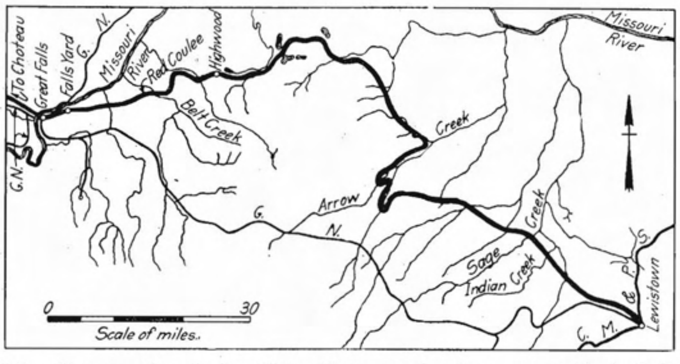
New Line From Lewistown, Mont., to Great Falls

The Chicago, Milwaukee & St. Paul Has Recently Completed a 138-Mile Extension of Permanent Construction

Immediately upon the completion of the coast extension of the Chicago, Milwaukee & St. Paul, about five years ago, this company began the construction of branch line feeders into the contiguous country, practically all of which had been regarded heretofore as Hill Lines territory. One of the most aggressive invasions of this nature is the construction of a new line from Lewistown, Mont., northwest 137.7 miles, to Great Falls. This line has been completed and opened for local freight and passenger service recently, and a further extension is under construction from Great Falls, northwest 67 miles, through Choteau to Agawam. This new line not only opens up for settlement a



Map Showing New St. Paul Line Between Lewistown and Great Fall

large area of very productive agricultural land in the Judith basin in central Montana, but also gives the St. Paul an entrance into Great Falls, the second city in commercial importance in Montana. The permanent character of the construction adopted also indicates the possibility of this line eventually forming a link in an alternate route to the Pacific coast.

GENERAL DETAILS

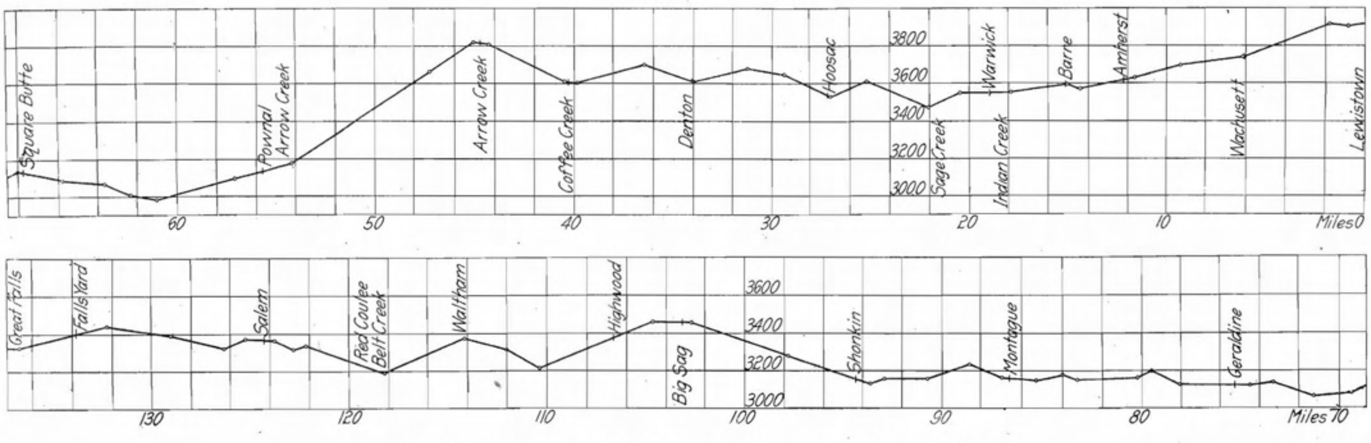
At the time the St. Paul built the coast extension, it purchased the Montana Railroad, extending from Lombard on the Northern Pacific to Lewistown, and completely rebuilt that portion from Lombard to Harlowton, making it a part of the main line. This new line extends northwest from a connection with the old Montana Railroad at Lewistown, generally parallel to, and about 20 miles northeast of the Billings-Great Falls line of the Great Northern.

In order to traverse the center of the Judith basin it was necessary to adopt a line 20 miles longer and with higher grades than the parallel line of the Great Northern between the same points. The country traversed is generally rolling, with occasional high benches and with very precipitous and deeply eroded stream beds. The benches are frequently close to the streams, making the problem of locating a satisfactory crossing more than usually difficult, especially since this line crosses the drainage approximately at right angles. At the crossing of Arrow creek the bench one mile east of the stream lies 800 ft. above the creek, and it was necessary to develop the line and to sacrifice 14 miles in distance to secure a crossing. At this point particularly, but also at Sage and Belt creeks, a very rough formation, closely resembling that found in the Bad Lands of North Dakota, was encountered, requiring very heavy and expensive work, which at Belt creek averaged 100,000 cu. yd. per mile for six miles. In fact, practically all the heavy work of the entire line was encountered in crossing these gashes.

