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Sleet and Third-Rail Operation

The recent experience of the Manhattan Railway in having its entire system practically tied up by a sleet storm has had a disquieting effect upon the community. Through misrepresentations of the sensational press the trouble experienced was magnified and distorted out of all proportion to its actual importance and significance. The real facts were bad enough, and an unfortunate combination of circumstances made them well-nigh intolerable, but a dispassionate review of the situation with a full knowledge of the conditions that obtained cannot fail to be reassuring, inasmuch as it shows that there is every reason to believe that the experience will not be repeated.

In the first place it may as well be frankly stated that the sleet storm found the company wholly unprepared to meet it; this fact admitted, no further explanation of the trouble is required by practical railway men, for it is recognized that to permit a sleet or snowstorm to gain headway generally means complete demoralization of traffic. But in justice to the management it may be stated that there were many extenuating circumstances, although naturally the public was in no mood to listen to explanations or give due consideration to excuses. It is only necessary, however, for the purposes of the present article to mention that the plans of the company for fighting sleet storms, as described in the STREET RAILWAY JOURNAL, Dec. 6, have since been put in operation, and the management is now convinced that no further serious delay or inconvenience will be experienced in the operation of the road from this cause.

It should also be thoroughly understood that the mixed service, which made the time interval between electric trains much longer than it would be if all the steam locomotives had been replaced by motors, permitted the third-rail at many points to become covered with a thin film of ice, and thus to be effectually insulated from the shoe. Just as soon as the motor car reached one of these points on the rail the flow of current was stopped and the train was brought to a standstill. If the shoe retained sufficient heat to melt the sleet from the rail and the motorman had not turned off the current the car would start with a jerk as soon as the shoe touched the rail, only to be brought to another stop when another covered portion of the rail was reached. With the entire road electrically operated and all the motor cars fitted with the track cleaning devices which are now being placed upon them it is believed that a repetition of these troubles will be avoided.

The means employed for removing sleet have been almost as numerous as the number of roads installed, but in the larger city systems, like Chicago and Boston, the companies depend almost entirely upon continuous service and the use of brushes and scrapers on the motor cars. The use of brine and oil have also been recommended as aids to keeping the sleet from adhering tenaciously to the third rail. In New York a solution of chloride of calcium is being used very effectively instead of brine. Both this material and the oil are sprayed on the rails by atomizers carried on cars especially fitted for this service. To be effective, of course, the oil should be used before the sleet gets on the rail, and the brine or chloride of calcium solution is put on to remove the sleet after it is on the rail. Being in an atomic spray there is no danger of its falling in drops on the street below.

One distinct difference between the New York construction and that in other cities is the use of guard timbers on each side of the third rail. These were installed to protect trackmen and others from accidental contact with the rail, and are undoubtedly a safety precaution of considerable advantage. It has been claimed that they add to the difficulty of keeping the third rail clear of snow and ice, and it is possible that this is the case. The present opinion, however, is that with the frequency of trains on the elevated, the detrimental effect of these timbers as regards snow and ice is slight if any. In Chicago, where no attempt is made to protect the rails, there has been no trouble whatever during the last three years from sleet, and none is anticipated. At one time the Lake Street L system in Chicago had protecting strips on

either side of the third rail similar to those employed on the Manhattan, but they were removed, and it is said that less trouble has since been experienced from sleet in the operation of this line.

It has been suggested that the third rail should be covered, or that it should be fastened so as to present a side contact, but numerous objections have been raised to both of these plans. Side contact could only be made by employing a spring to press the shoe against the third rail, and every railroad man knows that this would introduce many complications at switches and crossings, and might seriously impair the efficiency of the system. Protected third rail has been employed experimentally, but never on a large system nor upon an elevated structure, and it is contended that upon the latter in a driving sleet storm very little if any protection to the rail would be afforded by placing a board over it. On isolated sections, however, where the track was laid on the ground, this plan has worked very satisfactorily so far as sleet alone is concerned. But it has been found that snow will still drift and pack around the rail, and the ordinary form of contact-shoe will iron it down solid, and thus effectually insulate the shoe from the rail. To overcome this particular difficulty a special form of shoe has been tried on surface roads with a protected third rail for overcoming this difficulty. It consists of an iron bar about 15 ins. long, 1¼ ins. wide and ½ in. thick. Instead of making contact by crossing the rail at right angles this bar projects diagonally across the rail in the direction of travel, and thus forms a sort of a plow as well as a contact-shoe. Thus far no difficulty has been experienced with this device in operation at switches and crossings as might have been feared.

It seems to be the general consensus of opinion, however, among the men most experienced in third-rail operation that no protection is necessary in elevated systems where reasonable precautions are taken to prevent sleet from forming on the track, and where the interval between trains is as short as on the Manhattan Railway.

The Braking Problem

A pair of very interesting papers on this important topic have just been read before the American Institute of Electrical Engineers, and we earnestly commend them to the study of our readers. The first is a very lucid discussion of the general subject by R. A. Parke, taking up the principles of braking and their application in practice. The second paper, by J. D. Keiley, gives the results of a series of tests on electric cars with brakes of various types, the data being obtained by automatic recording mechanism that eliminated some of the sources of error usually found. Effective braking, as is now well understood, requires the application of power just insufficient to produce skidding of the wheels, and maintained at this point of efficiency as the car slows down. The change in the coefficients of friction forbids a constant brake pressure if the condition just mentioned is to be fulfilled, and the most recent types of air and electric brakes are designed to use a high shoe pressure at first, falling off gradually as the speed comes down. On account of its great facility in application and the ease with which this regulation of pressure may be attained, Mr. Parke strongly favors either the air brake, which can be manually controlled, or else the automatically-controlled magnetic track brake, which, in spite of obvious good qualities, has not yet taken a prominent place in electric railroading. In speaking of feasible brake pressures the interesting point is brought out that, with the use of sand on a slippery track, it is still possible to reach in theory, at least, a negative acceleration of about one-fourth gravity, that is about 5½ miles per hour per second. As this implies a corresponding thrust of one-fourth gravity on the passengers, it is safe to say that emergency stops at such a rate would never become popular. This possible figure of brake efficiency is considerably above safe practice, and it is, perhaps, fortunate that every-day brakes are far from attaining it. Mr. Parke does a good service in calling attention to the common fault of brakes in producing any unequal pressures on the front and rear wheels and in causing unpleasant vibration of the trucks. The common and simple forms of brake seem especially at fault in this matter, and it is safe to say that even hand brakes could be greatly improved by proper equalizing gear, suited to the special structure of the truck used. The track-brake Mr. Parke has little use for, unless in the electromagnetic form, and we think most practical street railway men will be inclined to concur.

On the working side of the electric-car braking question Mr. Keiley's paper is full of suggestive points. He worked with six different forms of brake, one being a late model of hand brake, the others power brakes of various sorts. The cars weighed about 18 tons, and were operated at speeds up to nearly 20 miles per hour. A large number of emergency stops were made and automatically recorded, and from the data thus determined Mr. Keiley has constructed a set of curves showing the characteristics of the various brakes employed. The most striking fact which appeared was, as might well have been expected, the great inferiority of hand brakes at anything above the most moderate speeds. For instance, at 15 miles per hour the car ran 152 ft. under hand braking, while the least effective of the power brakes stopped it in about 108 ft., and the most effective in 74 ft. At 20 miles per hour the hand-brake car ran 205 ft., and the best power brake brought it to a stop in 101 ft. In the rough, one would not go far wrong in saying that a first-class power brake will stop the car in about half the space required by the hand brake. But even among power brakes Mr. Keiley found considerable differences, and also found that redistribution of the pressure as between the front and rear wheels resulted in a very material improvement. Comparing Mr. Keiley's result with Mr. Parke's data it is interesting to note that the former's most effective power brake stopped the car in just about twice the space that would have been required by Mr. Parke's estimate of the best efficiency fairly attainable. This means a negative acceleration of 2½ miles to 3 miles per hour per second, which seems quite as great as is advisable in a passenger car, and greater than should be used except in an extreme emergency. One then reaches the interesting result, which current practice tends to confirm, that the best modern brakes will stop a car as quickly as it is safe to stop it under any ordinary conditions. If greater braking effect is demanded some means of protecting the live load must be devised. On the other hand, many of the brakes now in use fall far short of the permissible maximum efficiency, and are totally incapable of making a stop within a reasonable distance, save at low speed. With hand brakes the statement must be made still stronger. From Mr. Keiley's curves it is easy to deduce the result that if two cars were approaching each other on a single track, each running at 15 miles per hour, and through fog or curves got within 100 yds. of each other before knowing it, a serious collision must result in spite of all the hand brakes could do. There would really be no question of brakes being in order or not, or as regards their prompt application, for they simply would be inadequate. And it is correspondingly easy to see that even with power brakes a collision must result in a fog of any density. When interurban cars run at speed they must simply see to it that they have a clear track, for there is a limit to the capacity of even the best brakes.

Congested Traffic Conditions in Our Large Cities

The Merchants' Association and certain other public spirited bodies in New York have just commenced an active campaign to improve the condition of street railway traffic in New York, which is admitted by all to have become a very serious question. If taken up in the right way and if given popular support, a movement of this kind should be able to accomplish a great deal of good. We are heartily in sympathy with a campaign of this kind, and only regret that it was not commenced several years ago, in which case some of the conditions of which complaint is now made might possibly have been avoided. The street railway companies have done all that they can do by themselves to ameliorate the condition, but if they are now assisted by popular opinion

there is no doubt but that some improvement can be secured in a problem which is admittedly difficult and which at best is not capable of absolute cure.

The real trouble in New York, as in other large cities, is the fact that our large cities are not growing outward as rapidly as they are growing upward. The modern sky-scraper, besides revolutionizing city architecture, has complicated enormously the city transportation problem. The office building district below Fulton Street, in New York, for instance, contains perhaps four times as many tenants as it did ten years ago, and ten times as many as twenty years ago. Nevertheless, the streets are no wider, and although the railway companies have introduced improved motive power, which will care for some of the increased traffic which results from a twenty-story city, even electricity cannot do everything. The city authorities, on the other hand, have, up to this time, taken no steps to assist in a solution of the problem, and, with the single exception of the subway, whose capacity is limited, have refused to grant any more additional franchises in lower New York than when the average office building was only two or three stories in height. The result is that as most of the tenants of these buildings leave their work at practically the same time, or between 5 o'clock and 6 o'clock, the congestion is terrific.

Practically the same conditions exist, though at present to a somewhat less extent, in many of the residential districts and retail shopping districts in New York, where the modern apartment house or department store is replacing the single dwelling or individual two-story of our forefathers. Could the latter have foreseen the type of structures in which their descendants were to pass their days we trust that they would have made more and broader avenues of communication from one part of the city to another. But if, knowing the conditions, they did not, they would not have been any more unreasonable than our present day critical public, which complains about inadequate traveling facilities while doing its most to hamper those which exist.

Although the rearrangement of the streets of a city to secure more lines of track in each is out of the question, there are certain directions in which improvement can be secured. Whether they are made or not will depend on the public itself, and we sincerely trust that the crusade which is being inaugurated for improved transportation facilities in New York will bring about some reforms, the need for which is long outstanding.

Directions in Which Reforms Can be Secured

One of the most important steps for improving the situation which can be taken is in the direction of permissible speed. It has clearly been shown that placing more cars on the present tracks is simply out of the question, as, during the rush hours, when the greatest congestion exists, the tracks are now worked up to their capacity. Even in the non-rush hours it is very doubtful if additional cars, as suggested by the Mayor, would greatly, if at all, relieve the surface traffic situation. The fact of the matter is that the number of cars run during all business hours is very nearly the same, and the effect of the addition of more cars would be simply to reduce the speed at which those in operation could be passed any junction point. In other words, the "seat-miles per hour" would not be increased, and some other direction of improvement must be followed. There is no difficulty about a maximum speed in cities of 25 miles an hour, provided the tracks are kept comparatively clear of vehicles, and this speed is in regular use in many of the Western cities. But in the East, and particularly in New York, it is not at all uncommon for the trucks and drays habitually to use the part of the street covered by the tracks, and in this way hold back long lines of cars. If public opinion should decide that the tracks must be kept clear they would be kept clear, and it is up to the citizens of every large city where such a state of things exists to say whether rapid transit is of more importance to the business men and women who are on a dozen or more cars which are being delayed or to the case of dry-goods which is on the truck causing the obstruction.

Additional Routes Also a Requisite

Although an increase of speed would accomplish considerable relief in New York, it is not the only step available to improve traffic conditions. Additional routes of transit in the lower part of the city are absolutely indispensable. The new subway will help matters somewhat when it is finished, but its effect will not keep pace with the growth of the population, and more heroic measures are needed in addition. Both of the present New York transportation companies, the Metropolitan and the Manhattan, have been willing for a number of years to build additional routes, but their construction has been opposed by a community which has been particularly blind to its own interests. We hope, now the fact has become evident, that steps of some kind must be taken if people are to be transported between their offices and places of residence in ordinary comfort, to say nothing of safety. As long as ten years ago the Manhattan Elevated Railway Company presented to the city a plan for the construction of a number of additional routes, including a line extending the entire length of West Street on the North River front, and with two cross-town connections. But this plan, as well as attempts made by the Metropolitan Street Railway Company to secure additional trackage rights in the lower and other business parts of the city, have been continuously opposed for some inconceivable reason. If they had been granted the relief would long ago have been felt, and there would not now be occasion for the present agitation. We sincerely trust that the bodies interested in the present crusade will agitate the need of more and better transportation facilities, and will make their voices heard in municipal as well as legislative councils, so that New York city will soon have the additional elevated surface and underground tracks which are needed to carry its ever increasing population. The matter has already been delayed too long and action is imperative.

The record being made daily by the transportation companies of New York for their facilities is unparalleled in the world, and only those who are unacquainted with the conditions under which they operate could expect them to do materially better in caring for the traffic under the existing circumstances. A public hearing will be held at the City Hall at 10 o'clock next Tuesday morning, at which we hope the salient facts of the situation will be brought out and public recognition will be given to the efforts which are being made by the companies. When this is done the question of the best possible relief can be taken up in an intelligent manner.

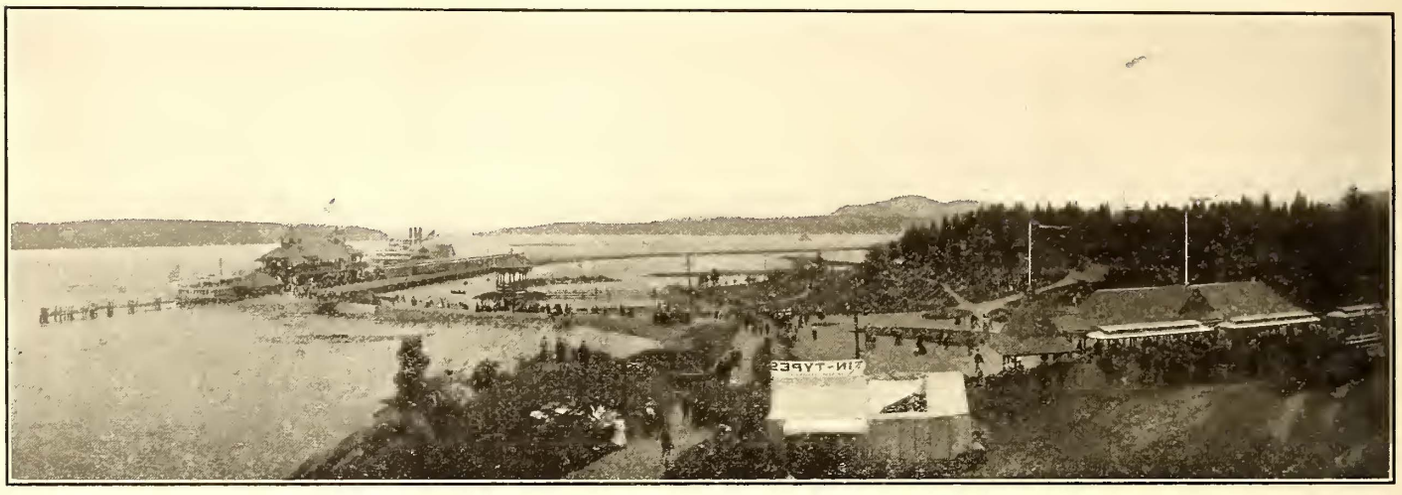
The Mayor's Letter

A good instance of the lack of appreciation of the real condition of affairs was given last week in a letter sent by Mayor Low to the presidents of the Manhattan and Metropolitan Street Railway Companies suggesting certain changes by which it was thought that better service could be secured. In his letter to the Manhattan Company Mr. Low referred to the large traffic carried by that company during "Dewey Day," four years ago, and stated that he did not see why the company could not do as well every day. In reply to this suggestion Mr. Skitt pointed out the fact that the travel on the Manhattan system during the Dewey celebration amounted on the first day to 805,000, and on the second day to 836,000, "under conditions with which everyone in New York at the time is familiar. On Dec. 22 last the company without undue delay or risk of accident in the ordinary course of business transported 931,000 passengers." Other suggestions made by the Mayor were taken up in detail, and some reasons were given why the present operating practice of the company was the most efficient. Mr. Skitt believed, however, that when the present improvements, now under way by the company were completed, there would be a marked increase in the carrying capacity of the company.

Mr. Vreeland stated that the subject matter in the Mayor's questions was too broad to be discussed with the limits of an ordinary letter, but he promised to take the matter up at the meeting on Dec. 30.

Kingston Consolidated Railroad Company

Among the smaller street railway systems of the country, probably none has received the attention which has been directed to those in Kingston. Since the organization of the Kingston City Electric Railway Company, in 1892, the situation has attracted the notice of railway financiers, lawyers and engineers, and after passing through many vicissitudes, a unification has been perfected which places the Kingston system in the front rank of economically-operated roads. The street railways of Kingston date back to 1865, when the Kingston & Rondout road was built. The name of this road was changed in 1879 to the Kingston City Railroad. About 1892 the formation of a new electric system, known as the Kingston City Electric Railway Company, was projected. Steps were then immediately taken to electrify the Kingston City Railroad, which had been operated by horses. In 1894 the name of the new road was changed to the Colonial City Electric Railway Company, and began operation under that name. In 1896 the name was again changed to the Colonial City Traction Company. The two rival lines were constantly involved in legal proceedings, and fought each other with great animosity until 1901, when the Colonial City Traction Company bought out its older rival, the Kingston City Railroad, and the combination which is now in effect was made. The name of the unified system was changed to the Kingston Consolidated Railroad on Dec. 11, 1901, and in the past year remarkable results in operating, both from a financial and service standpoint, have been effected.



GENERAL VIEW OF PARK—ALBANY DAY BOAT AT PIER

A PLEASANT SPOT FOR PICNICKERS

One of the most interesting features of the fight between the rival companies was the litigation resulting from the efforts of the Colonial Company to secure the right of crossing the tracks of the West Shore Railroad Company on the line of its rival, the Kingston City Company. This was carried as high as the Court of Appeals, and was ultimately won by the new company. The important legal questions involved created much interest at the time. It was finally decided, however, by the new company, as the result of a compromise, that, instead of crossing the steam railroad tracks at grade, a subway should be built near the existing crossing. During the time of the litigation and the building of the tunnel the road was under the direction of C. Gordon Reel, as engineer and superintendent, and a reorganization committee, consisting of John I. Waterbury, Charles M. Preston and August Belmont, had the operation in their charge. These same interests now control the entire property, and although after the building of the tunnel Mr. Reel's services were dispensed with for a time, at the final consolidation last year he was recalled and now fills the position of general manager of the consolidated road. It is under his direction, therefore, that the work of improving the property during the last year has been carried out.

The city of Kingston is situated on the west bank of the Hudson River, the town of Rondout, which is part of the municipality, being directly on the water. Between the two sections there is comparatively little population, except along a narrow connecting strip. This makes, from a street railway standpoint, an ideal distribution of traffic. The line is single track throughout, a great advantage during the hard winter season, when a double track would make it almost impossible to keep the road open during the heavy snowstorms. The service is frequent, the turnouts being arranged so that a possible schedule of ten minutes' headway can be made, and in ordinary operation that headway is maintained. Although a small amount of T-rail is used, by far the greater portion of the track is laid with 80 lb., 7-in. girder-rail made by the Pennsylvania Steel Company. A single trolley wire is, of course, used, the road having been built before it became customary to use two overhead wires, but a peculiarity of the construction is the stringing of a single guard wire about 2 ft. above the trolley line. This guard wire was put up with the original construction and has given good service in preventing telegraph and telephone wires from falling across the trolley wire.

THE BAND STAND IN THE LAGOON

The rolling stock consists of forty cars, fifteen closed, twenty-four open and a combination sprinkler and snowplow, most of which were built by the Pullman Company, and equipped with either Peckham or Diamond trucks. Although these cars are several years old, the careful attention that they have con-

stantly received has kept them in excellent condition. This is one of the principal features of the management's operating policy, great stress being laid upon efficient maintenance. Every year the cars are thoroughly overhauled and varnished, and once a day the brass work, even to the coverings of the controllers, is rubbed up. But little repair work is made necessary by this close attention to the apparatus, and a small shop in the car house is quite sufficient for the master mechanic's needs. A peculiar type of car has been operated for the last two or three years with excellent results. The amount of traffic in the old days, when the two rival roads were exerting every effort to attract passengers to their respective cars, was not sufficient to warrant the introduction of long cars, but the comfort of the cross-seat induced the Colonial Company to place this type of seat, made by the Hale & Kilburn Company, in an 18-ft. car. There are six seats on a side, and the three cars are probably the only ones of this type which are in service.

THE CASINO AND PIER

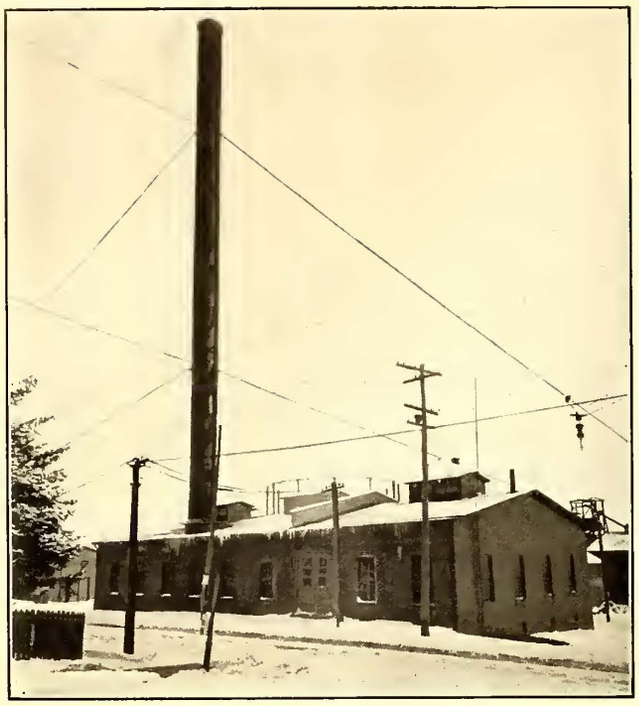
The power station has recently been greatly enlarged in capacity by the placing of two direct-connected units in the engine room, and the building of an addition to the boiler room. The former equipment consisted of two 150-hp horizontal tubular boilers and two belt-driven 150-kw Westinghouse railway generators. These machines were driven by Ball & Wood tandem compound engines of 175-hp capacity, each running at 240 r.p.m., the speeds of the generators being, respectively, 550 r. p. m. and 625 r. p. m. The new direct-connected units which have been installed consist of 300-hp Ball & Wood tandem compound engines running at a speed of 200 r. p. m. This nominally high speed makes a very compact unit, and the 200-kw rating of the generators is very much exceeded in regular service. The engines have cylinders 14½ ins. and 28 ins. x 16 ins. stroke, operating under a steam pressure of 150 lbs. The generators are all rated at 550 volts, being over-compounded 10 per cent, but 575 volts is ordinarily carried on the board. A new switchboard has recently been installed, which is the latest type of Westinghouse design for railway service and is equipped with Westinghouse apparatus and measuring instruments. It is of the simplest construction possible, there being but two feeder circuits, and the four generators being all connected directly to the buses. The two feeder panels each contain one single-pole, quick-break feeder switch and an ammeter. The board is equipped with a Thomson recording wattmeter, which measures the entire output of the stations.

