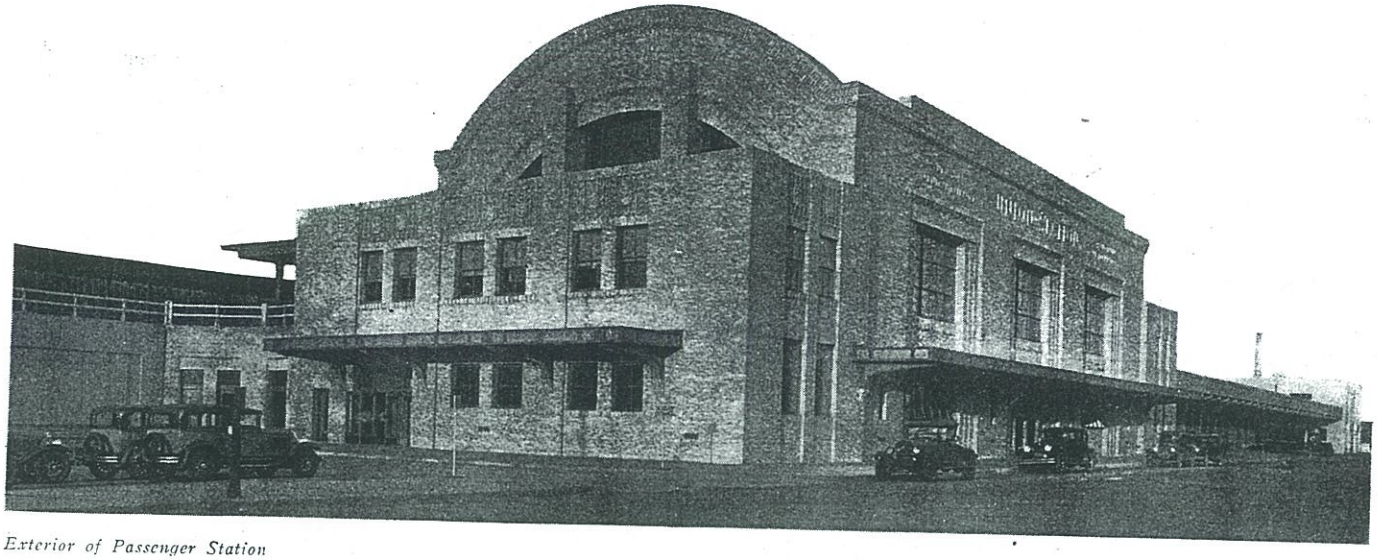
GRAND TRUNK WESTERN RAILWAY DIARY II

C. H. RIFF

Battle Creek.
South Bend
Suburban line
Detroit underpass
Grand Rapids station
Royal Oak
HighBall Freight
Port Huron



Exterior of Passenger Station

Eliminate 29 Busy Grade Crossings

New York Central and Grand Trunk Western complete extensive track elevation and construct joint facilities at South Bend, Ind.

THE New York Central and the Grand Trunk Western have completed track elevation projects of magnitude through the city of South Bend, Ind., which involved the elimination of 29 important street crossings at grade and of an interlocked railway grade crossing. In carrying out this work it was necessary for the Grand Trunk Western to build 1.3 miles of double-track main line, including three street subways and a six-span steel bridge over the St. Joseph river, the latter structure also separating the grades at two streets. When this was done, approximately one mile of main line which traversed Division street through the heart of the city was abandoned.

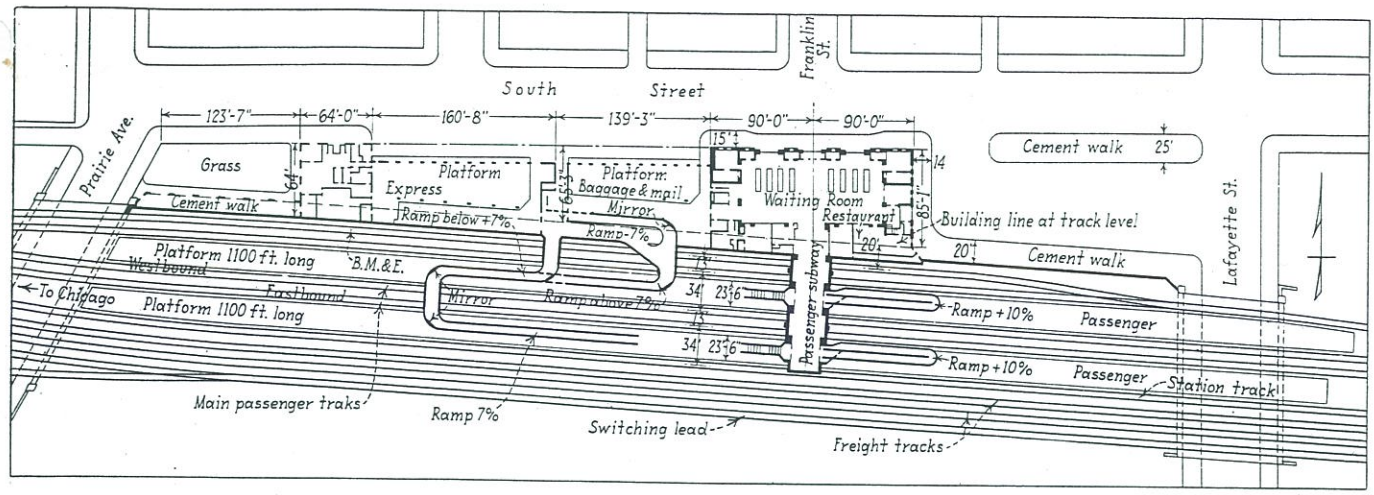
The New York Central elevated its tracks for 2.5 miles and extended its four-track system through the city. This involved the construction of 6 miles of temporary main tracks and 12 miles of permanent main tracks, 10 miles of which are laid with new 127-lb. rail and 2 miles with 105-lb. rail; the placing of more than 440,000 cu. yd. of filling; the construction of 8,200 lin. ft. of heavy retaining wall, which, together with bridge masonry and the walls and foundations for the passenger station, required the placing of more than 50,000 cu. yd. of concrete; the erection of 11 steel bridges, each carrying from four to eight tracks; the construction of enlarged passenger facilities, including a union station; and the installation of an extensive interlocking and signal system. As a necessary part of this work and preceding the elevation of the tracks, a new modern freighthouse and team tracks with paved driveways were built on a new site which provided room for present enlargement and later expansion. The cost of the project carried out by the New York Central was approximately $8,000,000 and of the Grand Trunk Western project $1,800,000.

For a number of years the continued industrial development of South Bend had created increasingly serious hazards at the numerous grade crossings over these two railways. The New York Central passes through the city from northwest to southeast, immediately south of the business district. Prior to the completion of the track elevation, the four-track system of this road ended near the westerly city limits, from which point two tracks continued east to Elkhart, Ind., 15 miles, where the line again expanded into four tracks. The double-track line of the Grand Trunk Western entered South Bend from the east, merging into a single track through the city, and extended due west through the business district, occupying Division street which carries a heavy vehicular traffic, and from which it turned southwest to cross the New York Central at grade, where double track was resumed.

Extended negotiations resulted, in 1924, in separate agreements between the railways and the city for the separation of grades and the removal of the track in Division street. A track-elevation contract ordinance was passed on January 9, 1925, under which the New York Central was to elevate its tracks and replace its passenger station with new facilities. The Grand Trunk agreed to relocate and elevate its tracks west of the St. Joseph river, so that they would lie north of and immediately adjacent to the New York Central, and build a separate passenger station. The latter road began the preparation of plans at once and started actual construction on May 10, 1927. It was necessary for the Grand Trunk to acquire considerable property, however, this being a slow process owing to the congested district through which its line was to pass, so that the starting of its work was delayed.

Agree to Joint Facilities

In the meantime a supplementary agreement was consummated between the city and the two railways, whereby



Station Layout, Showing Ramps and Floor Plan of Station Building

delaying the construction program. By utilizing this method it did not become necessary to close any one of the streets for more than a few hours, besides which considerable saving was made in the cost of the work. As soon as the riveting was completed, the reinforced concrete floor slabs were placed so as to be ready for use as soon as the grading was completed. The erection equipment consisted of two locomotive cranes, one bridge derrick and one caterpillar tractor, the erection being carried out from the original track level.

Method of Grading

Likewise, the plan, as outlined at the beginning of the construction program, provided that the grading should be done without the use of a temporary filling trestle to avoid subsequent settlement of the tracks as the timber decayed. The contractor provided equipment, therefore, which enabled him to cast up the embankment for the first two tracks with material which was unloaded at the original track level from the side dump cars in which the filling material was delivered to the site of the work. This was done by means of three dragline graders and one caterpillar tractor, the latter being used for leveling off and compacting the material placed by the dragline equipment. The fill for the first two permanent tracks was completed in this manner and the tracks were laid. Before they were placed in service, however, the embankment for the third track was completed by dumping from the most southerly of these two tracks.

As soon as the first two permanent tracks were placed in service the temporary tracks were removed and the construction of the south retaining wall and the remainder of the bridge masonry was begun. The third track was laid, and as rapidly as the bridges were erected the placing of the remainder of the fill was carried on progressively from the permanent track level. The tracks at the west end of the work were raised under traffic, the raise at the G.T.W. crossing being six feet.

The material for making the fill was obtained from a pit at Ginger Hill on the Illinois division about nine miles from the site of the work. The contractor used a 5-cu. yd. dragline excavator for loading the 18-yd. cars in which the material was transported. The average rate of delivery was 96 cars a day, so that approximately 255 working days were required to place the 440,000 cu yd. of material which were used in making the fill.

When the temporary tracks were placed in service, temporary passenger and baggage facilities were constructed to serve them, and the existing station and platforms were razed. When traffic was turned onto the [illegible] permanent tracks, the old freighthouse was utilized as a passenger station until the new union station was completed.

The retaining walls, exclusive of the bridge abutments, aggregated 8,200 lin. ft., and together with the bridge masonry required the placing of 45,000 cu. yd. of concrete. They range in height from about 6 ft. to more than 20 ft. above the footings. All walls and abutments are designed as gravity sections and, in general, are not supported on piles, the footings being spread to provide a safe unit-bearing load.

Street Bridges Designed for Heavy Loading

As has been mentioned, except at Main and High streets, independent bridges are provided for each track, so that the structures carrying any track can be removed or repaired without interfering with the use of the adjacent tracks. Each structure consists of half-through plate-girders, with sidewalk and roadway spans, and the tracks are carried on reinforced concrete floor slabs which are supported on I-beam floors. The concrete extends up to and over the top flange of the girders to protect them completely from brine drippings or other corrosive agents. Still further protection is afforded by the application of membrane waterproofing to the floor slab and the concrete which encases the inside face of the girders.

Because of the divergent tracks at the junction with the Grand Trunk Western at High street and the closing in of the station tracks at Main street, it was not practicable to use the through-girder construction at these streets, for which reason the tracks are carried on Bethlehem beams encased in concrete, which rest on transverse girders which, in turn, are supported on steel columns placed on the curb line at High street and at the center of the roadway and the curbs at Main street.

Prior to the track elevation, 14 streets crossed the tracks at grade, the crossing of Bronson and Michigan streets being at the intersection of these streets. Similarly, at Marietta and Ohio streets, the intersection was just outside the right of way, while there was a jog in Rush street where it crossed the tracks approximately at the crossing with Sample street. With the approval of the city, Rush and Ohio streets were closed across the tracks, but Ohio street was diverted south of the tracks so that a single subway serves to carry the traffic on Marietta and Ohio streets under the railway. A single bridge spans the intersection of Bronson and Michigan streets without disturbing the alinement of either. As a result of these changes, only 11 bridges are necessary to provide for the street traffic which formerly required 14 grade crossings.

Some of the streets involved in the grade crossing elimination are too narrow to serve efficiently the traffic they now carry. For this reason, the city plans to widen them as opportunity affords, and, in order that the subways at these streets might conform to this plan, the railway agreed to construct them to the proposed width and widen the streets for some distance on either side, the city paying for all work outside of the right of way lines. Accordingly, Fellows street was widened from 40 ft. to 60 ft.; Sample street from 40 ft. to 80 ft.; and Miami street from 50 ft. to 60 ft.; while the diversion of Ohio street was made 66 ft. wide, although the remainder of the street has a width of only 50 ft.

The Union Station

While the work on the track elevation was progressing, the construction of the passenger station and allied facilities was also under way, the walls for the passenger subway and ramps having been built at the time the north retaining wall was constructed. The station fronts on South street at the corner of La Fayette street and is located one block west of Main street, one of the principal north and south streets of the city. The passenger facilities include the station proper, with separate space masked from the main part of the building, for the handling of baggage and mail, and express.

The main part of the building, which is 180 ft. by 85 ft. in plan, is two stories high, the waiting room extending the full height of the building. Surrounding three sides of this room at the first floor or street level are the usual facilities for purchasing tickets and checking baggage, and the rest rooms and toilets. The concessions include a news stand, a restaurant, a barber shop and a taxicab stand. On the second floor the space surrounding the waiting room is given over to office purposes.

The main entrance to the waiting room is from South street, but passengers arriving or leaving in taxicabs use the entrance at the east end of the building. A wide passage leads from the main entrance to the subway, from which the platforms at the track level are reached by means of ramps and stairways. Separate ticket offices are maintained by the two roads, and these are located on the track side of the waiting room to the right of the passenger subway. At the west end of the waiting room, immediately to the right of the ticket offices, is the baggage counter for checking baggage and parcels and the delivery of hand baggage.

The exterior of the building, which is faced with a light gray brick, is severely plain but very attractive, the flat surfaces being broken by wide pilasters and panels. The arched roof which spans the waiting room, in combination with the vertical lines of the wall surfaces, gives an effect of height and great size and adds materially to the pleasing appearance which the building presents. On the South street front and the east end there is a 15-ft. concrete walk protected by long, deep canopies. Between the east end of the building and La Fayette street a large paved area provides parking space for automobiles and taxicabs.

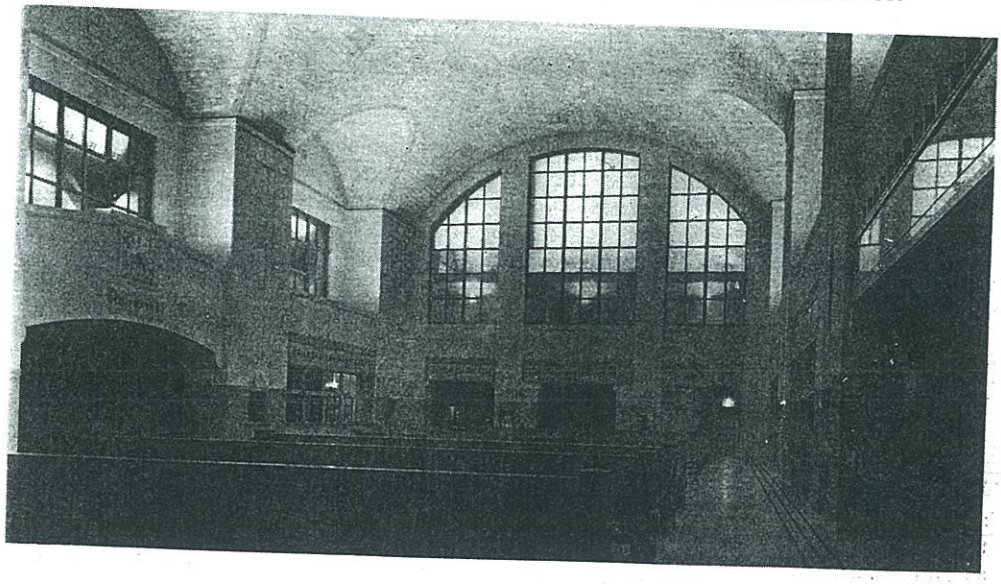
Features of the Waiting Room

The entire area at street level, except the ticket offices where wood floors are installed, is laid with terrazzo floors in alternate light and dark squares with three black bands for the border. The walls are finished in marble, the dado course being a dark-toned Botticino marble above which unpolished Tennessee marble extends to the ceiling. The Tennessee marble is omitted in the passenger tunnel, so that here the Botticino wall finish extends to the ceiling. The ceilings in both the waiting room and tunnel are of the barrel-vault type, the arches being constructed of light buff Gustavino tile. The groins at the intersecting arches which span the window openings are edged with darker tile, and small inserts and panels of darker tile in patterns have been introduced to break the monotony of the large vaulted surface. At lintel height, legible signs with recessed lettering indicate the location of the various facilities and concessions.

The large window areas provide ample daylighting, but without glare. The night lighting is of the indirect type and is accomplished by means of floodlighting units concealed in the parapet of the balconies on either side of the room. Fourteen units are employed in each of the center panels and 18 in the end panels to give a soft well diffused light. Half-hidden lights, not of the floodlight type diffuse a soft radiance through the passenger tunnel. Direct lighting is employed in the ticket offices and other rooms exterior to the waiting room.

Twelve radio clocks, which are controlled by a master clock that is regulated hourly by radio, are distributed throughout the public rooms and the various facilities, thus making it possible for both patrons and employees to ascertain the time from almost any position in the entire station. One of these clocks can be seen in the view of the waiting room.

The public rooms are heated by the indirect system of heating from a self contained heating plant in the basement. The Sturtevant system of heating and ventilation is used, there being no direct heating units in the building, except in the office on the second floor.



Waiting Room, Looking Toward Baggage Room

Separate facilities at street level have been provided for handling baggage and mail, and express, the quarters for these operations being in that part of the station building located immediately west of the main part of the structure. The baggage and mail room is 139 ft. by 65 ft., while the express room occupies an area 160 ft. by 65 ft., with additional office space 64 ft. by 64 ft. The main feature of both facilities is the high receiving and delivery platforms which are at wagonbed level. The floor upon which the trucks and trailers run, upon which shipments are taken to the platform at track level, are at street level. The station platforms are reached by an intricate system of ramps, one of which has two stages, as shown in the drawing.

Two station platforms, each 1,100 ft. long have been provided, the main passenger tracks being between them, with supplementary station tracks on either side. The third station track which was mentioned earlier, lies adjacent to the platform along the building and is used exclusively for unloading and loading baggage, mail and express cars which are received at or dispatched from South Bend.

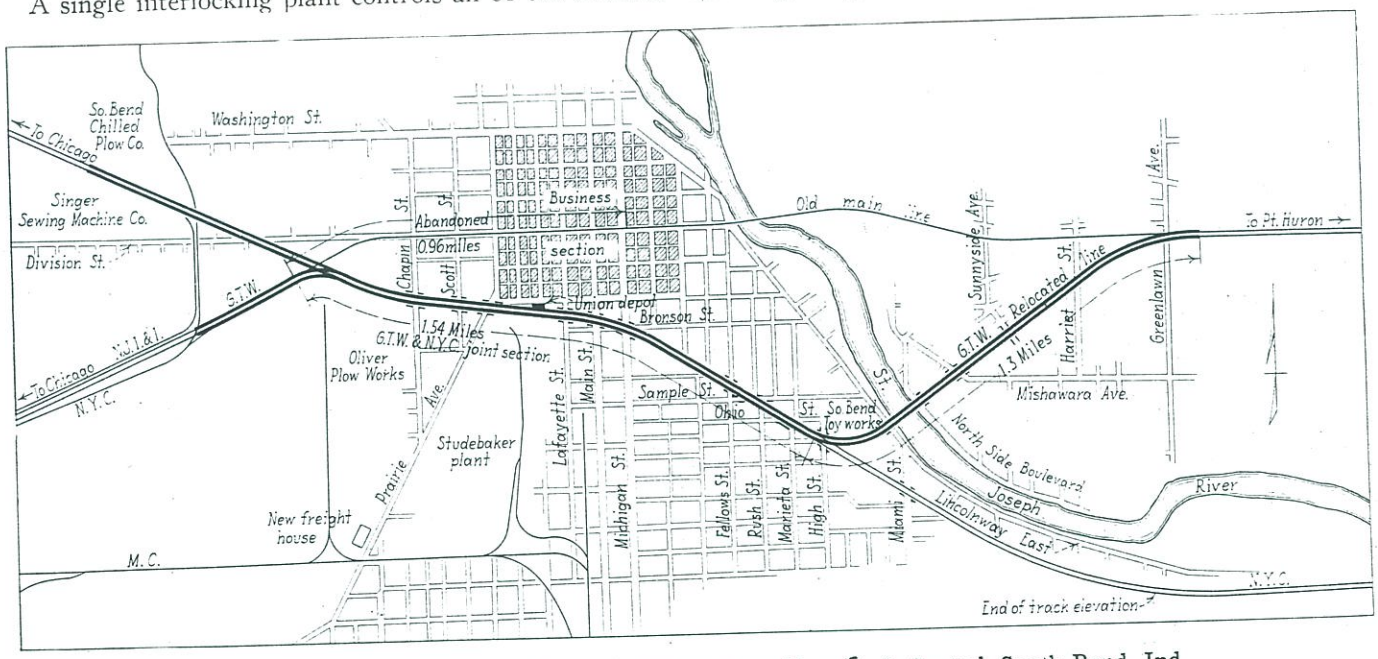
A single interlocking plant controls all of the switches from the end of the four-track system on the east to the crossing with the Illinois division on the west, a distance of 3.68 miles. The interlocking machine, which is of the all-electric type furnished by the General Railway Signal Company, has 259 working levers and is housed in a three-story brick tower, 17 ft. by 70 ft. which conforms in appearance to the station to which it is adjacent. All signals are of the color-light type, with approach lighting. They are mounted on ground masts, bracket masts or signal bridges as required to bring them to the right of the tracks they govern. Track 5, the switching track, is signalled in both directions, all other tracks being signalled for the normal direction only. A complete description of this plant and its operation appeared in the July issue of Railway Signaling.

Grand Trunk Western Diversion

Immediately east of South Bend, the Grand Trunk Western and the New York Central are about a mile apart and from this point the lines formerly converged to the point of crossing, about one mile west of Michigan

to begin its diversion approximately 1.5 miles east of Michigan avenue. The relocated line turns sharply to the southwest on a long easy curve as it leaves the old line and crosses the St. Joseph river nearly at right angles and then curves again to the west to join the New York Central at High street. This double-track diversion is carried on a high embankment for 1.3 miles, crossing Harriet street, Sunnyside street, Mishawaka avenue and the two streets which parallel the St. Joseph river on either bank of this stream. East of the river the fill was made by means of trucks with basement and other excavation from building projects in the city. Since the line passes through a recently-developed high-class residential and park district the slopes have been carefully dressed and sodded.

The height of the embankment facilitated the separation of grades at all of the five streets which are crossed. The principal structures on the new line are at Mishawaka avenue and the St. Joseph river. The tracks are carried over Harriet and Sunnyside streets on I-beam spans encased in concrete, which are supported on concrete abutments and reinforced concrete piers. The pleasing design of these structures is accentuated by the



Grand Trunk Diversion and Trackage Rights Over New York Central, South Bend, Ind.

paneled parapets which mask the tracks. Mishawaka avenue is crossed by means of a skew barrel arch having a clear span of 70 ft., the springing line of which is about 6 ft. above the sidewalk.

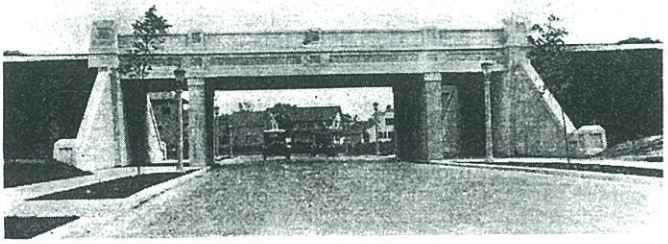
The arch has a rise of 15 ft. 9 in., giving a clearance of 20 ft. at the center of the street and 13 ft. at the curb. The cellular-type abutments are supported on creosoted piles to decrease the dead load and are filled with granulated slag to the elevation of the subgrade. Asphalt membrane waterproofing was applied to the barrel of the arch and this is protected with a layer of asphalt mastic blocks, over which a 6-in. layer of crushed stone was placed, with a system of cast-iron drain pipes embedded in the stone. The large surface of the spandrel walls and parapets is relieved by recessed panels. The entire exposed surface was waterproofed with an iron waterproofing applied with a cement gun, after which a cement finish was applied in the same manner. The construction of this arch required the placing of 2,000 cu. yd. of concrete, which was mixed at the site of the work. The concrete for the abutments was spouted from a bucket in the hoisting tower which was high enough to reach all

walls was placed by means of bottom-dump concrete cars which operated on a narrow-gage track and which were filled from the hoisting bucket. Street-car traffic was maintained at all times during construction, but vehicular traffic was detoured during the depositing and curing of the concrete in the arch ring.

St. Joseph River Bridge

The bridge over the St. Joseph river consists of four 107-ft. deck plate-girder spans over the channel and two 90-ft. half-through spans, one over the North Side boulevard along the east bank of the stream and the other over the Lincoln highway on the west bank. The outer girders of the boulevard spans are masked by concrete fascia and the piers and abutments which support them are extended upward as pylons to add to the decorative effect. On the channel spans the tracks are carried on reinforced concrete floors which rest on the top chords of the girders and are cantilevered out 4 ft. 9 in. to form a walk. The shorter spans are designed with I-beam floors which are encased in concrete which extends to the top of the girders and is also cantilevered out to form a walk. The concrete is also carried down on the outside faces of the outside girders of these spans to form the fasciae, the reinforcement of this concrete being wire mesh supported by longitudinal bars which are carried through holes in the legs of the stiffening angles.

The east pier and the cellular concrete approach which

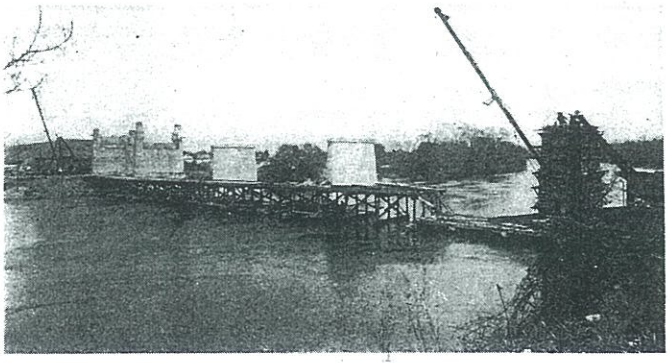


Grand Trunk Bridge Over Sunny Side Avenue

acts as an abutment are supported on concrete piles. The west abutment, which is similar in design to the one at the east end, rests on a stratum of gravel as do the channel piers which reach a depth of 16 ft. below low water. The foundations are protected by steel sheet piling which were used in the coffer-dams. They were anchored to the footings and left in place for this purpose.

In preparing for the construction of the piers, a wide low-level pile trestle with a wood plank floor was driven on the down-stream side of the structure. The coffer-dams were driven with a steam hammer working from a portable stiff-leg derrick from the deck of the trestle. After the driving was completed, the derrick was equipped with a clam-shell bucket for excavating the foundations. Later the same derrick handled the concrete from the mixer to the forms. The excavation was cast outside the coffer-dams and used for backfill.

When the footings were completed, the trestle was raised about 10 ft. on frame bents to facilitate the handling of the forms and concrete for the neat work. It was found convenient to utilize the aggregate storage and proportioning equipment which were being used for the arch at Mishawaka avenue, as it was only a short distance from the river. The aggregates were proportioned at this point and handled to the mixer in trucks. A mobile mixing plant was employed, which could be moved readily to the most convenient point on the trestle for work at any of the piers, the concrete being handled



Construction Trestle, Bridge Over St. Joseph River

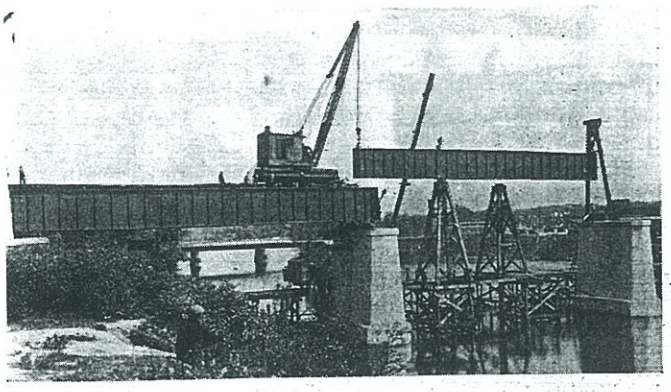
A total of 12,000 cu. yd. of concrete was placed in the substructure in this manner. The water-cement ratio was used for the concrete in this bridge as well as in the remaining structures on this line; the concrete for the arch ring at Mishawaka avenue was Class B concrete which has a required strength of 3,000 lb. per sq. in.

Erection Methods

Erection of the bridge over the St. Joseph river began at the west end, the girders being brought in over the connection with the New York Central at High street. The girders for the westbound track were placed first on each span, after which the girders for the eastbound track were erected, thus completing the double-track structure before proceeding to the next span. The girders for the span over the Lincoln highway were placed directly by a bridge derrick having a 60-ft. boom, thus avoiding the necessity for the use of falsework which would have obstructed the heavy traffic on this street. As a precaution, however, traffic was halted while each of these girders were being lowered onto its bearings.

The longer river spans were erected by an ingenious method of launching to a position where they could be lowered into place, thus avoiding the construction of expensive falsework. As each girder was to be erected, it was unloaded from flat cars at the west end of the bridge and placed on two 40-ton car trucks, then pushed slowly forward by a locomotive crane until its end rested on a timber tower equipped with dollies and vertical guide rollers, which was located about one-third of the way across the opening. The forward truck was then removed and a line from a hoisting engine was attached to the girder to pull it forward. This line passed through pulleys in an A-frame located on the pier next in advance. The launching continued until the girder rested on a second tower where a set of lifting blocks and line from the A-frame were attached. Thus, as the forward end reached the pier it was held suspended in the A-frame

(Continued on page 1234)



Underpass for 12-Mile Road Constructed to Accommodate Eight Lanes of Vehicle Traffic

Grand Trunk Builds Four-Track High-Speed Suburban Line

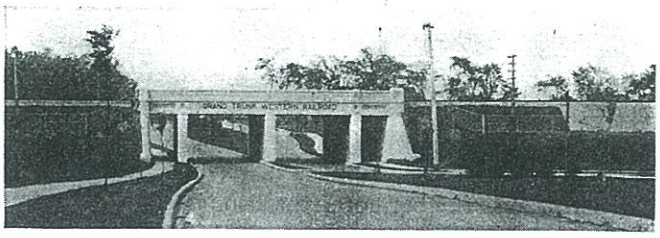
Project near Detroit includes reduction of grades, elimination of 86 crossings, landscaping of right of way and unique method of financing

THE complete relocation of nine miles of busy main line and the reduction of grades on an additional 2¼ miles; provision for four main tracks throughout the limits of the improvement; the construction of 19 grade-separation structures, the elimination of 67 other crossings by closing the streets and the construction of 17 street diversions; and especially the finished manner in which the work was done to bring it in harmony with the surroundings of the high-class suburban territory through which the line passes, are outstanding

Structure Built to Carry the Line Over First Street in Royal Oak

features of a construction project which has recently been completed by the Grand Trunk Western between Detroit, Mich., and Pontiac at a cost of $7,000,000. Still other features of special interest include an unusually complete system of subsurface drainage in cuts; the architectural treatment of the grade-separation structures; a system of landscaping the right of way and adjacent grounds; and an unique method of financing, in which the state initially provided the right of way for the relocated line and advanced the funds for construction. This project involved unusually heavy grading for this section of the country, more than 1,500,000 cu. yd. of material having been moved, an average of approximately 140,000 cu. yd. to the mile.

Woodward avenue, one of the principal streets of Detroit, extends northwest from the city as an important trunk highway. Between the city limits and Pontiac it passes through a highly-developed suburban territory as far as Birmingham, 18½ miles from Detroit. Between Royal Oak, 13 miles from Detroit, and a point two miles north of Birmingham, the highway was parallel with and immediately adjacent to the main line of the Grand Trunk. Because of present congestion and a constantly increasing traffic, the state desired to widen the highway to 204 ft. To obtain the land necessary for this purpose, the state agreed to purchase the necessary right of way for a relocation of the Grand Trunk tracks and the railway agreed to make the relocation, which extends from mile post 13, immediately north of the station at Royal Oak, to mile post 22.1, about 3½ miles north of Birmingham. From this latter point the line continues on the old location to Pontiac. Between the junction with the old line, however, and South boulevard, in the outskirts of Pontiac,



The Underpass for Northwood Boulevard

2¼ miles, the grades were reduced from 1 per cent to 0.65 per cent, to conform with those on the remainder of the line.

Method of Financing

To finance the project, the state agreed, in addition to providing initially the right of way for the relocated line in exchange for the property occupied by the old line, to pay initially all costs of construction below subgrade

for a double-track line and the laying of a single track. On its part, the railway agreed to repay the sums thus advanced by the state in 15 equal annual installments without interest.

Double track extended from Detroit to Royal Oak, but the old line was single track from this point to Pontiac. Existing traffic was sufficient to justify double track north of Royal Oak, while the prospective traffic which will result from the ultimate development of the entire area to Pontiac into a high-class suburban residential district, made it desirable to provide for a minimum of four tracks. Accordingly, two tracks were provided for present operation and all of the grading, culverts and grade separation structures were completed for four tracks, the railway paying the cost of all work in excess of that required for two tracks.

As a part of the general plan for the development of this line, suburban service was inaugurated on August 1, 1931, the date the new line was placed in operation, and will be expanded as required. The old line was abandoned and the tracks removed, coincident with the opening of the diversion. The relocated line is 0.8 mile east of the old line and is 0.28 mile shorter.

As soon as traffic justifies, as it is expected to do in the near future, the additional tracks will be laid. Present plans also definitely contemplate the electrification of the line between Detroit and Pontiac as soon as this is economically feasible. In short, the intention is to develop this section of the road into a high-class passenger, as well as a freight, line which will be in keeping with the character of the district through which it passes.

Since practically the entire area between Detroit and Pontiac is subdivided and is already partially built up, the acquisition of the right of way presented many troublesome problems. Many of the subdivisions are highly restricted and the ownership of the lots is widely distributed in the hands of individuals. Because of the restrictions, it became necessary not only to obtain the fee to the property actually needed for right of way purposes, but also to obtain negative restrictive easements on much of the adjacent property.

As an indication of some of the difficulties encountered in this phase of the project, in Royal Oak alone 25 houses were removed to other locations. Again, the work on the diversion was started in May, 1928, but was delayed for more than a year by injunction proceedings, based on objections to the violation of these restrictive rights and on plans for closing streets or the location of subways.

Eighty-Six Out of 88 Grade Crossings Eliminated

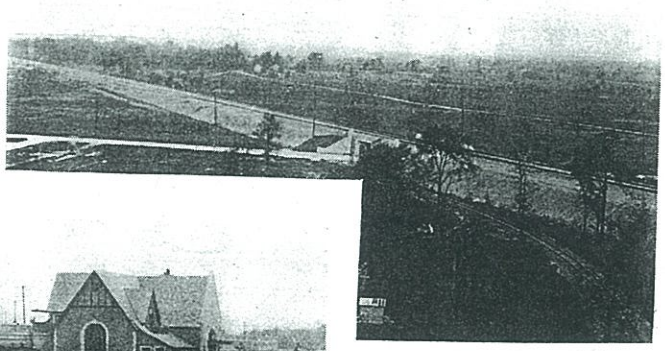
As already mentioned, the greater part of the section traversed by the relocated line had been subdivided. As a consequence, 85 streets and 13 alleys were crossed, and in addition there were 3 grade crossings within the limits of the grade reduction section. Because of the large number of crossings and the relatively dense present traffic, which is expected to increase materially in both volume and speed in the near future, the separation of grades became a matter of major importance. In carrying out the construction, all but two of these grade crossings were eliminated. This was accomplished by the construction of 15 subways and 4 viaducts, and by the closing of 67 streets and the 13 alleys. Seventeen marginal streets and other street diversions were constructed, one alley was diverted and two marginal pedestrian lanes were opened. Three new streets were opened at points where certain groups of streets that were to be closed could be better served in this manner and two of the subways and one viaduct are located at these new streets.

The Structure at 14-Mile Road Accommodates Four Lanes of Highway Traffic

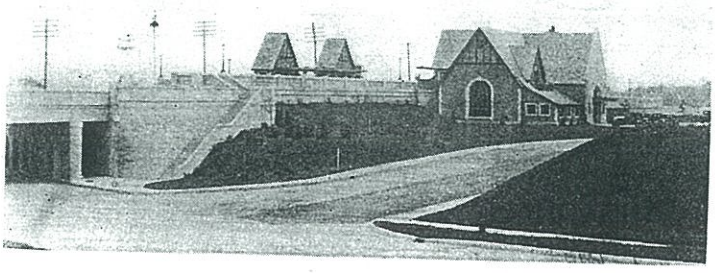
Design of Grade-Separation Structures

The design of the grade-separation structures constitutes one of the principal features of the construction. In general, the subways provide for two lanes of travel and two sidewalks. The roadway openings at 7 locations are 20 ft. and at 5 locations, 28 ft., and those for the sidewalks 7 ft. 9 in. At two of the less important crossings there is a single 28-ft. roadway opening, while at Oakwood boulevard in Royal Oak, four 28-ft. lanes were provided. The roadway on the viaducts is 30 ft. between curbs, outside of which are 5-ft. sidewalks. As stated, all grade-separation structures were built for four tracks.

Every effort was made to develop designs of pleasing appearance, so that considerable attention was paid to the architectural treatment. While simple, this treatment is in keeping with the purpose for which the structures are used. The piers are of the open arch type without ornamentation, except for a rather



Looking North from Station 180 — Part of the Old Line is Shown in the Foreground



The New Station at Birmingham, Mich.

for a double-track line and the laying of a single track. On its part, the railway agreed to repay the sums thus advanced by the state in 15 equal annual installments without interest.