The maximum grade in each direction was established at 1 per cent, except in descending into Arrow creek from the east, where a 1.5 per cent grade was inserted for 10 miles. All grades were compensated .04 per cent per degree for curvature. The maximum curvature was fixed at 8 deg. The construction of this line required the excavation of over 5,500,000 cu. yd. of materials, including 1,400,000 cu. yd. of earth, 2,500,000 cu. yd. of hard pan, 1,025,000 cu. yd. of loose rock and 575,000 cu. yd. of solid rock.

With the exception of a few temporary timber bridges constructed on the 10 miles of 1.5 per cent grade descending into Arrow creek, all structures were built of permanent construction. As this line crossed the drainage at right angles, large steel viaducts were required at the crossings of Judith river, Indian, Sage and Belt creeks, and Red coulee. Numerous long concrete arches were required under high fills at other points. The total amount of steel work required on this line was 10,000 tons, in addition to 76,000 cu. yd. of concrete.

Starting from a connection with the old Montana Railroad at Lewistown the new line of the Milwaukee parallels a branch of the Great Northern, built into Lewistown two years ago from a connection with the Billings-Great Falls line at Moccasin, crossing Big Spring creek, nine miles out of Lewistown, with the Great Northern on a single track gauntleted timber trestle, 1,300 ft. long and 80 ft. high, which is to be replaced by double track embankment. Beyond this point the Great Northern branch swings to the west, while the St. Paul line continues northwest, crossing Judith river and Indian and Sage creeks in the next 12 miles. After crossing the divide between Sage and Dry Wolf



Profile of New Line Between Lewistown and Great Falls

creeks, in Sage creek tunnel, this line traverses rolling country, requiring only moderately heavy embankments, until it reaches the bench near Belton, above Arrow creek, 23 miles beyond the crossing of Sage creek. From this point the line descends toward Arrow creek for 15 miles, 10 miles of which is on a 1.5 per cent grade on a supported line, requiring very heavy work through a badly broken formation. After leaving Arrow creek the line then continues across a fairly light rolling country for 50 miles, until it reaches Belt creek. The next 9 miles, including the crossings of Belt creek and Red coulee, involved some very heavy work. The remaining 17 miles into Great Falls were quite light.

THE GRADING

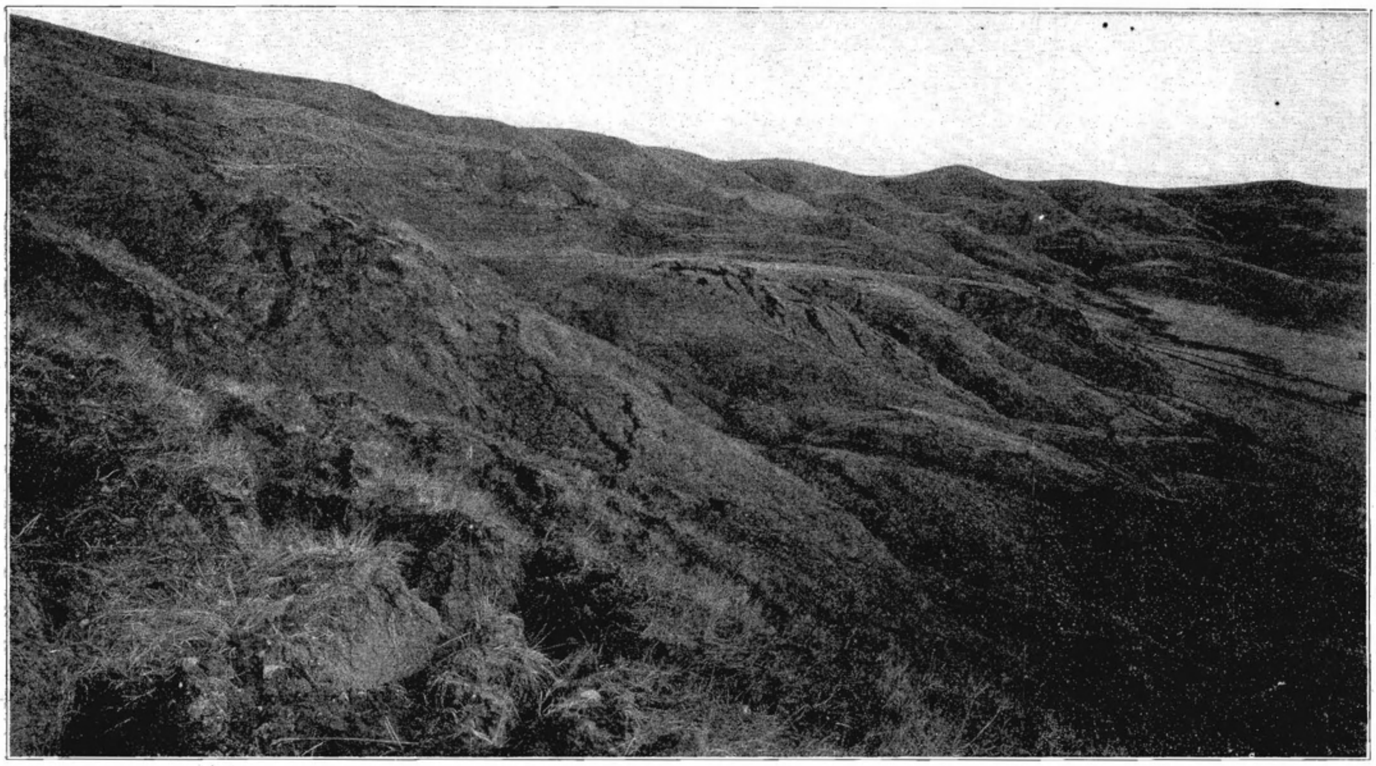
The grading was handled by steam shovels, elevating graders, fresnos and station men. Much of the material in the heavy portions of this line was moved by the station men who trapped the material into cars. Six steam shovels were also employed to carry out the work at various times. Aside from the crossings of the streams, the largest fills ranged from 55,000 to 150,000 cu. yd.

