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EDITORIAL NOTICE

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Contents of this Issue

Reorganization of Rapid Transit Commission Proposed

The agitation for a reorganization of the Rapid Transit Commission has been revived, and it is now confidently asserted that special legislation will be enacted next winter for this purpose. Only a rash man would attempt to predict at this distance what is to happen when the snow flies, yet the friends of the commission admit that there is a strong probability of a reorganization of the board on an entirely different basis from that upon which it was originally founded. The chief objection that has been raised against the organization is the fact that it is a self-perpetuating body, and, as such, is out of touch with the spirit of American institutions. It is proposed to make the tenure of office for the commissioners six years, which, it is said, meets the ideas of the present commission. The bill, if introduced, doubtless will give the Mayor the appointing of a full board of six regular members, and will provide that the terms of the commissioners to be appointed by him shall terminate in two, four and six years. This, it is explained, will make it possible to make changes in the board from time to time, and thus, the advocates of the measure point out, any unwise general policy could not be continued for an indefinite length of time.

The Cleveland Situation

It looks just now as if the 3-cent fare plans of Tom Johnson and his colleagues in Cleveland were knocked in a cocked-hat. Mayor Johnson and his followers have been engaged in the setting up of the pins for their game during the last few years, and they had everything arranged for an impressive climax, when to their amazement they found themselves pronounced intruders and usurpers and unceremoniously hustled out of office. The whole trouble developed as a result of the inability of the Supreme Court of Ohio to see things in the same light as the reformers, who have been in control of the Cleveland city government for some time. The present municipal organization is pronounced unconstitutional by the highest tribunal in the State, and the Attorney-General has instituted proceedings to oust the incumbents from office. In the meantime they have been enjoind from granting any franchises or enacting any legislation excepting as may be absolutely necessary for the continuance of the city government.

The Brooklyn Tunnel Contract

The opening of the bids by the Rapid Transit Commissioners of New York, on July 21, to construct a tunnel under the East River from the City Hall, Manhattan, to the foot of Atlantic Avenue, Brooklyn, was marked by one incident which calls for more than passing notice. This was the attempt made by President Swanstrom, of the Borough of Brooklyn, to prejudice the chances of the award of the contract to the Brooklyn Rapid Transit Company, by charging that company with bad faith in all of its previous dealings with that city. The letter from President Swanstrom, which was couched in the strongest and most intemperate language, when analyzed was found to consist of only two definite instances of what the president chooses to term a disregard by the company of its statutory obligations. One of these was that it refused to keep in repair, in certain streets, the street pavements between its tracks and for 2 ft. outside thereof, as required by its contract with the city; the other was that it had refused to remove its tracks from certain streets, as demanded by the municipality. These charges were in part denied and in part explained by the counsel of the company present, who stated that the contract for paving with the city was made when horse traction was in use, and was for cobblestone pavements, and that the company had always been ready to lay the pavement required from them by law or contribute the cost of such pavement to the expense of laying granite blocks, if such pavement was preferred by the city. This seems certainly a fair ground to take, for it is hardly reasonable to ask a company when its cars and motive power do not wear the pavement to go to greater expense than required by its contract, when they did. The defense of the company for not removing its tracks was not made public at the meeting, but President Swanstrom's position in the paving question, which formed the greater part of his letter, was so absurd that it is only reasonable to assume that his complaint in regard to the second matter was equally unfounded in justice. Independently, however, of the equity of the position taken by the Brooklyn Rapid Transit Company in these points, and independently also of the relative advantages to the city at large of the bids of the Belmont syndicate and the Brooklyn company for the construction of the tunnel, the Borough of Brooklyn would be best served, in our opinion, by the granting of the best possible facilities for the admission of the cars of the Brooklyn Rapid Transit Company into lower New York. This section of the Greater City is to Brooklyn what the business district of any city is to its residential sections, yet the incident which we have just related shows the chief executive of the borough doing all he can to defeat the through passage, and for one fare, of a large part of his constituents to their places of business. The outcome of the contest for the East River tunnel contract has yet to be announced, and undoubtedly the inducements offered by both bidders will receive due weight; nevertheless, the animus shown by the official representative of the borough most largely interested will hardly be relished, we think, by the residents of Brooklyn.

The Rapid Transit Commission is certainly confronted with a very serious problem in the matter of awarding the contract for the Brooklyn tunnel. We believe that altogether too much weight has been given to the financial question, as it is not by any means the most important consideration. At the present time the demand for additional transportation facilities comes principally from the people of Brooklyn doing business in Manhattan, and the requirements of this large and important class can only be met by affording direct communication between the downtown business district of New York and all parts of Brooklyn. When the subway system is completed it is expected that all sections of the greater city will be within easy access, and for this reason pressure is brought to bear upon the commission to make the proposed tunnel a part of the subway system at once and place it under the same management. The Rapid Transit Commission will be called upon to weigh carefully the claims submitted, and reach a decision that will conserve the best interests of the entire community.

The Pennsylvania Franchise Defeated.

The action of the New York Board of Aldermen upon the Pennsylvania Railroad tunnel franchise is discouraging, but it is in keeping with the record of that body. It had been hoped that the board would recognize the fair and generous attitude of the Pennsylvania company in its dealings with the Rapid Transit Commission, but the immediate compliance of the railroad company with demands that were generally considered prohibitive, has simply encouraged the aldermen to make a raid upon the corporation. The compensation provided for in the tunnel contract exceeded that paid by any corporation in the country for municipal privileges of any kind, yet the franchise imposed no burden upon the city or property owners; gave the company no rights which would burden the streets or present obstacles to traffic, in fact, took nothing from the city, but on the contrary provided for service that would be of great and lasting benefit.

The effect of the proposed improvement was noticeable upon the values of real estate in the locality of the terminals, even before the plans were perfected, yet in spite of this recognition of the value of the work to the city the aldermen rejected the plan and increased their demand. President Fornes' advice during the discussion should have been followed by his associates. He cautioned them not to be too eager. It should not be a question of how much could be gotten out of the corporation, he said, but how much ought to be asked; not a case of extortion, but of fair dealing. The aldermen were deaf to all such appeals, however, and only denounced those who made them as tools of the corporation.

The experience of the Pennsylvania company will not encourage corporations seeking privileges to be frank and generous when dealing with the New York municipality in the future, and the city is bound to feel the effects of this policy; moreover, it will doubtless result in great financial loss to the city, as well as inconvenience and delay in securing the transportation facilities which the business interests so much desired, and which it was the aim of this franchise to assist in securing.

The Drift of Railway Practice

In nothing more than in the character of the power plant does electric railroading show the change that a decade of experience has brought. The older plants with their small dynamos and mazes of shafting have been either reconstructed or abandoned, and the modern electric railway power station is, as a rule, of the highest order of efficiency as regards the nature of its equipment. When well operated, it delivers power at a price which only the best cotton mill practice can compete with. Yet we are bound to admit that the general run of electric railway power stations of moderate size are not economically successful. The cause is not hard to find. Setting aside the natural disadvantages of small plants in the matter of operating costs, one finds in these electric railway installations, first, a bad load factor, and, secondly, injudicious choice of units as regards capacity. Now, when only a small number of cars are operated it is a difficult matter to get a good load factor, and yet by a little tact on the part of the management much more can be done than would at first sight seem possible. The one most fruitful cause of trouble is simultaneous starting or grade climbing by a considerable proportion of the cars. The ordinary conditions of service prevent complete elimination of the first difficulty, although it may be ameliorated by watchfulness at the trying times when unusual crowds must be taken care of. But simultaneous grade climbing is another matter, and a little attention to schedules may result, not only in greatly improving the load factor of the system, but in actually relieving the maximum peak, so as to obviate the necessity of additional investment in apparatus.

We have in mind one plant in particular in which a great improvement was made by the good sense of the management in fixing the schedules. The city in which it operated had a public square which lay, as it were, at the bottom of a shallow bowl. Into this three diverging car lines ran and made connections. Out of it they climbed simultaneously, while the ammeter needle at the station made frenzied efforts to kick off the stop at the end of the scale. When the cars came into the bowl, on the other hand, the load was extremely light, unless the outgoing cars made unusual demands on the station. The result was not only a singularly bad load factor, but a villainously severe peak recurring every quarter of an hour, and during the evening hours of heavy load overtaxing the capacity of the generators. Finally the manager grew weary of the situation and readjusted the time table so that the cars entered and left the square successively at intervals long enough to allow one to clear the grade as another entered it. The relief was, of course, great and immediate. The periodical peak vanished and the maximum daily demand for current was diminished nearly 25 per cent. It might at first be supposed that the failure of the cars to meet at the inward end of the lines would have caused some inconvenience to the public, but as a matter of fact it worked both ways, for while some passengers who would have liked close connections, could not get them, others were glad to get five minutes or so for brief errands, and on the whole the plan worked admirably. The same sort of thing has been tried in divers places, with similar results, and it certainly enables a very important improvement to be made in the conditions of the power station.

But still other plants of moderate size suffer from what one may call "swelled head." That is the station is laid out by optimistic gentlemen, who, mindful of the chronic state of insufficiency which characterizes many urban systems, make what they are pleased to call "provision for future growth." This phrase too often implies units suited to a plant much larger than will be needed for some years to come. Provision for the future should assuredly be made, in opportunity for additional units and additions to the station itself. These imply only a small additional fixed charge, which is but a trifling burden. A direct-coupled unit, however, of twice the size that is necessary for present necessities is a constant drain on the exchequer, and will lose enough money before it is really needed for the load to buy a better machine. We do not advocate an eye merely to present necessities, but we do maintain that Squeedunk Court House does not need a station laid out on metropolitan lines, that a plant with units of capacities that can be fully utilized, and in which the load factor can be kept high will turn out power cheaper than a station of ever so imposing equipment kept in a normal state of quarter load. There are times when it is well to pull in one's horns and look at the future without roseate spectacles. It is a fact that many small electric roads do not pay at all, or pay very poorly, and we think that in not a few cases this result can be traced to over confidence in the future, leading to capital charges that are far too severe for the probable receipts. It must be remembered that the history of the art shows that roads are generally re-equipped, not from the wearing out of the old apparatus and tracks, but from its being superseded by better equipment. One cannot proudly fold his arms and congratulate himself that he has built as he would build a granite dam, for a century to come. In less than ten years he will probably re-equip the system, and hence it is good policy to keep on the alert and ahead of actual requirements, but not to construct things which must be rejected before the future for which they were built can possibly arrive.

The Eternal Transfer Question

What the average man does not know about the practical operation of street railways would fill a book as big as any unabridged dictionary, and several long chapters would have to be occupied by a rehearsal of his ignorance on the subject of free transfers. City councils would furnish copy for at least one additional chapter on the same subject. A popular opinion seems to be that street railway companies carefully select the combination routes over which no passenger wishes to ride and solemnly grant transfers over them, reserving all routes in actual use for the payment of double fares.

We earnestly wish that some experienced traffic manager would write up for the benefit of the public the situation as it actually presents itself, for only detailed reference to concrete cases can adequately present the subject, but there are at least a few simple and general considerations which can be laid down without entering into the troublesome features of any particular case.

As a rule we believe, as the result of somewhat extended observation, that most street railway companies aim at giving the passenger free transfers over their lines to complete his ride in any one given direction. We do not propose to discuss here the justice of this policy except to say that there need be no reason other than that of expediency for giving transfers at any junction. There is nothing in the payment of a 5-cent fare which gives the passenger an inherent right to be transferred to another car of the same or a different company. Nevertheless so many companies have adopted the practice that it has become an almost integral part of the American one-fare system, as distinguished from the foreign arrangement of graded fares, running from 1 cent or 2 cents up, according to distance. The difficulty comes in its application in such wise as to suit best the convenience of the traveling public.

Obviously it is unfair to ask a street railway company to give a passenger a return check for a single fare, and the same consideration makes it unreasonable to require free transfers to lines which virtually constitute a return route. A transfer from the Broadway to the Third Avenue line, at the post office, enabling a passenger to go up town again, would be manifestly absurd. The same condition is true for lines sufficiently convergent to form a closed route by a comparatively short walk at one end of the ride. Almost any old street railway man can call to mind instances of extraordinary ingenuity in beating the road by its own transfer system, and in most cities there exist practically closed transfer routes, which cannot be avoided save by denying a transfer when it really ought to be given. The aggregate amount of loss to the company is usually small, for the number of dead-beats is limited, but now and then routes which ought to be free transfer routes are kept as double fare routes for fear of dead-beats. A company certainly has a right thus to defend itself if it really incurs the risk of material loss, but a little shrewdness will oftentimes avert the difficulty.

Another class of cases in which street railways are frequently justified in refusing free transfers are those in which two routes are open between certain points, of which one is congested. For instance, two suburbs are connected by a car line, and also have lines meeting at some common point in the city. In such case it is distinctly for the benefit of the public that passengers should not be encouraged to use the crowded city lines as a route from suburb to suburb. If there is a single fare from suburb to suburb by a practicable route it is all that can reasonably be asked, particularly if free transfers are given for limited distances along the main lines from the cross line. Each locality has questions of its own as to details, but the general principle that of two possible free transfer routes the one should be chosen that will least inconvenience the majority of the traveling public is thoroughly sound.

A similar principle holds for lines like the crosstown lines in this city. The imperative need of the great mass of the public is good accommodation up and down town and a system of crosstown transfers which would tend to overload certain already congested downtown lines would soon prove to be a nuisance. It is one of the cases where the greatest good of the greatest number must prevail, and this requires such adjustment of crosstown transfers as will best distribute the traffic on downtown lines. Many cities present similar situations, which must be dealt with in like fashion.

Almost every free transfer system gives the railway company the bad end of the bargain at some point, and it is not unusual to find single fares over routes 12 miles or 15 miles in length, which is more than the public has a right to expect. Such cases probably do not result in any serious loss to the railway company, on account of the limited number of passengers who take advantage of them, but they are a bit annoying. There is a fortunate automatic check on indiscriminate abuse of the transfer system in the changes of cars, which are necessary. On a well-loaded railway a change of cars is an intolerable nuisance to the passengers, and the number of dead-beats who will go to the trouble of working their way over an elaborate transfer route for the sake of getting the better of the company is very limited.

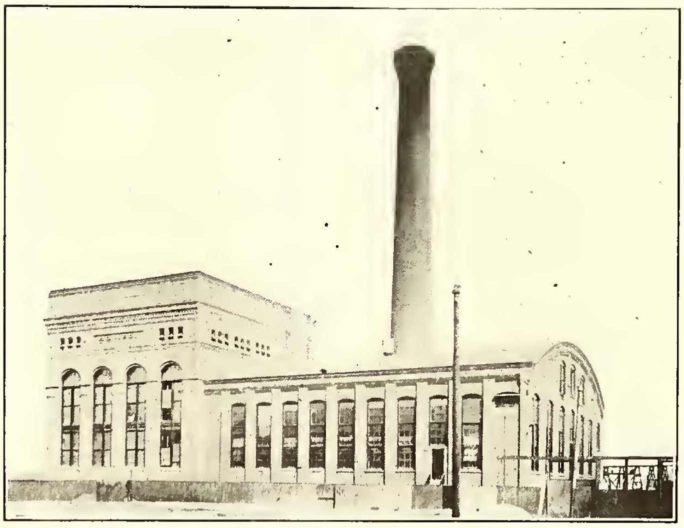
Under American conditions the public expects a liberal amount of free transfers and will get them by gentle means and mutual concessions if it can, forcibly if persuasion does not prevail. A broad policy on the part of a railway company will result in a liberal and sound transfer system, and nothing goes further in establishing pleasant relations with the public and in averting the continual attacks of the 3-cent fare contingent, which neither listens to argument nor considers the matter from a reasonable standpoint. But a really fair and wise transfer system is a tough proposition to work out. It needs very shrewd and careful attention to details of traffic to avoid the difficulties of the situation, and the whole matter ought to be given close and intelligent study. Every addition to the rapid transit facilities of a large city complicates the problem by establishing new points of junction. But the public, as we remarked at the start, understand so little the difficulties of the situation that it is apt to be quite unreasonable in its demands. If it could be brought clearly to see even the practical difficulties that surround a single case, one frequent source of friction between really allied interests would be removed.

Recent Improvements on the Boston Elevated Railway

The surface and elevated lines of Boston, included under the corporate management of the Boston Elevated Railway, are furnished current from eight power houses, namely, Central, Harvard, Lincoln, Dorchester, Allston, Charlestown, East Cambridge and East Boston stations. These stations are quite widely distributed, although all are operated in parallel except that at East Boston.

Especial interest centers at present in the Charlestown station, where the first of two large power units, recently installed, has been put in operation. In order to accommodate this unit an addition to the original power house was necessary, and the company succeeded in evolving a completed design by harmoniously blending the two radically different types of architecture.

The Charlestown station is located near the Sullivan Square terminal of the Boston Elevated Railway, at a point where water sufficient for condensing purposes can easily be obtained. The equipment of the old station consisted of three 500-hp boilers and



CHARLESTOWN STATION OF THE BOSTON ELEVATED RAILWAY

two horizontal cross-compound Allis engines, rated at 1000 hp each. These engines are direct-connected to multipolar generators of 800 kw capacity.

In order to take care of the largely increased demands of the service it was found necessary to enlarge the power equipment at Charlestown, and it was determined to install a Westinghouse vertical cross-compound engine, the order being placed through the Boston office of Westinghouse, Church, Kerr & Co. This engine has two cylinders, 44 ins. and 87 ins. in diameter, with 60-in. stroke, and runs at 75 r. p. m. It is given a nominal rating of 4500 hp, using steam at 160 lbs. initial pressure with a vacuum of 26 ins., and has an ultimate capacity somewhat exceeding 7000 hp.

The high-pressure cylinder is fitted with poppet valves for use with superheated steam, and the low-pressure cylinder with a Corliss valve gear of Westinghouse design. The cast-steel fly-wheel is 28 ft. in diameter, with 26-in. face, and weighs 350,000 lbs. The shaft is hydraulically forged steel, 37 ins. in diameter, with an 18-in. hole in the center. The total weight of the complete engine is, approximately, 1,125,000 lbs.

This engine is the first of the kind built in this country, making provision for using superheated steam.

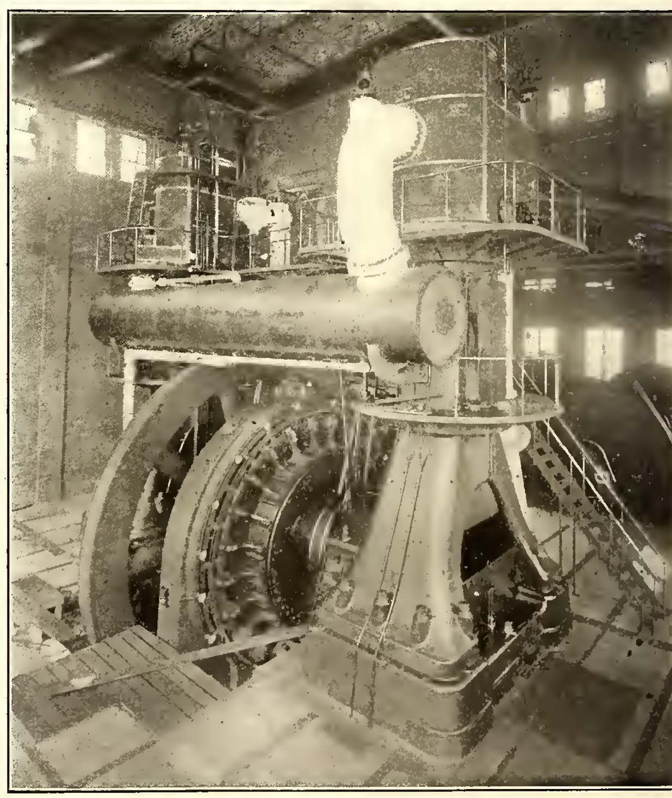
The general appearance of the machine is shown in the accompanying cuts. It is very similar to the Bay Ridge engines. The bed-plate is a heavily ribbed casting of box pattern, made from cupola iron, and supports the main journal. It forms a crank pit into which oil from the principal working parts drains. The main shaft journals are 34 ins. in diameter and 60 ins. in length. The lower shell is of the ball and socket type, and has a jacket through which water may be circulated. The bed-plate and lower shell have been designed to permit the latter to be removed if the shaft be raised one-eighth of an inch. The housings are generally rectangular in cross section, and are made in halves and fitted together at the top with a machined joint and turned bolts in reamed holes. The housings are doweled to the bed-plates to insure correct alignment. Sheet steel oil guards are fitted in the opening in the housing on the side next the generator. Oil guards also surround the eccentrics and the outer ends of the main bearings. Cross head slides are provided with bored guides, and have ample openings on the side to permit removal of the cross head.

The cylinders are not jacketed and a horizontal reheating receiver is placed between the high and low pressure cylinders. Cylinder covers are of the box pattern, heavily ribbed, and they contain the steam and exhaust valves and ports.

The valves are located in the cylinder heads, reducing the clearance to 3 per cent for the high pressure cylinder and 2 per cent for the low. The valve gear allows a cut-off up to three-quarters of the stroke. The crank is of the fan-tail pattern, finished all over, and the cross-head pins, crank pins and connecting rod are of open hearth forged steel. Especial attention has been given the details of the valve gear. The admission and exhaust valves of each cylinder are driven by separate eccentrics. The admission valves have what is commonly called a three-quarter gear, and the exhaust valves are actuated by a wrist plate gear. All valve gear connections are steel rods, fitted with heads provided with means for taking up wear, and for adjusting the length from center to center of journals. The maximum allowable pressures on projected areas of cross-head and crank pins are 1200 lbs. and 1000 lbs., respectively. The fly-wheel is of special construction, 28 ft. in diameter, 26 ins. face. The arms and rim are of cast steel and the center of air furnace cast iron, and the speed may be increased to 100 r. p. m. without exceeding the elastic limit of any member.

The crank shaft is of fluid compressed steel, 39 ins. in diameter in the wheel and 34 ins. diameter in the bearings, with a 16-in. hole through the center. It weighs 75,000 lbs. without cranks or wheel hub. The main bearings are lined with babbitt and are 60 ins. long. They are made in two parts, a top and a bottom shell, the latter being removable for relining or repairs by raising the shaft, as already described. The bottom shell is water-jacketed, and is so designed that should the babbitt metal be forced out, the shaft will not be let down on the shell. The maximum pressure per square inch on the projected area of the bearings does not exceed 250 lbs. An automatic stop is provided, and is fitted with pressure lubrication for both bearings and cylinders.

