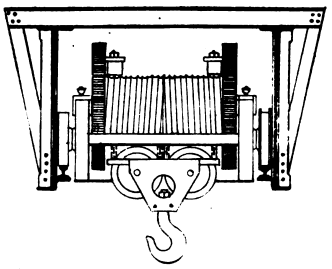
The object in making one loose on the shaft is to allow for any slight play, and thus prevent straining. The cut shows the vertical lateral stiffening and drums, with hoisting blocks, other details omitted.

The hoisting block has two sheaves, as shown in the cut. The chains are in two parts, each wound on separate parts of the drum; the winding running toward the middle, so there is no tendency to side pull either way, so the object lifted rises in a truly vertical line, a very important consideration in foundry work. The capacity of the hoisting trolleys is 100,000 lbs. each, but it is not expected that the higher speeds will be used with any loads near the full capacity. On the "far trolley," so called, is a separate drum and hoisting chain operated by a 5-H. P. Wenstrom motor, series wound, variable speed, fed by a cable that hangs in festoons on the side of the bridge, as may be seen in the picture. This auxiliary drum is very useful in handling lighter weights when the large drums are engaged.

The arrangement for moving the crane, as a whole, is operated by the 40-H. P. motors, and is located on the far side of the bridge as shown in the picture. This arrangement has two speeds, by which the crane may be traversed at 100 or 200 ft. per minute. On the operator's platforms are nine levers; six of these are for the hoisting trolleys, *i. e.*, two for hoisting or lowering; two for traversing and two for change of speed; the three remaining levers are for stop, start and change of speed of traverse of the whole crane. The above levers are, as far as possible arranged to move in the direction of the motion intended to be produced; so the first impulse of the operator's mind is in the right direc-



tion. The rheostat and switches are placed in a box a the side of the bridge.

Special remark should be made on the clutches in use on these cranes. The ordinary form of conical clutch consists of a conical piece, usually with a wood face, running in a metal flange of a corresponding shape, so that when pressed together, friction on the conical surface holds them. In cranes with even as slow a motion as five feet per minute a very gentle start or stop is frequently of great importance. To accomplish this it is necessary to let the clutches slide a little before taking a firm hold, the pressure uniformly increasing until a firm hold is secured, as is done in the case of a cable car grip. It has been found that with a conical clutch the heat developed by the friction of first pressure and sliding caused the outer metal part to expand to an increased diameter, thus again loosening the clutch. This either checked the increasing speed of motion or even allowed a backward movement, that in handling delicate sand molds might result in serious consequences. This necessitated the designing of a clutch in which a change of shape within reasonable limits would not affect its holding power whether the parts were firmly bound and moving together, or whether one part produced a constantly accelerating or retarding effect on the other. This result has been very successfully secured.

Car Service—Per Diem and Mileage.

A meeting of the Committee on Car Service of the American Railway Association was held at the Iroquois Hotel, Buffalo, on Thursday, Jan. 21, the following members being present:

Mr. Theo. Voorhees, General Superintendent, N. Y. C. & H. R. R. R., Chairman; Mr. S. M. Prevost, General Superintendent Transportation, P. R. R.; Mr. H. F. Royce, General Superintendent, C. R. I. & P. Ry.; Mr. W. H. Canniff, General Superintendent, L. S. & M. S. R. R.; Mr. C. H. Hudson, General Manager, E. T. V. & G. Ry.; Mr. W. G. Collins, General Superintendent, C. M. & St. P. Ry.; Mr. F. Huger, General Superintendent Transportation, representing Mr. J. H. Sands, Vice-President and General Manager, N. & W. R. R.

The Per Diem Committee of the International Car Accountants' Association held a meeting at Buffalo on the previous day and joined with the Committee of the American Railway Association in a general discussion of the "per diem" question on the 21st. There being present from the Car Accountants' Committee the following gentlemen: G. S. Russell, C. A., B. C. R. & N. R. R., Chairman; H. Sleight, C. A., Vandalia Line; A. Hale, C. C., Car Record Office, P. R. R.; F. E. Higbie, G. C. Agt., C. R. R. of N. J.; Asa P. Blakeslee, G. C. Agt., Lehigh Valley R. Ry.; W. W. Wheatley, C. A. West Shore R. R.; W. W. Halsey, W. N. Y. & P. R. R; T. F. Brennen, G. C. Agt., B. R. & P. Ry.; H. R. Payne, Secy., Union Tank Line.