Double track extended from Detroit to Royal Oak, but the old line was single track from this point to Pontiac. Existing traffic was sufficient to justify double track north of Royal Oak, while the prospective traffic which will result from the ultimate development of the entire area to Pontiac into a high-class suburban residential district, made it desirable to provide for a minimum of four tracks. Accordingly, two tracks were provided for present operation and all of the grading, culverts and grade separation structures were completed for four tracks, the railway paying the cost of all work in excess of that required for two tracks.

As a part of the general plan for the development of this line, suburban service was inaugurated on August 1, 1931, the date the new line was placed in operation, and will be expanded as required. The old line was abandoned and the tracks removed, coincident with the opening of the diversion. The relocated line is 0.8 mile east of the old line and is 0.28 mile shorter.

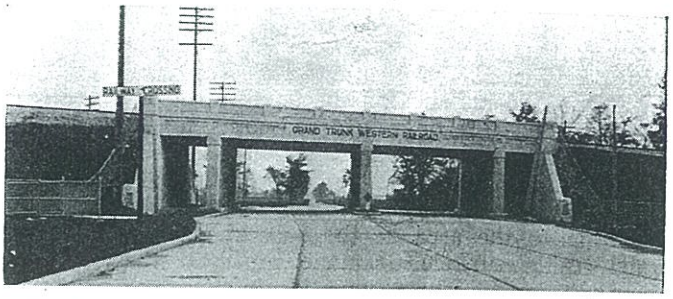
As soon as traffic justifies, as it is expected to do in the near future, the additional tracks will be laid. Present plans also definitely contemplate the electrification of the line between Detroit and Pontiac as soon as this is economically feasible. In short, the intention is to develop this section of the road into a high-class passenger, as well as a freight, line which will be in keeping with the character of the district through which it passes.

Since practically the entire area between Detroit and Pontiac is subdivided and is already partially built up, the acquisition of the right of way presented many troublesome problems. Many of the subdivisions are highly restricted and the ownership of the lots is widely distributed in the hands of individuals. Because of the restrictions, it became necessary not only to obtain the fee to the property actually needed for right of way purposes, but also to obtain negative restrictive easements on much of the adjacent property.

As an indication of some of the difficulties encountered in this phase of the project, in Royal Oak alone 25 houses were removed to other locations. Again, the work on the diversion was started in May, 1928, but was delayed for more than a year by injunction proceedings, based on objections to the violation of these restrictive rights and on plans for closing streets or the location of subways.

Eighty-Six Out of 88 Grade Crossings Eliminated

As already mentioned, the greater part of the section traversed by the relocated line had been subdivided. As a consequence, 85 streets and 13 alleys were crossed, and in addition there were 3 grade crossings within the limits of the grade reduction section. Because of the large number of crossings and the relatively dense present traffic, which is expected to increase materially in both volume and speed in the near future, the separation of grades became a matter of major importance. In carrying out the construction, all but two of these grade crossings were eliminated. This was accomplished by the construction of 15 subways and 4 viaducts, and by the closing of 67 streets and the 13 alleys. Seventeen marginal streets and other street diversions were constructed, one alley was diverted and two marginal pedestrian lanes were opened. Three new streets were opened at points where certain groups of streets that were to be closed could be better served in this manner and two of the subways and one viaduct are located at these new streets.

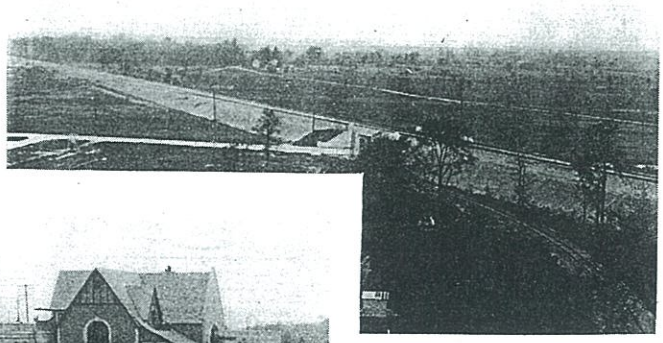


The Structure at 14-Mile Road Accommodates Four Lanes of Highway Traffic

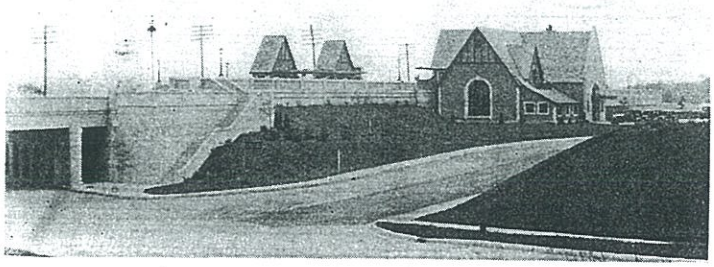
Design of Grade-Separation Structures

The design of the grade-separation structures constitutes one of the principal features of the construction. In general, the subways provide for two lanes of travel and two sidewalks. The roadway openings at 7 locations are 20 ft. and at 5 locations, 28 ft., and those for the sidewalks 7 ft. 9 in. At two of the less important crossings there is a single 28-ft. roadway opening, while at Oakwood boulevard in Royal Oak, four 28-ft. lanes were provided. The roadway on the viaducts is 30 ft. between curbs, outside of which are 5-ft. sidewalks. As stated, all grade-separation structures were built for four tracks.

Every effort was made to develop designs of pleasing appearance, so that considerable attention was paid to the architectural treatment. While simple, this treatment is in keeping with the purpose for which the structures are used. The piers are of the open arch type without ornamentation, except for a rather



Looking North from Station 180 — Part of the Old Line is Shown in the Foreground



The New Station at Birmingham, Mich.

deep coping. Parapets are provided on both subways and viaducts, and are broken by massive square balusters with recessed surfaces. The solid panels are also recessed to break the monotony of the plain surfaces, while the fascie of the floor slabs are recessed to give a paneled effect in harmony with those of the parapets.

All floor slabs on railway type structures are constructed of the new Carnegie CB-beams encased in concrete, except in one instance, at Benjamin avenue which is on a skew of about 30 deg., where built-up unit construction consisting of girders and floor beams encased in concrete were used. For the highway crossings, at Adams road in Birmingham the roadway of the viaduct, which is on a skew of 35 deg., is carried on 36-in. I-beams encased in concrete. The other two highway slabs are on reinforced-concrete beams. The standard under clearance for subways is 14 ft. and for viaducts 22 ft., although 15 ft. of headroom was provided at three subways.

Owing to the area of the subway or bridge decks, considerable surface drainage must be disposed of. For this purpose, three catch basins or sumps were located at subgrade level in the intertrack spaces immediately back of each abutment, and a line of 6-in. Armco perforated pipe was laid on the first bench of the backwall of the abutments, which in turn is connected by 6-in. Armco riser pipes into a concrete pipe laid at a lower level, through which the water is led to the sewer. The catch basins are directly connected to the Armco riser pipe and will function with the ballast frozen.

Grading Was Heavy

Owing to the generally flat country between Royal Oak and Birmingham, the tracks are carried on embankment continuously for more than five miles between these points. The height of this fill averaged about 14 ft., this being fixed by the elevation necessary to accommodate the numerous grade separation structures. While flat, the country rises rather sharply toward the north, requiring the introduction of maximum gradients of 0.65 per cent.

North of Birmingham the land continues to rise, but becomes more rolling. Cutting was necessary in this section, which also contains the largest fill on the project. This embankment, which is located about two miles north of Birmingham, is 6,500 ft. long and has a maximum height of 40 ft. There are three large cuts on the relocated line. The largest of these is 2,000 ft. long, more than 55 ft. deep and contained 430,000 cu. yd. in the normal section. The next in order of size involved the removal of 260,000 cu. yd., while 55,000 cu. yd. was taken from the third. On the grade-reduction section the greatest difference in elevation between the new and old subgrades was 24 ft.

Divided into Three Construction Zones

For purposes of construction the project was divided into three zones, the first of which extended south from M.P. 22.1, the end of the relocated line, approximately three miles. In this zone the embankments totaled more than 710,000 cu. yd., while the excavation from the normal section of the cuts amounted to 530,000 cu. yd., and 78,000 cu. yd. was obtained in connection with grade separations. The fill in this zone thus exceeded the excavation by 100,000 cu. yd. A sink hole at the north end of this zone required more than 100,000 cu. yd. additional material to make the fill across.

Zone 2 extended 2¼ miles farther south and involved the removal of 290,000 cu. yd. from cuts and 46,000 cu. yd. from grade separations. The fills in this zone contained 300,000 cu. yd., or 36,000 cu. yd. less than the yardage from the normal sections of the cuts.

Zone 3 included the remainder to the south end of the relocated line and included borrow from the grade-reduction section north of M.P. 22.1, and required a total of 640,000 cu. yd. for the embankment, with no excavation except 110,000 cu. yd. from street excavation at the grade-separation structures. The yardage required in the embankments thus exceeded the normal excavation by 530,000 cu. yd. The excess material required was obtained from the grade-reduction section which extended north from M.P. 22.1 to South boulevard, Pontiac, where 365,000 cu. yd. was available after making the small fills which required approximately 40,000 cu. yd., and from excavation for a small yard development adjacent to the grade-reduction section at the north end, which serves the Yellow Cab & Coach Mfg. Co. The yard work was done by the railway under a separate contract.

The sides of the largest cut were terraced, two wide benches being left on each side of the cut to minimize the tendency to slide or slough.

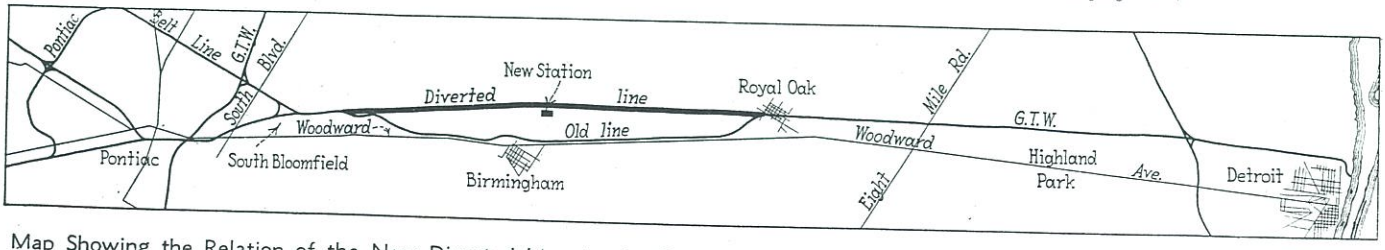
Both large and small power shovels and one dragline excavator were employed in the grading. The material was loaded into 5-yd. and 12-yd. Western air-dump cars which were handled to the point of disposal by gas dinkys on narrow-gage track and steam locomotives on standard gage. The haul was relatively short in Zones 1 and 2, but averaged nine miles for Zone 3.

Two Sink Holes Encountered

In this locality, sink holes, bowl-like depressions of varying extent and depth, are quite common. They are filled with unstable material, known locally as muck, which is composed largely of partly decomposed organic matter. They may be open or they are sometimes so overlaid with earth that their presence is not disclosed by surface indications.

Immediately south of South boulevard there is a cut 9,200 ft. long, near the north end of which one of these sink holes, about 300 ft. long and 27 ft. deep, was encountered where the depth of the cut was about 3 ft. Having had experience with similar conditions on the Pontiac Belt Line, which was placed in service on May 17, 1931, it was decided to remove all of the muck. Accordingly, it was excavated and wasted and

(Continued on page 51)



Map Showing the Relation of the New Diverted Line to the General Route of the Grand Trunk Western Between Detroit, Mich., and Pontiac

the relocation of the Grand Trunk was altered to enable it to operate over the New York Central tracks west of the river and use the station facilities which the latter was constructing. A supplementary contract ordinance was passed and after several minor amendments was accepted by both roads. This final agreement made no fundamental change in the New York Central plans. It was necessary, however, to make minor revisions in the track arrangement at each end of the section over which the Grand Trunk was to have trackage rights to provide for the Grand Trunk connections, to alter the details of two steel bridges and to extend the signal system to provide for interlocking the junction switches. This agreement also made possible the elimination of the crossing and interlocking plant at the point where the tracks of the two roads formerly crossed.

The final contract gives the Grand Trunk Western trackage rights over the New York Central for 1.54 miles and the joint use of the union station and passenger facilities. The old line of the Grand Trunk west of Michigan street has been removed from Division street, but that part east of Michigan street remains to serve the freighthouse, the team tracks and a number of industries which are located on this part of the line.

New York Central Track Elevation

The primary purpose of the New York Central in elevating its tracks was to eliminate the growing hazards which were presented by the street crossings at grade. A secondary but important reason was that by doing this it became practicable to extend its four-track system through the city and thus afford an opportunity later to fill out the gap which now extends to Osceolo, the first station west of Elkhart. Furthermore, there was a pressing need for expansion of its passenger facilities, which could best be accomplished by removal of its tracks from street level.

The track elevation proper begins about 0.5 miles west of the former crossing with the Grand Trunk Western and extends easterly for 2.5 miles on earth fill. The section between High street on the east and Chapin street on the west is confined between heavy retaining walls, with discontinuous retaining walls at several other points. The tracks are carried over the streets on steel bridges which are independent structures for individual tracks, except at High and Main streets where Bethlehem beams encased in concrete are used in order to accommodate turnouts and crossovers. The extension of the third and fourth tracks began a short distance west of the limits of the track elevation and ends at the eastern limits of the work, approximately 1.5 miles east of the new passenger station which occupies the site of the former station. In addition to the four main tracks, a switching lead and running track was constructed from a point just west of the former Grand Trunk Western crossing to Miami street, approximately two miles, and three station tracks were provided to serve the passenger platforms and the baggage, mail and express facilities.

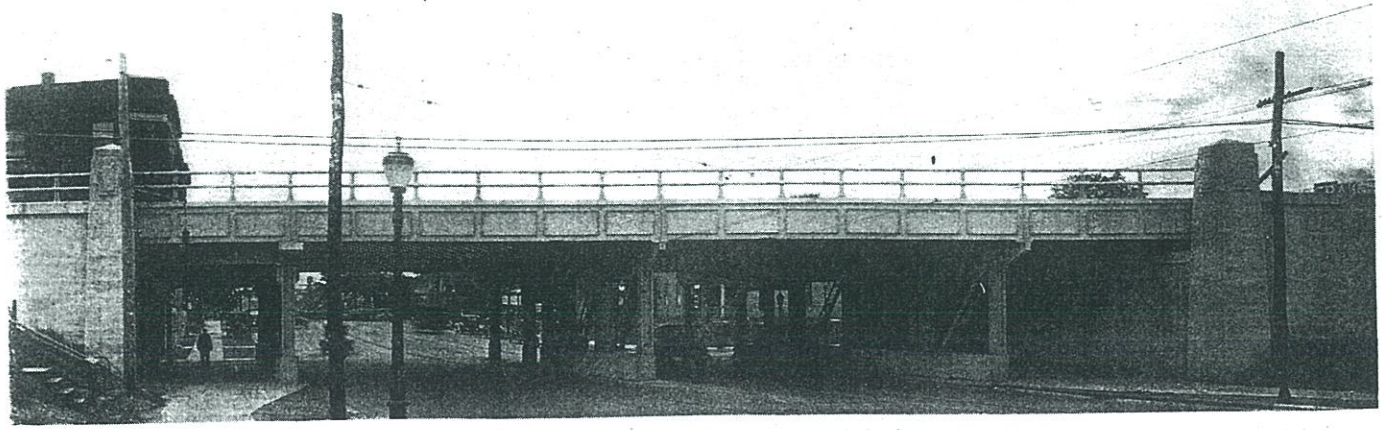
Prior to the track elevation, the New York Central freighthouse and team tracks were located immediately north of the main tracks and west of Scott street. This location not only interfered with the development of the passenger facilities, but, after the extension of the four-track system it would have been necessary to switch all cars to and from the freighthouse and team tracks across the main line passenger tracks almost at the throat of the station layout. Furthermore, the existing facilities had been outgrown, so that considerable expansion of these facilities was desirable, but was impracticable at this location. Accordingly, a new site was selected on Prairie avenue, some distance south of the original location, where adequate facilities have been constructed with ample room for future expansion.

Programming the Work

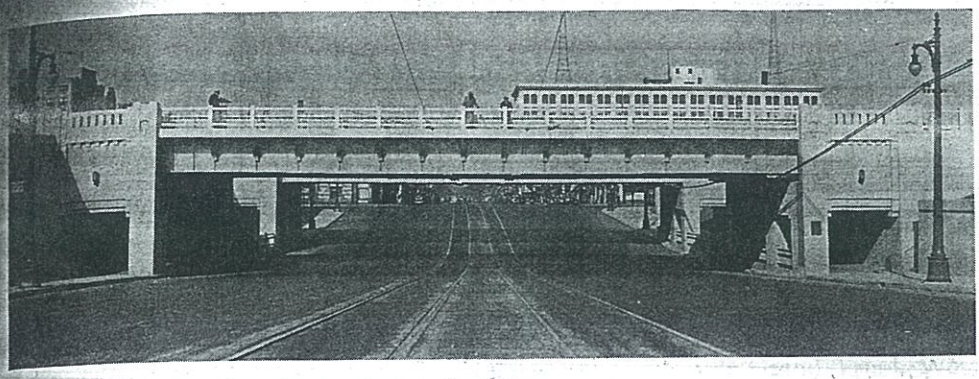
Between High street and the former Grand Trunk Western crossing the entire right of way is occupied by the new layout, so that within these limits the work was carried out under somewhat cramped conditions. Both the freight and passenger traffic passing over this line is heavy, with many important high-speed trains. It became necessary, therefore, to plan the work very carefully in order to minimize the interference with train movements and at the same time allow for as rapid progress as practicable on the construction of the various parts of the project. The removal of the freighthouse and its attendant switching greatly simplified the arrangement of temporary tracks and facilitated the placing of the filling material.

As soon as the freighthouse connections were removed, two temporary main tracks were constructed adjacent to the south right of way line from the G.T.W. crossing to the eastern limits of the work. This provided room for the construction of the north retaining wall, the abutments and piers for the bridges which carry the northerly two tracks, the subway and the ramps to reach the passenger platforms. As soon as the retaining wall and bridge masonry were completed, the grading and the erection of the bridge steel was started.

Owing to the heavy vehicular and foot traffic using the streets involved in the grade separation, it was planned to erect the steel bridges without recourse to falsework, in order to minimize the interference with this traffic. This was done at all of the streets except Michigan and Miami streets, where late delivery of the bridge steel made it necessary to employ falsework in order to avoid



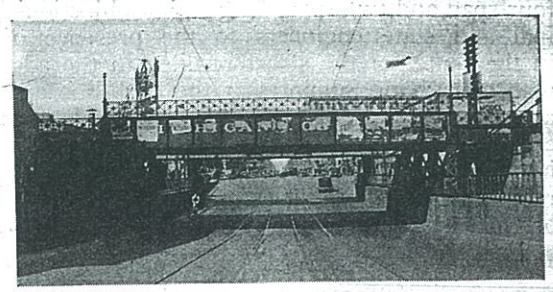
Michigan Street Bridge, Looking South



At the Left — How Woodward Avenue Crosses Under the Michigan Central and Grand Trunk

Below—The Old Subway Structure

May 18 1935



Underpass at Detroit Rebuilt to Accommodate Wider Street

Use federal funds to reconstruct Woodward Avenue undercrossing of Michigan Central and Grand Trunk

AN object lesson in the influence of the growing volume of highway traffic on the demand for increased expenditures for grade separation is afforded by the fact that one of the earlier projects carried out with funds supplied by the federal government involved the replacement of an old grade separation structure with a new one designed to provide a more commodious street thoroughfare under railway tracks at a cost of $400,000. The project in point concerns the structure that carries the tracks of the Michigan Central and the Grand Trunk Western over Woodward avenue (U. S. 10) in Detroit, Mich., which was entirely rebuilt to accommodate a widening of that busy artery of traffic from 74 ft. (at the crossing) to 120 ft.

Long Span Over Roadway

It is of interest to observe also that the structural requirements imposed in providing a clear span of 90 ft. over the central roadway in place of the old central span of 50 ft., made it necessary to raise the tracks 2 ft. 6 in. and depress the street an additional 1 ft. 8 in., although no change was made in the clear headroom of 14 ft. provided in the old underpass. This pronounced increase in the nominal railway floor depth was necessary in spite of the rather unusual expedient of avoiding double-strength girders of greater depth or unwieldy design by building the superstructure for each track as an independent single-track structure. In addition to decreasing the amount of steel required, this expedient, which introduced two girders between tracks instead of one, made it necessary to spread the tracks from 15 ft. centers to 16 ft. 9 in.

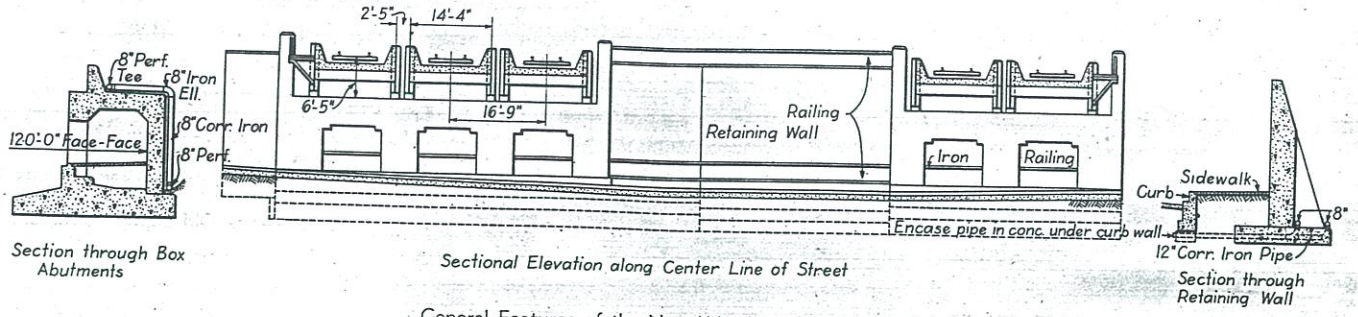
Special consideration was given in the design to insure effective architectural composition. However, it is especially noteworthy that this did not give rise to the masking of the outside girders by means of concrete, sheet metal, or the like. The girders are exposed, and the resulting effect is more genuine and probably no less pleasing than could have been obtained by any subterfuge.

Woodward avenue, which cuts through the axis of the city's business center and functions as the chief north and south route of street traffic, is crossed about two miles from the Detroit river by a group of railway tracks that embrace the Michigan Central's line to Bay City and Mackinaw City, and the West Detroit line of the Grand Trunk. Both lines provide access to important industrial areas of Detroit. The volume of traffic on both the street and the railway lines was such that this crossing was selected for one of the earliest grade separation projects in the city, completed in 1901, by elevating the tracks and lowering the street.

Two Separate Structures

Because the tracks of the two railways are some distance apart, two separate structures were built; one accommodating three tracks for the Michigan Central and another carrying one track for the Grand Trunk Western, the latter having been amplified to accommodate a second track in 1914. Each structure had a length of 74 ft. between the faces of abutments and was divided into a central span affording a clear opening over the roadway 50 ft. wide between curb lines, and flanking spans over the sidewalks. The superstructure consisted of through plate girder spans supported at the curb line by steel bents carried on concrete piers or curb walls. These walls were carried up to the level of the sidewalks, which were about five feet higher than the roadway.

The replacement of this structure was occasioned by a project for widening Woodward avenue to 120 ft., namely, 33 ft. on the west side and 13 ft. on the east side. Studies of the longer structure suggested both



General Features of the New Woodward Avenue Subway

four-span and two-span designs, but objections by municipal and state engineers to the presence of columns in the center of the street resulted in the adoption of a plan embodying supports at the curb-line and entailing a clear span over a roadway 90 ft. wide from curb to curb. The sidewalks were accommodated inside of reinforced concrete box abutments but the roadway span required plate girders 95 ft. 6 in. long, center to center of end bearings.

A Novel Expedient

As in other structures carrying tracks over a street, the floor depth was an important factor in the design, since this dimension plus the clear headroom determined the amount by which the grades must be separated. But with a span of 95 ft. 6 in., which necessarily dictated a through design, the actual details of the floor construction could be the governing factor only if it were possible to make the girders shallow enough or to spread them sufficiently to keep the inside edges of the top flanges from fouling the clearance diagram. These conditions could not be met in this case, even by spreading the tracks from the old spacing of 15 ft. to the maximum of 16 ft. 9 in. that was permissible in this case. As a result, the design adopted was a compromise of the conflicting considerations of a minimum separation of grades, satisfactory structural design and economy in the use of metal.

A View of the Concrete Plant Near One of the Abutments

Independent spans consisting of two single-strength girders spaced 14 ft. 4 in. center to center were provided for each track, the use of single strength girders permitting a practical design with a depth of 8 ft. ½ in. back to back of flange angles. With the 20-in. cover plates used, it was possible to depress the floor between the girders to a depth such that the base of rail was about 2 ft. 3 in. below the tops of the girders without fouling the clearance diagram. This arrangement resulted in placing the base of rail 6 ft. 4 in. above the bottom of the girders or a nominal floor depth 3 ft. 9 in. in excess of that in the old bridges. The girders of adjacent spans are separated by a clear space of 9 in., or enough to permit the inspection and painting of the outsides of the adjacent girders. Sidewalks are bracketed on the outside of the south girder of the Michigan Central structure and the north girder of the Grand Trunk bridge.

The track floors consist of 24-in. 94-lb. CB-section beams, placed transversely and framed into the webs of the girders at a spacing of 3 ft. These are covered with a cast-in-place reinforced concrete slab having a minimum thickness of 7¼ in., over which a mastic covered waterproofing was applied before introducing the ballast.

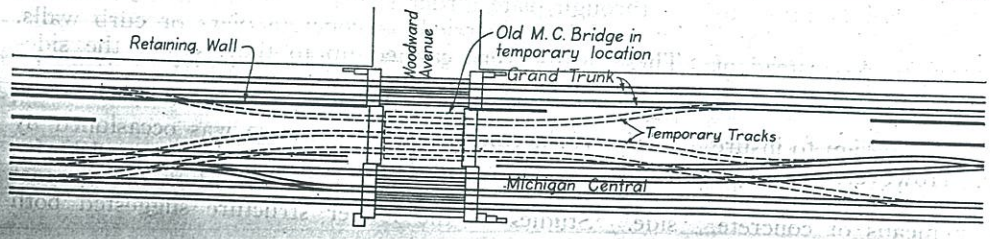
Box-Type Abutment

Contrary to expectations, excavation at the bridge site uncovered excellent foundation material, a dry gray-blue clay that was deemed capable of supporting natural foundations with a maximum applied bearing pressure of 5,500 lb. per square foot. Studies of a substructure designed to meet this condition led to the adoption of box-type abutments that provide passageways 10½ ft. wide for the sidewalks between the embankment walls and the curb piers that support the girder spans. With the toe extensions, these abutments have footings 28 ft. 6 in. wide. To increase the day-lighting of the walkways, the curb piers are pierced by openings 10 ft. 9 in. wide directly under each track.

In the space between the bridges of the two railroads, which are separated a distance of about 49 ft., the embankment is supported by retaining walls abutting on the street lines. However, footings of the same design as those for the abutments have been provided under the south portions of these walls for a sufficient width to accommodate an extension of the Michigan Central structure to provide for an additional track.

Attractive Appearance

As mentioned previously, considerable attention was given to esthetic treatment, and an effective result was

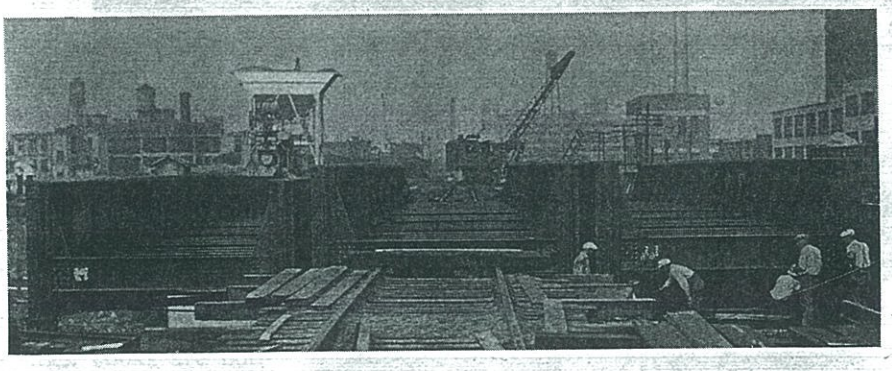


Sketch Map of the Grade Separation Site, Showing Temporary By-Pass

obtained without resort to means involving unusual expense. The ends of the abutments are emphasized by two massive pilasters that extend up to the level of ornamental iron railings placed along the edges of the sidewalks cantilevered from the roadway girders. Attractive panels were introduced over the portals of the sidewalk passages, the headroom of which was restricted to 8 ft. 9 in., for the purpose of giving greater emphasis to the central roadway. The ornamental railing was carried across the tops of the retaining walls between the two structures and was also introduced along the curb line at the street level. Parts of the steel seen from the street were given a final coat of aluminum paint.

Arrangements for Traffic During Construction

As the replacement of the bridges under traffic would have involved many complications, it was decided to take advantage of the clear space between the two railroads for the construction of a three-track temporary bridge to handle the traffic of both lines. And since it was required to provide for the continued use of the street during construction, the most practical plan was to shift the existing Michigan Central structure into position for such use, with pile trestle extensions on each end to permit the widening of the street, retaining wall construction, etc. The change in the bridge location was made with only 1-hr. 45-min. interruption of traffic, only 26 min. being required for the actual movement. However, elaborate falsework was required in making this change because of the obstructions offered by the existing masonry and the necessity for cutting away part of the old steel work to clear the location of the new masonry.



Three of the Girder Spans During Erection

Concrete Work

The concrete for the bridge was mixed in two plants, one on each side of the street, and spouted into dump buckets mounted on cars that ran on two-foot gage tracks parallel with the street behind the abutments and from which the buckets were hoisted by cranes for dumping into the forms. All concrete was batched by weight according to the water-cement ratio to give about a two-inch slump. In addition to that for abutments and the bridge floors, the concrete work included the construction of a retaining wall for some distance along the north side of the Grand Trunk tracks, and the capping of the wall to the south of these tracks to provide for the raise in grade. Provision for drainage included a well-designed system of pipe lines behind the abutments and the use of buck-shot gravel, a by-product of a local sand and gravel operation, for the back filling.

The diversion of traffic to the by-pass line cleared the site of actual construction effectively except for the building of the retaining walls and sidewalks under the temporary bridge. However, the fact that the operated tracks, which cut through the center of the construction side, handled an average of 60 train and switching movements during the daily working period called for the exercise of constant vigilance to guard against accidents. Erection of the superstructure introduced no special problems, and involved a minimum use of the operated tracks.

The new grade separation was constructed under the supervision of the Michigan State Highway Department, Murray D. VanWagoner, commissioner, with the co-operation of the two railroads. The structure was designed by the engineers of the two roads, the Michigan Central providing the plans for the superstructure and the Grand Trunk Western the substructure. The specifications of the A.R.E.A. were used for the design and fabrication of the steel superstructure, based upon Coopers E 70 loading. The specifications of the state highway department were used for concrete design, materials, and workmanship. P. D. Fitzpatrick, chief engineer, F. P. Sisson, principal assistant engineer, and A. N. Laird, bridge engineer, represented the Grand Trunk Western. George H. Harris, chief engineer, E. R. Lewis, office engineer, and J. E. Bebb, bridge engineer, represented the Michigan Central. The highway department was represented by L. W. Millard, bridge engineer, J. H. Cissel, engineer of bridge design, and J. H. Flynn, engineer of construction, and assisted the railroads' engineers in matters of design and construction.

The major part of the construction work was done under a contract let by the state highway department to the D. W. Thurston Company (now known as the W. J. Storen Company), Detroit. Each railroad arranged for or performed with its own forces the temporary bridge work, track work, grading, ballasting, signal, telegraph and telephone work. The steel superstructure was fabricated by the American Bridge Company and erected by the D. W. Thurston Company. The whole cost of the project, whether performed by railroad forces or by contract, was borne by the federal government under the provisions of Title II of the National Industrial Recovery Act.

THE ARGENTINE STATE RAILWAYS has recently ordered eighteen 25-metric tons Diesel rail motor cars, according to reports made public by the U. S. Commerce Department. By the terms of the purchase contract, these coaches must be delivered by April 1, 1936. Although several Diesel cars are already being used in Argentina by private railway companies, the Argentine State Railways will be the first to employ such types of cars over other than so-called short hauls, the report states. They will replace steam locomotives now operating on the runs between San Juan and Cordoba, a distance of 600 kilometers, and between Cordoba, La Rioja and Catamarca, a distance of 620 kilometers.

New Passenger Station on Grand Trunk Western

The G.T.W. station at Grand Rapids, Mich., completed and placed in service at the end of 1948, was provided at cost of $200,000, and is thoroughly modern in design. Its provision eliminates a back haul of one and one-half miles, necessitated by the location of the station which has been replaced.

The accompanying illustrations show the new passenger station on the Grand Trunk Western Rd. at Grand Rapids, Mich., which, provided at cost of $200,000, was officially opened for service on December 21 last, with appropriate ceremonies held within the structure, which is at Plainfield Avenue, near Leonard Street, N.W.

The new station building consists of three units, viz., a central waiting room, flanked by the yard office and by the baggage and express room. The waiting room section of the structure is 80 ft. long and 32 ft. wide; the yard office, 43 ft. long by 25 ft. wide, and the baggage and express section, 60 ft. 6 in. long by 26 ft. wide.

Simplicity is the keynote of the building design, with setbacks, curved surface and glass panels relieving the large areas of brickwork. A light, buff colored brick has been used for the exterior, and the low horizontal lines of the building are emphasized by stone belt courses and copings. A metal canopy adjacent to the passenger entrances provides protection from the weather.

The waiting room interior, also, features simplicity in its design. The floor is of patterned terrazzo surface, and the plain surfaces of the walls are offset by a marbleized wainscoting. Acoustic tile material is used for the ceiling. Lighting of the interior during daylight hours is by clerestory windows at high level. Artificial lighting fixtures are of the fluorescent type.

The new station is accessible from the street by means of a paved plaza, with ample parking space for patrons' automobiles. Roadway space along the station platform enables express and mail trucks to back up to the car doors of baggage and mail cars, thus expediting the handling of this phase of railway operations without interference with the movements of passengers.

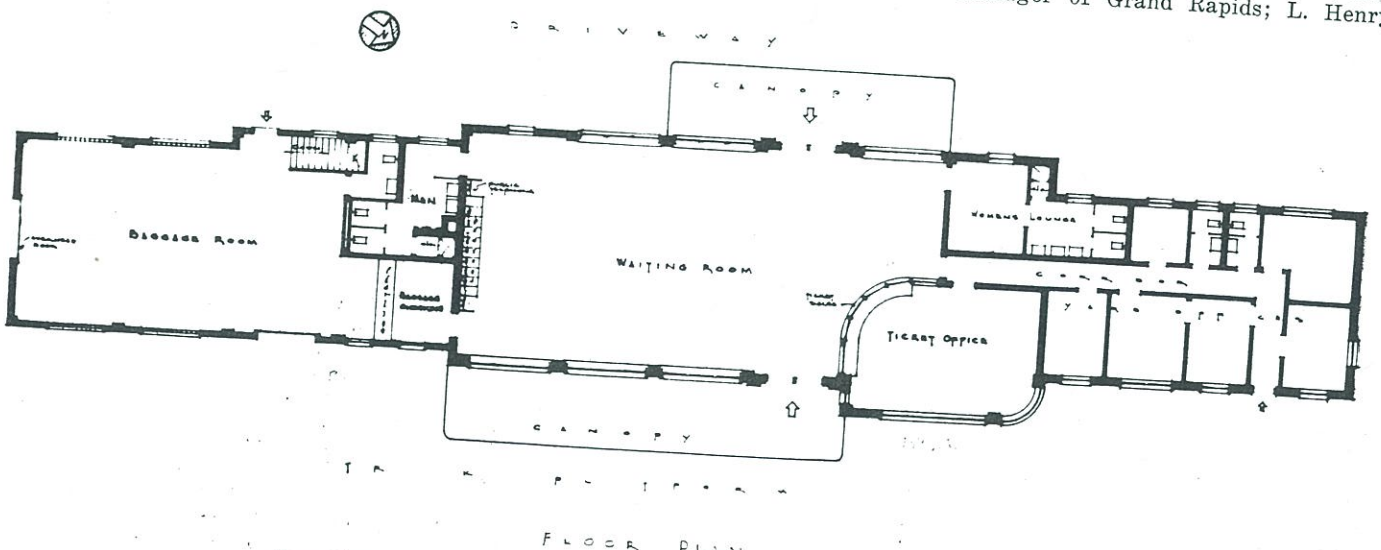
The construction of the new station and the choice of its site were undertaken by the Grand Trunk Western with the object of affording increased comfort and convenience for travellers to and from Grand Rapids. The latest improvements in facilities are provided, and the location of the station eliminates the back haul of one and one-half miles which was required at the old station, enabling the railway to speed up its schedules.

C. A. Skog, Vice President and General Manager, G.T.W., in speaking of the station, said that its construction was undertaken to permit improvement of the railway service in Grand Rapids, and expressed the hope that the project would enhance the position of the railway in the community.

At the formal opening of the station, on December 21 last, Mayor George W. Welsh of Grand Rapids and Mayor John Collins of East Grand Rapids were guests of honor, and were welcomed by Mr. Skog, who presented a gold key to the station to Mayor Welsh.