At three-quarters of rated horse-power a steam consumption is



NEW GENERATING SET; ENGINE DESIGNED FOR SUPER-HEATED STEAM

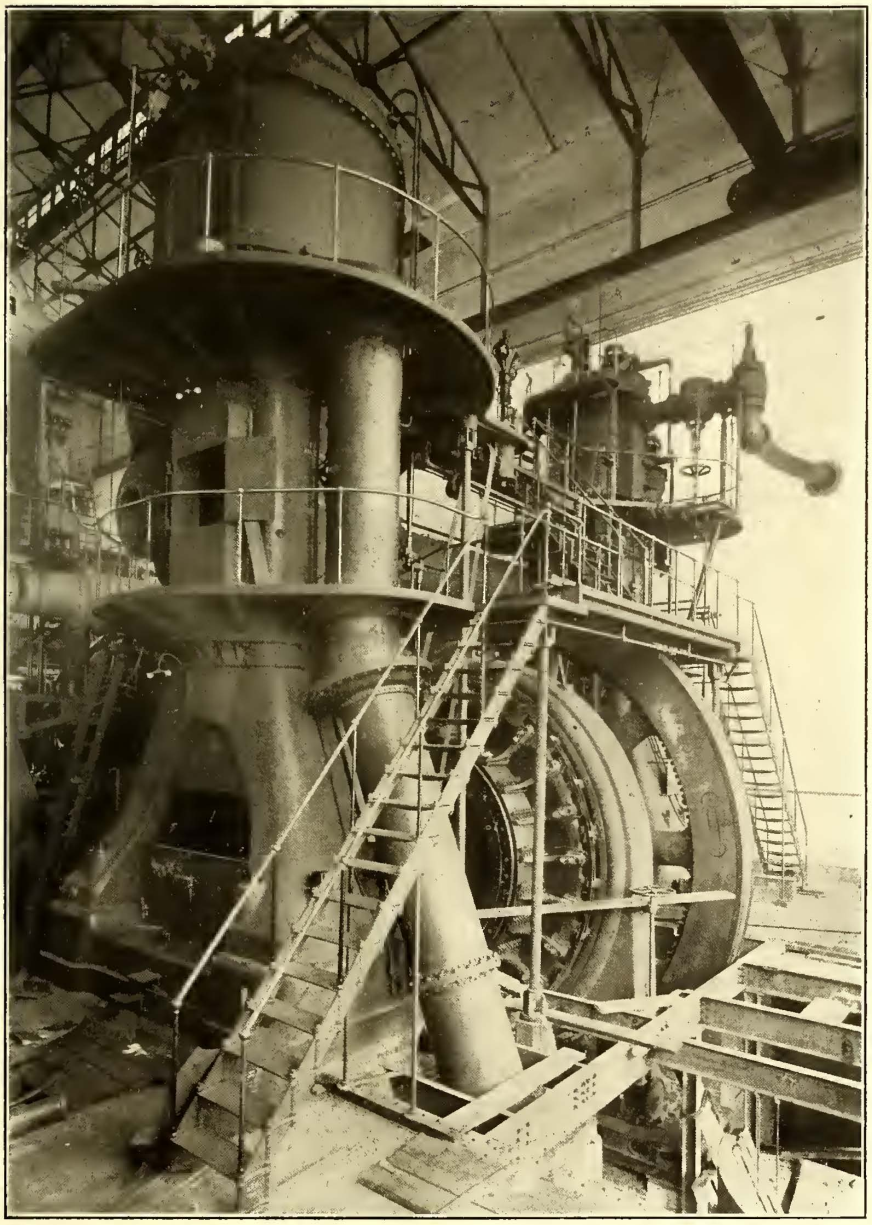
guaranteed of 15 lbs. per horse-power per hour, including the water furnished to the receiver, the initial pressure being 165 lbs. and the vacuum 26 ins. In case a vacuum of 26 ins. is not obtained, a credit of .4913 lbs. per square inch of mean effective pressure in the low pressure cylinder is to be allowed for each inch the vacuum falls below 26.

The armature of a Westinghouse direct-current generator is carried on the main shaft between the high pressure and low pressure cylinders. This is one of the largest direct-current railway generators in New England. It is a 24-pole machine of 2700-kw capacity. The commutator and armature are 12 ft. and 15 ft. in diameter, respectively, and the total weight of the generator is about 338,000 lbs.

An interesting feature of the switchboard installation, which was also designed by the Westinghouse Company, is the operation of the circuit breakers, which can be thrown out from any portion of the building by means of electric buttons.

The condensing system includes two Allis condensers for the small engines built by the Allis Company, and a Bulkley Jet Condenser for use with the Westinghouse engine.

The capacity of the boiler room has been increased by adding four 500-hp boilers, built by the Aultman & Taylor Company, of



ENGINE ROOM IN CHARLESTOWN POWER STATION, BOSTON ELEVATED RAILWAY

Mansfield, Ohio. Coal is supplied to the power house by rail and loaded from cars into overhead hoppers, although the power house is located so that coal can be brought by either water or rail. The boilers are equipped with Greene Economizers, arranged in the usual manner, with by-pass flues for leading the gases direct to the stack, should occasion require. The method employed for the removal of ashes is of particular interest. The overflow from the condensers and pumps is carried through trenches, which pass under the ash pits of the boilers. The ashes can be dumped at will into these trenches and carried off with the overflow to flats or meadows which are being filled and enclosed.

While the new boilers were primarily installed for the purpose of furnishing steam to the Westinghouse engine, the scheme of piping has been carefully arranged so that the boilers may supply steam to any engine. Cylinder oil for the entire station is forced by city water pressure from a tank located in the basement.

The company recently discontinued the former system of running trains on the Atlantic circuit of the elevated line, and established in substitution therefor a new and more extensive service, which enable passengers to ride from any elevated station directly to any other station on the entire system without the inconvenience of changing cars. No change was made in the service on the main line, trains in both directions between Dudley Street and Sullivan Square continuing to run through the subway. The changes will be confined to improvements and extensions of the service upon the Atlantic circuit, and are shown diagramatically in the cuts. Instead of simply passing around the circuit, all Atlantic trains will run to either Dudley Street or Sullivan Square. All connections made by Atlantic Avenue trains will be included in the new service.

The train movements so established are very simple. The new routes constitute a "loop" system. Starting from either of the terminals, trains will run inbound to the junction of the former Atlantic circuit, returning via the Atlantic Avenue subway circuit to the terminal station from which they started. Trains run on these routes in both directions, that is to say, trains run from Sullivan Square through the subway, continuing to Atlantic Avenue and returning to Sullivan Square, and other trains run from Sullivan Square direct to Atlantic Avenue, returning by way of the subway to Sullivan Square. Likewise trains start from Dudley Street and run through the subway, thence to Atlantic Avenue and return to Dudley Street, and other trains start from Dudley Street and run to Atlantic Avenue and the North station, returning by way of the subway.

The destination and route for each train is plainly indicated by three different methods. First, at each terminal station a brightly illuminated signboard shows the destination and route of each

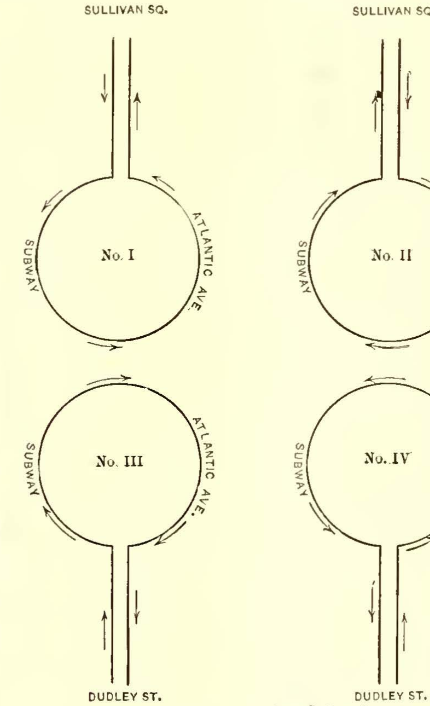


DIAGRAM OF TRAIN MOVEMENTS

train. Second, the platform men and the trainmen clearly and loudly announce the destination and route of each train while it is loading and unloading passengers. Third, colored lanterns or "markers" over the front end of the first car of each train indicate the destination and route of that train. A red light over the motorman's head, that is on the right-hand side of the hood, indicates that the train will run to Sullivan Square, and a green light in the same position indicates that it is bound for Dudley Street. A white light on the other side of the car indicates that the route from the terminal will be by way of the subway, and a yellow light in the same position indicates that the route from the terminal is by way of Atlantic Avenue.

The airship of Santos-Dumont is rapidly approaching completion at Brighton Beach, where a house has been built for it on the land of the Brooklyn Rapid Transit Company. An early voyage by the aeronaut is expected.

Improving the Service

The operation of an electric railway presents a never ending series of problems to the progressive manager. Each section of the country possesses peculiarities which are reflected in the traveling public, and scarcely a day passes on any busy system which does not bring to the manager or superintendent complaints of one kind or another concerning the service. Doubtless many of these are unjust, but few roads are so perfectly operated that the majority of complaints are without foundation. There is always abundant opportunity for the painstaking manager to effect changes for the better in a service that so closely affects the great masses as does the street railway.

During a recent trip across country in Massachusetts a few points were noted, small in themselves, but considerable in the aggregate, which afforded room for suggestive criticism. First of all the condition of the track and roadbed was impressed upon the passenger in a most disagreeable manner, for while in spots it was excellent, in other places, for several miles, the joints were in a condition that would scarcely be tolerated in a lumber camp. The motorman was operating a single truck, which lurched, tossed and jolted over the joints and around curves in the most reckless manner. The handling of the controller was in keeping with the rest of the experience, "full multiple and no coasting" being the motorman's motto. The discomfort of a single-truck car made itself felt here more than anywhere else on the trip, whereas the poor track and joints would have been far less wearing and racking if reasonable care had been used in the handling of the controllers. The line was a single track through a delightful country district, abounding in attractive scenery, and, if the amount of traffic noted on the cars is any index of the road's business, there was certainly little excuse for the abnormally poor track existing between the two important cities connected, and still less excuse for the operation of old and battered single-truck cars in a service which might be the company's pride, and contribute greatly to the comfort and pleasure of patrons. High-speed operation with single-truck cars oversteps the bounds of both safety and pleasure, to say nothing of the long continued jolting day after day to which the motorman and conductor are subjected with its injurious action upon their internal physical organization. Air brake control likewise is absolutely essential in all heavy and rapid service. The day is certainly coming when the double-truck car will reign supreme in long distance, fast service, above 25 miles per hour. No one can ride over a rough country road without at once feeling keenly the difference in comfort between these two classes of cars and being profoundly grateful to the company which has the progressiveness to employ the double-truck equipment for all such service where fast time is essential.

The incessant collection of fares which was kept up by the conductor was another drawback to riding in comfort and undisturbed peace. Instead of permitting through passengers to pay the full amount of their fares when they boarded the car they were called upon to contribute in small sums at frequent intervals. A visit from the conductor every 3 miles gradually gives the passenger the impression that he is being subjected to something akin to highway robbery, whereas, if the single straight fare to the passenger's destination could be paid at once, much inconvenience would be saved as well as much of the sensation of being mulcted by the company. In one car on this trip the conductor collected thirty-eight fares without ringing in one until the last was taken up, when the passengers were subjected to a continuous fusillade of thirty-eight shots from the register bell, which kept up for 15 to 20 seconds, and was, of course, thoroughly annoying. Nor was the car seriously crowded. Transfer checks were almost unknown on this trip. Once a conductor handed a passenger who asked him for transfers two bits of pasteboard marked "13", which he collected again from the same passenger some 5 miles further on, leaving the astonished patron of the road in the dark to this day as to the "transfer" effected.

It was a pleasure to notice, however, that no "stealing turnouts" occurred on this line. The confidence of the passenger in the railway company's safety of operation shrinks to small dimensions when his car rounds a curve at high speed to meet one coming head on in the opposite direction a hundred yards away.

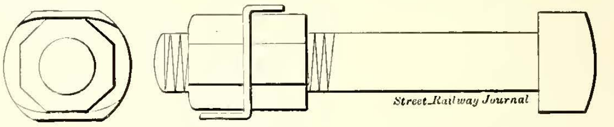
On one line which operates an hourly time table the car had just left the small town where connection was to have been made when the second car arrived. A delay of an hour ensued. A reasonable attention to good time table practice would have obviated all this vexation as no known delay in time had occurred, and the annoyance to which the passengers were subjected on this occasion was due entirely to the failure of the management to appreciate the importance of this feature of successful operation.

Last, but not least, the passenger himself can do much to improve the service. In one case an open car entered a siding on a city street at the end of its run, and the passengers attempted to disembark. A large crowd which had been waiting, boarded the car before scarcely any of the passengers had alighted, and one woman, in a selfish frenzy, lest she might miss a seat, attempted to turn over the seat back, despite the fact that in doing so she was pinning in an elderly lady who was utterly helpless to move either way. The common principle of decency and consideration for the rights of others on the part of passengers will often do more toward assisting the company to give good service than a dozen printed rules in an operating book.

It is in no spirit of carping fault finding that these lines are written, and if they contain any suggestions which may help superintendents or managers to make some of the ragged edges of operation smooth, their purpose will have been attained.

Nut Lock on Compound Thread Bolt

An ingenious nut lock has been devised by W. W. Annable, master mechanic of the Grand Rapids Railway Company. The bolts on which this nut lock is to be applied are cut with a compound thread; that is, a right-hand thread is cut on the bolt, and the bolt is then run through a die which will give a left-hand thread of the same pitch. There are, therefore, two threads on the same bolt, one right-hand and the other left-hand. The only place that the thread is materially weakened is at the two points diametrically opposite each other, at which the right and left hand threads



COMPOUND THREAD AND NUT LOCK

cross, yet this takes out only a relatively small percentage of the total strength of the thread. The action of the nut lock is as follows: A nut with the usual right-hand thread is run onto the bolt and tightened in the ordinary way. A washer, the total diameter of which is somewhat larger than the nut, is then put on top of this first nut, and is followed with a nut having a left-hand thread. This nut with the left-hand thread is screwed down onto the first nut and washer. One edge of the washer is bent down over one of the faces of the nut with the right-hand thread, the other edge of the washer is bent up over one of the faces of the nut with the left-hand thread. If the nuts turn they must then turn together. If the lower nut starts to unscrew, it has the effect of tightening the upper nut with the left-hand thread down against it. If the upper nut starts to unscrew it has the effect of tightening the lower nut so that it is absolutely impossible for either nut to turn in either direction.

The accompanying sketch shows the nut lock as applied.

Allotment of Space for Street Railway Exhibition at Detroit

The allotment of space for exhibition purposes in connection with the Detroit convention of the American Street Railway Association was made by John H. Fry, chairman of the committee on exhibits, and T. C. Pennington, secretary and treasurer, at Detroit on July 5. A list of exhibitors, showing the space number, name and address of company or individual making exhibit, and amount of space allotted is presented herewith, together with diagrams of the main floor and gallery of the exhibition hall. At the time of the allotment it was found that 22,530 sq. ft. of floor space had been reserved by applicants.

The Light Guard Armory, in which this exhibition is to be held, contains in the main floor and gallery, upward of 15,000 sq. ft. of floor space available for exhibition purposes, in addition to a reasonable allowance for aisles. It was apparent that provision would have to be made at once for additional space, as the applications then filed exceeded this amount of space. The Common Council of the city was appealed to and permission was granted the association to utilize the sidewalk and part of the roadway for exhibition purposes. The armory occupies a corner, and, by placing a temporary structure over the sidewalk on the two streets upon which it faces, upward of 7000 sq. ft. was added to the available floor space. This annex, as it is termed on the diagram herewith presented, will be connected with the main hall so as to form a part of the exhibition proper. It will be noticed that there is very little space left for exhibition purposes, and manufacturers who desire representation should make immediate application to John H. Fry, assistant general passenger agent, Detroit United Railway, 12 Woodward Avenue, Detroit, who is chairman of the committee on exhibits.

Plotting Speed-time Curves

BY C. O. MAILLOUX

PART II.

The information and knowledge obtained in the preceding investigation of the nature and character of the three kinds of fundamental speed-time curves, namely, the acceleration curve, coasting curve and brake curve, is of much practical utility and convenience in the plotting of these curves, and also in the plotting of run curves, which, as we have already seen, are in reality made up by joining together various portions of acceleration, drifting and braking curves.

In this case we must, in a measure, reverse the process followed in the analysis of train motion, for, instead of separating the curve into its components, we must assemble these components synthetically, so as to produce the curve.

Preliminary Considerations.—There are certain considerations which enter into the discussion of every specific problem in train motion. These include many things, such as the character and

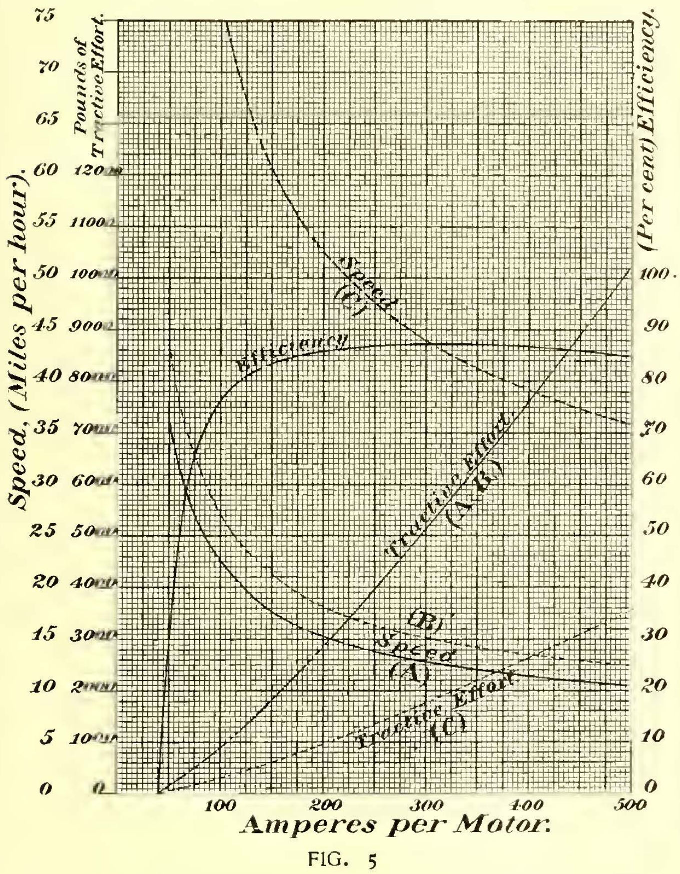


FIG. 5

location of the railway lines to be operated, the nature, character and other characteristics and conditions of the train service required, etc., etc. These things react upon and determine the schedule speed, headway and other service conditions, which, in turn, together with the total weight of a loaded train unit, determine the character and capacity of motor equipment required per train unit. A complete analysis of all these characteristics and conditions is beyond the scope of this paper. The preliminary calculations, by means of which the first approximation is made in regard to the number and capacity of motors per train equipment, are also beyond the scope of this paper.

The purpose of this section of the paper will be fulfilled if we assume that the motor equipment has already been decided upon, since one of the principal practical applications of the speed-time curves, more especially the service run curve, is to test or gage the qualities and fitness of a specific equipment, by furnishing information as to whether the proposed equipment is capable of doing the service required or wanted under the actual or assumed service conditions.

The plotting of the three fundamental speed-time curves will first be discussed, after which we will be better prepared to understand the process of plotting the run curve.

NOTE.—The first instalment of this paper appeared in the STREET RAILWAY JOURNAL July 5, and contained Figs. 1, 2, 3 and 4, to which reference is made in the text.

Acceleration Curves.—The acceleration curve of a car, being the criterion of the performance of this car and of its motor equipment, must be constructed by reference to the fundamental data relating to the performance of the particular electric motors used in the said equipment. These data are carefully determined by the motor manufacturers, by means of more or less comprehensive and elaborate special tests made for that purpose, and they are shown graphically on certain curves known as "motor characteristic curves" (Fig. 5), which usually give the relation between the various values of current (amperes) sent through the motor, and three different quantities, namely, the tractive effort or horizontal pull (pounds) exerted by the motor, the speed attained (m.p.h.), and the efficiency obtained, corresponding to the current values. The currents (in amperes) are usually represented in these diagrams by distances measured horizontally, while the other three quantities are represented by distances measured vertically, each according to its own appropriate scale. The tests of which the curves are the graphical summary and representation, are based in each case upon a particular gear ratio, which is noted on the curve sheet. These curves are sometimes made for various gear ratios, but usually are made only for one or two particular gear ratios. By means of these curves, the curves corresponding to other ratios can be easily obtained.

These curves are usually based upon tests made at a standard voltage of 500 to 550 volts. If the voltage to be used in the case under consideration is greater or less than the standard voltage, a correction will be required in the speed values. The speed in a series motor is, as is well known, practically proportional to the potential difference at its terminals. Hence, an increase in the voltage will increase the train speed in proportion. If, for instance, in the actual case, a mean voltage of 550 volts were assumed, the corrected speed curve (*B* in Fig. 5) would be one having ordinate values 20 per cent greater at every point. The curve of tractive efforts (*A B*) would remain unchanged so long as the gearing ratio remained the same. A change in the gearing ratio has the effect of modifying both the tractive effort and the speed. If the gearing ratio is made such as to cause the train to run faster, that is to say, if the number of teeth in the driving or motor pinion is increased, while the number of teeth in the driven wheel or gear on the car axle is correspondingly reduced, the result will be to raise the speed, while lowering the tractive effort; and vice versa. The corrected curves corresponding to each particular gear ratio may be drawn, and a new set of curves can be made for each change. This is not absolutely necessary, however, since the corrected values, both for speed and tractive effort, may be obtained direct from the original curves, by multiplying the values therein given by a suitable correcting factor or coefficient, as is well known. The speed correcting factor may include both the change in voltage and the change in gear ratio, or it may include either of those two things separately. When a change is made in the gear ratio, a correcting factor will also be required for the tractive effort—this factor being equal to the reciprocal of the factor determining the change in speed due to change in gear ratio. An illustration of the effect of change in voltage and in gear ratio on the motor characteristics is given in Fig. 5. In this diagram the speed curve drawn with solid line (*A*) is the curve showing the results obtained in the original shop test with a certain gear ratio and a mean voltage of 500 volts at the motor terminals. The dotted speed curve (*B*) shows the increase in speed which would result if the mean voltage were raised to 600 volts. As the gearing ratio remains unchanged, the tractive effort curve shown by the solid line (*A-B*) would remain the same for both speeds. The speed curve drawn with broken line (*C*) indicates the speed values resulting from a change both in gearing ratio and in voltage. The change in gearing ratio in this particular case was such as to increase the relative speed of the car 2.87 times. The change in voltage being, as already stated, such as to increase it in the ratio of 600 to 500, or 1.2 times, it follows that the total increase of speed was

$$1.2 \times 2.88 = 3.46 \text{ times.}$$

In this case, the dotted line of tractive efforts (*C*) shows the tractive effort values which correspond to the speed curve (*C*). The co-efficient, by which the values of tractive effort corresponding to the curve *A* must be multiplied, is, as already stated, equal to the reciprocal of the change in the gearing ratio

$$\frac{1}{2.88} = 0.347.$$

The method of approximate determination of the gear ratio is passed over as being beyond the scope of this paper.

The various correcting factors, if any, having been determined and applied, in each particular case, substantially in the manner just indicated, the corrected values of tractive effort and speed corresponding to the various current values will now be known; and these values may be plotted in curves analogous to the corrected curves

(C) in Fig. 5. Dividing the tractive effort values, which correspond to the various current values, by the total weight of train expressed in tons, we have the gross tractive effort per ton, which is the quantity P used in equation V. Taking the speed values and the tractive effort values corresponding to the same current values, we may tabulate the tractive effort values as a function of the speed. On referring to the equation (V), we see that we still need the values of the terms f, c and G. It is usual to begin by plotting the acceleration curve corresponding to a level and straight track. In such a case, the values of c and G both become zero. The values of

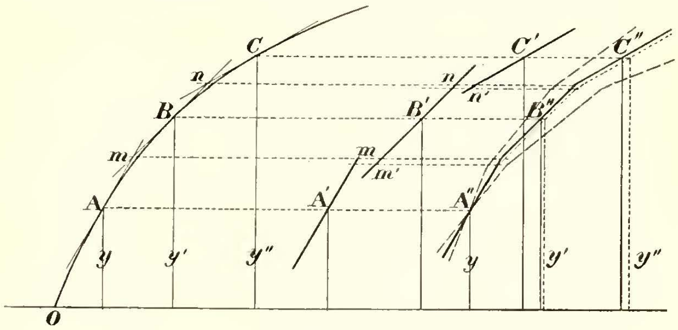


FIG. 6

the train resistance (f) are usually computed for different speeds, by means of some particular formula. The number of these formulæ is legion, but a completely satisfactory and comprehensive one still remains to be found. The latest and, perhaps, the most authoritative information on this subject will be found in some articles on "Train Resistance" in the STREET RAILWAY JOURNAL for May and June, 1902.

