per plates. The side sheets and crown sheet are $^{7}/_{16}$ in.; the tube plates are $^{11}/_{16}$ in. thick, and are stayed to the outer shell by copper stays $^{15}/_{16}$ in. in diameter and about 4 in. pitch, with the tell-tale holes at their centers drilled 1½ in. in each end. There are 150 solid drawn brass tubes of 1½ in. external diameter. The total heating surface is 336 sq. ft., and the working steam pressure is 160 lbs. per sq. in. The engine has been fitted complete with oiling apparatus, including a Wakefield's sight feed lubricator to the cylinders. There is a steam whistle actuated from either end of the coach. The boiler is fitted with two glass water gages with stop cocks and protectors, with steam pressure gages marked in lbs. per sq. in., and kilos per sq. c.m. Two combination injectors, with solid drawn copper pipes and rubber hose connections to the tank are provided. The cab is built of mild steel plates, with double roof, the inner roof being of teak. Sliding plate glass windows are provided in front, and there is also a louvre in the center as shown in the illustration. The cab is furnished with oil lamps for the water and steam gages. The vehicle is fitted with a steam turbine dynamo of 110 volts and the necessary switchboard.

The dynamo provides electric light for two headlights, two side lamps and for lamps for the engine compartment, as well as the lamps for lighting the interior of the coach. There are 11 lamps in all, each of 16 candle power. Both ends of the coach are fitted with a steel cow-catcher. The tank has a water capacity of 300 gallons, and there is a fuel space of 33 cu. ft. The tractive force, at three-quarters "cut-off," amounts to 4,220 lbs. The interior of the coach is finished in polished oak paneling. The seats are turn-over upholstered seats. As shown in the illustration, the coaches are divided into two passenger compartments, having 24 seats in the second and 28 in the first class compartment; there is also a luggage and guard's compartment at the rear end.

The Chicago Freight Terminals of the Chicago & North-Western.

The Chicago & North-Western's problem in Chicago is to operate into the city three double-track through lines carrying more passenger trains daily than any other railroad into Chicago and at the same time to take care of a very large freight traffic which must be interchanged between these three lines, and the most comprehensive system of freight terminals in the city. In order to realize the seriousness of the problem it is worth noticing that against the three lines of the Chicago & North-Western there are only two other railroads, or three including the two Pennsylvania lines, the Pittsburg, Ft. Wayne & Chicago and the Pan Handle (operated separately), which have more than one through line into the city. These are the Illinois Central and the Chicago, Milwaukee & St. Paul. Having the largest needs, the North-Western is fortunate in possessing correspondingly large terminal facilities. According to an unofficial estimate the company owns about 320 miles of track within the city limits against something over 100 miles owned by the two Pennsylvania lines which together have the next largest trackage. On this basis the North-Western has more than twice as much track in Chicago as any other road. The *Railroad Gazette* is indebted for an inspection of the Chicago & North-Western freight terminals and the accompanying forms, maps and plans to Mr. W. D. Cantillon, General Superintendent; Mr. E. C. Carter, Chief Engineer; Mr. J. S. Robinson, Division Engineer; Mr. E. E. Betts, Car Service Agent, and particularly to Mr. R. H. Johnson, Trainmaster of Freight Terminals, to whose active and personal interest much of the information is due. A large number of others also whose names cannot because of their number be mentioned gave their time and hearty co-operation.

The accompanying map (Fig. 1) gives the general relation of the North-Western's lines into Chicago to each other and to the territory in and about the city. The Galena division runs due west from the Wells street passenger station to Omaha. The Milwaukee and Wisconsin divisions leave the Galena division in a four-track line just west of the Wells street station, the former to run north near the shore of the lake to Milwaukee and beyond to the northern peninsula of Michigan. The Wisconsin division, which leaves the Milwaukee division three miles out at Clybourn Junction, and runs to St. Paul and Minneapolis, forms roughly the bisector of the angle made by the other two. Though for operating purposes the Wisconsin and Milwaukee divisions are combined as the Wisconsin division, it will be simpler in describing the general terminal situation to consider them, as is done on the time cards issued to the public, as two separate divisions. The map also shows the cut-off south from Lake Bluff on the Milwaukee division, which was described in the *Railroad Gazette* of August 11, page 128. This is used to divert freight and through passenger traffic from the Milwaukee division at that point in order to relieve the Chicago end of the division on which is much the heaviest part of the North-Western's suburban business. This cut-off is also to be part of the new low-grade air line now building to a point near Milwaukee. This as described at that time is similarly to relieve the present Milwaukee division of much of its freight and through passenger traffic. Near the outside of the map is the Elgin, Joliet & Eastern, an outer belt line meeting the three divisions of the North-Western at West Chicago, Waukegan and Barrington respectively, with which considerable business is interchanged, relieving to that extent the crowded condition of the terminals in Chicago.