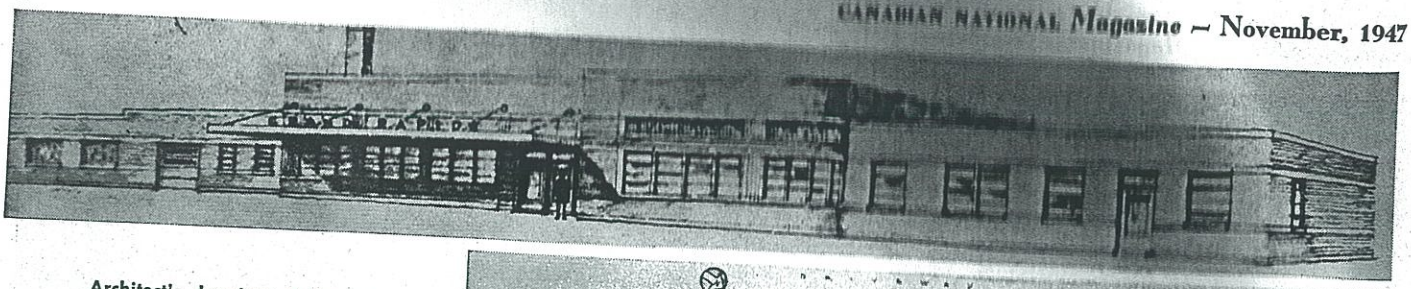
Other dignitaries participating in the ceremonies were Frank H. Goebel, City Manager of Grand Rapids; L. Henry

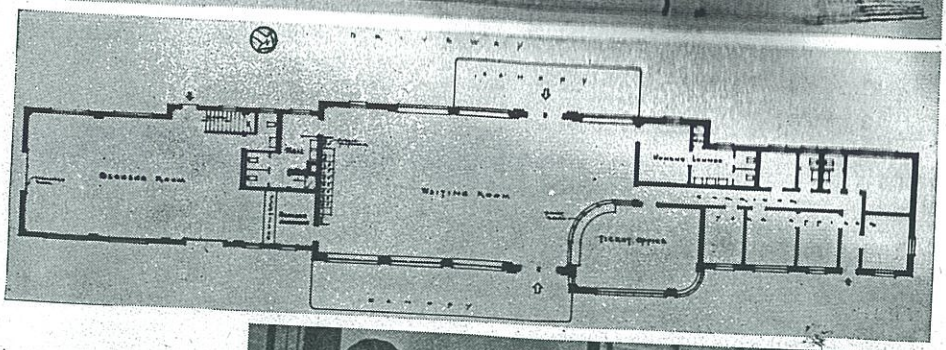
Front of the Grand Trunk Western Passenger Station at Grand Rapids



Floor Plan of the Grand Trunk Western Passenger Station at Grand Rapids, Mich.

Dec 1949





Architect's drawing of the exterior (from track elevation) of the proposed new station for Grand Rapids. The drawing on right shows the floor plan.

MODERN *Passenger Station for Grand Rapids*

Construction to begin shortly on new depot, consisting of three units, to be accessible from the street with ample parking space for patrons' automobiles

Indication that the City of Grand Rapids is interested in acquiring the present Grand Trunk depot when a new one is erected took representatives of the road to the City Hall recently for a preliminary discussion. Left to right are: City Manager Frank H. Goebel; Mayor George W. Welsh; J. S. Lillie of Detroit, GTW property and tax commissioner; M. A. O'Brien of Grand Rapids, division freight agent, and J. S. Walker of Grand Rapids, freight traffic representative.

A NEW passenger station providing every modern comfort and convenience for the travelling public will be built in Grand Rapids by the Grand Trunk Western Railroad, it is announced by C. A. Skog, Detroit, vice president and general manager.

The station, which will cost approximately $200,000, will be located at Plainfield Avenue and will permit a reduction of 20 minutes in schedules of passenger trains between Detroit and Muskegon as well as a saving of nearly 10 minutes from the old schedules to and from Michigan Avenue for patrons travelling to or from Grand Rapids.

Construction is expected to begin in about three months, according to Mr. Skog, and the work will be completed as soon as possible thereafter.

Choosing the Plainfield Avenue site for the station will put it on a direct line East and West, eliminating the back-haul movement via the wye tracts down to the present Michigan Avenue station, a distance of 1.5 miles.

The new location will be advantageous to residents of Grand Rapids, Mr. Skog said, since, although it is on one of the important streets of the city, it can be reached by automobile without having to drive through the heavily congested downtown section. Good public transportation will also be afforded to all parts of the city.

Under the construction plans which have been made by the railroad, passengers will entrain and detrain from the station platform, which will be on a level with Plainfield Avenue. This design has been developed to avoid the necessity for passengers to climb a flight of steps from the station platform level to the waiting room.

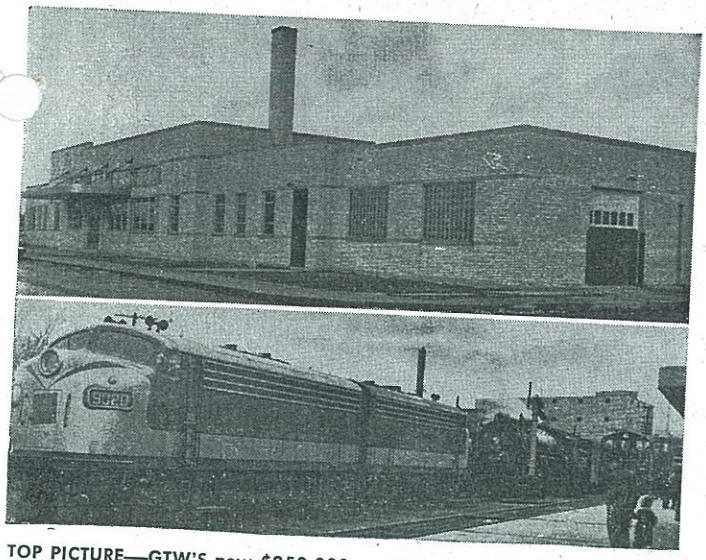
The proposed new station would be accessible from the street, by means of a paved plaza, with ample parking space for patrons' automobiles. Roadway space alongside the station platform will enable express and mail trucks to back up to the car doors of baggage and mail cars, thus expediting the handling of this phase of the railroad's operations without interfering with the movements of passengers.

The depot building will consist of three units, a central waiting room, flanked by the yard office and a baggage and express room. The waiting room section of the building will be 80 feet long and 32 feet wide, the baggage section will be 60 ft. 6 in. by 26 feet wide, and the yard office will be 43 feet long by 25 feet wide.

Simplicity is the keynote of the building design, utilizing setbacks, curved surface and glass block panels to relieve the large areas of brickwork. It it proposed to use a light buff colored brick for the exterior, and the low horizontal lines of the building will be emphasized by stone belt courses and copings. Adjacent to the passenger entrances, a metal canopy will provide protection from the weather.

The interior of the waiting room will also be simple in design. The floor will be of patterned terrazzo surface and the plain surfaces of the walls will be offset by a marbleized wainscoting. Acoustic tile material will be used for the ceiling, and the interior will be lighted by the clerestory windows at high level during daylight hours. Artificial lighting fixtures will be fluorescent type.

Construction of the new passenger station, adjacent to the main tracks of the Grand Trunk, Mr. Skog declared, is being undertaken to provide better service to Grand Rapids, and he expressed the hope that this project would enhance the railroad's position in the community.



TOP PICTURE—GTW'S new $250,000 passenger station at Grand Rapids, and, BELOW, one of the Grand Trunk Western's new diesel locomotives and other powerful engines provided a display of motive power outside the new station during the opening ceremonies.

Exit the old, enter the new. A shiny gold key was presented to Mayor George W. Welsh of Grand Rapids by C. A. Skog, vice president and general manager, in a symbolic gesture of welcome by the railroad to its new station. Mayor Welsh had a symbolic key of welcome for Mr. Skog also. Left to right: V. C. Palmer, superintendent, Milwaukee Junction; A. N. Laird, chief engineer, Detroit; Mr. Skog; A. C. McCarthy, general superintendent, Detroit; Mayor Welsh; Geo. L. Bryson, O.B.E., passenger traffic manager, Chicago; Frank H. Goebel, city manager of Grand Rapids; Otto L. Metzger, ticket agent, Grand Rapids; R. D. Keith, assistant superintendent, S. & D. car department, Battle Creek.

New Station Opened At Grand Rapids

BY A. A. MONSON

A NEW $250,000 passenger station, the first to be built by any railroad in Michigan in more than 25 years, was opened to the public recently by the Grand Trunk Western in Grand Rapids.

In a "double key" ceremony, Mayor George W. Welsh received a gold key to the station from C. A. Skog, vice president and general manager, and, in turn, gave Mr. Skog a gold key to the city.

Other dignitaries participating in the ceremonies included the Hon. John Collins, mayor of East Grand Rapids; Frank H. Goebel, city manager of Grand Rapids; L. Henry Gork, city manager of East Grand Rapids; N. J. Harkness, president of the Grand Rapids Chamber of Commerce; L. H. Woodruff, editor in chief of the Grand Rapids Press; Louis A. Weil, Jr., publisher of the Grand Rapids Herald; Geo. L. Bryson, O.B.E., passenger traffic manager, Chicago; J. V. Maloney, freight traffic manager, Chicago; D. M. Crawford, general freight agent, Detroit; and J. M. Munnings, superintendent, Battle Creek.

Congratulatory telegrams from President R. C. Vaughan, C.M.G., Montreal, and the Hon. Kim Sigler, governor of the State of Michigan, were read by M. A. O'Brien, division agent, who acted as master of ceremonies at the open-

Mr. Vaughan's message said:

"Sincerely regret I cannot be with you to take part in the ceremonies marking the opening of the new station at Grand Rapids. Please convey to the citizens of this enterprising community my cordial greetings. We of the Grand Trunk and Canadian National Railways greatly value our long and mutually helpful association with Grand Rapids and trust that the new facilities, eliminating, as they do, an awkward and uneconomical operation, and providing improved service to one of the most important industrial centres on our line, will be to the advantage of both the railways and the city. We rejoice in the development of Grand Rapids and are proud to have a part in making it prosperous."

Gov. Sigler wired:

"I congratulate you and the citizens of Grand Rapids on the opening of the new Grand Trunk Western Railroad station. This is indeed a step forward in the development of this fine city and will contribute to improved transportation facilities for Grand Rapids."

Special tribute was paid to A. Z. Mullins, former division freight agent in Grand Rapids and the oldest Grand Trunk pensioner in the city, as the representative of all the line's pensioners there. Mr. Mullins retired in 1932 after 48 years of service with the railroad and is now 87 years old.

Guests at the ceremonies and at a buffet luncheon served on Grand Trunk Western diners parked outside the station included 175 of Grand Rapids' business and civic leaders.

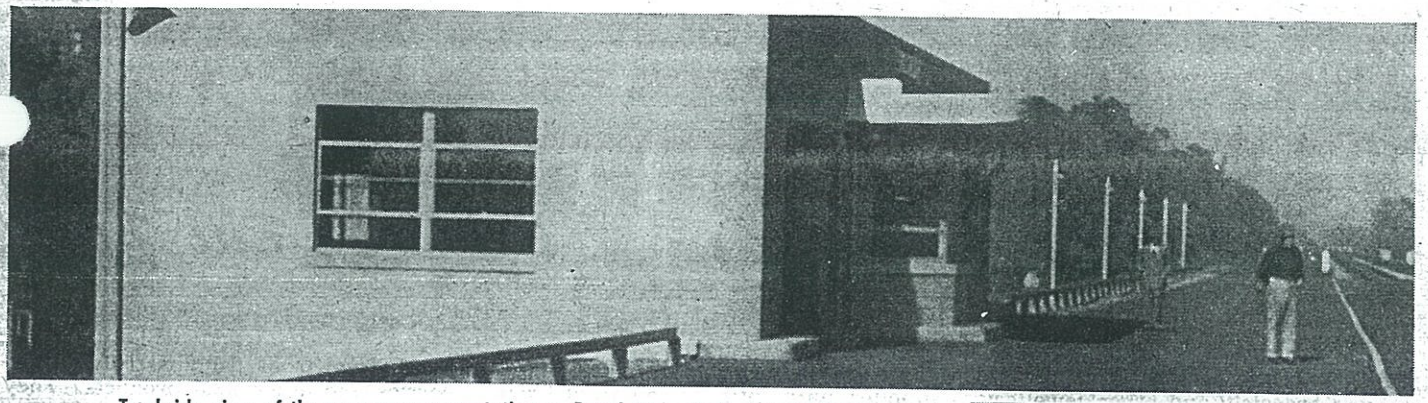
The new station replaces the Grand Trunk's old station adjoining Grand River, built in 1905, which has been purchased by the city. The Grand Trunk has been operating in West Michigan for 90 years and began operations in Grand Rapids as the Detroit and Milwaukee Railroad in 1858, just 20 years after the Village of Grand Rapids was incorporated.

Construction of the new station and the choice of its site were undertaken by the Grand Trunk to afford greater comfort and convenience of Grand Rapids travelers. The latest improvements in facilities are provided in the depot, and its location eliminates the backhaul of one and a half miles required at the old station, enabling the road to speed up its schedules.

The station is simple and modern in design, utilizing setbacks, curved surface and glass block panels to relieve the large areas of brickwork. Light buff-colored brick has been used for the exterior, and the low horizontal lines of the building are emphasized by stone belt courses and copings. A metal canopy provides protection from the weather for the passenger entrances, and parking space is available for 100 cars directly outside the station.

Also modern and functional in design is the interior of the depot. The floor is of patterned terrazzo surface, and the surface of the walls is offset by a marbleized wainscoting. Acoustic tile material has been used for the ceiling, and the station is lighted during daylight hours by clerestory windows at high level. Artificial lighting fixtures are of fluorescent type.

In an editorial commending the Grand Trunk Western for its progressive spirit, the Grand Rapids Press said, "The road has tried consistently over the years to give this city good service. Its new station is a most welcome evidence of that policy." Similar expressions of good-will toward the road were printed in an editorial in the Grand Rapids Herald following the station



Trackside view of the new passenger station at Royal Oak, Mich., in mid-October.

New G.T.W. Station Opened At Royal Oak

By A. A. MONSON

THE newest civic improvement in Royal Oak, Mich., began serving the public recently, when the Grand Trunk Western's new passenger station was officially opened by C. A. Skog, Detroit, vice president and general manager.

Hon. Vernald E. Horn, mayor of Royal Oak, joined Mr. Skog in planting twin oak trees at the entrance to the station as part of the opening ceremonies.

In welcoming the guests at the opening, Mr. Skog said, "Speaking not only for myself but also for the railroad as a whole, I want you to know that we are profoundly grateful for the splendid and wholehearted cooperation you have extended to make possible this modern depot, which has been designed to afford the maximum convenience and comfort for the citizens of Royal Oak.

"It is a special pleasure to have with us the general chairmen of the railroad labor organizations, representing the employees of the Grand Trunk Western, who have always displayed keen interest in the development of our system . . . .

"To accommodate the large number of commuters between Royal Oak and Detroit—approximately 3,000 daily—the Grand Trunk Western operates five trains a day in either direction, taking residents either into the heart of Detroit's downtown section or back to their homes here in less than half an hour. Connections are also offer

(*Continued on Page* 21)

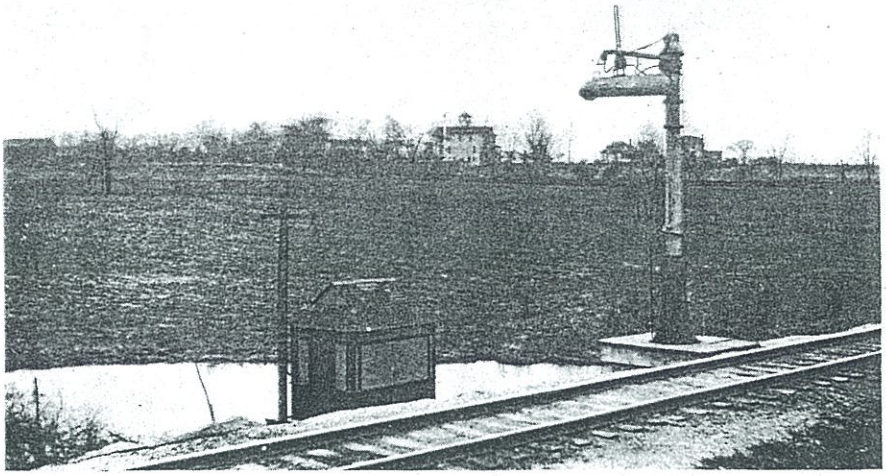
One of the twin oaks which will beautify the lawn in front of the new station is planted by Mayor Vernald E. Horn (right) and C. A. Skog, vice-president and general manager of the railroad. The tree-planting was a part of the opening ceremonies for the station.

U.S. Congressman George A. Dondero (right) receives a special inaugural key from Geo. L. Bryson, passenger traffic manager, to open the doors of the station to the public for the first time.

Royal Oak Chamber of Commerce officers are presented with trainmen's lanterns by A. C. McCarthy, general superintendent. Left to right: Philip Miller, vice-president of the chamber, and vice-president of the Royal Oak Daily Tribune; Paul Jacobs, Chamber of Commerce president; Mr. McCarthy; Allwyn Hilligus, treasurer; and Earl Becker, secretary.

In the cab of the first train to come into the new station are (left to right): William Hayward, former mayor of Royal Oak; Mayor Horn; J. B. Sparks, former city commissioner; Engineer Wayne Dunton and A. N. Laird, GTW chief engineer.

Railway Engineering and Maintenance



View of the Direct Delivery Installation at Holly, Mich.

JAN 1936

By P. D. FITZPATRICK

Chief Engineer,
Grand Trunk Western,
Detroit, Mich.

Direct Delivery Pumps Eliminate Water Tanks*

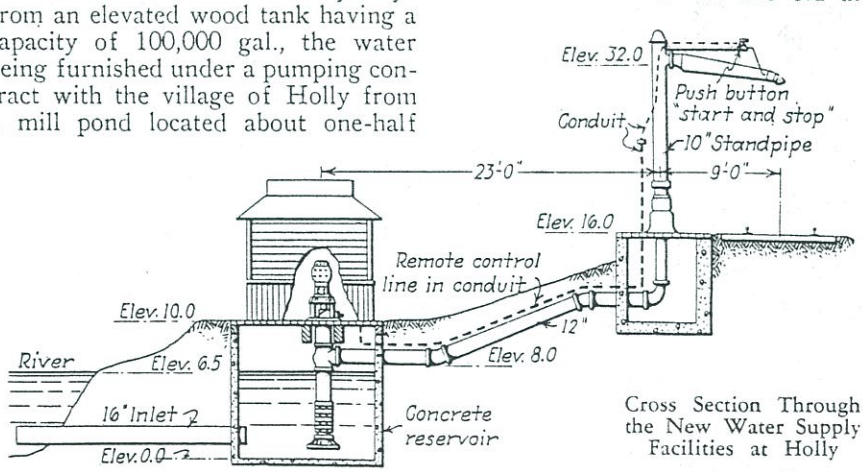
LOCOMOTIVE water storage tanks have been displaced at some of the intermediate water stations on the Grand Trunk Western by the installation of pumping units for handling water direct from the source to the engine tenders. The railroad was first led to a consideration of the new type of pumping installation because of the benefits accruing through the low initial cost and the economy of operation and maintenance.

For purposes of experimentation, installations of the direct pumping units were first made on less important branch lines. The first installation was made in 1929 at North Branch, Mich., on the Cass City subdivision, where an 8-in. vertical sump pump having a capacity of 1,500 gal. per min. was installed directly over a sump fed by two flowing wells, and connected with a water column near the track. This pump was driven by a directly-connected 15-hp. electric motor which is controlled by means of a switch situated on the water column within convenient reach of the locomotive firemen. So efficient and economical did this installation prove to be during two years of operation that similar installations were made at Cass City, Mich., on the same subdivision and at Ashley, Mich., and Sparta on the Muskegon sub-division.

*Abstracted from an article published in the October, 1935, issue of the Canadian National Railways Magazine.

The first installation of a direct pumping unit on the main line was made at Holly, Mich., in 1934. At this point, which is 46 miles west of Detroit, Mich., on the main line between Detroit, Grand Rapids and Muskegon, water had been supplied to locomotives since the early days from an elevated wood tank having a capacity of 100,000 gal., the water being furnished under a pumping contract with the village of Holly from a mill pond located about one-half mile from the tank. In 1934 it became evident that the wood storage tank had reached the limit of its service life and the question arose as to the type of plant that should be installed in its place. In order to avoid the comparatively heavy expense of a new steel water tank and appurtenances, including the wages of attendants, the cost of maintenance and the charge for the water, the railroad decided on a direct pumping arrangement.

The new facility was installed at a point a mile west of the Holly station where the tracks are adjacent to the Shiawassee river which contains an adequate supply of water suitable for locomotive use. Under the old arrangement passenger locomotives obtained water at the Holly station through two water columns but as such engines are now equipped with larger tenders they can avoid taking water at this station. The station therefore served freight trains primarily.



Cross Section Through the New Water Supply Facilities at Holly

The new facilities, which were furnished by Fairbanks, Morse & Co., consist of a 30-hp. 440-volt, 3-phase

motor operating a vertical 4-stage submerged-impeller centrifugal pump, which raises water from a concrete intake well through a 12-in. main to a 10-in. water column. A 6-ft. by 8-ft. watchman's shanty over the intake well houses the motor and pump. Water is admitted into the intake well through a 16-in. galvanized iron pipe 30 ft. long.

Operation of the pump, which has a capacity of 2,950 g.p.m., is controlled by a button situated on the water column within convenient reach of the firemen. The button controls an alternating-current automatic compensator connected to a three-wire accelerating panel. Power for this operation is furnished from the same 440-volt commercial line from which power for operating the pump motor is obtained, the voltage being reduced to 100 by means of an air-cooled transformer in order to avoid the possibility of injury to the firemen incident to the use of the high voltage at the water column.

In order to permit the free flow of water, all working parts were removed from the interior of the water column. Moreover, the discharge piping is on a descending grade of 2 in. in 10 ft. from the water column to the pump, thereby allowing for complete drainage of the standpipe and the discharge line so that no water remains in the facilities above the level of the water in the sump when the pump is inactive. As the pump operates somewhat in excess of its rated capacity, it is readily apparent that a locomotive tender can be filled in a few minutes time.

The new facility was installed at a cost of approximately $3,100, exclusive of the cost of the water column, which was moved from the old location. It was placed in service in the fall of 1934 and the expenditures for maintenance to date have been negligible. The power company assesses a fixed demand charge of $16.88 per month and the energy consumed per month averages 40 kw.-hr., so that the total cost of operating the station is about $18 per month.

A number of years ago plants such as that at Holly would not have been considered dependable; however, power companies are now very efficient in providing constant service to their customers so that the possibility of a failure in the supply of power is remote.

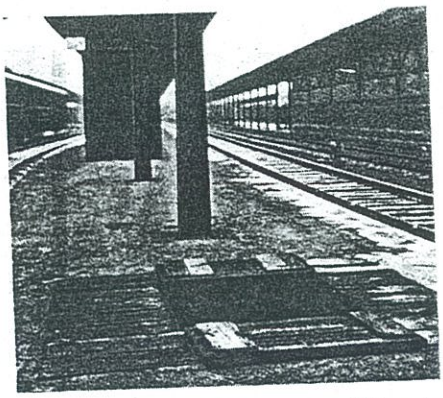
The direct pumping installations that have been made on the Grand Trunk Western were developed by R. Walters, supervisor of water service, and H. E. Smith, supervisor of signals, under the direction of J. A. Clancey, superintendent, all with headquarters at Durand, Mich.

Snow Melting Pits Used at South Station

By A. S. Tuttle

Engineer,
Boston Terminal Company

SNOW melting pits have been used to great advantage at the South Station, Boston, Mass., by the Boston Terminal Company. With a layout of 26 intensively-used tracks and 14 platforms 7 in. above the top of rail, covered in whole or in part by butterfly type sheds, it is apparent that when snow storms occur the tracks and platforms must be cleared of snow in the shortest possible time, with the least inconvenience to passengers and without interruption to train service.

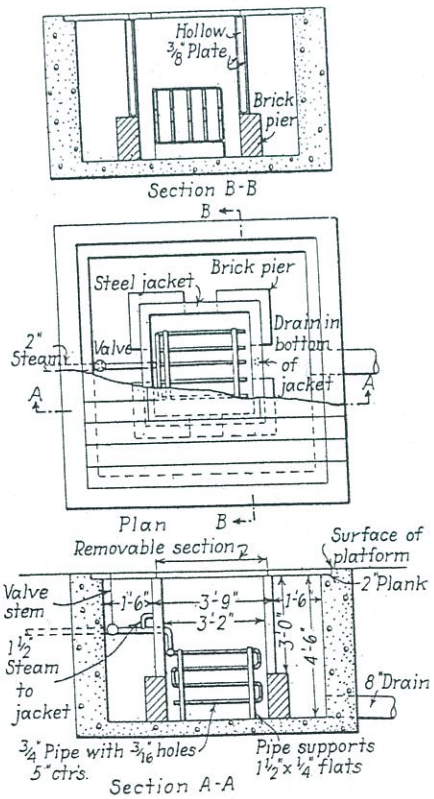


One of the Snow-Melting Pits. When in Use They Are Guarded by a Railing

While this had been recognized for some years, it was obvious that when the track and platform facilities were modernized in 1929-1930, and the old balloon-type train shed was removed, some means should be provided for the disposal of the additional snow which would fall on the platforms and adjacent tracks. With the limited area for piling snow either temporarily or where it might melt naturally, and in view of the amount of labor and the physical difficulties which would be involved in loading out and hauling away large quantities of accumulated snow, it was decided to provide snow melting pits in a number of the platforms. These were located near the outer ends of the platforms to avoid interference with the normal use of the platforms, and, at the same time, to make it possible to use the pits while all except the longest trains are discharging or taking on passengers.

Much of any accumulation of snow on the platforms is pushed by hand plows directly into the pits for disposal, while excess snow on the tracks and the inner ends of the platforms is shoveled on to track push cars and thence moved to the pits. As a result, work-train service, which would be not only costly but would interfere with passenger train movements during many hours of the day, is not required for the removal of snow.

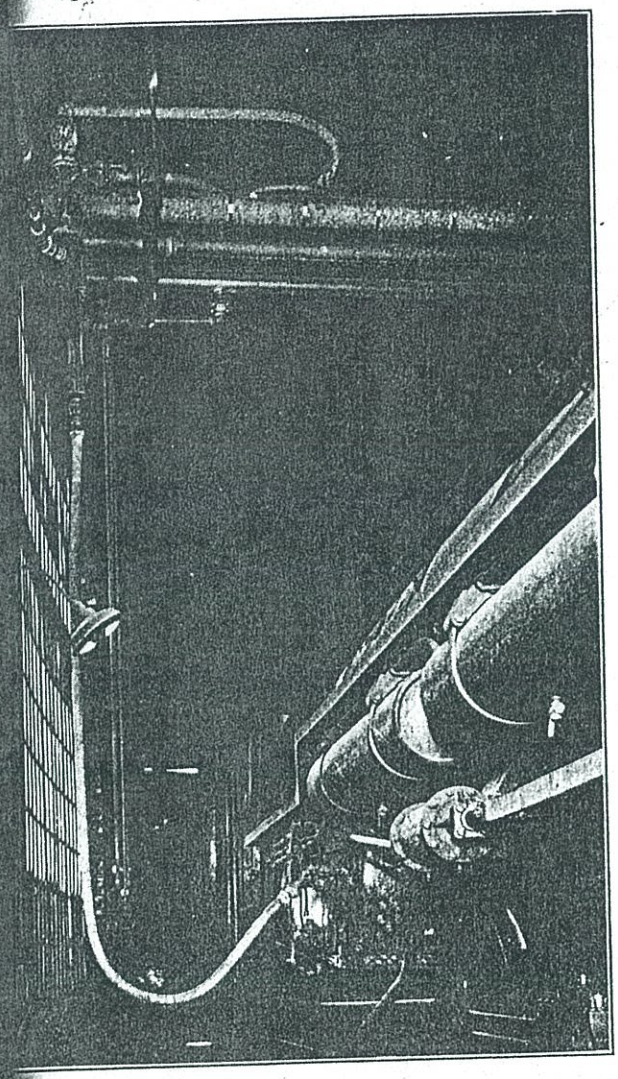
The snow melting pits are constructed of concrete, and are approximately 6 ft. 9 in. square on the inside, and 4 ft. 6 in. deep. The bottoms are drained to near-by catch basins of the drainage system which serves the station track area, and the tops are covered with 2-in. planking, the center portion of



Plan and Section of the Pits

*This discussion was submitted for publication in the "What's the Answer" department of the December issue, but because of its scope was withheld for presentation here as an independent article. For further discussion of this subject, see page 750 of the December issue.

manner similar to the blowoff for a hot-water ing system. The latent heat and steam are used eat the fill-up water. When the boiler work is ed the boiler is filled with steam for a few minutes, ualize the temperature, after which water at 180 F. and stationary boiler plant steam are admitted e same time, resulting in from 10 to 15 lb. pres- in the boiler by the time the water appears at the m of the water column. The water is then turned nd steam alone allowed to build up the pressure. operation of filling and steaming requires approx- ely 30 minutes, depending entirely on the steam lable and the temperature of the fill-up water. the pressure has been raised to the desired point



rect Steaming Connection to the Locomotive from the Overhead Piping in the Enginehouse

large 2-in. steam boosting line is closed and the in. steam line turned on for holding the engine der steam until despatched. All of the above opera- ns are accomplished with but one flexible copper e connection to the blow-off cock, which can be at- hed very quickly. The control valves are mounted overhead pipe lines and are operated by extension ndles within easy reach of the floor.

Prior to despatching the locomotive the 2-in. booster is opened while the air is being pumped up, assur- a full head of steam and air for the movement to fire-up track.

After leaving the enginehouse the locomotive is delivered to the fire-up track. Here fuel oil and air stations are installed to which fire-up torches are attached. The torch is of the syphon type, the oil pressure being only a few ounces, with air at approximately 100 lb. pressure. Five or six minutes are usually required to ignite the fuel bed, after which the locomotive is ready for movement to the train yard. The time intervening between firing and coupling on to the train has been found sufficient to give the fireman plenty of time to have the fire in good condition for handling a train. The success of despatching depends largely upon the steam pressure on the boiler at the time of firing. Low steam pressures result in poorly ignited fires and considerable smoke.

The Power Plant

Because the power plant is the heart of the direct steaming system, it was necessary to install high pressure boilers. The plant consists of two 300-hp. 200-lb. bent tube boilers set in one battery. The boilers are fired by chain grate stokers, a feature of the stokers being individual engine drive with two speeds through gear reduction, eliminating the old style line shaft. Coal is dumped on an elevated structure and fed automatically to a chain bucket conveyor which feeds independent hoppers for each boiler. From storage hoppers the coal is fed by gravity to the stokers. The ashes are dumped into a pit under the stokers and removed by a steam ash ejector into a hopper feeding directly into cars outside of the plant.

Dispatcher Signaling System Operates Through Sleet Storm

A heavy sleet storn in northwestern Ohio on March 29 and 30 broke down hundreds of telegraph poles along the railways in that area, including over 600 poles on the New York Central lines in that vicinity, about 200 of which were on the 40-mile installation of the centralized dispatching system extending from Berwick to Stanley. In spite of the loss of these poles no delays to trains resulted on this line because of any shortcomings of the dispatching system, notwithstanding the fact that all other communication and facilities for directing train movements were out of commission. This storm subjected the dispatcher signaling system, installed last summer by the General Railway Signal Company, to an operating test beyond anything anticipated at the time of its installation. All control wires are carried in Hazard steel-armored cable which did not break the circuit continuity at any point, despite the pole line failure.*

The storm extended over an area from Toledo, Ohio south to Sycamore, about 55 miles, and from Ft. Wayne, Ind., east to Lima, Ohio, about 59 miles. Ice began to form on the wires about 9 p.m. on March 29 and at 11 p.m. the regular telephone and telegraph wires began to break, so that all communication was lost. About 3 a.m. the ice became so heavy that poles were broken down and by morning over 200 poles were down on the Ohio Central Lines between Toledo and Berwick. A total of 600 poles were destroyed on the New York Central alone in this entire area before the storm subsided. At 4 a.m. a high-tension pole of a power company fell across the tracks at Norris, Ohio and rail-

* A description of this system of centralized dispatching was published in the *Railway Age* for August 20, 1927, page 325.

Grand Trunk Western Equips Fireless Enginehouse at Chicago

Direct steaming installation has eliminated smoke and produced operating economies

THE elimination of smoke at engine terminals in thickly populated districts is a problem which is demanding considerable attention at the present time. A recent installation of direct steaming equipment at the Elsdon engine terminal of the Grand Trunk Western, located within the limits of the city of Chicago, has resulted in the almost complete elimination of smoke and has actually created a fireless enginehouse. The Elsdon terminal handles passenger, freight and yard power and despatches an average of about 35 locomotives each 24 hours. The enginehouse has 23 stalls and since it was originally built about 1885, has had the stalls remodeled from time to time to accommodate modern power. In the conversion to operation with direct steaming the smoke jacks have been omitted.

Under present operating methods the fires on all locomotives are dumped at the inbound ash pit before the engines are taken into the house. Unless a boiler is to be blown down for washout or repairs the locomotive is immediately placed on the line and the steam pressure held at 150 lb. or more until called for service when it is moved out of the house under this pressure, and fired up outside. It has been found, after several months experimenting, that when the engines leave the house under 150 lb. pressure or more, they can be fired up with but a very slight trace of smoke.

The sizes of the locomotives handled at this terminal range from the 0-8-0 type switchers, the boilers of which hold about 1,800 gallons of water to the second gage, to the 4-8-4 type passenger locomotives which take over 4,000 gal. to fill to the second gage. The average Mikado type locomotive handled at Elsdon terminal takes about 2,500 gal. of water to fill the boiler to the second gage. On an average only about three locomotives are blown down, refilled or washed out each day, the rest being held under steam.

The System Expedites Despatching Locomotives

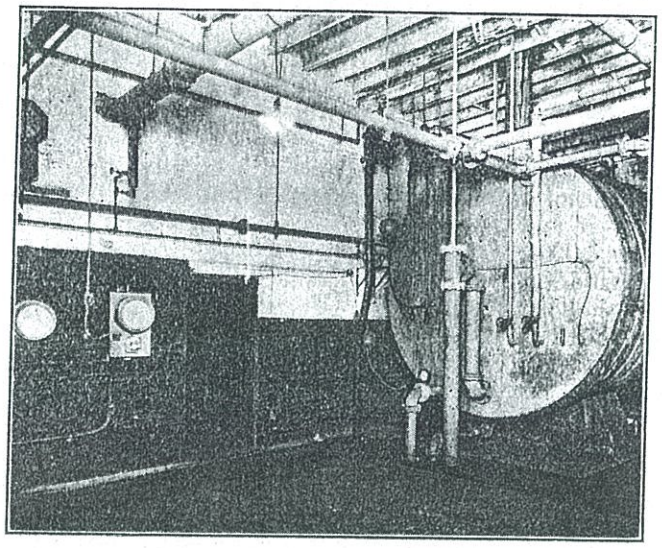
Contrary to the general belief, the system has expedited the despatching of locomotives and has effected economies which were not anticipated. Owing to the elimination of smoke, gases, noise and steam from popping safety valves, the roar of the old type blowers and the smoke and soot in cabs, the working conditions for the enginehouse employee have been improved so that they are comparable with those of the back shop. This has resulted in the removal of many conditions that were objectionable from the employee's standpoints and a decided improvement in the appearance and attitude of the men is noticeable. Some of the older employees stated that they had never expected to work in an enginehouse under such pleasant conditions.

Probably the most important tangible saving effected has been that of locomotive fuel. It is however worth

Locomotive at the Fire Lighting Station

Ten Minutes Later, All Ready to Go

while noting that while the enginehouse is equipped with an indirect heating system it has not been used so far this winter. Although the outside temperature has been below zero on several occasions the interior



The Hot Water Storage in the Pump Room

of the house is said to have been comfortably warm at all times. This condition is due to the fact that there are from 15 to 18 engines under steam in the house all the time and the removal of the smoke jacks makes it possible to retain the heat in the house.