The new boiler equipment consists of two water-tube boilers of 302 hp each, built by the Babcock & Wilcox Company, of New York. These boilers are installed in a brick extension, recently built to the old boiler room, and a new stack has been erected between the new and the old boilers. This is a semi-self-supporting steel stack 6 ft. in diameter and 150 ft. high, and its erection necessitated the construction of new breeching for both old and new boilers. Along the side of the new boiler room a shed has been built about 45 ft. long x 25 ft. wide, with a capacity of 250 tons coal storage, which is sufficient for about forty days.

The feed pumps, condensers, feed-water heaters,etc., are placed under the engine room in a low-studded basement. This basement was originally intended to accommodate the auxiliaries for the two smaller machines, and considerable ingenuity has been shown in placing the entire equipment for the larger plant in the somewhat cramped quarters. Two feed-water heaters, of the American type, made by the Whitlock Coil Pipe Company, of Hartford, Conn., are used to raise the temperature of the water before it passes into the boilers. The distance to the feed pumps from the boilers, and the general lay-out of the plant made the installation of economizers in the flues out of the question, and the feed-water heaters are depended upon for this service. The primary heater takes exhaust steam directly from the engine and heats the water to a temperature of about 130 degs. F. The secondary heater raises the temperature to 216 degs. F. by the exhaust from the auxiliaries. Worthington condensers are used and Worthington pressure-pattern plunger pumps for the feed-water. Water for condensing and boiler purposes is taken from the Hudson River nearby. The steam piping is designed to

KINGSTON POINT PARK

amply meet all future requirements. It is made up with Van Stone joints, manufactured by the Walworth Manufacturing Company, of Boston.



KINGSTON POWER STATION

Outside of the basement a brick oil house has been constructed, the top of which is level with the engine room floor and forms a convenient landing stage for supplies. A steam railroad siding on the Ulster & Delaware system runs directly behind the power house, so that the facilities for receiving machinery and fuel are excellent. To improve the fire risk the oil house is fitted with solid doors and windows made of wood and covered with tin-plate sheets having lap-joints. A gravity oiling system is used in the engine room, oil being supplied from a tank under the roof. A rotary pump is used for forcing the oil from the filters in the basement to the reservoirs above, and a generous quantity is kept in continual circulation.

The management has given particular attention to the selection of its employees, and as the wages paid are higher than ordinarily found in towns of this size, it has succeeded in retaining on its pay-roll a most efficient force. The economical operation of the road is claimed to be due in a great measure to the co-operation of the men on the platform with the general manager in keeping up the high standard which the road has reached, and in retaining the commendation of the public. The thoroughness with which the equipment is overhauled and maintained, and the strictness with which the men are required to keep the appearance of themselves and the apparatus in condition adds greatly to the feeling of personal interest in the welfare of the road, and the management is sure of the support of its employees in any emergency. As an example of the feeling of esprit de corps among the men may be mentioned the fact that although no benefit association has been thought advisable, yet in case of illness or other trouble generous donations have always been made to those in distress by voluntary contributions. A thorough investigation is immediately made in case of accident, either to passengers or others, and during the past year a most remarkable showing has resulted in consequence. If it is possible to settle a case out of court it is immediately closed, but the company has been very successful in proving in its court cases that any

negligence shown has in general been on the part of the injured parties. During the last eleven months the damage account has been $136.

The consolidation has increased the net earnings something over $12,000 in the last eleven months. The percentage of operating expenses to gross earnings has been reduced from 68.11 per cent to 57.53 per cent, the latter figure being unusually low for a small system where satisfactory service is given.

A great source of revenue to the system is the operation of Kingston Point Park, a number of views of which are shown in the accompanying illustrations. This park is situated on a point of land running out into the Hudson River, and is probably one of the handsomest pleasure grounds in the State. Its natural attractions have been materially added to by the construction of appropriate summer houses and pavilions, and the general development of the grounds has resulted in many beautiful examples of landscape architecture. The class of patrons to the park is of the highest order, as it is essentially a resort for Sunday schools, Young Men's Christian Associations, and social societies and organizations. A large convenient hall, which seats 400 people, has been built on the grounds, which makes an ideal place for the holding of meetings of a literary or religious nature, and is largely used by organizations, which thus enjoy pleasant outings as well as instructive sessions at the summer meetings. A pier in the park is the landing-place for the Hudson River Day line as well as excursion boats, and many of the visitors to the park arrive in this manner. No charge is made either for trolley passengers, pedestrians, bicyclists or excursionists who arrive by the water to any part of the park. A handsome bandstand is built on an island in the lagoon formed by the pier, and band concerts are given afternoon and evenings. A large number of boats are owned by the company, and at 25 cents an hour prove a very satisfactory method of hearing the music as well as being extensively used at all times. A carousel and a restaurant where light refreshments are served are features of the park. A handsome station has been built at the end of the trolley track where seats are provided for those waiting to take the cars. Along the side of the track a series of beams, placed end to end, is laid to serve as an additional step to passengers alighting from open cars, which is highly appreciated by the patrons. This step can be seen in the view of the entrance to the park. Summer houses and walks are plentiful throughout the grounds, and in many places rustic tables and benches have been placed for the convenience of picnickers. The policy of the company in welcoming all to the park without restricting that right to trolley riders or direct patrons of the road has resulted in a general friendliness of feeling highly remunerative to the management. As much as $200 a day has been made on the "merry-go-round" alone, while the restaurant privileges bring in a handsome revenue without risk to the railway company. The traffic on special days and nights, when some extra attractions, such as fireworks, etc., are supplied, has been very great, but owing to the short haul and the maintenance of an accurate schedule crowds have been handled with satisfaction to all. On public holidays as many as 40,000 passengers have been carried in a city of 30,000 population. This percentage is surely remarkable. It is, of course, made possible by reason of excursionists coming into the park. The present plans for the coming year include important additions to the amusements in Kingston Point Park as well as improved facilities for handling the traffic, and there is little chance but that these figures will be largely increased during 1903. As an interesting street railway proposition, the Kingston road, as said before, has been observed for a number of years, and it is pleasant to note that at present the only features of interest which are found are the excellent way in which it is managed, and its bright prospects for future development. The present officers of the company are: Charles M. Preston, president; George Hutton, vice-president; C. Gordon Reel, general manager and chief engineer; G. B. T. Bow, superintendent; Augustus J. Phillips, secretary; Abraham Hasbrouck, treasurer; A. M. Day, auditor; C. J. McNellis, chief electrician; M. J. Sullivan, chief engineer of power station, and John Ryan, master mechanic.

Street Railway Traffic Circulars—III.

In the series of park circulars which have been published in this paper attention has been given so far to roads which might be termed of the largest class. These, it may have been thought by many, can afford to advertise and go to a greater extent into the business of publishing circulars than would be warranted in the case of a smaller company. An examination, however, will disclose the fact that probably more of the smaller companies have found it more profitable to issue circulars of this description than those who are operating in large cities. This is especially true of roads which make a specialty of the park business, and some of the circulars advertising parks on the electric railway lines are very artistic.

ARTISTIC COVERS FOR PARK CIRCULARS

The accompanying engravings show the covers only of three circulars of this kind. The first two of these were published by the Fonda, Johnstown & Gloversville Railroad Company, and the third by the Erie Traction Company. The first one of the series illustrated herewith is a small five-leaf circular, containing a time-table of the steam and electric divisions of the company and a map showing the route. The second is a much more pretentious circular, and is descriptive of Sacondaga Park, which is reached by the railroad company. It contains thirty-two pages, with tasteful cover, and is illustrated by small, attractive half-tone views of the park and its attractions. Both covers are printed in colors, in one case red and green, and in the second case red, green and brown, although this would not be indicated in the photographic reproductions.

This circular, entitled "The Edinboro Route," is a sixteen-page pamphlet, of which only the cover is reproduced. It is published

by the Erie Traction Company, of Erie, Pa., and is devoted particularly to describing the charms of Conneauttee Lake, at Edinboro, Pa., which is on the line of the company, and of Cambridge Springs, which is at the southern terminal of the road. The pamphlet also contains two maps of the route, one on a small scale showing the location with relation to neighboring large cities, like Buffalo, Cleveland and Pittsburgh, the other being on a larger scale. This cover, as well as those of the two circulars previously described, were designed by the Matthews-Northup Company, of Buffalo, who make a specialty of this kind of printing. The sizes of the circulars in the order in which they are described are 3¼ ins. wide by 6 ins. high; 4½ ins. wide by 7 ins. high, and 3½ ins. wide by 6¼ ins. high.

Chicago Experience with Sleet on the Third Rail

The Chicago elevated roads, having operated electrically for several years, have had considerable experience with battling with sleet on the third rail. While sleet is probably the worst enemy to the operation of a third-rail electric road that exists, it is not the bugbear to Chicago roads that it was in the early days of third-rail operation. The Metropolitan Elevated was the first to be equipped electrically, and General Manager H. M. Brinckerhoff, who has been connected with the road from the first, and has consequently had a large experience with third-rail operation, reports that his company has experienced no serious difficulty with any sleet storm for three years past. In that time there has been no sleet storm in Chicago which could not be taken care of by the steel brushes, which are carried fore and aft of each contact-shoe. About three years ago there was a very severe sleet storm, necessitating the use of scrapers in addition to the brushes. These scrapers were carried in advance of the brushes to break up the ice, and the brushes finished the job. They now form part of the equipment carried by each motor car.

Mr. Brinckerhoff thinks it possible that heavy sleet storms will be more troublesome in New York than in Chicago, although they are occasionally very severe in Chicago. The use of the protecting trough or guard on each side of the third rail on the Manhattan Railway in New York, which was required by the Board of Health, he considers will be responsible for much trouble in third-rail operation in sleet and snowstorms. The Lake Street Elevated Railroad in Chicago was once equipped with guard boards, but these were not a success.

Superintendent Headley, of the Lake Street and Northwestern Elevated Railroads in Chicago, has devised something for removing sleet which combines some of the features of both a brush and a scraper, and which has been put on all the cars of those companies. It is in reality a number of scraper blades cast into one solid iron back, and bearing on the rail in the same manner as a brush would. This was described in the Street Railway Journal of Jan. 4, 1902.

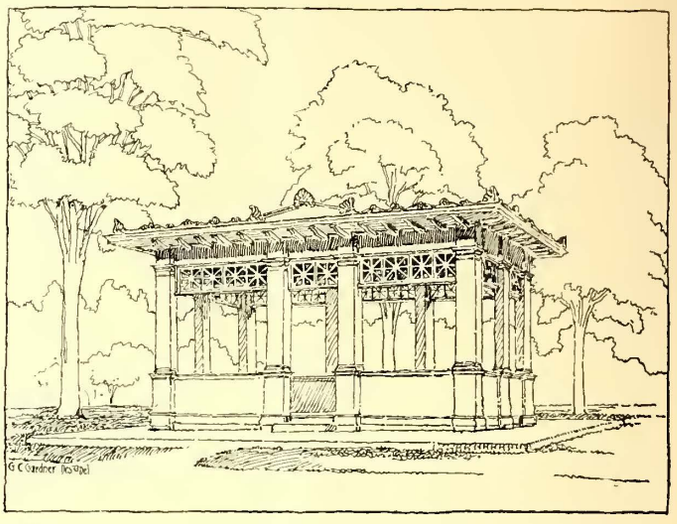
A sleet storm on an elevated road is very much like a snowstorm on a street railway. It must be battled with from the start, or scrapers and brushes are useless. All the elevated cars in Chicago during the winter season are equipped with sleet-fighting devices, which can be let down onto the third rail on short notice.

Interesting New York Traffic Figures

In an interview last week Oren Root, assistant manager of the Interurban Street Railway Company, of New York, made public some interesting figures in regard to the operation of cars on some of the main lines of that system. He stated the well-known fact that the maximum number of cars which could be operated on the longitudinal lines was limited by the number which could be passed the busiest cross street on that particular system. Thus the maximum number of cars on Broadway is the number that can be pushed past the most congested intersection, which is at the corner of Broadway, Sixth Avenue and Thirty-Fourth Street, where two north and south and one cross-town line intersect in a small triangle, and the records show that during the busy hours of the day 1150 cars pass that corner hourly, or an average of 192 cars per minute. The busiest double-track cross section on the system is at the corner of Fourth Avenue and Twenty-Third Street, where 900 cars per hour, or 150 cars per minute, are driven through the intersection. According to Mr. Root the records are unequaled elsewhere, and the Interurban Street Railway Company has only been able to accomplish as much as it does by the most expert practice secured through years of operating under these conditions.

Unique Design for Shelter and Waiting Room

The Springfield (Mass.) Street Railway Company has adopted a new design for a waiting station for the accommodation of its patrons in West Springfield. A raised concrete walk, 5 ft. wide, surrounds the building, which is 17 ft. x 20 ft., outside measurement. The roof is supported by ten pilasters, and all the space between is occupied by windows and doors in winter, but they can be taken out in warm weather. The interior will be sheathed and



RUSTIC WAITING ROOM IN NEW ENGLAND

finished in North Carolina pine. A tin roof is provided, and there is an overhanging cornice, 3 ft. wide, supported by brackets of an attractive design. The roof is decorated by zinc crestings. The building provides a waiting room 15 ft. x 18 ft. and 10 ft. high, interior measurements. It will be heated by electricity. The estimated cost is $1,000. E. C. & G. C. Gardner, of Springfield, Mass., are the architects.

The accompanying cut, which is a reproduction of the architects' sketch, shows the building with the doors and windows out as it will appear in warm weather.

The Coal Famine in Detroit

Although the scarcity of coal suitable for car heating, and even for other commercial purposes, is being felt somewhat all over the country, Detroit seems to have been one of the worst sufferers in this respect ever since the beginning of the anthracite strike.

The Detroit United Weekly, which is found regularly on all the cars of the Detroit United Railway Company, graphically presents the situation to the patrons of that company in a few words of explanation, which doubtless go far to induce passengers to put up cheerfully with unavoidable discomfort, where otherwise they would be grumbling against poor management on the part of the company. One of the greatest values of a publication of the nature of the Detroit United Weekly is in keeping the public in touch with the efforts of the management to give the best service possible, even if through matters beyond the control of the management the service is not always perfect. Mr. Fry, assistant general passenger agent, who has supervision of this publication, and who many exhibitors at the last American Street Railway Association convention will remember with most cordial feelings, is to be congratulated on his efforts in the direction mentioned. The paragraph spoken of is as follows:

We are all having trouble with coal, or rather, without coal. One is having trouble to get it to sell and someone else to get it to burn. We are all involved, but the degrees of embarrassment vary. The man who needs a scuttlefull to start his fire is not up against it as hard as the man who needs 4 tons to start his fire, for the scuttle is easier to fill than the 4-ton wagon.

The Detroit United Railway needs 10 tons a day to heat its cars alone—300 tons a month. We burn about 1500 tons of coal in our cars between Nov. 15 and April 15. It is coming just as hard for us to get coal as for the man who starts his furnace with a scuttlefull and then goes up stairs to read the papers. It is coming very much harder for us to get coal, in that we need more. The coal dealer fills the scuttle before the wagon. We have fallen upon dinky lots of coal with the avidity of the hungry rooster upon the succulent worm. We have bought odd carloads, odd boatloads, odd pockets-full. We have used soft coal, coke and wandering fragments of anthracite. We are doing our best. That is all.

Railroad Car Braking*

BY R. A. PARKE

The special advantages of compressed air for the transmission of the power throughout trains of considerable length have established the air brake in a pre-eminent position. At first, the compressed air was stored in a reservoir upon the locomotive and, by means of a pipe, extending throughout the length of the train, and an operating valve upon the locomotive, it was conducted to the brake cylinder upon each car, by which the brakes were applied to the wheels, through the intervention of suitable rods and levers. The time required to convey the necessary volume of compressed air from the storage reservoir upon the locomotive to all the brake cylinders of even a comparatively short train, and the total disability resulting from rupture at any point of the air conduit, caused this form of air brake to be supplanted by the automatic air brake, in which an auxiliary storage reservoir, of sufficient capacity to operate a single brake cylinder, was added upon each car. Through the operation of a triple valve device, which connects the train pipe or air conduit, the auxiliary reservoir and the brake cylinder upon each car, admission of compressed air into the train pipe causes each auxiliary reservoir to become charged to operate the brakes, and discharge of air from the train pipe, from any cause, causes communication with the auxiliary reservoir to be transferred from the train pipe to the brake cylinder, whereby a corresponding quantity of compressed air is discharged from the auxiliary reservoir into the brake cylinder. By defining the reduction of pressure of air in the train pipe, the pressure of the brake-shoes upon the wheels may be graduated to any desired degree within the limit established by the ultimate equalization of air pressure in the auxiliary reservoir and the brake cylinder, and accidental rupture of the train pipe instantly operates to stop the train and to prevent further progress without effective repair. In any case restoration of the air pressure in the train pipe actuates the triple valve to re-establish access to the auxiliary reservoir, whereby it is recharged with air pressure, and to transfer communication with the brake cylinder from the auxiliary reservoir to the atmosphere, through which the brakes are released.

THE AUTOMATIC AIR BRAKE

When the automatic air brake became employed upon freight trains it was discovered that, in making a quick stop by venting the train pipe at the locomotive, the interval of time required to cause an operative reduction of the air pressure in the train pipe at the rear end of the train was so considerable that effective application of the brakes upon the rear cars was delayed until sufficient retardation of the forward portion of the train had become effected to cause a collision with the rear cars, which damaged and often disabled the cars and did violence to the lading. To remove this obstacle the automatic air brake became superseded by the quick-action automatic air brake, in which, when a quick stop is desired, each triple valve opens a vent in the train pipe, in addition to the vent upon the locomotive. By this means an operative reduction of the air pressure progresses throughout the train pipe, of the longest trains, with nearly the velocity of sound, and damage from the serial character of the application of brakes by compressed air becomes practically eliminated. Incidentally, also, in the local venting of the train pipe air at each succeeding triple valve, the utilization of this source of power, formerly wasted at the engineer's operating valve, was accomplished by conducting the vented air into the adjacent empty brake cylinder before it receives the ordinary supply provided by the auxiliary reservoir. Thereby the ultimate air pressure in the brake cylinder is augmented about 20 per cent, and the character of the application of the brakes in disaster-threatening emergencies is further distinguished from that in ordinary service, where neither the violence nor the power of the emergency application is desirable or even tolerable.

COEFFICIENT OF BRAKE-SHOE FRICTION

The early Westinghouse-Galton brake tests showed results which may be summarized as follows: The coefficient of brake-shoe friction decreases with increased speeds and, at constant speed, it decreases with the increase of the time that the surfaces are in contact. The coefficient of friction does not appear to increase with increased pressure per square inch. When the wheels roll without sliding upon the rails the rail friction (or adhesion) is unaffected by the speed, but declines greatly with sliding of the wheels when it varies inversely with the speed corresponding with the brake-shoe friction, but is much inferior thereto. The rail friction is very materially affected by the condition of the rail, being greatest when the rail is perfectly dry or very wet (as when washed by a hard rain) and least when the rail is quite moist; but, by the use of sand upon the rails, the effect of moisture is practically eliminated.

The actual variation of the brake-shoe friction with increased speeds is very regular, beginning with the friction of rest (static friction), and declining, very rapidly at first, but with continually decreasing rapidity, up to the highest speeds of the experiments. The undoubted fact that the friction cannot vanish for any finite speed, considered in conjunction with the peculiar character of the decline, suggested to the writer that the results of the experiments might be approximately represented by a portion of an equilateral hyperbola, so far as the maximum and mean values are concerned. The minimum values are too irregular to suggest more than a general inclination to decline as the speed is increased.

The decrease of the coefficient of brake-shoe friction from continued contact apparently follows the same character of law as does that from increase of speed; that is, the fall is rapid at first, but the rate of fall quickly begins to decline. It has been assumed that the decline of the friction is as the increase of the time of contact, but a careful analysis shows that it is a function of the product of the speed and the time, or of the distance through which the shoe rubs upon the wheel. The more recent experiments appear to show that, at the same speed, the friction becomes constant after a time, but it is probable that the coefficient of friction continues to yield to the influence of continued rubbing throughout stops from the highest speeds yet attained in practice.

Recent experiments have also shown very conclusively that, other conditions being the same, the coefficient of friction declines as the pressure increases, and, while insufficient data has yet been presented to determine the character of the decline, there are substantial reasons for believing that it follows the same character of law as do the declines from increased speed and extended rubbing contact.

COEFFICIENT OF RAIL FRICTION

The coefficient rail friction was found to vary for dry rails from .19 to .35, and averaged about .25. Upon wet or greasy rails, without sand, it fell to as low as .15 in one experiment, but averaged .18. With sand upon wet rails it never fell below .20, and rose in some cases as high as .40, so that, with the use of sand, the rail friction of a wet rail is at least equal to that of a dry rail without sand. When the brake-shoe friction overcame the rail friction and caused the wheels to slide upon the rails, the coefficient of rail friction immediately began to decline and then varied inversely as the speed, in much the same way as brake-shoe friction, but is much inferior thereto. This may be readily explained by the greatly reduced area of contact and consequent high pressure per square inch between wheels and rails. It may also, of course, be due in some measure to inferior fractional qualities of the steel wheel upon steel rails, as compared with cast-iron brake-shoes upon steel wheels.

CONDITIONS FOR MAXIMUM RETARDATION

The maximum retardation which may be utilized in stopping railroad vehicles by the customary means of brakes, is therefore that which is realized by so applying brake-shoes to the wheels that the resulting brake-shoe friction shall be uniform, and just insufficient to overcome the constant, static rail friction. If sand be suitably provided whenever the condition of the rail requires it, the coefficient of rail friction always available (unless perhaps in the case of railroads running in streets) is at least .20, and may doubtless be safely regarded, in at least all cases where emergency calls for the highest efficiency, as .25, of the pressure of the wheel upon the rail. A brake system of ideal efficiency in the time of necessity, is thus one in which the brake-shoes are so applied to the wheels that a retarding rail friction equal to one-fourth the weight of the train is instantly realized and continuously maintained throughout the stop. In such a case the retardation (ignoring the resistances of rolling friction and the atmosphere), is one-fourth the acceleration of gravity, or 8.04 ft. per second, which amounts to reducing the speed at the rate of almost 5½ miles an hour per second. Stops would be made in a distance represented by .1338 V^2, where V is the initial speed in miles per hour, or in 482 ft. at 60 miles an hour, 214 ft. at 40 miles an hour, and only 53½ ft. at 20 miles an hour. The obstacles to the realization of a brake of such efficiency are apparent at once when the variable nature of the coefficient of brake-shoe friction is understood, and the difficulties which attend variation of the pressure of the brake-shoe upon the wheel to compensate for the fluctuation of the coefficient of friction, from the simultaneous operation of such complex influences, appear insuperable. But the problem is not entirely hopeless and it is useful to consider what has been and what may yet be done to increase the efficiency of braking.

* Abstract of a paper read at a meeting of the American Institute of Electrical Engineers, New York, Dec. 19, 1902.

