Electric Railway Journal

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Straight Runs Plus Trippers May Be Better Than Swings

THOSE who have read Ibsen's "Lady of the Sea" may recall that so long as the lady had no choice but to stay with her husband she was very unhappy; yet when he gave her absolute freedom to choose any corner of the "triangle" she found she loved him best.

A parallel psychological problem appears to have been solved on a number of Southern and Southwestern properties by changing from swing to straight runs plus voluntary trippers. So long as the men were ordered to work on swings, many had a grievance against long hours. No sooner were they told that nine to nine and one-half hour straight runs would be substituted with the choice of working trippers entirely up to them than they asked for the extra hours almost unanimously. In short, while the men want to work the extra hours because they need the money, they feel a lot better because whether they do or don't is entirely their decision. If the practical results are so advantageous to the railways under unheard-of labor shortage conditions, why shouldn't others take this up with their men? Vexatious problems sometimes have a happy way of settling themselves if we only leave the rut of traditional practices.

When Run-Down Accidents Increase

THE value of high-rate acceleration with modern equipment is so great that it would be a pity to forego it through an assumption that too many run-downs will be the inevitable consequence. It must not be forgotten that it takes a motorman some time to adjust himself to the difference in accelerating at say 1 and 2 or even 2½ m.p.h.p.s. The old rate has become an acquired instinct with him and until he has replaced it by a new set of instincts, he is likely to have more accidents. This is especially so where the mistake is made of permitting the same man to work on low-accelerating and high-accelerating equipment.

Nobody would deny that the air brake is a safety device of the first order. For all that, we recall a case where in the first year with air the men had more accidents than with hand brakes, in the second year they equaled the hand brake average, in the third and following years they went below the hand brake. In other words, more than a year was required to inculcate the difference between air and hand braking. Therefore we believe that as motormen become accustomed to faster acceleration they will be just as able to avoid accident as with slower equipment. This will certainly be so on cars of light construction where a smash-up means more to the physical welfare of the motorman than it does back of a "battleship" style of car.

Mr. Mortimer Advocates the Zone System and Discusses Public Ownership

EVERY reader, we believe, will be interested in the interview in this issue with James D. Mortimer, president North American Company, on the present situation. Mr. Mortimer has just returned from a visit to the Pacific Coast so that his views may be considered to be based upon conditions in the Far West as well as in the Central States and the East. Frankly, he is not optimistic. Regulation, he says, has broken down. Railway credit has largely gone. The construction of extensions has ceased. Labor thinks more of the sanctity of the union than of the solvency of the employer. Traffic has fallen off in those properties where a 6-cent fare has been permitted, so that they are but little better off in a financial way now than formerly. On the other hand, an 8 or a 10-cent fare would probably drive off very much more traffic and encourage jitney competition so that the net gain from such a fare increase would be slight or would disappear.

Mr. Mortimer, however, does not stop with his diagnosis of the disease. He tells what may be done, in his opinion, to relieve the patient. The case is desperate but not entirely hopeless. It is this portion of the interview in which we believe our readers will be particularly interested. Fundamentally Mr. Mortimer's remedy is to encourage short-haul and non-rush hour travel as these are the most profitable parts of a railway company's business. This means the zone system with possibly lower fares between the rush-hour peaks. The logic of Mr. Mortimer's argument on this point seems reasonable.

Finally, Mr. Mortimer disposes of the bogey of municipal ownership, at least so far as the electric railway companies are concerned. If the public insists upon taking over the properties, it can have them, though preferably they should be taken over by the State rather than the municipality. Only let the requirements of sound finance and accounting be followed. The companies will have to receive fair compensation, as the courts will protect their equities in the properties. This may prove the best way out of the difficulty in many cases. The security holders would at least get back their investment, and if the State could not make a profit out of the lines it could look upon its loss from operation as a subsidy to provide cheap public transportation. From the point of view of the taxpayer or from that of ultimate economy and efficiency in city transportation this plan may not be a desirable one, but the State is certainly in a more logical position to defray a subsidy than a private company. At all events, these comments of Mr. Mortimer will stimulate thought and, we hope, will also hasten progress toward a more rational treatment of railway properties and a profitable rate of fare.

Big Things Cannot Be Done in a Little Way

THE decision of the Board of Public Utility Commissioners of New Jersey granting the Public Service Railway a revenue increase of $860,000, instead of the desired $3,700,000, is a matter of national importance. This company is one of the three largest systems in the country, its operations covering the entire State. Denial of more nearly adequate relief to a company of such importance will not pass unnoticed, and it is a distinct misfortune to the entire industry.

The decision of the New Jersey commission followed a protracted series of hearings extending over three months. The case of the company was presented in thorough and comprehensive fashion, while the testimony submitted by the municipalities was puerile and was destroyed upon cross-examination. Judged merely from the standpoint of the record, the need of the company for material relief was undeniable. In view of these circumstances, what reason did the commission give for bestowing such niggardly relief?

The answer lies in the commission's notion as to what constitutes proper emergency relief during the period of abnormal conditions caused by the war. Listen to its enunciation: "An emergency for which a carrier is entitled to relief by a temporary emergency rate exists where, by reason of general conditions not affecting the applicant utility alone, the operating revenues are insufficient to operate and maintain its property and to pay rentals and interest on such of its securities a default in the payment of which would jeopardize the solvency of the company."

Acting upon this theory, the commission reduced the measure of relief so as to require the Public Service Railway to pass its dividends. Thus the plain inference of the decision is that a sufficient amount to pay a fair return upon the investment (providing that return is not greater than was paid prior to the beginning of the emergency) will only be allowed when a valuation constitutes a part of the rate proceeding. But why should the commission's belief that the ascertainment of the value of utility property "requires exhaustive investigation and is inconsistent with the granting of emergency relief required by general conditions" give it license to disregard the evidence presented that the property is worth much more than $100,000,000, exclusive of franchise values? The value mentioned was obtained by a very careful appraisement made by Dean Cooley, the money expended on the property since that appraisement was made and other fair adjustments. As Mr. McCarter showed, the desired revenue increase would not give the company a fair return of 8 per cent on more than $81,000,000—certainly less, he said, than the value of the property.

One particularly amazing part of the decision is the assertion that the company will not have to invest additional capital during the period of the war. Every well-managed company in the country, in replacing track, substitutes a structure of greater cost, in which the investment of additional capital is consequently required. The absurdity of the commission's opinion is clear when the evidence concerning the hundreds of war industries in New Jersey is considered. The testimony showed that almost 200,000 workers in such establishments are handled daily. The government is helping to finance some new construction, but this tells only a small part of the story. No company in the country has been required or will be required to make larger investments as a means of assisting in the successful prosecution of the war.

It is noteworthy that some of the newspapers in New Jersey have not been slow to point out the political complexion of the decision. The Governor of New Jersey is a candidate for United States Senator. He has recently appointed two of the present members of the commission. The leading spirit in the opposition was George L. Record, who also aspires to the Senatorship. The Public Service Railway has apparently become a football in a sordid struggle for political preferment. Each side has endeavored to make capital out of the company's necessities. The action of the New Jersey commission is one of the strongest arguments for the assumption of absolute control over utility rates by the federal government. If the state bodies fail they must be ruthlessly swept aside, for such companies as the Public Service Railway are just as much a part of the nation's machinery for making war as are the shipyards which it serves.

The Remote-Control or Push-Button Car

A WRITER in a recent issue of the *Scientific American* allows his mind to wander fancy free on the automobile of the future. He notes how one manual operation after another has been eliminated, such as hand cranking and hand pumping, and ventures to prophesy that some day all of the functions of starting, stopping, steering, lighting, etc., will be performed through the medium of a push-button board.

As we read the article, there arose before our eyes a companion vision. We no longer saw an electric car platform cluttered with a controller, brakes, door and step levers, sander rods, gong pedals, circuit-breaker handles and all the other impedimenta that are accepted necessities of the present-day car. What we saw in their place was a neat little benchboard on which were buttons or keys with names indicating the several devices, and an attractive young lady seated in a comfortable chair playing on these keys as on an organ!

Shall this vision remain a dream when men conceive such possibilities for a vehicle which must carry its own power plant? Is it not far easier to do these things on a railway car which is untroubled by a power plant and which may draw at will directly upon stores of power already converted to electricity? Is it possible that manual cranking and manual pumping of automobiles are being superseded because the automobile is so often driven by the owner himself, and automobile makers outvie one another to cut out the curse of work? Would the automobile have advanced so rapidly in the direction of abolishing hand labor if it had been made for operation by chauffeurs only?

These are pertinent, some may say impertinent, questions, but they direct a finger at a point long overlooked in electric railroading. This point is that power-operated or indirect-control devices are something more than means of making life easier for the operators. Basically, they are intended to increase the mileage out-

put of the car through saving seconds or fractions of seconds.

Some years ago we forecast the combination of power, braking, sanding and door control devices in one mechanism—and it has come to pass. The push-button control of air-operated doors has also arrived. So we feel no undue degree of rashness in prophesying the day when the perfection of remote control so peculiar to electricity will give us a car operated by a "cashier-motoress" and a platform cleared of everything that can hamper the interchange of passengers.

Boiler Firing as an Art, With Firemen as Artisans

WITHIN the memory of most men having considerable experience in power production the boiler fireman's province enjoyed the status of a trade. The fireman was an artisan. "Once a fireman always a fireman" was true in a very great number of instances. The avenues of advancement were less numerous, means of education were much less common, correspondence schools were barely in existence and the technical press was less developed. Aggregations of power production apparatus as we have them to-day in great power plants were non-existent.

The fireman nearly everywhere was an individual, not a mere unit in a group. His social condition was nearly stationary. Many a man of unlettered though strong intelligence swung the shovel and had swung it steadily for years. He had learned to swing it through a sort of apprenticeship to some other older man who had swung it for years himself.

The fireman's skill was comparable certainly to that of a gardener with his tools. Firing was an art and the fireman an artisan. There was distinctly good form in firing. To possess it was to be a fireman and to earn what were, for that time, fair wages. To-day certainly in great power plants the fireman is a laborer. The measure of his work is a quantity unit—tons of coal per hour per boiler, perhaps—not a quality unit. Even with the ever-growing use of automatic stokers the converted fireman hardly emerges from the laborer's status. He has not one or two stoker fires to tend but a whole group or row of them. He earns high wages and works only eight hours, but he comes and goes for all that. Has he the art of firing? He is quite innocent of it. If he had science he would need no art. There are instruments for this and instruments for that—air gages, draft gages, temperature gages, steam-flow gages, even CO_2 gages. But he passes them up.

And the boiler efficiency—is it to be passed up too? Not in these days of efficiency urge. Surely not when the country looks so directly to the power plants to take a large part and a leading part in the coal conservation so greatly needed. Let the chief engineer take the burden then. Let him with patience and knowledge and skill and faith and enthusiasm get out among the laborer firemen and the laborer stoker operators. We cannot sigh for a day that is gone. The day of the mammoth boiler with the engineer to run it has barely yet come among us. Let formal firing rules be eschewed. But let there be personal contact and personal guidance.

Take up the white man's burden,
Ye dare not let it fall.

Power System Inter-Connection As a War-Time Necessity

BROAD-VISIONED engineers and utility managers have been advocating power plant inter-connection for years. To them a power line is just as much of a transportation unit as a railroad, and, as railway interconnections "proved in" their value long years ago, they have felt optimistic about the possibilities in the energy-carrying field. That state regulatory bodies are beginning to see the light is clearly indicated by the action of the California Commission a couple of years ago in its recommendation of State-wide power system interconnection.

But why is the problem of such pertinent interest to-day? The answer is that our visible supply of coal for the current year, according to the latest reports of the Fuel Administration, is short some 50,000,000 tons of what it ought to be and that at all costs war supplies must go forward to the fighting front. The economic ideal of a few years ago has become the stern military necessity of the present moment. That the problem is of more than academic interest is evidenced by the recommendation recently made to the federal authorities by government engineers relative to the power systems in several of our important industrial districts. And in these days action follows recommendation with sometimes a disconcerting promptness.

It is beside the point here to discuss at large the advantages of inter-connection. Suffice it to say that in most cases they are great both from the standpoint of fuel saving and from that of continuity of service. The real questions which military necessity is forcing on the industry are those dealing with how to do it and not whether it is worth doing. Thus the problems of labor, material and the technical matters involved in construction and operation are the all-important ones.

The technical problems are rather numerous and on the whole are of interest to the electric railway industry since in inter-connected districts they will receive their energy supply from the common source. Increased generating capacity back of a line increases the duty required of circuit-breaking switches and other overload protective devices and magnifies the destructive effects of short-circuit. Increasing the mileage of connected transmission lines increases their ability to store energy and therefore the violence of line surges. Line troubles are spread out over a wide district by conduction. Connecting lines or cables may be of insufficient current carrying capacity to carry the necessary synchronizing currents. The difficulties of fault location are increased.

We see therefore that inter-connection of lines brings in new problems, both of construction and of operation. Old lines may have to be reinforced both in insulation and current carrying capacity. New circuit-breaking switches may be necessary as well as special provisions for localizing and isolating trouble. Short gaps between existing lines may be required. For new construction made at the demand of the government federal funds will no doubt be available, but the problems of construction and operation will be squarely up to the utilities. Their prompt solution will depend largely on the utilities' knowledge of operating conditions on their lines and upon preparedness in the way of tentative plans of action.

Providing Strength and Attractiveness in Special Overhead Supports

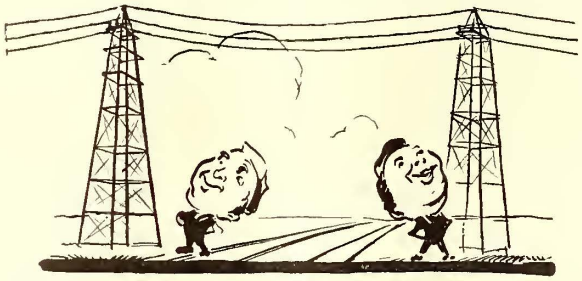
By Charles R. Harte

Construction Engineer The Connecticut Company, New Haven, Conn.

Overhead Bridges and Other Special Structures Furnish an Opportunity for Ingenuity and Application of Correct Design Principles

THE first electric roads differed from their predecessors the horse railways only in the method of moving the cars, and the service was readily cared for by simple and light overhead construction. As the art advanced, however, and it became necessary to collect heavier and heavier currents at ever-increasing speeds, the overhead had to be correspondingly developed.

The pulls in the direction of the line practically balance at each point of support, or if they do not, because of unequal lengths of adjacent spans, the excess can be cared for by guys ahead or back which do not require any additional space outside the poles. But the tendency to pull the support over toward the track when, as is the case with heavy overhead, the pull is greater than the pole itself alone can resist, is not so easily provided for. To avoid the expense and trouble of special concrete foundations or side guys with their requirement of much additional right-of-way there was developed the bridge support, consisting of a pair of poles or frames, one on each side of the track, with a connecting truss serving the double purpose of providing a carrier for the overhead itself and a strut to balance the inward pulls on the two frames.



That was a tough problem in tower design, but we solved it, all right!

A Bridge Structure with Wood Posts

As in the case of transmission-line towers there has been quite a range of design, from forms so light as to require temporary bracing until the messengers are attached (after which they act as guys), to those which, like the early Westinghouse, are substantially each one an anchor bridge. Abroad, the Siemens-Schuckert electrifications employed A-frames, of channels back to back with diagonal and horizontal lacing of angles, with a pair of channels back to back for the cross strut between. The legs were evidently set in concrete or masonry in most cases, as the only protection against cross swaying of the structure is by a tie rod from the top of each frame to about the quarter point of the strut. The German General Electric Company employed a very similar form. In England, the Midland used two types, one involving a wood pole at each end of paired channels, the other, used at terminals, of structural steel throughout. Both forms have very interesting details. The wood posts, some of which are round while others are square, have notched into them a pair of clamping collars which are close to the top and about 2 ft. apart. The bottom collar has flanges which take between them a gusset plate extending up between the two channels of the strut, while the flanges of the upper collar go outside the webs of the channels, and are fastened to them by rivets extending through flanges, webs and gusset plate. Attachments to the strut are held in place by bolts passing between the channels, which are maintained a uniform distance apart by spacers between. While this treatment, by making it unnecessary to drill holes in the flanges for attachments, preserves the full strength of the section, the narrow space between the channels tends to hold moisture and cause corrosion, and is very difficult to paint or otherwise protect. The steel bridges consist of square posts with angle-iron corners and inside lacing. These carry a built-up truss with straight top chord, diagonal bracing and a lower chord, parallel to the top chord for most of its length but curved down at the ends to meet the post, thus both forming a bracket and relieving the severity of the design. As with the wood-pole form the truss, which is of angles, is double, but in this the angles are much farther apart, and are tied together by diagonal lacing bars on top of the top member and on the bottom of the bottom member.

In this country a design somewhat like the Siemens-Schuckert was early developed by the Archbold-Brady Company. This company's bridges have triangular posts with channels for legs, but the bracing consists of horizontal angles and diagonal tie rods. The ends of the angles are "bulldozed" flat and bent at right angles for riveting to the channel backs, while the diagonals take hold of bolts going through the flattened position of the angle close to the bend. The chief difference is in the strut, which consists of two channels back to back and some 3 ft. apart, braced by vertical angles and diagonal ties, the ends of the lower channel bending up at the last angle and meeting the ends of the top channel at the post, while a pair of angle braces from the bend down at an angle of 45 deg. to the legs of the main post give the desired stiffness and permit a comparatively light connection to the foundation.

The Westinghouse bridges, developed at about the same time as the Midland form, have similar square posts with angle corners, but the lacing is outside, and the truss has parallel top and bottom chords. Incidentally, the connections are much stronger, for where the Midland diagonals are riveted to the flange of the chord angle the Westinghouse form has connection plates.

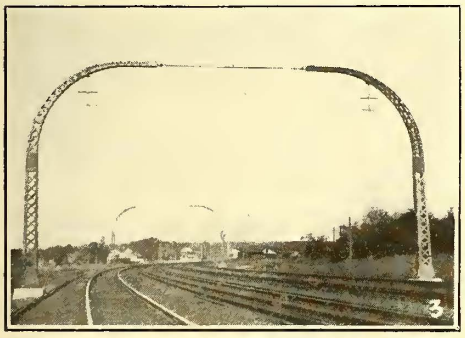
In an endeavor to secure a design which should be more economical and less severe in appearance the New York, New Haven & Hartford Railroad, on an experimental extension toward New Haven, employed an entirely different type, made up of two posts square in section with diagonal lacing, tapering from butt to end, each having a vertical lower portion with the top bent to a quarter circle. Between the ends was fitted a strut of pipe braced by tie rods passing over a central spider and bolting through end plates. This was of very pleasing appearance, but fabrication proved difficult and costly, the curved sections insisting upon twisting when riveted, and when the work was extended to New Haven the railroad employed a still different form, combining the good points of both the earlier types.

In this the posts are vertical, square in section and double laced, but the taper is from a comparatively small section at the bottom to a considerably larger one at the truss, and then in an extension carrying the crossarms, to a small top. The truss has parallel chords and single diagonals, but the "curse" of the square corners at the connection to the post is removed by a curved bracket which, with the tapered post, gives a decided arch effect. This effect is very pleasing and at the same time, as in the Archbold-Brady type, the resulting stiffness relieves the footings of the duty of meeting heavy bending stresses.

The present day tendency, however, seems to be away from these heavy rigid structures, for the most recent three electrifications, the Norfolk & Western, the Pennsylvania and the New York Connecting Railroad, wherever conditions permit, employ tubular poles heavily side guyed with cross catenary spans between, while where side guys are not practicable the same type of pole is employed with a very light truss.

Particularly abroad, where the smaller equipment makes the scheme more satisfactory, center poles with brackets have been used with some success. In this country, however, the clearance requirements of our large equipment would force the use of such long brackets that the necessary bracing and extra strength on the part of the support plus such shifting of tracks as is necessary to give required clearance between them, would usually much more than balance the saving over a bridge with its two posts. In some places, however, notably at stations and similar points where conditions seriously restrict the possibilities of support location, the center pole with double brackets is much the best treatment.

Where the track is put down in connection with the electrical system, provision for bridges or for guyed poles can often be made in spite of apparently very serious obstacles. But when the track has been installed without regard to electrification the later erection of wires may prove a good deal of a problem. In the case of the New Haven Railroad at Bridgeport, Conn., the tracks are largely on an earth fill between stone retaining walls, the faces of which form the side lines of parallel streets. The narrowness of the viaduct at certain points brings the side of a car on the outside track practically at the street line. Where the viaduct is high enough the trouble has been met by building a reinforced-concrete bracket out from the wall and carrying the bridge footing on it. But there were close points where the viaduct was so low that such a bracket would project into the street clearance. Here "broken-backed" or more properly speaking, broken-legged, towers were used, the lower portion bending in to follow the car clearance line, bringing the foot on the wall. Of course, in such a case the connection at the angle and the inclined portion must be very carefully studied and designed safely to resist the bending stresses which occur. The New York Connecting Railroad has a somewhat



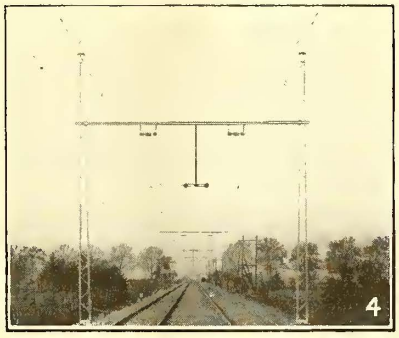


Fig. 1—Overhead construction on Midland Railway electrification. Wood-pole and channel-iron strut in foreground; structural steel bridge in background.

Fig. 2—Overhead construction on Midland electrification; wood poles with double channel-iron truss.

Fig. 3—Experimental crane type of overhead bridge on New Haven electrification.

Fig. 4—Light bridge type of overhead construction used by General Electric Company of Germany.

Fig. 5—Bridge type of support on Pennsylvania electrification.

OVERHEAD BRIDGE SUPPORTS ARRANGED TO BALANCE INWARD PULLS ON TWO FRAMES

similar viaduct, but while this has compelled the use of some bridges the foreknowledge of the electrification enabled suitable provision to be made at the start.

Guyed-Pole, Cross-Catenary Span Construction Is Promising

The question of the contact system and its method of support, particularly if it is overhead, is of much importance in steam road electrification, and while there has been much progress there is still room for improvement. The unpleasant results which might be anticipated if light supports should let down the overhead very naturally deter any extensive ventures in the direction of lightness, and indeed compel very conservative work in all directions. At the same time a little longer service with guyed-pole and cross-catenary span should give information which will to a considerable degree establish reasonable limits for design.

The design of anchor and switching bridges involves nothing new, and as the pulls and loads which they must meet can be determined quite accurately for each case, the only complications are those resulting from cramped location. Frequently the anchoring and switching functions are combined, in which case it is essential so to separate or protect the two junctions that a breakdown of one will not involve the other nor prevent access to the unaffected portions. Provision must be made so that mechanical failure of any of the anchor points will not wreck the switches mechanically nor afford opportunity for an arc to or over them. Further, the misbehavior of one of the switches must not flood the bridge, nor for that matter the tracks below, with hot or blazing oil nor can it be permitted to let loose on the structure currents which may burn it, to create such potential gradients on it as seriously to shock an attendant, to burn off the anchored messengers or to bridge over their insulation.

Switches or Bridges Require Safeguarding to Reduce Hazard

The first requirement can usually be provided by having the anchor attachments on the outside of the structure while the switching apparatus goes between the girders. Suitable drains with collecting shields (and it must not be forgotten that an oil switch in eruption throws out the oil rather vigorously) will prevent damage from oil. Thorough bonding and grounding of the structure and provision of passageways and operating spaces of such width that the operator does not come in contact with more than one point at a time, will take care of the electrical hazard. As a matter of fact, all such apparatus-carrying structures should be considered and treated as stations, both in design and in operation. As between construction and operation, provided the construction has been right, which will insure absolute safety, on one hand, and that which is a long ways from so doing, on the other, there is astonishingly little difference in actual cost in the majority of cases. A minor accident will cost several times as much as the extra cost of construction, while the knowledge on the part of the operators that they are protected will result in work of a quality sufficiently higher to make the extra investment worth while.

The early transmission lines, serving only as direct connections between primary and substations or switching stations, with all apparatus housed, had little occasion for special structures other than those serving to get around some right-of-way complication or to carry the line in a long span across some obstacle preventing the normal type of construction.

Of the first, an interesting example is the Swiss line along the shore of Lake Lucerne where, with the highway occupying all of the shelf at the edge of the water, the towers are carried on steel beams "cantilevered" out from the retaining wall for the road. Where footings can be had on each side of a road a passageway or bridge may serve. Because of the powerful twisting moment in case of any unbalancing of the pulls by the spans, it is undesirable to have an arrangement not symmetrical with the pole. In one case where the line ran along a road with a heavy cliff at one side, it was proposed to use poles with outrigged arms having struts against the rock. This was never built, however, which was undoubtedly fortunate. Because of its location it was certain to catch anything which came down the cliff, and the expenditure of a little more than double the estimated cost on a line which was longer but in location far better in every way was very much the more economical treatment. Where location on the face of a cliff is unavoidable it may be possible to cut towers down to small and simple frames, but in such cases it must not be forgotten that there reasonable access to these frames must be provided for use in case of trouble.

A Very Unusual Case at Niagara Falls

An interesting example of special structure is furnished by the cantilevers of the Niagara, Lockport & Ontario Power Company line at the Niagara River gorge. The span at the top of the cliffs was considered too long for so important a line, and it was decided to cross at the bottom of the gorge. The pitch of the face of the gorge is so steep that with towers at the very edge of the top the conductors would not clear. Accordingly cantilevers were extended well beyond the edge. The conductors span from a tower near the edge to the cantilevers; thence down to the towers at the foot; and thence across. The heavy angle at the bottom towers is up and away from the insulators, the attachment of the conductors being by special clamp. At the top, however, the angle would bring the conductors so close to the petticoats of the insulators that the latter would largely be useless. To obviate this difficulty each cantilever carries two sets of insulators. Special heads carry supports parallel to the line but a short distance each side of it. These in turn carry a steel bar at right angles to the line to which the conductor is tied, and from which it drops to the tower below.

To-day such conditions are largely met by the use of suspension type insulators, which are able to handle almost any kind of complication arising from angles, whether vertical or horizontal, and that very largely on standard towers. Indeed the suspension-type insulator has very much simplified the problem of the long span, and where in the earlier days of transmission quite special structures were required for the necessarily complicated combinations of pin-type insulators and clamping devices, to-day the crossing towers as a rule have only to furnish suitable attachments for the strings of strain insulators, and sufficient strength on the part of the tower safely to meet this pull. There is,

however, one case in which a special tower is still used, and that is where a long span is carried by towers one or both of which must be very high and it is important to reduce the pulls to a minimum because of the fast increasing cost of each additional pound of resistance required.

A scheme which has been used with success in several instances is to counterweight the pull of the span, either directly or through some multiplying device such as is often employed for elevators, the travel of the clamp on the span being as many times the travel of the counterweight as there are parts of rope between the sheaves. The counterweight itself must, of course, be inversely as heavy as its travel is multiplied. The operating cable is flexible steel hoisting cable attached to the conductor by suitable strain insulators and clamps; the conductor is carried over or through the tower and must have provision for taking care of the slack when the counterweight is down. In one case, where the span wire changes 2 ft. for every foot of counterweight travel, the span is connected with the line wire beyond by a jumper which, going over a sheave on insulators to a pin-type insulator, carries in the space between a small weight with a sheave through which it runs. As the span is shortened or lengthened this weight keeps the jumper taut, ample clearance from the structure preventing any contact. This treatment involves very little special treatment of the tower itself. It has also been proposed, although, so far as the writer knows, this has never been done, to mount one tower on trunnions and allow it to tilt and so adjust the sag to the load, a suitable counterweight maintaining the desired stress.

There is one more form of special structure—the development of a spirit of reason and fairness in the matter of high-tension crossing protection having taken its supports out of the special class—which is steadily gaining in importance, and that is the outdoor switching station. This, however, is special as a development rather than as a structure, for after all it is merely the skeleton of what up to recently has been the high-tension switching room of the power or substation. Starting as a group of plain knifeblade switches on a standard tower, for emergency sectionalizing, the outdoor switching station has developed until to-day these installations frequently consist of elaborate busbar systems with every switching and protective refinement capable of effecting under load all sorts of transposition of service.

In short, the full facilities of the station to this end are moved out of doors, as when inside the station it is essential that there be ample clearances and facilities for safe and comfortable operation. Outside of this, and the circuit arrangements which are apt to be special for each case, the problem is one for the structural engineer rather than the overhead man.

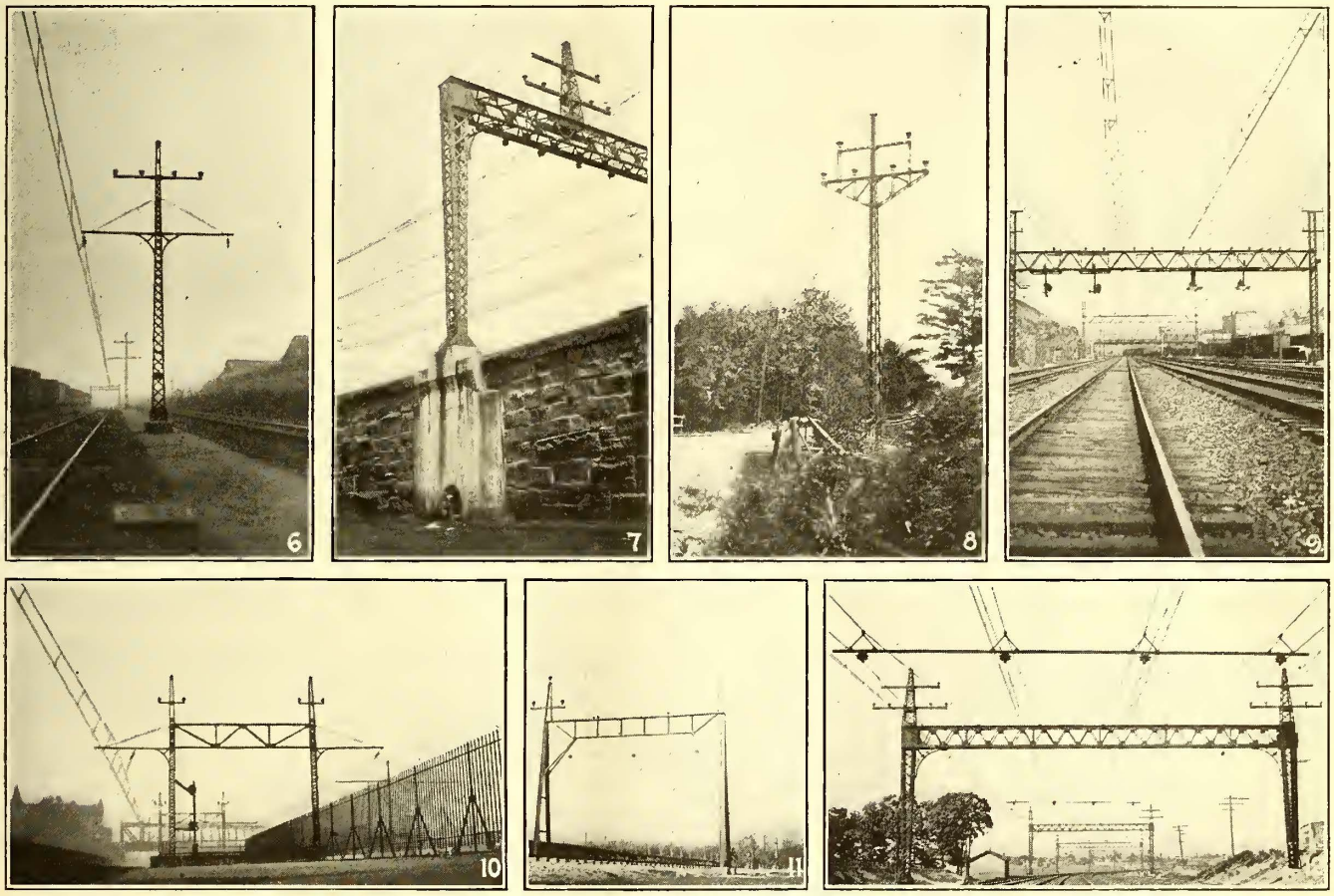


Fig. 6—Center-pole overhead supports, Pennsylvania Railroad electrification.
Fig. 7—Bridge posts bracketed out from viaduct wall on New Haven electrification at Bridgeport, Conn.
Fig. 8—Bracket type of pole in pinched location, Connecticut River Power Company.
Fig. 9—Westinghouse bridge on New Haven electrification.
Fig 10—Combined bridge and bracket overhead support on Pennsylvania electrification.
Fig. 11—Light type of overhead bridge on line of Syracuse, Lake Shore & Northern Railway.
Fig. 12—McHenry-Murray bridge on New Haven electrification. (Note the pleasing effect of the tapered posts and the curved brackets.)

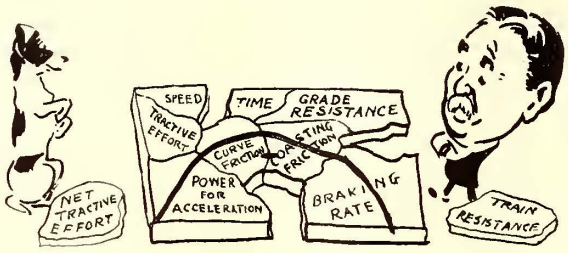
CENTER POLE OVERHEAD CONSTRUCTION AND COMBINED BRIDGE AND BRACKET SUPPORTS

Effect of Grades and Curves in Plotting Speed-Time Graphs

By C. W. Squier
Electrical Engineer

The Author Describes How Grades and Curves Are Taken Into Consideration in Plotting a Continuous Speed-Time Graph

AT THE BEGINNING of this discussion on the preliminary calculation necessary in choosing car equipment I called attention to the fact that it is usual to assume a typical run for studying the various characteristics of the equipment. Different typical runs representing the service under consideration have been worked out and the proceedure necessary for calculating and plotting the various graphs has been described. All this, however, has been done for a level tangent track. There are times when a proper study will necessitate taking into consideration the individual runs as they are actually made with due regard to the curves and grades encountered. Such studies of operation are absolutely necessary when determining the maximum capacity of a certain section of track, that is, the greatest number of cars or trains that can be operated through a given section per hour or during any given time interval.



All necessary considerations fit together to make a speed-time curve, but it's some puzzle at that

Also in laying out signals it is necessary to know the speed at various points and this, of course, will be affected by the grades and curves of the line. Problems of this nature are continually occurring in the work of the operating engineer and while it is not usual to go into this great detail in choosing the car equipment, still a knowledge of the factors involved is essential.

I shall describe briefly the calculations and methods most generally used in determining speed-time, distance-time and speed-distance curves when all variations of grade and curves are taken into consideration. As the graphs for current and power input are derived curves the methods already described for obtaining these will apply here also.

To illustrate this I have chosen an express run from Union Square to Canal Street in the new Broadway subway in New York City, with train make up and equipment as shown in Table I.

The speed in miles per hour on curves is limited to the square root of the radius of the curve in feet, and this speed is not exceeded until the last car of the train is off the curve. This is the usual assumption for the safe maximum speed while rounding curves and is limited by the elevation of the outside rail. Easements are considered as having a radius of twice that of the curve having the easement. A speed of 15 m.p.h. must not be exceeded by the train while taking crossovers, as superelevation cannot be provided at these points.

The motors used are arranged for tapped-field control, and the change from full field to permanent field is made when the current drops to 200 amp. This takes place at a speed of 16.7 m.p.h. The current swing is from 200 amp. to 337 amp. and the tractive effort from 2870 lb. to 4750 lb. The run is made at the highest possible schedule speed. The amount of coasting and braking is limited to that necessary for slowing down the train whenever short-radius curves, steep down grades or crossovers make this necessary. In order to conform to actual operating conditions four seconds are allowed from the time the motorman drops off power and starts to apply the brakes to the instant that the braking rate of 2 m.p.h.p.s. begins.

