

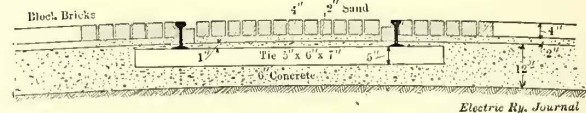


Fig. 15—Illinois Traction System—Standard T-Rail Construction in Brick Pavement

sand and 3 slag, is placed on the slag foundation, and on this the brick pavement between tracks is laid. This company uses Continuous rail joints, staggered in all cases, and for new work is putting in manganese steel special work.

NASHVILLE

The Nashville Railway & Light Company uses 70-lb.

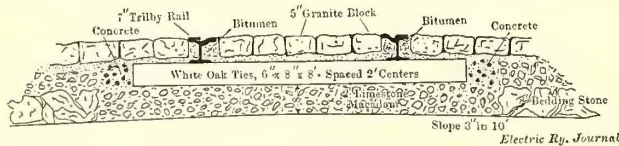


Fig. 16—Construction in Block Pavement in Nashville, Tennessee

number of other cities and towns through which its interurban lines pass. Fig. 10 shows a cross-section of track rebuilt in Ft. Wayne last year. The rail used had been in service in this track for nearly 14 years and was worn somewhat, but the rails were reversed so as to bring the gage line outside and were relaid. The space between the tracks had formerly been paved

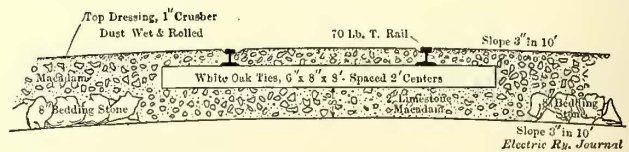


Fig. 17—T-Rail Construction in Macadam Streets in Nashville, Tennessee

A. S. C. E. T-rail for tracks laid in dirt or macadam streets. In macadam streets the layer of bedding stone used under the roadway is replaced by 8 in. of 2-in. broken limestone ballast under the ties. The pavement above the top of the ties is laid and rolled in the same manner as the surface of the roadway, leaving a groove or trough inside the rail heads. In streets



paved with stone block 80-lb., 96-lb. and 109-lb. Trilby rail is used. The same sub-base for the roadway is used in Nashville for stone block paving as for macadam, consisting of broken stone on 8-in. bedding stone. Under the tracks this bedding stone is replaced by 8 in. of broken stone ballast under the ties. On top of this a layer of concrete 6 in. thick is deposited between ties and for a distance of 8 in. beyond the ends of the ties. This concrete bed is covered with 2 in. of sand on which the paving blocks are bedded. The space under the head of the rail is filled with bitumen and the paving blocks are pitched in. Continuous rail joints are used, staggered on both straight and curved track. The concrete is mixed by hand in the proportions of 1 cement, 3 sand and 6 stone.

BUFFALO, N. Y.

The International Railway Company, in paved streets in Buffalo, uses a Lorain No. 402, 140-lb. grooved girder rail laid on Carnegie steel ties 6 ft. long and spaced 5 ft. apart. A continuous concrete beam 10 in. deep and 12 in. wide is

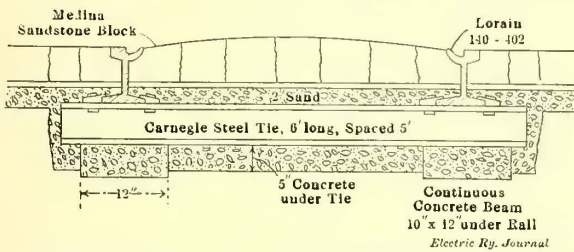


Fig. 18—Standard Construction in Paved Streets in Buffalo

built under each rail, and the ties are embedded in the center connecting slab of concrete, which is carried down 5 in. below the bottom flange. Between ties this center slab is reduced in thickness to 6 in. On top of the concrete is a 2-in. sand cushion on which the Medina sandstone paving blocks are laid. The paving is crowned between rails, and on the outside alternate header and stretcher blocks are laid into which the roadway pavement is worked. Tie rods, 2 in. x 3/8 in., are

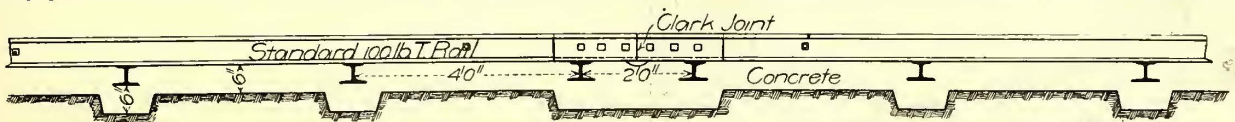


Fig. 19—T-Rail Construction with Steel Ties in Syracuse

spaced 5 ft. apart between ties and embedded in the concrete paving foundation. Both hand and machine mixed concrete in the proportions of 1 cement, 3 sand and 6 stone is used. The Clark thermit welded plate joint is used for all new track construction, the joints being staggered in all cases. All special work is manganese steel construction.

CHICAGO

The extensive track reconstruction now being carried out

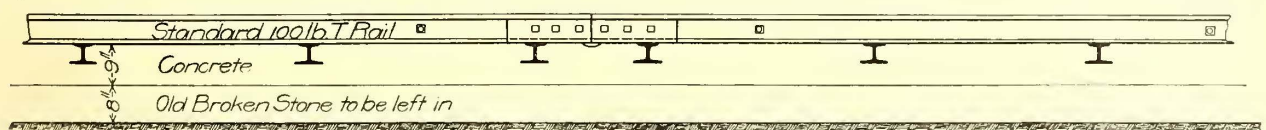


Fig. 20—T-Rail Construction with Steel Ties on Old Stone Ballast in Syracuse

in Chicago by the Chicago City Railway Company and the Chicago Railways Company under the specifications of the Board of Supervising Engineers has been fully described. The rail section used is a special design of grooved rail 8 in. high and weighing 129 lb. per yard, rolled by the Lorain Steel Company. It closely resembles the section used in Philadelphia, except for the reinforcement under the outside of the

head. Both steel and wooden ties are used. The steel ties are Carnegie 4 1/2-in. girder section spaced 5 ft. apart center to center, and the wooden ties are sawed pine, untreated, 6 in. x 8 in. x 7 ft. long spaced 4 ft. apart center to center.

Much of the reconstruction work has involved tearing out the old cable slot and conduit which was embedded in concrete. The cast-iron yokes, which formerly carried the cable sheaves, are broken off with battering rams handled by six men and the cable trough completely uncovered, although the concrete below the top surface of the trough is not disturbed. Multiple duct feeder cable conduit is laid in the old cable trough and covered over with earth which is thoroughly tamped. The ties are then distributed and the rails laid down and fastened to the ties with bolted clips for the steel ties and screw spikes for the wooden ties. The track is then brought to surface and alignment by temporarily blocking up the ties in the trench, leaving a space of about 6 in. under them. Concrete is deposited in the trench and thoroughly tamped under the ties and to a depth of 1 1/2 in. over them. The Chicago City Railway Company has used for this concreting a continuous pug mill type of mixer, mounted on a motor flat car, running on the blocked-up track ahead of the concreting. The Chicago Railways Company is mixing by hand part of

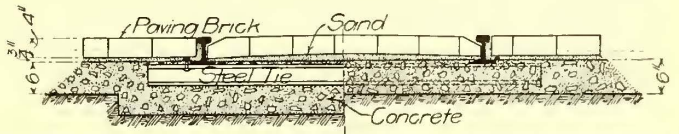


Fig. 21—Cross-Section of T-Rail Construction in Syracuse

the concrete used and is also using a motor-driven machine mixer of the batch type, mounted on a flat car, which is moved forward by a motor car. The continuous mixer of the Chicago City Railway Company is fed by a conveyor on to which the ingredients of the concrete, sand, stone and cement are shoveled by a gang of laborers. The sand and stone are distributed along the track and shoveled into a continuous pile of predetermined cross-section, after which the proper quantity of

cement is placed in a layer on top. The aggregate is shoveled continuously onto the conveyor of the mixer as the car is moved ahead. The batch mixer used by the Chicago Railways Company is charged by a skip bucket holding the exact quantity of the aggregate for one batch of 1/3 cu. yd. of concrete. The sand and stone are shoveled into wheel barrows, which are dumped into the skip bucket and raised to the charging spout of the mixer. Both of these types of machines have a capacity of between 20 and 25 cu. yd. an

hour. As the amount of concrete to be laid averages about 1650 cu. yd. per mile for each track, one of these machines can cover between 600 and 700 lin. ft. per day of 10 hr.

The stone block paving follows the concrete by about two days in order to protect the exposed rails. After the concrete has set seven days welding is begun. The track of the Chicago Railways Company is being electrically welded with a

Lorain outfit. An interval of seven days is allowed after the welding before traffic is opened on the new track. The paving is left open at the joints, which are placed opposite each other, and is not completed until after the grinding car has passed.

SYRACUSE, N. Y.

The track construction of the Syracuse Rapid Transit Railway Company resembles closely the construction used in Utica,



Fig. 22—7-in. T-Rail Construction in South Salina Street, Syracuse

with the exception that 7-in. T-rail weighing 95 lb. per yd. is being used in place of 100-lb. A. S. C. E. rail on most of the new work. A trial stretch of track on North Salina Street has been laid with the latter section, however. This piece of track has been put in with Clark joints and steel ties and is identical with the latest construction in Utica, except that the thickness of the concrete under the rails and ties has



Fig. 23—100-lb. T-Rail Construction in North Salina Street, Syracuse

been reduced from 8 in. to 6 in. The 7-in. T-rail construction put in this year is jointed partly with thermit welds and partly with Clark joints.

LOUISVILLE, KY.

The Louisville Railway Company has a 5-ft. gage and uses a Lorain No. 374, 104-lb. grooved girder rail. In reconstructing track in streets about to be paved the railway company blocks up its track to grade and surface and allows the municipal contractor to place the concrete for the track foundation. The trench is excavated to give 6 in. of concrete under the ties and the concrete is deposited to a depth sufficient

to entirely cover the tops of the ties. White oak ties, 5 1/2 in. x 8 in. x 7 ft. 6 in. and spaced 24 in. center to center, are used. Tie rods, 3/8 in. x 1 3/4 in., are put in every 10 ft. The rails are connected with Continuous rail joints. Where new track is laid in unpaved streets it is also placed on a concrete foundation extending 6 in. below the ties, after first ascertaining from the city authorities the exact street grade. This work is done by the company's own forces. All con-



Fig. 24—7-in. T-Rail Construction in South Salina Street, Syracuse

crete is mixed by hand in the proportion of 1 cement, 2 sand and 5 washed gravel. The company is using manganese steel special work.

DENVER

Concrete beam construction with 72-lb. high T-rail is used by the Denver City Tramway Company for track in

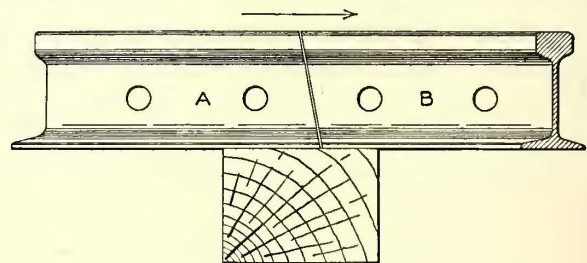


Fig. 25—Jones Beveled Rail Joint Used in Denver

paved streets. As will be seen from Fig. 26, the foundation is a 10-in. bed of gravel or broken stone on which the ties are laid. A concrete beam 5 in. thick is carried under each rail and extending beyond the ends of the ties. The ties used are

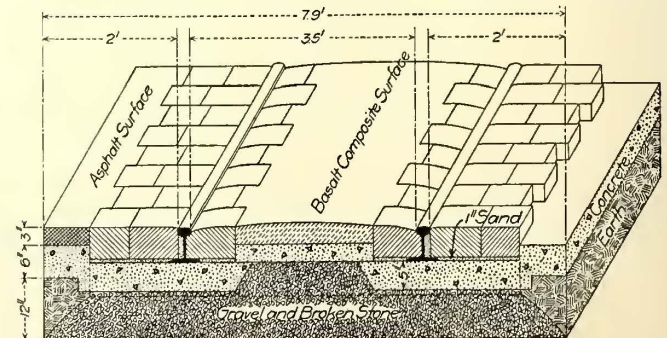


Fig. 26—Denver City Tramway Company—Standard T-Rail Construction in Paved Streets

of Texas pine treated with carbolineum. The Jones beveled rail joint is used. In this joint the plane of the bevel is at right angles to the plane of the web and forms an angle of

78 deg. with the base of the rail. The bevel is inclined toward the on-coming wheels. Two four-bolt angle bars are used with this joint. All joints are staggered. In unpaved streets this company uses 65-lb. A. S. C. E. T-rail.

MILWAUKEE, WIS.

Two forms of T-rail track and pavement construction used by The Milwaukee Electric Railway & Light Company are shown in Figs. 27 and 28. Fig. 27 shows the method of laying brick pavement, and Fig. 28 shows the surface construction for asphalt roadway and devil strip pavement with granite block between the rails of each track. The substructure and track construction are the same in both types. A trench 7 ft. 6 in. wide is excavated under each track to a depth of 6 in. below the bottom of the ties. The track is then laid and blocked up to surface in the trench and concreting begun. For this purpose a machine mixer, motor driven and mounted on a four-wheel truck, is used. The truck is fitted with a trolley and is self-propelling. The discharge spout of the mixer discharges the concrete onto a belt conveyor mounted on a long swinging arm. This arm is long enough to reach across the entire width of the roadway, so that the concrete foundation for the track and roadway pavement can be put in at one time with this machine if desired. A mixture of 1:2 1/2:5 concrete is used for track foundations.

It will be seen from the drawing that the ties are only 6 ft.

PHILADELPHIA

The Philadelphia Rapid Transit Company uses a special 137-lb. 9-in. girder rail rolled by the Lorain Steel Company for all new track construction in streets. The general design

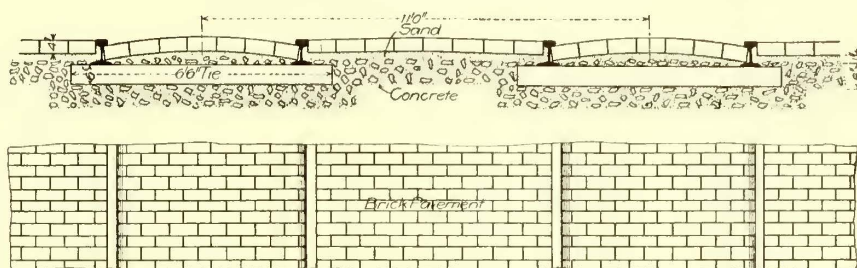


Fig. 27—T-Rail Construction for Brick Paving in Milwaukee

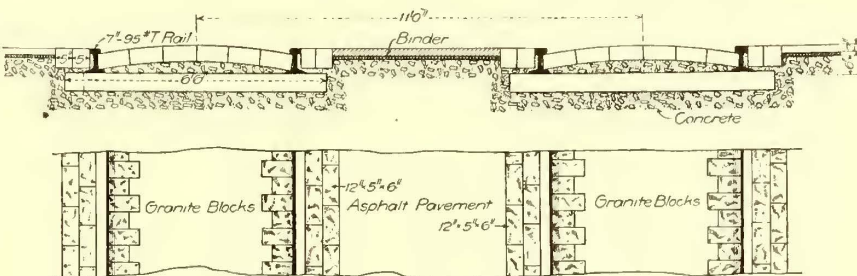


Fig. 28—T-Rail Construction for Asphalt Paving in Milwaukee

of the section is shown in the track cross-section Fig. 30. This is practically a center bearing rail with a 3-in. tread. The gage line is moved in 3/4 in. from the center of the web and the rail can withstand prolonged side wear before being weakened materially. The groove is self-cleaning, offers little obstruction to vehicle travel, and at the same time is made deep enough to allow for an extra amount of top wear on the rail head.

Two forms of construction are used for the track substructure. For tracks subjected to moderate traffic yellow pine ties, 5 in. x 9 in. x 8 ft. and spaced from 24 in. to 26 in. apart center to center, are laid on broken stone ballast. The rails are fastened to the ties by special bolted braces, as shown in Fig. 30. These braces are made of malleable iron and are fastened to the top of the ties by three 5/8-in. lag screws before the ties are laid. The vertical leg is drilled for two 7/8-in. bolts, one of the holes being tapped with standard threads. The rails are placed on the ties and adjusted to slightly wide gage. Bolts A are then passed through holes in the web of the rail and the vertical leg of the braces and by tightening on the nuts the rails are brought to exact gage. The set screws, B, are then put in the threaded holes of the braces and tightened up against the web of the rail. This holds the rail firmly in place to exact gage. The advantage claimed for this construction is that the

rails can be adjusted to exact gage when first laid, and the gage can be varied from time to time to compensate for side wear by adjusting the bolts and without disturbing the tie fastenings.

Concrete beam construction is used for tracks which carry very heavy traffic in the center of the city. Fig. 31 shows the details of this construction. The rails rest on continuous



Fig. 29—Motor-Driven Concrete Mixer with Swinging Delivery Spout Used in Milwaukee

6 in. long. They are not treated. The rail used is a 95-lb. section T section, 7 in. high, joined with cast welds which are spaced opposite to each other on straight track. In both the brick and asphalt paving constructions the surface between the rails is crowned and the paving blocks fitted in square under the head of the rail. The stretchers on the outside are put in flush with the top of the rail.

concrete beams 18 in. wide and 14 1/4 in. deep, which are joined between the rails by a slab of concrete 6 1/2 in. deep. The whole forms a monolithic substructure, which is rein-

forced at intervals of 5 ft. This attachment consists of two clips bolted down on the base of the rail with 3/4-in. bolts working in transverse slots in the top of the yoke. Two set screws bearing on these clips are used for adjusting the position of the rail laterally in bringing the track to gage. The clips hold the rail down firmly on the top surface of the concrete beams and prevent heaving. The purpose of the yokes is not to carry the rail but simply to anchor it down.

The concrete used in this construction is mixed in the proportion of 1 cement, 3 sand and 6 stone for the lower part, and 1 cement, 1 sand and 2 stone for the final tamping. Both hand and machine mixing methods are used.

All rail joints used in Philadelphia are of the Nichols-Voynow composite or zinc type, which has been described frequently in the technical press. Briefly, this joint consists of two special fish plates with 12 rivet holes, which are riveted up, and the interstices between plates and rail filled with molten zinc after preheating to a temperature of 350 deg. A high electrical conductivity and mechanical strength is claimed

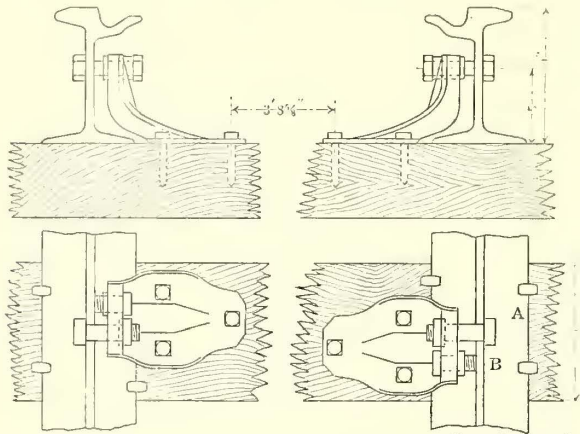


Fig. 30—Rail Brace Construction in Philadelphia

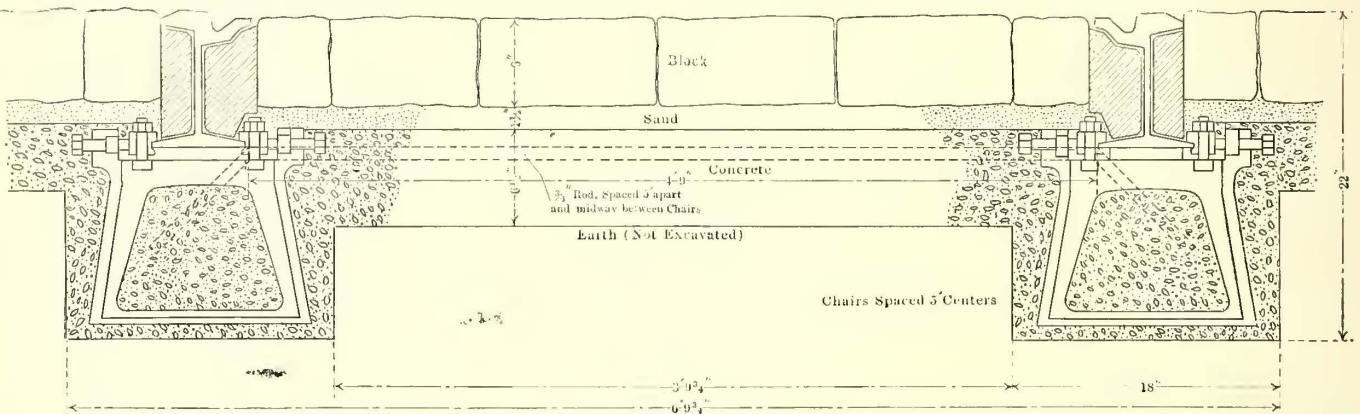


Fig. 31—Philadelphia Rapid Transit Company—Concrete Beam and Chair Construction

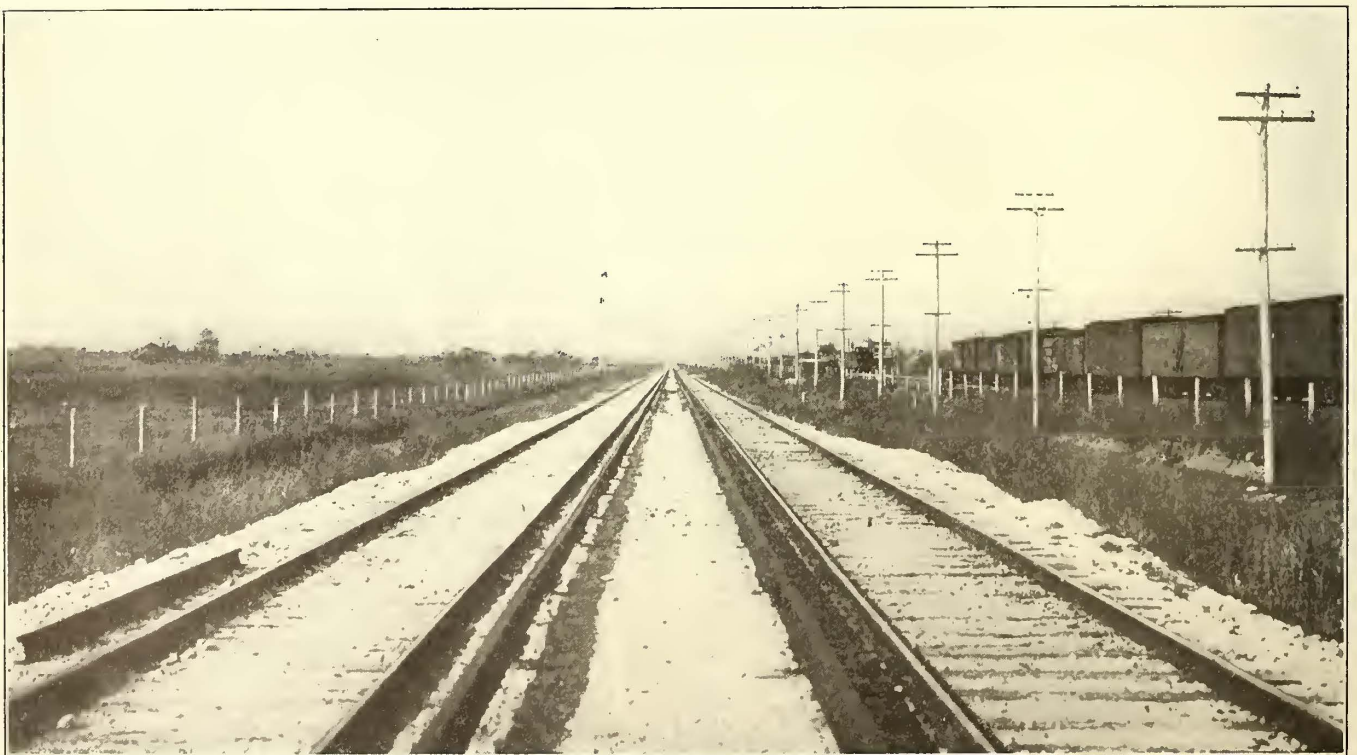


Fig. 32—Aurora, Elgin & Chicago—Double-Track Third-Rail Roadbed, with Stone Ballast

forced at intervals by cross rods embedded in the center slab and bent down in the side beams. The rails are anchored to the concrete by attachment to cast-iron yokes embedded in

for this joint. All joints in both straight and curved track are staggered.

Both manganese steel and chrome steel special work is

used, and some manganese rails have been laid on curves subjected to heavy traffic, notably at the Camden Ferry terminal.

MINNEAPOLIS, MINN.

The Twin City Rapid Transit Company uses a 7-in. 91-lb.

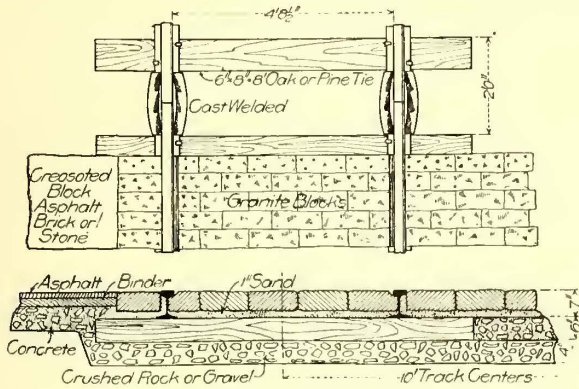


Fig. 33—Twin City Rapid Transit Company—Standard T-Rail Construction

T-rail section on all new construction in paved streets and a 5-in. 80-lb. A. S. C. E. section in unpaved streets and private right of way. The joints in the 7-in. rail are cast welded,

of broken stone or gravel tamped under the ties. On top of this 6 in. of 1: 2: 4 1/2 concrete, hand mixed, is deposited flush with the top surface of the ties. The 6-in. granite blocks with which the space between tracks is paved are then laid on a sand cushion 1 in. thick on top of the ties and concrete. The

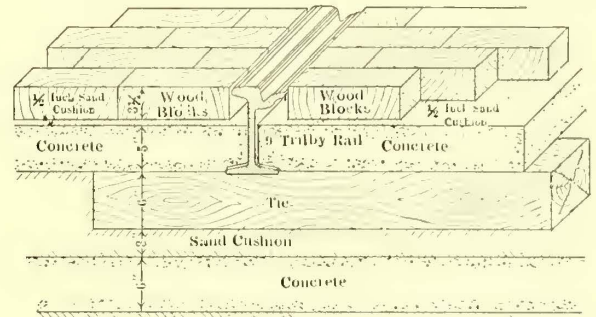


Fig. 34—Standard Track Construction in Springfield, Mass.

blocks on the inside of the rail heads are chipped out to fit under the rail and form a flange-way. This company spaces rail joints opposite each other on straight track and staggers them on curves. With the exception of a small amount of built-up special work made at the company's shops all special work used is solid manganese steel.

TABLE I—STANDARDS OF TRACK CONSTRUCTION IN PAVED STREETS

NAME OF ROAD	RAIL		TIES			RAIL JOINTS		CONCRETE	
	Weight, Lbs.	Type	Size	Material	Spacing	Make	Spaced	Mixture	Method of Mixing
Birmingham Ry., Lt. & Pwr. Co.	89	Grooved	6" x 8" x 8'	Pine, Creosoted	24"	Continuous	Staggered	1 2 3	Hand
Boston Elevated Ry. Co.	125	Grooved	6" x 8" x 7'	Chestnut	30"	Continuous	Opposite	1 3 7	Hand
Chicago Railways Co.	127	Grooved	6" x 8" x 8'	Oak	48"	Elec. Weld	Opposite	1 3 6	Machine
Detroit United Railway	91	Tee	6" x 10" x 7'	Oak	30"	Angle Bar	Staggered	1 3 6	Machine
Ft. Wayne & Wabash Valley	72	Tee	6" x 8" x 8'	Oak	24"	Continuous	Staggered	1 5 5	Hand
Illinois Traction System	70	Tee	5" x 7" x 7'	Oak	36"	Angle Bar	Opposite	1 3 7	Hand
Indianapolis Traction & Ter. Co.	91	Tee	6" x 8" x 8'	Oak	24"	Continuous	Staggered	1 3 6	Machine
International Ry. Co. (Buffalo)	140	Grooved	4 1/2"	Steel	60"	Clark	Staggered	1 3 6	Machine
Louisville Ry. Co.	104	Grooved	5 1/2" x 8" x 7' 6"	Oak	24"	Continuous	Staggered	1 2 5	Hand
Metropolitan St. Ry. (Kansas City)	100	Tee	6" x 8" x 8'	Oak	24"	100%	Staggered	1 3 1/2	Hand
The Milwaukee Elec. Ry. & Lt. Co.	95	Tee	6" x 8" x 8'	Cedar	24"	Cast Welded	Opposite	1 2 1/2	Machine
Nashville Ry. & Lt. Co.	109	Trilby	6" x 8" x 8'	Oak	24"	Continuous	Staggered	1 3 6	Hand
Pacific Electric Railway	72	Girder	6" x 8" x 7'	Redwood	24"	Thermit	Opposite		
Portland (Me.) R. Co.	90	Girder	6" x 8" x 8'	Cedar	24"	Weber	Opposite		
Syracuse Rapid Transit Ry.	100	Tee	4 1/2"	Steel	48"	Clark	Staggered	1 3 5	Hand
Twin City Rp. Tr. Co. (Minneapolis)	91	Tee	6" x 8" x 8'	Creosoted Pine	24"	Cast Weld	Opposite	1 2 4 1/2	Hand
Utica & Mohawk Valley	100	Tee	4 1/2"	Steel	48"	Clark	Staggered	1 3 6	Hand

TABLE II—STANDARDS OF TRACK CONSTRUCTION ON PRIVATE RIGHT-OF-WAY

NAME OF ROAD	Weight of Rail	Kind of Ballast	Size	TIES		JOINTS	
				Material	Spacing	Type	Spacing
Birmingham Railway, Light & Power Co	70	Slag	6" x 8" x 8'	Creosoted Pine	24"	Continuous	Staggered
Boston & Worcester	75	Gravel	6" x 8" x 8'	Chestnut	22"	Weber	Staggered
Fort Wayne & Wabash Valley	70	Gravel	6" x 8" x 8'	Oak	24"	Continuous	Staggered
Illinois Traction System	70	Gravel and Chats.	6" x 8" x 8'	Oak	24"	Continuous	Staggered
International Railway Co.	85	Stone	6" x 8" x 8'	Oak	24"	Angle Bars	Staggered
Lake Shore Electric	70	Gravel	6" x 8" x 8'	Oak	24"	Continuous	Staggered
Lackawanna & Wyoming Valley	90	Stone	6" x 8" x 8'	Pine	24"	Angle Bars	Staggered
Louisville Railway Co.	70	Stone	6" x 8" x 8'	Oak	24"	Continuous	Staggered
The Milwaukee Electric Railway & Light Co.	80	Gravel	6" x 8" x 8'	Cedar	24"	Weber	Staggered
Northern Electric Co.	60	Stone	6" x 8" x 8'	Pine	24"	Angle Bars	Staggered
Springfield Street Railway Co.	80	Gravel	6" x 8" x 8'	Chestnut	24"	Weber	Staggered
Twin City Rapid Transit Co.	80	Gravel	6" x 8" x 8'	Pine	24"	Continuous	Opposite

but in the 80-lb. A. S. C. E. rail, Continuous, Wolhaupter and Weber joints have all been used. Sawed white pine and sawed or hewn white oak ties, 6 in. x 8 in. x 8 ft. and spaced 2 ft. center to center, are standard for both classes of track. About 35,000 of the ties recently laid have been creosoted. In paved streets the foundation consists of from 4 in. to 6 in.

DETROIT

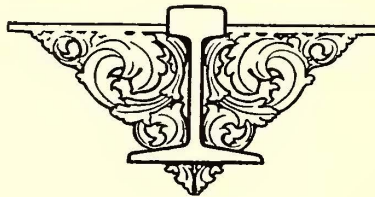
The latest standard track construction of the Detroit United Railway, which will be used for all new work in Detroit, employs a Lorain No. 375, 7-in., 91-lb. T-rail. The substructure consists of a bed of concrete 8 in. deep and 7 ft. 6 in. wide which is deposited in the excavated trench. The

concrete is mixed in the proportion of five sacks or 1 1/4 barrels of Portland cement, 1/2 cubic yard of sand and 1 cubic yard of stone. A motor-driven machine mixer mounted on a flat car is used, and each batch is deposited in dump buckets handled by a crane car, both cars running on the adjoining track. The concrete is mixed wet and thoroughly tamped. After the lower bed of concrete has been allowed to set for 6 to 10 days, a layer of clean, sharp sand 1 in. thick is deposited, and on this the 6-in. x 10-in. x 7-ft. oak ties are laid to 24-in. centers. The rails are then laid, spiked and surfaced by tamping the sand under the ties, after which concrete is deposited to a depth 2 in. above the top of the

ties, completely embedding them and the sand cushion under them. The paving brick used between and outside the rails is laid on a 1-in. sand cushion. A granite nose block is preferred for forming the groove inside the rail.

#### INTERURBAN TRACK

The construction of interurban track does not present so many opportunities for modifications. Steam road standards have in general been closely followed. The principal features of the design of some of the interurban roads visited are given in Table II. Table I summarizes the practice of city companies and includes data from a number of lines whose construction has not been described in detail.