A full and free discussion of the present situation in regard to the settlement of car service was held and it developed a marked unanimity of opinion on the part of all those present in favor of adopting the mixed mileage and per diem plan, which had heretofore been recommended by the Committee of the American Railway Association, with some slight modifications.

Mr. C. H. Hudson, General Manager of the E. T., V. & G. Ry., some time since, in a communication addressed to the General Time Convention, had pointed out the difficulty in the way of the adoption of the "per diem" plan as then recommended by the committee. The average mileage per car per day on all roads in the United States, according to the best information that is to be obtained, is now about 24 miles. At the existing mileage rate of three-quarters of a cent per mile this produces an expense of 18 cents per day. Mr. Hudson argued that it would not be feasible for the railroads who were borrowers of equipment to go into any "per diem plan, unless they could see that their average expense would not in any way be increased by so doing. In order to accomplish this, it becomes necessary to reduce the "per diem" to six cents per day, the mileage rate being reduced to one-half cent per mile. At those figures, the mixed plan will not involve any increased expense and will, no doubt, be more acceptable to a large number of roads.

These views originally presented by Mr. Hudson were fully discussed by the meeting in Buffalo and resulted in a general agreement of opinion on the part of those present, that the rates as suggested above would be equitable and should be recommended to the American Railway Association.

Another opinion that has heretofore been a stumbling block in the way of the general adoption of the mixed plan of car service was the question of co-operative line cars. It is customary for very many roads west of Chicago and St. Louis to receive large numbers of line cars during the greater part of the year and hold them in anticipation of shipments eastbound. The payment of "per diem" on such cars would be very burdensome and expensive, and this has stood in the way of the adoption of this plan by many roads so situated. After full and careful consideration of this point, the meeting concluded that it would be better to recommend that all such cars should not be subject to "per diem," but that settlement for them should be continued on a mileage basis.

The steadily increasing number of private cars and cars owned by firms or companies, other than railroad companies, was the subject of careful consideration. At present, as is well known, there are very many lines of cars in service running over different railroads in the country, on which the mileage at the present rate of three-quarters of a cent per mile is equivalent to a return on the investment of from 35 to 50 per cent. per annum. Such large profits for the use of cars have stimulated their production in a marked degree. Firms and companies controlling any considerable volume of freight find it for their interest to own the cars in which their business is carried and by so doing are, in very many cases, enabled not only to dictate to the railroad companies the rate of freight they are willing to pay, but also the rate of mileage they must have for their equipment. It has resulted not only that cars for the movement of live stock, dressed beef, and other freight requiring cars of special construction, are now wholly owned by individuals or private companies; but also a large number of such cars are being used by railroad companies for coal, coke and other coarse commodities. To such an extent is this now being carried that cars are being paid for by railroad companies in very many directions, when the cars owned by the companies which would be perfectly fit and suitable for carrying the business, have to stand on sidings. The Committee came to the conclusion that the only way to check this growing evil would be by a reduction of the mileage earnings on such cars, and after full discussion they came to the unanimous opinion that they would recommend to the American Railway Association that the mileage on all cars owned by individuals, firms and private companies, and also on co-operative line cars, should be reduced to one-half cent per mile, and that no *per diem* be allowed on any such cars. It may be urged that very many railroad companies have made long time contracts with individuals and special shippers in regard to mileage to be paid for the use of their equipment. Granted that this may be true, there is still no reason why the railroad companies, as a whole, should not agree and unite upon a general reduction in the mileage rate for such cars. It is certainly only by some such action that the present tendency on the part of shippers to insist upon the use of their own cars can be checked.

The above represents the main points of the discussion, after which the special committee of the American Railway Association held an executive meeting and agreed upon a form of report, which will be published and distributed to all railroad companies within the next few days. It was agreed by all that the present was a favorable time for the consideration of this question. There has probably not been in many years so great a demand for cars as existed during the past fall and the indications are that the railroad companies will have all they can possibly do with the existing equipment for months to come.