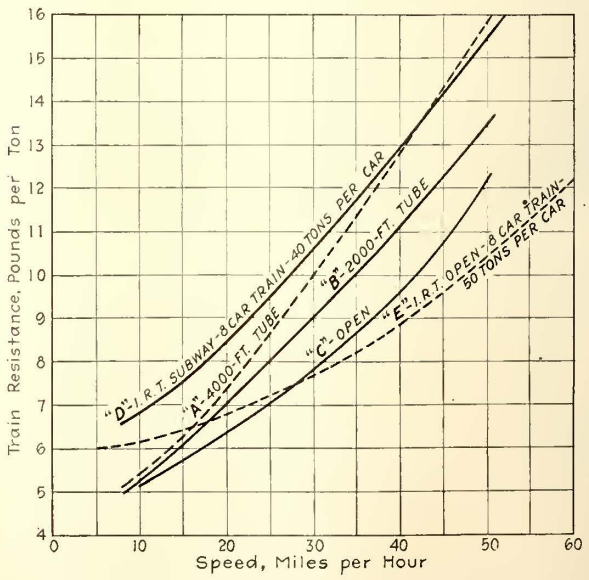


FIG. 1—GRAPHS OF TRAIN RESISTANCE

A, B and *C*, from Tests on the Hudson & Manhattan Railroad. *D* and *E*, from Tests in the Interborough Rapid Transit Subway.

Fig. 2 shows the completed speed-time, distance-time, speed-distance and power-input graphs for this run. The profile and alignment for the track are included for convenience in determining the points at which the

TABLE I—OPERATING CONDITIONS FOR PLOTTING SPEED-TIME GRAPH

Number of cars in train	8
Total length of train	536 ft.
Weight of car as equipped	89,000 lb.
Weight of passenger load per car (200 passengers at 140 lb. each)	28,000 lb.
Total weight of car with load	117,000 lb.
Motor equipment, G.-E. 248-A motors per car	2
Gear ratio	61:22
Diameter of wheels	32 in.
Train resistance from tests in service (See Fig. 1, Curve D)	
Curve resistance per degree of curvature	0.8 lb. per ton
Average line volts	550
Average accelerating current per motor	290 amp.
Average braking rate	2 m.p.h.p.s.

TABLE II—VALUES OF DIFFERENT QUANTITIES FOR EACH STEP OF SPEED-TIME CURVE CONSTRUCTION

	Per Motor											
Speed, m.p.h.	Amperes	Tractive Effort, Pounds	Grade, per Cent	Grade Resistance, Pounds	Curve, Degrees	Curve Radius, Feet	Curve Resistance, Pounds	Train Resistance, Pounds	Total Resistance, Pounds	Net Tractive Effort, Pounds	Rate of Acceleration or Retardation, m.p.h.p.s.	Distance from Start, Feet
6.4	290	4,800	Level	...	Straight	Straight	.....	...	...	....	....	...
14.2	290	4,800	Level	...	Straight	Straight	.....	218	218	4,582	1.57	...
16.7	200	2,870	Level	...	Straight	Straight	.....	228	228	2,642	0.91	...
16.7	337	4,750	Level	...	Straight	Straight	.....	228	228	4,522	1.55	...
18.0	295	3,900	Level	...	Straight	Straight	.....	236	236	3,664	1.25	...
19.0	267	3,370	Level	...	Straight	Straight	.....	242	242	3,128	1.07	...
20.0	243	2,900	Level	...	Straight	Straight	.....	248	248	2,652	0.91	...
21.0	225	2,600	Level	...	Straight	Straight	.....	254	254	2,346	0.80	250
22.0	209	2,300	+0.37	216	Straight	Straight	.....	261	477	1,823	0.62	...
23.0	195	2,070	+0.37	216	Straight	Straight	.....	267	483	1,587	0.54	...
24.0	182	1,850	+0.37	216	Straight	Straight	.....	273	489	1,361	0.46	...
25.0	172	1,700	+0.37	216	Straight	Straight	.....	280	496	1,204	0.41	...
26.0	163	1,550	+0.37	216	Straight	Straight	.....	286	502	1,048	0.36	...
27.0	155	1,410	+0.37	216	Straight	Straight	.....	292	508	902	0.31	...
27.5	150	1,340	+0.37	216	Straight	Straight	.....	296	512	828	0.28	...
27.25	Coasting	....	+0.37	216	Straight	Straight	.....	294	510	...	—0.18	930
27.25	Coasting	....	—1	—585	Straight	Straight	.....	294	294	291	0.10	...
22.25	Braking	....	—1	—585	Straight	Straight	.....	...	Braking	....	—2.00	....
22.25	Braking	....	—1	—585	Straight	Straight	.....	...	Braking	....	....	1,230
22.25	Braking	....	—1	—585	11 5	500	279	262	541	44		1,550

speed is limited and to assist in calculating the combined train resistance.

How the Degree of a Curve Is Determined

The values of railway curves are commonly expressed in terms of the central angle subtended by a chord 100 ft. long. Thus a 1-deg. curve is one such that the angle at the center end of the radius is 1 deg. and the radius is $100 \times 360 \div 2\pi = 5730$ ft. The radius in feet for any curve is therefore to 5730 ÷ degrees of curvature.

A convenient form for tabulating the various values is shown in Table II, which gives the figures obtained for the first part of the run. The speed-time graph is plotted by using these values as described in my previous articles. The graphical method of W. S. Valentine referred to in the article of May 18 is a great convenience in a case such as this, and in Fig. 3 is shown this method as applied to the problem we are considering. From these graphs the acceleration at any speed on any grade may be read direct.

At the beginning of the run the track is straight and level for 250 ft. and the train accelerates at a rate of 1.57 m.p.h.p.s. to a speed of 14.2 m.p.h. when all resistance is cut out. The point *A*, Fig. 3, shows this speed and *K* the corresponding acceleration. From this point, *A* the speed is increased to 16.7 m.p.h., point *B*, using the full field of the motors and the rate of acceleration decreases from *K* to *L*. The change to the permanent field is then made and the acceleration rate increases to 1.55 m.p.h.p.s. as shown at *M*.

The speed now increases from *C* to *D* and the acceleration rate decreased from *M* to *N*. At this point the train reaches the 0.37 per cent grade and the rate of

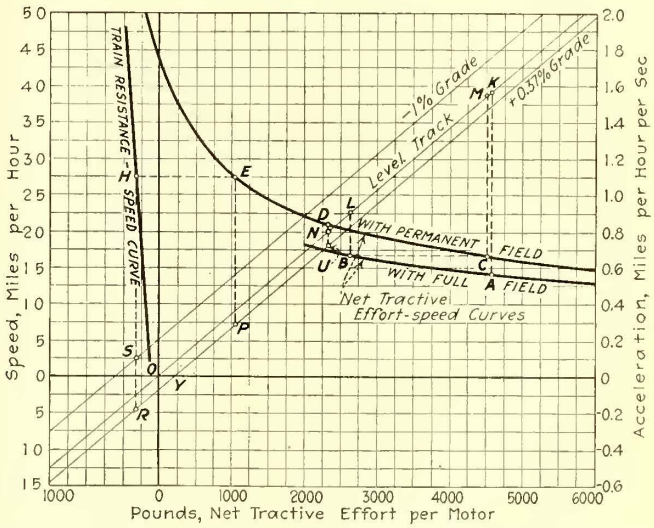


FIG. 3—GRAPHS FOR PLOTTING SPEED-TIME CURVES WITH VARIOUS GRADES AND CURVES

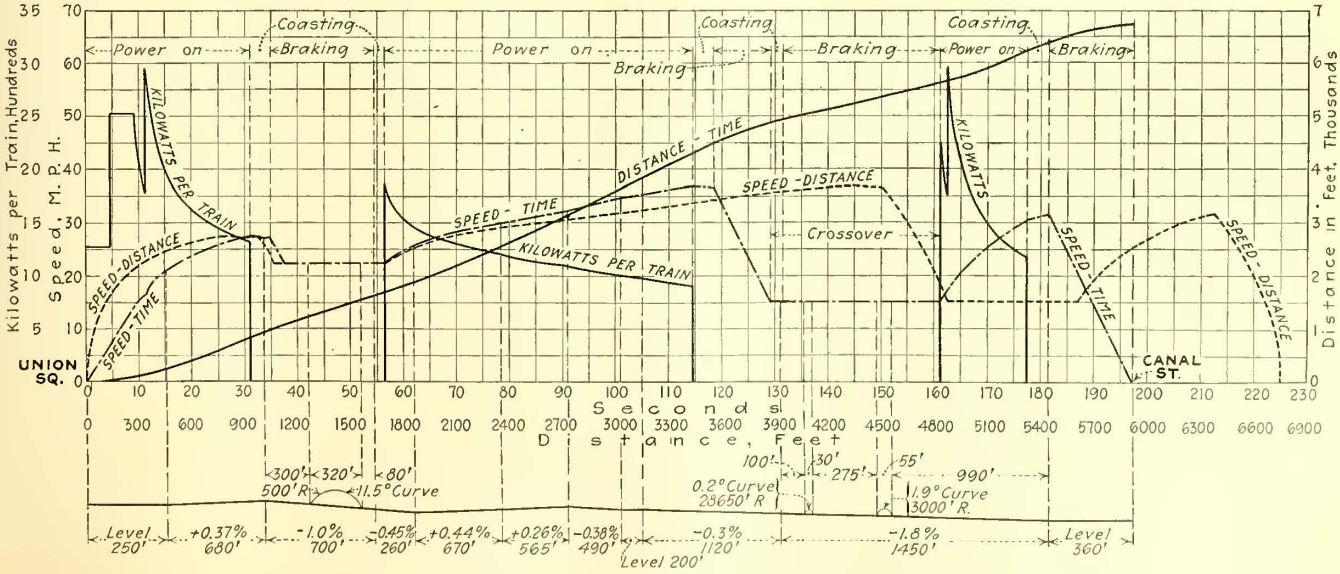


FIG. 2—SPEED-TIME, RESISTANCE-TIME AND SPEED-DISTANCE GRAPHS

acceleration is then indicated by the line *RYPU* which is obtained as follows: When a train is operating on a grade, it is equivalent to having the net tractive effort decreased by the amount of the grade resistance. The amount of the grade resistance per motor in this case is (117,000 lb. $\times$ 0.0037) $\div$ 2 or 216.5 lb. This value is laid off to the right of the point *O* as shown by *OY*. A straight line drawn through *Y* parallel to *ONLMK* will be the required acceleration graph on this grade. The train continues to increase in speed to the point *E* 27.5 m.p.h. on the speed-net tractive-effort curve, and the rate of acceleration decreases from the point *U* to the point *P*.

Slowdowns Must Be Made for Short-Radius Curves

As the train is now approaching a 500-ft.-radius curve, the speed must be decreased to $\sqrt{500}$ or 22.3 m.p.h. Power is accordingly shut off and the train coasts for four seconds before the brakes are effective. The rate of retardation while coasting is found by projecting the point *H* corresponding to 27.5 m.p.h. on the train resistance-speed graph to the point *R* on the acceleration graph. This rate of retardation is found to be 0.18 m.p.h.p.s. After four seconds the brakes are applied and the speed of the train decreases to 22.3 m.p.h. When the train reaches the 1 per cent down grade the increased tractive effort from this grade is more than the train resistance at that speed, so that the train would accelerate if the brakes were not kept applied. It is thus necessary to keep the brakes on until the rear of the train is around the curve. Power is then again applied and the train accelerates to a speed of 37 m.p.h. when it is again necessary to reduce the speed to 15 m.p.h. to take a crossover.

In order to determine when the train reaches a certain grade or curve some method for determining the distance traveled must be used. As already pointed out in a previous article, the area under the speed-time graph is a measure of the distance traveled. The speed-time graph can be plotted and the area measured until it is found to be just sufficient to correspond to the required distance, or a distance-time graph can be plotted at the same time as the speed-time graph. A method of determining the distance-time from the speed-time graph is as follows:

How a Distance-Time Graph Is Plotted

The speed-time graph is divided into increments corresponding to a certain increase or decrease in speed. It is assumed that the average speed of the train during this time is equal to one-half the initial and final speed and the distance which the train would travel at this average speed in the length of time taken is computed. Thus referring to Fig. 2 we find that twenty-three seconds from the start the train has a speed of 25 m.p.h. and at twenty-six seconds the speed is 26 m.p.h. The average speed for these three seconds is 25½ m.p.h. or 37.4 ft. per second. The distance traveled will then be 3 $\times$ 37.4 or 112.2 ft. The smaller the increments taken the greater will be the accuracy of the calculations. Usually the same increments can be used as are taken in plotting the speed-time graph, and the two graphs can then be carried along together. In Fig. 2 the distance-time graph *OTUV* is shown constructed.

TABLE III—DETERMINATION OF EQUIVALENT GRADE FOR A RUN WITH GRADES OF VARIOUS LENGTHS

Per Cent Grade	Length of Grade, Feet	Rise in Feet	Fall in Feet
Level	250	.....	.....
+0.37	680	2.516	.....
—1.00	700	.....	7.000
—0.45	260	.....	1.170
+0.44	670	2.948	.....
+0.26	565	1.469	.....
—0.38	490	.....	1.862
Level	200	.....	.....
—0.30	1,120	.....	3.360
—1.80	1,450	.....	26.100
Level	360	.....	.....
Total.....	6,745	6.933	39.492

(39.492 ft. — 6.933 ft.) $\div$ 6,745 ft. = 0.48 per cent Equivalent Grade.

Some engineers prefer to plot a speed-distance graph as an aid in determining where to stop the construction of the speed-time curve for a given grade or curve so as to conform to the conditions governing operation on the new grade or curve. In laying out signals a speed-distance graph is necessary since the spacing of the signals will depend on the distance required to stop the train from the speed at which it is traveling. Speed-time curves provide a method for determining the power and energy consumed in a given service and speed-distance curves, aside from their use in connecting up different portions of runs, also give information of particular value to the operating engineer since they show the speed at every portion of the distance. A speed-distance graph with distance plotted as the horizontal element resembles a speed-time graph in appearance, as will be seen by referring to Fig. 2. The straight line portions of the speed-time graph when the accelerating and retarding force is constant become parabolic curves in the speed-distance graph. This has led to many graphical methods being worked out for obtaining these curves, many of which possess considerable merit. I find the method of determining distance by measuring the area under the speed-time graph the most convenient.

How Equivalent Grade Is Determined

To illustrate how the uniform grade for any particular run or series of runs is determined I will calculate this for the particular run under consideration in this article. The average or equivalent grade for any section of track connecting two points is the ratio of the difference in elevation of these two points to their distance apart measured in the same units. The accompanying Table III shows a convenient method for tabulating the various steps of the calculation. The distance that the track rises or falls for each grade is computed and from this the total difference in elevation of the ends of the run is determined. This value divided by the total distance apart of the points gives the equivalent grade which is usually expressed in per cent. The use of the equivalent grades in plotting speed-time curves assumes that the energy stored in the train as a result of down grades may be used to furnish the tractive effort necessary in addition to that supplied by the motors of the train to ascend a following up grade.

The amount of energy available as a result of such grades will, of course, depend on the amount of braking necessary on the down grades to prevent excessive speeds being attained and will also be affected by the location of the stops or stations on the line with respect to the grades.

Getting a High Vacuum at the Turbine Exhaust

The Purpose of This Article Is to Show How the Faults in Condenser Design Are Being Overcome and to Emphasize This Idea: "Cool Steam in the Turbine Exhaust Is the Desideratum"

By Hartley LeH. Smith
Chief of Testing Bureau
Brooklyn Rapid Transit System

AFTER extensive use of fairly large steam turbines had led to the development of the so-called high vacuum surface condenser it was found that its design had been based at least partially upon some serious misconceptions. It was ultimately realized, however, that there is no justification for looking upon the condenser as an end in itself. Such a conception has led to the basing of essential elements of condenser design upon principles which might be valid if its purpose were not strictly secondary, as I shall proceed to show.

High vacuum, even very high vacuum, is of no value *in a power station condenser*. The place for high vacuum is in the exhaust nozzle of each turbine in a power station. This statement may seem trite, but it is far from being so.

That's a good vacuum, and it's in the turbine exhaust at that

It was but a very few years ago, even after turbines of fairly large size and good economy had been placed in operation in numerous power stations, that surface condenser manufacturers were building condensers designed to produce high vacuum *in the condenser*. Apparently the vacuum in the turbine exhaust nozzle, was left to take care of itself. Power station engineers allowed this situation to develop seemingly in a spirit of indifference. They seem to have been dazzled by the rival claims of the several manufacturers as to the ability of the latter to produce apparatus capable of eclipsing each best previous vacuum record. But it should be noted that these records were made for that part of the condenser where the highest vacuum was to be had, that is, where the temperature was lowest.

The situation which I have described was probably brought about through the commercial relationships of the manufacturers. The turbine manufacturers made the turbine, and tried to build it of ample capacity, and reliable and economical in operation. The condenser manufacturer designed the condenser and tried energetically so to design it as to produce somewhere within it a very high vacuum. He seemed not to care particularly what vacuum existed at the top of the condenser, although he knew that it was the poorest vacuum to be found anywhere in the entire apparatus which he had turned out. On the other hand, the power station engineer did not insist that attention should be directed to it. The fact is, however, that for real *plant economy* effort must be concentrated upon it.

It would be difficult with entire justice to assign the credit for the bringing about of a better understanding of the vital facts in connection with condenser design. Certainly one factor was the entry of a large turbine builder into the condenser field in competition with the firms building condensers and accompanying auxiliary apparatus.

Until this better understanding was brought about great attention and much misdirected analysis was devoted to such matters as temperature of hot-well water and cooling of air previous to its extraction by the air pump. This pump, by the way, was generally of the reciprocating and so-called "dry" type and as such was much affected in volumetric efficiency by the temperature of the air suction. At the same time an enormous amount of attention was devoted to formulating and experimentally determining the laws of heat transfer through condenser tubes, and to expressing such transfer in terms of an average thermal transmission coefficient. All of the talk about the "contraflow," that is, bringing the hottest steam into contact with the warmest water, and its part in establishing the average heat transmission coefficient, missed the real point. In fact, the whole discussion of the surface condenser as an apparatus through which heat energy was transferred at a very rapid rate missed the point, because it placed the principal emphasis elsewhere than upon the ways and means of creating the utmost vacuum at the *top* of the condenser. That is to say, the discussion should have centered in the production of high vacuum in the connection between the condenser and the turbine where this high vacuum can do some good to the turbine and accordingly can improve the plant economy.

The Mass of the Exhaust Steam Must Be Taken into Account

As soon as designers realized that they had been putting the emphasis at the wrong place several notable changes in practice were quickly evident. The basis of contract relationship changed. Guarantees of turbine economy as affected by condenser performance came to be based, as they should always have been based, upon the vacuum between the turbine and the condenser. Condenser manufacturers, with some alarm, took into consideration the pressure drop through the tube banks instead of practically closing their eyes to it as formerly. The great congestion of heat transfer in the upper tubes of the upper bank, with its accompaniment of shockingly ineffective utilization of costly material in the lower tube bank, received at last the attention which it deserved.

Steam leaves the turbine in an extremely attenuated state. However, it has mass, and on entering the condenser it has great momentum due to its enormous speed. The mass and the momentum must be taken care of in the design or great quantities of steam will penetrate far into the condenser before interference with the steam path occurs. This fact gradually dawned on condenser designers, and more and more they have arranged the tubes in graduated density instead of having them uniformly packed in close formation.

The Coolest Water Must Be in Contact with the Hottest Steam

But even yet the inertia of past conceptions has not been entirely overcome. The contraflow principle and its relation to the average thermal transmission coefficient, in the writer's opinion, stand in the way of progress. The intake circulation water is cool. Because it is cool it has great *potential* power to extract heat from the cool steam in the turbine exhaust nozzle or the condenser inlet, and this potential power should be utilized. Cool steam is steam at very high vacuum, and obviously if it is the turbine exhaust or condenser entrance steam which is the cool high-vacuum steam the turbine benefits and hence good plant economy results.

All talk about keeping up the average thermal transmission coefficient, cooling the air so that the volumetric efficiency of the air pump may be high, etc., is quite beside the mark. The air which must be removed from a condenser is air which leaks into the condenser structure. It makes no difference at what temperature this air is removed nor what volumetric efficiency the air pump may have while in the act of removing it. The air coming into the condenser through the turbine exhaust mixed with the steam in accordance with Dalton's law* is a quantity practically negligibly small. But if the exhaust nozzle steam is to be cool steam and yet if it is to have its heat (its enormous latent heat) extracted in the condenser it must come in contact with cool water. *Cool steam in the turbine exhaust is the desideratum.*

Modern Condensers Have Graduated Tube Spacing

Instead, therefore, of the earlier forms of so-called high-vacuum surface condensers, marred by great pressure drop from the turbine exhaust nozzle to the hot-well or to the air pump of the dry vacuum or ejector type caused by closely packed tube banks, we now have condensers of various forms of shell. Sometimes these are V-shaped with graduated density of tube spacing, allowing greatly increased penetration of steam to the lower tube bank.

Devices, such as rain plates, designed to prevent the cooling of water of condensation while making its way to the hot-well are now recognized as contributing to pressure drop through the condenser. In causing this pressure drop they create an evil far worse than that which they are designed to alleviate. In consequence they have been abandoned in design, and in some cases where originally installed they have been removed.

Contracts and turbine economy guarantees are now based upon the vacuum which the condenser is capable of maintaining in the turbine exhaust nozzle. The average temperature, or an approximation to the average yearly temperature of the intake circulating water, is now used as a basis of guarantees instead of a nominal and rather high temperature. A very late conception is the necessity of providing gradual acceleration of the air flow from the pocketed air cooled space of large cross-section to the far smaller cross-sectional area of the air suction from the condenser to the air pump, thus avoiding a baneful pipe entrance pressure loss.

The fundamental fact of surface condenser performance is that, with contraflow, the temperature of the discharge circulating water establishes the potential capacity for heat withdrawal from the turbine exhaust steam. An ideal condenser employing this principle could do no better than bring the turbine exhaust steam temperature down as low as the circulating water discharge temperature. Of course, the temperature of the turbine exhaust steam establishes its absolute pressure and therefore its vacuum.

Condensation Congestion Must Be Avoided

Only to the extent that steam can penetrate to the tube bank containing the cool intake circulating water can this bank condense steam and in so doing relieve the congestion of condensation in the region where the turbine exhaust steam first finds itself. Congestion of condensation cannot occur unless there occurs a sufficiently large difference of heat potential. For this to be large the turbine exhaust steam temperature must remain far above the temperature of the discharge circulating water temperature, which temperature is fixed by the initial temperature and the rate of flow of the circulating water and the extent to which the heat of the exhaust steam is imparted to it. Contraflow condensers frequently absorb as little as 15 per cent of total heat in the lower pass, which pass, of course, having the cool water, has far greater potential heat-absorbing capacity than the upper pass.

This shockingly inadequate sharing of the load by the lower pass, with consequent overloading and inefficient operation of the upper pass, can be maintained as a condition of unbalance in one or both of two ways: Either the lower tubes with the cool water may be drowned in a cloud of air, or the tubes of the lower pass may be surrounded by cool steam. As air is a good heat insulator, obviously the first condition results in low heat absorption. Again, as cool steam is necessarily steam of low absolute pressure (in other words, steam at high vacuum) we have a condition where there is high vacuum steam in the lower part of the condenser, while in the upper part there is steam of higher temperature and therefore a lower vacuum. There is consequently a large steam pressure drop through the condenser. This latter obviously cannot exist unless the design embodies tubes in close formation, hence the modern tendency away from this arrangement.

Air in Condensers Presents a Rather Complicated Problem

The case of the insulating cloud of air is not so simple. All the air which leaks into a condenser is removed as fast as it enters by the air pump, no matter how bad

*Dalton's Law. "This states that, if several gases which do not react on each other are put inside a certain vessel, the mixture becomes uniform throughout, and the pressure at any point is the sum of the pressure which each gas would produce if it occupied the vessel by itself." Ames' "Theory of Physics," page 135.

the air leakage nor how poor and inadequate the pump. Otherwise equilibrium conditions could not obtain. But the essential thing here is not the *rate* of air entrance nor the equal *rate* of air removal. The essential thing is the *mass* of air existing in the condenser at any given time. A good financial analogy of this can be found in one's bank balance, which is quite distinct from the rate of depositing and the rate of checking out the account. If air leakage into a condenser is high it will require a pump of large capacity to remove air at a uniform rate *at low absolute pressure.* But still more vital than its volumetric capacity is the *limiting absolute pressure* at which the pump *can* remove *air.* Its limitations in this regard are fixed by its design or to its state of mechanical excellence with respect to maintenance, or to both jointly.

This point determined, it is obvious that the mass of the cloud of air in the condenser will be determined by the limiting absolute pressure and by the volumetric displacement of the pump in unit time. The product of these (times the gas constant) is the mass of air removed by the pump in unit time, which is necessarily equal to the mass of air entering the condenser in unit time. The mass of the cloud of air in the condenser, or, referring again to our analogy, the "bank balance," adjusts itself in such degree as to establish this entrance-exit equation.

Good Condenser Pump Maintenance Is Essential to High Vacuum

If the air leakage into the condenser is moderate and remains constant, but if at the same time the pump undergoes service deterioration for want of maintenance, the cloud of air in the condenser will *compress* until the deteriorated pump can take out the leaking quantity at higher absolute pressure than before; in other words, at lower vacuum. This compressed air, *occupying in the condenser the same space as before,* will have greater mass. In consequence it will have much increased heat-insulating ability and by reducing the heat absorption of the lower pass will overload the upper pass, since the entire heat coming in with the steam from the condenser must be absorbed. This overloading of the upper pass still further lowers the vacuum and thus in this manner a cumulative effect is secured.

In recent years an expedient extensively adopted is to provide a pump of very great volumetric capacity and of design inherently capable of working at very low absolute pressure, a pump of the rotary ejector type. This solves the problem of high vacuum maintenance but often at the expense of rather high power required for driving. With such a pump, if the air leakage into the condenser is slight, a source of extravagance is tapped.

As the volumetric displacement is large the pump will draw out steam when there is but little air to extract. This steam in consequence does not get into the hot-well as condensate and therefore is not returned to the boilers. This is a source of loss not always realized, but it is recognized by those who have given it proper consideration. Turbine guaranteed economy tests are not run with such pumps in action if test facilities exist for making temporary use of pumps of moderate volumetric capacity.

New Type of Lightning Arrester Makes Its Appearance

The "Oxide Film" Arrester Has General Properties Like the Aluminum Cell Arrester but Also Has Virtues All Its Own

AN IMPORTANT development in lightning arresters was announced in papers at the recent A. I. E. E. convention at Atlantic City by Charles P. Steinmetz, General Electric Company, and Crosby Field, United States Ordnance Department, who gave structural and operating details of the new "oxide film" arrester. This has now been in service long enough to demonstrate its practical qualities so that the authors felt safe in giving out details. The functioning of this arrester depends upon the fact that certain dry chemical compounds can be changed with extreme rapidity from very good conductors to almost perfect non-conductors by the application of slight amounts of heat. Lead peroxide is a good example of this property and this compound is used in the commercial arresters.

Lead peroxide is normally a powder. If, however, it is placed between two electrodes and a current is passed

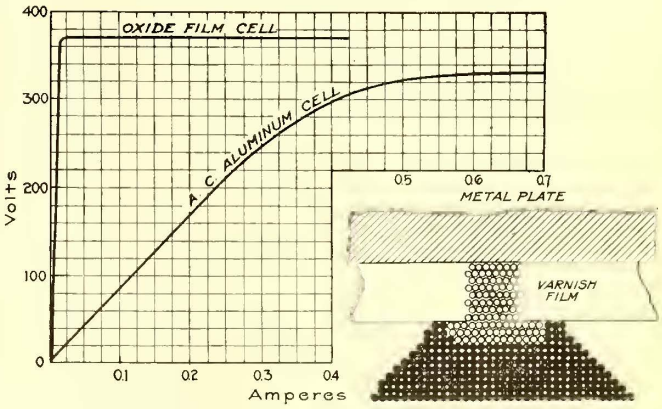


FIG. 1—VOLT-AMPERE CHARACTERISTICS OF OXIDE FILM AND A. C. ALUMINUM ARRESTERS. FIG. 2—CONVENTIONAL DIAGRAM OF LITHARGE PLUG STOPPING GAP IN OXIDE FILM ARRESTER

through it, there will be a rise in temperature due to the resistance at the contact of the peroxide and the metal. This causes heat to be generated at points on the surface, and when the temperature has attained a value of 150 deg. C. a film of lower oxides forms. This film is a non-conductor and it interrupts the current. The formation of the film by this means is, however, rather irregular and in the commercial arrester the electrodes are dipped in varnish or lacquer for the purpose of producing a uniform film.

The commercial arrester consists of two sherardized steel disks, 6 in. or more in diameter, spun on the two sides of a porcelain ring, the interior space being filled with the peroxide. The distance between electrodes is about ½ in. Either one or both of them is covered with a thin insulating film.

When such a cell is subjected to a voltage up to about 300 the insulating film prevents any appreciable current from flowing under normal conditions (see Fig. 1). As soon as the voltage rises slightly above this value the film punctures in one or more microscopic points, the lightning charge meets with practically no resistance

and flows to earth. The dynamic current starts to follow but because the insulation was punctured in very fine points the current density near these points is exceedingly great. There is thus a localized heating to a value sufficient to change to insulating litharge all of the conducting peroxide in this minute path of the current flow in contact with the electrodes. The film consequently reseals, stopping further flow of the dynamic current. The action is so rapid that the resealing occurs in less than one four-thousandth part of a second after the excess of lightning voltage has ceased. Fig. 2 represents in a conventional manner the way in which a litharge plug, indicated by the white circles, promptly fills the gap in the film.

In applying the cells commercially they are piled upon each other, to a number depending upon the voltage of the circuit, with a spark gap in series. As they are hermetically sealed, because the metal of the electrodes is spun over the porcelain separating rings, the cells can be installed out of doors as well as indoors, requiring in an outdoor installation merely some protection by peticoats to keep the rain from short-circuiting the cells. An accompanying illustration shows the details of mounting for a high-voltage arrester.

In order to render the arrester "instantaneous" in its action, the horn gap inserted in series with the cells is shunted by a properly proportioned sphere gap, which for outdoor use must be shielded from the weather. A protected sphere gap which has been designed for this purpose is shown in one of the illustrations.

The aluminum cell arrester comprises a series of cells —usually conical and stacked into each other—of aluminum electrodes, with an electrolyte of which neither the salt nor its ions appreciably dissolve alumina. In "forming" the cell by an alternating current passing through it, the electrodes are coated with a thin non-conducting film of alumina, which grows in thickness until it holds back the impressed voltage. Any over-voltage punctures this film, but the current passing through the puncture hole again forms alumina and closes the holes. Thus the aluminum cell acts like a self-repairing electrostatic condenser of a disruptive strength equal to the impressed voltage, about 250 to 300 per cell. On account of its excellent protective qualities the aluminum cell arrester has been adopted very generally in high-power circuits in spite of the inconveniences incident to the need of daily attention in charging, the use of a liquid electrolyte, and the difficulty of testing the arrester without taking it apart except by watching the appearance of the charging arc or measuring the charging current.

The oxide film arrester does not require any charging and thus needs no special attention; it contains no liquid electrolyte of inflammable material, and like the aluminum cell arrester it can be located out of doors as well as indoors. Fig. 1 shows comparative volt-ampere characteristics of the oxide film arrester and the a.c. aluminum arrester. Both of these arresters have a leakage current which wears the plates of the cell when alternating current is supplied and it is necessary to place a spark gap in series with the cells. This spark gap is set at a value slightly above the normal potential of the circuit so that nothing but abnormal voltages will cause a discharge.

It is seen, then, that the oxide film arrester has general characteristics closely like the standard aluminum electrolytic arrester and in addition it has obvious advantages, due to the facts that it is dry rather than wet, that it will not congeal and that it needs no daily charging.

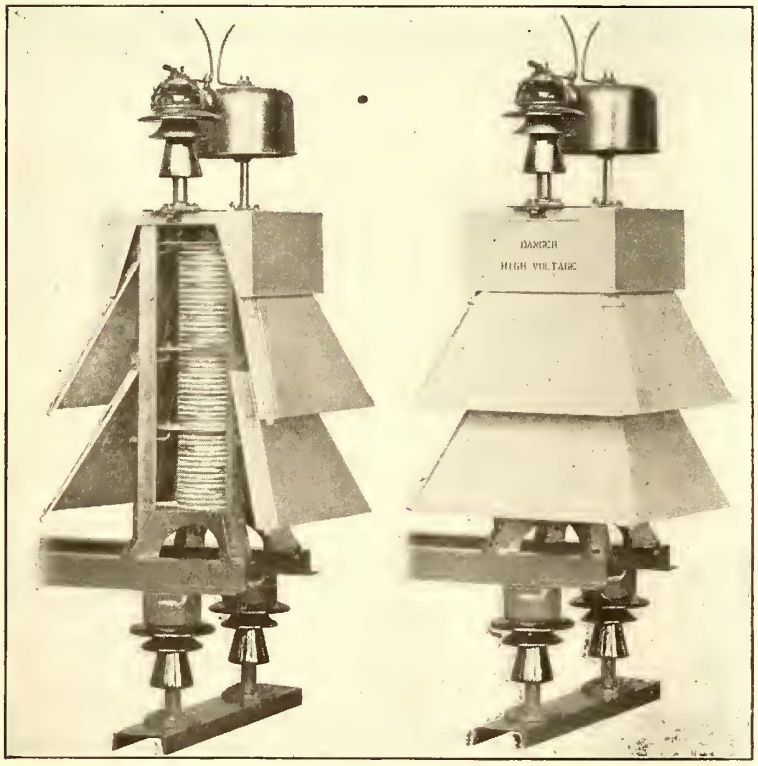


FIG. 3—OUTDOOR TYPE OF OXIDE FILM LIGHTNING ARRESTER FOR USE ON 15,000 TO 25,000-VOLT CIRCUITS

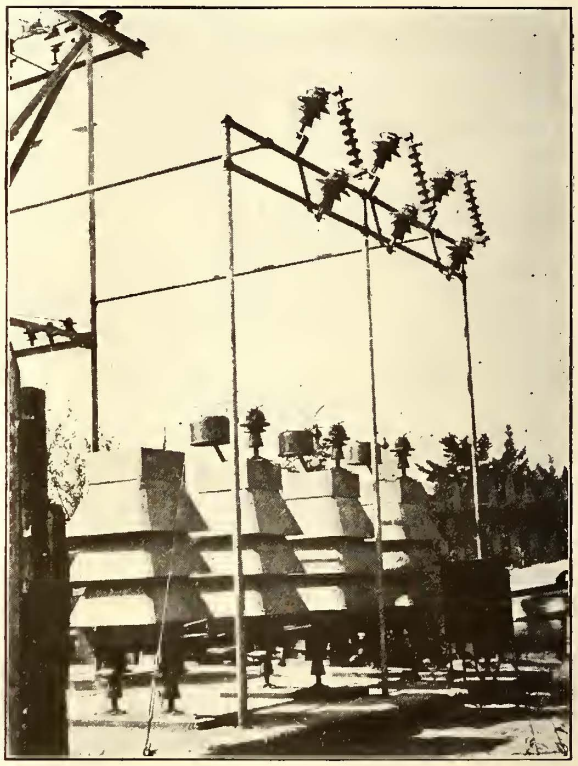


FIG. 4—OXIDE FILM LIGHTNING ARRESTER INSTALLED ON 33,000-VOLT CIRCUIT

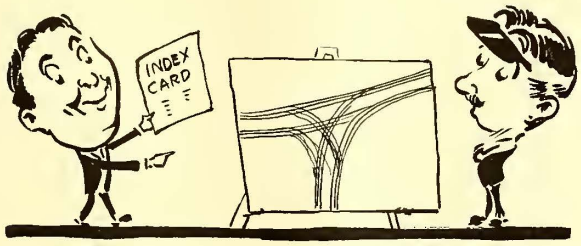
Money-Saving Factors in the Maintenance of Special Work

By R. C. Cram

Assistant Engineer, Department of Way and Structure, Brooklyn Rapid Transit System

For Economical Maintenance There Must Be Intelligent Selection of Types of Special Work, Careful Workmanship in Installation, Accurate Records of Performance and Prompt Attention to Needed Repairs

SPECIAL track work is the most expensive part of a street railway track system, both in first cost and in maintenance. It is no uncommon sight to see a special-work layout which has cost $10,000 or more confined within the limits of a 60-ft. street intersection. In pre-war times, special work would cost in place and paved from $10 to $15 per foot of single track, which is about double the cost of plain, tangent track. Slot-rail underground conduit construction cost much more than any other type, as indicated in the article by H. P. Hunting describing an installation of this type in Washington, D. C., which appeared in the ELECTRIC RAILWAY JOURNAL for June 15, 1918. The installation referred to was stated to have cost $56,239.19 net. The detailed cost figures indicated a unit cost of $65.90 per foot of single track for the special work in place and about $14 per foot of single track for adjacent tangent slot-rail track.