Six tunnels were constructed with a total length of 5,333 ft. The longest one was 2,063 ft., located three miles west of Sage creek viaduct. A tunnel 250 ft. long was driven near the top of the ascent from Arrow creek on the south side. The other four tunnels were located within a distance of 3 miles, near Belt creek viaduct.

The methods adopted in driving these tunnels varied somewhat. At Sage creek, where a wet shale was encountered, a full arch section top heading was driven, and the bench then removed, all excavation being done by hand. Work was pushed from both portals, and also from two shafts. In most of the other tunnels a center bottom drift was first driven and the remaining material was then trapped into small cars. Tunnels 1 and 5 are on tangent, while tunnels 3 and 4 are on 8 deg. curves. Tunnel 6, 780 ft. long, is on an 8 deg. reverse curve with 150 ft. of intermediate tangent. All tunnels were lined with concrete before the road was turned over for operation, excepting the Arrow creek tunnel, 250 ft. long.

AMPHITHEATER SLIDE

The most puzzling problem, which arose in connection with the grading, developed at a large slide at the east end of tunnel 4, known locally as Amphitheater slide from the shape of the mountain at that point. Here the entire side of the mountain has been moving at irregular intervals ever since the first stages of the work destroyed the equilibrium, until now the original grade line, which is about 190 ft. above the level of the flats, has settled over 100 ft., going down as much as 7 ft. in 48 hours. This material has broken about 150 ft. above grade, and is moving on a stratum inclined about 10 deg. from the vertical. In addition to the vertical settlement, it has moved 75 ft. laterally during this time. The adjacent end of tunnel 4 was also moved about 14 in. out of line, which caused a serious distortion of the easternmost 200 ft. of the tunnel, and made necessary the retimbering of the bore for this distance. At the time this distortion became apparent, the bore was preserved, as far as possible, by timber struts placed between opposite wall timbers and the retimbering was done just ahead of the placing of the concrete lining. A peculiar characteristic of this slide is the fact that the movement is the greatest during dry weather, and appears to be entirely arrested during a rainy season. The underlying cause for the movement has not been definitely determined. An examination of several smaller slides in the vicinity has shown that they rest on a shale which crumbles after exposure to the air for five or six months, and that this disintegration ceases about 10 ft. from the face. One theory advanced is that the crumbling of this shale allows the material above to settle and in this way starts it moving.



Amphitheater Slide Showing Steam Shovel Working at Grade in the Center of the Photograph

To arrest this movement, sliding material was transferred from the upper to the lower side of the railway embankment by steam shovels in an attempt to equalize the weight. This effort proved successful in June of last year, the slide discontinuing movement, but for purposes of safety and to allow the material ample time to gain a dependable equilibrium, a shoo-fly track skirting the hill has been built for train operation, and no attempt will be made to operate trains on the original alinement before next summer. Owing to the geological formation peculiar to this section of the country and chiefly to the widespread presence of shales subject to rapid air-slaking disintegration, a number of similar slides of lesser magnitude have developed, notably on the Arrow creek hill, which have been arrested in the manner outlined above.

HAULING MATERIAL

The most interesting feature in the construction of this line was the bridge work, which was estimated to cost $1,700,000. This included 5 high steel viaducts, 14 arch culverts, and numerous smaller openings. The bridge work was handled by company forces from its inception to completion.