The general spread of the system of car service associations at junction points and the application of car service rules at local stations on so many roads, it was reported on all sides, had produced most beneficial results. Cars have never been unloaded so promptly as during the past year and many roads reported considerable economy in switching and yard service as one of the results of the enforcement of these rules. At the same time, the complaint is general that as yet nothing has been accomplished by the railroad companies, either individually or as a whole, to prevent the misuse and diversion of foreign cars. Car service rules, when properly enforced, will release the loaded car without delay, but at present there is no incentive to any transportation man to expedite the return home of the empty foreign car.

It was the belief generally expressed by those at the Buffalo meeting that the operation of the "per diem" plan would be a long step toward the removal of this particular abuse. Even so small a sum as six cents per day, when multiplied by the large number of foreign road cars in use on almost all lines, would prove a very considerable incentive toward the establishment of such methods in the routine handling of empty cars as would bring about a prompt return in the proper direction of all foreign equipment.

The meeting was of the opinion that it would be desirable to bring about a general adoption of this mixed plan with the opening of the next fiscal year, July 1, 1892, and to enter into an agreement among all companies to try this method of settlement of car service balances for twelve months. It was suggested that it was not necessary that all roads in the United States should agree to this. Very many roads might be willing to try this experiment, provided the roads with which they have immediate connection or with which they had the greatest volume of interchange should agree to do likewise. It is proposed, therefore, by the Buffalo meeting to ask the managers of the various roads, first, whether they will be willing to adopt and try the "per diem" plan for one year from July 1 next, if all roads agree, and, second, if they will be willing to do so if certain of their connections would agree, and asking each road to name those of their connections with which they would be the most interested. It is hoped that the responses to this circular will be prompt and general, so that the matter may be fully condensed and put in proper form to be submitted to the coming meeting of the American Railway Association.

There were several minor points discussed at the meeting in regard to proper application of these rules, but the above is a summary of the more important action taken.

The Stewart Avenue (Chicago) Interlocking.

In our issue of April 24, 1891, appeared a plan of the very complicated system of railroad crossings in Chicago known as the Stewart avenue, the Canal and Sixteenth street and St. Charles Air Line crossings. There, within an area included in a circle with a radius of less than 1,500 ft. is one of the busiest and most complicated networks of railroad crossings in the world. The best method of dealing with this locality has been under consideration for a long time, and it is now proposed to operate the crossings by three interlocking towers, with the necessary signals and other safety equipment. The contract for the Stewart avenue crossing was recently let to the Union Switch & Signal Co., and we show a plan of the tracks and arrangement of signals for that situation. The following description of the plant is contained in a letter written to us by Mr. George H. Paine, General Agent of the Union Switch & Signal Co., and as we cannot easily improve upon his description we shall not attempt to paraphrase it. The machine which he mentions is, it will be understood, the Westinghouse electro-pneumatic apparatus, which has often been described in our columns.

There are 84 signals on the plan, 37 single switches, 22 double slips, 22 movable frogs, all of them worked from a machine having 48 working levers and six spare spaces. If the attempt were made to do this work with a mechanical machine it would require, according to American practice, a machine of 187 working levers, which would occupy a floor space in the tower of 14×77 ft. If a mechanical machine of the English pattern, worked out according to their ideas, were used, there would be 213 working levers in it, which would require a floor space of 17×93 ft. There is no practicable place on the ground for putting a tower of that size. The pneumatic tower will be only 34×12 ft., which gives a large amount of extra room, as the machine will occupy a floor space of only 24×5 ft. There are on the plan 197 signaled routes, and in addition to the routes which are signalled there are 103 for which there are no signals, but which are possible. There will be nearly 10,000 ft. of detector bars required, which, according to the best of my knowledge, is the largest amount ever worked from any one machine.