VARIATIONS IN RAIL AND WHEEL FRICTION

In the outset, while at first glance the coefficient of static rail friction, which measures the maximum retardation, appears to be inflexibly established, such is not altogether the case. The inferiority of the coefficient of friction between the wheel and the rail to that of the brake-shoe upon the wheel must be attributed chiefly to the very great difference in the areas of the surfaces in contact and the consequent difference in the pressure per unit area. The convenient doctrine of Morin that the friction is independent of the area of the surfaces in contact has been the cause of much misapprehension and of many errors of construction. Mr. P. H. Dudley has clearly demonstrated that broad-headed rails yield a materially greater tractive power to locomotives than narrow heads, and it may be confidently assumed that any means of increasing the surface of contact between wheels and rails adds to the resistance which measures the maximum efficiency of the brakes. The theoretical line of contact between a wheel and rail broadens out practically into a somewhat pear-shaped surface, which differs in form and extent with different materials and pressures. The head of the rail is locally depressed and the circular periphery of the wheel becomes flattened, resulting in a surface of contact, the extent of which depends upon the elasticity of the materials, the diameter of the wheel and the forms of the rail head and wheel tread. It is evident that a greater contact area occurs with a large than with a small diameter of wheel, and it is equally clear that greater elasticity of material of either wheel or rail conduces to the same result. Steel is generally more elastic than chilled cast-iron, and recent observation indicates a higher coefficient of rail friction with steel-tired wheels than with chilled iron. It is true that, while such a result should thus be expected because of a larger area of contact, it may also be that the frictional qualities of the materials in contact constitute a factor of some importance. It has generally been understood that the dynamic friction of cast-iron brake-shoes upon chilled cast-iron wheels exceeds that of the same shoes upon steel-tired wheels. While this conclusion does not appear to have been actually established, yet, even if it be correct, it does not follow that the static friction of steel-tired wheels upon steel rails may not be greater than that of chilled cast-iron wheels. But, whatever the fact may be in this respect, it is reasonable to expect that the most effective surface of rail contact occurs with large, steel-tired, straight-tread wheels upon broad rails, and, so far as our information yet extends, observation confirms this view sufficiently to warrant the statement that it is a matter of considerable importance.

DESIDERATA FOR EFFECTIVE BRAKING

The utilization of the retarding force available as rail friction, by means of brakes, involves the application of a brake-shoe pressure which shall (*a*) diminish as declining speed causes the coefficient of friction to increase, which shall (*b*) increase as increased distance of frictional contact causes the coefficient of friction to decline, and which shall (*c*), when diminishing or increasing for such purposes, further diminish or increase as reduction or increase of pressure itself causes the coefficient of friction to correspondingly increase or decline. The combined effect of declining speed and increasing distance is far from being uniform in stops from different initial speeds. The friction apparently declines from continued rubbing in about the same proportion, through a given distance—the first 100 feet of the application, for illustration—whether the initial speed is high or low; but the elevation of the coefficient of friction by declining speed during such first 100 ft. of application, is much less proportionally when the initial speed is high than when it is low. The two opposing influences are thus uniformly effective. In stops from low speeds the coefficient of friction increases, slowly at first and rapidly at the close, but continuously from beginning to end. At high speeds the elevating influence is proportionately less effective at first, so that, for a time, the friction remains about stationary, or even declines at first before becoming stationary; but it always subsequently arises with an increasing rapidity that becomes so great as to be almost abrupt at its termination. It is, therefore, a characteristic of all stops that the coefficient of friction is comparatively low during the early portion and much higher toward the close; and, while manipulation of the pressure to compensate for the compound fluctuation of the coefficient of friction appears hopelessly complicated, a partial realization of the efficiency of such an ideal brake system may be accomplished by employing a comparatively high brake-shoe pressure during the early part of the stop, and subsequently so reducing it that the high coefficient of friction near the end of the stop shall not cause the wheels to slide upon the rails. The provision of means by which this partial utilization of the advantage of compensating the pressure is practically realized constitutes the latest and highest progress thus far made in the practical development of the air brake.

In accomplishing the purpose of applying an increased brake-shoe pressure during the early part of the stop, the quick-action automatic brake has been modified by the addition of an automatic pressure-reducing valve to each brake cylinder, by the use of which a high air pressure is utilized in the brake cylinder in emergency applications of the brakes, and is gradually reduced to the level of that which, in earlier forms of the air brake, is maintained continuously throughout the stop without sliding wheels at the close. That material progress in braking is marked by this step will be easily appreciated when it is understood that, with the use of this apparatus, called the "high-speed" brake, stops from the higher speeds are about 30 per cent shorter than those attained by the quick-action brake. By the more prompt application of a greater brake-shoe pressure than immunity from injurious wheel sliding permitted in ordinary applications of the brakes, the "emergency stop" became clearly distinguished by the quick-action air brake, and, in passenger train service it was shortened to about 80 per cent of the shortest stop of the older automatic air brake. By the application of a greater brake-shoe pressure during the early period of stops for utilizing a larger proportion of the retarding force realized at lower speeds the high-speed brake shortens emergency stops from high speeds to about 70 per cent of those of the quick-action brake, or 56 per cent of those of the old automatic brake. The increased brake-shoe pressure is secured by the use of a high air pressure, which, through the operation of the automatic reducing valve, is available only in emergency applications of the brakes, the moderate pressures of the old automatic brake being still preserved in ordinary operation to prevent possible injury of wheels. But the higher storage pressure of the auxiliary reservoir air is equivalent to a correspondingly increased volume of air stored at the pressure of ordinary service, and thus the high-speed brake also provides for repeated brake applications without recharging the auxiliary reservoirs—an incidental advantage greatly increasing the security of trains under conditions of daily occurrence.

DIFFERENCES IN STEAM AND ELECTRIC RAILWAY BRAKING

It is opportune to digress at this point to consider an application of the high-speed brake which concerns conditions to which electric railroad operation is peculiarly adapted. Hitherto, the ordinary stops of railroad trains have generally consisted of a preliminary reduction of speed at a long distance from the stopping point, to bring the train under full control, and then of a gradual reduction of the remaining speed, continuously or in stages, to suit the conditions or the operator's views, until the train comes to a standstill at the stopping point. The stops of express trains have been infrequent, and the speed of way trains has been moderate, so that, in both cases, the time occupied in the stop has not called for careful consideration. But with the rapid growth of suburban traffic in all large cities, particularly since the introduction of electric railroads, the changed operating conditions of suburban trains give great importance to the time consumed in the frequent stops. Both in steam and electric railroad traffic of this kind large expenditures of thought and money have been made to secure high acceleration in starting trains, while almost nothing has been done to secure the equally important high retardation in stopping. Every start is accompanied by a stop, and if economy of time is important in one it is equally important in the other. The neglect which efficiency of stopping has suffered is doubtless due to the fact that, while acceleration in starting has generally been limited to that which may be acquired from the rail friction of a few wheels, the retardation resulting from brakes upon practically all the wheels is so effective in comparison that its inferiority to what it might be is overlooked. Moreover, the character of the train stop of ordinary service has been so firmly established and avoidance of the use of full power—the emergency application—of the brake has been insisted upon for such good reasons that departure from the customary "service" application of the brakes does not readily suggest itself. But the conditions now under consideration are quite different. At low speeds the violence of the emergency application is apt to result in discomfort to passengers, and the brake-shoe pressure is too near the wheel-sliding limit to be desirable. But at the high speeds attained between stations in efficient suburban service the initial coefficient of brake-shoe friction is so low that no perceptible shock or disagreeable effect accompanies an emergency application of even the high-speed brake; and the coefficient of friction near the end of the stop is so much lower, through the effect of continued rubbing through so much longer distance than in a stop from the lower speeds, that the danger of wheel sliding is not troublesome.

There is also another important time-saving feature of the

emergency application for service stops in train service of this character. In making an ordinary service application the personal equation of the operator is an important element. The proper point at which to apply the brake, the force of initial application and each subsequent increase or reduction of the braking force (to prevent over-running or stopping short of the station) are matters of personal judgment in which men differ materially; the consequence of which is that, to be safe, the brakes are usually applied too early and time is lost in drifting into the station at low speed. In an emergency application the personal element is largely eliminated, as the full application is practically instantaneous, and, where definite speed may always be depended upon, the point at which the brakes should be applied may be designated by a signal post. Thus, full speed might be obtained over much the larger part of the distance traversed during an ordinary service stop, followed by a quick stop of the high-speed brake, and fully half the time occupied by the service stop would be saved.

EFFECT OF BRAKING ON THE PRESSURE OF THE WHEELS ON THE RAILS

In utilizing the rail friction for the retarding force, while it has the proper direction, it is applied at the lowest points of the mass of the car. In consequence the center of inertia of the car body being above the points of application of the retarding force, rotation through the eccentrically applied retarding force is prevented only by the resisting rotative moment of a greater supporting pressure from the forward than from the rear truck. Each truck is subject to the combined rotative moment of the eccentric retarding force at its lower extremity, and the eccentric reacting force from the car body at its upper extremity, and rotation is prevented only by a contrary rotative moment of a greater supporting pressure by the rails upon the forward than upon the rear pair of wheels. Thus the very act of applying the brakes to the wheels produces a new and very different system of wheel pressures upon the rails, and it is the wheel pressures under those conditions which determine the available retarding force. As the total pressure of all the wheels upon the rails cannot vary it is obvious that the existence of a greater rail pressure for the forward than for the rear pair of wheels of the truck implies the virtual transfer of a portion of the normal pressure from one pair of wheels to the other. The brake-shoe pressure upon the rear pair of wheels must be insufficient to cause the wheels to slide upon the rails, and must, therefore, be cut down in proportion to the transfer of weight from the rear to the forward pair of wheels. But as the forward pair of wheels will become the rear pair when the car moves in the opposite direction, the brake-shoe pressure upon that pair of wheels must also be limited in the same way. Thus, the braking pressure upon each pair of wheels must be restricted to correspond with the minimum pressure of the wheels upon the rails, and when it is understood that this minimum rail pressure, which occurs in the maximum application of the brakes, is less than 85 per cent of the normal, or, in other words, that the effective wheel pressure, available for braking, of an ordinary eight-wheeled passenger car is but 85 per cent of the weight of the entire car, the importance of an investigation and of the provision of means to compensate for such a serious loss of retarding efficiency becomes clearly manifest. [A solution of this problem, devised by the writer, was submitted, in which a formula was given representing the greatest wheel pressure which can be applied to each wheel of an eight-wheel car without sliding any of them.]

METHOD OF PROPORTIONING BRAKING PRESSURES TO CORRESPOND TO RAIL FRICTIONS

A means of automatically proportioning the brake-shoe pressure upon the forward and rear wheels of the truck so that they should more nearly correspond to the respective rail friction equations is then important. A method of accomplishing this is through the angularity of the hanger link, by which, if the brake-shoes be applied upon the inner face of the wheel—that nearest the center of the truck—and the hanger link supporting the brake-shoe be inclined at a proper angle with the tangent to the wheel at the center of the bearing surface of the brake-shoe, the brake-shoe pressure is proportioned to the wheel pressure. This matter merits very careful consideration.

More as a matter of convenience than for any other apparent reason it has generally been customary in passenger car construction to suspend the brake-shoes from the end timbers of the truck at the outer face of the wheels. It is true that the brake-shoes are thus more accessible for renewals, but the arrangement is inconvenient in other respects, requiring the disconnection and often the removal of the brake beams to remove the wheels. The application of the brake-shoes at the outer face of the wheels results in an upward thrust of the brake hangers, proportioned to the brake-shoe friction, upon the end timber at the rear end of the truck, and a corresponding downward drag upon that at the forward end. It has already been shown that the retardation of the car by the rail friction produces a rotative effect upon the truck, which is greatly augmented by this direct action of the brake-shoe friction through the hanger links, and the result is that a considerable rotation or tilting of the truck frame actually occurs, compressing the forward equalizing bar springs and relaxing those at the rear. The reaction or recoil of these springs is the cause of the frequently observed violent backward surge or shock, so disagreeable to passengers and sometimes throwing unguarded standing persons to the floor at the instant of stopping. If, however, the brake-shoes were suspended at the inner face of the wheels the upward thrust of the hanger links would act upon the forward portion of the truck frame and the downward thrust upon the rear portion, so that the effect would be to counteract and neutralize instead of aggravate the disagreeable influence of the rail friction.

Another and still more serious objection to this method of suspending the brake-shoes is the evil effect of the angular inclination of the hanger links, which is not only desirable to insure clearance of the shoes from the wheels when the brakes are released, but is usually unavoidable for constructive reasons. This feature will be better understood upon further consideration of the effect of inclining the brake beam hanger links. On the other hand it can be shown mathematically (see paper) that by hanging the brake beams between the wheels, instead of outside, and inclining the hanger links at a proper angle. The increased pressure and consequently the increased friction of the brake-shoes upon the forward pair of wheels and the diminished pressure and friction of the brake-shoes upon the rear wheels, due to the effect of the friction itself in causing the shoes to press more or less forcibly upon the wheels through the angularity of the hanger links, are made to correspond with and compensate for the transferred weight from the rear to the forward wheels. In the same manner that running in the opposite direction causes a reversal of the conditions for the transfer of weights; so, too, the rotation of the wheels in the opposite direction causes a reversal of the effect of the inclined hanger links, and the increased brake-shoe pressure is always applied to the wheels carrying the increased weight. The braking force P upon the brake beam must, however, be so reduced that the rear pair of wheels shall not be caused to slide, and the combined friction of the brake-shoes upon the two pair of wheels be thereby reduced accordingly. The loss of more than 15 per cent in braking efficiency, which has been stated to result from the use of a uniform brake-shoe pressure instead of pressures proportioned to the rail pressures occurs when the hanger links are not inclined, but it will now be understood that, with outside-hung brakes having the ordinary inclination of hanger links, the loss is considerably greater, the retardation probably averaging at least 20 per cent below that attainable by the expedient of inside-hung brakes with properly inclined hangers.

In practice the application of this method of inclined hanger links is not without some difficulty. The chief trouble is that no constant angle of the links can be maintained, as the wearing away of the brake-shoes, together with wearing and turning down of the tires of steel-tired wheels, causes constant and considerable variation. Thus, if the angle of inclination and the braking pressure be calculated for the conditions existing when the brake-shoes and wheels are new, the increased angle when the shoes become much worn and the tires have been well turnd off, would probably cause the forward wheels to slide upon the rails. On the other hand, if the calculations be made for turned wheels and worn shoes, the efficiency is too much reduced when the wheels and brake-shoes are new. It is, therefore, necessary to compromise between the extremes, in reference to the angle of inclination of the hanger links. It is obvious that the variation of the angularity of the hanger links, through the allowance necessary for wear (2¾ ins. for steel-tired and 1¾ ins. for chilled cast-iron wheels), is an inverse function of the length of the hanger link itself, which should therefore be as long as practicable. With the use of that form of brake-shoe holder or head in which the hanger link pin is located behind the center of the brake-shoe, the maximum length of hanger is secured. The form of brake head in which the pin is considerably above the center shortens the hanger materially, and its use should be avoided.

The equation deduced (and contained in the original paper) shows that the angle of inclination of the hanger links varies inversely with the wheel base of the truck, which is fortunate, since long wheel base is desirable also in all other respects (ease of riding, minimum wear and tear of wheel flanges and truck frames, etc.), except in cases where curves are so sharp that a long wheel base interferes with curving.

FORMULA FOR MAXIMUM BRAKING FORCE

Examination of the practice in passenger-car construction of ordinary American steam railroads indicate quite general uni-

formity in respect to most of the various features which determine the angle of inclination of the brake hanger link and the braking force. In general, for practical purposes, the average of the conditions existing is sufficiently accurate, and may be taken as follows: The coefficient of rail friction may be regarded as $f_1 = .25$, particularly as the limiting conditions are those of emergency applications. The coefficient of brake-shoe friction most apt to slide wheels is that of low speeds, near the end of the stop, and experience indicates a safe value to $f_2 = 1\text{-}3$. Little error will, in any ordinary case, result from making W_1 (weight of car body) $= 2\text{-}3$ W (total weight of car) and W_2 (weight of each truck) $= 1/6$ W. Generally, h (height of bottom of car body above rails) $= 34$ ins., and $k/l = 1/15$, k = height of center of inertia of car body above truck support; l = distance apart of truck supports. The height of the center of gravity of the truck (d) varies with the diameter of the wheels; for 33-in. wheels, $d = 20$ ins.; for 36-in. wheels, $d = 20.5$; for 38-in. wheels, $d = 21$; for 40-in. wheels, $d = 21.25$, and for 42-in. wheels, $d = 21.5$; the weights of wheels (w) differ both with the diameter and the construction; a fair average appears to make $4.8\ w = .071\ W$ for 33-in. steel-tired wheels, $.080\ W$ for 36-in., $.089\ W$ for 38-in., $094\ W$ for 40-in., and $.098\ W$ for 42-in. With these values (except those depending upon the diameter of the wheels) the maximum braking force, as ordinarily calculated, which may be used without injurious wheel sliding, becomes

$$B = \frac{15\,(1 + 4.8\,w/W)\,(1 - 1/g\tan^2\Phi)\cos\Phi}{16\left\{\frac{46}{45} - \frac{68}{66} + d + \frac{1}{3}\,(1 + \frac{4\,8w}{W})\,\tan\Phi\right\}\cos\,(a + \varphi)}\ W$$

Φ = angle which the link hanger makes with the tangent to the wheel at the center of the brake-shoe when the brake-shoe and wheel are fully worn, and a = angle between the radial direction of the brake-shoe pressure and the horizontal with worn shoe and wheel.

BRAKE-SHOE RELEASE SPRINGS

In which it would be a serious oversight to dismiss this subject of truck brake gear construction without mentioning the pernicious break beam release spring. The custom of hanging b ake beams from the end timbers of passenger-car trucks has been attended—in the many cases where the inclination of the ranger links is insufficient to cause the brake beams to fall away from the wheels by gravity—by the necessary use of springs to insure clearance between brake-shoes and wheels when the brakes are not applied.

The loss of brake-shoe pressure from the use of such springs might, of course, be readily compensated by increasing the braking force correspondingly, if such loss could be determined. But these springs vary to such an extent, even when made apparently alike and applied in the same way, that allowance for their influence is well-nigh impossible. Springs, so applied to trucks that they should keep the shoes uniformly away from the wheels, are found to operate so unevenly that—to prevent the brake-shoe at one end of a beam from dragging upon the wheel—that at the other end must be permitted to stand off so far from its wheel that excessive travel of the brake-cylinder piston is necessary to apply the brakes, whereby the air pressure in the brake cylinder is reduced and the efficiency of the brakes correspondingly impaired. Even if these springs were so constructed and applied that they exert a uniform influence upon the brake beams, the inequalities of brake-shoe material cause them to wear unevenly so that a new shoe at one end of the brake beam is often accompanied by a considerably worn shoe at the other end, and adjustment of clearance that will avoid excessive piston travel at the brake cylinder is impossible. The impossibility of adequately measuring and providing braking force for the resistance of these springs, added to the loss of efficiency from excessive piston travel or the alternative trouble from dragging brakes, renders the brake-beam release spring one of the most serious evils of modern brake practice. By the use of inside-hung brake beams, where sufficient inclination of the hanger links insures brake-shoe clearance through the action of gravity, both the expense and trouble due to the release springs is avoided.

THE BRAKING APPARATUS

To enter into the detail of the air-brake apparatus employed to furnish the braking force, in a paper of this character, would unduly extend it and would also be a work of supererogation. The compressed air supply generally implies a suitable compressor upon the car, or, if operated in trains, one or more upon each train. Storage of the compressed air in sufficient quantity has, however, been satisfactorily accomplished in some cases and possesses certain advantages. The air is usually stored at a comparatively high pressure (generally 150 lbs.) in large reservoirs secured beneath the car, or in any other convenient place. It is delivered through a reducing valve into the "main reservoir" of brake operation, at the desired pressure, where it is handled in the ordinary manner. In such a system a single air compressor of large capacity and high efficiency, compresses the air at a station where it is stored and charged into the car storage reservoirs from time to time. The advantages lie in avoiding the cost of installing and maintaining compressors upon all the cars, and in cheapness of operation. The disadvantages consist of the bulkiness of the storage reservoirs and the time required to stop and charge them, and also the limited distance that may be traversed in the intervals. Where the air is compressed upon the car, the compressor must be accessibly constructed and placed upon the car, and supplied with clean, dry air. It may be operated by steam, by a separate electric motor, or by the car motor, through suitable connection with the car axle, as circumstances render it expedient. Its operations should be so controlled by a governor that it shall cease whenever the maximum storage pressure has been attained in the main reservoir, and shall be renewed when operation of the brakes has reduced the storage pressure to the inferior limit.

Upon the motorman's operating valve the satisfactory operation of the brake system in large measure depends. It must not only present the means of accurately gaging the force of brake application and of promptly releasing the brakes, but must also define with precision the pressure of the air with which the auxiliary reservoirs are charged, to insure the full efficiency of braking without exceeding it to the injury of wheels and detriment of efficiency; while at the same time it must provide a superior pressure, that may vary considerably under different conditions, in the main storage reservoir, to insure prompt release of the brakes and restoration of pressure in the auxiliary reservoirs, without any variation of the working pressure in the latter—an exacting combination of conditions not easy of realization but of capital importance.

Of the apparatus for the immediate application of the brakes to the wheels sufficient has already been said, it having been indicated that, in the single case where the unit invariably consists of a single car, simply an air cylinder in communication with the motorman's valve meets all the requirements, while the conditions of every other case justify nothing short of the efficiency of the quick-acting automatic apparatus, and, where characterized by high speeds and frequent stops, the superior efficiency of the high-speed brake is essential to high efficiency of service.

OTHER FORMS OF BRAKE

The application of other forms of power than compressed air to brake service has been practically limited to the vacuum and electricity. The limited pressure and bulky apparatus have restricted the use of the vacuum to comparatively light vehicles, and it is fast becoming a mere historical feature of the development of the art of braking. Electricity has been experimentally applied in various forms of apparatus, but has only recently become recognized as a means of promising utility in practical braking. The simplicity of employing the back torque of the car motors of electric railroads for retarding purposes has appeared very attractive to those unacquainted with the objection to dependence upon that means alone. In combination with other means of retardation, so that excessive heating may be avoided, this means of braking cars has been used with some practical success. But the application of electricity to the purpose of braking that appears to overshadow all others is that of the magnetic brake, which embodies such novel applications of old devices, with results so phenomenal that the use of electricity as the source of braking force in electric railroad service at once occupies an interesting position with a very promising future. [The writer then referred to the magnetic track brake, which has been described in these columns.]

Car License Fees Decisions in New York

The Appellate Division, by Justice Ingraham, holds that the complaint in the action brought by the city against the Third Avenue Railroad Company and the Metropolitan Street Railway Company to recover car license fees aggregating $25,750, due from the former company to the city during the years 1894 to 1899, did not state facts sufficient to constitute a cause of action as against the Metropolitan Company. A judgment of the Supreme Court overruling the Metropolitan Company's separate demurrer to the complaint is therefore reversed. The lease of the Third Avenue Railroad Company to the Metropolitan Street Railway Company turned over all the railroad property "subject to all debts and liabilities" of the lessor, but with no provision imposing upon the lessee an obligation to pay such debts and liabilities.

"The Third Avenue Railroad Company," said Justice Ingraham, "is not dissolved or merged with the Metropolitan Street Railway

Company, but is an existing corporation liable for its debts and obligations. The Metropolitan Street Railway Company did not assume the payment of the debts, but accepted a demise of the property subject to the debts and liabilities of the lessor corporation."

Another car license fee case brought by the city against the Sixth Avenue Railroad Company, the Houston, West Street & Pavonia Ferry Railroad Company and the Metropolitan Railway Company has also been decided adversely to the municipality. In that case it appeared that the Sixth Avenue Company had leased its road to the Houston & Pavonia Ferry Company, and that the latter was subsequently consolidated with the Metropolitan. There the Sixth Avenue Company was to pay a license fee for "each passenger car to be used on the said road." The court decided that when the Sixth Avenue ceased to operate its road, leasing it and its franchises to the Houston, West Street & Pavonia Ferry Railroad Company, it in fact ceased to use cars. The judgment, so far as it overrules the separate demurrer of the Metropolitan, is, however, affirmed.

The Appellate Division has decided that as to the Twenty-Third Street Railway Company no license fees can be collected by the city. The franchise of that road was purchased from the city at auction under authority of a law passed in 1869 for $150,000. No condition as to license fees was incorporated in its charter.