It was necessary that all the culverts and substructures for the viaducts be built in advance of the grading, to enable the line to be completed at the earliest possible date, and, as a result, the material for these structures had to be hauled in wagons from the nearest railroad stations, sometimes as far as 30 miles distant. Over $100,000 was paid for this item of hauling alone.

Material required on the east end of the line was unloaded at a temporary spur 2½ miles east of Glengarry, a station on the Milwaukee road a short distance east of Lewistown, while that required at the west end was hauled in from Swift and Wayne on the Great Northern.

This hauling was let by contract to local freighting contractors. At Glengarry the contractor received 35 cents per ton-mile, and 35 cents per 1,000 ft. B. M. for lumber, hauling all the material required for the first 30 miles of the line out of Lewistown, which included the substructure material for three of the viaducts. On this contract the railway company handled all material at the siding and loaded all wagons. The average haul was 12 miles. At Wayne and Swift, where the average haul was 14 miles, the contractor was paid 50 cents per ton-mile, and per 1,000 ft. B. M. for lumber. Here, however, all loading and unloading of material and payment of demurrage charges were cared for by the contractor.

A material clerk was stationed at the unloading point on the railroad, and he checked all material as it was unloaded from the cars into the wagons. He issued triplicate tickets for each wagon load, showing the contents of the wagon; he retained one of the tickets, one was given to the teamster and one was sent to the office of the engineer in charge of the work to which the material was going. The teamster handed his tickets to the contractor, and once each month the contractor and the various engineers checked their accounts, after which the teaming bill for the month was made up. Under this system not a single controversy arose between the contractors and the engineer in charge, nor was any material lost.

The hauling was done with traction engines and teams. When the roads were good, traction engines would haul two Buffalo-Pitts wagons of 20 tons capacity each, doubling the hills by dropping one trailer. As many as 750 sacks of cement could be hauled in this way at one trip, requiring 14 hours for 24 miles. On this short haul the engines would make the trip during the day, returning to the railroad in the evening, and the wagons would then be loaded at night. However, these engines could not be operated across the adobe flats during wet weather, and about 150 horses were required at Glengarry and a similar number at Swift and Wayne. These horses were generally operated in "four- and six-up" teams, but at times as many as 14 horses had to be used to transport such heavy equipment as hoisting engines. As would be expected in a new country, the hauling of these large quantities of material required the construction of a considerable mileage of new roads, all of which were built and maintained by the contractors with the co-operation of the railroad.

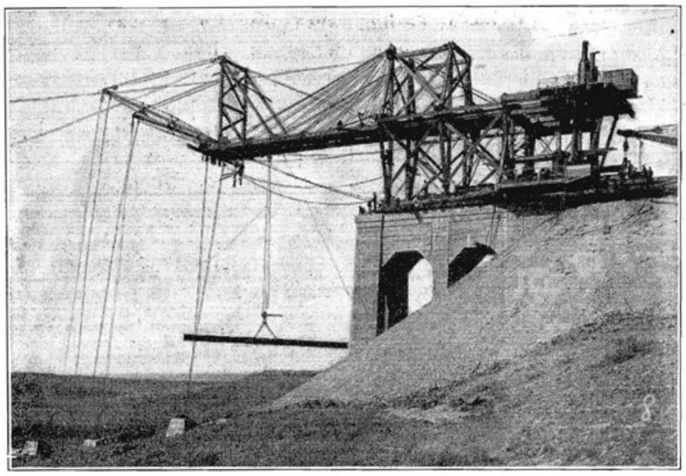
Sage Creek Viaduct

CULVERTS

The larger culverts were constructed of reinforced concrete of parabolic-arch cross section. These were constructed with the use of wooden movable forms made in sections 16 ft. in length, and the work was handled in such a manner that after a start was made, almost all stages of the work were in progress at the same time. One of these culverts was a double 20 ft. by 15.5 ft. arch under a 60 ft. fill. One 10 ft. arch was built under a 65 ft. fill and a 16 ft. arch was placed under an embankment 102 ft. high.

Because of the high freight and teaming charges on cast-iron pipe, careful attention was given to the selection of the materials for small culvert openings up to 42 in. in diameter. For fills up to 6 ft. in height American Ingot Iron and Acme Nestable corrugated iron culverts were used. For fills higher than 6 ft., cast-iron pipe was used for the most part, although after establishing a concrete pipe plant at Great Falls, concrete pipe was substituted for cast iron in those openings remaining on the line to Lewistown, and for all openings on the Choteau extension. About 1,275 tons of cast iron, and 3,000 lineal ft. of corrugated iron pipe were used on the Lewistown line.

