

# Electric Railway Journal

Consolidation of STREET RAILWAY JOURNAL and ELECTRIC RAILWAY REVIEW

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## Are You Making the Best Possible Use of These Special Monthly Issues?

FOR several months now one issue of this paper in each month has been devoted especially to the shop, track, line and power departments. In planning these issues we invited several specialists to furnish each a series of articles dealing with the fundamentals of the technical departments of the electric railway. Each issue now consists of two technical divisions, one dealing with the general principles and the other illustrating from all departments in all parts of the country the application of these principles in every-day work.

It has undoubtedly occurred to many readers of these special issues that they have in their hands an unparalleled educational opportunity. If they were paying a correspondence school a large fee for this material they would appreciate it still more. There is a comprehensive plan underlying both the longer articles and the shorter ones which is already apparent through careful reading of the articles. This plan should work in well with the ambitions of young men for the best available information in their several lines, and it should be used by men in responsible positions in training the younger men under them. The articles could be readily made the basis of regular study, their topics could be discussed at company section and shop meetings, or quizzes could be held upon them from time to time with the voluntary attendance of the more ambitious youngsters, etc.

The writers of the articles are making considerable sacrifice of time and energy for the benefit of the industry. This will not have been in vain if the industry is making the best possible use of the fruits of their thought and experience.

### Standardization in General and on Track Spirals in Particular

**A** MOST interesting and instructive discussion was started by E. M. T. Ryder in an article in the issue for April 6 on the standardization of track spirals. In all of this there has been apparent a hope that ultimately the condition of standardization may be approximated, for only thus will it be possible to reduce materially the number of spirals now in use. It would appear that there are more obstacles in the way of standardizing track spirals than in standardizing other elements of electric railway equipment, if that is possible. Those who have discussed the matter appear to feel that however desirable ultimate standardization may be it can only be brought about gradually.

Starting with the assumption then that ultimate standardization is desirable and not impossible, two inevitable facts must be faced. First, there must be

visualized somehow a picture of the standards towards which progress is desirable. In the second place steps must be taken successively and consistently in the direction of the desired goal. No one will deny that immediate standardization of track spirals or anything else is impracticable. Even if all way engineers could agree on what they would like to have it would take time to enable them to get it. Mr. Ryder, after painstaking analysis, has outlined what he considers to be the ideal toward which to work. Mr. Angerer thinks that a less elaborate system would be better. It seems to us to be up to the American Electric Railway Engineering Association, and initially to its committee on way matters, to take all of this material now available and set up some kind of a group of standards towards which progress may be directed. It is true that committee work is now in abeyance, but it must in time be resumed, and when it is resumed it might well take up this matter of track spirals.

On principle, standardization is right. It conduces to economy, and if sufficiently flexible it need not involve stagnation. There are difficulties in the way of bringing it about, but the very effort to establish a standard is stimulating and has tangible engineering value. To repeat, standardization without stagnation is the desideratum.

### Demands for Higher Fares Come From All Sides

**R**ECENT developments throughout the country would seem to indicate that organized labor is beginning to see the light on the question of increased revenues for electric railways. This applies at least to that portion of the working classes who owe their daily bread to utilities of this kind. While this may suggest a selfish motive, the point probably is the stronger because these employees have at last come to realize that existing rates of fare will not cover increasing operating costs, including the larger wages which they are seeking.

For some years past, one of the strongest arguments of dissatisfied trainmen in arbitration proceedings has been the very evident increased cost of living. They may have overlooked the fact that the employing companies also had to exist under conditions where mounting costs of supplies met them on all sides. Labor began to take a broader view of the situation when some settlements were made on the promise from the companies of higher wages when the added burden could be afforded.

Within the past few weeks the employees of the New York Railways Company received encouragement from the chairman of the Public Service Commission when

they urged franchise modifications which would permit higher fares. In St. Louis organized labor joined in the appeal to the State commission for increased revenues for the employing company. And now comes one of the official organs of the Amalgamated Association which asks editorially: "Where it can be honestly shown that increased fare rates are necessary to meet operating costs, why should they be denied? Why should a traction company be forced to carry passengers at a loss?"

And so the tide of public sentiment mounts higher and becomes more forceful. The people are coming to appreciate that they must have service at any cost, because without service industry of all kinds will suffer. The higher wage inducement in other occupations is having its effect, and if the people want transportation facilities they must be willing to pay the price which will enable the companies to hold their present forces and maintain or add to existing equipment. The public authorities who are called upon to act in cases of this kind must indeed be blind and deaf if they cannot see and hear the evidence which is so overwhelming.

### The Essential Nature of the Electric Railway Business

THE greatest thing about the electric railway business is that, in common with other primary forms of transportation, it is essential to the welfare and the development of the country. This characteristic of essentiality makes the business a fascinating one and holds thousands of capable men in it even through times of stress and of rival attractions in other lines. At the moment the public demands more in the way of electric railway transportation than it seems willing to pay for. This, however, is a transient condition which ultimately will redound to the benefit of the industry. It will do so for at least two reasons: First, the general educational effect of the railway pressure for increased fares will be ultimately to make the public reasonable. Furthermore, the reflex influence on the railways themselves will be in the direction of improved service with the best procurable operating economies.

In his recent company section address on "Our Job," abstracted in the issue of this paper for May 4, N. W. Bolen raised and answered the question as to why men remain in electric railway work under the present strenuous conditions. His only answer to this was that to the men fitted for the work it makes an irresistible appeal. If one is "called" to this work he will stay by it through thick and thin. If he has at any time a tendency to feel a little blue all that is necessary is a freshening of the conviction that his work is worth while because it furnishes something which the people cannot do without.

What is true with regard to the operating side of the business is equally true of the manufacturing side. Railway men cannot give good service without good equipment. Cars are needed and will continue to be needed, fitted with modern motors, controllers, brakes and all sorts of economical and convenient devices. These cars must roll on rails supported on modern ties, and they will require power which must be produced cheaply and transmitted economically. Reliable signals must make possible the safe and speedy operation of

these cars. To be sure, the railways are not buying maintenance supplies as they would in normal times and few extensions are being made. But even now in the aggregate the business is a tremendous one, and when the railways again come into their own, as they must do in the reasonably near future, the wear and tear of these "off" years will be made good and the arrested growth will be compensated for by well considered expansion.

### A Well-Deserved Honor for the Rhode Island Company

SOME weeks ago the ELECTRIC RAILWAY JOURNAL offered a silver cup to the company section of the American Electric Railway Association which should be organized with a charter membership larger than that of the Rhode Island Company section. This was done by way of seconding the challenge of that section to electric railway companies generally to exceed its achievement of organizing with 216 members. In making its offer the JOURNAL did not have in mind the award of the cup to the Rhode Island Company section itself, but further consideration made it seem eminently fitting that this company should have the cup and hold it until the challenge had been met. The cup has therefore been purchased and a picture of it appears on the "Association News" page in this issue. It has been accepted by the association, under whose auspices it will be fittingly awarded at an early date.

There are now twelve company sections in the association, all, we believe, accomplishing a worthy purpose and forming an admirable connecting link between managers and men. While few in numbers these sections represent a very much larger fraction of the total mileage and rolling stock than the number and membership would indicate. Through the wide publicity given to their proceedings they are exerting a powerful influence throughout the industry. As has been pointed out in these columns before, these sections are needed now if they ever were, which is to say that they are needed now very much indeed. The publishers of this paper hope that the cup will serve at least to focus attention, from time to time, upon the duty which devolves upon those companies which can do so to form company sections in their ranks. It will at least provide an impulse for starting new sections off with the greatest possible accelerating force.