What would we have done without these records of special work?

These references to cost are made for the purpose of emphasizing the fact that special-work maintenance is a very important feature in the work of the way department. It hardly seems necessary to say that such high costs should be the only warrant needed for the expenditure of money in making frequent inspection and timely repairs. It may also be noted that high renewal costs often create a tendency or desire to keep a layout in service as long as possible and often beyond the time when renewal is properly due. In these times, particularly, it is difficult to secure the combination of material, labor and funds which is essential to good maintenance, and very careful planning is needed to make the best use of whatever parts of this combination may be available.

There are a number of problems and features of special-work maintenance which are more or less common to an electric railway, and an attempt will be made to present some of them in this article. While the methods and practices described are thought to be those prevailing generally, there are several factors which influence their application to individual systems. Among them are the following: (1) Size of the road in terms of mileage. (2) Number of special-work layouts. (3) General characteristics of the system with respect to whether it is a city system, an interurban system or a combination of the two. (4) Character of the special-work layouts with respect to relative simplicity. (5) General character or type of special-work construction in use. (6) Wheel contours and settings. (7) Type, weight and schedule of cars.

The first item naturally determines the second as it follows that, regardless of the general characteristics of the property, there is a fairly well fixed relation between track mileage and the amount or number of special-work layouts required for operation. Judging

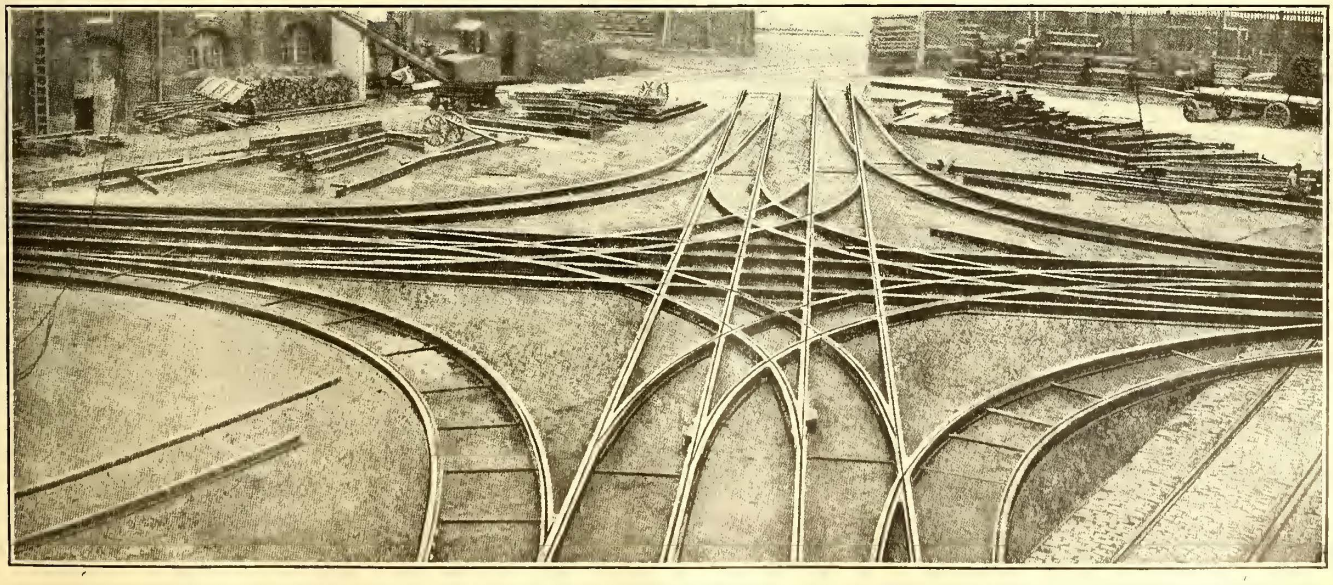


FIG. 1—SPECIAL COMPLICATED HEAVY SERVICE TRACK SPECIAL WORK LAYOUT FOR INSTALLATION ON CHICAGO SURFACE LINES

from the rather meager information available, we may assume that as a rule there are from one to two layouts per mile of single track. The second item will largely determine the amount of maintenance which must be undertaken in order to keep the work in good operating condition, although the car schedules and weight of cars also have an important bearing on this item. The third item will determine the type of construction used. Large city properties usually require deep rails, heavy castings, sharp curves, tongue switches, and pavements. Interurbans usually require standard-section rails, spring frogs, split switches and little or no pavement. Combined systems naturally require both of the foregoing.

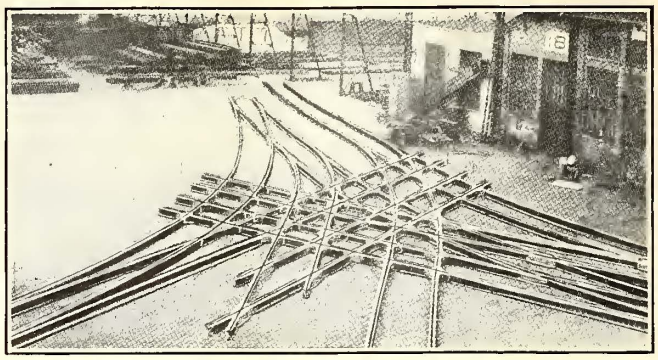


FIG. 2—COMPLICATED GRAND UNION TRACK SPECIAL WORK LAYOUT SET UP IN MANUFACTURER'S YARD FOR ASSEMBLY

There Is a Wide Difference Between City and Interurban Special Work Layouts

The fourth item can be traced through item No. 3. City systems, especially where double tracked, have a great many complex layouts. Interurban systems, on the other hand, have very simple layouts, such as turnout ends, and long, easy, plain curves. Combined systems have their share of both complex and simple. It may be of interest to note this difference in character by comparing the complex city layouts shown in Figs. 1 and 2 with the familiar simple interurban turnout.

The fifth item in turn, shows the influence of the characteristics indicated in items Nos. 3 and 4. The complex city layouts, requiring heavy castings, deep rails, tongue switches, sharp curves and expensive pavement, naturally cost more to maintain than the more simple interurban construction where split switches, stiff or spring frogs and easy curves are used ordinarily with little or no pavement. It will be seen that repairs to special work of the city type will require the greater expense, just as it is also clear that it will require the greater outlay for original construction, not only for the work itself but also in labor cost for installation.

As to the sixth item, wheel contours and settings have a greater bearing on maintenance of special work than appears at first. On city systems, the wheel treads are comparatively narrow. (About 2¼ in. is the prevailing width.) On the other hand, interurbans or roads operating solely upon private right-of way have cars with wheel treads 3 in. or more in width. Narrow treads are particularly hard on frogs and mates because such treads will not fully span the flangways, thus leading to rail-head cutting. To a certain extent this may be offset by the use of flange-bearing frogs.

The proper maintenance of accurate wheel setting or gage will lessen special-work maintenance. Wheels which are set or which become out of gage beyond tolerance limits will strike frog and mate points severely, will cause excessive wear of guard rails and will often

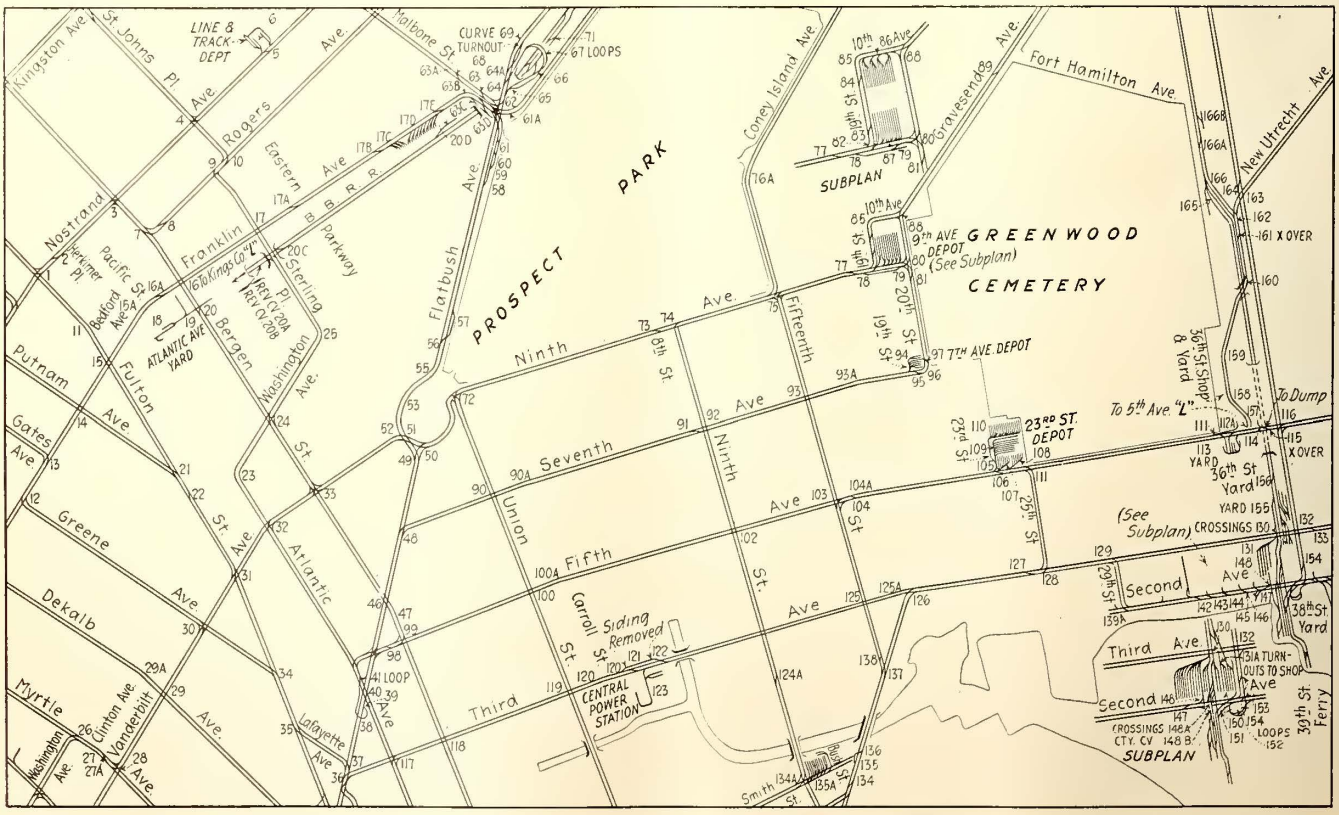
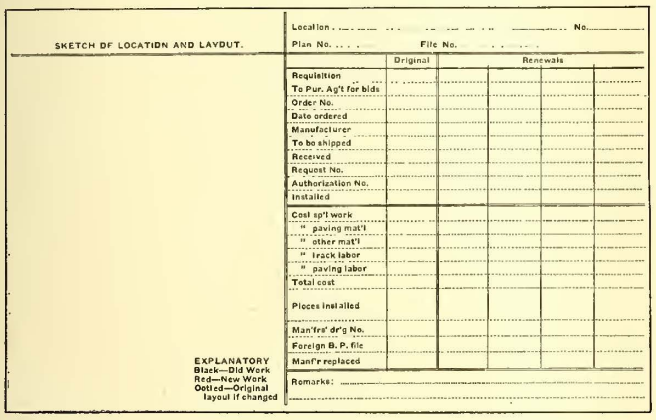


FIG. 3—ONE SECTION OF KEY OR INDEX MAP OF SPECIAL WORK LAYOUTS ON A LARGE CITY SYSTEM

lead to costly derailments. If it is necessary to provide for more than one type of wheel contour, additional maintenance can be expected because it is almost impossible to design special work to suit different contours and at the same time satisfy the principles of correct design.

The last item refers to type, weight and schedule of cars, which influence design. For example, if it is necessary to operate both single and double-truck cars around the same sharp curves, the guard rail grooves must be ground excessively to suit the single-truck wheelbase, and more than is necessary for double-truck wheelbases. Hence the guard rails have less wearable metal in them and they will require more frequent renewal. The weight of the car, its equipment and the load carried, determine the load upon each wheel and it follows that, with a given car schedule and type of car truck, a heavy car will do more damage than a light one. On the other hand, it is believed that a very frequent service with fairly light-weight cars will cause about as much wear as a less frequent service with heavy cars.


SKETCH OF LOCATION AND LAYOUT.

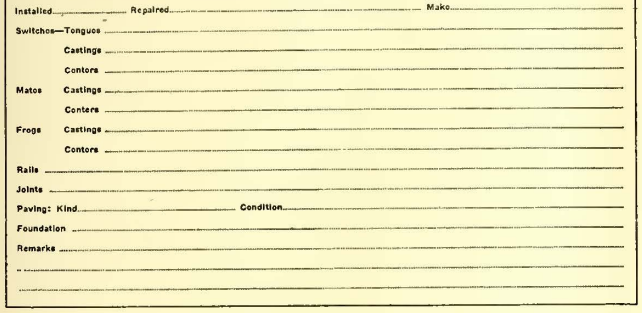
Location ..... No.
Plan No. .... File No. ....

	Original	Renewals			
Requisition					
To Pur. Ag't for bids					
Order No.					
Date ordered					
Manufacturer					
To be shipped					
Received					
Request No.					
Authorization No.					
Installed					
Cost sp'l work					
" paving mat'l					
" other mat'l					
" track labor					
" paving labor					
Total cost					
Pieces installed					
Man'fra' dr'g No.					
Foreign B. P. file					
Man'fr replaced					

EXPLANATORY
Black—Old Work
Red—New Work
Dotted—Original layout if changed

Remarks: .....

FIG. 4—CARD RECORD FOR COMPILING COSTS, ETC.


REPORT OF SPECIAL WORK DEFECTS No.

Date..... Desc..... Location.....
Installed..... Repaired..... Make.....
Switches—Tongues .....
Castings .....
Centers .....
Mates Castings .....
Centers .....
Frogs Castings .....
Centers .....
Rails .....
Joints .....
Paving: Kind..... Condition.....
Foundation .....
Remarks .....

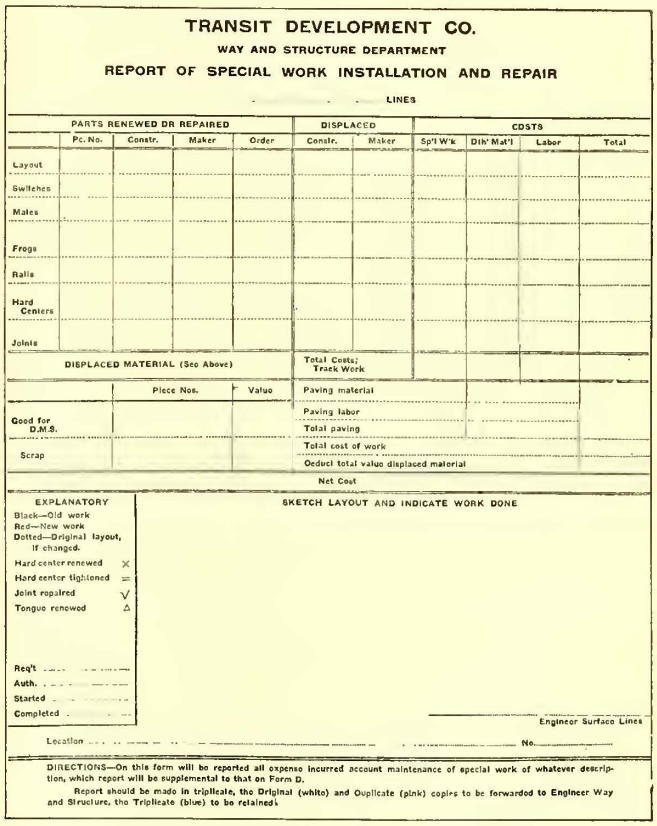
FIG. 6—FORM USED IN REPORTING SPECIAL WORK DEFECTS

Type of Special Work Also Influences Maintenance Costs

There are four general types of special-work construction, each of which has its peculiarities and requires a different degree of maintenance under equal traffic conditions. These types are: (1) Plain bolted; (2) cast steel, hard center; (3) iron-bound, hard center, and (4) solid manganese.

The plain bolted type includes both split switches and spring or stiff frogs used in open track, as well as the built-up tongue switches, open-point mates and frogs, which may be used in city work but their use determines characteristics which practically make a distinct type for each class of service. Each of the four general types mentioned has its peculiar field of service although the iron-bound hard-center type is often used under the same conditions which control the use of the solid manganese type.

There is no measure by which the performance of the various types may be compared except by installation under similiar conditions of service in a given location. Neither is there any means, except general observation, by which the service of a particular type on one road may be compared with that of another road. This will explain, to a certain extent, why the use of some one type will prevail on one road while some other type is thought best on another road.


TRANSIT DEVELOPMENT CO.
WAY AND STRUCTURE DEPARTMENT
REPORT OF SPECIAL WORK INSTALLATION AND REPAIR
..... LINES

	PARTS RENEWED OR REPAIRED				DISPLACED		COSTS			
	Pc. No.	Constr.	Maker	Order	Constr.	Maker	Sp'l W'k	Dih' Mat'l	Labor	Total
Layout										
Switches										
Mates										
Frogs										
Rails										
Hard Centers										
Joints										
DISPLACED MATERIAL (See Above)					Total Costs; Track Work					

	Piece Nos.	Value		
Good for D.M.S.			Paving material	
			Paving labor	
			Total paving	
Scrap			Total cost of work	
			Deduct total value displaced material	
			Net Cost	

EXPLANATORY
Black—Old work
Red—New work
Dotted—Original layout, if changed.
Hard center renewed X
Hard center tightened =
Joint repaired V
Tongue renewed Δ

Req't .....
Auth. .....
Started .....
Completed .....

SKETCH LAYOUT AND INDICATE WORK DONE

Engineer Surface Lines

Location ..... No.

DIRECTIONS—On this form will be reported all expense incurred account maintenance of special work of whatever description, which report will be supplemental to that on Form D.
Report should be made in triplicate, the Original (white) and Duplicate (pink) copies to be forwarded to Engineer Way and Structure, the Triplicate (blue) to be retained.

FIG. 5—FORM USED FOR REPORTING ON SPECIAL WORK INSTALLATION AND REPAIR

There are as many types of hard-center fastening devices as there are manufacturers of special work. This is true also of tongue-switch construction details. Each may have merit, but as yet there is no general tendency toward settling upon a combination of the desirable features into one general type. If this could be done, there would be a great decrease in maintenance cost, owing to the reduction in the number of parts which must be carried in stock, to say nothing of the reduction in price which should come with a reduction in the number of patterns. At present, however, patents and royalties have prevented much progress in this direction, although in solid manganese layouts there is a substantial agreement in many details of construction which has been effected through the efforts of the Manganese Track Society, an association of special-work manufacturers. Incidentally, reference may here be made to two extensive articles, describing methods of

fastening and maintaining hard centers, which appeared in the ELECTRIC RAILWAY JOURNAL for Sept. 19, 1914, and July 25, 1914, respectively.

Maintenance expense will, in a fair measure, be determined by the type of construction selected for a particular service and more study should be given to this selection than has heretofore prevailed. There is no doubt but that much good money has been wasted through the selection of a type not suited to the car service it was required to care for. The economical side of the question has not always been carefully considered. For instance, it has been definitely determined that one costly manganese layout may not always be as economical in a given location as two or even three less costly types of work, when interest on first cost is taken into consideration. Some interesting data on this point were included in an article by M. Bernard which appeared in the JOURNAL for Oct. 6, 1917.

Records play a large part in the work of maintaining special work. It is essential that information should be ready at hand covering such matters as location, type of construction, replacements, betterments, abandonments and costs. For the purpose of location, it is the custom to prepare a small-scale key map of the system, upon which all layouts are shown and given numbers. These numbers are used in correspondence and upon all plans, serving to identify the job even though the description by streets may be in error. When this system is in use it is a custom to have all manufacturers' plans show their numbers in addition to the company's own record numbers. Such a key map is shown in Fig. 3.

Further, it is a good plan to prepare drawings to a scale of $\frac{1}{10}$ in. = 1 ft., showing each layout or location, with all essential engineering data thereon, such as piece numbers, angles, lengths, street widths, obstructions, etc. These are usually made to one scale and as far as possible upon one standard-size sheet. Blueprints from these plans can be used to good advantage in the field for marking those pieces which require renewal or repairs. They save a great deal of writing and sketching, and consequently time, which is essential when getting up annual repair programs. When there are many layouts some sort of card-record system is the best method of keeping track of renewals, repairs and costs. A record card for such a system is shown in Fig. 4.

Other forms which have been found useful are those shown in Figs. 5, 6, and 7. That shown in Fig. 5 serves to notify all concerned that certain work on schedule is about to be started, calling attention to any changes in orders. Thus, also, if for some reason unknown to the field forces the work should be deferred proper instructions can be given.

Fig. 6 is a form for reporting defects, while Fig. 7 shows one used for reporting emergency defects, such as broken switches, tongues or other items requiring immediate attention. This latter form is filled in by the telephone operator who receives the report, and then it is either handed to the emergency crews, or repeated over the telephone when the crews call in for instructions.

Naturally, the use of so many report forms is not essential on comparatively small systems, where one or two department heads may have the work under close control, but upon systems having hundreds of scattered layouts forms of similar type will be found in almost universal use. It may also be noted in passing that the large systems ordinarily assign an assistant engineer or a special-work engineer to take charge of the numerous plans, schedules, records and estimates which are essential to well-ordered maintenance.

Another purpose served by adequate record systems is the accumulation of data upon the lengths of service of different types of construction in the same location. From such data it is possible to judge whether any particular type of construction is suitable for a given location and what modifications may be incorporated in renewals which will tend to improve the service given. Good records are invaluable in case of necessity for making an appraisal of a property, and for use in making charges or deductions from capital which may result from changes in type of construction.

But the best system of records ever invented, even if well kept up, will not of itself maintain the special work. It is only through constant effort and by taking the "stitch in time" that it can be properly maintained. One of the first principles of maintenance is that faulty installation will do more toward destroying the most substantial special work than thousands of cars. Good track work deserves a good foundation, and every pos-

Call No. .....

Date .....

Location .....

.....

.....

.....

.....

.....

.....

Dup. to Eng. W. & S.

Date .....

EMERGENCY TELEPHONE REPORT No. .....

Call No. .....Date.....Time.....M. Location.....

Nature .....Reported by.....

Part .....Make.....Type .....Piece No. .....

Line .....Track.....Rail .....

As found .....

Cause .....

Repaired: Date.....Time..... M. By .....

Remarks .....

.....

.....

.....

FIG. 7—FORM USED IN EMERGENCY REPORTING OF SPECIAL WORK DEFECTS

sible precaution should be taken to see that it is secured.

Much good special work has been destroyed before its time, and the manufacturers have been blamed for its short life, whereas the blame more properly should have been attributed to lack of care on the part of the railroad company in installation and maintenance. It is common to see a complete new layout going in upon a bed of old ties. It is even more common to observe partial renewals being made on old and badly worn ties, sometimes with shims of various sorts to bring up the level. The use of special tie layouts is not so common as it should be, and the old method of interlacing ties of standard length still prevails on many roads. This may not be true in open track work where there is every opportunity for easy installation of the longer timber used in special tie layouts, but in city work the installation of ties longer than the standard length of 8 ft. is somewhat difficult, especially where traffic must be maintained, because of pavement interference. These factors are apt to make the use of special ties appear unfavorable in spite of the known fact that it is almost impossible properly to tamp ties when closely interlaced, even with a pneumatic tamper.

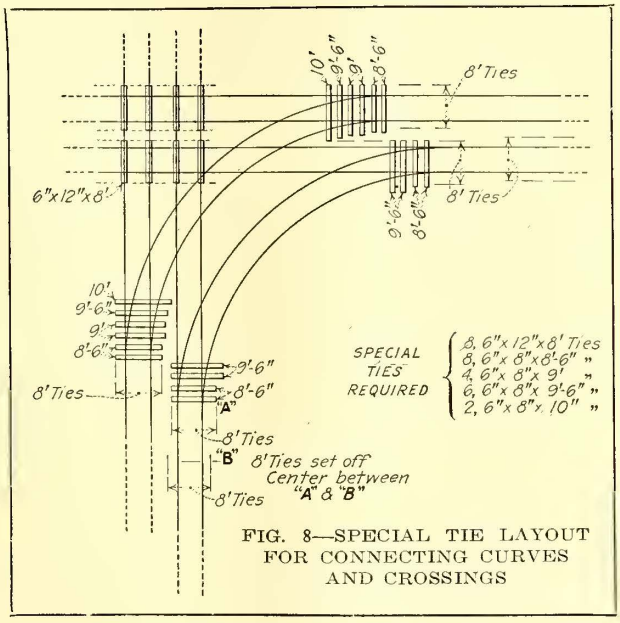


FIG. 8—SPECIAL TIE LAYOUT FOR CONNECTING CURVES AND CROSSINGS

It is possible, however, to use switch timbers, even under these seemingly adverse conditions, to an extent which will greatly benefit the stability of the installation. This can be seen by reference to Fig. 8, which is for use in renewal work where a complete special tie layout cannot be installed except at very great expense and with excessive delays to traffic. Furthermore, it is considered essential that all special work should be installed upon special tie layouts wherever possible, and as a rule only very heavy traffic conditions combined with very complicated special work will prevent their use.

The advantage gained by the use of special tie layouts is made even more evident by the results in increasing the life of railroad crossings through the installation of the special steel tie foundations. These have been rapidly coming into general use, not alone for railroad crossings but also for crossings strictly confined to street railway service. Another factor which affects the wearing qualities of special work is ballast. Many failures of special work, particularly of the iron-bound, hard-center type, both at joints and at the junctions of the centers with the rail arms, can be traced to lack of a good ballast foundation, well tamped under the ties. It is safe to say one of the chief factors in causing high maintenance expense has been the lack of use of adequate specifications for special work. Until recently there were none available except those prepared by the large companies for their own systems. Even these were not always sufficiently careful in detail to describe accurately all of the essential features. This situation often led to the acceptance of inferior material upon the lowest bid obtained by the purchasing agent, and the engineer of way had nothing but his observations to back up his claims that the special work supplied was of inferior quality.

The recommended standard specifications for the various types of special work and for materials entering into its manufacture, which were adopted by the American Electric Railway Engineering Association in 1916, represent a long step in advance. A glance through any one of them will make clear why they were needed.

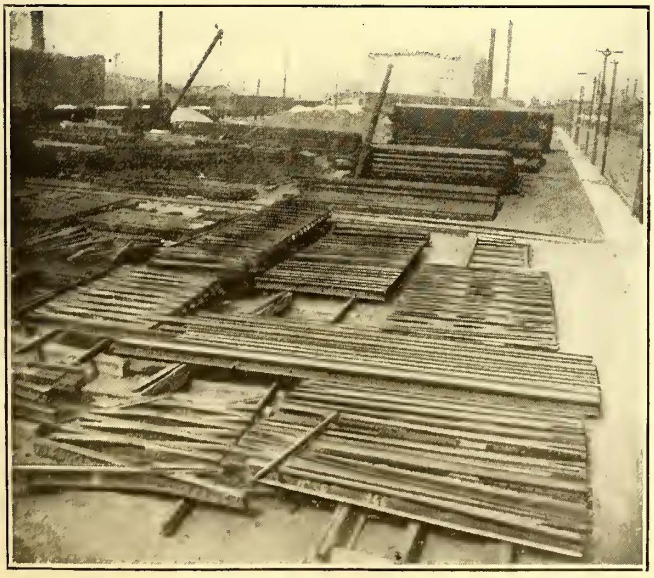


FIG. 9—STOCK OF STANDARD SPECIAL WORK IN A STORAGE YARD

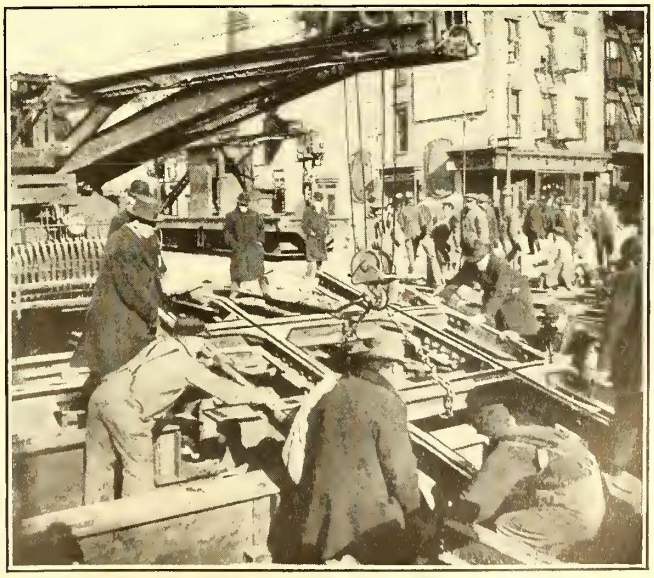


FIG. 10—CRANE CAR ASSISTING IN INSTALLATION OF HEAVY RIGHT-ANGLE CROSSING

These specifications leave nothing in doubt; every detail essential to good material and workmanship is covered and all manufacturers are placed upon the same footing in bidding under them. A more general use of these specifications by the railway companies, combined with manufacturing inspection at the plant, would undoubtedly lead to a lessening in maintenance charges.

Standardization in This Field Is Making Some Progress

The influence of standard designs on special-work maintenance is very marked. Almost every system of any considerable size has at least adopted standard engineering data, piece lengths and radii for crossovers and turnout ends. In most cases the standard lengths of switches and mates are those of the Engineering Association. The general engineering data are usually those found in the catalogs of the several manufacturers, and those data are applied to all crossovers and turnouts of the same radius, no matter by whom the work is ultimately manufactured. Simplicity is gained in this way and the number of repair parts to be carried in stock is generally reduced, while the renewal of worn parts is facilitated. In a similar manner standardization can be carried into more complicated layouts, as can be seen from the following quotation from an article by Burr S. Watters, assistant engineer of way of the Columbus Railway, Power & Light Company, on interchangeable special-work layouts. This article appeared in the issue of the ELECTRIC RAILWAY JOURNAL for May 6, 1916. After describing how the Columbus standards were designed upon standard grand unions as a starting point, including the exclusive use of right and left-hand switches of 97-ft. 7½-in. radius, of association standard lengths, Mr. Watters says: "The number of standard frogs has been cut down. * * * We have been able to obtain much better deliveries. * * * Furthermore, these standards greatly facilitate the laying out of special work. Instead of spending much time in trying to obtain the best possible design, the problem simplifies itself into determining which of the standard designs best fits the conditions imposed. These standards are also valuable because most of the pieces are interchangeable. This permits a certain number of pieces to be carried in stock, thus eliminating delays that occasionally occur in emergencies. After all of these advantages are considered, and from our experience with these standard layouts during the past five years, we feel very well repaid for our work in preparing standards, and we know that we are in a much better position to make original layouts or renewals than we were before their adoption."

FIG. 11—USING THE ARC WELDER IN REPAIRING A FROG

It is a custom on most roads to prepare a program or schedule of the special-work renewals and repairs which will be required during the year. The preparation of such programs requires both experience and good judgment. As a rule, on the smaller systems, the track foreman prepares a list of items of work which the roadmaster checks and revises and forwards to the engineer of way. The engineer makes such inspections as he deems advisable and prepares requisitions for the material. On large systems the special-work engineer makes up this program, acting in conjunction with the roadmaster, while requisitions are prepared by the engineer of way.

Inspections under these programs are usually made annually and programs are revised to suit the individual cases at the time of making requisitions. The engineer usually prepares plans for submission with requisitions, upon which bids can be taken. Where possible, it is also a custom to order renewals and parts from existing plans, after checking details against possible changes which may be found in the field. Sometimes the manufacturers are requested to send their engineers to make the measurements. In conjunction with such programs it is also a custom to prepare a budget of the estimated cost of the entire work, which is submitted to the management for approval. Actual work is again later approved under the regular authorization procedure obtaining. In the actual work of renewals, a regular procedure is necessary and a work order system as used in Denver and described by W. L. Whitlock in the JOURNAL for Nov. 10, 1917, can well be applied. Here the foreman receives a set of instructions giving each operation in its proper order. Much of the work must be done at night, and always at great disadvantage. It is often necessary to install portable crossovers and other temporary track in order to permit the work to be done. Crane cars are a great help towards saving labor and time in this work as they readily lift the heavy parts, leaving the men free to work at actual installation instead of tiring themselves by handling heavy castings. In the absence of crane cars, a team of horses will serve the same purpose, although the speed of installation is much slower.

Arc welders and rail grinders are two indispensable tools which are used in special-work maintenance. The welders serve to build up cupped rail heads and battered frog points, while the grinders smooth down the welds after these have been completed, deepen flangeways, grind frog and mate points, and remove "fins" from switch-tongue castings.

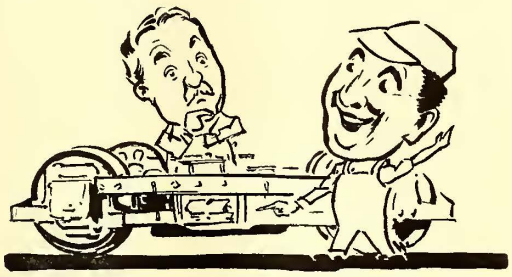
It is desirable, in special-work maintenance, to have one or more foremen who are particularly skilled in the various operations necessary to carry on the work over which they have supervision. Many men who are good track foremen and as such render valuable service in taking charge of the usual repairs to tracks, are not necessarily well qualified to maintain special work. There are many "tricks of the trade" which a special-work foreman and a well-trained gang can apply to the work, so as to make certain that it is done properly and with a minimum consumption of time.

Applying Engineering Principles in the Design of Trucks

By Norman Litchfield

Some Facts About Trucks Which Should Be Understood by Every Truck Purchaser and Maintainer

THE standard types of trucks in general use to-day are of designs which have been developed partly by experimental service and somewhat by a study of engineering principles involved in the structure. By reason of the character of the work it has to perform it is a difficult matter to analyze in any complete manner the strains to which the truck structure is put. Hence even the most careful study from a theoretical standpoint must be supplemented by experiment and service. Certain fundamental factors, however, can be determined simply, and these have a large bearing on the successful issue of any design. As in the study of any structure it is necessary first to ascertain the chief external forces acting upon the truck. The conditions are quite different from those surrounding the design of a bridge truss, for example, which is stationary and has varying force applied to it through a combination of the dead weight of the structure itself, the rolling load of locomotives, cars and other vehicles, and the addition of wind pressure together with an ice and snow load. In designing a bridge structure careful attention also has to be given to the stresses which may be set up in the course of erection. These are quite different from those caused by the normal loading, and often prove exceedingly troublesome.



I don't know what you mean by bending moment, but that truck will never buckle

In the case of the car truck, on the other hand, the structure is not stationary, but instead has to be carried along at a high rate of speed over uneven rails, on poor roadbeds which subject it to continual pounding, and around curves which apply severe side thrusts and which have a tendency to distort the structure in every conceivable manner.

Eight Points to Consider in Regard to Truck Loading

Before proceeding to analyze the forces acting on the truck it will be convenient to enumerate briefly the chief factors which require study. These are:

1. The weight which is carried with the car standing straight.
2. The shifting of this weight from one side of the truck to the other by the action of centrifugal force.
3. The shifting of a portion of the load from the rear truck to the front truck by the action of the brakes.
4. A similar shifting of the load from the rear pair of wheels to the front pair by the action of the brakes.
5. The forces set up by the motor during acceleration.
6. The so-called "flywheel" effect, or tendency of the rotating parts of the truck to continue rotating.
7. The forces set up by the friction of the brakeshoes on the wheels which are transmitted to the truck structure through the brake hangers.
8. The distortional effect of the horizontal force applied to one corner of the truck by virtue of the thrust of the forward outer wheel against the rail in rounding curves.

To obtain a general idea of the manner in which these forces affect the structure, we may consider the case of a double truck with American Electric Railway Association standard axle *EC*. This axle is designed for a static load of 27,000 lb., making the total weight of the car including wheels, axles, and passengers approximately 5 tons. The other data concerning the car are as shown in the table below. With the car stationary on a level, straight track the load carried on the center plate of each truck is obviously equal to one-half the car body weight, including the maximum load. The total in the case under consideration is 58,000 lb., or 29,000 lb. per truck. In tracing out the various parts of the truck structure it is convenient and proper to start from the center plate, which is mounted directly on the bolster, which in turn rests on the elliptic springs. Under the conditions of normal loading, therefore, the truck bolster is in fact a simple beam supported at each end, with a load concentrated at the center. The distance between centers of the elliptic springs will vary with local conditions and the ideas of the designer, but may be assumed for an example to be 60 in. This gives a maximum bending moment of 435,000 in.-lb.