The concrete pipe plant at Great Falls was a field plant, erected for this one piece of construction alone. Four sizes of pipe, 24 in., 30 in., 36 in. and 42 in., were made at this yard. The concrete was mixed, depositing in the forms was done by hand, the



Traveler Placing the First Steel at Judith River Viaduct

concrete being delivered to the forms in steel dump cars. During warm weather the inside forms were removed in four hours, while the outer forms were taken off the following day, all forms and pipes being handled by a traveler moving on a track spanning the working platform. In order to keep up the output in cold weather, live steam was turned into the interior of the inner form, which enabled the inner form to be removed almost as soon as in warm weather. Fourteen men and a foreman made nine pipes regularly every day at the beginning, and the output was later increased to 12 per day by the addition of other forms. This included all work, such as removing the forms, preparing the reinforcement, etc. Wooden forms were used for making the pipe.

VIADUCTS

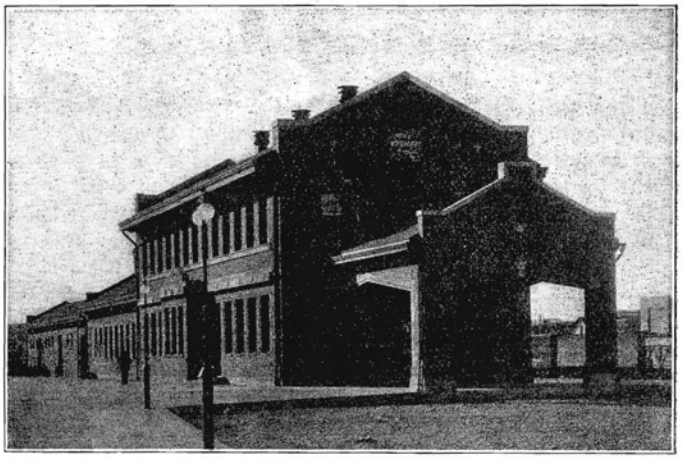
The largest single structure on the line is the Judith river viaduct, 14 miles northwest of Lewistown, which is 1,953 ft. 10 in. long and 135 ft. high. This one structure required 2,829 tons of steel, and cost $300,000. It consists of 46 ft. 6 in.-towers and 69 ft. 6 in.-intermediate deck spans supported on concrete pedestals, with large concrete abutments at each end. The viaduct was designed for Cooper's E-60 loading, and is provided with a ballasted concrete floor. One interesting detail of the design is that no horizontal bracing is used in the towers. The high abutments are of the type developed at the time of the construction of the coast extension, and described previously in these columns. (See *Railway Age Gazette,* October 27, 1913, page 839.) The east abutment is 65 ft. high above the top of the footing.

About 5,000 cu. yd. of concrete was required in the abutments and pedestals at the crossing. As this concrete was placed in advance of the grading, that for the west abutment was placed by means of a tower, while at the east abutment a trestle was run out from the adjacent bank. The pedestals on the side hill were built by delivering the concrete into the forms by spouts leading from the mixer set farther up the hill. In constructing the pedestals across the flat area in the center, a trestle was built and the mixer moved out over each in turn, going out on one side of the structure and returning on the other. With these arrangements one mixer delivered about 150 cu. yd. of concrete per day. Sand and gravel were delivered to the work in wagons from a nearby pit opened for the purpose.

No steel was erected until after the track laying had reached the bridge site. The erection was accomplished with a large traveler of the type developed by the Milwaukee several years ago, and first used in the construction of a high viaduct at Tekoa, Wash., in 1908. The traveler is shown setting the first steel at Judith river viaduct in one of the accompanying photographs. The material was delivered to this traveler by two work trains, each provided with a derrick car. A force of 100 men, including the derrick crews, erected and riveted about 100 tons of steel daily. The entire 33 spans were erected in 31½ working days of nine hours each.

At Indian creek a viaduct 1,302 ft. 10 in. long and 150 ft. 6 in. high was built. This structure required 1,803 tons of steel and about 3,000 cu. yd. of concrete. Sage creek viaduct is 1,698 ft. 2 in. long and 156 ft. 6 in. high, and contains 2,735 tons of steel and 7,000 cu. yd. of concrete. These structures are four and ten miles west of Judith river viaduct, respectively, and are practically identical in design and construction with that structure. At Sage creek some difficulty was encountered with foundations, and 1,600 piles were driven under the pedestals. The 22 spans at Indian creek were erected in 22 days.

The two remaining viaducts are about 20 miles east of Great Falls. Red coulee viaduct is 675 ft. long and 137 ft. high, requiring 916 tons of steel and 2,400 cu. yd. of concrete. It was possible here to deliver material on top of the bench above the coulee at both ends of the structure, and this made two setups of the concrete plant necessary, one at each abutment. For each setup, two light rail industrial tracks were laid on a trestle, built just high enough to enable concrete to be delivered to the pedestal forms, out to a point midway of the viaduct. By means of a cable on a specially designed drum, a loaded steel dump car was made to pull an empty car up to the mixer. With this layout concrete was taken from the mixer as rapidly as it could be mixed, and both lines of pedestals were concreted simultaneously.