By means of the two sets of values of P and f, and using the formula given in equation (V), the acceleration coefficients A', corresponding to various difinite values of these quantities, and, therefore, to certain definite speeds, may be computed and tabulated. We then have two things, namely, the speed value and the acceleration coefficient corresponding to said speed. In the first method used for plotting speed-time curves, this is all the information that was required. The process of plotting consisted in drawing ordinates equal to the speed value, and drawing tangents to these ordinates, equal to the acceleration coefficient—then displacing the ordinate to the right or left, until the tangent line met the tangent line corresponding to the ordinate of the previous speed point.

Reference to Fig. 6 will clearly show the general nature of this method. The process of plotting consisted in drawing ordinates such as y, y', y'', equal to various speed values, and then drawing at the upper end (A' B' C') of each of these ordinates, a tangent line whose angularity is proportional to the corresponding acceleration coefficient for each of these ordinates. The ordinates are then to be displaced sidewise (to the left, in this case), until the tangent line of any ordinate meets or crosses the tangent line corresponding to the ordinate of the previous speed point, that is to say, of the ordinate immediatly to the left of it. The proper meeting points (m n) between the tangent lines are to be determined by the eye, being located usualy about half-way between the two corresponding ordinate points. The process might be illustrated by means of a file of soldiers of unequal height, with outstretched arms, and moving closer together until their hands touch. If the proper place of the tangent to the ordinate y in Fig. 6 is at the point A on the curve $OABC$, then the tangent lines B' and C' would find their proper places when the ordinates y' and y'' have moved to the left as far as the points B and C respectively. The curve $OABC$ osculating these tangent lines, as shown in the figure, would be the curve required. This method has serious drawbacks. In the first place, it is not easy to determine the proper points, m and n, at which the tangent lines should meet. The difficulty of accurately drawing the tangent line itself is already very great, without the difficulty of determining by the eye the distance at which the next ordinate should be placed. If, for instance, in Fig. 6 the tangent lines were made to meet at the points m' and n' corresponding to the mean ordinate, or half of the speed increment, instead of meeting at the exact points, m and n, the result would be to displace each ordinate, as clearly shown at the right end of the figure, where the solid tangent lines passing through the points A'' B'' and C'' represent the tangent lines in the same relative locations as the tangents at the corresponding points in the curve $OABC$, while the dotted lines represent the effect of changing the meeting point from the points m n, to the half-way points, m' and n' respectively. The figure also shows the effect of an error in the angle of the tangent line. This error is usually constant, being due to the particular method of drawing and the protracting instruments used. It is, therefore, apt to be a cumulative error. As clearly indicated by the broken lines, starting from the initial ordinate at the point A'' the diagram shows the increase in divergence resulting from a constant error in angularity, the effect being to make the curve too high when the angle is too large, and too low when the angle is too small. The errors due to the two causes might be cumulative, or they might tend to partially compensate each other. In the figure it is clearly seen that, under the conditions shown, the errors would tend to compensate if the error in the angle of the tangent was such as to make this angle greater than it actually is, while they would be cumulative in the contrary case. The method is totally unscientific and unsatisfactory, notwithstanding the fact that it is still used. There is really no telling what the percentage of error may be. It is all conjecture and guess-work.

No method of curve plotting can be entirely satisfactory without some means of predetermining both co-ordinates of each point to be plotted.

The method of calculating the time increments, as analyzed in

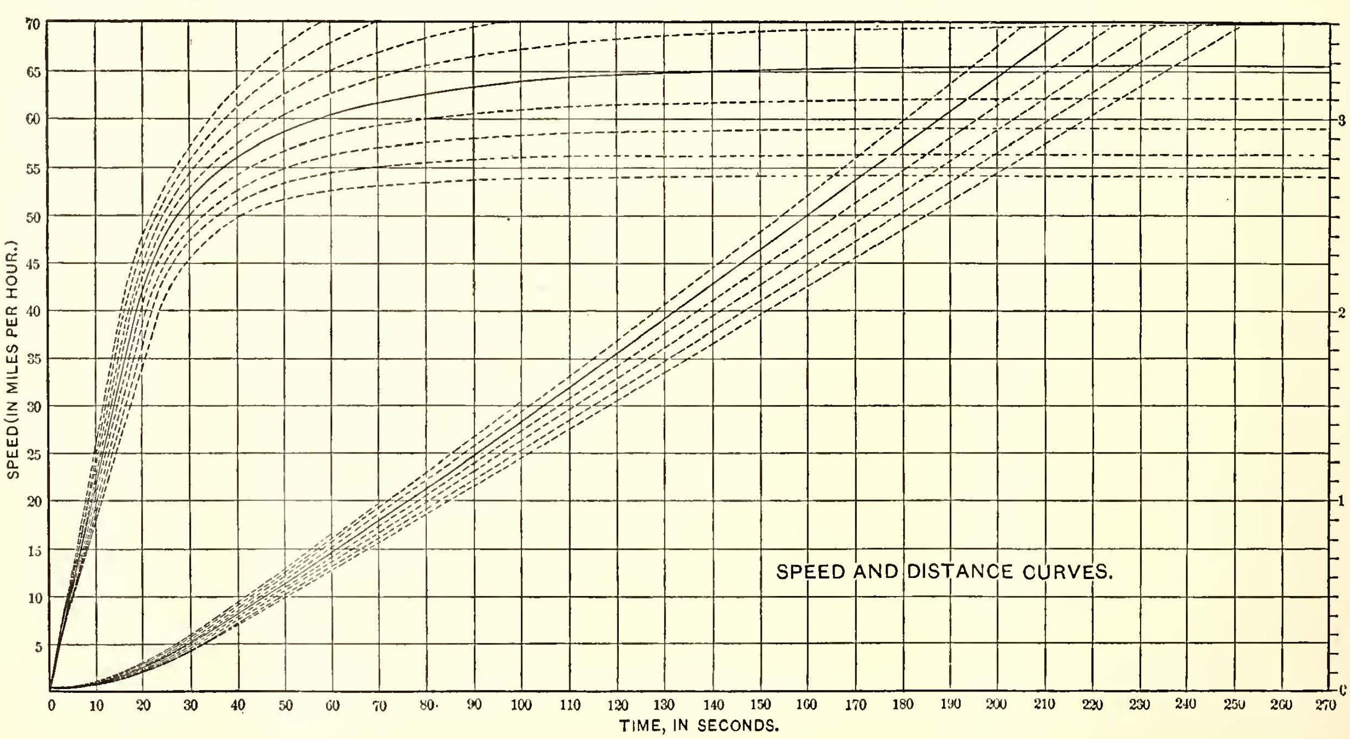
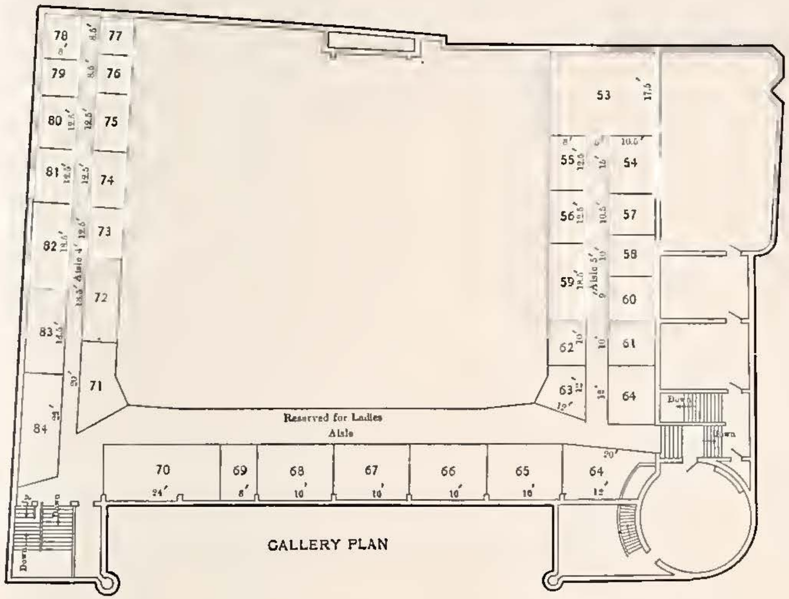
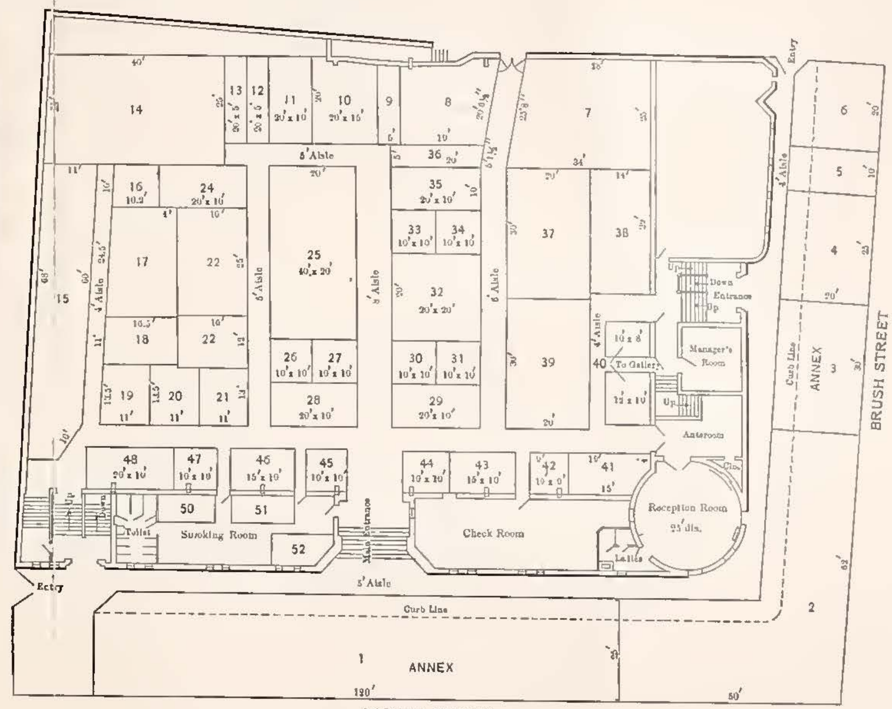


FIG. 7

DIAGRAM OF FLOOR SPACE OF LIGHT GUARD ARMORY, DETROIT, WHERE EXHIBITION WILL BE HELD DURING CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION, OCTOBER 8, 9, 10, 1902





Assignment of Exhibit Space for American Street Railway Convention, Detroit, October, 1902

LIST OF EXHIBITORS

No. of Space	Name and Address	No. of Sq. Ft.
68.	Adams & Westlake Company, Chicago	200
45.	American Brake Shoe & Foundry Company, Mahwah, N. J.	100
42.	American Car Seat Company, Brooklyn	100
36.	American Machinery Company, Grand Rapids, Mich.	100
33.	American Railway Supply Company, New York	100
10.	American Steel & Wire Company, Chicago	300
35.	Atlas Railway Supply Company, Chicago	200
22.	Berry Brothers, Ltd., Detroit	200
81.	Bishop Gutta Percha Company, New York	100
57.	Bliss, R., Manufacturing Company, Pawtucket, R. I.	100
51.	Bidwell Car Telephone Company, Grand Rapids, Mich.	100
65.	Brady Brass Company, New York	200
58.	Brandeau, George F., Utica, N. Y.	100
3.	Brill, J. G., Company, Philadelphia	600
8.	Brown, Harold P., New York	400
15.	Christensen Engineering Company, Milwaukee	800
44.	Conant, R. W., Cambridge, Mass.	100
47.	Consolidated Car Heating Company, Albany	100
37.	Consolidated Car Fender Company, New York	600
9.	Continuous Rail Joint Company of America, Newark, N. J.	100
43.	Crane Company, Chicago	150
11.	Creaghead Engineering Company, Cincinnati	200
67.	Curtain Supply Company, Chicago	200
66.	Dearborn Drug & Chemical Works, Chicago	200
20.	Doig-Stivers Manufacturing Company, Denver	150
56.	Duff Manufacturing Company, Pittsburgh	100
30.	Electrical Review Publishing Company, New York	100
25.	Electric Storage Battery Company, Philadelphia	300
54.	Garton-Daniels Company, Keokuk, Ia.	150
2.	General Electric Company, Schenectady	2,000
62.	Globe Ticket Company, Philadelphia	80
48.	Gold Street Car Heating Company, New York	200
31.	Gould Storage Battery Company, New York	100
18.	Griffin Wheel Company, Chicago	150
70.	Hale & Kilburn Manufacturing Company, Philadelphia	300
75.	Ham Sand Box Company, Troy	100
6.	Harrington, C. J., New York	400
12.	Heywood Brothers & Wakefield Company, Wakefield, Mass.	100
72.	International Register Company, Chicago	150
41.	Johns (H. W.)-Manville Company, New York	200
23.	Knell Air Brake Company, Battle Creek, Mich.	400
5.	Kuhlman, G. C., Car Company, Collinwood, Ohio	200
63.	Lumen Bearing Company, Buffalo	100
64.	Ludlow Supply Company, Cleveland	300
7.	Lorain Steel Company, Lorain, Ohio	760
38.	Magann, G. P., Air Brake Company, Ltd., Detroit	450
76.	McLaughlin Car Coupler Company, Philadelphia	70
52.	Maltby Lumber Company, Bay City, Mich.	100
80.	Monarch Fire Appliance Company, New York	100
53.	Morris Electric Company, New York	400
55.	National Carbon Company, Cleveland	100
34.	National Lock Washer Company, Newark, N. J.	100
73.	Newcomb, F. H., Brooklyn	100
83.	New Haven Car Register Company, New Haven	150
26.	Northern Electric Manufacturing Company, Madison	100
59.	Nuttall, R. D., Company, Pittsburgh	150
39.	Ohio Brass Company, Mansfield, Ohio	600
71.	Ohmer Car Register Company, Dayton, Ohio	150
69.	Pantasote Company, New York	100
14.	Pennsylvania Steel Company, Steelton, Pa.	1,000
40.	Ridlon, Frank, Company, Boston	200
61.	Root Track Scraper Company, Kalamazoo, Mich.	100
82.	St. Louis Register Company, St. Louis	150
19.	Sherwin-Williams Company, Cleveland	150
46.	Smith, Peter, Heater Company, Detroit	150
77.	Speer Carbon Company, St. Marys, Pa.	70
21.	Standard Varnish Works, New York	150
25.	Stanley Electric Manufacturing Company, Pittsfield	400
60.	Star Brass Works, Kalamazoo, Mich.	100
84.	Sterling-Meaker Company, Newark, N. J.	200
29.	STREET RAILWAY JOURNAL, New York	200
28.	Street Railway Review, Chicago	200
4.	Taylor Electric Truck Company, Troy, N. Y.	500
26.	Tramway and Railway World, London, England	100
74.	Union Stop & Signal Company, Fall River, Mass.	100
17.	United States Steel Company, Boston	400
50.	Universal Sanitary Cuspidor Company, Worcester, Mass.	100
24.	Van Dorn-Elliott Electric Company, Cleveland	} 200
24.	Van Dorn & Dutton Company, Cleveland	
13.	Weber Railway Joint Manufacturing Company, Chicago	100
16.	Wheel Truing Brake Shoe Company, Detroit	100
27.	Western Electrician, Chicago	100
1.	Westinghouse Electric & Manufacturing Company, Pittsburgh	} 3,000
1.	Standard Traction Brake Company, New York	
1.	Westinghouse Air Brake Company, Pittsburgh	
32.	Wharton, Wm., Jr., & Co., Incorporated, Philadelphia	400

For space and full particulars address the Chairman of Exhibit Committee, John H. Fry, 12 Woodward Avenue, Detroit, Mich.

Appendix C, constitutes a great improvement on the method just described. The method is sufficiently described in Appendix C. By means of this method, using equations (*i*) and (*ii*), the time points corresponding to the various speed points may be determined with any degree of accuracy desired. The conditions influencing the accuracy, and the error to be expected, in any case, are fully discussed in Appendix C. These time values having been tabulated, the curve may be plotted by locating the ordinates on a sheet of paper in the usual way. After obtaining the co-ordinates for an acceleration curve on a straight and level track, we can, by assuming proper values for *G*, in equation (*V*), obtain and tabulate the acceleration coefficients of other acceleration curves corresponding to various grades; and the time values corresponding to the various speed values having been computed and tabulated, these curves may be plotted. Fig. 7 shows a set of nine acceleration curves, including one for a level and straight track, four for up-grades of ½ per cent, 1 per cent, 1½ per cent and 2 per cent, respectively, and four for the corresponding down grades. This method, while more simple and far more accurate than the crude "tangent" method, still admits of improvement.

The method to be described has the advantage of being practically a graphical method, and of being comparatively simple and quick in practical use. Incidentally, it serves many useful purposes, by scissa. The curve is then drawn through these points. In one of the curves, (Q), the resistance values (*f*) used in computing the acceleration coefficients, included the friction of motor bearings and gearing, while in the other curve (R) this additional resistance was excluded. This explains the difference in ordinate values between the two curves. The first curve, (Q), corresponds to cases when the car is moving by momentum only, at which times the mechanical resistance due to friction of motor bearing and gears must be overcome by the kinetic energy of the car. The second curve, (R) corresponds to cases when motive power is being applied to the car. It is true that this resistance still consumes energy when the motors are furnishing power to the car, but since the curve of tractive effort, (Fig. 5), represents the tractive effort which is available for *external work*, it follows that in determining the amount of gross traction per ton ("*P*"), the friction of motor bearings and motor gearing is already eliminated. It is for this reason that two curves of equivalent acceleration due to train resistance are required, (Q, R,)—one to be used in plotting acceleration curves, and the other to be used in plotting retardation curves.

The curves Q′, R′, are the same as the curves Q, R, but reproduced below the axis of x (with ordinates of negative signs).

(The train resistance values for speeds above 1 m. p. h. used in computing the co-ordinates of the curve R, agree substantially

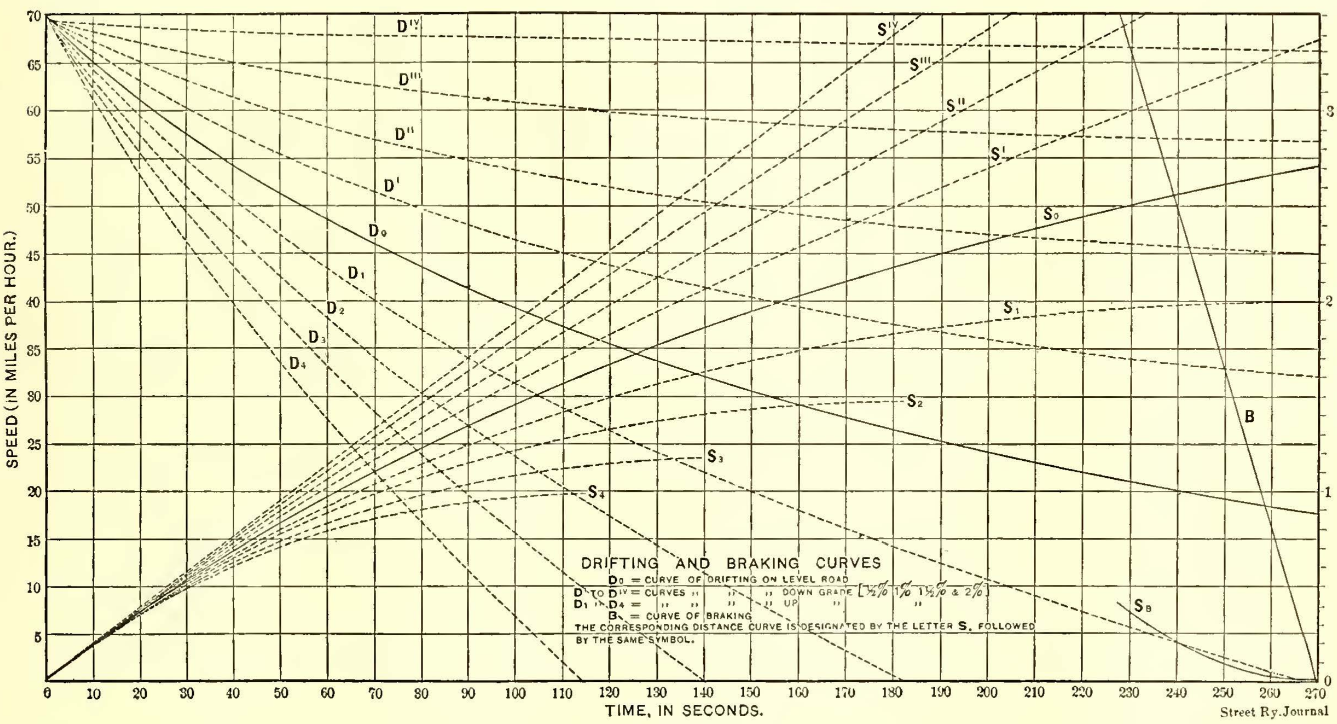


FIG. 8

giving graphically and accurately, in readily intelligible manner, the answer to many questions, the answer to which otherwise necessitates and involves more or less tedious computations and some thought. The method is based upon the theorem given at the end of the Appendix B, to which reference has already been made. It requires two charts, which may be drawn either on separate sheets, or else combined together on the same sheet. These charts are, respectively, the "Chart of Coefficients" (Fig. 9) and the "Chart of Reciprocals" (Fig. 10).

In the "Chart of Coefficients," the abscissæ represent speed values in miles per hour, and the ordinates represent acceleration coefficients, that is to say, the values of the differential coefficients ($\frac{dv}{dt} = k$), ranging between zero and 2.5 miles per hour per second. On this chart are drawn various curves representing the variation of the acceleration coefficient as a function of the speed. These curves are really curves of "equivalent" acceleration for the various quantities, *P*, *f*, *G*, *c*, which enter into the equation (*V*) for resultant acceleration.

The curves Q, R, are the curves of equivalent acceleration for the train resistance (*f*). These curves are plotted as follows: The value of *f* having been determined, for various speeds, either by means of some formula, or by reference to tabulated data or to curves obtained from actual test, the "equivalent" acceleration corresponding to each value is calculated by the formula given in equation (21*a*); and each acceleration coefficient is then plotted as an ordinate, using the speed value corresponding thereto, as ab-

with the values obtainable for the train resistance of a single car by the formula of W. J. Davis, Jr., [see STREET RAILWAY JOURNAL, Volume XIX., May 3, 1902, page 554]. Between 0 m. p. h. and 1 m. p. h. the train resistance values used are such as to make allowance for the increase in train resistance when starting from rest. The curve, as drawn, indicates an initial starting resistance of about 18 lbs. per ton. For further information on this subject see paper on "Train Resistance" by J. A. F. Aspinall, M.I.C.E., read before the Institution of Civil Engineers, Nov. 26, 1901.)