Passing from the bolster, the next link in the truck structure is the elliptic spring. This feature of the truck is one of some particular interest and, as its design is in itself quite a study, it will be treated separately in a later article.

Next to the elliptic spring comes the link suspending the elliptic spring from the transom, and known variously as the "swing link" or "swing motion hanger." This detail, while apparently simple, has been the source of considerable trouble on some trucks due to failure of parts not properly designed. Three general types of hangers are in use. The first consists of a continuous U-shaped strap forged fairly square at the corners; the second is also a continuous strap but it is bent to

DIMENSION AND WEIGHT OF CAR CONSIDERED

Length	50 ft.
Distance between centers of trucks	36 ft.
Wheelbase of truck	6 ft.
Weight of car body, apparatus and passengers	58,000 lb.
Weight of two trucks and motors	50,000 lb.
Weight of complete car with passengers	108,000 lb.

a radius equal to one-half the distance between the vertical legs, and the third is formed of separate vertical links forged with eyes at the bottom through which passes a pin or axle upon which rests a casting forming a seat for the elliptic spring.

As the swing links are hung from the transom the latter is naturally the next member to be considered. From thence the load is carried to the side frames and so through the coil springs to the equalizer bars and journal boxes, and finally through the wedges and brasses to the journal.

How the Weight Is Shifted on Curves

As it would be mere repetition to consider the strains in all of these parts with the normal loading, I therefore have outlined the mechanical functions of the parts of the combination and we may pass to the second condition, namely the shifting of the weight from one side of the truck to the other due to the action of centrifugal force on curves.

In an article by the writer in a recent issue of the ELECTRIC RAILWAY JOURNAL, a discussion is given of the strains in car axles. It was pointed out therein that it is customary to assume that all of the weight has been removed from the inner wheel and concentrated on the outer one through the side thrust set up by the centrifugal force or other sidewise forces.

To find the loading on the truck parts with the car tipped by action of the centrifugal force we may proceed as follows:

The weight of the car body, apparatus and passengers is 58,000 lb. It is this weight which is carried by the

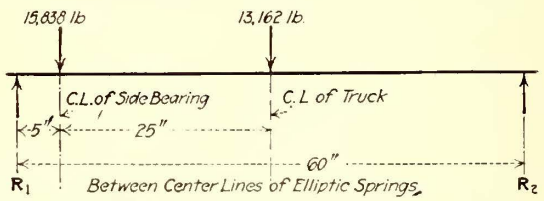


FIG. 1—DIAGRAMMATIC LOADING OF BOLSTER OF TRUCK UNDER CONSIDERATION

truck bolsters. To find the effect of the centrifugal force we must first ascertain the location of the center of gravity of this weight. The distribution of the component parts of this weight is approximately as follows:

Car-body weight,	30,000 lb.	Center of gravity 6 ft. above rail	Moment, 180,000 lb.-ft.
Apparatus on bottom of body of car, weight	10,000 lb.	Center of gravity 2½ ft. above rail	Moment, 25,000 lb.-ft.
Passengers, weight	18,000 lb.	Center of gravity 6 ft. above rail	Moment, 108,000 lb.-ft.
Total	58,000 lb.		313,000 lb.-ft.

Then 313,000 ÷ 58,000 = 5.4 ft. That is, the center of gravity of the load carried by the truck bolster is 65 in. above the rail.

It has already been shown in the axle article before referred to that the center of gravity of the total weight on the axle (27,000 lb.) is 60 in. above the rail and the centrifugal force sufficient to throw all the load on the outer rail is 12,713 lb. The proportionate centrifugal force acting on the weight carried by the bolster is, therefore,

$$F = 2 \times 12{,}713 \times \frac{58{,}000/4}{27{,}000} = 13{,}654\ lb.$$

The point of application of this centrifugal force is, as before stated, 65 in. above the rail. The top of the side bearings is approximately 3 ft. above the rail and the distance between center lines of the bearings is 50 in. Hence the additional load thrown on the outer side bearing is as follows:

$$F = \frac{13{,}654 \times (65 - 36)}{50/2} = 15{,}838\ lb.$$

As the load carried by each bolster, with everything normal, is 29,000 lb., concentrated at the center plate, this means that with full centrifugal force acting sufficiently to overturn the car, the load on the bolster would be distributed thus: 15,838 lb. on the outer side bearing and 13,162 lb. on the center plate.

The diagrammatic loading is, therefore, as shown in Fig. 1.

Here $R_1 = 6581 + (\frac{55}{60} \times 15{,}838) = 21{,}099\ lb.$

Bending moment at outer side bearing = 21,099 × 5 = 105,495 in.-lb.

Bending moment of truck = (21,099 × 30) — (15,838 × 25) = 237,020 in.-lb.

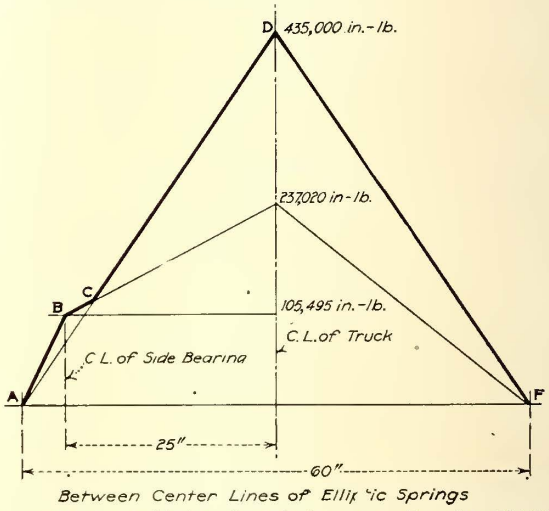


FIG. 2—COMBINED MOMENT DIAGRAM FOR DETERMINING FORCES ACTING UPON TRUCK FRAME

For convenience we may plot a combined moment diagram of the loading with the car standing in its central position and also when tipped by centrifugal force, as shown in Fig. 2. This diagram shows clearly that between the elliptic spring and the side bearing the loading conditions with the car tipped are controlling, while between side bearings the normal loading gives the maximum bending and the bolster must be designed accordingly. For those who are interested in a further detailed study of the strains in truck bolsters the writer would refer them to a very thorough article by Messrs. Chiles and Kelley, in recent issues of the *Railway Mechanical Engineer*, in which a discussion is given of the various specifications extant, and the stresses imposed by the different loadings required by different designers. This article refers, of course, to bolsters for freight-car trucks, but the reader will find it easy to alter the diagrams and calculations to suit his own passenger-truck conditions.

The authors referred to point out the fact to which the writer of the present article has previously referred, namely, the wide divergence in the conditions of loading and allowable fiber stress set down by different designers.

It will be noted that, in the set of eight factors for study enumerated herein, no mention has been made of any allowance for impact. In the case of a bridge truss this factor is ordinarily taken care of by an allowance such as given in the authoritative specification of Dr. Waddell, which is as follows:

$$I = 400/(L + 500),$$

in which L is the length in feet of the member, and I is the percentage by which the load is to be increased. Applying this formula to a truck bolster would make I equal to 400/500, or 80 per cent. Inasmuch, however, as the bolster is carried on springs which absorb a considerable portion of the blows resulting from faulty track conditions, the factor of impact is generally covered by limiting the allowable fiber stress to between 9000 and 10,000 lb. per square inch.

When Is a Rail Joint Well Bonded?

The Conductance of a Bonded Joint Is Quite Different From That of the Bond or Bonds Installed

By G. H. McKelway
Engineer of Distribution, Brooklyn Rapid Transit System

THE usual answers to the question asked in the title of this article are: "When the conductance of the bonds equals that of the rail," or "when the resistance of the joint and short lengths of the abutting rails equals the resistance of the same length of unbroken rail."

Most men giving one of these two answers will say that the two are really the same and that either could be called 100 per cent bonding.

The two answers, however, are not the same and a little thought will show where they differ. A joint with copper bonds of a cross-section just large enough so that the conductance of the strands or ribbons will exactly equal that of the rail will, if tested without the splice bars, give a result below 100 per cent conductance. This is due to some slack being necessary in the bond wire to allow for the movement of the rails, and to the additional contact resistance between the terminals of the bond and the rail.

However, it should be understood that in many cases there is a great difference between the conductance of the bond or bonds installed at a joint and the conductance of the bonded joint. This is due to the addition of the conductance of the splice bars to that of the bond. The value of the bars as conductors will frequently bring the conductance of the joint considerably higher than that of the joint alone, so that there are many "100 per cent joints" where the conductance of the bonds is much less than that of an equal length of unbroken rail.

Splice Bars Are Not a Substitute for Bonds

The value of the splice bars as part of the return circuit is small and no one should get the idea that it will be possible to substitute the joint plates for bonds. This can be done only in cases where rails laid temporarily will be taken up or shifted in a short time, or sometimes on short permanent tracks such as sidings which are very infrequently used and so short that the total ground drop, though high per foot of track, will not affect operation. There is always the danger of men walking or working on the tracks receiving shocks when tracks are not bonded so that care must be taken in this work. The cost in damages when such an accident occurs would probably pay for bonding the track many times over.

Tests of the conductance of the joints are often made as soon as the bonds are installed, and perhaps a year later similar tests of the same joints are made to determine the deterioration of the bonds. All of the increased drop over the joints, as found in the second test, is charged to the deterioration of the bond contact, while probably most of it is caused by the increase in resistance of the contact between the rails and the plates, due to the loosening of the bolts and working in of rust between the plates and the rails. After the joint resistance has increased above a calculated maximum, equal to the resistance of the joint bonded but without splice bars, it is safe to assume that the bond contact has deteriorated. But before that point has been reached it is unfair to the bond to charge it with all or even a comparatively small proportion of the whole increase. It will be found that the conductance of the path through the plates will fall much faster than the one through the bonds and the latter will seldom be seriously affected until the joint has loosened up to such an extent that the bond or its contact has been damaged by the movement of the rails.

100 Per Cent Conductance Is Sometimes Impossible

I have occasionally heard of roads having 80-lb. rails, or even heavier, bonded with one or two No. 0000 bonds where the claim is made that the resistance of the rail joints is never allowed to rise above that of 3 ft. or 5 ft. of unbroken rail. At one time a certain city official requested the company with which the writer is connected to bring the conductance of all of its joints on a certain piece of track up to the value of that of 3 ft. of unbroken rail. He quoted the measurements made by one of his engineers as showing that many of the joints were below the resistance of that length of rail. The measurements quoted were made with a Whitney bond tester where the section measured across the joint included 3 ft. of rail, so that he was asking for a minimum of 100 per cent conductance.

Owing to the poor foundation of the track in this case it was impossible to use short bonds at the joints, and the plates had to be spanned by long ones, 37-in. bonds being the shortest that could be used. After two such bonds were installed still longer ones were required to go around the shorter ones. It proved to be absolutely impossible to comply with the request if the bonds alone were relied on, as the two bonds had a cross-section of 422,000 circ.mil, as against a copper equivalent of about 800,000 circ.mil in the rail.

If the efficiency of the bond is to be calculated as it should be without taking into consideration the conductance of the joint plate it will be well to see just what should be expected of a well-installed bond. The standard bond with nearly all companies is of No. 0000 section, but the lengths vary greatly, running from 3½ in. to as many feet or more. Of two bonds of the same cross-section, but of different lengths, a joint bonded with the longer one will show the higher resist-

ance, except with very light rail or very heavy bonds, because the section covered by the bond tester will cover not only the entire length of the short bond but some of the rail as well. The conductance of the additional length of rail will help out that of the bond.

Assume two joints of an 80-lb. rail bonded with No. 0000 bonds, one bond 12 in. long and the other 36 in. long. The path around one joint will consist of the 36-in. bond and, but for the contact resistance, will have a resistance due to 211,000 circ.mil of copper. The length measured at the other joint will be made up of 1 ft. of No. 0000 bond and 2 ft. of 80-lb. rail which has a conductance approximately equivalent to 800,000 circ.mil. The average conductance of the joint bonded with the short bond will therefore be (800,000) 2 + 211,000 ÷ 3, or 604,000 circ.mil, as against 211,000 circ.mil with the long bond.

It would appear to be an easy task to determine the resistance of a bond if its unformed length, not the distance between centers of a crimped or otherwise bent bond, is known. While this is a fact so far as the bond itself is concerned there may be a considerable difference between the resistance of the bond between the centers of its terminals and the resistance between these centers on a bonded joint. In the latter case the contact resistance between the rail and the bond terminal has to be taken into account.

There are many opinions as to what this resistance should be. The writer has collected figures from different authorities which show more than thirty different results, the highest being fifty times the lowest, the figures varying from 0.00002 to 0.0000004 ohm per terminal. When considering these differences it should be remembered, however, that they are for more than one size of terminal, the diameters varying from $\frac{5}{8}$ in. to 1 in. Also it is very difficult to record the exact results of tests, as the contact resistance is very low so that a very small error in determining the actual resistance will make a large proportionate variation. Still another cause is the difference in the thickness of rail webs. As the webs of heavy T-rails are much thicker than those of girder rails of the same weight they furnish a much broader path for the current from the rail into the bond or vice versa.

To the writer it seems that a resistance of 0.000004 ohm for the two terminals of a bond is all that can be hoped for in practice, and this is a very low resistance for field work although lower results have been obtained in the laboratory. As this is equivalent to the resistance of only about 1 in. of a No. 0000 bond it can easily be seen that the contact resistance of a carefully compressed bond is almost negligible. However, the difference in resistance between a No. 0000 bond, or even two of them, and the resistance of the unbroken rail is so great that it will be found impossible to approach the 3-ft. limit mentioned for good bonding unless considerable help is obtained from the joint plates.

For instance, take an 80-lb. rail bonded with a single No. 0000 bond 12 in. in length, but pulled so tight that the distance between centers of the bond holes is but 12 in. The bond tester will span 3 ft. of rail, or 2 ft. of unbroken rail and 1 ft. of bond. The resistance will then be:

2 ft. of rail	0.000025 ohm
12 in. of bond	0.00005 ohm
Contacts	0.000004 ohm
Total	0.000079 ohm

This is the equivalent of 6.92 ft. of unbroken rail.

The addition of another No. 0000 bond of the same length will not cut this resistance in two as it will affect only the 12 in. covered by the bond. With two 12-in., No. 0000 bonds the resistance would be:

2 ft. of rail	0.000025 ohm
2 bonds	0.000025 ohm
Contacts	0.000002 ohm
Total	0.000052 ohm

This is the equivalent of 4.16 ft. of unbroken rail.

If a 6-in. bond were used with an 80-lb. rail the resistance of the joint would be:

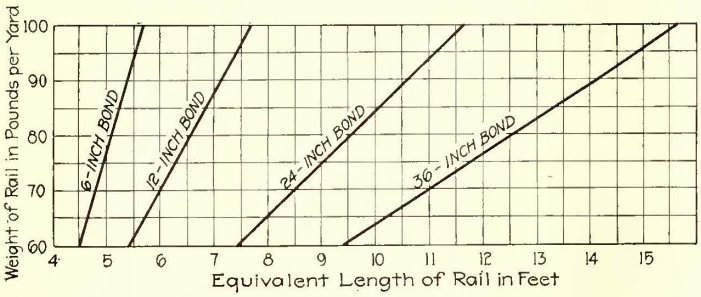
2½ ft. of rail	0.0000312 ohm
Bond	0.000025 ohm
Contact	0.000004 ohm
Total	0.0000602 ohm

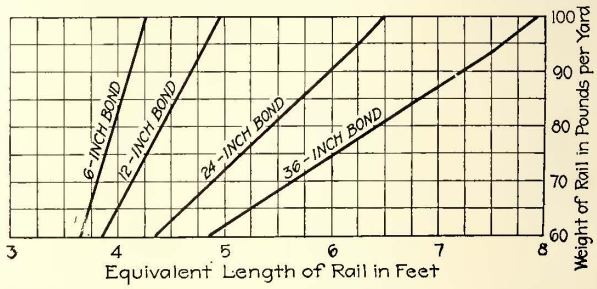
This is the equivalent of 4.8 ft. of unbroken rail.

A 6-in. bond is about as short as can be installed with any hope of its remaining unbroken for any length of time, but even if two of them are used with an 80-lb. rail the resistance will be as much as for 3.65 ft. of unbroken rail.

With the long bonds often used around the plates, generally from 36 in. to 42 in. in length, the resistance of the joint is much greater than it would be with short bonds, especially as the bonds are usually from 3 in. to 6 in. longer than the distance between the centers of the bond holes. With such bonds a joint resistance equal to 12 ft. of rail will often be found even when the terminals have been carefully compressed and the bond is in good condition. Thus the futility of giving any one number of feet of rail as the limiting resistance of several types of bonds is apparent.

The accompanying graphs show the equivalent length of unbroken rail that will have the same resistance as the joint if the conductance of the plates is not taken into account and if the bond tester spans 3 ft. of rail.





GRAPHS SHOWING EQUIVALENT LENGTH OF UNBROKEN RAIL WITH SAME RESISTANCE AS BONDED JOINT
At left, one No. 0000 bond. At right, two No. 0000 bonds per joint with length 3 in. longer than distance between bond holes

$860,000 of Relief—With a String Attached

Public Service Railway Through One-Cent Transfer Charge Receives Less Than One-Quarter of Desired Financial Aid from New Jersey Board—To Obtain Even This It Must File a Zone Plan by January 1

WANTED—$3,700,000 more revenue to meet increased costs of operation. Granted—$860,000 by means of a 1-cent transfer charge, upon the express condition that a plan for an equitable zone system shall be submitted to the commission by Jan. 1, 1919. This, in brief, is the story thus far of the struggle of the Public Service Railway, Newark, N. J., for a living rate of fare.

This company in March, 1918, filed a petition with the Board of Public Utility Commissioners of New Jersey, asking for increases from a franchise flat 5-cent fare with free transfers to a 7-cent fare, 2-cent first transfers and 1-cent additional transfers. In a decision just handed down, as briefly noted in the ELECTRIC RAILWAY JOURNAL of July 13, the board has affirmed its power to alter franchise rates, but it has reduced the company's financial estimates to what it considers a more "reasonable" basis and bestowed less than one-quarter of the aid desired.

WHAT THE BOARD CONSIDERS AN EMERGENCY

In considering what measure of relief should be granted to meet the admittedly more severe burdens of present-day operating costs, the commission defined an emergency in these words:

> An emergency for which a carrier is entitled to relief by a temporary emergency rate exists where, by reason of general conditions not affecting the applicant utility alone, the operating revenues are insufficient to operate and maintain its property and to pay rentals and interest on such of its securities, a default in the payment of which would jeopardize the solvency of the company.
>
> During the war period and in accordance with national and state war policies, while in underwriting normal returns for public utilities we should allow rates sufficient to keep the utility solvent and in good operating condition, we must also continue our declared policy of disallowing rates, in war times, for the purpose of increasing dividends. Stockholders in such corporations must share in the burdens and hardships resulting from financial changes due to the war and cannot expect to escape wholly therefrom.

COMPANY'S ESTIMATES ARE REDUCED

The exact manner in which the commission reduced the estimates upon which the company predicated its plea for an increase of $3,700,000 in revenues is shown in the comparative table on page 116. The company's estimated appropriation for depreciation reserve, it will be noticed, was $1,188,149, on the basis of the work carried out in 1916 at the prices now prevailing. This would leave a deficit of $1,010,631 for 1918, on the estimated revenue at the old rates. For dividends, the company proposed $1,491,066 on the capital stock outstanding, equal to the amount paid in 1916, and 8 per cent on the $1,250,000 of additional stock now authorized, or $100,000, resulting in an estimated deficit of $2,601,698.

The company also estimated the annual wage increase not included in operating expenses at $635,714, and the amounts to be paid for franchise taxes and federal income taxes on the additional revenue at $257,061, making the total estimated deficit $3,494,473. After this estimate was prepared additional labor difficulties resulted in an increase in the wage estimate to $1,085,714. Based on this estimate, the additional revenue required would be $3,687,412. Accordingly, the franchise taxes and federal income taxes would be increased to approximately $292,700, making the total estimated deficit $3,980,112.

The board, however, set up estimates which appeared to it "more reasonable in the light of the operating results of previous years and the first four months of 1918." After raising the revenue and reducing the expense totals, it cut the depreciation estimate from $1,188,149 to $800,000 on the ground that this was sufficiently in accord during an emergency with the amounts appropriated to the depreciation reserve and the amounts actually spent for renewals and replacements during the last five years.

Operation on the basis of the board's figures for revenues and expenses, with no provision at all for a return to stockholders, but with the grant of $1,086,000 more wages to employees, would produce an annual deficit of $797,000. The commission estimated the additional taxes at $63,000. Thus the total amount which must be added to the company's revenues in order to enable it to meet its operating expenses, pay bond interest and rentals on leased properties, provide a reasonable appropriation to depreciation reserve and pay increased wages was estimated by the commission at $860,000.

TRANSFER CHARGE SEEMS MOST EXPEDIENT NOW

The commission decided, therefore, that the company should have approximately $860,000 of additional revenue, and its choice of method was based on the following reasoning:

Zone Basis

This additional revenue might be secured by increasing the flat 5 cent fare now charged by introducing a zone system of charges whereby the fare should be commensurate with the distance traveled. The zoning system would tend to make the cost of the service more nearly approximate its value to the passenger and would tend to secure the maximum revenue to the operating company at the mimimum equitable cost to the passengers carried. It would also tend to make the cost per unit of service more equitable, but it cannot be resorted to to furnish emergency relief on account of the long delay that would ensue before such a system could be developed and equitably applied.

Car-Mile Basis

It may be suggested that the company's revenue for this emergency should be based on a study of the average revenue per car-mile adjusted to present conditions. The board does not consider that this method is logical or feasible. The cars in thickly populated traffic centers are usually crowded to capacity at certain hours and the revenue per car-mile in that portion of the line is high. As the car proceeds and the suburban area is reached or passed, the load becomes very light. If the company were allowed a uniform revenue per car-mile, the total cost per car-mile

(which does not vary largely in percentage) would be assessed on the few remaining passengers and would make the cost of the service so largely exceed its value that the method would fail by reason of such high cost to the passengers.

Transfer Basis

The company estimates that a charge of 1 cent for each transfer issued on a base fare of 5 cents will provide approximately $850,000 of additional revenue a year, which is substantially the amount of additional revenue required. By making a charge for transfers the additional revenue now required can be promptly secured. At the same time the additional burden will, in general, be carried by the long-haul passengers since as a rule the average total length of ride by passengers who use transfers (including the ride on the cash fare and the ride on the transfer) is longer than the average ride of passengers not using transfers. The transfer charge seems to be the best applicable in the present case, and we have accordingly adopted this method.

Zone System Should Be Studied

While the board did not consider the zone system a proper means for emergency relief in the case of the Public Service Railway, it indicated thus its support of this plan for future adoption:

Numerous witnesses produced by the company clearly indicated their opinion that the flat fare system is an inheritance from horse-car days and is in no sense a scientific or proper charge for the service rendered. While the board's power to increase railway fares despite the existence of a municipal ordinance specifying the maximum fare to be charged has been sustained, an important question would arise as to whether we would countenance a horizontal raise of the uniform 5-cent rate without an investigation of the nature and the extent of the service rendered for the fare charged and all the elements involved therein. The charge for the service does not bear any fixed relation to the service. Under the present existing 5-cent uniform rate, some passengers are permitted to be carried a considerably greater distance for the same rate than other passengers. This may unduly discriminate against the short-haul passenger or short-rider, and any horizontal increase in the flat rate would further exaggerate this discrimination.

The witnesses for the company further testified that in the event of a horizontal increase in fares it was reasonably certain that the traffic would diminish by from 15 to 20 per cent, and that this loss of traffic would be the short-haul traffic, for the reason that most of the short-riders in cities would walk rather than use the cars at the increased fare.

If the intimations of the company are correctly interpreted, we can expect with the advent of normal times after the war an application for a readjustment of fares. The matter as to the method of raising revenue and adjusting rates having been so fully discussed in the present application, we are of the opinion that it would not be remiss for us to suggest that the company make a comprehensive study of the question for future use. It is important to the public as well as to the company that the short-haul traffic business should be retained. Such business may be the determining feature which will make possible a general reduction of fares, inasmuch as the best method of development is clearly to retain a low minimum fare. The necessity for modification of the fares being admitted, some method can certainly be devised by a proper study of the company's system. While the system is extensive, covering nearly 1000 miles of track, it is separated and operated in six divisions and is capable of a practical zoning system.

Increase Is Granted Conditionally

In allowing the company to institute a charge of 1 cent for transfers on Aug. 1, the board stipulated that the sum of $1,086,000 must be appropriated toward any wage increase granted by the War Labor Board, since this amount was allowed in the calculation. Moreover, $800,000 must be reserved for depreciation and not used for any other purpose. Then, since the transfer charge is purely an emergency one, it is said to be effective subject to a written acceptance before July 24 of these conditions:

(a) The company shall promptly file with the board for each calendar month, beginning with June, 1918, as long as this surcharge is added to its schedule of rates, a statement giving the total amount of wages and salaries paid, duly classified by character of service rendered to the company, and the rates per hour, day or period for which the wage or salary is payable, likewise classified, and indicating any change in classification of employees and the wage rates resulting therefrom.

(b) The company shall likewise file with the board for each calendar month, beginning with June, 1918, a complete comparative income statement for 1917 and 1918 of its operations showing revenue and revenue deductions, classified in accordance with the uniform system of accounts for railway utilities (first issue) prescribed by the board, together with mileage, traffic and miscellaneous statistics as required in the annual report to the board.

(c) The board will retain jurisdiction of the emergency or war surcharge, for the purpose of modifying or abrogating it as and if the conditions change.

(d) The company shall file or submit to the board before Jan. 1, 1919, a plan whereby the method of charging at present in force may be revised by an equitable zoning system over its entire territory, proper consideration being given to all of the elements to relate more properly the cost of service to the length of haul and the value of service.

In the course of its remarks the commission alleged that in 1917 the amount which should have been

HOW THE 1918 FINANCIAL ESTIMATES OF THE PUBLIC SERVICE RAILWAY AND THE BOARD OF PUBLIC UTILITY COMMISSIONERS DIFFERED

			Company's Estimate	Board's Estimate
Revenue from transportation			$18,418,783	$18,434,000
Revenue from operations other than transportation			465,200	600,000
Total operating revenues			$18,883,983	$19,334,000
Operating expenses and taxes (depreciation not included)			13,752,720	13,010,000
Net operating revenue			$5,131,263	$6,024,000
Income from other operations			12,000	11,000
Total operating income			$5,143,263	$6,035,000
Non-operating income			200,000	220,000
Gross corporate income			$5,343,263	$6,255,000
Income deductions (interest on funded debt and rentals)			5,165,745	5,166,000
Balance available for depreciation, dividends and surplus			$177,518	$1,089,000
Appropriation to depreciation reserve			1,188,149	800,000
Balance			§$1,010,631	$289,000
Dividends:				
Capital stock outstanding	$48,750,000			
Earnings in 1916		$1,491,066		
Additional stock now authorized	1,250,000			
Earnings at 8 per cent		100,000	1,591,067	.....
Balance for the year			§$2,601,698	$289,000
Annual amount of wage increases necessary and not included above			† 1,085,714	†1,086,000
Deficit			$3,687,412	$797,000
Amounts to be paid for franchise taxes and federal income taxes if additional revenue required is allowed			292,700	63,000
Total deficit			$3,980,112	$860,000

§ Estimated in proportion to company's original estimate.

† Revised estimate due to increased wage scale ($635,714 plus $450,000)

(Continued on page 115)

The Industry Is Facing More Serious Problems

Mr. Mortimer Doubts That a Fair Return Can Be Earned Under the Flat-Fare System and Urges the Industry to Adopt an "Economically Sound Method" for Stimulating Short-Haul Convenience Travel—Says Public Ownership Should Not Be Fought

A THOROUGH student of fundamental electric railway economics, and at the same time a keen observer of practical conditions and tendencies in the industry—such is James D. Mortimer, president North American Company, New York, N. Y. Mr. Mortimer has heretofore contributed much to the thought of the industry, and when he recently reurned from an extensive trip to the Pacific Coast, it seemed to the ELECTRIC RAILWAY JOURNAL that the moment was opportune for comments from him in regard to his impressions of the general utility situation—North, East, South and West.

Mr. Mortimer has frankly responded to the request of this journal, and his opinions will be set forth in this article. He feels that as one travels through the country or reads the press reports of what is occurring in various cities, he cannot do otherwise than conclude that electric railways are facing problems so serious as to threaten in the long run their permanency as a means of ransportation. The situation calls for a free discussion of the facts and tendencies. No false ideas of protection of market prices of securities should obscure the facts.

THE EXISTING CONDITIONS ARE THESE

The present conditions in the electric railway industry, as they appear to Mr. Mortimer, may be summarized in this manner:

1. There has been no appreciable expansion of electric railway facilities in the last five years. It has been recognized by investors that the business is one of decreasing returns, subject to great hazard and accordingly uninviting for the investment of capital. Betting on a horse race was comparatively safe compared with the stability of electric railway net earnings. There has been no evidence of such a change in the public attitude toward the railways as suggests that private capital will again renew its interest.

2. Jitney competition sprang up, and about the time that it began to wane the industry was hit with the first of the rapidly increasing costs of operation, following the commencement of the war in Europe.

3. Many electric railways have sought the protection of the courts, and others are in imminent danger of receivership. Their earnings have been inadequate to meet interest charges, and they have lacked credit upon which to finance maturing obligations. Little has been done by the public authorities to rehabilitate such credit.

4. In cities where shipbuilding is in progress, the proper transportation of shipyard workers has become impossible. The railways lack, and have no means of procuring, the money with which to extend facilities for this important work. In other cities where war industries are active, cars are more heavily loaded than ever before. In only a few cases have any of the obvious and economical palliatives been applied.

5. The public is generally aware of the increased costs of electric railway service, and it is generally reconciled to the payment of any increased fares which the public authorities may say are fair.

6. But regulation where it exists has broken down. Where it does not exist, the public authorities have generally been afraid to assume the responsibility of allowing the public to pay the railways the increased revenues to which they are entitled. In one instance, where the franchise contract between the railway and the city provides for automatically increasing the fares under specified conditions, the municipal officials have resorted to the courts to prevent or delay the needed and agreed increase in fares. The moral and ethical standards of local administrative bodies have not been chastened by war experience.

7. Regulation first completely demonstrated its failure in Massachusetts. Its failure was forecast in other states when the character of the personnel of the commissions began to decline and when the members began the attempt to right the fancied wrongs of ages gone by. They lack courage; they wish to experiment; they delay action while the deficits multiply.

8. Organized labor has not co-operated to the full practicable extent in assisting railways to adjust their revenues to the increased costs. Organized labor has been fearful that its advocacy of higher revenues might cause public opinion to be directed against it. But labor has been insistent in its demands for higher wages. To the extent that these are necessary to compensate for increases in the necessary cost of living, labor is entirely justified. But labor has a part which it should play, and it has rather consistently declined to play it.

(Concluded from page 114)

credited to the depreciation reserve was cut to the extent of more than $500,000 to permit the payment of dividends. This it characterized as a wholly unjustifiable act and a violation of the paramount duty of the utility. If earnings do not permit a proper reservation for depreciation and also a fair return upon the used and useful property, the remedy, in the board's opinion, is not a reduction of the depreciation allowance but a prompt application to it for relief.

In regard to the rentals paid by the Public Service Railway for leased lines, the board took cognizance of the criticisms made by the opponents of a fare increase by remarking that under long-term leases utilities can secure returns to which they may not be entitled, and the abuse of leases is more marked where the lessor and the lessee are so co-related as to be practically under the same control. The board believes that to secure the complete advantage and benefits of regulation all charges should be carried as far as possible directly by the operating utility.

The sanctity of the union has been placed above the solvency of the employer.

9. Many increases in fares have been authorized. On urban lines these have usually taken the form of an increase in the flat fare. The increase in revenue has not been in proportion to the increase in fare. A 20 per cent increase in the rate has usually shown an increase of 8 to 10 per cent in revenue. There has been a relative decrease in the riding habit. The decreases in the number of passengers carried will be found to occur largely, if not entirely, during the non-rush hours. Convenience travel has been reduced. Operators of railways with 6-cent fares, observing the ill effects of the higher unit fare, realize that a new fare scheme must take the place of the time-honored American system.

10. The inadequate revenues on American urban railways have been due, not so much to the fact that the unit fare was too low, but rather to the fact that traffic was being carried too far for the fare paid.

11. The statutes of many states prevent any adjustment of present fares. Until new legislation can be enacted or the federal government exercises its wartime power, the railways will have to continue to operate with losses.

Mr. Mortimer said that he had observed some tendency on the part of urban electric railway operators to propose unit fares higher than 6 cents. If the total required revenues are divided by the number of passengers carried, an 8 or 10-cent fare may be readily justified by the arithmetic operation. But, in his opinion, continuation along this line of reasoning may well prove disastrous to the industry. The suggestion of 7, 8 and 10-cent fares may be a proper method for forcing some other fare system, but its realization in practice is not desirable. The reasons for this he stated as follows:

"A 10-cent fare is almost certain to cause the restoration of automobile carrier competition on hauls of 3 miles or less. Laws or ordinances heretofore passed restricting automobile competition can be readily amended or repealed, and the permanent effectiveness of the present laws and regulations cannot be relied on—it should be guaranteed by sound economics. It would be unwise to adopt any system of fares which would encourage the restoration of competition. If this competition again springs up, it is much more likely to have a longer life.

"Competition would, through the diversion of traffic from the street cars, require still higher fares until the point would be reached where the cars had lost all their business, including even their long-haul traffic. Then the electric railways would have no substantial place in the transportation scheme except as other methods of transportation would overcrowd the streets of most cities. The present tendencies are toward a most unstable and hazardous condition. But the good sense of the electric railway industry will return before that time comes. Its attention needs only to be called to the danger toward which it is heading to cause it to change its course."

The fundamental point, Mr. Mortimer averred, is that urban electric railways need more traffic rather than less. They need this traffic during the non-rush hours, when they have ample equipment and track facilities to care for it. The largest amount of "convenience travel" takes place during these non-rush hours, and it is generally of short haul. A stand-up ride during rush hours cannot as a rule be classed as "convenience travel."

Unit fares involving the payment of more than 5 cents are destructive to convenience short-haul traffic. A 6-cent ride is paid for by the payment of a nickel and 1 cent, or by a dime with 4 cents change. The 4 cents remaining out of a nickel have less value psychologically than 80 per cent of a nickel. In many instances a 6-cent ride accordingly has an apparent cost higher than the actual cost. To walk a short distance then appeals to many passengers as the saving of 10 cents.

Hence, Mr. Mortimer believes, if a new fare scheme is to be adopted, the industry should try to design it so that the short haul "convenience travel" will be attracted. The more traffic carried during these hours, the more frequent will cars have to be run, and frequent service encourages short haul "convenience travel"; the effect is cumulative. Continuing, he said:

"Some early electric railway executive said that strap-hangers pay dividends." No greater untruth has ever been stated. The remark has been handed down as an economic principle. It was seized as a battle-cry by politicians desirous of securing labor votes, and it has had its effect in promoting lower fares for workmen. But low fares during rush hours tend to promote peak travel. Peak travel increases investment, results in a heavier standing load and contributes to the general dissatisfaction directed against electric railway service.

"New occasions teach new duties,
Time makes ancient good uncouth;
They must upward still and onward
Who would keep abreast of truth."

1. Unit fares higher than 6 cents are economically unsound. A new fare scheme for American electric railways is necessary in the interest of preserving their place among the transportation media of the cities. No scheme of fares should be adopted that will reduce short haul and "convenience travel" or that will encourage competition. If the ride for a single fare could be sufficiently shortened, a return to the nickel unit would be desirable.

2. Public ownership of electric railways should not possess the terrors for investors that have heretofore been assigned to it. Much good may come from the advocacy of public ownership. It will at least destroy a popular issue among the politicians, and the electric railway operators need not think, because they advocate it, that public ownership is likely to become any more popular. They should have measured by this time the kind of reaction that their expressed opinions make on the public mind.

3. The electric railway industry is facing a crisis which calls for the exercise of new methods and a departure from the old principles that so far have guided it into the difficult position where it now finds itself. Is this fact generally recognized, or is the industry gradually to be forced into complete financial and economic bankruptcy?

JAMES D. MORTIMER.