# OVERHEAD LINE CONSTRUCTION AND MAINTENANCE

**E**XPERIENCE has taught electric railways that the overhead line cannot be made too strong and substantial and that its proper maintenance is essential to the uninterrupted operation of cars. The standards of construction for both city and interurban lines have tended toward heavier trolley wire and more substantial fittings, with the aim of reducing failures and prolonging the life of the overhead structure. The general increase in speed on interurban roads has developed the many weaknesses of the older forms of construction. High speed is just as destructive on the overhead system as on the track, and the aim in designing recent overhead constructions for high speed lines has been to secure as nearly as possible perfect alignment of the trolley wire, and at the same time to provide some degree of elasticity or yielding to absorb the unavoidable blows of the trolley wheel or contact bar due to oscillation of the car or irregularities in the track. The catenary form of construction is now being used for direct current systems as well as alternating current systems to which it was originally applied.

In cities, the old type of center pole bracket construction is being generally discarded in favor of span-wire construction, which is less unsightly and less expensive to maintain on account of its greater flexibility. The use of 0000 trolley wire for city lines is now quite general, although 00 wire remains the standard on a large number of roads. Among the features of overhead construction and maintenance for city lines, which were investigated especially for this issue, were the size and section of trolley wire, size of span wire, spacing of poles, preservative treatment for poles, location of lightning arresters, use of span-wire and bracket construction

tenance methods are particularly interesting. It uses 00 round trolley wire and 5/16-in. 7-strand galvanized span wire on the 417 miles of track over which this construction is used. Little trouble is experienced from lightning on the trolley wires, and lightning arresters are put in only at junctions of underground and overhead feeders and at the power station terminals.



Boston Elevated Railway—Center Pole Bracket Construction on Commonwealth Avenue

The overhead maintenance force is under the direct charge of the superintendent and assistant superintendent of wires and conduits. The regular maintenance and repair work is divided among a day force working on overhead feeders and underground conduits, a day force working on pole line and trolley repairs and a night force working on trolley repairs only. Each of these forces is directed by a foreman, who has from four to five sub-foremen under him. The day foreman of feeder and conduit repairs has five crews under him, the day foreman of pole line and trolley repairs has two pole line repair crews and two trolley repair crews under him, and the night foreman of trolley maintenance is in charge of four tower wagon crews. This combined night and day force maintains 18,894 poles, 214 miles of underground feed cables, 147 miles of underground return cable, 549 miles of overhead feeders, 92 miles of overhead return cables and 442 miles of trolley wire.

The accompanying illustrations show two of the overhead work cars used by this company. One of these cars is used for stringing trolley wire. A rack on which a reel of wire can be carried is mounted in the center of the car floor under the tower. The wire is run over a large sheave on one end of the roof and back over another sheave mounted on a boom attached to the tower. When the car is pushed by a motor car behind the wire is reeled out. The other car is a platform trail car with a fixed platform mounted on the roof. A cluster of incandescent lamps with a reflector is fixed on the roof to throw light upward on the wires which are being repaired. Two views are also shown of ornamental bracket construction at Dudley Street Terminal and on Commonwealth Avenue, which is a parked street.

The emergency crews of this company comprise 32 men stationed at seven points as follows: Portland Street, Camden Street, Bartlett Street, Dorchester Avenue, Sullivan Square,



Boston Elevated Railway—Ornamental Bracket Pole Construction at Dudley Street Terminal

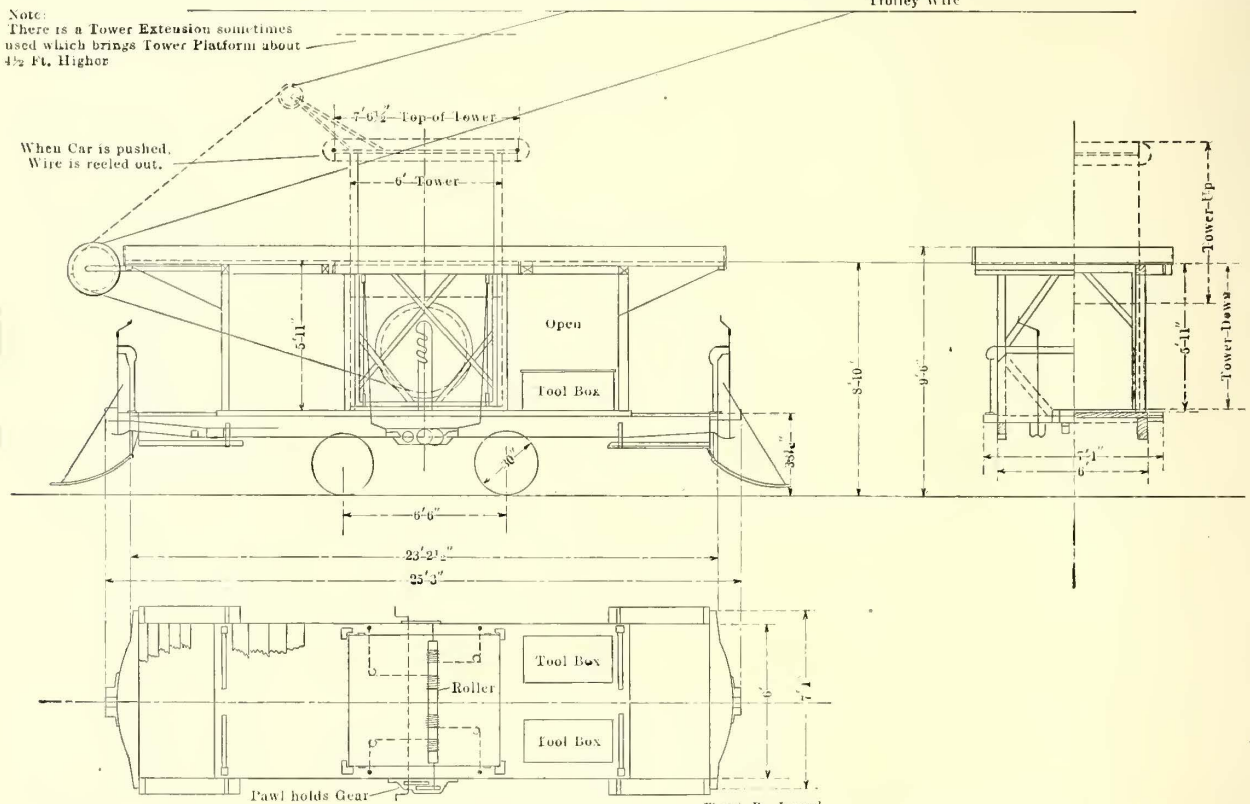
and the organization and equipment of the overhead maintenance force. The following paragraphs summarize the practice of a number of city systems in these respects:

## BOSTON, MASS.

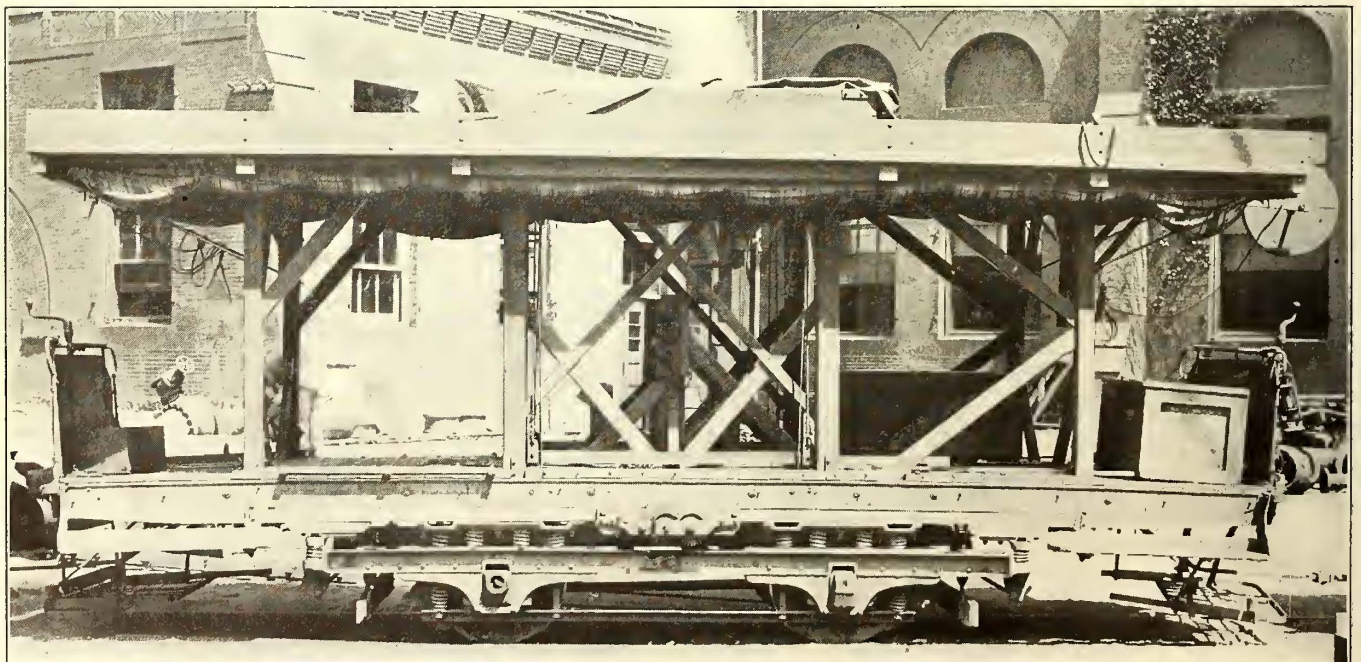
The surface lines of the Boston Elevated Railway Company comprise a total of 442 miles of track and its main-

Harvard Square and Washington Street, Brighton. Each station cares for about 65 miles of line. Crews are on duty at only four of these stations at night, one crew being off duty and two crews working each night on regular maintenance under the direction of the night foreman of trolley repairs. The crews rotate on regular maintenance work. Each crew

The work of the emergency crews is systematically organized. The company's lines are divided into seven districts, and the district of each emergency station is shown on a special map hung in the station. Each crew is in charge of a head lineman who apportions the regular work among the other men, makes daily reports of all calls answered and signs all requi-



Boston Elevated Railway—Line Construction Car for Stringing Trolley Wire



Boston Elevated Railway—Line Construction Car for Stringing Trolley Wire

works two nights a week, is on watch four nights and off duty one night. The emergency stations are equipped with a line wagon, which carries a light extension ladder, and a wreck wagon together with four horses. The horses are not kept in harness, but a quick-hitch type of harness is used, as shown in the illustration herewith.

sitions for material and supplies. The superintendent of the division in which the station is located has general supervision over the conduct of the men and the condition of the equipment. The day crew is on duty from 7 a. m. to 6:30 p. m. and the night shift for the remaining portion of the 24 hours. The stations are equipped with fire department instruments,



which show the location of every fire alarm turned in in any part of the city, and a schedule has been prepared showing the fire alarm boxes which, when rung, must be responded to by each station.

The emergency crews are called on for repairs to overhead lines, relief of broken down or obstructed cars, and to answer fire alarms when the fire is in a district which might interfere with the regular operation of the company's cars. Strict discipline is enforced among the members of the crews, who are required to respond promptly to calls for assistance. They are not allowed to leave the station and must always wear the prescribed uniform while on duty. This consists of a single-breasted corduroy coat, vest, trousers and cap. The coat buttons are of gilt of the company's standard design. Service stripes of scarlet cloth for each five years of service are worn on each coat sleeve and a line department employee's badge is worn on the cap.

Three of the seven crews are specially assigned to trouble in the Subway. Any crew responding to a call in another crew's district is required to notify the crew into whose district they go before proceeding. In the event of a general alarm of fire, the crews which may be called on to respond are required to hold themselves in readiness to start at once if a telephone message comes from the men on the ground stating that their presence is needed at the fire. On a general or second fire alarm the outside crews summoned must execute the orders of the head lineman of the district in which the fire occurs. If a fire alarm call is given in a district in which the crew is out on some other call, the division superintendent's office notifies the nearest available crew which responds at once. The crew missing the call, on returning to headquarters holds itself in readiness to answer the calls of the crew which has responded to its call. The head lineman in charge of a crew responding to a fire alarm upon his arrival notifies the

station and emergency station. These diagrams show the numbers of all feeders, with poles, street and switch numbers, the sizes of trolley wires and cables, location of section insulators, section switches and conduits. The location of all pole switches is expressed as a fraction, of which the numerator is the street number and the denominator the pole number. By

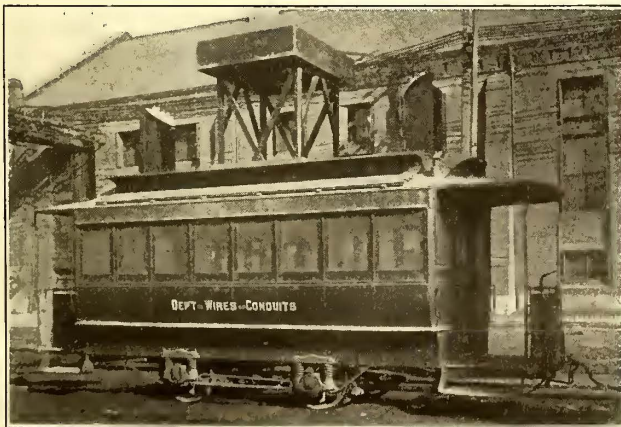


Boston Elevated Railway—Emergency Station

referring to these diagrams the superintendent of power distribution can order any changes made in the switches which may be necessary to meet the power requirements. The work of changing over is usually done by the emergency crews.

LOS ANGELES, CAL.

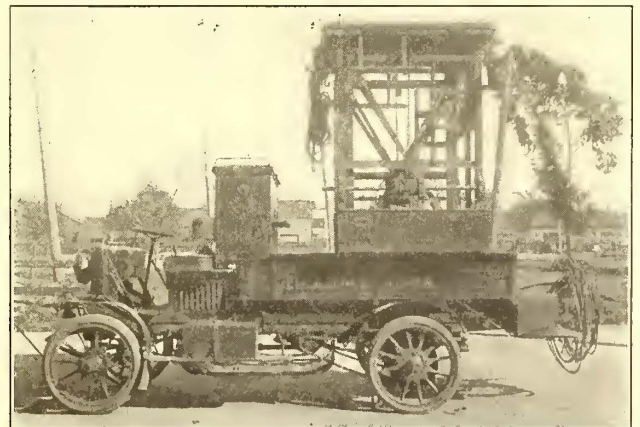
The Pacific Electric Company, of Los Angeles, operates 100 miles of city street car lines in Los Angeles and about 400 miles of interurban lines. The city lines are largely bracket construction and are strung with 0000 figure 8 trolley wire.



Boston Elevated Railway—Tower Line Car

Fire Marshal of his presence and the point where his crew is stationed. The care and protection of the company's property is his first consideration, but he is required to assist the Fire Marshal in any way possible.

The entire feeder system of the company is divided into sections which are drawn as diagrams and hung in each power



Pacific Electric Railway—Auto Emergency Wagon

Where span wire construction is used, 3/8 in. and 5/16-in. cable is used. The butts of all wooden poles are impregnated with crude oil as a preservative. Poles are spaced 115 ft. apart. This company reports that it uses no lightning arresters.

The maintenance of city overhead lines requires a force

of 12 men and a foreman. Two tower wagons, a tower car and a gasoline auto tower wagon are used. Emergency calls are answered by the tower car or the auto car, which is an

and 5/16-in. 7-strand span wire. The pole spacing is 100 ft. and the spacing of lightning arresters 1000 ft. The maintenance department is divided into regular maintenance crews and emergency crews and a pole gang, which are under separate foremen. The regular maintenance foreman has two crews consisting of two linemen, one helper and a driver, and the pole gang consists of the foreman and five helpers. The emergency foreman is in charge of seven emergency stations in winter and eight in summer. The crews in these stations consist of two linemen, two helpers and two drivers, divided into day and night shifts on duty 12 hours each. The eight stations care for approximately 75 miles of line each,



Philadelphia Rapid Transit Company—Extension Tower Wagon

Oldsmobile 30-hp commercial truck, rebuilt and strengthened. It is shown in the accompanying illustration. At the rear of the driver's seat is a large tool box, with a second seat on top of it. In this box are kept all the tools necessary for making ordinary emergency repairs. A material box is mounted on each side of the tower and a fourth box, under the rear of the car, is used for storing rope and tackle. This

7

What feeds 20th Street, Bainbridge to Catharine Street?

\_\_\_\_\_

\_\_\_\_\_

32

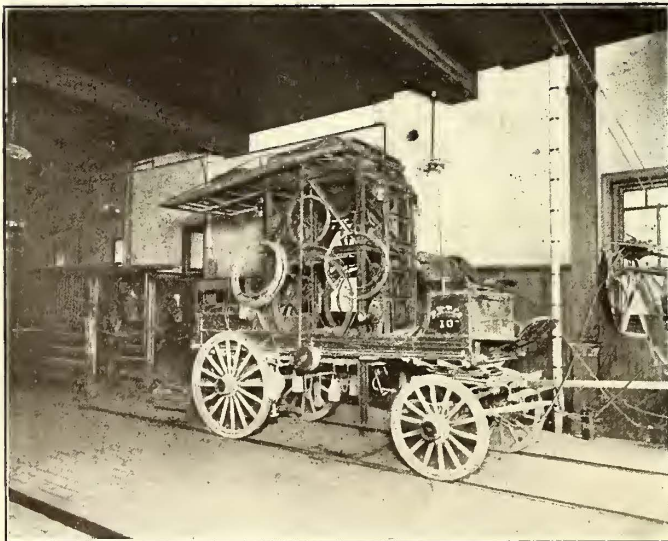
What Cables join on Pulaski Ave, North of Erie Ave.?

\_\_\_\_\_

\_\_\_\_\_

Philadelphia Rapid Transit Company—Sample Pages from Lineman's Examination Book

although when necessary the crews answer calls outside of their own districts. The equipment of the stations consists of one two-horse telescopic tower wagon and four horses. In addition, three of the stations are equipped with telescopic tower cars for heavy work. The accompanying illustrations



Philadelphia Rapid Transit Company—Emergency Station auto car has performed the service of two horse-drawn tower wagons.

PHILADELPHIA

Span wire construction is the standard of the Philadelphia Rapid Transit Company, which uses 0000 grooved trolley



Emergency Station in Nashville, Tenn.

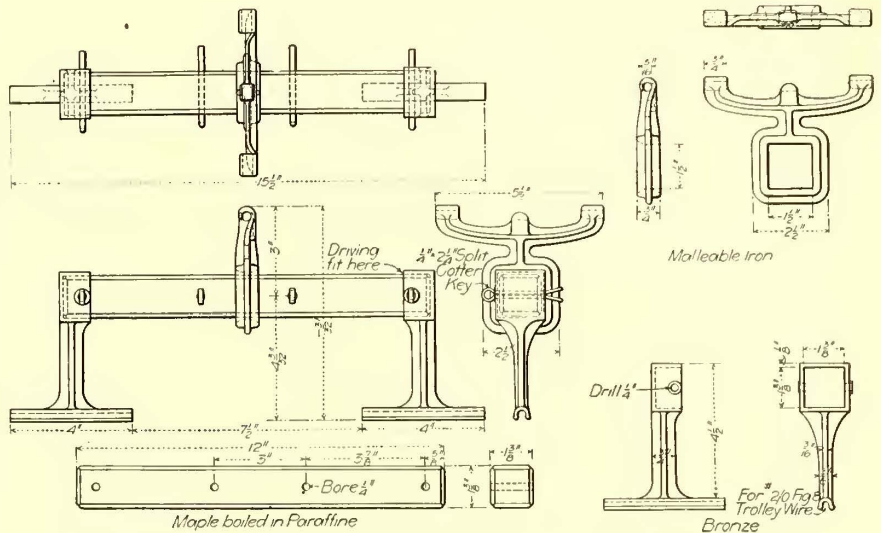
show the interior of one of the emergency stations and one of the tower wagons in use.

The tower wagon horses are not kept harnessed, but quick-hitch harness is used and fast time is made in leaving the house after a call is sent in. Great rivalry exists between the

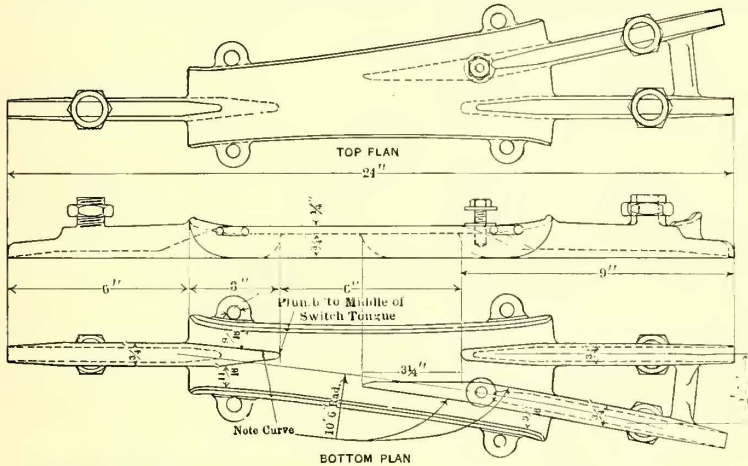
16 crews of the eight stations in establishing records for quick work in this respect, and the company encourages this rivalry by holding periodic competitions and offering two prizes of \$10 and \$5 to the crews making the best time in leaving the house after receiving a call. The best record is 55 3/5 seconds. During the past year the eight stations answered an average of 1048 emergency calls of all kinds per month.

The company requires all members of the emergency crews to have an accurate knowledge of all feeder and return-circuit cables on the system, and to aid them in this a book has been prepared showing the feeder layouts, with all junctions, switches and the 22 distribution points on the system. Once every six months the crews are subjected to a written examination. For this purpose a small book containing 50 pages with one question and space for the answer printed on each page is used. Two sample pages, somewhat reduced, are reproduced herewith. The men are required to answer these 50 questions in one hour. A prize

and St. Paul, uses span wire construction on all of its 354 miles of city and suburban lines. The trolley wire is 00 figure 8 and the span wire is 3-strand No. 11. Poles are



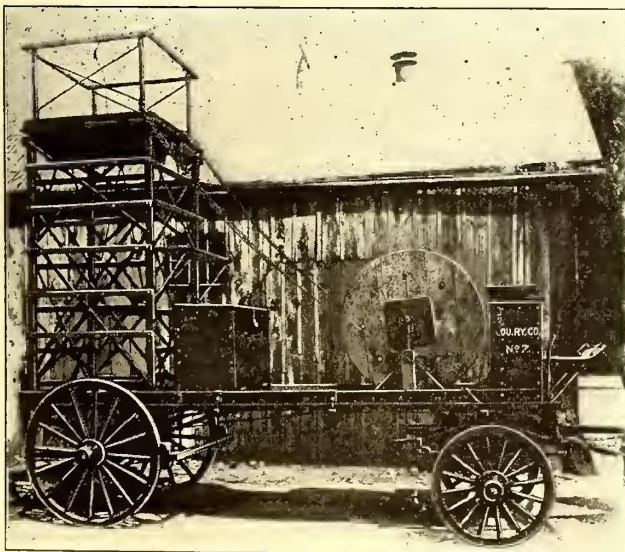
Twin City Rapid Transit Company—Standard Trolley Hanger



Twin City Rapid Transit Company—Standard Trolley Frog

spaced from 100 to 110 ft. apart, and the butts are treated with creosote for 3 ft. of their length at the ground line. Lightning arresters are put in only at junctions with underground feeder cables.

The trolley wire on the Twin City lines is supported by hangers of a simple design, which are shown in the accompanying illustration. The insulation comprises a piece of maple 12 in. long and square in section. Before mounting, this wood is thoroughly boiled in paraffin. On the piece of wood are mounted two bronze hanger castings and a malleable-iron sister hook. The hanger castings are designed for a driving fit over the ends of the maple insulating stick. When so placed the castings are secured by split cotter pins. The sister hook, which slips over the wooden piece, is held near the middle by inserting two cotter pins, one on either side, through 1/4-in. holes in the stick.



Louisville Railway Company—Tower Line Wagon



Louisville Railway Company—Emergency Wagon

of \$10 is given to the man who correctly answers every question within the time limit.

MINNEAPOLIS, MINN.

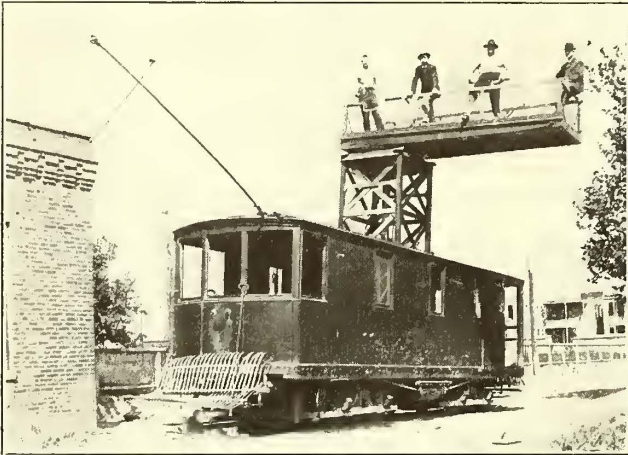
The Twin City Rapid Transit Company, of Minneapolis

As assembled, this hanger has a total depth of 7 3/32 in. and provides two ears 11 1/2 in. between centers for attaching to the trolley wire. The hanger is comparatively light, is a good insulator and may be assembled

or have the damaged parts replaced with simple hand tools.

An overhead trolley frog designed for an angle of  $12\frac{1}{2}$  deg. is also illustrated. The engineers of the Twin City Rapid Transit Company, in designing this trolley frog, have given especial attention to the arrangement of the three points under the pan. It will be noted that the point from which the turnout wire leads has been made longer than usual. This point also is so shaped that under normal conditions the trolley wheel must take the proper lead.

The maintenance of overhead lines is in charge of a line



United Railways of St. Louis—Line Car

superintendent, who has two foremen for the city lines in Minneapolis and St. Paul and two foremen for the Minnetonka and Stillwater interurban lines. The day emergency crews in Minneapolis and St. Paul are kept on regular maintenance work, but are in touch with headquarters by telephone at frequent intervals and can usually be reached promptly for emergency calls, which do not average over four or five a day. One night emergency crew, consisting of two men, responds to all calls in both cities, using a tower car. This crew remains at its station until midnight, and then, unless required for emergency service, goes out on regular maintenance work for the remaining six hours of the night.

The emergency tower wagons and cars of a number of other city systems are shown in the accompanying illustrations.

#### DETROIT, MICH.

All of the city lines of the Detroit United Railway have span construction with 00 round trolley wire and 5/16-in. 7-strand span wire. Poles are spaced 110 ft. apart. Some experiments have been made with preservative methods of treatment for the butts of poles and are being closely watched, but the poles so treated have not been in long enough to determine the value of the treatment. Lightning arresters are spaced at intervals of about one-third of a mile, but near substations the spacing is reduced to seven per mile.

The maintenance force of this company consists of 23 men under the direction of a city line foreman reporting to the superintendent of power. Three construction tower wagons are kept on regular maintenance work, and for heavy emergency work two tower line cars are used. These cars distribute line supplies and material and are called on to aid in moving disabled cars or other heavy work. The crews of these cars consist of a motorman and two linemen, one of which acts as conductor.

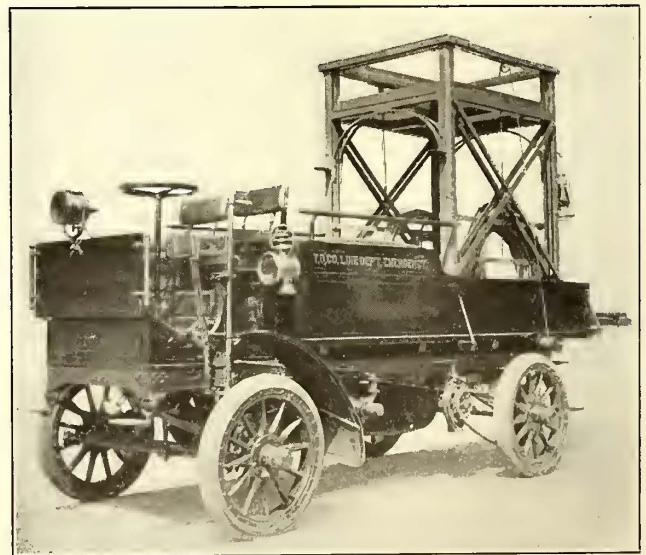
One emergency station in the center of the city serves 186 miles of city lines. Its equipment includes two one-horse, ball-bearing, light tower wagons, a hose jumper wagon, wreck wagon and four horses. Two men are on duty night and

day, and in addition the two line cars and their crews are stationed in the same building when not engaged in outside work. This emergency station answers approximately 300 calls a month for trolley wire breakdowns. The horses are not kept harnessed, but the wagons have quick-hitch harness.

#### DENVER, COL.

The Denver City Tramway Company is now using on all new construction 0000 grooved trolley wire. For carrying single 00 trolley on old construction 1/4-in., 7-strand span wire is used, but for single or double 0000 trolley or double 00 trolley 5/16-in. 7-strand wire is used. Poles are spaced 100 ft. apart wherever possible on both bracket and span wire construction. Poles are painted with carbolineum preservative compound commencing 3 ft. from the butt and continuing up for 4 ft. to protect that part of the poles exposed at the surface of the ground where decay is most active. Lightning arresters of various standard types are put in at intervals of from one-fifth to one-tenth miles, according to the location of the line and the trouble experienced with lightning. Span-wire construction is standard on all new work, and only a small fraction of the companies' lines is equipped with bracket construction.

The overhead maintenance force consists of two day crews of three men each and a night crew of two men, which is on duty from 5:30 p. m. until 7 a. m. These crews are under a general foreman who reports to the superintendent of overhead lines. One emergency station serves the entire city system of 210 miles. Its equipment consists of one light tower wagon and two horses which are not kept harnessed. One day crew is engaged on regular maintenance work, while the other crew is always within call for emergency service, although usually occupied with regular maintenance near the emergency station. The station crews answer approximately



Brooklyn Rapid Transit Company—Auto Emergency Wagon

125 emergency calls a month, which includes replacement of burned-out lamps in marker clusters, signal failures and trolley wire breakdowns.

#### LITTLE ROCK, ARK.

The Little Rock Railway & Electric Company uses both round and grooved 00 trolley wire and 1/4-in. 7-strand galvanized span wire. All wooden poles are impregnated with creosote. The 31 1/2 miles of line are maintained by one lineman, a helper and a driver, who also respond to any emergency calls. The equipment of the line department in-

cludes a tower wagon and two horses and an electric automobile emergency wagon.

#### MILWAUKEE, WIS.

The Milwaukee Electric Railway & Light Company is another city system which uses 0000 trolley wire of grooved section. Its pole spacing is 110 ft. and span wire construction used throughout on the 123 miles of this company's system. From 8 to 10 lightning arresters per mile of track are put in. The city is divided into three districts for emergency line repair work and a station is located in each district, serving about 40 miles of line. The city stations answer between 30 and 40 calls a month.

#### BIRMINGHAM, ALA.

The Birmingham Railway, Light & Power Company operates 130 miles of city and suburban lines running heavy cars at fairly high speed. It uses span-wire construction on 115 miles of its system and bracket construction on 15 miles. The standard trolley wire used is 000 grooved, supported by 3/8-in., 7-strand, extra galvanized span wire for double trolley and 5/16-in. or 1/4-in. span wire for single trolley. Poles are spaced 100 ft. apart. The entire length of the poles is treated by the vacuum creosote process, 10 lb. of creosote per cu.ft. being injected. Lightning arresters are spaced seven to the mile.

The maintenance force for the overhead lines consists of two foremen and 12 men, who are under the superintendent of the electric department. Only one emergency station is used for the entire system. Its equipment includes one two-horse tower wagon, one one-horse buggy on which a ladder is carried and one motor tower car for heavy repairs and emergency work on the suburban lines. This station answers as many as 350 calls a month for all kinds of emergency repairs.

#### LOUISVILLE, KY.

The Louisville Railway Company uses 00 round trolley wire and 1/4-in. span-wire cable. No center pole bracket construction is used. Poles are spaced 100 ft. apart and the butts are painted with crude oil to prevent decay. Lightning arresters are spaced to five to the mile.

The overhead maintenance force consists of two day emergency crews of one driver and one lineman each, who are on duty from 7 a. m. to 6 p. m., and a night crew of two men. In addition to these men two regular maintenance gangs of four men each are employed for general repair work on the overhead cables and trolley lines. Only one emergency station is maintained near the center of the city, the equipment consisting of a light two-horse tower wagon for ordinary use, a heavy spare repair wagon and ten mules. A team of mules is kept hitched to the tower wagon at all times and these teams are relieved every 6 hours. The accompanying illustrations show the type of emergency wagon used and also a heavy tower wagon built to carry a reel of trolley wire when making extraordinary repairs. The emergency station serves the entire city system of 150 miles, and during 1907 answered an average of 280 emergency calls a month, of which half were answered by the day crews and half by the night crew.

#### INDIANAPOLIS, IND.

The Indianapolis Traction & Terminal Company uses 00 round trolley wire and 3/8-in., 7-strand cable for span wires. It spaces poles 100 ft. apart on both bracket and span-wire construction. Wooden poles are not treated with any preservative compound. An average of five lightning arresters per mile are used. The maintenance force consists of two repair gangs of four men each and two emergency crews of

two men each. Both emergency crews have headquarters at one station, which is equipped with two one-horse ladder wagons, two horses and a one-horse hose bridge wagon. This station serves the whole city system consisting of 136 miles of line. It answers an average of 36 calls a month, and on account of the infrequent calls the horses are not kept harnessed.

#### INTERURBAN LINE CONSTRUCTION

The most interesting feature of recent overhead line construction for high-speed interurban railways is the increasing use of catenary construction for both a.c. and d.c. systems. Catenary construction was originally developed in the United States for single-phase alternating-current lines, but its numerous mechanical advantages over the older type of single-support construction have caused it to be adopted by a number of roads using direct current. These mechanical advantages are longer pole spacing and flatter trolley wire; flexibility and overcoming the effects of hammer blow of the collector at suspension points, and a reduction in mechanical breakage of the trolley wire under the strain of supporting the weight of the entire span from pole to pole. For high-tension a.c. and d.c. trolley the insulation possible with the old form of construction is insufficient, while with catenary construction the messenger cable can be insulated for any trolley line voltage yet proposed. In the following paragraphs the construction features of a number of recent catenary installations, including the latest type used by the New York, New Haven & Hartford, are briefly described. The construction and maintenance methods of a number of high-speed interurban lines which do not employ catenary trolley are also summarized.