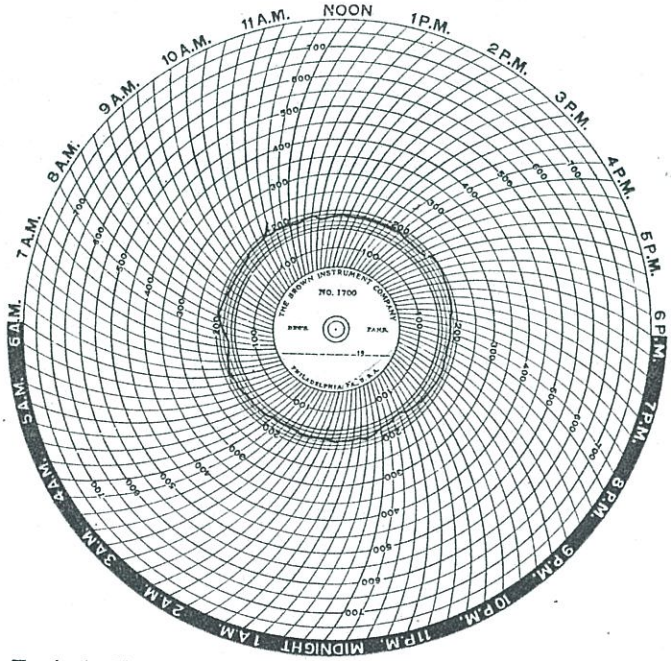
Terminal Consumption of Fuel Reduced

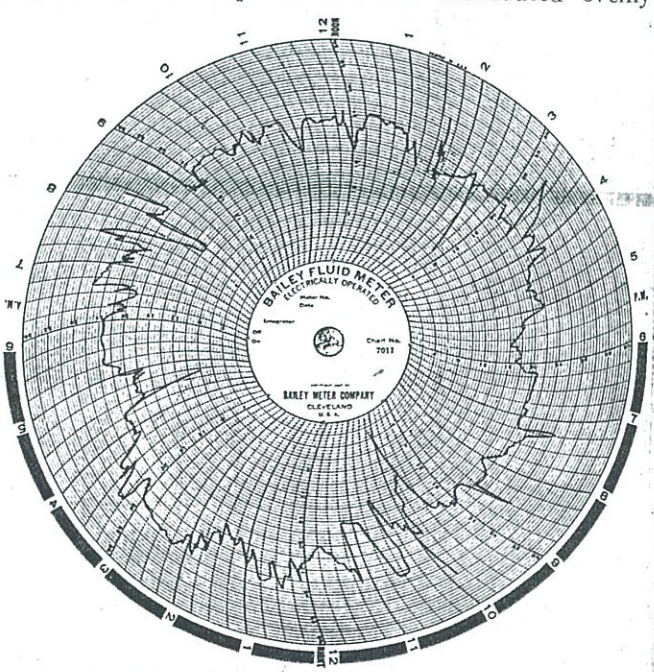
In order to determine the savings effected by the installation of the direct steaming equipment a series of tests were made to obtain the cost of handling power in the old way. So many variable factors enter in that it is not desirable to attempt to give specific figures relating to these tests. A summary of the tests will give an idea of the possibilities of future operation. To obtain the cost of holding locomotives under steam, as U. S. R. A. light Mikado, the engine being fired by hand and held at approximately 150 lb. steam pressure for 24 hours. The results indicated an average fuel consumption of 375 lb. of coal an hour. To determine the amount of coal required to fire up a similar locomotive from fill-up water at a temperature of 125 deg. F. to 150 lb. gage pressure, test results indicated that 2,885 lb. of coal were required. Assuming that the locomotive was in the house for eight hours, the coal required per hour would be 356.9 lb. To handle the same type of locomotive with direct steaming would require 112.5 lb. of coal an hour, indicating a saving under the direct steaming system of about two-thirds of the locomotive fuel used in the old style engine terminal. It appears from results obtained so far that with the direct steaming of locomotives there should be an extension of the life of the enginehouse itself due to the elimination of smoke and gases with a resultant lower cost of building maintenance, as no smoke jacks are required.

Description of the Installation

The system was designed and licensed by the Railway Engineering Equipment Company, Chicago, in cooperation with the railroad company's engineers and installed by the National Boiler Washing Company, contractors, Chicago. It is known as the direct steaming system whereby the locomotives are supplied with steam from a stationary boiler plant through the medium of flexible connections at each stall.

After leaving the cinder pit, where the fires are dumped, the locomotive proceeds under its own steam to the enginehouse stall where it is immediately connected to the power plant supply through an extra heavy 2-in. flexible copper hose and a ½-in. steam line which holds the pressure to within a few pounds of that of the stationary plant. After boiler and fire box inspection, 90 scoops of coal are distributed evenly over the grates. All operations, such as testing air pumps, headlight generator turbines, and injectors, can be made under power plant pressure and with comfort to the workmen.



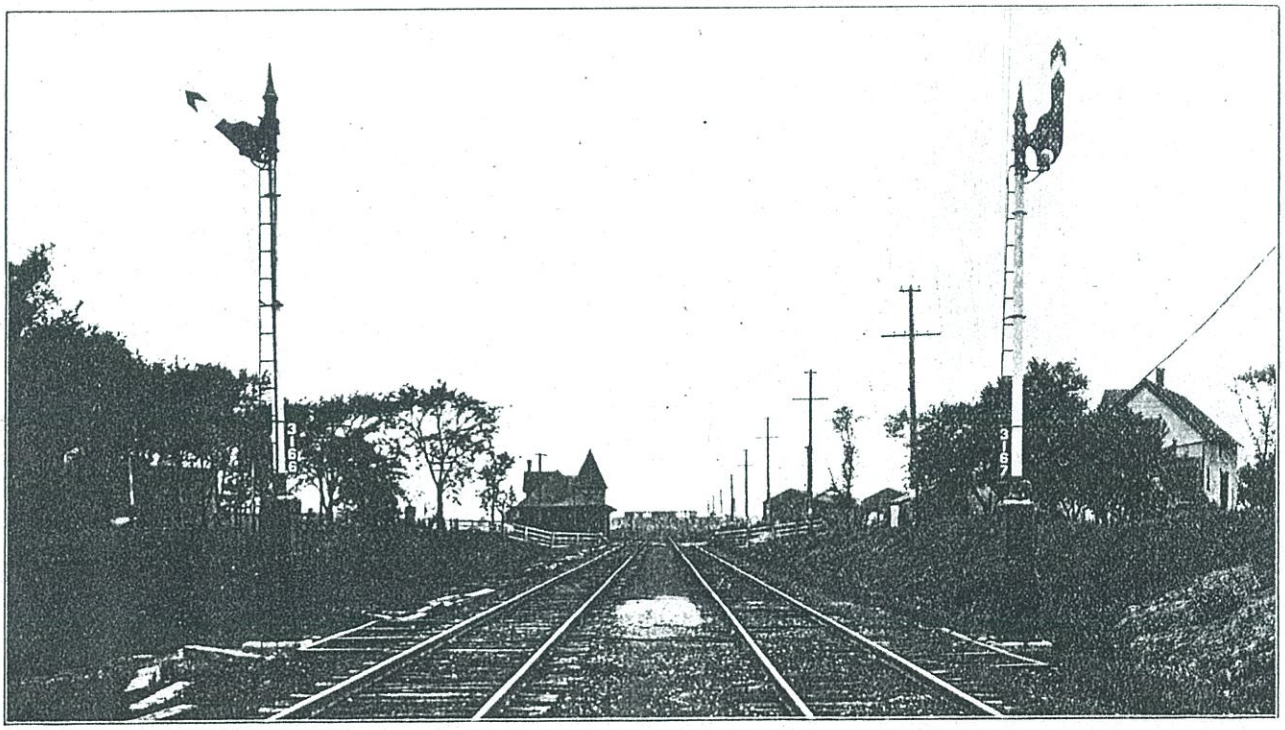


Typical Charts Showing (left) the Filling Water Temperature, and (right) Thousands of Pounds of Feedwater per Hour to the Stationary Boilers

and A. L. Curtis, assistant engineer of the New Haven. The station was designed and built under the direction of F. W. Mellor, architect of the New Haven. C. W. Blakeslee & Sons, New Haven, were general contractors for all masonry work and all street changes, including paving, alterations in sewers and grading of street approaches. Practically all steam shovel and track work was handled by company forces. The American Bridge Company, New York, erected the Conant and Dexter street bridges, while all other steel bridges were erected by the Boston Bridge Works. The steel for the station was furnished and erected by Levering & Garrigues, New York, while the station proper was built by Norcross Brothers Company, Worcester, Mass.

NEW ALTERNATING CURRENT SIGNAL INSTALLATION ON THE GRAND TRUNK

The marked advantages of alternating current power for the operation of automatic signals under certain conditions, even when a line is not electrified, are well illustrated in the installation on the Grand Trunk between Chicago & Western Indiana Junction and Thornton Junction, recently placed in service. This 19-mile section lying partly within the city limits of Chicago carries a heavy traffic, including through passenger and freight, suburban passenger, and all Chicago freight transfer business. This work completes the automatic signaling of the double-track main line of the Grand Trunk from Chicago to Granger, Mich., approximately 108 miles.



Transmission Line and Control Wires at the Right
New Alternating Current Signaling on the Grank Trunk in Illinois

Unusual Track Circuit Conditions

The track conditions on this section of line made the operation of track circuits unusually difficult, and it is probable that certain of the blocks could never have been operated satisfactorily with ordinary direct current circuits. Two factors are principally responsible for this condition, the impregnation of the ballast and ties with brine drippings, and the high ground water level, found in the swampy country in which most of this section of the line is located. The Grand Trunk has had a heavy eastbound refrigerator car traffic for years, and it was on the eastbound track that most of the trouble was experienced. The thoroughness of the brine impregnation is shown by the fact that the ballast in drying out after a shower is almost white with the salt crystallized on the surface. This trouble is, of course, aggravated by the fact that much of the ballast is kept constantly moist through capillary attraction from the ground water below.

While the resistance of this ballast when dry is about normal —5 to 6 ohms per 1,000 ft.—during very wet summer weather this resistance amounts to only about 0.3 ohm per 1,000 ft. This change in ballast resistance takes place rapidly during warm summer rains, 10 minutes often being sufficient for it to drop to 0.6 ohm per 1,000 ft. The temperature has a very marked effect on this action. A cold rain will not reduce the ballast resistance to anywhere near the point that the same amount of precipitation will if the temperature is higher. The only explanation of this fact seems to be that the solubility of the salt increases with the rise in temperature, thus giving a path of low resistance for the leakage current due to the increased amount of salt dissolved in the water. A steady light rain appears to reduce the ballast resistance more than a heavy rain, probably due to the fact that the heavy rain washes much of the salt away, while the former allows it to more thoroughly impregnate the ties and ballast.

A further harmful effect of these brine drippings is that a coating of rust scale has been formed on the rails and angle bars; and this scale, being a good insulator, forces practically all of the track current to flow through the bond wires instead of a considerable portion flowing through the angle bars and the abutting rail ends. This materially increases the total rail resistance and impedance. A recent test on rails similarly coated in D. C. territory showed that the cutting of the bond wires at one joint in the eastbound track resulted in a reduction of the current through the relay of 40 per cent, while on the opposite section of the westbound track, under similar conditions except that the rail was practically free from scale, a similar cutting of the bond wires caused a reduction of only

11 per cent in the relay current. As a result of this test, three copper-clad bond wires were placed at each joint on the eastbound track, instead of two iron wires; but in certain cases even this treatment did not remedy the trouble, and where the length was over 3,000 ft. the section had to be shortened to secure satisfactory service.

On account of the comparatively short block length—averaging slightly less than a mile—which was found best suited to the traffic on the section recently completed, it was decided when the plans were made that it would be possible to operate A. C. track circuits of full block length in all cases. The circuits were installed according to this plan; but it was found that satisfactory operation could not be obtained during the warm summer rains, and 18 of the sections had to be cut in two, and in one case the length was reduced to about 1,800 ft. before satisfactory operation under all weather conditions could be obtained.

Adoption of Alternating Current

In addition to the fact that the adoption of an alternating current system made it possible to install track circuits on a section which would have been impossible to operate with ordinary D. C. circuits, the availability of A. C. commercial power at reasonable rates, and the possibility of lighting the signals and the station buildings from the transmission line, were also important considerations. The lighting feature, especially, has proved most successful as shown by the fact that at present the lighting load is approximately twice the signal load. Power is bought under a wholesale contract at a cost of approximately three cents per k.w.-hour, and this cost will be even less as the load increases. Previously, these lights were supplied with current metered at many points at retail lighting prices, amounting to 8 ct. per k.w.-hour. This saving, if capitalized, would go a long way toward paying the first cost of the transmission line. A further advantage results from the fact that with cheap lighting the road equips electrically even its smallest stations within this zone, thus giving better service to the patrons of the road at a cost that is practically the same as for oil lamps.

In view of the numerous lines in this territory from which power could be obtained, it did not seem advisable for the company to generate its own current. A substation serving the entire line was put up at Elsdon, which is the center for the combined signal and lighting load, and power was secured from two independent 2,200-volt distributing circuits which cross the right-of-way a short distance each side of this point. In this substation, which is a portable 9-ft. by 13-ft. reinforced concrete building, the power is transformed to 4,400 volts, at which potential it is transmitted along the railroad to both ends of the section.

A steel core stranded aluminum cable of a resistance approximately equal to that of a No. 6 B. & S. gage hard-drawn copper wire is used for this high-tension line. The reasons that led to the use of aluminum instead of copper were: First, greater mechanical strength together with less weight; second, its greater ability to withstand rough treatment without serious damage; and third, a small saving in first cost. No. 10 B. & S. gage, 40 per cent bare copper-clad line wire is used for the low-tension control circuits and a clearance of 6 ft. is maintained between high and low tension lines. The high-tension transmission line is sectionalized at four points about five miles apart, thus minimizing the zone affected in case of a line failure.

Signal Control and Operation

The transmission line voltage is transformed to 110 volts at signal locations, which is used for the operation of the 60-cycle single-phase induction motors in the G. R. S. model 2-A bottom post signal mechanisms. The 110-volt current is in turn transformed down to the track and lamp voltages, a separate track transformer being used for each section. The 3-position, upper quadrant signals are lighted by 2 c.p., 6-volt tungsten lamps, burning in multiple, which are operated on 5 volts. This has been found to give sufficient light and materially increases the life of the lamp.

Except in special cases, G. R. S. model 2-A, 3-position tra relays, with 110-volt locals, are used in the signal control c cuits. However, in a case where there are facing point switch in the block, a separate 45-deg. line control circuit is used, a this is broken through all facing-point switches. The switch are equipped with double shunt wires and this protection alo is relied on for the trailing point switches. Switch indicato are provided for all main line switches except those locate in yard zones where switching is constantly going on. In the cases the indicators would be in the stop position so large portion of the time as to be practically valueless. The ind cators are normally energized, 0 to 90 deg., upper-quadra semaphore type, it being thought that with the normally ene gized type there is less likelihood of trainmen neglecting observe the indication. All indicators are clearly marked show whether they refer to movements on the eastbound the westbound track, such information being of material intere to trainmen, particularly at crossovers, in familiarizing them selves with the use of the indicators.

Interlocking Plants

At the two interlocking plants within the limits of this i stallation, the mechanical home and distant signals on the Gran Trunk were replaced by 3-position, semi-automatic A. C. signal incorporated with the automatic block system. Route lockin was installed for the Grand Trunk high speed route, and de tector locking is effective when the home signal lever is re versed. The latter feature allowed the removal of the cros ing bars. For each route, disk type indicators are provide for the track sections between derails and for the track sectio extending from the backup dwarf signal to the next automat block signal in advance. Semaphore type repeaters were pr vided in the towers only for the distant signals. Approa annunciators are not provided, except for eastbound mov ments in the Blue Island plant, a telephone circuit being i stalled in their place between Thornton Junction and t Harvey and Blue Island plants. The eastbound annunciat at Blue Island was necessary, since there is no interlockin west of that point for some 13 miles. Levermen are require to telephone the station in advance of the approach of train In addition, there is a listening set installed on the telepho train despatching line, allowing the levermen to get informati from the despatcher.

This work has been installed under the supervision of t signal engineer's office of the Grand Trunk. We are indebte for the foregoing information to B. Wheelwright, assistant signa engineer.

ASK WHAT YOU WILL

W. T. Lechlider, superintendent of the Cleveland division o the Baltimore & Ohio, remarking that men in his position fr quently are asked to recommend men for places in the railroa service, notifies all his employees to make their desires know "It is a pleasure," says Mr. Lechlider, "for any superintende to be able to respond to such requests. In order to do this it necessary that the superintendent know what available timbe he has to draw from . . . I shall be glad if all who aspi to any of these positions (subordinate official positions, includi station agents and freight house foremen) will write me, in the own handwriting, giving a brief outline of their knowledge handling such position as they aspire to. It is my intention the to talk to each applicant and if necessary put him in line to g hold of such reading matter as will best fit him for the desire position. At the same time I shall endeavor to satisfy myse as to the qualifications of aspirants for handling men We a forming a class which will meet at the headquarters buildi in Cleveland, at night, during the winter months, for the purpo of encouraging the movement."

Employees who have boys whom they want to start in ra road work are invited to send in the name, age, address a school education of the proposed candidates.

Opera

At the annual meet Engineers held in N presented by Anato parallel and radial a was of a historical arrangements for ac tems of transmission ing rotating element In the first class we by endless chain an second class belong located in the longit lating levers or equ able lengths.

Notwithstanding volves, the author e ity which has devel past sixty years and be found which com cal operation of suc

The paper brough possibilities of incr ing extracts are tak

E. A. Averill—It obtain a tractive e ders are concerned factor of adhesion tractive effort wou which means a dri for drivers 60 in. be impossible for ing sidewise action in of the tires or tractive effort of It is not a very that is desired an an important prol long wheelbase.

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The Port Huron Bed Symbolizes the Joining of the Grand Trunk and the Canadian National

Grand Trunk Beautifies With Flowers

Over 248 beds, more than 100,000 plants and 16 acres of lawn are maintained at 80 stations

THE Grand Trunk Western, as a result of concentration on the development of horticulture to beautify station grounds, now has a floral display, the like of which is found on few other railroads. Last year a total of 248 flower beds and 16 acres of lawns were maintained at 80 stations, while the number of plants in beds and boxes totaled more than 100,000. This array has been developed by establishing greenhouses from which plants can be forwarded to agents in the spring and retrieved in the fall.

One of the outstanding floral beds last year was that at Jackson, Mich., specially designed to commemorate the centenary of the city's founding. An additional mark of historical significance was the fact that the Jackson station grounds are located on the site where sod was first broken in that city.

In completing the design of this plot, special attention was paid to the historic significance of the grounds. The picture of the carpet bed depicted the founding of the city by an allegorical foundation stone being lowered against the rising sun. The numerals 1829 appeared on the stone and, underneath, in large letters was worked the word "Jackson." The American flag banked each side. The color scheme was worked out with some 7,100 plants, in red, yellow, brown and green alternantheras; white dwarf alyssum; and dwarf blue lobelia.

Apart from its centennial significance, Jackson is claimed to be the birthplace of the Republican party in 1854, and a secondary celebration was held to commemorate the event, which launched a new political party in the Union. To give due acknowledgment to this phase of the celebration, an elephant was designed and centered in a triangle just below the main flower bed.

In 1929 the Floral Display at Jackson, Mich., Commemorated the Founding of the City and the Republican Party

The Flower Bed at Battle Creek, Mich., is Typical of the More Elaborate Displays

The ingenuity of the railway in co-operating in a floral way with the city in its centennial year aroused wide interest and permission was secured by the city to erect a replica of the original log cabin on the grounds and to display numerous exhibits of pioneer days. The Jackson station flower bed was designed for a special and a unique occasion, but it may be added that this station has long been noted for the care of its lawn and floral displays.

Another striking bed is that at the Port Huron station. In the designing of this bed an effort has been made to give it something of an international character. This bed, which has an elaborate carpet of flowers and foliage, is located just east of the depot and has won much praise for its excellency as a work of horticultural art. The back is raised three feet, so that the design slants towards the tracks and is seen to advantage from the train.

The floral picture covers a plot of ground 30 ft. long and 13 ft. wide. It contains 9,000 plants and depicts the junction of the Canadian National and the Grand Trunk. It is centered by a rug of yellow alternantheras, turned up on both ends, on which the initials, "C. N." and "G. T." appear with the word "Railway" underneath, all formed by brown alternantheras. A chain symbolizing the unity of the two railroads extends at the bottom of the rug from end to end. On either side of the lettering is the front portion of a locomotive, worked out with gray santalinas and green alternantheras. At the top, the smoke from both locomotives joins and is represented by gray santalinas. In the upper portion, forming an arch, are the words "Port Huron" in large letters of yellow alternantheras. On the west end of the bed, in curtain effect is a portion of the American flag; and on the east end the Canadian flag, worked out with white dwarf alyssum, dwarf lobelia, and red alternantheras. Extending around the 330 sq. ft. of flowers in the bed, and dividing its parts, are borders of gray santalinas. A 60-ft. hedge of hydrangeas and mock-orange bushes fences the grounds from the street and forms a background for the bed. Owing to the fact that there are no bare spots on the bed where the gardeners can stand to trim the plants, it was necessary to improvise a platform which could be used over the bed. This platform is supported by stools placed on the lawn.

Less elaborate beds of flowers and foliage adorn the grounds at the Port Huron freight sheds and car shops and the St. Clair tunnel power house. The Battle Creek shops are adorned by a park adjacent to the general office building, which is noted for its flower beds, foliage and well-groomed lawn.

Olaf Jensen, of Battle Creek, is chief designer of all flower beds and has charge of the maintenance of station grounds over the western lines. Mr. Jensen is assisted in this work by George H. Clarke, of Port Huron.

A. I. E. E. Holds Transportation Meeting

SIX papers concerning various phases of heavy electric traction and the use of internal combustion engines for rail motor cars and locomotives were presented at the summer convention of the American Institute of Electrical Engineers, held at Toronto, Canada, June 23-27.

Rail Bonding

An increasing preference for heat-applied or welded bonds is indicated in a paper on rail bonding practice and experience on electrified steam railroads by H. F. Brown, assistant electrical engineer, New York, New Haven & Hartford. This paper deals primarily with the development, description and characteristics of various types of rail bonds used at track joints for traction return and, incidentally, signal track circuits. It outlines their performance and reasons for selection on representative electrified steam railroads which include: Baltimore & Ohio; Boston & Maine; Chicago, Milwaukee, St. Paul & Pacific; Delaware, Lackawanna & Western; Illinois Central; New York Central; New York, New Haven & Hartford; Norfolk & Western; Pennsylvania; Reading; Virginian.

Power Consumption for Yard Switching

Electric Power Consumption for Yard Switching is the title of a paper by P. H. Hatch, engineer of automotive equipment, New York, New Haven & Hartford. It consists of a study of electric power consumption for switching locomotives in the Oak Point yard of the New Haven. Data were collected on two electric locomotives equipped with the necessary instruments and a period of 39 1/6 hours operation was observed and recorded. The average power consumption was 96 watt-hours per total ton-mile. The minimum was 72 watt-hours for flat yard classifying, and the maximum was 157 watt-hours per total ton-mile for unloading car floats.

Auxiliaries for M. U. Cars

Auxiliaries for High-Voltage D. C. Multiple Unit Cars, is the title of a paper presented by C. J. Axtell,

Campaign Specials on the G.T.W.

TWO candidates for the presidency of the United States used the services of the Grand Trunk Western Railway to reach several of the important industrial centres of Michigan. Hon. Franklin Delano Roosevelt, President of the United States, and Governor Alfred M. Landon, nominee of the Republican Party each travelled by special train. Their journeys in Michigan largely covered the same ground but in reverse direction.

Governor Landon came to the Grand Trunk lines on October 14th, when his ten-car special was transferred to the system at Flint and moved to Lansing, Capital of the State.

The following day the eleven-car special carrying President Roosevelt and his party, moved on to the Grand Trunk at Trowbridge and went into Lansing. From the Capital the train proceeded over the main line into Flint. While the President left the train at Flint, the train was turned and headed westwards to leave the Chicago-Port Huron line at Durand and thus travel towards Pontiac and Detroit. The special was halted at Highland Park to allow the President to disembark and motor to a nearby meeting after which he continued on to Detroit to address an open air meeting in that city.

The composition of both trains was similar. In one President Roosevelt and Mrs. Roosevelt occupied the private car "Pioneer" and there were compartment cars for correspondents, members of the White House staff, and political leaders, the consist including dining cars and club cars.

In Governor Landon's special, the private car "David Livingstone" was reserved for the Republican Candidate, and, as in the President's train, newspapermen and party leaders were accommodated, each train carrying over one hundred passengers. An equal number of newspapermen were found in each train consisting of representatives of the press associations, leading national dailies and Michigan State papers. It would be difficult to estimate their "file" but at each stopping place the telegraph companies gathered thousands of words giving the high lights and the incidents of that particular community.

For the President's special, linemen and technicians of the Bell Telephone Company were on hand with heavy duty cable which was on board at an indicated point almost before the train had come to a halt. These provided for two direct telephone circuits from the President's car to the White House at Washington while a third one set up connection with the local exchange.

Photograph by Detroit Free Press.

President Roosevelt's campaign special train on the Grand Trunk Western lines at Lansing, Michigan. The President is speaking into the microphone and amplifiers carry his voice over a wide area in the station grounds. Mrs. Roosevelt is at the President's side.

In addition to the newspaper and the private methods of communication, the radio chains were on hand at each city using mobile broadcasting stations from which to send out a running commentary on the happenings and then to relay the candidate's speech.

At Flint the performance of the State Police in closing Saginaw Street to traffic, establishing good lines and maintaining them was excellent. Here the President left his train to speak in the Stadium. For convenience in disembarking, a special ramp, or gangway, was carried on the train. As this was in the forward baggage car and was required at the opposite end of the train, the carrying of this heavy piece of furniture ten car lengths seemed to present quite a problem. On the Grand Trunk it was neatly solved. A gasoline-engined section car was spotted beside the baggage car, half a dozen men hefted the ramp on to the car and in the proverbial jig time it was at the other end and being set up, a similar performance getting it back to the baggage car without delay.

For exact schedule and smoothness of operation the movements of these two special trains were carried out by the Grand Trunk Western forces in perfect style and everything done was done smartly and efficiently. For the actual train work crews of long service were chosen; the men who were on duty in the engine and on the train for Governor Landon's special record a total of 147 years' service with the company. The engineer was Horace Carr with 42 years' service, a sprightly veteran, who is highly regarded. The fireman was Clarence A. Shive, 20 years' service. The conductor and trainmen who served on both specials were Harry C. Clausen, 34 years' service; conductor; E. J. Carey, brakeman, 26 years' service and Harry Kind, brakeman, 25 years' service. For the President's special while the same conductor and brakemen were again on duty, there was a change of engine men. C. W. Bose, took the train out of Lansing with Leo G. Porter fireman, who continued until the end of the journey. Moving towards Detroit John M. Donnelly took over because of his experience over the Detroit Division. Mr. Donnelly is General Chairman of the Brotherhood of Locomotive Engineers.

Every department co-operated in the work of moving the special trains and the result fully accords a hundred per cent. rating. A. B. Chown, Passenger Traffic Manager, Chicago, accompanied both specials, as did H. L. McCaughey, General Agent, Passenger Department, Detroit. A further representative of the Passenger Traffic Department was George L. Bryson, District Passenger Agent, Washington, D.C. W. J. Hogan, Superintendent, Battle Creek, took charge of the operations of both special trains. Others whose duties brought them on board were Homer J. Billington, Road Foreman of Engines, Battle Creek, B. L. Tyler, Trainmaster, Durand, J. M. Munnings, Trainmaster, Pontiac, and General Yardmasters, Basso, Lansing, and Rose, Flint.

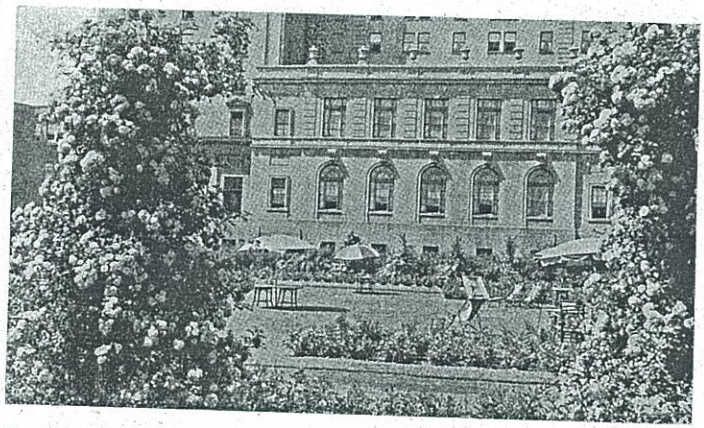
J. B. MacGregor, Superintendent of Telegraphs and Telephones, was on board, and there were representatives of the Investigation Department under the direction of Supt. of Investigation H. Brandes and headed by Inspector Ralph Day, and various necessary technical experts including W. L. Dayton, Superintendent of Signals, ready to cope with any emergency but nothing arose to require their special services. On the President's Special was P. D. Fitzpatrick, Chief Engineer of the Grand Trunk Western. The final operation of the President's Special to Highland Park was supervised by E. F. Gorman, Superintendent, Detroit. Movements of both trains were arranged under instructions of J. A. Clancey, General Superintendent of Transportation, Detroit.

Both special trains were drawn by Engine No. 6041 which had two perfect scores.

Canada's Railway Spirit Exemplified

CANADA'S story of railway development throughout a century was told in a graphic, pictorial way at the Canadian National Exhibition, Toronto, this year. Past and present triumphs were pictured boldly and with a wealth of color in the Canadian National Railways' display. From the past came the pioneer locomotive of Canada, the "Dorchester", which made its first trip in 1836 and was reproduced to its full size. The gigantic, silhouetted old-time figures grouped around the "Dorchester" peered intently into the years to come and to them was presented the emergence of the locomotive giants of the twentieth century, including the mammoth streamlined 6400. The 14-mile iron highway connecting the St. Lawrence and Richelieu Waterways one hundred years ago was seen in its steady development until it spanned the continent. On illuminated glass engraved for the first time a series of railway maps showing with historical accuracy the growth of the Canadian National System during the century. In 1836, a mere inch of railway line, 1870, the growth of the Grand Trunk system and the early sections of the Intercolonial. In 1890, more railway building east and west and throughout the central area of the Dominion. In the map of 1910 the penetration of the northwestern frontiers of Canada is outlined with the rapid development of the Grand Trunk Pacific and the thrusting eastward of The Canadian Northern. In the 1936 map, the story was told of the Canadian National System as it is today with approximately 24,000 miles of road, serving every province and linking up the important centres of Canada with those in the United States.

Nor were the latest features of comfortable and speedy travel overlooked. New illuminated, colored picturization was used to illustrate modern equipment in day coach, dining, parlor car and sleeping cars and brought forcibly to the spectator the truism that a passenger train of today is something more than a medium of bridging distance, that it is an up-to-date hotel on wheels offering every convenience to its patrons.



Popular with summer visitors to Halifax, the beautiful Rose Garden at the Nova Scotian Hotel, Halifax, was one of the city's most attractive spots.

In keeping with the brilliant coloring of the historical feature of the exhibit was a relief replica of Jasper National Park and its mountain peaks, complete with Jasper Park Lodge and golf course, and the numerous mountain streams and rivers, while "The Continental Limited", operating between Eastern Canada and Vancouver, drew into the station, stopped and moved onward again, with motor cars swiftly running over the roads from the station to the Lodge.

Executed in broad outline and brilliant tints, the modernistic touch was given the exhibit which was fully in keeping with the spirit of railway progress exemplified.

FIRE PREVENTION WEEK

Originally sponsored and carried on from year to year by the railways and later as a community affair, Alexandria, Ontario fire prevention week demonstration this year was well staged. Sirens were blown and a parade headed by Mayor Laurin and Fire Chief Seger, with the Citizens' Band in attendance, brought home to everyone the urgency of fire prevention at all times.

Across the Border

Aug 1935

By C. J. HANRATTY

YET another new train rolled into Chicago to display its features to the railroaders and the public and thus add to the importance of this city as the appropriate centre in which to exhibit new fashions in transport. The newcomer, *The Rebel*, represented the contribution of the Gulf, Mobile & Northern Railroad Company to the new trend in passenger service. The name has no political significance but was chosen, so it is explained "... to indicate the management's desire to distinguish the difference between them (the new trains) and traditional methods of transportation." This desire is further emphasized by the exterior color scheme and style of decoration. A broad band of Chinese red extends from 3 inches below to 2 inches above the windows and is unbroken from the front to the rear end of the train. The roofs and the remainder of the sides are of aluminum color, except for a band of gray 11 inches wide, covering the inwardly curved skirting at the bottom. To add to the striking appearance of the front end of the train the sides and roof of the monitor are in red and an emblem of conventionalized wings on the front below the windows is also in red with black lines and across it are the initials of the road in polished chromium.

The trains—there are two of them—are fully streamlined Diesel-electric and of lightweight construction. Unlike most trains of light-weight streamlined construction which have been built recently, the G.M. & N. trains are not articulated but are made up of completely separate coach units. Each train consists of three cars; a power car, a buffet coach with compartments for white and colored passengers and an observation-sleeping car. A coach without buffet facilities is provided for use interchangeably in the two trains. These trains will handle the through service between Jackson, Tennesee, and New Orleans, Louisiana. These are night runs which will be made on a schedule of approximately twelve hours for the 488 miles in each direction, with 39 stops.

It is hoped to effect economies in operation by the use of this new equipment. The run from the manufacturer's shops to Chicago, a distance of 762 miles, was performed on an expenditure of $17.08 for fuel. This represented a total of about 515 gallons of oil consumed at an approximate cost of 3.3 cents a gallon, or an average of 2.2 cents per mile fuel cost.

While *The Rebel* has sacrificed something in weight reduction—about fifteen tons—by not employing articulated trucks, official belief is that there is compensation in the increase of flexibility. Uncoupling requires about the same time as would be the case with standard equipment, while in coupling there is said to be a substantial saving. A mechanical failure affecting one car does not affect the entire train as in the case of articulated trains. It is stated that uncoupling of articulated units is a two-hour shop job.

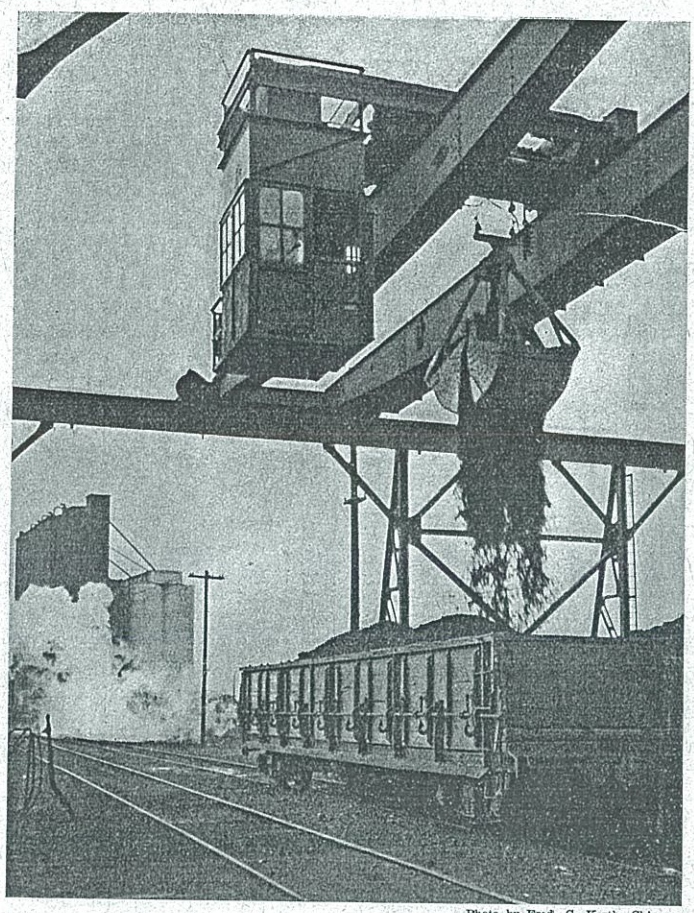


Photo by Fred. G. Korth, Chicago.

"On Line" Scenes—The cinder hoist at Battle Creek, Mich.

"Abraham Lincoln" in Service

One of the new trains recently described in these columns is now in service between Chicago and St. Louis. This is the *Abraham Lincoln*, the steam streamlined train operating over the Alton railroad. The rail distance between terminals is 283.9 miles and the schedule calls for the run in 5½ hours. The time-card allows for two stops, Bloomington and Springfield, with a permissive stop at College Avenue, Alton. The new folder describes the *Abraham Lincoln* as "the world's most modern train", but similar statements have been made on both sides of the Atlantic so that the traveller may be rather puzzled over these rival claims. It is too soon to pass judgment on the effects of these new trains but the statement has been made that railroad passenger traffic between Chicago and St. Louis has risen sharply since trains were speeded up. Similar statements regarding passenger travel have been made by the roads operating new and faster trains between Chicago and the Twin Cities. On some of these trains it is necessary to purchase a ticket fairly well in advance because space is reserved and the sale ceases when all seats are sold on that particular run. There is no additional charge for the privilege, it is merely that the seats are reserved. From answers given in response to invitations from managements, it would appear that an appreciable percentage of passengers—more than 20%—travelling on the new trains would have made the journey in private automobiles, while approximately 7% would have used busses, a fair indication of the channels into which traffic lost to the railroads has flown.

Lightweight Freight Cars

A considerable proportion of these notes has hitherto been given over to novel design in passenger vehicles and there is evidence that this movement is gaining momentum and that more space will be required to record further departures from what has come to be regarded as the conventional. Now that the first blush of novelty has slightly faded from the passenger fashions, the freight services are making known new trend in design and manufacture of freight rolling stock. Examples of new design in lightweight equipment have been shown in Chicago, such displays being staged at Dearborn Station—the Grand Trunk Terminal—and the Union and Illinois Central stations, these exhibitions being in connection with the fourteenth annual meeting of the mechanical division of the Association of American Railroads. One type of lightweight box car represented a saving of 7,900 pounds from standard design, the reduction in weight being due to the use of Cor-Ten steel and similar steel alloy. Another type of box car using welded Cor-Ten steel body and special alloy. steel trucks weighed 10,200 than a standard car built a year previously. Another specimen shown was a rustless steel coal hopper weighing 33,000 pounds as compared with 50,000 for the present standard. It was stated that the new steel alloys are now within the price reach of the railroads.

Chicago Shop Goes Travelling

Readers of "Overseas Notes" in this magazine will recall that three years ago there came from London a paragraph telling of the enterprise of an English merchant in organizing a shop on wheels which moved over the railroads from place to place. The idea has reached Chicago and during the month of July one big store sent out on the rails a 12-car train—a wholesale store on wheels—loaded with merchandise for display to merchants in the cities and towns of the Mississippi valley. The train was conditioned for this modern adaptation of the old-time peddler's cart by the Baltimore and Ohio Railroad and consisted of a dynamo car to furnish light, a baggage car, two sleeping cars, a lounge car, a dining car and six coaches,

G. T. W.—C. V. STAFF ACTIVITIES

Passenger Traffic Men Meet

OPTIMISM and enthusiasm were characteristic notes of the staff meeting of the Passenger Traffic Department held in Chicago, to discuss summer and fall traffic and the general conditions of holiday travel. A. B. Chown, Passenger Traffic Manager, was in the chair and was supported by W. R. Eastman, General Passenger Agent, and A. H. Davis, General Western Passenger Agent. The field force reported favorably regarding Alaska bookings, both by the regular services and the special cruises operated by the *S.S. Prince Robert*. Jasper was stated to be holding its own as an attraction for western people on vacation, and, generally speaking, it was held that so far as the Grand Trunk territory is concerned, this is a "western" year. That is a satisfactory condition for the Chicago business of the system because the greater number of travellers who make for the Pacific Coast desire part of their journey through Canada. Bookings from this territory for summer cruises via the Canadian National Steamships (West Indies) were declared to be on a high level. A deterrent factor in the early summer business was the weather which made the fore part of June reminiscent of April owing to a generous rainfall, fog and many cool days. With the coming of real sunshine and an upward climb of the thermometer travel business immediately became brisk.