In this connection it is interesting to note the charter memberships of the earlier formed sections. From association headquarters we learn that grouped according to number of charter members these were as follows: Public Service Railway 156; Cumberland County Power & Light Company 145; Chicago Elevated Railroads and The Connecticut Company 138 each; Toledo Railways & Light Company 120; Capital Traction Company 78; Newport News & Hampton Railway, Gas & Electric Company 60; Washington Railway & Electric Company 53; Milwaukee Electric Railway & Light Company 48; Denver Tramway 32; and Manila Electric Railway & Light Company 18. These data show what a remarkable start the Rhode Island Company section has had, but the present memberships of several of the sections prove that it ought to be possible to do even better yet.

### Automatic Operation as a War Measure

THE use of automatic devices in car equipment has received increased attention during the past year. Such equipment may be properly considered as war necessities since it is aiding electric railways to solve their labor problems at this time of great demand for experienced men. As motormen, conductors and other railway employees enlist or are called to their country's service, others must do their work. Experienced men are hard to find and it takes time to develop new men so that they may become efficient car operators. Manifestly, the simpler the operating devices are, the quicker the men can be made experts. This is war work. Many of the men have gone. Others are needed to replace them. Their jobs should be made as pleasant as possible so they will be filled with enthusiasm for their work.

There is still another problem coming—one we do not like to think of. Soon some of the brave lads will be returning to us with an arm or a leg gone or some other defect resulting from their service. We would be glad to see them at their former work again. A real field for automatic appliances in car operation is thus opened up for the use of men who have been physically incapacitated from the war. For this work, we want all the improvements possible injected into car operation and we want the idealists and the progressives to help to the limit of their resources in developing such devices.

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### Why Shopmen Leave Electric Railway Service

NINE times out of ten the man who throws up his job gives as his unanswerable reason the laconic reply: "To get more money." Perhaps this little story from life will bring out one reason why the railway shopman, not only in these times but always, is so willing to move.

An engineer accustomed to checking railway payrolls was requested to check some labor force accounts for an electric contracting firm. Conceive his astonishment when he found that 75 cents per hour was being paid for wiremen whereas he knew that railways paid 30 to 40 cents for the same work.

His first thought was that the work must have included overtime or was of special character for which the men were allowed double time. But this was not so—it was straight time and at regular rates of pay. Can you blame the railway shopman for "leaving home"? Railways are not getting many young technically trained men at present, either. Where do such men go? They may be found in the big manufacturing plants, and they "fight shy" of electric railway properties.

Superintendents of equipment are not to blame for the deplorable labor situation in their departments. They know the way out but unfortunately are rarely supplied with data that would enable them to prove definitely that the traffic losses due to poor maintenance labor are big enough to justify the payment of the prevailing rate of wages at least. When shopmen are rated properly and are paid for their ability to prevent accidents and delays in service, then and only then will they "stay at home."

### "Nothing Is Ever Settled Until It Is Settled Right"

SOMETHING certainly is "rotten in the state of Denmark" when cities like Rochester, Syracuse and Utica can be forced to undergo weeks of turmoil and ill-feeling, and finally stoppage of street railway service, before a routine question such as a new wage scale can even be started toward settlement.

The New York State Railways operates the lines in the above cities. It is the largest electric railway company in the Second Public Service (upstate) District.

The company was perfectly willing to pay its men more but said it could not—its income was not enough.

Call it a strike or not—the point is that enough men quit work in Rochester on May 11 to stop the service and didn't go back to work till May 14. The company promised to raise the pay and take its chances on proving to the satisfaction of the city authorities that it couldn't afford to raise wages unless fares were increased.

This situation grew directly out of the Court of Appeals decision that no matter what the necessities of the company, the Public Service Commission has not the power to raise fares if they are established in the franchise. The city authorities must amend the franchise.

The company has been ready to show the facts ever since last August. Meantime, it is compelled to go on pocketing losses.

In Syracuse there is no franchise limitation, but in Rochester there is. The company enjoys public goodwill, generally speaking, in Syracuse. In Rochester a certain degree of ill-will has been developed. Just how or why need not be discussed.

In one city the company might get the consent of the city authorities to raise fares. In the other city it might fail, though the need were just as great.

The important point of it all is that here is an intolerable situation.

It were fruitless to discuss whether company, city or employees should most be blamed. The moral is plain: the State Legislature should put the Public Service Commission in full power over the affairs of the public utilities.

It was supposed in 1907 that this had been done. The people certainly wanted it done.

To leave matters as at present is to invite repetitions of the Rochester-Syracuse-Utica incidents, or worse. It will still further discourage investors from furnishing capital for the extension of street railway facilities and deprive the public of its needed service.

In any readjustment of the public service law, a speedier settlement of rate matters must be provided. At present, not only in New York State but in most others, a company must be actually suffering losses before it can apply for consideration. It cannot forestall losses with the most ordinary quality of business foresight, and it takes months and months to come to conclusions, while the losses go on.

Of the thirty odd cases put before the upstate commission in New York nine months ago, relief to companies has come to only three or four. Relief, apparently, cannot come to the rest for several months more, at least.

This is one thing, certainly, that "is rotten in the state of Denmark."

# Virtues and Limitations of Steel Supports in Overhead Construction

By Charles R. Harte

Construction Engineer

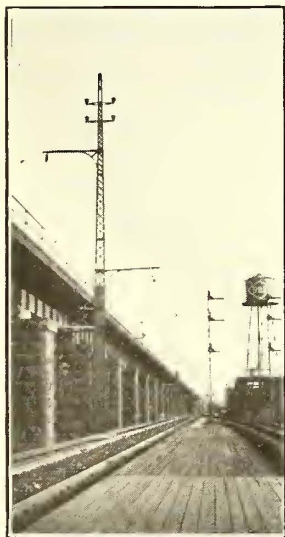
The Connecticut Company, New Haven, Conn.

**Greater Permanence and More Attractive Appearance of Steel Poles and Towers Bring Them into Keen Competition with Wood Poles for Supporting Transmission Lines and Aerial Contact Conductors**

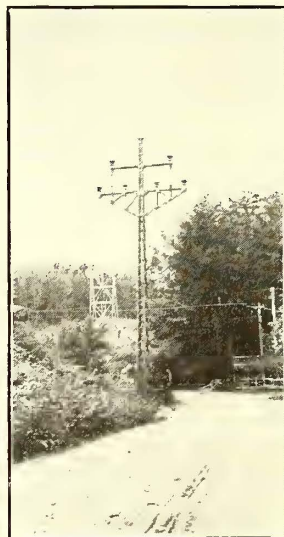
**I**N FAVOR of the use of wood poles in overhead construction are low first cost, ease of framing for any construction, comparatively light weight facilitating both field transportation and erection, and ease of climbing. On the other hand they have to answer for rather short life, involving not only replacement of the pole itself at frequent intervals, but also inevitable injury at such time to the attachments; for liability of burning in case of current leakage or of grass or other fires near by; and in many instances for the appearance if not the fact of obstruction to traffic. With a public not entirely in sympathy with the owners, such appearance is quite likely to lead to agitation for underground construction.

For heavier service the section is usually square, with angles for corners and latticing outside. If the legs are slightly curved outward at the base, as in the case of the New York Central Railroad poles, the effect is much more pleasing than that produced with a straight taper.

