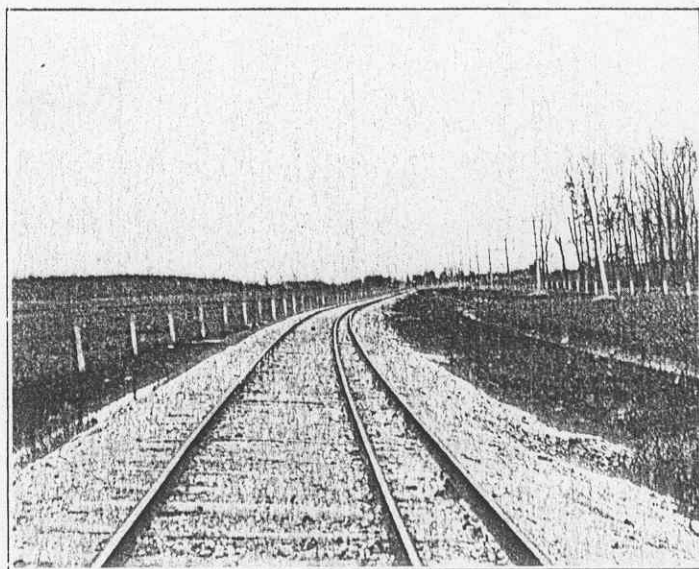


THE JACKSON & BATTLE CREEK RAILWAY

BY W. G. FARGO

This electric line has recently been completed by the Jackson & Battle Creek Traction Company and connects the two important industrial and steam railroad centers of Southern Michigan, the cities of Jackson and Battle Creek.



VIEW OF LINE EAST OF ALBION. THE CURVE SHOWN IS 3 DEGS., WITH 5½ INS. ELEVATION

Both cities are developing rapidly. Jackson is the division headquarters for the Michigan Central Railway. It is also the distributing headquarters of all the large agricultural concerns of the country. Battle Creek is division headquarters for the Chicago & Grand Trunk

Railroad, and is a large manufacturing town, with diversified interests. Some of the largest steam engine and threshing machine works and steam pump works, sanitariums and adventist institutions in the country are located here. At Jackson the road connects with the Detroit, Ypsilanti, Ann Arbor & Jackson Electric Railway to Detroit, and at Battle Creek with the line of the Michigan Traction Company to Kalamazoo.

Between the cities of Jackson and Battle Creek, and along the line of the railway, are the cities of Albion and Marshall, the village of Parma and several smaller places. The country traversed is of very productive soil, and constitutes one of Michigan's finest agricultural districts.

The population served by this road is as follows:

Jackson	30,000
Albion	6,500
Marshall	6,000
Battle Creek.....	30,000
Parma	1,000
Tributary population aggregates.....	73,500
	23,000
Making a population served of.....	96,500

The distances from Jackson are:

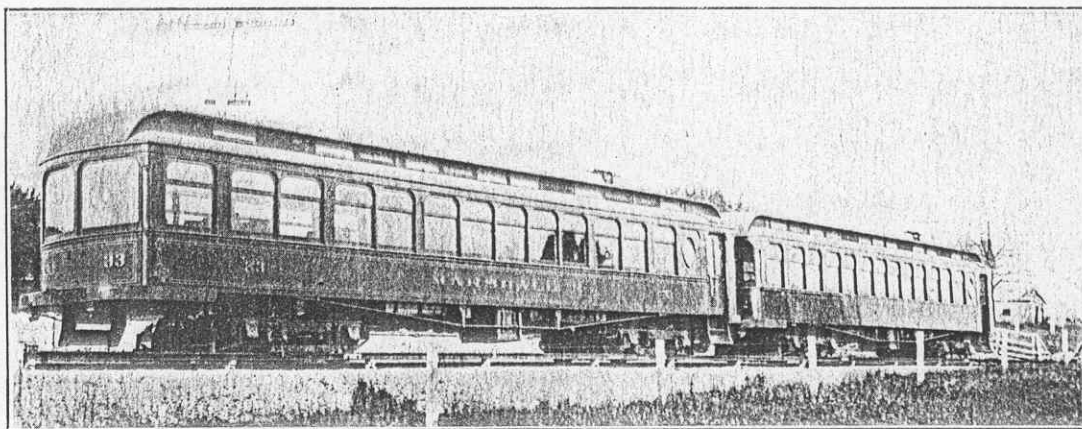
Parma	11	miles
Albion	21	"
Marshall	33	"
Battle Creek.....	45½	"