Grand Standers Go Travelling

Chicago—Of travellers there is an infinite variety and an interesting specimen of the genus is the "Grand Stand" performer. At once let it be understood that this is a perfectly legitimate characterization and has nothing to do with that species of human who pushes forward, or does tricks, or attempts sensational plays and is promptly dubbed a "grand stander". The individual under discussion is a performer who appears on the open air entertainment platforms at county fairs and exhibitions in larger communities and as such performances and displays are always given in front of the Grand Stand the title becomes obvious. For this class of entertainment Chicago furnishes by far the greater proportion of acts and individuals and many of these performers cross the border and appear at Canadian fairs. The first of such big groups to start out consisted of 67 individuals and they faced westwards and after entering Canada were routed over the Canadian National Railways in the Prairie Provinces. Other groups will later travel over the Grand Trunk and Canadian National lines to appear in Ottawa, Toronto, London and other places where the late summer and fall fair season is in full bloom, while yet others are booked to travel over Grand Trunk lines to places in Michigan and adjacent territory. The "Grand Stand" performer, it must be noted is distinct from the "Midway" type. The latter work in tents.

An International Carnival

Port Huron, Michigan:—When they get to celebrating in the Thumb of Michigan they do so with real enthusiasm: The big event was the International Blue Water Carnival which began on Canada's Dominion Day and terminated on United States Independence Day which appears to be a fit and proper way to make use of two national festivals so neighborly in th

(Continued on page 88)

ments, one rated at 13 watts and the other at 3.5 watts. The lamp is so designed that the 13-watt filament will burn out first, with an adequate factor of safety so that the other filament will continue to burn for an extended period thereafter. The illumination in the signal is, of course, materially reduced, so that the enginemen and the maintainers at once notice the difference and a new bulb is installed. However, in the meantime, the 3.5-watt filament gives enough light to afford a signal indication so that no train delays are occasioned by the absence of a signal.

As a part of the new installation, an independent telephone circuit was provided, with a telephone located in a booth near each power-operated, as well as near each hand-thrown, switch. These phones are useful in case any unusual condition arises, and at hand-thrown switches must be used frequently as the rules require trainmen to receive permission from the operator at Holliday before occupying the main line, and the same rule applies for switching operations at the power-operated switches.

The straight alternating-current system of power supply and operation was used on the old semaphore automatic signaling, the distribution system being at 4,400 volts 25 cycles. When installing the new signaling, the power supply was changed over to the a-c. floating system, the distribution being changed to 2,300 volts, 60 cycles. Storage batteries charged by rectifiers are used for the operation of the switch machines, track circuits and line-control circuits. The signal lamps are rated at eight volts and operate normally on a-c., but in case of a power failure they are switched to the storage battery supply.

All of the equipment required for the new system, including the signals, dual-control switch machines, coded centralized control machine and related apparatus, was furnished by the Union Switch & Signal Company. The construction was handled by the Santa Fe signal department forces, an interesting feature of the program being that the old signaling was kept in service until the new system was complete, the change-over being effected without a single train delay.

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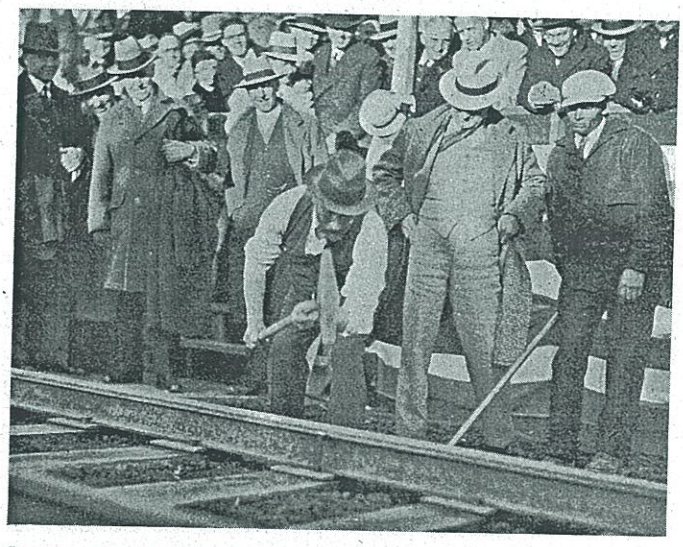


Courtesy Great Northern Railway

Completing the New California Connection of the Great Northern and Western Pacific

Arthur Curtiss James of New York, the largest individual stockholder in the Great Northern and the controlling factor in the Western Pacific, driving the golden spike that marked the completion of the year's most important piece of new line construction. As described in the *Railway Age* for November 14, page 749, the ceremony took place on Tuesday, November 10, at Bieber, Cal., where a 91-mile extension of the Great Northern, running south from Klamath Falls, Ore., joins a 112-mile Western Pacific line north from Keddie, Cal.

"Box Car" Trailer Used by G.T.W. in Detroit

"Box Car" Trailers Speed G.T.W. Freight Service

HIGHWAY trailers which are replicas of railroad freight cars, even to the grab irons and the hand brake, are being used by the Grand Trunk Western in Detroit, Mich., to reduce the time in transit on l.c.l. shipments between Detroit and Chicago.

In Detroit the outlying freight houses of the railways are situated at a distance of several miles from the main station. Formerly transfers between these substations and the main stations were accomplished by railway switching movements. L.c.l. shipments delivered to these substations on one day did not arrive at the main station, after the switching movement, until late at night, and they remained there until the following morning before continuing on their way to destination.

Under the present arrangement, shipments delivered to the substations as late as 3 P.M. are trucked to the main station, where they are loaded into outbound trains for departure the same evening. In many cases delivery is made at destination the next morning. The same time-saving is also provided in handling inbound shipments which, on the arrival of inbound trains at the main station in the morning, are at once forwarded by truck to the substation where they are available to the consignees before noon. On the complete movement from origin to destination, a saving of approximately 24 hr. is made through effecting these transfers by motor trucks.

Trailers Operated Under Contract

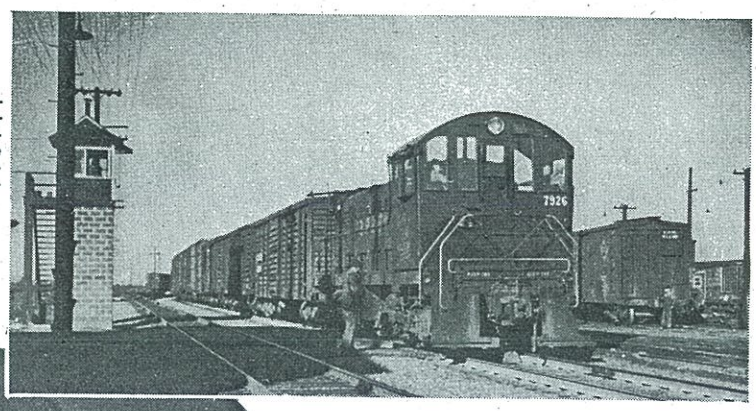
In Detroit the Michigan Cartage and Storage Company is under contract with the Grand Trunk Western to handle the transfers of l.c.l. freight between the substations and the main station. This company built the special "box car" truck bodies which carry the Grand Trunk Western trademark and which are used entirely in the service of the railway. In addition to providing a means of faster freight service, these "box car" trailers are a permanent and valuable advertisement of the fast freight service available on the railway.

RAILROADS IN TEXAS are considering the establishment of taxi service at certain points for the convenience of passengers traveling to those points by rail. Under the plan the patron will be furnished transportation from the point at which he boards the train to his hotel or home at the point of destination.

HIGH BALLING G.T.W. FREIGHT

ABOVE—Belt run en route from Clearing to Elsdon

BELOW—Yard engine making up Train No. 492 at Elsdon



The photographs — by Ken Hand, Canadian National Railways—are from the article as it appeared in Trains Magazine.

fore 490 pulls out of Elsdon Yard with seven cars of meat and rush merchandise. Eleven miles down the line, at Blue Island, the train picks up 29 loads of perishables from western connections, then settles down to keep its morning appointment at Port Huron.

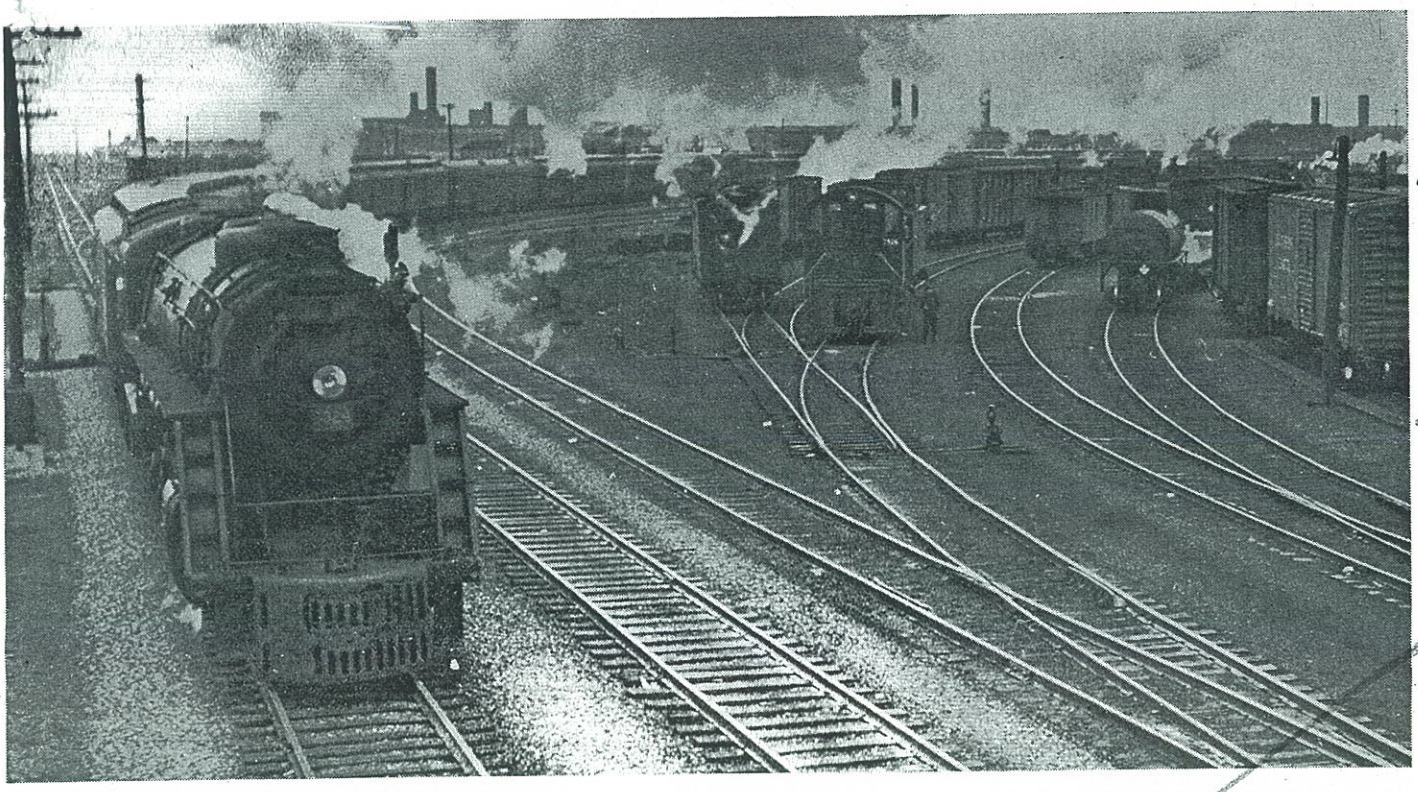
"The caboose swings and sways as the mile-a-minute pace continues through Haskells, Wellsboro and Stillwell," writes Mr. Wyllie. "At Haskells we cross the Michigan City Division of the Monon Route; at Wellsboro, the LaCrosse Division of the Pere Marquette and the main line of the B & O; at Stillwell, the Michigan City branch of the Nickel Plate. All these crossings remind us that the Grand Trunk follows a more northerly route to the East than do other railroads out of Chicago. We have crossed 14 other lines since we left Blue Island."

The story unfolds as 490 speeds through the night. "Then it's 6 a.m. and an on-time run has ended in Tunnel Yard," the writer continues. "Port Huron is the end of the line for the Grand Trunk Western. Soon 490's cars will be taken in charge by electric locomotives for a two-mile ride through the St. Clair Tunnel, which

(*Continued on page* 20)

. . . . makes up his wheel report of cars in train.

. . . . looks over his train when pulling out of Elsdon yard.



Train No. 20 rounding a curve at Elsdon yard.

THE importance of the Grand Trunk Western as a part of the Canadian National Railways was vividly described by Cleland B. Wyllie in an article in a recent issue of *Trains*, published at Milwaukee, Wis., for national distribution to railway enthusiasts. Centering his story on the fast freight service offered by the Grand Trunk, Mr. Wyllie takes his readers for a ride in the caboose of Train 490 from Chicago to Port Huron, describing interesting features along the line and weaving into the narrative pertinent facts about the railroad and its history.

Mr. Wyllie points out that the GTW pioneered fast freight service 'way back in 1898, when the railroad, then known as the Chicago & Grand Trunk, began numbering its manifest runs, using the series of numbers in the 480's and 490's. "These numbers have become traditional with fast freights on the GTW and are still used to designate the hotshots that hurry between Chicago and points in eastern and northeastern United States and the cities of eastern Canada," Mr. Wyllie writes. "Fastest of all is No. 490, which makes the nightly run between Chicago and Port Huron in about eight hours. Let's climb aboard the morency orange caboose of 490 as it sits awaiting its train in Elsdon Yard, in the southwest corner of Chicago, and see what we can learn about the operation of this fast freight."

Suiting words to action, the writer takes his readers through the making up of the train and for a brief inspection trip in the cab of engine 6317 be-

Conductor Verne Walters receiving his orders from the operator . . . .

. . . . boards caboose with waybills and orders, ready to leave terminal.

CANADIAN NATIONAL TELEGRAPHS OPERATING THE NORTHWEST COMMUNICATION SYSTEM

ON APRIL 1st, under an arrangement between the Canadian and United States Governments, the Northwest Communication System (previously known as the Alcan Telephones, and constructed during the war as a defence project) became available for public and commercial use. This system covers all the important points along the Highway in the Pacific Northwest between Edmonton, Alberta and Fairbanks, Alaska.

The U.S. Signal Corps entered the area and constructed this communication system, which in Canada consists of about 1,750 miles of pole line and wire circuits as well as 18 repeater stations which are located along the Northwest highway approximately 100 miles apart. From the Yukon border to Fairbanks there is an additional 500 miles of pole line and repeater stations. Each station is equipped with the most modern type of telephone and telegraph communication equipment.

During the war, this communication system played an important part in the protection of the coast line and proved invaluable to the military authorities.

In April, 1946, the Canadian Government took over from the United States Government that portion of the system erected on Canadian soil and responsibility for its operation and maintenance was delegated to the Royal Canadian Air Force. In June of the same year, the Department of Transport assumed the responsibility for the system and appointed Canadian National Telegraphs as its agent, to operate the system on a commercial basis. The transfer from R.C.A.F. to C.N. Telegraphs has been taking place over the past few months with full co-operation of the R. C. A. F. and was completed by March 31st.

To carry out its new responsibility, the C.N. Telegraphs set up a District Superintendent's organization at Edmonton under the jurisdiction of the Western Regional General Superintendent. Special training was arranged for technical personnel to operate the equipment. More than 200 persons, many of whom are highly skilled technicians, were required to handle all phases of the work. In addition, extensive transportation, housing and living accommodation arrangements were necessary.

The system is operated as a standard commercial telephone and telegraph system, connecting with commercial companies at Edmonton, Alta., and Fairbanks, Alaska. This makes available to the public a communication service to all parts of the world, bringing the extensive Northwest districts of Canada and Alaska more closely in touch with the trade and commerce of Canada and the United States. Because of this Communication System, the formerly isolated and remote areas are only a matter of minutes from the commercial centres of the two countries and will undoubtedly contribute to the development of the Northwest.

TELEGRAPH SERVICE TO GERMANY REOPENS

TELEGRAPH service for messages of a personal or social nature between Canada and the American and British occupation zones of Germany, is announced by Canadian National Telegraphs.

Telegrams in English, French, German and Russian will be accepted at full and deferred rates for these zones but cannot be accepted for transmission to Berlin or the French and Russian zones. Business and commercial telegrams dealing only with the exchange of ideas or the accumulation of facts in relation to business matter will also be accepted.

High Balling G.T.W. Freight

Continued from Page 5

plunges under the St. Clair River and emerges at Sarnia in Canada. There the Canadian National will take over to rush the freight eastward over the old Grand Trunk main to Toronto, Montreal, and Portland, Me., with another line curving away at Hamilton, Ont., to Niagara Falls, where connections are made with the eastern roads serving the New York and Pennsylvania areas."

Feb 15 1936

The Re-erected Shop Ready for Occupancy

Move Steel Car Shop Building from Chicago to Port Huron

Grand Trunk Western replaces unit destroyed by fire, with modern all-steel construction at minimum cost

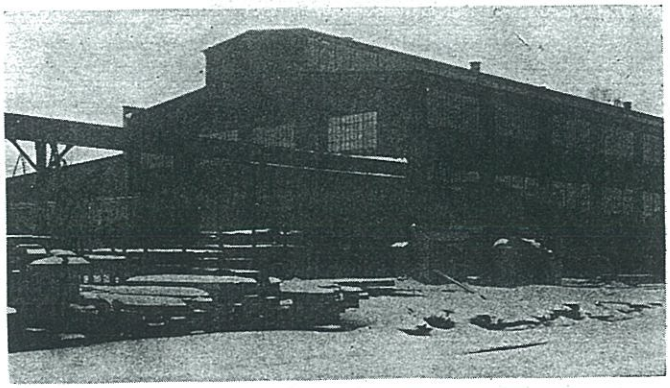
BY TAKING down the steel frame of an unused shop building at Chicago and re-erecting it at Port Huron, Mich., the Grank Trunk Western was able to replace at minimum expense an old structure that had been destroyed by fire with what is now virtually a new building, modern in every respect and much better suited to the purpose for which it is used. A feature of particular note is the salvaging of the old corrugated siding of genuine wrought iron and its reuse in combination with other materials to provide insulated walls for the re-erected structure. Construction was completed in 81 days after the award of the contract.

The old car shop at Port Huron was a building 360 ft. long by 160 ft. wide with brick bearing walls and timber posts 20 ft. center to center in both directions supporting a wood roof of beam and purlin construction. It was divided along the longitudinal center line by a brick fire wall. Each half of the building was served by four tracks extending through the structure in the lengthwide direction. The floor was of concrete with mastic surface. A low leanto, 15 ft. wide, extending for a distance of 200 ft. along the north wall was occupied as an office, a tool room and other auxiliary facilities.

Fire Wall Saves Half of Structure

The fire, which occurred on January 9, 1935, started in the north half of the shop and when it had been put out little more than the walls of that unit and the leanto remained. However, the presence of the fire wall made it possible to save the south unit, and prompt work by the railway's maintenance forces in installing temporary electric power lines, and water, steam and other service pipes, to replace lines that had extended through the north shop to reach the south shop, enabled the mechanical department to resume operations in the latter within 24 hours. The removal of the wreckage followed, and within a short time the leanto was in condition for use.

Owing to the limited car repair program under way at the time of the fire, there was no immediate need to replace the burned structure, but when, a few months later, it was proposed to undertake an extensive project for the reconstruction of box and steel hopper cars it



The New Shop from the Northeast

Oct 19 1906

blades inside the posts. On interlocking and train order signals the lamps are fixed one above another as in ordinary practice, but on the automatic signals they are staggered, as before stated. These lamps are 6 ft. apart, measured vertically, and 2 ft. apart measured horizontally. The compressed air is conveyed from the compressor at Media through a 2½-in. pipe. In emergencies air pressure can be supplied from West Philadelphia. Batteries for most of the automatic signals are kept in the bases of the signal posts, but at three places they are in boxes on signal bridges. Isolated switches, when turned off from the main track shunt the track circuit by means of a switch box in the usual manner, In connection with each switch there is a derail in the side track, this and the switch being moved by a single lever.

At cross-overs both switches are worked by one lever through a switch and lock movement. This lever must be locked before the signal for that section can go to the clear position, and the lever is fixed in the middle of the track of the cross-over so that in case an engine is standing on the cross-over its presence will make it impossible to get at the lever to move the switch.

The relays are 5-ohm universal polarized type.

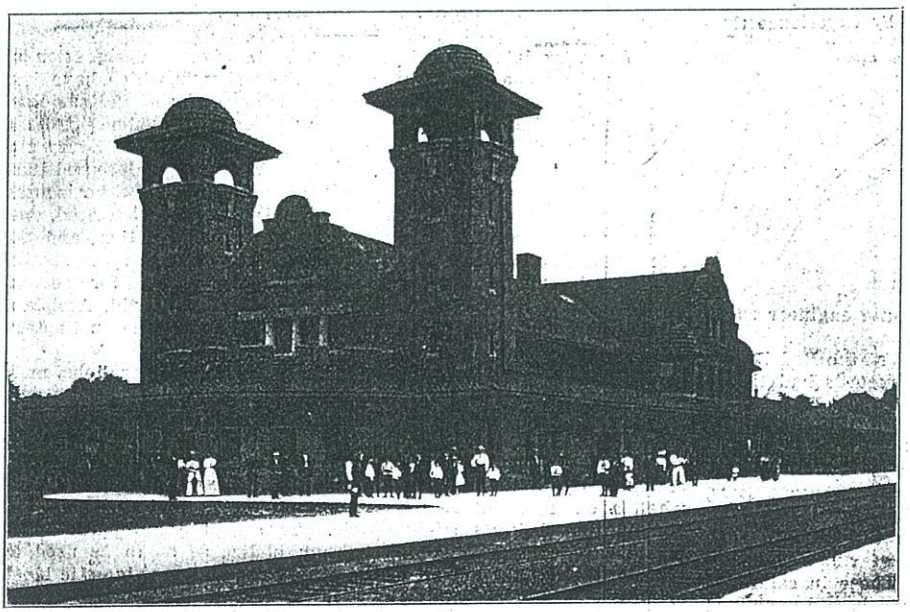
The track circuits are worked by storage batteries, as are also the controlling circuits of the signals themselves. The batteries are charged in series from the power plant at Media, through a No. 6 copper line extending throughout the signaled territory, and by means of a 500-volt generator, as has been the custom on Pennsylvania Railroad signal work for several years past. The voltage is about 500, and the effective charging current about 5 amperes.

The night color indications in these signals conform to the Pennsylvania standard; white for proceed, green for caution or distant and red for stop. In the automatic signals the upper blade works precisely as on the Fort Wayne and other roads where the three-position signal has been used. On the passage of a train the blade goes to the stop position; on the passage of the rear of the train out of that block section the blade takes the 45-degree position (upward), and when the train clears the second block in advance, the blade goes to the 90-degree position (vertical, upward). The lower blade on an automatic signal, which is a "dummy," fixed in the horizontal position, has a light always showing red.

The signal material and apparatus, except the wire and pipe, were furnished by the Union Switch & Signal Company, Swissvale, Pa.

The Grand Trunk Station at Battle Creek.

The new passenger station of the Grand Trunk at Battle Creek, Mich., occupies the whole block fronting on East Hill street, between East Main and Beach streets. The walls of the building are of Maine granite and the roofs are made of semi-glazed red Spanish tile. On the first story is the entrance lobby, general waiting room, smoking room and ladies' parlor. In the southeast corner is the lunch room, with a capacity of 50 persons, and in offices. The platforms and walks are all concrete. The floor the waiting room is of mosaic tile, and the walls are wainscot 9 ft. high with ivory enameled tile, above which is a gilt frie This room is two stories high and the ceiling is vaulted wi groined arches. The station was built by Lewis & Sons, Bat Creek, and the architects were Spier & Rohms, Detroit, Mich.



New Grand Trunk Passenger Station at Battle Creek, Michigan.

Steel Passenger Cars Built by the Pressed Steel Car Company

In the spring of 1905 the Pressed Steel Car Company, of Pit burg, announced that it would build a plant to be devoted exc sively to building steel passenger cars for both steam and elect railroads. Since that time work has been pushed on the new bui ings. Contracts for all-steel passenger cars covering several mont operation of the plant have already been taken. The first turned out at the new plant was completed early this year the United Railways of San Francisco—an all-steel street car of "California" type. The aim has been to preserve the external c tour and general inside and outside appearance of the wooden p senger car, at the same time building the car for the greater p of steel plates, pressed shapes and commercial sections. This fo of construction gives rigidity, which means resistance in c lisions with lightness. It has been possible to build cars of t sort which, with dimensions corresponding to wooden cars of t same type, are difficult to distinguish from the wooden cars. carrying out this idea the rivets on the outside of the car bo are covered with special drawn moldings and all steel parts and t steel posts, panels, etc., are grained to conform to ordinary wo finish. The "California" type of car is one adapted to the clima conditions of that state. It has open sections at each end with closed section in the middle, thus forming an arrangement suit for service the year round. The accompanying photograph gi a general view of the framing of the car and the general dim sions are as follows:

Seating capacity	40
Length over all	40 ft. 6 in.
Length over closed part of car	13 " 2 "
Distance from center to center of trucks	23 " 6 "
Width over side sills	7 "10½
Width over side sheets at belt rail	8 " 2¼
Height from top of rail to top of roof	11 " 5½

The underframe and side sheets together with the outsi finish up to the eaves of the closed section of the car and the pl form posts on the open sections are made of rolled or pressed st plates. The doors, window sashes, floor mats and deck moldi are wood. The floor is $^{3}/_{32}$ in. steel plate, with one course of wo above. The lower and upper deck ceilings are made of steel shee The carlines and purlins are of rolled angles and the center si are 6-in. channels. The side sill is built of Z bars and pressed an plates, and the bumper is made of 8-in. rolled channel, pressed shape. In order to carry the weight of the car entirely on t side it was necessary to provide openings for the steps betwe the trucks next to the closed car section wi out weakening the car at these points. T was done by placing reinforcing angles, tending past the body bolster, alongside the openings for the steps. In the closed p of the car the longitudinal seat supports built up of steel plates and angles. The bo bolsters are steel trusses to be used with Pe ham trucks having 33-in. wheels. The is fitted with Wood's patent standard gat in the open part of the car with "Walkov cross seats, and in the closed part with lon tudinal rattan seats and backs.

After this "California" car, the next o built in the new plant were three passen cars now being used on the Southern R way and 40 all-steel passenger car bodies, m of which have been built for the Philadelp Rapid Transit. The car for the Southern R way was exhibited at the Atlantic City c ventions in June and illustrated in the *R road Gazette* on June 22, 1906. The frami of the car is of steel throughout; the ve bules are of steel and the outside sheathi up to the window rail is made of steel pla To meet the wishes of the railroad compa wood finish was used above the wind rail.

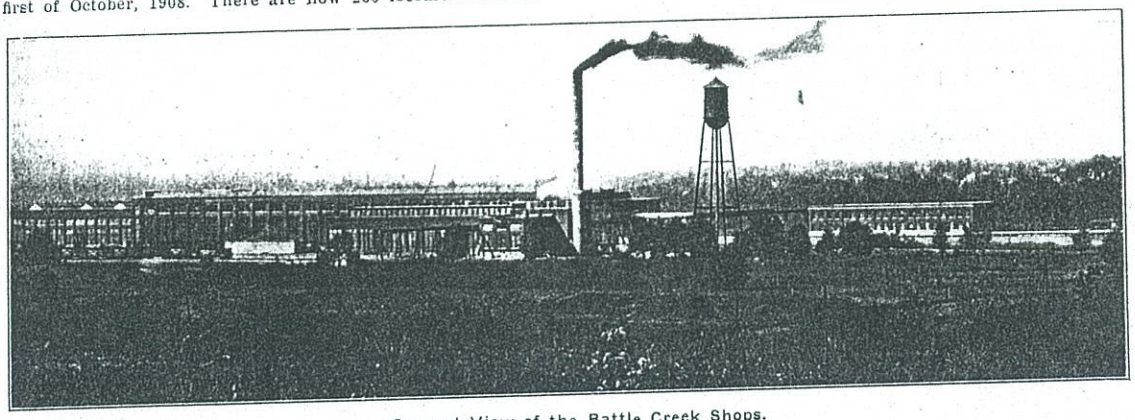
The cars for the Philadelphia Rapid Tra sit are to be used on the Market street e vated and subway. They are illustrated in the accompanying p tographs. These cars are of steel throughout with non-combus

NEW LOCOMOTIVE REPAIR SHOP OF THE GRAND TRUNK, BATTLE CREEK, MICH.

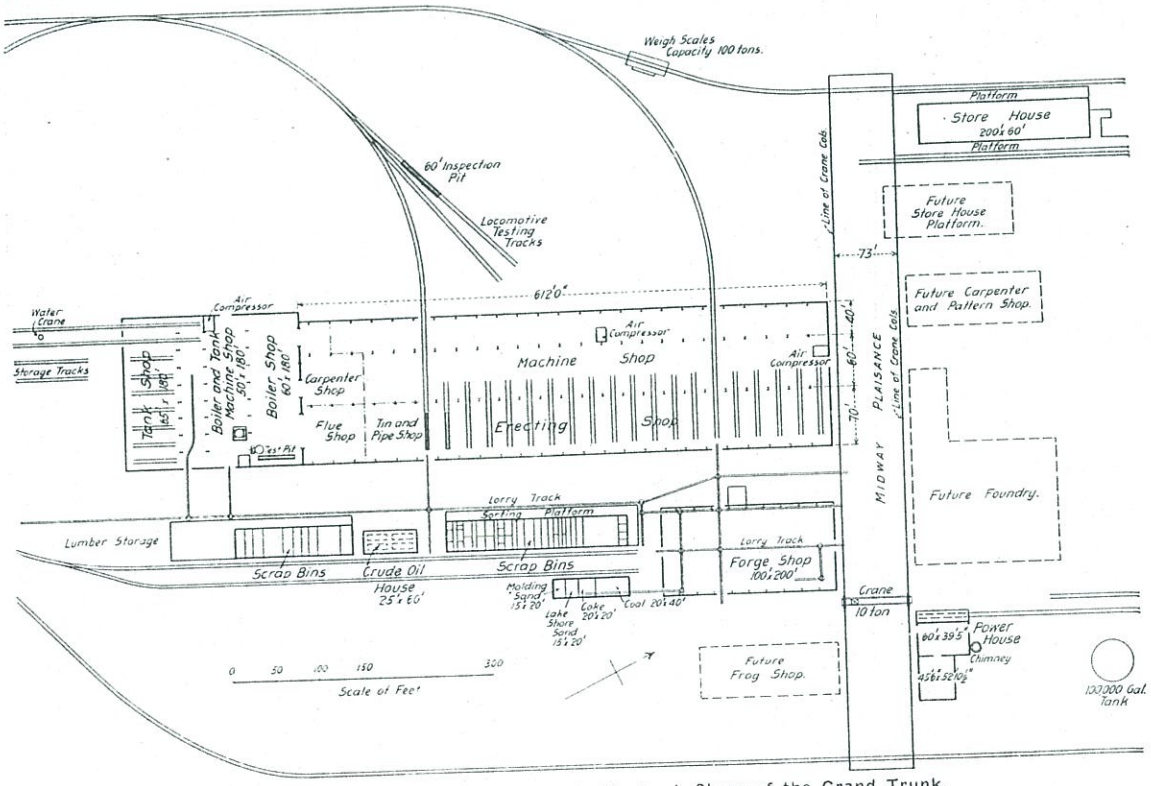
[WITH AN INSET.]

The shops for the care of locomotives on the Grand Trunk system west of St. Clair river were removed from the old buildings at Port Hope to the new shops at Battle Creek the first of October, 1908. There are now 260 locomotives tributary to this division. The erecting shop has 25 pits, 18 of which are now in use, and the plant is turning out engines with light and heavy repairs at the rate of two engines per pit per month.

The general plans and cross sections of the large buildings were illustrated in *The Railway Age*, March 8, 1907. The general layout provides for a future extension of 100 per cent. to each building in such a manner that the area for extension is not between the structures, as in that case it would be necessary to carry material from different departments over this additional area. Ample provision has also been made for car shops, which are to be located east of the present buildings. The power house is located at the extreme east side of the locomotive shops so as to be central when the car shops are erected. The 75-ft., 10-ton, outside traveling crane serves all the shops, the storehouse and the platform which is used for the storage of heavy material, castings, etc. A future foundry, carpenter shop and pattern shop will be located on the north side of the crane runway opposite the large locomotive shop, and a frog shop will be built parallel



General View of the Battle Creek Shops.



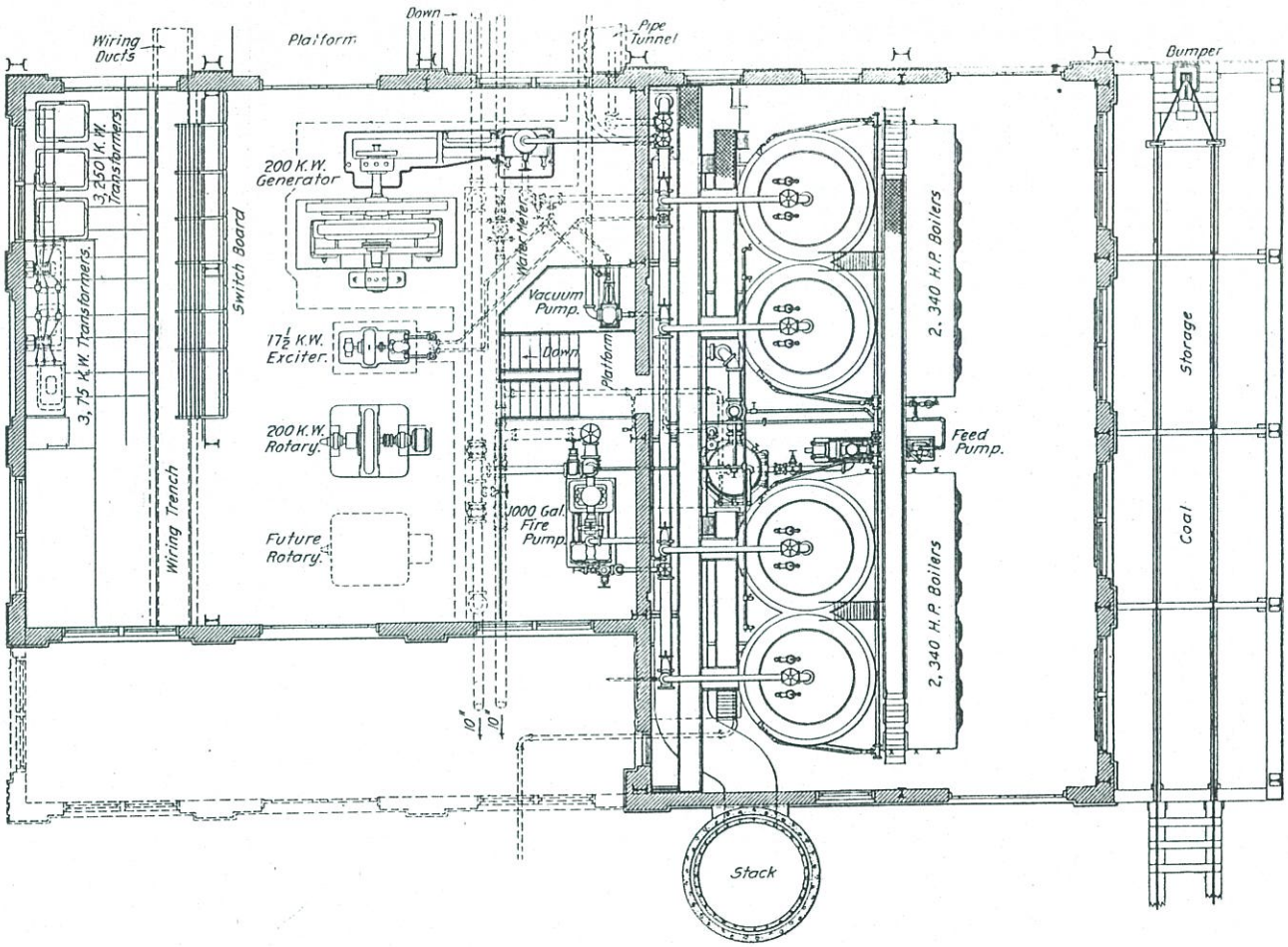
General Layout of Shops and Tracks; Battle Creek Shops of the Grand Trunk.

with the blacksmith shop and opposite the power house. All the buildings are parallel to the main line and all the yard tracks to the buildings connect with the main line so as to give through movement of material to and from the shops.

POWER HOUSE.

The power house is a handsome, substantial building with concrete foundation, which is carried up to a height of 5 ft. above the ground, and which supports the steel structure with its colonial shale brick walls and flat composite roof of asphaltum. The floors throughout the building are of concrete. The power house is not large, as the bulk of the electric power is purchased. The boiler equipment consists of 4 Wickes boilers, each 340 h.p. Coal is dumped into the bunker directly from the cars and fed into coal chutes, which are conveniently arranged before each firebox, and the labor of stoking is thus reduced to a minimum. The chimney is made of concrete with an air space; it is 175 ft. high and 9 ft. in diameter inside, and is large enough to permit of a considerable increase in the boiler plant when more power or steam is required. The chimney was built by the Metal Concrete Chimney Co., St. Louis, and is a fine example of smooth concrete work. The cost is said to have been 25 per cent. less than an equivalent brick chimney. High pressure steam is supplied to the engine room for power, to the forge shop to operate the steam hammers, to the locomotive shops to drive the heating fans and for boiler testing purposes, and to the office and store where it is reduced in pressure and used for heating purposes. Low pressure exhaust steam—and when this is insufficient steam reduced from high pressure—is used to heat the large locomotive and forge shops. The steam piping leading to the different buildings is suspended in an underground concrete tunnel covered with movable concrete slabs, which extend slightly above the surface of the yard and form a convenient footwalk down the midway.