It will, I believe, be understood that great care has been used in designing this work, which has to a large extent been done by Messrs. Corthell and Wallace, of Chicago. The plan is the outcome of several years work by the most competent men on the different railroads concerned, and it is hoped and believed that it will to a large extent simplify and make more safe the operation of this most difficult system of tracks. I would like to

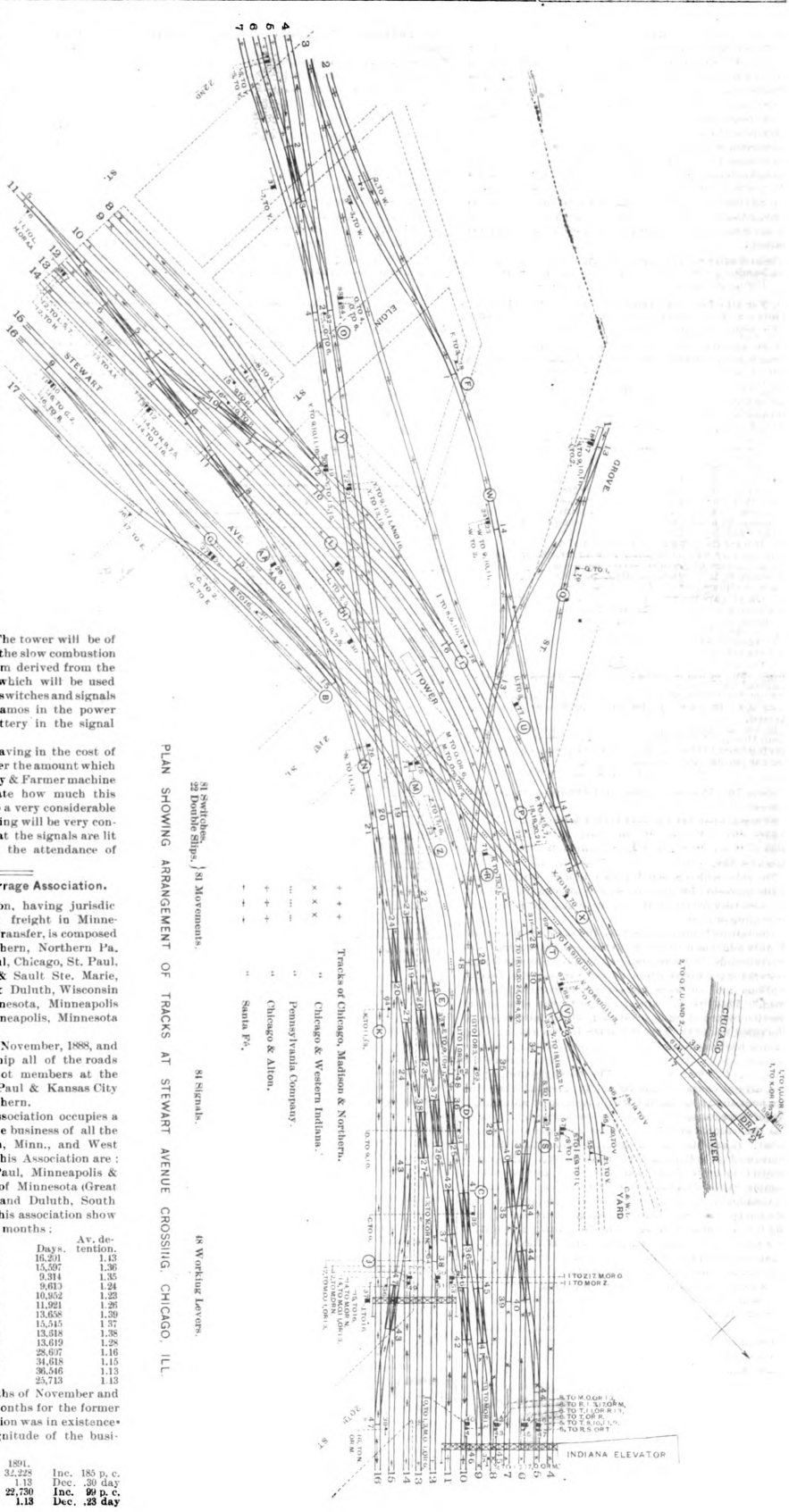
give you an idea of the number of trains using this crossing and adjacent switches in the course of 24 hours, but am sorry to say that the figures are not available.