rod feeders are tapped to the rail, near the end, and carried underground in wooden conduits. This conduit or box is made of 1-in. redwood boards, with interior dimensions of 3 3-16 ins. x 3 3-16 ins.—just large enough to hold the General Electric No. 69,010 porcelain rack insulator. These insulators are spaced about 5 ft. apart, and are fastened in the conduit by means of wooden wedges after the rod is laid in them. At the ends the conduit is built at an angle of about 45 degs., and is carried up to the height of the contact-rail. After the cable is laid in this manner the box is closed, and filled from the ends with hot asphaltic pitch of practically the same composition as is used for Edison underground tubing. The construction of the conduit is shown on page 10, that for the feeder on the left being completed, while the right one is ready for the pitch, which is being poured into it. This method of pouring in the pitch for the horizontal portion of the conduit is interesting, as shown. After the box is filled with pitch, small roof-like protections are placed over the ends of the conduit, as shown in the cut, to prevent moisture entering the box.

This form of underground conduit has also been used at points where overhead feeders are tapped in. The construction was done during the dry season, and as every piece of work was finished the same day it was started the chances for moisture getting to the rods were very slight, and so far as known there has been no leakage from any of these conduits.

TRACK RETURN

For track return the single standard-gage rail and the narrow-gage rail are bonded with Brown plastic bonds. The track rail that is common to both standard and narrow-gage trains is used for the block-signal system. A Brown grinding machine was used to polish the rail ends for the bonds. Opposite the power house the return track rails are connected to two return feeders, consisting of the same size aluminum rod as is used for the contact-rail feeders. These return feeders are



TRAIN OF TWO "LIMITED" CARS ON THE JACKSON & BATTLE CREEK RAILWAY

carried across the salt-water marsh intervening between the station and track in a wooden trough, built about a foot above high-tide mark, and upon entering the station are connected to four 800,000-circ. mil bare copper cables, for connection through a double-pole, double-throw switch to the battery booster or generator negative bus-bar.

POWER STATION AND SUB-STATIONS

The second installment of this article will be devoted to a description of the main power house and sub-stations, with their equipment and notes upon operation, and as this is a modern plant throughout it may be accepted as an example of engineering practice on the coast. The transmission system, employing 40,000 volts, contains many interesting features, as well as the new signaling apparatus, which will be discussed in detail. A storage battery auxiliary is another feature of the plant. Operating details, and a practical discussion of the conditions prevailing in the vicinity of San Francisco, will be included in the second part of this article, which will be presented next week.

The road is single track, and is built on private right of way, except through cities and the village of Parma.

The maximum grade is 2 per cent, and the curves are all moderate and elevated for speed of 60 m. p. h.

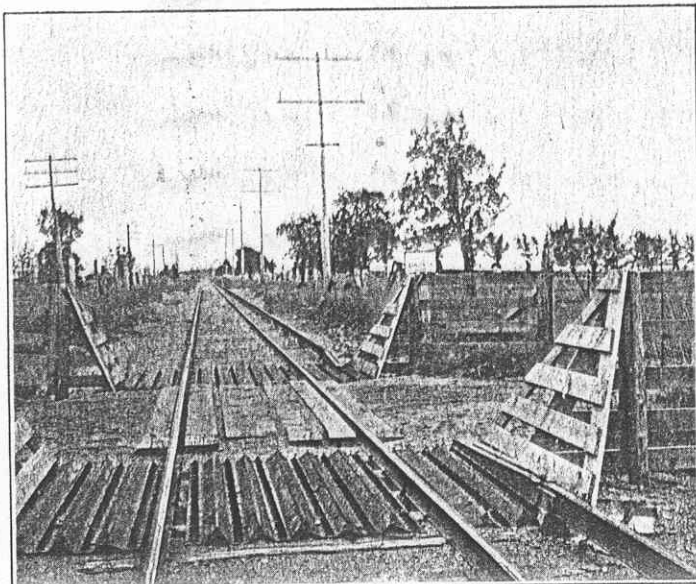
Gravel ballast is used throughout with 6 ins. under the ties, averaging 1800 cu. yds. of ballast to the mile of track.

The Michigan Central, the Lansing division of the Lake Shore & Michigan Southern Railroad, and the Kalamazoo River at Albion, are crossed by viaducts, thus avoiding grade crossings. Deck-plate girders, 75 ft. x 96 ins., constitute the river span; the span over the steam road is a 135-ft. Pratt truss, designed for a live load, equivalent to 3530 lbs. per lineal foot throughout.

TRACK

Track is laid with 30-ft., 70-lb. A. S. C. E. rail, on 3000 6-in. x 8-in. x 8-ft. cedar and oak ties to the mile. Twenty-six inch four-bolt Continuous rail-joints are used, with elastic nuts on the bolts. The joints are supported, and oak ties or tie-plates are used on curves as required.