If travel were uniformly distributed throughout eighteen hours of each day, a seat could be provided for each passenger, lower fare for the same distance made effective or passengers hauled a longer distance for the same fare, and electric railway service operated with only a small part of the dissatisfaction now so prevalent. Uniform travel is, of course, the limiting case and cannot be achieved in practice, but it is suggestive of tendencies."

Non-Rush-Hour Traffic Can Be Promoted by Lower Unit Fares

In Mr. Mortimer's opinion, short-haul "convenience travel" should be promoted by the railways, even to the extent of establishing lower tariffs effective only during the non-rush hours, when working out a new fare scheme as a result of present conditions. The differential in fare between rush and non-rush hours required to cause a substantial flattening of the rush-hour peaks cannot be computed or even estimated, but it is believed that the cost of electric railway service is an item so small in the family budget that any change in price of service would not cause a heavy readjustment in the hour of factory and store closing. The greatest advantage of low tariff fares during non-rush hours would come from the cumulative effects of increased convenience riding and increased service that might be possible thereby.

Public Ownership Should Not Be Opposed

Turning to another subject, Mr. Mortimer stated that no electric railway should oppose ownership by the state. In expanding this idea he said:

"State ownership may do violence to our preconceived notions of sound economics and politics. Our troubles in the future may be lessened by inviting it now. Virtual state ownership has been the solution of some of the most difficult situations in Massachusetts, and the early invitation of state or even municipal ownership might have avoided municipal competition in some situations where it is now producing distressing results for the railways that pioneered in the community. It is most unwise for any utility to suggest by implication that it is fearful of the results of municipal or state ownership.

"All talk about the wasteful methods of state operation falls on a majority of deaf ears. If a utility opposes public ownership, it encourages its advocates. Were the utility to advocate state ownership, the socialists and progressives would be deprived of an issue, and an issue is far more useful to the politician than its realization. Many public ownership projects have been forced upon politicians to make good on their representations, and others have come from the reaction of some real or fancied grievance against the existing utility.

"If electric railways are to be publicly owned, however, they should be owned by the state rather than by one or more municipalities. The better and larger electric railways are inter-city, and their problems and economic structure affect portions of the state rather than one community. Unjust discrimination between cities and towns is a patent possibility with a system owned by the largest municipality or divided up among several."

When asked what the development of the near future should be, Mr. Mortimer replied:

"The coming sessions of the various state legislatures will see many bills introduced, designed both to permit and to prevent relief from being granted to electric railways. In this forthcoming legislation it is desirable that all the restrictions heretofore imposed upon the rate of fare being either above or below 5 cents be removed. The requirement that there be a universal fare good for a ride from any part of a municipality to any other part is not in line with the requirements of the times and does not accord with sound economics. Moreover, the opportunities for public ownership of electric railways should be unrestricted except for the requirements of sound finance and accounting methods."

The Slogan for Car Repairs—"Do It Right—Do It Now"

Shop Foremen Should Check Carefully All Work Done Under Them and Make Certain That No Temporary Repairs are Resorted To

By J. J. Sinclair
Assistant Engineer of Car Equipment, New York Municipal Railway Corporation

IN DESIGNING electric railway cars and their equipment the engineers of the operating company and manufacturer devote a great deal of consideration to the materials which enter into the structure of the car or apparatus. They consider the strength and character of the materials and the advisability of their use in connection with the particular functioning of parts. This is followed by a close inspection to insure that the material is used as called for in the specifications.

After the engineer has calculated the various strengths of materials and the inspector has carefully checked the materials used to insure compliance with specifications, the management has every right to expect that as long as the worn parts are properly replaced all danger of breakage of vital parts which may cause serious accidents will be avoided. Parts which are worn, broken, or seriously reduced in capacity should be replaced at the proper time. It should be the aim of every man in charge of the maintenance of this equipment to make repairs at once upon inspection where in his judgment replacement is advisable. Such replacement should never be made with a temporary arrangement. In other words there should be no procrastination in connection with the work of inspection and maintenance of the equipment, as disastrous results are almost sure to follow such procedure.

In order to carry out inspection and maintenance of the equipment with a definite policy for immediate action it is absolutely essential that those having supervision of maintenance and inspection shops spend a considerable portion of their time in looking over the work of the sub-departments, to see that it has been carried out in a thorough manner. When a railway company selects a supervisor for maintenance and inspection work, considerable care is used to see that he is a man of judgment. After the selection has been made, the company relies very largely upon him to see that adequate repairs are made at the proper time. In checking the performance of work he should proceed according to a definite schedule, with a positive system, so that maintainers or overhaulers of equipment will realize that

every care must be taken by them to see that all details are covered before equipment leaves their hands for final check. Then there is no reason why a car, when placed in service will not operate in a satisfactory manner, providing that it has been properly designed for the service which it is called upon to perform.

Service Conditions Determine Electrical Equipment Specifications

There are many little points which need constant consideration and immediate attention to keep equipment in the full state of efficiency, some of which may be worth mentioning here.

In order to get normal service as well as emergency service from equipment which has been properly selected it is necessary that the various parts which go to make up the equipment be properly assembled, that all switches be properly lined up, that contact fingers be given proper adjustment, that circuit breakers be properly adjusted so that they will operate as safety valves in cases of overload and that fuses and fuse clips be set so that full rated capacity may be obtained.

When equipment is received it is inspected to make sure that the details have been properly covered by the manufacturer and that the equipment is in proper condition to be placed in service. After a time various parts will become worn. Inspectors should be impressed with the importance of looking ahead and anticipating trouble with these parts by at once removing any that are dangerously worn or broken and making the replacement in a thoroughly workmanlike manner. They must follow the policy of "doing it right and doing it now" rather than wait until a short-circuit from some improperly adjusted finger or temporary repair occurs, with the consequent delay, risk and criticism.

Circuit breakers should have, above everything else, the most scrupulous attention. They must be kept in proper adjustment and set to operate on overloads in accordance with outstanding instructions. Contact tips and boxes, and tripping and latching mechanism must be kept in good condition in order that when the breaker is called upon to function and protect remaining parts from short-circuit it will be ready. It should be considered as part of the safety apparatus of the car.

As an extra precaution against severe short-circuits in cables or other parts of the equipment, cars are equipped with main fuses. These fuses have a definite capacity rating. Fuses of definite capacity are selected for certain classes of equipment to perform a definite service, and it is absolutely essential that the terminal clips be kept in a normal condition and that the wires soldered into the terminals should have good, substantial contact. Often an inspector in looking over a fuse and finding terminals loose or wires improperly connected will make a temporary connection with the idea that the first time the car is brought into the shop the repair will be made permanent. This practice is wrong. A car may give trouble within five minutes after it leaves the shop with vital parts connected in such a temporary manner. That particular fuse would no doubt heat up without proper terminal connections and its capacity would thereby be reduced so that it would "blow" under normal operating conditions, causing delay to service or possibly serious accident.

In purchasing the airbrake equipment for any car, careful consideration is given to the brakeshoe pressure on the wheels, so that when the motorman applies his brakes he will stop the car under the most advantageous conditions and without sliding the wheels. After a motorman has been operating a car with the brakes properly set he can determine very closely what his stopping distance will be with a certain application of the brake.

Unless this equipment is maintained in normal condition, practically the same as when the car is first turned out from the construction shop, this braking distance will vary considerably with the varying condition of the part of the equipment which affect the final brakeshoe pressure. For that reason it is of the utmost importance that inspectors take every precaution to repair at once any leaks in the brake piping, packing leathers of brake cylinders, brake valves, etc. Under no conditions should a car be permitted to leave the shop when leaks are known to exist which will affect the braking power of the equipment. Under no circumstances should a temporary connection be made to permit such car to leave the shop.

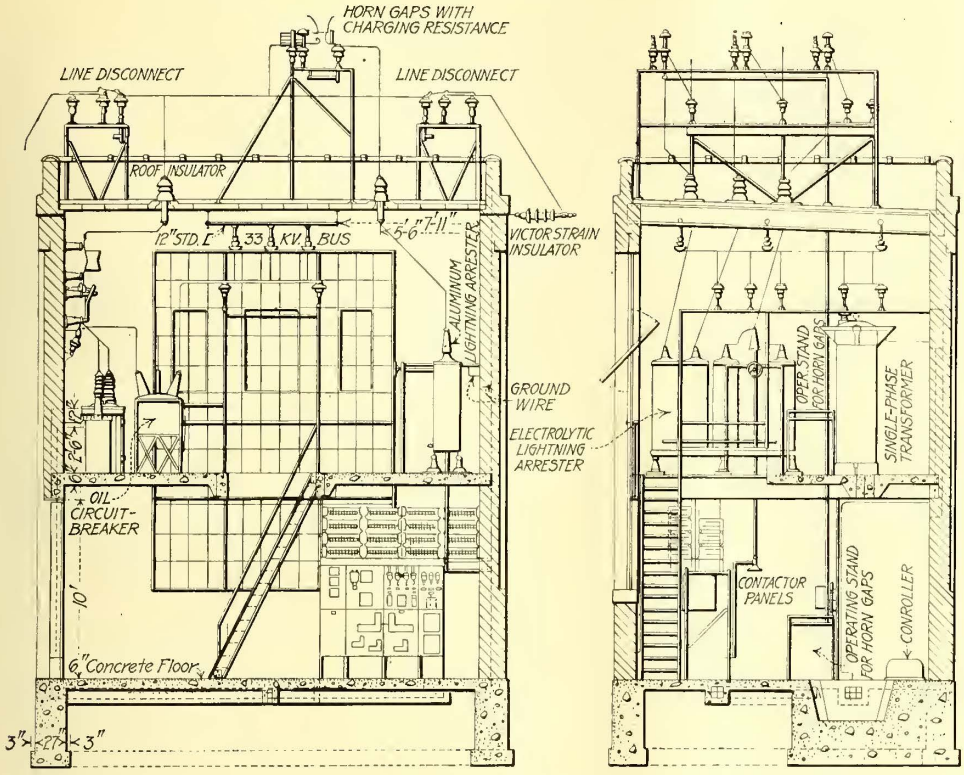
Space Saved by Double-Deck Arrangement in Automatic Substation

Features of Construction and New Equipment Which Reduce Cost and Improve Operation in Iowa Ry. & Light Co.'s New Substation

AN AUTOMATIC substation which the Iowa Railway & Light Company has recently placed in service for the purpose of feeding a section of its interurban railway lines, contains several distinct features in substation design. The building itself is of double-deck construction, and all space is economically utilized. The high tension lines coming to and leaving the station are dead-ended on suspension insulators attached to the building walls instead of the more general plan of ending them on pin-type insulators attached to the racks. The section switches and lighting arrester horn gaps are on the roof. The transformers, lightning arresters and oil switches are on the second floor. The rotary converter and all control equipment, including the handles for operating the section switches and arrester charging equipment, are all on the ground floor, which reduces the amount of stair climbing. The direct-current feeders leave the station underground. The building occupies a space measuring only 25½ ft. x 21½ ft. outside and aside from the economies resulting from the use of shorter copper leads, a considerable saving was effected in its construction over similar buildings.

Other features of the station include the use of a new type of flash-over-proof rotary converter rated at 500-kw. and insulated for 1200 volts, although now operating at only 600 volts. Extra lightning protection was provided by placing aluminum cell lightning arresters on each of the two outgoing 600-volt lines as well as on the direct-current bus. An endeavor was thus made to provide a bypass for the lightning that will be sure to stop it before it enters the control equipment.

Another feature is the method of connecting various sections of the grid resistors by short pieces of bus.



DETAILS OF AUTOMATIC RAILWAY SUBSTATION

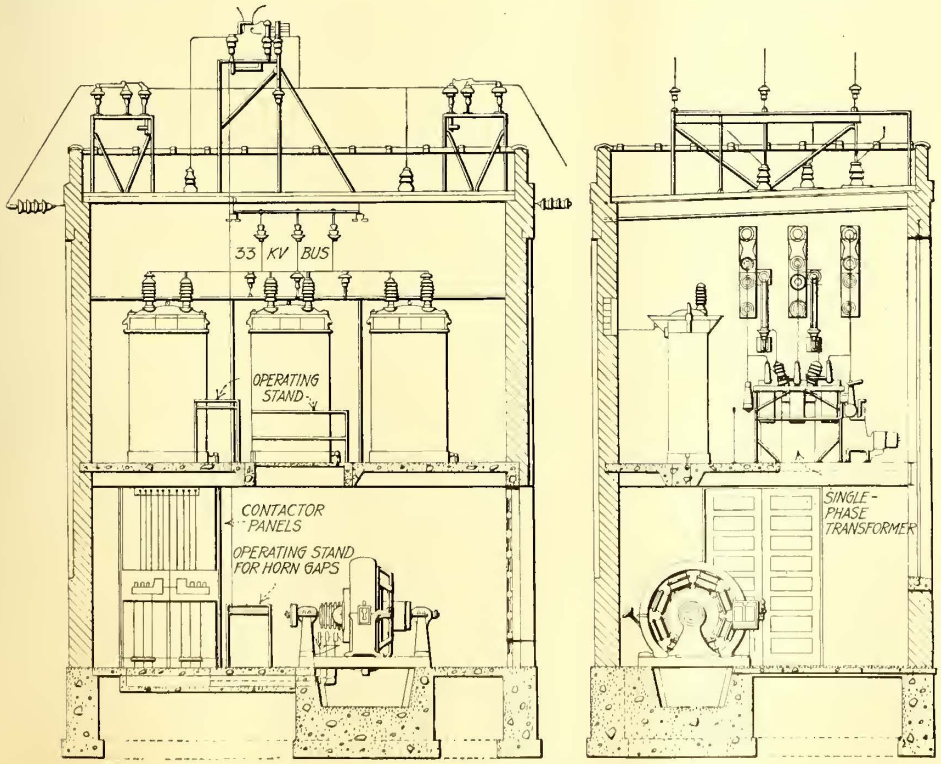
copper instead of pieces of cable. This method of construction saved considerable time in the original installation by simplifying the soldering of the different connections. They will also be much easier to maintain than cable connections.

The drum controller which actuates the contactors of the automatic control is of a new type having the spindle horizontal instead of vertical. The method of bringing the operating handles of the section switches and the lightning arrester charging equipment down to the ground floor level to reduce the amount of stair climbing and to keep employees away from the high-tension equipment is also of interest.

A special feature in the alternating-current control apparatus is the use of a new type of quick-opening relay. Another new piece of equipment which will probably be tried out after the substation has been in operation for a time is a time-limit device designed for controlling the starting of the station under such abnormal conditions as might be imposed upon it by the operation of a work train in the near vicinity of the substation.

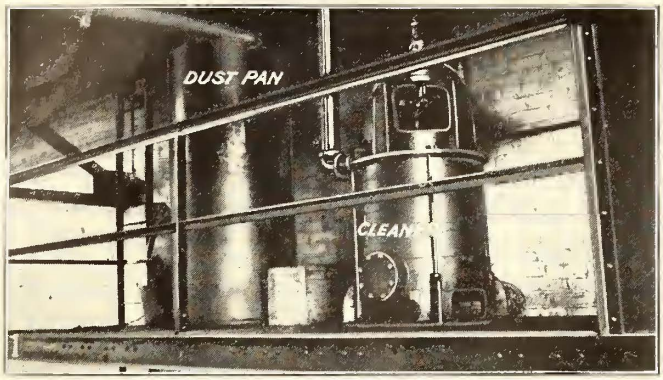
From the accompanying drawings of the station it will be observed that apparently no provision has been made for handling the transformers within the building. There is, however, a standard 12-in. I-beam in the ceiling of the top floor located immediately over a grating in the floor of the second story. By attaching a large chain hoist to this I-beam it is possible to lower any transformer to the ground level where it may be removed from the building through large double doors.

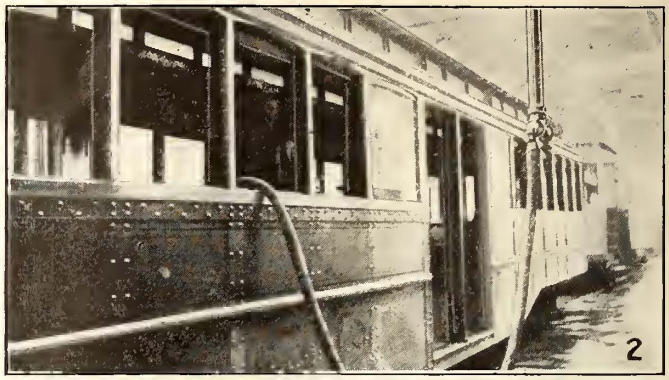
The chain hoist is not installed permanently in the substation but is kept at the main power house, where it may be obtained for use at any point on the system. The substation was designed by John M. Drabelle, electrical engineer for the Iowa Railway & Light Company.

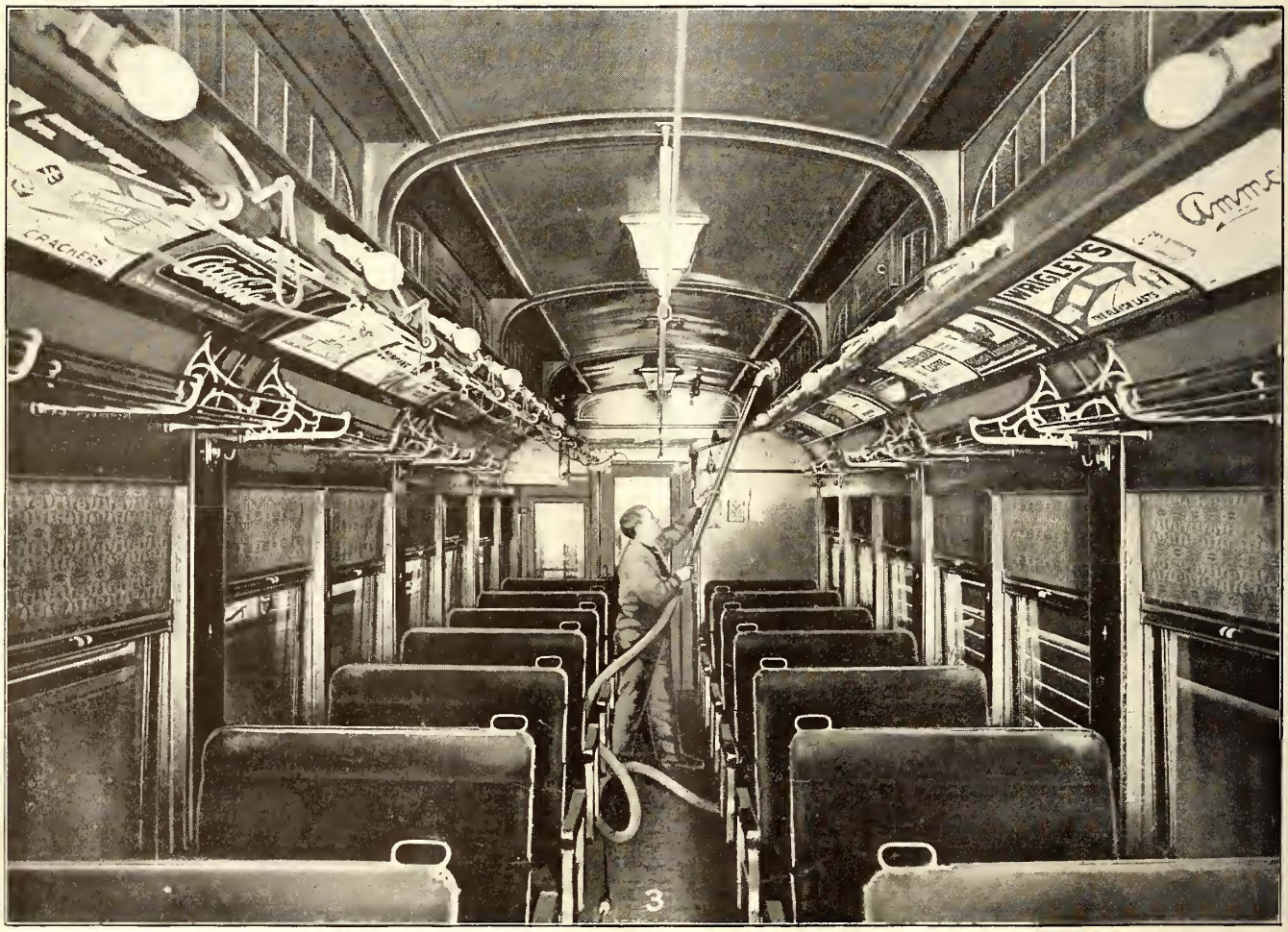


SECTIONS THROUGH DOUBLE DECK SUBSTATION

As rolling stock comes through the shops for overhaul, the Dallas (Tex.) Railway is rewiring the cars and refinishing the interior. Instead of four circuits of five 23-watt lamps, the altered cars have two circuits of 36-watt Mazda lamps running down the center line of the roof. Thus ten sockets are saved, and the energy consumption for lighting is changed from 460 to 360 watts. To improve the diffusion of light, the headlinings are removed, and the ceilings and the carlines painted white. The sockets for the new lamps are set in a white board which runs the length of the car.







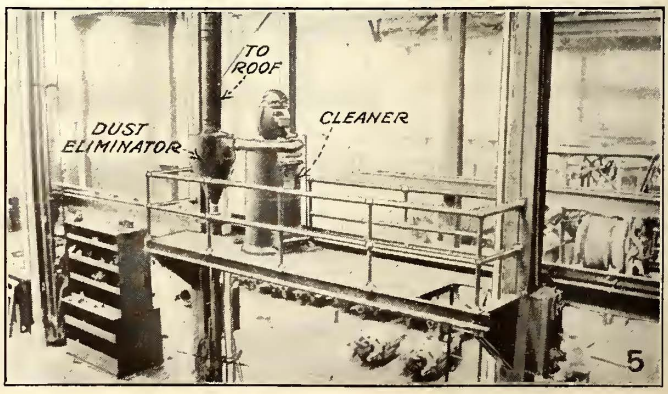


Fig. 1—"Tuec" turbine cleaner mounted near the roof—wash room Cleveland Railway

Fig. 2—Suction pipe line and flexible hose for cleaning car interiors at Cleveland

Fig. 3—Cleaning car interior with vacuum cleaner

Fig. 4—Cleaning motors by vacuum cleaner and air blast

Fig. 5—Vacuum cleaner arrangement in Cleveland Railway motor repair shop

Vacuum Cleaning Equipment for Railway Repair Shops

Vacuum Cleaners Save Labor and Clean Inaccessible Places

Installation of Vacuum Cleaners in the Shops of the Cleveland Railway Make Cleaning More Efficient, Healthful and Pleasant

VACUUM cleaners have been used in the shops of the Cleveland (Ohio) Railway for nearly twenty years and have given great satisfaction both in the saving of labor and in the thoroughness of the work performed. Two "Tuec" turbine cleaners of the stationary type are in use and were furnished by the United Electric Company.

One cleaner is used in the washroom of the paint shop to remove dust and dirt from car interiors prior to painting and varnishing. Seats, window pockets and all spaces inaccessible to a broom or brush are thoroughly cleaned. In this installation the cleaner is mounted at the middle of the shop on a platform near the roof and a suction header is run in both directions to the ends of the building. The layout is shown in Fig. 1 in which the cleaner is on the right. A single centrifugal fan at the top of the cleaner furnishes the suction and is driven by a vertically mounted motor controlled from the floor. The dust tank is shown on the left with the so-called permanent line at the top. Heavy particles of dirt deposit within the cleaner, while the dust and the lighter particles of dirt are carried across to the dust chamber. The exhaust air is carried above the roof of the building when it is discharged. The only wearing parts of the machine are the upper and lower bearings on the motor shaft, and these operate in a constant oil bath.

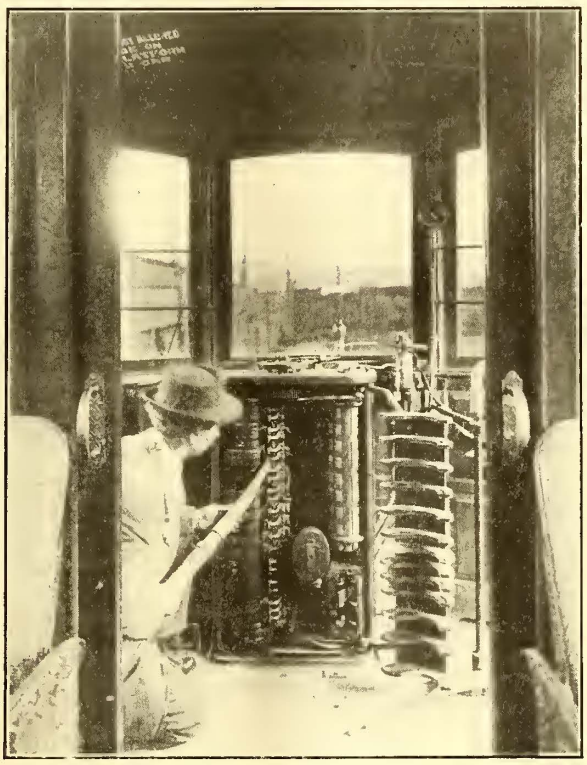


FIG. 6—CONTROLLER BEING CLEANED IN POSITION ON PLATFORM

The permanent line connects with the suction header previously mentioned and from this drop lines extend down to within 7 ft. of the floor. These drop-line pipes, as shown in Fig. 2, have at the lower end a fitting to receive the end of a flexible suction hose. In this way the whole room is served by a minimum length of hose.

The other cleaner is in the motor repair shop, where it is used to remove dust and dirt from motor frames preparatory to overhauling. This machine is of the same general type as that already described and is located in a similar position.

The operation of the motor repair shop cleaner differs somewhat, however, from that of the washroom cleaner. The motor to be cleaned is placed on a grating over a small pit in the shop floor, the pit being connected to the suction end of the cleaner. A hood made of canvas stretched on a light frame is placed over the motor as shown in Fig. 4, and an air jet is directed against the motor frame through openings in the top and sides of the hood.

The dirt thus loosened is carried to the cleaner through the suction line. The heavy particles deposit in the cleaner and the dust is washed into a settling basin under the shop floor by means of a water spray inclosed in the eliminator shown at the left of the cleaner, Fig. 5. This spray and the motor are controlled from the shop floor. The air exhausts to the roof of the building and the water runs to the sewer. The dust remains in the basin until a sufficient quantity collects to necessitate removal.

Before installing the cleaner the dust and dirt cleaned from the motor frames filled the air and made the work extremely disagreeable. Under the present arrangement there is no dust in the work room and conditions are therefore much more healthful for the men. The same is true when cleaning the car interiors. Aside from the cleanliness and more pleasant and healthful conditions resulting from the installation of the cleaners, it is possible to do the work more thoroughly, in a much shorter time, and with a materially reduced force. In cleaning car interiors and equipment parts installed on the car body a flexible hose is attached to the permanent drop lines. This hose is of sufficient length to reach all parts of the car and is provided with the necessary fittings for attaching to the permanent line and for cleaning the various parts. Accompanying illustrations show the method used in cleaning a car interior and a controller located on the car platform. The apparatus is particularly adapted to reaching inaccessible and out-of-the-way places that ordinarily would not receive attention, and is more sanitary than other methods.

Cars to Be Battleship Gray

THE cars of the Virginia Railway & Power Company are to be painted a battleship gray. President Wheelwright states that but from three to four days will be consumed in painting the cars the new color while formerly the painting and revarnishing took as many weeks. Not only will the use of battleship gray paint be more economical, but the efficiency of the system will be increased as cars will not be withdrawn from service for such long periods of time as would otherwise be necessary.

The long-standing tradition that electric railway cars must be painted and varnished much like a piano is not in harmony with these times when efficiency and economy count for more than ever before.

Well Attended Meeting of C. E. R. A.

The Convention Was Held at Cedar Point and the Discussion Centered on Labor, Automatic Substations and Publicity

THERE was a good-sized gathering at the annual summer meeting of the Central Electric Railway Association, held at Cedar Point, near Sandusky, Ohio, on July 17-18. Many of the delegates came as usual on through-routed electric cars from different points in the Central States.

At the meeting of the executive committee on Wednesday morning the election was announced to the committee of W. S. Rodger, general traffic manager Detroit United Railway instead of E. J. Burdick of the same company. The Central Electric Railway Accountants' Association also held a short informal meeting at which no papers were presented.

At the regular meeting of the association G. K. Jeffries, Terre Haute, speaking for the joint interline folder committee, reported inadequate support from the companies of the folder now in use, and Secretary Neereamer was requested to canvass the membership asking for increased orders for folders or any suggestions which would improve their usefulness.

An address was scheduled after the reports of the committees by H. O. Bentley, general attorney, Western Ohio Railway, Lima, but he was unable to be present. H. A. Nicholl, Union Traction Company of Indiana, then presented an interesting paper on the labor situation. It will be published in abstract next week. The paper was followed by a spirited discussion on the labor problem. The association then passed a resolution of sympathy for former President E. T. Peck, on account of his illness.

SUBSTATION AND PUBLICITY DISCUSSED

In place of the program printed for Thursday, G. Dorticus, General Electric Company, spoke informally on the battles of the Marne and Verdun. He also outlined the history of automatic substation developments and answered numerous questions as to their present status, difficulties, costs, etc. Harry Rimelspach, claim agent, Lake Shore Electric Railway, then spoke on the opportunities offered to the claims departments of the railway companies to improve railway efficiency, closing with a patriotic appeal to electric railways to do all they can to help win the war.

E. R. Kelsey, publicity agent, Toledo Railways & Light Company, gave an enthusiastic talk on railway advertising, showing how the best advertising assets are a company's own employees and that car space campaigns must be continuous, not fitful or for special propaganda. Any live railway, he said, bristles with news which the newspapers are glad to get as such, but advertising in the guise of news is not welcome. Any good salesman can write good copy if he will put himself into it.

The convention entertainment consisted of an informal baseball game between the railway and the supply men in the afternoon, which the latter won. A very popular feature of the entire convention was patriotic music by a mixed quartet under the direction of J. F. Starkey, general passenger agent, Lake Shore Electric Railway. The next meeting of the association will be held at Indianapolis on Thursday, Nov. 21.

LETTER TO THE EDITORS

Factors in Purifying Turbine Lubricating Oil

THE RICHARDSON-PHENIX COMPANY

NEW YORK CITY, July 8, 1918.

To the Editors:

The writer read with much interest the excellent article by Hartley Le H. Smith on "Keeping Power Plant Oil in Good Condition," which appeared in your June 15 issue.

Most engineers believe that an oil filter in connection with a steam-turbine oiling system is simply to remove grit and dirt. If this were the case very few filters would have to be installed in steam-turbine generating stations. However, due to oxidation taking place in the oil and causing the flocculent deposits, of which Mr. Smith's article treats, it is almost imperative in steam-turbine practice carefully to consider the matter of oil purification. Mr. Smith says the ordinary bag type of engine oil filter could not be successfully used for steam-turbine oil purification, and with this statement the writer agrees thoroughly. Mr. Smith suggests that the filter press, which he has seen used in one instance, is admirably suited for this class of work. The writer would like to modify this, however, as he believes that most engineers will appreciate the fact that if oil is forced through any kind of filtering medium under heavy pressure there is the possibility that suspended foreign matter will be carried through with the oil.

For this reason the type of filter made by this company has been proved to be more satisfactory than a pressure type of filter, as the oil is forced through the filtering media by a comparatively low pressure. In fact, it is designed so that the oil practically gravitates with just enough force to carry it through to the clean oil side of the filter.

The five requirements for a suitable oil filter in the modern power plant are: (1) Means for reducing (if necessary) the viscosity of the entering oil. (2) Ample precipitation area. (3) Water removal facilities. (4) Vertical cloth system of dry filtration. (5) Multiple-unit design to facilitate cloth changes without interruption of operation.

As a rule it is not necessary to heat the oil drawn from a steam turbine, but it is always advisable to put coils in a filter, especially if it is of the batch type, so that if the charge of oil has been withdrawn from the turbine oil tank and not immediately used, heat may be applied at some subsequent time when it is desired to begin the process of filtration. The fourth item should be explained by stating that, on account of the evenness of the texture of cloth and the fact that there is no chance of "channeling" (as with the use of waste, Fuller's earth, or bone black, or other loose filtering media), it should be employed and should always be in a vertical position, so that the direction of flow of oil as it is being purified is horizontal. This will prevent "caking" of the foreign matter on the filter cloth, which would be the case if the latter were in a horizontal position. Furthermore, no water should be used for the so-called "washing" of oil.

EDWIN M. MAY.

News of the Electric Railways

TRAFFIC AND TRANSPORTATION

FINANCIAL AND CORPORATE • PERSONAL MENTION • CONSTRUCTION NEWS

Indictments in St. Louis

Disappearance of Franchise Referendum Petition Results in Proceeding Before the Grand Jury

Bruce Cameron, superintendent of transportation of the United Railways, St. Louis, Mo., was indicted on July 8 for second degree burglary and larceny by the grand jury in that city. The indictment is based on the alleged connection of Mr. Cameron with the forcible opening of the safe in which the Citizens' Referendum League had stored petitions for a vote of the people on the United Railways franchise settlement bill, passed on March 29 by the Board of Aldermen. Mr. Cameron promptly gave bail.

The following day Mr. Cameron made a public statement. He said in part:

Mr. Cameron Proclaims His Innocence

"I have been indicted upon the evidence of one Jackson, who confesses he committed the deed himself, and of which I am innocent and had no knowledge or connection. I have been in the employ of the United Railways for twenty years, giving nothing but faithful and honorable service. My case will be tried in court, where my innocence will be established. In the meantime I do not wish to cause any embarrassment to the company; therefore, you may consider my resignation at your pleasure."

This statement, although made primarily to the directors of the railway, was given out for general publication. The reference to his resignation from the company had to do with Mr. Cameron's acceptance of an important post with the International Railway, Buffalo, N. Y., which position it is expected he will assume as soon as the charges against him in St. Louis have been removed. The directors of the company accordingly decided to allow the resignation to lie on the table pending the determination of Mr. Cameron's innocence by the trial court. In the meantime the referendum league prepared other petitions and filed them with the proper authorities.

No Presumption of Guilt

Richard McCulloch, president of the company, made a statement in which he said:

"The directors would rather take Mr. Cameron's word than that of Jackson, a man in a shady business and a confessed crook. The indictment of Mr. Cameron, under the circumstances, is only ex-parte presentation and does not afford a presumption of guilt."

In an interview which he gave on July 9 Circuit Attorney McDaniel is reported to have said:

"Early in April, Jackson said Mr. Cameron told him that he must see to it that the preliminary referendum petitions, containing the signatures of 2 per cent of the registered voters, should not be filed. If the filing of these petitions had been prevented, further steps toward a referendum would not have been possible under the charter. May 9 was the last day for filing the 2 per cent petitions."

A renewal of the application for a receiver for the company is referred to on page 128.

Wage Advance in Kansas City

The Kansas City (Mo.) Railways announced to its employees that an increase of 5 cents an hour would be granted coincident with the establishment of the 6-cent fare on July 15. Further increases will be a matter of negotiations under the direction of the War Labor Board.

The company made the promise of the 5-cent increase subject to the granting of increased fare. The union refused the 5-cent offer. Another organization of employees not affiliated with the union asked the company to institute the 5-cent increase pending further negotiations over wages. This request was responded to favorably by the company.

This second organization of employees is known as the "Kansas City Railways Employees' Brotherhood." It consists of about 400 men. There is also an auxiliary of this brotherhood known as the "Kansas City Railways' Women Employees" which includes most of the women who have been recently put to work by the railway company.

The increased wages will apply only to employees on the Missouri division. There are two divisions in Kansas, including about 400 trainmen. These men will receive no increase under the arrangement announced, as the 5-cent advance is due entirely to the increased fare—and the increased fare applies only to Missouri. The fact that the railway is short of employees on the Missouri side suggests that Kansas employees are likely to seek work on the Missouri division and as a result the Kansas service may suffer.

Any negotiations taken up by the War Labor Board will of course apply to both Kansas and Missouri, but the increase to the trainmen in Kansas will doubtless be conditioned upon increased fare similar to the advance made in Missouri.

Wage Increase in Denver

Without Waiting for Increased Fares, Denver Tramway Adds $240,000 to Yearly Payroll

As a result of delay in action on the petition of May 3 of the Denver (Col.) Tramway to the State Utility Commission for an increase in fares to 6 cents the employees have become anxious concerning the wage increase to which the company had advised them they were entitled. The condition has been augmented by a storm of protest raised by the public against the increase in telephone rates, which has been followed by controversy and delay, by the dispute of the city and the State over the jurisdiction of the Public Utility Commission in rate-making cases and by a misunderstanding of items concerning the attitude of the government in regard to the questions of fare increases and the authority of the War Labor Board.