In connection with the water system there is a storage tank of 100,000 gal. capacity with a hemispherical bottom. It is supported on a steel structure 125 ft. high, the total height to the top being 165 ft. The water pipes pass through the power house, and the piping valves are so arranged that the shops can be supplied either from this tank or from the city mains, and water can be pumped by a fire pump into the tank or from either the tank or the city mains into the shop water system. This pump is a Worthington fire pump with a capacity of 1,000 gallons a minute, and capable of maintaining a pressure of 75 lbs. There is a vacuum pump connected with the return from the heating system which reduces the pressure in the return pipes to an equivalent 10 in. of vacuum. These two pumps are placed in the engine room on the floor below the level of the main room.



General Plan of Power House.

In regard to electric power, after careful consideration it was decided that it could be purchased more economically than generated. Power is therefore obtained from a hydro-electric plant at Jackson Mich., 45 miles distant, which delivers it over a 3-phase 60-cycle 5,000-volt a.c. transmission line, provided, on entering the power house, with necessary lightning arresters. In the shops direct current at 220 volts and alternating current at 440 volts are used. To meet these requirements, there are two banks of transformers in the power house, one composed of 3 single-phase 250 kw. transformers by means of which the voltage is stepped down from 5,000 to 440 volts; and the other consisting of 3 single-phase 75 kw. transformers. A 250 kw. rotary converter is provided for

the desired 220-volt direct current. A small induction motor is used to bring this converter up to synchronous speed.

The main generator in the power house is a 200-kw. 440-volt 60-cycle 3-phase machine driven by a 300-h.p. simple non-condensing Corliss engine. There is also a generator exciter driven by a small vertical engine. This generator can be used to avoid complete shut-down in case of trouble with the transmission line or the generating plant. As more exhaust steam than that obtained from the fan engines and steam hammers is required for heating purposes in cold weather, it is profitable to utilize the live steam from these engines for heating. All the electrical apparatus in the power house was manufactured by the Westinghouse company.

The high tension apparatus, which can be operated from the switchboard by means of remote control switches, is located on two balconies, one above the other, beneath which the transformers are situated. In front of these and facing the balconies is the switchboard, and before it are located the generator, exciter and converter. Connected with the switchboard are two sets of a.c. bus-bars carrying 440 volts, one set for the generator and the other for the purchased power, and also the buses for the 250-volt d.c. circuit. The switchboard comprises the necessary panels for the control of the converter, the d.c. and a.c. generator and purchased power lines, as well as six a.c. and two d.c. feeders. The a.c. feeders are so connected that they can be thrown on either the generator or the purchased power buses. Beneath the floor behind the switchboard is a tunnel built of concrete; passing through this the feeders are carried in lead-covered cables through clay conduits from the power house to the fuse panels in the shops. Branches to motors and lighting circuits are connected to the feeders in surface boxes.

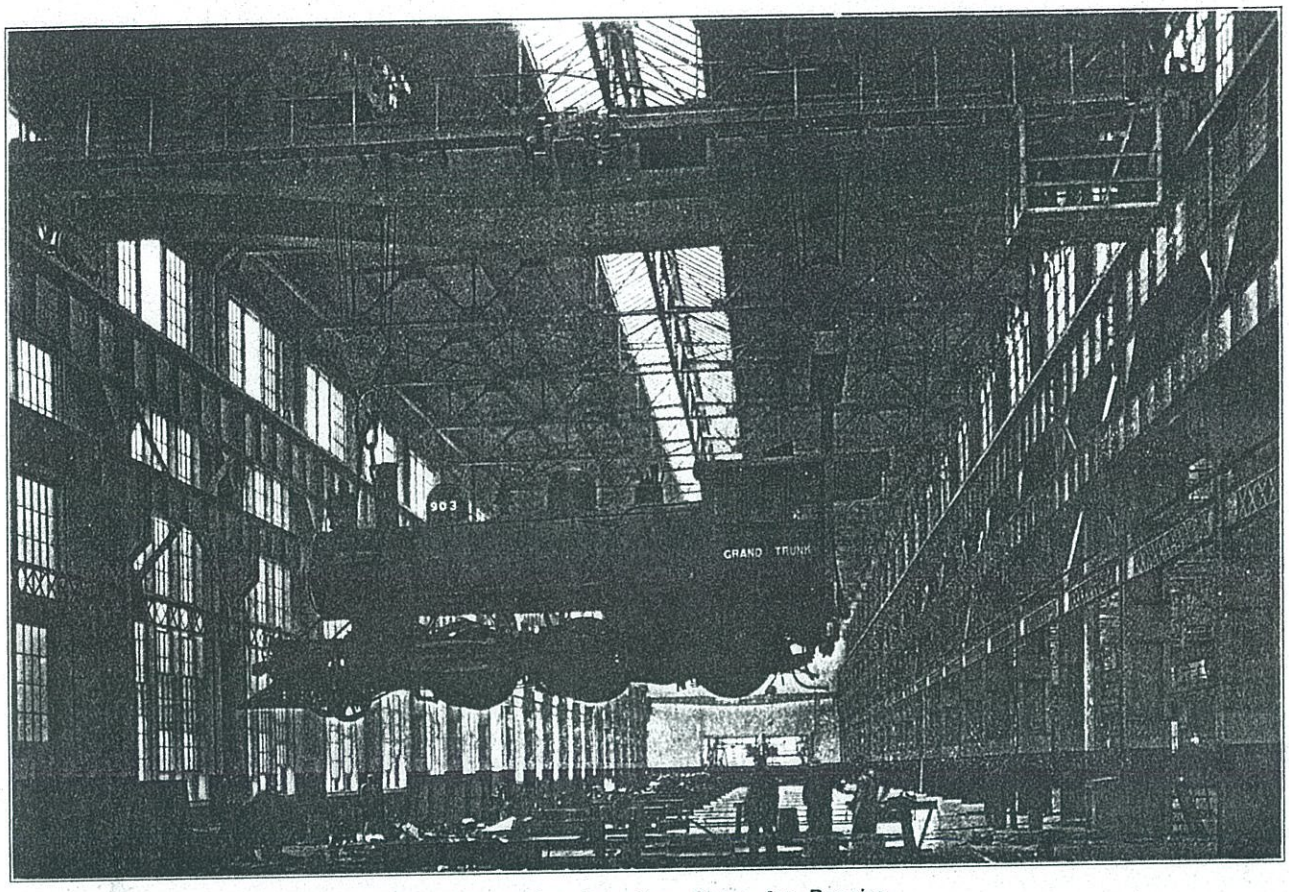
Interior View of Erecting Shop.

ERECTING AND MACHINE SHOP.

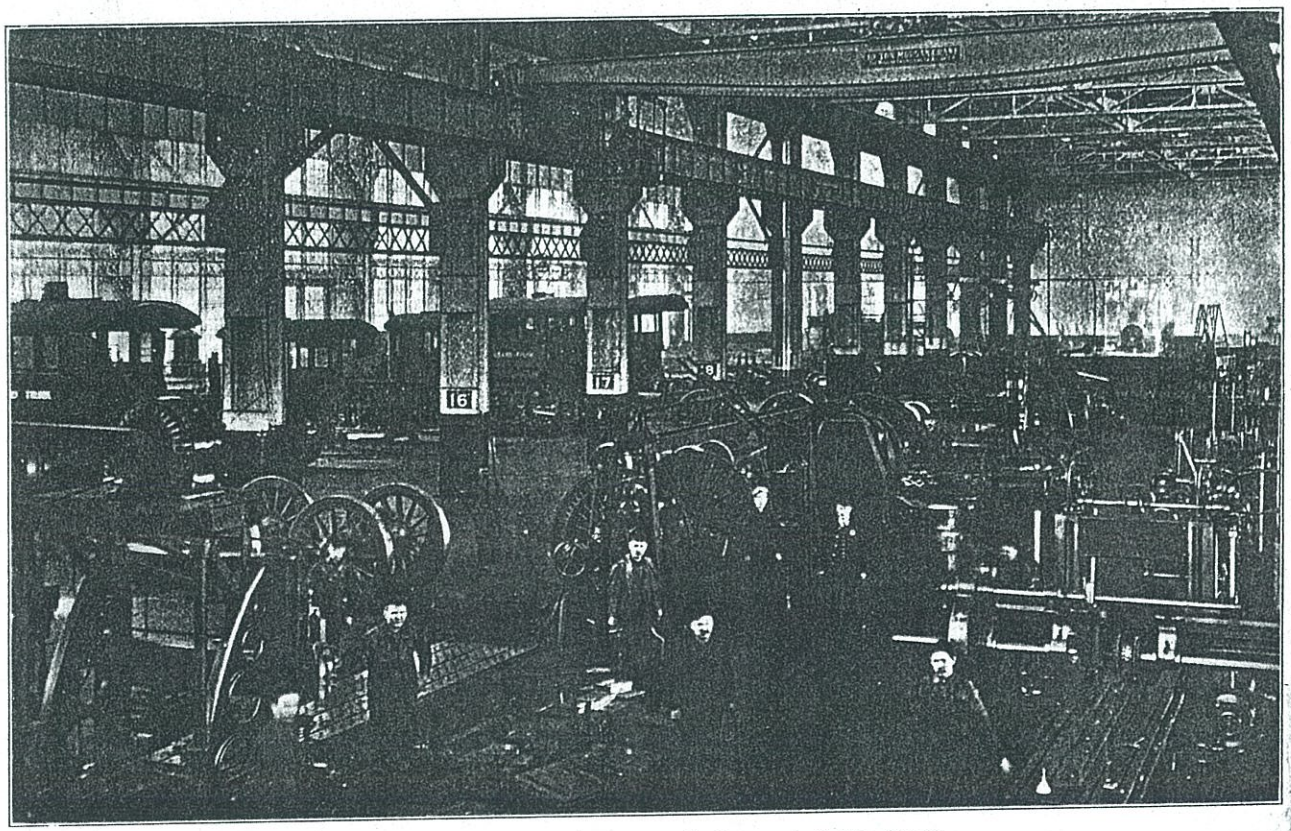
The erecting and machine departments are under one roof in a large building constructed of steel, concrete and brick, being of the self-supporting type and having floor dimensions 170 ft. x 612 ft. The concrete portion of the walls rises to the level of the window sills, from which point to the roof brick is employed, colonial shale brick being used on the outside face. The roof covering is felt and tar with the usual covering of gravel. The shop is well lighted by skylights and the surrounding windows of the clear story of the erecting shop, while the roof lighting of the machine shop is furnished through windows arranged saw-tooth fashion. The flashings and ventilators are of copper, and water from the roof is conducted to the sewer by 4-in. pipes inside the building, placed at intervals of 24 ft. Particular attention has been given to the lighting feature of the shop, and instead of ordinary window glass, corrugated glass was adopted. While this is not clear enough to distinguish objects outside, it produces a better diffusion of light and almost entirely eliminates shadows, preventing much of the annoyance due to direct sunlight. The interiors of the buildings are painted white and produce an excellent reflecting surface. While no pretense to ornamentation enters into the design of this building, yet it is clean-cut and presents an imposing appearance. A balcony extends along the machine shop side having a length of 588 ft. and a width of 40 ft. On this balcony are situated three heating fans having a total of 43,500 lineal ft. of 1-in. steam pipe coils. The heated air passes through down ducts and enters the concrete tunnels under the main floor; these tunnels lead to the diffusers along the wall which are slightly above the floor level. In this way the shops are not only comfortably heated, but a perfect circulation of air is satisfactorily maintained. A 60-h.p. engine drives each of these fans, the exhaust steam passing through the coils.

There are also located on the balcony toilet rooms and lavatories of approved design, and a supply of hot and cold water is provided. Individual lockers of the hospital type are placed along the walls of the lavatories. Metal urinals, which are also sanitary in design, are located on the ground floor at the columns on the dividing line between the erecting and machine shop bays. The shop floor is made of hemlock sleepers spaced 4 ft. apart in well tamped sand; and these are covered with 3-in. x 6-in. yellow pine.

In the erecting bay, which is 70 ft. wide by 612 ft. long, are



First Locomotive Into New Shops for Repairs.



Heavy Machine Bay; Grand Trunk Shops at Battle Creek.

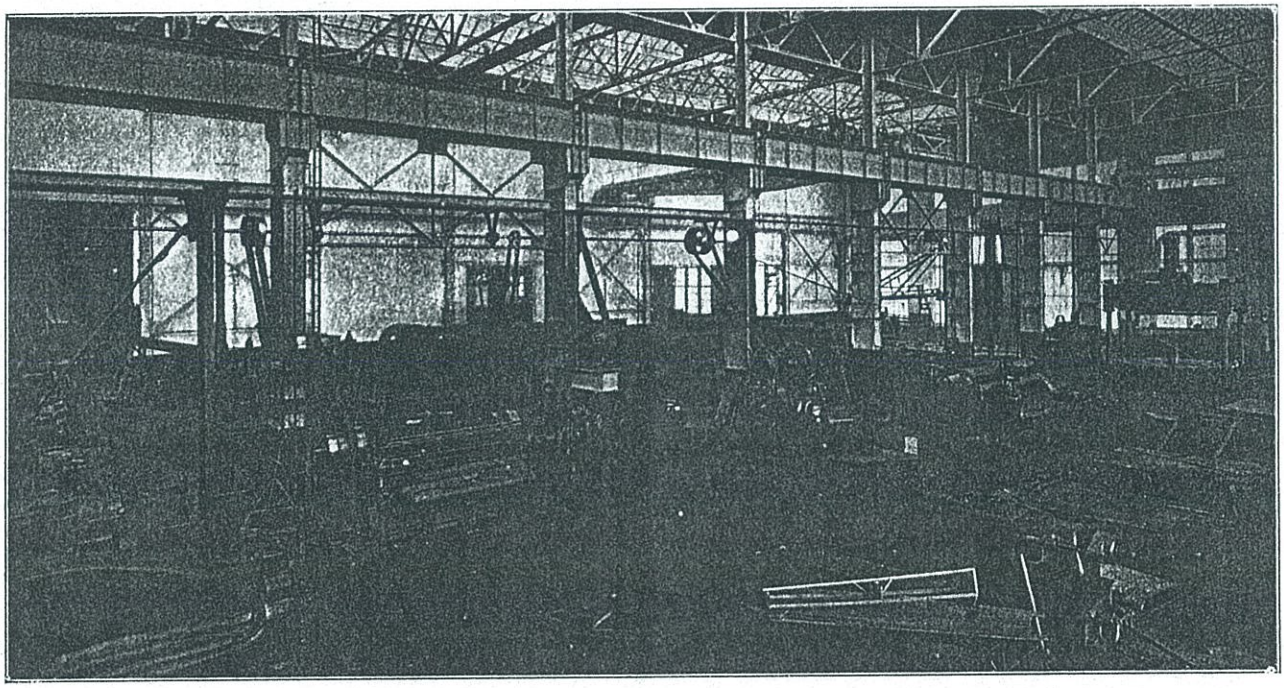
25 engine pits, each 43 ft. in length and having a space allowance of 24 ft. between centers. Extending along the sides of each pit are recesses in which are hung air pipes and wire conduits. The former have connection with pneumatic tools. In the latter are two plug receptacles to permit of the use of extension incandescent lamps. Water and steam pipe valves are placed at the back end of each pit to be used in connection with the customary boiler tests. Between each two pits is a work bench attached to which are two extension lamps similar to those in the pits. Each of the benches is equipped with two heavy vises. All the supporting columns adjacent to the back end of the pits are provided with air pipe connections and plug receptacles which prove of great convenience.

The erecting bay is equipped with two electric cranes, one 120-ton and the other 10-ton capacity. These are supported on separate runways attached to the steel frame of the building. The larger crane has ample head room to carry a locomotive the entire length of the shop over the others, while the smaller crane is used in the work of stripping and erecting the various parts of the engines. All the traveling cranes were supplied by the Morgan Engineering Company, Alliance, Ohio. Motor driven double emery wheels are placed along the walls and immediately in front of the locomotives, and assist materially in saving time on the various portions of the work. There are two tracks which enter the shop, one opposite the sixth pit from each end of the erecting shop. These are used for convenient transfer of engines to and from the shops. At one end of the erecting bay five pits are temporarily covered over, that portion being allotted to the pipe and tube department. A motor driven pressure-blower delivers a 14-ounce blast to these departments.

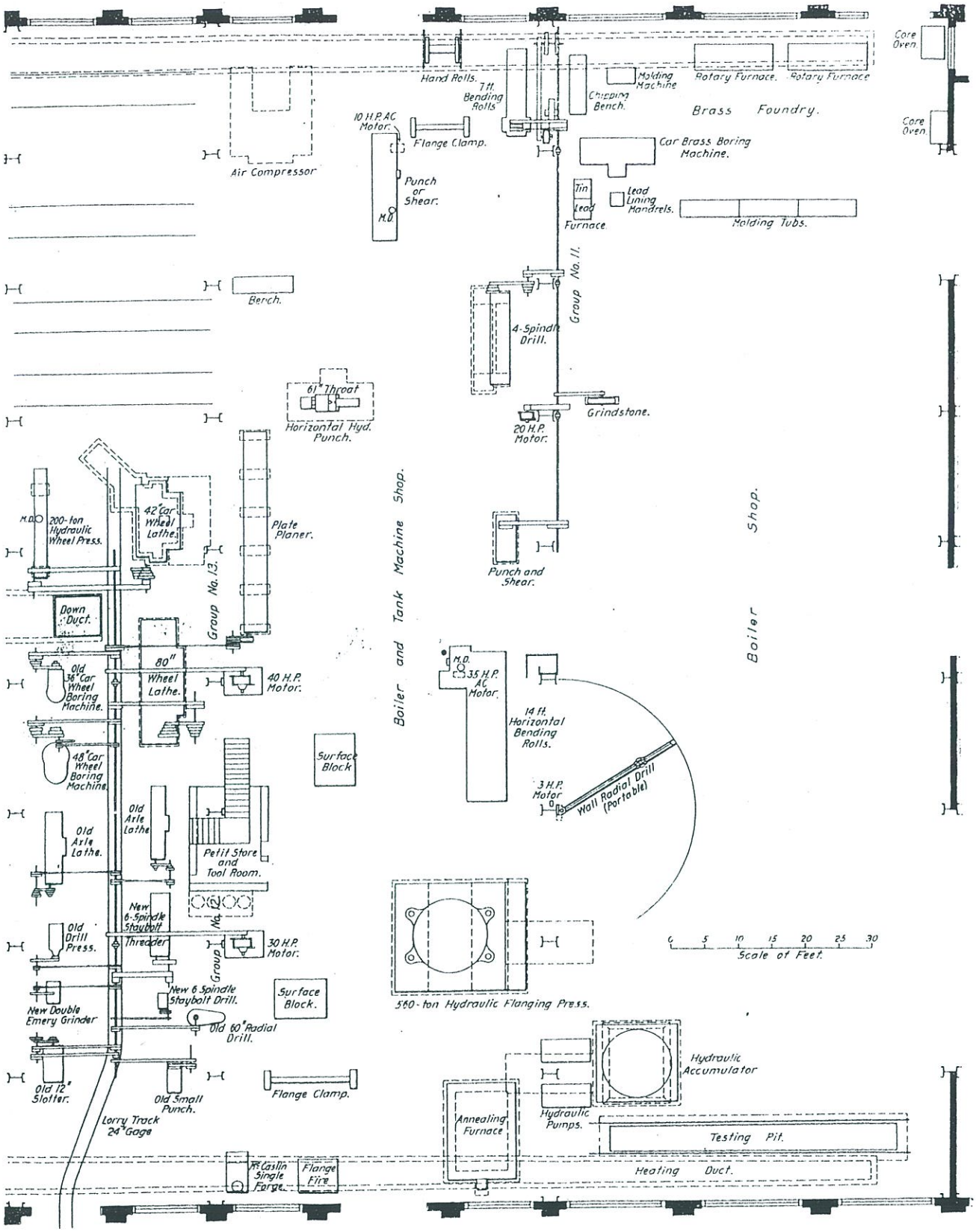
Running parallel with the erecting bay is located the heavy machine tool section of the shop. This section is 60 ft. wide and 212 ft. long. It is not at present entirely used for machine tools, about 120 ft. being occupied by the carpenter shop. The entire length of this section is also served by a 10-ton traveling crane. Most of the machines in this section are driven by individual motors. With the exception of the wheel and truck department and a majority of the larger tools, the other departments embraced within the machine shop on the ground floor are arranged under the balcony in the following order: Commencing 24 ft. from the west end, wheel and truck; piston and crosshead; valve motion; tool room; bolt and rod department. The tin, paint, air brake, brass finishing, machine repairs, belt and electrical departments are located on the balcony floor, which is made of reinforced concrete 6 in. thick. In order that each of the above departments may be self-sustained a sufficient number of machines of various types has been allotted to each, thus obviating the frequent handling of the work. In the central part of the machine shop there is a concrete and cement lye vat, 20 ft. long, 10 ft. wide and 10 ft. deep. This was made large enough so that a complete pair of driving wheels with their boxes, eccentrics and rods can be immersed in the lye and cleaned. They are easily handled for this purpose by the overhead electric crane. A small motor driven exhaust fan carries the fumes from this vat to the outside of the building.

BOILER AND TANK SHOP.

These departments are located at one end of the machine and erecting shop at right angles thereto, being constructed on lines similar to those of the erecting shop, and have floor dimensions 180 ft. x 205 ft. A brick curtain wall separates this shop from the erecting and machine shops, which prevents much of the noise from riveters extending beyond the boiler shop. An opening, however, admits of the transfer of boilers to and from the erecting shop, the boilers being passed through by means of a truck with a revolving top. The main boiler bay is 60 ft. x 180 ft., has ample capacity to accommodate nine boilers at one time, and is covered by a 30-ton double trolley crane. In the boiler machinery bay which has dimensions 50 ft. x 180 ft. an accumulator capable of exerting water pressure of 1,500 lbs. per. sq. in. has been installed. This is supplied by two motor driven pumps adjacent to it. The hydraulic tools consist of a large four post flanger and a horizontal punch having a 60-in. throat. In addition to these there are in the forge shop two heavy shears, a large punch and a bulldozer, which receive power from this plant. The riveting tower has not yet been equipped with its relative machinery. The pump for the accumulator was furnished by the Goulds Mfg. Co., Seneca Falls, N. Y., and is driven by a 40 h.p. three-phase motor. The Ferguson oil furnaces, supplied by the Railway Materials Company, Chicago, are used throughout.



Boiler Shop.



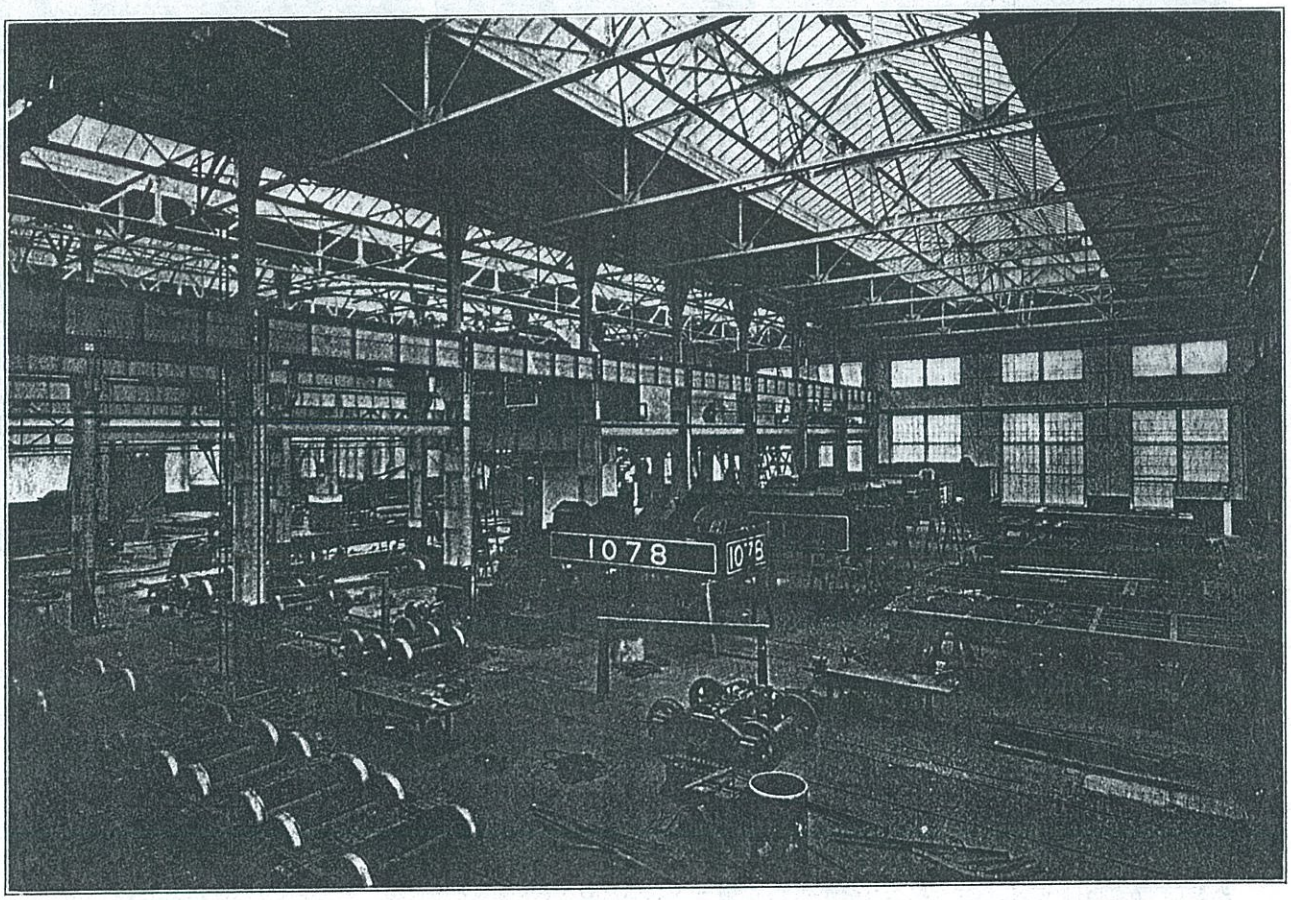
General Plan of Boiler Shop and Boiler and Tank Machine Shop.

The rolls were furnished by the Niles-Bement-Pond Company, New York, and are driven by a 35-h.p. motor. Williams & White, Moline, Ill., furnished the large shear, and the hydraulic riveter was supplied by R. D. Wood & Co., Philadelphia. A large annealing furnace forms a part of the equipment of this department; also a motor-driven splitting shears and punch. The brass department is at present located in a portion of the boiler shop and it is equipped with a duplex melting furnace, heated by oil fuel, made by the Rockwell Furnace Co., New York. Near this is a large 4-spindle boring machine for finishing bearings, built by the Niles-Bement-Pond Company, and this machine is driven by a 7½-h.p. motor. A 10-ton overhead crane and several jib cranes facilitate the handling of the work in this bay.

The tank shop is divided into two bays running parallel with each other, one in which truck wheels and axles are dealt with and the other dealing with repairs to frames and tanks, the tank bay having a floor space of 65 ft. x 205 ft., which gives ample room to place a tank and a frame on a single stall. A 20-ton double trolley crane is employed in this bay. The machine bay of the boiler shop has a floor space 30 ft. x 205 ft. Half of this bay is traversed by a 5-ton single trolley crane. The remainder is provided with a balcony, on which are located toilet rooms, lavatories and lockers, and in addition there is a hot blast fan for heating, with coils containing 15,500 lineal feet of 1-in. pipe. On each column in this building there are drops and lighting receptacles similar to those described in the machine and erecting shops. In the locomotive, boiler and tank shops, offices for the foreman have been provided. These are elevated above the floor in a second story, thus commanding an unobstructed view of the entire shop. The floor underneath is occupied by the air compressors.

FORGE SHOP.

The forge shop is 66 ft. east of the machine and erecting shop with the north end on the yard crane runway. The building has a self-supported steel frame with brick curtain walls, composition roof and cinder floor. The floor space is 100 ft. x 200 ft. and the height 24 ft. from the floor line to the bottom of the roof trusses. The building is divided into ten bays of 20 ft. each. The windows are 15 ft. 8 in. wide and extend from the concrete water table to the bottom of the roof trusses. The center of the roof has a monitor 10 ft. high and 20 ft. wide, with a pivoted sash, mechanically operated for ventilation and light, and this with the wall windows gives excellent lighting. Ribbed glass is used, which diffuses the direct rays of the sun so that men working close to the windows are not inconvenienced when the sun shines directly on the sides of the building.

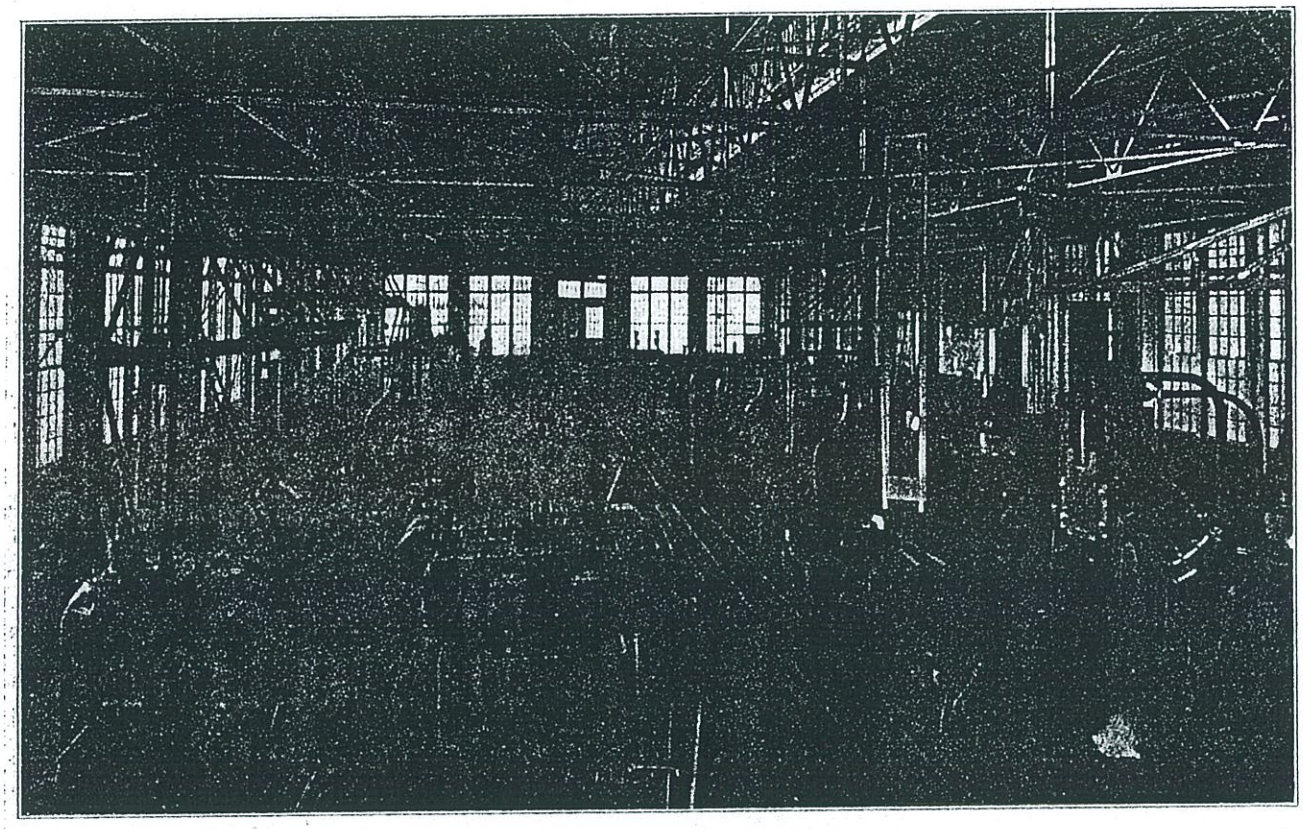


Battle Creek Tank Shop.

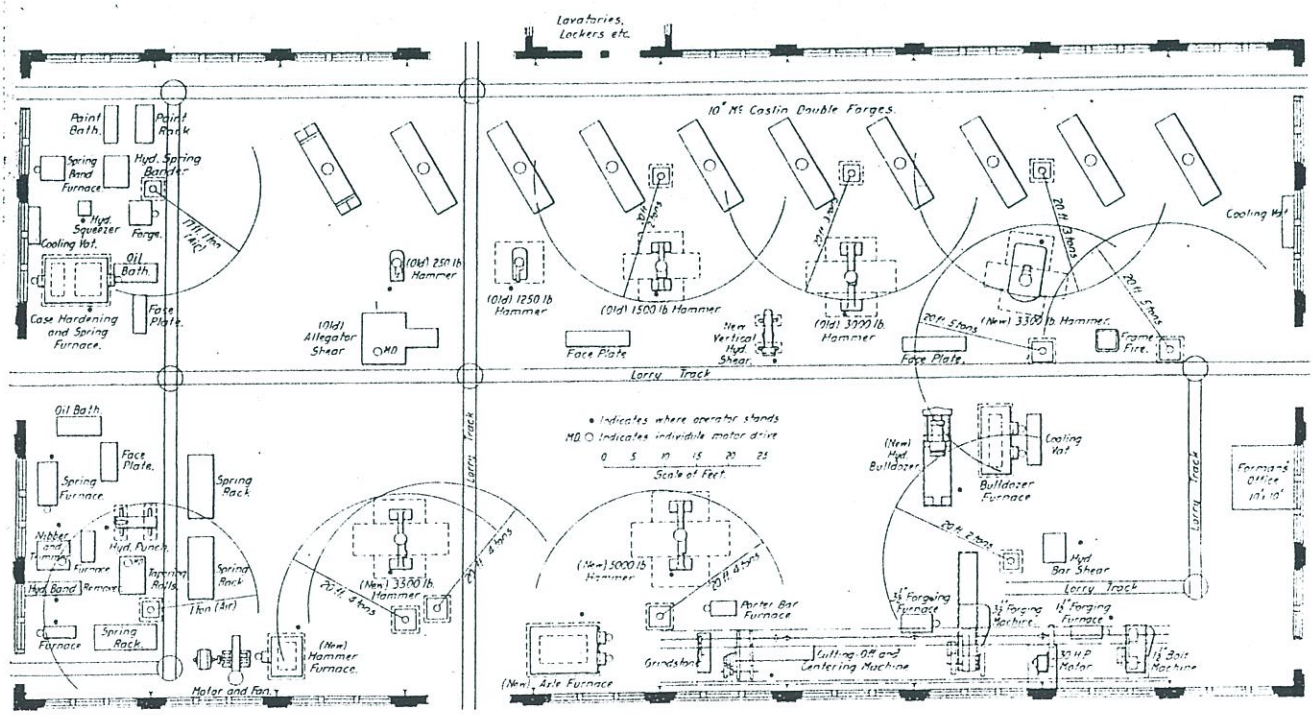
The toilet and locker rooms are located in a small wing, 20 ft. x 21 ft., two stories high, the first story for closets, urinals and shower baths, and the second for lavatories and lockers. All steam piping is carried in an underground tunnel in the center of the building to and from the steam hammers. The oil and water piping is carried underground in pipes laid in concrete and high pressure air pipes in roof trusses with outlets on columns. All material in this shop is handled by jib cranes and cars on a 24-in. industrial track, which serves all parts of the building. The coal and coke sheds are located just south of the shops and the industrial track runs into them, so that coal can be taken to all forges on a small car. The draft for all furnaces and forges is furnished by the American Blower Company's (Detroit, Mich.) blower, directly connected to a 100-h.p. induction motor. The air piping is galvanized iron and is carried overhead to forges and furnaces, except where

the down pipe would interfere with the jib cranes, when it is brought down along the wall and underground to furnace of forge. There are 10 McCaslin double forges on the west side of the building. All light work is done on the side next the wall while the inside floor space is occupied by 7 hammers which range from 250 lbs. to 3,300 lbs. Near the north end of the forges in the center of the building is placed a special fire, which is raised and lowered by air; this is used for welding frames and is close to a 3,300-lb. single frame hammer, both of which are covered by a jib crane and a yard crane for handling engine frames.

The hydraulic bulldozer, the hydraulic bar shear, the 3½-in.



Forge Shop.



General Plan of Forge Shop.

forging machine, the 1½-in. bolt forging machine, with their oil furnaces, are located in the northeast corner of the shop. Just south of this on the east side of the building is the axle department with axle furnace, 5,000-lb. hammer and double cut-off and centering machine. This machine and the two forging machines are run by a 30-h.p. group motor. The 3,500-lb. hammer and furnace are located just south of this and take care of the heavy forge work.

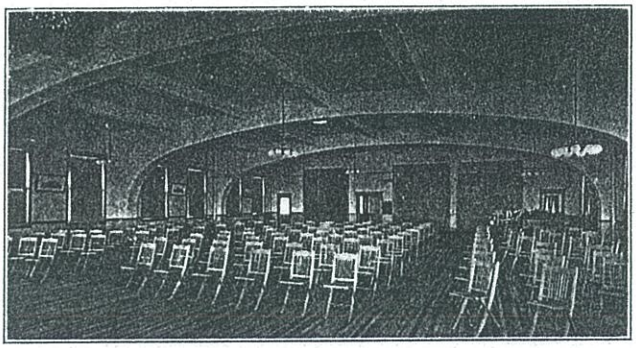
The spring department is located in the south end of the shop and contains the nibber and trimmer, tapering rolls with individual motors, a hydraulic punch and hydraulic spring bender with suitable furnaces conveniently located. There is a vertical hydraulic shear near the center of the shop for general purposes. All furnaces are of oil burning type, supplied from tanks located in a concrete oil house about 200 ft. south of the forge shop, under a pressure of 20 lbs. All forges are fitted with 22-ft. stacks extending through the roof, thus removing the smoke and gases by means of natural draft.