The turnouts, of about 600 ft. in length, and laid with No. 10 spring rail frogs, and split switches are used at intervals of



TRACK, HIGH-TENSION LINE AND CATTLE-GUARD

about 2 miles. All switches have rigid connecting rods and regulation switch lights at night, and are kept locked. The tongue switches on the turnouts located in city streets are operated by ground-throw levers beneath the rails, and provided with a crank rigidly connected to the switch tongue and to a mechanical semaphore located on the curbs.

Each track joint is bonded with two No. 0000 9-in. protected rail-bonds, placed under the joints.

THIRD RAIL

The third-rail is 70-lb. section, in 30-ft. lengths, and of the same composition as track rail. Its head is 6-ins. above that of the traffic rail, and it is supported on reconstructed granite insulators, without iron top or base, every 10 ft. The center line is 20 ins. outside the center of the outside traffic rail, and 21 3/4 ins. outside the gage line. The joints used on the third rail consist on one side of one plain round edge-bar, 3 ins. x 1/2 in. x 14 ins., with 7/8-in. round holes and two 3/4-in. machine bolts, and on the opposite side an oak block, 1 3/4 ins. thick, forming a nut lock.

The third rail is bonded with two 300,000-circ. mil foot bonds, applied with hydraulic presses in holes punched in the base of the rail.

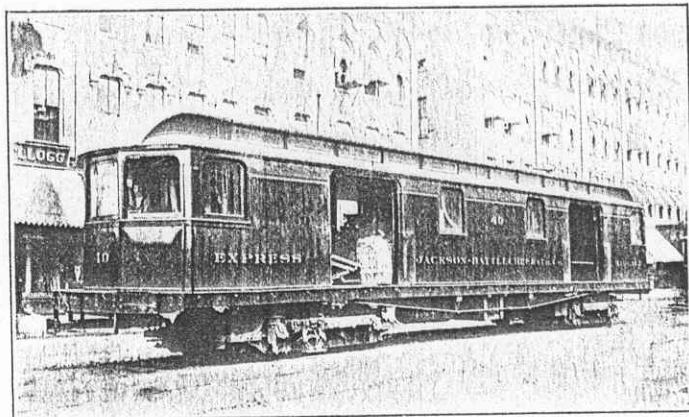
The third rail is coupled under crossings with 1,000,000-circ. mil lead-covered and paper-insulated cable. The cable terminals

are of the General Electric Company's pattern with porcelain upper insulation.

The third rails have oak inclines or tips, which extend partly over the metal guards, as shown in the full page diagram.

POWER EQUIPMENT

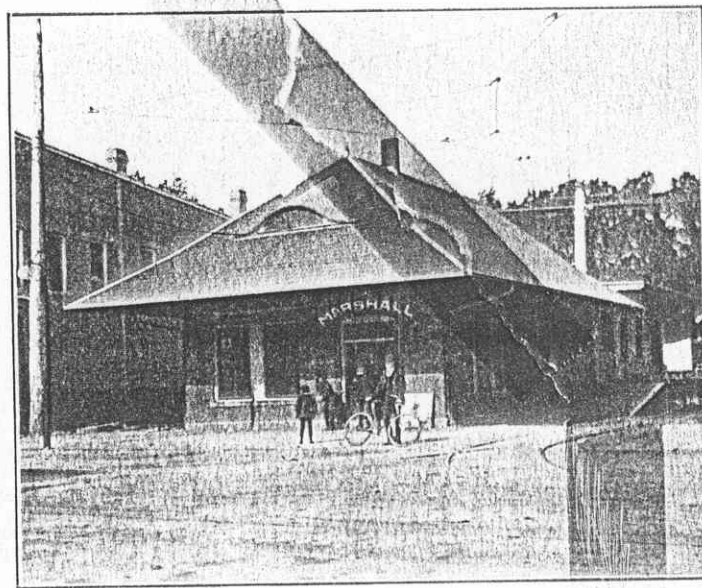
Power is purchased from the Kalamazoo Valley Electric



ELECTRIC FREIGHT CAR IN FRONT OF OFFICE BUILDING AND FREIGHT DEPOT, IN JACKSON

Company, whose three water plants are located a few miles apart on the Kalamazoo River, in Allegan County, 90 miles from Jackson, the eastern terminus of the road, and 45 miles from Battle Creek, the western terminus. This power is furnished to the sub-stations of the Jackson & Battle Creek Traction Company at 40,000 volts, three-phase, 60 cycles. Direct current is fed from the sub-stations into the third rail at five different points, viz., Battle Creek, Marshall, Albion, Parma and Jackson, the sub-stations averaging 11 miles apart.