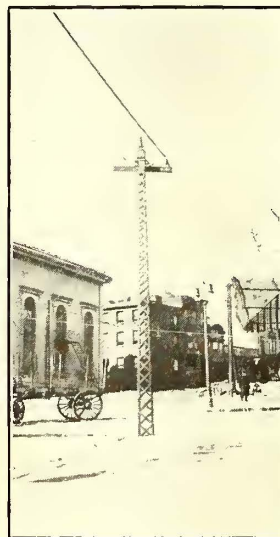
Fabricated lattice poles, being almost invariably used to meet special conditions which fix the dimensions, possibly require special designing. This is best done jointly by the line engineer and the designing engineer of the shop which is to build them, in order that on the one hand the service requirements shall be met and on the other that so far as possible the details follow the regular practice of the shop. Sometimes special construction requires special details, but in the majority



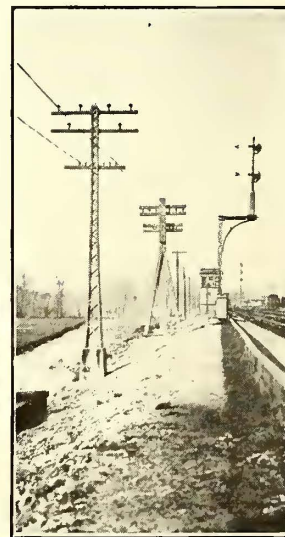
Pole in Restricted Space, Pennsylvania Railroad, Philadelphia Electrification



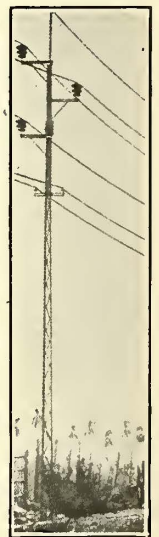
Pole Used to Avoid Right-of-Way Difficulties, Connecticut River Power Company



Trolley Pole Used at Albany, N. Y.



Pole, with Legs Slightly Curved, Used by New York Central Railroad



One-Piece Expanded Pole Supported Transmission Line

## SEVERAL TYPES OF LATTICED STEEL POLES

The permanent poles divide naturally into several groups, namely, latticed steel poles, steel towers, tubular poles and concrete poles. The last-named will not be taken up in the present article.

Latticed steel poles are the least common and generally speaking—although there is at least one exception, the Bates pole—the most costly. In fact, until the appearance of the exception referred to, latticed poles were used chiefly in special cases where towers required too much room and tubular poles failed to give the necessary strength. For trolley service they have had some use in a few cities, and they are rather attractive in appearance, but the large amount of labor involved in their construction makes the cost excessive.

of cases this is unnecessary or can be avoided by unimportant changes in the main design. In a small shop doing a large variety of work with a limited equipment special designs and details do not make so much difference, but in a large establishment equipped for quantity production variations from the routine practice not infrequently double both cost and time of production.

### The Expanded Type of Pole Is Promising

The latticed pole which is an exception to the high cost of the majority of types, and which seems to have a considerable field before it is, at least up to a length

of 35 ft., made from a single piece of metal, an H-beam of special section. The web of this is first slit properly by a special rotary punch, and then, after heating, the flanges are pulled apart, the web sections forming the equivalent of lattice bars, with the marked advantage that they do not require riveting. For lengths above 35 ft. two sections are spliced together. While at least at present the available stock and apparatus limits the size and capacity it would seem that heavy service square poles might well be fabricated with considerable economy by using two poles of suitable size of this type with lattice bar or plate connections. They have been employed and, it is claimed, very successfully as legs for short towers.

Grading insensibly into poles are the steel towers, which are used very extensively on transmission lines of voltages above 22,000; and to a constantly increasing extent on the lower voltage lines. Their ability to carry long spans and thus reduce the number of insulators and their insurance against interruptions is supplemented by comparatively low cost.

**We Owe Something to the Windmill Tower.**

While in the past there have been designs without end, there is to-day a tendency toward standardization. The steel towers first used were straightaway windmill towers, including the operating platform at the top. The platform long ago disappeared, but the general design, with light angle legs and long and lighter braces, still persists and the towers give good service too. Breakdowns, due to failure of the designers to recognize the limitations of the type, led to the development of a more rugged design. In this heavy angle legs were designed to carry all the stress, whereas in towers of the

very light type it was expected that every member would take a share of the load. Finally, as a compromise between the two extremes there has been developed the scheme which is generally credited to the Italian engineer Semenza, the use of flexible supports.

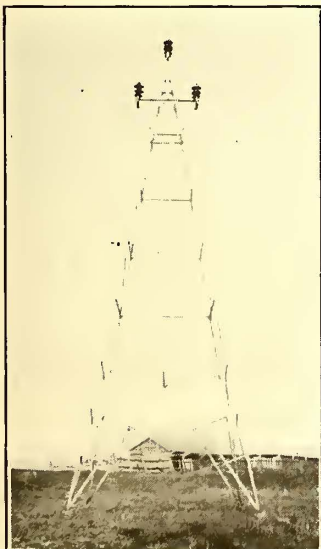
The supports of a line must carry the vertical dead load due to the weights of the half spans either side. In addition, when the wind blows there is a force at right angles to the line and each span pulls in the direction of the line. As these forces in general oppose each other the support needs to meet only the *difference* in pulls. If they are balanced, either by making spans and deflections

equal or increasing the sag properly on the longer span, the support need only have enough strength to carry the dead load as a column, and sufficient stiffness across the line to meet the maximum wind effort. Further, other things remaining unchanged, increasing or decreasing the sag decreases or increases the pull in exactly the same relation. For sags which are quite small in proportion to length of span, a very slight decrease or increase in the length of the conductors or, what is practically the same, an equal increase or decrease in the distance between supports without change in the length of conductor between them makes a very considerable decrease or increase in the sag. As a result there is a corresponding increase or decrease in the pull. A difference in pull, if not excessive, is automatically balanced by a small deflection of the support. In case one conductor breaks, the frame twists as well as bends, but if structural connections and wire ties are good it will usually hold up, and in many cases can be repaired.

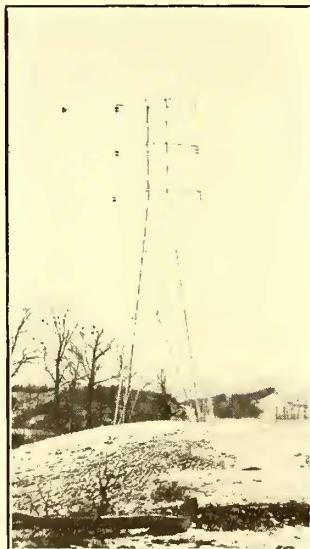
The anchor towers for flexible construction are usually standard type square towers with such modifica-



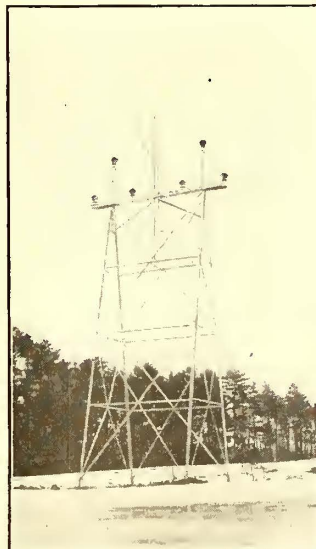
It's Fun to Put up a Steel Overhead Structure



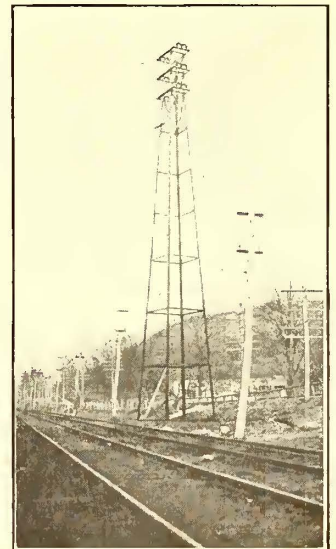
Square Tower on the Line of the Niagara, Lockport & Ontario Power Company