The curve M gives the equivalent acceleration values of the gross traction (*P*) of the particular motor equipment, whose time-function curves are to be examined. The curve is prepared substantially in the same manner as the curves Q, R, the values of "*P*" being determined by reference to the "corrected" motor characteristic curves, as already stated. The acceleration coefficients corresponding to the gross traction (per ton) obtainable at various speeds, are computed by equation (21*a*), and the values so obtained are plotted on the chart (curve M).

The curve N is what might be called a curve of "net" acceleration coefficients, obtained by subtracting the ordinate values of the train resistance coefficients (curve R) from the corresponding ordinate values of the gross traction coefficients (curve M).

The gravity factor *G*, is, as we know, independent of the speed; consequently, the value obtained by equation 21*a*, for any given value of *G*, corresponding to any definite gradient, is constant at all speeds; the resultant curve will, therefore, be a straight line, parallel with the axis of x. In the chart, these lines have been drawn at the proper calculated ordinate distances corresponding and equivalent to all percentages of grades between 0.1 per cent and 5 per cent. These gradient percentage lines have been repeated below the axis of x, the two sets being thus suitable for up-grades and down-grades.

Since, as already seen, a grade of 1 per cent represents a force of 20 lbs., it follows from equation (V) that the acceleration coefficient due to such a grade would be

$$= .01098 \times 20 = .22 \text{ m. p. h. per second.}$$

It follows, therefore, that the scale of gradient percentages given at the right-hand end of the chart is such that the vertical distance, corresponding to each 1 per cent of grade, is equal to 0.22 when measured on the scale of coefficients at the left-hand end of the chart.

The quantity c being also constant at all speeds, will also be represented by a straight line. The curves corresponding to this value are not shown on the chart.

The correction for curvature may, however, be made by reference to the gradiant percentage lines, the effect of the track curvature being the same as an equivalent "up-grade." Since a 1 per cent grade corresponds to 20 lbs. of tractive effort, the number of degrees of track curvature which is equivalent to a 1 per cent grade will be:

$$\frac{20}{b} = N \qquad (XI)$$

where N = the number of degrees of curvature,
and b = increased train resistance in pounds per ton per degree of track curvature.

And the "equivalent grade percentage" would be:

$$G = \frac{N\,b}{20} = .05\,N\,b \qquad (XII)$$

As an illustration, let us assume an up-grade having an actual gradient of 2.67 2per cent, and a track curvature of 4°-30′ (4.5°), and let b equal 0.9. The equivalent grade due to the curvature would be:

$$\frac{4.5 \times 0.9}{20} = 0.203\%$$

The effect under those conditions would, therefore, be the same as if the total grade were:

$$= + 2.672 + 0.203 = + 2.875\%$$

In the case of a down-grade the effect, of course, would be equal to the difference between these two values, or

$$= - 2.672 + 0.203 = - 2.469\%$$

This net value, which includes the allowance for both gradient and curvature, is the value that would be used in plotting the curve by means of the chart of coefficients.

When b equals 0.8 we have, from equation (XI),

$$N = \frac{20}{0.8} = 25°$$

In this case the coefficient for each degree of curvature would, therefore, be 1/25, or 0.04 of the coefficient corresponding to a 1 per cent grade. It follows, therefore, that two of the smaller spaces, each corresponding to a tenth of a per cent of grade, would represent the coefficient for 5 degs. of track curvature.

When b equals some other number the relation between the two kinds of coefficients is not so simple, for which reason the writer finds it preferable to make all corrections for track curvature by reference to equation (XII).

When there is no track curvature, the algebraical sum of acceleration coefficients includes only three coefficients, namely, those due to the gross traction, the train resistance and the grade. The curve N being already the algebraical sum of the first two, it follows that we have only to take either the *sum* or the *difference* in ordinate values, at any speed point, between the curve N and the horizontal line corresponding to any gradient, in order to obtain the corresponding resultant acceleration. This resultant acceleration coefficient is equal to the sum of the ordinate values in the case of a down-grade, and to their difference in the case of an up-grade. Thus, on a down-grade of 1 per cent, the resultant coefficient would be equal to the full vertical distance between the curve N and the "1 per cent" line *below* the "zero" line (or axis of X), just as if the zero line itself had been displaced downward as far as the "1 per cent" down-grade line.

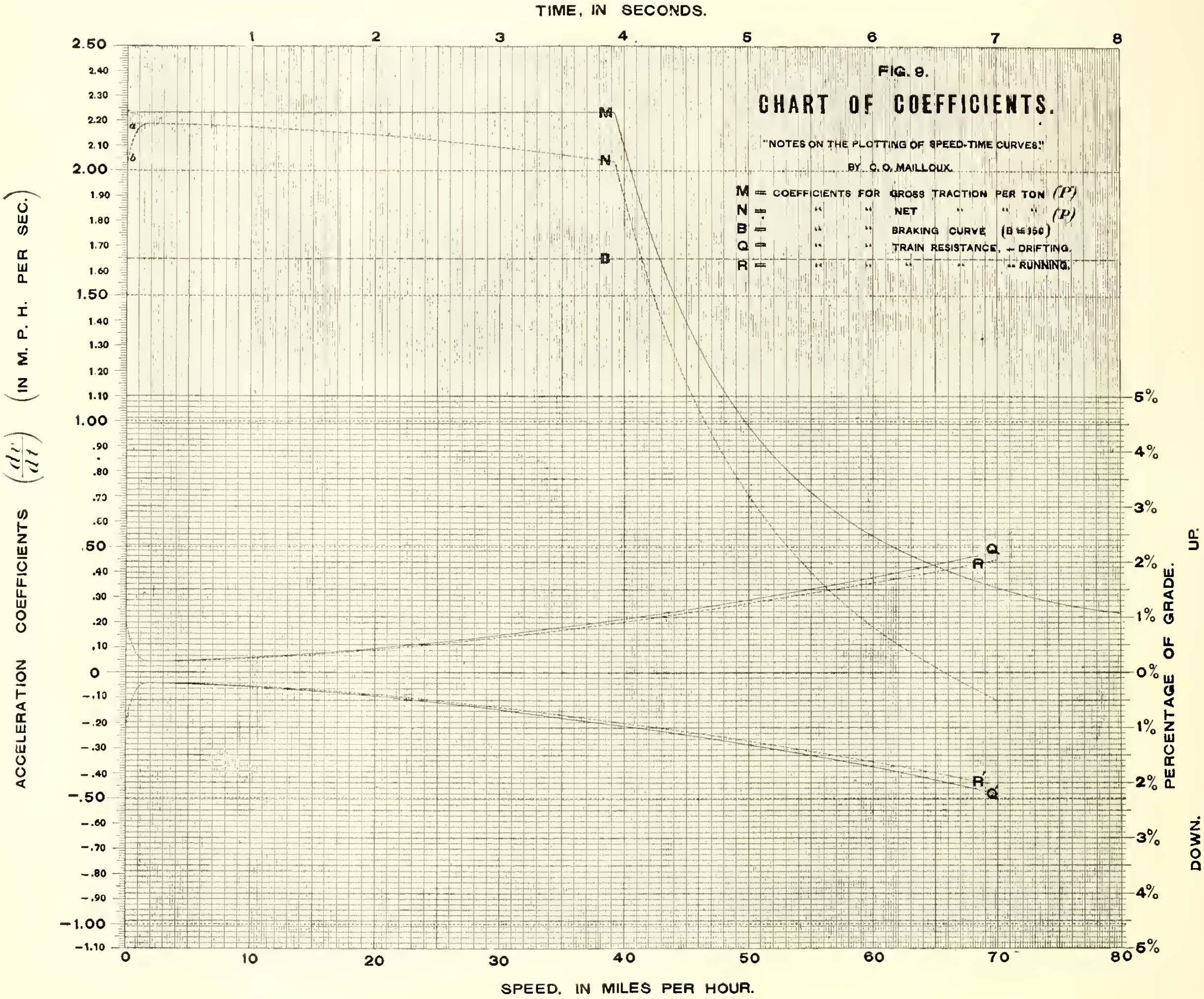


FIG. 9

The effect of an up-grade would be exactly contrary, being the same as if the zero line had been displaced upward to the corresponding up-grade "percentage" line.

The point at which the curve N crosses any gradient percentage line corresponding to an up-grade being, of course, the point at which the equivalent acceleration coefficients cancel each other, and give a resultant acceleration equal to zero, it follows that this point is at the maximum speed that the particular motor equipment under consideration would give on that grade. If, instead of an up-grade, we examine the point of intersection of the curve N with a down-grade, we find, as is to be expected, that the maximum speed will be considerably higher. The chart may also be used to answer questions such as the following: On what down-grade, at any given speed, would the equivalent acceleration due to gravity be the same as that due to the train resistance? Also, on what grades would this force be sufficient to cause acceleration, and at what rates? The answer to this question is obtained very easily by taking the ordinate of the curve (Q), corresponding to any speed, and comparing it with the ordinate corresponding to any grade. When the two values are alike there is no resultant acceleration. If one is greater than the other there will be acceleration or retardation, according to the case. The chart thus answers at once, and in a very satisfactory manner, all questions in regard to the speed attainable under any desired set or aggregation of conditions. The chart of coefficients is, therefore, an instrument for quickly and accurately determining the answer to equations (28) and (I) under any kind of conditions, actual or hypothetical.

The train resistance coefficients, when once properly determined, will serve for any case where the *train units* are of the same *kind* and *character*, it being now known that the train resistance values (*"f,"* from which the curve R is derived) vary with the number of cars per train, and it being probable that they also vary according to the form and the size of car. It is evident that several different curves, analogous to the curve R and corresponding to train units of different kinds, may be all plotted on the same chart of coefficients. The gradient percentage lines on the chart will, for obvious reasons, be the same for all cases whatsoever. Hence, we have only to plot the curve of gross traction coefficients (M) for any other motor, to be at once able to answer all questions about the speed and acceleration obtainable under any and all conditions. It is not well however, to plot too many curves on the same chart, especially when they run closely together. It is more convenient, less confusing, and therefore preferable, to use a distinct chart for the "traction" curves (*"M"* and *"N"*), and for the "resistance" curves (*"R"*), corresponding to each kind of train unit, or for not more than two distinct kinds of train units.

It is desirable to plot the chart of coefficients with a rather large scale of ordinates. The scale of ordinates, in the original chart of coefficient, from which Fig. 9 was made, is such that 1 m. p. h. per second equals 20 cms, so that the acceleration coefficient values may be easily read and plotted to the third decimal place. This accuracy is not so important for the portions of speed-time curves having a high rate of acceleration, but it becomes very important in the case of low accelerations, that is to say, in plotting the relatively flat portions of acceleration and retardation curves. In these portions the acceleration coefficients have relatively small values, and consequently the percentage of error would be increased, unless these values can be read at least to the second, preferably to the third, decimal place. The greater ease and facility with which a chart can be used when plotted to a larger scale really simplifies the task of plotting the curves and probably saves time in the end.

It is obviously desirable that the scale of *ordinates* be precisely the same in both charts, since otherwise it would be necessary to use proportional dividers or equivalent means of compensation for the difference in scales, in transferring the ordinate values from the chart of coefficients to the chart of reciprocals, in order to get the proper time increment values corresponding thereto. For this reason the two charts should be both made on the same kind of co-ordinate paper.

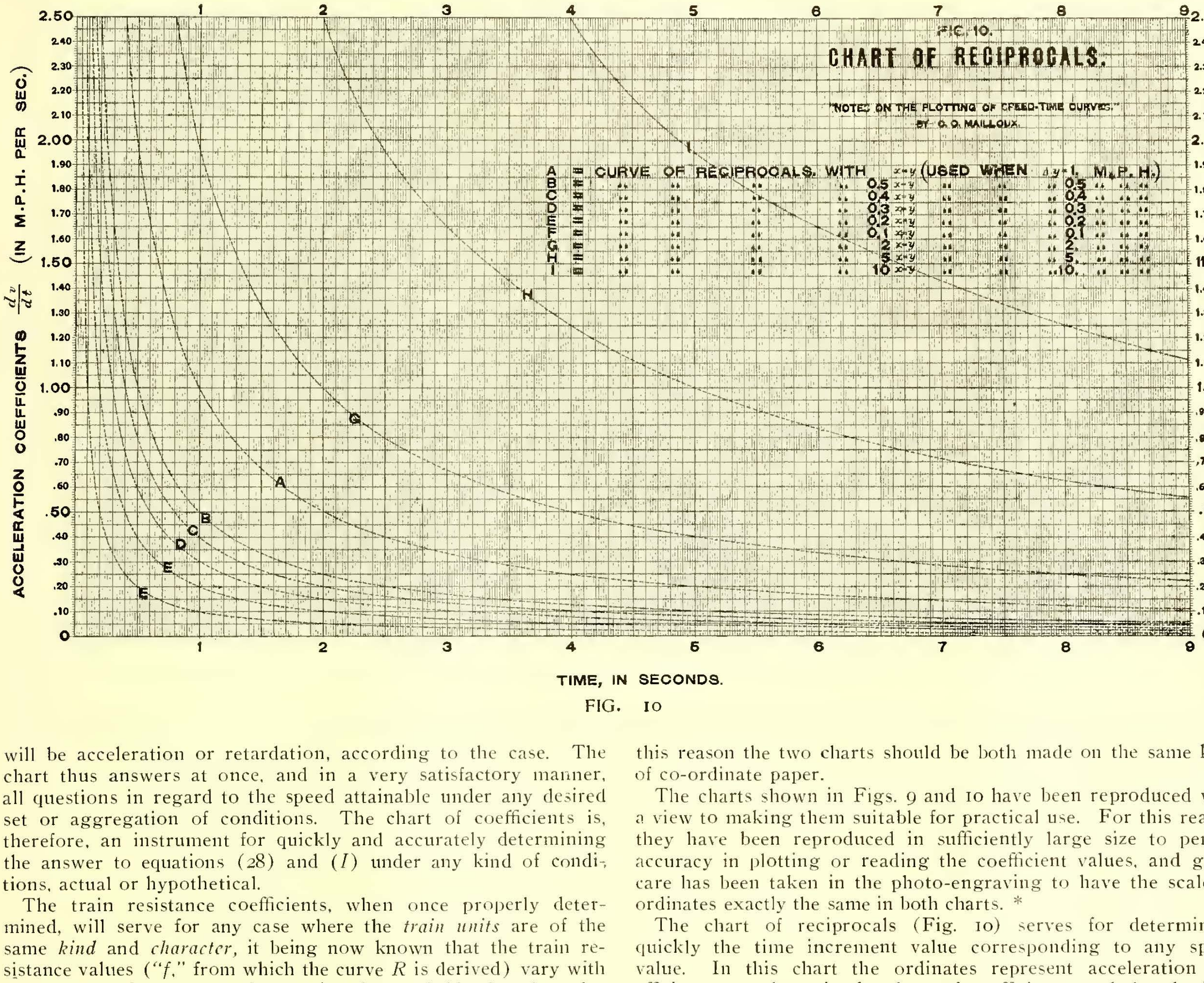


FIG. 10

The charts shown in Figs. 9 and 10 have been reproduced with a view to making them suitable for practical use. For this reason they have been reproduced in sufficiently large size to permit accuracy in plotting or reading the coefficient values, and great care has been taken in the photo-engraving to have the scale of ordinates exactly the same in both charts. *

The chart of reciprocals (Fig. 10) serves for determining quickly the time increment value corresponding to any speed value. In this chart the ordinates represent acceleration coefficients exactly as in the chart of coefficients, and the abscissæ represent time values in seconds, on a scale sufficiently large to indicate small fractional values of seconds. On this chart are drawn various reciprocal curves. The curve A is the true reciprocal curve, being obtained by dividing 1 by *each* acceleration coefficient value and plotting the resulting value. The curve B is a curve obtained in the same way, by taking *half* the reciprocal value. In like manner, we obtain the curves C, D, E, F, corresponding, respectively, to the 0.4, 0.3, 0.2, 0.1, reciprocal values, and the curves G, H, I, corresponding, respectively, to twice, five times, and ten times, the reciprocal value.

This chart is so prepared as to take advantage of the relation shown in Appendix C in equation (i), where the acceleration coefficient enters, it will be noted, as a *reciprocal*. The manner of

* These two charts have been reproduced to a smaller scale in this case.—[EDS.]

using it is very simple. The acceleration coefficient value for any speed having been determined by means of the chart of coefficients, it is transferred by dividers, or in any convenient way, to the chart of reciprocals, where it is used as an ordinate value and moved sideways, as such, until it intersects the "proper" reciprocal line. The "proper" reciprocal line depends upon the speed differences or increments, as the equations in Appendix *C* clearly show. Consequently, with speed increments of 1 mile per hour, curve *A* would be the proper curve; with speed increments of, respectively, 0.1 m. p. h., and 10 m. p. h. the "proper" curves would be curves *F* and *H*. The smaller the speed increments the more numerous will be the plotted points, and the greater accuracy of the curve plotted. The process of determining, by means of these charts, the co-ordinates of a speed-time curve corresponding to any set of conditions, is so simple as compared with all previously known methods that one can afford to use smaller speed increments and thus make the curve easier to draw and more accurate and satisfactory for any purpose.

It is important to note that the same reciprocal curve will not serve for all portions of a given speed-time curve, with equal accuracy, and that the reciprocal curves corresponding to relatively large speed increments (such as, for instance, curve *I*) will be quite limited, both in application and in accuracy. This peculiarity, which is due to the form of the reciprocal curves, will be understood without difficulty, on glancing at the chart of reciprocals. It is seen that the higher acceleration coefficients (which correspond, as we know, to the more inclined portions of speed-time curves) have the shortest time-increment values, and that as the coefficient values become reduced (that is to say, as the speed-time curve "flattens") the time increment values increase more and more rapidly. This relative increase in time increments continues until, for each reciprocal curve, in succession, beginning with curve *I*, which corresponds to the highest speed increments ($\triangle y = 10$ m.p h.) and ending with curve *F*, which corresponds to the smallest speed increment ($\triangle y = 0.1$ m. p. h.), a point is finally reached at which the time-increment values obtained by reference to that particular curve would exceed the longest time value (9 seconds) which can be read on the chart. Thus, in the case of curve *I*, the chart limit would be reached when the acceleration coefficient became reduced to 1.11. This means that the curve *I* would be entirely useless for determining the time values of any speed-time curve or portion thereof not having acceleration coefficient greater than 1.11. The chart limit for curve *H* would be, in like manner, an acceleration coefficient,

$$= \frac{5}{9} = 0.55$$

and the chart limit for any other curve would be

$$= \frac{\triangle y}{9}$$

where $\triangle y =$ the speed increment corresponding to that particular curve. For example, in the case of curve *A*, where $\triangle y = 1$, the limit would be

$$\frac{\triangle y}{9} = \frac{1}{9} = 0.111$$

and for curve *F* where $\triangle y = 0.1$ the limit would be

$$\frac{\triangle y}{9} = \frac{0.1}{9} = 0.011$$

These considerations clearly show that the reciprocal curves corresponding to the larger speed increments, such as curves *G*, *H*, *I*, can be used for determining the time-values only when plotting speed-time curves which have considerable slope or inclination, (either upward or downward). It also becomes apparent that as the speed-time curve flattens, the reciprocal curves corresponding to smaller speed increments, (such as *B*, *C*, *D*, etc.), become, first, desirable, then indispensable. For very accurate work the writer uses the curve *A* or the curve *B* for the highest accelerations, (usually the curve *A* for coefficients above 2. and the curve *B* for coefficients between 1.5 and 2.); and he uses, successively, the curves *C*, *D*, *E*, for intermediate lower coefficients, the curve *F* being used for the lowest coefficients. In cases when still greater accuracy is required than can be obtained with curve *F*, such as for plotting the nearly horizontal portions of speed-time curves (having coefficients approaching zero), the writer proceeds as follows: The net coefficient value, as obtained from the chart of coefficients by means of dividers or in other convenient manner, is increased twice, three times or four times its value, and then used in the usual way for finding the time increment on the chart of reciprocals, by reference to curve *F*; the time value thus obtained is then divided by the multiplying factor used in enlarging the net coefficient, the result being the net time-increment value. A glance at the chart will readily show that this process is virtually the same as if a new reciprocal curve corresponding to smaller speed increments than the curve *F* were to be drawn. The method has the advantage over such a curve, however, that the coefficient is magnified, and that the time-increment reading is made at a point farther to the left, on the chart, where the reciprocal curves are farther apart, and where their inclination is greater, thereby enabling the reading to be made with much greater accuracy.

The five "observations" given at the end of Appendix C, constitute rules which may be useful in selecting the proper reciprocal curves, for each particular case. Practical experience will, however, be the best guide.

Drifting Curves.—In the case of drifting curves, we have, as pointed out in equation (*VII*) to consider only the effects of the train resistance, track curvature and grades. The resultant acceleration coefficient at any speed is readily obtained from the chart of coefficients just as in the case of acceleration curves. When the train is drifting and the energy required for turning the motors comes from the kinetic energy stored in the train, there is usually an increase in the train resistance due to the friction of the motor gears, etc., these motors being no longer electrically driven. The kinetic energy of the rotating parts, tends, in some measure, to counterbalance, or to neutralize, this increase. In case it is not fully neutralized, a new curve should be drawn, showing the acceleration coefficients corresponding to drifting and braking curves. The curve, Q, as already stated, represents such a curve on the chart of coefficients. The values of the acceleration coefficient, as given on this curve, are the ones which should be taken in determining the resultant retardation graphically by means of this chart. The determination of the time increments is done in exactly the same manner as in the case of acceleration curves. Fig. 7 shows a set of nine drifting curves, including the drifting curve for a level and straight track, and four curves, each corresponding to up-grades and down-grades of, respectively, ½ per cent, 1 per cent, 1½ per cent and 2 per cent.

Braking Curves.—The co-ordinates of a braking curve should, in reality, be determined in substantially the same manner as the co-ordinates of acceleration and coasting curves. In order to do this, it would be necessary to draw on the chart of coefficients the curve of equivalent acceleration coefficients, corresponding to a given rate of braking. This curve would be almost, but not quite, a straight line parallel with the axis of *x*. The difficulty of this method is, that the form of brake lines varies so widely and at times quite erraticaly. In practice, the process of plotting the braking curves is greatly simplified by making the assumption that the braking curve is a straight line. This is not exactly true, as already pointed out. In Fig. 3 the curve *y* A B C is a true braking curve reproduced from an actual diagram obtained in the braking tests conducted by the New York Railroad Commission with various street-car brakes in New York City, in 1899. The dotted straight line, *y a b c*, is the line inclosing the same area as the brake curve, this fact being clearly shown by the two distance curves o *e f g* and o *c′ f′ g′* on the lower part of the diagram. The first of these curves correspond to the true brake curve, *y a b c*, while the second corresponds to the equivalent brake curve, *y a b c*. It will be seen that while the area enclosed by the two curves is exactly the same (being a trifle under .02 mile), the time required to cover this distance is greater in the case of the true brake curve than in the case of the modified one. In some cases, the time error resulting from the assumption of a constant rate of retardation, would be greater than in others, and might be serious. In most cases, however, it is negligible.