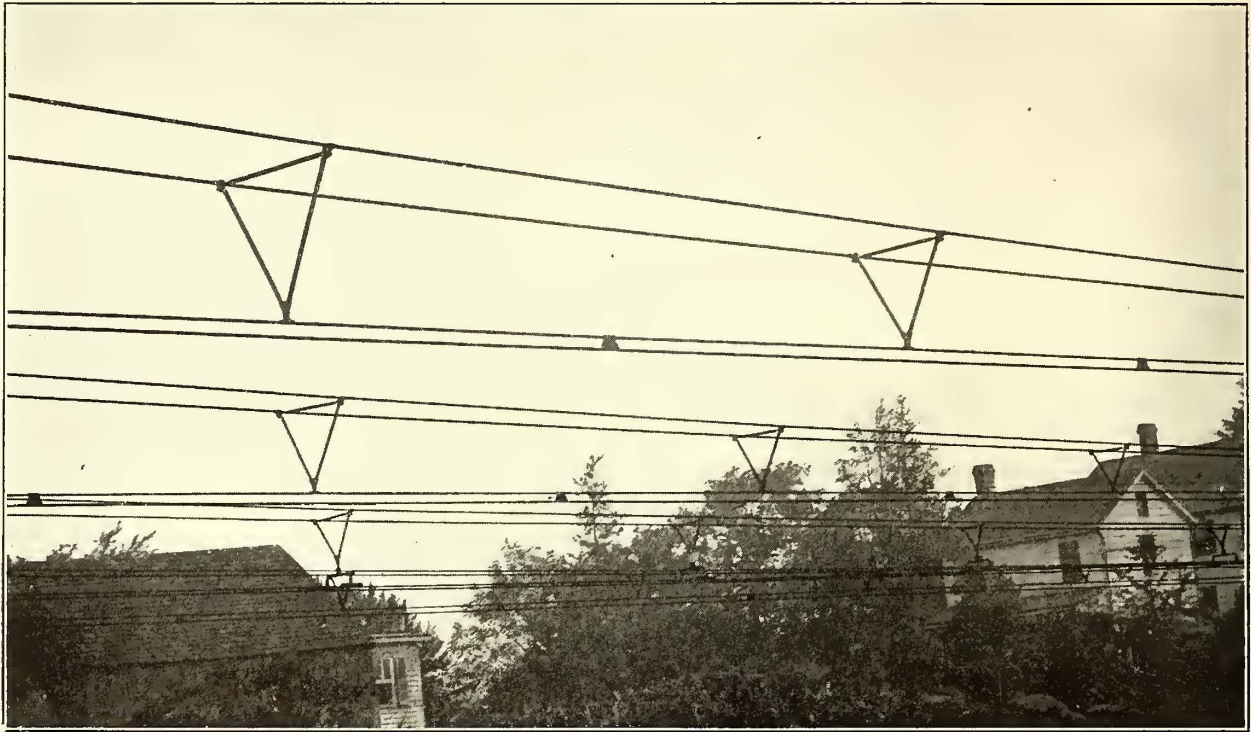
#### NEW YORK, NEW HAVEN & HARTFORD

The original catenary construction of the New York, New Haven & Hartford Railroad is familiar through descriptions which have been published in this and other journals and in papers which have been read before engineering societies. In it the working conductor was suspended from two messenger cables by triangular supports or hangers. In a paper presented Jan. 10, 1908, at a meeting of the American Institute of Electrical Engineers, and reprinted in abstract in the *STREET RAILWAY JOURNAL* of Jan. 18, W. S. Murray, electrical engineer of the New Haven Company, explained that, on certain later sections of the line, a more flexible construction had been adopted by supporting the catenary from span wires instead of from bridges, and that on still other sections, the New Canaan division, for example, a single catenary had been employed. The results of this form of catenary construction proved so satisfactory that during the last six months the New York, New Haven & Hartford Railroad Company has made an important change in its main line catenary construction by suspending below its former working conductor a new working conductor in a manner somewhat similar to that employed on the Blankenese-Ohlsdorf single-phase line at Hamburg, and described in the *STREET RAILWAY JOURNAL* of April 6, 1907. Instead of looping the auxiliary or working conductor to the upper wire, however, as in the German road, it is attached in the New Haven work to the former working conductor by short clips which are located midway between the triangular hangers on the messenger cables, or at distances of 10 ft. apart, so that each clip has a flexible support. Where the line passes under very low highway bridges, this form of construction is modified by substituting for the single clip and single working conductor a double-arm clip which supports two working conductors in the same horizontal plane. This permits the trolley bow to make two contacts. The new working conductor is of steel and No.

0000 in size. The former working conductor, which now acts simply as a support, is of copper.

In discussing the new form of construction, Mr. Murray said in a recent interview: "Very soon after the commercial

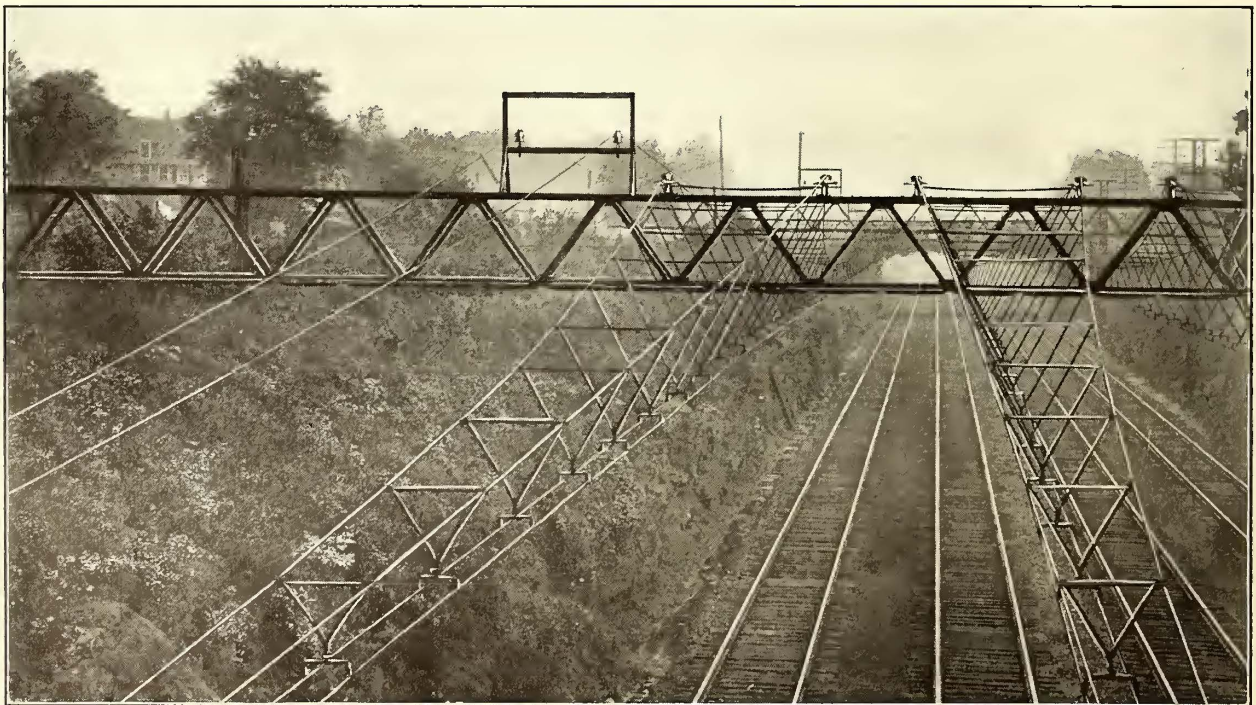
extreme roughness of the copper wire, due to kinking, the locomotive shoe was constantly interrupted in its contact with the trolley, delivering, and in turn receiving, hard blows in its uneven progress along the line and causing excessive sparking.



New York, New Haven & Hartford—Improved Catenary Construction on Main Line

service was put on an electric basis it was found that the current-collecting device on the electric locomotive, commonly known as the shoe, was producing two very serious effects on

The fourth wire has proved the panacea of all of these troubles. During the past three months of operation upon it absolutely no kinking has been noted and the wear is inappre-



New York, New Haven & Hartford—Improved Catenary Construction Adjacent to Low Highway Bridges

the copper wire: (1) Reducing its cross section by wear, and (2) kinking it badly at the point of suspension. The result of the combination brought about fractures of the trolley (the messengers never breaking). Moreover, on account of the

ciable. In the original form of construction where the locomotive shoe made contact with the copper wire, it was found that on account of the high expansion properties of copper wire, changes in temperature lengthened considerably the span

between the hanger points, and because of the ductility of the copper the passage of the shoe at high speed, with some considerable upward pressure, gathered up the slack in the form of a kink at the hanger point. Steel does not possess this disadvantage, as it has a much lower expansion coefficient than copper, is not ductile and has no tendency to kink."

#### TEXAS TRACTION COMPANY

The Texas Traction Company commenced operation on July 1, 1908, between Dallas and Sherman, Tex., 60 miles. It is a good example of the latest construction for a high-speed, 600-volt, direct-current interurban line. The overhead line is three-point catenary suspension with bracket construction. Idaho cedar poles 40 ft. long with 7-in. tops and set 7 ft. 6 in. in the ground are used. They are spaced 150 ft. apart on tangents and curves not exceeding 3 deg.; on sharper curves the span is reduced proportionately, being only 55 ft. on a 20-deg. curve. The trolley wire is 000 grooved copper, and is carried 19 ft. above the rails. The messenger wire is a 3/8-in. 7-strand steel cable. Steady braces on the trolley wire are located at each feeder tap and half way between taps, averaging about 500 ft. apart. They are also used on each bracket on curves in connection with bridle pull-offs. The trolley and messenger wires are anchored every half mile on tangents and at the ends of curves. All catenary wiring is insulated with 9-in. wood strain insulators. Lightning arresters are located every 2000 ft. at alternate feeder taps. In cities and towns span-wire catenary construction is used.

#### THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

The accompanying illustrations show the latest type of catenary center pole bracket construction on the a.c. suburban lines of The Milwaukee Electric Railway & Light Company. The



Milwaukee Interurban Lines—Catenary Construction on Curves

trolley wire is 0000 grooved copper carried by a 9/16-in. messenger wire. On tangents the poles are spaced 110 ft. apart, but this spacing is reduced somewhat on curves. Typical curve construction is shown in one of the illustrations.

Steady braces are used on both the inside and outside trolley wires and the bracket arms are extended on the outside far enough to permit stringing a strain wire to which the bridle pull-offs between brackets are attached. It will be noticed



Milwaukee Interurban Lines—High Tension Wire Protection

that the steady brace on the outside trolley wire is placed outside the wire.

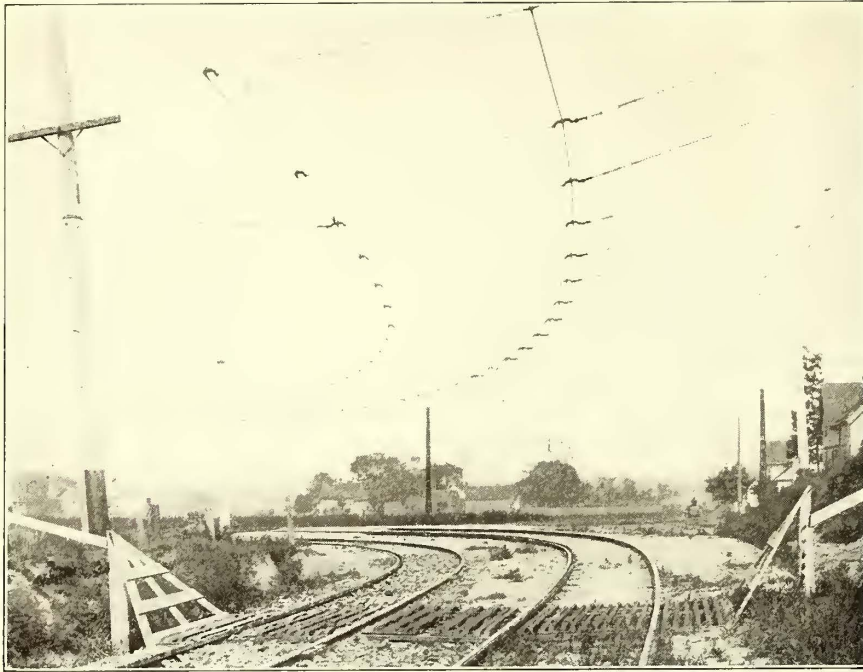
This company has recently had in experimental use a gasoline motor line inspection or patrol car, which is shown on the following page. The peculiar feature of this car is the means provided for quickly removing the car from the track at road crossings to allow a regular car to pass. Below the body is mounted a swivel turn-table with shoes fitting over the rails. This can be lowered from the driver's seat and the car raised so that the wheels clear the rails. The car is then turned 90 deg., lowered again and run off.

#### WASHINGTON, BALTIMORE & ANNAPOLIS

The single-phase alternating-current sections of this line have single catenary overhead construction throughout. The trolley wire carries 6000-volt current and is 0000 hard-drawn copper. Although the poles along the double-track portion of the road are placed in pairs on opposite sides of the roadbed, side bracket construction has been employed. The bracket arms are of T-section, 2 1/4 in. x 2 1/4 in. x 11 ft. long. They are secured in lugs on the poles and are held in position by a single iron rod brace attached near the top of the pole. The brackets on opposite poles are tied together with an iron wire cable containing a 24-in. wooden strain insulator at the center, which is inserted to insure safety to linemen working with the wire over one track while current is on the other wire. All poles are guyed back with 24-in. wooden strain insulators and Miller anchors, so that the pole line and messenger cable structure possess great stability. The poles are spaced 150 ft. apart, except on curves of more than 6 deg., and are painted with carbolineum as a preservative. The messenger cable is 3/8-in. high-strength steel wire. On straight track, hangers are spaced 16 ft. 8 in. apart, or nine to the span of 150 ft. The messenger wire insulators are of the double-cloaked type, made of brown porcelain. On curves two forms of construction are employed, both of which

are shown in the accompanying engravings. The steady brace construction is used on curves of large radius, but on sharper curves the back-bone construction is used. The connecting

of this road run over the Columbia line of the Washington Railway & Electric Company. This is an overhead, 600-volt direct-current system using a double trolley return circuit.



Milwaukee Interurban Lines—Span Wire Construction on Curves

strain wires between messenger cables are all insulated, and the guy wires on each side of the brackets are attached to an insulator on the outside pole. The pull-off wire at the center

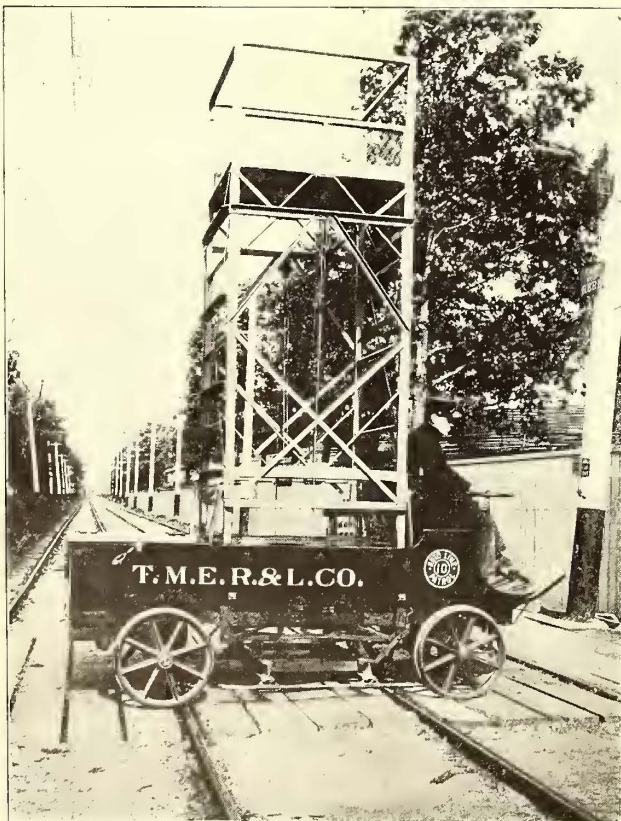
cross truss is 30 ft. long and its top chord is approximately 25 ft. above the rails. These bridges are spaced 300 ft.

The accompanying engraving shows the overhead construction on this section, and is reproduced principally on account of the fact that Washington, D. C., and Cincinnati, Ohio, are the only two cities in the United States which require the use of a trolley return circuit. Span wire construction is used, and the opposite poles are braced at the top by an iron pipe. The left-hand wire carries the positive current and the right-hand wire carries the negative current.

#### SYRACUSE, LAKE SHORE & NORTHERN

The direct current catenary overhead line of the Syracuse, Lake Shore & Northern presents some interesting features. On the latest construction between Baldwinsville and Fulton, N. Y., 222 steel catenary bridges are being put in to carry the double track overhead line. These bridges are made up of two A-frame side towers and a connecting truss, built of light angles and channels. Each foot of the A-frames is mounted on a concrete foundation pier 2 ft. x 2 ft. and of varying depth. The

cross truss is 30 ft. long and its top chord is approximately 25 ft. above the rails. These bridges are spaced 300 ft.



Auto Line Patrol Car—Moving Off Track

of the span is attached with an insulator to a strain cable connecting the two posts. Both the trolley wire and the messenger cable are braced in this construction.

For 4 miles in the outskirts of Washington, D. C., the cars



Auto Line Patrol Car—Inspecting Trolley Wire

apart on tangents, but on curves this spacing is reduced to a minimum of 70 ft.

The messenger cable is 7/16-in. in diameter, stranded and galvanized and supports a 0000 copper trolley wire. In the

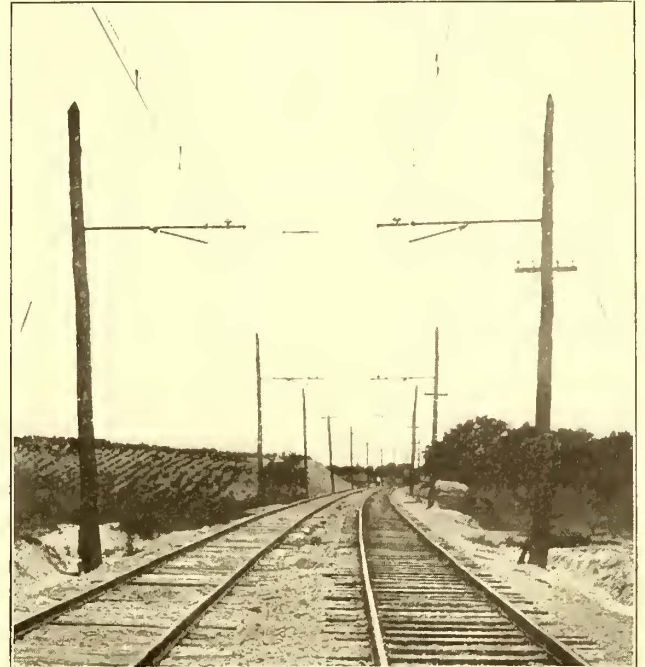


original construction the 5/8-in. steel rod hangers were spaced 10 ft. apart or 30 to the span, but on the latest construction this spacing has been increased to 30 ft. or 10 to the span

BOSTON & WORCESTER STREET RAILWAY  
The Boston & Worcester Street Railway Company is now



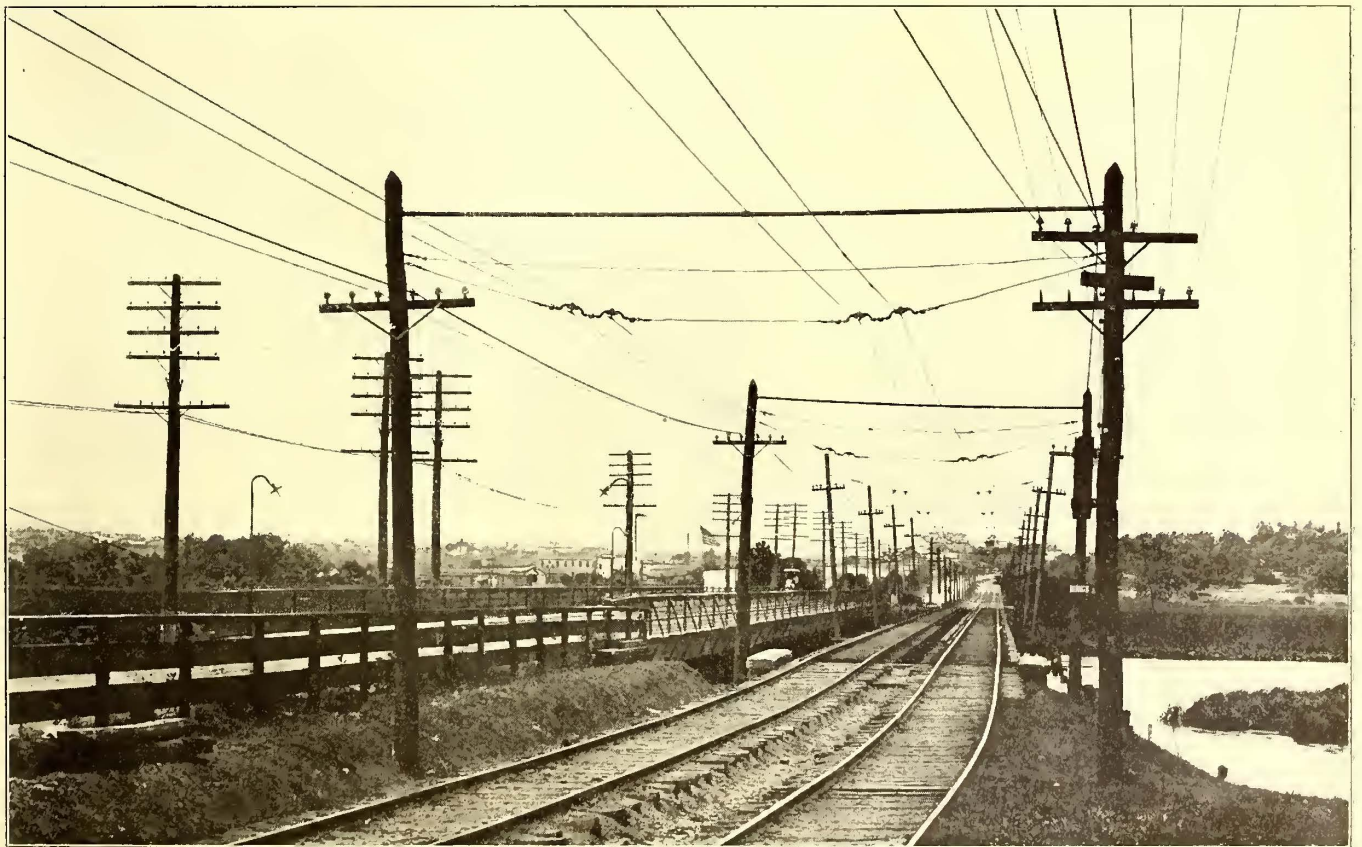
Washington, Baltimore & Annapolis—Backbone Catenary Construction on Curves



Washington, Baltimore & Annapolis—Catenary Construction with Steady Braces on Curves

in order to give greater flexibility to the trolley wire. The longest hanger is 77 1/2 in. in length. The line is electrically insulated for 6600 volts, A. C., which may be employed

using 0000 round trolley wire. Grooved wire was tried, but trouble was experienced with the wire breaking near the hangers when subjected to the repeated blows of trolley wheels.



Double Trolley Construction on Columbia Line of Washington Railway & Electric Company

some time in the future. It is claimed that these catenary bridges provide much greater stability to the overhead line, and that they cost only \$800 per mile more than standard double-track wooden pole bracket or span-wire construction.

The round wire, hammered into 15-in. ears, gives more flexibility and longer life. The double-track mileage of this company is about equally divided between span wire construction and center pole bracket construction, there being 16

miles of bracket and 15 miles of span wire. In both types the pole spacing is 100 ft. The poles are not treated with any preservative compound, but the company is replacing some of the hard pine poles put in six years ago with chestnut poles. No chestnut poles which were put in at the same time have yet shown signs of decay.

The maintenance of all of the overhead trolley feeder, 13,200-volt transmission, telephone, signal and lighting wires along the company's 46 miles of line is in charge of one line foreman, who has six helpers in the summer and four in the winter. The headquarters of the line maintenance force are the Framingham car house, about midway between terminals. Its equipment consists of one tower wagon and an emergency car, which is used for all serious emergency calls more than 2 miles from the car house where the wagon is kept. For minor emergency repairs linemen are sent out on regular cars with tools and a ladder, and they make repairs from the roof of the regular car when possible.

#### INDIANAPOLIS & CINCINNATI

The Indianapolis & Cincinnati Traction Company operates two divisions, 49 miles and 58 miles long, respectively, with single-phase alternating current at 3300 volts. Catenary suspension from bracket poles is employed, the poles being spaced 120 ft. apart. Lightning arresters are put in one-third of a mile apart. One chief lineman has charge of a maintenance crew on each division, consisting of two linemen and a groundman. Each division crew, in addition to maintaining the wires along the railway right of way, cares for half of the 20-mile cross-country transmission line between the Rushville power station and Shelbyville. Each crew is furnished with a tower push car and a hand car and, when necessary, a motor work car is placed at their disposal.

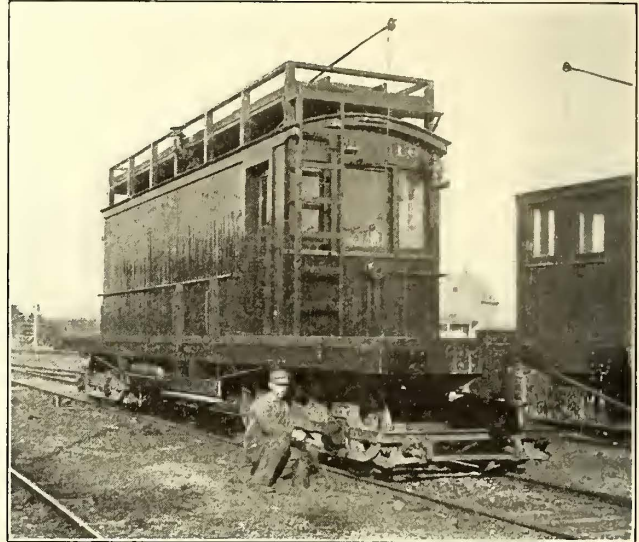
#### ILLINOIS TRACTION SYSTEM

The Illinois Traction System has adopted the three-point catenary suspension with bracket construction for all new construction on both a.c. and d.c. lines. On tangents the poles are spaced 140 ft. apart, but on curves this spacing is reduced somewhat. All poles are treated for their entire length with the creosote process. Between substations lightning arresters are put in at intervals of one-third of a mile, but near

district reports to a superintendent of overhead lines, who in turn reports to the electrical and mechanical engineer. In addition to this force, a telephone line repairman is assigned to each division dispatcher's office to maintain all the telephone lines and instruments as well as the signal system. These men report to a superintendent of telephones and signals.

#### FT. WAYNE & WABASH VALLEY

The Ft. Wayne & Wabash Valley has about 115 miles



Cleveland, Southwestern & Columbus—Line Car

of bracket construction and 20 miles of span construction, which occurs mostly on sharp curves and in cities and towns. A 000 round trolley wire is used, and in span construction the trolley is hung from 3/8-in. stranded span wires. Poles are spaced 100 ft. apart and are not treated. The line is divided into sections averaging 30 miles long, and the maintenance of the overhead lines and transmission system of each section is cared for by a crew of two men with a line car.

#### SPOKANE & INLAND EMPIRE

The system of the Spokane & Inland Empire comprises 42 1/2 miles of 600-volt d.c. span wire construction and



Syracuse, Lake Shore & Northern—Catenary Construction with Steel Bridges

substations the number per mile is increased to from five to seven.

The line is divided, for overhead maintenance purposes, into districts averaging 90 miles in length. A line foreman and three helpers are assigned to each district and are given a tower line car with a regular crew. The members of the crew act as groundmen on heavy repair work. The foreman of each

129 miles of a.c. catenary bracket pole construction. On the d.c. lines 0000 figure 8 trolley wire supported by 5/16-in. 7-strand span wire is used. On the a.c. lines the trolley wire is 000 grooved. Poles are spaced 100 ft. apart in both types of construction. The maintenance of the d.c. lines is in charge of a foreman who has two helpers, and a similar crew maintains the entire 129 miles of a.c. catenary line.

## UTICA &amp; MOHAWK VALLEY

This company employs 0000 round trolley with span wire construction for the most part, the poles being spaced only 80 ft. apart. The butts of all wooden poles for 7 ft. from the end are painted with three coats of carbolineum. Lightning arresters are spaced 1/2 mile apart. The Auburn & Syracuse has practically the same standards of construction.

## CLEVELAND, SOUTHWESTERN &amp; COLUMBUS

The Cleveland, Southwestern & Columbus has 195 miles of bracket pole construction and uses span wire only in cities and towns. The poles are not treated and are spaced 100 ft. apart. The overhead lines on each division, averaging 70 miles of track, are maintained by a crew of three men, who are furnished with the type of line car shown in the accompanying illustration. These crews keep in communication with the dispatcher at frequent intervals by telephone when working on regular maintenance so as to be prepared to answer an emergency call. Only about four calls a month are sent in, however, for emergency repairs.

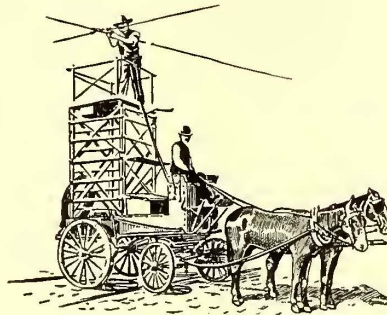
## DETROIT UNITED RAILWAY

The interurban lines of the Detroit United Railway, comprising nearly 540 miles of track, are built with 00 figure 8 trolley wire suspended from pole brackets on tangents and

from span wires on curves. With bracket construction the poles are spaced 110 ft. apart. Lightning arresters are spaced one-third of a mile apart, except near substations, where from six to seven per mile are put in. The overhead maintenance force consists of nine crews of three men each, covering about 50 miles of line with a double-truck line car. The foremen of these division crews report to an interurban line foreman attached to the office of the superintendent of power.

## INDIANA UNION TRACTION COMPANY

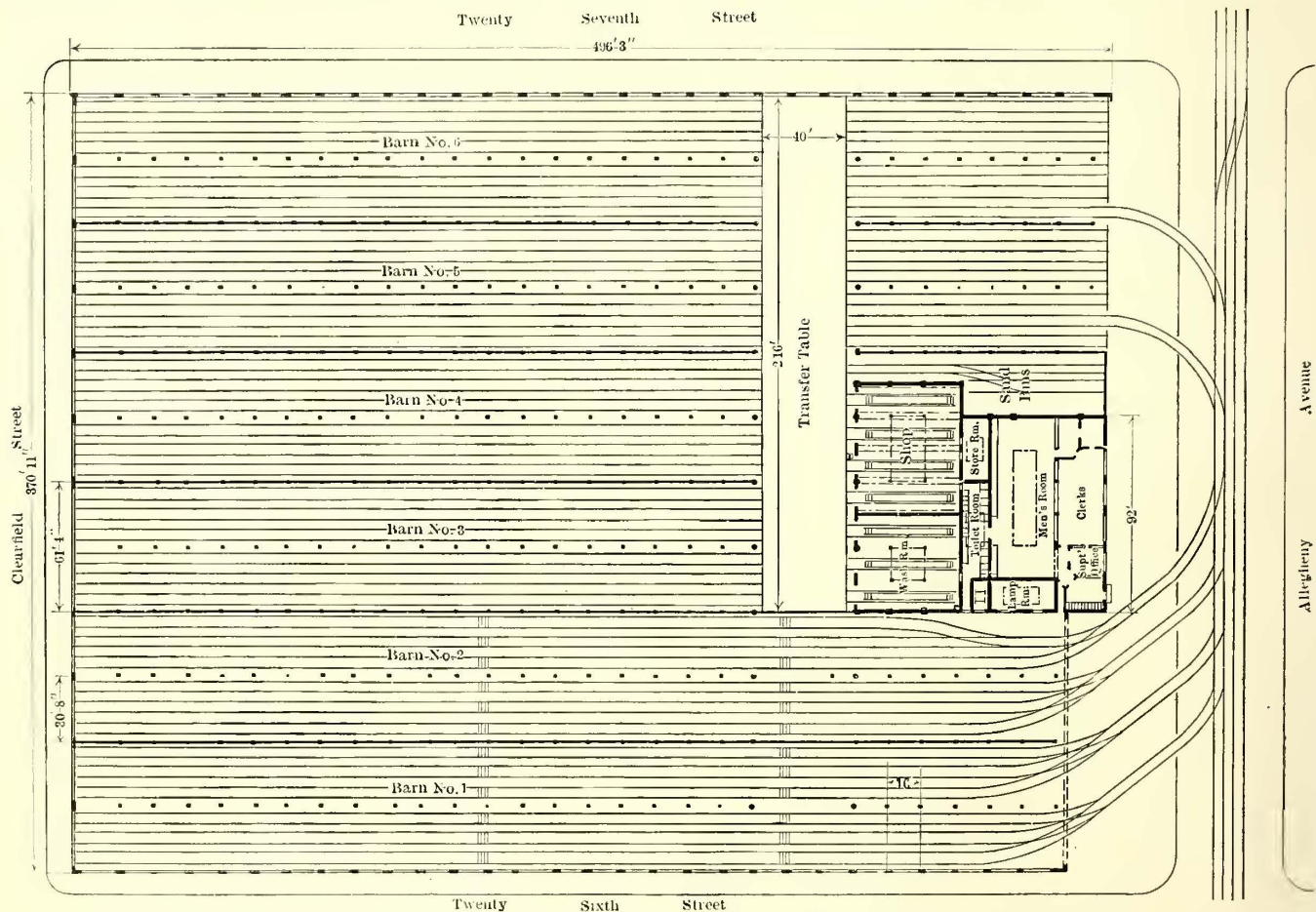
The older lines of this company, comprising about 200 miles, are built with span wire construction, but bracket construction has been used on the 165 miles of lines built more recently. All trolley wire is 000 figure 8. Poles are spaced 100 ft. apart on both span and bracket construction and are untreated. The maintenance force consists of nine crews of two men each, who cover about 40 miles of track. Each crew is supplied with a light, single-truck tower car and a tower push car. When engaged in repair work they are required to report to the dispatcher once each hour for instructions and orders in case they are wanted for emergency repairs. Ordinary repairs to the high-tension lines are made between 2 a. m. and 5 a. m., when the power house is shut down.