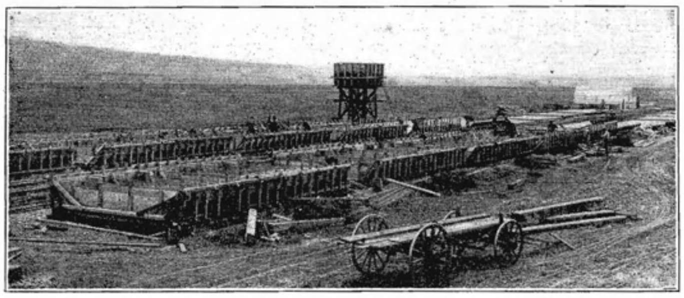
The Passenger Station at Lewistown

Belt creek viaduct is 651 ft. 10 in. long and 189 ft. 6 in. high, and contains 1,002 tons of steel and 2,000 cu. yd. of concrete. At this point the concrete material was delivered to the site in the bottom of the canyon and the concrete had to be raised by various means. Industrial track on low trestles, upon which 18 cu. ft. steel dump cars were used, enabled the concrete to be placed in the pedestals lying between the bases of the high cliffs. To place the concrete in the pedestals, situated high up on the west cliff and the west abutment, a timber skidway and bucket were devised. The bucket was drawn up or down the skidway by means of a hoisting engine and was made to dump automatically at any desired point by means of a specially arranged timber yoke. The west abutment was poured by means of a bucket operated with a stiff leg derrick mounted on top of the cliff near the abutment.

The steel in Belt creek and Red coulee viaducts was erected by means of derrick cars. At Red coulee no difficulty was encountered, but at Belt creek tunnels adjacent to the ends of the viaduct necessitated the delivery of the steel by the work train inside of tunnel 6, from which point the erection derrick had to secure it. This slowed up the erection somewhat, but it was accomplished in 15 days.

The concrete deck slabs for these viaducts were built in two yards, established for the purpose. Those for Judith river, Indian creek and Sage creek were made on a level piece of ground just east of Judith river and adjacent to an adequate supply of gravel in a pit which was opened to supply material for viaduct substructures. In the gravel pit, at the extreme east end of the slab yard, was placed a loading trap, and from this trap a light rail track extended the entire length of the yard. Parallel to this track a standard gage track was laid upon which the concrete mixer was operated. The mixer was placed upon a raised timber platform, mounted on trucks, its height being such as to enable the concrete to be delivered directly to the slab forms by spouting. Gravel and cement were delivered to the mixer in steel dump cars, operated by a hoisting engine and cable, and the mixer was moved along its track as the slab forms were filled. The gravel was loaded at the trap with fresnos.

The forms for the slabs were built in sections so that they



Concrete Slab Yard Near Judith River Viaduct

could be easily removerd, as soon as the concrete had set, and placed again for other slabs. The reinforcing was assembled to form complete units for one slab to avoid assembling the steel in the forms. More than 1,200 slabs, 3 ft. 4 in. to 4 ft. 10 in. wide, were built in this yard, with an average of 25 slabs built per day for the entire time the plant was in operation.

The second slab yard was established just west of Red coulee, where the deck slabs were made for Red coulee and Belt creek viaducts. The space was so limited at this point, due to the topography, that it was necessary to build half of the slabs on top of the other half. This, together with the fact that the gravel had to be hauled in wagons a distance of three miles, reduced the average daily production of slabs to 18. For this yard the mixer was stationed at the point where the gravel was delivered by wagons, and the concrete was delivered to the forms in steel dump cars, operated on a light rail track.

Immediately after the steel was erected at the viaducts, the slabs were loaded onto flat cars by means of derrick cars, taken to the structure sites, and put into place by the derrick cars. On the average, 40 slabs were placed per day during the time that the work was in progress.

TERMINALS

At Lewistown, where several lines of the St. Paul enter a 12-stall roundhouse, 96 ft. deep, was built, together with a power house, machine shop, oil house, rotary sand dryer, storehouse, and office building, all of which are of brick construction. A 170-ton mechanical coal hoist of timber construction, C. M. & St. P. standard clinker pit, 225 ft. long, and a 67,000-gal. water tank, were also provided, in addition to the usual small buildings.

At Great Falls a 9-stall engine house, 96 ft. deep, a power house, an oil and tool house and a sand drying house of brick construction were built, and an air-operated coal dock of timber, a water tank identical with that at Lewistown, and a clinker pit 150 ft. long were provided. For the water supply of this engine terminal, a triplex pump, direct-connected to a 10 hp. a. c. motor, was installed on the bank of the Missouri river, from which water is pumped a distance of one mile and raised a height of 268 ft. to the water tank through 6-in. cast-iron and wooden water pipe. All machines in both terminals are operated electrically.