The trainmen have been encouraged and led on by labor representatives until they believed that an increase in fare would be indefinitely postponed and that before any recognition of their needs would be taken by the War Labor Board it would be necessary for them to unionize. The men believed that such a step would benefit the company in its petition for a fare increase and accordingly without confirming this by meeting with the company officials the wage committee called a meeting of the men for July 17.

As soon as the company received word of this action a statement was issued by F. W. Hild, general manager, in which he said that because of progress made in the fare increase case and confidence in the justness of the cause the following increase would be granted to take effect on or prior to Aug. 15: 6 cents an hour in pay of trainmen and shopmen; 5 cents an hour in scale for employees of the engineering department and for employees of other departments.

This step was taken in the hope that radical action on the part of the employees would be withheld. In spite of the announcement, the meeting was held and a large number of the trainmen organized and affiliated themselves with the Amalgamated Association.

With the increase just granted, the pay of the employees has been advanced 35 per cent since June 1, 1917. The present increase adds to the payroll $240,000 a year and makes the scale for the trainmen 34 to 40 cents. If the petition for a 6-cent fare is granted it is estimated that the revenue will be increased only $325,000.

Troubles Pile Up Before Boston Trustees

Quick to Realize Advantage of Full Publicity New Officials Go On Record Regarding Their Problems

The trustees of the Boston (Mass.) Elevated Railway issued statements on July 9 and 12 dealing with problems before them for settlement. The one of July 9 was referred to in the ELECTRIC RAILWAY JOURNAL for July 13. It was preliminary in its nature, but it indicated plainly that the trustees would have no option in the future than to make a substantial increase in fares. After reviewing fare applications pending and those granted elsewhere in Massachusetts and in the other states the company said in part:

"The trustees find the elevated road is no exception to the general case throughout the country, and in the analysis that they have and are making of the property they find that for the first five months of this calendar year there has been a deficit below fixed charges of $233,719, or at the rate of $560,900 a year.

"The trustees are confronted with a problem that they are compelled by the action of the last Legislature so to adjust the fares as to meet all operating expenses, taxes, rentals, interest on all indebtedness, allowance for depreciation and all other expenditures together with fixed charges on the new preferred stock recently issued as well as $5 per share on the common stock, this latter amounting to $1,194,000.

"One cent an hour increase for every employee of the company is equivalent to approximately $250,000 a year increase in the company's payroll. The total payroll for the company last year was $9,035,000. It can readily be seen, therefore, that any slight increase in fare or slight modification of tariff will by no means meet the situation, and, in view of the fact that they are compelled by the act to charge such fares as actually to meet the cost of service, they will have no option in the immediate future than to make a very substantial increase in fares.

"The case is serious, however, and requires prompt action. The trustees anticipate continuing their study of the situation with a view to ascertaining, if possible, whether some still more equitable and improved method of increasing the revenue can be devised. Any delay, however, at this time resulting from an extended survey or study of the general fare situation would be decidedly injurious, from the standpoint of carrying out the terms of the act in furnishing as good transportation as possible.

"Estimated increases in cost of operation, including dividends and depreciation for the ensuing year which are absolutely certain, making no allowance whatever for increased cost of material, increased income taxes, increased standard of maintenance, etc., or any provision for the necessary increase in rates of wages of employees, amount to more than $4,200,000.

"When it is recognized that 1 cent increase of the flat unit of fare, assuming that as many cash passengers ride the ensuing year as rode last year, would amount to $3,650,000, it can readily be seen that the situation demands prompt and strenuous action.

"The trustees, of course, expect to do everything within their power to reduce operating expenses and to bring about any economies consistent with good service. They are convinced, however, that the opportunity for such economies from the standpoint of large savings is not sufficient for the present, substantially to affect any revised tariff which may be necessary to meet the increased charges. The trustees realize that any delay in properly facing the facts at the outset merely piles up trouble for the future, as all charges under the act commenced July 1, 1918, and the dividends on all stock outstanding, together with fixed charges, rentals, taxes, bond interest, etc., including higher wages, must all be paid by the company securing ample revenue by means of increased fares.

"The trustees fully expect to take definite action on the fare question in the immediate future and sincerely hope that the public as a whole, who indicated their desire for public management by the action of the recent Legislature, will give the trustees every conceivable co-operation and benefit of doubt and show sufficient patience to permit them to work out a most difficult and trying situation."

The statement issued by the trustees on July 12 follows in part:

$2,000,000 WAGE INCREASE

"The trustees at a meeting held yesterday, in addition to taking up the question of the request of the carmen's union for an increase in their rate of pay, further studied the question of what action it seemed best to take with regard to increasing the fares.

"They find that the gross receipts of the company from all sources for twelve months ending June 30, 1918, were $19,407,000 and that the operating expenses were $14,132,668. If the same rate of increase per hour for employees were given as was allowed by the arbitrator in the case of the Springfield, Worcester and other properties, that is, approximately 8 cents an hour, there would be an increase in wage expense of $2,000,000.

"Summing up, therefore, the trustees are confronted with the necessity of securing gross revenue of at least $25,560,270 to continue present facilities, which compared with the earnings of last year of $19,407,000 leaves, without regard to increased cost of material, taxes, fuel, etc., or possible increases in wages in excess of that granted in other cities, approximately $6,200,000 to be secured.

"The only source of revenue that the trustees have is from car riders and therefore they are compelled by law to charge such fares as will earn a sufficient amount to meet all of the above additional charges.

"There are other items of increases this year over last year which it is impossible to estimate, such as increase in cost of coal, increase in cost of material, unknown increases in taxes, etc.

"In studying the situation the trustees are confronted with the fact that they are compelled to pay either a return or rental on a subway investment of $43,678,734. So far as they know the general practice in other cities where subways are constructed is for the railway to pay interest on the bonded indebtedness of subways only after having paid all other operating expenses, fixed charges and dividends. Of the total investment in subways on which a return must be earned $9,084,080 is for the Cambridge subway, which is owned by the company. The remaining investment of $34,594,654 is for subways owned by the city of Boston. The total amount that the trustees must pay during the next twelve months as a result of the subway construction is therefore $1,898,826."

Another Subway Link Opened

Temporary operation of the new Lexington Avenue subway, from Forty-second Street and Park Avenue, Manhattan, to 167th Street station on the Jerome Avenue branch, was begun on July 17, at 2 p.m. The arrangements for the opening of this part of the new rapid transit lines in New York City were perfected as a result of almost daily conferences recently between the special committee of the Public Service Commission on operation of the "H" lines, and officials of the Interborough Rapid Transit Company. It will be some weeks, however, before the necessary track arrangements will be completed at Times Square and Grand Central station to permit the through operation of the new Lexington Avenue line in connection with the old subway south of Forty-second Street and the new Seventh Avenue subway in connection with the old subway north of Forty-second Street.

For the present, service in the Lexington Avenue subway will consist of six-car trains using the local tracks. Beyond 167th Street on the Jerome Avenue branch service will be had by elevated trains operating to and from the Sixth and Ninth Avenue elevated lines via the new 162nd Street connection, except that north of Kingsbridge Road station the service will be by shuttle to and from Woodlawn.

The Lexington Avenue subway has been in course of construction for several years. It will cost completed about $58,800,000, including the equipment furnished by the Interborough Rapid Transit Company. It represents about 6.25 linear miles of subway but adds 23.6 miles of track to the new lines of the dual system in operation.

Labor Board Hearings

At Various Hearings Before Examiners the Companies Present Testimony Regarding Local Conditions

During the last ten days examiners of the War Labor Board have been holding hearings in various localities in order to secure supplementary evidence in the twenty-eight pending electric railway cases. Previously, as noted from time to time in this journal, evidence bearing upon the general labor situation in the industry had been presented before the joint chairmen, William H. Taft and Frank P. Walsh. The purpose of the present hearings before the examiners is primarily to bring out facts showing in what way, if any, the labor conditions in particular cities differ from the general situation.

New York Hearing Adjourned

As mentioned briefly in last week's issue, a hearing was held in New York City on July 12 in reference to the demands of employees in Buffalo, Albany, Schenectady, Rochester, Newark and Trenton. The representatives of the men in general rested their cases upon the brief prepared in the Cleveland and Detroit cases, while the railways made arrangements to prepare briefs on any important local points and submit these to the board by July 20 if possible. On July 22 Messrs. Taft and Walsh have scheduled a hearing for the presentation of general economic testimony by the Public Service Railway, and the board desires to have all the briefs in hand before that time. Representatives of Newark employees expressed the intention of filing a supplementary petition to ask for a 60-cent-an-hour rate.

In the Trenton case, Gaylord Thompson, vice-president and manager of the New Jersey & Pennsylvania Traction Company, explained that the conditions in his company's territory are in no way similar to those in Newark. His company operates through a territory largely agricultural in character, with 75 per cent of the service in Pennsylvania. The operating rate is from 70 to 75 per cent under normal conditions because of the low traffic. Mr. Thompson said that the men demanded an increase of 9 cents to 40 cents, but that a rate of 35 cents offered by the company would exhaust the revenues.

Chicago Evidence Submitted

Examiners on July 13 and 15 took evidence in Chicago to be used in determination of wage scales for employees of the Chicago Surface Lines, the Chicago Elevated Railways, the Chicago & West Towns Railway and the Evanston Railway. The proceedings consisted mostly of the introduction of briefs and other exhibits pertaining to the financial condition of the companies. Examiner John A. Henderson said that he understood it is the intention of the board to provide first a living wage for the employees and after that try to help the companies meet the added expenses.

W. W. Gurley, general counsel of the Chicago Surface Lines, said he would not contest the right of the men to a proper wage. He thought it would be useless, however, to seek the necessary higher rate of fare from the City Council. While he believed the Illinois Public Utilities Commission had the right to regulate fares in Chicago, relief from that source would probably be delayed for a long time if it was found necessary to fix a valuation for the properties. He said it took six months to do this in 1906 when the value was placed at $50,000,000, and it would undoubtedly take much longer now when the value is about $155,000,000.

A. L. Gardner, attorney of the Chicago Elevated Railways, made a short statement in explanation of the brief submitted. He contended that every cent per hour increase in wages would cost $129,562 a year. F. H. McCulloch, attorney for the Evanston Railway, argued that while his company had always paid wages similar to those of the Chicago company there was no justification for this. He made the point that Evanston is a city of homes, with working conditions most agreeable, and that no other company of similar size pays the men so well.

Willard McEwen, attorney for the West Towns company, suggested that the fare level throughout the United States be raised to 10 cents and that all surplus after paying expenses and return on investment be retained by the government. This, he said, would be a proper way of distributing a war tax, as the majority of people patronize car lines. He contended that even a 6 or 7-cent fare might not be sufficient to meet the continual increase in costs.

June 15 was taken up with the testimony of union officials as to the nature of employment of the various classes of employees.

Similar hearings before examiners were held in East St. Louis, Ill., on July 13, in the Galesburg and East St. Louis cases, and in Columbus, Ohio, on July 17, in the Elyria, Cleveland and Columbus cases. Hearings in the Portland, Ore., New Orleans, La., and Jacksonville, Fla., cases will be held in Washington, the exact dates to be announced later.

U. S. Housing Corporation Created

The Department of Labor announces the creation of the United States Housing Corporation, which will, in a large measure, take over the functions that are now being performed by the bureau of industrial housing and transportation. It is expected that this new vehicle will afford more facility in operation than would be possible under the usual governmental agency.

The executive officers of the corporation are: President, Otto M. Eidlitz; vice-president, Joseph D. Leland; treasurer, George G. Box; secretary, B. L. Fenner.

The stock is held on behalf of the government by the Secretary of Labor.

Two Weeks More Needed

Special Counsel Fisher Hopes by Aug. 1 to Complete Draft of New Chicago Merger Ordinance

Eleventh-hour opposition to the proposed ordinance for the merger of the surface and the elevated lines in Chicago and for a subway system in that city almost led to the shelving of the pending plan during the week ended July 13. At a meeting on July 15, however, the members of the local transportation committee decided to continue with their work until a satisfactory report is completed, with the hope of having the City Council approve it before adjournment. Another development at this meeting was the decision to give serious consideration to the trustee plan of Special Counsel Fisher with a view to having "service-at-cost" features worked into the measure in such shape that the companies may find it acceptable.

Hopes of M. O. Crowd Raised

Several obstacles were presented without any previous hint of delay to the program, which had been debated for many months by the committee. The municipal ownership element had been silent for some time, but hope for some of their plans was kindled anew with the proposal of Attorney Fisher that the constitutional barrier against such a scheme could be overcome by having the transporation lines taken over by a trustee corporation "not for pecuniary profit" but in reality for municipal operation. This plan was outlined in the ELECTRIC RAILWAY JOURNAL of May 4, 1918. The sub-committee thought it impracticable and decided to go ahead with the franchise to the existing companies. They reached the point a few weeks ago where all essentials had been practically agreed to and the final drafting of the measure was being worked out by the lawyers.

Draft Work to Proceed

At the committee meeting of July 15, Attorney Fisher said it would require about two weeks to complete the draft of the franchise. The Aldermen told him and the companies' representatives to go ahead with the work and an effort would be made to prevent adjournment of the Council. At the same time Mr. Fisher was asked to present his trustee plan in the form of an ordinance. This he said could be done with little delay. He had overcome one of the points of previous objection by providing that the first board of trustees be selected by the companies and the City Council for a period of eight years—or beyond the date of expiration of the Surface Lines ordinances. He also proposed that the properties be taken over subject to existing liens under a guarantee of present interest rates on bonds and 7 per cent on capital stock. Fares would be raised if necessary to meet these payments, thus giving service at cost. The financial part of the Fisher plan did not appeal to the companies, but Presi-

dent Busby said he would consult the owners of the properties and thought that a solution could be worked out by mutual concessions.

War Bonus in Indianapolis

An increase of 3 cents an hour in the wages of motormen and conductors, in the form of a war bonus, was announced by the Indianapolis Traction & Terminal Company, Indianapolis, Ind., on June 29, the new rate to go into effect on June 30. Robert I. Todd, president of the company, stated that while the company had been losing money under its present rate of fare, and had so far been unable to secure any relief from the city or State authorities, the men were entitled to an advance in wages, as they had been working long hours to maintain the service, which had been difficult owing to the shortage of men. The new wage scale in cents per hour follows:

Less than six months' service	25
Six months and less than one year	26
One year and less than two years	27
Two years and less than three years	28
Three years and less than four years	29
Four years and less than five years	30
Five years and less than six years	31
Six years and less than seven years	32
Seven years and over	33

Three-Cent Wage Increase

The Philadelphia (Pa.) Rapid Transit Company is now experiencing large increases in gross passenger revenues and the management has therefore decided to further anticipate the increased fare and make effective at once the remaining advance in the rate of wage promised to its employees of 3 cents an hour which represents an added charge of more than $1,000,000 to the annual payroll of the company. The new wage scale for motormen and conductors is as follows: New men, 38 cents; second year, 39 cents; third year, 40 cents; fourth year, 41 cents; fifth year, 42 cents; after five years, 43 cents.

Early in May of this year the employees of the company petitioned the management for an increase in wage of 5 cents per hour, at the same time requesting that application be made to City Councils for an increase in fare to provide sufficient gross revenues to make this large wage advance.

Effective as of May 16 an increase of 2 cents an hour was granted to all employees in anticipation of the increased fare, this wage advance representing an addition of more than $700,000 to the annual payroll. City Councils on June 20 by resolution referred all procedure in the matter of an increased fare to the Public Service Commission on account of the fact that the new contract between the city and the company now pending before the commission contains provisions for changes in rate of fare, and also in conformity with the ruling of the Attorney General of the State of Pennsylvania that the sole power to regulate fares is now vested in the Public Service Commission.

News Notes

Manchester Wage Matter Settled.—Motormen and conductors employed by the Manchester (N. H.) Street Railway have accepted the offer of the company of an increase in wages of 4½ cents an hour, which was made following a demand by the men for a substantial increase.

Wage Increase in Princeton.—The motormen and conductors of the Princeton Power Company, Princeton, W. Va., have been granted an increase in wages of 5 cents an hour. The operatives on the Princeton-Bluefield interurban lines are advanced from 30 to 35 cents an hour and those on the city cars are to receive an advance of from 25 to 30 cents an hour. The men received an advance of 6 cents an hour six months ago.

Will Oppose Commission Assuming Authority.—The executive board of the Kansas League of Municipalities has adopted a resolution authorizing its officials to oppose assumption of authority over utilities by the State Public Utilities Commission. Richard J. Hopkins, Garden City, Kan., president of the League, will probably take an active part in any controversies wherein the question is the exercise of authority with reference to rates by public service commissions when clauses governing such matters are included in franchises or contracts granted by the municipalities.

City Retaliates by Cutting Power.—Because the Henderson (Ky.) Railway refused to pay street oiling taxes amounting to more than $3,000 which have accumulated during the last four years, the City Council ordered the current supplied to the railway from the municipal plant discontinued. When asked what steps would be taken by the company in the matter, John C. Worsham, Henderson, attorney for the company, said the city cars and the interurbans would stop running. A formal demand has been made on the city officials to furnish power to operate the cars.

The New Little Rock Scale.—The contract of the Little Rock Railway & Electric Company, Little Rock, Ark., with its trainmen, referred to in the ELECTRIC RAILWAY JOURNAL for June 29, page 1247, was entered into and became effective on May 22. The scale of wages prior to renewal of the contract was from 20 cents to 29 cents an hour. The new scale is from 30 cents to 37 cents an hour. The contract further provides for a ten-hour basic day with time and a half for overtime, and time and a half for the following holidays: July 4, Labor Day, Thanksgiving and Christmas.

Strike in Anniston.—Following the refusal of the Alabama Power Company, Anniston, Ala., to grant an increase in the wage scale of the motormen and conductors, the men ran the cars into the carhouse on July 1 and abandoned their runs. The men asked 25 cents an hour for the first year with an increase of 2 cents an hour up to the sixth year of continuous service. The matter was adjusted by compromise and the men returned to work on July 4. The men will receive 1 cent less than the minimum asked for the first six months. The scale of wages demanded by the men beyond the first six months has been granted by the company.

Increase in Pay on Municipal Line.—The platform men in the employ of the San Francisco (Cal.) Municipal Railway are to have their wages increased 50 cents a day as a result of a decision by the public utilities committee of the Board of Supervisors. This means an increase from $3.50 to $4. Car repairers will be increased from $4 to $4.50. Fred Boeken, superintendent of the railway, estimates the cost of this increase to the city as $10,648 a month. The men have agreed to work eight hours and twenty minutes instead of eight hours before charging overtime. This has led to a considerable discussion in San Francisco as to the desirability of inaugurating a 6-cent fare.

Examiners Wanted in Patent Office.—The Patent Office in Washington is in need of men or women who have a scientific education, particularly in higher mathematics, chemistry, physics, and French or German, and who are not subject to the draft for military service. Engineering or teaching experience in addition to the above is valued. The entrance salary is $1,500. Examinations for the position of assistant examiner are held frequently by the Civil Service Commission at many points in the United States. One is announced for Aug. 21 and 22. Details of the examination may be had upon application to the Civil Service Commission, Washington, D. C., or to the patent office.

Hog Island Line Opened.—At 2 p.m. on July 15 the Philadelphia (Pa.) Railways started operation into the Hog Island Shipyard of the American International Shipbuilding Corporation, Emergency Fleet Corporation. With the carpenters and painters still working on the prepayment gates partial operation was started with an 8-cent fare into South Philadelphia. Up to this time the bulk of the traffic has been handled by the shipbuilding corporation's own shuttle train and by workmen's trains on the Pennsylvania Railroad and the Philadelphia & Reading Railroad. These roads now handle about 28,000 people a day. No publicity was given the opening of the new line, but the cars were crowded. The very efficient police force of the Emergency Fleet Corporation facilitates loading.

Financial and Corporate

Dividend Postponed

Statement to First Preferred Stockholders at Worcester from President Dewey Explains Reasons

The directors of the Worcester (Mass.) Consolidated Street Railway postponed the declaration of the usual June 30 dividend of $2.50 per share upon the first preferred stock. A statement to the stockholders dated June 27 says:

"This action seemed to the directors advisable because of the recent great increase, amounting to about 24½ per cent, in the wages of the company's employees, resulting from the award of Henry B. Endicott, executive manager of the Public Safety Committee, to whom as arbitrator the decision of the proper increase in wages was submitted by the company and its employees. Payment of the wages on the new scale is effective beginning June 1.

"Application has already been made to the Public Service Commission for approval of an increase in the passenger rates charged by the company. Such an increase seems imperatively necessary to offset the largely increased operating expenses occasioned by the increase in wages. Pending a decision by the commission on this application it was deemed prudent to postpone the declaration of the dividend."

Company Hopeful

"Dividends on the first preferred stock are cumulative, and the general public recognition of the need of increased revenue for street railway companies leads the directors to hope that an early and favorable decision may be expected from the Public Service Commission, and that the increase of income will enable the company to pay the postponed dividend."

In 1917 the Worcester Consolidated Street Railway converted 36,000 shares, par $100, of common into 45,000 shares, par $80, of first preferred. The New England Investment & Security Company owns the entire common stock, now 33,260 shares, par $100, and a small amount of first preferred.

The Worcester Railways & Investment Company, which finally held all the stock of the Worcester Consolidated Street Railway, completed liquidation and distribution of its assets on Dec. 31, 1917. The New England Investment & Security Company being on that date the sole stockholder in the Worcester Railways & Investment Company received all the assets including the entire common stock and the small amount of first preferred stock of the Worcester Consolidated Street Railway.

The New England Investment & Security Company for several years has asked and received the indulgence of the owner of its coupon notes and the note holder has accepted for its coupons a part of their face in cash and a part in contingent obligations of the New England Investment & Security Company. The postponing of the Worcester Consolidated first preferred dividend will affect the payment of interest on its coupon notes, which so far have been held by one party, just to the extent that the dividend payment is delayed.

Committee on Capital Issues

W. F. C. Effects Permanent Organization in Federal Reserve Districts to Pass on Securities

The Capital Issues Committee of the War Finance Corporation has made a permanent plan of organization of the committees in each Federal Reserve district. Each district committee will comprise fifteen members selected from bankers and business men in the district. This reorganization takes the place of the temporary committees that have been serving since February.

The appointments to these committees have been made with regard to geographical and business interests in each district. The chairman of the Federal Reserve Board in each district will act as chairman and the governor of the Federal Reserve Bank will act as vice-chairman. An executive committee of not more than seven members residing conveniently near the Federal Reserve city will meet regularly to pass on applications referred by the Capital Issues Committee in Washington.

Charles S. Hamlin, chairman of the Capital Issues Committee, says:

"The object of the Capital Issues Committee in passing upon all issues of new securities to determine their compatibility with the national interest is to secure the postponement until after the war of the use of capital, materials, and labor in order to give the right of way to the government's financial requirements and to the production of war necessities.

"The district committees will hereafter act definitely upon all applications to issue securities amounting to $100,000 or less, and in advisory capacity to the main committee at Washington in the matter of applications involving larger amounts. The Capital Issues Committee also has the benefit of the advice of all other departments and branches of the government, including the Food, Fuel, and Railway Administrations, the War Industries Board and other agencies having knowledge of the requirements of essential war industries."

Reorganization Appeal

Petaluma & Santa Rosa Railway Asks California Commission to Approve Its Reorganization Plan

The reorganization committee of the Petaluma & Santa Rosa Railway, Petaluma, Cal., has filed with the Railroad Commission an application for authority to transfer the company's properties to a new corporation; to issue $1,250,000 of capital stock, 10,000 shares of common stock and 2500 shares of preferred stock, the last with cumulative dividends at 6 per cent, and to issue $750,000 of 5½ per cent twenty-five-year bonds. The new company wants also to secure these bonds with the First Federal Trust Company, San Francisco, as trustee, with a mortgage by which net earnings ordinarily applicable to dividends on common stock are limited to $25,000 a year, and that all excess, not needed for the company's business requirements, shall be paid one-half as additional dividends on common stock, one-fourth to a sinking fund to redeem the bonds at not more than 105 per cent, and the remaining quarter to redeem preferred stock at par.

Personnel of Committee

The reorganization committee consists of H. P. Goodman, James Otis, L. B. Mackay, Allen I. Kittle, W. H. Hamilton, Russell Lowry, Rudolph Spreckles, George P. McNear and Frank A. Brush, and its petition is accompanied by a printed reorganization agreement dated Oct. 25, 1917. The old company's capital stock is $1,000,000, of which $99,410 is outstanding. In 1904 the company executed a mortgage of all its properties to the Mercantile Trust Company, to secure a $1,000,000 bond issue, of which $655,000 is outstanding. Of a second mortgage, which is also secured with the Mercantile Trust Company, $217,000 of the $250,000 issue is outstanding.

The First Federal Trust Company was substituted as trustee on Feb. 5 last. The company, besides its bond obligations of $872,000, has deposited in pledge $80,000 of first mortgage bonds, and $33,000 of second mortgage bonds to secure a floating indebtedness of $76,000.

Default has occurred under the second mortgage agreement, and the principal amount is overdue, besides first mortgage covenants unperformed and sundry sinking fund payments unmade.

Sale by Court Ordered

Last February the First Federal Trust Company sued the railway to foreclose the second mortgage, the Mercantile Trust Company intervened, and on May 17 the courts directed the sale of the properties, which sale will occur shortly. The reorganization plan was made in October last, and it is stated that the holders of most of the securities approve it. The application made on July 2 asks for a hearing, and for permission to carry the reorganization agreement into effect.

W. F. C. Makes Advance

Will Furnish Commonwealth Company $2,400,000 Out of $8,047,000 of Maturing Obligations

The Commonwealth Power, Railway & Light Company, Grand Rapids, Mich., announced on July 16 that the War Finance Corporation had agreed to advance $2,400,000 toward the retirement of its $8,047,000 of convertible 5 per cent bonds, provided the company obtained an extension of the balance of the obligation. The bonds fell due on May 1 last. As in case of the $57,000,000 note issue of the Brooklyn Rapid Transit Company, the funds to be raised by the War Finance Corporation amounted to approximately 30 per cent of the Commonwealth's bonds.

In a letter signed by Anton G. Hodenpyl, president, two plans for carrying out the operation were offered holders of the bonds. Under one plan owners have the opportunity of taking in exchange for their matured bonds a new $1,000 five-year 7 per cent secured convertible gold bond and $25 in cash, representing 2½ per cent discount on the new bond, for each $1,000 old bond. The other proposal calls for a new $700 five-year 7 per cent convertible gold bond, together with $17.50 representing a discount of 2½ per cent on the $700 bond, and $300 in cash for each $1,000 of bonds matured. The larger cash payment would represent a payment on principal and to it will be added interest on $300 at 7 per cent from May 1 to date of payment.

The old bonds of $500 and $100 denomination will be entitled to one-half and one-tenth, respectively of the amounts set out in the offers. By reason of the discount the price of the new bonds is equivalent to 97½ and holders will receive a return of 7½ per cent if they keep the bonds to maturity.

The letter asked owners of the old bonds to deposit them under one of the plans as soon as possible. After Aug. 5 deposits will be received only with the consent of the company. When the plan is declared operative, notice will be sent to all owners of deposit receipts who may receive then their cash and new bonds.

First Refunding Issue Proposed

The Syracuse & Suburban Railroad Syracuse, N. Y., has filed with the Public Service Commission for the Second District of New York a petition in which it asks authority to issue a first refunding mortgage to secure an issue of $1,000,000 of 5 per cent bonds. The petition shows that the company is to use the proceeds, if the commission approves, by applying $400,000 to the retirement of a like amount of first mortgage bonds due on Aug. 2, 1927, and $150,000 in first consolidated gold mortgage bonds, due on April 1, 1953. It is also proposed to use $225,000 to reimburse the treasury for capital expenditures already made and for capital expenditures which must be made in the immediate future and $225,000 to be used for such capital expenditures as may be necessary after the expenditure of the first $225,000. The amounts are to be expended under certain conditions and restrictions named in the mortgage.

A Minimum Income Law

Counsel for New York Commission Says It's Time for Such a Law for Public Utilities

In an address made before the National Municipal League, printed in *The Bulletin of the City Club*, ex-Judge William L. Ransom, chief counsel of the Public Service Commission for the First District of New York, said that public utilities were entitled to a living income, and that the public could not afford to have these properties deteriorate to the point where it was impossible adequately to supply the public needs. In answer to the question, "What use ought municipalities to make now of the power placed in their hands by a condition of rising costs and the companies' need for exceeding the rates fixed by franchises?" Mr. Ransom said:

"I believe there is a great opportunity for a firm, just, broad-minded, far-visioned assertion of the public right and interest. The thing the public needs and wants most is good, adequate, satisfactory service. The public cannot afford to force the deterioration and breaking down of the public utility properties, until service goes to pieces, operation becomes unsafe, and the public needs are miserably met. The public utilities are entitled to have a living income; the public interest demands that no less than the interests of the utilities or the investors. The time is at hand when we may have to start an agitation for a 'minimum income law' for our utilities unless public utility service is to go to pieces.

"When the companies agreed to be and remain bound by a 5-cent fare limitation, they gained something of value for it, something which the public gave them in return for such a covenant. If now the companies wish to be relieved from their agreement as to fares, ought not each municipality to impose just, fair, reasonable terms, as conditions of such modification of the contract? It appears to me that the turn of events has placed a wholesome and salutary power in the hands of municipalities—not a power obstinately and short-sightedly to block the rate increases necessary to a continuance of decent service, but a power to procure just and desirable changes in franchise terms, for future public protection.

"Old franchises, granted in reckless disregard of public rights, as to duration, terms and the like, may now be put upon a fair, modern basis. The companies which ask public authorities to modify the fare provisions of franchise contracts will doubtless recognize the propriety of municipal insistence upon other changes in the public interest."

Principal Remains Unpaid

Unable to Take Up Maturing Bonds Key Route Will Continue to Pay Interest

In view of the general financial situation and of the financial condition of the San Francisco-Oakland Terminal Railways, Oakland, Cal., this company announced on July 3 that it would be unable to provide for the payment of the issue of Oakland Transit Company first consolidated mortgage 6 per cent gold bonds maturing on July 7. In a circular to the bondholders F. W. Frost, secretary of the company, said:

"The bankers of San Francisco and Oakland who have from time to time considered the formulation of a plan of reorganization, which is complicated by the twelve bond issues upon the company's property, have found it impractical to put forward a plan, with any hope of success, until the franchise situation of the traction division has been readjusted and the earnings of the company have been improved.

"A resettlement franchise is now under consideration by a general committee appointed by the Mayors of the cities of Oakland, Berkeley and Alameda, which committee is understood to have about agreed upon a draft of the proposed franchise.

"The revenues of the company can only be improved by an increase of the rates of fare. Applications for increases have been made to and hearings had before the Railroad Commission. Immediately upon a settlement of the franchise and rate matters, it is the expectation of the directors to undertake a plan of reorganization which, when completed, will be presented to the security holders for action.

"The directors expect to provide for the payment of interest upon the transit bonds referred to pending the completion of the above outlined plans."

Receivership Petition Renewed

The alleged referendum burglary referred to elsewhere in this issue, is used as an argument for the appointment of a receiver for the United Railways, St. Louis, Mo., in an amended petition filed on July 13 in the United States District Court by John W. Seaman, New York, a holder of the company's preferred stock. This receivership suit is a renewal of the one filed by Mr. Seaman on Jan. 7 last, which was dismissed.

The petition charges "improper influencing of State and municipal legislation," and says that "all such expenditures and misconduct are unlawful and harmful to a majority of the stockholders, who had no knowledge of such expenditures."

The fact that the company was compelled to borrow from the United States government $3,500,000 to pay off bonds maturing on June 1 and the inability of the company to pay the mill tax judgment of more than $2,000,000 are submitted as proof of insolvency.

Financial News Notes

Would Sell $3,000,000 of Notes.—The Columbus Railway, Power & Light Company, Columbus, Ohio, has applied to the Ohio Public Utilities Commission for permission to sell $3,000,000 of two-year 7 per cent notes.

Ohio Road Being Dismantled.—The property of the Suburban Traction Company, owned and operated by the Interurban Railway & Terminal Company, Cincinnati, Ohio, is being dismantled and the rails, etc., are being sold for junk.

Ordered Sold on Aug. 5.—The St. Petersburg & Gulf Railway, St. Petersburg, Fla., has been ordered sold under foreclosure on Aug. 5. Unsecured creditors of the company are said to be organizing to oppose the sale on that date as not likely to prove to their best interest.

Montreal Dividend Deferred.—The directors of Montreal (Que.) Tramways have deferred the payment of the dividend on the common stock payable ordinarily on Aug. 1. The directors state the dividend is deferred until any appeal is heard regarding the increase in fares, to which reference was made in the ELECTRIC RAILWAY JOURNAL for July 13, page 78.

Extra Dividend in Washington, D. C.—The Capitol Traction Company, Washington, D. C., has declared an extra dividend of one-half of 1 per cent payable on Aug. 1. The company has been distributing quarterly dividends of 1¼ per cent each, the last payment having been made on July 1. Last December an extra dividend of 1¼ per cent was paid.

Petition to Dismantle Refused.—The Indiana Public Service Commission has entered an order denying the petition of Charles M. Alford to dismantle that part of the Gary Connecting Railways which extends from Gary to Woodville Junction. The commission points out in its order that during war times it is the duty of that body to keep every line of transportation open. It indicated that the road could be made to earn enough to keep it in operation.

Minneapolis Tax Valuation Reduced.—The Minneapolis Street Railway, controlled by the Twin City Rapid Transit Company, Minneapolis, Minn., has had its tax assessment cut from $8,102,355 to $7,960,905 for 1918. City Assessor G. L. Fort, commenting on this, the first reduction of the company's taxation valuation ever made, called attention to the fact that in 1917 the company's common stock was quoted at $96 a share and now it is quoted at about $40.

International Notes Offered.—E. H. Rollins & Sons, Boston, Mass., are offering collateral trust 6 per cent gold notes for the International Traction Company, Buffalo, N. Y., of 1917, due on Aug. 1, 1920. The authorized issue is $5,000,000, of which there is outstanding $2,000,000. The outstanding notes are further secured by a supplemental indenture, made by other interests, pledging with the trustee $2,667,000 refunding and improvement mortgage 5 per cent gold bonds of 1962, of the International Railway, the entire capital stock of which is owned by the International Traction Company.

Tacoma Property Financing.—Finance Commissioner Shoemaker of Tacoma, Wash., has completed an analysis of the financial report of the Tacoma Railway & Power Company. The analysis is said to show that a reserve fund of $223,480 in 1910 was converted into a deficit of $683,870 in 1917. Commissioner Shoemaker alleges that instead of issuing low interest bonds for additions to plant, the company has apparently expected to take care of new facilities from earnings. The property is said to have increased in value from $2,800,000 to $6,300,000 with no increase in bonds or stocks, the company bringing this about by borrowing from the Puget Sound Electric Company. Commissioner Shoemaker suggests that the company should be refinanced with a reduction of debt.

B. R. T. Note Plan Operative.—The plan for refunding the $57,735,000 Brooklyn (N. Y.) Rapid Transit Company note issue into a new three-year 7 per cent note issue for the same amount has been declared operative. Thirty per cent of the new notes are to be taken up for cash by the War Finance Corporation which permits the company to give holders of the old notes 30 per cent of their holdings in cash and 70 per cent in the new notes. The new notes will be deliverable, with payment in cash of the 30 per cent balance, at the office of the Central Union Trust Company, on Aug. 15, and holders of the old notes who have not yet deposited them have until Aug. 9 to do so, if they desire to obtain the part cash payment. After that, they will be offered only the new notes.

Suit to Test Responsibility for Taxes.—Fourteen suits were filed against the Philadelphia (Pa.) Rapid Transit Company on July 15 by its underlying companies to recover income and excess profits taxes paid the government a few weeks ago. The suits are filed primarily to test the action of the holding company in refusing to pay these taxes, which, according to counsel for the underlying concerns, is in violation of the contracts entered into by the Philadelphia Rapid Transit Company and its subsidiary companies when the contracts were framed. Ellis Ames Ballard, counsel for the Philadelphia Rapid Transit Company, several weeks ago appeared before the special committee of the House at Washington, urging that in framing the new $8,000,000,000 revenue bill it provide that underlying companies be forced to pay their own income and excess-profit taxes.