The other map (Fig. 2) shows the terminal situation more in detail. The territory embraced in the terminals includes the Milwaukee division to Central street station, North Evanston; the North Evanston-Mayfair cut-off, used for the same purpose as the Lake Bluff cut-off and the first step in the new line to Milwaukee; the Wisconsin division to a point beyond Mayfair; the freight connection between Mayfair (Hunting avenue) and the 40th avenue yards; the Galena division to Elmhurst (shown in Fig. 1) 16 miles due west of the Wells street station and 11 miles west of 40th avenue, and all territory included in or south of these lines. This includes 51 miles of double main track and is all under the direct authority of the Trainmaster of Freight Terminals, who ranks as a Superintendent. The yards in the terminal territory average in capacity from 50 (40 ft.) cars at some of the suburban stations between Clybourn Junction and Evanston on the Milwaukee division to 1,800 cars at 16th street, 2,000 at Western avenue, 2,000 in the new yard now building at Melrose Park just east of Elmhurst on the Galena division, 2,200 at Wood street, and 5,000 cars at 40th avenue. With the completion of this year's work on the new Melrose Park yard the terminals will have a total yard capacity of about 15,500 cars. The 51 miles of main double track in the terminals includes nine miles of three-track, three miles of four-track, two miles of five-track and three miles of six-track. These are all main tracks. There are also 144 miles of yard track and 21 miles of private track. The number of actual cars handled in and out of the city each month is from 170,000 to 175,000 cars, or a total of from 340,000 to 350,000 car movements. In the month of June there were 349,000 car movements.

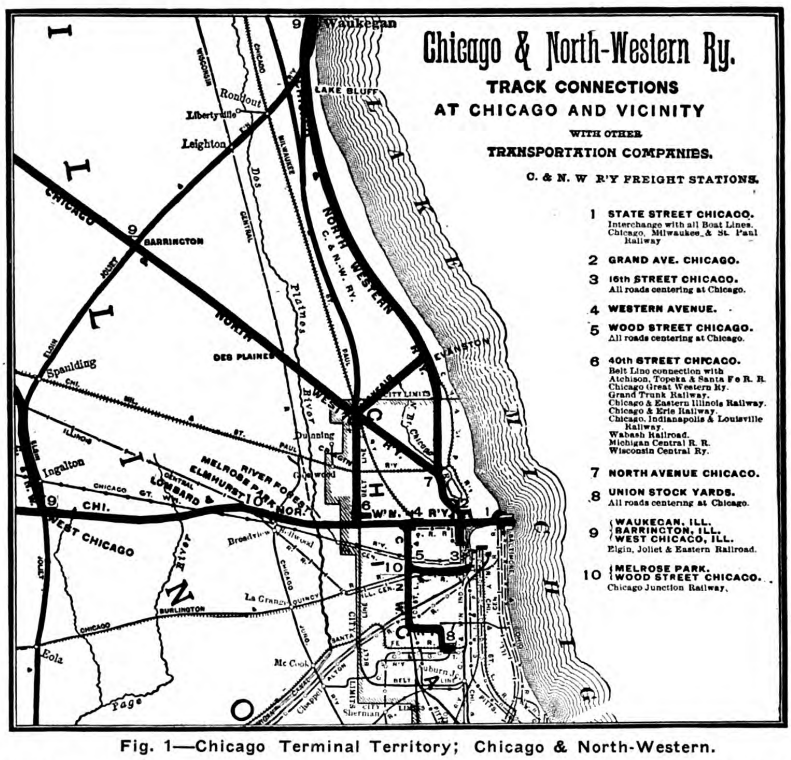

Fig. 1—Chicago Terminal Territory; Chicago & North-Western.

The principal freight houses are at State street, Grand avenue, Wood street and 16th street. The State street house receives from and ships to the Galena division, and the Grand avenue house, from the other two divisions. Wood street is a transfer freight house

for freight to and from connecting lines delivered in cars, and Sixteenth street for connecting line freight for the North-Western delivered by teams. The mixed freight (except perishable) from the road for connecting lines received at Wood street is there distributed into the proper foreign cars. Practically the only freight for Chicago received at either Wood street or Sixteenth street is in carload lots for delivery on near-by team tracks.

In addition to the four freight houses mentioned, the North-Western has Chicago freight stations at North avenue, 40th street, Deering, Cragin, and the Union Stock Yards. These handle car load freight only, which is delivered on team or industry tracks, there being for instance in the North avenue district, which covers the territory about Clybourn Junction, five team-track yards and over 70 industries, 40 of which have private tracks. Included in the Chicago terminals of the North-Western are a total of over 360 industries, 223 of which have their own industry tracks. Including the 108 industries in the Union Stock Yards district to which the North-Western has trackage rights from Wood street over the Chicago