Some Brake Tests and Deductions Therefrom*

BY J. D. KEILEY

In the braking of elevated and light interurban cars or trains, the problem has, of course, been changed from the conditions of locomotive traction to the conditions of electric traction with distributed motors. In the former we have slow acceleration to comparatively low maximum speeds, and the braking of light cars with maximum passenger load equal to 60 per cent or 70 per cent of weight of cars, and in the latter case the motors are carried on the passenger trucks, with armatures geared directly to axles, where we find rapid acceleration to high maximum speeds, and the braking of cars with maximum passenger loads equal to but 45 per cent or 50 per cent of the weight of cars. The rapid acceleration and high maximum speeds with very efficient braking make possible high schedule speeds under conditions of frequent stops. A concurrent condition, in many instances of the first importance, is the relation between effective braking and liability to accident. Notwithstanding these changes in mechanical limitations and operating requirements, many small electric railroad companies, and even many very large systems, have apparently been satisfied with old apparatus and have continued to use the single floating lever (or sway bar) inherited from horse-car practice. Another class of users has, at great expense, equipped the cars with novel and complicated apparatus, to be used in developing greater force for the application of brake-shoes to wheels than could be produced with similar dispatch by human muscular effort when applied to brake wheels or crank handles. A third class of users and a large class of investigators have endeavored to effect the retardation of cars by other means than friction between wheel and rail, set up by the pressure of brake-shoes upon wheels.

A class of braking which is of the first importance on account of the very large number of cars in service and the magnitude of the accident liability affected by them each year, is the emergency braking of cars of from 15 tons to 25 tons weight (including passenger load), from speeds which are under 30 miles per hour. This class of brake service is clearly different from what is commonly known as "high-speed" braking, and requires for its accomplishment a different sort of apparatus. Consider, for instance, the case of a double-truck electric car used in city, suburban or interurban runs, or for all three classes of service collectively. This is a very ordinary case, and perhaps the most exacting requirements on the braking apparatus of such a car are those met with in the city or suburban runs, where cars are operated over public highways and unprotected crossings at comparatively high speeds. Under these conditions emergency stops must often be made, and a braking apparatus is required which is able to stop a car that is moving at a rate varying from 15 miles to 30 miles per hour, and in the shortest possible distance after the motorman receives notice of the necessity to check the speed.

Such cars are frequently equipped with merely a hand brake and a single floating lever (giving anywhere from 25 per cent to 40 per cent excess brake pressure on the rear brake); with a hand brake and some system of equalizing levers; with air or other power brake and equalizing levers; or with some power brake in which, in addition to the friction between wheels and rails, as introduced by a rail-shoe depending for its friction either upon a portion of the weight of the car, an entirely separate frictional force is set up by electromagnetic action between the rail-shoe and the rail. None of this apparatus, except, perhaps, the last mentioned, exhibits any marked advance over the braking of cars used in locomotive traction in city or suburban service.

No attempt will be made in this paper to give a comprehensive summary of the principles and theory, distribution of pressure between trucks or wheels or the design and construction of foundation rigging or truck rigging. It will contain a brief statement of certain methods which have been used in the determining for an electric traction company the relative merits of several types of power brakes.

In designing new or investigating existing brake apparatus the identity and relative importance of the several consecutive events which occur in the stopping of a car under ordinary conditions should be fully considered. It was thought desirable in the brake tests described below to plot accurately a curve sheet, such as is shown in Fig. 1, where the distances in which a car can be

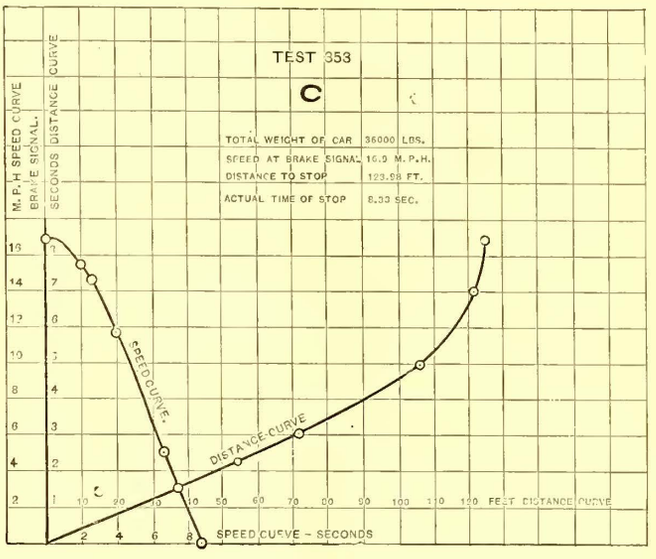


FIG. 1.—TIME AND DISTANCE CURVES FOR EMERGENCY STOPS

brought to a stop from different speeds at brake signal, are shown graphically for the brakes under consideration, as this is the first question usually asked concerning the performance of a brake. A curve sheet was worked up for each braking test, and a specimen of these sheets for individual stops is shown in Fig. 1. A considerable number of individual sheets were worked up for each type of brake tested, and from these sheets were determined coefficients or equations of curves of comparison, as shown on chart, Fig. 2.

Specimen speed-time and distance-time curves for emergency stops (Fig. 1) were made for six different types of brakes. Fig. 3 is a diagram showing the method of obtaining accurate measurements of the distance required for stops. Fig. 2 is a comparison chart showing stops from speeds of 12 miles per hour to 18 miles per hour, with six different brakes. In Figs. 5 and 6 the recording apparatus used in these tests is illustrated.

The following method was adopted to secure the requisite data for plotting these curves:

In all tests the same type of car was used, mounted on similar trucks, and all cars were put in as nearly the same condition as possible and loaded to the same gross weight by an amount equivalent to a heavy passenger load. The cars were run in the same direction over the same section of track on a uniform grade, wind and humidity conditions being as nearly uniform as possible, and great care was taken to determine with accuracy in each case the speed of car at brake signal and the actual distance traversed between brake signal and the stopping of the car. An axle of the car was fitted with a drum carrying a contact plate, which momentarily closed a battery circuit once in each revolution; this circuit energized an electromagnet operating one or two recording pencils, under which a strip of paper was drawn at uniform speed by a very accurately adjusted spring motor. The operating magnet of the other pencil of the two above-mentioned was energized by a circuit which was closed every half second by a contact maker actuated by a carefully adjusted clock movement.

* Read at the 171st meeting of the American Institute of Electrical Engineers, New York, Dec. 19, 1902.

It will be readily seen that with this apparatus a record sheet could be obtained that would contain a clear record of wheel revolutions. From this the number of revolutions during any interval or the duration of any particular wheel revolution could be determined with great accuracy; the method of using this apparatus to obtain the data desired was as follows:

DIAGRAM SHOWING METHOD OF DETERMINING DISTANCE FROM BRAKE SIGNAL TO STOP

When the arrow mark on wheel is in contact with rail, the revolution counter circuit is closed by contact on axle. Each run started with this mark in contact; at stop the point of contact between wheel and rail was marked on rail, and the car rolled on until the arrow mark on wheel again came in contact with rail, giving the final fractional part of a revolution to be used in getting the total length of run by wheel revolutions, which was subtracted from the length of run by tape measurements to get the distance skidded.

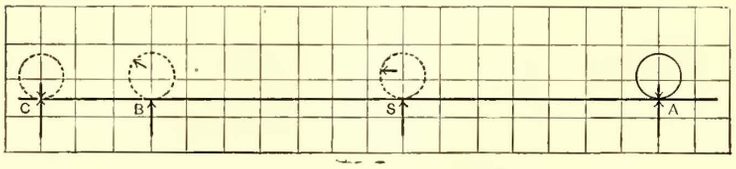


FIG. 3.—METHOD OF OBTAINING ACCURATE MEASUREMENT OF DISTANCE REQUIRED FOR STOPS

A—Position of wheel at start.
B—Position of wheel at stop.
C—Position to which wheel was rolled to get last fractional part of a revolution.
S—Point at which brake signal was given, determined by record of revolution counter.
A B—Tape measurement; total distance run.
A S—Computed from revolution recorder.
A B—A S = Distance to stop = S B.

The car was placed near the starting point and moved backward or forward until the contact on the axle drum was closed, then the point of contact between the wheel and rail was chalk-marked both on wheel and rail. Then the record paper was put in motion, the car started and brought up to speed very gradually to avoid the possibility of slipping of the wheels. When the desired speed was attained an electric bell was rung as a signal for an emergency stop. The circuit of this bell traversed the operating magnet of the chronograph pencil, and by drawing this pencil farther than it was ordinarily drawn by the clock circuit, produced a clearly defined record of the exact time at which the signal bell was rung. When the car was brought to a full stop, the bell was rung again in order to make a record of the time elapsed between brake signal and stop. The position of the point of contact of the front wheel was then carefully marked on the track and the car moved slowly along until the first chalk mark made on the wheel was brought again in contact with the rail, and the rail was marked at this point. A tape measurement was then made between the first and second marks, giving accurately the total length of run, and between the second and third marks to determine the distance traversed in the final fractional part of a wheel revolution. The distance from start to brake signal determined by the wheel revolution record on the chronograph chart was calculated; this distance deducted from the total length of run (a tape measurement), gave an accurate measure of the distance from brake signal to stop. Furthermore, where there was a difference between the total distance run by tape measurement and the total distance indicated by the wheel-revolution chart, such difference only occurred in case of skidding, then the difference was the measure of the distance skidded.

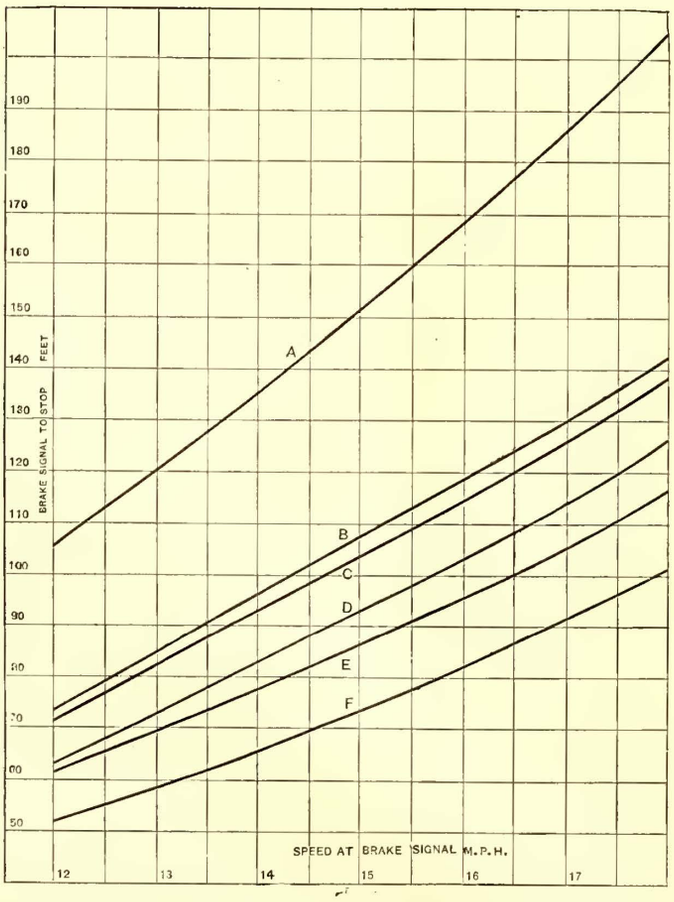


FIG. 2.—COMPARISON CURVES FOR EMERGENCY STOPS

It should be noted that by the use of the methods outlined the measurement of the two quantities whose accurate determination is essential to an accurate brake test—namely, the speed at brake signal and the distance to stop—are obtained with a high degree of accuracy and with apparatus which can be attached to any car in a few minutes. This apparatus is complete in itself, no stops, signals or other special appliances being required on the track or roadbed.

The time elapsing between brake signal and stop, may for the present purpose of tests of emergency stops, be divided into three parts:

1. Duration of time between brake signal and beginning of movement of brake handle or lever by motorman; that is, the personal equation of motorman.
2. Duration of time between beginning of movement of brake handle or lever and setting of the brake-shoes.
3. Duration of time between the setting of the brake-shoes and stopping of the car.

The first interval of time above depends on the motorman, the second on the brake mechanism, and the third on the amount of the frictional resistance which can be developed between the car and the rails for a stop from a given speed. The first and second intervals of time are practically constant for a given motorman and brake apparatus and independent of speed; the third interval will vary with the speed at brake signal.

After being brought up to speed and allowed to run without power, the speed of cars on the test track was found to fall off at the rate of about 0.16 miles per hour per second. Hence, for a given brake and motorman the distance run by car from time of brake signal to time of full application of brake-shoe would be:

$$\left(S - \frac{0.16.T}{2}\right) 1.467\ T = d \text{ (distance in feet)} \qquad (1)$$

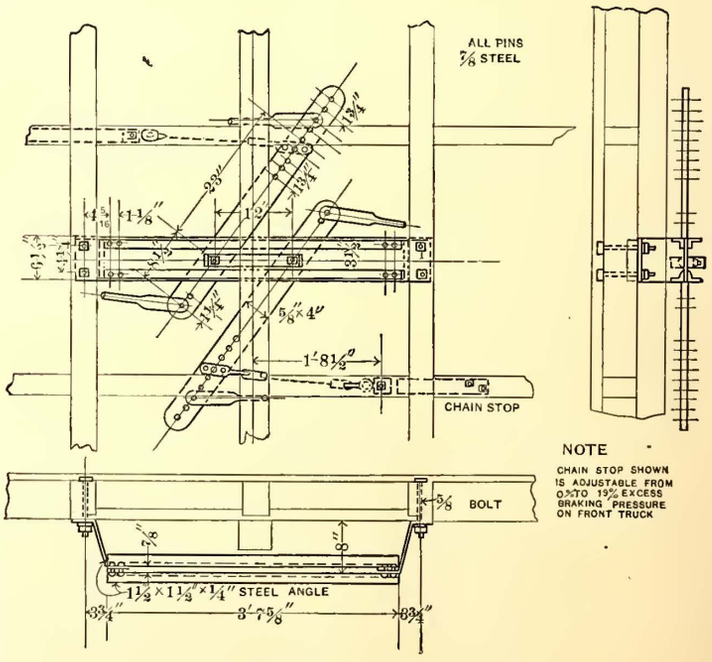


FIG. 4.—DIFFERENTIAL BRAKE RIGGING

where S = speed at brake signal in miles per hour,

T = time from brake signal to application of brake shoes, and 1.467 = number of feet per second corresponding to 1 mile per hour. S being the speed at brake signal, and 0.16 miles per hour per second the retardation due to friction and windage between brake signal and application of brakes, the total retardation in T seconds will be 0.16 T, and the speed of car at the end of the interval of T seconds, i. e., at the time of application of the brakes will be (S — 0.16 T) miles per hour.

Letting d^1 = distance from application of brake-shoes to stop

$$\left(S - \frac{0.16\ T}{2}\right) 1.467\ T + (S - 0.16\ T)^2 \frac{1.467}{2\ R} = D \qquad (4)$$

Equation (4) gives the distance from brake signal to stop in terms of S, T and R. Expanding the expressions and collecting the coefficients of S and S^2 we get

$$L\ S^2 + M\ S + N = D$$

where $$L = \frac{0.733}{R}$$

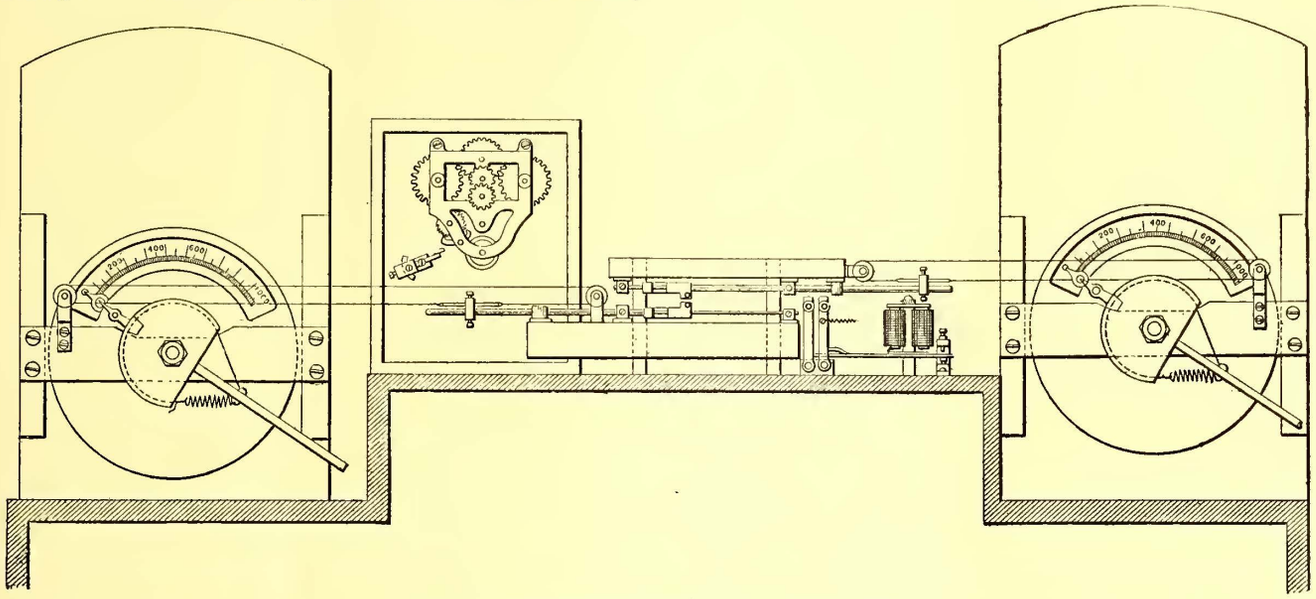


FIG. 5.—RECORDING APPARATUS, ELEVATION

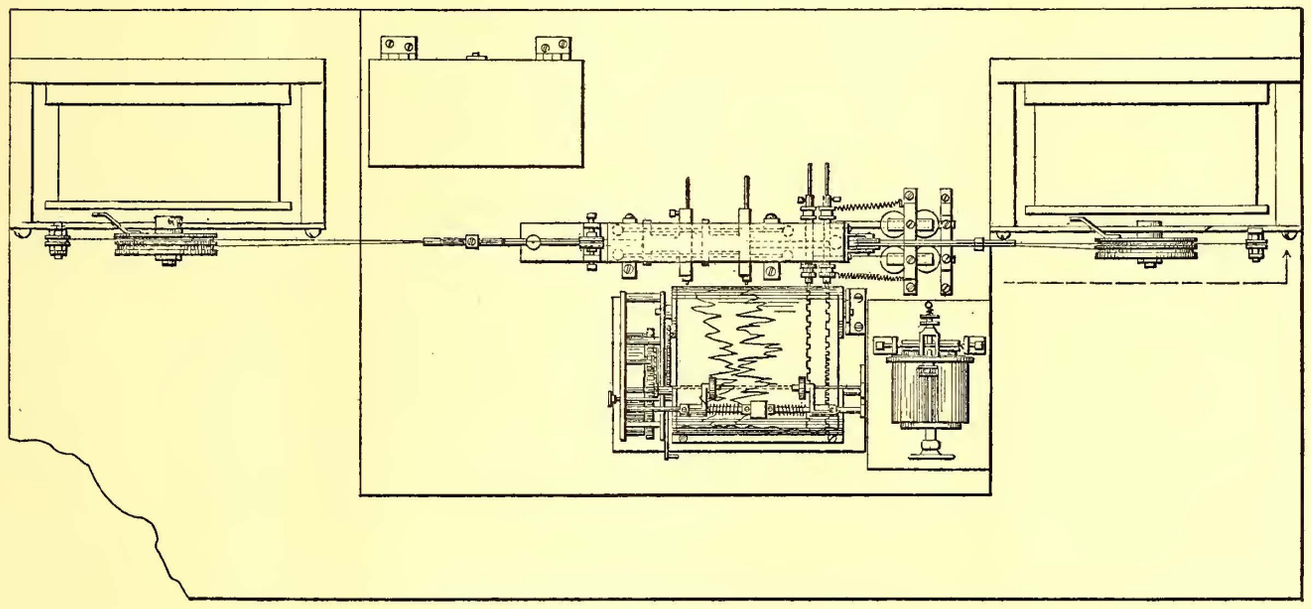


FIG. 6.—RECORDING APPARATUS, PLAN

and T^1 = time in seconds from application of brake shoes to stop, we have

$$\frac{1}{2}(S - 0.16\ T)\ 1.467 \times T^1 = d^1 \qquad (2)$$

But if R = rate of retardation in miles per hour per second after brakes are set, the time T^1 may be expressed as follows:

$$T^1 = \frac{S - 0.16\ T}{R}$$

and substituting this value in equation (2) we have:

$$\frac{(S - 0.16\ T)\ 1.467}{2} \times \frac{S - 0.16\ T}{R} = d^1$$

or

$$(S - 0.16\ T)^2 \frac{1.467}{2R} = d^1 \qquad (3)$$

Let D = total distance from brake signal to stop. Then $d + d^1 = D$ and substituting from equations (1) and (3) we have:

$$M = \left(1.467 - \frac{0.235}{R}\right) T$$

$$N = \left(\frac{0.0188}{R} - 0.117\right) T^2$$

L, M and N are practically constant for each equipment.

From test stops with each brake curves were plotted showing speed on a time base from the brake signal to time of stop. From these curves may be obtained values for T and R, and from these the values of the coefficients of S^2 and S in the above equation may be computed. From this equation with D and S as variables, we may compute the values of D (distance) corresponding to several values of S (speed), and plot a curve showing for different speeds the distances run from brake signal to stop for each of the equipments tested.

To get the time elapsed from brake signal to stop from different speeds at brake signal, we have the following relations:

T = first and second parts of time above referred to.

$$\frac{S - 0.16\ T}{R} = \text{third part.}$$

Hence, if t = the total time in seconds from brake signal to stop, from a given speed at brake signal, then

$$t = T + \frac{S - 0.10\ T}{R}$$

The coefficients of this equation for any equipment may be obtained as noted above from the speed curves, and, these coefficients once determined, the values of t for several values of S may be computed; and from these values a curve may be plotted showing for different speeds at brake signal the time from brake signal to stop for each of the equipments tested. Distance and time curves have been plotted in this way for brakes A, B, C, D, E and F.

These charts show the relative efficiencies of the various brakes for emergency stops; for instance, at 15¾ miles per hour speed at brake signal, the distance from brake signal to stop are:

For brake A, hand brake, 164 ft.; for brake B, power brake, 115 ft.; for brake C, power brake, 112 ft.; for brake D, power brake, 100 ft.; for brake E, power brake B, with differential levers, 93 ft.; for brake F, power brake, 80 ft.

These curves show plainly the relative efficiencies of the several brakes in making emergency stops.

To reduce the liability to accident and to effect economy in the use of motive power it is desirable to secure as high a rate of braking as is consistent with the comfort of passengers. If we assign a total cost per equipment per year to each type of brake considered, then the most desirable brake will be that for which this total is a minimum. The total cost per equipment per year should include the following items:

Cost of maintenance, labor and material.

Cost of power for operating brakes.

Interest on investment.

Cost of accidents per equipment per year.

The cost of maintenance and for power must be estimated from the best data at hand. As to the cost of accidents a figure was readily obtained for hand brakes. A figure was also obtained for brake D, for which the record of a number of equipments was accessible. From these amounts, chargeable to hand brakes and brake D, the amounts which should be applied to the other brakes were estimated by a graphical method, taking into consideration the distances in which stops may be made with the respective brakes. Under the item of cost of power in the original comparison a charge was made against the hand brake, which represents the amount of power necessary for operation with hand brakes in excess of what would be required with a power brake, due to the lower rate of braking with hand brakes; as the same schedule speed can be maintained at a smaller expenditure of energy by using a more effective brake, the time of running with power being reduced and cars allowed to coast a greater distance.

Below is given an approximate comparison table for several power brakes:

APPROXIMATE COMPARISON TABLE

	B	C	D	E	F
Maintenance of power brakes and extraordinary repairs, chargeable to brakes	58.80	10.95	36.25	....	29.20
Power	29.20	....	....	25.00	....
Interest	15.00	5.00	6.50	17.50	11.50
Accidents	58.00	53.00	37.00	30.00	15.00
	161.00	68.95	79.75	72.50	55.70

The totals above, which are, of course, only of approximate accuracy, show that under certain conditions a very considerable amount per annum may be saved by the judicious selection of brakes.