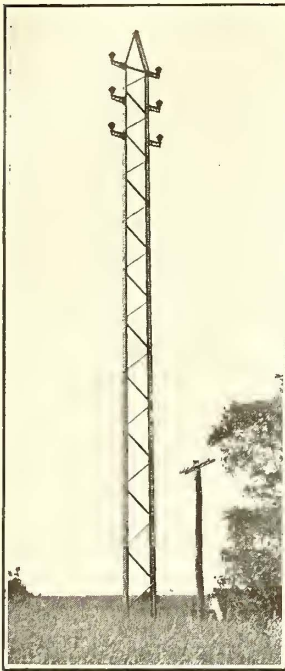
Double-Circuit Tower on the Transmission Line of the Schenectady Power Company



Tower Used for Transmission Line of Connecticut River Power Company

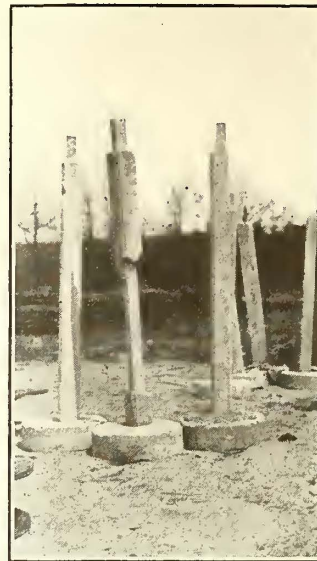


Heavy Type of Tower on the Lines of the Hoosatic Power Company



Flexible Tower, Berkshire Street Railway

tion at the top as may be necessary to carry the anchor insulators. The intermediate supports are generally the so-called A-frames with channel-iron sides and braces, the latter being horizontal, and round rod diagonals. These are almost always fabricated in the shop and sent out complete except for the insulator brackets, which are as a rule of malleable iron, and are bolted on in the field. A form which also is frequently used is practically a latticed pole, having no horizontal bracing, the diagonals being angles or channels with the ends bent so they can be riveted to the legs on the center line of the webs.



AT LEFT, STUB TOWER FOOTINGS PROTECTED BY CONCRETE CASTINGS (Note how protection has been broken; this is the chief difficulty with this type of footing), AT RIGHT, HEAVY TUBULAR POLE WITH ROD GUYS, PENNSYLVANIA RAILROAD, PHILADELPHIA ELECTRIFICATION

Judiciously used, the flexible support scheme is exceedingly good; but unfortunately its reputation has suffered because of over-enthusiasm of some of its advocates. With anchors at proper intervals, the lengths of which will depend upon the conditions and will vary from one to six per mile, and with a ground wire securely attached to each frame so it acts as a continuous tie, a flexible support line should be practically as dependable as one with rigid towers. If it is not so anchored, however, there is a possibility of stresses accumulating at one span under heavy loads, breaking the conductors and wrecking the line back to the nearest anchors. The use of guys in the direction of the line often obviates the necessity for some of the anchor towers.

Peculiar conditions demand special designs of towers, but for the average case there are several lines of stock design from which there can be chosen a form practically if not quite as good as a special type, and at much less cost. With the larger bridge companies regularly

making towers, and at least one company specializing in them, there is less occasion for insisting on high factors of safety than was the case a few years ago. Furthermore the designs have been so rationalized that it is possible to get a fair idea of the probable behavior under load. Practically any reputable concern which has had considerable experience in building towers can furnish either directly or with very little modification, a stock design which fully meets requirements. For this purpose a broad specification of the service required is necessary, including in this data as to the loads to be sustained and whether pin or suspension-type insulators are to be used. In the latter case particular attention must be given to insure that there are ample clearances for a swinging conductor.

As to what stress a tower should stand in the direction of the line there is considerable difference of opinion. The National Electrical Safety Code requires that for grades of construction A, B and C, in regions of

TABLE I—DEFLECTIONS OF EXPANDED POLES FOR GIVEN LOADS (MANUFACTURERS' DATA)

Section	Length in Feet	Set in Ground, Ft.	Base of Pole in Inches	Weight in Pounds	DEFLECTION IN INCHES UNDER VARIOUS DEFLECTING FORCES																											
					200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600
					Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
4 In.	20	4	7	246	0.23	0.65	1.04	1.61	2.34	2.92	3.27	4.62	5.17	5.74	6.13																	
	25	5	8	308	0.63	1.63	2.18	3.50	4.50	5.63	7.00	9.06																				
	30	5 1/2	9	370	0.75	2.25	3.81	5.63	8.18	10.25																						
	35	6	10	430	0.88	2.63	5.00	7.88																								
5 In.	20	4	9 1/2	322	0.23	0.45	0.71	1.08	1.42	1.75	2.14	2.70	3.58	4.39	5.64	6.15																
	25	5	10 1/2	403	0.44	1.03	1.53	2.25	2.94	3.65	4.31	5.25	6.65																			
	30	5 1/2	11 1/2	483	0.81	1.31	2.05	3.12	4.62	5.50	7.18																					
	35	6	12 1/2	564	1.06	2.06	3.31	4.56	6.00	7.56																						
6 In.	20	4	11 1/2	404	0.18	0.31	0.45	0.58	0.74	0.83	1.11	1.35	1.66	2.11	3.42	4.46	5.99	6.69														
	25	5	12 1/2	506	0.50	0.87	1.25	1.62	1.87	1.87	2.87	3.62	4.50	5.75	7.25	8.75																
	30	5 1/2	13 1/2	607	0.50	0.87	1.25	1.62	2.31	2.93	3.74	4.12	5.12	6.56																		
	35	6	15	708	0.63	1.25	1.88	2.50	3.38	3.88	4.88	5.63	6.63																			
7 In.	20	4	13	498	0.11	0.18	0.26	0.34	0.43	0.49	0.65	0.79	0.97	1.24	2.00	2.61	3.51	4.76	6.94	9.25	17.5	43	5.70	5.93	6.17	6.42						
	25	5	14	622	0.29	0.51	0.73	0.95	1.10	1.10	1.68	2.12	2.63	3.73	4.07	4.40	4.71	5.04	5.34	5.61	5.89	6.18	6.49	6.81	7.15							
	30	5 1/2	16	747	0.30	0.54	0.78	0.98	1.35	1.71	1.97	2.41	3.00	3.84	4.24	4.60	4.97	5.32	5.69	6.03	6.33	6.65	6.98	7.33								
	35	6	17 1/2	871	0.37	0.73	1.10	1.47	1.98	2.27	2.86	3.30	3.89	4.98	5.47	5.97	6.45	6.90	7.38	7.82	8.12											
8 In.	20	4	15	585	0.07	0.12	0.17	0.22	0.28	0.31	0.42	0.50	0.62	0.79	0.87	0.95	1.03	1.10	1.18	1.25	1.35	1.42	1.49	1.56	1.64	1.72	1.79	1.86	1.93	2.00	2.08	2.16
	25	5	16 1/2	731	0.19	0.33	0.47	0.61	0.70	0.70	1.07	1.35	1.68	2.15	2.70	2.94	3.18	3.40	3.64	3.86	4.05	4.25	4.46	4.64	4.84	5.05	5.25	5.45	5.65	5.86	6.01	6.25
	30	5 1/2	18 1/2	877	0.20	0.35	0.48	0.62	0.86	1.01	1.26	1.50	1.84	2.25	2.85	3.10	3.35	3.50	3.83	4.06	4.26	4.47	4.64	4.82	5.01	5.20	5.39	5.58	5.78	6.01	6.25	
	35	6	20	1023	0.24	0.47	0.70	0.94	1.26	1.28	1.83	2.11	2.48	3.18	3.50	3.81	4.14	4.25	4.51	4.79	5.05	5.25	5.51	5.79	6.07	6.38	6.69					

Above table of deflections from actual test by dynamometer readings taken one-tenth length of pole below top.