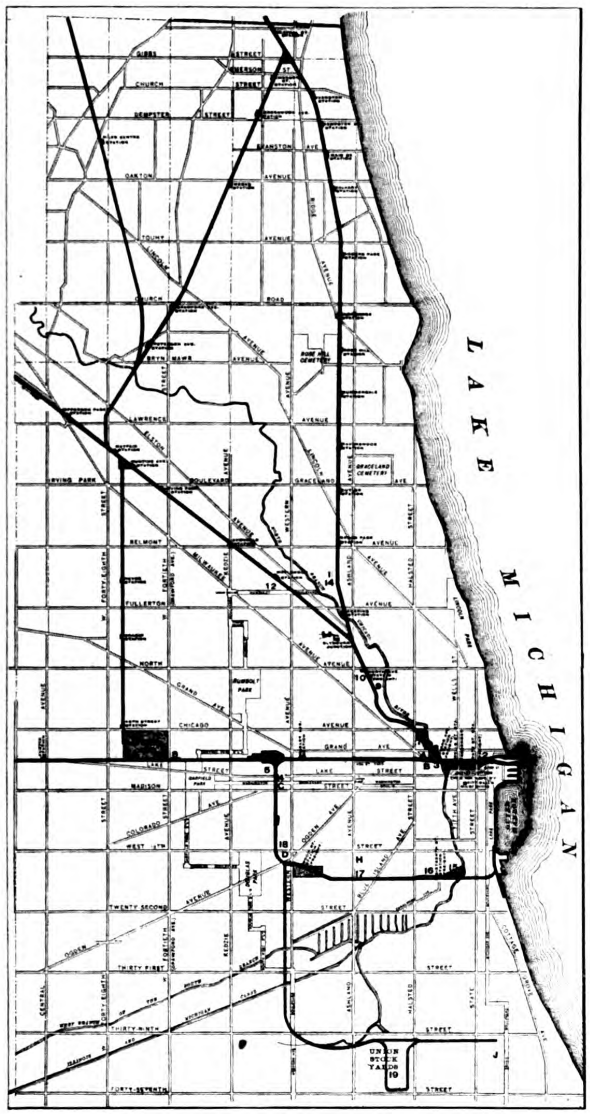

Fig. 2—Location of Terminal Facilities of the Chicago & North-Western at Chicago and Vicinity.

Junction Railway, there are 468 industries on the North-Western's Chicago terminal, 331 of which are reached by direct track connection. Some of these are reached exclusively by the North-Western; the traffic from others is divided with other roads. This is sometimes done on an agreed basis, as at Deering, where the large traffic originating at the works of the International Harvester Company at that point goes for six months of the year to the North-Western and for the other six months to the Chicago, Milwaukee & St. Paul. For each industry a switching report (Fig. 3) is made out each day for the information of the agent in the district, showing the cars removed from and switched to each industry track.

At the Union Stock Yards the North-Western handled during 1904 more of the live stock traffic into Chicago than any other road. In that year the total receipts at Chicago were 286,873 cars of live stock. Of these the North-Western brought 62,601 cars, the largest number for any single road. Its heaviest month's traffic was during February, when 6,526 cars were handled to the stock yards. The heaviest day's traffic was over 800 cars. During the year 42,032 head of cattle were handled by the North-Western out of Chicago.

The State street district is divided into two parts, one west and the other east of the north branch of the Chicago river. Each district contains about 50 industries. West of the river there is a connection with the Chicago, Milwaukee & St. Paul. The section east of the river is east of the Wells street station and takes in the docks near the mouth of the Chicago river and the factories and warehouses on North Pier. About a third of a mile east of the station are the inbound and outbound freight houses. At the "in" freight house is received all less-than-car-load freight from the Galena division. From the other divisions such freight comes only for trans-shipment to lake steamers. All lake traffic in both directions is handled at State street, and this is the only l. c. l. freight which comes to or goes out from State street to the Wisconsin and Milwaukee divisions. Perishable freight from the Galena division destined for other railroads comes to State street and is at once loaded on teams and carried across the city to connections, the whole process of trans-shipment sometimes taking no more than an hour. Perishable goods are the only sort of l. c. l. freight for connecting lines from the road, which do not go to Wood street for transfer. In order to have the least possible delay, such freight is carried into the center of the city at State street and, from the other two divisions, to Grand avenue, where the transfer can be made in the shortest possible time.

The State street "out" freight house loads cars for all points on the North-Western Line, large deliveries in l. c. l. lots being made at the house daily by teams. Five tracks of 18 cars each are loaded at a time. Each five cars opposite each other are called a "run" and are in charge of a stevedore, who is entirely responsible for correct loading. To make his responsibility complete, freight is not wheeled into the cars by the truckers. They leave the loaded trucks on the freight house platform just outside the door of the first car in the run. Then as the stevedore takes each piece of freight into the car himself, all mistakes in loading can be traced directly to him. It is also his business to examine each piece of freight for its actual destination instead of depending on the marker's chalk marks which are intended solely for the direction of the trucker. For instance, if his run were number 4 (i.e., the five cars each of which is fourth on its track) and the car on the third track were a straight car for Minnesota Transfer, he must be sure that each piece of freight that goes into that car is really destined for points on connecting lines beyond St. Paul and Minneapolis and not simply that it is marked "3-4" (third car on fourth track).

West of the Chicago river and just north of the junction of the Wisconsin and Milwaukee divisions with the Galena division are the Grand avenue freight houses and team tracks. Grand avenue is the regular freight terminus of the Wisconsin and Milwaukee divisions just as State street is of the Galena division, no freight from the Galena division going to Grand avenue except car load freight destined for some of the industries in that district. Grand avenue is a large receiving point for potatoes and for butter and cheese. During the four months, June to September, there is an average of about 400,000 lbs. of butter and 250,000 lbs. of cheese received there daily, as much as 560,000 lbs. of butter or 300,000 lbs. of cheese being sometimes received in one day. In this district of the North-Western's terminal there are about 70 adjacent industries.