Another Step in Northern Electric Reorganization. — The Sacramento (Cal.) Northern Railroad has filed with the Railroad Commission for approval a copy of its proposed mortgage securing the payment of $5,500,000 of 5 per cent twenty-year first mortgage bonds. The Sacramento Northern Railroad was organized in June for the purpose of acquiring the properties formerly owned and operated by the Northern Electric Company, the Northern Electric Railway, the Northern Electric Company—Marysville and Colusa Branch, the Sacramento & Woodland Company, the Sacramento Terminal Company and the affiliated companies. The properties of these companies were sold at foreclosure on May 28, 1918, to Walter D. Mansfield, Oscar J. Cushing and George F. Detrick, acting for the reorganization committee of the Northern Electric Railway. The purchasers of the properties propose now to transfer the sale to the Sacramento Northern Railroad. In its decision of May 25, 1918, the commission indicated the condition under which it would authorize the transfer of the properties. The details of the plan of organization of the successor company were reviewed in the ELECTRIC RAILWAY JOURNAL for June 15, page 1161.

Electric Railway Monthly Earnings

BANGOR RAILWAY & ELECTRIC COMPANY, BANGOR, ME.

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., May, '18	$71,190	*$45,993	$25,197	$19,875	$5,322
1m., May, '17	65,428	*39,979	25,449	18,711	6,738
12m., May, '18	902,794	*536,073	366,721	233,238	133,483
12m., May, '17	861,583	*487,555	374,028	220,318	153,710

CUMBERLAND COUNTY POWER & LIGHT COMPANY, PORTLAND, ME.

1m., May, '18	$254,438	*$183,761	$70,677	$70,343	$334
1m., May, '17	236,728	*174,718	62,010	67,985	†5,975
12m., May, '18	3,107,855	*2,159,311	948,544	843,734	104,810
12m., May, '17	2,973,215	*1,931,979	1,041,236	812,431	228,805

EAST ST. LOUIS & SUBURBAN COMPANY, EAST ST. LOUIS, ILL.

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., May, '18	$337,079	*$240,069	$97,010	$68,084	$28,926
1m., May, '17	301,645	*202,805	98,840	64,870	33,970
12m., May, '18	3,841,814	*2,766,053	1,075,761	798,300	277,461
12m., May, '17	3,309,740	*2,050,501	1,259,239	765,337	493,902

NEW YORK (N. Y.) RAILWAYS

1 m., May, '18	$1,017,842	* $842,434	$ 166,803	$284,481	†‡ $54,096
1 m., May, '17	1,045,801	* 792,483	253,318	284,393	‡ 26,163
11 m., May, '18	10,985,820	*8,492,016	2,493,804	3,117,185	†‡ 45,041
11 m., May, '17	10,435,616	*8,340,461	2,095,155	3,104,589	†‡ 425,367

*Includes taxes. † Deficit. ‡Includes non-operating income.

Traffic and Transportation

Buffalo Fare Referendum

Six-Cent Fare for That City Will Go Before Voters as Result of Court of Appeals Decision

The New York State Court of Appeals at Albany, N. Y., on July 12 upheld the power of the voters of Buffalo, N. Y., to hold a referendum on the question of whether or not the action taken by the City Council shall be repealed in reference to waiving certain franchise agreements with the International Railway and recommending to the Public Service Commission, Second District, that the company be allowed to charge a 6-cent fare within the city limits. The action of the Court of Appeals affirms the decision of the Appellate Division at Rochester and also the opinion handed down by Justice Herbert P. Bissell in the Supreme Court of Erie County.

Referendum Petitions Filed

Referendum petitions asking the City Council to repeal its action in reference to the 6-cent fare agreement with the International Railway have been filed with the City Council. They contain more than 15,000 names, almost four times the number required by law. Under the Commission Charter the Council is now required to reaffirm its previous action or repeal it. If the 6-cent fare agreement with the company is reaffirmed, a special referendum election must be held within ninety days. The referendum is now a certainty and plans are being made by the inspectors of election for taking the vote on the question. Henry W. Killeen, of Penney, Killeen & Nye, of counsel for the company, says that the voters will overwhelmingly defeat the Council's 6-cent fare action and a strike of the company's employees will result unless there is intervention on the part of the federal authorities.

Clifton Reeves, government labor mediator, who has been in Buffalo, making a study of the local traction problem, has gone to Washington to make his report to the War Labor Board. The board has announced that it has no desire to take over the operation of the International Railway as a war necessity, but just what action will be taken by the board is now awaited by the city authorities.

The ultimatum of Mayor George S. Buck to E. G. Connette, president of the International Railway, in which the Mayor threatened to petition the Supreme Court of Erie County for the appointment of a receiver to operate the company, should the company's directors vote to suspend the wage increase of 8-cents an hour, recently granted the platform employees, has apparently had its desired effect. At the meeting of the board of directors of the company, no action was taken on the matter of withdrawing the wage advance, but President Connette says that the increase will be withdrawn at the next meeting of the board. He says now that the company cannot collect the additional 1-cent from passengers until after the final count on the proposed referendum, which will probably be adverse to the increase. He declares the company is not in a financial condition to assume the additional expense of $2,000 a day involved in the wage advance.

Emergency Resolution Urged

Efforts are being made by Thomas Penney, vice-president of the railway, and Mr. Killeen, of counsel, to have the Council enact an emergency resolution waiving the franchise agreement with the city and allowing the Public Service Commission to determine what is a just and equitable rate of fare to be charged for the duration of war and six months thereafter. It is the contention of Mr. Killeen that an emergency resolution could not be reviewed by voters at a referendum election. An opinion of the city attorney holds that any action taken by the Council on a franchise matter is subject to a referendum. This opinion has been upheld by the Supreme Court, the Appellate Division and by the New York State Court of Appeals.

Albany Fare Increase Opposed

Flat denial as to the merits of the claims of the United Traction Company for a fare increase in the city of Albany, N. Y., was made at the hearing held recently in the 6-cent fare case before the Public Service Commission.

The three main issues on which Arthur L. Andrews and Judge Woollard, representing the city, based their arguments against the justice of a fare increase follow:

First, it is contended that the figures showing cost of operation as submitted by the company are not properly allocated. It is claimed that these contain figures which really should be increased capital charges.

Second, that in the great and growing deficits the past three years, starting with $219,000 in 1915 and representing $244,000 in 1917, are contained expenditures for track repairs which should be apportioned over a longer period and also met by funds which should have been accumulated for this emergency during the company's "years of plenty."

Third, that notwithstanding the fact the application for fare increase applies to the system of the United Traction Company in its entirety, the merits of the case should be tried on the zone basis and the case of each community be taken and considered separately.

Judge Woollard charged that the company had suffered from poor management since being taken over by the Delaware & Hudson Company in 1907.

Seven Cents for Tacoma

City Council Approves Increase in Fare As Emergency Measure in Aid of Prosecution of War

The City Council of Tacoma, Wash., on July 6 passed the ordinance authorizing the Tacoma Railway & Power Company to collect 7-cent fares within the city limits. It was decided the whole affair was a war emergency and should be put on that basis. The preamble to the ordinance follows:

"An ordinance relating to street car fares and service in aid of the prosecution of the war between the government of the United States and the imperial German government; authorizing the Mayor of the city of Tacoma to enter into a temporary contract on behalf of the city with the companies and prescribing the form of such contract; repealing all ordinances or parts of ordinances in conflict herewith; and declaring an emergency."

In order to avoid legal tangles no ordinances are repealed by number and the whole proceeding is based on the assumption that the people will grasp the conclusion reached by the committee of twenty-five that it is absolutely essential that immediate, ample service be given by the railway and that the city is willing to go the limit in means to secure this service.

The principal features of the new agreement are as follows:

Fare inside city on all lines, 7 cents. Tickets fifteen for $1, on sale at various stores, shipyards, etc. Universal transfers provided between the Municipal Railway and the lines of the Tacoma Railway & Power Company. One hundred and six cars, the number operated in normal times, to be put back in operation. Cash fare boxes to be taken out to be made over to receive pennies and metal tickets. Old tickets already sold to be honored. Carmen to be paid 50, 55 and 60 cents an hour.

City will get 2 cents out of each transfer collected by the Tacoma Railway & Power Company. City will get 3 2-3 cents on every transfer it takes up coming from the Tacoma Railway & Power Company lines.

Little Rock Fares Before Council

Without discussion the City Council of Little Rock, Ark., on July 8 referred the petition of the Little Rock Railway & Electric Company for an increase of fares to 6 cents to a special committee, composed of the public utilities committee of the Council and three citizens. This action was taken after D. H. Cantrell, president of the company, explained the reason for the company's request, and after the reading of a message by Mayor Taylor recommending that the petition be denied.

Trenton Fare Case Closed

All the Evidence Submitted, Final Argument Heard and Board Now Ready for Briefs

The hearing before the Board of Public Utility Commissioners of New Jersey on the application of the Trenton & Mercer County Traction Corporation for the abolition of strip tickets and the establishment of a 6-cent fare was concluded on July 2. It was agreed that Frank S. Katzenbach, Jr., counsel for the company, and George L. Record, special counsel for the city, should argue the case before the commission on July 19.

Valuation Discussed

The hearing on July 2 was occupied chiefly with a discussion as to whether the valuation of the physical property for taxing purposes made by State Engineer Louis Focht for the State Board of Taxation in 1915, should be admitted in a rate case. The utilities board decided finally to admit the valuation for what it was worth with the understanding as stated by Mr. Focht that it was not made with a view to representing the investment in the property.

Mr. Katzenbach asked Rankin Johnson, president of the railway company, concerning Peter Witt's plan for a 3-cent fare by which a second fare would be collected for all passengers who pass the center of Trenton, the cars to be operated part of the time on the "pay-as-you-enter" plan and the rest of the time on the "pay-as-you-leave" plan. Mr. Johnson said the chief difficulty in carrying out such a plan was that the resulting revenues were unknown. According to Mr. Johnson the deficit from a year's operation on such a basis might amount to several hundred thousand dollars, the burden of which, under Mr. Witt's plan, would rest entirely on the railway. Mr. Johnson said that the adoption of Mr. Witt's suggestion for an hourly schedule from Trenton to Princeton and to Hamilton Square increasing the company's revenues has resulted in a decrease in gross receipts during the five months it has been in operation.

Mr. Witt again testified on July 1. He advocated the tearing up of another suburban line, that from Lawrenceville to Princeton, in addition to those he has already recommended should be eliminated. He said that a 6-cent fare would produce less revenue in Trenton than the present 4⅙-cent rate. When asked if he had in mind increased revenues with 6-cent fares put into effect during the past few months in other cities, the witness replied that he had no knowledge of what had been the effect on the revenues with the increased fare in those places.

Mr. Witt Suggests One-Man Cars

Mr. Witt recommended the use of one-man cars exclusively during the non-rush hours. He would add a woman conductor to these cars during rush hours. The witness said that by the adoption of one-man cars and the use of fare boxes, passengers would pay as they enter the car on approaching the center of the city. After passing that corner they would pay as they left the car. By the elimination of transfers and by this system, he estimated that so many more people would ride that the revenue of the company would be increased sufficiently to meet all demands.

Mr. Record introduced at the hearing J. C. Brackenridge, who testified at the hearing in 1915 regarding the elimination of strip tickets, as to the valuation of the company's property.

Counsel for the city and for the corporation completed oral argument on July 9 before the commission. Briefs will be submitted to the board by counsel during the week commencing July 15. The case will then be taken under advisement by the commission.

Mr. Katzenbach argued that there could be no equity in a policy which provides a single valuation for rate making and taxing purposes. He insisted that there was a marked difference between values for taxes and for rate making and declared that all authorities agree that a property may have different values for different purposes. Mr. Katzenbach read a decision of the Wisconsin commission stating that the difference between valuation for taxation and for rate making is entirely proper and logical. He showed that the deficit of the company for the year 1918 at the present rate of fare would exceed $300,000. With such a deficit, he argued, the company would be powerless to provide improved service. It might be different, he said, if the company were asking for a higher rate of fare than neighboring companies are receiving, but the reverse was the case.

No Obstacle in Way of Commission

In view of the recent decision of the Court of Errors and Appeals, the speaker said, giving the Utilities Commission power to abrogate franchise agreements, there was no obstacle in the way of favorable consideration of the company's application by the board. Referring again to valuations, he said the one made by the J. G. White Engineering Corporation was the only accurate and complete appraisal of the company in existence. He expressed the view that this valuation gives the commission "something to lean upon." None of the other appraisals which the city insisted upon using had been made with the care which characterized the White report. Mr. Katzenbach said that the conditions imposed by the city upon the company through the leases had been carried out by the company. He then outlined the recommendations made by Mr. Witt. He declared the people would prefer to ride comfortably at 6 cents a ride than to travel in Mr. Witt's one-man cars.

Mr. Record argued that the company should reduce its expenses to meet war conditions instead of seeking an increase in fares. He objected to a different valuation for taxing purposes than that presented for rate making. He argued against the decision of the Court of Errors upholding the abrogation of franchise agreements and said that whether the franchise was to stand or fall rested with the utilities board. He said the company bargained for the contract it has with Trenton and now it asked for relief from terms of the grant which it had come to consider onerous, but did not want the perpetual clause of the franchise disturbed. He said that the commission existed to protect the people's interests. He then attacked the leases of the company which he said the board's predecessor had approved notwithstanding the testimony of its chief engineer that the company could never earn money under them.

"In a Hell of a Fix"

According to a conclusion recently reached and announced by the Public Service Commission of the State of Washington, the Spokane & Inland Empire Railroad, Spokane, Wash., "is in a hell of a fix." Commissioners F. R. Spinning and A. A. Lewis assent officially to everything concerning the situation except the form of statement used, but Chairman E. F. Blaine maintains that no other words will aid the public to understand what has happened. Here is the stated condition confronting the Spokane & Inland Empire Railroad and the commission:

The government assumed possession of this railroad on Jan. 1, 1918, and by order No. 28 established rates radically different and in excess of prior rates, and without consultation or approval of the State Commission. After such passenger and freight rates were in effect for periods of twenty and of five days, respectively, the director general relinquished possession of the road and there is no question but that it is now subject to the jurisdiction of the State Public Service Commission.

But what are the rates? Were the said rates in suspension during the period from the date of order No. 28 to July 1, the date the road was turned back by the Director General? If in suspension, under what provision of the State statutes were they suspended? Can it be said that the rates established by order No. 28 are in force? They were federal rates and in no sense State rates. Perhaps the road is without any rates and must, until new rates are established according to the State statutes, operate gratis or not operate at all.

The new Spokane & Inland Empire Railroad rates are fixed on the basic charge of 3 cents a mile with a 10-cent minimum similar to the increase recently filed by the Washington Water Power Company. They were protested on the ground that they imposed a 10-cent charge for less than 1 mile.

Change in Unit Fare

Five-Cent Unit Fare with Shorter Zones Approved for Massachusetts Northeastern Street Railway

The Massachusetts Northeastern Street Railway was authorized in an order dated June 29 by the Public Service Commission of Massachusetts to revise its rates upon the basis of a 5-cent unit fare with shortened zones, in the endeavor to procure additional revenue. The present unit of cash fare upon all lines is 6 cents, but a ticket rate of 5 cents is available for about 3.5 miles from the centers of the cities of Haverhill and Lawrence. Certain workingmen's and commutation tickets are sold at reduced rates. The present fare zones range from 1.35 to 6.45 miles in length, with an average of about 4 miles. Including transfer privileges, a maximum ride of 7.65 miles and an average ride of about 5.25 miles are available for a single fare. Lap-over privileges are in use on certain lines.

Fare Sections According to Population

For this system of irregular overlapping zones, the company proposes to substitute a new fare scheme containing certain features of the copper-zone system and certain features of the previously standard fare system used on New England lines. The company proposes a division of its system into fare sections according to population density and other local conditions varying from 1.7 to 3.8 miles in length, and a subdivision of each fare section into two approximately equal zones. The average length of the proposed fare sections is about 2.5 miles and the average fare per mile about 2 cents. The cash fare is to be 5 cents for each fare section, but passengers may ride from any point in the first fare section to any point in the first zone of the adjacent fare section, i. e., over any three consecutive sections, at the rate of 7.5 cents by the use of tickets which are sold in strips of ten for 75 cents.

This arrangement amounts to a reduction in the length of existing zones from an average of 4 miles to about 2.5 miles, a reduction of the unit of fare from 6 to 5 cents, and a graduated increase, instead of the payment of a full additional fare, for rides beyond the first fare section. The plan also involves the abolition of overlapping zones, of certain free transfer privileges, and a reduction of the transfer area where such privileges continue.

The tariff also provides for the sale of twenty-ride workingmen's tickets good during certain hours between designated points, at 75 per cent of the regular cash fare, and for certain round-trip excursion rates to Hampton Beach and Canobie Lake Park. On four short beach lines it is proposed to retain the present fare zones and 6-cent unit, as these are operated during the summer only. By the changes planned the company expects $72,500, or about 9 per cent increase in revenue.

The commission's investigation of revenue and cost conditions on the property indicates that the company might reasonably justify its need for additional revenue of at least $150,000 a year. The board holds that the company should be allowed a reasonable degree of discretion in regard to the exact fare plan to be adopted, unless the scheme proposed is likely to yield an excessive increase in revenue, to prove discriminatory as between different groups of car riders, or to impose burdens upon the public disproportionate to the revenue results obtained.

In the populous centers of Lawrence, Haverhill, Amesbury and Newburyport the company plans to issue transfers which allow passengers to ride within any two contiguous fare zones for 5 cents. Fare concessions are also made to other points through the issue of workingmen's tickets.

At the hearing complaints were made of specific increases between certain points, but few of these were 25 per cent for passengers who choose to avail themselves of the commutation tickets provided by the company. The company agreed to adjust some of these complaints by modifying the length of the fare zones, or by the establishment of special tickets. The commission in general approves the company's tariff plan, but on the summer lines from Plum Island Pavilion to Plum Island Point (1.4-mile existing zone length) and from Salisbury Beach to Black Rocks (existing zone length 1.5 miles), it rules that the 5-cent rate should apply. With other minor changes the company's schedule is adjudged fair and reasonable, and the commission commends the administration of the road and announces its approval of a new tariff modified as outlined.

Fare Statistics Played Up

Doherty News, published by Henry L. Doherty & Company, New York, N. Y., used to advantage recently statistics of fare increases, citing sixty-seven cities in the United States having a population of 100,000 or more and noting that in fifty-seven of these cities street-car fares have been increased, or applications for increases are pending. Thirteen among the sixty-seven are either charging or have been authorized to charge 6-cent fares. In three the zone system is in effect.

In Cleveland, often called the "low-fare city," the highest rate permitted under the present agreement with the city is in effect, and steps are contemplated to amend the agreement to permit of higher fares. In four other cities revenue has been increased by the abolition of reduced-rate tickets.

In thirteen cities a 6-cent fare has been asked for, while in two cities such an application is in immediate prospect. Two other cities are asking for permission to impose an extra charge when a transfer is issued and thirteen cities are asking for increased revenue in other forms.

Skip Stops in Philadelphia

The skip stop was put into effect in Philadelphia on July 15. Only the central section will be immediately affected by the fuel administration's order to the Philadelphia Rapid Transit Company to conserve fuel by reducing the number of car stops. Of 699 regular stops in the district between the Delaware and Schuylkill Rivers, and between Spring Garden Street and South Street, 135 will be abandoned. This is about 19 per cent reduction. In this one district the curtailment of stops will effect a saving of about 1025 tons of coal for essential war industries. The other sections of the city will not be affected until later because of the time required to study traffic conditions.

Wilmington Fares Six Cents

For the present at least the Wilmington & Philadelphia Traction Company will charge a 6-cent fare in Wilmington, Del., instead of the 7-cent fare recently authorized. This was settled on July 3 by agreement of counsel for both sides of the controversy before Chief Justice Pennewill and Judges Rice and Heisel, sitting as a special session of Superior Court, after the judges had decided sufficient notice had not been given to the public regarding the effort to have the Board of Public Utility Commissioners authorize the company to charge 7 cents. The application for a 6-cent fare was made on May 7. A public hearing was held. The application for a 7-cent fare was made on June 3. On the same day an order was entered allowing the 7-cent fare with four tickets for 25 cents. Objection being entered to the 7-cent fare the board replied that it held two public meetings. The court considered the second of these was not properly called. In commenting on the proceedings before the commission the court said in part:

"The court has no doubt that the board have endeavored to do their duty to all parties, but we think it not improper to suggest that their duties might be made easier in the future if they should adopt some plain and simple rules governing their procedure, including a rule providing for a fair hearing on the part of both the public and the public utility."

In its order to the company the court said:

"It is hereby ordered that the order of said Board of Public Utility Commissioners for the city of Wilmington, bearing date of June 5, 1918, for the granting of leave to charge a 7-cent fare, be amended and modified so as to permit the said Wilmington & Philadelphia Traction Company to charge a straight fare of 6 cents."

Appeals to Chamber of Commerce

Theodore P. Shonts, president of the New York (N. Y.) Railways, on July 15 addressed a long letter to the officers and members of the Chamber of Commerce of New York City in which he said that the emergency conditions confronting the company "threaten early bankruptcy" if permission is withheld for an increase to a fare of 6 cents. Mr. Shonts said in part:

"This is purely an emergency action. We do not ask the Board of Estimate to abrogate any of the city's rights or powers, not to alter—except for the temporary emergency—any franchise condition.

"The emergency is extreme. It threatens early bankruptcy. It is a matter of the deepest concern to every civic and business body and to every business man and resident of the city. We believe that when the public knows the facts its judgment will be fair. The interest of the public is continuous and adequate service. Such service cannot be rendered by a utility company unless its income will meet operating expenses, maintenance, depreciation, and a fair return to the owners on the capital invested. Our income is meeting none of these conditions."

Mr. Shonts announces that he will send similar communications to all leading commercial and taxpaying organizations, whose good-will, he observes, is a supremely important factor in all of the transit work.

The Merchants' Association approves a commission hearing on the question of increase in fares, but reserves official sanction for or against the project pending decision by the Public Service Commission. In the bulletin of the association, *Greater New York*, issued July 15, is published a review of the subject, in which the city is asked to suspend street railway contracts to enable the Public Service Commission to consider increased fare applications.

Los Angeles to Zone

The Pacific Electric Railway, Los Angeles, Cal., has made public a statement of the changes it desires in its fares in connection with the application for higher rates referred to in the ELECTRIC RAILWAY JOURNAL for June 8, page 1114.

The plan to adjust all interurban fares on a mileage basis is stated briefly as follows:

One-way fares, 3 cents a mile, and round-trip fares, 2½ cents a mile, while no increase in round-trip fare will be more than 20 per cent above the existing round-trip fares.

On commutation tickets, a ten-ride individual ticket, limited to thirty days from date of sale, will be 2 cents a mile; a thirty-ride family ticket, limited to forty days, 1½ cents a mile; and for the daily commuter, a sixty-ride ticket, limited to forty days, as follows: One to 10 miles, 1 cent a mile; 10 miles to 15 miles, 9 mills per mile; 15 miles to 20 miles, 8 mills per mile; more than 20 miles, 7½ mills per mile.

In Los Angeles it is proposed to establish a zone system of fares. The present 5-cent fares will be continued to points on all lines within a radius of approximately 5½ miles of the Hill Street or Main Street stations, as the case may be. Beyond this distance where the present fare is 5 cents the same will be increased to 7 cents. Fares in cities outside Los Angeles will be increased from 5 cents to 6 cents a ride.

Iowa Roads Secure Relief

Iowa interurban railways have practically been granted the right to establish the 3-cent fare basis. A federal order has been issued restraining the state officials and legal department from instituting civil and criminal proceedings against three Iowa interurban railways that are about to increase their fares to 3 cents a mile. The hearing was before Judge Martin J. Wade, of Iowa, Judge Walter Sanborn, of the Eighth Circuit Court of Appeals, and Judge James D. Elliott of the United State District Court in the city of Sioux Falls, S. D.

The three interurbans directly effected are the Cedar Rapids & Marion City Railway, Mason City & Clear Lake Railway and the Clinton, Davenport & Muscatine Railway. The roads were placed under bond to cover refunds in case the 2-cent fare is found not to be confiscatory and that the roads are making a satisfactory income under the 2-cent fare. Until the case is finally disposed of all companies will be required to furnish each ticket purchaser a certificate showing the amount of fare paid.

Increased Fares or Reduced Service

J. J. Stanley, president of the Cleveland (Ohio) Railway, announced on July 8 that Attorney Charles Higley had been selected to represent the company on a board of arbitration to decide whether the rate of fare shall be increased or the service be reduced, following an expression from the city administration to the effect that the fare will not be raised until the Federal War Labor Board has announced its decision on the wage question.

A letter, embodying Mr. Stanley's views, was presented to the City Council on the evening of July 8. It was read and referred to the street railway committee without comment. Mr. Stanley pointed out the position the company will occupy if a large increase in wages, dating from May 1, should be allowed and no funds be accumulated to pay the debt. He argued that the rate of fare should be made large enough at once to take care of the situation.

Another attempt was made recently to induce the company to reduce the rate of dividends to stockholders from 6 per cent to 4 per cent. Mr. Stanley, however, is still unwilling to ask investors to make this sacrifice.

Airs His Troubles in His Cars

William O. Wood, president of the New York & Queens County Railway, Long Island City, N. Y., operating in an important industrial district in which many plants are engaged on government work, in his efforts to obtain men for motormen and men and women for conductors, has posted in each end of every car operated on the system a large placard reading as follows:

"Help Wanted. Factories in this borough engaged in government work to win the war require additional car service.

"To provide for it and at the same time adequately to serve our regular patrons, we must have men and women to operate the cars.

"We need men for motormen, men and women for conductors.

"An allowance will be made for period of instruction, and 30 cents an hour as soon as qualified, with further increases on account of length of service.

"Steady work—permanent employment."

Mr. Wood said:

"I have tried all the ordinary methods of advertising for help, and at last have decided to resort to this scheme. I paid for advertisements in the New York papers, the Brooklyn papers and the Long Island papers, but labor does not seem to realize the opportunity we are offering. We are paying the best wages of any company in the city of New York for beginners. Those engaged in government work are complaining of our service, but we cannot get the men and women to run the cars. I, therefore, concluded that if I placed before all of our riders the advertisement such as is now displayed, it might help us."

The company operates more than 70 miles of city and suburban railway.

Increase for Ohio Interurbans

The Public Utilities Commission of Ohio has just allowed increases in fares to fourteen interurban roads in that State, awards being made according to the showing of financial necessity of each. The range of fares is from 2 to 3 cents a mile, with the majority of the roads being allowed 3 cents.

Commenting on the rate raises, F. W. Coen, president of the Central Electric Railway Association, stated to a representative of the ELECTRIC RAILWAY JOURNAL that the result showed a reasonable attitude on the part of the commission and appreciation of the situation confronting the interurban railways.

On the Lake Shore Electric Railway, of which Mr. Coen is vice-president and general manager, the raise is about 0.4 cent, making the average 2.6 cents. This it is estimated will yield an increase of 10 per cent in the income. The plan was to keep about the same differential with interstate steam rates as before.

Transportation News Notes

Six Cents in Battle Creek.—The City Commission of Battle Creek, Mich., has authorized the Michigan United Railways to charge a 6-cent fare in that city.

Increase Authorized for Maryland Company.—The Cumberland & Westernport Electric Railway, Cumberland, Md., has been authorized to increase its rates 20 per cent.

Wants Seven-Cent Fare.—The Southern Public Utilities Company, Charlotte, N. C., has petitioned the Corporation Commission to be allowed to increase its fares to 7 cents, or four tickets for 25 cents.

Skip-Stop Hearing in Milwaukee.—The Railroad Commission of Wisconsin ordered a hearing held on July 17, on the skip-stop plan and also on the near stops. The hearing is in response to the petition from the company.

One Killed and Thirteen Injured.—Two cars on the Stark Electric Railroad, Alliance, Ohio, collided 3 miles east of Alliance on July 4. One man was killed and thirteen other persons were injured. The cars were very badly damaged.

Penalize the Thoughtless.—The International Railway, Buffalo, N. Y., has discontinued the practice of selling tickets on its interurban cars. Hereafter when passengers have failed to buy a ticket before boarding a car, the regular one-way fare will be charged.

Would Increase Suburban Fare.—The Montgomery Light & Traction Company, Montgomery, Ala., has applied to the Public Service Commission of Alabama for an increase from 5 to 10 cents in fare on the Pickett Springs line. A hearing was set for July 18.

Skip Stop for Fort Worth.—G. H. Clifford, general manager of the Northern Texas Traction Company, Fort Worth, Tex., says the skip-stop system will be put in operation on all lines in the city as soon as the plan can be worked out and street markers showing places where street cars will stop can be placed along the streets.

2,000,000 Pennies and 200,000 Metal Tickets.—Nearly 2,000,000 pennies and more than 200,000 metal tickets were secured by the Kansas City (Mo.) Railways for use when the 6-cent fare went into operation on July 15. The decision of the Missouri Commission in this case was reviewed in the ELECTRIC RAILWAY JOURNAL for July 6, page 30.

Railway and Bus Conference.—A conference between officials of the Minneapolis Street Railway, controlled by the Twin City Rapid Transit Company, and jitney bus owners is to be arranged by City Aldermen, with a view to formulating a plan for co-ordinate operation of the two modes of transportation, pending the outcome of franchise negotiations.

Macon Fare Hearing Aug. 13.—The hearing on the petition of the Macon Railway & Light Company, Macon, Ga., for an increase from 5 cents to 6 cents in railway fares has been set for Aug. 13. Macon's Mayor and Council have agreed to waive the provision of the franchise contract to a 5-cent fare, leaving the whole matter in the hands of the commission.

Fare Case Rehearing Refused.—The Public Service Commission of Missouri on July 5 overruled the motion of Col. E. M. Harber, city counselor for Kansas City, for a rehearing of the Kansas City Railways fare increase case, in which a 6-cent fare recently was granted by the commission. It is said that the city will now carry the matter to the courts.

Bartlesville Wants Fare Increase.—The Bartlesville (Okla.) Interurban Railway has filed with the State Corporation Commission of Oklahoma application for an increase in fares to be charged between points on its line. The company asks permission to increase local fares in the towns of Bartlesville and Dewey, in which it operates, from 5 cents to 7 cents.

Kaw Line Asks Rate Raise.—The Kansas City, Kaw Valley & Western Railway, Bonner Springs, Kan., filed with the Interstate Commerce Commission on July 13 an application for permission to increase passenger rates to 3 cents a mile, so its rates might be made the same as prescribed for steam lines by the general increase order of the Railroad Administration.

Three Fives Replace Two Sixes.—On July 4 the Claremont Railway & Lighting Company, Claremont, N. H., was allowed to put into effect an increase in passenger fares. Formerly the length of the car line was divided into two zones—6 cents per zone. According to the new schedule, the car line is divided into three zones, and the fare has been made 5 cents in each of the zones.

Conductorettes in Baltimore.—The first women conductors to be employed by the United Railways & Electric Company, Baltimore, Md., went to work on July 10. The women are to fill vacancies only and do not replace men except when the latter leave service, their employment being strictly a war measure with the railway. They will receive the same pay as men conductors.

Service Cut and Rates Advanced.—The Twin City Rapid Transit Company, Minneapolis, Minn., some time ago decided to cut service and advance rates on its Lake Minnetonka suburban lines. Patrons of the line, at a mass meeting at Excelsior, the main suburban point, agreed to the two changes as presented by Horace Lowry, president of the company, and A. W. Warnock, general passenger agent.

Increase in Rates on Calistoga Valley Roads.—The San Francisco, Napa & Calistoga Valley Railway, Napa, Cal., on June 19 was granted permission by the Railroad Commission of California to increase rates. The increase consisted of permission to abolish all round-trip rates and increase on commutation and school children's tickets of 10 per cent. The new rates became effective on July 1.

Car-Bus Connections at Austin.—To serve Camp Mabny, a government school for automobile mechanics, located 5 miles from the center of Austin, Tex., a bus line (Liberty Motor Bus Company) makes connection with a terminus of the Austin Street Railway 1½ miles from camp. The trolley ride is 5 cents cash or 4½ cent ticket; the bus ride, 10 cents. The camp structures are brick buildings and ultimately will have facilities for training more than 3000 men.

Formal Fare Appeal Made.—The Morris County Traction Company, Morristown, N. J., has appealed to the Board of Public Utility Commissioners for an increase in its rates of fare. A flat 6 cents in each of its twelve zones is asked, as against a 5-cent fare generally and tickets at six for a quarter, which are sold solely within the limits of Summit. Notice of the company's intention to file such an application was published in the ELECTRIC RAILWAY JOURNAL for July 13, page 80.

Skip Stop in Dallas Aug. 1.—Orders directing the immediate inauguration of skip-stop operation of cars on the lines in Dallas have been issued by Wiley Blair, Federal Fuel Administrator for Texas. M. N. Baker, supervisor of public utilities of Dallas, had been at work on a plan using the skip-stop system. The orders received from Fuel Administrator Blair will serve to speed up this work. It is announced that the plan will likely be put in operation throughout the city by Aug. 1.

Missoula Opposed to Fare Raise.—According to recent reports the city of Missoula, Mont., will resist the increase in fares on the Missoula Street Railway from 5 cents to 7½ cents for rural lines out of Missoula. Application for the increase has been made by the company to the Railroad and Public Service Commission. The city officials contend that the franchise provides for a 5-cent fare within 3 miles of the city limits, and that the company is bound by this provision not to raise its fares.

Six-Cent Fare in Effect in Sioux Falls.—The 6-cent fare voted to the Sioux Falls (S. D.) Traction Company at the election on May 28, noted in the ELECTRIC RAILWAY JOURNAL of June 8, page 1113, was put into effect by the company on July 1. The paper tickets have been replaced by metal tokens which are being sold at the rate of five for 30 cents or seventeen for $1. The operation of one-man safety cars is planned. A special edition of *On the Cars*, the company's paper, was issued to acquaint the public with the changes.

Six Cents in Vancouver.—The city of Vancouver, B. C., has passed a by-law authorizing the British Columbia Electric Railway to charge 6 cents within the city. The City Council of New Westminster and the Council of the municipality of Point Grey have passed resolutions agreeable to similar changes. South Vancouver, whose affairs are in the hands of an administrator, has signified its willingness to allow a 6-cent fare. From Victoria it is reported the City Council is not agreeable to granting the company permission to raise fares unless concessions are made.

Savannah's War Program Approved.—The Savannah (Ga.) Electric Company on July 10 was authorized by the Railroad Commission of Georgia to install the sweeping changes, made in its petition, first to the City Council, then to the Railroad Commission. July 15 was named as the day when the new system was to go into effect. On that date the Whitaker and Liberty Street cars were to be discontinued during the war, and the skip-stop system was made effective. The one-man crew cars on the Battery Park, Fifty-fourth and the Indian Street lines also becomes effective on July 15.

May Appeal Ohio Fare Case.—It is understood that an application will soon be made by the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, for a rehearing in the case in which the Supreme Court of Ohio on June 20 sustained a ruling of the Public Utilities Commission of that State to the effect that it had no authority to increase the rates of fare of interurban roads which have accepted certain rates in consideration of franchises from the cities and counties through which they pass. The decision of the court was referred to in the ELECTRIC RAILWAY JOURNAL of June 29, page 1254.

Increase on Atlantic City-Pleasantville Line.—Increases in rates on the Atlantic City and Somers Point division of the Atlantic & Suburban Railway, Pleasantville, N. J., that will advance the revenue of the company $15,897 a year were allowed by the Public Utility Commission on July 13. The new rates, in the nature of war surcharges, are 12 instead of 10 cents from Atlantic City and Pleasantville, 6 cents instead of 5 cents between Linwood and Somers Point; 6 cents instead of 5 cents between Pleasantville and Absecon; six tickets for 60 cents instead of six for 50 cents between Atlantic City and Pleasantville. There are no changes in the sixty-trip commutation tickets sold by the company.

Louisville Interurban Fares Increased.—On July 1 the Louisville & Interurban Railroad, Louisville, Ky., increased fares on all suburban lines to approximately 2½ cents per mile. Business books will be sold at a rate of approximately 2 cents per mile. Except on milk, cream and livestock, the increase in freight rates will be 25 per cent. At the same time the suburban rates were advanced the company raised the rates to and from Camp Taylor from 5 cents to 10 cents, 5 cents from the city to the city limits and 5 cents thence to the camp. This particular increase resulted in protests from both soldiers and civilians. After a conference with a committee from the Board of Trade, the company announced that the fare would again be placed at 5 cents, subject perhaps to later revision.