One practical result of the tests above described was the application by the writer of differential levers to hand-brakes; one form of construction of this type of foundation rigging being shown at Fig. 4. The levers, as shown, may be varied from 0 per cent to 19 per cent excess pressure on the front truck and may be adjusted to suit different types of car bodies. Another result was the application of differential levers to one type of power brake, the braking characteristic curves *B* and *E*, Fig. 2, showing that the distance required to stop a car with power brake *B* has been reduced by approximately 18 per cent by the use of non-equalizing levers, applying to the front truck a braking pressure exceeding that applied to the rear truck in a certain predetermined ratio.

New York Subway Car Contracts

The contracts for 500 of the cars to be used by the Interborough Rapid Transit Company in the New York subway have been let. The general type of car to be adopted was described in the Street Railway Journal for Sept. 20, 1902, written from the specifications of the cars and illustrated by views taken of two specimen cars then being examined by engineers of the railway company. As it was impossible to obtain satisfactory guarantees of delivery in the specified time from one concern, the 500 cars were divided up into lots, and the orders were given to the following companies: The St. Louis Car Company, of St. Louis, Mo., received 200; the John Stephenson Company, of Elizabeth, N. J., 100; the Jewett Car Company, of Newark, Ohio, 100, and the Wason Manufacturing Company, of Springfield, Mass., 100. The motor trucks for these cars have not yet been contracted for, but orders for 660 trail trucks have been given out and have been equally divided between the Wason and St. Louis companies.

The Popular Double Trolley

The editorial comments of the Chicago Tribune on the St. Paul electrolysis suit reveal a wealth of technical information in the editorial mind that is startling if not refreshing. Here they are:

"That the question of possible damages to city water and gas mains through electrolysis is one that must be reckoned with in all future franchises for new trolley lines or extensions is emphasized once more by recent developments in the city of St. Paul.

"Application has just been made in the District Court of that city in behalf of the Board of Water Commissioners for a permanent injunction against the City Railway Company to restrain it from using the mains of the city water system as a conduit for its return electrical current. It appears that the water mains have been used for the return current since the building of the trolley road, and it is claimed that a rapid disintegration of the pipes has resulted, so much so that the Board of Water Commissioners asks that the railway company be required to make restitution in the sum of $500,000.

"The purpose of the application, of course, is to compel the company to put in the double trolley system, which is now being used successfully in nearly all the larger cities. Electrolysis of water and gas mains through proximity of the return electric currents of trolley systems of street traction is now so thoroughly established that no city would permit for a moment such a practice as the St. Paul Company appears to have been guilty of. Where direct contact is made with the water mains for the return current as was done in St. Paul, the destruction of the pipes is rapid and certain. Where new franchises are granted or extensions allowed nothing short of the double trolley system, in which the return current is sent back through a suspended cable, or some other means adapted specially to that end, should be seriously entertained."

A Massachusetts Paving Suit Goes to United States Supreme Court

The City Council, of Worcester, Mass., has directed the city solicitor to go to the United States Supreme Court to test the constitutionality of the Massachusetts street railway law of 1898. Worcester is the largest city in the State which is affected by this law, Boston being exempted in its provisions. In 1900 the city began action against the Worcester Consolidated Street Railway Company to compel the company to keep in repair the paving between and 18 ins. outside the rails where it had locations. Relying on the law of 1898 the company fought the case, and it was carried to the full bench of the Supreme Court of Massachusetts. The Supreme Court handed down a decision supporting the contention of the company that the law is constitutional. The questions that the Supreme Court of the United States will be asked to settle are: Does he act of 1898 impair the validity of a contract? Does the act of 1898 take away a property right without due process of law?

The idea of the street railway law of 1898 is that, in return for an excise tax which the company contributes to cities and towns through which it operates, it shall be relieved of conditions as to repair of the highway and the care of snow on the street. The excise tax provided for by the law is a percentage of the gross receipts of each mile of track in operation, varying with the gross earnings per mile, from 1 per cent for roads earning $4,000 or less, to 3 per cent for roads whose gross receipts per mile of track operated are $28,000 or more. The tax is fixed annually. The excise tax is in addition to other taxes. About $10,000 a year is involved in the case brought by the city of Worcester.

New England Street Railway Club

The December meeting of the New England Strect Railway Club was held in Wesleyan Hall, 36 Bromfield Street, Boston, on Thursday, Dec. 18, with President Farrington in the chair. In the unavoidable absence of William Pestell, of the Worcester Consolidated Street Railway, who was to read a paper, the subject of the evening, "Labor-Saving Devices in Car Houses and Shops," was discussed by several members of the club. Charles F. Baker, superintendent of motive power and machinery of the Boston Elevated Railway Company, mentioned numerous labor-saving devices in use on the Boston Elevated, many of which had been designed to meet the manifold varieties of trouble which arise on such a large system. Thus, the improper handling of motors and car equipments by motormen results in many faults in the apparatus. If motormen would tell their car house foremen of the peculiarities and troubles which occur in their own equipments, much work and expense could be saved. "Jerky" cars are often caused by improper controller handling or by defects in the resistance, which, perhaps, is open circuited on the first notch of the controller, resulting in a large excess rush of current when the second notch is reached. This is bad for both motor and passenger. There is a great variety of equipment on the Boston Elevated, which calls for a large supply of spare parts to be kept on hand.

Labor-saving devices may begin in the blacksmith shop. We may have special wrenches, jigs and tools of many kinds which an ingenious mechanic will use to expedite his work. In the car house the pit cradle is perhaps the most useful appliance. Screw and hydraulic jacks also are handy for use in removing wheels and motors from the cars. The company now operates closed cars with 16 ft., 20 ft. and 25-ft. bodies, and the pit cradle, which is built up of chain blocks attached to four rods, two of which are movable, enables a car to be lifted up or the trucks taken out inside of ten minutes by four men.

Mr. Baker then referred to the Conant testing instruments for locating weak fields in motors as valuable adjuncts to a car house and shop equipment. On the Boston Elevated machine shop work is not done to any great extent in the car houses. The company has a very complete stock room, and general repairs are made in shops designed for the purpose. In the armature room compressed air is used for blowing out motors and also for cleaning out cars. There are numerous emery wheels and drill presses in the machine shop. Air hoists are used to some extent. The company does its own armature work, and has its own baking ovens, makes its own field and armature coils, which latter requires many special tools. The motors in use on the surface lines comprise 1500 of the General Electric W. P. type, a number of General Electric 800's, Westinghouse 120's and 68's and General Electric 58's. Special soldering irons, operated by gas flame are in use, and frames for testing armatures over a range of 200 volts to 2000 volts are operated. Heat tests are made by placing two motors in a testing frame and running one as a generator, with the other as a motor, the two machines being connected together by a sleeve coupling, which slips over the pinion. One motor is fastened in a stationary position, and a water rheostat is used for load. There are also lathes, drill presses, hydraulic presses and armature winding machines. In making armature coils a hand bobbin is used for winding tape, and, though home-made, it well answers the company's purpose. The company makes its own mica rings and shells, and does practically all the repair work on its cars as well as that on its generators in the various power houses. Winding stands are used in the armature room, and a 100-lb. Post hammer has recently been added, with another for the elevated repair shops at Sullivan Square, which is run by compressed air.

In answer to a question Mr. Baker said that he had found no trouble from leakage in using air hoists. In the elevated shop a chain hoist with a worm gear is used to advantage.

Roger W. Conant, of Cambridge, Mass., then spoke of some appliances he had seen in car houses throughout the country. At the Detroit United Railway Company's shops was an interesting machine for taping motor field coils. As the cotton insulation is carbonized by baking out, the field is placed in a spindle, the wire unrolls and the end is passed through a set of knives or dies, which scrape off the cotton from the conductor. Usually the cotton is in such frail condition that it strips or falls off, and the knives simply scrape the wire clean. A roll of tape is then revolved spirally around the wire, no attempt being made to weave a layer in the manner of machines in wire manufactories. For insulation the dependence is upon the overlapping of the tape, and if the work is done carefully and with close inspection the results are very satisfactory. Although the tape is not as thick as Grimshaw's it is possible to get the same number of turns upon the spool and have the winding occupy about the same space as the original coil. No reselling of the old copper at a lower price is necessary, and in this matter the company is independent of the fluctuations of the copper market.

In a car house at South Framingham, Mass., Mr. Conant noted a convenient arrangement for quickly removing the motors of a car. The blacksmith shop or repair shop here is at one side of the pits, and the level of the floor is the same as that of the pit floor. The motors can quickly be dropped into a cradle and run over the pit, where the fields or armature can be taken out and inspection quickly made.

The last five or six years of electric railway operation have shown that the final test of service capacity of motors lies in their ability to withstand heavy currents for long periods. This long-continued heating is cumulative, as the resistance of the coils rises with increased temperature and more and more heat is evolved to limit the life and carbonize the insulation of the cotton covering of the coils. This heating is further increased by poor ventilation, conduction and radiation. Gotshall and Mailloux have recently been working on a system of pipes for cooling off motors by air, which may greatly change the operating capacity of equipments.

As more heat is evolved by the increase in resistance of the coils the cotton insulation becomes scorched as if with a hot flat iron, then more baking ensues, and the insulation may be reduced to a black powder thoroughly carbonized. The coil then becomes defective and short circuits more or less completely. Often all the coils are taken out when only one is defective. These troubles weaken the field and cause severe flashing and sparking through the distortion which occurs. Four-field motors spark much more badly with one field gone than do two-field machines, on account of the much greater distortion. Flashing and bucking is very injurious to motors, but if located at the start a great deal of time and money can be saved. Heavy excess currents may be caused by the brakes being set too tightly, by poor judgment of motormen in handling controllers, by defective repairing, such as taping together the wrong leads, by a sandy rail with a groove worn in it filled with dirt, and by low voltage, due to insufficient copper, bad joints or other troubles. The heating which follows low voltage is not due, as many suppose, to larger currents which are required to propel the car, but to the longer time the current is on. This last is a very important factor in the life and maintenance of a motor. Mr. Conant then spoke of his apparatus for detecting a weakened field by a magnetic test, which he said was better than a direct-resistance test, as the latter was often deceptive or of little variation, and sometimes a fault which develops when the motor is hot disappears when it cools down. The magnetic test can be made as easily and satisfactorily when the motor is cold as when it is hot.

William S. Collins, superintendent of motor car repairs of the Boston Elevated, then described more in detail some of his company's appliances for saving labor in the maintenance department. He stated that the pit cradle mentioned by Mr. Baker was a frame, 9 ft. 6 ins. long by 2 ft. 6 ins. wide, made of 6 in. x 8-in. hard pine pieces bolted up, and a section of rail, 4 ft. 8 ins. long, on each side. The rail sections are movable. The cradle is raised or lowered by two sets of chain falls. The car body is first run over the pit cradle and is raised up by two jacks placed at the end of either sill. A bar is placed across the top of the wheels through the spokes, resting on the trucks, the pieces of rail are taken out and tie straps and bar make one suspension of the truck frame with the car body. Sometimes the bottom half of the motor is dropped with the wheels, but usually the cap bolts and axle caps are taken out and the motor suspended by an eye-bolt and bar on top. The wheels are dropped into the pit, and flats, chipped flanges or other troubles are removed. On each side is a chain hoist. In every car house of the company a body hoist is provided for raising car bodies off the trucks. This is made up of 8-in. x 10-in. hard pine timbers, at one end of which are two 1-in. rods, with the ends turned up so that the hoist can be fastened to them. These are some 7 ft. from the floor. The other end has a 10-in. I-beam, 10 ft. long, with traveler for raising the bodies of 7, 8, 9, 10 or 12-bench open cars. These can be raised by means of horse-car T-rails, with rings on the end, through which could be secured the hooks of chain falls. He had recently seen a car put up in less than ten minutes by this arrangement. A Harrington hoist of 2-tons capacity is frequently used.

E. E. Potter, of the New Bedford Street Railway Company, said that his road had about 150 cars to take care of, and it was often necessary to do work in different places. He saw in the shops of the United Traction Company, of Albany, a very handy traveling crane, made up of two rails, on the side of two tracks, from which were suspended two I-beams on rollers, from which run two triplex Western hoists, operated by trolley. Mr. Potter said

that he has two pits, over which ten eight-wheeled cars can be accommodated, and this arrangement of traveling crane can be utilized over any pit. The crane has been found handy in transporting armatures. Table hoists of several kinds are easy and cheap to make, and can readily be moved to different points in the pit. Mr. Potter than spoke of the Conant field testing device, and said that it had proved extremely useful in his car house work. He uses some G. E.-800 motors whose fields are very sensitive, and previous to the employment of the field tester it was often difficult to know when the trouble in the coils was serious, or even if trouble existed then. An almost inexperienced man can use the apparatus, which has the advantage of locating a trouble in the winding at its early stages. In his armature room a boy at $3 per week tapes up coils by a special machine. Many car houses raise up four-wheeled cars with jacks, and a bar across the front of the car, but Mr. Potter criticised this method as dangerous to the men, since the slipping point is indeterminate.

Paul Winsor, assistant to the vice-president of the Boston Elevated Railway Company, then said that the Sullivan Square shops of the elevated division started with very limited equipment to fit up and assemble 100 cars, when the overhead system was being gotten ready for operation, in 1901. Fortunately compressed air was available, as the block and interlocking signal system is operated by that motive power. There was a 14-in. air hoist which would lift 12,000 lbs. Air jacks were also used. Motors are blown out by air, as is the Sprague control. Equipping was started with a little boom derrick with a crab on it. Five men were required to raise a single truck. Then air cylinders were put on and the men soon became used to handling the device in much better time.

President Farrington said that his road used air for blowing out motors and cleaning cushions, and then introduced Mr. John Lindall, foreman of shops on the elevated division of the Boston Elevated.

Mr. Lindall described the shops which are under his supervision, and said that at Sullivan Square the train shed and repair shops are on the structure level. Trucks and motors are usually disconnected in the repair shops. The machine shop is located below the repair shop, and in the latter is the stock room, which is divided into a number of compartments. In one is kept all controller parts, in another motor fittings, in a third car body fittings, in a fourth bolts and nuts, in a fifth tools, and a sixth air brake parts, etc. The check system is used in giving out tools, a workman leaving a check always in place of a borrowed tool. The proper laying out of a stock room is an important feature if labor is to be saved. Trucks are carried from car house to machine shop by a hydraulic elevator. Trucks can be lowered from a car in about five minutes, the car body being held by posts on each side of the car. Pneumatic jacks have been found much better than screw jacks. In handling motors and trucks weighing 12 tons the trucks are arranged to be self-propelling, control of the movement being attained by rheostat. The method saves a vast amount of pushing and pulling. The equipment of the shops includes a 300-ton wheel press, a 42-in. lathe, a 36-in. engine lathe, a 20-in. shaper, 36-in. radial drill, pipe cutter, grinders and other tools, all motor driven. Compressed air is used freely in cleaning. A tire heater, designed by C. T. Baker, is in use. This apparatus is operated by gas and compressed air. Old tires are heated in six minutes, so that they fall off from the wheels. New tires can be expanded to slip upon the wheel in ten minutes. A wrecking car is now being equipped with blocking, tools, tackle, jacks, etc., so that in the event of an accident trains can quickly be gotten clear.

The car house floor between tracks is depressed one foot beneath them. This is extremely useful in facilitating the removing of brake-shoes, third-rail shoes, etc. Special labor-saving arrangements often pay for themselves in a single day. Recently 2000 5/8-in. bolts were to be removed. The foreman made a wrench with a bit stock handle and saved much valuable time by using it in place of a monkey or a T-wrench.

Mr. Baker then said that out of 45,000,000 car miles run by his road last year but 8 or 9 broken axles resulted. Usually in such cases the emergency crew goes out with a two-wheeled car, to which the wrecked car can be chained up, and the outfit is then run into the car house as soon as possible.

Mr. Potter, of New Bedford, described an arrangement for towing in a wrecked car, which has been found very useful on his road, especially on the longer lines of the company. It consists of a pair of small 20-in. wheels from which are run two frames made up of two angle-irons about 5 ins. apart. On one end of the angle-irons is an ordinary journal box. The journals have slotted ends. The box slips over the journal past the thrust key, which holds it in place. At the other end is a U-shaped piece. This outfit is carried in a wrecking car. When the car is reached two sides pieces are slipped on like a wheelbarrow arrangement next to the broken wheel or axle. These pieces will go inside, and by jacking up the frame, dropping the stirrup and attaching to the car, the entire outfit can start for home. He had never seen it get off the track, even on the sharpest curves, and it is possible to go home at a lively pace, regardless of whether it is a four or an eight-wheeled car.

Mr. Miller, of the Boston & Maine Railroad, said that air hoists were very extensively employed in the Concord (N. H.) shops of his company. At one time 300 trucks were stored at this point and a common piston hoist was first used, with a pipe 10 ft. long and 8 ins. in diameter. A great deal of room was lost by this arrangement. Later on a geared air hoist connected with the truck by wire rope or cable was used with great success. This did not depend on the air to hold the truck just where it was wanted. No instance of failure has been recorded, and the apparatus has proved to be far better than the old type of cylinder hoist. Mr. Miller stated that he was planning to support some form of hoist from some 8-in. x 15-in. pieces of timber, spaced 14 ft. to 15 ft. on centers. T-irons will be attached to these timbers by bolts, and the lower web or flange of the T will be used as a track for running the hoist. Probably a 6-ton hoist will be used. Another instance of labor-saving was made by drilling a large number of bolt holes for car hinges with an air drill. The hinges were of malleable iron and the shrinkage was not always the same. A piece of plank was placed against the side of the car and drilled through clear into the iron. A sharp drill was used. In putting the nuts on, an S wrench was first tried, then a T wrench and then a socket wrench, driven by an air drill. This last device worked very rapidly. Some years ago the Boston & Maine found that it was putting the safety chain hook on the wrong side of the car from the Master Car Builders' requirements, and in order to facilitate interchange, especially with Pullmans operating on the Canadian Pacific and Rutland Railroads, all these had to be changed. As there were some 2000 cars affected, and each one required two extra hooks and two extra links, there was a large job on hand for the blacksmiths. After finding that the work was not progressing satisfactorily, Mr. Miller made up some foremen for quicker work on the hooks, and after trying several men he found that about seven times as many hooks could be made per day. It had been his experience that usually workmen felt that the introduction of a new labor-saving device resulted in taking away their bread and butter. This was not so in a railroad shop, as the work there increased with the facilities, and there was always so much to be done that only the most important things could be undertaken.

Mr. Sturgis declared that he had found compressed air very useful in cleaning cushions, and in operating hoists. In small car houses, where facilities were limited, he obtains his air supply by attaching a hose to the air brake compressor.

J. P. Conway, of the Old Colony Street Railway, said that in his opinion the proper instructing of men in handling equipment was entitled to be called a labor-saving device. He was surprised to find how little men sometimes appeared to know about the use of the ordinary series-parallel controller, and had found it to be of great advantage to take a piece of red chalk and mark out on paper in the lobby the various warys in which the current passes through the motors for different positions of the controller handle. It is easy for a motorman seriously to injure a motor by careless or ignorant handling.

Mr. Winsor said that an instruction school for elevated trainmen was maintained at the Sullivan Square terminal, and that a great deal of time was given to the education of the employees for the train service. In the school room were three skeleton cars with everything in the way of actual apparatus mounted upon them, with the exception of the motors. Especially thorough instruction was given in the use of the automatic air brake, which is the most vital safety feature of the system.

Mr. Collins said that motormen on surface lines were first put on with an experienced motorman, after which they were sent to their car house foreman, who instructed them still further in the proper handling of the controller. After this they were examined by Mr. Senter, superintendent of employment.

The Mansfield Technical Society, of Mansfield, Ohio, has been organized among the officers and employees of the Ohio Brass Company, of that city. The object of the society is the promotion of technical knowledge among its members. The regular meetings are held on every third Tuesday, at which time papers pertaining to various branches of technical work are read and discussed. A reading and reference library has been established in connection with the society. Contributions of scientific and trade papers are being thankfully received, and a large amount of good reading matter is already on the files for the use of members.

New York's Transportation Facilities

The complaints from Manhattan regarding the overcrowding of the cars of the surface and elevated roads are to form the subject of a public hearing before the State Railroad Commission. Walter Berg entered a formal complaint regarding the Ninth Avenue elevated road and F. H. Weeks concerning the Third Avenue line, while Secretary Mead, of the Merchants' Association of New York, requested that he be permitted to appear before the Commission in regard to this question. The Commission will meet at the Aldermanic Chamber, City Hall, Manhattan Borough, on Tuesday next at 10 a. m.

These complaints regarding the service in Manahattan has led Mayor Low to appeal to the Metropolitan and Manhattan managements for relief. Regarding surface cars Mayor Low suggests the following points for consideration:

First—It is my own experience, and I think it is the common experience, that it is almost impossible to obtain a continuous seat for a ride on any surface line at any hour of the day or evening. This situation evidently reflects the fact that cars are withdrawn from service, after the rush hours, too rapidly. My first question, therefore, is: Why is it not practicable to run at all hours during the day and evening as many cars as you now operate during the rush hours?

Second—At all hours when the cars are overcrowded it is practically impossible for one conductor to collect the fares and regulate the stopping and starting of the car. My second question, therefore, is: Why is it not practicable to place two conductors on every car during the crowded hours, one of whom shall be required to be always on the rear platform?

Third—In many of the cities of the northern part of the country all street cars are vestibuled so as to protect the driver from the weather. No one would think of sending out a locomotive driver without the protection of a cab. Now that the street cars are operated by power, so that they can be inclosed in front without embarrassment, it seems to me altogether in the public interest that the street cars of New York should be vestibuled for the protection of the motorman. My third question, therefore, is: What objections, if any, are there to this course.

In his communication to the elevated railway company the Mayor declared that the service of that company was open to serious criticism in many respects. He suggested that trains ought to be run as the public convenience demanded, even if it should be necessary to maintain at all hours of the day the same number of trains as were run during the rush hours. The Mayor concludes his letter as follows:

Upon the elevated roads, also where passengers gather at a single station, is it not possible to do something to better conditions by providing for the better handling of them? Is it not practicable, for example, to provide that the passengers shall all leave the cars at one end and enter at the other end, thus avoiding a conflict between crowds moving in opposite directions? Again, why might not the elevated roads adopt the form of car used upon the Bridge, which has a door on the side as well as at the ends?

At such exceptional times as the days of the Dewey celebration, the elevated roads handled almost twice as many people as on ordinary days. Of course, at such times overcrowding is unavoidable. It would seem, however, that if the same number of trains were used and the same effort put forth on ordinary days the public could travel upon the lines with comparative comfort, except during rush hours.

I shall be greatly obliged if you will let me know whether your company will co-operate with the city authorities in meeting the present conditions upon your lines, and in what way you think such improvement may be made. In particular, I should like to know why it is not practicable for your company to operate during all hours of the day and evening as many trains as are operated during the rush hours?

BROOKLYN'S SERVICE CRITICISED

The State Railroad Commission will give a hearing at the old Common Council chamber in the Borough Hall, Brooklyn, Dec. 29, at 10 a. m., on the complaints of the Manufacturers' Association, of New York, with headquarters in Brooklyn, and Edwin F. Clark, E. P. Barnes, R. W. Smith, B. W. Byington, David Morehouse, J. H. Bragdon, C. E. Keator and W. S. Kitchell, residents of Brooklyn, as to the transportation service of Brooklyn.

The complaints against the Brooklyn Rapid Transit Company are couched in general terms and assert that the company runs too few cars, thereby compelling people to stand, and that its service is irregular, and that complaints are disregarded or met with promises which the company fails to fulfil. It is alleged that the company has cars in its barns and refuses to put them in service.