TABLE II. TUBULAR STEEL POLES—DEFLECTIONS AND LOADS

Length of Pole (Ft.)	Description of Poles				Weight of Pole (Lb.)	Section Lengths			Load in Pounds Applied 18 in. from Free End of Pole												Greatest Safe Load (Lb.)	Length of Pole (Ft.)	
	Size and Kind of Pipe					Butt	Middle	Top	Pole set 6 ft. 0 in. in ground—load applied and deflection measured 18 in. from free end, probable deflections when held and loaded as stated														
	Butt		Middle	Top					100	500	600	800	1,000	1,200	1,400	1,600	1,800	2,100	2,400	2,700			3,000
	Stand- ard	Extra Heavy	Stand- ard	Stand- ard																			
28	5		4	3	385	18	7	6	1.23										443	28			
28	5		4	3	495	18	7	6	.90	4.52	5.42								603	28			
28	6		5	4	509	18	7	6	.65	3.24	3.89								692	28			
28	6		5	4	681	18	7	6	.46	2.28	2.73	3.64							993	28			
28	7		6	5	645	18	7	6	.39	1.93	2.32	3.09							992	28			
28	7		6	5	906	18	7	6	.26	1.27	1.53	2.04	2.55	3.06	3.57				1,525	28			
28	8		7	6	791	18	7	6	.25	1.23	1.48	1.98	2.47	2.97					1,366	28			
28	8		7	6	1,058	18	7	6	.17	.84	1.01	1.34	1.68	2.02	2.35	2.69	3.03		1,996	28			
28	9		8	7	951	18	7	6	.17	.83	.99	1.32	1.65	1.98	2.31	2.64	2.97		1,817	28			
28	9		8	7	1,218	18	7	6	.12	.59	.71	.94	1.18	1.42	1.65	1.89	2.12	2.48	2.83	2,527	28		
28	10		9	8	1,137	18	7	6	.11	.57	.68	.90	1.13	1.36	1.58	1.81	2.04	2.37	2.71	2,432	28		
28	10		9	8	1,393	18	7	6	.08	.41	.50	.66	.83	1.00	1.16	1.33	1.49	1.74	1.99	2.24	2.49	3,205	28
29	5		4	3	393	18	7	7	1.45										422	29			
29	5		4	3	503	18	7	7	1.07	5.35									575	29			
29	6		5	4	520	18	7	7	.76	3.83	4.58								658	29			
29	6		5	4	692	18	7	7	.54	2.67	3.21	4.28							947	29			
29	7		6	5	659	18	7	7	.45	2.26	2.72	3.63							946	29			
29	7		6	5	920	18	7	7	.30	1.49	1.79	2.38	2.98	3.58	4.17				1,450	29			
29	8		7	6	811	18	7	7	.29	1.44	1.73	2.31	2.88	3.46					1,304	29			
29	8		7	6	1,078	18	7	7	.20	.98	1.18	1.57	1.96	2.35	2.74	3.14	3.53		1,900	29			
29	9		8	7	974	18	7	7	.19	.96	1.15	1.54	1.92	2.30	2.69	3.07			1,733	29			
29	9		8	7	1,241	18	7	7	.14	.69	.82	1.09	1.37	1.64	1.92	2.19	2.46	2.88	3.29	2,410	29		
29	10		9	8	1,166	18	7	7	.13	.65	.77	1.03	1.29	1.55	1.81	2.06	2.32	2.71		2,320	29		
29	10		9	8	1,422	18	7	7	.10	.48	.58	.78	.97	1.16	1.36	1.55	1.74	2.04	2.33	2.62	2.91	3,060	29
30	5		4	3	406	18	9	6	1.67										403	30			
30	5		4	3	516	18	9	6	1.23	6.16									550	30			
30	6		5	4	539	18	9	6	.88	4.39	5.27								629	30			
30	6		5	4	711	18	9	6	.62	3.08	3.70	4.93							906	30			
30	7		6	5	682	18	9	6	.52	2.60	3.12	4.17							903	30			
30	7		6	5	943	18	9	6	.34	1.71	2.06	2.74	3.43	4.12					1,387	30			
30	8		7	6	840	18	9	6	.33	1.65	1.99	2.65	3.31	3.97					1,245	30			
30	8		7	6	1,107	18	9	6	.23	1.12	1.35	1.80	2.25	2.70	3.15	3.60	4.05		1,815	30			
30	9		8	7	1,008	18	9	6	.22	1.10	1.33	1.77	2.21	2.65	3.09	3.54			1,655	30			
30	9		8	7	1,275	18	9	6	.16	.79	.95	1.26	1.58	1.90	2.21	2.53	2.85	3.32		2,305	30		
30	10		9	8	1,205	18	9	6	.15	.74	.89	1.18	1.48	1.78	2.07	2.37	2.66	3.11		2,220	30		
30	10		9	8	1,461	18	9	6	.11	.56	.67	.90	1.12	1.34	1.57	1.79	2.02	2.35	2.69	3.02	2,920	30	
31	5		4	3	413	18	9	7	1.95										527	31			
31	5		4	3	523	18	9	7	1.44	7.18									387	31			
31	6		5	4	549	18	9	7	1.02	5.09	6.12								603	31			
31	6		5	4	721	18	9	7	.72	3.58	4.29	5.72							867	31			
31	7		6	5	696	18	9	7	.60	3.00	3.60	4.80							865	31			
31	7		6	5	958	18	9	7	.40	1.98	2.38	3.18	3.97	4.77					1,325	31			
31	8		7	6	860	18	9	7	.38	1.90	2.29	3.05	3.81						1,192	31			
31	8		7	6	1,127	18	9	7	.26	1.30	1.55	2.07	2.59	3.11	3.63	4.15			1,740	31			
31	9		8	7	1,031	18	9	7	.25	1.27	1.52	2.03	2.54	3.05	3.56				1,585	31			
31	9		8	7	1,299	18	9	7	.18	.91	1.09	1.46	1.82	2.18	2.55	2.91	3.28	3.82		2,205	31		
31	10		9	8	1,234	18	9	7	.17	.85	1.02	1.36	1.70	2.04	2.38	2.72	3.06	3.57		2,125	31		
31	10		9	8	1,491	18	9	7	.13	.64	.77	1.02	1.28	1.54	1.79	2.05	2.31	2.69	3.07	3.45	2,795	31	
32	5		4	3	427	19	9	7	2.17										371	32			
32	5		4	3	545	19	9	7	1.61	8.02									505	32			
32	6		5	4	568	19	9	7	1.14	5.70									578	32			
32	6		5	4	749	19	9	7	.80	4.01	4.82	6.42							832	32			
32	7		6	5	720	19	9	7	.68	3.37	4.05	5.40							830	32			
32	7		6	5	995	19	9	7	.45	2.22	2.67	3.56	4.45	5.33					1,275	32			
32	8		7	6	888	19	9	7	.43	2.14	2.57	3.43	4.28						1,143	32			
32	8		7	6	1,169	19	9	7	.29	1.46	1.75	2.33	2.92	3.50	4.08	4.67			1,665	32			
32	9		8	7	1,066	19	9	7	.29	1.43	1.72	2.29	2.86	3.43	4.00				1,520	32			
32	9		8	7	1,348	19	9	7	.20	1.02	1.22	1.63	2.04	2.45	2.85	3.27	3.67	4.28		2,115	32		
32	10		9	8	1,274	19	9	7	.19	.96	1.15	1.53	1.92	2.30	2.69	3.07	3.46		2,035	32			
32	10		9	8	1,545	19	9	7	.14	.72	.86	1.15	1.44	1.73	2.02	2.31	2.59	3.03	3.45	2,680	32		
33	5		4	3	439	19	10	7	2.48										357	33			
33	5		4	3	555	19	10	7	1.83										487	33			
33	6		5	4	582	19	10	7	1.30	6.49									555	33			
33	6		5	4	764	19	10	7	.91	4.56	5.47								798	33			
33	7		6	5	739	19	10	7	.77	3.83	4.60								797	33			
33	7		6	5	1,015	19	10	7	.51	2.53	3.04	4.05	5.07	6.08					1,255	33			
33	8		7	6	910	19	10	7	.49	2.43	2.92	3.89	4.87						1,098	33			
33	8		7	6	1,192	19	10	7	.33	1.65	1.99	2.65	3.31	3.97	4.63	5.30			1,645	33			
33	9		8	7																			