In each of the sub-stations are three 225-kw, 40,000-volt-375-volt step-down transformers. These transformers are wound with two separate secondaries, so that two 300-kw rotaries can be run from one bank of transformers in parallel on the direct-current side. The transformer secondaries are provided with taps and switches so that the voltage on the rotary may be varied 50 volts in two steps of 25 volts each. The transformers are water and oil cooled, and were built by



MARSHALL PASSENGER, FREIGHT AND SUB-STATION

the General Electric Company. They are all delta connected on the high-tension side. The oil switches for cutting them out of circuit are located in separate switch houses, located a short distance from the sub-station building.

Each station, with the exception of Albion, also contains one

300-kw, 8-pole, 900-revolution General Electric rotary converter. At the Albion sub-station there are two, making six 300-kw rotaries supplying current for the road. The rotaries are started by the use of small induction motors.

TRANSMISSION LINE

The transmission line is composed of three No. 1 stranded aluminum wires mounted on 10½-in. porcelain Locke insula-

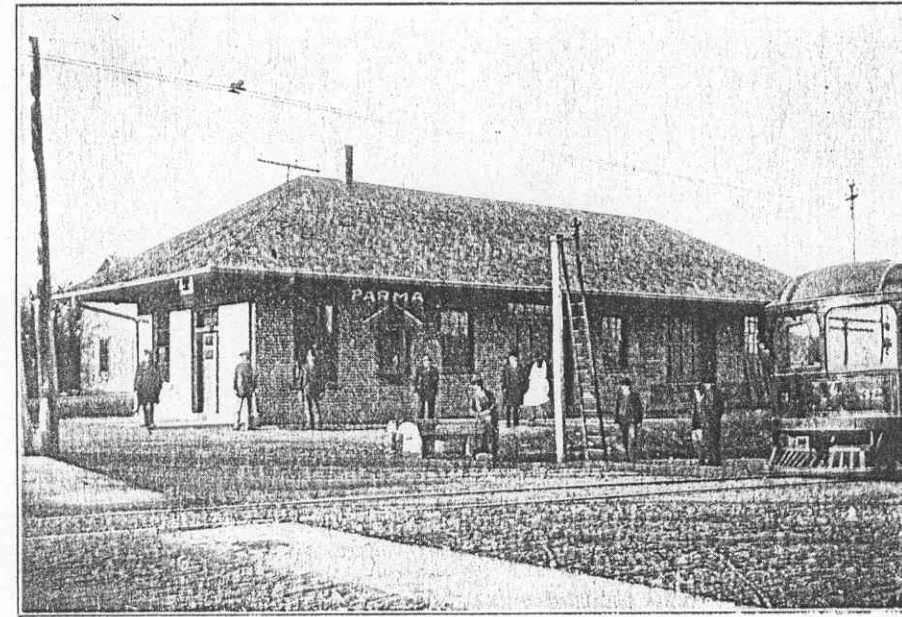
for waiting-rooms and freight depots, and the sub-station attendants act as station agents, taking care of the freight and ticket selling. A plan and elevations of the Marshall sub-station are shown in the accompanying diagram.

POWER CONTRACT

The contract under which power is purchased from the Kalamazoo Valley Electric Company is rather interesting, and some of its features will be given in detail.

It provides that the railway company shall be furnished with the current which may be necessary or required by it to operate its railway system in a manner satisfactory to it on every day, including Sundays, for at least eighteen continuous hours per day, between such hours as the Jackson & Battle Creek Company may from time to time designate.

The railway company reserves the right to order whatever extra service is needed beyond eighteen hours per day by giving the power company 24 hours notice of its intention. For this power the Jackson & Battle Creek Company agrees to pay at the following rate: For the first 3000 kw-hours per day 1¼ cents per kilowatt-hour, and for all amounts in excess per day 1 cent per kilowatt-hour. The current delivered under this contract is direct current, at approximately 600 volts, and is measured at the direct-current switchboards located in the sub-stations of the Jackson &