Time freight trains of l. c. l. merchandise are loaded at Grand avenue for the Wisconsin and Milwaukee divisions. On one of these trains, No. 287, the Iron Range Time Freight, for the Milwaukee division, loading goes on until 6 p.m. The train leaves at 6.38, which does not give time for making up the complete waybills covering each shipment. In order not to delay the train, card or slip waybills are made out for each car and given to the conductor before starting. The regular waybills when ready are forwarded by passenger trains so that each will overtake the car at the proper station or junction point. All Milwaukee division through freight trains from Grand avenue run via Clybourn Junction and the Wisconsin division to Mayfair, and thence north to Milwaukee by the Lake Bluff cut-off.

At Wood street the Chicago & North-Western interchanges mixed car-load freight both ways with all roads entering Chicago, and straight car load freight both ways with the following roads: Baltimore & Ohio; Chicago & Alton; Chicago, Burlington & Quincy; Chicago, Rock Island & Pacific; Illinois Central; Lake Shore & Michigan Southern; Michigan Central (perishable shipments only); New York, Chicago & St. Louis; Pittsburg, Ft. Wayne & Chicago;

Pan Handle (P., C., C. & St. L.), and Pere Marquette. These are the roads with which car-load interchange is regularly at Wood street instead of via the Belt Railway of Chicago at 40th avenue.

There is, however, through the Chicago Junction and the Chicago Terminal Transfer connection at Wood street with all roads entering Chicago. The Illinois Central, Michigan Central and other roads east of Wood street send freight here over the St. Charles Air Line, a one-mile connecting road running east from the North-Western's tracks at 16th street to the Illinois Central yards. This is owned jointly by the Chicago & North-Western, Chicago, Burlington & Quincy, Illinois Central and Michigan Central. Its use is free to all adjoining roads when delivering to or receiving from one of the owning roads. But on strictly private business such as switching cars to industries on the St. Charles Air Line, there is a charge for trackage for both cars and engine.

New York, Boston, Philadelphia, West Albany Transfer, Buffalo, Cleveland, Pittsburg, Alliance, Columbus, Ft. Wayne Transfer, the Erie Despatch, Lackawanna Despatch and Merchants Despatch Transportation Co. are among the eastern points and fast freight lines which load straight cars for Wood street. These cars must contain nothing but freight for points beyond Chicago on or via the Chicago & North-Western. A mixed car, for instance, containing merchandise, part for some point on the Chicago & North-Western, the rest for Grand avenue or State street, Chicago, would be returned to the connecting line for proper loading. Straight cars from connecting lines are switched at Wood street to the proper westbound track for handling by transfer trains. Foreign cars of

CHICAGO & NORTH WESTERN RY. CO.

Industrial Switching Report.

_____ 190__

TO THE GENERAL YARDMASTER:

The track of _____

WAS switched at _____ *o'clock this* _____ *M. and the following cars removed and placed.*

CARS REMOVED		CARS PLACED	
INITIALS	NUMBERS	INITIALS	NUMBERS

FOREMAN

This report must be made by Engine Foreman for every industry switched.

Fig. 3—Industrial Switching Report.

mixed freight are run into the freight house from the east end on a track running through the center of the house. They are then unloaded and their freight reloaded into cars for the road, those for the Galena division being on the four tracks at the north side of the freight house and those for the Wisconsin and Milwaukee divisions on the four tracks at the south side. As the front cars in the house are emptied, the whole line is pulled through, the empty cars detached at the north end of the line and the whole process gone over again. If it is necessary to unload more connecting line cars at once than the number which this track inside the freight house will hold, extra cars may be unloaded at the south end of the house, where there is a platform 30 cars long. About 125 cars of such mixed merchandise freight are received daily from connecting lines. Some 60 or 70 of these cars are daily sent back to their home roads after having been loaded with connecting line freight which comes in in mixed cars from points on the North-Western Line. These mixed cars from the road are unloaded on platforms at the east end of the house.

Foreign cars are handled by means of form 55 A (Fig. 4), which was adopted July 1. It is a green slip and is used for all foreign car movements, loaded or empty, except as explained on its face. The space at the top marked "Symbol" is used in connection with the Chicago & North-Western's time freight system, which was described in detail in the *Railroad Gazette* of September 1, page 208; the letter designates the station from which the car is forwarded, and the number shows the consecutive number of the car from that station. The first spaces in the body of the slip are for directing the movement of an empty foreign car. If, for instance, a firm in Milwaukee wires the car service agent for a car to be loaded to Cincinnati via the Pan Handle, the car service agent, through men specially detailed to keep track of empty foreign cars for this purpose, sends the first empty Pennsylvania car that is available to the Milwaukee firm. To do this the card would be filled out: "From Wood street to Milwaukee." "Empty movement authorized by E. E. Betts, Car Service Agent." Under the word "Penalty" is recorded the date on which the $1 a day car service payment will begin, the date on which the car was received, at what junction point and from what road. Under the head "Send Home" is recorded the road and junction point to which the car should be returned, which is, unless otherwise ordered by the car service agent, the same road and place as that from which the car was received, it being the general rule to return cars to the road from which they are received and at the same point at which they came on to the line.

55A SYMBOL { LETTER ..... NUMBER .....

Chicago & North Western Railway Co.