heavy loading, the wind pressure shall be taken at right angles to the direction of the line and shall be assumed, for cylindrical surfaces, at 12 lb. per square foot of protected area for grade A, 7 lb. for grade B, and 4 lb. for grade C. The conductors are figured as being covered with a layer of ice, increasing the conductor diameter by 1 in., while the supports are figured as bare. For flat surfaces these pressures are to be increased by 60 per cent, making them 19.2, 11.2 and 6.4 lb., respectively. Latticed faces are taken as having an area 50 per cent greater than actual, to allow for the effect of the wind blowing through the spaces and so against the inside of the opposite face, unless this gives a total pressure greater than would result if the structure were solid. In this case the latter value should be used.

Steel structures are required to have a minimum factor of safety of two against these stresses. The use of guys to secure this is considered undesirable although they can be used if necessary. In the latter case if the support can deflect much the guys must be capable of taking all the stress, the support being considered as acting only as a strut.

When steel supports or towers are used which will not stand as great stresses longitudinally as those prescribed for the transverse strength, anchor towers capable of withstanding the total pulls of all the conductors up to a maximum of 10,000 lb. plus one-half the excess above 10,000 lb. shall be placed at intervals not greater than ten spans apart.

The code requirements have in mind protection to the individual and do not apply to lines in the country, but maintenance of service practically demands similar construction standards. And there is a point in this connection which is often missed. The transmission or distribution lines, even when most substantially built, represent but a very small percentage of the total cost of the system. The interest on the idle investment plus the loss of revenue during a short shutdown due to a line failure will very nearly pay the difference between "cheap and nasty" construction and a first-class line.

#### **Steel Templates Are Best in Setting Tower Footings**

Tower foundations are of several types. For structures subject to heavy stresses large concrete footings with anchor bolts are usually employed. A plan which is being followed more and more is to use "stubs," which are practically short extensions of the tower legs with a piece of channel or angle iron at right angles at the end, forming an inverted T. These are sometimes bedded in concrete in place, and sometimes have concrete cast about them at a central yard. More and more frequently they are set directly in the earth, with some rock filling if the tower is to carry heavy stresses or if the ground is soft. Bolts or stubs are best placed by means of a template made of structural steel, which holds them in exactly correct position until the concrete is set or the earth is rammed. Wood templates are cheaper in first cost but are easily injured, and the cost of correcting one wrong footing even in good country, particularly if, as is usually the case, the trouble is not discovered until the tower is raised into position, will eat up the "economy" and more.

Of the other metal supports the diamond, tripartite, and several other special forms of poles are used to a

very limited extent. The diamond pole consists of two parts of high strength steel of V-shape, with specially flanged edges. When properly interlocked these form a diamond section which is set so that the main strains come in the line of the diagonals. While this pole is light and strong the joints are said to render it particularly subject to corrosion. Its chief use is for trolley overhead. The tripartite pole has three legs of Bessemer steel, each of U-section, of such dimensions that each size just fits inside the next larger. The legs are held, with the "round" out, by means of spreaders and collars. Of these there is a large variety, so that a great many combinations of leg sections can be made with any one of many tapers. There have been several installations of this type of pole on transmission lines, notably those of the United States Reclamation Service in connection with the Roosevelt Dam project in Arizona, and the Pueblo line of the Anglo-Mexican Hydroelectric Company of Mexico City, Mexico. The first line has both single and double three-phase circuits of No. 2 copper, in spans of from 300 ft. to 400 ft., on poles 40, 45 and 50 ft. in length. The Mexican line has one three-phase circuit of No. 1 copper and a pair of No. 8 telephone wires in spans of from 285 ft. to 350 ft., on poles 43 ft. 7 in. long, with one leg extended 6 ft. above the top of the pole proper to take a ground wire.

#### **There Are Still Too Many "Standard" Tubular Poles**

Tubular poles, originally made up from iron pipe, now consist of special steel tubing and are listed in innumerable combinations, while even more can be had as "specials." In 1913 the American Electric Railway Engineering Association "standardized," cutting down the number between the lengths of 28 ft. and 35 ft. to only ninety-six, there being twelve of each length. As a matter of fact it would seem entirely practicable to reduce the list to not more than thirty "regulars," for many of the sizes listed are very heavy for their strength, and it hardly seems necessary to have lengths varying by single feet.

While tubular poles are practically standard for city trolley lines they have had very little use in transmission service except when the latter lines were on trolley poles. They are, however, coming into use in heavy electrification overhead, notably on the Norfolk & Western, the Pennsylvania at Philadelphia, and the New York Connecting Railroad. In these installations poles of extra large size and strength are employed, and with the solid steel-rod guys are really more of the nature of "baby" towers than poles.

The tubular pole tends to corrode both on the inside and at the ground line, "man's best friend" playing no mean part in the latter, although to-day it is almost universal practice to buy tubular poles with a protecting "dog sleeve" extending a foot or so above the ground. Interior corrosion is less serious; it can be prevented by filling the pole with concrete, but the large majority of users believe that the cost of the protection is greater than the results warrant, and the practice is not common.

Table II, from the 1915 report of the American Electric Railway Engineering Association, gives full and most valuable details of tubular poles of standard sizes.



# Getting More Energy Out of Coal in the Power Plant

**Good Station Operation Involves a Knowledge of the Heating Value of the Fuels Used—Coal Cost Is So Large an Element in Total Operating Cost that Conservation in Its Use Can Effect Large Economies**

*By Hartley LeH. Smith*

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THE cost of coal is so great an item in the total operating cost of producing electrical energy at the switchboard of a power plant that its efficient use effects a tremendous saving, while its inefficient, negligent use cuts down dividend rates not by fractions but by integers. This cost varies from about 55 per cent in average localities during normal times to as much as 85 per cent in districts somewhat remote from mines in these days of coal scarcity and deteriorated quality.

As mentioned in an earlier article dealing with water in steam-driven electric power plant operation, the finished product in the power plant is kinetic energy in electrical form, while the fundamental raw material, using the term "material" in a rhetorical sense only, is the potential heat energy of the coal. The coal itself as an actual material substance involves problems so numerous and difficult to handle that broad technical knowledge is needed in the boiler room for their solution. It is here that men properly equipped can do most to make the whole plant most highly efficient and produce a saving that will show to advantage in the report of power cost.

## Excessive Combustible in the Ash Is Reprehensible

The chief problem with coal is to burn it. This is the engineer's problem, and it is a difficult one, although the purchasing agent may think just now that his problem is still more difficult. A lot of the coal which enters the power plant never does get burned. This fact has led many power plant operators to make the determination of combustible in the refuse a routine procedure. Probably many operators do not realize how great a loss can be occasioned by allowing refuse unduly rich in combustible to leave the plant. When the percentage of true ash in the coal is high the danger is particularly great.

Omitting refinements the approximate formula for the loss in the combustible, expressed as a decimal fraction, is:

$$\text{Loss} = \frac{(f + y)xy}{f(1 - x)}$$

Where

$f$  = fixed carbon in coal

$y$  = true ash in coal

$x$  = combustible in refuse, all in per cent.