# CAR HOUSE DESIGN

THERE are usually many local conditions affecting the general design of terminal car houses for city street railway systems. The size and shape of the available ground area, topography and nature of the soil, climate, location of running tracks with respect to the building, character of neighboring buildings and surroundings, type of rolling stock to be housed, location of main repair shops and numerous other considerations are involved. For this reason it is difficult to draw any conclusions as to the relative merits of various general types. A through track arrangement is best in some locations and a stub track layout is the only one that can be used in other places. Transfer tables offer some advantages in one type of house and elaborate special-work con-

reprinted in the STREET RAILWAY JOURNAL of Oct. 26, 1907, was prepared in connection with a committee of the National Fire Protection Association, and embodies the latest and most approved recommendations of the fire underwriters. Among the general requirements are the following: That sectional fire areas should be not greater than 20,000 sq. ft., or of such size as to confine the loss on equipment stored in any one area to \$200,000, or should not contain to exceed 1800 lin. ft. of interior trackage. The report also recommends the use of ceiling curtains and both aisle and ceiling sprinklers. None of the houses described in the following pages have been built strictly in accordance with these recommendations, but none are lacking in fire protection features.



Philadelphia Rapid Transit Company—Plan of Allegheny Avenue Car House

nections are, in the end, more economical in others. In the following pages a number of modern city car houses of different types are illustrated and briefly described. These include houses designed to accommodate from 25 to 250 cars, located in cities of large and small size. One or two houses designed especially for interurban cars are also shown.

Fireproof construction and protection against the spread of fires are most important considerations in the design of car houses, and current practice in these matters as shown in the designs illustrated is of interest, in view of the fact that at the 1907 convention of the American Street & Interurban Railway Association, the structural requirements of car houses for fire protection purposes as outlined in a committee report were formally adopted by the association. This report, which was

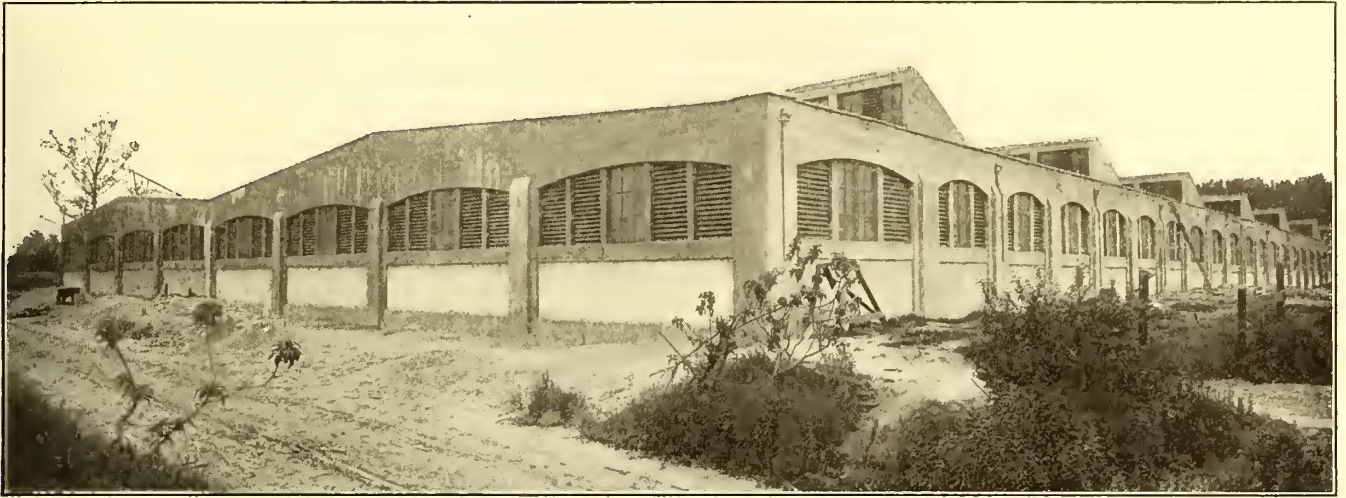
## PHILADELPHIA

The new concrete operating car house of the Philadelphia Rapid Transit Company, at Twenty-sixth Street and Allegheny Avenue, is a stub-end house in which both transfer table and special work entrances are combined. This company prefers the transfer table arrangement for handling light, single-truck cars, of which it has a large number still in service, but for its standard double-truck, semi-convertible cars it uses special-work layouts in front of the building. As shown on the plan, the Allegheny Avenue car house consists of six bays, two of which have track entrances while the other four are entered over a transfer table. At the present time bays No. 5 and 6 have not been erected, but the tracks have been laid and some

cars are stored on them outside of the partially completed building. All bays are of a uniform width of 61 ft. 4 in. and contain two groups of three tracks each which are separated by a central row of roof columns. The 12 tracks in Nos. 1 and 2 bays are 440 ft. long and will hold 11 each of the standard 38-ft. double-truck cars, or a total of 132 cars. The four bays entered over the transfer table will hold 360

roof, although the switch points are outside. There are two tracks leading into the front section of bays Nos. 5 and 6 and thence to the transfer table.

The outside walls of the car house are plain concrete but the interior partition walls are hollow tile. All walls are carried up as roof parapets for a height of 18 in. The roof is built of reinforced concrete slabs and cross girders supported

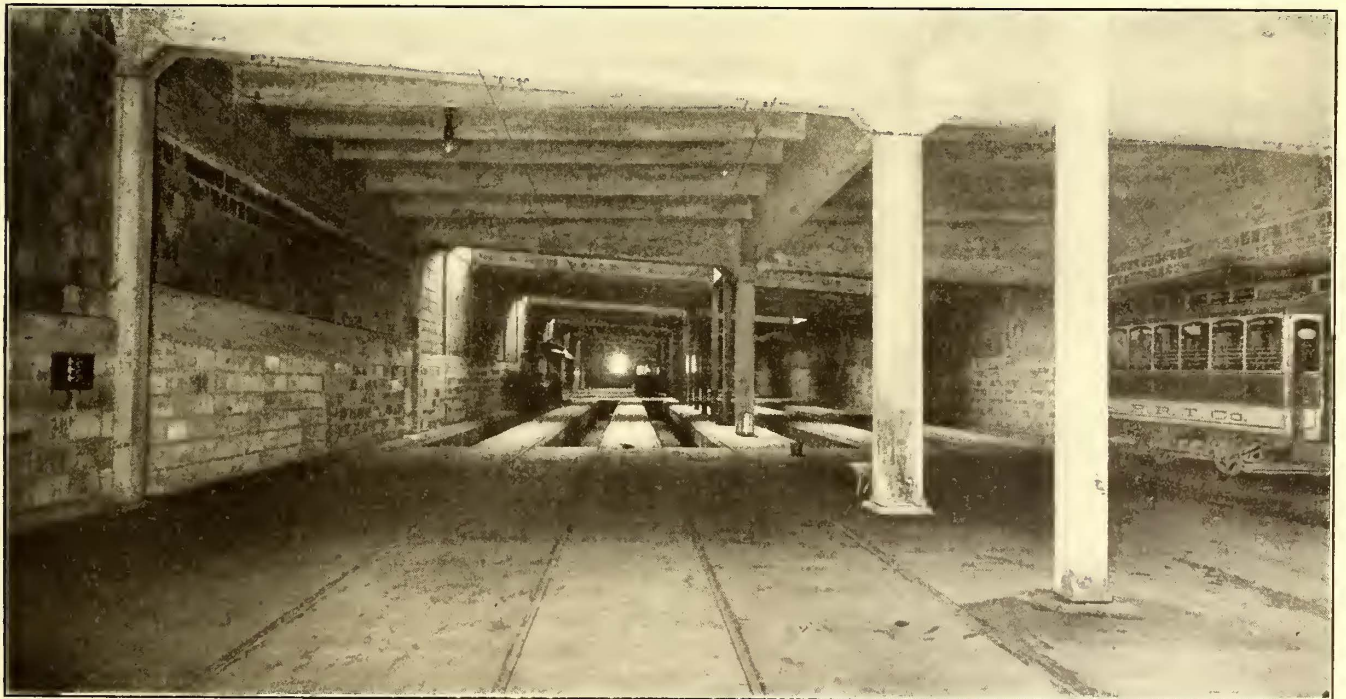


Philadelphia Rapid Transit Company—Exterior of Allegheny Avenue Car House

single-truck closed cars, or 240 single-truck open cars, or 192 standard double-truck cars in the rear portion, and 30 single-truck closed cars, or 18 single-truck open cars, or 12 standard double-truck cars in the front portion. In addition, seven cars can be stored on the shop and wash room tracks. The maximum number of cars which can be stored in any one sectional fire area is 66, in bays Nos. 1 and 2.

by reinforced concrete columns spaced 16 ft. apart down the center of each bay. Saw-tooth ventilator skylights provide top light for the interior bays. The floor throughout the house, except around the pits, is cinder concrete laid on a cinder bed and finished with 1 in. of cement mortar.

In the center of bays Nos. 1 and 2, inspection pits 145 ft. long have been built under all 12 tracks. The rails rest on



Philadelphia Rapid Transit Company—Interior of Allegheny Avenue Car House

It will be seen from the track layout on the plan that all cars enter and leave from the north, or Allegheny Avenue end. There are four leads from a twin track paralleling the east-bound running track on Allegheny Avenue connecting with the four groups of three tracks each in bays Nos. 1 and 2. The front end of these bays is open, and the special work for the three diverging tracks of each group is partly under the

concrete girders 19 1/2 in. deep, which are supported by concrete columns 12 in. square and 8 ft. apart, and are held down by 3/4-in. anchor bolts encased in 1 1/4-in. pipe spaced every 4 ft. Between pits the aisles are floored over with 4 in. of concrete, but the space below is open for the entire width of the bay. The pit floor is 4 ft. 6 in. below the top of rail and the pits are 4 ft. 6 in. wide between girders. These pits

serve for the inspection of the double-truck cars stored in these two bays. Single-truck cars and any double-truck cars which need careful inspection or repairs are inspected over the five pits in the shop section adjoining the transfer table.

The offices, trainmen's room and toilet room are in the front of the building in the center, and behind them are the shop and car wash room. There are three pit tracks in the wash room 40 ft. long and five pit tracks in the shop. The openings over each track into the transfer table aisle are closed with steel rolling shutter doors. Only light repairs are made here, all heavy work being done at one or the other of the company's two main repair shops.

The general lighting of the building is done with enclosed arc lamps hung from the roof, but incandescent lamps are also used in some places. No heating apparatus has been installed in the pits, but the main part of the building is heated with steam-pipe coils mounted on the side walls. No sprinklers of any kind have been put in.

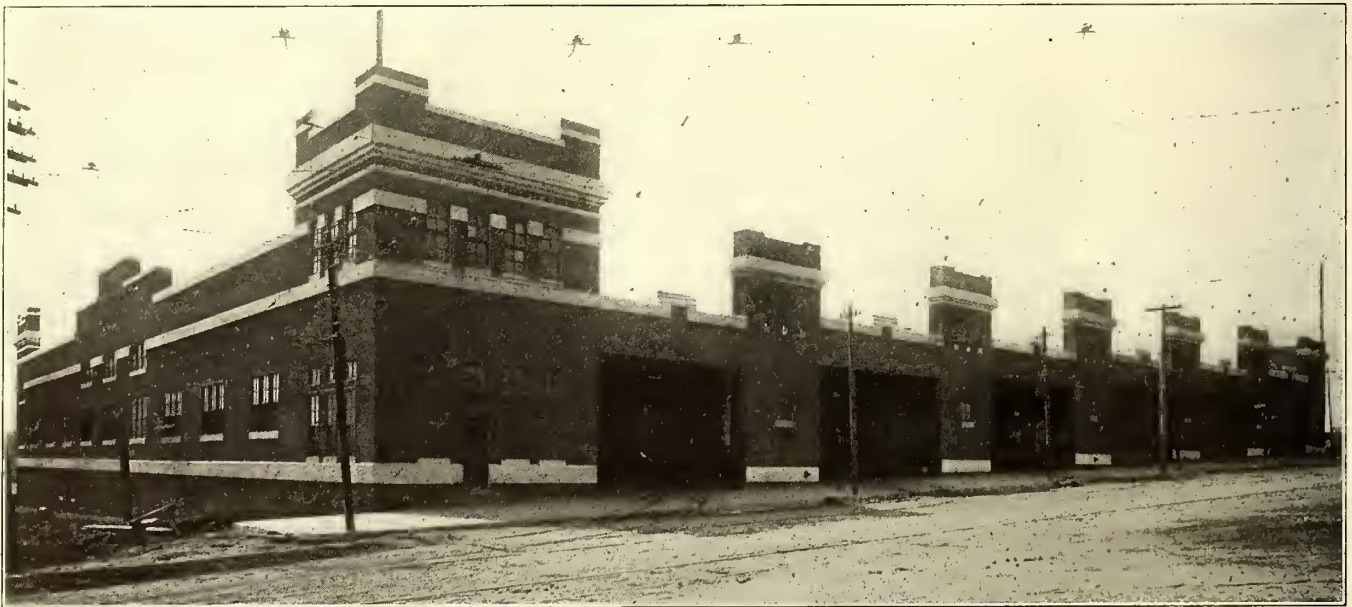
#### BALTIMORE

During the last few years the United Railways & Electric Company, of Baltimore, has built several extensions to its

terior and interior partition walls, while the Edmonson Avenue and Highlandtown car houses are built entirely of reinforced concrete.

The Edmonson Avenue car house, of which an exterior view is shown in the accompanying illustration, is divided by 6-in. reinforced concrete fire walls into three bays containing eight tracks each. These tracks are 220 ft. long and will accommodate five standard double-truck cars 42 ft. long, giving the house a total storage capacity of from 110 to 125 cars. Fourteen of these tracks are provided with pits 45 ft. long, having the aisles between depressed 18 in. below the top of rail. A 9-in. girder rail is used throughout. The floors of the pits and the entire ground floor of the building are of 4-in. concrete laid on cinders and surfaced with a granolithic finish of Portland cement, 1 in. thick. The roof is pitched from the rear to the front and covered with slag. All sash are in metal frames and are glazed with wire glass.

Both aisle and ceiling automatic sprinklers have been installed. They are operated on the dry pipe system. The aisle sprinklers are placed 8 ft. above the floor, or about 3 in. below the tops of the car windows, and are spaced 7 ft. apart.



Exterior of Edmonson Avenue Car House, Baltimore

lines and added a large number of cars to its rolling stock equipment. Shortly after the now famous Baltimore fire the company decided on a plan of dividing the city into eight districts and building a modern fireproof operating car house in each which would accommodate from 100 to 125 cars. The importance of fireproof construction was forcibly impressed on the engineers of the company, and in designing these new car houses particular attention was paid to this feature. In deciding on the type of depots to be built, the use of open terminals was considered, but it was thought that the resulting depreciation of rolling stock from exposure to the weather and the additional power required to start cars on cold mornings warranted discarding this less expensive plan in favor of closed houses.

Of the eight houses planned, six have been built and are now in use. All follow the same general plan of having an entrance at one end only and having the several storage tracks sectionalized into bays by longitudinal fire walls. Several construction materials have been employed, including brick, reinforced concrete and concrete blocks. The York Road car house, illustrated herewith, is built with concrete block ex-

The roof sprinklers are carried in a line over the center of each track and each aisle and are spaced 10 ft. apart, so that each sprinkler head covers an area of approximately 100 sq. ft. All sprinklers are connected to a 6-in. water supply main by 2 1/2-in. to 4 1/2-in. pipes. A 40,000-gal. tank mounted 20 ft. above the roof supplies pressure.

The Highlandtown car house has a front of 204 ft., including the service building on Lombard Street, a depth of 355 ft. on Seventh Street and a front of 114 ft. on Pratt Street. The building consists of two storage bays, both being identical in trackage, width and depth, and a third section, or the service building, adjoining. This is a two-story building 90 ft. x 45 ft. 6 in. The entire structure covers a total area of 45,000 sq. ft., and will house 68 cars. The service building contains a waiting room for passengers, with separate toilets for men and women. It is located on the corner of Lombard and Eighth Streets, and has an entrance on the corner. The dispatcher's and receiver's offices are located near the car-house entrance, where the departure and arrival of cars can be observed. Adjoining, and in communication with these offices and the car house, is the general room for

motormen and conductors. A private room for conductors and the locker and toilet rooms open off of the general room. The second floor contains offices for the superintendents stationed at this car house and a large assembly hall for em-

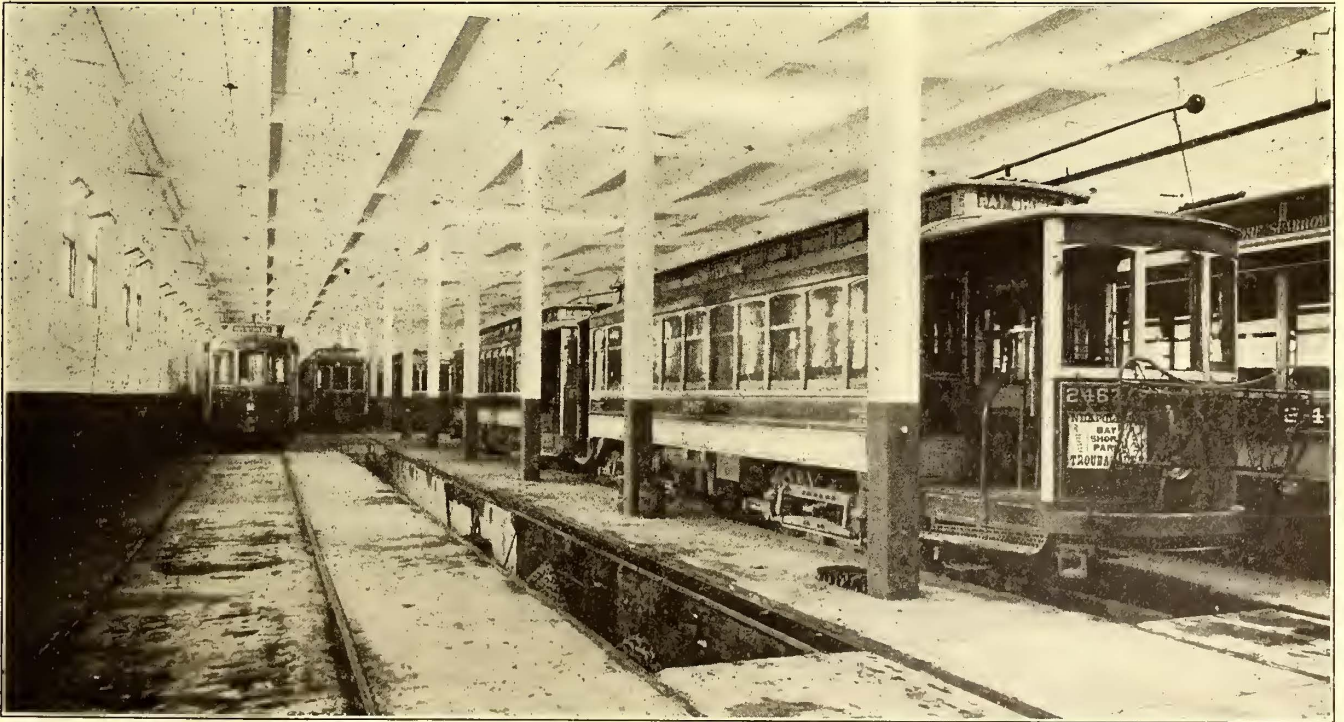
ployees. This assembly room now contains pool tables and will be more elaborately furnished later. The shop, oil and sand rooms are located in the car-house sections, where they are most convenient to their respective requirements. It will



Exterior of Highlandtown Car House, Baltimore

ployees. This assembly room now contains pool tables and will be more elaborately furnished later. The shop, oil and sand rooms are located in the car-house sections, where they are most convenient to their respective requirements. It will

wired glass. The skylight frames are of concrete and ribbed wire glass is used. All doors are sheathed with metal. The service building and track pits are heated with steam pipes and lighted with incandescent lamps. The plumbing throughout is



Interior of Highlandtown Car House, Baltimore

be noticed that there is a separate sand room for each bay.

The entire house, including the service building, is constructed of reinforced concrete and is of plain design. The two sections contain five tracks each and all tracks, save one,

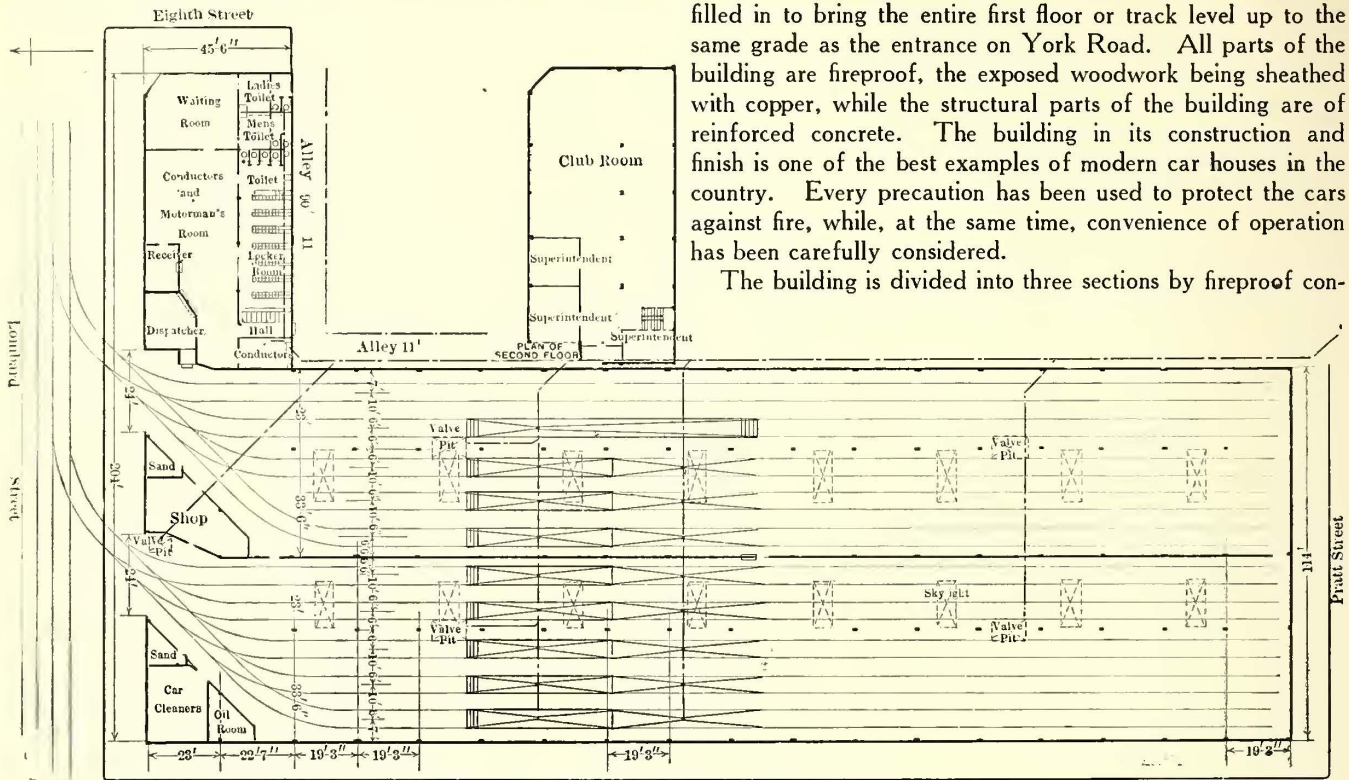
of modern sanitary type. Hydrants are used for washing the cars and floors. A complete hose standpipe system and underground sprinkler piping have been put in so that the sprinklers can be installed whenever it is considered that they are needed

without disturbing the present construction. Both the stand-pipe and sprinkler mains have Siamese steamer connections for the use of the Fire Department.

The York Road car house occupies a lot with a frontage

partition walls are built of plain concrete blocks on a foundation of reinforced concrete. The Ready Avenue front is trimmed with bluestone. There is a fall of nearly 10 ft. from York Road back to Ready Avenue, which has been filled in to bring the entire first floor or track level up to the same grade as the entrance on York Road. All parts of the building are fireproof, the exposed woodwork being sheathed with copper, while the structural parts of the building are of reinforced concrete. The building in its construction and finish is one of the best examples of modern car houses in the country. Every precaution has been used to protect the cars against fire, while, at the same time, convenience of operation has been carefully considered.

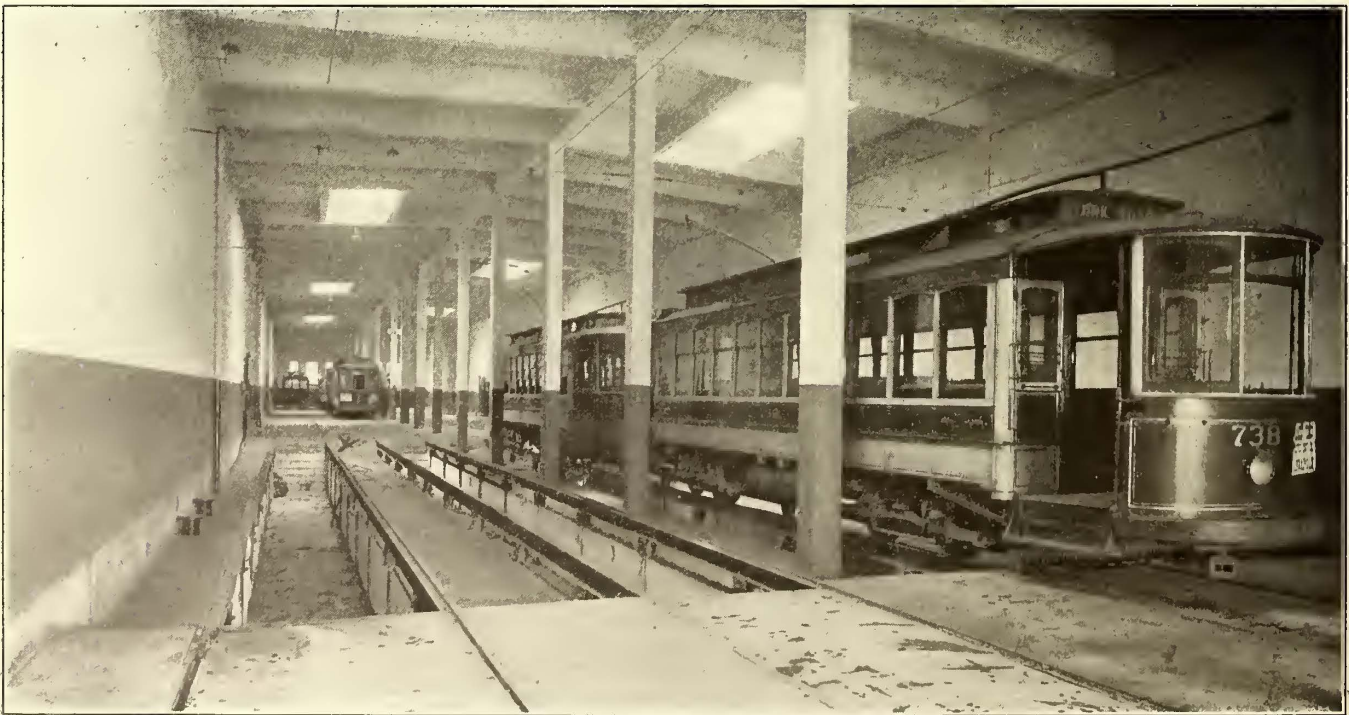
The building is divided into three sections by fireproof con-



Plan of Highlandtown Car House, Baltimore

of 140 ft. on York Road, and a depth of 402 ft. 6 in. through to Ready Avenue. The depth of the house is east and west, thus securing maximum light.

crete block division walls between. Kinnear rolling and interlocking steel shutters about 30 ft. wide are used at the York Road entrance to each section, and the smaller openings be-



Interior of Highlandtown Car House, Baltimore

The design of the building is in the modern French Renaissance style of architecture, simple but dignified and massive. The York Road front is built of special finish concrete blocks trimmed with ornamental terra cotta; the remaining side and

tween each section are closed with double fireproof, fusible link sliding doors. The floors are of concrete with granolithic finish, but brick headers are laid along the curved track at the entrances to prevent wheel-scoring and to facilitate the removal



of worn-out special-work. Section No. 1, in which 24 cars can be stored, contains offices for the line superintendent and dispatcher, conductors' and motormen's room, the general assembly or club room for employees, shop room, car cleaners' room, toilet rooms, locker rooms, etc. All of these rooms are separated by fireproof partitions, and the openings from them into the car sheds are closed with iron doors set in metal frames. The building occupies the entire lot, and no openings were left in the side walls as a protection against fire on the adjoining property. Light is obtained by metal skylights in the roof, which are glazed with 3/8-in. wire glass, as are all the other doors and windows opening on the street. The doors of the utilities rooms mentioned are all neatly lettered in gold. The metal fittings in the toilet rooms are nickeled, and the equipment of the offices in general is equal to that found in the best office buildings, the company believing that attractive surroundings make satisfied employees.

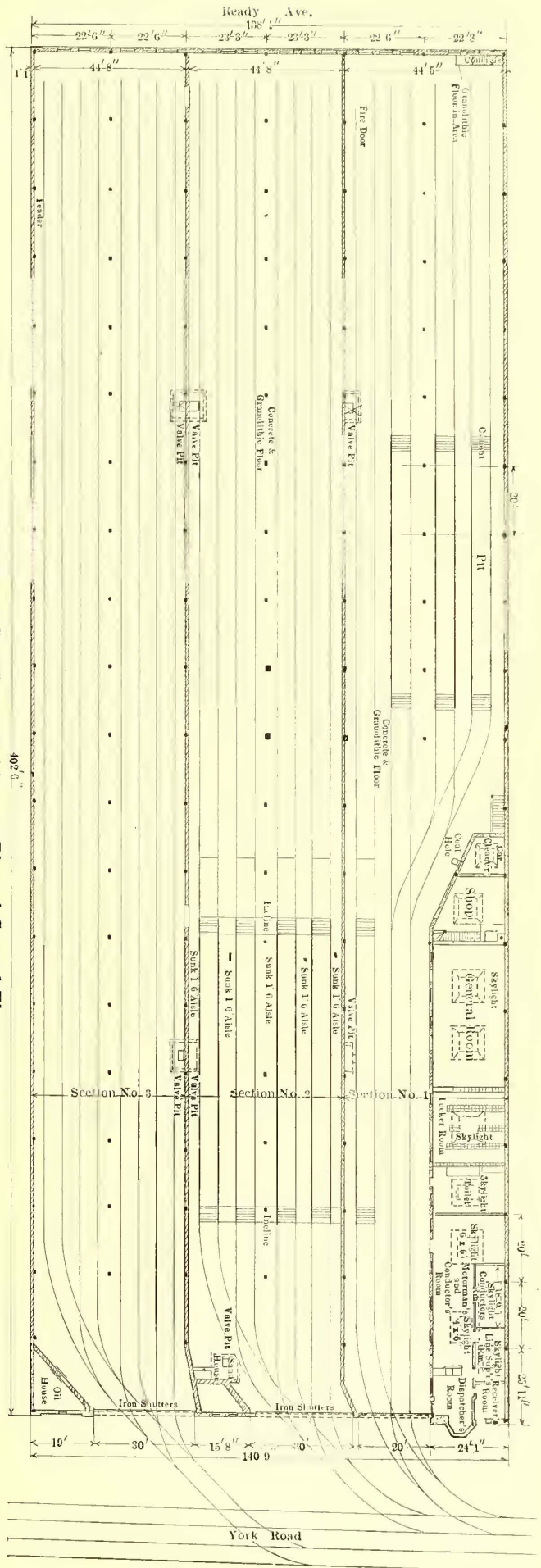
The middle section, in which 32 cars can be stored, contains a sand bin at the entrance, and section No. 3, which has track room for storing 32 cars, contains a large oil house near the entrance, in which are placed two 120-gal. oil tanks connected with Bowser self-measuring pumps. All the tracks in sections Nos. 1 and 2 are provided with inspection pits about 90 ft. long. These pits are constructed of reinforced concrete and are about 5 ft. deep. They are well heated and lighted to facilitate making necessary repairs to the motors and trucks of cars. The pits in section No. 1 are of the flush type with the rails set in rail irons and carried on reinforced concrete brackets or pilasters. The pits in the middle section have aisles depressed 1 ft. 6 in., and follow the design already described in connection with the Edmonson Avenue car house. The lamps in both types of pits are placed in recesses in the concrete walls.

The building, including the pits, is heated by steam pipes from two boilers in the basement under the offices. It is lighted during the day by the large skylights symmetrically placed in the roof to give equal distribution of light over the cars, and at night is lighted throughout with five-cluster and individual incandescent lamps, the wiring of which is carried in wall conduits. The building has been equipped with a complete hose standpipe system, with Siamese steamer connections and the underground piping for a complete sprinkler system has been installed. Sprinklers can be put in at any time without disturbing the permanent structure.