Brooklyn Petition Goes to Committee.—The Board of Estimate of New York City at its meeting on July 12 referred to the committee on franchises, without comment, the petition of the Brooklyn Rapid Transit Company that the matter of increased fares on all the lines of the company be transferred to the Public Service Commission, with power to act. The company wants to increase the rate of fare to 7 cents, and intimated that if consent to the increase could not be obtained it would establish the zone system which was in operation while Brooklyn was an independent municipality. Petitions similar to that of the Brooklyn company, presented by the New York & Long Island Traction Company, the New York & Queens County Railway and the Long Island Electric Railway have also been referred to the same committee.

San Diego Fare Case Stated.—Many misstatements made in regard to the proposal of the San Diego (Cal.) Electric Railway to increase fares, referred to briefly in the ELECTRIC RAILWAY JOURNAL of June 15, page 1168, led to the company issuing a special edition of the *San Diego Electric Railway News* on June 1, so as completely and fully to advise the public of the facts. The company explained that it has not made application to raise fares to 6 cents or any other sum. The application is a statement of facts in relation to the affairs of the San Diego Electric Railway and the Point Loma Railroad and a request on behalf of the companies that the Railroad Commission investigate the railways and suggest a remedy to be pursued. The company has reprinted the main text of its application to the Railroad Commission.

May Again Raise Rates.—It is said unofficially that the Springfield (Mass.) Street Railway has found that the elimination of all reduced rate ticket privileges and the increase in fares of the new zone system outside of Springfield will not supply the additional revenue needed by the company and that a new tariff calling for a further fare increase will probably be filed with the Public Service Commission of Massachusetts to go into effect on Sept. 1. A few months ago the company announced that an increase of $600,000 in the yearly receipts was needed in 1918 but with the new wage scale the estimate is now $1,000,000. The Springfield rate case was referred to in the ELECTRIC RAILWAY JOURNAL for April 6, page 663, and May 4, page 882, while the wage decision was reviewed in the issue for June 22, page 1202.

Claims Right to Fix Fare.—The Toledo Railways & Light Company, Toledo, Ohio, claims the right to fix its own rate of fare in the absence of valid legislation by Council regulating fare. This claim, despite the assertion that the company must "take what the city offers or get off the streets," was made by the utility in a brief filed to enjoin the city of Toledo permanently from interfering in the collection of the 5-cent fare and a 1-cent charge for a transfer. The company's brief states: "In the absence of any valid legislation by the city regulating the rates of fare in force upon the railway system, it is obvious that the company is at liberty to fix the rates at whatever figure it deems proper, subject, of course, to the right of the city to pass valid legislation fixing a rate of fare which will allow a reasonable rate of return upon the property."

Increased Fares for Peoria.—By virtue of an order entered on July 2 by the Public Utilities Commission of Illinois the Peoria-Railway, controlled by the Illinois Traction System, Peoria, Ill., adopted straight 5-cent fares on July 3. The sale of commutation books and tickets has been abandoned. The commission did not authorize the company to charge a fee of 2 cents for each transfer issued. The order is temporary and until the commission has made a thorough investigation of the earnings of the company. The showing made by the company was deemed sufficient to merit partial relief until the final decision had been announced. The lines of the company in Peoria were not included in the previous order of the commission allowing increases to the company, which decision was reviewed briefly in the issue of the ELECTRIC RAILWAY JOURNAL for June 1, page 1072.

Towns Agree to Fare Increase.—The towns of Portland, Westfield and Ripley, N. Y., through which the lines of the Buffalo & Lake Erie Traction Company, Buffalo, N. Y., pass, have consented to an increase in passenger rates and the matter will be presented to the Public Service Commission for the Second District, to determine what is a just and reasonable rate of fare. By the terms of the franchises granted to the railway by these towns and other communities along the company's line between Buffalo and Erie, Pa., the company was limited to charge certain fares. Some time ago the company petitioned the Public Service Commission for permission to increase its interurban fares to 2½ cents a mile, but the franchise agreements blocked action, the commission holding it had no authority to increase fares in towns and cities where the company was bound by franchise restrictions. The company claimed it was a matter of being allowed to charge a higher rate of fare or having to abandon its line west of Fredonia to the New York and Pennsylvania state line.

Personal Mention

J. D. Woodward has been elected president of the Selma (Ala.) Traction Company to succeed Robert Wetheril. Mr. Woodward has also been appointed general manager to succeed A. H. Knean.

B. H. Elliott, formerly superintendent of lines of the Birmingham Railway, Light & Power Company, Birmingham, Ala., has been appointed superintendent of power houses and substations of the company.

E. L. Tait, heretofore assistant engineer of maintenance of way of the British Columbia Electric Railway, Vancouver, B. C., has been appointed engineer of maintenance of way, succeeding A. C. Eddy, who has been granted extended leave of absence for military duty, having joined the U. S. Army.

Arthur H. Young has resigned as director of the American Museum of Safety, New York, to take charge of the employee relations department of the International Harvester Company. Although giving up the actual direction of the museum's work, Mr. Young will continue with that institution as vice-president, in which capacity he has succeeded the late Dr. Frederic R. Hutton.

O. F. Brock has been appointed purchasing agent of the Birmingham Railway, Light & Power Company, Birmingham, Ala., to succeed Charles T. Doerr, who recently resigned to become local purchasing agent at Birmingham for the Air Nitrates Corporation, agents for the United States government in the construction and operation of the nitrate plants at Sheffield, Ala.

A. C. Eddy, maintenance-of-way engineer for the British Columbia Electric Railway, Vancouver, B. C., is now a captain with the Fifty-fifth United States Engineers. He volunteered for service in May, and left on May 31 for Camp Grant, near Chicago. Before leaving, his friends in the company presented him with a purse of more than $90, the presentation being made by George Kidd, general manager.

L. L. Newman, assistant general manager of the Birmingham Railway, Light & Power Company, Birmingham, Ala., has also been elected vice-president of the company. Mr. Newman was appointed assistant general manager of the company early in 1916, prior to which time he was superintendent of way and structures. Previous to Mr. Newman's connection with the Birmingham Light & Power Company, he was employed in various departments of the Pennsylvania Railroad.

James E. Carnes, formerly contract agent and advertising manager of the Nashville Railway & Light Company, Nashville, Tenn., has been appointed to the newly-created position of sales and new-business manager. Mr. Carnes' new duties will embrace responsibility for all activities in the sales and lighting department as well as the direction of advertising. Mr. Carnes entered the employ of the company in 1904, and during his fourteen years' connection with the company has served in practically every department.

Lieut. Nugent Fallon, Boston, Mass., is now serving as aviation instructor at the Naval station in Pensacola, Fla. He was formerly superintendent of the South Boston division of the Boston (Mass.) Elevated Railway. He has had an adventurous career as a flier in the service of both England and France at the front. He was promoted from ensign to lieutenant for gallantry in action, on the recommendation of Admiral Sims, commanding the United States Naval forces in European waters.

Thomas F. Hill, of the railway department of the Southern Public Utilities Company in Anderson, N. C., has had his authority extended to cover the meter and contract department, as the result of the resignation of A. E. Holman, who has been superintendent of the latter department for some years. Mr. Hill is one of the oldest men in point of service with the company and its predecessors. He was with the old Anderson Traction Company when that company operated the railway in Anderson and the electric railway from Anderson to Belton.

R. M. Little has been appointed director of the American Museum of Safety, New York, N. Y., to succeed Arthur H. Young. Mr. Little was formerly a trustee of the museum. He is thoroughly versed in work along sociological lines, having served as chairman of the executive committee of the Organized Charities of Chicago and as general secretary of the Philadelphia Society for Organizing Charity. In March, 1917, President Wilson appointed him chairman of the United States Employees Compensation Commission, an office he held until called upon to take up active directorship of the Museum of Safety.

E. B. Wade recently received his commission as captain of the Engineers Corps of the National Army. Captain Wade has been on the staff of Ford, Bacon & Davis, consulting engineers, New York, N. Y., for a number of years. In 1915 he was engineering accountant for the Board of Commissioners of the Port of New Orleans, for the firm, in the construction of cotton warehouses and grain elevators. Since Dec. 1, 1916, Captain Wade has been attached to the New York office, but was sent to California, where he specialized on valuation work as engineering accountant. He went into the service on May 27 at Camp Merritt, N. J., and is doubtless somewhere in France by this time as his corps is no longer in this country. Captain Wade is thirty-eight years of age. He is well known in electric railway and professional engineering circles.

Hamilton Baluss, who has been general manager of the West Chester, Kennett & Wilmington Electric Railway, Kennett Square, Pa., for the last twelve years, has resigned to accept a position with the United States Ordnance Department as army chief inspector at Philadelphia, Pa. After leaving high school at Detroit, Mich., Mr. Baluss took up the study of law, but abandoned this to enter electric railway work. He held positions with the Detroit, Ypsilanti, Ann Arbor & Jackson Railway, the Grand Rapids, Holland & Chicago Railway and the Chicago & Joliet Electric Railway. He then became general manager of the Marquette City & Presque Isle Railway; then general manager of the Susquehanna Traction Company at Lock Haven, Pa., and then general superintendent of the Cincinnati, Georgetown & Portsmouth Railroad. He resigned from the last-named company to become general manager of the West Chester, Kennett & Wilmington Electric Railway.

William C. Bird, who has been acting as assistant to William T. Cobb, president of the Rockland, Thomaston & Camden Street Railway, Rockland, Me., has been elected general manager. With the presidency Mr. Cobb had combined the duties of general manager, but since he was elected president of the Bath Iron Works, Mr. Cobb has necessarily been absent from Rockland much of the time. In Mr. Cobb's absence Mr. Bird has performed the duties of manager. Mr. Bird was born in Rockland, was graduated from the Massachusetts Institute of Technology in 1912, and during the following year engaged in railroad construction work in Canada. During the next four years his efforts were wholly devoted to railroad construction and operation in the West and South. His last position prior to returning to Rockland was assistant to the chief engineer of the Texas, Oklahoma & Eastern Railroad, with headquarters in Kansas City. On Feb. 1, 1917, he became assistant to President Cobb of the Rockland, Thomaston & Camden Street Railway, which does power business.

Obituary

Wesley Meeteer, president of the Wallace Supplies Manufacturing Company, Chicago and New York, died at his home in East Orange, N. J., on July 10. Interment took place in Wilmington, Del., on July 13.

Construction News

Construction News Notes are classified under each heading alphabetically by States. An asterisk (*) indicates a project not previously reported.

Recent Incorporations

***Emergency Fleet Railroad Company, Camden, N. J.**—Incorporated to construct a line from the shipyard plants in Camden to connect with the Public Service Railway. Capital stock, $250,000. Incorporators: Norman Grey, G. T. Seeley, assistant director of the division of passenger transportation of the Emergency Fleet Corporation, and G. D. Connelly.

***American Power & Railway Company, Charlotte, N. C.**—Incorporated to operate electric and steam railroads, also to generate and transmit electric power. Capital stock, $100,000. Incorporators: H. M. Victor, C. B. Bryant and D. D. Trawick.

Franchises

East St. Louis, Ill.—The East St. Louis, Columbia & Waterloo Railroad has been granted a twenty-year franchise by the City Council of East St. Louis to use certain local streets of the city, with the provision that 2 per cent of the gross receipts taken in the city is to go to the city treasury of East St. Louis. The cars of the company are now operated over tracks owned by the East St. Louis & Suburban Railway. Regular passenger cars are operated between Waterloo and East St. Louis.

Track and Roadway

Valdosta (Ga.) Street Railway.—Work will soon be begun by this company on the construction of a ½-mile extension to the fair grounds.

Chicago, Milwaukee & St. Paul Railroad, Chicago, Ill.—A contract has recently been awarded by the Chicago, Milwaukee & St. Paul Railroad to the Union Switch & Signal Company, Swissvale, Pa., for the material for the installation of an automatic block signaling system on its line now being electrified, from Othello to Black River Junction, a distance of 184 miles, where it divides and extends to Tacoma, Wash., 27 miles, and to Seattle, Wash., 9 miles, a total distance of 220 miles. The railroad company's field forces will do the construction work.

Lincoln (Ill.) Municipal Railway.—A report from the Lincoln Municipal Railway states that the construction of 1 mile of new track is contemplated.

Lewiston, Augusta & Waterville Street Railway, Lewiston, Maine.—The Lewiston, Augusta & Waterville Street Railway has filed with the Public Utilities Commission of Maine for its approval a petition which evidences the first step toward the large improvement of its service promised at the recent hearings in Lewiston when it asked for increased rates to better its financial standing and enable it to make contracts on reasonable terms. It contemplates a complete rehabilitation of the service between Lewiston and Bath and improvements to other lines. The company has completed negotiations with the United States Shipping Board Emergency Fleet Corporation whereby the latter, in order to secure better car service in Bath and between Bath and Brunswick, agrees to assist to the extent of $165,000 by providing new cars, transformers, transmission lines and other equipment.

Interborough Rapid Transit Company, New York, N. Y.—Operation has been begun by the Interborough Rapid Transit Company on the Lexington Avenue extension of the subway from Forty-second Street to 167th Street on the Jerome Avenue branch. From there elevated and shuttle service will be provided to the end of the line.

Sapulpa & Interurban Railway, Sapulpa, Okla.—This company will eliminate some curves on the Sapulpa-Kiefer line.

Philadelphia, Pa.—By agreement reached on July 11 in the negotiations for the suspension or annulment of the subway contract for the period of the war, the Keystone State Construction Company will not extend its present operations, but will confine its activities to the completion of the actual work within the limits where the streets have been opened. This status will continue until the City Councils reconvene and either approve or reject the terms of settlement.

Philadelphia (Pa.) Railways.—Operation was begun on July 15 by the Philadelphia Railways into the Hog Island Shipyard of the American International Shipbuilding Corporation, Emergency Fleet Corporation. Up to this time the bulk of the traffic has been handled by the American International Shipbuilding Corporation's own shuttle train and by workmen's trains on the Pennsylvania Railroad and the Philadelphia & Reading Railroad.

Knoxville Railway & Light Company, Knoxville, Tenn.—Plans are being made to construct a viaduct on Gay Street from Depot to Vine Avenue to cost about $200,000. The cost will be borne by the City of Knoxville, the Southern Railway and the Knoxville Railway & Light Company. J. B. McCalla, city engineer.

Morgantown & Wheeling Railroad, Morgantown, W. Va.—It is reported that a contract has been awarded to Kelly Brothers, Clarksburg, W. Va., for grading in connection with the improvement of the line of the Morgantown & Wheeling Railroad between Randall and Barker.

Shops and Buildings

Cincinnati & Dayton Traction Company, Cincinnati, Ohio.—Plans are being made by the Cincinnati & Dayton Traction Company to construct a new terminal on Spring Grove Avenue, Cincinnati.

Oklahoma Union Railway, Tulsa, Okla.—A new carhouse will be erected by the Oklahoma Union Railway at 700 South Maybell Street, Tulsa, to cost about $25,000.

Power Houses and Substations

Pine Bluff (Ark.) Company.—A report from the Pine Bluff Company states that it will purchase two 600-hp. boilers.

Vincennes (Ind.) Traction Company.—This company reports that its power station at Vincennes has been abandoned and power is now being purchased from the Indiana Power & Water Company.

Kansas Electric Utilities Company, Parsons, Kan.—A frequency changer set of 1000-kva. capacity is being installed by the Kansas Electric Utilities Company in its power plant.

United Railways & Electric Company, Baltimore, Md.—A report from the United Railways & Electric Company states that it is now installing one 20,000-kw. turbo-generator in its Pratt Street power station.

Boston & Maine Railroad, Boston, Mass.—Plans have been prepared by the Boston & Maine Railroad for extensions and improvements in its power house near Lawrence. The work is estimated to cost $14,000.

Atlantic Coast Electric Railway, Asbury Park, N. J.—A new power station is being built by the Atlantic Coast Electric Railway at Allenhurst, N. J., and it is expected that it will be ready for operation at an early date.

New York (N. Y.) Railways.—Plans have been prepared by the New York Railways for alterations and improvements at its station at 13-17 Front Street. The work is estimated to cost about $6,000.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS

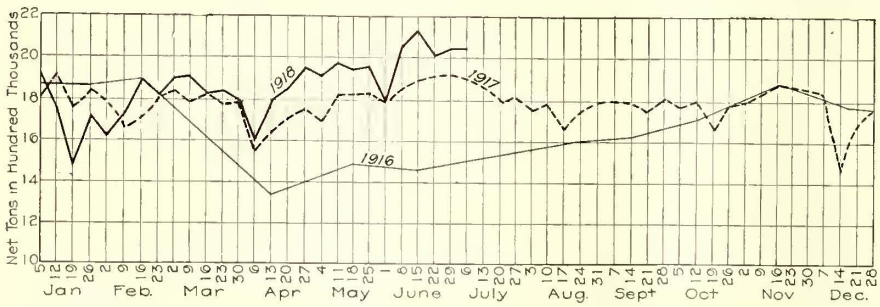
FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES • MARKET QUOTATIONS • BUSINESS ANNOUNCEMENTS

Coal Production and Transportation

Modified Mine-Run Coal Prices Fixed by Government—Labor Shortage Affects Anthracite

Following the report of the United States Geological Survey, for the week ending July 13, it is learned that the observance of July 4 caused bituminous coal production during the week of July 6 to decrease 2,081,000 net tons or approximately 17 per cent. The total output (including lignite and coal made into coke) is estimated at 10,259,000 net tons as against 12,340,000 net tons during the week preceding and 9,241,000 net tons during the current week of 1917. The average production per working day (five-day week) is estimated at 2,052,000 net tons, slightly lower than the average production per working day during the week of June 29 of 2,057,000 net tons and 11 per cent greater than average production per working day during the week of July 6, 1917. Railroad shipments during the week decreased from all districts. Improper working conditions with a better car supply, are reported in a majority of the coal fields.



ESTIMATED AVERAGE TOTAL PRODUCTION PER WORKING DAY OF BITUMINOUS COAL INCLUDING COAL COKED

A shortage of mine labor may cause a curtailment of anthracite allotment, contemplated by the Fuel Administration for the twelve months to April 1 next. Such allotment was based upon an estimated production of 54,345,783 tons of domestic anthracite for the coal year. The actual output of domestic anthracite sizes for the three months period to the end of June was 13,279,889 tons. That is, at the rate of 53,120,000 tons for the year, or 1,226,000 tons less than was counted upon in the estimate.

The prices of "modified mine-run" coal shipped on and after July 5 have been fixed f.o.b. cars at the mine per net ton at not to exceed the applicable government mine prices for screenings at the mine where such "modified mine-run" coal is produced plus the following percentages of the margin or difference between the applicable government mine prices for mine run and screenings at such mines, viz.:

	Per Cent of Such Margin
Run of mine passed through—	
2-in. openings	40
3-in. openings	75
4-in. openings	90
5-in. openings	95

Increased Cost of Production

Manufacturer Shows How Costs Have Advanced During First Six Months of 1918

While prices have advanced considerably in the electric railway field it is doubtful if the increases represent altogether the higher production costs with which the manufacturers have to contend. In this connection are given below some figures furnished by the Drew Electric & Manufacturing Company, manufacturer of electric railway, light, power and gas materials, Indianapolis, Ind. These figures show the increases in costs during the first six months of 1918.

	Per Cent Increase
Copper	10.6
Lead	13.3
Tin	44.5
Zinc	12.9
Malleable iron	10.0
Molders and coremakers	33.3
Furnace tenders	25.0
Laborers	20.0
Machinists	20.0
Freight rates	25.0
General expenses (estimated) such as postage, printing, advertising, office supplies, fire and liability insurance, clerk hire, etc	20.0

"The above comparisons," says James H. Drew, president of the company, "speak for themselves. Considerably more might be said on the subject of other handicaps that confront the manufacturer at this time, such as traveling expenses, migratory tendencies of skilled and unskilled labor, restrictions on raw material, delays in receiving raw material, delay in payment of accounts, and many other subtle and hidden items that run up the cost of manufacture and cannot be discovered until the balance sheet is brought in."

Cotton Costs Reflected in Electrical Goods

Advances in Cotton Goods and Yarns Account for Much of the Higher Cost of Insulated Wire, Tapes, Etc.

Rising prices of raw materials inevitably affect the cost of manufacturing electrical products of many kinds, though it is difficult to predict just what the influence of a given advance in raw-material cost will be upon the selling price of equipment in any particular case. There are two principal reasons for this—the latitude allowed the cost department or price-fixing branch of the manufacturing organization in compensating for the advance and the varying amounts of any particular material used in different types, forms or sizes of apparatus. Nevertheless, it is possible to instance actual figures drawn from practice to show that changes in raw or finished component material costs may have an appreciable effect upon the ultimate price of the finished product.

Upward Trend of Cotton

An investigation along this line was recently made by the Electric Railway Journal with respect to the effect of price changes in cotton upon the selling price of electrical equipment. Cotton has undergone an extraordinary change in price since the beginning of the war. Spot cotton was quoted at 12.50 cents per pound in New York City on July 30, 1914, the day the Cotton Exchange closed, and on Nov. 16 of that year the price upon the reopening of the exchange had fallen to 7.75 cents. During the interim President Wilson inaugurated the "Buy a bale of cotton" movement, and at that time the price was about 10 cents. It is well known that since the fall of 1914 cotton has increased in price until it passed the 30-cent mark in the spring of this year, shot up to 36 cents or thereabouts on a speculative drive, and the quotation of June 22 was 30.4 cents. Electrical insulation is dependent upon cotton as its base material, and of tapes alone probably 97 to 98 per cent are fabricated of cotton yarns. Wire covering trolley cord and many other products are affected by the rising and falling prices of cotton, but it appears that the day-to-day temporary fluctuations have less influence upon the resulting cost of electrical equipment and supplies than the longer and more sweeping changes. The reason for this is doubtless that manufacturers are accustomed to purchasing raw material of a cotton base far ahead of the dates upon which this material is to be utilized in pro-

duction, and the market price at some future time may be taken into account rather than the price actually paid some months previously for a given consignment of insulating material base, when the establishing of sales figures takes place.

Changes in Price of Goods

The accompanying table gives an idea of the changes in price which have occurred since the war began, the increases ranging from 106 to 342 per cent. These materials all bear the marks of increased labor cost as well of increased raw-cotton price, and in the case of tape alone it is known that labor cost has increased certainly 50 per cent since the outbreak of the war.

	Before the War Prices	Last Paid Price	Approximate per Cent Advance
68/72 gray goods, lb...	$0.06	$0.21	250
4/4 muslin, yd.....	0.08	0.255	219
Cotton tape, gr. yd....	0.385	1.05	173
Varnished cloth, yd....	0.108	0.307	184
Cotton yarn, course, lb.	0.215	0.95	342
Cotton yarn, fine, lb...	0.85	1.75	106

On account of the increase in the price of material manufactured from cotton, the total cost of generators and motors, which are insulated with cotton tape, has been increased from 0.05 per cent to 1.5 per cent.

Effect on Wire and Cord

In the case of the coarser sizes of wire the range in price from the beginning of the war was from about 14 cents per pound to 39 cents, this of course being due in part to the increase in the price of copper and also to higher labor charges. An analysis by the cost department of a prominent wire maker indicates that of this increase probably about 7 cents per pound can properly be charged to the rise in the price of cotton from 12.5 cents to 30 cents. Magnet wire rose from 18 cents to 33 cents per pound between 1914 and 1918, and about 9 cents of this may be attributed to cotton price advance, the smaller wire having a relatively larger amount of cotton insulation. Trolley cord increased from 35 to 75 cents per pound during a period when cotton advanced from 10 to 35 cents, and about 60 per cent of the advance in the price of cord, or 24 cents, may be charged to cotton, labor cost having about doubled in the period.

New Equipment to Be Provided for Boston Elevated

New equipment will be provided for the Boston (Mass.) Elevated Railway as soon as war conditions will permit, it was announced after a meeting of the trustees of the company on July 2. The road went over to public management on July 1 under the recent law providing for service at cost with an ultimate return of 6 per cent on the investment, and the trustees anticipate availing themselves of the options and bids made not long ago to the company on new cars and other equipment. The company has secured quotations on 100 new center-entrance motor cars and 100 trailers, but it will be several months before deliveries can be made on account of the absorption of materials and labor by the government.

Rail Prices Still Under Consideration

Stand Taken for $42 a Ton for Bessemer Product in Spite of Higher Cost

Rail prices and prices on other parts of the steel output were under consideration on Monday at a meeting in New York of the Director of Steel Supply and the steel producers' committee. No decision was reached, however. There is but 100,000 tons additional of rail wanted for this year but, it is understood, the Railroad Administration wants the price fixed because of large purchases to be made in 1919.

A stand has been taken for $42 a ton for Bessemer rails in spite of an average cost of production of $50 or more. One prominent producer contends that the rail manufacturer should receive $60 for Bessemer and $65 for open-hearth rails.

Iron Age suggests that "a possible solution of the rail controversy is the payment of different prices to different mills in view of widely differing costs. This might be worked, seeing that the government will take nearly all the output."

Rolling Stock

Rochester & Syracuse Railroad, Inc., Syracuse, N. Y., has placed an order for a double truck snowplow sweeper from the Russell Snow Plow Company, through Wendell & MacDuffie, its representatives in this territory.

Tampa (Fla.) Electric Company's order for eight Birney-type safety cars, referred to in the ELECTRIC RAILWAY JOURNAL of July 6, was placed with the American Car Company, St. Louis, Mo., and not the St. Louis Car Company.

United Railways Electric Company, Baltimore, Md., advises the ELECTRIC RAILWAY JOURNAL that the cars referred to on July 6 as ordered by the company, are "merely the equipment of twenty high-speed double-truck cars with multiple-unit control."

Philadelphia, (Pa.) Rapid Transit Company has ordered fifty additional cars, duplicates of former types, from the J. G. Brill Company. The cars were purchased and will be delivered under priority certificate before next winter. The cars, complete, cost $13,000 each. This totals 150 cars on delivery from the Brill Company. The Philadelphia Company is reported as also re-equipping and overhauling several hundred other cars at a cost of about $1,000 each.

Terre Haute, Indianapolis & Eastern Traction Company, Indianapolis, Ind., referring to the action of the City Council of Terre Haute approving the purchase of thirty one-man cars for the Terre Haute Traction & Light Company, states under date of July 15 that the contract for these cars has been verbally closed, but the official contract has not yet been signed. The cars are of the Birney one-man standard type, as manufactured by the American Car Company, St. Louis, Mo., and with the regular standard equipment and safety devices specified on the Birney one-man car with a seating capacity of twenty-eight. The cars were practically bought as stock equipment. Reference to this order was made in the ELECTRIC RAILWAY JOURNAL last week.

Wilmington & Philadelphia Traction Company, Wilmington, Del., whose order for twenty-two new cars, placed with the J. G. Brill Company, mentioned in the ELECTRIC RAILWAY JOURNAL of July 6, are being bought by the United States Shipping Board, Emergency Fleet Corporation, and come through on a priority preference. They are to be operated on the company's lines between Darby and Chester, Pa. This rolling stock is to be leased by the Wilmington & Philadelphia Traction Company and will eventually become its property. The specifications follow:

Number of cars ordered	22
Date order was placed	June 24, 1918
Date of delivery	90 to 120 days
Builder of car body	J. G. Brill Co.
Type of car	Passenger, motor
Seating capacity	52
Weight:	
Car body	21,000 lb.
Trucks	14,000 lb.
Equipment	12,000 lb.
Total	47,400 lb.
Bolster centers, length	21 ft. 10 in.
Length over all	45 ft. 4 in.
Truck wheelbase	5 ft. 9 in.
Width over all	8 ft. 6 in.
Height, rail to trolley base	11 ft. 5 in.
Body	Semi-steel
Interior trim	Cherry
Headlining	Nevasplit
Roof	Arch
Air brakes	General Electric, straight with emergency
Armature bearings	Babbitt lined
Axles	Hammered steel
Bumpers	Hedley
Car signal system:	Consolidated Car Heating buzzers and bells and pneumatic door light signal
Car trimmings	Car builder's
Center and side bearings	Brill
Control	Pneumatic for two-car train operation
Couplers	Tomlinson form 8
Curtain fixtures	Curtain Supply
Curtain material	Pantasote
Designation signs	Electric Service
Door operating mechanism	National Pneumatic manual air operated
Fare boxes	Johnson
Fenders or wheelguards	H-B
Gears and pinions	G. E. heat treated
Hand brakes	National Staffless
Heater equipment	Peter Smith electric
Headlights	Ohio Brass, gold ray
Journal bearings	Plain
Journal boxes	Brill
Lightning arresters	M. D-3
Motors, type and number	4 G. E.-247-D, inside hung
Registers	International double
Sanders	Ohio Brass, air controlled
Sash fixtures	O. M. Edwards
Seats	Brill reversible
Seating material	cherry slats
Slack adjuster	Anderson
Springs	Brill
Step treads	Universal
Trolley catchers or retrievers	Ohio Brass
Trolley base	U. S. 11
Trolley wheels or shoes	5-in wheel
Trucks	Brill, 27 M. C. B.-1
Ventilators	Railway Utility
Wheels (type and size)	33-in. rolled steel
Special devices, etc	Simplex Jack

Trade Notes

Standard Underground Cable Company, Pittsburgh, Pa., last week sold $40,000 of lead-covered cable to the Georgia Railway & Light Company.

Tubular Woven Fabric Company Pawtucket, R. I., has received an order from the Bay State Street Railway, Boston, Mass., for 500 ft. of 1½-in. and 200 ft. of ¾-in Duraduct.

M. H. Callan, general manager of plants, and W. P. Pussinger, general manager of sales, have been elected vice-presidents of the Chicago (Ill.) Pneumatic Tool Company.

Dual Welding Apparatus, Elizabeth, N. J., has been chartered with a capital stock of $50,000 by M. Lucas, Frederick De Meese and Robert Zuber of Elizabeth. The company proposes to manufacture welding equipment.

Babcock & Wilcox Company, Bayonne, N. J., manufacturer of boilers, etc., has commenced operations in a large new addition to its plant recently completed. The structure, which with its new equipment is estimated to cost $1,500,000, is about 150 ft. x 330 ft.

Henry R. Worthington Company, Harrison, N. J., manufacturer of pumping equipment, is said to be considering plans for extensions to its plant on property recently acquired adjoining its works, at Ann Street and Ogden Avenue. The property is about 65 ft. x 225 ft.

Railway Improvement Company, New York, N. Y., announces that it has received an order for Rico anti-climbers to take care of the fifty additional new cars for the Philadelphia Rapid Transit Company's Hog Island service. The first 100 cars recently constructed for this service are also equipped with Rico anti-climbers.

Westinghouse Air Brake Company, Pittsburgh, Pa., at a recent meeting of directors, elected George W. Wildin general manager of the company, vice A. L. Humphrey, resigned. Mr. Humphrey continues as ranking vice-president and in that capacity will as heretofore have general direction of the company's operations in all departments and subsidiary organizations, Mr. Wildin reporting to him.

W. L. Chandler, of the Dodge Sales & Engineering Company, Mishawaka, Ind., as chairman of the standardization committee of the National Association of Purchasing Agents, informs the ELECTRIC RAILWAY JOURNAL that the National Retail Hardware Association, made up of twenty-nine affiliated organizations, has indorsed the standard size 7½ in. x 10⅝ in. for all catalogs and similar literature.

"Iron Trade Review," Cleveland, Ohio, has published a revised and amplified booklet giving the complete schedules of maximum prices on iron, steel and non-ferrous products as fixed by the government, which now are in effect. It is claimed to be the only up-to-date price manual on iron and steel now in circulation, as the numerous changes during the past six months have rendered practically obsolete those previously printed.

J. W. Maloney on July 1 severed his relations with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to begin practice as a consulting mechanical and electrical engineer in New York, N. Y. He will specialize in the design and application of railway brake and control apparatus of the mechanically, electrically or pneumatically operated forms. Mr. Maloney's experience in these lines has extended over a period of more than twenty years. Until further notice, his address after July 1, will be 574 Eighty-first Street, Brooklyn, N. Y.

New Advertising Literature

Du Pont Chemical Works, New York, N. Y.: "Tar Products," a twelve-page pamphlet describing their nature and use.

Bastian-Blissing Company, Chicago, Ill.: Catalog illustrating and describing the "Rigo Welding and Cutting Apparatus." Complete units are first outlined in the pages of this interesting publication, followed by a detailed description of regulators and torches.

NEW YORK METAL MARKET PRICES

	July 10	July 17
Copper, ingots, cents per lb	26	26
Copper wire base, cents per lb	30	29.25
Lead, cents per lb	8.05	8.05
Nickel, cents per lb	40	40
Spelter, cents per lb	8.87½	8.90
Tin, Chinese*, cents per lb	92	92
Aluminum, 98 to 99 per cent., cents per lb	†33.00	†33.00

* No Straits offering. † Government price in 50-ton lots or more, f. o. b. plant.

OLD METAL PRICES—NEW YORK

	July 10	July 17
Heavy copper, cents per lb	23½	23½
Light copper, cents per lb	20	20
Red brass, cents per lb	19	22
Yellow brass, cents per lb	13	14
Lead, heavy, cents per lb	7	7
Zinc, cents per lb	5¾	5¾
Steel car axles, Chicago, per net ton	$41.52	$41.52
Old carwheels, Chicago, per gross ton	$29.00	$29.00
Steel rails (scrap), Chicago, per gross ton	$34.00	$34.00
Steel rails (relaying), Chicago, gross ton	$60.00	$60.00
Machine shop turnings, Chicago, net ton	$16.25	$16.25

ELECTRIC RAILWAY MATERIAL PRICES

	July 10	July 17
Rubber-covered wire base, New York, cents per lb	30 to 37	30 to 39
Weatherproof wire (100 lb. lots), cents per lb., New York	32.10 to 32.40	32.40 to 34.10
Weatherproof wire (100 lb. lots), cents per lb., Chicago	33.42 to 35.00	35.00 to 37.72
T rails (A. S. C. E. standard), per gross ton	$70.00 to $80.00	$70.00 to $80.00
T rails (A. S. C. E. standard), 100 to 500 ton lots, per gross ton	$67.50	$67.50
T rails (A. S. C. E. standard), 500 ton lots, per gross tons	$62.50	$62.50
T rail, high (Shangbair), cents per lb	4¼	4¼
Rails, girder (grooved, cents per lb	4¼	4¼
Wire nails, Pittsburgh, cents per lb	3½	3½
Railroad spikes, drive, Pittsburgh base, cents per lb	4½	4½
Railroad spikes, screw, Pittsburgh base, cents per lb	8	8
Tie plates (flat type), cents per lb	*3¼	*3¼
Tie plates (brace type), cents per lb	*3¼	*3¼
Tie rods, Pittsburgh base, cents per lb	7	7
Fish plates, cents per lb	*3¼	*3¼
Angle plates, cents per lb	*3¼	*3¼
Angle bars, cents per lb	*3¼	*3¼
Rail bolts and nuts, Pittsburgh base, cents per lb	4.90	4.90
Steel bars, Pittsburgh, cents per lb	5	5
Sheet iron, black (24 gage), Pittsburgh, cents per lb	4.90	4.90
Sheet iron, galvanized (24 gage), Pittsburgh, cents per lb	5.80	5.80
Galvanized barbed wire, Pittsburgh, cents per lb	4.35	4.35
Galvanized wire, ordinary, Pittsburgh, cents per lb	3.95	3.95
Car window glass (single strength), first three brackets, A quality, New York, discount†	80%	80%
Car window glass (single strength, first three brackets, B quality), New York, discount	80%	80½%
Car window glass (double strength, all sizes AA quality), New York discount	82 & 3%	82 & 3%
Waste, wool (according to grade), cents per lb	11½ to 22	11½ to 22
Waste, cotton (100 lb. bale), cents per lb.	13 to 13½	13 to 13½
Asphalt, hot (150 tons minimum), per ton delivered	$38.50	$38.50
Asphalt, cold (150 tons minimum, pkgs. weighed in, F. O. B. plant, Maurer, N. J.), per ton	$42.50	$42.50
Asphalt filler, per ton	$45.00	$45.00
Cement (carload lots), New York, per bbl	$3.20	$3.20
Cement (carload lots), Chicago, per bbl	$3.34	$3.34
Cement (carload lots), Seattle, per bbl	$3.68	$3.68
Linseed oil (raw, 5 bbl. lots), New York, per gal	$1.64	$1.80
Linseed oil (boiled, 5 bbl. lots), New York, per gal	$1.65	$1.81
White lead (100 lb. keg), New York, cents per lb	10½	10½
Turpentine (bbl. lots), New York, cents per gal	75	73

* Government price. † These prices are f. o. b. works, with boring charges extra.