The loss may be expressed as a percentage thus:

$$\text{Loss} = \frac{(f + y)xy}{f(100 - x)}$$

A still simpler formula, if the fixed carbon is not

known but if data are available as to the combustible in the refuse and the ash in the coal, is:

$$\text{Loss} = \frac{xy}{(1 - x)(1 - y)}$$

Or, in per cent,

$$\text{Loss} = \frac{100xy}{(100 - x)(100 - y)}$$

For example, if the fixed carbon is 76 per cent, the true ash is 6 per cent and the combustible in the refuse is 15 per cent, then the power plant loss is 1.1 per cent. Again, if the fixed carbon is 62 per cent and the true ash in the coal is high, say 18 per cent, while the combustible in the refuse is 30 per cent, the power plant loss is 9.9 per cent.

To avoid large losses of this kind the fires must be well burned down before cleaning, or dumping, if they are stoker fires. Such burning down is not a hardship to the fireman, and only adequate and tactful supervision is required to bring it about. Such burning down does not need to have charged against it a period of undesirably low steaming rate, for fires while being burned down are capable of making steam actively.

## Clinkers Do Not Necessarily Mean Low Efficiency

The subject of clinker in the refuse is of considerable interest in this connection. Where there is much clinker there is apt to be very little combustible. The writer noticed this some years ago and called attention to it in a letter written to the editors of *Power*, in September, 1905. Some time later he was interested to find reference to the letter, with confirmation of the relationship mentioned, in Bulletin No. 325 of the United States Geological Survey.

When clinker forms with any freedom it is obvious that combustion is occurring at high temperature. A temperature high enough to melt ash does not let much carbon go unburned. Of course, no one is desirous of encouraging the formation of clinker with its attendant troubles, but there is at least some consolation in the fact that when it does form the refuse losses due to the presence of combustible are small.

The nature of the true ash primarily determines the extent of clinkering. The main point seems to be that burning all but the last bit of carbon involves the burning of some carbon which is surrounded by great quantities of ash. For this high temperature is required, and at this high temperature at least some of the ash will fuse or melt.

## Some Lessons from Domestic Fuel Consumption

On the general subject of combustible in the refuse of the power plant it is interesting to turn for a moment to that of the domestic use of coal in house heaters.

Here we know that the use of the rotary ash sifter has done wonders in cutting down coal consumption. Mainly no doubt, this has come about through making the rejected ash practically true ash almost in powdered form. Another saving perhaps is through the more complete burning of the volatile matter of the coal when each charge of green coal is covered with a layer of sifted cinders.

An engineer in a recent letter to *Power* stated that last year 8 tons of coal had been burned in his heater with no sifting of ashes, while during the current year, up to the time of writing, less than 6 tons had been burned and he expected that the season's consumption would be but 6½ tons. This letter was called forth by an editorial in the same paper dealing not with ashes from house heaters rich in combustible but those from many private plants in large cities. The central stations, under present conditions, have patriotism as well as fuel economy to consider.

### Buying Coal According to Specifications

On the subject of coal specifications not much need be said in these days nor apparently for some time to come on account of the general fuel situation. When, however, specifications were more useful than at present, in most cases it was the heating value of the coal which was considered the most important active control factor in business dealings between coal consumer and coal dealer. Sometimes, however, the ash and volatile matter were specified, with bonus and penalty clauses included.

The determination of heating value by means of a bomb calorimeter is now quite general practice, and where the coal is received in barges and, therefore, in units of hundreds of tons, a determination of the heat content of every barge load is frequently undertaken. The trouble and cost are looked upon as worth while even if the results are only useful for purpose of record. Where such record is available there is no doubt that extensive use is made of it in that operation known commonly as "registering a kick."

### It Is Often Important to Know the Ash Fusion Temperature

Along with the growing practice of making calorimetric determinations of coal there are many plants which also make frequent measurements of the actual fusion temperature of the ash in the coal. This is especially true in plants having large installations of underfeed stokers, for such stokers inherently operate with high furnace temperatures. It might perhaps be more accurate to say that they operate inherently with zones of very high temperature in the fuel beds and particularly at high ratings. For this reason the ash fuses, and there is trouble with the furnace walls unless the ash of the coal has decidedly high fusion temperature.

To justify the expense of laboratory work for the measurement of fusion temperature of ash in coal shipments, etc., there must be furnished an opportunity to prevent damage by ash with low fusion temperature. This is especially true where such coal is to be kept out of underfeed stokers. It is always somewhat difficult to arrange this, for it involves a laboratory equipped and manned on a scale making possible the putting

through of tests with a rush. The writer was once told by a man in considerable authority in a large plant that the men in his plant could tell how the cones of ash were going to act in the high-temperature laboratory furnace by the extent to which the coal had clinkered on the underfeed stokers. This is surely "getting the cart before the horse."

### Ultimate Analyses of Coal Are Not Necessary

So far as the analysis of coal goes it may be said that no plant makes ultimate analyses. Proximate analysis is relied upon entirely. For the purpose of registering effective complaints such analysis is greatly superior to the mere determination of heating value. It furnishes ammunition for campaigns of complaint about the amount of volatile matter and a corresponding tendency to produce smoky flue gases, about the heating value, also, because the determination of ash, volatile matter and corresponding fixed carbon permits very close calculations of heating values. But the power plant man cannot kick about the moisture, for the coal man will always say that "it rained."

Just a word more about the heating value of coal. This is obtained with great accuracy in a bomb calorimeter or approximately by calculation from the result of proximate analysis, and whether or not many of the data are looked upon as worth while, anyway, just as a matter of record, it is positively essential to know the heating value of the coal so that the thermal efficiency of the station can be calculated. Every engineer nowadays wants to calculate the thermal efficiency of his plant. It is impossible otherwise for him to know what he is doing with his plant. My advice, therefore, to the power plant man who lacks a calorimeter, crucibles, gas burners and oxygen tanks is to make out a requisition for these necessities. The boss will surely sign it.

### What About the Poor-Quality Coal That We Are Getting Now?

The present crisis in the coal industry has produced a great deal of irregularity in the quality of coal and it has deteriorated noticeably. A great deal has been written to explain this situation and to outline the steps that the government might take to restore conditions more nearly to normal. Lately the federal Fuel Administrator has issued regulations for the purpose of improving conditions. Power plant engineers have complained bitterly of the quality of coal which they are receiving.

Undoubtedly in many instances coal has been supplied which, because of its poor quality, has produced an alarming rise in maintenance cost of furnace equipment. In some cases, however, the poor quality has meant little more than a serious lowering of heating value. It seems to me sometimes that users of high-quality coal grow to be a pampered element in our population. Barring coal of low heating value which happens also to be characterized by low fusing temperature of ash, it seems to me to be an open question whether something other than very high-quality coal is not the most suitable for power-plant service. Of course, very high-quality coal is not used in many large power plants. There is not, in truth, enough of it to go around. Even in normal times the steamship trade

takes most of this coal and it is proper that it should do so. Aside from the steamship trade really good coal should be looked upon as a luxury which only the rich among corporations can afford.

In power-plant service the dictum is sometimes heard: "The cheapest coal to buy is the cheapest coal to burn," but this is a very unsafe dictum if taken without reservation. It is, however, one which bears examination in concrete cases, but such examination has a reliable basis only in tests of the evaporating quality of the fuel. These tests should be comprehensive and planned definitely to cover a range of steaming rates wide enough to reveal possibilities of economical use of the coal under conditions of station operation possibly differing somewhat from the normal.

Such conditions may be entirely satisfactory and may, in fact, resemble those which have long been used elsewhere.