A closer approximation to the actual form of the brake curve can be made in the manner indicated in the right-hand portion of Fig. 3, where the true brake curve *y A B C*, and the straight line *y a b c*, previously referred to, are both reproduced, together with the broken line, *y-b-C*. It will be seen that this broken line constitutes a much closer approximation to the actual brake curve than the straight line, *y a b c*. The acceleration coefficient of the straight line is found by calculation to be, approximately, 1.84. The broken line has an acceleration coefficient of about 2.31 in the upper portion, and 1.2 in the lower portion. The two portions of the broken line, *y-b′*, and *b′-C*, correspond to equal "drops" or reductions of speed. It is seen that the acceleration coefficient, (which, in this case, might better be called retardation coefficient), is about 25 per cent greater, for the upper portion (*y b′*), while the retardation coefficient of the lower portion, (*b′-C*) is nearly 40 per cent less, than the acceleration coefficient of the straight braking line, *y-a-b-c*. By sub-dividing the brake curve into three portions, the broken line, now consisting of three portions, would enable a still greater degree of approximation to the true curve to be obtained, as will be readily understood. Unfortunately, owing to the erratic variations in the form of the curve itself, it would be more difficult to assign proper values to the retardation coefficients of the different portions in terms of the retardation coefficient of the straight braking line, (*y-a-b-c*), corresponding to the same distance. For this reason, the writer does not recommend sub-dividing the brake curve into more than two portions, and does not even recommend this except in cases where extreme accuracy is desired.

The assumption that the braking curve is a straight line greatly simplifies the process of plotting. The determination of the speed and time values, by which the line of braking may be drawn, comes under three general cases constituting braking problems, which are treated and discussed as such in Appendix D.

It will be evident, of course, that the slope of the brake curve will still vary, even though the rate of retardation, due to the friction of the brake shoes, be assumed to be constant. This is apparent from equation (*IX*), in which it is seen that four factors (*B, f, c, G,*) enter into the equation for the retardation coefficient in braking. Owing, however, to the very fact that there is so much variation and uncertainty in the form of the brake curve, it is usual to make the assumption that a braking force of 150 lbs. per ton covers all three of the factors, *B*, *f* and *c* for high speed service. Hence, the only other force usually considered is the force of gravity (*G*). This, as we have already seen in Section I, enables equation (*IX*) to be simplified practically to the form shown in equation (*X*). The reason why the factor *G* is still retained and considered separately, is that the effect of gravity may be considerable on grades of relatively high percentage, and also that the effect would be opposite on up-grades and down grades, respectively. In the case of the factors *f* and *c*, on the other hand, the effect is relatively small and always has the same sign. The force of gravity (*G*) being positive on down grades will have the effect of neutralizing a part of the braking force applied. Thus, on a down-grade of 1 per cent, which corresponds, as already seen, to a tractive effort of 20 lbs., and taking, according to the usual practice, as stated above,

$$B - f - c = 150$$

the net braking effort would be

$$150 - 20 = 130 \text{ lbs.}$$

and the coefficient, which, in this case, might properly be called retardation coefficient, would be, according to equation (IV),

$$= .01098 \times 130 = 1.43$$

In the case of an up-grade of 1 per cent, the retardation coefficient would be equivalent to

$$= .01098\ (150 + 20) = 1.87$$

The value of *k* used in the equations given in Appendix D is understood to be, in every case, that which corresponds to the resultant or net retardation, and it is determined in the manner just indicated.

It is seen that the foregoing method of plotting the braking curve still involves certain assumptions, which, in the present state of our knowledge, are unfortunately unavoidable. It is very much to be hoped that further experiments should be made for the purpose of determining the form of the true braking curve under various conditions of braking. It is also to be hoped that some convenient and practical means of analytical expression or of graphical representation of an average or typical braking curve may be arrived at. It is only then that it will be possible to eliminate the assumptions which now have to be made, and to attain a higher degree of precision in the plotting of the braking curve.

Distance-Time Curve.—Attention was called in Appendix A, in connection with equation (*c*), to the fact that the area of any portion of the speed-time curve comprised between two given intervals of time corresponds and is equal to the distance traversed by the moving body during that time. By taking advantage of this fact it is possible to plot on the same diagram on which the speed-time curve itself is drawn, another curve, the distance-time curve, usually called the "distance" curve. Such distance curves are shown in Figs. 1 to 4, inclusive. The co-ordinates for this curve are obtained, in each case, by integrating, successively, small strips of the area enclosed by the speed-time curve. This integration is usually done in practice by means of a planimeter or other integrating instrument. If, for example, we first integrate the portion corresponding to the first 20 seconds, the result obtained by the integration may be made a measure of the distance which the car will have traversed within the first 20 seconds. If, as pointed out in Appendix D, the numerical "area" result of the integration is divided by 3600 (the number of seconds in one hour) the resulting figure will be the distance expressed in miles. Integrating, in like manner, the area comprised between 20 and 30 seconds we obtain the distance traversed in the interval of time comprised between the twentieth and thirtieth second. By integrating successively all the other portions of the speed-time curve between definite time limits in the same manner, other corresponding distance values (*s*) will be obtained. The total distance traversed will evidently be equal to the aggregate sum of all the separate distance values thus obtained. This total distance will be the highest point of the distance curve.

The object of integrating the area enclosed by the speed-time curve in separate strips, or "by parts," is, of course, to obtain the co-ordinates for various intermediate points on the curve for the purpose of plotting the same. In plotting out the distance curve, the distance corresponding to the inferior time limit of integration (in equation [*e*], Appendix A) is equal to the so-called "constant of integration." Thus, in Fig. 4, in plotting the distance curve, *o-a-c-e*, between the points *a* and *c*, the distance value (*a*) obtained, as indicated in equation (*c*), by the integration of the acceleration curve from the beginning to the point *b*, would be equal to the constant of integration, which, in the case shown, is

$$a = \text{one mile,}$$

and this value would have to be added to the distance value obtained by the integration of the portion of curve comprised between the points *b* and *d*, in order to give the total ordinate value or the actual location of the distance curve corresponding to the point *c*—that is to say, the ordinate at the upper limit of integration. This is evident, for, if the distance value obtained by integrating the area comprised between the points *b* and *d*, were to be plotted by measuring off from the axis of *x*, instead of from some point (*a*) higher up, it would then serve to indicate only the increase of distance covered between the points *b* and *d*. The addition of a distance value (*a*) equal to the distance already covered up to the point *b*, is necessary to bring the corresponding portion of the distance curve comprised between the points *b* and *d* into its proper place (*c*).

It is evident that the smaller the strips of area which are integrated at a time, and the more accurate the method of integration used, the more numerous will be the plotting points and the greater will be the accuracy with which the distance curve can be plotted. In the diagrams Figs. 1 to 4, inclusive, the distance curves are plotted so as to represent distances in miles, according to a scale of miles which is shown at the right-hand end of the diagram in each case. The process of computing the total area enclosed by the speed-time curve in very small portions is somewhat tedious. The work may be greatly simplified by the use of an instrument called the integraph, which was once exhibited, in 1888, before this Institute, by its learned inventor, the late Mr. B. Abdank-Abakanowicz. This instrument is an integrating instrument which, in addition to giving the numerical result of the integration, actually shows the steps of integration graphically, by drawing the so-called "integral" line. It is made in two sizes by Mr. G. Coradi, of Zürich, Switzerland, the distinguished maker of integrating instruments known by his name. The instrument admits of some range of adjustment, whereby the scale or ordinates may be varied. It is evident, however, that by means of proportional dividers, or by other well-known drafting-room methods, the scale or ordinates may be enlarged or reduced, so as to make it suitable for any scale desired for plotting the curve. The writer has made considerable use of the integraph during the last two years, and has found it exceedingly useful and convenient, not only on account of its precision but also as a time-saving device in work of this character.

The distance-curve is of great utility in the plotting of the run curves, because it constitutes the most practical means of determining the proper time points corresponding to a given distance. This is exemplified by means of the simple run-curve shown in Fig. 4. In plotting this run-curve it was desired to let the first or accelerating portion (which, as previously stated, was taken from Fig. 1), continue until a distance of exactly 1 mile had been covered. The dotted line *b-a* in Fig. 1, which intersects the distance-curve at a point (*a*) equal to a distance of 1 mile on the right-hand or "distance" scale, therefore represents the point at which the acceleration portion terminates. The drifting portion (*B*) of the curve in Fig. 4, was obtained by means of Fig. 2, beginning at a point (*b*) representing exactly the same speed as the point (*b*) in Fig. 1. The line *b-a* in Fig. 2 intersects the distance curve at the point *a*. It being desired to let the drifting portion (*B*) of the run-curve also represent the same total distance traversed, exactly 1 mile, this curve was cut off in Fig. 2 at the point (*d*), so located that the last ordinate would intersect the distance-curve, in Fig. 2, at a point (*c*) whose vertical distance (*c, c'*) above the starting point (*a*) was equal to 1 mile, when measured on the distance scale. The portion of the distance-curve in Fig. 2, comprised between the points *a* and *c*, could, therefore, be reproduced in Fig. 4, starting from the point *a*. It is seen that the point *c*, in Fig. 4, corresponds to a distance of exactly 2 miles on the distance-scale. The distance curve constitutes a convenient means, and the most practical means, whereby the various kinds of curves may be cut off and connected at the proper points in assembling them together to form the run-curves. This will be further exemplified hereinafter in discussing the plotting of a service run-curve, constituting a practical illustration of the process of plotting such curves.

From the above it will be seen that the speed-time curve establishes a relation between the distance, speed, and the time, in any given case. Hence, if any two of these three quantities are given or assumed the third can be determined. In the majority of cases the distance is known, at least approximately. The quantities to be determined by means of speed-time curves are either the speed to be obtained when the time is assumed, or known, or else the time required for a given service when the speed is known or assumed.

Brooklyn Tunnel Bids

Bids for the construction and operation of the Brooklyn tunnel extension were opened Monday by the Rapid Transit Commission. The Brooklyn Rapid Transit Company offered to build the tunnel for $7,000,000 and to provide a system of transfers good over about 90 per cent of the company's lines in Brooklyn. The Interborough Rapid Transit Company, to which the interests of the Belmont-McDonald syndicate have been transferred, made an offer to construct the subway for $2,000,000, and to carry passengers between the Bronx and Brooklyn for a single fare of 5 cents. The company put in an alternative bid of $3,000,000, with the condition that the company should have the privilege of building a subway under Broadway between Union Square and Forty-Second Street.

Each bid is exclusive of $1,000,000 which the commisison is willing to allow for terminals and for the purchase of real estate. It was estimated that the cost of building the Broadway extension would be at least $3,600,000. The effect, therefore, of the alternative bid of the Interborough company, should it be accepted, would be that deducting the cost of the Broadway extension—an improvement that the Commission has always had in contemplation—the city would have to pay out only $500,000 for the Brooklyn tunnel.

Mr. McDonald, on behalf of the Interborough Company, explained that that corporation was very anxious to have the Brooklyn tunnel a part of the present subway system. It was because of this fact that such a low bid was made, as its acceptance would leave the city with sufficient funds to "proceed with the extension of the Rapid Transit road from Broadway and Forty-Second Street to Union Square, this extension being absolutely indispensable to the successful operation of the road and the serving of the most important shopping district in the city, with a view to giving a connection with the projected Pennsylvania terminal at Thirty-Third Street and Broadway to furnish an equal facility to that now provided at the Grand Central Station."

If the alternative bid of $3,000,000 for the Brooklyn extension is accepted by the Commission the Interborough Company will construct the extension from Forty-Second Street and Broadway to Union Square for the nominal sum of $100,000, provided this piece of road is authorized by the first of next July.

Mr. McDonald said that the cost of building the tunnel to Brooklyn would be at least $10,000,000, but that the company had made a low bid because it wanted the tunnel. He pointed out also that his company could afford to bid less than the Brooklyn Rapid Transit Company, because it had all its plant ready and on the spot to begin work.

John L. Wells, counsel to the Brooklyn Rapid Transit Company, laid before the commission a long list of routes over which the tunnel passengers would be transported in Brooklyn for one 5-cent fare. Mr. Wells added, however, that people traveling south of Kings Highway on these lines, for instance, to Coney Island, would have to pay an additional 5-cent fare.

August Belmont, on behalf of the Interborough Company, said passengers would be conveyed from the Bronx to the Brooklyn terminal for one 5-cent fare. He said he had been assured that if his company got the contract his companies would be allowed to operate through cars to Jamaica over the lines of the Long Island Railroad for an additional 3-cent fare. Mr. Belmont added he had received other assurances from a Brooklyn trolley company which enabled him practically to promise that an agreement would be entered into with that company whereby passengers would be conveyed to Coney Island and other outlying points on the system owned by the company he referred to for a 3-cent additional fare.

Strike at Albany Averted

The Troy branch of the labor organization which controls the employees of the United Traction Company, operating in the cities of Troy, Albany, Watervliet, Rensselaer and Cohoes, threatened to strike recently unless the company dismissed two former members of the union, who were charged with embezzling funds of the order to the amount of between $100 and $200. The company suggested that the matter be referred to a board of arbitration. Bishop Burke, of Albany, was selected by the company, and Michael Muldoon, of Troy, by the employees. In accepting the responsibility Bishop Burke said: "It will be my purpose to consider fully the points and differences and to decide fairly. The company and the men both have rights, and I believe that much more can be accomplished through arbitration than by striking. I shall also consider the public."

When the question was submitted to the Board of Arbitrators they had little difficulty in reaching a decision. They reported to the company that the two men, William F. McGuire and Michael Pickett, whose discharge from the service of the traction company was demanded by the union, should be dismissed, the testimony taken showing that the company would be within its rights in letting them go. The company immediately discharged the men, and all danger of a strike was averted.

Cleveland's Three-Cent Council Enjoined

The last two weeks have been a most exciting period in the history of Mayor Tom L. Johnson's campaign for 3-cent fare railroads in Cleveland. On Monday, July 14, the Council passed eleven ordinances establishing as many routes for 3-cent fare lines, and calling for bids for them. The routes included the former Hoefgen lines, which have been shown by a map in the Street Railway Journal, with the addition of franchises for a road through the flats to connect with the proposed new line to Akron, and for crosstown lines on Doan Street and Madison Avenue. During the week the public, and probably the Mayor as well, were treated to a surprise in the announcement that a company headed by Harrison B. McGraw, a prominent attorney, would enter the field with bids for the franchises over the proposed routes. Mr. McGraw is a partner of H. Clark Ford, president of the Eastern Ohio Traction Company, and has acted as attorney in many of the Everett-Moore transactions. This was taken to indicate that Mr. Everett would again enter the local Cleveland field, and on a 3-cent fare basis. Thus far matters looked promising for Mayor Johnson and his pet project.

But on Saturday afternoon the Mayor's hopes were shattered when Attorney-General Sheets started quo-warranto proceedings in the Circuit Court to oust the Cleveland City Council and demanded that the members show by what right they hold office. Judge Caldwell, of the Circuit Court, granted on order restraining the Council from granting further franchises or special privileges of any kind until the case is heard and decided. The suit is the result of the recent decision of the Supreme Court of Ohio in declaring the Cleveland city government unconstitutional. There is little possibility that the case will ever come to trial, since in October the State Legislature will convene to decide on a new code for Ohio cities, and in that event even a favorable decision for the City Council would count for naught. The suit was started by Judge W. W. Boynton, who is a property owner on one of the streets over which it was proposed to build a 3-cent fare line. He denies that he is acting for any one but himself and neighboring property owners. The injunction not only restrains the City Council from taking further action in 3-cent fare matters, but prevents possibility of extensions of franchises for the existing companies, hence it seems improbable that the latter are in any way connected with the suit. Members of the Council have taken steps to induce Governor Nash to call an immediate special session of the Legislature to relieve the city of its embarrassing position and to preserve its credit, which is now endangered.

In the meantime John B. Hoefgen's car load of rails, scattered on Rhodes Avenue, will continue to gather rust, since it begins to look as if it would be many a day before a 3-cent fare car ran over them.

Picturesque Park for Roanoke

The Roanoke Railway & Electric Company, of Roanoke, Va., has just purchased a tract of about forty acres of mountain land, lying 3 miles south of the city and extending about three-quarters of a mile up the ravine between the mountains south of the city. The northern end of this tract is near one of the principal lines operated by the company, and it is understood to be its intention to use the property for park purposes. The natural advantages are such that it is not unreasonable to suppose that it will prove to be one of the most picturesque spots in Virginia. It is reported that the railway company will at once put a large force of men to work on the property under the direction of an experienced landscape architect, and that it is the intention to erect a large casino, dancing pavilion and other attractions, and also build a lake at the lower end of the tract.

Topics of the Week

Mayor Low announced last week that, after a conference with Messrs. Lindenthal and Parsons, in which all the plans for the relief of the Brooklyn Bridge traffic had been considered, it had been decided to connect the two bridges as proposed by Mr. Parsons. Mr. Lindenthal will prepare plans for the bridge, and Mr. Parsons will produce a scheme for the subway part. The Mayor hopes to have these plans submitted by September 1. Mr. Lindenthal, however, has not given up his plan of installing a moving sidewalk, and he does not consider the present decision as a rejection of his proposal.

The June report of one of the suburban companies operating in the West shows the effect of the cool weather of that month on the earnings of the electric railways that are heavy carriers during the summer months. By actual count there were twenty-eight rainy days for the month. The gross receipts of the company increased only $500 over the same month in 1901, while the increase for the latter month over June, 1900, was almost $14,000. The net earnings of this company, instead of showing a healthy increase, as has been noted since the road was first placed in operation, actually show that there was a decrease of $471 for 1902 as compared with 1901.

A timely note of warning to steam railway companies, who make a point of hampering trolley companies, has been sounded by Judge Mand, at Morristown, Pa. In the course of a decision upon one of these controversies the court said: "Technical objections against trolley companies only tend to establish them in popular favor. I think railroad companies ought to let well enough alone. If they do not, I think the time will soon come when the people will tire of this senseless litigation and rise up and elect a Legislature that will grant greater franchises and give more power to the trolley corporations." This is a sensible and conservative statement, and is deserving of very careful consideration by public officials as well as steam railroad managers.

In Iowa, where considerable construction work is being done and where many extensive interurban lines are projected, the officials of the various interurban railways of the State, both those which are partially completed and those which have not as yet actually commenced the work of construction, have agreed upon the fare to be charged for the transportation of passengers. This rate as agreed upon will be 1½ cents per mile, or just one-half the rate charged by steam railways. Freight rates have not yet been arranged, and it may be that no action will be taken on these rates for some time. The agreement as to passenger rates does not bar the several companies from making special rates for excursions.

Judging from the daily newspaper accounts of street railway events the "dog days" are having the customary effect upon copy makers. Last week a "Chicago invention" delighted the heart of every imaginative journalist of the yellow order. It proved to be an oft-exploited and exploded theory of street railway propulsion, in which it was proposed to employ "small electro-magnets" imbedded between the tracks, which would work automatically, so that the car would be attracted to magnets ahead, cutting out those which it passed over. A simple calculation as to the power required to "attract" a street car carrying an ordinary motor equipment, and the size and character of the "small electro-magnets" proposed for this purpose, might jar the average reader, but it could not hope to make an impression upon the yellow journalist.

The popularity of trolley rides as a means of recreation, especially when the lines extend into the suburban districts or connect nearby towns, has attracted several enterprising authors and publishers to present hand-books explaining the connections between cities and villages in certain localities, where the network of trolleys can be utilized for pleasure riding. Some of these guides are very interesting and instructive, and the demand for them demonstrates that when they are accurate in their information and reliable in their descriptions of the points of interest along the line, their production can be made profitable. They can also be made very serviceable for the railway companies, and progressive managers, by encouraging the distribution of this class of literature, will attract many sightseers to their lines. This has been shown to be the case particularly in New England, in the vicinity of New York and among the coast resorts.

The franchise tax litigation has advanced another step toward final settlement. At Albany last week Supreme Court Justice D. Cady Herrick confirmed pro forma the report of Referee Robert Earl. In order to bring in all questions raised by the corporations so that they can be passed upon by the higher courts on appeal, Justice Herrick announced that he would decline to find favorably on all questions raised by the corporations upon which Referee Earl had declined so to find. William H. Page, representing the Metropolitan Street Railroad Company, was the spokesman for the corporations at the hearing, and Attorney General John C. Davies and Deputy Attorney General Henry C. Coman appeared for the State. Former United States Senator David B. Hill and Charles F. Brown appeared as special counsel for the Metropolitan Street Railway, and Charles A. Collin for the Brooklyn Rapid Transit Company. An appeal from Justice Herrick's decision, affirming that of Referee Earl, will be heard at the September term of the Appellate Division. The Appellate Division is expected to render a decision so that the case can be argued in the Court of Appeals in November, and final decision is looked for in December.

The legal department of the Metropolitan Street Railway Company and the corporation counsel of New York do not agree upon the question of the right of the city to tear up tracks in streets for which the company holds franchises. Some time ago the corporation counsel advised Borough President Cantor that he had authority to remove "unused tracks," and added the following explanation of his views on what constituted an abandoned route: "There is a popular impression that the running of one car or train a day is an exercise of a franchise technically necessary to and sufficient for its preservation. I can find no authority for such doctrine and I do not believe it is sound. The franchise confers a right to operate a road for the convenience of the public, and a street railroad, I believe, necessarily implies frequent running of cars at all times of the day. The running of a single car is, however, some evidence of an intention not to abandon the route, and when such intention is a material circumstance it is possible that the court might regard it as sufficient to save the rights of the company." Thereupon Mr. Cantor announced his intention of tearing up the tracks when the company refused to remove them. It was contended on the part of the company that the franchise had been obtained from the State, and that the borough president had no authority in the premises. In order to protect its interests the company secured an injunction restraining the city from removing the tracks.

Pennsylvania Railroad Tunnel Contract Rejected

The railroad committee of the New York Board of Aldermen reported adversely upon the contract for the Pennsylvania Railroad tunnel, which had been approved by the Rapid Transit Commissioners, and this action was sustained by the Board, much to the surprise of all who had been interested in securing the passage of the measure. The reasons given by the committee for its adverse report upon the proposed contract were that "it does not provide for pipe galleries in the tunnel for the use of the city; no time limit is fixed on the construction, and there is no provision for the employment of union labor at the prevailing rate of wages."

During the debate upon the measure Borough President Cantor added to the list of objections "that the compensation is inadequate; that the franchise is exclusive and perpetual, and that power of control is with the self-perpetuating Rapid Transit Commission, the only undemocratic body in the State."

The final vote by which the contract was rejected showed that many members who had been counted upon as friends of the measure were recorded against it. The action of the aldermen kills the contract made between the Pennsylvania Railroad Company and the Rapid Transit Commission. The special act passed by the Legislature last spring which was designed to empower the Commission to grant a perpetual franchise to the Pennsylvania company provided that the aldermen should have the right to approve or reject the contract, but that they should not have the right to modify it in any way. The decision of the aldermen is final, and the only thing left for the Pennsylvania company now is to renew its application if it still desires to go ahead with its project on terms likely to be accepted by this Board of Aldermen, and it will be necessary for an entirely new contract to be drawn. Mr. Boardman, representing the Pennsylvania company, is reported to have said when opposition developed, that even if the contract were defeated the company would make another application and would ultimately succeed in getting the franchise. The Pennsylvania company has already begun work on the Jersey side of the tunnel.