CHICAGO

The Cottage Grove Avenue car house of the Chicago City Railway Company was completed a little less than a year ago and is typical of the structures of this class which this company is building as part of its rehabilitation work. The building is of brick and reinforced concrete construction and has a storage capacity of 222 standard double-track cars on 28 tracks. Twenty-two cars can also be stored on the entrance tracks outside of the house. Five of the six storage bays have entrances from both ends of the building, but the sixth storage bay and the repair shop and utility bays are stub ended. This was made necessary by the peculiar shape of the available property. The outside and interior partition walls are of brick 13 in. thick supported on concrete foundations. The five storage bays are 47 ft. wide and 18 ft. high from top of rail to trolley trough. The roof is made of reinforced concrete slabs supported by steel cross girders made up of angles and fireproofed with 1 in. of adamant plaster on No. 27 herringbone metal lath. These girders are spaced 16 ft. apart and are 4 ft. 3 in. deep, thus serving also as curtain walls under the roof. A skylight opening 7 ft. 3 in. wide and

York Road Car House, Baltimore—Plan of Ground Floor



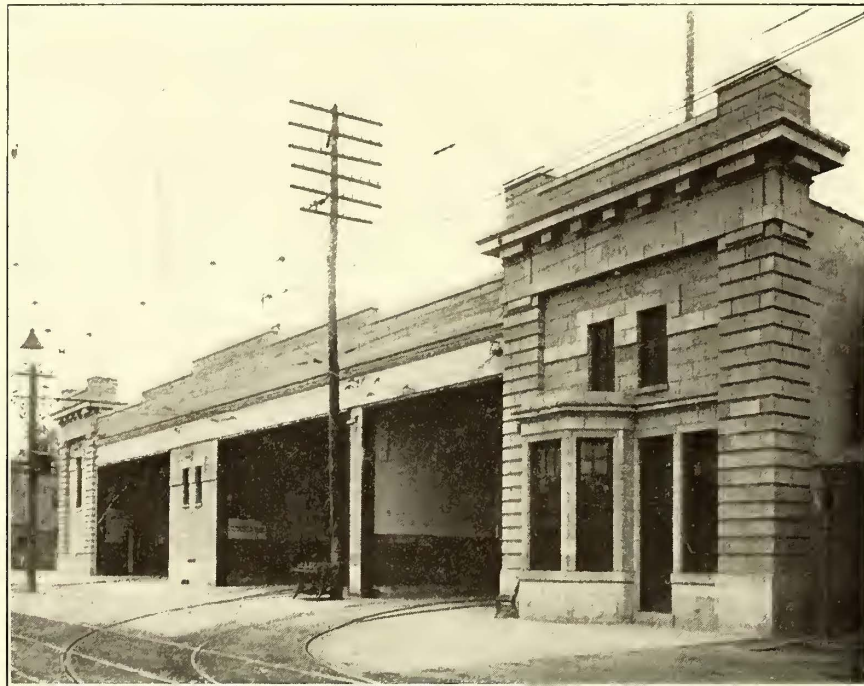
glazed with 1/4-in. wire glass extends the entire length of each bay over the center. The skylight frames are supported by 8-in. I-beams built in a concrete curb and carried on the top chord of the roof trusses.

There are four tracks in each bay, spaced 11 ft. 2 in. apart center to center, which gives an aisle 26 in. wide be-

bay. Two hand-fired low-pressure boilers connected to a 125-ft. concrete stack supply steam for the heating system. Enclosed arc lamps are used for general lighting at night. No sprinkler system has been installed, but a complete equipment of hydrants, fire hose and water and sand buckets has been provided for use in case of fire.

WASHINGTON, D. C.

The Fourteenth Street terminal car house of the Capital Traction Company, of Washington, D. C., is one of the largest structures of its kind in the United States and embodies all of the most modern ideas of construction. It is an unusual design in a number of respects, in that it is a two-story house, is built with two transfer tables and only two entrance tracks, and was designed to accommodate cars fitted with conduit trolley plows. The building is located in one of the best residential sections of Washington, and the exterior was designed to be in keeping with the surroundings. It is rectangular in shape, 537 ft. x 208 ft., and covers an area of 109,000 sq. ft. There are 7900 lineal feet of storage track accommodating 250 cars on the first floor and 3000 lineal feet of storage track in the basement under one end. The exterior walls are red brick trimmed with white brick and limestone. With the exception of the slate roofs of the office building and the tower, in which a 50,000-gal. water

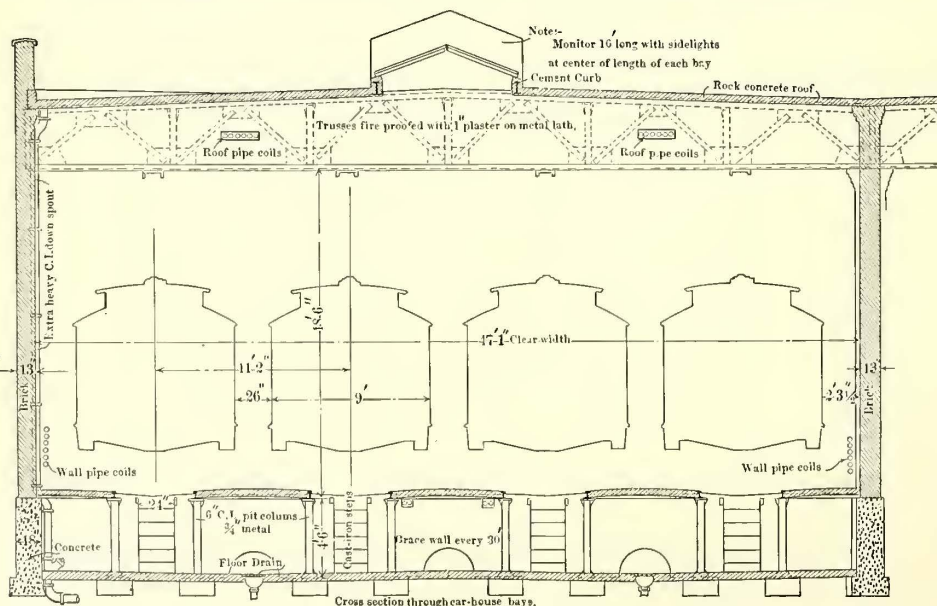


Exterior of York Road Car House, Baltimore

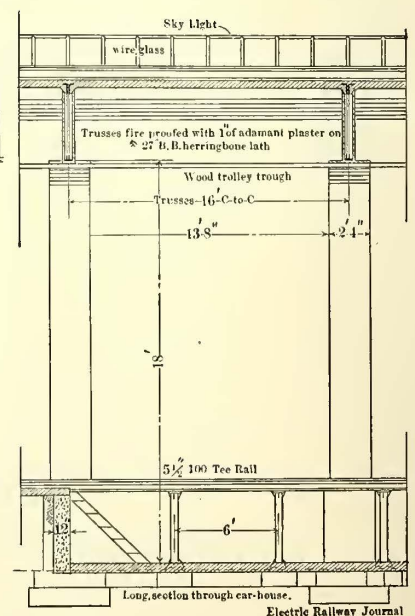
tween cars 9 ft. wide over sheathing. Pits 250 ft. long are built under each storage track, and the space under the aisle floors is open so that inspectors can move from one track to the other under the cars. The pit track rails are 5 1/2-in., 100-lb. T-section, and are supported by 6-in. round cast

tank is built, all the roofs, floors and columns are of reinforced concrete, while the interior partition fire walls are of 8-in. hollow tile.

The site of the building was an abrupt slope, and instead of filling in, the end farthest from the entrance loop was



Cottage Grove Avenue Car House, Chicago—Cross Section of Storage Bay



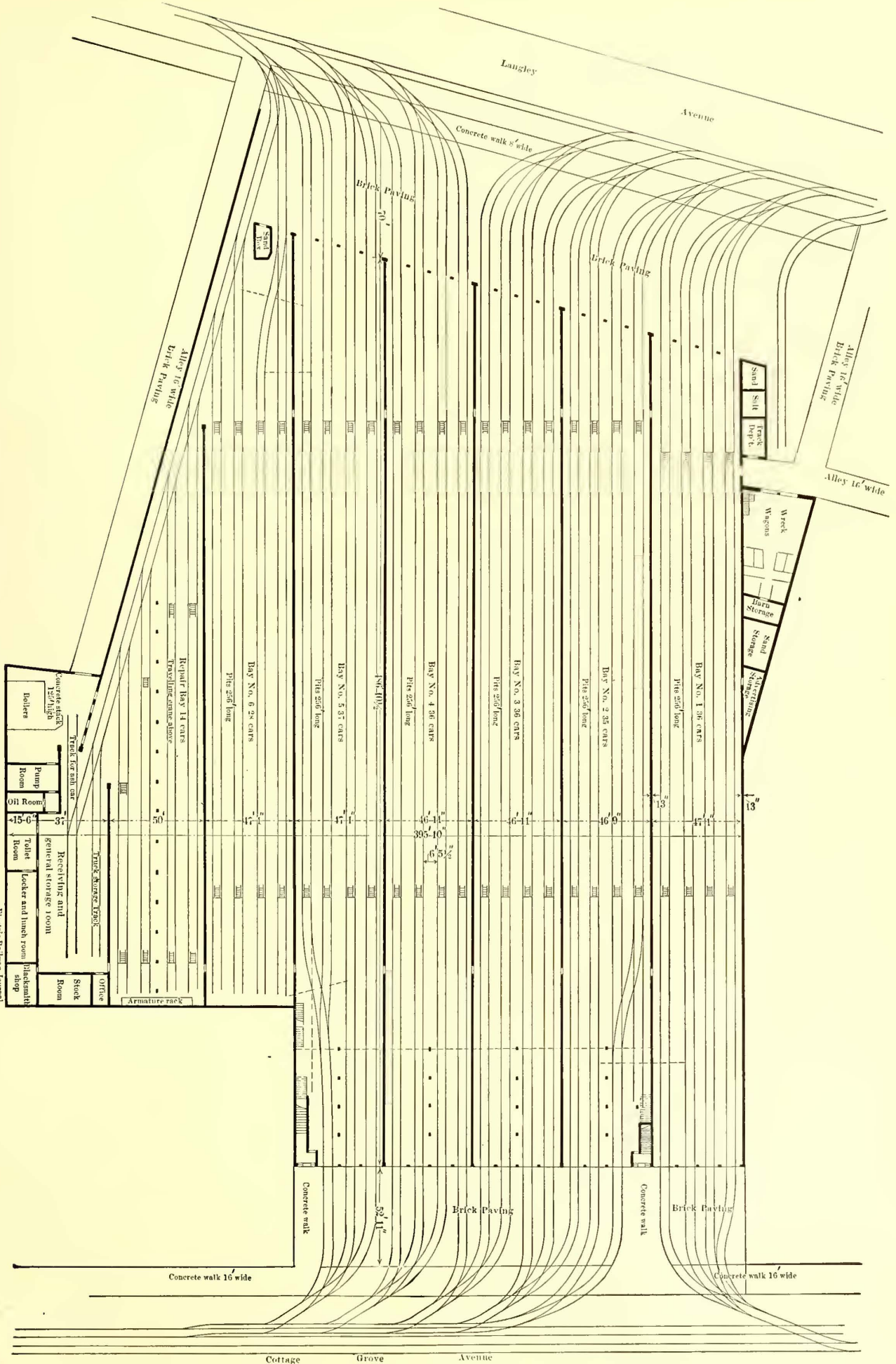
iron columns spaced 6 ft. apart. Aisle floors are 4-in. reinforced concrete slabs carried by the track rails.

The building is heated by the Van Auken vacuum return low-pressure steam system. Steam pipe coils are mounted on the walls 3 ft. above the floor, under the floor of the middle aisle and two banks of six pipes each under the roof of each

made two stories high. The main floor over the basement section was designed to carry 20-ton cars, and is supported by concrete columns 18 in. square and spaced 21 ft. between centers. These columns carry 18-in. x 36-in. reinforced concrete beams on which the pit floors rest.

The roof is supported by 12-in. x 12-in. reinforced con-

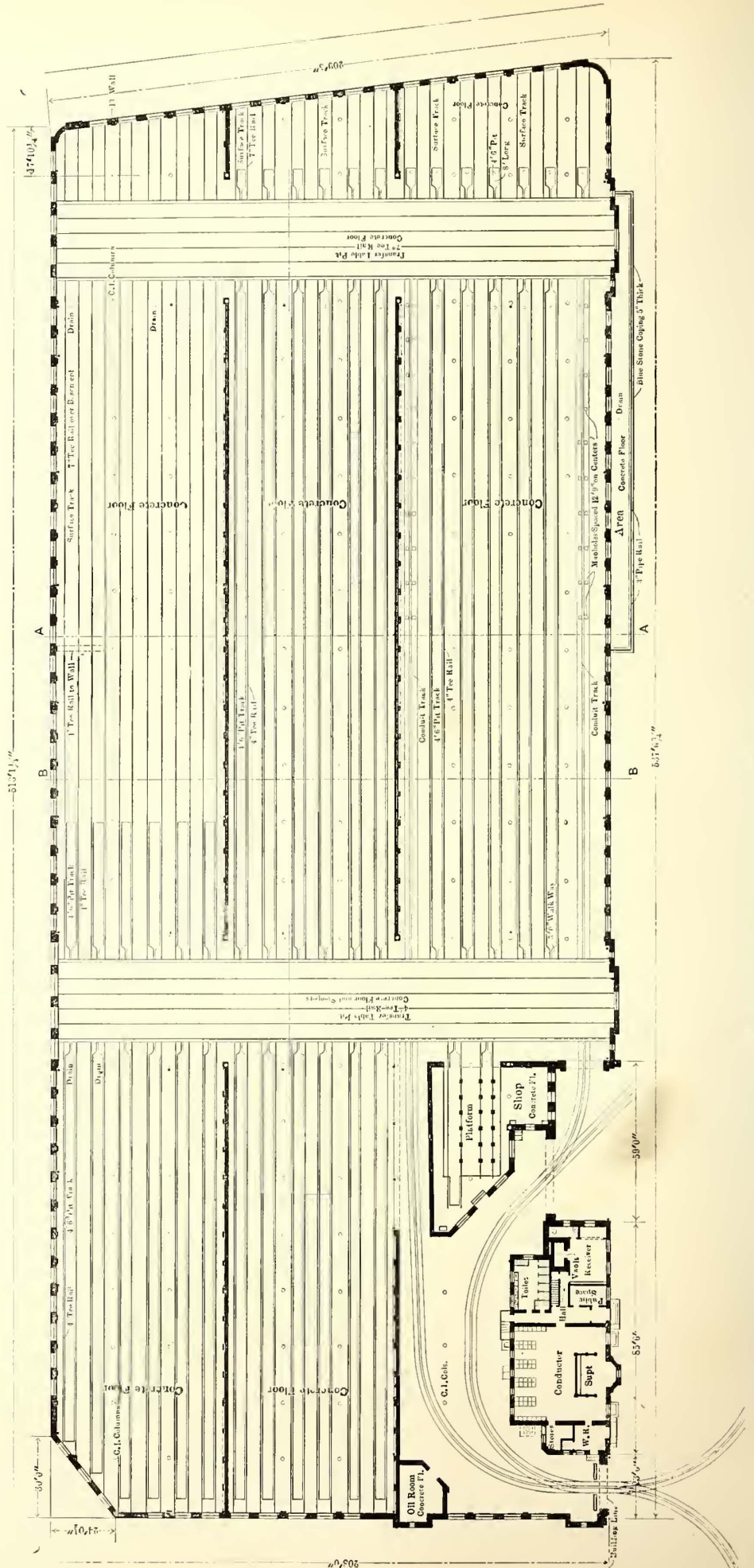
Plan of Cottage Grove Avenue Car House—Chicago City Railway Company



Electric Railway Journal

crete columns spaced 21 ft. apart which carry the 9-in. x 18 1/2-in. concrete roof girders. Over the transfer tables the span of the roof girders is 46 ft. 9 in. and their cross-sectional dimensions in the center are 10 in. x 48 in. The roof slabs are 3 1/2 in. thick, reinforced with 1/2-in. round rods spaced 12 in. center to center. A top coating of slag and pitch is applied. Skylights 9 ft. wide extend the full length of each bay. They are glazed with wire glass held in metal frames and are provided with ventilators placed about 21 ft. apart.

The track arrangement of the first floor is shown on the accompanying plan. Entrance to the house is from the terminal loop of the Fourteenth Street line which passes around the office building. There are two tracks, one on each side of the detached shop building, leading to the first transfer table. These tracks are standard conduit construction, and cars are run onto the first transfer table under their own power. The conduit construction is continued in the extension of these two tracks through the middle section to the second transfer table at the south end of the building. All other tracks in the building have open pits below the solid floors. The tracks with solid floors between are in the west bay and are used for storing dismantled or trail cars. All of the tracks in the middle section slope toward the south to the second transfer on a 2 per cent grade, so that with the momentum acquired on leaving the first transfer table, cars can coast on the open pit tracks to any position desired. In storing cars at night in the middle section, the upper transfer table is placed opposite the entrance track next to the outside wall and cars backed in on it off of the loop. The table is then set opposite the desired storage track and the car is run off to its place. In getting cars out of the house in the morning they are dropped down by gravity to the lower transfer table, which is then placed opposite the east conduit track and the cars run out over the upper transfer table to the spur connecting with the loop. Cars in either of the end sections are moved out

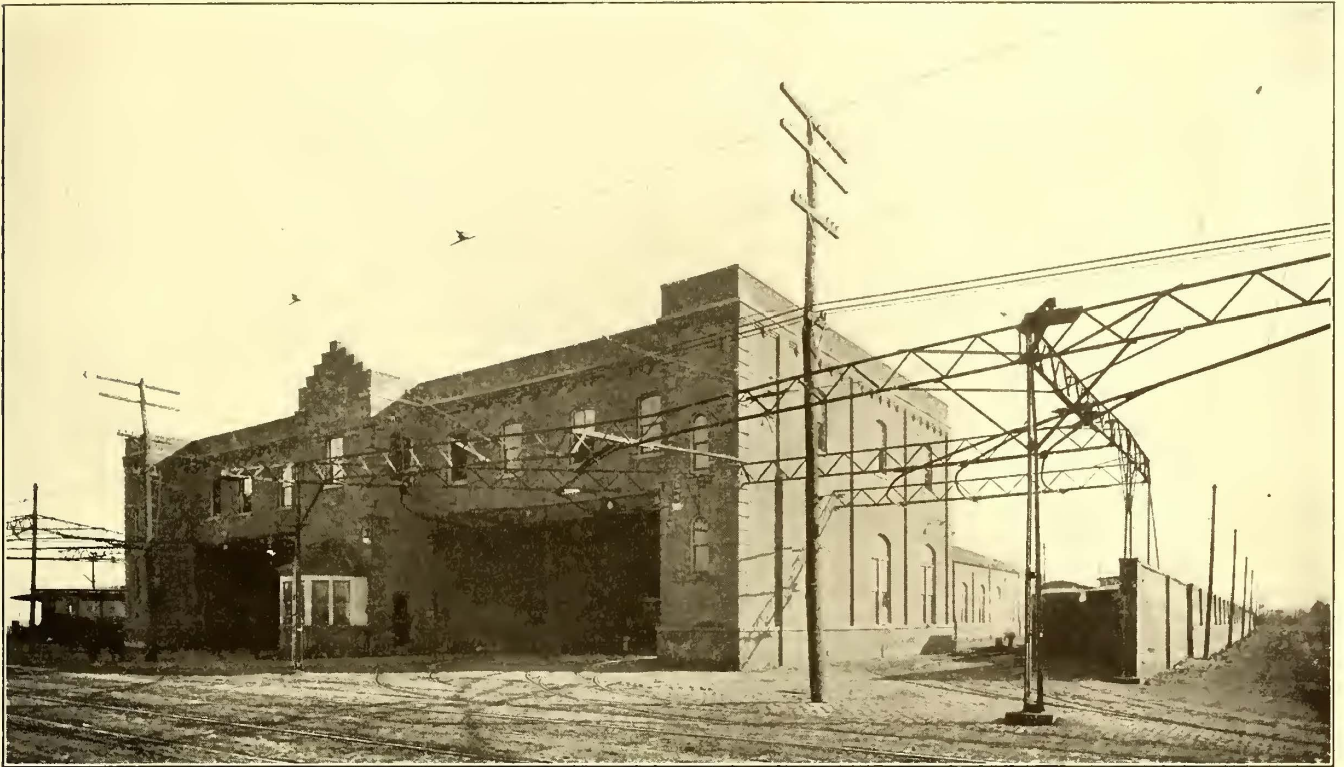


Washington Railway & Electric Company—Plan of Fourteenth Street Car House

by their own power onto one or the other of the transfer tables and placed opposite the proper conduit track. To move cars in these sections the plows are connected to 600-volt outlets in

upper table under their own power by means of the 600-volt flexible lead plow connections already referred to.

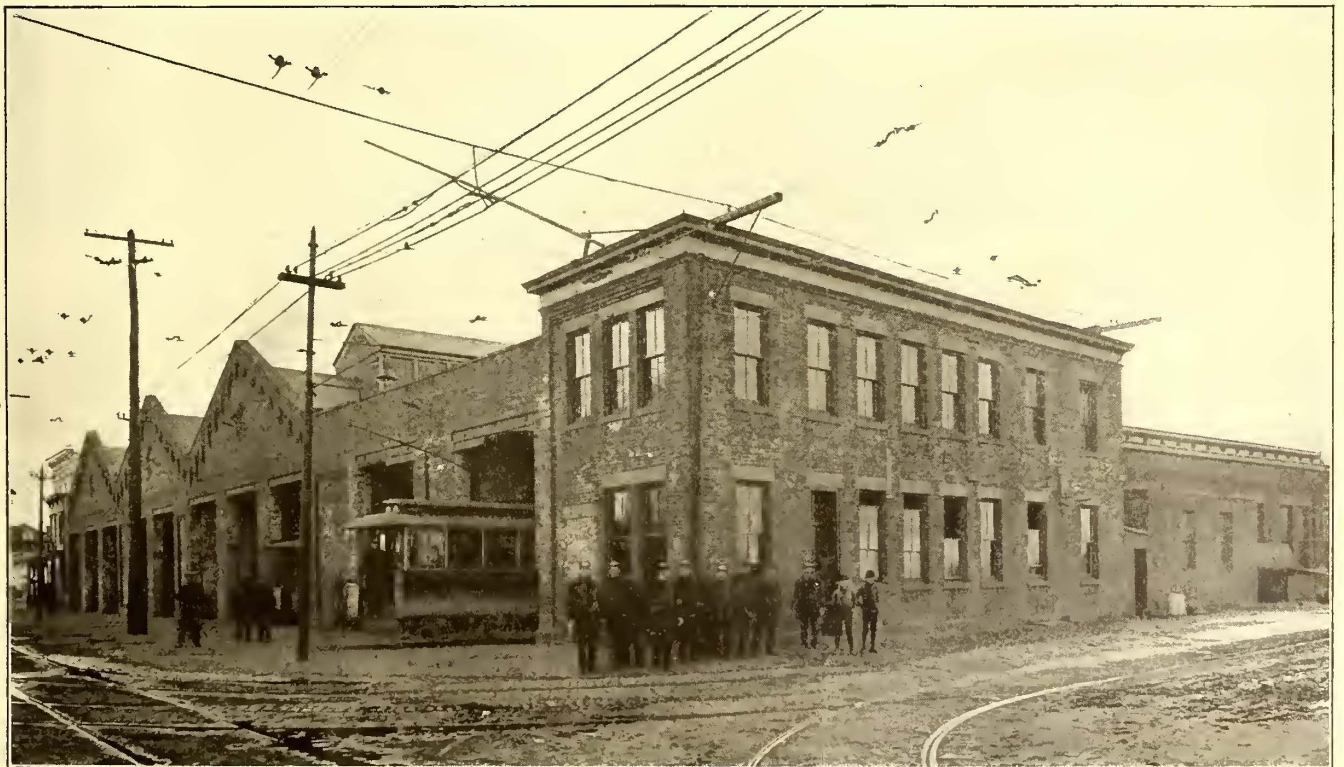
The structure is equipped throughout with automatic aisle



Brooklyn Rapid Transit Company—Flatbush Surface Car Depot

the pits by long flexible leads. Either the upper or lower transfer table can be out of commission without seriously interfering with the operation of the house. If the upper table

sprinklers of the dry-pipe type mounted between tracks 6 in. below the tops of the car windows. There are 1165 sprinkler heads on the first floor and 488 in the basement, located 7 ft.



Brooklyn Rapid Transit Company—Canarsie Surface Car Depot

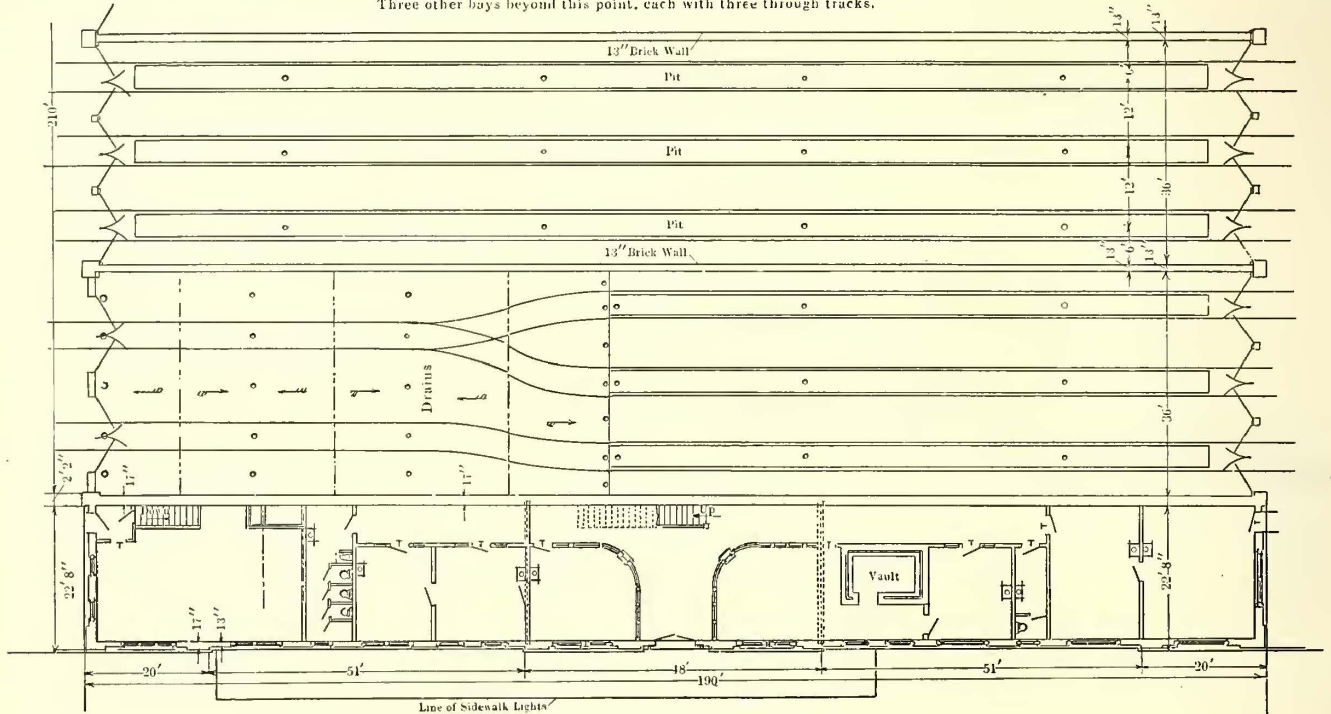
is out of order it is moved to bridge one of the conduit tracks, and the cars are placed by the lower table. If the lower table is out of order cars can be moved up the grade to the

apart on the pipe lines. In addition to this protection, curtain sprinklers are provided across the ends of the storage bays next to the transfer tables. It was not possible, of course, to

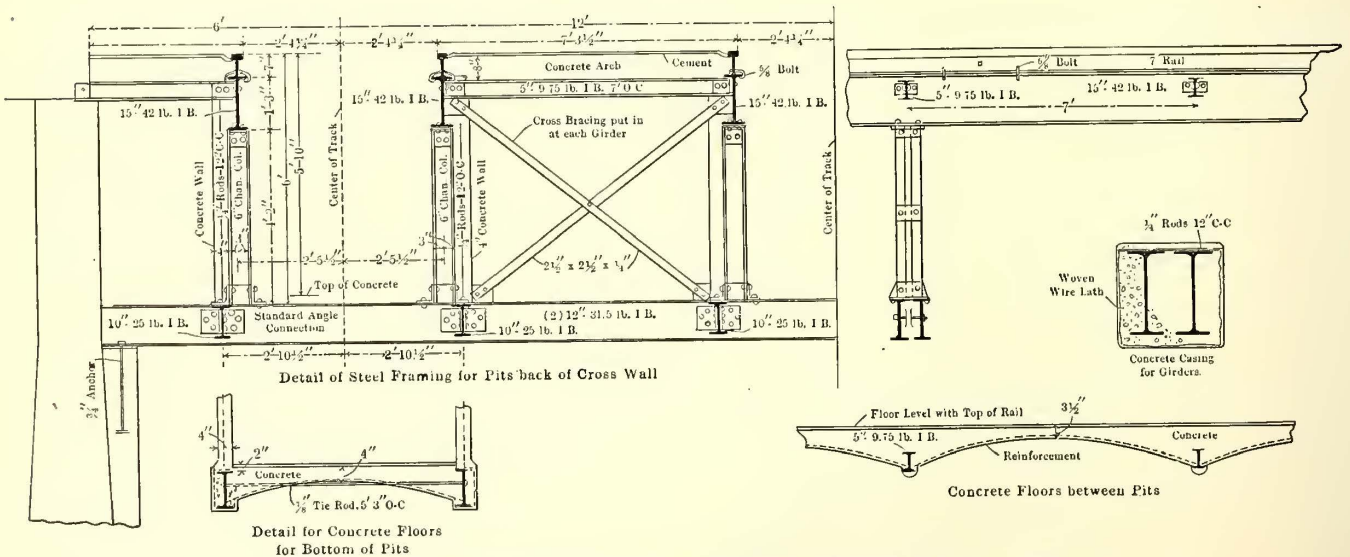
continue the partition fire walls across the transfer table pits and these curtain sprinklers were installed as a substitute. The sprinkler system is connected to the city mains, and also to the 50,000-gal. tank, already mentioned, which is mounted in the tower 25 ft. above the roof. As an auxiliary supply the system is provided with a Siamese connection outside the building to which fire engines can be attached. Standpipe and nozzle connections and hand fire extinguishers are also distributed along the walls at frequent intervals.

containing three tracks. The general offices of the company are located in the two-story addition fronting on Third Street. The exterior walls are of brick with stone trimmings, and the ends of the building are closed with double folding doors containing large windows to admit light. Top light is provided by ample skylights over each bay. The partition walls between bays are 24 ft. high and the peak roof over each bay is supported by steel trusses placed on the partition walls. A typical cross-section of the pits, which are built

Three other bays beyond this point, each with three through tracks.



Chattanooga Railways Company—Part Plan of Central Car House



Chattanooga Railways Company—Details of Car House Pit Construction

The building is lighted throughout with 16-cp incandescent lamps and all wiring is run in conduit. The entire cost of the building was about \$300,000.

CHATTANOOGA, TENN.

The car house of the Chattanooga Railways Company, completed this year, is a composite brick, steel and reinforced concrete structure designed to accommodate 100 cars on 15 through tracks. It covers an area of 210 ft. x 190 ft., and is divided by 13-in. brick fire walls in five sections, each

under each track, is shown in the engravings. The aisle floor is of cement carried on reinforced concrete arches supported by 5-in. I-beam girders between pit walls. The track rails, which are 7-in. T-section, are carried on a 15-in., 42-lb. I-beam longitudinal girder supported by 6-in. channel columns spaced 21 ft. apart and partially embedded in 4-in. concrete pit walls. Diagonal cross-braces tie the pit walls together. The tracks in the storage bays are spaced 12 ft. apart center to center, but in the wash room bay adjoining the offices the two tracks are spread to 16-ft. centers. The

floor in this bay is drained to 22 catch basins. No sprinkler system has been installed in this house.

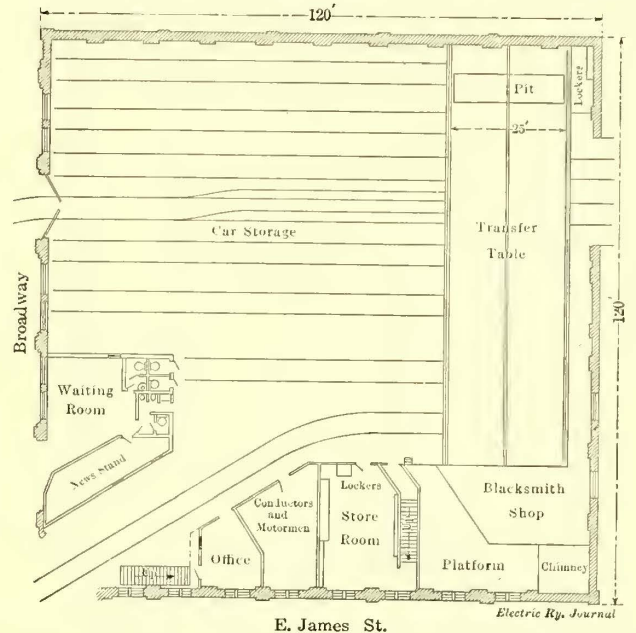
SEATTLE, WASH.

The Broadway car house of the Seattle (Wash.) Electric Company is an example of a small terminal car house. It is a brick building approximately 120 ft. square in which can be housed 27 single-truck cars. The car storage space is on the level of Broadway and below it in the basement is an auxiliary steam power station. There are two track entrances from Broadway leading to the 25-ft. transfer table on which the cars are distributed to the six storage tracks. The superintendent's office, trainmen's room and locker and store room are on one side of the track entering through the corner of the building, and a passengers' waiting room with toilet accommodations and a news-stand are across the track with an entrance on Broadway.

NASHVILLE, TENN.