President Greatsinger has been notified of the proposed meeting, and in response has sent the Commissioners a statement of the company's position, in which he says:

We are at present operating, during rush hours, every car for which we can manufacture or buy electric power. The contracts for our new power house called for its completion during the past summer, but, notwithstanding our best efforts, owing to the failure to obtain material, to strikes in the shops of manufacturers and various other unavoidable delays, we will be unable to get any power from this source for six weeks or two months, but expect to obtain power from one of the engines by the middle of February, and from others at succeeding intervals of two weeks to a month.

We have been purchasing for the last year from the Edison Electric Company of Brooklyn all of the power which their plant was able to supply during the rush hours, and have tried without success to obtain power from other sources. When additional power is obtained it will be possible to put on more cars in the suburban districts, but no more cars can be run on Fulton Street or on the Bridge than are now operated.

Contracts for the construction of four additional loops on the New York end of the Bridge at the sole cost of this company have been placed, which we expect will, to a degree, alleviate the conditions at that point.

We have a force of men engaged in counting the passengers upon the different lines at various points along the system, and as fast as their reports indicate that sufficient service is not furnished during non-rush hours we are adding additional service.

The fact that these complaints are made at this time undoubtedly arises from the condition of the streets in Brooklyn during the last two or three weeks. The accumulation of ice upon the sides of the streets throughout the city forced all heavy trucks to drive upon our tracks. Very many of these trucks were overloaded, and as a consequence became stalled upon the tracks, or broke down, and very frequently it was necessary for one of our cars to push a truck for a long distance before it could be induced to leave the track. These delays were universal throughout the city and continued until yesterday.

With regard to the heating of the cars, orders were given out two weeks ago to heat every car thoroughly before it left the barn in the morning and to keep the heat turned on at all hours, except during the two hours in the evening, when, owing to the lack of power for the operation of the cars, it was impossible to furnish power for heating.

We would be very glad to have your Board investigate the question of the number of cars operated during non-rush hours, and would be very glad to adopt any suggestions made by you with reference to an improvement in the service.

We cannot, however, take any action upon complaints such as those sent us by you which do not state the lines where the service is found deficient.

COMMUNICATION

The Front Platform and Crossing Question

Fort Lee, N. J., Dec. 14, 1902.

EDITORS STREET RAILWAY JOURNAL:

Reading in your Dec. 13 issue your comments on the "No seat, no fare! campaign," moves me, having had some experience as a conductor on trolley cars, to put in writing an idea, long in my mind, which I believe would go far toward solving the problem of accommodating the passenger traffic in rush hours. It is particularly applicable to conditions in large cities where short blocks are the rule.

My suggestion is that cars should stop at every other street only; the first car at the first, third and so on, and the second car at the second, fourth, etc., each following car alternating corners.

And then further—though objectionable with non-vestibuled cars in cold weather—I would have all cars stop at the near crossing, and all passengers enter by the front door, and have all alight by the rear door; or the order might be reversed. I am not aware that these suggestions have heretofore been made, but the advantages in time-saving, as well as comfort-giving, must be apparent to those having to do with handling passenger traffic on trolley or other street cars.

A. P. WILLIAMS.

An attempt was made to introduce the first plan suggested by you in Philadelphia several years ago, but it was abandoned, and it is very likely that other cities have had the same experience. The latter plan is in use in several cities, and it has also been tried and abandoned in several cities. We have advocated both methods, and there seems to be no theoretical reason why either or both plans should not prove advantageous if the general public could be brought to understand the plan and act in harmony with it. The trouble found has been with the perversity of the ordinary passenger. People have become so used to boarding the car at any corner that it seems almost impossible to teach them any other course, even when it would result in a much better service. Undoubtedly if a company should persist in a plan of this kind the benefits to all concerned would be considerable, but it is a question whether the company would not become so unpopular during the course of instruction that the trouble would be worth the while. Of course there are certain objections to the second proposition, that is that of allowing passengers to use the front as well as the rear platform in entering or leaving the car. They interfere to a certain extent with the motorman, and the conductor cannot watch two platforms as easily as one to see that all passengers are in a safe position for starting the car. There is also the question in a muddy street of providing a dry crossing for the passengers to reach the sidewalk. Nevertheless, we believe that in many cases the advantages of both plans would more than outweigh the disadvantages.

Rates and Methods of Paying Employees

One of the papers presented at the New York meeting of the American Society of Mechancial Engineers last week discussed methods of paying workmen and plans for stimulating them to increase their earning capacity. The author, Frank Richards, of New York, did not approve the practice now in vogue, and he expressed the belief that it was followed because nothing better had been devised that would be generally adopted. As stated by the author the problem that confronts the employer is: How shall the worker, whatever his grade of skill or efficiency, who has hitherto worked only for a fixed daily wage, be so paid hereafter that he shall not only get all that he earns, but that he shall be willing and even desirous to do more, and thus to earn more, up to the limit of his ability? Americans have done much boasting, especially over the excellence of machines and the continuing increase in their efficiencies, and the query is presented: Why have we not been equally exultant over the individual efficiencies of men, and equally diligent and successful in promoting their efficiencies? "It is notorious, and it is absurd that it should be so," says the author, "that the worker finds little satisfaction in his increasing output, and that he takes no pride in it, but rather organizes to retard it as much as he can."

It is pointed out that daily wages, and the same wage for each, offer nothing at all to induce one man to do more than another. In spite of all efforts at equalization there is always an appreciable and often a very great difference in the quality or quantity of work done by different men; and if all are paid alike, then either some are not paid enough or some are paid too much, and pay by the day would never seem to be fair and just to all. The "premium plan" and the "bonus system," both modifications of the "daily wage," are rejected on the ground that they are not just and equitable, and in the end are bound to cause trouble. The essential error in both of these is declared to be in the ignoring of the strictly business relation of employer and employee. The employer of any worker is simply a buyer of what the worker has to sell, ostensibly paying equitably for all that is done. Why, if possible, it is asked, should he not pay in exact proportion to the quantity done, the same as in buying coal or beef or any other merchantable commodity? This would be done, the author claims, if payment were made on the piece plan; but if the general lines of commerce are to be followed in establishing a scale of prices, the workmen must be prepared to receive a smaller proportionate price when the volume of business is great than when there is only a limited demand. This is merely in keeping with the custom that prevails in all markets. Against this view the author contends that in general manufacturing and machine-shop practice, at least, it is greatly to the benefit of the employer to have every man working up to his full capacity. In this way the output can be increased 30 per cent to 50 per cent without requiring additional investment in machinery, leaving labor and power costs the only items of expense that are increased. While the conditions are somewhat different in the case of power house attendants and the general run of labor employed in railway service, the principal holds good that a small but efficient force is much more desirable and of greater value to the employer than a larger one, the capacity of whose numbers is relatively lower.

In work that is paid for by day wages there is always the recognized ability in the man to increase somewhat his output if sufficient inducement is offered. There is a "fair day's work" that is recognized as such and accepted as satisfactory all around, and still it is never assumed to be the extreme limit of a man's possible accomplishment. There are different ways of applying inducements to the men to get them to turn out the possible surplus of work. The author of the paper under consideration believes the best results can be obtained by establishing a piece rate in manufacturing establishments, but he does not suggest any practicable plan for other classes of employees.

Catalogue of the "Four-Track Series"

The New York Central Railroad Company was the pioneer in attractive railroad advertising, and has always managed to keep a little in advance of other railroad companies in this respect. It is safe to say that no other railroad has done as much in the direction of advertising American achievements in machinery and railway equipment, and in giving to the world correct ideas of the facilities for safe, rapid and luxurious travel as the New York Central.

The most popular scheme of advertising devised by Mr. Daniels, general passenger agent of the road, was the establishment of what is termed the "Four-Track Series." This was a series of publications, issued at occasional intervals, describing or illustrating some of the most attractive points reached by the lines. The special feature of the series, however, was the fact that each publication was intrinsically attractive, either for the interest of the contents published therein, or artistically, for several of the series were etchings or photogravures, or for both illustrations and text. The company has recently prepared a catalogue of its publications, which now number thirty-five or more, and which gives in a most impressive way an idea of the enterprise of the company, and of its efforts to aid in building up American institutions. The catalogue also gives a miniature reproduction of each of the eight etchings, which are issued by the New York Central, of scenes along its lines, trains, locomotives, etc., and a list of seventy-six maps printed in the various numbers of "The Four-Track Series."

The illustrated catalogue of "The Four-Track Series," fifty-two pages, will be sent free to any address, on receipt of a two-cent stamp, by George H. Daniels, general passenger agent, Grand Central Station, New York.

Electric Railway Securities

The demand for electric railway securities has increased so rapidly that many large investment houses are now giving especial attention to the subject. One of these has issued a circular letter to its clients cautioning them against plunging in this class of securities, on the ground that while there are many excellent properties, it is quite probable that much less desirable lines would be selected by those not familiar with their respective merits. "Buy on facts and not on faith," is the advice of the experts, who remind sanguine investors that "the history of the transportation enterprises is, that at the start they have heavily over-capitalized the faith of their promoters, and the persons who put in their money have usually either lost all or they have to go through long and drastic reorganizations, in which they have been forced to sacrifice heavily if they hoped to recover any part of their capital."

A careful investigation before investment is recommended. The conditions which would be considered as establishing reasonable probability of success are thus outlined:

A productive region, with a numerous population bound together by important industrial and commercial interests of such a character as to presage steady growth of wealth and increase of general social well-being.

Intimate interdependence of the communities of the region in the exchange of products among themselves.

High civic and personal credit in these communities encouraging an influx of capital and productive labor.

The personal qualities of the managers of the enterprise—their responsibility, sagacity, executive ability and grasp of local conditions in the territory of the carrier.

Conservative capitalization, scientific construction and equipment to meet traffic conditions, and judicious economies in operation.

It is pointed out that many of the companies do not provide sufficient capital for operating their roads, merely taking care of the construction and equipment of the lines, and then depending upon influencing additional capital to carry the work on to a successful completion. It is explained that "for many reasons these companies are unable at the outset to borrow on capital issues more than the bare amount of money needed to begin earning revenue, and the first few years of their existence are usually spent in struggling to get fresh capital for necessary extensions of plant and equipment. These years are trying for small investors, who cannot afford to let their money lie dormant and have no way of getting back their capital without heavy sacrifices."

It is not intended to condem all trolley securities, but to warn investors against unscrupulous and irresponsible promoters, the latter in many cases being the most dangerous, as they have faith in the projects they are pushing, and may, through their enthusiasm, lead others into difficulty. Electric railway properties, whether engaged in city, suburban or interurban service, it is pointed out, invite thorough investigation when organized on substantial basis and established in a territory that can reasonably be expected to support the class of service the company is formed to provide.

Evolution in Street Cars

A street parade was held in Evansville, Ind., on a recent holiday to show the progress made during the last thirty years in street railway transportation. "Old Slick," the veteran mule of the service, with docked tail, appeared pulling one of the first cars used in the city, and as many who witnessed the parade had never seen a mule car, this feature was particularly instructive. The many children who lined the route of march simply gazed on in wonderment. There were five types of cars in the parade. Bringing up in the rear was one of the latest acquisitions of the company—a large winter coach with a seating capacity of 100 persons.

The Davol Oil Engine

Considerable interest is being taken on the Pacific coast in the development of oil engines. It is thought that machines of this kind, if perfected, will have a large field of usefulness on the coast, in view of the fact that oil is now being used as fuel in most of the principal power stations in California; and its direct employment in the engine will have many advantages over its use under the boilers.

The Davol engine, to which considerable attention is being given now in San Francisco, is a distinct departure from the ordinary Otto cycle engine, in that it works on the constant pressure cycle, which is sometimes known as the Brayton cycle. This cycle, however, as carried out in the Davol engine, differs considerably from that employed by Brayton. The construction of the engine is such as to permit the utilization of very high cylinder temperatures, and this feature renders it possible to obtain a much larger percentage of the theoretical possible efficiency. The engine is reversible, and, it is hoped, will be capable of as wide variations in speed and output as a steam engine, and is equally as well under control.

A 200-hp engine is now in process of construction, which will be given thorough and complete tests probably not later than next February. While it is not possible to predict absolutely what the efficiency will be it is expected that a thermal efficiency approximating 50 per cent will be shown.

The capitalists who are engaged in developing this engine are well known. The directors of the company are A. M. Hunt, president; Charles C. Moore, vice-president, both of San Francisco, with Leon Sloss, of San Francisco; L. N. Breed, of Los Angeles, and G. K. Davol, the inventor.

London Letter

(From Our Regular Correspondent.)

The city of Birmingham during the past month has been the center of one of the most determined fights between municipal interests and those of a private company, the British Electric Traction Company having for some time been endeavoring to secure the control of the tramways of that city. The local papers have been filled with arguments for and against the municipalization of the tramways, and as the result of the poll of the electors of Birmingham they have had a large majority approving of the bill proposed by the Corporation to enable the municipality to make and work the tramways for the common good. This fight has served to indicate the state of the public mind in Great Britain on municipal enterprise, and it would seem as if most cities in Great Britain at the present time are clearly in favor of owning and operating their own tramways. The result of the voting was: For the bill, 15,139; against, 8558; giving a clear majority in favor of municipalization of 6581. The situation in Birmingham is somewhat peculiar, most of the tramways in that city being operated and owned by private companies, though the city of Birmingham some three years ago, by a practically unanimous vote, decided to municipalize the whole of the tramways at the expiration of the current leases, some of which expire in 1906, and the others in 1911. There is probably no city of any magnitude in Great Britain at present in which the tramways are in such a backward state as Birmingham. Most of them are operated by the old-fashioned, noisy and dirty steam engines, only one line having as yet been equipped, and that only during the last year, with the electric overhead system, replacing a storage battery system, which had long been a reproach to the city. The British Electric Traction Company has got systems of tramways in several towns round about Birmingham, so that they have been eagerly attracted toward Birmingham for some time, and during the last year secured the control of the City of Birmingham Tramways Company. The result of the vote is in the nature of a defeat for this enterprising company, as the Corporation will now be able to proceed with its own bill in Parliament.

The battle of the tubes still goes on in London, and the entire solution of the question of tramways is now so many sided that it is difficult in a few words to state just in what position it is. Much has been recently written in the press as to the best solution of the underground problem, many of those who have given the subject the most consideration believing that some general commission should be formed to inquire into the whole subject. The scheme promoted by the London United Tramways Company, in conjunction with the Piccadilly & City Railway, for an underground tube which would have paralleled in some portions the tube already being constructed by the Yerkes group, has been withdrawn, and it is now being rumored that the London United Tramways have entered into arrangements with the District Railway. There will, therefore, next session be many schemes promoted and heavy competition in Parliament. The London County Council has unanimously passed a resolution on the question of the tubes, and has decided that a deputation is to wait upon Mr. Gerald Balfour with the idea of a commission being appointed to inquire into the whole subject of underground transportation.

The Blackfriars terminus of the South London Tramways has been long the scene of unseemly fighting for position on the cars during the rush hours in the evening. This fighting has become so serious that it had to receive the attention of the authorities, and it is now announced that the highways committee of the London County Council has decided that another terminus will be constructed in the same vicinity, south of Stamford Street, which would enable it to divide the cars and so provide greater facilities for terminal work. It was also proposed to introduce the Queue system, which has been used very successfully in Sheffield; barricades of "pens" would have to be erected in the street opposite to the place where the cars stopped, and passengers would have to take their place in these pens and so prevent any danger from crowding.

The Huddersfield tramways committee have entered into a contract with Messrs. Martin, Son & Co., Ltd., to convey for seven years the coal required at their works. This is an entirely new step in the direction of municipal trading, though the idea has been on foot for about two years. Specially constructed trucks, to hold about 5 tons each, will have to be used, each of which will be fitted with two electric motors. It is estimated that between 45 tons and 50 tons of coal a day will be required to be conveyed for Messrs. Martin, Sons & Co.'s consumption.

The town clerk of Leeds has received a telegram stating that the Board of Trade has sanctioned the new tramway by-laws. The by-laws will not be put into operation until the tramways committee has decided on the number of excess passengers to be allowed inside the cars. The practice of carrying excess passengers inside the car is legalized, but outside passengers must not exceed the number for which there is seating accommodation. The usual practice of standing outside a car in wet weather is expressly forbidden.

The London County Council has adopted a recommendation from the highways committee that application be made to Parliament for powers for the construction by the Council of new tramways from Battersea Park Road, via Battersea Bridge Road, and Battersea Bridge to Beaufort Street, Chelsea, at a point near King's Road. The estimated cost of the extension is £57,667.

A syndicate has been formed to promote a scheme of electricity supply covering the whole of Cheshire and North Staffordshire and part of Derbyshire, comprising an area of 1770 square miles. The share capital of the undertaking is fixed at a million and a half. Power gas is to be manufactured and distributed, and also used for the production of electricity. Large central power stations will be established at Frodsham, Sutton (near Macclesfield), and at Stone. The syndicate (which is to be styled the Cheshire and North Staffordshire Electrical and Power Syndicate) will promote its bill in the next session of Parliament.

A Manchester syndicate has been formed to apply for Parliamentary powers to erect electric generating stations and lay mains for the supply of electricity and power gas throughout a district comprising the County of Chester, the greater part of the County of Flint, the Wrexham district of Denbighshire, North Staffordshire, etc., a total of some 2000 square miles, with a population of over 1,500,000.

Two schemes for the development of electric traction in the neighborhood of Edinburgh have been submitted to the Town Council as a preliminary to Parliamentary sanction being sought. One proposal is for the formation of a company, and the construction by it of a tramway from the city of Edinburgh to the burgh of Queensferry. The line will be worked by electricity, and probably the promoters will be able to arrange with the city of Edinburgh for a supply of electric power. Messrs. Blyth & Westland, C. E., George Street, Edinburgh, are the engineers. The provost, magistrates and Council of Queensferry unanimously approved of the proposal, and recorded their hope to have the line constructed as speedily as possible. The other scheme is one which has been previously before the Council. The Drake & Gorham Electric Power & Traction (Pioneer) Syndicate, Ltd., London, have written to the Edinburgh Corporation offering to enter into a friendly arrangement with the Corporation by which the gap now existing between the Musselburgh Tramways Order and the Edinburgh Corporation system could be bridged over, and that they would be prepared, if they were to get the support of the Council, to apply for a new tramway order in respect of this intervening gap.

At the formal opening of the electric tramways, established by the British Electric Traction Company for Barnsley and Worsborough, in the presence of officials of the company, the members

of the Town Council, and other gentlemen, the trams were largely patronized.

At a meeting of the New Castle tramways committee, the chairman reported that the number of cars originally contemplated as being necessary to be run was ninety; but, as showing the great increase in the traffic, the number actually in use last Saturday was 140. The energy in reserve at the power house was taxed to the utmost, and, with the prospect of a further increase in the number of cars, it would be necessary to make some immediate arrangements to have additional engine power. Specifications had been sent out by the committee for the building of a new 3000-hp engine, which was sanctioned by the committee some little time ago, and that, it was expected, would be ready next September. In the meantime it would be necessary to have some relief, and Mr. Le Rossignol had been empowered to make inquiries with a view to obtaining a 1000-hp engine at an early date.

A. C. S.

London Locomotion

An interesting series of articles on the traffic facilities of London, which has been appearing for the last few months in "Traction and Transmission" (London), is completed in the December issue. The articles are by the Hon. Robert P. Porter, and give an exhaustive compilation of facts and figures relating to the present conditions, with an expert opinion upon the past successes and failures and the future needs. Through the courtesy of the author and publishers in furnishing to the Street Railway Journal advance proofs of the final instalment it is possible to give a brief outline of the extremely interesting data and deductions contained in the articles.

Greater London, or the Metropolitan Police District, contains a population of 6,581,077, and the county of London 4,536,524. In studying the traffic problem these two district areas must be kept in mind as well as a constantly growing district extending in every direction on the outskirts, which are all natural outgrowths of the parent city. In some localities the population has increased 175 per cent in twenty years. London presents exceptional difficulties when an attempt is made to estimate, even approximately, the magnitude of its traffic, but the following may be taken as having some elements of probability:

Railways (on basis of Mr. Kinnear Clark's estimate, in 1891, of 75 per head of population)	400,000,000
Omnibuses (estimated on basis of number of passengers carried per omnibus by the London General and Road Car Companies)	500,000,000
Tramways (estimated by deducting 10 per cent from the actual total number of passengers carried by the London tramway companies)	300,000,000
Hackney carriages (estimated on basis of 6000 passengers per annum for two-wheeled and four-wheeled vehicles alike)	70,000,000
Steamboats	3,500,000
Total	1,273,500,000

The London passengers are carried in a great variety of ways by a network of steam railways, underground railways, tramways and omnibuses, and each line is treated in detail. There is a total mileage of 228.45 miles, with 273 stations within the 121 square miles comprising the superficial area of the county of London. Within the county lines there are 114.87 miles of tramway, and without 31.89 miles. The average number of omnibuses running must be fully 3200.

At the close of the present session of Parliament the situation is substantially as it was at the opening. Out of over 82 miles of proposed tube railways only 4 miles haye been sanctioned. This may have the effect of hastening the electrical equipment of the steam-operated underground roads, and although the unexpected and somewhat sensational withdrawal of part of the London Suburban Railway project by the London United Railway interests, and the subsequent rejection of the entire bill by Parliament, wipes that scheme off the slate for the present, progress is not stopped on the network of tubes now being pushed in various directions by what is known as the Yerkes group, which, when completed, will connect important north and south districts of the city. Although the advisory work of both Board of Trade and County Council has been excellent, and the latter now announces that it has instructed its officers to make a complete scheme of locomotion for London, the author gives a brief review of the work being done by the New York Rapid Transit Commission, the Boston Transit Commission, and points out that it may be possible for Parliament to construct, out of the material now available in England, a body capable of doing similar work in solving the London problems. What is needed is a commission of action, which would take the initiative in deciding routes and providing the best service and lowest fares by offering the franchise to the most advantageous bidder. A policy of this sort would seem more practical than the present system of allowing each promoter to fight for the choice routes and throw the whole business into chaos if he fails to obtain what he wants.

Extensions During 1903

The result of the annual canvass of the street railway companies of the entire country, made by the Street Railway Journal, for the purpose of obtaining an idea of the amount of new work to be done in the coming year, shows that the work of extending and perfecting the present systems will call for the expenditure of an amount equalling that which has been expended in previous years in this work. Of course, many of the large companies, where unification of the systems has been perfected, do not report on improvements to be made, which though in their way considerable do not admit of general reference. On the other hand, many companies, their plans not fully matured, are loath to commit themselves because of the uncertainty as to what will be done. A notable feature of the reports is the many references to park and park attractions, showing the increased attention this feature of street railway operation is being given. Below is given an outline of some of the new work proposed:

PARIS TRANSIT COMPANY, of Paris, Tex., will purchase a merry-go-round and theater equipment.

BRISTOL & PLAINVILLE TRAMWAY COMPANY, of Bristol, Conn., will build about 4¼ miles of track.

TWIN CITY GENERAL ELECTRIC COMPANY, of Ironwood, Mich., will purchase four new cars complete.

THE FORT SCOTT CONSOLIDATED SUPPLY COMPANY, of Fort Scott, Kan., will buy one or two open cars.

LOWELL & BOSTON STREET RAILWAY COMPANY, of Boston, Mass., contemplates making a number of extensions.

CHARLESTON CONSOLIDATED RAILWAY, GAS & ELECTRIC COMPANY, of Charleston, S. C., will open a theater.

GREENFIELD & TURNERS FALLS STREET RAILWAY COMPANY, of Greenfield, Mass., will build 3 miles of line in Greenfield.

OCEAN CITY ELECTRIC RAILROAD COMPANY, of Ocean City, N. J., expects to purchase five or six ten to twelve-bench open cars.

NEGAUNEE & ISHPEMING STREET RAILWAY & ELECTRIC COMPANY, of Ishpeming, Mich., will build 2 miles of line next spring.

WICHITA RAILROAD & LIGHT COMPANY, of Wichita, Kan., will buy new cars and power station machinery. Two miles of new track will be built.

DENVER & NORTHWESTERN RAILWAY COMPANY, of Denver, Col., is about to place contracts for a 25-mile extension into the Rocky Mountains.