New York Transportation Needs

The second of Mayor Low's weekly talks upon municipal matters was devoted largely to consideration of the subject of interborough communication, although the official title of the bulletin was "Our Insufficient Working Capital." The Mayor pointed out that the city was suffering because of present conditions and that its proper development was being seriously retarded.

"From the moment of the creation of Greater New York, the city has been confronted with the problem of interborough communication. This is as it should be, for consolidation, among other things, was intended to bring about just that. The extent to which this subject has momentarily involved the city in expenditure is shown by the estimated cost of the works now in course of construction:

1—Rapid transit subway	$36,500,000
2—Williamsburg Bridge	20,000,000
3—Manhattan Bridge	16,000,000
4—Blackwell's Island Bridge	12,500,000
Total	$85,000,000

"For the single purpose of developing interborough communication the city is already committed to an increase of its debt, within the next few years, in the sum of, say, $32,000,000; and it is confronted with a very large additional expenditure for the same purpose in the near future, say, perhaps, $55,000,000 more. I say this because a suitable connection of the East River bridges, the East Side tunnel, and a second tunnel to Brooklyn in a certain sense are already pressing."

The Mayor advocates a liberal policy, and points out that the introduction of a municipal system of interborough communication may be fairly likened to the introduction of a municipal system of water supply. The cost of the initial plant only comes once.

Union Freight Station for Electric Lines at Cleveland

It seems probable that immediate steps will be taken by the Cleveland interurban and city companies to erect a temporary union freight station at which several interurban roads may unload goods without delaying city traffic. A year ago the city and interurban companies formed a freight station company. A lot having a frontage of 132 ft. on Bolivar Street and running through to Eagle Street, a distance of 396 ft., was purchased and leveled off, and turnouts were laid from the tracks on Erie Street. Then came the Everett-Moore embarassment affecting three of the interurban roads and the largest city company. Since then the matter has been held in abeyance, and in the meantime the freight business of the roads has increased to such an extent that absolutely no more business can be handled with the present facilities. Recently several conferences were held, and the city companies submitted a proposition offering to erect the station and charge the interurbans for its use. It has practically been settled that one-half of the station shall be built at once. This plan is favored, because it will not require the expenditure of a large sum at the outset, and it will be easy to double the capacity of the station at short notice. The turnouts are already in and three tracks with a complete system of crossovers are to be laid at once. Extending the full length of the property will be a wide platform, giving access to cars standing on the tracks nearest the station. The system of crossovers will make it possible for any of the cars to be placed in any position on the tracks. At the platform there will be room for eight or ten cars to unload or load at once. Back of the platform there will be a station building, but plans for this have not been prepared. At the other side of the station building there will be space for a wide road for teams. When the business demands it, a duplicate station and platform can be erected on the other side of the tracks and other tracks may be added if necessary.

A Handsome Time Table

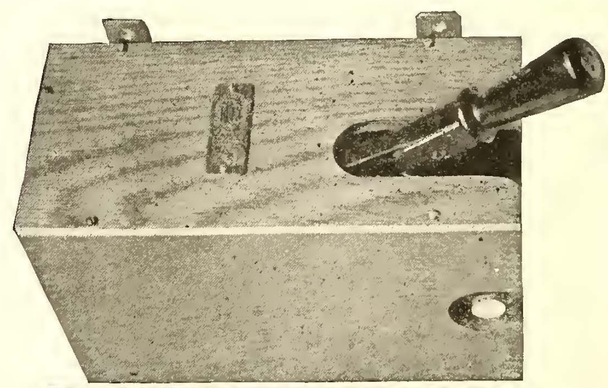
The Milford, Holliston & Framingham Street Railway Company, of Milford, Mass., has issued for the convenience of its patrons one of the neatest time-tables of the year. Superintendent M. E. Nash has arranged a very complete train schedule, which is printed in clear type, of the style used in steam railroad practice, and has adopted the use of light-faced type for morning and heavy-faced type for afternoon and evening hours. The book contains a very complete map of the system and its connections, as well as a large number of views along the road and in Lake Nipmuc Park, which is operated by the company, and is one of the most attractive trolley resorts in Massachusetts. No expense has been spared by the treasurer and general manager, E. W. Goss, in building the road, beautifying the park or supplying the rolling stock, and the service required, as indicated by the timetable, shows that his efforts have been appreciated by the residents of the territory traversed by his lines. The pamphlet gives all connecting lines, rates of fares, names of hotels and boarding-houses in the towns through which the road passes, etc., and a most interesting description of the country.

Boston Elevated to Increase Stock

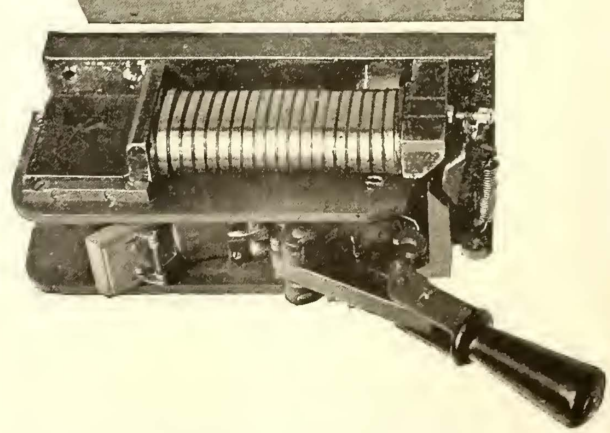
A special meeting of the Boston Elevated Railway Company has been called for July 25, to authorize an increase in the capital stock of the company from $10,000,000 to $15,000,000. The proceeds of the new stock are to be applied to defraying the cost of the construction and equipment of the road and expenses incidental thereto, and to pay the indebtedness so contracted. It is said that the cost of erecting the elevated structure, both road and terminals, has far exceeded the estimates of the engineers, and the cost of the rolling stock is also said to have exceeded the original estimates. The Railroad Commissioners will hear the application of the company for permission to increase its capital stock on July 28.

An Efficient Car Circuit-Breaker

The novelty of using circuit-breakers on electric cars in place of overhead switches, has entirely worn off, and a number of roads have adopted this system of protecting their rolling stock equipments. As street railway problems have increased in importance, the managers have appreciated the necessity of keeping their cars in continual operation, and the use of circuit-breakers has been claimed by many to largely prevent the blocking of the line. The automatic and instantaneous action of the brake, and the ease with which it can be reset after it has been thrown out, in addition to the fact that it can also be used as a hood switch, has placed it in a position where its merits are now thoroughly appreciated. The Cutter Company, of Philadelphia, realizing the importance of keeping this branch of its business up to the standard which it has produced in developing its other lines of well-known I. T. E. circuit-breakers, have perfected the form shown in the accompanying engravings. This circuit-breaker has laminated copper contacts and a magnetic blow-out. The first break is at the copper contacts, and the final arc is made on carbon blocks. It is upon this



CIRCUIT BREAKER FOR ELECTRIC CARS



WORKING PARTS OF CIRCUIT BREAKER

arc that the magnetic blow-out is effective, and the breaker thereby combines the best features of both a carbon break and a magnetic blow-out. This car circuit-breaker is made for all capacities up to 450 amps. for ordinary service, and a special line of larger sizes has been designed for use on heavy interurban cars.

The illustrations show the instrument, both as it appears in service, and with the box cover removed showing the working parts. The device is as small as is consistent with efficient operation, the dimensions being but 12 ins. long, 8⅝ ins. wide, and 5 ins. deep. It may be conveniently placed, therefore, in the hood of the car directly over the head of the motorman, where it can be thrown as readily as an overhead switch, and in case of a blow-out can be replaced in a moment.

Richmond Trolley Strike Settled

The strike of the employees of the Virginia Passenger & Power Company, of Richmond, Va., has been settled by arbitration. The entire system is in operation and no man has lost his place. The arbitrators—two men selected by the men and two by the company—met July 18, and in a short session reached a compromise without calling in the fifth man provided for in the agreement. The men demanded a nine-hour day and 20 cents an hour. They secured the nine-hour day and 18½ cents for motormen and 17½ cents for conductors on main lines and on branch lines 16½ cents for motormen and 15½ cents for conductors.

Levis County Railway Company

Progress on the new electric railway in Levis, St. Joseph, Bienville and St. Romuald, the towns across the St. Lawrence River from Quebec, goes steadily forward. The mortgage, or deed of trust, to the New York Security & Trust Company, was recently recorded at the Levis Registry office.

The car house of the company is situated on Fraser Street, and is in full view from the terrace in Quebec. It is a very pretty and substantial structure, with brick walls and wooden roof. The two pointed towers on the front face the river and are each to be surmounted by a flagstaff. This building at present is receiving its roof.

The brick sub-station building was completed several weeks ago, and on July 17 the machinery foundations and the cement floor were finished. The switchboard has been shipped by the Bullock Electric Manufacturing Company, of Cincinnati, Ohio, and is expected July 25. The motor generators follow in two weeks. Power at 10,000 volts has been contracted for with the Canadian Electric Light Company. There is a mile and a half of street trenched, and with the ties laid stands ready to receive the steel rails, which will be shipped from Sault Ste Marie on July 24. The ties are distributed along the greater part of the streets. There are 5 miles of poles erected. All the overhead material arrived in town last week and will be put in place as soon as the rails are laid. The private telephone system is completed and in operation.

The cars and equipment will be ready about the time the rest of the construction is finished, which will be about the end of August. A 350-ft. trestle is being built at one part of the line, and the piers for the reception of a 65-ft. steel bridge across a river will be ready Aug. 1.

The electric elevator up the side of the cliff, opposite the Intercolonial Railway station, is in the hands of the Fensom Elevator Works, of Toronto. The face of the cliff, where it is to be located, has been grubbed and cleared for the reception of the steel work, due to arrive Aug. 1.

Altogether, the outlook is most promising that the Levis County Railway will be running before fall.

New Publications

The Municipal Year Book, 1902. With Summaries and Editorial Discussion by M. N. Baker, Ph. B., C. E. 310 pages. Price $3.00. Published by the Engineering News Publishing Company, New York, 1902.

This work includes a directory of municipal officials and franchise companies engaged in conducting public service works in each of the 1524 largest cities of the country. This list includes all of the incorporated communities of 3000 inhabitants, and a complete exhibit of the relative extent of municipal and private ownership. The information is classified first alphabetically by States and afterwards in compact tabular form with the cities, arranged in order of population, Greater New York leading with 3,437,202, Rice Lake, Wis., closing the list with 3002 inhabitants. The work ought to be of special interest to engineers and city officials who are engaged in making comparative statiscal studies in this line, and for all who are interested in any way in municipal service. The data contained in the book was furnished by city officials of the places mentioned, and the publishers mention the fact that all but five or six of the 1524 cities and towns included furnished formal reports. When the material had been compiled copies of the matter were sent to the officials of the cities interested, for final correction, so that the work can be accepted as not only authentic but in a measure official.

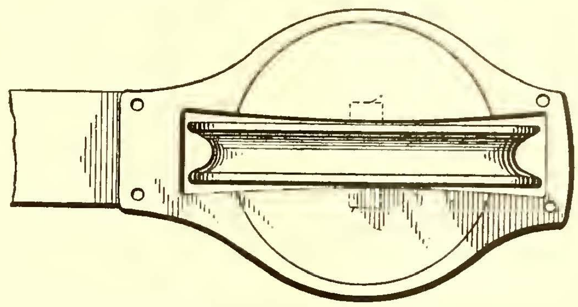
Street Railway Patents

[This department is conducted by W. A. Rosenbaum, patent attorney, Room No. 1203-7 Nassau-Beekman Building, New York.]

UNITED STATES PATENTS ISSUED JULY 15, 1902

704,506. Car Brake; F. O. Brown and E. T. Moore, Dallas, Tex. App. filed Oct. 4, 1901. An object coming in contact with the lower front edge of the fender presses it downward and operates the front and rear brake rods positively, to force a shoe down on the rail and under the wheel.

704,749. Trolley Pole Attachment; C. P. Lapham, Houghton N. Y. App. filed Feb. 7, 1902. The wheel is mounted in two horizontally arranged semi-disks, which permit it to swing laterally to a limited extent.



PATENT NO. 704,749

704,776. Car Fender; E. A. Booser, Altoona, Pa. App. filed Feb. 10, 1902. This fender is constructed to be easily folded against the dash of the car, and when folded permits the bumpers to project through it.

704,797. Railway Heater System; S. H. Harrington, New York, N. Y. App. filed Jan. 3, 1901. A switch controlling the heater circuit is operated automatically by the brake staff, so that when the brake is applied the heater circuit will be closed and at all other times open.

704,784. Track Sanding Apparatus; J. J. Dolan, Jr., Baltimore, Md. App. filed April 26, 1902. The end of the air pipe, which projects into the sand boxe, is covered by a shield, which prevents the sand from running out when the pipe is removed for any purpose.

704,803. Electric Controller; A. E. Hobrebe, Philadelphia, Pa. App. filed Dec. 12, 1901. The controller cylinder is mounted upon the hinged door of the casing so that it may be swung into view when desired.

PERSONAL MENTION

MR. H. C. LANG has resigned his position of secretary of the Springfield & Xenia Traction Company, of Springfield, Ohio, and Mr. Will Christy has been elected to fill the vacancy. Mr. Lang continues as secretary of the Southern Ohio Traction Company and the Western Ohio Railway.

MR. J. R. CURTISS has been appointed superintendent of construction on the extension of the Canton-Akron Railway, of Canton, Ohio, from Navarre to New Philadelphia. Mr. Curtiss was formerly at the head of the Curtiss Construction Company, of Cleveland, and has been identified with the building of a number of Ohio roads.

MR. F. F. BODLER, master mechanic at the repair shops of the North Jersey Street Railway Company, has resigned to accept a similar position with the United Railways of San Francisco. He will be succeeded by Mr. J. M. Young, who was master mechanic at the West Hoboken shops of the Jersey City, Hoboken & Paterson Street Railway Company. Mr. Bodler has been connected with the New Jersey systems for a number of years, having been assistant master mechanic of the North Jersey and master mechanic of the Jersey City, Hoboken & Paterson Companies before being made master mechanic of the former. He joins in San Francisco Mr. G. F. Chapman, who recently resigned his position of general superintendent of the North Jersey to become general manager of the Western system.

LEGAL DEPARTMENT

CONDUCTED BY WILBUR LARREMORE OF THE NEW YORK BAR

Ambulances and Fire Engines

In Smith vs. American Society for the Prevention of Cruelty to Animals (7 Misc., 158), it was held that an ambulance is entitled to the right of way in a street, and it is the duty of owners or drivers of other vehicles, upon seeing it approaching on the tracks of a railway, to deviate from their course sufficiently to enable it to turn out of the track to avoid collision with an approaching car on the same track. The following language from the opinion by Judge Bischoff is worthy of quotation:

> The ambulance was entitled to the right of way. Laws 1879, Chap. 186; 3 R. S. (Banks Bros., 7th ed.), 2086. Hence it was incumbent upon those in charge of plaintiff's wagon, upon seeing the ambulance approaching in an opposite direction, to deviate from their course sufficiently to enable the ambulance to turn out of the downtown track to avoid its collision with a car approaching toward it on the same track. Instead of so doing those in charge of plaintiff's wagon persisted in their course, thus leaving the driver of the ambulance no means of escape but to turn to the right or easterly side of the roadway, which he attempted to do when the collision occurred, as already stated.
>
> The inference, therefore, is irresistible either that, seeing the ambulance, the persons in charge of plaintiff's wagon disregarded it and its right of way, or that they failed to use the ordinary precaution of persons driving along the public highways or city streets, to be on the alert for vehicles approaching in an opposite direction, and so failed to see the ambulance. In either case, therefore, the collision was the fault of those to whom plaintiff had intrusted his wagon for the time being, and not of the driver of the ambulance."

In New York a right of way to ambulances is expressly granted by the statute above cited (c. 186, laws 1879), which act also provides that the right of way so conferred shall not affect the existing right of way of the United States mail or of the officers, men and fire apparatus of any municipal fire department, or insurance patrol. In other States, special privileges in favor of ambulances and fire engines exist at common law. (See Thomas on Negligence, pp. 1172, 1180; Elliott's Roads and Streets, Second Edition, Section 839, Note.) It was held by the Supreme Court of Kansas in City of Kansas vs. McDonald (45 L. R. A., 429) that a city ordinance making it a misdemeanor for any person intentionally to ride or drive any horse, mule, or other beast faster than an ordinary traveling gait in any of the streets of the city, is unreasonable as applied to officers of the fire department when driving to a fire, and for that reason will not be enforced.

The rule is that an ordinary vehicle has equal rights with a horse car or electric car in the streets of a city. This rule is subject to such modifications as the rigid roadbed of the street railway company renders inevitable. "A street railway company has a paramount, but not exclusive right to the use of that portion of the street occupied by its tracks. A person lawfully driving on the tracks may not recklessly or negligently obstruct the passage of cars, but he is not absolutely bound to keep off or get off the same." (Thomas on Negligence, p. 1143.) Of course a car cannot leave the track even to make way for ambulances or fire engines, but by stopping when called upon to do so, or in any other feasible manner according to circumstances, it is under the same duty as an ordinary vehicle to facilitate their passage.

A case recently decided by the Supreme Court of Alabama illustrates the liberal attitude of the courts toward the rights of fire wagons, and of persons connected with them. (Birmingham Ry. & Electric Co. vs. Baker, 31 So. R., 618.) It was held that where the concurring negligence of the driver of a hose cart and employees in charge of a street car results in a collision, the negligence of the driver cannot be imputed to a fireman riding on the cart, but having nothing to do with the driving, who is injured in the collision, and it will not preclude him from recovering from the street car company.

It appeared that a hose cart, going about as fast as the horses could run, and with the gong sounding, collided at a street crossing with a street car; and plaintiff, who was a fireman on the cart, was injured. Plaintiff's witnesses testified that the car had stopped before attempting to cross the street on which the cart was approaching, and that the motorman started his car without warning when the cart was only 18 or 20 ft. from the intersection of the streets, and made no attempt thereafter to stop the car. One witness testified that the motorman was looking ahead when he started the car, and another that he was looking back through the car. Defendant's witnesses testified that the car did not start after it had stopped, and that the cart ran into it. It was held that the question whether the motorman saw or heard the approaching cart when he started the car, if he did start it, and wilfully or wantonly or with reckless indifference to consequences, failed to exercise proper care to prevent the collision, was for the jury.

It was further held that the question whether a fireman, who has no time to put on his coat before responding to a fire alarm, and who does so while on the cart on the way to a fire, is negligent in so doing, is a question for the jury.

"The evidence tended to show that the firemen, when starting to a fire, would not have time to put on their coats, and to avoid getting wet, and to be in readiness for service when they arrived at the fire, they put them on while on the way, and this they were allowed to do." It is not improbable that if a person riding in an ordinary vehicle going at great speed should rise to his feet and attempt to put on his coat, such action would be held contributory negligence as matter of law.

Note.—Communications relating to this department should be addressed to Mr. Larremore, 32 Nassau Street, New York City.

LIABILITY FOR NEGLIGENCE.

NEW YORK.—Steet Railways—Crossing—Contributory Negligence—Persons Crossing Track—Rights—Charge—Instruction—Operation of Car—Notice—Damages—Amount.

1. Plaintiff, driving on a city street, saw a street car near him, going up town on the nearest track, and a car coming down town on the other track, at rapid speed, some 300 ft. away. He checked his horse until the nearest car had passed, and drove back of it. When he reached the point where he could see the other car, his horse was on the track, and the car was coming at a rapid rate, and only 20 or 30 ft. away. He whipped up his horse, but the hind wheels of his buggy were struck by the car, throwing him to the ground, and he was injured. Held, that the court properly refused to hold that plaintiff was guilty of contributory negligence in going on the track in front of the car, knowing that it was running at such rapid rate, since plaintiff had a right to presume that the speed of the car would be checked on approaching the crossing.

2. Any error in charging that plaintiff "had the right to assume that the car would not be run in such a way as to endanger him" was obviated by adding, "Every person who uses the street crossings has a right to assume that the people who are operating street cars are exercising them with due regard to the rights of others, and that they will exercise ordinary care and prudence in their operation."

3. Where a person driving to cross a street railway at a street crossing sees a car, running at a rapid rate, 300 ft. distant, such fact is not notice to him of an intention to continue such rate of speed in disregard of the rights of others at the crossing.

4. Where plaintiff in a personal injury case—a young man—appears to have sustained the permanent crippling of a limb, in addition to temporary suffering, a verdict for $4,346.98 is not excessive.—(Bertsch vs. Metropolitan St. Ry. Co., 74 N. Y. Suppl., 238.)

NEW YORK.—Street Railroads—Action for Injuries—Persons Crossing Track—Negligence—Evidence.

Plaintiff, while crossing defendant street railway company's track at night, immediately behind one of its cars which had stopped at a crossing, fell into the "fender" attached to the rear of the car, and was dragged some distance. The conductor was collecting fares when the accident happened, and neither saw him fall nor knew he had fallen when he signaled to go ahead. The fender was properly folded up when the car started on its trip, and there was evidence that it was folded up nine blocks from the scene of the accident, and it did not appear how it had fallen, or that it was improperly constructed, or that its fastenings were defective. Held, that the facts did not show any negligence on part of defendant.—(Levison vs. Metropolitan St. Ry. Co., 74 N. Y Supp., 882.)

NEW YORK.—Street Railways—Injuries—Negligence—Question for Jury—Contributory Negligence.

1. Where in an action against a street railway for injuries, there was evidence that a northbound car standing on the north corner served to cut off the view of persons seeking to cross the street from east to west, and that the southbound car, which struck

plaintiff at the crossing was going at 10 miles an hour at the time, and that the bell was not rung on such car, the question of defendant's negligence is for the jury.

2. Where, in an action against a street railroad for injuries, there is evidence that plaintiff, on approaching the track on a certain street from east to west, saw a car go south, and looked up and down the street for approaching cars, and saw or heard none, owing to the fact that a northbound car standing on the north corner served to cut off the view of persons seeking to cross the track, and the failure to ring the bell of a rapidly moving southbound car, the question of contributory negligence in attempting to cross the track is for the jury.—(Tupper vs. Metropolitan St. Ry Co., 74 N. Y. Supp., 868.)

NEW YORK.—Street Railroads—Negligence—Unexplained Accident—Res Ipsa Loquitur.

Plaintiff was injured by the sudden and unexplained stopping of defendant's street car, and on trial introduced proof of such occurrence and rested. Defendant introduced four of its employees, who testified to the use of the best-known appliances, careful supervision and skillful service. Held, that the dismissal of plaintiff's case was error, since under the doctrine of res ipsa loquitur proof of the accident cast the burden of explanation on defendant.—(Langley vs. Metropolitan St. Ry. Co., 74 N. Y. Supp., 857.)

NEW YORK.—Street Railroads—Action for Injuries—Failure to Produce Evidence—Inferences—Underground Trolley—Shock from Slot Rail—Res Ipsa Loquitur—Instructions—Sufficiency of Instructions—Overcoming Presumption—Sufficiency of Evidence—Liability for Defective Track—Duty to Repair—Electric Shock from Slot Rail—Expert Testimony.

1. In an action against a street railway company for injuries alleged to have been caused by an electric shock from the slot rail of defendant's underground-trolley railway track, wherein it appeared that defendant had appliances from which it could detect any escape of electricity from the conductor rails to the slot rail, and defendant introduced its track master, chief engineer, and electrical engineer to show that there was no leak at the time of the accident, but failed to produce those in direct charge of the detecting appliances, every inference warranted by the evidence should be indulged against defendant, because, presumably having evidence in its possession, it omitted to produce it or to explain the omission.