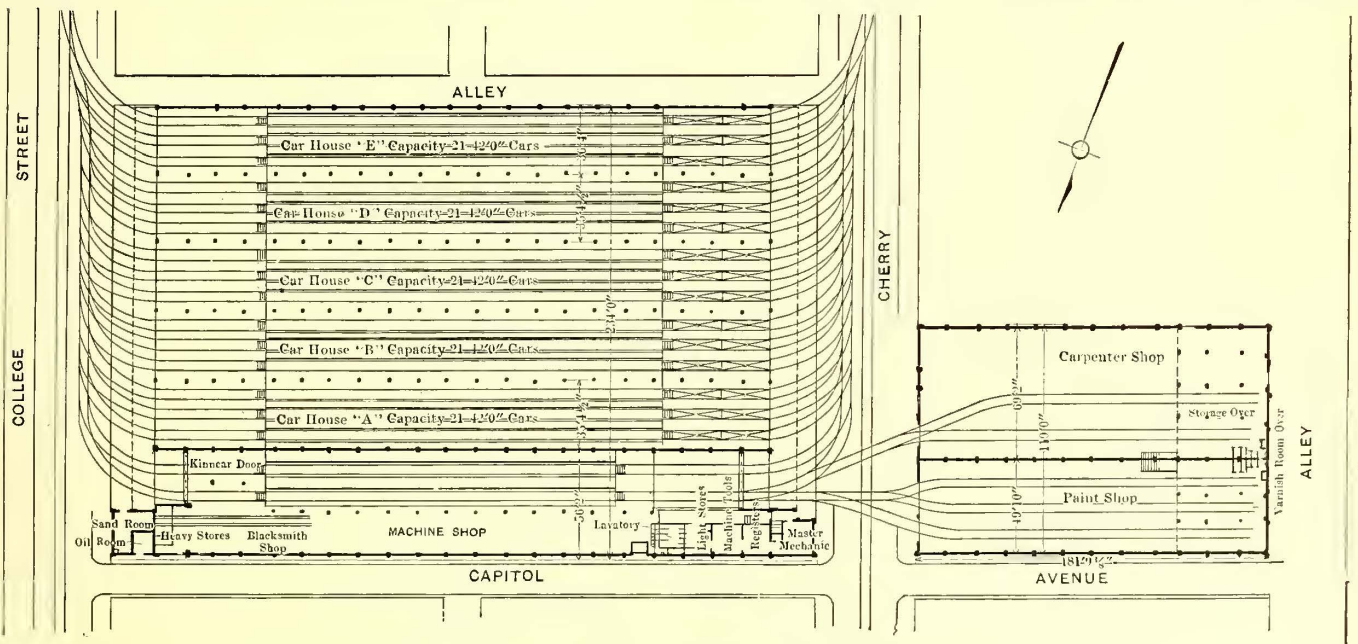
The Nashville Railway & Light Company's new shops and car house are located only one block from the transfer station in the center of Nashville, which is the terminus of cars on all lines. This location was decided on after determining the relative difference in the cost of real estate and the cost of empty car mileage involved with a downtown location and a site on the outskirts of the city. While the car house and main shop building adjoin each other they are separated by a brick fire wall. As the climate in Nashville is comparatively mild the ends of the car house were not closed by doors or walls. The shed contains 15 tracks, each with a capacity for storing seven 42-ft. cars, giving a total capacity for the house of 105 cars. The five sections

cleaning depot. It adjoins the company's main repair shops and is a concrete, fireproof structure 350 ft. x 121 ft., containing six pit tracks in two separate bays. This company stores its cars in the open on yard tracks, having a capacity of 275 cars at one side of and in the rear of the car house.



Seattle Electric Company—Plan of Broadway Car House

The night inspection crew inspects, oils and cleans 160 cars in this house each night, and the day crew handles 40 tripper cars in the same way. The tripper cars and regular cars are



Nashville Railway & Light Company—Plan of Car House and Shops

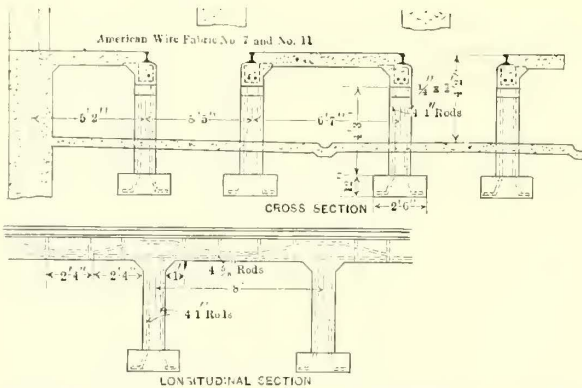
are divided by rows of reinforced concrete columns spaced 15 ft. apart and which support the concrete slab roof. Flat skylights in the roof supply an abundance of top light. For 300 ft. of the length of the storage tracks open pit construction has been used. The rails are carried by rows of cast-iron columns and removable timber floors have been laid in the aisles between tracks. No sprinklers have been used.

MINNEAPOLIS, MINN.

The Snelling Avenue car house of the Twin City Rapid Transit Company is used primarily as an inspection and

changed off each week to give the same average service to all rolling stock. The last 40 cars, which are inspected at night, are left in the house, but are put in service on the first runs in the morning so as to clear the house. The light repair work done consists of inspecting and adjusting brakes and shoes, controllers, electrical equipment and, when necessary, changing trucks. The practice in all of the car houses of the Twin City Rapid Transit Company is to remove bad order trucks and replace them with trucks in good operating condition from a supply kept on hand at each car house. Bad order trucks are sent to the main shop for repairs in trains

of five or six trucks coupled together with temporary coupling bars and hauled by a work car. The motor leads of the rear truck are so connected that if the train should break in two the motors on the rear truck would act as generators and produce a braking effect.



Twin City Car House—Details of Pit Reinforcement

The car house walls are made of hollow concrete blocks 2 ft. long 9 in. thick and 7 3/4 in. high. The outside of the exterior walls is finished with a veneer of cement bricks of standard size. Reinforced concrete girders 40 ft. long support the concrete roof slabs 4-in. thick, which are reinforced with wire fabric and steel rods and are waterproofed with pitch and gravel. All floors are of reinforced concrete.

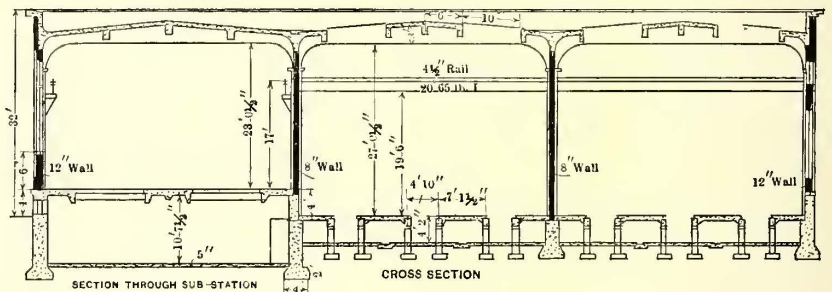
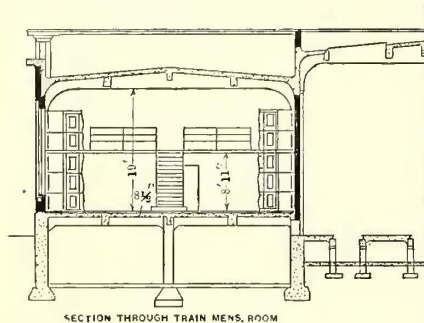
This company has two other older car houses in which sprinklers are used, however.

Two rows of skylights in the roof over each bay provide ample light during the day, and at night the house is illuminated with enclosed arc lamps and Gem 50-watt incandescent lamps fitted with holophane reflector globes. The building is heated with hot air blown through pipes into the pits, from which it rises to heat the remainder of the space above the floor.

FRAMINGHAM, MASS.

The Boston & Worcester Street Railway Company completed last spring a new car house at Framingham, Mass., which embodies all the requirements for fire protection demanded by the exacting code of rules of the Board of Fire Underwriters. These requirements are substantially the same as those recommended by the American Street & Interurban Railway Association and the National Fire Protection Association. The method of heating the building is also novel in several respects and is said to have proved very satisfactory.

The building is 206 ft. long and 86 ft. wide with a roof only 18 ft. above the floor, and is a good example of low first-cost "mill-type" construction. The outside walls are of brick 12 in. thick, and the central partition wall, dividing the house into two separate bays containing three tracks each, is concrete 20 in. thick. This wall is extended at each end 5 ft. beyond the end walls and also 5 ft. above the roof. Along

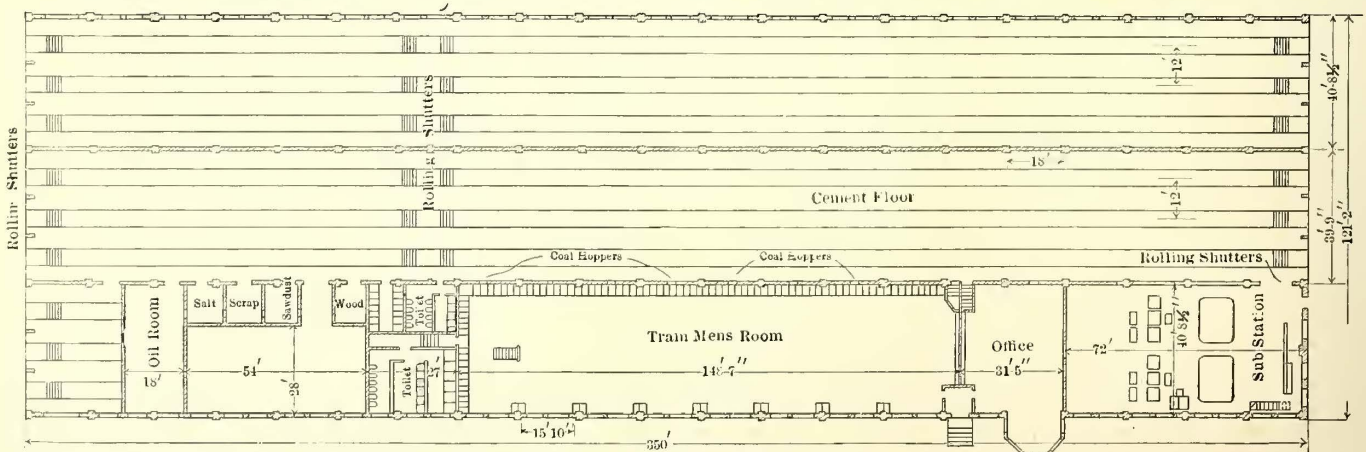


Twin City Car House—Cross Sections

The accompanying drawing shows the method of reinforcing the pit columns and girders supporting the rails and floor slabs.

The outside bay of the car house is occupied by a sub-station room, superintendent's office, trainmen's rooms and

the side of one bay are located the foreman's office, employees' lobby and lavatory, express, line, track, boiler and storage rooms. The house is located several miles from the other car houses and shops of the company, and was designed as a unit plant with provision for storing, inspecting, cleaning,



Twin City Rapid Transit Company—Plan of Snelling Avenue Car House

storeroom for light repair parts, with a basement floor below. All outside openings in the end walls of the car house are closed with Kinnear rolling steel shutters. No sprinkler system has been installed because cars are not stored in the house any longer than is necessary to clean and inspect them.

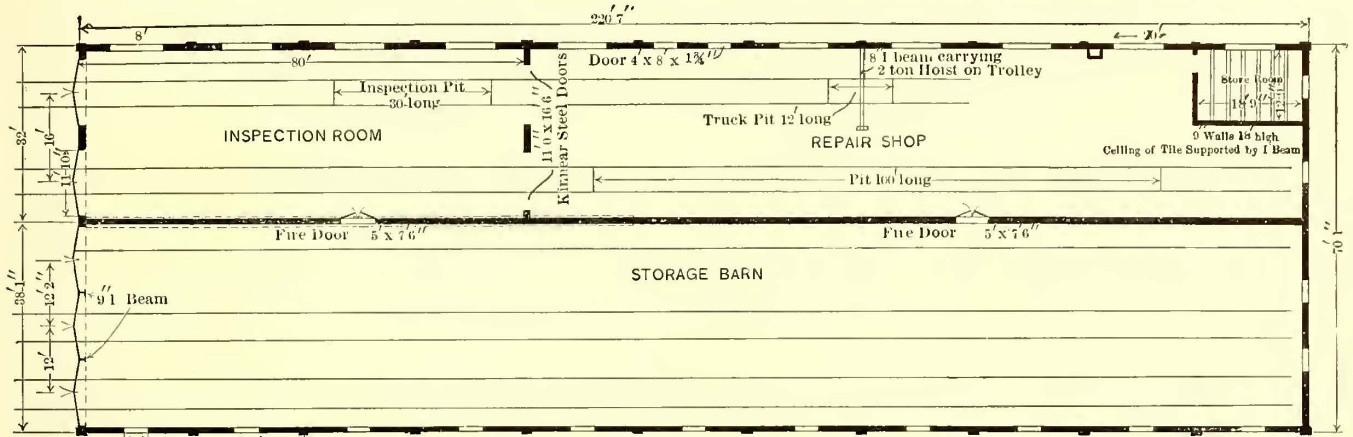
repairing and painting the cars operated from it. Two tracks in the rear of the storage bay are used for painting and the pit tracks in the other bay are used for inspection and light repair work. The wash room is at the front end of this bay. The floor between the working pits is laid with 2-in.



planks resting on the 8-in. x 10-in. hard pine sticks on which the track rails are laid. These beams are supported on brick piers. In the wash room the same construction is used, except that the floor planks are separated 1/2 in. to allow the water to drain through to the concrete floor laid under the entire area of the bay 4 ft. 6 in. below the tracks.

The roof consists of 2 1/2-in. tongued and grooved pine

ply is furnished from an 8-in. city main. The aisle sprinklers are mounted 8 ft. 6 in. above the rails between tracks and are spaced 8 ft. apart, the heads on adjacent lines being staggered. Ceiling sprinklers are spaced 12 ft. center to center in two parallel rows above each bay. There are always attendants at the car house in the day time, and at night a watchman is on duty who makes hourly rounds and records



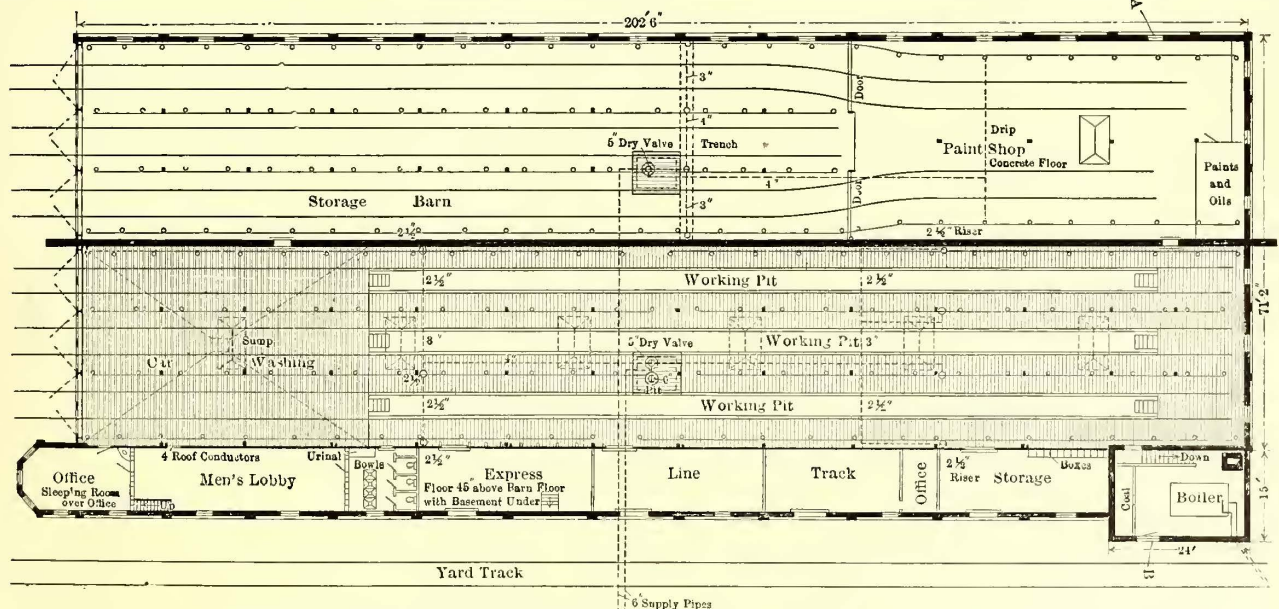
Indiana Union Traction Company—Plan of Division Car House and Repair Shop at Tipton

planks laid on pine rafters supported by two rows of timber posts between tracks. The planks are covered with 5-ply tar paper and a gravel top coat. Six skylights of wire glass in galvanized iron frames are placed in the roof over the working bay and one over the paint shop. Extra high "mill-type" windows are also used in the side and end walls. The end doors are of wood.

The working bay, including the offices, is heated with steam from a boiler mounted in a sunken fireproof boiler room in the rear of the house and a gravity return is used. The boiler is of the cast-iron sectional type for low-pressure

them at a number of points on a watchman's clock. TIPTON, IND.

The Indiana Union Traction Company's division terminal at Tipton, Ind., is a combined storage depot and inspection shop for interurban cars only. It is a brick building with a sloping corrugated iron roof supported by triangular steel trusses resting on the side walls and the central brick fire wall dividing the storage room from the inspection room. The storage room contains three tracks 210 ft. long, on each of which four 50-ft. interurban cars can be stored. Three cars can be stored on one track in the inspection room and four



Boston & Worcester Street Railway Company—Plan of Framingham Car House

steam, which does not require a licensed fireman to operate it. Horizontal heating coils are mounted under the floor between pits for the whole length of the building, but vertical coils are used in the offices and paint shop.

The sprinkler system installed in both the storage and working bays includes both aisle and ceiling sprinklers and, in addition, chemical hand extinguishers, sand and water pails and hydrants with hose attached have been provided. The dry-pipe system is used for the sprinklers and the water sup-

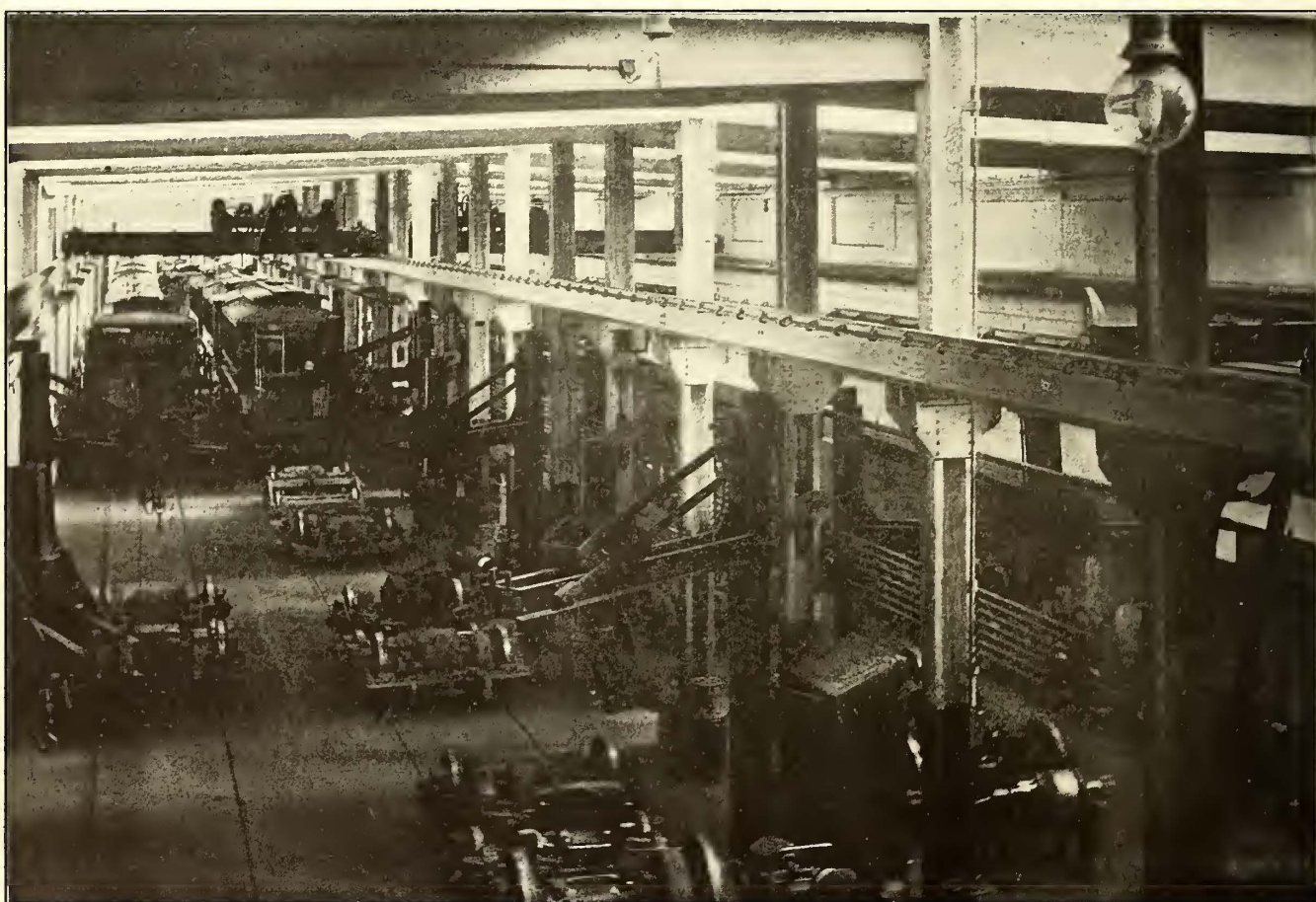
ply is furnished from an 8-in. city main. The car shed has a cinder floor and is not heated. The building is isolated from surrounding buildings and there is practically no danger from fire originating outside of the house. In each section of the building there are 12 pairs of water and sand pails hung from brackets on the walls, and in addition four hydrants with hose and nozzle attached. No fixed lights have been provided in the storage shed. When lights are required at night cluster drops hung from the trolley wire are used.

## CAR REPAIR SHOP DESIGN

THE arrangement and equipment of a main repair shop for an electric railway, like the design of car houses, presents opportunities for wide variations. The conditions affecting the problem are much the same as outlined in the beginning of the preceding chapter, with one important addition, which is the location of the shops with respect to the other property of the company. When the size of the system will permit there are strong arguments for centralizing the repair shop facilities in one plant and relieving the car house forces from any work on the cars except inspection, cleaning and running repairs and adjustments. With a central shop, the question of location is a most important consideration for two reasons. The first involves a study of non-revenue mileage

the approximate grouping and location of the principal machine tools. The construction features of the buildings are relatively unimportant, except in the matter of lighting, heating and ventilating and fire protection. Fire protection is essential in shops as in car houses, because a fire which destroys the shops can cripple the service as much or sometimes more than a fire in a car house.

In the following pages a number of typical modern repair shops, representing four different arrangements, are illustrated and briefly described. The general types included are (1) parallel stub tracks holding from three to six cars; (2) parallel through tracks; (3) parallel stub tracks holding single cars and all connected to a ladder track outside of the build-



Brooklyn Rapid Transit Company—Interior of Ninth Avenue Surface Car Shop

of cars moving to and from the shops. Where the shop is located a considerable distance away from the center of the system excessive non-revenue mileage must be made. The second reason is the tendency to hold cars in service too long before sending them to the shop, if the shop is not easy of access. This results in an increase in the amount of work done in the car houses, where it is more expensive to carry it on, and where the work is less efficiently executed than at the main shop.

The track layout and the relation of the separate buildings or shop departments to each other, is the first consideration in designing a shop after the location has been selected. On this depends the crane and hoist arrangement best suited to the needs of the several departments, and to a large extent

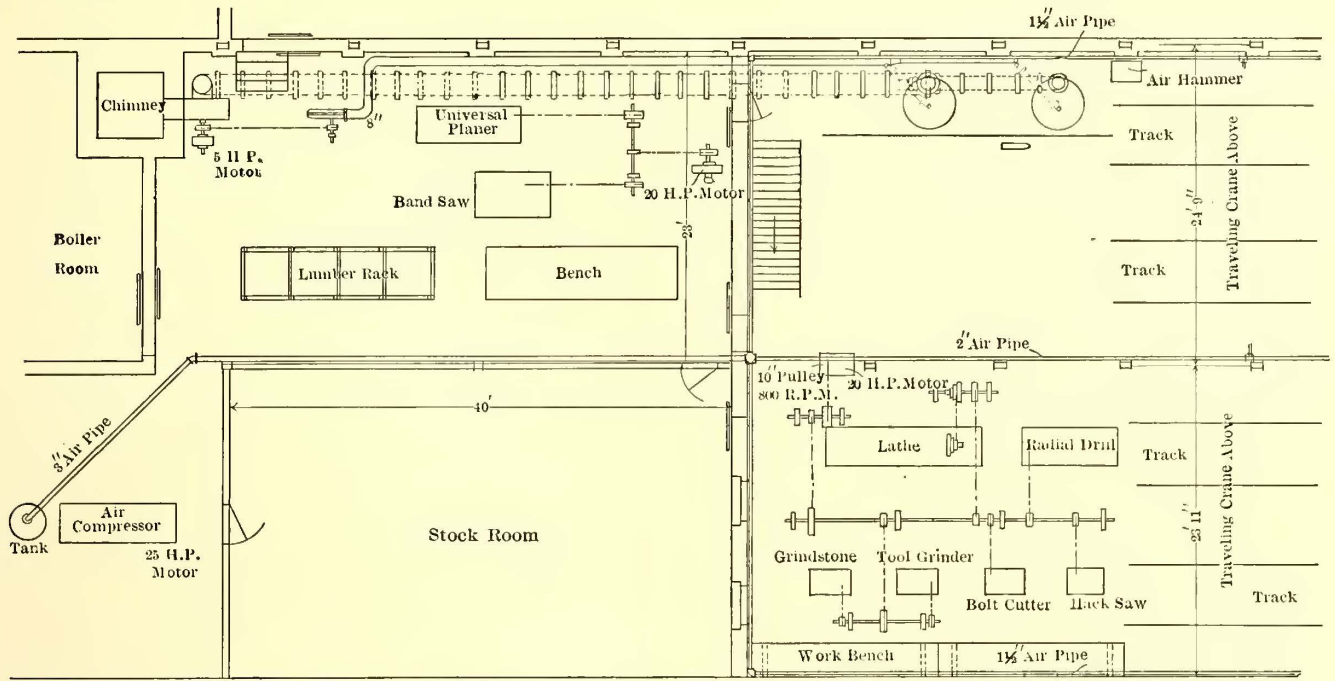
ing; (4) parallel stub tracks connected with a transfer table.

### BROOKLYN

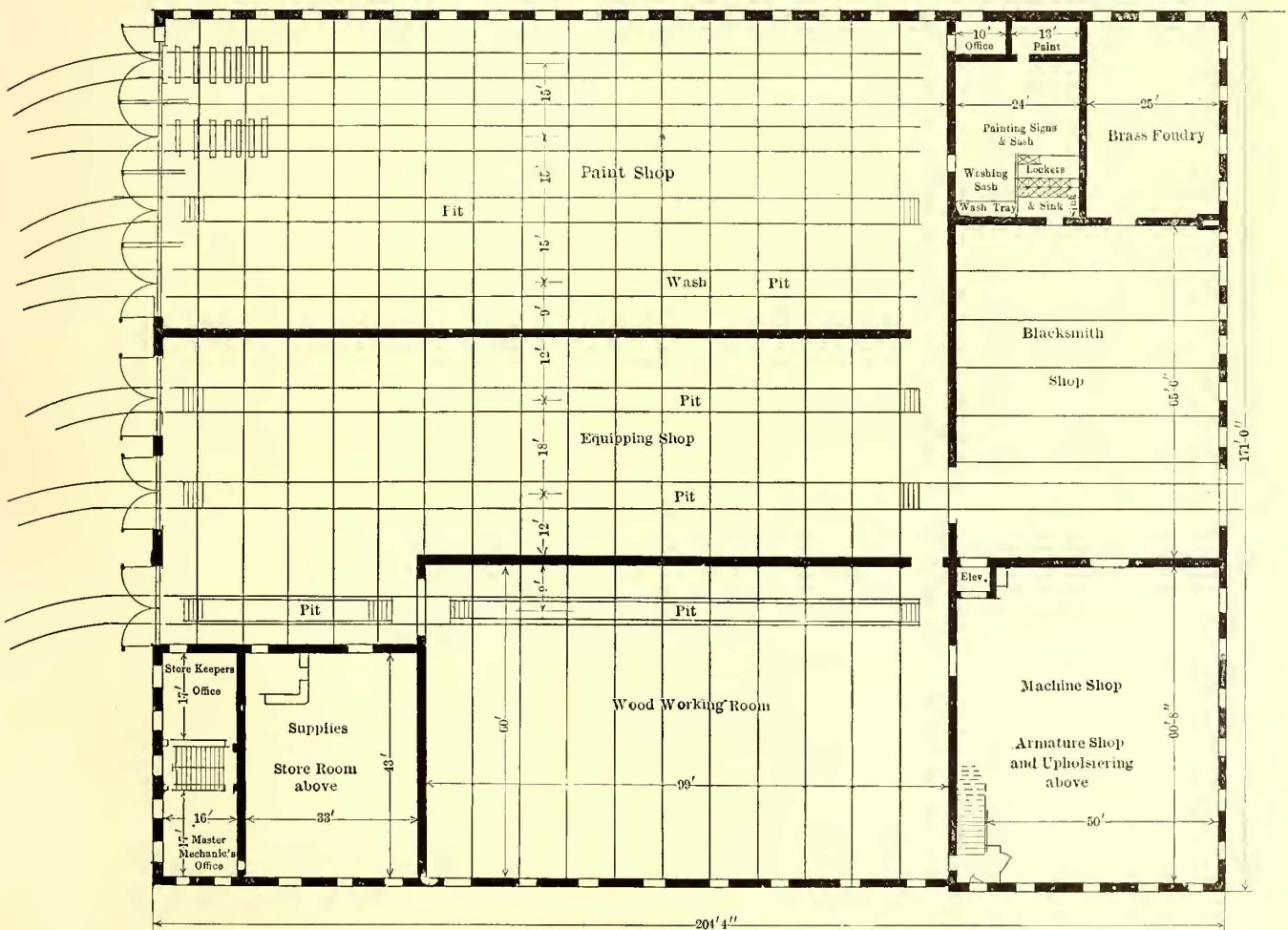
The Ninth Avenue surface car division shop of the Brooklyn Rapid Transit Company is typical of the parallel stub track arrangement. The shop occupies the blind end of the inspection bay of the Ninth Avenue car house. About 225 cars are inspected, cleaned and repaired at this depot, and the shop is equipped to make repairs of any kind required. The entire car house and shop building is of fireproof construction, having brick walls, steel framing, reinforced concrete roof and granolithic concrete floor. The four tracks of the inspection bay terminate on the shop floor. Each pair of tracks is spanned by a 15-ton electric traveling crane, which

is used as a car hoist and for lifting trucks from the inspection pits to the shop floor. The crane runways extend up to the partition wall dividing the machine shop from the wood-working shop, so that the cranes can be used to serve the

machine tools when required. Two tracks in one truck aisle and one track in the other aisle are served by eight 2-ton pneumatic jib cranes, as shown in the illustration from a photograph. These cranes are mounted on pillars supported



Brooklyn Rapid Transit Company—Plan of Ninth Avenue Surface Car Shop



Portland Railroad Company—Plan of Main Repair Shop

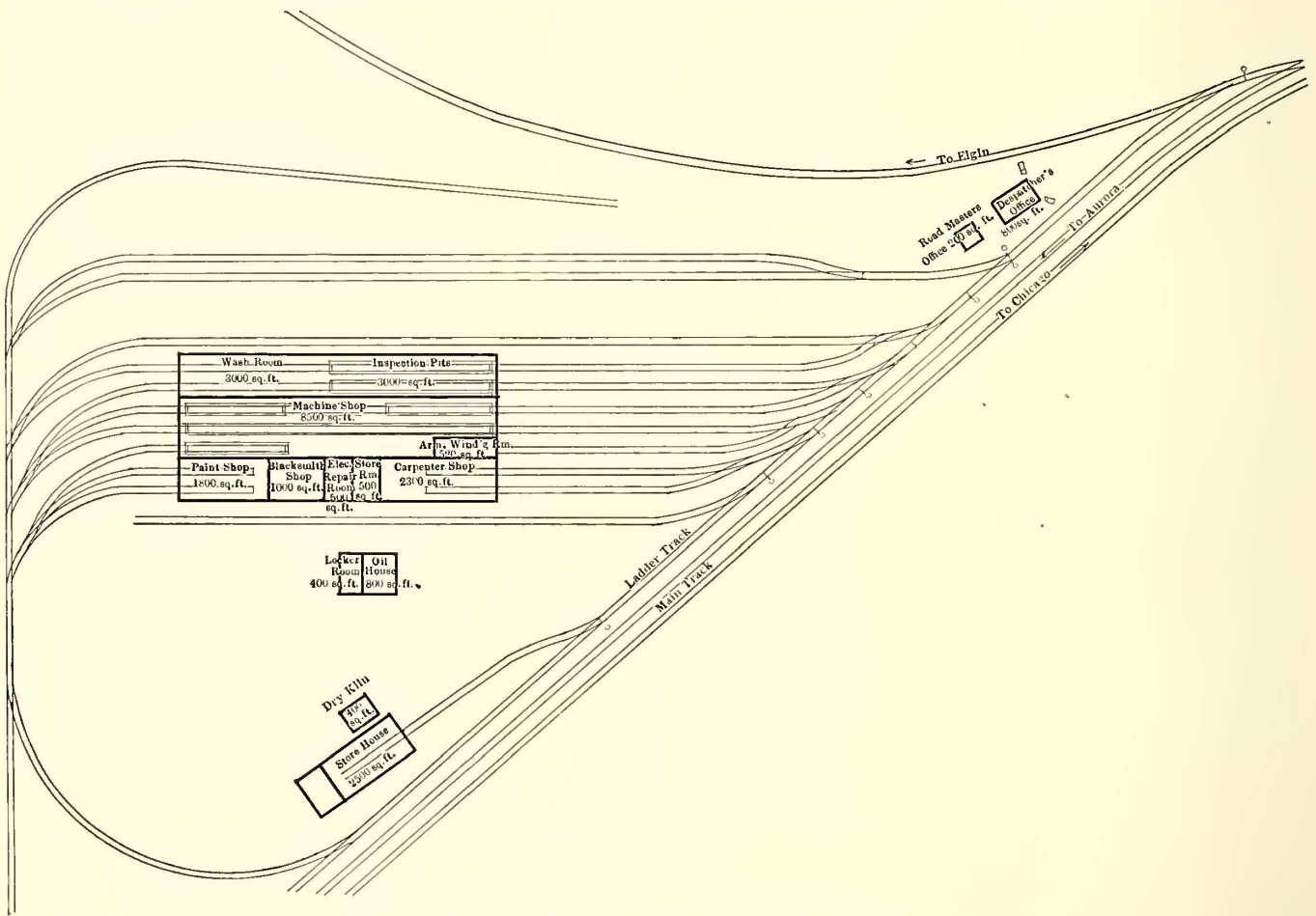
by trunnions on the roof columns. The machine shop occupies a space approximately 24 x 30 ft. It is equipped with the following tools, which are group-driven from line shafting connected to a 20-hp motor:

- |                      |                                  |
|----------------------|----------------------------------|
| 30-in. Engine lathe. | Double emery wheel tool grinder. |
| 36-in. Radial drill. | Single Bolt Cutter.              |
| 36-in. Grindstone.   | 12-in. Power hack saw.           |

The blacksmith shop occupies a similar space at the end of the main truck aisle. The equipment includes a 250-lb. air hammer, two down-draft forges, an anvil and a 10-in. plate and rod hand shears. In the wood-working mill are a hand scroll saw and a universal rip and cross-cut saw and planer. These two tools are driven from a jack shaft, to which a 20-hp motor is belted. A 5-hp motor in this room operates the exhaust and blower fans connected to the forges in the smith shop. The armature and controller repair shop is on a mezzanine floor over the carpenter shop and store room.

up through the roof 2 ft. All openings in these walls are closed with sliding doors held open with fusible links. An automatic sprinkler system has been installed covering the entire floor area of the shops. A 10,000-gallon storage tank mounted on the roof is connected to the sprinkler system, and in addition to this protection, hydrants with hose and nozzle attached are connected to the city water mains. The shops are heated by steam, generated in three low-pressure boilers, which also supply steam to heat the St. John Street car house, which is the adjoining building.