FOREIGN CAR, Home Route and Record Card.

(This Space to be used for the Movement of an Empty Foreign Car.)

FROM _____

TO _____

(Empty Movement Authorized by) _____

Car Initials _____ **Car No.** _____

PENALTY

Will begin _____ **190**

Received from _____ **R. R.**

At _____ **Station,**

Date _____ **190**

SEND HOME

To _____ **R. R.**

At _____ **Station**

REMARKS

INSTRUCTIONS.

A card of this form must be completely filled in by Agent for each Foreign Car received, loaded or empty, from other roads, which the Agent will deliver to Conductor who moves car from his station. If a loaded car, the card must be attached to and put with the way-bills covering same, and the card must accompany car, loaded or empty, until it passes off this line.

When a car is delivered to connecting line Agent will take up this card.

When a car is received in "return" movement, the Agent will make a new card, showing the date (30 days after date of receipt) when Penalty will begin; the R. R. from which it is returned, station and date, and must ascertain from his record and fill in under the head of "Send Home" the original "Home Route" as was shown by the old card, giving the R. R. and station from which it was originally received.

Conductors will not move a Foreign Car, loaded or empty, unless accompanied by this card, except in handling Foreign Cars to or from Non-Agency stations, in which case they must deliver to or receive from the Agent who makes billing for such Non-Agency station, a card of this form to cover.

A Foreign Car belonging to a road with which we have direct connection should be returned to that road at nearest junction point, provided such routing does not involve additional mileage.

THIS CARD DOES NOT AUTHORIZE EMPTY MOVEMENT. SUCH MOVEMENT WILL BE DIRECTED BY THE SUPERINTENDENT, CHIEF TRAIN DISPATCHER OR CAR SERVICE AGENT.

NOTE.—These rules will not apply to such Refrigerators and other cars as are assigned to this Company from time to time, due notice of which will be given.

E. E. BETTS, Car Service Agent.

Fig. 4—Record Card, Foreign Cars.

The accompanying loading plan (Fig. 5) shows the arrangement of cars loaded for the road at Wood street. Each numbered space represents a car. Runs 1 to and including 14 on tracks 1 to 4 inclusive are on the north side of the house and are cars for points on or via the Galena division. Runs 16 to 31 are on the south side of the house and are cars for the Wisconsin and Milwaukee divisions. As will be seen from the chart, most of the cars are way or "peddler" cars which run on through trains to the beginning of their respective territories and over their territories on way freight trains. On these cars it is, of course, important that freight for the first station in the peddling territory be loaded next the door. Straight cars on the other hand such as the one for Elgin, Run 6, Track 1, or the nine for points west of Omaha, Runs 1 to 9, Track 4, are loaded with no care for any special arrangement inside the cars. The "runs" are the same as at State street,

but instead of marking with chalk on a box of freight destined for Elgin, "6-1," as would be done there, the trucker is given a ticket (Fig. 6) which would be filled out in this case: Run No. 6, Box No. 21. In each car is hung on a nail a tin box with a number on it. The box in the Elgin car is box No. 21, because counting from the first car on the first track and across and so on down it is the 21st of the Galena division cars. Similarly Run 17, Box 67, is a way car from Oshkosh to Neenah over the Wisconsin division, and is the second car on the third track south of the house and, counting in the way described, the 67th car from the first car on the first track of the Galena division.

The unloading of each foreign car on the track in the center of the house is done by a gang of seven men, a checker, caller and five truckers. The checker makes out a ticket for each piece of freight as it is brought out of the car. This the trucker takes along with him and drops into the box of the designated car when he deposits the freight in that car. Before the train leaves for the road, an inspector goes into each car and examines all tickets in order to see that there are none in any box except those which belong there. There is a stevedore for each "run" who, although comes from the cars and each set of truckers has exactly the same chance.

The 103 cars designated on the loading chart are the very least number of cars for the road which are loaded in any one day. The average at Wood street is about 130 cars per day. The extra cars not designated on the chart (most of which are usually "straight" cars, for instance extra cars for San Francisco or Minnesota Transfer) are set for loading on the tracks in places represented by the blank spaces on the chart or on available tracks at the east end of the freight house.

For computing train tonnage it is necessary to know the weight of the loaded cars. There is not time to make this up from the waybills and mark it on each car before leaving. It is necessary, therefore, to get a working average for the weight of a loaded car. In order to do this a record is kept each month of the weight of all cars loaded at Wood street and the average weight computed at the end of the month. This is used as a unit figure during the following month. For instance, during July the average weight of a loaded car was found to be something over 45,000 lbs. The nearest number of even tons was therefore adopted as the unit,