ROCHESTER, CHARLOTTE & MANITOU RAIROAD COMPANY, of Rochester, N. Y., will build several new switches. Some new cars will be purchased.

PITTSBURGH RAILROAD COMPANY, of Pittsburgh, Kan., contemplates building an extension, and will also extend and increase its power and power station.

METROPOLITAN RAILWAY COMPANY, of Oklahoma City, Okla., will build about 8 miles of new track. Five vestibuled 20-ft. motor closed cars will be purchased.

MOBILE LIGHT & RAILROAD COMPANY, of Mobile, Ala., will build an additional paint shop, car house and carpenter shop, and an extension to track of 3½ miles.

CITIZENS' RAILWAY & LIGHT COMPANY, of Muscatine, Ia., has not yet definitely decided as to extensions to be built. It is possible that a storage house will be built.

BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY, of Birmingham, Ala., is building a new car house, 140 ft. x 400 ft., and a new machine shop, 140 ft. x 400 ft.

CONCORD, MAYNARD & HUDSON STREET RAILWAY COMPANY, of Maynard, Mass., during the next six months will award contracts for a 7-mile extension.

GAINESVILLE & DAHLONEGA RAILWAY COMPANY, of Dahlonega, Ga., is now building repair shops and a car house in Gainesville. Rails will be required for 15 miles of track.

CLEVELAND CITY RAILWAY COMPANY, of Cleveland, Ohio, will build about 2 miles double track next spring. A new car house will be built, and two sprinklers are to be purchased.

DAYTON & NORTHERN TRACTION COMPANY, of Dayton, Ohio, is building 48 miles from Greenville to Union City, Winchester and Muncie; also power house at Winchester, Ind.

DURHAM TRACTION COMPANY, of Durham, N. C., will build 15 miles of single track and may make other improvements. The company is unable to give further information at this time.

RAPID TRANSIT COMPANY, of Chattanooga, Tenn., will place contracts during the next few months for a 3-mile extension, also addition to car house, and will purchase motor and trailer cars.

BUTLER PASSENGER RAILWAY COMPANY, of Butler, Pa., will build, at once, an addition to car house to accommodate six more cars. Four miles of new track will also be built early in 1903.

PROVIDENCE & DANIELSON RAILWAY COMPANY, of Providence, R. I., will purchase five to eight new passenger cars in the near future.

KITTANNING & LEECHBURG STREET RAILWAY COMPANY, of Kittanning, Pa., will build a power house. The road is to be extended 15 miles. Contracts will be placed during February and March.

COLUMBUS, NEW ALBANY & JOHNSTOWN TRACTION COMPANY, of Columbus, Ohio, within the next ninety days will award contracts for 18 miles of road, and also order four passenger and one baggage car.

FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD, of Gloversville, N. Y., is in the market for a new electric lo omotive. The company expects to build a new frame car house in Gloversville, size 75 ft. x 180 ft.

SARNIA STREET RAILWAY COMPANY, of Sarnia, Ont., expects to build 3 miles of new line. If this work is carried out another generator and three or four large open cars, equipped with trucks, motors, etc., will be required.

GRAND VALLEY RAILWAY COMPANY, of Brantford, Ont., will build as follows: Twenty-mile extension, car house of brick, 66 ft. x 230 ft., theater and merry-go-round. Four motor cars with equipment will be purchased.

KITTANNING & COWANSHANNOCK VALLEY STREET RAILWAY COMPANY, of Allegheny, Pa., will complete the balance of a 6½-mile extension; grading to be finished about March 1, and construction Sept. 1.

MIDDLETOWN STREET RAILWAY COMPANY, of Middletown, Conn., will purchase two open cars, one box-car and one snowplow, each equipped complete. The company will relay 1½ miles of track and build 2 miles of new track.

GRANITE CITY & ST. LOUIS RAILWAY COMPANY, of Venice, Ill., will build between Alton and Granite City to connect with present lines, which will necessitate additional power station apparatus, structures, etc. Ten cars will be bought.

BURLINGTON & HINESBURGH RAILWAY COMPANY, of Burlington, Vt., is in the market for four first-class convertible double-truck passenger cars, each equipped with four motors. A 400-kw 10,000-volt generator is to be purchased.

CANTON-AKRON RAILWAY COMPANY, of Canton, Ohio, contemplates building an extension to East Greenville, and will probably build a new car house at Canton. The company is in the market for a launch, figure 8 toboggan and a merry-go-round.

SHERBROOKE STREET RAILWAY, of Sherbrooke, Que., during the next six months will place contracts for a 1-mile extension of its East Sherbrooke line. The company will buy a dynamo, and two cars equipped with fenders, motors, brakes, etc.

MONROE COUNTY ELECTRIC BELT LINE RAILWAY COMPANY, of Rochester, N. Y., will not begin active construction of it before spring. The Syracuse Railroad Construction Company has the contract for both construction and equipment complete.

HOMESTEAD & MIFFLIN STREET RAILWAY COMPANY, of Homestead, Pa., will place contracts during the next six months for a new extension of 3½ miles, a new power plant and 200 ft. of viaduct. Open or convertible cars and a merry-go-round will be purchased.

MINNEAPOLIS LAND & INVESTMENT COMPANY, of Minneapolis, Minn., had its cars, car house and repair shops destroyed by fire on Oct. 26. The company is building a new car house and repair shops and will have to purchase quite a little new rolling stock and equipment.

DANVILLE, URBAN & CHAMPAIGN RAILWAY COMPANY, Champaign, Ill., will, within the next three months, award contract for a 33-mile interurban road, and orders will be placed for 1000-kw power house machinery. A car house, to be 50 ft. x 100 ft., will be built.

COLUMBIA & MONTOUR ELECTRIC RAILWAY, of Bloomsburg, Pa., will build a car house at Berwick, Pa. The company has added a 30 ft. x 45-ft. building at Bloomsburg, exclusively for repair purposes. A lathe, boring mill, planer, emery wheel and drill press are to be purchased.

BERLIN STREET RAILWAY, of Berlin, N. H., is in the market for a storage battery to use on Berlin end of line, 8 miles from power house, on which there is a 6 per cent grade 300 ft. long and several smaller grades. An electric fountain, merry-go-round and any other park attractions will be purchased.

CAMDEN & SUBURBAN RAILWAY COMPANY, of Camden, N. J., will build as follows: Two and one-half miles double track, Hadclose Heights; 3 miles double track, Riverton extension; 1 mile single track, Moonstown; one bridge, Morris Station; storage battery, sub-station, Moorstown, N. J.

NORTON & TAUNTON STREET RAILWAY COMPANY, of Norton, Mass., during the next six months will award contracts for extension of track and overhead trolley a distance of 5 miles. The company will build a three-track addition to its car house, and purchase six double-truck open cars, with trucks, renders, etc.

LYNCHBURG TRACTION & LIGHT COMPANY, of Lynchburg, Va., during the spring will probably build a new modern car hause and repair shop. The company will also build a new water-power plant with a capacity of 2200 kw. The contract for all electrical apparatus has been given to the General Electric Company.

WARREN & JAMESTOWN ELECTRIC RAILWAY COMPANY, of Warren, Pa., will build 20 miles of track, a power house and several bridges, and will purchase storage batteries, dynamos, rotary transformers, six interurban cars, with trucks, four motor equipments, air brakes, etc. Contracts will be let during the next six months.

MIDDLESEX & SOMERSET TRACTION COMPANY, of New Brunswick, N. J., within the next few months will award contracts for a 5-mile extension. The company will install the alternating system to operate outlying lines, and will want 400-hp engine and at least 350-kw alternator for sub-station. A summer park is to be opened.

BUFFALO & DEPEW RAILWAY COMPANY, of Depew, N. Y., will build as follows: Sixty miles of track, two new car houses and one central power station with sub-station. Complete equipment for power house and shops is to be built, also rolling stock and rolling stock equipment. Orders are to be placed during the next two months.

NEW ORLEANS & SOUTHWESTERN RAILROAD, of Thibodiaux, La., will begin work in February, 1903, for its road of 120 miles. The company will be in the market for everything in the way of power station apparatus and rolling stock necessary to the complete equipment of the road, including the building of bridges and other structures, etc.

WASHINGTON & CANONSBURG RAILWAY COMPANY, of Washington, Pa., completes grading 7 miles of line. Rails have already been purchased. A car house and power station will be built in the immediate future. Orders have already been placed for power station apparatus, and orders for rolling stock and equipment are about to be placed.

JAMESTOWN STREET RAILWAY COMPANY, of Jamestown, N. Y., expects to place contracts during the next thirty days for the building of 3 miles, 6-in. T-rail; 14 miles, 75-lb. or 80-lb. T-rail; an addition to power house. The company will purchase two 500-kw generators, engines, ten fifty-passenger cars, and ten semi-convertible and combination cars.

INDIANAPOLIS, SHELBYVILLE & SOUTHEASTERN TRACTION COMPANY, of Shelbyville, Ind., will, within the next three months, place contracts for the extension of the road to Batesville, a distance of about 40 miles. The road is now being surveyed. It is not yet determined as to what car houses, power stations and other structures will be built, nor has a decision been reached as to the power station apparatus that will be purchased.

LATROBE STREET RAILWAY COMPANY, of Latrobe, Pa., expects to build 5 miles more of track next summer, contracts to be placed within the next three months. The company is now building a new car house, has contracted for a new power plant, and will purchase three new cars soon. A merry-go-round and some other park attractions will be purchased before spring.

CONESTOGA TRACTION COMPANY, of Lancaster, Pa., during 1903 will complete the Lancaster & Mount Joy Railway, 17 miles; the Lancaster & Rohrstown Railway, 4½ miles, and extend the Lancaster, Mechanicsburg & New Holland Railway from New Holland to Terre Hill, by way of Blue Ball and Churchtown, a distance of about 6 miles. The company expects to open a new park for the 1903 season.

RUTLAND STREET RAILWAY COMPANY, of Rutland, Vt., will award contract within the next three months for a 200-hp power station (water power); a new car house and a repair shop, and will complete a 3-mile extension in the spring. The company expects to purchase dynamos, water-wheels, large open and closed cars and a snowplow, but is undecided as yet as to whether any park attractions will be bought.

FORT SMITH & VAN BUREN LIGHT & TRANSIT COMPANY of Fort Smith, Ark., will award contracts during the next ninety days for an extension of 2½ miles and the building of one bridge across the Arkansas River at Van Buren, 1900 ft. long, as soon as legislation is secured. The company will purchase park attractions in general, also three vestibuled cars, 37 ft. long, equipped with motors, air brakes, arc headlights, etc.

OHIO & INDIANA AIR LINE RAILWAY COMPANY, of Toledo, Ohio, will build 95 miles of track (single) between Fort Wayne, Ind., and Toledo, Ohio, contracts for which are to be let within the next three months. The company will be in the market for everything required for such a road, including the rolling stock and rolling stock equipment, power house and repair shop apparatus, car houses and other structures, etc. Park attractions will be purchased for a pleasure resort which the company plans to open.

TOLEDO, COLUMBUS, SPRINGFIELD & CINCINNATI RAILWAY COMPANY, of Toledo, Ohio, has placed contracts with the United States Construction Company, of Lima, Ohio, for 40 miles of new line, 20 miles to be in operation June 1, 1903, and the other 20 miles within a year. The company will need about 38 miles of equipment about July, 1903. A power station, two substations, one or two car houses, a repair shop and four to six depots and freight houses will be built. Large tiling for bridges and equipment for power house complete will be required. Eight passenger cars and one combination car will be purchased, also trailers.

LONDON, AYLMER & NORTH SHORE ELECTRIC RAILWAY COMPANY, 1036 Majestic Building, Detroit, Mich., will build about 45 miles of track, the necessary car houses, power stations, repair shops, bridges, etc., and will purchase everything needed in the way of rolling stock and rolling stock equipment, dynamos, storage batteries, engines, boilers, conveying machinery and other power station apparatus necessary to equip the line for high speed. Contracts will be awarded in about sixty days. The company does not expect to purchase, at present, anything in the way of park attractions, but would be glad to receive any information about them for future use.

The Interstate Railways Company

Announcement has been made that control of the United Power & Transportation Company has been sold to the Interstate Railways Company at $75 a share, payable in forty-year collateral trust gold coupon bonds, to be issued by the Interstate Railways Company. The bonds will be dated February 1, 1903, and will bear interest at the rate of 3 per cent for the first year, 3½ for the second year, and 4 for the third year and thereafter. The Interstate Railways Company was incorporated recently in New Jersey, with a capital of $10,000,000, for the purpose of operating electric companies and street railways, and sensational announcements as to the magnitude of plans of the company were made at once.

The United Power & Transportation Company is also a New Jersey corporation, chartered in 1899. Its authorized capital was $12,500,000, of which $3,125,000, par $25, full paid, is outstanding. Among the operations controlled by the company are the following: Edison Illuminating Company, of Lebanon; Schuylkill Valley Traction Company, Trenton (N. J.) Street Railway; United Traction Company, of Reading; Wilkesbarre & Wyoming Valley Traction Company, of Wilkesbarre; Dallas & Harvey's Lake Railway, of Wilkesbarre; Wilmington & Chester Traction Company, Wilmington City Electric Company, Citizens' Electric Light & Power Company, of Delaware County; Delaware County & Philadelphia Electric Railway, and several lines in the suburbs of Philadelphia.

Financing the Indianapolis & Northwestern Traction Company

Messrs. Tucker, Anthony & Co., according to the Boston News Bureau, have just concluded arrangements for the financing of the Indianapolis & Northwest Traction Company, which is organized under Indiana laws and will build a high-speed electric interurban railway between Indianapolis and Lafayette, Ind., a distance of 64 miles. The company has an authorized capitalization of $3,000,000 bonds and $3,000,000 stock, but only $2,000,000 of each class of securities will be issued at the present time. The remainder is authorized to provide for a proposed extension later on. The financing of the above has all been underwriten. The road will be equipped with 70-lb. steel rails and regular steam railway construction. It will be built on a private right of way and will be tributary to a population of about 250,000.

Subway Talk in Chicago

A sub-committee of the local transportation committee of the Chicago City Council has outlined the terms on which a franchise may be granted to the Washburne-Alexander syndicate, which proposes to build a system of subways in the downtown districts of Chicago for street railway purposes. The plan suggested by the committee is that the promoters build the tunnel and the city own it. To compensate the promoters the full use of the subway is to rest with the promoters, who are to reap the benefits until such time as the city elects to buy it, or until the city's interest amounts to enough to meet the original cost of construction. There seemed to be some question in the minds of the committee as to whether the city could invest any proposed company with the right of eminent domain necessary to remove the existing obstructions in the streets. It was proposed, therefore, that instead of having the company build the tunnel the city should build it with the company's money, the title to remain with the city. Instead of a franchise granting the company the right to build and operate the subway the city would execute with the company a contract giving it entire possession, with full power to operate, and to receive and retain all profits which might be had. It was suggested that a profit of 7 per cent be allowed on the investment, and if the dividends amounted to more than 7 per cent half of all over 7 per cent and up to 10 per cent be credited to the city's account, the company, however, retaining the money. If over 10 per cent is earned two-thirds of all up to 15 per cent to be credited to the city, and over 15 per cent still larger amounts, always, however, leaving the company something as a reward for good management. As these credits accrued to the city the amounts would be deducted from the original amount of the capitalization, the balance fixing the amount the city must pay at any time it might elect to take over the possession as well as the title of the property.

Premiums at Pittsburgh

The Pittsburgh Railway Company, of Pittsburgh, Pa., distributed almost $30,000 to 2400 men Dec. 23. This is the premium money promised six months ago by the company to motormen and conductors as a reward for carefulness in avoiding accidents during the six month ended Nov. 30. About 80 per cent of the motormen and conductors participate in the premium distributions. Some 300 of the 2400 had small accident charges, which aggregated less than the amount of their premiums, and they get the difference. About eight premiums were wiped out by accident charges. The money will be paid in the form of a special check adopted for the purpose. With each check goes a premium certificate, which many of the men will treasure more than the money, as it will at all times be a recommendation for employment elsewhere should the holder need it. The payment of the premium money is practically an advance of wages of 1 cent per hour to all the men participating. This makes the third advance this year.

New Elevated Railway Trucks for Brooklyn

The Peckham Manufacturing Company, of New York, has closed a contract with the Brooklyn Rapid Transit Company for a new type of truck to be used on the new elevated equipment of that road. The order comprises trucks for 480 motor cars. They will be needed at an early date for use on the 240 old steam coaches soon to be remodeled for electric service by the railway company and for the 120 open cars recently ordered. The type of truck selected is a modification of Master Car Builders' designs, containing many features of additional strength and servicability, controlled by patents owned by the manufacturing company, as well as others specified by the engineers of the railway. The placing of so large a single order at this time may be looked upon as practically standardizing the truck equipment of the Brooklyn elevated roads, and the Peckham company has very satisfactorily proved the merits of its high-speed trucks by securing this contract.

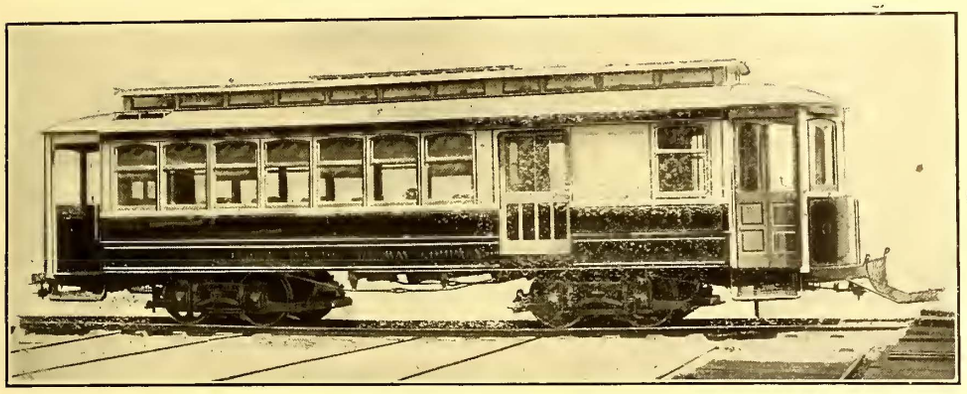
Important Legal Decision in Illinois

On Dec. 22 the Appellate Court of Illinois, in session at Freeport, rendered an important decision, holding that city councils and supervisors have power to grant street railway franchises to corporations only, and not to individuals. This decision may invalidate many existing franchises.

Semi-Convertible Cars for Tyrone, Pa.

A number of fine cars were lately placed in commission on the lines of the Tyrone Electric Railway Company, and were built by the J. G. Brill Company, of Philadelphia. The length over the end panels is 30 ft. 8 ins.; length over crown-pieces, 40 ft. 1 in.; width over sills, 8 ft., and, width, over belt rail, 8 ft. 3½ ins. The weight without motors is 30,000 lbs.

The baggage compartments, which are 10 ft. 10 ins. in length,



NEW CARS FOR TYRONE

are fitted with folding seats for smokers. The passenger compartments are seated for twenty-eight passengers. As the system of roof storage of windows does away with the necessity for wall-pockets, the panel lining is set within the posts and the seat ends brought thereto, increasing the aisle width nearly 7½ ins. Brill angle-iron bumpers, radial draw-bars, "Dedenda" gongs, and ratchet brake-handles are included in the equipment. The trucks are the No. 27-G.

Street Railway Patents

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

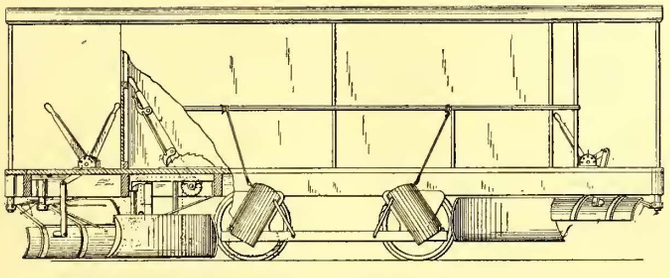
UNITED STATES PATENTS ISSUED DEC. 16, 1902

715,791. Railroad Truck; W. C. Happe, Davenport, Ia. App. filed July 14, 1902. Stub-shafts mounted in the side of the car carry wheels which run against the under side of rails suitably supported by the track structure, whereby the cars will be held against displacement when traveling at high speed.

715,906. Adjustable Brake-Shoe Head; C. F. Uebelacker, Elmira, N. Y. App. filed June 16, 1900. Relates to means for adjusting the brake-shoe so that uneven wearing thereof may be prevented.

715,975. Controller for Electric Motors; E. R. Carichoff, East Orange, N. J. App. filed Aug. 1, 1901. To give the required quick movement, the spring is compressed between each notch and suddenly released.

715,983. Trolley Wheel; L. Chroninger & J. E. Adams, Findlay, Ohio. App. filed May 21, 1902. On each side of the wheel spiral tracks are formed on cones to conduct the wire into the central groove when it becomes displaced.



PATENT NO. 716,283

715,995. Brake Beam; S. A. Crone, New York, N. Y. App. filed June 27, 1902. Comprises a beam member having on its ends the brake-shoe heads, a truss rod member engaging said heads, and a central strut adapted to receive the brake lever.

715,996. Brake Beam; S. A. Crone, New York, N. Y. App. filed Aug. 19, 1902. See preceding invention.

715,997. Brake Beam; S. A. Crone, New York, N. Y. App. filed Sept. 22, 1902. Details.

716,070. Car Fender; G. Linhard and P. Linhard, Sublett, Mo. App. filed July 28, 1902. Consists of a frame, a pair of arms extending forward therefrom, links connected to the arms, angle-levers connected to the links, side and forward buffer springs and a catch basket.

716,101. Electric Railway; W. B. Potter, Schenectady, N. Y. App. filed April 28, 1900. A plurality of sources of current, a supply circuit, a control circuit, and means brought into action through the instrumentality of said control circuit for connecting said supply circuit with any one of said sources of current.

716,113. Driving Mechanism of Motor Cars; A. Schmid, Havre, France. App. filed Jan. 28, 1902. The engine, dynamo, motors and controller are all mounted on the same vehicle.

716,125. Electric Railway; E. A. Sperry, Cleveland, Ohio. App. filed Oct. 20, 1902. A traction rail engaged by suitable spur-wheels, also serves as the "third-rail."

716,145. Trolley Catcher; A. Thode, Hamburg, Germany. App. filed Sept. 25, 1902. The trolley cord is controlled by a spring drum arrangement.

716,189. Motor Control System; F. E. Case, Schenectady, N. Y. App. filed June 3, 1901. A motor controller consisting of a group of independent elements arranged to control both the direction of rotation and the speed of one or more motors, each of said elements comprising a single set of contacts connected to the motor circuit, and means for actuating the same.

716,200. Controlling Electric Motors; M. W. Day, Schenectady, N. Y. App. filed Nov. 2, 1899. A combined magnetic and friction brake for electrically propelled devices, comprising connections for putting the motor on short circuit when the supply circuit is broken, a brake releasing coil in series with the motor, and an auxiliary brake-releasing coil in shunt to the armature.

716,244. Tramway Switch; J. W. Keefer, Voorheesville, N. Y. App. filed Aug. 30, 1902. A bed-plate, a shifting block pivoted thereon, a cross-bar adapted to engage with the shifting block, means for adjustably securing the cross-bar to the shifting block and a guide arranged along the edges of the bed-plate.

716,283. Snow Plow; M. Rounds, Roxbury, Mass. App. filed Aug. 14, 1902. A snow plow for street railways in which the wings or "shares" of the plow are adjustable to throw the snow to the right and left, or all to the right or to the left, and the scope of the plow may be increased or decreased at will.

716,294. Flexible Car Truck; C. S. Schallenberger, Milwaukee, Wis. App. filed July 14, 1902. Consist of the combination with a car truck, of springs inserted between the sides of the bolster and the frame and rollers under the bolster, so as to allow the bolster to move laterally against the tension of the springs, to thus make the truck flexible.