2. Where a pedestrian is injured by a shock of electricity received from the slot rail of an underground-trolley street railway track, the doctrine of res ipsa loquitur applies, so as to raise a presumption of negligence sufficient to call for an explanation from the company, or to put it to its proof.

3. Plaintiff claimed to have been injured, just after a snowstorm, by an electric shock from the slot rail on defendant's underground-trolley street railway track. There was evidence that electricity could escape from the conductor rails if excessive snow or moisture settled in the conductor conduit, or by defective insulation. There was also evidence that defendant's road was constructed properly. Held, that an instruction assuming the proper construction of the road, and that there was no evidence that electricity could escape except in consequence of the snowstorm, and charging that, if the snowstorm was the cause of plaintiff's injury, he could not recover, was properly refused, as improperly assuming that the electricity could not escape except through snow, and as omitting defendant's duty to use due care to remove the snow.

4. Refusal to give instructions whose subject-matter is fully covered by other instructions is not error where the requests therefor are not read before the jury, but are given to the court in writing, and it merely fails to give the instructions requested.

5. Plaintiff claimed to have been injured, just after a snowstorm, by an electric shock from defendant's underground-trolley railway track, while defendant denied this, and claimed plaintiff merely slipped and fell. The court instructed that, if the jury believed defendant had exercised ordinary care to prevent the escape of electricity, or that it was impossible for the slot rail to become charged therewith, or that defendant had sufficiently explained the accident, or that it was unavoidable by ordinary care, they must find for defendant; but that, if they should find that plaintiff was free from contributory negligence, that the accident was due to an electric shock, and not inevitable, but could have been prevented by ordinary care, and that defendant was guilty of negligence, they should find for plaintiff; that the burden of proof was on plaintiff to show by a fair preponderance of the evidence that his injuries were caused by some negligence of defendant, and that, if the evidence was as consistent with the absence of such negligence as with it, plaintiff could not recover, as he was "bound to make it more than a balanced case"; and that plaintiff could not recover "without affirmative proof that defendant did not exercise ordinary care in the construction, operation," etc., of its road. Held, that the instructions were sufficient to justify a failure to instruct specifically that plaintiff must establish his case by a preponderance of evidence, and that the mere happening of the accident was not sufficient to justify a recovery.

6. Plaintiff was injured, just after a snowstorm, by an electric shock from the slot rail of defendant's underground-trolley railway track. There was evidence to show that the slot rail could have become charged from the conductor rail in only two ways, viz., defective insulation, or by snow or excessive moisture in the conductor conduit; and defendant showed by expert testimony that its road was properly constructed, and by its employees that it had exercised care in removing the snow and other substances from the conduit, which evidence was uncontradicted except by the circumstances of the accident. Defendant also introduced employees to show that the ground-leak indicators at the power house showed no leak at the time in question, but no one in direct charge of these indicators was introduced. Held, that the question whether defendant's evidence sufficiently overcame the presumption of negligence raised by the fact of the injury by electricity was for the jury.

7. Where the insulator of the conductor rails of an underground-trolley railway gets out of repair, or the conductor conduit becomes filled with snow or moisture, so as to charge the slot rail with electricity, without any negligence on the part of the railway company, it is not liable for injuries to pedestrians, caused by such conditions, unless it fails to remedy the defects within a reasonable time after actual or constructive notice thereof.

8. Where the plaintiff claimed to have been injured by an electric shock from the slot rail of defendant's underground-trolley railway track, the testimony of an experienced electrical engineer, who knew the effect of electricity upon the human body, and was thoroughly conversant with the subject, was admissible to show that, if the slot rail was charged with electricity, and plaintiff stepped upon it under the conditions existing at the time of the accident, he would receive an electric shock.—(Ludwig vs. Metropolitan St. Ry. Co., 75 N. Y. Supp. 667.)

NEW YORK.—Connecting Carriers—Ejection of Passenger—Street Railways—Transfers—Error of Initial Carrier—Contributory Negligence—Liability of Carrier—Damages—Malice.

1. A street railway company is liable for ejecting a person who presents a transfer ticket from a connecting road, not acceptable under the rules of the company because not properly punched, though the mistake was made by an employee of a connecting road, there being a traffic agreement between the two roads, whereby transfers were issued from one to the other.

2. Where one is ejected from a street car because his transfer ticket was not properly punched, he is not to be charged with contributory negligence in receiving the same, he not understanding the ticket, and being ignorant of whether it was correctly punched.

3. Where one is ejected from a street car because his transfer ticket is not properly punched, and is arrested at the instance of the conductor, and imprisoned, the refusal of the transfer, ejection, arrest, and imprisonment are to be treated as continuous acts, for which the company is responsible.

4. The passenger is only entitled to compensatory damages for loss of time, fare on another car, and injury to feelings because of the indignities suffered.

5. The good faith of the conductor is no defense.

6. Where one is ejected from a street car because the hour was not correctly punched in his transfer ticket, a regulation of the company making such a transfer worthless is no defense to an action for the ejection.—(Jacobs vs. Third Ave. R. R. Co. et al., 75 N. Y. Supp. 679.)

NEW YORK.—Street Railroads—Collision with Wagon—Contributory Negligence.

Where the driver of a heavy wagon attempts to cross the tracks of a street car company at night, and, before doing so, looks both ways upon the track, and is unable to discover any car approaching, but does see the headlight of one, which he believes to be moving toward him at a distance of three or four hundred yards and where the evidence justifies the jury in determining that such car was travelling at an unusual, reckless, and dangerous rate of speed, which fact such driver did not and could not know before starting to drive across such track; and when, by reason of such high rate of speed, and the failure of those in charge of the car to make any effort to stop it, such wagon is struck, and the driver injured—the question as to whether the latter was so far guilty of contributory negligence as that he may not recover is one of fact for the jury, under proper instructions of the court.—(Metropolitan St. Ry. Co. vs. Slayman, 68 Pacific Rep. 628.)

OHIO.—Carriers—Injury to Passenger—Evidence.

1. In an action to recover for personal injury occasioned by negligence of the defendant, the plaintiff cannot recover by merely proving an act of the defendant which was the proximate cause of the injury; but, to authorize a recovery, the plaintiff must also show that such act resulted from culpable negligence by the defendant.

2. Where a passenger on a street railway car was thrown from the car and injured by the sudden stopping of the car in the effort to avoid a collision, and by the shock of a collision which was not brought about by the negligence of the defendant, it is damnum absque injuria.—(Cleveland City Ry. Co. vs. Osborn, 63 N. E. Rep. 604.)

PENNSYLVANIA.—Carriers—Injury to Passenger in Alighting—Negligence—Evidence.

Negligence of a carrier is not shown by testimony of a passenger that as he went to get off the car his foot caught in the step, and that he pulled to get it loose, and when he did get it loose he fell.—(Howell vs. Union Traction Co., 51 Atlantic Rep. 885.)

PENNSYLVANIA.—Street Railway—Injury to Cyclist—Contributory Negligence.

1. The dominant right to the use of street railway tracks is in the company, and must be deferred to by all the public having a right to cross, and they must use ordinary prudence to ascertain whether the owner of the track is about to use it.

2. A cyclist is bound to look and listen just before crossing street railway tracks, and is guilty of contributory negligence if he fails to do so.

3. In a suit against a street railway company for killing a cyclist of mature years crossing its tracks, there was evidence of the car going at a high rate of speed. Plaintiff's witnesses, including decedent's son, testified that the car was 50 ft. to 75 ft. away when decedent attempted to cross. He had then 17½ ft. to go to entirely clear both tracks and place himself outside the running board on the far side of the car, and was moving at from 10 ft. to 15 ft. per second. Several of plaintiff's witnesses testified that they were afraid the car would strike him. Held, that even if decedent looked to see if a car was coming, he was negligent in crossing.—(McCracken vs. Consolidated Traction Co., 50 Atlantic Rep., 830.)

PENNSYLVANIA.—Street Railways —Negligence—Parent and Child—Evidence.

Where a child two years old was in the front room of her father's house, in charge of a sister fifteen years, who was scrubbing the walk in front, and while such sister went arond the house for a pail of water the child went out onto a street car track, and was run into by a car, the question of the parents' negligence in permitting such escape of the child is for the jury.—(Jones et al vs. United Traction Co., 50 Atlantic Rep.,827.)

PENNSYLVANIA.—Street Railroads—Crossing Accident—Negligence of Carriage Driver—Evidence.

1. The driver of a carriage approaching street car tracks on a cross street at a slow trot checked his horse, but did not stop, and, on getting within the house line, looked west (the view being unobstructed for about 100 feet), and, seeing no car, looked east, and then west, when a car was seen approaching at a distance of about 50 feet; and, the horse being near the track, the driver, to avoid a collision, turned to the east and drove rapidly in the direction the car was going, but was unable to keep ahead of the car or get off the track before the carriage was struck by the car. The car was running about 20 miles an hour, and no notice was given of its approach. Held not to show, as a matter of law, that the drive was negligent.

2. There being no fixed duty to stop before attempting to drive across street car tracks, the question whether a failure to do so is negligence is for the jury.—(Haas vs. Chester St. Ry. Co. et el., 51 A. Rep., 744.)

PENNSYLVANIA. — Street Railroads—Crossing Accident—Collision With Wagon—Negligence of Driver—Failure to Look for Cars.

Where the driver of a covered wagon, approaching street car tracks on a cross street, merely glances down the track for a distance of 50 or 70 feet on first reaching the street where the tracks are located, and then drives across the tracks, without again looking for approaching cars, his negligence precludes a recovery for injuries received in a collision with a car.—(Pieper vs. Union Traction Co. of Philadelphia, 51 At. Rep., 739.)

PENNSYLVANIA.— Railroads — Crossing Accident — Collision—Negligence of Driver of Wagon—Duty of Looking—Country Electric Roads.

1. Where the driver of a covered wagon stops and gets out on the swingletree, and looks for an approaching electric car, while about 35 feet from the track, at a place where he has an unobstructed view of the track for 319 feet, and then climbs back into the wagon, and, without looking further, attempts to cross the track at a walk, and is struck by a car, his contributory negligence precludes his recovery.

2. The fact that an electric railroad is in the country, and that cars are not so frequent, and obstructions to travel are not so great as in a city, does not relieve a person about to cross the track from the duty of continuing to look for approaching cars till he reaches the track.—(Keenan vs. Union Traction Co., 51 At. Rep., 742.)

PENNSYLVANIA.—Injury to Employee—Negligence of Fellow Servant.

Any negligence of an inspector of the electrical apparatus of a trolley car, who, after inspecting it for efficiency, says: "All right. Put your pole on"—acting on which the conductors puts on the trolley, and the car runs on him, the controller being open, is that of a fellow servant.—(Shugard vs. Union Traction Co., 51 At. Rep., 325.)

PENNSYLVANIA.—Injury to Employee—Negligence—Presumption—Cross-Examination.

1. In an action by an employee, negligence of a street railway company as to sanding wet tracks cannot be presumed from the mere fact that two weeks before the accident from slipping of the car it substituted a new system of sanding in place of that used before.

2. Where the complaint is that defendant did not properly sand its tracks, it is proper cross-examination of a witness testifying that sand boxes had been discontinued on the cars to show by him that another system of sanding had been adopted, and was then being used.—(Smith vs. Philadelphia Traction Co., 51 At. Rep., 345.)

PENNSYLVANIA.—Street Railroads—Accident at Street Crossing—Pedestrians—Sufficiency of Evidence.

In an action against a street railway company for negligent killing of a pedestrian at a crossing, three witnesses for plaintiff testified that the car was running from twelve to twenty miles an hour, and that no bell was sounded; and two other witnesses testified to the excessive speed of the car. Three witnesses for defendant testified that a bell was sounded, and two that they heard none. It also appeared that when deceased left the curbing she looked toward the car, then about 200 ft. away, and when struck she was almost across the track, and that the car ran 180 ft. before it stopped, after striking deceased. Held, that the evidence was sufficient to sustain a judgment for plaintiff.—(Henderson vs. United Traction Co., 51 Atlantic Rep., 1027.)

PENNSYLVANIA—Street Railroads—Accident on Street—Negilgence—Absence of Lights.

Several witnesses testified, in an action against a street car company for running over a child on the street while going down a hill on a dark night, that there were no lights in the car, and that the conductor was attempting to put on the trolley. One witness testified that no bell was rung before the accident, and another testified that if a bell had been rung he would have heard it. The motorman testified that the night was very dark and the track was slippery. A witness testified that he believed the lights were burning in the car, and another testified that there must have been a headlight. Held, sufficient evidence of defendants' negligence to sustain a recovery.—(Welsh et al. vs. United Traction Co., 51 Atlantic Rep., 1026.)

PENNSYLVANIA—Street Railways—Collision with Delivery Wagon—Negligence—Contributory Negligence—Question for Jury.

1. A boy driving a delivery wagon was not guilty of contributory negligence, as matter of law, in backing it up at right angles to the curb to deliver heavy goods at a store, though in so doing his horses necessarily stood across defendant's street car tracks, where, owing to obstructions in the street, he could not have placed his horses and wagon longitudinally opposite such store, and it was not shown that he saw any car approaching when he placed his wagon against the curb, nor that he had reason to apprehend the approach of one before he could deliver his goods.

2. In an action against the street railway company to recover for his wrongful death, the wagon having been run into by a car, certain of the plaintiff's witnesses testified that they heard no bell or other signal, and others that no warning was given. This evidence was contradicted by that of the defendant. Witnesses for the plaintiff testified that the car was going twenty miles per hour.

It appeared that the wagon was carried 50 ft. after being struck, and that the car ran 160 ft. beyond the point of collision. The street was narrow, and the community thickly populated. The obstructions at the point in question had been there for several months. Held, that the question of defendant's negligence was for the jury.

3. The motorman of the car was negligent in failing to give warning of his car's approach, though the place of the accident was not at a street crossing.—(Fenner et al. vs. Wilkesbarre & W. V. Traction Co., 51 Atlantic Rep., 1034.)

TEXAS.—Street Railways—Passengers — Injuries — Instructions.

Plaintiff, a street car passenger, as a car slowed down upon reaching a cross street, stepped from the car to its sideboard, intending to alight, and was thrown off by its sudden start. There was evidence showing that by the company's rules cars only stopped to let off passengers after crossing cross streets, and also evidence that the car slowed down just as it reached a cross street for the purpose of permitting plaintiff to alight. Held, that an instruction which assumed that the car slowed down when reaching the cross street to enable plaintiff to alight was erroneous, since defendant's servants were not negligent in slowing down the car if they did not know of plaintiff's intention, while, if the slowing down was to enable him to alight, it would be liable for lack of ordinary care, and these were matters of fact to be determined by the jury. (Rapid Transit Railway Company vs. Lusk, 66 S. W. Rep., 799.)

TEXAS.—Railroads—Obstruction of Street—Negligence.

Where a railroad company tore up the pavement at a point where its road intersected a street and left stones lying at the place without any signal light to show their presence, as required by an ordinance, violation of the ordinance constituted negligence, rendering the company liable to a cyclist injured by colliding with the stones. (Houston, B. & N. Ry. Co. vs. Pollard, 66 S. W. Rep., 851.)

VIRGINIA.—Street Railways—Negligence—Piling Snow on Crossing—Contributory Negligence—Instructions—Trial—Reading Law to Jury—Damages.

1. In an action against a street railway for injuries sustained owing to the piling of snow on a crosswalk by defendant, it having been assumed that the street was a public highway, and it being shown that there was a crossing constantly used, the importance of which the company recognized, as shown by the evidence of the superintendent that he directed the men to clean the snow from all crossings, and that he knew they removed it from that particular crossing, a contention that the street was not a public highway was of no avail to defendant, inasmuch as such question was immaterial.

2. It was not error to permit plaintiff to prove that others than herself had walked over the snowbank.

3. Defendant asked the court to instruct that, if the tracks were covered with snow, it had the right to remove it therefrom, provided that in doing so it exercised ordinary care, to which instruction the court added, "and, where the snow might reasonably have been deposited so as not to obstruct the way of pedestrians passing along the crosswalk, the depositing of snow at such a point so as to create an obstruction is a negligent act." Held, that the instruction as amended was proper.

4. The snow, having been removed from tracks by hand, it was not error to refuse to add to the former instruction, "if the snow was allowed to remain for an unreasonable time," since the negligence of the company consisted not in its failure to remove within a reasonable time, but in putting the snow in the first instance on the crossing.

5. Plaintiff testified that she knew that the crossing was obstructed by snow, which made it dangerous, but she had passed over the crossing shortly before the accident, and it was shown that many other persons had made their way over the same obstruction; and the court instructed that, though plaintiff saw the heap of snow and knew it was dangerous, she was not guilty of contributory negligence if she was exercising such care as persons of ordinary prudence would exercise under the circumstances. Held, that the instruction was not erroneous.

6. Where defendant claimed it was not guilty of negligence unless the snow was allowed to remain for an unreasonable time, it was proper not to permit counsel to read the jury a definition of "reasonable time" from a reported case and to read from another case a discussion as to what constitutes contributory negligence.

7. In an action for personal injuries a verdict for $2500 as compensation for a broken leg and much consequent suffering will not be disturbed as excessive. (Newport News & O. P. Ry. & Electric Co. vs. Bradford, 40 S. E. Rep., 900.)

WASHINGTON.—Street Railroads—Negligence — Construction of Tracks—Runaway Horse—Question for Jury—New Trial —Appeal.

1. Where a buggy attached to a runaway horse is overturned by street car tracks negligently allowed to remain above the street level the runaway cannot be said, as a matter of law, in an action against the car company, to be the proximate cause of an injury received by an occupant of the buggy, but the question of proximate cause is for the jury.

2. The question whether street car tracks allowed to remain above the level of a street render the street unsafe for ordinary travel is for the jury, in an action against the company for an injury alleged to have been caused thereby.

3. Where an order granting a motion for new trial, raising questions of law and fact, shows that it is sustained on one specific question of law only, which ruling was erroneous, the Supreme Court will not determine whether the motion should have been sustained on other grounds. (Gray et ux. vs. Washington Water Power Co., 68 Pacific Rep.)

WASHINGTON.—Street Railways—Personal Injuries—Negligence—Contributory Negligence—Direction of Verdict.

1. Plaintiff, while crossing a street car track at the top of a hill, was struck by a car which had just ascended the hill. The grade of the hill was 20 per cent, and the car, which was propelled by cable, was apparently stopped as quickly as possible on reaching the level; but before it had cleared the incline the accident had occurred. The speed of the car could not be checked without releasing its grip on the cable. Held, not to show, as matter of law, a want of negligence in the street car company.

2. In an action against a street railway company for personal injuries, where there was some evidence that the gong was not rung, it was a question for the jury to determine what the facts were in that particular, and whether failure to sound the gong was negligence.

3. The plaintiff had crossed one track of a street car company at about the center of the crossing of two streets, and had stopped to wait for a car on the other track to pass. While standing there he observed that his family had not followed him, and turned to go back, and was struck by a car which had just ascended a hill. He did not turn towards the direction from which the car was coming. There was some evidence that no gong was sounded. Held, not to show contributory negligence as matter of law.

4. Before the court will be justified in taking from the jury a question of contributory negligence, the acts done must be so palpably negligent that there can be no two opinions concerning them.—(Burian vs. Seattle Electric Co., 67 Pacific Rep., 214.)

WISCONSIN.—Street Railways—Disposition of Snow—Negligence—Pleading—Evidence—Instruction.

1. Where a case is submitted to the jury on a special verdict, it is error to tell them the legal effect of their answer on the question of contributory negligence.

2. A complaint against a street railway company, setting forth the requirements of an ordinance that it shall not allow snow or ice to accumulate on its tracks in a quantity to obstruct or hinder the passage of teams, or deposit the same on any portion of any street so as to obstruct it or render it unsafe, or so as to interfere with ordinary travel, also charges a breach of the common-law duty not to render the street unsafe for travel, by alleging that the company negligently caused the snow and ice on its tracks to be excavated and removed so as to leave a deep ditch, rendering the street unsafe and dangerous for public travel.

3. A street railway, by accepting its franchise to operate over public streets, assumes the duty of not leaving declivities on the sides of its track, dangerous to travel, in clearing the snow from its track.

4. For one to attempt to drive across a street railway track where there is a slope of 11 ins. to 14 ins. in the snow in a distance of from 1½ ft. to 3 ft. is not negligence per se.—(Gerrard vs. La Crosse City Ry. Co., 89 N. W. Rep., 125.)

WEST VIRGINIA.—Street Railways—Injury to Person on Track—Evidence.

1. A declaration by the motorman running on an electric car, made while the car was still on the body of one it had run down, that "I saw the child, but thought I could pass it;" or, "This is a terrible thing, I saw the child, but thought I could run past it,"—is admissible in evidence as a part of the res gestae in an action for the injury.

2. A motorman in charge of an electric car moving in the public street, where he has reason to expect little children are playing, must exercise a high degree of watchfulness in the operation of the car.—(Sample vs. Consolidated Light & Ry. Co., 40 S. E. Rep., 597.)

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, July 23, 1902.

The week's developments have in the main been favorable to continued ease in the money market. It seems now to be pretty clear that the heavy currency transfers to the West in the early part of the month were connected with the Gates deal in the corn pit. Whether the corn operations have been completed is a matter upon which opinions differ. But at all events their influence upon the money market is no longer apparent, and the heavy outgo of funds has been succeeded by a return movement to this city of considerable proportions. The Treasury's excess of expenditures over receipts continues, but at nothing like the rate of the first two weeks in July. As a matter of fact the Sub-Treasury would have been a creditor during the last week in the exchanges with the local banks had it not been for large overland remittances of Alaskan gold. These arrivals aggregated more than $2,000,000 for the period ending last Saturday, and they left the banks with a net gain of $1,500,000 odd at the Sub-Treasury. This, together with the receipts from the out-of-town centers, caused an increase of over $3,000,000 cash in the last bank report, while despite the activity on the Stock Exchange, loans were reduced upwards of $3,000,000. The improvement in the bank reserve accompanying these changes was altogether satisfactory, although the surplus item is below the average run of previous years. An offset somewhat unexpected has come now, however, with the resumption of gold exports to Europe. A million dollars gold was taken Monday by the National City Bank for shipment to Berlin, and the very firm tendency maintained in the foreign exchange market suggests that more engagements will shortly follow. The exchange position, it will be noted, has been distinctly altered even from a week ago, first by the decline in New York money rates, and second, by the sales of our securities by foreign speculators. It is hard to foresee any considerable gold movement at this time, when the demands for the domestic harvest are so near at hand. Nevertheless even moderate exports, if continued, will project a new complication into the money situation. The most that can be said just now is that rates will doubtless continue easy for several weeks; but that afterwards the outlook is quite uncertain.

Time money is in strong demand for six months, at 4½ per cent, but not much is offered. Call money on the Stock Exchange does not go above 3 per cent.