CHICAGO & NORTH WESTERN RAILWAY

WOOD STREET STATION. ______ 190

TRACK ONE				TRACK TWO				TRACK THREE				TRACK FOUR							
Run	STATION	Box	Car No.	Run	STATION	Box	Car No.	Run	STATION	Box	Car No.	Run	STATION	Box	Car No.	Run	STATION	Box	Car No.
1	AUSTIN TO OAK PARK	1		1		2		1	KELLY TO DES MOINES	3		1	OGDEN	4		1			
2	RIVER FOREST TO CORTLAND	5		2	SYCAMORE AND DE KALB	6		2	MARSHALLTOWN AND IOWA CENT	7		2	U. P. TRANSFER	8		2			
3	ELVA TO SPRING VALLEY	9		3	NACHUSA TO MALTA	10		3	CEDAR RAPIDS	11		3	SAN FRANCISCO	12		3			
4	TERRA COTTA TO WILLIAMS BAY	13		4	DIXON	14		4	CLINTON OIL	15		4	SACRAMENTO	16		4			
5	DUNDEE TO ALGONQUIN	17		5	STERLING	18		5	CLINTON TO LUZERNE	19		5	POCATELLO	20		5			
6	ELGIN	21		6	FULTON TO LIMESTONE	22		6	BOONE TO GLIDDEN	23		6	U. P. TRANSFER	24		6			
7	PECATONICA TO WAYNE	25		7	Tracy to Oakes, Pierre and Gettysburg	26		7	CHADRON TO CASPER AND BELLE FOURCHE	27		7	PORTLAND	28		7			
8	FREEPORT & RIDOTT	29		8	MASON CITY TO VESTA AND WALNUT GROVE	30		8	Fremont to Lincoln, Superior and Hastings	31		8	PORTLAND	32		8			
9	ROCKFORD	33		9	Belle Plaine to Hubbard, Buxton and Ames	34		9	Sioux City to Carnes and C., St. P., M. & O. Ry.	35		9	COLORADO	36		9			
10	BELVIDERE	37		10	Orange City to Esmond, Mitchell and Yankton	38		10	Carroll to Audubon, Harlan, Turin, Vail and Bronson	39		10		40		10			
11	BATAVIA	41		11	THOR TO ALTON AND MONTROSE	42		11	Denison to Crescent, Onawa, Kiron and Blencoe	43		11		44		11			
12	AURORA AND NO. AURORA	45		12	Tama to Woolstock and Auburn	46		12	BLAIR TO BORDEAUX	47		12		48		12			
13	GENEVA AND ST. CHARLES	49		13	Eagle Grove to Manyaska and Elmore, Inc. Gladbrook	50		13	OMAHA, VIA BLAIR	51		13	LYONS TO ANAMOSA	52		13			
14	WEST CHICAGO	53		14		54		14	COUNCIL BLUFFS	55		14	PEORIA	56		14			
15		57		15		58		15		59		15		60		15			
16	NO. CHICAGO & WAUKEGAN	61		16	WOODSTOCK TO HARVARD	62		16	OCONTO TO ATKINSON	63		16		64		16			
17	Jefferson Park to Shopiere	65		17	WIS. DIV. OIL CAR	66		17	OSHKOSH TO NEENAH	67		17	POWERS TO MICHIGAMME	68		17			
18	NO. EVANSTON TO ZION CITY	69		18	MINNEAPOLIS	70		18	APPLETON TO GREEN BAY	71		18	MILTON JCT. TO OAKFIELD	72		18			
19	KENOSHA	73		19	MINNEAPOLIS	74		19	MILWAUKEE	75		19	KIRKWOOD TO GALESVILLE	76		19			
20	RACINE JCT	77		20	ST. PAUL	78		20	MILWAUKEE	79		20	SPARTA TO LA CROSSE	80		20			
21	RACINE	81		21	ST. PAUL	82		21	MILWAUKEE	83		21	MADISON TO WOODMAN, LANCASTER AND GALENA	84		21			
22	DEERING TO EVANSTON	85		22	EAU CLAIRE TO ITASCA AND STILLWATER JUNCTION	86		22	MILW. NORTH	87		22	WINONA	88		22			
23	WINTHROP HARBOR TO SO. MILWAUKEE	89		23	DULUTH	90		23	MILW. WEST	91		23	WINONA TRANS.	92		23			
24	MINN. TRANS. G. N.	93		24	WEST SUPERIOR	94		24	SHEBOYGAN TO PLYMOUTH	95		24		96		24			
25	MINN. TRANS. G. N.	97		25	HUSTLER TO ALTOONA	98		25	LAKE SHORE JC. TO KIMBERLY	99		25	SUGAR BUSH TO MARSHFIELD	100		25			
26	MINN. TRANS.	101		26	JANESVILLE	102		26	FOND DU LAC	103		26	BIRNAMWOOD TO ASHLAND	104		26			
27	MINN. TRANS.	105		27	BELOIT	106		27		107		27	LARSEN, NEW LONDON and G. B. & W.	108		27			
28	MINN. TRANS.	109		28	CALEDONIA TO BARABOO	110		28		111		28		112		28			
29	MINN. TRANS.	113		29	HIGHWOOD & LAKE FOREST	114		29		115		29		116		29			
30	CUDAHY	117		30	HIGHLAND PARK	118													
31		121		31		122													
32		125																	

Fig. 5—Loading Plan; Wood Street Station; Chicago & North-Western.