PASSENGER AND FREIGHT STATIONS

Various standard and special designs were used for the passenger and freight stations along the line, all of which are of timber construction. At Lewistown a brick passenger station building, 273 ft. long and 24 ft. to 36 ft. wide, with shingle tile roof, art marble floor and tile wainscoting, and timber beamed ceiling, was built. A portion of the building 81 ft. long and 36 ft. wide is two stories high, on the second floor of which is provided room for division offices. The building also houses a lunch counter for which space 58 ft. by 26 ft. is assigned. All platforms about the building are of concrete and these are lighted by electric lamps, mounted on iron lamp posts, with two 60-watt lamps enclosed in 10-in. frosted globes on each post, and lights placed beneath the building cornice. A novel feature of the building is the C. M. & St. P. trademark in mosaic, placed in the gables and illuminated by reflecting lamps.

The freight house and office building at Lewistown is 302 ft. by 32 ft., of which space 70 ft. by 32 ft. is used for the office. This building is one story high and of brick construction, with concrete floors.

At Great Falls it was very desirable to locate the freight station near the center of the business section, and to accomplish this the area occupied by the city's restricted district was purchased and all the buildings were razed prior to beginning construction. Here a building 469 ft. by 40 ft. was constructed of brick, with concrete floors and basement. One end of this building, 40 ft. by 49 ft. two stories high, contains the local offices of the company. The passenger station at Great Falls, a brick and concrete building 207 ft. by 46 ft., two stories high, has art marble floors, tile wainscoting, Spanish tile roof and coping and plaster beam ceilings. An indirect lighting system is employed. At one corner of the building is a tower 135 ft. high, near the top of which is placed the Milwaukee trademark, made of terra cotta and illuminated with flaming arc lamps. The station platforms are of concrete, lighted in the same manner as at Lewistown, except that there are no cornice lights about the building. Instead of these there are a number of arc lamps on the walls of the building and numerous incandescent lamps about the ornamental iron marquises.

BOARDING CAMPS

As all bridge work was handled by company forces, it was necessary for the railroad to arrange to feed these men. This was done by organizing a commissary department directly, instead of bringing in a boarding contractor. Each camp was placed in charge of a camp clerk with the usual number of cooks and assistants, reporting direct to the engineer's office at Lewistown. Each clerk was allowed to order the food he desired for his camp by telephone from the Lewistown office, one clerk assembling the orders from these various men and then buying in large quantities, and locally as far as possible. At the end of each month an inventory of the supplies on hand at each camp was taken and the actual cost of the meals was computed. A circular letter was then sent to all camps, giving the cost per meal at each camp, with the names of the assistant engineer, the clerk, the foreman and the cooks. It was found that this public comparison stimulated considerable interest among the men in securing the best food at a low cost. The men in each camp were charged a uniform rate per day, which was deducted by the timekeeper in the usual manner, although this rate varied somewhat in the different camps, depending upon the class of camp; that is, skilled mechanics desired better food than did the laborers and paid a correspondingly higher rate. An average of about 550 men were fed in this manner, at as many as nine different camps. The camps were not run for profit, but were managed so as to be self-sustaining, while endeavoring to give the men the best possible food for the money paid, two direct results being that the company camps held their men on the work and there was a very small amount of sickness. There was no typhoid fever in any of the company camps, although other camps along the line were not immune.

The track was laid by hand from Lewistown to Sage creek crossing. North of this point a Roberts track-laying machine was employed. Seventy-five pound rail was laid on sawed ties fully tie plated and in gravel ballast. Stations were established at intervals of 8 miles, with a house track 1,500 to 2,000 ft. long at each station, and a passing track at each alternate station. Water is secured from streams in most instances, although a gravity supply is secured from one spring at Highwood, and a deep well was driven at Pownal, near the crossing of Arrow creek.

The construction of this line was started in July, 1912. The track laying was completed last spring, and irregular freight service was inaugurated as far as Great Falls about May 15. Local passenger service was started on August 10, and it is expected that through passenger service will be started soon. The grading on the Choteau line has been completed, but no rail has been laid.

The construction of this line was handled under the direction of Charles F. Loweth, chief engineer, and E. O. Reeder, assistant chief engineer. F. J. Herlihy was assistant engineer in charge of all masonry, steel, superstructure, and building work until October 1, 1913, when he resigned to accept service with another company, and was succeeded by F. B. Walker. A. G. Baker was division engineer in charge of grading and water supply work. Assisting him were district engineers C. D. Jackson, W. R. Felton and J. D. McVicar, each of whom was in charge of five resident engineers. C. L. Whiting, superintendent of construction, had charge of track laying and ballasting. Twohy Brothers, of Portland, Oregon, were the contractors for the grading of the Great Falls terminals and for the first 70 miles of the line out of Lewistown. Winston Brothers, of Minneapolis, had the contract for grading the intermediate portion. All other work was done by company forces.