Consolidation in Central New York

A certificate of consolidation of the Fonda, Johnstown & Gloversville Railroad Company, the Amsterdam Street Railroad Company, and the Cayadutta Electric Railroad Company, under the title of the Fonda, Johnstown & Gloversville Railroad Company, was filed for record at Albany on Dec. 23. The capital of the company is $1,950,000, and the officers and directors are: J. L. Hees, of Fonda, president; Gustave Levor, of Gloversville, first vice-president; J. C. Ferris, of Johnstown, second vice-president; G. M. Place, of Gloversville, secretary and treasurer; S. H. Shotwell, Erastus Darling, S. B. Whitney and A. J. Zimmer, of Gloversville; G. F. Moore, of Fonda; J. G. Younglove and James Stewart, of Johnstown; R. T. McKeever, of Houghton, Mich.; J. S. Friedman, of Albany; Chauncey M. Depew, of New York city; W. M. Hardis, of Northville, directors.

Ten Hour Law for Railroad Employees

The act passed by the Rhode Island Legislature last January which limited the time of employment of motormen and conductors employed by electric railroad companies to ten hours of actual labor, performed within twelve consecutive hours, and which was the cause of the railroad strike on the Providence lines several months back, has been under discussion ever since. This legislation resulted in the partial defeat of the Republican party in Rhode Island at the last November election. The subject was

taken up at the adjourned session just ended, and the law passed last January was amended so that nothing contained in the act should prevent an employee working more than ten hours, through written contract, should he see fit to do so. This is a practical repeal of the first act in its original intents and purposes.

PERSONAL MENTION

MR. T. L. LYMAN, manager of the asbestos department of H. W. Johns-Manville Company, New York, sailed on Dec. 20 for Havana, Cuba, where he will remain two weeks for the benefit of his health.

MR. C. O. FITCH, electrician of the Cudahy Packing Company, with headquarters in Omaha, Neb., has resigned from that company, to become connected with the Hudson Valley Railway, of Glens Falls.

MR. ALBERT C. WISWALL, who has been connected with the United Traction Company, of Albany, N. Y., for some time as master mechanic, has resigned from the company, to become master mechanic of the Utica & Mohawk Valley Railway Company, of Utica, N. Y.

MR. L. W. SANBORN, who has sold to Mr. Thomas W. Peterson his interest in the People's Traction Company, of Galesburg, Ill., will retire as president of the company. Mr. E. B. Hardy, the vice-president of the company, will, according to report, succeed Mr. Sanborn temporarily.

MR. E. GONZENBACH, well known through his connection with the Aurora, Elgin & Chicago Railway and other interurban roads, will said for Europe early in the new year for the purpose of inspecting recent interurban railway installations, especially those employing the third-rail and those using alternating-current motors.

MR. JOHN S. BRACKETT has recently been appointed superintendent by the Boston & Northern Street Railway Company of its Nashua, N. H., system, which includes several lines in the city of Nashua, and one for Lowell. He was for about five years superintendent of the North Woburn Division of the Boston & Northern Street Railway.

MR. LEMUEL S. BOGGS has been appointed to the management of the Boston & Great Falls Light & Power Company and the Great Falls Street Railway Company, of Great Falls, Montana. Mr. Boggs has for some time been on the engineering staff of Sargent & Lundy, of Chicago, and his wide engineering experience fits him well for his new duties.

MR. HARNETT J. FULLER, formerly a civil and railroad engineer of England, is now located with offices in the Arcade Building in Seattle, Wash., from which headquarters he is supervising the surveys and preliminary field work of the Pierce County Improvement Company in the development of the Puyallup River electric power transmission, which is being pushed by Messrs. Stone & Webster, of Boston. Mr. D. P. Robinson, of the Seattle Electric Company, is looking after the local interests of the electrical side of the proposition.

MR. F. M. WHYTE, mechanical engineer of the New York Central & Hudson River Railroad, was elected secretary of the New York Railroad Club at a recent meeting of the executive committee. The selection of Mr. Whyte to fill the vacancy made by the resignation of Secretary W. B. Yereance, has placed the affairs of the club in the hands of one who has not only had a large experience in the work as former secretary of the Western Railroad Club, of Chicago, but has a very large acquaintance with the membership. His duties as secretary of the New York Railroad Club commence at once.

MR. H. F. SWAIN has recently been appointed engineer of way and structure of the Brooklyn Heights Railroad Company. Mr. Swain was connected with the track department of the Brooklyn system from 1893 to 1895, and later for a short time in 1897, so that he is thoroughly familiar with the requirements of his position, and has a large number of friends on the road. During the interval between 1895 and 1897 he was on the engineering staff of the Hazelton Boiler Company, and since 1897 he has been with the Metropolitan Street Railway Company, of New York, where he has superintended much of the new construction recently completed, including the Ninth Avenue line and some of the crosstown lines.

MR. E. C. NOE has just been appointed general superintendent of the Northwestern and Lake Street Elevated Railways, of Chicago, to succeed Mr. Frank Hedley, who has resigned to become connected with the Interborough Railway Company of New York. Mr. Noe has had an extended electrical experience. He began his electrical career with the Chicago Edison Company in 1881, and has been connected with the Edison and General Electric companies ever since. At present he is chief engineer of the Chicago office of the latter company, which position he has occupied for several years past. He is familiar with the elevated properties, and has a high reputation in Chicago. The selection was made quickly after the announcement of Mr. Hedley's resignation.

MR. C. GORDON REEL, general manager of the Kingston Consolidated Railroad Company, has been intimately connected with that property for a number of years, and it is largely owing to his efforts and ability that the railway situation in Kingston is as satisfactory as described in the article appearing elsewhere in this issue. Mr. Reel was graduated in 1893 as a civil engineer from the five-year course at Washington University. In 1895 he built the St. Louis & Meremac Highlands Railroad, and afterwards became chief engineer of the Lindell Railway, of St. Louis, the nucleus of the present St. Louis Transit Company. In 1897 he was made engineer and superintendent of the Colonial City Traction Company, of Kingston, and remained in that position for two years, during which time the bitter litigation between the then separate street railway system of the city was at its height. Leaving Kingston, Mr. Reel became connected with other municipal engineering work, and in 1900 he associated himself as principal assistant to Mr. Charles H. Ledlie, of St. Louis, and devoted himself to consulting engineering until 1901. Last year he was made vice-president of the Kingston City road, and after the consolidation became general manager of the consolidated companies, which position he now holds.

C. GORDON REEL

MR. FRANK HEDLEY has been appointed general superintendent of the underground lines of the Interborough Rapid Transit Company, of New York. This is the company which will operate the new rapid transit subway now under construction. For about ten years past Mr. Hedley has been making a fine record as superintendent of elevated roads in Chicago. When he first came to Chicago, in 1893, it was to start the operation of the Lake Street Elevated Railroad, as superintendent of motive power and transportation. He had full charge of the construction of the cars and locomotives, and operation of the road. In 1894 and 1895 the construction of the Northwestern Elevated Railroad and the Union Loop was begun, and during all the construction Mr. Hedley was on the consulting engineering staff, in addition to his duties as superintendent of the Lake Street Elevated. He has, since their completion, acted as general superintendent of their operation.

FRANK HEDLEY

Mr. Hedley comes from a family of English engineers, prominently connected with the steam railroad and locomotive engineering. His granduncle, William Hedley, was the designer and builder of the first locomotive traction engine ever constructed, the model of which was exhibited in Chicago at the Columbian Exposition in 1893. This model is now in the Metropolitan Museum in Chicago.

Mr. Hedley learned the mechanical engineering profession in England, coming to this country in 1882, and engaging with the Erie Railroad at its Jersey City shops, as a machinist. Later he was machinist and general inspector of the Third Avenue division of the Manhattan Elevated, from which he was promoted to the position of the assistant general foreman in the locomotive department. He remained with the Manhattan Elevated for 5½ years, which company he left to become master mechanic for the Kings County Elevated Railroad in Brooklyn, where he remained 3½ years, before going to Chicago.

Mr. Hedley is not only a broad-minded transportation engineer, but a first-class operating superintendent as well, as can be easily judged from the fact that he has been chosen to fill one of the most important positions the local transportation world has to offer to-day.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, Dec. 24, 1902.

The money market has grown decidedly easier in all quarters during the past week. Call money, which loaned as high as 12 per cent ten days ago, is now freely supplied at 6 and under. Time money for sixty and ninety-day contracts, which command at one time 7½ per cent, is now offered at 6. This sudden loosening of the market stringency reflects not so much actual relief to bank reserves as confidence that relief is immediately in sight. The surplus reserve continued its decline even in last Saturday's statement, but in the opinion of all competent observers the low point of the season has probably been reached and the corner has been turned. This view is based chiefly upon the two most important recent developments in the market, one being the increasing return movement of funds from the harvest sections, the other being the diminished absorption of money by the Sub-Treasury. Following the normal course of events the return of crop-moving currency may be expected to continue from now on up to the end of February. January is always a period of heavy government expenditures, and consequently the more favorable turn in the bank exchanges with the Treasury which has been noticed during the past fortnight is not likely to be only a temporary incident. Meanwhile sterling exchange, which, during the early part of the month, hung steadily around the gold-shipping level, has dropped off a full cent in the pound, thus rendering gold exports out of the question, for the time being at least. These various evidences of improvement in the money situation, combined with the extensive liquidation which has gone on among loans upon speculative collateral, are the obvious reasons for the decline in money rates. The chances seem to favor a continuance of the recent relaxation, with possibly easier terms for borrowers, such as is usually witnessed after the first of the new year.

The Stock Market

The recovery which set in a week ago on the Stock Exchange has made further progress, though with greater display of irregularity during the last few days. In part the suspension of activity is due to the holidays, in part to the tighter money, expected over the first of the year, and in part to the belief that some reaction is in order after the very sharp rally which prices have enjoyed from their low points of last Monday week. This expectation has been partially realized during the last day or two, but not to the extent that many people looked for. Consequently the trading element is hesitating whether to think that the immediate course of the market will be lower, or whether to feel that the decline has gone far enough already to put conditions in shape for a further advance. Meanwhile there is no disposition to sell on the part of the more solid class of security holders, which indicates that their attitude is one of hopefulness for the future. The Venezuelan episode has ceased to trouble the market. Reports of earnings for the December quarter, and the semi-annual period are not as encouraging as they might be, the Vanderbilt roads in particular showing that operating expenses have been increasing a good deal faster than gross receipts. But on the other hand the gross earnings reported from week to week at the present time are making an improved exhibit.

The local traction stocks have been favorites of the trading, especially during the last day or two. Insiders and their friends have bought Brooklyn Rapid Transit freely on the remarkably good earnings statements which are now coming to hand. Manhattan and Metropolitan have done little on their own hook, but have merely sympathized with the rise in Brooklyn.

Chicago

All the leading Chicago issues have responded quickly to the general upward tendency in the speculative markets. South Side Elevated, which has held better than anything else during the recent depression, sold early in the week at 108, but the next sale was 109¼, with the dividend off. City Railway has also been notably strong at 208. Officials of the company claim that earnings since last September have shown up at the rate of 18 per cent on the share capital. Union Traction has been quiet but firmer, with some vague intimations that something important concerning the financing of the company's affairs will be made known after the first of January. The common is selling at 14, against 13 a week ago, while the preferred has changed hands in small blocks between 45 and 45½. The recovery carried Metropolitan common back from 34 to 35¾, and the preferred from 85 to 85½. Lake Street, after selling as low as 8, rallied to 8⅞. No attempt will be made, according to good authority, to reorganize the company, at least yet awhile.

Philadelphia

The Philadelphia market for street railway shares has enjoyed a sharp recovery during the week, in common with the markets elsewhere. American Railways, which went as low as 50 during the break, rallied to 53 on sales of a few hundred shares. Philadelphia Traction was dealt in between 97½ and 98, and Union Traction between 45 and 46. In both these stocks the dealings were fairly large. Philadelphia Rapid Transit was comparatively dull but strong, rallying two points or more to 16¾. Consolidated Traction of New Jersey moved up from 67 to 69, reacting later to 68. A hundred shares of Railways General sold at 4, and 200 Reading Traction at 30. There was little or no news or developments of a particular nature. All the stocks mentioned were merely reflecting general market conditions.

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	
	Dec. 16	Dec. 23
American Railways Company	51¾	51¾
Aurora, Elgin & Chicago	39	37
Boston Elevated	150	154½
Brooklyn R. T.	61⅝	65⅛
Chicago City	208	208
Chicago Union Tr. (common)	13	14½
Chicago Union Tr. (preferred)	45	44
Cleveland Electric	86¼	84¾
Columbus (common)	60	60
Columbus (preferred)	105½	105½
Consolidated Traction of N. J.	68	68½
Consolidated Traction of N. J. 5s	107¾	107
Detroit United	86½	84
Electric People's Traction (Philadelphia) 4s	98¼	—
Elgin, Aurora & Southern	53	48
Indianapolis Street Railway 4s	86¾	85½
Lake Shore Electric	13¾	13½
Lake Street Elevated	8¾	8½
Manhattan Railway	143¼	145⅜
Massachusetts Elec. Cos. (common)	34	35½
Massachusetts Elec. Cos. (preferred)	94	94
Metropolitan Elevated, Chicago (common)	35⅝	35
Metropolitan Elevated, Chicago (preferred)	85	84½
Metropolitan Street	136¾	139
New Orleans Railways (common)	13½	—
New Orleans Railways (preferred)	44½	46
North American	111¾	114
Northern Ohio Traction (common)	—	a67¾
Northern Ohio Traction (preferred)	—	a93
North Jersey	30¾	29½
Northwestern Elevated, Chicago (common)	—	—
Philadelphia Rapid Transit	15	16½
Philadelphia Traction	97	97½
St. Louis Transit (common)	27½	26¼
South Side Elevated (Chicago)	109	109¼
Syracuse Rapid Transit	32	31¾
Syracuse Rapid Transit (preferred)	79	76
Third Avenue	125	124
Toledo Railway & Light	35	a35
Twin City, Minneapolis (common)	114	115¾
United Railways, St. Louis (preferred)	82	80½
United Railways, St. Louis, 4s	84½	—
Union Traction (Philadelphia)	45¼	45⅞
Western Ohio Receipts	26	23

a Asked. b Last sale.

Other Traction Securities

In Boston the week has been dull and devoid of feature, but prices have moved back in sympathy with the general market. Boston Elevated recovered five points from the lowest to 154½, Massachusetts Electric rose two points to 35½, the preferred selling ex-dividend, went up to 93½, West End common sold at 94¾ and the preferred ex-dividend at 112. In all these stocks the lots actually changing hands were extremely small. There has been some improvement also in Baltimore during the week. United Railways incomes rallied to 66¼ from 65⅛, the recent low point, the stock recovered from 13 to 13¾, and the general 4s from 94 to 94¾. Nashville Railway shares were active at 4½, and sales

of North Baltimore Traction 5s were reported at 110¼. These comprised all the week's business in the traction specialties. On the New York curb some activity was manifested in New Orleans 4½s at an advance to 79, and in United Railways of St. Louis 4s, which sold up from 84, to 84¾. Otherwise business was poor, the only sales reported being New Orleans common, from 13 to 14, the preferred at 45, St. Louis Transit at 26½, and Interborough Rapid Transit 40 per cent paid stock at 107 and 106½. While bank stocks have been quite active on the Cleveland Exchange during the last week, and money seems to be easier, there is little or no interest in tractions, and prices continue to show fractional declines. Lake Shore Electric preferred sold at 57 and the common for 14 in small lots; later a small lot of the latter sold at 13. A number of small sales of Northern Ohio Traction preferred receipts took place at 95¾ to 95½, and the common receipts were held at 70. A small lot of Springfield & Xenia sold at 17½, and a small lot of Western Ohio receipts at 26, both close to low marks. Monday the Northern Ohio preferred receipts dropped to 92½ for small lots.

MACON, GA.—The Macon Railway & Light Company has executed a mortgage for $1,000,000 on all its properties to the North American Trust Company, of New York, as trustee, to secure an issue of fifty-year 5 per cent gold bonds.

CHICAGO, ILL.—New York and Chicago capitalists have joined forces to launch one of the largest traction ventures this city has known, according to *The Daily News*. The scheme is for an underground railroad, combined with a new elevated road, the cost of the entire project to be from $51,000,000 to $55,000,000. The plan includes the construction of a tunnel under the downtown streets, making a loop of the business section and connecting with a new elevated road, which it is proposed to construct parallel with the existing South Side line. The elevated road is to be reached by means of an incline. The scheme is designed largely to benefit the stock-yards district. The Interborough Rapid Transit Company of New York is said to be at the head of the scheme. Eight New York men are interested, it is said, while only six Chicagoans have so far been mentioned in the deal. It is reported that, until it was learned that Mayor Harrison did not approve of the plan, it was intended to introduce the petition in the Council before the spring elections, but when Mayor Harrison's opposition became known, it was decided to wait for the election of his successor.

CHICAGO, ILL.—The directors of North Chicago Street Railroad have declared the regular quarterly dividend of 3 per cent, payable Jan. 15.

CHICAGO, ILL.—A "spread" story of one of the local daily papers says that a new move by the street railway companies of Chicago to avoid the renewal of their franchises and to overcome the twenty-year limitation is reported to be on foot. The proposition is said to bring about a gigantic merger of all the street railway lines of the city by lease or otherwise, and operate them under the protecting privileges of the Chicago General Railways Company's charter, which still has forty years to run.

CHICAGO, ILL.—It is announced that the remaining $300,000 of the preferred stock and $1,200,000 of the common stock of the Aurora, Elgin & Chicago Railway will be delivered to receipt holders in the near future. The original agreement provided that the stock should not be delivered until the road was in full operation, but a number of the stockholders are desirous of securing their stock at once. It is probable that the $3,000,000 of bonds in the hands of the Western Reserve Trust Company, as trustees, will be syndicated and sold in a lump, instead of being delivered to the original receipt holders.

NEW ALBANY, IND.—The Jeffersonville, New Albany & Sellersburg Rapid Transit Company has filed for record a deed transferring its property and rights to the Southern Indiana Interurban Railway Company.

COUNCIL BLUFFS, IA.—The entire street railway system of the Omaha & Council Bluffs Railway & Bridge Company, with its Lake Manawa property, has been leased for twenty-five years to the Omaha Street Railway Company, which was recently purchased by the Seligmans, of New York. Both properties are to be consolidated under the name of the Omaha & Council Bluffs Street Railway Company on Jan. 1. The consolidated company is capitalized at about $6,000,000. The capital of the Omaha, Council Bluffs Railway & Bridge Company is $1,500,000. It is stated that Frank Murphy, president of the Omaha Street Railway Company, is to be president of the new corporation, and that W. B. Tarkington, general manager of the Omaha & Council Bluffs Railway & Bridge Company, will be retained by the new company to take charge of its Council Bluffs and Manawa properties. The power house and car houses, located in Council Bluffs will no doubt be used in operating the new system.

LOUISVILLE, KY.—The stockholders of the Louisville, Anchorage & Pewee Valley Electric Railway Company have voted to increase the capital stock of the company from $350,000 to $1,200,000. It is said that a large issue of bonds is to be placed.

BOSTON, MASS.—The trustees of the Boston Suburban Electric Street Railway Companies have declared the quarterly dividend of $1 per share, payable Jan. 15, to stockholders of record Dec. 31.

MINNEAPOLIS, MINN.—Twin City Rapid Transit Company has declared the quarterly dividend, 1¾ per cent, on preferred stock, payable Jan. 2.

MINNEAPOLIS, MINN.—The local papers say that the Twin City Rapid Transit Company has in contemplation the purchase of the railway operated by the Minneapolis Land & Investment Company between Minneapolis and Hopkins, 4 miles distant.

NEW YORK, N. Y.—It is reported that a deal is on for the purchase or lease of the property of the New York & Queens County Electric Railway Company by the Interborough Rapid Transit Company.

ROCHESTER, N. Y.—The Rochester Railway Company has declared the regular quarterly dividend of 1¼ per cent on preferred stock, payable Jan. 1 to stock of record Dec. 20.

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

November	1902	1901
Gross earnings	$1,057,665	$996,850
Operating expenses	602,529	661,248
Net earnings	$455,136	$335,602
From July 1 to Nov. 30		
Gross earnings	$5,783,616	$5,498,520
Operating expenses	3,494,532	3,762,359
Net earnings	$2,289,084	$1,736,161

CINCINNATI, OHIO.—The regular quarterly dividend at the rate of 5½ per cent per annum has been declared by the Cincinnati Street Railway Company.

CLEVELAND, OHIO.—The Cleveland City Railway Company has filed a motion to dismiss the injunction against the company secured some time ago by Frank DeHass Robinson, preventing the officials from issuing new stock. The company desires to issue $1,000,000 worth of stock to cover recent improvements. The company maintains that Robinson's claims have been settled.

CLEVELAND, OHIO.—For the first time since President Andrews took charge of the Cleveland Electric Railway Company has an inkling been given as to the earnings of the company. It is stated that for November the receipts were $214,993, a gain of $25,552 over the same month last year. For eleven months the receipts were $2,284,335, as against $2,077,012 for the previous eleven months, an average gain of $10,000 a month.

CLEVELAND, OHIO.—The directors of the Cleveland, Elyria & Western Railway Company and the Cleveland & Southern Company have ratified the consolidation of the properties as the Cleveland & Southwestern Traction Company. The matter will be ratified by the stockholders of both companies at meetings to be held Jan. 15. The new company will also absorb the Norwalk Gas & Electric Light Company.

BATTLE CREEK, MICH.—Spitzer & Company, bankers, of Toledo and New York, who have acquired the control of the Jackson & Battle Creek Traction Company, advise us that the construction of this railway is largely completed and that the line will be in operation by Feb. 1. The company has a capital stock of $1,500,000 and a bond issue of $1,200,000; 200,000 of the bonds are to be put up with the trustee, the Savings & Trust Company, of Cleveland, Ohio, and to be issued only upon a majority vote of the stockholders and a majority vote of the directors, for future extensions or improvements. The securities have been underwritten by the owners of the property. The statement that some of the securities would be put on the market, made in a recent issue of this paper, was erroneous. The system is operated by means of the third rail, and the company owns a private right of way. The track is laid with 70-lb. steel rail and No. 1 ties, laid 2-ft. centers. The construction throughout is substantial, the same as a steam railroad.

TOLEDO, OHIO.—The Toledo & Maumee Valley Railway Company and the Toledo, Waterville & Southern Company have consolidated as the Maumee Valley Railways & Light Company. The roads have been operated as one for some time. The capital stock of the new company is $1,000,000, and bonds to the same amount will be issued. The stockholders of the Toledo & Maumee Company will receive $900,000, or three shares of new stock for one of old, and those of the Toledo, Waterville & Southern Company will receive $100,000, or four shares of new stock for one of old. The officers of the new company are: R. H. Baker, president; E. J. Rechtel, vice-president; William H. McLellan, secretary; Charles T. Munz, treasurer. The property is owned by the Everett-Moore syndicate, and is operated by the same management as the Toledo Railways & Light Company. It is understood that the company is going into the electric lighting business with a view to supplying power for lighting Maumee, Perrysburg, Waterville and other towns in the valley.

ALLENTOWN, PA.—The first consolidated mortgage of the Allentown & Kutztown Traction Company to the Integrity Title & Safe Deposit Company, of Pennsylvania, for $750,000 has been filed for record. The mortgage is given to secure an issue of $750,000 bonds bearing interest at the rate of 6 per cent. The right to cancel the bonds after 1917 is reserved.

LEECHBURG, PA.—The agreement of merger of the Apollo, Vandergrift & Leechburg Electric Street Railway Company, and the Vandergrift & New Kensington, forming the Pittsburgh & Allegheny Valley Railway Company. The capital stock of the company is $1,500,000. The directors of the company are. John S. Cochrane, S. M. Nelson, of Apollo; J. D. Orr, Edward Hill, J. B. Kifer, John P. Klingensmith, Leechburg; S. B. Cochrane, Kittanning.

PHILADELPHIA, PA.—The directors of the Philadelphia Company have declared a regular quarterly dividend of 1½ per cent on the common stock, payable Feb. 2 to stockholders of record Jan. 2.