he does not himself truck the freight into the cars as at State street, is responsible for its being in the right car and for its arrangement in the car. The weight of each piece in each car, taken generally from the waybill or as weighed when taken out of the foreign car, is recorded on a slip by a clerk in the office and the total tonnage unloaded from that car recorded to the credit of the gang which did the work. Instead of being paid by the hour, as at State street, the check clerks, callers and truckers are paid on a tonnage basis, the amount actually handled from each car being credited each to the checker and the caller and divided among the five truckers. There is a minimum day wage which is paid in case the tonnage payment falls below that amount, but this seldom happens. The system is said to have worked most satisfactorily both to the company and to the men. The same system has not been applied at any of the other freight houses because at all of them, freight is received by teams and by collusion between truckers and teamsters some men would be able to make large earnings on the tonnage basis by getting all the heavy freight to carry, while others would handle only light freight and would make correspondingly low wages. At Wood street the freight is trucked just as it

and during August all train tonnage was reckoned on the basis of 23 tons for each loaded car. This is on the basis of 17 tons for the weight of the car and six tons for the weight of the merchandise in the car. If during August the average recorded weight of all cars loaded for the road rose to over 47,000 lbs., 24 tons per car would be the working basis during September. Refrigerator cars are rated two tons heavier than the working figure, this amount extra being allowed for the weight of the tanks.

There are daily shipped west over the Chicago & North-Western from Wood street from 15,000 to 20,000 pieces of merchandise. A careful record shows that the mistakes in loading amount to at most one-tenth of 1 per cent., or about 15 out of the 15,000 to 20,000 pieces handled. This is quite remarkable in view of the fact that merchandise received at Wood street comes out of foreign cars indiscriminately instead of as at freight houses used by the public being delivered at the most convenient door by a teamster who knows the arrangement of the house and the destination of his goods and who keeps his shipments separate for loading.

At 5 p.m. the "boxes" are taken out of the loaded cars, the doors are closed and sealed and the cars are ready for the road.

The connecting line cars are closed at 6 p.m. In addition to the road cars loaded in the house, solid cars loaded on nearby team tracks go out of Wood street.

The Sixteenth street freight house and team tracks are about two miles east of Wood street between the Chicago, Burlington & Quincy main line tracks coming in from the west just before they turn north to run into the Union Station, and the Chicago Terminal Transfer Co.'s tracks used by the Baltimore & Ohio, Pere Marquette and Chicago Great Western. The Chicago & North-Western owns five tracks directly north of the Burlington's eight tracks. Two of these, crossing the Burlington and the Pittsburg, Fort Wayne & Chicago, run on east to the river, where from 40 to 50 cars of sand and gravel are handled daily. At Sixteenth street is the eastern terminus of the St. Charles Air Line previously mentioned. From here it runs east about a mile to a connection with the Illinois Central yards.

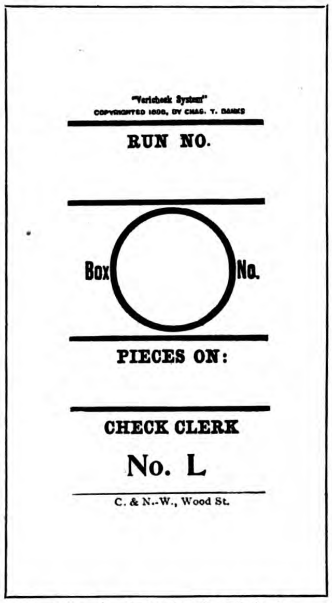

Fig. 6—Trucker's Ticket.

Not more than three tons a day of l. c. l. freight is received at Sixteenth street, but the "out" freight house has a capacity of 60 cars—30 on three tracks inside the house and 30 on three tracks outside. Much l. c. l. freight from those railroads which are most conveniently situated in relation to Sixteenth street comes here by teams for loading to points on the North-Western Line. These are principally the Atchison, Topeka & Santa Fe, Chicago & Eastern Illinois, Chicago, Indianapolis & Louisville (Monon), Erie, Grand Trunk, Wabash and Wisconsin Central, and in some cases the Lake Shore & Michigan Southern and Michigan Central. All of these roads interchange mixed car loads for the C. & N.-W. at Wood street. A considerable amount of freight is also received at Sixteenth street by teams from the public.

An average of 40 cars a day are loaded for all three divisions, the Galena division cars being closed at 4 p.m., the Milwaukee division at 4.30, and the Wisconsin division cars at 6 p.m. When there is not enough freight to fill a road car at Sixteenth street, the partly filled car is sent on to Wood street, where it is consolidated with a Wood street car for the same destination.

(To be continued.)

Railway Construction in North China.*

BY E. H. RIGBY AND W. O. LEITCH, JR., RESIDENT ENGINEERS.

The first standard-gage (4 ft. 8½ in.) railroad in China, the original section of the system now known as the Imperial Railways of North China, was built in 1880-1881, and connects the Tongshan collieries with the head of the Lutai canal, seven miles distant. An account of the great difficulties met with in the construction of this line and in its subsequent extension to Tientsin in 1888, has already been published. So successful was this work that the Chinese Government decided to extend the line westward from the original starting point; this extension was proceeded with after many unavoidable delays, chiefly due to the opposition of the people, who drove back the first survey party in 1888, and delayed the work for years.

The rails reached the Ma Chia Pu terminus, outside Peking, in 1897. In 1899 an electric tramway was laid to the South gate. From a point near Peking the railroad to Pao Ting Fu was next constructed; this line was opened in 1899. A new city station was subsequently opened in Peking, at the Chien-Men, and a branch line eastwards to Tungchou was constructed in 1901.