STORE AND OFFICE BUILDING AND OIL HOUSE.

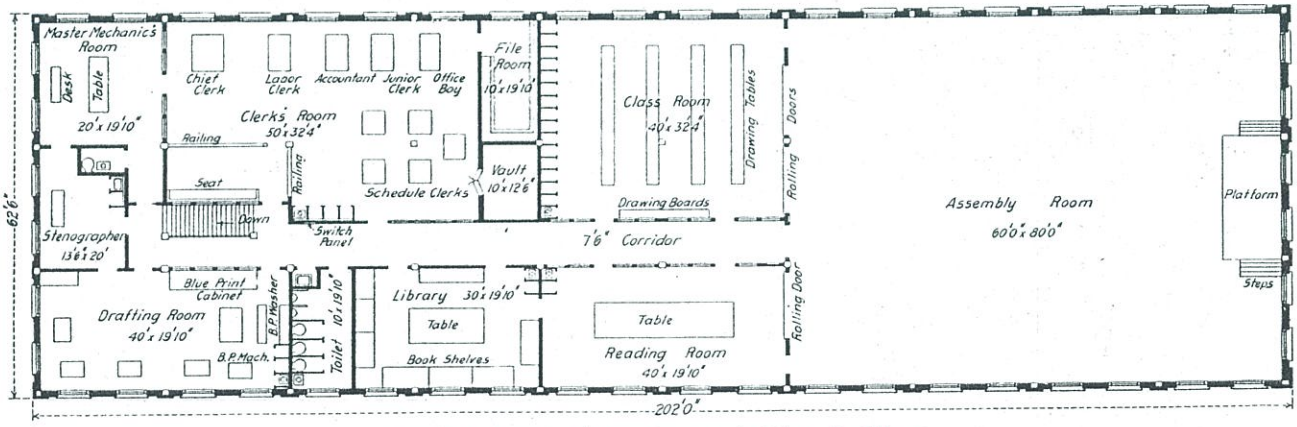
The store and office building is a two-story structure, built of reinforced concrete and brick. It is 60 ft. x 200 ft. On each of the two sides there is a concrete platform 12 ft. wide. This platform is on a level with the first floor, which is occupied by the stores department; and the unloading tracks, which run on either side of the building, are located at a level convenient for unloading freight from the cars to the platform. These platforms extend to the center of the midway, where heavy material may be easily handled with the yard crane. The platform along the east side extends to and around the oil house, which is located about 150 ft. from the store and office building. On entering the building one finds himself in a spacious hallway; to the right is the clerk's office

a week are devoted to the instructions of apprentices in Mechanical Drawing, Practical Mechanics and Electricity. Across the hall from the drawing class room is a reading room 20 ft. x 40 ft.; this room is provided with the latest periodicals. Leading from this room and also from the drawing class room are vertical rolling doors, which may be opened into the assembly room. The assembly room is 60 ft. x 80 ft., and will accommodate about 400 persons easily, making an ideal place for social functions, lectures, etc. Continuing along the east side and opening from the reading room is a well stocked library, and next to it the drafting room, 20 ft. x 40 ft.

The oil house is a single story building, 30 ft. x 40 ft., built of reinforced concrete and brick. The floor of the building is about 10 ft. above the ground level, which happens to be low at this point and makes a convenient place for the oil storage tanks, of which there are ten with a capacity of



The Assembly Room.



Plan of Second Floor; Store and Office Building.

of the stores department and to the left is the storekeeper's private office; while directly in front is a stairway leading to the motive power department offices which occupy the second floor. Back of the stairway on the first floor are located the vault, filing and toilet rooms; and then comes the general store room which is fitted up with the necessary shelving, counters, scales, etc., and is very complete in detail.

The second story is occupied by the master mechanic and his staff. It is divided into two sections by a hallway running from the top of the stairway to the assembly rooms at the north end. The master mechanic's private office, which is located at the southwest corner, is a commodious room, 20 ft. square, finished in quartered oak with maple floor and tinted walls. Next to this is the stenographer's office, 14 ft. x 20 ft., and further on the clerks' room, 32 ft. x 50 ft.; adjacent to the clerks' room are the filing room and vaults. Continuing along the west side, the drawing class room is next; this is 32 ft. x 40 ft. It is fitted with tables, drawing boards, blackboards, etc., and across one end is a row of clothes lockers for those who attend the evening classes. Two evenings

8,000 gal. each. The oil house is divided into two rooms of equal size. One is used as a pump room for pumping the oil from the tank below and the other for the storing of oil in barrels. There are six oil pumps, three of which are power pumps and the others operated by hand. They are of the self-measuring type, made by S. F. Bowser & Co., Inc., Fort Wayne, Ind. The power pumps are operated by a 2-h.p. Western Electric motors, belted to a line shaft.

SEWERAGE.

It was necessary to install two sewer systems, as it is against the rules of the city board of health to dump raw sewage into the creek at this point because it would become a nuisance in the summer when the water is low, as the creek flows through the center of the city for two miles. It was a case of either putting in a purification plant or pump 1,000 ft. against a head of 25 ft. into the city sewer. There is such a small difference in elevation between the end of the sewer and the creek which is close by, that filtration beds would be overflowed several times every year by the high water in the creek; therefore it was decided to install the

pumping plant. The pump pit house is located south of the buildings and all sewage is brought to this point by gravity. The pumping apparatus consists of two separate units so that one is always ready in case anything goes wrong with the other. Each has a centrifugal pump directly connected to a vertical motor which is controlled by a float switch, and when water reaches the required height in the pit one pump starts up and pumps it out, and if this pump does not work the other pump will start when the level gets a few inches higher. All rain water and water used for washing out engines, cooling compressors, etc., is carried into the storm sewer and into the creek by gravity. The sewers are built of extra heavy double strength sewer tile with self-cleaning grades outside of the buildings, and inside the buildings all sewers are of cast iron soil pipe to a point 4 in. outside the buildings.

TELEPHONE SYSTEM.

A local telephone system, connecting all foremen's offices, small stores, power house and other departments, has been installed. The switchboard is located in the general office of the master mechanic. At present 14 telephones are used and provision has been made on the switchboard for a total of 25, which will be installed when the foundry, frog shop, carpenter shop and car department are added to the present plant.

TIME REGISTRATION.

Each workman is required to punch a time clock on entering the shop in the morning, when leaving and returning at noon and when leaving in the evening. Eight-day time registering clocks are used for this purpose. They are distributed in such a manner that they are convenient for a workman to punch without extra walking from his entrance to the building.

MOTORS.

The a.c. motor is used in all cases except where speed variations cannot be mechanically accomplished, in which case d.c. motors are employed. All motors from 5 h.p. and over are equipped with suitable starting devices, fuses and circuit breakers with low voltage release.

LIGHTING.

The general shop lighting is by Cooper-Hewitt Co.'s (New York) a.c. mercury lamps which give a very steady and efficient light. They use a set of balanced coils, star connected to the 440 volt shop feeders. This gives a voltage between the neutral wire and any phase of 255 volts, which operates them. They are self-starting and light up as soon as the switch is turned without tilting the tubes. They are connected two in multiple for each switch. The installation here is interesting because this is about the first large shop in the country to install the a.c. type of Cooper-Hewitt lamp. The incandescent lights for drop lights in the engine pit, erecting bay and foremen's offices are tapped directly off the 250-volt d.c. feeders. The lights for offices and store houses are incandescent and use transformers to step down to 440-volt a.c. to 100 volts. The yard lighting uses series arc lights. A special panel and constant current transformer is located in the power house for these, as the switchboard attendant turns them off and on.

COMPRESSED AIR.

The compressed air system is rather a novel departure from the usual practice, as a number of units distributed over the shops are used instead of a centrally located one. There are three 100-h.p. Ingersoll-Rand Co.'s (New York) air compressors, directly connected to 106 h.p. Western Electric inducing motors having Cutler Hammer magnetic starters that automatically maintain an air pressure of 100 lbs. One is located in the north end of the machine shop, one in the center and the other in the boiler shop; two of them can supply the maximum demand, one being available in case of emergency. These receive air from the outside. The air piping is carried overhead on the roof trusses and pipes to drops are carried down the column, piping for its pits being hung in the heating tunnel which extends along the end of the pits.

In all negotiations in regard to the new shops the railway company was represented by E. H. Fitzhugh, third vice-president of the Grand Trunk Railway System. He was assisted in his conferences with regard to the details of the work by W. D. Robb, superintendent of motive power, and by J. T. McGrath, master mechanic, who is now in charge of the operation of the shops. The contract for the concrete foundations and for the building superstructure was let to Henry L. Vander Horst, Kalamazoo, Mich. The contract for the steel work and its erection was let to the American Bridge Company, New York. The complete piping systems for air, steam, water and oil have been installed by John R. Kehm Company, of Chicago; while the Western Electric Company, through its New York office, had the contract for furnishing and installing all power and light wiring. The Arnold Company, Chicago, engineers and constructors, served the railway company in the capacity of designers and supervisors of the complete shop plant, including buildings and equipment, with the exception of the machine tool layout, which was handled by the railway company.

RAIL FAILURES ON THE ROCK ISLAND LINES.

Rail failures on the Rock Island lines for the six months ending October 31, 1908, are shown in the accompanying tables. This period is the first of the six-month periods covered by the reports on rail failures made by the railways to the American Railway Association; reports are also to be made regularly each six months thereafter. We are indebted to J. B. Berry, Chief Engineer of the Rock Island, for this data. He says that "when the trackmen become thoroughly familiar with requirements of the failed rail reports it is hoped that future series of diagrams will give more information than the present set."

Table I. shows total rail failures by months for the various sections. The 80-lb. re-rolled section weighs slightly over 73 lbs. per yard, being reduced from 80-lb. A. S. C. E. section.

TABLE I.

	Total failures				Total failures per 100 miles track.			
	80-lb.*	80-lb.	85-lb.	100-lb.	80-lb.*	80-lb.	85-lb.	100-lb.
May	....	9	1	1	....	0.38	0.19	22.22
June	....	18	5	2	....	0.76	0.95	44.44
July	1	7	...	....	0.80	0.29	....	.....
August	2	8	...	1	1.59	0.34	....	22.22
September	....	10	4	5	....	0.42	0.76	111.12
October	....	17	4	....	....	0.71	0.76	.....
Total	3	69	14	9	2.39	2.90	2.66	200.00
Track, miles	125.8	2,378.1	526.8	4.5	....	....	....	.....

NOTE.—The track mileage is for each section.

*Rerolled.

While the mileage of the 100-lb. section is small, the rate of failures per 100 track miles is exceedingly large.

Table II. shows the life of failed rails. The noticeable feature is the extremely high rate of failure of the 100-lb. rail; also the high rate of failure of the 85-lb. section as compared with the 80-lb. section with life of three years or less.

TABLE II.

Life.	Failures per 100 miles of track. 80-lb. rerolled.	80-lb.	85-lb.	100-lb.
1 year or less	....	....	....	200.0
From 1 to 2 years	3.80	....	0.95	.....
" 2 " 3 "	....	0.13	3.98	.....
" 3 " 4 "	....	0.17	....	.....
" 4 " 5 "	....	0.85	....	.....
" 5 " 6 "	....	0.25	....	.....
" 6 " 7 "	....	0.59	....	.....
" 7 " 8 "	....	0.85	....	.....
" 8 " 9 "	....	0.81	....	.....
" 9 " 10 "	....	0.77	....	.....
Over 10 years	....	3.44	....	.....

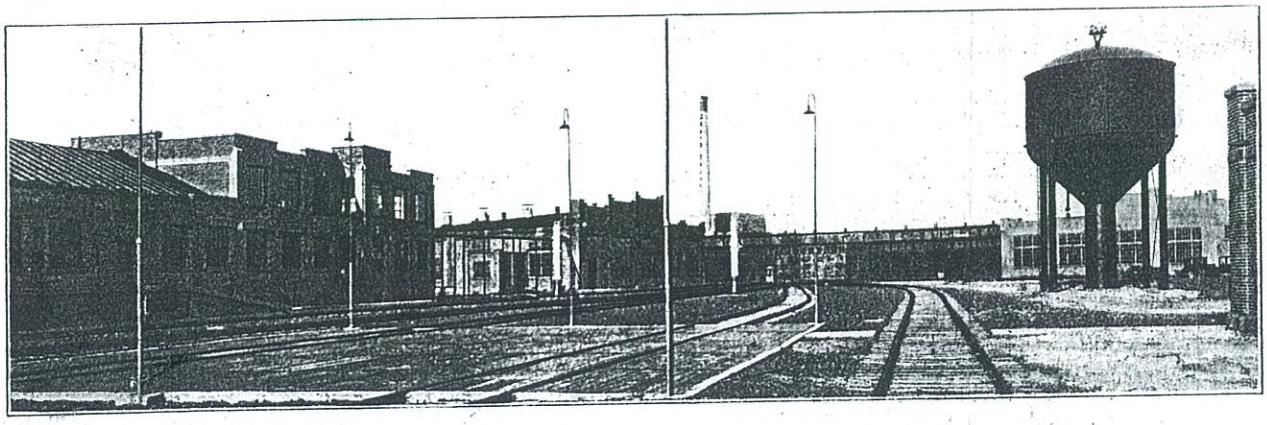
NOTE.—No. 80-lb. rerolled rail laid prior to 1906. No 80-lb. rail laid since 1905. No 85-lb. rail laid prior to 1905. No 100-lb. rail laid prior to 1907.

Table III. shows the several kinds of failures per 100 miles of track:

TABLE III.

Kind of failure.	Failures per 100 miles of track. 80-lb. rerolled	80-lb.	85-lb.	100-lb.
Broken rail	2.39	1.64	0.95	.....
Split end or head	....	0.46	1.14	160.0
Mashed head	....	0.04	0.57	40.0
Battered end or top	....	0.29	....	.....
Crack in web or through bolt holes	....	0.34	....	.....
Broken base	....	0.13	....	.....
Total	2.39	2.90	2.66	200.0

Broken rails cover nearly 57 per cent. of the failures of the

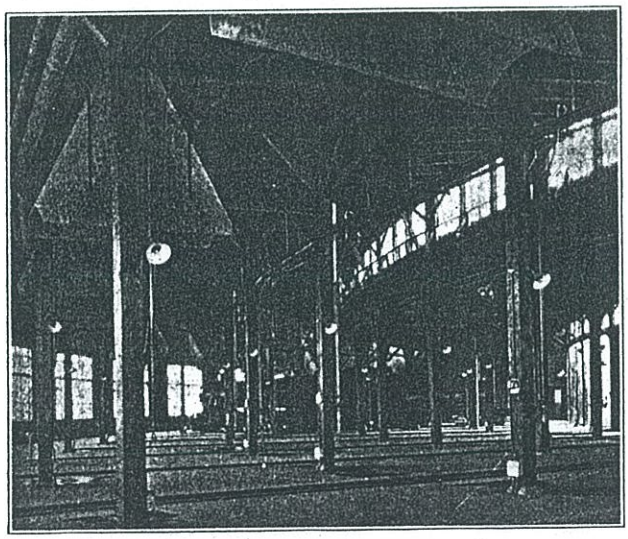


Permanence of Construction is Evidenced in all of the Terminal Buildings

Grand Trunk Western Builds Modern Terminal at Battle Creek

General layout and mechanical facilities insure efficient and economical operation

THE Grand Trunk Western has recently completed and placed in operation a new and modern engine terminal at Battle Creek, Mich. Although no concerted effort was made to deviate greatly from conventional designs, the resulting layout and structures show a successful attempt to combine a pleasing arrangement and design of buildings with mechanical facilities conducive of efficient and economical operation. Recognizing that railway structures, more than others, are exposed to fire and the elements, permanence has been embodied throughout construction as the first step to economy. While the facilities as designed are adequate for present needs, they are so arranged and constructed that they can be enlarged and expanded as necessity may require.



The Enginehouse Is Clean and Well Lighted

This terminal replaces one built in 1880. The main facilities comprise a 40-stall enginehouse, which can be readily enlarged by five stalls, a machine shop, 75 ft. by 103 ft., a power house 62 ft. by 88 ft., an office and store building 50 ft. by 230 ft., a 500-ton mechanical coaling station, a cinder handling plant, and an engine washing platform. The new terminal, under present operating conditions despatches an average of 1,118 locomotives per month or 37 each 24 hours. About 93 per cent of the power despatched is in freight and switching service. The period of peak demand for power occurs between the hours of 11 p. m. and 6 a. m., which peak is occasioned by the arrival and departure of eastbound manifest freight trains from Chicago.

The Enginehouse

The enginehouse at the new terminal is of the monitor-top type with walls of reinforced concrete and brick, the frame and roof structure being of slow-burning mill construction. The roof covering is of composition construction, the doors are of the wooden bifolding type and the building is provided with a concrete floor throughout. Large areas of galvanized steel sash windows in the outside wall, and wood sash windows above the doors in the inner circle and in the monitor section of the roof provide adequate natural lighting.

The house has 40 stalls 110 ft. long, each of which is served with an engine pit 80 ft. in length. There are also four drop pits in the house for handling driver, pony, trailer and tender wheels. The engine pits are constructed of concrete, reinforced with old rails and vary in depth from 2 ft. 9 in. to 3 ft. 3 in. The walls of the pits are three feet thick at the top, with oak ties embedded in them to support the track rails. The pits are drained by a concrete duct extending around the entire inner circle. At each pit there is a sump covered by an iron grating, and beyond the pit wall, through which the water flows in a six-inch cast iron pipe, there is a cleanout chamber by means of which the drainage duct is easily kept clean.

The house is heated by the indirect system, hot air being

pulled through steam heated coils by two engine-driven fans of 80,000 cu. ft. per min. capacity each, and forced into a reinforced concrete duct which extends around the outer circumference of the building, thence through tile laterals to the engine pits, terminating in three outlets at each pit. Baffles are placed in the duct at each stall to insure a uniform distribution of air.

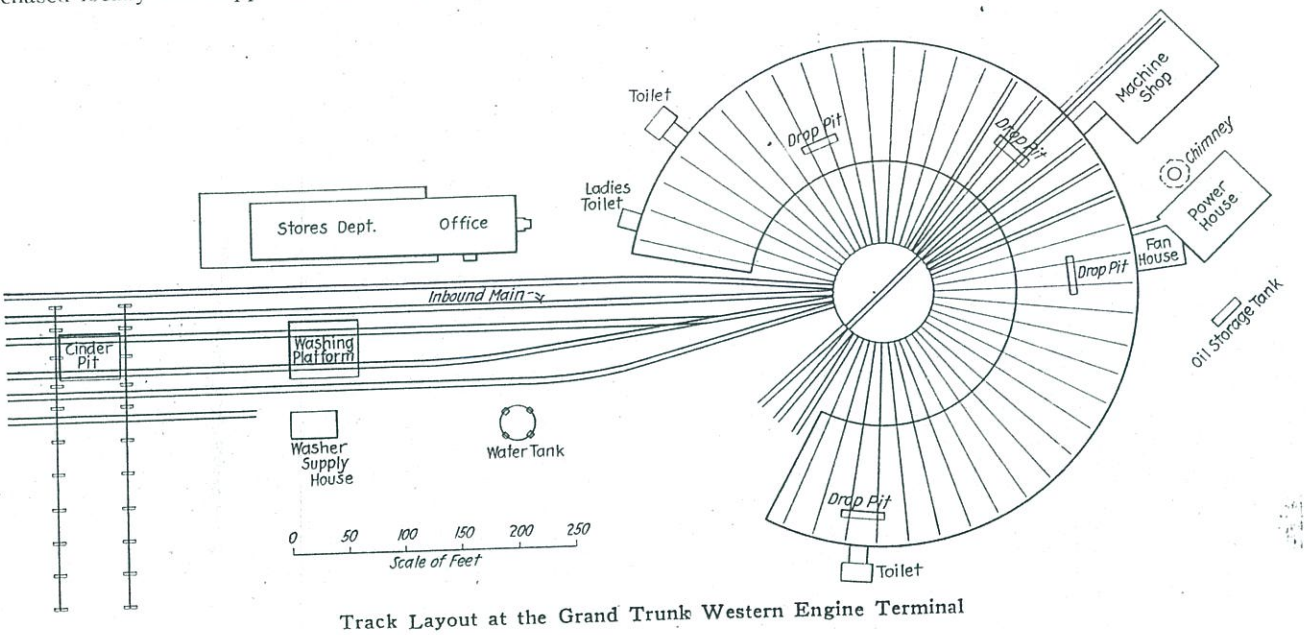
Artificial lighting of the enginehouse is afforded by the use of ten 75-watt lamps at each stall, which can be controlled at either end of the pit by means of two three-way switches. The lights on the inner and outer circles are controlled from the main panel in the power plant, and service for these lights is run in open wiring around the inner and outer circles of the enginehouse, being carried under the concrete floor to each column in Sheraduct conduit. Each stall is provided with Ralco twin receptacles and one 440-volt power receptacle. Current for both power and lighting throughout the terminal is purchased locally and stepped down through a bank of transformers to the main distribution panel, located in the powerhouse.

The arrangement of the enginehouse, which is divided into five concentric panels, provides column supports for the various piping systems installed. On the fifth row of columns there is a high pressure blower line from 6 in. to 2½ in. in diameter with a one-inch flexible copper blower drop at each pit. The fourth row of columns supports the blowoff, washout and filling lines, and the third row, air and oil lines, while the second row carries a cold water line. All piping used in this work is of leadized steel, furnished by the National Boiler Washing Company, Chicago, with the exception of the boiler washing line which is of wrought iron.

All of the 40 stalls of the enginehouse are piped for the Miller boiler washing and filling system. This comprises a washout and a refill tank, each of 25,000 gal. capacity, which are served by two steam-driven pumps, each with a capacity of 1,000 gal, per min. Water and steam from the locomotives are blown into these tanks through a centrifugal separator which separates the steam and water, the mud being thrown into a sump. One pump is used to wash out boilers, forcing the hot water through a nozzle at 125 lb. pressure, while the other returns the hot water from the refill tank to refill the boilers.

Each stall in the enginehouse is also piped with a steam blower line and an oil line for the torch firing system in which from four to six inches of green coal is spread on the grates and then ignited by a special oil torch through the fire door. The fuel oil supply for this system is stored in a 10,000-gal. tank, located outside, and filled by air pressure direct from tank cars. The oil is fed by gravity to a centrifugal pump which circulates it through the pipe lines to all stalls and returns it to the tank. A steam coil is provided in the main storage tank to aid the oil circulation in cold weather. The oil and air line drop at each pit is equipped with 15 ft. of special flexible oil hose to which the special firing nozzle is attached.

Fifteen of the stalls are arranged for a direct steaming system designed by the Locomotive Terminal Improvement Company, Chicago. By means of this system, after the boilers have been washed out, they are filled with water at a temperature of about 180 deg. F. and then charged with live steam at a pressure of approximately 150 lb. per sq. in.



Track Layout at the Grand Trunk Western Engine Terminal

Another feature of the equipment in the enginehouse is the electric storage battery crane which takes the place of the usual monorail system for handling material. Traveling with ease over the concrete floor of the enginehouse, this crane not only lifts equipment and heavy repair parts directly on the locomotives, but handles heavy material from the stores department to all parts of the enginehouse and machine shop.

The enginehouse is served by a 90-ft. turntable of the three-point continuous type, furnished by the Bethlehem Steel Company, and is operated by two 25-hp. electric motors. The table is also equipped with a dead engine puller operated by an electric motor.

The Power Plant

A small machine shop is located at the rear of enginehouse stalls Nos. 18 to 20, inclusive. Direct communication with this shop was afforded by extending the track from Stall 18, which is served by the trailer drop pit, through into the machine shop. A monorail overhead traveler serves all of the machines in the shop as well as the through track from the enginehouse.

The power plant is also located directly to the rear of

the enginehouse. This plant is equipped for the complete mechanical handling of coal and ashes and requires an operating force of only three men, one on each eight-hour shift. Steam is generated by three 234-hp. Stirling-type, water-tube boilers carrying a working pressure of 160 lb. with a superheat of 100 deg. F. Natural draft is provided by a reinforced concrete chimney 150 ft. high.

Coal, after being dumped through a track hopper, is crushed and elevated to a bunker of 155-tons capacity, from which it is dumped into a one-ton weigh lorry, which may be spotted for delivery direct to the hoppers of any one of the automatic stokers. By this means an accurate tally can be kept of all coal consumed by each boiler. The conveyor is used for both coal and ashes, the latter being elevated from the basement to a bin of 25-tons capacity and thence down a chute to a cinder car placed directly over the track hopper pit. The boilers are fired by Laclede chain-grate stokers and the coal and ash handling system is of Brownhoist manufacture.

All underground piping is carried in a concrete trench covered with subway grating, which affords easy access for repairs, besides serving as a drain for downspouts, floor drains, tank overflows, etc., the effluent being carried to a storm sewer.

Office and Stores Building

Immediately in front of the enginehouse is the two-story office building which is of reinforced concrete and brick construction. This building is used for quarters for the general foreman and his staff, the road foreman of engines, the boiler inspector and the engine dispatcher. It also includes an assembly room, a first-aid room, an engineers' register room, a pay office and a room for time clocks. The location of the general foreman's office, which has a large bay window, is such that an unobstructed view can be had of the coaling station, cinder pit, washing platform and turntable. The second floor is set aside for the engineers and firemen, the facilities including a washroom with shower baths and individual lockers.

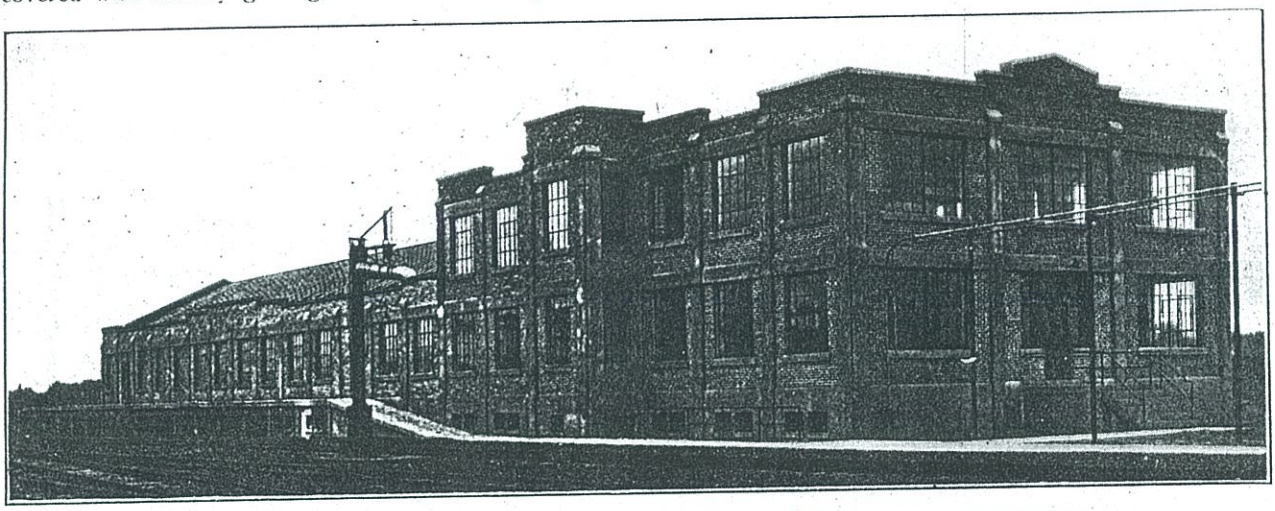
Continuous with the office building and of similar construction, is the storehouse, 150 ft. long, with a basement for oil tanks and inflammable supplies. The tanks are equipped with storage indicators and the four pumps located on the main floor are of the gallon-stroke, self-measuring type. Both the tanks and pumps were furnished by S. F. Bowser & Co.

The unit system of piling materials is in use in the store and a permanent inventory is assured by the use of the individual card system. Arch bricks get special attention and protection in this steam heated building, being stored on specially built racks. Spacious platforms gird three sides of the building at car floor level. Material for the basement is handled by a 2,000-lb. capacity electrically operated elevator.

Outside Facilities

The cinder pit at the Battle Creek terminal is one of the outstanding features of the new facilities in that it constitutes a somewhat unusual method of handling the cinders which enables them to be disposed of immediately without tying up cars or other equipment. This pit is of the deep quenching type, 37 ft. wide, 54 ft. long and 14 ft. deep, maintaining water at a depth of 10 ft. It is of reinforced concrete with extra heavy rail reinforcement in the 24 in. floor. The side walls, 12 in. in thickness, are supported on counterfort walls which also carry a continuous reinforced concrete track beam four feet deep.

Loading tracks are provided for the disposal of cinders into cars although an innovation in the design consists in providing special facilities for winter disposition. The pit is served by a crane runway of 60 ft. span, 330 ft. long, extending over an unused area which affords space for the storage of 10,000 cu. yd. of cinders or over three months' accumulation. This runway is equipped with a 4-ton Shaw overhead crane provided with a Blaw-Knox Speedster grab bucket of 1¼ yd. capacity.



A Substantial and Attractive Building Houses the Terminal Offices and Store Department

Near the cinder pit is a concrete, plank-covered washing platform where engines are sprayed with an emulsion of paraffin oil and hot water under the Durham & McGuirk engine washing system. Opposite this platform is a supply building 24 ft. by 40 ft. for the storage of oil and D. & M. cleaner, with a lavatory and locker room for the men.

On entering the terminal, locomotives are coaled at an automatic electric coaling station located about 1500 ft. from the turntable. The station has a 500-ton capacity and is provided with two delivery aprons for each of three tracks. Here an average of 252 tons of coal is issued to locomotives each 24 hours although at times this approaches a maximum of 500 tons in the same period. Sand is also delivered to locomotives at the coaling station from the storage bin with a capacity of 250 tons. The same track hopper and elevating equipment are used for the receiving and handling of coal and sand. One detail of the coaling station that is of interest from a

mechanical standpoint is the installation of an independent electric-driven air compressor which eliminates the necessity of piping air over a distance of practically 2,000 ft. from the terminal power plant. The coaling station was designed and constructed by the Ogle Construction Company, Chicago.

Flood lighting throughout the terminal is provided by 12 floodlights focused to give the desired distribution and intensity at such points as the turntable, coaling station and cinder pit.

Water is obtained from the city of Battle Creek, but a complete storage and distribution system has been installed at the terminal, consisting of two 100,000-gal. steel tanks furnished by the Chicago Bridge & Iron Works, and 6,000 ft. of 8-in. and 6-in. cast iron pipe with numerous fire hydrants throughout the yard. A booster pump of adequate capacity, located at the railway shops less than a mile south of the new terminal, develops a pressure for adequate fire protection. Engines are watered by three Poage automatic standpipes.

Sewage is conducted through a mile of 12-in. pipe to a sump at the locomotive shops, from which point it is pumped to the city sewer. To take care of pit drainage and storm water, it was necessary to lay 2,000 ft. of reinforced concrete pipe varying from 2 ft. to 5 ft. in diameter.

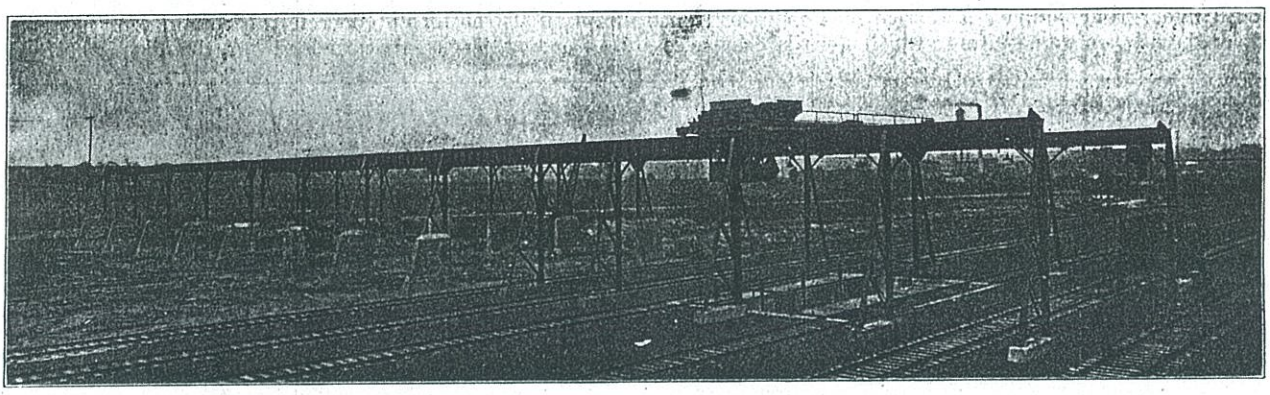
Unusual Drainage Problems Encountered

With a small lake and three-fourths of the terminal area a swamp from 3 to 12 ft. below grade, extensive ditching had to be carried out before a start could be made on any of the foundation work. The area was covered with muck and peat to a depth of two feet, overlying the sub-soil of yellow sand. This provided a good foundation when all surface water had been drained off. However, a permanent water level was encountered about eight feet below grade and an apparently inexhaustible supply of water in the form of flowing wells gave great trouble in the deeper foundations, such as those for the coaling station, cinder pit and power plant. In the case of the coaling station extreme water conditions were imposed and it was found impossible to keep the water down to a workable level. Excavation, therefore, was handled under water, and as the material was sand, pumps were used to create a continuous inflow of water and a corresponding outflow of sand. A heavy sub-bottom of concrete was poured under the coaling per and pit foundations while adequate piling was driven for pier and column supports.

In several instances natural wells were encountered, one of these being located almost directly under the power plant where it was necessary to go to a great deal of trouble to seal the foundation walls against seepage. Fortunately, the purity of this water makes it of exceptional value for boiler feed purposes and it is planned to utilize it.

Due likewise to these conditions, the usual method of laying temporary tracks and jacking them up to grade had to be abandoned in favor of a caterpillar dragline. This machine borrowed enough dirt from the site to bring the main inbound track to grade. Using this as a base, nearly 70,000 cu. yd. of filling was brought from an adjacent gravel pit and spread. Approximately six miles of track was laid throughout the terminal.

The complete layout at Battle Creek was designed and built under the direction of J. A. Heaman, chief engineer, and F. P. Sisson, division engineer. A. N. Laird, assistant engineer, had supervision of the preparation of building plans and was aided by G. E. Murray, electrical and mechanical engineer, as to the mechanical features, while W. G. Heggie, field engineer was in charge of work on the ground. Bierd, Lydon & Grandpre, Chicago, were general contractors for the building work. We are indebted to Mr. Heaman for the information contained in this article.



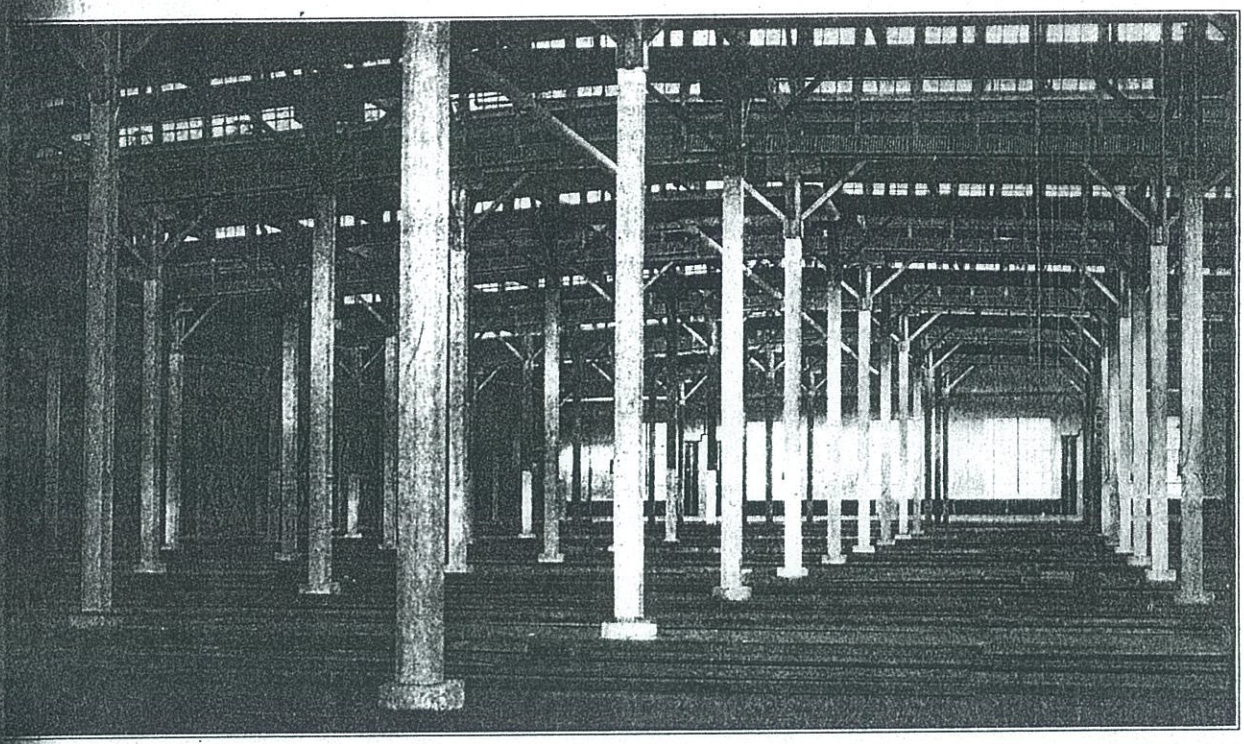
This Crane Handles the Cinders Either Direct to Cars or to the Storage Space

Railway Executives Urge Passage of Labor Bill

WASHINGTON, D. C.