PARMA PASSENGER, FREIGHT AND SUB-STATION

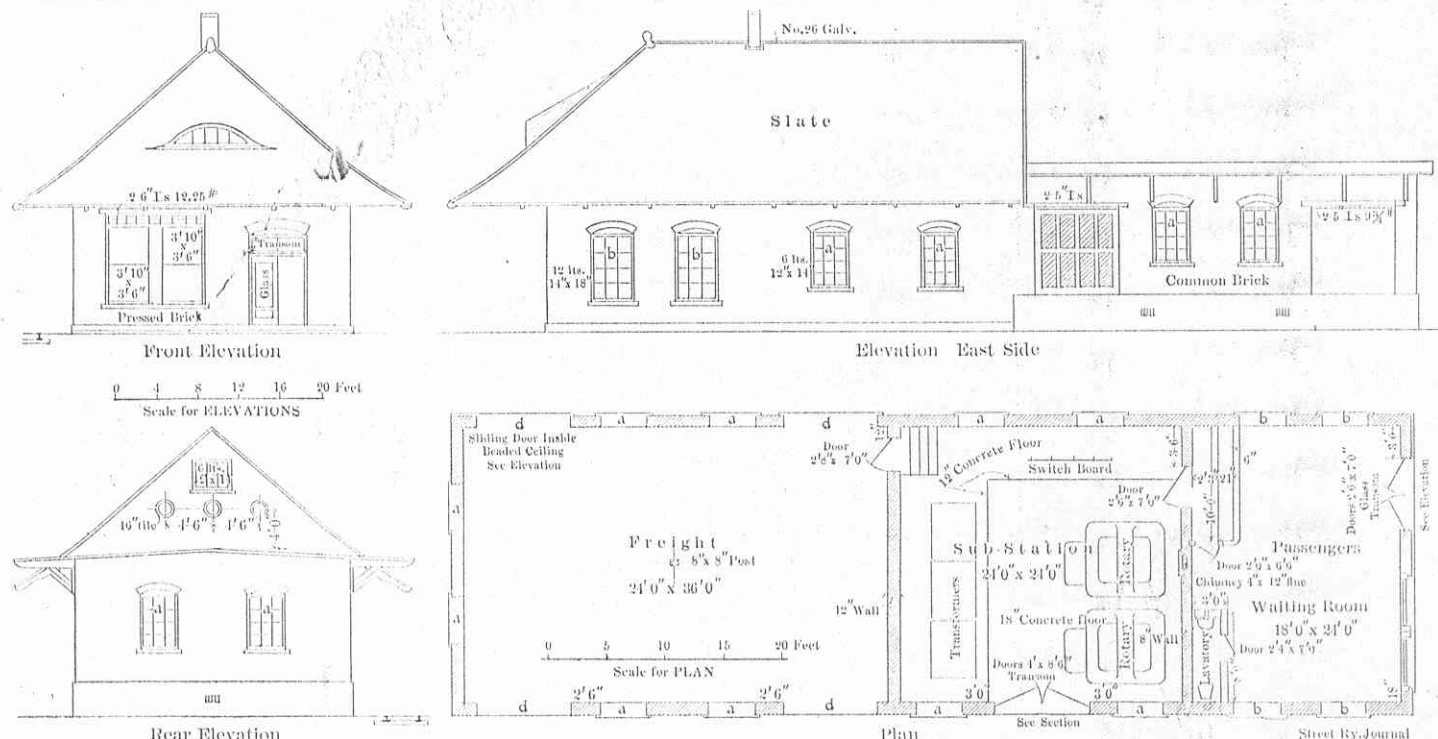
tors. The wires are arranged on two cross-arms, two wires at the outer ends of the lower cross-arm and one near the center of the top cross-arm, forming a triangle of about 8 ft. on a side. At each outer end of the top cross-arm is installed a grounded barbed wire for lightning protection, also three banks of General Electric lightning arresters of standard construction. The high-tension line is provided with oil-break switches at five different points in the 90 miles of line whereby it can be cut into sections in case of trouble.

Battle Creek Traction Company, at Jackson, Mich., Albion, Mich., and Battle Creek, Mich., by standard Thomson wattmeters manufactured by the General Electric Company, or some other meter satisfactory to both parties. The power is paid for monthly.

The contract also provides that the Jackson & Battle Creek Traction Company is not liable for or required to pay the power company for any power when its cars are not operated for some extraordinary cause. The power company agrees that in the event of its being necessary to shut down a portion of its plant or plants by reason of accident, or for any other cause whatsoever, it will continue to furnish the traction company power,