Eastwards from Tongshan the railroad was gradually pushed on to Shan Hai Kuan, where the Great Wall of China meets the sea, and almost on the boundary between Chihli and Manchuria. The extension was opened to Kuyeh in 1890, to Lanchou in 1892, and to Shan Hai Kuan in 1893. At Lanchou is the largest, although not the longest, bridge on the system; it consists of five spans of 200 ft., ten spans of 100 ft., and two spans of 30 ft. This bridge was opened on Feb. 27, 1894. It was intended at that time to prolong the line to Chinchou, Mukden and Kirin, and surveys were made. A considerable amount of earthwork was done as far as Ta Ling Ho, but want of funds seriously hampered the work, and the war between China and Japan, declared on Aug. 1, 1894, not only stopped operations but swallowed up the funds and completely altered the whole political situation in North China. By 1896 the rails had been laid only to Chung Ho So, 40 miles from Shan Hai Kuan. To enable progress to be made, it was necessary to put the funds on a firmer basis, and in 1898 a preliminary agreement was made to raise a loan in London for the purpose of extending the line to Hsin Min Tun and Yingkow (Newchwang) with a branch to Nan Piao, where there is a good coal field. The Russian Government strongly objected to this, and a long diplomatic battle ensued, one result of which was an important alteration in the original agreement, to the effect that the new lines were not to be mortgaged to meet the services of the loan, and finally, on Oct. 10, 1898, an agreement was arrived at between the Administrator-General of Railways and the Hong Kong and Shanghai Banking Corporation, to raise a loan of £2,300,000 for the purpose of executing certain works on the old line, paying off former loans, and extending the railroad as already described, the total length of the extension, east of Chung Ho So, being 270 miles.

The work has been completed within the estimate, and in this paper the authors propose to describe the Chinchou-Yingkow section, 97 miles in length, commencing one-half mile east of Chinchou; and to supplement the general information given in the two papers already referred to. The line as far as Chinchou was opened for traffic in October, 1899.

Chinchou-Yingkow Section.

The survey for the Chinchou-Yingkow section was completed in April, 1899, and the laying of the rails was finished in December of the same year. Deviations were made round bridges, and as little work as possible was done in advance of the track-laying, in order to get the benefit of rail transport. By the spring of 1900, all the bridge foundations except those of Ta Ling and Shuang Tai Tzu bridges were finished, a wharf was built at Yingkow, the stations and buildings were well advanced, and the plant and material necessary to complete the work were on the ground, when the Boxer outbreak completely upset all arrangements. The head office was burned to the ground, the Director-General was killed, and the other directors had to flee for their lives; 130 miles length of the line from Peking to the East of Tangku was rooted up, the buildings were demolished, and the Engineer-in-Chief and his staff were besieged in Tientsin. Although the railroad from Chinchou to Yingkow was not much damaged, the whole country was in violent disorder. The foreign staff made their escape to Newchwang, and the railroad was taken over by the local military authorities, who destroyed a part of the temporary bridge at Shuang Tai Tzu as a military precaution and held the line till October, 1900, when it was taken by the Russian military authorities. In order to keep open their lines of communication, the Russians repaired the railroad, ferried locomotives across the river, and reopened traffic with a trans-shipment at Shuang Tai Tzu in April, 1901. By the month of August the Shuang Tai Tzu temporary bridge was rebuilt by the Russian military engineers, and trains were run through again. Several bridge-tops were permanently finished, and buildings were erected to accommodate the troops, but nothing was done to the permanent work of the bridges at Ta Ling Ho and Shung Tai Tzu, or to the ballasting, etc., as the object was simply to keep the trains running, pending developments. Besides the Chinchou-Yingkow section, the Russians held the line as far as Shan Hai Kuan, and also the construction-stores and bridge-wor' s at that place. After protracted negotiations, the line was returned to the Chinese Government on Oct. 10, 1902, and immediately afterwards the engineering staff resumed control, but little could be done during the winter season, and it was not until the spring of 1903 that the necessary materials were obtained and operations were again commenced. After another interruption, due to severe floods, the rails were finally laid to Hsin Min Tun, in the autumn of 1903. Pending the opening-up of the coal field, the Nan Piao branch, 30 miles in length, has not yet been constructed.

Excluding the Pao Ting Fu line, the total length of the railroad and extensions is 588 miles. The total expenditure on the lines, when completed, will have been about £3,850,000.

The Peking line, 78 miles in length, was originally a double line and cost £10,000 per mile, but after the Boxer outbreak it was relaid as a single line, and the remaining rails and girders were used for the Tungchou extension, 20 miles in length, and for relaying the Tangku-Tientsin section, in order to have 85-lb. rails right through from Tangku to Peking, the Tangku-Tientsin section originally having only 70-lb. rails.

General Description of Route.—Chinchou, the starting-point of the section to be described, is a walled city near the northwest corner of the Gulf of Liao Tung. From Chinchou to Ta Ling Ho, 15½ miles, the route lies among hills; from Ta Ling Ho to Kou Pang Tzu, 25 miles, along the plain at the foot of the hills; and from Kou Pang Tzu to Yingkow, 57 miles, across the flat alluvial

*Extract from a paper read before the Institution of Civil Engineers.