The paint shop along one side of the building contains four tracks, two of which have pits their entire length. One of these pits is used for washing and cleaning the cars. The tracks are spaced 15 ft. apart center to center. Adjoining the paint shop in the rear of the building is a small room, which is used for painting signs and window sash and for washing window sash. Opening off of this room is the paint



Aurora, Elgin & Chicago—Layout of Wheaton Shops

Compressed air for operating the air hammer, pneumatic hoists and other pneumatic tools is supplied by a motor-driven air compressor having a capacity of 135 cu. ft. per minute. The shop is heated by hot air with indirect steam pipe radiation. Enclosed arc lamps are used for general illumination. No sprinklers are installed, but hydrants with hose and nozzles attached and hand extinguishers have been provided.

PORTLAND, ME.

The new shops of the Portland (Me.) Railroad Company are also of the first type mentioned, i. e., having parallel stub tracks, and have an equipment for repairing 230 cars. The building is of brick, 204 ft. x 171 ft., with steel roof trusses supporting a slate roof. It adjoins the St. John Street car house. As shown on the accompanying plan, the several shop departments are isolated by 16-in. brick fire walls extending

storage room, which is entirely surrounded with a 16-in. fire wall carried 4 ft. above the roof. The door of this room is made air tight, and in case of a fire the walls would confine the fire as in a chimney. The sash painting room has no outside light and is illuminated by enclosed arc lamps.

The equipping shop contains two tracks extending the full length of this section and a shorter pit track which extends into the wood-working room. The tracks in this section are placed 18 ft. apart from center to center so as to allow ample room between cars in making repairs. One of the equipping shop tracks is extended through the blacksmith shop and out of the building at the opposite end, and this track serves as a truck aisle. There are four 4-ton hand trolley hoists mounted on I-beam runways over the equipping room and they serve both tracks. They are also used for raising bodies off the trucks.

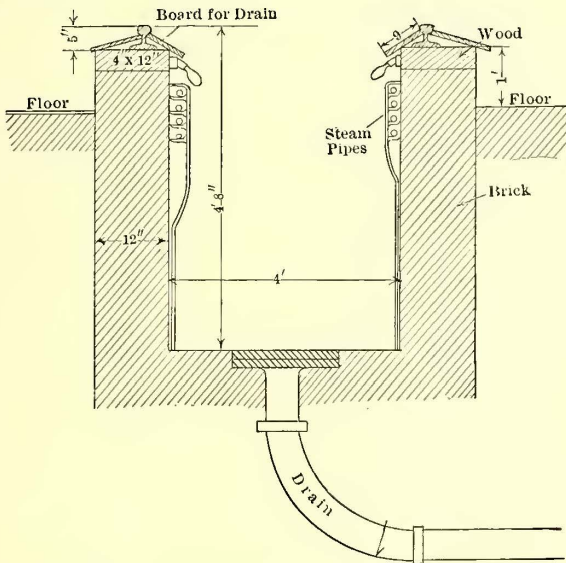
The wood-working mill occupies a space 60 ft. x 90 ft., and contains the following tools which are belted to line shafting driven by a 30-hp motor:

- Circular cross-cut and rip saw.
- Jointer.
- Band saw.
- Grindstone.
- Mortising machine.
- Universal molding machine.
- Planer.
- Surfacer.
- Wood lathe

The machine shop is in the corner of the building back of the wood-working mill. It contains the following machine tools, which are group-driven by a 15-hp motor:

- 125-ton Hydraulic wheel press.
- 24-in. Engine lathe.
- 21-in. Engine lathe.
- Universal milling machine.
- 36-in. Upright drill.
- 9-ft. Planer.
- 36-in. Boring machine.

A 2 1/2-ton trolley hoist runs on an overhead track between the truck aisle in the blacksmith shop and the machine shop. This hoist is used in distributing all heavy parts into the machine shop and is also used in the smith shop for handling heavy forgings.



Wheaton Shops—Detail of Inspection Pits

The blacksmith shop is 50 ft. x 65 ft. 6 in. and is equipped with three forges, one screw machine, one 28-in. drill press and one power hammer. The three forges are supplied with blast by a blower, direct-connected to a 2 1/2-hp motor, and the three machine tools are group-driven by a 10-hp motor. The brass foundry, which has an entrance from the blacksmith shop, is fully equipped with foundry appliances for making small brass castings and for babbitting journal and motor bearings. The crucible furnace is furnished with a galvanized hood to which is attached a ventilating pipe leading up through the roof. Before this ventilator was put in, the heat from the crucible furnace occasionally started the automatic sprinkler system into action.

In the space above the machine shop, on the second floor, are the armature shop and upholstery room. An electric elevator driven by a 10-hp motor connects the machine shop with the floor above, and all armatures and controllers and other heavy parts are handled on this elevator. The equipment of the armature shop includes a banding machine, field-coil winding machine and a 22 1/2-in. engine lathe for truing up commutators. This lathe is served by a 1-ton hand hoist. A steam drying oven has also been supplied for baking coils.

Part of the shop is supplied with daylight from the outside windows and the remainder through monitor skylights. At night the shops are lighted with enclosed arc lamps and with incandescent lamps where concentrated light is needed.

AURORA, ELGIN & CHICAGO

The division shops of the Aurora, Elgin & Chicago Railroad at Wheaton, Ill., are an example of a through track layout. These shops were built to accommodate the third-rail interurban equipment of this road, and at the present time a total of 63 cars are regularly inspected and repaired here. The building is rectangular in shape and is divided into three bays by longitudinal fire walls. The north bay contains two tracks which extend through the building from end to end. The cars are brought in over the inspection pits, which will accommodate two 50-ft. cars, and are then run through to the wash room at the opposite end of this bay where they are cleaned. In the machine shop there are two through tracks and one short stub track, all of which are furnished with pits. Two stub tracks enter the carpenter shop at one end of the third bay and two corresponding stub tracks enter the paint shop at the other end of this bay. These stub tracks are long enough to accommodate one car each.

The walls of the building are of brick and the roof is of composition tarred paper which is laid on matched boards. The roof trusses are of steel.

No automatic sprinklers are used in any part of these shops, reliance being placed on the hydrants connected with the city water mains and on water and sand pails distributed throughout the different departments. The building is heated by steam. Incandescent lamps are used in general for lighting.

There are no trolley hoists or car lifts used in any part of this building. A 10-ton electric traveling crane, spanning the machine shop, is used for any heavy lifting required. This crane has a sufficient lifting capacity to raise one end of a car body in order to remove the truck, and is in constant use for serving the machine tools, which are grouped in the open space shown between the end of the single stub track and the armature winding room at the other end of the building. The machine shop equipment includes the following tools:

- 2 Engine lathes.
- 1 Small screw cutting lathe.
- 1 Wheel lathe.
- 2 Drill presses.
- 1 Shaper.
- 1 Emery grinder.
- 1 Grindstone.

The equipment of the smith shop includes one forge, one power hammer and a power-driven hack saw. In the carpenter shop one universal saw table and one band saw are installed. All of the tools in the machine shop are group-driven by two motors and one motor drives both of the machines in the carpenter shop.

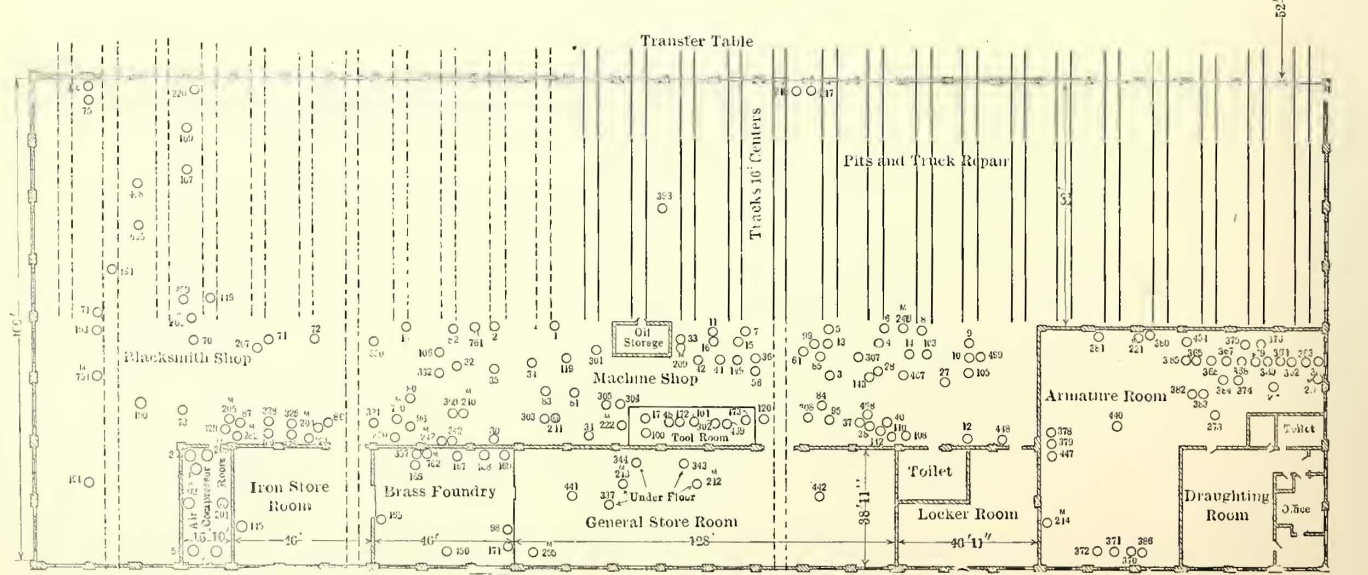
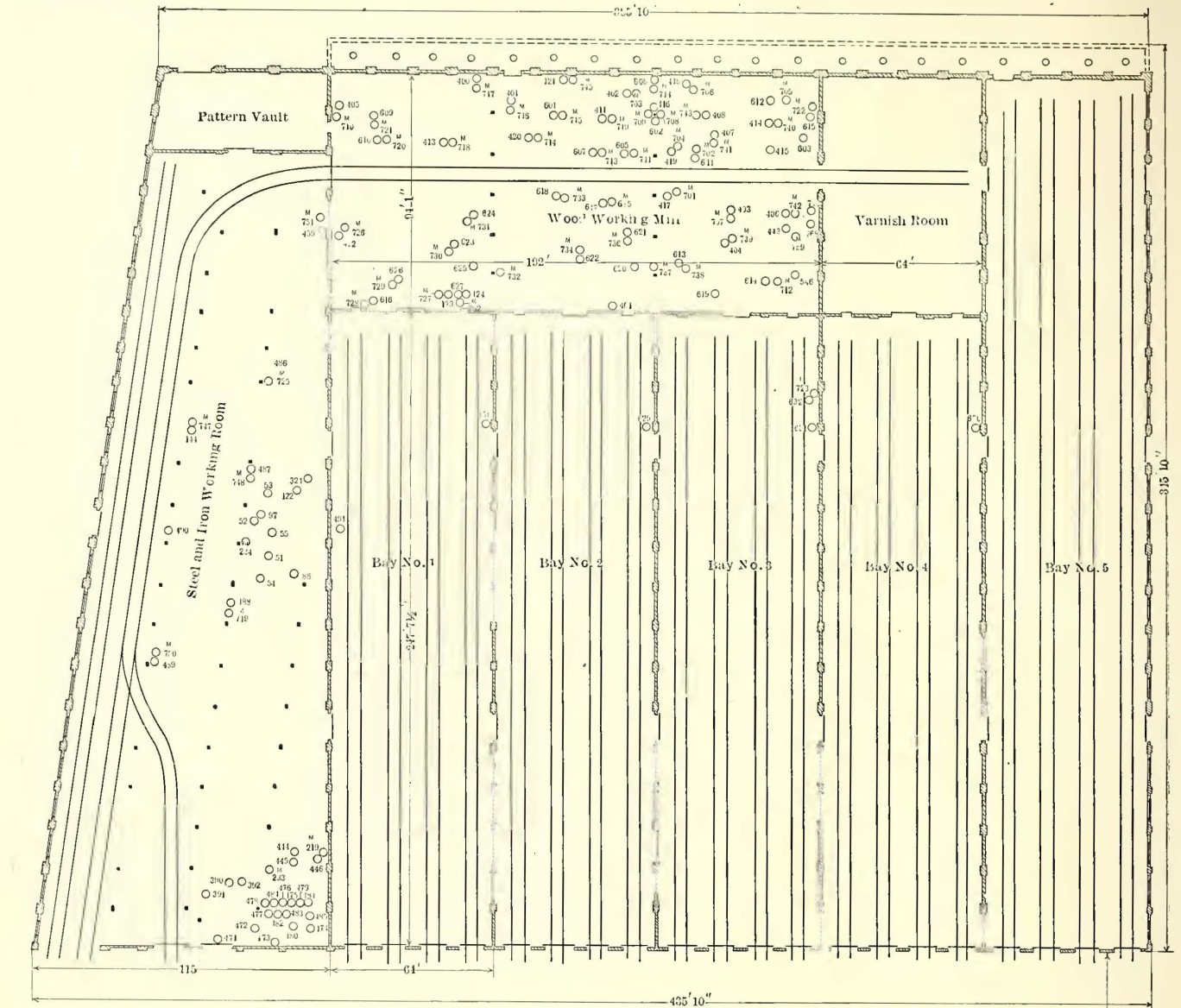
The track layout surrounding these shops presents some features of interest. The shop is located at the junction of the Elgin branch with the main line and the shop ladder track on one side is parallel to the double-track main line. This ladder track forms a complete loop around the shop building connecting both ends of all the shop tracks.

ST. LOUIS

The main repair shops of the United Railways of St. Louis, at Park and Vandeventer Avenues, are one of the best examples of a transfer table layout. The machine shop section on the west side of the transfer table was completed in 1903 and the mill and paint shop section was built in 1907. The shops are fully equipped, not only for repairing the 1500 cars operated by the company, but also for building new cars from the trucks up. The machine shop building is 160 ft. x

436 ft. and contains 27 stub tracks 80 ft. long and spaced 16 ft. apart. It has brick walls, steel roof framing and a saw-tooth roof with nine north skylights. A transfer table pit

trusses. The new shop is divided into six bays, five of which have saw-tooth roofs, and the sixth or steel working shop has a flat roof. The division walls between bays and around the



United Railways of St. Louis—Plan of Shops, Showing Location of Tools

52 ft. wide and extending the entire length of the building separates it from the new mill and paint shop, which is of slow-burning mill construction with brick walls and wood roof

wood-working mill and varnish room are extended up through the roof as parapet walls for fire protection.

The arrangement of cranes and hoists in this shop is very

complete. In the machine shop section, 18 of the 27 repair tracks are equipped with screw car hoists. These consist of a 12-in. I-beam on each side of the track supported on 5-in. screw columns, which extend below the floor and are carried by revolving nuts. These nuts take the form of sprocket wheels, and all four are driven simultaneously with chain drive by a motor mounted in the pit under the floor. A type-K controller near the wall of the building is used for starting and stopping the motor and reversing its direction of rotation.

The light hoisting and conveying in the machine shop is done with 21 pneumatic trolley hoists of 1-ton capacity. These hoists run on a system of overhead tracks formed of

irregular shape, contains the shears, punches, bending rolls, etc., necessary for fabricating the steel underframes and bottom sheathing of the cars. A 10-ton electric traveling crane spans the material tracks along the north wall and is used principally in unloading raw material from cars. A 5-ton electric traveling crane serves the punches, shears, riveters and other machines in this shop. In bay No. 1 adjoining, the steel underframes are assembled, and two 6-ton crane bridges, each carrying two 3-ton hand hoists, are provided for use in erecting. After the steel framing has been completed the cars are shifted to bay No. 5, where the wood-work is completed. Bays Nos. 2, 3 and 4 are used for general body

MACHINE, ARMATURE AND BLACKSMITH SHOPS

STEEL AND IRON SHOP AND WOOD WORKING MILL

1- 18	Engine lathes	242	5-hp motor
27- 28	Engine lathes	245	30-hp motor
30- 38	Drill presses	255	10-hp motor
40- 42	Drill presses	282	10-hp motor
48	Drill press	300-302	Milling machines
56	Drill press	303	Planer
61	Drill press	304-305	Shapers
70	Bulldozer	307	Shaper
71- 72	Upsetting and forging machines	308	Gear cutter
		320	Bolt cutter
73	Pneumatic bending machine	321	Nut tapper
74	Tire bending machine	324-326	Bolt cutters
75	Tire setting machine	328-329	Bolt cutters
80	Car wheel boring mill	330-331	Hydraulic wheel presses
81	Boring and turning mill	332	Axle straightener
82	Horizontal boring mill	339	Blower
83	Slotter	340	Exhaust fan
84- 85	Punch presses	341-342	Blowers
86- 87	Punch and shears	343-344	Heating fans
95	Punch press	357	Blower
96	Car wheel boring mill	360-364	Armature coil machines
98	Bench grinder	365-369	Field winding machines
99	Emery wheel	370-372	Armature banding machines
100-101	Universal grinders	373	GE-800 coil machine
103	Emery wheel	374	Coil winding lathe
105-106	Grind stones	375-376	Reinsulating machine
107-108	Cup grinding machines	377	A. C. field testing magnet
109-110	Emery wheels	378-379	A.C. armature testing magnets
119-120	Emery wheels	380	Transformer
142	Circular metal saw	381	Armature and field coil oven
143	Metal saw	382-383	Square shears
145	Metal saw	384	Coil taping machine
149	Power hack saw	385	Coil winding machine
165	Core oven	386	Armature banding machine
165	Metal melting furnace	440	Electric traveling crane
167-169	Babbitt furnaces	441-442	Pneumatic traveling cranes
171	Gate cutter	447	Hydraulic commutator press
172	Emery wheel	448	Hydraulic press
173	Hand milling machine	449	Pneumatic truck clamp
190-191	Steam hammers	450	Moulding machine
193	Belted trip hammer	459	Pneumatic riveter
201-202	50-hp motors	465	Pneumatic riveter
203	30-hp motor	466	Bending rolls
204-207	25-hp motors	467	Planer
208-211	10-hp motors	468	Milling machine
212-213	30-hp motors	469	Shaper
214	5-hp motor	498	Portable pneumatic shear
217	10-hp motor	499	Bearing-boring machine
218	5 1-2 kw 110 volt generator	540-541	Air compressors
220	10-hp motor	754	10-hp motor
221	Motor-generator, 550 volt d.c.—110 volt a.c.	760	5-hp motor
		761	30-hp motor
222	5-hp motor	762	25-hp motor

51- 55	Drill presses	608	Single-head molder
88	Punch and shear	609	Band saw
97	Drill grinder	610	Universal wood-worker
121-122	Emery wheels	611	Boring machine
123	Automatic knife grinder	612	Carving machine
124	Circular saw sharpener	613	Double cut-off saw
144	Metal saw	614	Combination saw
234	30-hp motor	615	Wood-turning lathe
268	5-hp motor	616	Automatic knife grinder
324	Bolt cutter	617	Combination cut-off saw
400-401	Four-side molders	618	Hand jointer
402	Cabinet tenoner	619	Glue clamp machine
403	Sash and blind tenoner	620	Shaper
404	Sander	621	Molding machine
405	Wood-turning lathe	622	Band saw
406	Four-spindle multiple borer	623	Band rip saw
407	Band saw	624	Double surface planer
408	Scroll saw	625	Panel planer
411	Combination saw	626	Band resaw
412	Cut-off saw	627	Saw roller
413	Self-feed rip saw	628-631	Emery wheels
414-415	Edge-molding machines	632	Tool dressing machine
416	Upright cabinet mortiser	701-702	7 1-2 hp motors
417-418	Hollow chisel mortisers	703-709	5-hp motors
419	Universal wood worker	710	3-hp motor
420	Finishing planer	711	7 1-2 hp motor
443	Portable crane	712	5-hp motor
444-445	Rattan splitters	713	10-hp motor
446	Pneumatic rattan cutter	714	15-hp motor
461	Band saw filer	715-716	7 1-2 hp motors
471	Tinner's brake	717-718	10-hp motors
472	Tinner's square shear	719-721	5-hp motors
473	Tinner's circular shear	722	3-hp motor
474	Tinner's wiring machine	723	1-hp motor
475-476	Tinner's burring machines	725-727	5-hp motors
477	Tinner's grooving machine	728	3-hp motor
478	Tinner's beading machine	729-730	20-hp motors
479-480	Tinner's turning machines	731	50-hp motor
481	Tinner's setting-down machine	732	25-hp motor
482	Tinner's crimper and grooving machine	733	10-hp motor
483-484	Tinner's folding machines	734	15-hp motor
485	Tinner's rolling machine	735	10-hp motor
486	Punch	736	25-hp motor
487-489	Punches and shears	737-739	15-hp motors
490-491	Pneumatic riveters	740	10-hp motor
546	Air compressor	741	5-hp motor
601	Finishing planer	742-746	2-hp motors
602	Upright cabinet mortiser	747	5-hp motor
603	Shaper	748-750	10-hp motors
605	Hand jointer	751	150-hp motor
607	Automatic saw	758	1-hp motor
		759	30-hp motor

United Railroads of St. Louis—Tool List of Repair Shops

10-in. I-beams suspended from the roof trusses. A continuous track runs the entire length of the shop above the inner end of the repair tracks, and branches turn off of this main runway over each of the repair tracks and over the armature shop, machine shop and blacksmith shop, serving all of the heavy tools. This arrangement has proved very satisfactory as it has great flexibility and capacity.

In the new shop across the transfer table a comparatively simple crane and hoist arrangement has been provided. This shop was built primarily to give facilities for repairing car bodies and building the new type of semi-steel car bodies now standard on this company's system. The north bay, which is of

repair work and painting. No cranes have been installed.

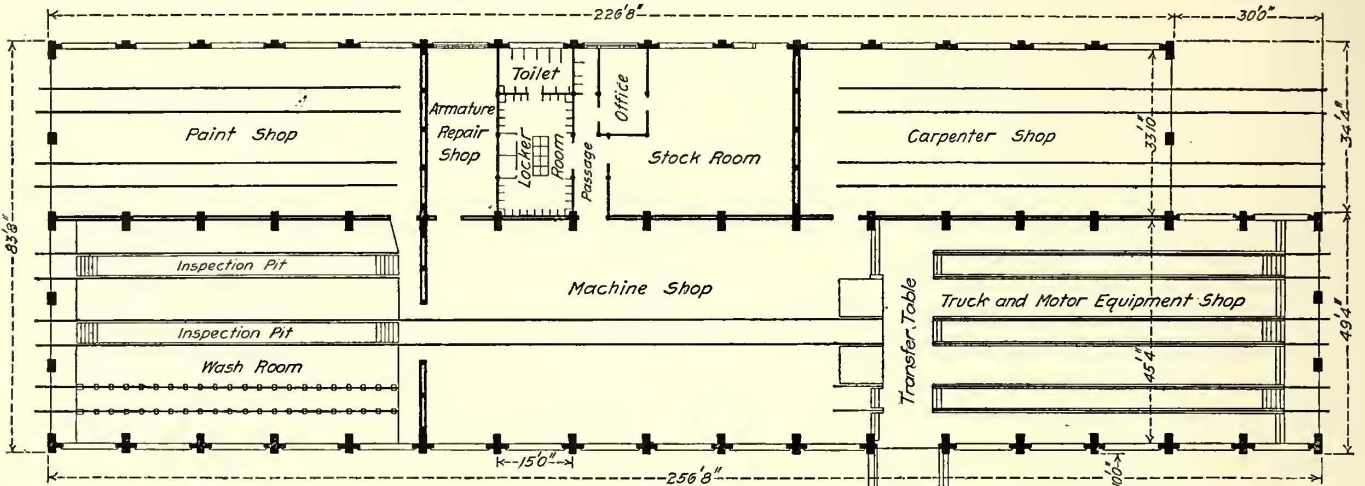
The equipment of machine and wood-working tools in this shop is very complete. On the plan the location of all tools and driving motors is shown by numbered circles, to which the accompanying table is a key:

The machines in the machine, armature and blacksmith shops, as indicated on the plan, are group-driven by motors ranging in size from 5 hp to 50 hp. In the mill and iron shop in the new building all tools are driven by individual motors of from 2 hp to 50 hp. These motors are placed in concrete pits under the floor, and the covers to these pits are provided by a glass protected by an iron grating through which

the commutators may be seen and any trouble detected before it becomes serious.

basement supply steam. The shop is lighted with both arc and incandescent lamps. No sprinklers are installed, but 15 hydrants with hose and nozzle attached have been distributed

The machines in the wood-working mill are so arranged



Washington, Baltimore & Annapolis—Plan of Academy Junction Shops

that the material moves toward the varnish room as the work progresses. A track runs through the center of the mill from north to south, and stock is hauled from the lumber yard to the several machines on special flat cars. The mill has a complete dust collector system with a double 80-in. exhaust

about the building and fire buckets and water barrels are also provided.

These shops employ a total of 442 men, divided among



Washington, Baltimore & Annapolis—Exterior of Academy Junction Shops

fan driven by a 150-hp motor, and the shavings can be delivered either to a storage tank or to the boiler room of the heating plant. The mill is heated by direct radiation from steam pipe coils mounted on the walls. Two 150-hp boilers in the

some of the principal departments as follows: Blacksmith shop, 40; wood-working mill, 31; machine shop, 56; paint shop, 32; truck repairs, 26; car body repairs, 100; armature shop, 48; fog shop, 35.



## WASHINGTON, BALTIMORE &amp; ANNAPOLIS

The general shops of the Washington, Baltimore & Annapolis are located at Academy Junction, which is approximately the geographical center of the system. In general arrangement they resemble somewhat the Aurora, Elgin & Chicago shops already described. The carpenter and paint shop each contain two stub tracks long enough to accommodate one car. They are in the same bay at opposite ends of the building and are separated by the offices, store room and armature shop. The inspection pits, machine shop and truck and motor overhauling shop are in the adjoining bay, which is wider and higher. One track of the three in the inspection room is used as a wash track, and the middle track is extended past the pit and through the division fire wall into the

The shop building is of fireproof construction and is built with reinforced concrete walls and roof and cement floors. It is equipped throughout with ceiling sprinklers supplied with pressure from the overhead tank shown in the illustration of the exterior of the building. The pits are heated with hot air.

## INDIANA UNION TRACTION COMPANY

The Anderson shop plant of the Indiana Union Traction Company is one of the largest and best equipped of interurban railway repair shops. It was completed less than a year ago, and is interesting chiefly on account of the somewhat unusual track and crane arrangement employed and the method of lighting. The shop is located on a triangular plot south of the main power house in North Anderson, which is close to the geographical center of the system. The shop tract is



Washington, Baltimore & Annapolis—Interior of Machine Shop

machine shop. At the other end of this bay the motor and truck shop contains three stub pit tracks terminating at the inner end with a transfer table pit. These tracks and the machine shop are served by a 15-ton electric traveling crane, which is used as a car hoist when it is necessary to remove the trucks from under a car. The transfer table is only long enough to hold one truck. The pit extends into the blacksmith shop, which is in a detached building and the transfer table is used in moving truck frames or other heavy forgings between the machine and smith shops. Two portable jib cranes with chain block hoists are provided in the machine shop for handling light work on the machines. These cranes can be mounted on any of the brackets attached to each of the pilasters in the walls.

bounded on one side by Meridian Avenue, which is laid with double track and is used by a line of city cars and by cars of the Anderson-Wabash interurban division. A diagonal ladder track on the east side of the shops connects with Meridian Avenue and another ladder across the north end of the building is also provided. There are 18 parallel shop tracks leading from this latter ladder track, five of which run through the buildings and connect at the lower end with the diagonal ladder track on the east side. The other 13 shop tracks are all stub-ended and extend into the buildings only about 75 ft.

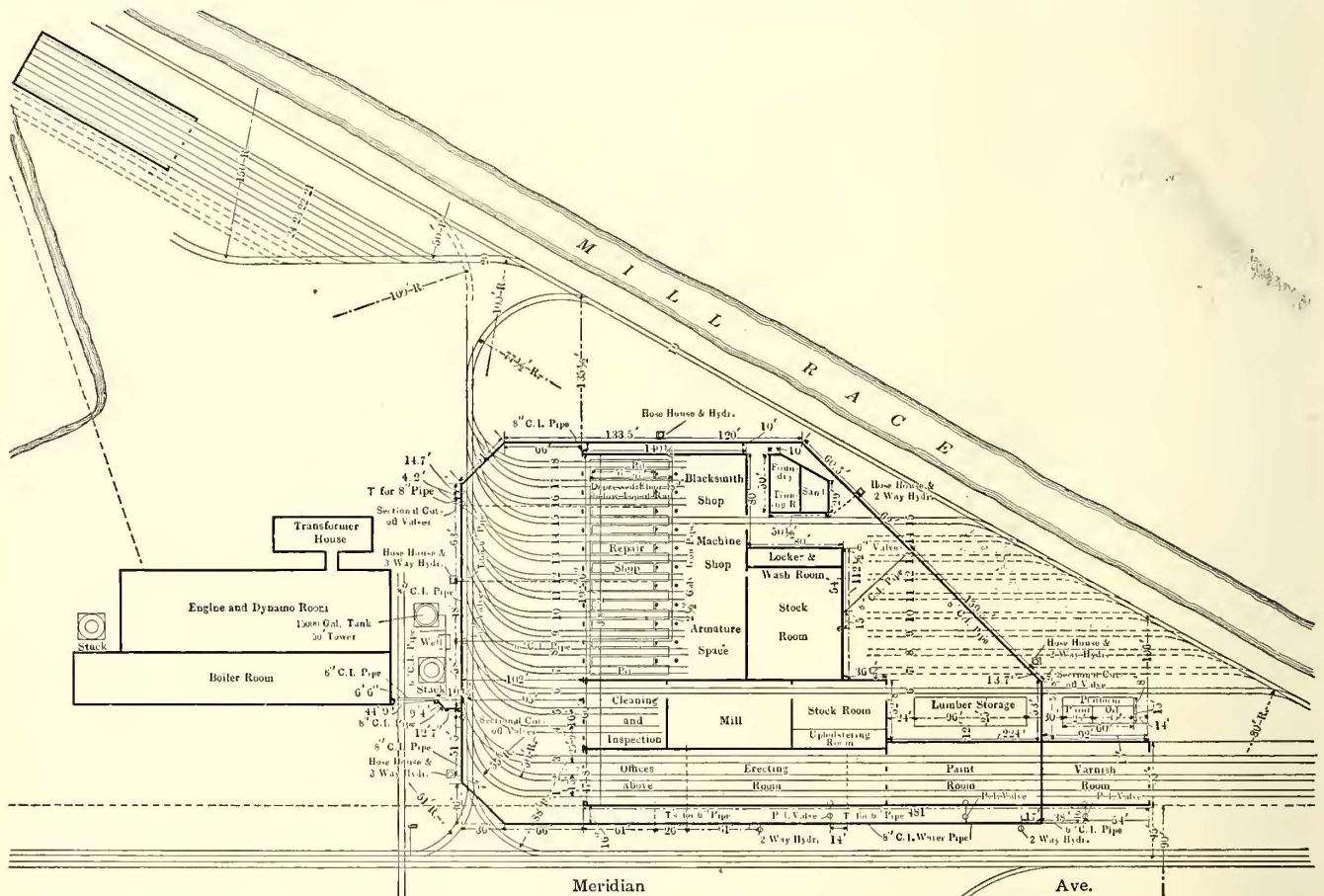
The shop is practically one building, 300 ft. wide and 481 ft. long, the several departments being separated by fire walls. The construction is brick walls on concrete foundations with steel roof trusses and supporting columns. The main repair

shop occupies more than half of the width of the building across the north end and contains 12 pit tracks, which are extended across a lateral truck aisle into the machine shop space. The pits are 67 ft. long and are spaced 16 ft. center to center. The aisles between are depressed 18 in. below the pit rails for convenience in making repairs to trucks. In the remaining space back of the truck aisle are the smith shop, machine shop and armature winding departments. In the adjoining bay there are three inspection and wash tracks, one of which is a through track running through the wood-working mill, store room and lumber shed. The erecting shop, paint shop and varnish room are in the third bay parallel to Meridian Avenue and contain three through tracks. A partition wall with rolling steel shutter doors separates the erecting shop from the paint shop. The south end of the paint shop is used for varnishing, which is the last shop operation.

heavy repairs, and even building new cars. The following is a list of the principal tools:

- |                               |                                      |
|-------------------------------|--------------------------------------|
| 42-in. wheel lathe            | Band saw                             |
| 200-ton wheel press           | Rip saw                              |
| 36-in. boring mill            | Cross-cut saw                        |
| 10-ft. bed planer             | Combined jig saw and shaper          |
| 24-in. shaper                 | Universal wood-worker                |
| 24-in. radial drill           | Two-spindle shaper                   |
| 20-in. radial drill           | Four-head tenoner                    |
| Sensitive drill presses (two) | Mortiser and borer                   |
| 36-in. lathe                  | Wood lathe                           |
| 14-in. lathe                  | Molder                               |
| 2 1/2-in. bolt cutter         | Four-cylinder surfacer               |
| Circular metal saw            | Automatic knife grinder              |
| Hack saw                      | Down-draft forges (four)             |
| Coil taping machine           | Power hammer                         |
| Field taping machine          | Brass foundry outfit                 |
| Banding machine               | Portable vacuum car cleaning machine |
| Vacuum impregnating outfit    |                                      |

The shops are heated by the Evans-Almirall system of



Indiana Union Traction Company—Plan of Anderson Shops

A unique car hoist and crane arrangement is used in the main repair shop. Four 5-ton electric trolley hoists are provided, running on the bottom flanges of 12-in. I-beam runways hung from the bottom chords of the roof trusses between each pair of pits. Over the truck aisle across the inner end of the pits are two transfer bridges also carrying a 12-in. I-beam at the same level as the beams between pits. By means of these transfer bridges the trolley hoists can be shifted to any of the runways between pits. These hoists are used to raise car bodies in changing trucks and when carried on one of the transfer bridges over the truck aisle are used in making truck repairs. A 15-ton electric traveling crane spans the machine shop, smith shop and armature shop and is used for all heavy lifting, transporting armatures, heavy forgings and getting work into and out of the machines.