LOCATION OF SUB-STATION

The sub-stations in the cities are located at convenient points



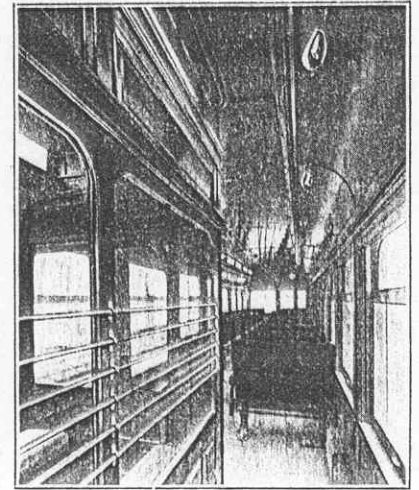
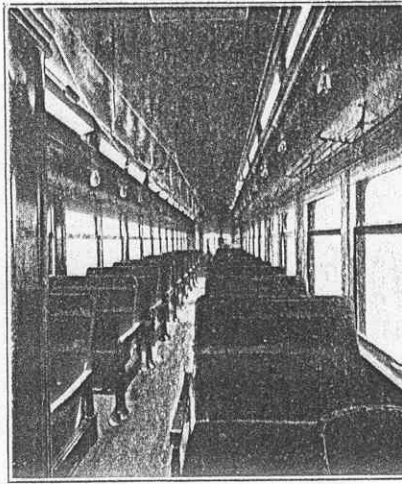
PLAN AND ELEVATIONS OF TYPICAL FREIGHT AND PASSENGER WAITING STATION

as contemplated in the contract, if it is possible for the company to do so, even if such service should require the use of the entire remaining capacity of its plants, to the exclusion of the light or other power business.

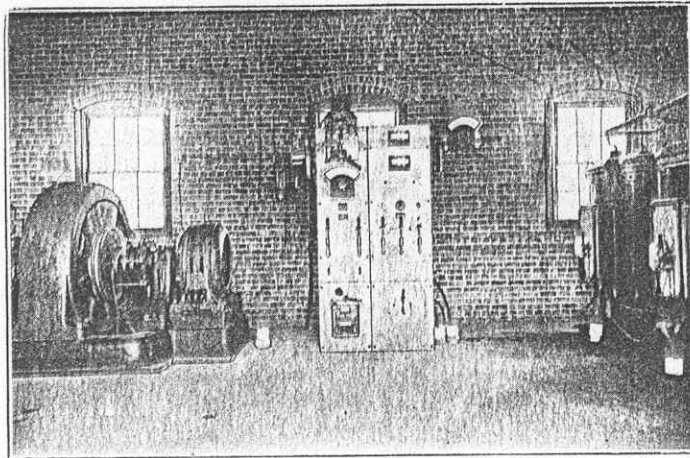
The contract also provides that if the power company shall at any time fail to furnish power contemplated in the contract it shall pay to the traction company all loss the latter may sustain by reason of such default. This loss is to be based upon the amount of gross earnings per day, less the cost of power, which shall be estimated by taking the average of the daily gross earnings less the cost of power for the week next preceding such default.

DESPATCHING SYSTEM

A telephone line for despatching cars, composed of two No. 11 hard-drawn copper wires, transposed every fifth pole, is run along the pole line 7 ft. below the lower transmission arm. Telephone booths are installed at all turn-outs,



INTERIOR OF LIMITED CARS, FRONT AND REAR VIEWS



INTERIOR OF PARMA SUB-STATION

posing car there the conductor calls up the despatcher, and receives orders whether to proceed. He is required to write out on a printed blank the order received, making a duplicate carbon copy of it. He then repeats the order, as he has written it, to the despatcher, and upon receiving his O. K. and entering on the blank the time at which the O. K. is received, the conductor hands the motorman the carbon copy and retains the original. Trains, which become late for any cause, are handled by orders from the despatcher from point to point.

On arrival at all stations the conductor of each train registers on a printed blank the time of arrival and departure. This is immediately reported over the telephone to the despatcher by the station agent. The despatcher enters this information upon a regular steam railroad train sheet. At the end of the day this sheet gives full information as to the time of arrival and departure of all trains from all the stations on the line during the day.