The Stock Market

Another week of almost uninterrupted advance still finds no sign of an immediate termination of the "bull" campaign on the Stock Exchange. Prices for the general average of railway stocks stand now far above any previous level of recent years. Yet the sentiment of the leading speculative interests, and, to all appearances, of the great majority of the small outside speculators, continues confident in the ability of the market, not only to hold what it has gained, but to ascend to even greater heights. There must be some limit to the upward movement, and conservative people are constantly asking themselves whether the turn is not near at hand. But no one can point as yet to any danger signals, and few care to prophesy when the end will be reached. The one thing evident to all observers is that there is nothing in outside conditions which threatens an immediate check to the speculative buying movement. The money market may give trouble later on, but for the next four weeks at least there seems no likelihood of local resources becoming insufficient to accommodate all demands. Crops are making satisfactory progress, and the chances of a "bumper" corn yield, which is the main point of speculative concern, do not grow less as the season advances. The anthracite coal strike may drag along for some time further, but its most serious effects, now that the bituminous miners have decided to remain at work, have beyond much doubt been discounted. Railway earnings are on the increase, and with the assurance of a heavy grain movement for the coming season, traffic officials anticipate confidently that even the wonderful record of the last two years will be surpassed. Evidently the revulsion in the stock market, when it comes, will be the result of its own internal conditions; that is, will come about through over-speculation and excessive inflation of prices by manipulation. Only the close observer of day-to-day developments can tell when these seeds of reaction are about to bear fruit.

The local traction stocks, as anticipated in last week's article, have at length joined vigorously in the general upswing. No comment bearing on the specific value of their properties is called for, inasmuch as their movement is referable so obviously to general market conditions. The pool in Brooklyn Rapid Transit has made good use of its opportunities, and has apparently succeeded in attracting a fair-sized outside following. It is said that a prominent banking house has been buying the stock heavily of late, but we are not prepared to vouch for the correctness of this report. Manhattan Elevated has been taken in hand by a number of the larger operators, and although it is not clear whether insiders are co-operating, they are certainly not interfering with the advance. The rise in Metropolitan so far seems to be entirely sympathetic with the movement in the other tractions. There has been no heavy or no concentrated buying. Metropolitan Securities, however, has been bid up energetically by speculators who feel that they are amply protected so long as only one installment of the subscription money has been called for.

Philadelphia

The feature of the week in Philadelphia has been the heavy dealings and steady advance in Philadelphia Rapid Transit. The shares touched 11¾ on Friday, as compared with 10⅜ three days previous, and held the greater part of their gain in the subsequent trading. Nothing has developed in connection with the property beyond what has been commonly known for some time. Apparently the rise means nothing more than that a speculative clique is taking advantage of the revival of activity in the general market, to put the stock up. The noteworthy feature is that Union Traction, the lessee company stock, has refused to take part in the advance, and that the volume of dealings in the issue has been comparatively small. This bears out the view suggested in this column several weeks ago that Union Traction has pretty well discounted the advantages expected to accrue to it under the deal, and that speculative interest will be diverted to Philadelphia Rapid Transit as the issue which has the main possibilities of a future increase in value. Business in the rest of the traction department has been very light. Sales are reported in Philadelphia Traction at a further half-point advance to 99⅞, in American Railways at 46¼, Railways General at 5, Rochester Railway common (200 shares) at 66½, Consolidated of New Jersey at 69½, United Traction of Pittsburgh preferred at 51, Reading Traction (100 shares) at 32, and Indianapolis Street Railway at 83, the last-named three points down from the previous sale. In bonds Electric People's Traction 4s have again led the list in activity, large blocks changing hands around 99½. The other recorded sales include People's Passenger 4s at 105 (ex-interest), United Railways 4s at 87½, and Newark Passenger 5s at 116½.

Chicago

Sharp recoveries on light dealings have taken place in Chicago surface line stocks during the week. Union Traction common, which a week ago hung around 15, went back to 18, and the preferred reacted from 47 to 51. Denials of the speculative gossip about a reorganization was the ostensible reason for the advance. Chicago City Railway is up over 5 points on reports of excellent earnings. It is stated that the road is earning 16 per cent on its stock, against 11 per cent last year. Business in the elevated securities has been generally inconsequential. Metropolitan preferred holds strong at 92. Lake Street is quotably a half-point higher at 10½, but there is no disposition to buy the shares until the future status of the road is more definitely determined. Schemes of reorganization for the property are said to be well under way.

Other Traction Securities

A somewhat better demand developed in Massachusetts Electric during the week, under which the stock moved up from 41½ to 42¼. Boston Elevated rose a point on casual purchases to 165, and West End common was very firm at 96. In Baltimore the Nashville Railway securities have again been a notable feature. After last week's decision invalidating the company's charter had caused a sharp slump, support was extended by the pool, and the 5 per cent certificates rose to 74 and the stock to 6. On attempts of the speculative interests to realize, however, the certificates later on reacted to 72, and the shares to 4¾. The hardening tendency noted for some time past in United Railways of Baltimore issues, continues. The stock is up on fair-sized dealings to 16⅜, the income bonds to 70⅞, and the general 4s to 97¼. Other transactions of the week comprise Anacostia and Potomac 5s at 104, Atlantic Consolidated 5s at 105½, Charleston Consolidated Electric 5s at 94, City & Suburban (Washington) 5s at 104, Lexington Street Railway 5s at 104, Nashville Street Railway 5s at 102¾, and Norfolk Railway 5s at 113½. The New Jersey securities have not done much during the week. North Jersey Traction stock is off a half-point to 30½, but the bonds are up the same amount to 84½. The New York curb has been enlivened by the launching of the new New Orleans Railways stocks, which has been accompanied by active manipulation for the advance. A syndicate of Eastern capitalists, known as the Pearsall Syndicate, took over some time ago, it will be remembered, the traction and lighting properties of New Orleans and formed a new corporation. The common stock, until lately, has been quoted in the New Orleans market, as low as 10½, and the preferred at 51. But the inaugural performance on the New York curb has been a jump to 17¾ in the common and 56 in the preferred. Evidently the rise reflects simply the attempt to create a wider market for the new securities. Sales are also reported in the local curb dealings of San Francisco preferred at 64⅛ and 64¼, the preferred at 47¾. The total sales of traction stocks in Cleveland last week were 2352 shares, compared with 2417 for the previous week. Detroit United advanced during the week from 79 to 80, last sale at 79¾; total sales, 1304 shares. Toledo Railways & Light are strong at an advance from 30 to 31¼ for 461 shares. Northern Ohio Traction held strong around 40¼, sales amounting to 162 shares. This price is now regarded as rather low, although a short time ago there was plenty on the market at 34 and 35. The new Cincinnati, Dayton & Toledo stock has appeared on the board at around 23; of the little remaining Southern Ohio Traction stock, 325 shares sold strong at 71 to 71½. Lake Shore Electric shows a tendency toward establishing trading quotations under 15. The first lot of the stock to change hands sold two weeks ago at 10, but with the news that the Everett-Moore Syndicate had arranged to finance the property, bids were raised and a small lot sold at 14⅛. The course of this stock is being watched with considerable interest. It is considered one of the most promising traction properties in the State, but the bonded indebtedness is so heavy that it will be a long time before it is on a dividend-paying basis. Monday 175 shares of Detroit United sold at 79¾. A small block of Cleveland, Elyria & Western went at 75, the first of this stock sold in some time.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Closing Bid July 15	Closing Bid July 22
American Railways Company	45½	46¼
Boston Elevated	164	165
Brooklyn R. T.	68⅝	71
Chicago City	205	210
Chicago Union Tr. (common)	14¾	16¾
Chicago Union Tr. (preferred)	47½	52
Cleveland Electric	..	82½
Cleveland City	..	..
Columbus (common)	52	52
Columbus (preferred)	108¼	108
Consolidated Traction of N. J	68¼	69½
Consolidated Traction of N. J. 5s	109¾	110½
Detroit United	78⅞	79¾
Electric People's Traction (Philadelphia) 4s	99½	99¾
Elgin, Aurora & Southern	a45	41½
Indianapolis Street Railway 4s	87¾	87¾
Lake Street Elevated	10¼	10¼
Manhattan Railway	132½	136½
Massachusetts Elec. Cos. (common)	41½	42
Massachusetts Elec. Cos. (preferred)	97½	97½
Metropolitan Elevated, Chicago (common)	37½	38
Metropolitan Elevated, Chicago	90	92
Metropolitan Street	148¼	150¾
North American	126¼	126
Northern Ohio Traction (common)	39¾	39¾
Northern Ohio Traction (preferred)	89	89
North Jersey	30½	30½
Northwestern Elevated, Chicago (common)	36	35
Northwestern Elevated, Chicago (preferred)	80	80
Philadelphia Rapid Transit	9⅜	11¼
Philadelphia Traction	99¼	99¾
St. Louis Transit Co. (common)	30½	31
South Side Elevated (Chicago)	109	110
Southern Ohio Traction	70⅞	..
Syracuse Rapid Transit	..	..
Syracuse Rapid Transit (preferred)	..	65
Third Avenue	131	132½
Toledo Railway & Light	30⅞	30¾
Twin City, Minneapolis (common)	119	121½
United Railways, St. Louis (preferred)	82½	84
United Railways, St. Louis, 4s	87¼	87¼
Union Traction (Philadelphia)	45	44⅞
Western Ohio Railway	22⅛	..
New Orleans Railways (common)	..	17¼
New Orleans Railways (preferred)	..	56

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

There is not much to say that is new concerning the iron trade situation. Conditions remain substantially what they were a week ago, namely, a pronounced scarcity of the foundry and basic pig iron, due to the coal strike, and a very active demand in nearly all departments. Steel billets are easier on domestic resales and foreign competition, but as an offset to this the shortage of the pig iron supply threatens to curtail production. Orders are now on the books in the structural material branch for as far ahead as the last quarter of 1903. Quotations are as follows: Bessemer pig iron, $21.25; steel billets, $32; steel rails, $28.

Metal

Quotations for the leading metals are as follows: Copper, 11⅞ cents; lead, 4⅛ cents; tin, 28⅝ cents, and spelter, 5⅜ cents.

NEW HAVEN, CONN.—The new issue of stock which the directors of the Fair Haven & Westville Railroad Company have voted to make in accordance with authority conferred at a recent meeting of stockholders will bear the date of Oct. 1. The issue will amount approximately to $633,000, and will be offered at par to stockholders of record at the ratio of one share of new stock to six shares of old. Dating from Jan. 1, 1903, the new stock will begin to pay a 5 per cent dividend. The stock of the Fair Haven & Westville Railroad has a par valuc of $25, and its present quotation is about $49. The general purposes for which the new stock is to be issued will include the cost of construction of the Derby extension and of the additions to the power plant in Fair Haven. With the new stock issue the absorption of the Winchester Avenue system will be substantially completed.

SIOUX CITY, IA.—It is said that control of the Sioux City Traction Company and the Sioux City Gas & Electric Company has passed into hands that will effect a consolidation of the companies.

SPRINGFIELD, ILL.—E. W. Clark & Company, of Philadelphia, are reported to be negotiating for the purchase of the Springfield Consolidated Railway Company. It is also said that Clark & Company are anxious to purchase the local electric light plant and that a consolidation of the railway and lighting interests of the city is planned.

PADUCAH, KY.—The reorganization of the Paducah Street Railway Company has been effected. The company will issue $600,000 in bonds and will make extensive improvements. Officers have been elected as follows: George C. Thomas, president; George C. Wallage, vice-president; A. L. Rich,. of Cincinnati, secretary-treasurer; H. L. Porter, of Cincinnati, superintendent.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company has obtained the sanction of the city to issue $2,500,000 bonds. The company has voted to issue the bonds, but its franchise requires that the assent of the city shall be secured before the bonds are placed.

CARROLLTON, MO.—The electric lighting, waterworks and street railway interests of Carrollton have been consolidated by the Carrollton Water, Light & Railway Company. The company is capitalized at $100,000. The officers and directors of the company are: Herndon Ely, president; T. L. West, vice-president; P. E. Trotter, secretary; J. T. Marshall, treasurer; W. R. Painter, auditor; L. B. Ely and V. D. Ely, both of St. Louis, directors.

ST. JOSEPH, MO.—The property of the St. Joseph Railway, Light, Heat & Power Company, which includes the street railway system, an electric lighting plant, steam heating plant and other utilities, has been sold by F. H. Harriman, of New York, to Seligman & Company, of New York, and E. W. Clark & Company, of Philadelphia. The company is bonded for $3,500,000. There will be no change in the local management, President W. T. Van Brunt remaining in charge, it is said.

SCHENECTADY, N. Y.—The Schenectady Railway Company has begun work at Ballston on its Schenectady-Ballston branch.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

May.	1902	1901
Gross receipts	$1,156,344.84	$1,075,576.47
Expenses, including taxes	730,152.44	715,161.32
Net receipts	$426,192.40	$360,415.15
For eleven months ending May 31.		
Gross receipts	$11,624,417.09	$10,920,174.38
Expenses, including taxes	8,220,062.33	7,237,894.12
Net receipts	$3,404,354.76	$3,682,280.26

CLEVELAND, OHIO.—An arrangement for financing the Lake Shore Electric Railway which will result in relieving the road of a receiver is said to have been effected. The company will issue bonds to the amount of $6,000,000. Two-thirds of the sum will cover floating indebtedness, underlying bonds and receivers' certificates; $1,000,000 will be used in completing the road, and another $1,000,000 will be held in the treasury for future emergencies. The capital stock is also to be $6,000,000. This will be divided into $1,500,000 preferred stock and $4,500,000 common stock.

CLEVELAND, OHIO.—The Cincinnati, Dayton & Toledo Traction Company has filed in the several counties traversed by its line a trust mortgage for $5,000,000, given to the Cleveland Trust Company to secure an issue of $5,000,000 5 per cent, twenty-year bonds. The mortgage covers all the property recently consolidated to form the company mentioned. A portion of the money derived will be used for the purpose of absorbing other lines to complete the through line from Toledo to Cincinnati.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., June '02	67,631	36,589	31,041	14,121	17,021
	1 " " '01	58,191	32,123	26,069	13,056	15,946
	5 " May '02	251,306	148,773	102,533	------	------
	5 " " '01	210,776	132,335	78,441	------	------
	12 " Dec. '01	617,011	*350,845	266,166	136,162	130,004
	12 " " '00	513,725	*317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., May '02	131,371	90,393	40,977	23,476	17,501
	1 " " '01	73,725	60,993	12,730	19,901	†7,170
	11 " " '02	1,347,142	928,159	418,983	239,299	179,684
	11 " " '01	1,214,749	836,460	378,289	219,334	158,955
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., May '02	17,194	9,118	8,075	------	------
	1 " " '01	15,678	9,341	6,337	------	------
	10 " " '02	187,658	103,986	83,672	------	------
	10 " " '01	169,756	94,355	75,401	------	------
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,336,597	3,532,899	2,896,359	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,133	3,915,486	1,862,648	937,206	925,442
	12 " " '00	5,518,837	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., May '02	1,156,345	*730,152	426,192	------	------
	1 " " '01	1,075,576	*715,161	360,415	------	------
	11 " " 02	11,624,417	*8220062	3,404,355	------	------
	11 " " '01	10,920,174	*7237894	3,682,280	------	------
	12 " June '01	12,135,559	*7216008	4,919,551	4,341,748	577,803
	12 " " '00	11,768,550	*7106373	4,662,177	4,135,405	526,772
BUFFALO, N. Y.						
International Tr. Co.	1 m., May '02	264,184	146,787	117,398	97,330	20,068
	1 " " '01	291,666	161,077	130,589	92,020	38,569
CHARLESTON, S. C.	1 " " '00	209,309	115,487	93,823	78,250	15,572
Charleston Consol'ted Ry. Gas & El. Co.	6 m., May '02	399,572	208,325	191,248	75,826	115,422
	6 " " '01	245,745	159,425	86,320	76,714	9,607
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., June '02	17,750	7,065	10,685	------	------
	1 " " '01	17,253	6,195	11,057	------	------
	6 " " '02	78,940	38,021	40,919	------	------
	6 " " '01	65,461	34,403	31,058	------	------
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	------	------
	12 " " '00	757,954	378,661	379,293	------	------
CLEVELAND, O.						
Cleveland & Chagrin Falls	1 m., Feb. '02	3,454	2,255	1,199	------	------
	1 " " '01	2,435	3,016	†581	------	------
	12 " Dec. '01	47,976	*32,002	15,974	13,023	2,951
	12 " " '00	49,646	*33,272	16,374	13,294	3,080
Cleveland & Eastern	1 m., Feb. '02	4,916	3,616	1,300	------	------
	1 " " '01	3,525	4,037	†512	------	------
	12 " Dec. '01	90,390	52,022	38,368	43,678	†4,310
	12 " " '00	62,893	36,672	26,221	36,148	†9,927
Cleveland El. Ry. Co.	1 m., May '02	217,563	------	------	------	------
	1 " " '01	187,049	------	------	------	------
	5 " " '02	962,890	------	------	------	------
	5 " " '01	854,594	------	------	------	------
	12 " Dec. '01	2,296,898	1,265,953	1,030,945	244,231	786,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., June '02	25,198	13,026	12,172	------	------
	1 " " '01	22,236	9,736	12,501	------	------
	6 " " '02	128,392	77,728	50,664	------	------
	6 " " '01	107,027	64,259	42,768	------	------
	12 " Dec. '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,698	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., June '02	17,747	9,520	8,227	------	......
	1 " " '01	15,748	8,035	7,714	------	------
	6 " " '02	79,557	44,670	34,857	------	------
	6 " " '01	65,449	36,228	29,221	------	------
DENVER, COL.	12 " Dec. '01	164,971	*87,102	77,869	72,500	5,369
Denver City Tramway Co.	12 " " '00	141,112	*89,592	71,520	72,500	†980
	1 m., Apl. '02	124,516	66,533	57,983	32,865	26,119
	1 " " '01	116,357	62,866	53,490	31,304	22,186
	4 " " '02	481,348	261,118	220,230	131,259	88,972
	4 " " '01	435,297	236,915	198,382	125,622	72,759
	12 " Dec. '01	1,507,293	818,521	688,965	383,180	305,785
	12 " " '00	1,302,290	722,458	579,839	374,291	205,548
DETROIT, MICH.						
Detroit United Ry.	1 m., June '02	291,470	*159,333	132,137	------	------
	1 " " '01	260,109	*139,412	120,697	------	------
	6 " " '02	1,600,675	*907,044	693,631	395,739	297,892
	6 " " '01	1,384,181	*775,347	608,834	345,119	263,715
	12 " Dec. '01	2,919,171	*1596765	1,322,046	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,568	651
	1 " " 01	28,877	18,062	10,816	9,692	1,124

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., June '02	48,497	22,136	26,361	9,655	16,705
	1 " " '01	39,265	20,076	19,189	9,188	10,001
	6 " " '02	245,406	132,413	112,992	57,844	55,148
	6 " " '01	208,339	119,603	88,736	54,765	33,970
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., May '02	35,115	20,343	14,773	8,333	6,439
	1 " " '01	29,616	16,097	13,519	8,333	5,186
	12 " " '02	379,252	216,017	163,235	100,000	63,235
	13 " " '01	330,578	208,823	121,755	100,000	21,755
HAMILTON, O.						
Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,245	12,529	7,500	5,029
	1 " " '01	23,530	14,405	9,125	7,500	1,625
	12 " " '02	353,144	186,365	166,779	90,000	76,779
	12 " " '01	303,704	166,757	136,946	90,000	46,946
LONDON, ONT.						
London St. Ry. Co.	1 m., May '02	12,234	7,886	4,348	2,410	1,938
	1 " " '01	10,003	6,818	3,185	2,079	1,107
	5 " " '02	51,421	34,609	16,812	11,306	5,507
	5 " " '01	46,195	31,954	14,241	9,886	4,355
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m. June '02	222,450	107,193	115,257	66,015	49,242
	1 " " '01	202,416	94,430	107,986	62,780	45,207
	6 " " '02	1,274,629	612,304	662,325	389,554	272,771
	6 " " '01	1,123,765	586,463	537,302	365,323	171,978
	12 " Dec., '01	2,442,342	1,185,534	1,256,808	755,139	501,669
	12 " " '00	2,220,698	1,129,787	1,090,911	824,665	266,247
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., May '02	296,991	136,964	160,028	58,733	101,294
	1 " " '01	251,946	114,340	137,605	56,633	80,971
	5 " " '02	1,356,556	649,003	707,553	292,800	414,752
	5 " " '01	1,178,257	563,664	614,593	273,093	341,498
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., May '02	178,408	86,780	91,628	18,672	72,955
	1 " " '01	161,283	90,766	70,518	11 633	58,885
	8 " " '02	1,257,518	766,238	491,280	124,907	366,373
	8 " " '01	1,174,099	743,687	430,412	75,995	354,417
NEW YORK CITY.						
Manhattan Ry. Co.	3 m., Dec. '01	3,038,435	1,404,971	1,633,465	753,135	880,329
	3 " " '00	2,728,598	1,340,696	1,387,902	749,857	638,045
	12 " Sept. 01	10,455,872	5,328,649	5,127,223	2,683,132	2,444,091
	12 " " '00	9,950,735	5,195,312	4,755,423	2,688,644	2,066,779
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,723,972	2,143,964	1,151,140	992,824
	3 " " '00	3,786 030	1,699,649	2,086,381	1,138,467	947,914
	12 " June '01	14,720,767	6,755,131	7,965,636	4,534,068	3,431,567
	12 " " '00	14,437,134	6,631,254	7,805,880	4,445,720	3,360,160
OLEAN, N. Y.						
Olean St. Ry. Co	1 m., Mar. '02	3,994	2,411	1,584	1,146	438
	9 " " '01	3,835	2,043	1,792	1,187	604
	9 " " '02	41,735	21 611	20,124	12,343	7,781
	9 " " '01	39,270	19,276	19,994	11,068	8,925
PHILADELPHIA, PA.	1 m., May '02	97,701	------	------	------	------
American Railways	1 " " '01	73,406	------	------	------	------
	11 " " '02	908,356	------	------	------	------
	11 " " '01	764,560	------	------	------	------
RICHMOND, VA.						
Richmond Trac. Co.	1 m., Sept. '01	20,991	15,669	5,322	3,196	2,126
	1 " " '00	20,727	10,770	9,957	3.843	6,115
	12 " " '01	218,569	139,542	79,027	38,618	40,410
	12 " " '00	203,057	108,198	94,859	37,608	57,250
ROCHESTER, N. Y.						
Rochester Ry.	1 m., June '02	89,236	46,809	42,426	24,754	17,672
	1 " " '01	85,227	45,814	39,413	26 704	12,709
	6 " " '02	527,742	288,005	239,737	148,608	91,130
	6 " " '01	495,226	306,966	188,259	147,157	41,102
SCHENECTADY, N. Y.						
Schenectady Ry. Co.	3 m., Dec. '01	84,061	46,949	37,112	13,454	23,658
	3 " " '00	30,876	14,517	16,359	6,087	10,272
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., June '02	60,863	34,780	26,064	19,025	7,039
	1 " " '01	56,952	30,942	26,010	18,947	7,063
	12 " " '02	693,284	384,265	309,019	228,246	80,773
	12 " " '01	621,299	340,830	280,469	223,918	56,550
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., May '02	117,005	*60,246	56,759	------	------
	1 " " '01	101,255	*53,037	48,218	------	------
	5 " " '02	548,601	*288,224	260,377	------	------
	5 " " '01	486,027	*249,479	236,548	------	------
	12 " Dec. '01	1,311,084	*636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	*616,945	565,572	409,051	156,521
W. NEW BRIGHTON, S. I.						
Staten Island Ry.	3 m., Mar. '02	38,189	46,906	†8,717	8,778	†17,495
	3 " " '01	35,897	38,288	†2,391	8,217	†10,608