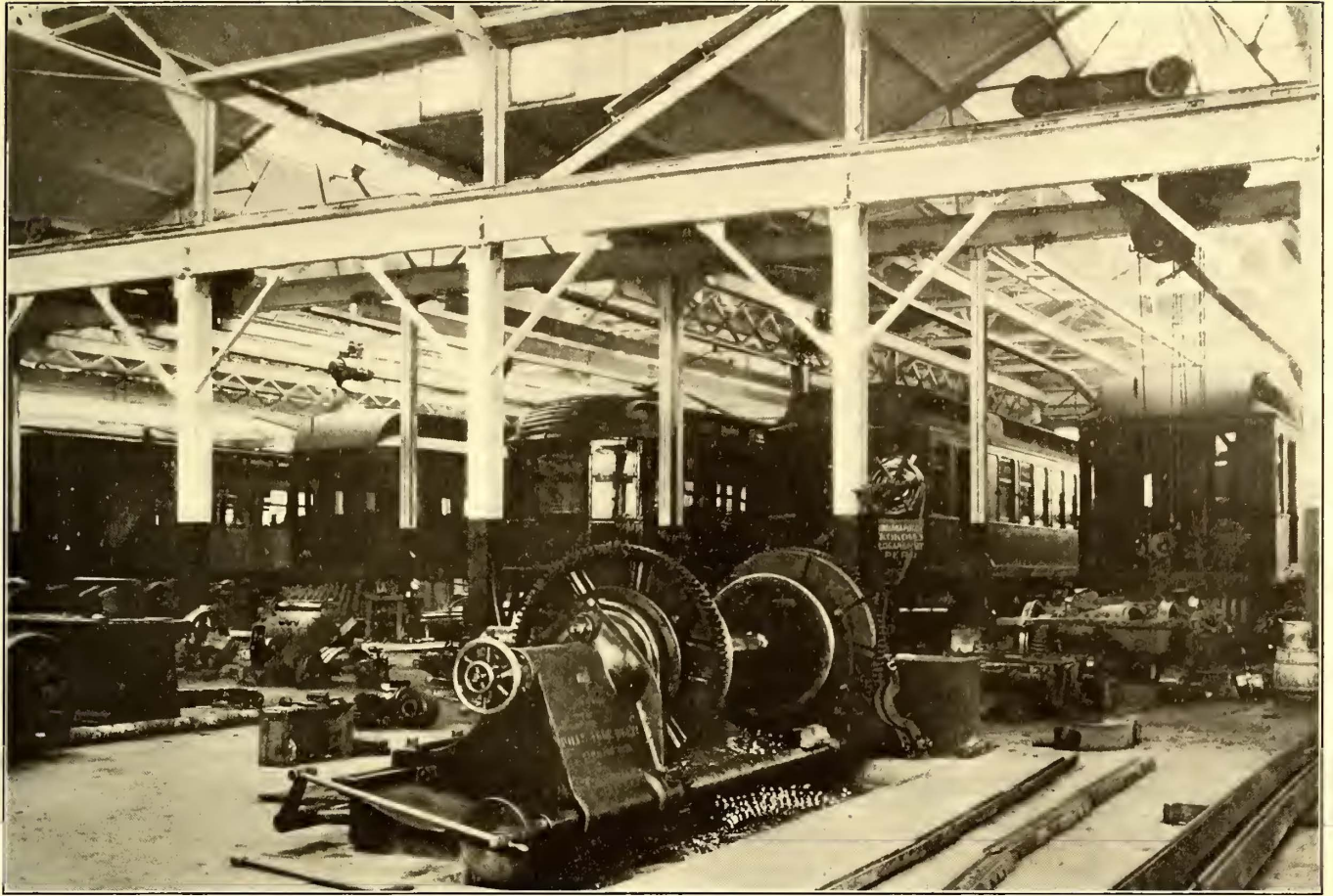
The tool equipment of these shops is very complete and facilities have been provided for making any kind of light or

forced circulation of hot water. In the paint shop, erecting shop and mill room the coils are supported under the roof trusses, but in the main repair shop the coils are mounted on the pit walls so that the warm air will rise under cars standing over the pits and dry out the motors and other equipment. An extra large surface is provided in the paint shop to assist in drying out the paint on cars. With the exception of the paint shop, which is lighted with enclosed arc lamps, all the other departments are illuminated at night with Cooper-Hewitt mercury vapor lamps mounted up in the roof trusses to secure maximum diffusion.

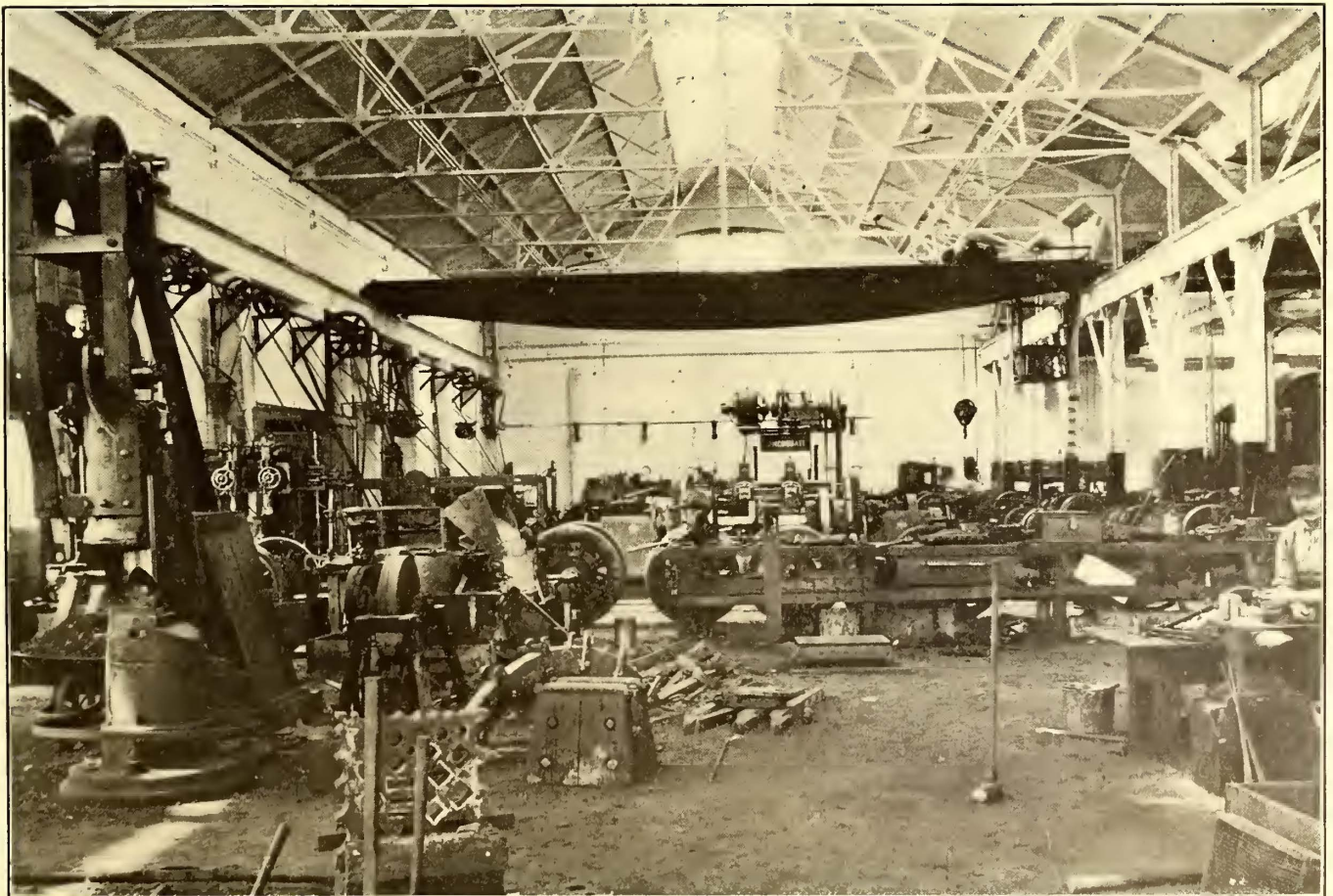
These shops care for 311 cars, including 92 small city cars used in Anderson, Muncie and Marion. A total of 81 men are regularly employed in the various departments.

MINNEAPOLIS

The new Snelling Avenue shops of the Twin City Rapid Transit Company are centrally located about half way be-



Anderson Shops—View Showing Transfer Bridge and Electric Hoist Over Truck Aisle



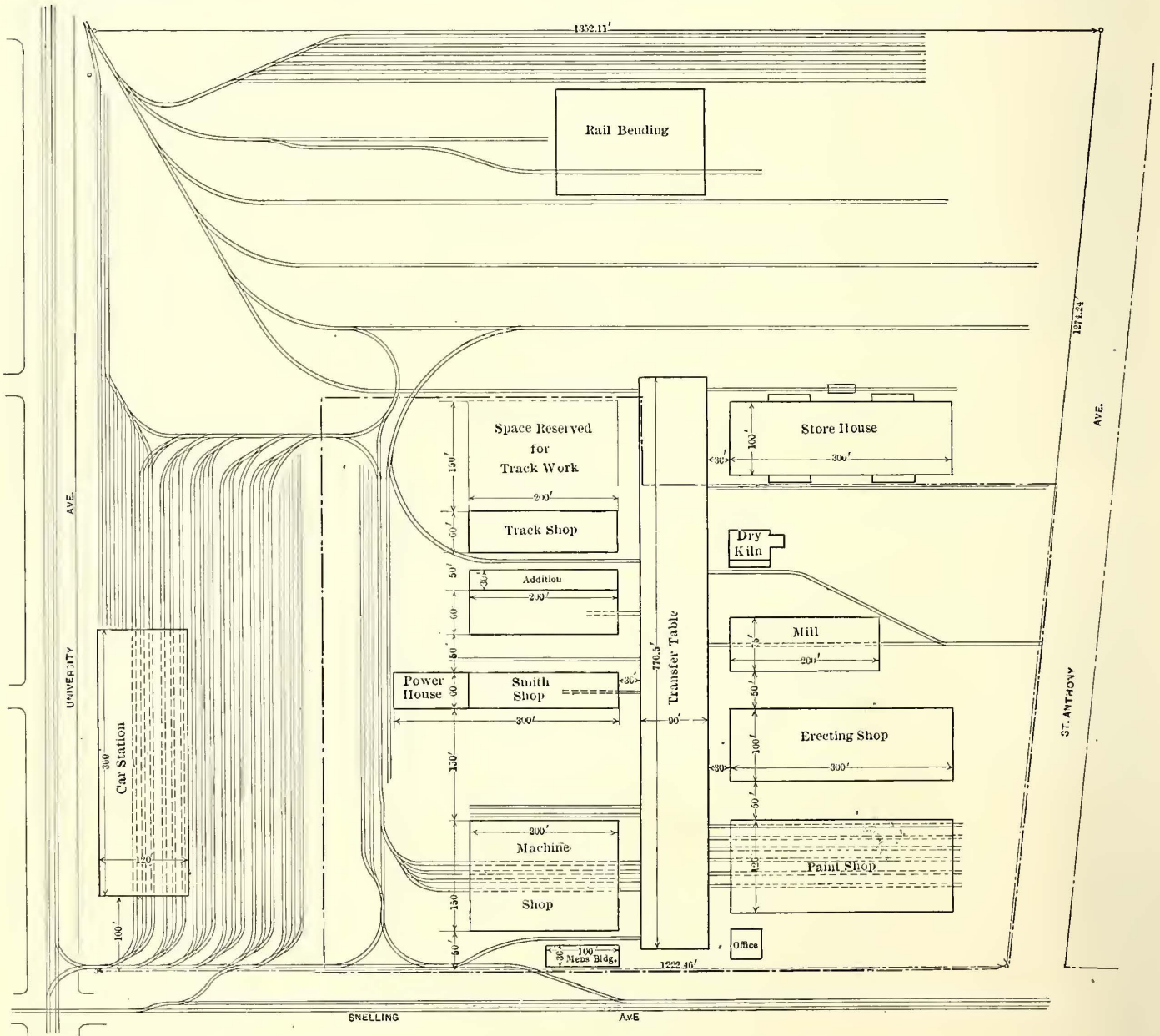
Anderson Shops—Traveling Crane Over Machine Shop

tween Minneapolis and St. Paul, on a plot of ground covering about 40 acres. The different departments are housed in separate buildings placed on both sides of a transfer table pit 90 ft. wide and 776 ft. long. These buildings are all of one type of construction, having walls of hollow concrete blocks faced with cement bricks, reinforced concrete columns and roofs and granolithic concrete floors.

The shop department makes all repairs to rolling stock and, in addition, builds trucks and cars, overhead line material, track special work, maintains the company's buildings and does such other general electrical and mechanical work as

turing is carried on. There are four through tracks in the central bay or truck shop, and these are served by four 50-ft. span crane bridges, each of which carries four 6-ton electric hoists, making a total of 16 hoists. Each of the machine shop bays is served with an 18-ft. span I-beam crane bridge traveling the full length of the shop, which carries one 2-ton electric hoist. The electrical shop bays in the galleries above are served with similar crane bridges which, however, carry hoists of only 1-ton capacity. No pit tracks are used in any part of these shops, all work being done on the floor.

In the forge shop, which is a building 60 x 200 ft., one



Twin City Rapid Transit Company—Plan of Snelling Avenue Shops

cannot be done conveniently by other departments. Under the jurisdiction of the shop master mechanic are the engineers, firemen and deckhands of the 13 passenger boats operated by the company on Lake Minnetonka and all of the car house inspection and repair forces.

The machine shop building is 150 ft. x 200 ft., and is divided into a central bay used for truck overhauling and two narrower bays on each side in which the machine tools are placed. Over these side bays are galleries, also divided into twin bays, in which the electrical repair work and manufac-

I-beam crane bridge with hand-chain block hoist is provided and also a number of jib cranes with chain blocks to serve the large forges and power hammers. The erecting shop, 300 ft. x 100 ft., is served with a 10-ton electric traveling crane having a span of 60 ft. and a travel of 200 ft.

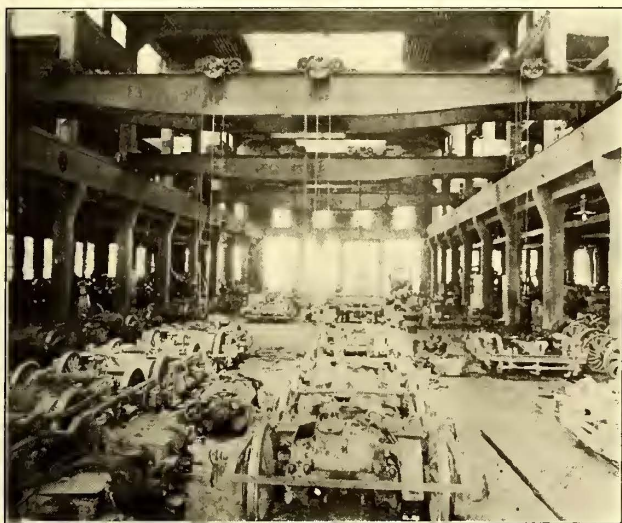
The shops are lighted with arc lamps hung from the ceiling and 50-watt Gem incandescent lamps with holophane reflectors on the side walls. All lamps are operated on a 250-volt circuit. The buildings are heated with a vacuum return direct steam system.

The following is a list of the principal tools installed:

- |                                      |                          |
|--------------------------------------|--------------------------|
| 20 lathes                            | 4 heating furnaces       |
| 17 grinders                          | 8 riveters and drills    |
| 6 milling machines                   | 5 pipe and bolt cutters  |
| 20 drill presses and boring machines | 11 forges                |
| 2 keyseaters                         | 1 bulldozer              |
| 2 planers                            | 1 forging machine        |
| 1 wheel press                        | 7 surfacers and jointers |
| 2 metal cold saws                    | 1 sander                 |
| 3 air compressors                    | 7 saws                   |
| 2 shapers                            | 2 tenoners               |
| 3 steam hammers                      | 3 molders                |
| 1 power hammer                       | 3 mortisers              |
| 9 punches and shears                 | 1 two-spindle shaper     |
| 3 rolls and formers                  |                          |

built last year on the outskirts of the city. This company operates only 65 motor cars and 25 trail cars and its shop facilities are necessarily small. Only 12 men are employed in repairing and inspecting rolling stock.

The building, which consists of two storage bays and a shop bay with a two-story office and store room addition adjoining, is built with brick walls on concrete foundations, concrete floors and reinforced concrete roof. It is 216 ft. deep, and the shop bay, which contains two tracks for its entire length, is 38 ft. wide. The machine shop section in front is 124 ft. long and is separated from the carpenter shop next in the rear by a brick fire wall and metal sheathed folding



Twin City Shops—Truck Aisle



Springfield Shops—Interior of Shop Bay

All tools requiring more than 5 hp are individually driven by direct-connected motors, but the smaller tools are group driven by motors suspended near the ceiling. About 60

fire doors. The carpenter shop is 46 ft. long and is likewise separated by a fire wall and folding doors from the paint shop, 45 ft. long in the extreme rear. The blacksmith shop,



Springfield (Ill.) Consolidated Railway Company—Shop and Car House

motors of various sizes are used for driving the tools and all are connected on a 230-volt direct-current circuit.

SPRINGFIELD, ILL.

The shops of the Springfield (Ill.) Consolidated Railway Company occupy one bay of the fireproof operating car house

20 ft. x 36 ft., in which centers the principal fire risk is located in the office and store room addition, and is isolated by 9-in. brick fire walls.

A simple hoist arrangement has been provided, consisting of two chain block car hoists of 7 tons and 1 1/2 tons capacity, respectively, which are hung from the roof girders

over the pit tracks in the machine shop and three 1-ton hand-operated chain blocks which can be carried around the shop and used wherever needed. Only a few machine tools have been installed for making ordinary repairs. These consist of an engine lathe, drill press, emery wheel, field coil winding machine and blacksmith's forge and anvil. This company finds that it is more economical to ship all wheel work 125

building, all connected to a common ladder truck. A total of 568 cars are cared for.

The erecting shop contains nine tracks in five bays. Three of these tracks have pits 58 ft. long and a fourth has a pit 194 ft. long. The construction of these pits is unique in that the pits are wider than the tracks under which they are built. The tracks are supported on cast-iron A-frame columns and

these columns are braced laterally by T-rails, which are embedded in the masonry pit walls just below the floor. The pit walls are built of granite paving blocks removed from streets on which asphalt paving had been laid. This arrangement of wide pits enables a man to repair journal boxes and other outside parts of the trucks while standing in the pit and has been found very convenient.

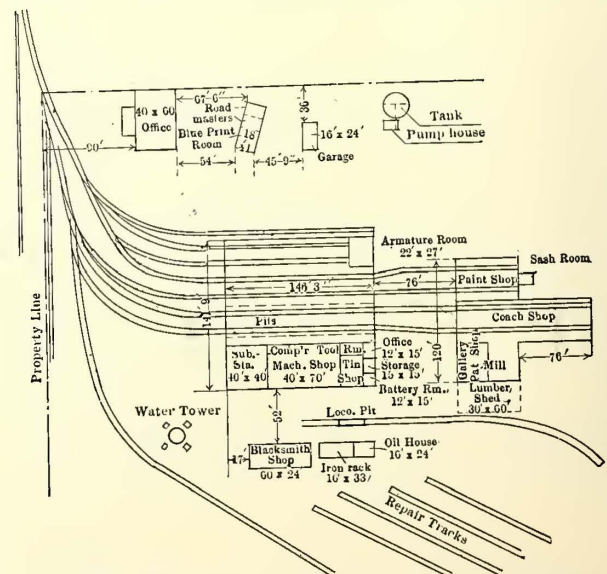
Each of the five bays of the erecting shop are served by a traveling crane bridge with a span of 24 ft., on which is mounted a pneumatic hoist having a lifting capacity of 8 tons with 100-lb. air pressure. There has recently been added to this equipment a home-made electric traveling crane spanning one of

the bays which has a capacity of 10 tons. A crane bridge with pneumatic hoist also spans the machine shop space, which extends across the building in the rear of the erecting shop.

The tool equipment of this shop includes the following machines:

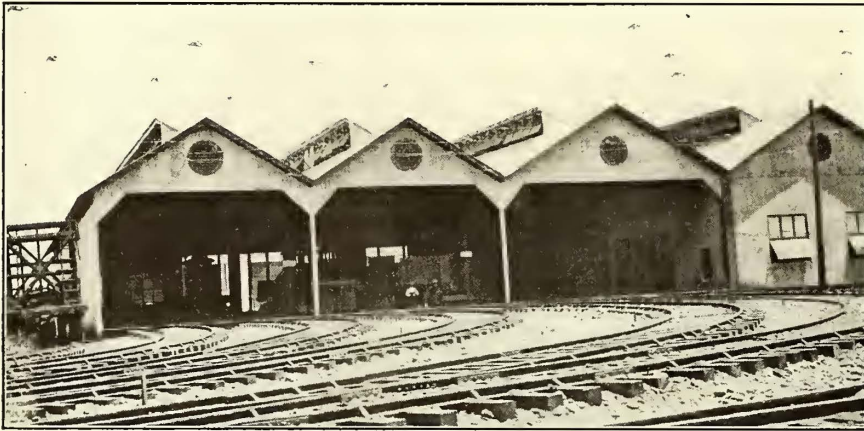
8 engine lathes	3 planers and surfacers
2 boring mills	3 circular saws
8 drill presses	2 band saws
2 shapers	3 mortisers and tenoners
2 planers	1 boring machine
1 wheel press	1 molding machine
1 wheel grinder	1 wood lathe
4 grinding machines	1 sanding machine
6 smiths' forges	1 armature banding machine
1 power hammer	

The larger tools are individually driven by direct-connected motors, but the light tools are group-driven. At the present time 214 men are employed, but the normal force is only



Northern Electric Company—Plan of Chico Shops

about 170 men. The increased force is engaged principally in rebuilding a large number of the company's standard double truck cars into pay-as-you-enter type equipment.



Northern Electric Company—Chico Shops

miles to a machine shop in St. Louis than to make an investment in a wheel press and boring mill in order to change wheels in its own shops.

#### NORTHERN ELECTRIC COMPANY

The main shop of the Northern Electric Company, a third-rail interurban road in California 116 miles long, are located at Chico. The general arrangement of the buildings and tracks on the shop tract is shown on the accompanying plan. The main building is approximately square and contains four through tracks and two stub tracks. Two of the through tracks are built with inspection pits long enough to hold three cars each. The car shed section is divided into three bays, and the machine shop, substation and store room occupy the fourth bay adjoining. Each bay has a peak roof with a monitor skylight along the ridge. The building has a wood frame and the sides and roof are of corrugated galvanized iron. On account of the mild climate no doors are provided at either end of the car shed.

The paint shop, wood mill and carpenter shop are in a separate building in the rear of the main shop building, and the blacksmith shop is also in a detached building, 60 ft. x 24 ft., at one side of the main building. The only hoist or crane equipment provided consists of two 1 1/2-ton air hoists in the machine shop to serve the larger tools. The following is a list of the machine and wood-working tools provided:

2 engine lathes	2 planers and surfacers
3 drill presses	1 circular saw
1 shaper	1 jig saw
1 wheel press	1 mortiser and tenoner
3 grinding machines	1 boring machine
3 smiths' forges	1 molding machine
1 power hammer	1 wood lathe

These shops employ about 50 men and care for 28 passenger cars, 300 freight cars and six electric locomotives. The fire protection equipment consists of water and sand pails and a number of hydrants connected to an elevated storage tank located near the main building. Much of the light repair work, especially on freight cars, is done on the outside repair tracks shown on the plan.

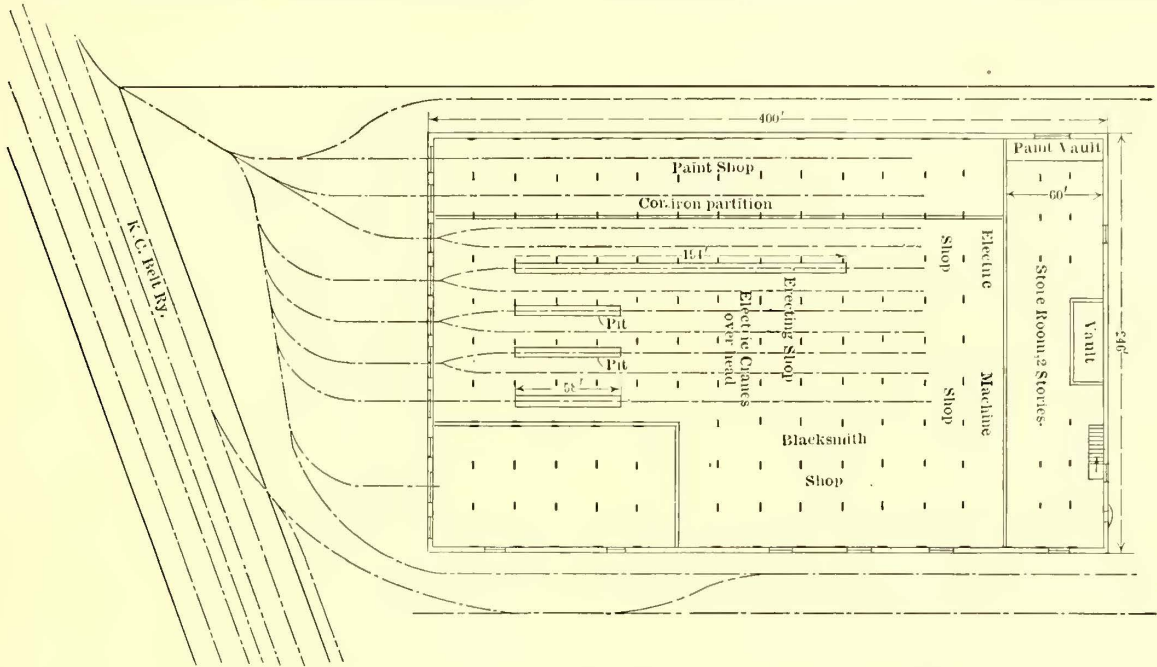
#### KANSAS CITY, MO.

The shops of the Metropolitan Street Railway of Kansas City are housed in one large building, 400 ft. x 246 ft. They have a stub track arrangement with 11 tracks entering the

CLEVELAND, SOUTHWESTERN & COLUMBUS

The Elyria shops of the Cleveland, Southwestern & Columbus, of which a floor plan is shown in the engraving here-

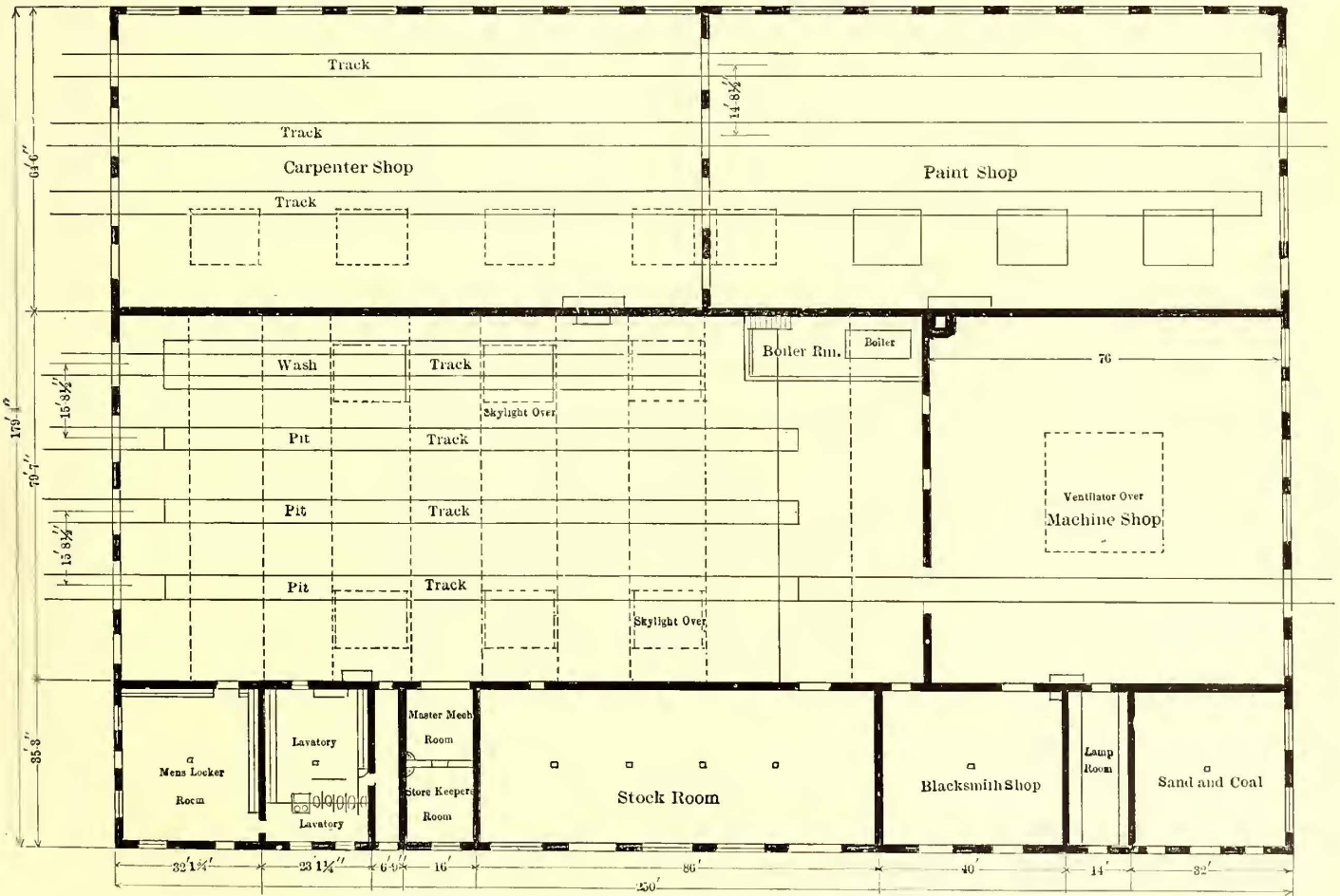
boards. All floors are of concrete covered with wood. In the main section of the building in front are four pit tracks, one for wheel changing, one for washing and two for car in-



Metropolitan Street Railway Company, Kansas City—Plan of Main Shop

with, care for 65 interurban cars. The various shop departments are under one roof, but are separated from each

section and repairs. These tracks are spanned by a pneumatic traveling crane and are also served by two electric



Cleveland, Southwestern & Columbus—Plan of Elyria Shop

other by fire walls and doors. The building is of brick with a slate roof supported by steel trusses over the main portion. The wings on each side are roofed with tar and gravel on

trolley hoists for carrying heavy parts into or out of the machine shop in the rear. Four pneumatic jacks are provided for lifting car bodies off of the trucks.

The machine shop, 76 ft. x 79 ft., is in the rear of the building. The truck repair track is continued through it and into the rear yard, where it connects with a switch track from the main line. The machine tool equipment includes the following:

3 engine lathes	1 planer
1 wheel lathe	1 wheel press
1 boring mill	1 milling machine
3 drill presses	1 emery wheel
2 shapers	1 bolt cutter

All these machines are belt-driven by a 20-hp, 500-volt, d. c. motor. The wheel lathe is served by a jib crane carrying a chain block hand hoist.

The blacksmith shop adjoins the machine shop and contains three forges, one power hammer and a forging machine. These

machines and the forge blowers are run by a 15-hp motor. The carpenter shop, 126 ft. x 64 ft., is in the annex on the east side of the building. It has three tracks, which will hold two cars each, and these tracks extend back into the paint shop so that cars can be moved along for painting after the carpenter work is completed without taking them out of the shop. The middle track in the paint shop extends through the rear wall and connects with the switch track in the rear yard. Cars on this track can be taken out of either the carpenter or paint shop without disturbing any others which may be under repair on the two side tracks. The carpenter shop contains the following machines all driven by a 15-hp motor:

2 planers and surfacers	1 band saw
2 circular saws	1 molding machine