ROLLING STOCK

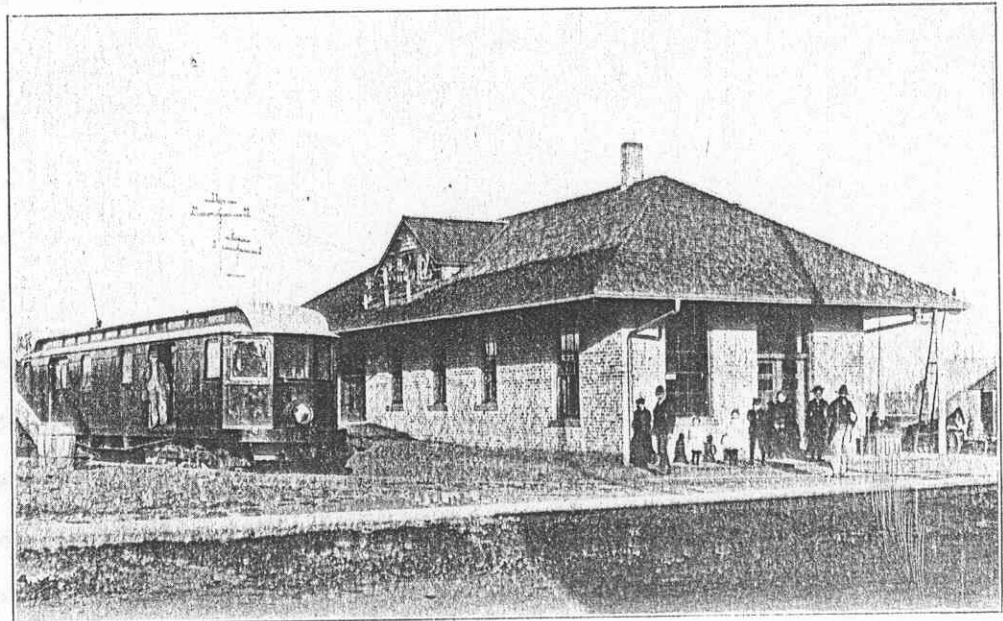
The company operates both express and local passenger service. The express cars measure 58 ft. 4 ins. over all, and are

and telephones are placed in all sub-stations and ticket offices.

The telephone system is a combined central energy and magneto call. All the telephones in the turn-out booths call the despatcher up by simply taking the receiver off the hook, and when the receiver is on the hook the telephone is entirely cut off. All telephones in sub-stations, ticket offices, etc., are supplied with a regular magneto call, so that they can reach any other telephone on the line. The telephones are equipped with a condenser to neutralize the static effect of the high-tension line.

The principal reason for using this kind of telephone for turn-outs, was to relieve the line from the large number of magneto bells and generators that would be cut in along the line if all the telephones were cut on, as there are over twenty telephones connected with the central switchboard.

A train despatcher is always on duty, and trains are handled by him according to the standard steam road practice. All trains are run on a printed time-table, and when on time at their regular scheduled meeting places run without special orders. On reaching the terminals, however, the conductors report



PARMA FREIGHT AND PASSENGER STATION—FREIGHT-TRACK SIDE

elaborately fitted up, having smoking and toilet compartments and high-backed, red upholstered seats. They were built by the St. Louis Car Company, and are mounted on Peckham

extra heavy M. C. B. trucks. The trucks have a 7-ft. wheel base with axles 7 ins. in diameter in wheel and gear seats, and 6 ins. in diameter through the motors. The axle gears are solid, and pressed on by hydraulic pressure ahead of the wheel. Thirty-four-inch steel-tired wheels are used with 3-in. tread and $\frac{7}{8}$ -in. flange.

The cars are equipped with four General Electric 66, 125-hp motors each, geared to 60 m. p. h., with General Electric type-M control and Christensen motor compressors. The company also has four trail cars of the same length, mounted on light M. C. B. trucks, which are used on busy days behind the limited trains. They are equipped with Van Dorn couplers, and are also fitted with brake cylinders and hose connections, so that their brakes can be operated by the motorman on the head car.

For its local service the company has five 50-ft. combination baggage and passenger cars, built by the G. C. Kuhlman Company, and illustrated on page 774 of the STREET RAILWAY JOURNAL for May 23, 1903; also two 50-ft. light freight and express cars. Each of these cars is equipped with four General Electric 57, 50-hp motors, geared to speed of about 40 m. p. h.

TRAIN SERVICE

This road, so far as known, is the first to put into service a regular system of limited and local trains, making alternate trains local and limited through the day. The arrangement has proved very successful, it being found that the part of the traffic is between cities and the proportion which comes from the country districts is amply served by the local cars. The practice, heretofore, has been to subject the most profitable part of the business, namely, the interurban traffic, to the annoyance of the slow schedule of a service which makes every train stop on signal. By cutting out the local stops on every other train a service can be rendered for this class of traffic which is better than the local steam road service.

The limited trains run on an average of $1\frac{3}{4}$ hours apart, while local trains are sandwiched in between. The limited trains stop only at stations in the principal towns through which they run, while the local trains stop anywhere. The local trains also handle baggage and light express matter.

The $4\frac{1}{2}$ -mile run between Jackson and Battle Creek comprises about $3\frac{7}{8}$ miles of private right of way and 8 miles of city streets. The running time is 1 hour and 35 minutes for the limited trains, including delays and interruptions at terminals. This allows 13 minutes for getting out of Battle Creek and 12 minutes for getting into Jackson, which makes the distance between the limits of the two cities covered in 1 hour and 10 minutes, making six regular stops.