TRAIN INDICATORS AT EUSTON STATION

In the terminal station of the London & North Western at Euston, London, the train indicators, showing the times that outgoing passenger trains will start, are mounted in cases standing on the floor, an arrangement which brings the reading matter into the best possible situation for the convenience of passengers seeking information. There are four of these indicators at Euston, and one of them is shown herewith. Indicators of the same kind are in use at Crewe, Liverpool, Manchester and other important points on that road.

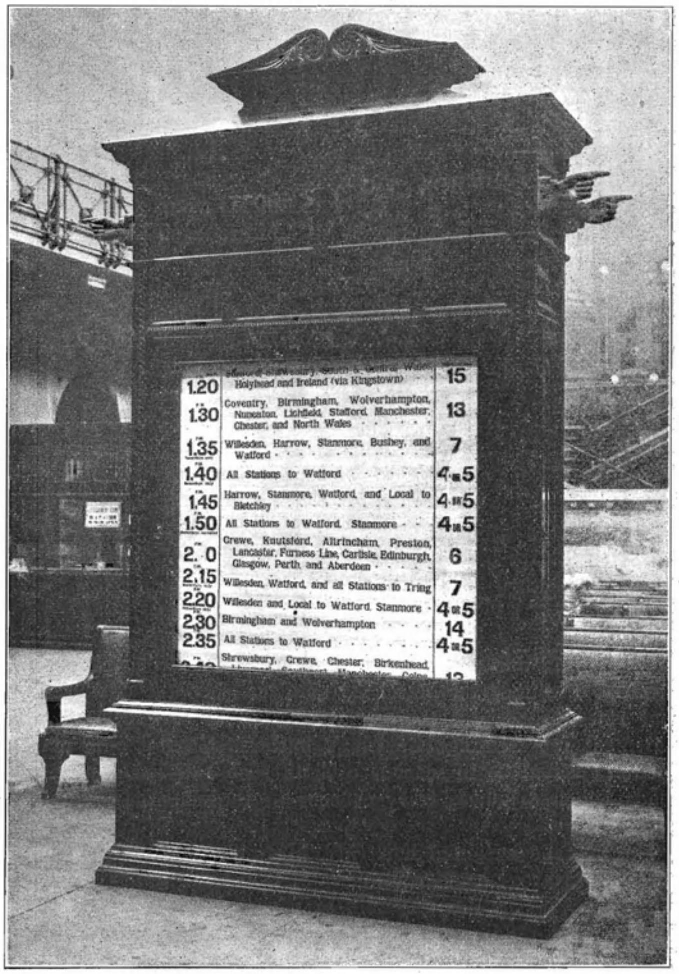
The lettering is black, printed on white paper, the sheets of paper being pasted on a continuous apron or curtain of white canvas. The curtain is carried on rollers and is rolled on to the upper roller and off the lower one as occasion demands, the practice being to show at all times every train that is scheduled to depart within the next hour, or thereabouts. The lettering on the case, above the white space, not clear in the illustration, shows that the bold-face figures in the column in the right hand margin of the curtain indicate the number of the platform at which the train stands. At the top of the case, opposite the index fingers, the passenger is informed which platforms are at the right and which at the left.

It is to be noted that four of the trains among the eleven here shown are run on Saturdays only, while a fifth, that leaving at 1:50, runs every day except Saturday. This condition suggests that a different sheet, with these Saturday trains left out, might well be used on the other days of the week.

New sheets are usually printed twice a year. When it is necessary to make changes at other times, narrow slips are pasted over the lines which are superseded.

For the foregoing information and for the photograph, we are indebted to L. W. Horne, superintendent of the London & North Western, London.

Readers desiring to make comparisons with American prac-



London & North Western Train Indicators

tice will find the indicators recently put up at Kansas City and at Memphis, described in the *Railway Age Gazette*, February 12 last, page 272, and those used at the Pennsylvania and the Grand Central stations in New York City in the issue of February 14, 1913, page 296. An indicator arranged on the same general principle as that at Euston, but different in some particulars, is in use at Charing Cross, London. This was described in the *Railway Age Gazette*, December 12, 1913, page 1122. The indicators at the Central station, Glasgow, Scotland, unique in some respects, were described August 9, 1912, page 255.

The Antung-Mukden Railway.—At the conference between the Chinese and Japanese representatives in Peking on March 10, the Chinese agreed to an extension of the Antung-Mukden railway agreement, which expires in 1923, to 99 years.