At the Chicago River, where the Pittsburgh, Ft. Wayne & Chicago crosses, the compressed air and the electric cable will be run under the river, very much as was done at the large plant put in for the Chicago & Northern Pacific.

The large letters shown on this plan are for the purpose of more plainly indicating the routes to trainmen, and will probably be used on the plan when the instructions for the operation of the plant are issued.

All the power for the plant will be derived from two 75-H.P. boilers, situated between Elgin and 22d streets. The power house will be 35 × 62 ft., with a brick stack 65 ft. high. It will contain besides the boilers two 25-H.P. Westinghouse engines for the operation of two 125-light dynamos of 110 volts potential and two 14 × 16 air compressors. The main air pipe will be 3 in. in diameter and will be, together with the wires, buried underground. Each signal will be illuminated by a 16 candle-power electric light and the tower and power house will also be lit by electricity. Each of the main tracks will have a track circuit annunciator, and wherever necessary on side tracks a push button annunciator with recording dials in the tower. The dispatcher will be on a raised platform in a bay window and in such a position that he can see to all parts of the system. The tower will be of brick, with a slate roof, and built on the slow combustion principle, and will be heated by steam derived from the power house. The electric current which will be used for controlling the movement of the switches and signals will be taken directly from the dynamos in the power house and pass through a storage battery in the signal cabin.

There will be a very considerable saving in the cost of operating the pneumatic machine over the amount which would be required to operate a Saxby & Farmer machine of 187 levers. It is impossible to state how much this will be, but it is known to amount to a very considerable sum, and in the present case the saving will be very considerably increased from the fact that the signals are lit by electricity and will not require the attendance of lamp men.



PLAN SHOWING ARRANGEMENT OF TRACKS AT STEWART AVENUE CROSSING, CHICAGO, ILL.

The St. Paul-Minneapolis Demurrage Association.

The Terminal Dispatch Association, having jurisdiction over the movement of bulk freight in Minneapolis, St. Paul and the Minnesota Transfer, is composed of the following roads: Great Northern, Northern Pacific, Chicago, Milwaukee & St. Paul, Chicago, St. Paul, Minneapolis & Omaha, M., St. P. & Sault Ste. Marie, Minneapolis & St. Louis, St. Paul & Duluth, Wisconsin Central, Eastern Railway of Minnesota, Minneapolis Eastern, Railway Transfer of Minneapolis, Minnesota Transfer Railway.

This Association was formed in November, 1888, and originally embraced in its membership all of the roads of that section. Two roads are not members at the present time, viz., the Chicago, St. Paul & Kansas City and the Chicago, Burlington & Northern.

The Lake Superior Car Service Association occupies a similar position with relation to the business of all the roads having terminals at Duluth, Minn., and West Superior, Wis. The roads forming this Association are: St. Paul & Duluth, Chicago, St. Paul, Minneapolis & Omaha, Northern Pacific, Eastern of Minnesota (Great Northern), Duluth & Iron Range and Duluth, South Shore & Atlantic. The records of this association show the following results for the past 14 months:

Total.	Cars.	Days.	Av. detention.
November, 1890	11,302	16,201	1.43
December, 1890	11,392	15,597	1.36
January, 1891	6,928	9,314	1.35
February, 1891	7,781	9,613	1.24
March, 1891	8,917	10,952	1.23
April, 1891	9,468	11,921	1.26
May, 1891	9,864	13,658	1.39
June, 1891	11,308	15,545	1.37
July, 1891	9,689	13,518	1.38
August, 1891	10,639	13,619	1.28
September, 1891	24,599	28,677	1.16
October, 1891	30,126	34,618	1.15
November, 1891	32,228	36,546	1.13
December, 1891	22,730	25,713	1.13

Comparison is limited to the months of November and December of 1890 and 1891, those months for the former year being the first that the association was in existence. The following figures show the magnitude of the business and some of the results:

	1890.	1891.	
Total cars, November	11,302	32,228	Inc. 185 p. c.
Average detention, November	1.43	1.13	Dec. .30 day
Total cars, December	11,392	22,730	Inc. 99 p. c.
Average detention, December	1.36	1.13	Dec. .23 day