THE public interest in uninterrupted transportation service imperatively demands the passage of the Watson-Parker railway labor bill, expected to come up shortly for consideration in the Senate, according to a statement issued by the Committee on Labor Legislation of the Association of Railway Executives following a meeting in Washington on April 23. The committee called on Chairman Watson of the Senate interstate commerce committee for the purpose of urging on the Senate, through him, the early consideration and passage of the bill.

"Attention was called to the fact that demands for very large increases in wages are now pending and that the carriers are looking to the pending bill as the method of adjusting the demands now presented," the statement said. "They have the assurance of their employees that the machinery of this bill will be availed of for the purpose of adjusting these demands. Unless this machinery is afforded, there will be no governmental machinery adequate for the purpose and there can be no assurance against serious public inconvenience resulting from the



Interior View of the Large Passenger Car Shop.

New Grand Trunk Car Shops at Port Huron

Special Attention Given to Arrangement to Insure Distribution of Power and Possibility of Extension

With the exception of the installation of machines the Grand Trunk has completed the construction of a complete new layout at Port Huron, Mich., for the construction and repair of freight and passenger cars. Including tracks and buildings the new plant covers an area of 55 acres and represents an expenditure of more than $700,000. The layout includes two buildings for the repair of passenger cars with a total capacity of 27 cars, a steel freight car shop and a wood freight car shop each with a 28-car capacity, a repair track yard with a capacity for 200 cars and auxiliary buildings including a modern power plant, cabinet shop, blacksmith shop, machine shop, wood mill, dry kiln, general offices and paint and general stores buildings, as well as a complete system of piping and fire hydrants for fire protection, watchmen's shanties and other facilities of minor importance.

One of the principal car repair shops for the Grand Trunk lines west of the St. Clair river has been located at Port Huron for many years. During the winter of 1914-1915 the old plant was destroyed by fire. Its loss was a serious handicap to the railroad and as its replacement with as little delay as possible was essential, work was begun on the plant as soon after the fire as plans could be prepared and the necessary property acquired.

The old plant which was built almost at the beginning of the road's operation was located in the older part of the city on the river front at the terminus of the line previous to the construction of the tunnel under the St. Clair river. It was small and inadequate and the site would not permit of the expansion necessary to meet present day needs. Furthermore the location precluded the provision of ample switching facilities. Consequently, after the fire, it was decided to abandon the old site and locate the facilities on property adjoining the tunnel line and convenient to the main switching yard and roundhouse. At this point it was possible to lay out the plant in such a way as to produce a minimum amount of switching and a maximum degree of efficiency in the handling of bad order cars.

The Plant

In planning the layout of the new plant special attention was given to the arrangement of the buildings with a view to the economical distribution of power and the possibility of extension and to ensure the materials being handled by a direct movement from the stores to the finished car. To this end as may be seen in the general map of the plant, the power plant and stores buildings occupy a central location with the various other buildings located conveniently about the central unit.

The passenger car shops include two buildings, the larger shop being 134 ft. 6 in. by 303 ft. 6 in. with a capacity for 15 cars. The small shop is 134 ft. 6 in. wide by 240 ft. long and has a capacity for 12 cars. The cabinet shop, the only two-story building in the layout, is connected to the small passenger car shop.

These shops are so planned that each car under construction or repair occupies one bay with an ample allowance for working space. The two buildings are parallel to each other with a space of 100 ft. between them which is occupied by a Nichols standard 80-ft. electrically-operated transfer table, designed to carry a 96-ton coach.

Both buildings are of concrete and brick construction with

3-in. plank floors and tar and gravel roofs. The roofs are designed with monitors running across the buildings, lighting and ventilating each bay. Additional light and ventilation are provided by the windows. The middle sash of alternate windows are hinged and metal sash chain-operating devices are provided for the ventilators in both the windows and monitors.

The cabinet shop is 53 ft. wide by 250 ft. long. The first floor is occupied by the glue room, acid room and the upholstering room. The cabinet work is done on the second floor. An electrically operated elevator is provided in this building. The freight car shops provide the facilities for the construction and repair of freight cars. These shops are divided into equal sections by brick fire walls, one section being devoted to steel cars and the other to wood cars. Both sections of the shops are planned for the cars to enter at one end. A repair track yard with capacity for 200 cars is located convenient to this shop.

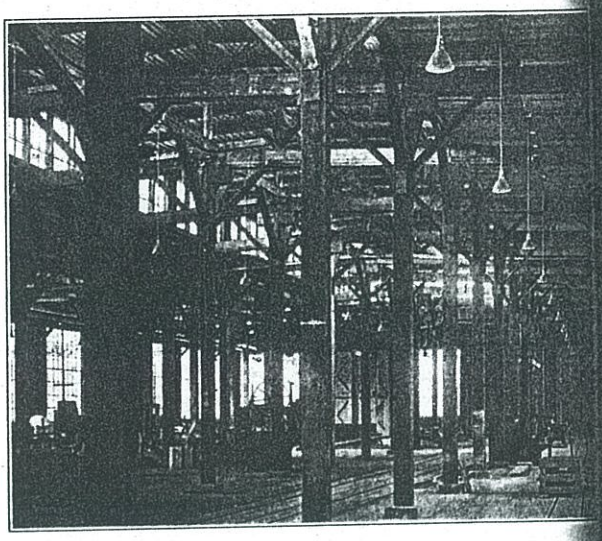
Each division of the shop is 78 ft. wide and 360 ft. long, providing a capacity for 28 cars. In addition to the standing tracks, four of which are provided in each shop, both sections are provided with two service tracks. The arrangement of these tracks is shown in the sectional plan. The natural lighting and the ventilation plans are similar to those of the passenger shops, as is the construction with the exception of the floor, which is of mastic laid on a 4-in. concrete base.

The power plant consists of the boiler room 55 ft. by 98 ft. and an engine room 35 ft. 6 in. by 70 ft. This building is of concrete and brick construction, with a tar and gravel roof, carried on steel trusses, thus avoiding posts in the rooms. A brick partition separates the two rooms. The floor in the boiler room is of concrete, while a maple floor is used in the engine room.

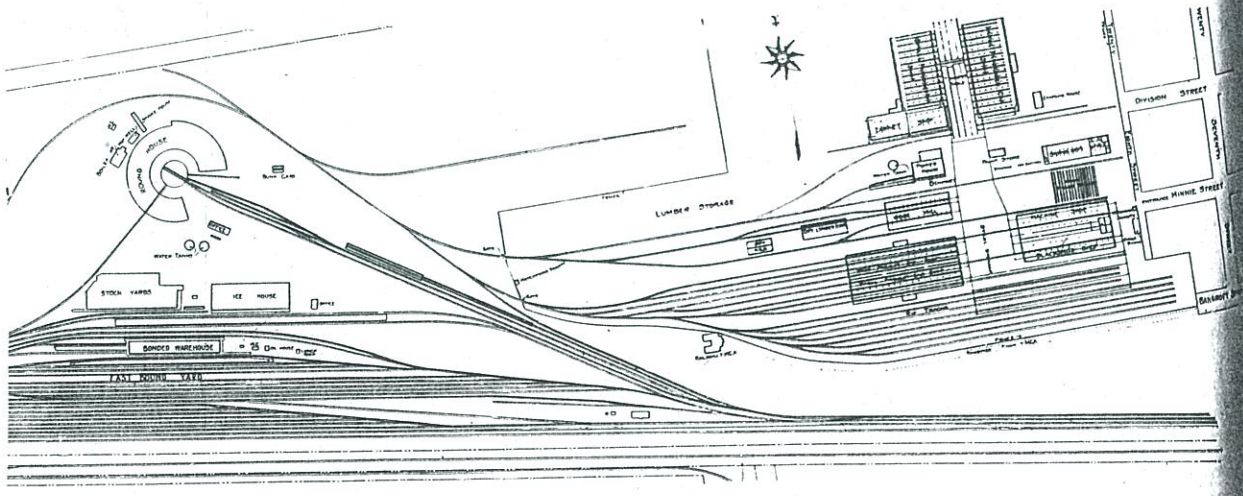
Three 200 b.h.p. and three 150 b.h.p. return tubular boilers are provided in the power plant, the boiler pressure being 150 lb. per sq. in. The boilers are fitted with superheaters giving 150 deg. superheat when coal is used and 200 deg. when wood refuse is used. Three of the boilers can burn either coal or wood, and three can burn coal only. They are adapted for hand firing because of the large amount of refuse of varied character which will be burned.

The boilers supply heat to the entire plant, power for two steam hammers in the blacksmith shop, and for testing out radiation in cars in the passenger car shops as well as for minor lines for heating water in the cabinet shop, glue room, etc. All steam lines are fitted with an asbestos insulating covering and are laid in concrete trenches in which space is also provided for steam return pipes, air lines to various buildings and tracks, water lines for fire protection and gas lines. Owing to the large amount of special work in painting and varnishing, the heating requirements in the plant are considerable, requiring about 50,000 sq. ft. of radiation which is provided by means of cast iron radiators of the wall type and pipe coils distributed as required.

The brick chimney for the boilers is 150 ft. high, 13 ft. in. in diameter at the base, and 6 ft. 6 in. in diameter at the top. It rests on a concrete base 30 ft. in diameter, and was built by the Heine Chimney Company of New York. The coal for the boilers is delivered direct to bunkers inside the boiler room by means of hopper cars discharging through a steel trestle having a capacity of two cars in the house. The ashes will be taken direct from the boilers through a pit conveyor located beneath the floor in the building and risi



Interior View of the Wood Mill



General Layout of the New Car Shop at Port Huron

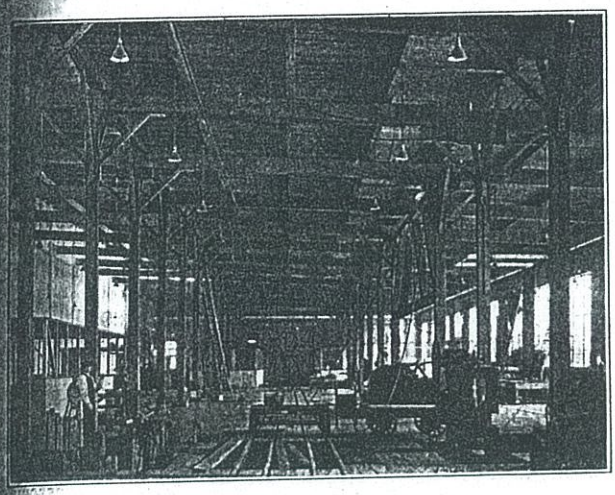
outside to the proper height for delivery direct to a car. The ash ejector was furnished by the American Steam Conveyor Corporation, Chicago, and is operated by the ejection of steam from the boilers at the far end of the conveyor. The carpenter shop and woodmill are fitted with shaving exhaust systems, which delivers wood refuse to the boiler room. The draft for these systems is furnished by a fan arrangement.

The engine room contains two boiler feed pumps, two vacuum pumps, a fire pump, an open type water heater, and two air compressors of 2,500 cu. ft. combined capacity,

compound type, specially adapted for use with superheated steam. The superheat of these air compressors may be controlled by proportioning their supply of wet steam.

The machine and blacksmith shop building is 138 ft. by 99 ft. and is planned in a similar manner to the freight car shops, with a fire wall separating the two rooms. A cinder floor is provided in the blacksmith shop.

The woodmill is of frame construction and was built



The Machine Shop Nearing Completion

almost entirely of material, salvaged from a former industrial plant occupying the site. Metal lath and a 2-in. stucco finish gives the building an appearance in harmony with the others. The dry lumber storage building is also of frame construction with a stucco finish. This building also was salvaged in its entirety from the industrial plant and moved by a horse and winch one-quarter of a mile to its present location.

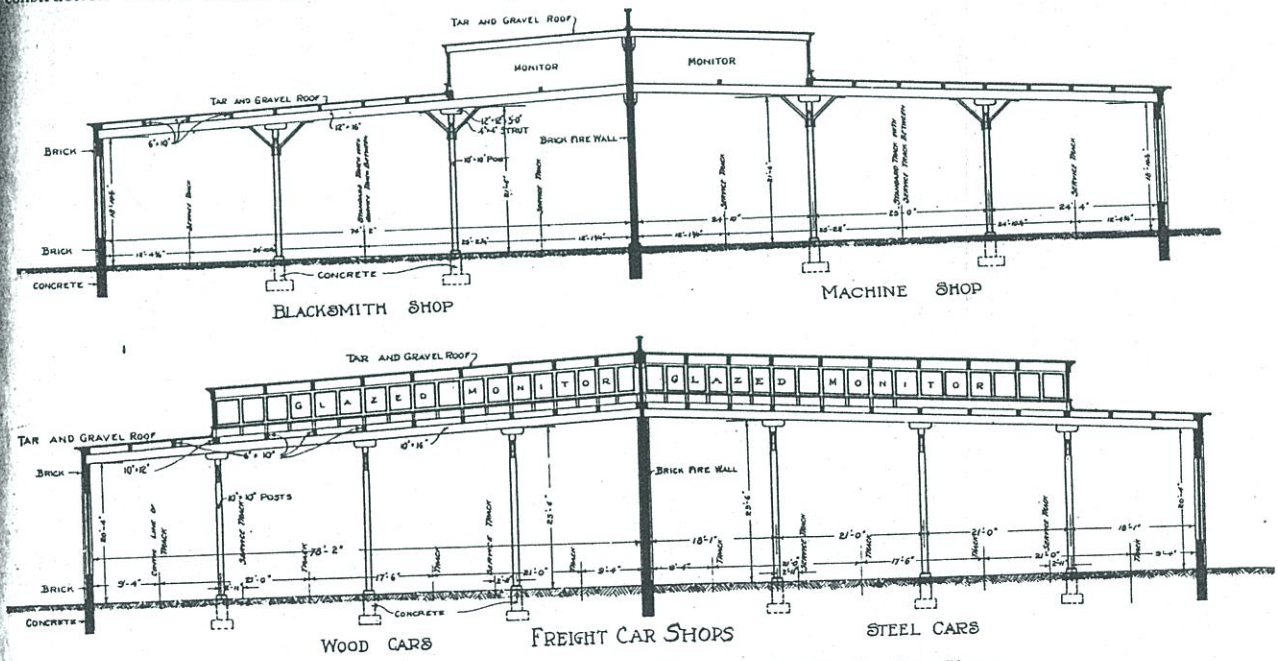
The drying kiln is a specially designed building of two compartments with doors at each end. This arrangement permits cars with lumber to enter at one end, and when dried to be removed at the other without any delay or inconvenience as a result of having to remove one car to get at or remove another. Each compartment is separate from the other and capable of being used independently. The heat will be supplied by means of steam pipes located below the rail level. A special system of air ducts will provide ample air changes which will be capable of regulation. Provision is also made for the introduction of steam as required to check too rapid drying. The walls and the roof are insulated by air cavities so that an even temperature may be maintained.

The general stores building is constructed on the same general lines as the car shops, and is provided with racks and shelves designed especially for the varied stores which have to be carried in stock. Office space for the storekeeper and his staff is provided at one end. The other buildings include the paint stores building, the battery charging room, and a bicycle storage room and a garage at the main entrance. The paint stores building and battery charging room are of fireproof construction.

The general offices are attached to one end of the stores building with a brick firewall between. The interior is divided by means of terra cotta hollow tile walls, and the exterior walls are furred with the same material. All interior walls and ceilings are plastered and painted.

The layout provides for ample storage space for wheels, steel, lumber, etc., and special attention has been paid to economical operation. Ample sanitary facilities and lockers are provided in each building for a full quota of workmen when the plant is in operation. Electrical energy for lighting and for the operation of the machines is supplied by the Port Huron Electric Power Company. Provision has also been made for fire protection by the erection of a 100,000-gal. steel storage tank, 100 ft. above the ground line, with a complete system of piping and fire hydrants situated at convenient points. The fire pump in the engine room draws water direct from the city mains and, in connection with the tank, a pressure of 60 lb. is maintained at all times. Hand fire extinguishers are also provided, one for every 2,000 sq. ft. of floor space, or 140 in all. Two fire houses, centrally located, are also provided.

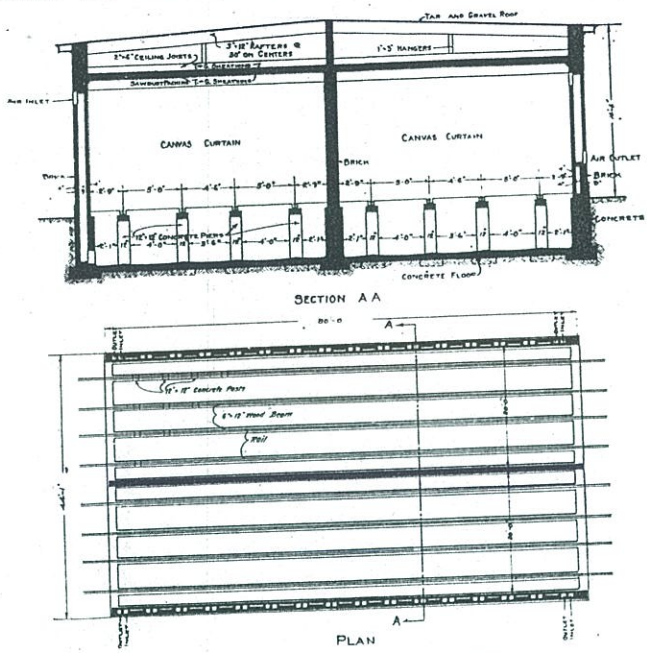
On a portion of the site acquired by the railroad were buildings of frame and brick construction which had been



Cross Sections of the Blacksmith, Machine and Freight Car Shops

occupied by an industrial plant. To utilize the land properly for railroad purposes these buildings had to be removed. From these and the old roundhouse and freight car repair shops which were wrecked after the fire, large quantities of usable material were salvaged and utilized in the construction of the new plant with a considerable saving in the requirements for new materials, time and money.

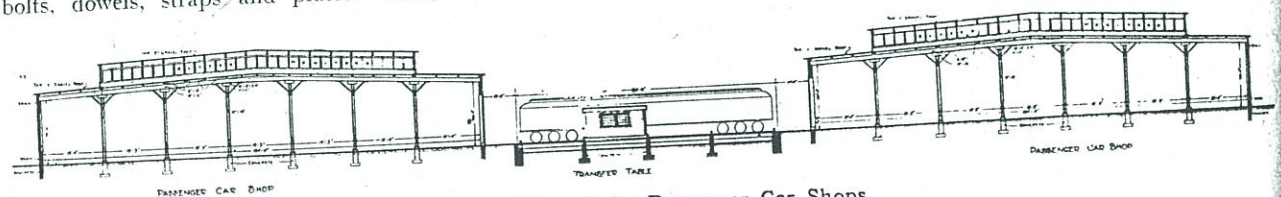
This salvaged material, in addition to an old building which was moved bodily to a new foundation and re-



Section and Plan of the Dry Kiln

modeled, included 517,000 ft. b.m. of timber of all sizes, 900,000 brick and miscellaneous materials. The new wood mill requiring approximately 35,000 ft. b.m. of timber was built almost entirely of salvaged materials and the second-hand timber was utilized in other buildings for plank flooring, sheathing, rafters, sleepers, forms for concrete, sheet piling, etc. The salvaged brick were used as backing in the new brick buildings.

The miscellaneous materials recovered included 400 wood and 30 steel sash, 8,600 lb. of steel rods, bars and angles which were used as reinforcing in concrete lintels and in foundation work, and 8,000 lb. of steel utilized for anchor bolts, dowels, straps and plates. Also, several thousand



A Sectional View of the Passenger Car Shops

hangers and brackets used in connection with the heating equipment, etc., were manufactured on the site from second hand material by company blacksmiths. A considerable quantity of miscellaneous material such as pipe, fittings, valves, etc., were likewise salvaged from the industrial plant which was abandoned and a material saving in expense, as well as time, was effected by this arrangement owing to the rapidly increasing costs of new material and the difficulty in getting prompt delivery.

This entire project has been carried out under the direction of H. R. Safford, chief engineer of the Grand Trunk. The contractor was James Stewart & Company of New York.

Alba B. Johnson Elected President of Railway Business Association

ALBA B. JOHNSON, president of the Baldwin Locomotive Works, was elected president of the Railway Business Association by the general executive committee at a special meeting held in New York, May 23, to take effect forthwith, George A. Post, who has served as president since the association was formed, having declined re-election. This was pursuant to authority given to the committee by the association at its convention in Chicago, April 8. The other elective offices, seven vice-presidents and treasurer will be filled later. The executive members, eight of whose terms have just expired, are appointed by the president. The secretary is a permanent officer during pleasure of the executive committee.

The committee on nominations and organization, in addition to recommending the election of Mr. Johnson, reported progress on organization to meet the problems arising out of adjustment to the new conditions in railway purchasing as discussed at the Chicago convention of the association.

It is expected that the election and re-organization will be completed at a meeting of the general executive committee to be called for some date in June.

Beside his work as a locomotive builder, in which capacity he is thoroughly familiar to the readers of the *Railway Age*, Mr. Johnson has for many years been active in the leadership of business organizations. He was chairman of several of the Foreign Trade conventions and president of the American Manufacturers' Export Association. He was the leader in the movement two or three years ago for strengthening and reorganizing the resources and service of the Philadelphia Chamber of Commerce, and is now president of the Pennsylvania State Chamber of Commerce. It was at the annual meeting of the Chamber of Commerce of the United States at Chicago in April that Mr. Johnson delivered his now well-known address urging a wide latitude for the individual railway manager in determining what locomotive designs are best adapted to the conditions under which he operates, and also urging that in whatever standardization might be attempted care should be taken to facilitate rather than obstruct mechanical progress.

News that Mr. Johnson had consented to undertake the presidency of the Railway Business Association was received on all sides with expressions of gratification that a man so engrossed in operations on as large a scale as Mr. Johnson should have regarded the work of the Railway Business Association as a call which he ought not to decline, and of confidence that with his prestige and personality he would command the hearty support both of the members and of many other manufacturers whom it is hoped to enroll in view of the new conditions under which railway purchasing is now done.

real and Toronto. They were claimed to be the speediest locomotives in the world.

In 1936, the five famous streamline Northern-type locomotives, No. 6400-type, made their appearance. Specially constructed for passenger service, No. 6400 made its test run over "The International Limited" route between Montreal and Toronto. This locomotive was the sensation of the hour and was inspected by some thousands of people on its exhibition tours. The appearance of the five streamliners marked the 100th anniversary of the opening of the first railway in Canada, the Champlain and St. Lawrence, a short portage road of about 16 miles between St. Johns and Laprairie, Quebec. To celebrate the centenary of Canada's first railway, a part of the Canadian National System, a model of the pioneer locomotive "Dorchester" was built and was exhibited with No. 6000. The ancient "Dorchester" was not quite as long as the tender of the big streamliner. Here was shown the great advance made in steam motive power over 100 years. In 1939, No. 6000 attained its height of interest. Refurbished with paint and polish and carrying the Royal Arms of Great Britain, it had the honor of drawing the Royal Train through South-western Ontario on the visit of Their Majesties King George VI and Queen Elizabeth to Canada.

There were other motive power changes to mark the progress of "The International Limited": No. 6100, a later Northern-type locomotive, made its initial run between Montreal and Toronto at the end of the thirties and in 1942 came the greatest of all the Northerns, No. 6200-series, dual-purpose locomotives which could haul 80 freight loads at 60 miles per hour or the heaviest passenger train.

The progress and enterprise which marked the development of "The International Limited" in motive power was reflected in travel facilities provided for passengers. Over the years, these included the introduction of new-type club cars; the elimination of the old, open observation-platform for a space enclosed with vita glass; diners of newest design; specially designed day coaches; the use of chambrette cars; new-type, reclining day-coach seats and chairs; and, lastly, the famous duplex-roomette cars, exclusively put into service this year by the Canadian National Railways.

The old generalization that innovations are merely of passing interest is particularly true of "The International Limited." In 1925, the steam railway celebrated its centenary. It was the only great industry which had not made radical advancement in its principle of power over a century. It was in 1925 that the Canadian National Railways, in co-operation with the Beardmore Co., of Glasgow, adapted diesel power to railway operation. It was successfully demonstrated in what were termed "oil-electric cars." In 1929, the only diesel locomotive of its type in the world was constructed for the Canadian National Railways. Locomotive No. 9000 was given its trial run between Montreal and Toronto on the second section of "The International Limited," as its schedule was the most gruelling test for railway operation on the system. No. 9000 was the forerunner of the various streamlined diesel locomotives which subsequently made railway history on the continent.

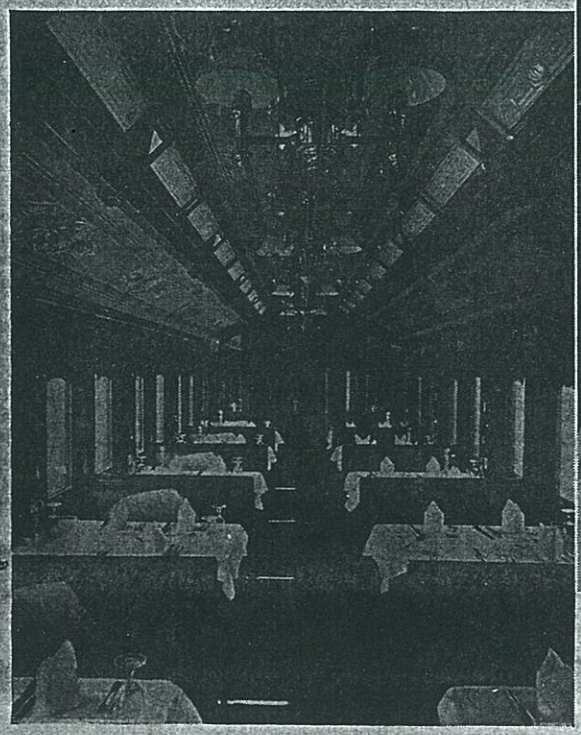
Indeed, some of the most interesting features which mark the history of "The International Limited" are now mere shadows on public memory. There was the installation of radio reception on the club-library observation cars, equipped with both loudspeaker and earphones, and compartments, on the same cars, wired for sound. There was the introduction of telephone communication to and from the train between Montreal and Toronto. Here, again, "The International Limited" had the distinction of leading the world in placing at the disposal of its passengers a two-way telephone system which worked with the facility and ease of an ordinary long-distance call. It was true that those innovations were later discontinued owing to the economic situation of the thirties but, notwithstanding this, Canadian National radio and electrical engineers had successfully overcome the isolation which previously had marked a train en route between stations.

"The International Limited" has symbolized the finest tradition of railway service since "Locomotion No. 1" pulled the first train over the Stockton and Darlington Railway of England, in 1825, to open a new era of man's social and economic development.

The Rt. Hon. Louis St. Laurent honored the Canadian National Railways recently by officiating at the observance of the 50th anniversary of the International Limited, which began service between Canada and Chicago in 1900. The Prime Minister was at the throttle of the big "6400" locomotive when the train pulled into Chicago on its run from Montreal, apparently getting as big a thrill out of driving the passenger train as the welcoming crowd in the Dearborn Station had in seeing him at the controls.

"I've always been a railroad fan," the Prime Minister said. "I always play with my grandchildren's miniature trains. This has been a very interesting experience. Like piloting a ship of state, driving a locomotive requires a great deal of concentration."

(*Continued on page* 23)



These two pictures of dining cars, one in service about the turn of the century and one in service today, show vividly the development in the architecture of railway passenger train equipment during the past 50 years and the trend towards simplicity and functional design.

known throughout Canada as a member of the famous New Westminster "Salmonbellies" lacrosse team, and for his interest in young people and sport. It is a fitting tribute that this section of British Columbia, which is now being assessed for its recreational value to the tourist by the parks division of the Forestry Branch, should bear the name of one who contributed so much to the development of British Columbia.

The phrase "A Primitive Wonderland" may be accepted as a concise description of Wells Gray Park. It is one of British Columbia's contributions to Canada's system of scenic parks, and a splendid recognition of man's inherent love of the great outdoors. Although primitive as it is, in the sense of its being totally unspoiled, and primitive as it will remain, it is not intended to suspend all developments; as time goes on, existing trails will be improved and extended, and facilities provided on a judicious scale for the convenience of travellers to supplement the accommodation already to be found within the park and the vicinity.★

International Limited

Continued from page 9

He added that, "The Governor General is going to be very jealous of me when he learns about this. He is as much a railroad fan as I am."

H. A. Grover, Grand Trunk Western road foreman of engines, under whose guidance the Prime Minister drove the train, said the statesman made a competent and very enthusiastic engineer. "He seemed to like blowing the whistle and waving to folks along the way," Mr. Grover said.

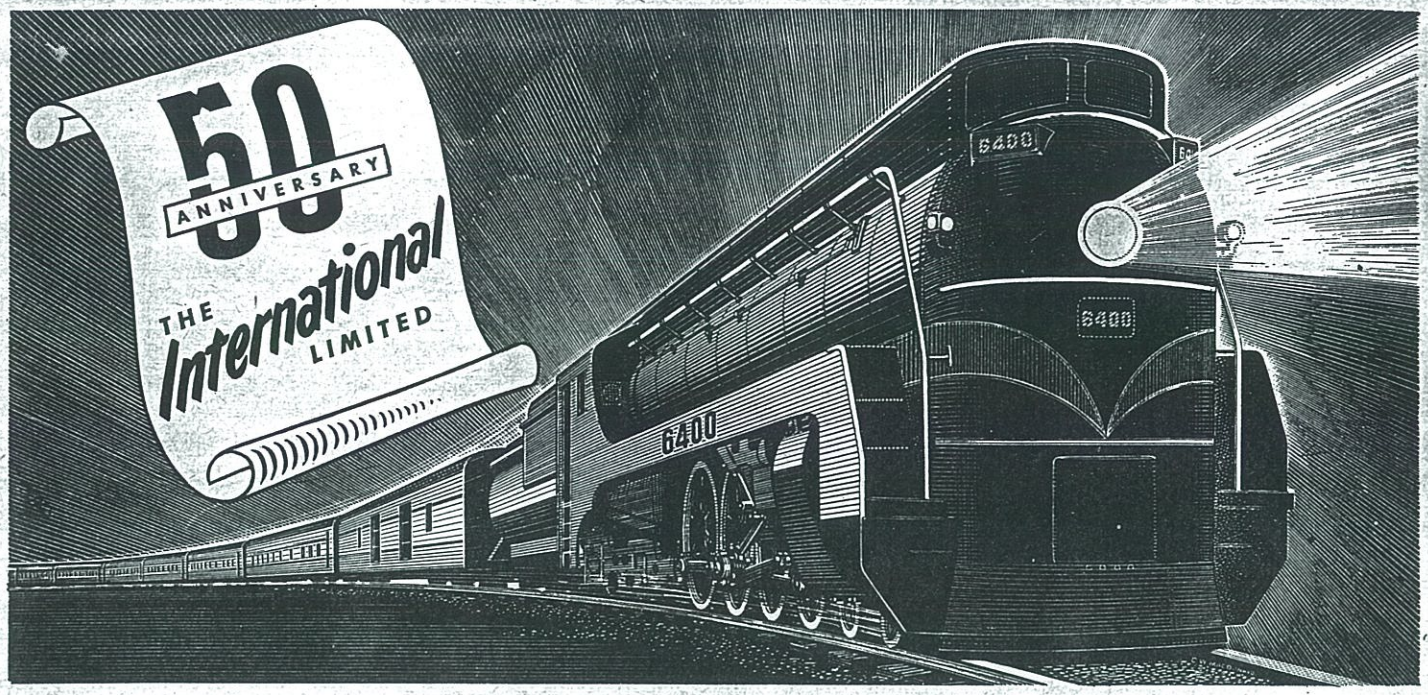
On arrival at the station, the Prime Minister alternated between "Good morning" and "Bon jour" in greeting friends, newspapermen and the Canadian consul general at Chicago, Edmond Turcotte, who met him there.

Accompanying Mr. St. Laurent were his wife and his daughter and son-in-law, Mr. and Mrs. Hugh O'Donnell.

Geo. L. Bryson, passenger traffic manager at Chicago, who was in charge of train arrangements, and A. A. Monson, Chicago public relations officer, met the Prime Minister's train in Toronto for the trip to Chicago, and A. G. Thernstrom, superintendent of the Chicago Division, boarded the train at Battle Creek.

John Pullen, general freight traffic manager, Montreal, headed a delegation of railroad officials who met the party in Chicago. In the group were J. V. Maloney, freight traffic manager; J. L. Bickley, general passenger agent; T. D. Ash, superintendent of terminals; and Henry Craig, assistant to the general freight traffic manager.

After a day of sightseeing in Chicago, the Prime Minister went on to St. Louis to give the commencement address at the University of St. Louis and to receive an honorary degree.★



FIFTY years ago this month two announcements, apparently unrelated but brought together by events unforeseen, appeared in the press. The first was a short news item that the Senate of Canada had thrown out a bill to incorporate the Canadian National Railway and Transport Co., which proposed to build a new railroad from Toronto to Collingwood, in competition with the Grand Trunk Railway's line through the same district, formerly known as the Northern Railway. The second was an advertisement announcing the inauguration of a new fast train between Montreal, Toronto and Chicago. This train was named "The International Limited."

The advertisement was a modest one, a column in width and less than two inches in depth. It read:

"INTERNATIONAL LIMITED"
Unapproachable Fast Service via
Grand Trunk

Leave Montreal ..... 9.00 a.m.
Leave Toronto ..... 4.35 p.m.
Leave Hamilton ..... 5.30 p.m.
Arrive Windsor ..... 10 p.m.
Arrive Detroit ..... 9.30 p.m.
Depart 10 p.m. (Central Time)
Arrive Chicago 7.30 a.m. (Central Time).
Magnificent equipment, day coach and sleeper, Montreal and Toronto to Chicago without change.
Dining Car service Hamilton to London.

In such a matter of fact way did the most outstanding of Canada's "Blue Book" of famous trains make its appearance to the travelling public.

By the time "The International Limited" celebrated its Silver Anniversary of undiminished popularity, the Government of Canada had created the Canadian National Railway Co., and, with the amalgamation of the Grand Trunk System and the Canadian National Railways, in 1922, "The International Limited" became one of the outstanding trains of the new Canadian National System. Time had brought together the two unrelated press announcements in the dawn of the Twentieth Century.

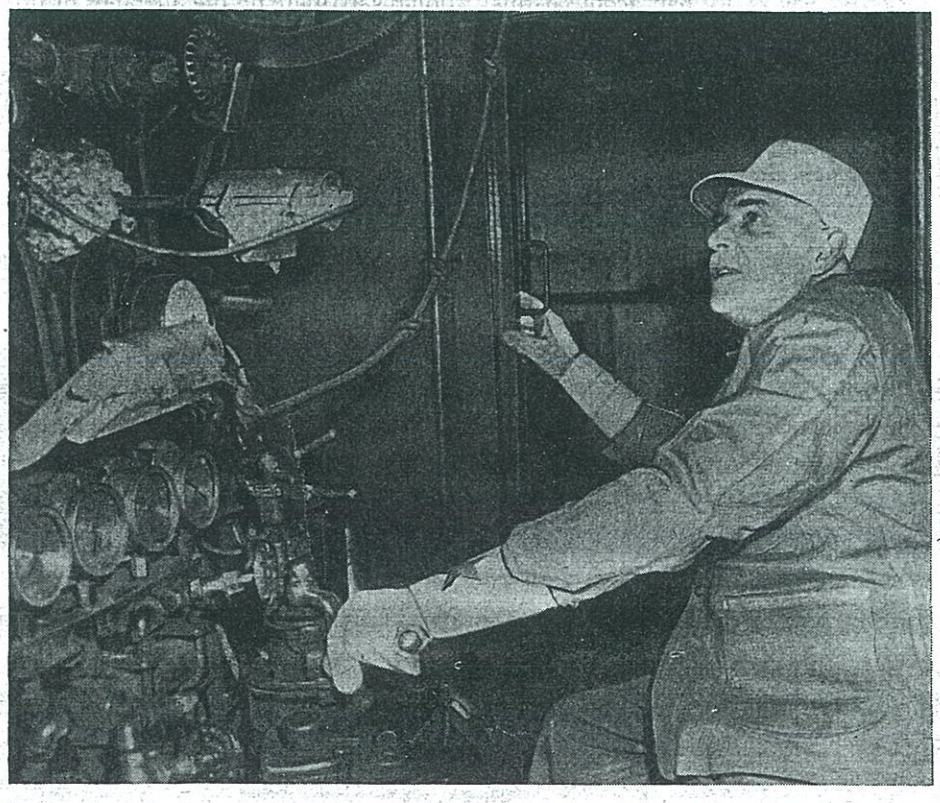
From the first "The International Limited" was noted for its high-quality of performance, daily each way, between Montreal and Chicago; its equipment in motive power and passenger accommodation was of the same high standard. At the turn of the thirties, "The International Limited" proved itself the fastest train in the world for the distance of its run between Toronto and Montreal, speeding over the 334 miles separating the two cities, in 360 minutes.

The steady improvement in motive power indicates the unsparing effort made by the Canadian National management to maintain "The International Limited" in its foremost position.

In 1923, when the new mountain-type, 6000-class locomotives were constructed they were at once placed in service on this train. At that time these locomotives were the largest in the British Empire.

Again, in 1930, four new Hudson-type, No. 5700-series, locomotives were specially designed for service on "The International Limited" between Mont-

THE PRIME MINISTER AT THE THROTTLE



Rt. Hon. Louis St. Laurent, sits at the controls of the locomotive bringing the International Limited into Dearborn Station, Chicago, recently. Properly clad for the occasion, the Prime Minister brought the train in to celebrate the line's 50th anniversary of service between Montreal and Chicago.