FARES

The rate of fare is $1\frac{1}{2}$ cents per mile, with a 5-cent minimum. Five cents is the rate for any ride within the city limits of any city. Baggage is checked between all points on the road for a uniform price of 15 cents per piece, and is carried on all local cars. Round-trip tickets are sold at reduced rates between stations. Experience up to date has shown that fully two-thirds of the business is done by tickets. This takes considerable work off the conductors, and enables them easily to collect their fares and attend to their other duties. Four-hundred-mile mileage books are sold for \$5. These books are good for purchaser and members of his family.

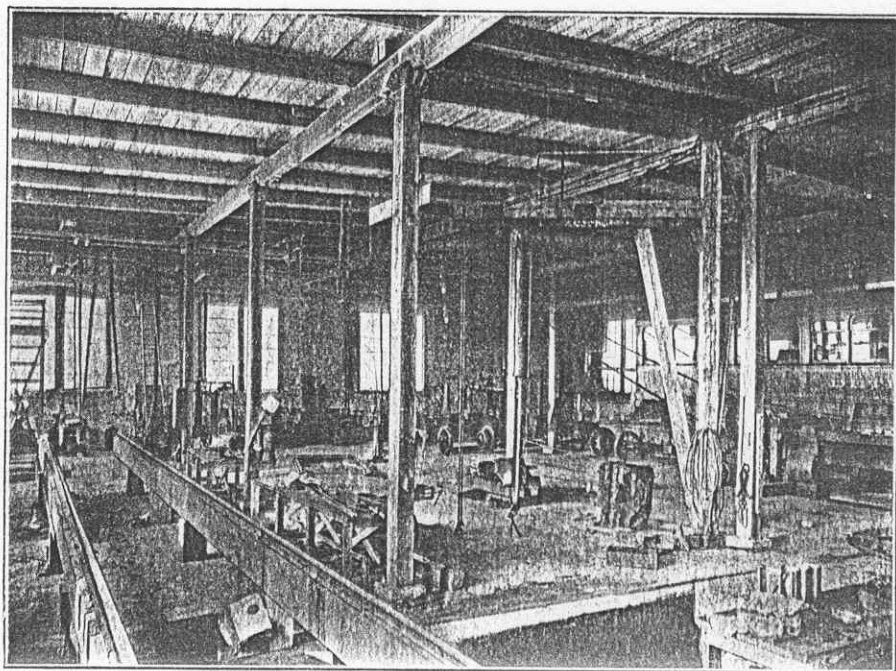
Cash fare passengers are given duplex cash fare receipts.

All passengers are registered on Ohmer fare registers, being rung up as "Cash Fare," "Ticket," "Pass," or "Transfer." Transfers are given from the local cars to limited cars at

Albion, because the latter pass the local cars going in the same direction at Albion, and any passengers collected from the country by the local running ahead of the limited are transferred at this point to the limited for stations beyond.

The freight business is handled under standard steam railroad classification, rates, way bills, expense bills, etc., and at the same freight rates as competing steam roads. No free cartage is furnished, all freight being delivered to the company at its stations and delivered by them only to their stations. It has been found that owing to the greater convenience and speed of the electric freight service the company gets practically all the business in the territory under even conditions as to charges and delivery, with the steam roads.

Milk is handled by both the freight and combination baggage cars from points along the line into Battle Creek and Jackson



INTERIOR OF REPAIR SHOP AT ALBION

in large quantities, without the use of way bills. The milk companies and farmers along the line buy a coupon ticket, which is at the same time a tag, and this ticket calls for the delivery of the can of milk and the return of the empty can.

REPAIR SHOP

The repair shop located at Albion is equipped with lathes, shapers, forges, 200-ton wheel press, overhead I-beam trolley with pneumatic hoists, a jib crane, turn-tables for quickly removing trucks from beneath cars, and all modern conveniences. The cars for inspection are run out upon elevated tracks, the entire floor of the repair shop being sunk $3\frac{1}{2}$ ft. beneath the level of the tracks.

A wash house for washing cars is provided, heated by steam so that the cars can be washed in winter.

A large storage yard for storing extra equipments is provided outside of shops. The tracks are well separated so as to reduce fire risk as much as possible.

OFFICERS

The officers of the company are: President, C. M. Spitzer; vice-president, A. L. Spitzer; treasurer, N. S. Potter; secretary, W. T. Foote; superintendent, E. S. Loomis; passenger and freight agent, J. A. Bucknell. The Messrs. Spitzer are of the firm of Spitzer & Company, bankers of Toledo and New York.

The Lake Shore Electric Railway is now operating, nightly, Cleveland theater cars from as far west as Norwalk, 57 miles, the cars being held until all the theaters are out. The return to Norwalk is made in two hours.