The great problem with coal, as stated before, is to burn it efficiently. We shall assume that it has been properly selected; that it is of quality not too good for the circumstances, and not too cheap, if cheapness is accompanied by the presence of clinking qualities caused by ash with low fusing temperature. Further, we shall assume that proper supervision has been provided and good firing methods ingrained in the fireman so as to insure no large loss of combustible through the ashpits. The next question is how the heat loss up the stack is to be kept moderate or low. This is a very important question. Many people are willing to step forward to tell us how to answer it, or to write articles about it. Engineering societies spend unhappy evenings discussing it. Makers of instruments are anxious to provide equipment designed to make the solution of the problem easy. Personally I do not desire to be one of the general company of wisacres along this line.

There was a time when I was much impressed with magazine articles demonstrating so easily the enormous heat losses through the stacks occasioned by decreasing values of  $\text{CO}_2$  (on the false basis that the flue temperature remained unchanged). The savings to be made by high  $\text{CO}_2$  were heralded so widely that the power-plant operator who had escaped being greatly impressed thereby was surely a "wayfaring man and a fool." I was, however, much depressed by the absence of sharply definite counsel on how to get high  $\text{CO}_2$ . The articles simply said when the  $\text{CO}_2$  percentage is high the excess air is low.

#### A Practical Demonstration in Efficient Boiler Operation

I found out later how to manipulate the furnaces and drafts so as to produce a high percentage of  $\text{CO}_2$ , but along with this knowledge came the conviction that such manipulation is not worth while. The following experience contributed to this conclusion.

I was conducting a series of tests on a water-tube boiler fired by an overfeed stoker using semi-bituminous coal low in ash and of a quality considered particularly suited to the station conditions. This coal had long

been used in the station and on the stoker in question. There had been conferences, tests and what not for a long time in regard to the operation of the equipment. The stoker manufacturer sent an expert operator to do his bit.

The tests were made long after the stokers had been installed. They included three series of tests exactly alike except that during each of the series a different man was in charge. Each man operated with unimpeded control except in one particular, namely, that the flue draft was maintained during each eight-hour test by a man who watched constantly a draft gage connected to the flue nozzle on the boiler side of the damper and manipulated the damper so as to maintain constant draft.

Each series consisted of five tests of eight hours each, and flue drafts of 0.36 in., 0.40 in., 0.44 in., 0.48 in.

and 0.52 in. water column were used. Each man operated the stoker with these drafts, there being fifteen tests in all. Each man manipulated the stoker mechanism to suit himself, adjusting the rates of coal feed and grate movement, deciding when and how to dump ashes, etc.

In every way he did what he pleased except that the draft at the flue nozzle was established for him. The coal and water were weighed, the gas was analyzed for his inspection, temperature and pressure measurements were made and displayed to his view if he cared to look at them.

#### High Efficiency Accompanies Low Coal Consumption

As previously stated, one man was an expert sent by the stoker manufacturer. Another was a head fireman who ordinarily did not run stokers but graduated years before and put in his time eight hours a day showing others how to do it. The third man was a good stoker operator but of no particular skill, and he was quite illiterate judged by any standards current among combustion experts. He could barely speak the English language.

Now I am not going to say that the last man beat the other two. It is not so easy as all that. At every one of the five values of flue draft the highest economy of evaporation, the highest over-all efficiency by far, was attained by the man who at each particular value of flue draft used the least coal per hour. At one draft value it was one man, at another another man. Each of the three men secured honors in the tests, but how they were divided I do not remember. Always, however, the man who with a given flue draft used less coal than the other two at the same draft was the man who won out, and by a large margin.

This conclusion that the least coal at a given flue draft corresponded to the best operation is worthy of careful thought. Does it mean the use of a thin fire? Does it argue for considerable excess air? I leave these questions to the reader as a profitable subject for his reflection. The problem is obviously a vital one if fuel consumption is to be fully controlled.



Don't Lose a Single B.T.U. Out of This Bucket of Coal

# Proper Analysis Is Fundamental in Choosing Railway Motors

The Writer Shows How Speed-Time Graphs Are Constructed and Describes the Considerations Which Are Necessary for Proper Choice of Car Motors

By C. W. Squier

Electrical Engineer

**R**AILWAY motor characteristic curves show speed in miles per hour with a certain gear ratio and size wheel, tractive effort at the rim of the wheel and efficiency. The efficiency is usually expressed as the relation between the electrical input to the motor and the mechanical output from its armature shaft. By deducting the losses in the gears connecting the armature shaft with the car axle, we obtain the relation between the electrical input to the motor and the output at the rim of the car wheels. This relation is referred to as "efficiency with gears" and is the one most generally used, although it is desirable to have both given in order to eliminate errors made by determining gear and friction losses by different methods.

Motor characteristics form the basis of all calculations of motor performance, and in comparing motors for a particular service it is usual to replot the curves as furnished by the manufacturer, making any changes necessitated by any difference in voltage, gear ratio or diameter of driving wheels. The following formulas give the various changes in speed and tractive effort as effected by a change in gear ratio or diameter of wheels:

$S$  = Speed ordinate for any current value on original curve.

$S_1$  = Speed ordinate for any current value on derived curve.

$T$  = Tractive effort for any current value on original curve.

$T_1$  = Tractive effort for any current value on derived curve.

$D$  = Diameter in inches of driving wheels for original curve.

$D_1$  = Diameter in inches of driving wheels for derived curve.

$G$  = Gear ratio for original curve.

$G_1$  = Gear ratio for derived curve.

Then:

$$S_1 = \frac{(G \times D_1)}{(G_1 \times D)} S \text{ and } T_1 = \frac{(G_1 \times D)}{(G \times D_1)} T$$

For example, suppose we have the characteristic curve for a motor with 33-in. wheels and  $15:69 = 4.6$  gear ratio and we wish to find the desired curves for 30-in. wheels and  $17:67 = 3.94$  gear ratio.

$$\text{Speed ordinate } S_1 = \frac{4.6 \times 30}{3.94 \times 33} S = 1.061S \text{ and}$$

$$\text{Tractive effort ordinate } T_1 = \frac{3.94 \times 33}{4.6 \times 30} T = 0.942T$$

The factors by which the speed and tractive effort at any current are to be multiplied to give the derived values are the reciprocals of each other. It should also be noted that in changing the gear ratio on the same motor, the sum of the number of teeth in the pinion and gear must remain the same.

The voltage at the terminals of a railway motor may be divided into two parts, the counter-emf. and the voltage required to overcome the internal resistance of the motor. This last component is equal to the product of the resistance in ohms by the current in amperes and is thus constant for any given current regardless of the terminal voltage. In a certain 50-hp. motor with a resistance of  $\frac{1}{2}$  ohm 20 volts are necessary to force 40 amp. through the windings, and for any other current the value will be proportional.

The speed of a railway motor when operating with any given current is directly proportional to its counter-emf., that is, the voltage produced by the armature conductors cutting the magnetic flux.

Thus,

$$\frac{S_1}{S} = \frac{E_1 - Ir}{E - Ir}$$

where

$E$  is the terminal voltage for the original curve

$E_1$  is the terminal voltage for the derived curve

$I$  is the current value

and  $r$  is the internal resistance of the motor

If the 50-hp. motor referred to above is operating at 40 amp. and 600 volts, the voltage required to overcome the internal resistance is 20 and the counter-emf. is 580 volts. If the voltage at the terminals is reduced to 500, with the same current, the counter-emf. will be 480 volts and the speed of the motor will be reduced in the same proportion. The ratio of 480 to 580 is 0.827 and if the speed at 600 volts was 17 m.p.h., it would be reduced to 14.06 m.p.h. at 500 volts. It is thus seen that the speed is reduced in greater proportion than the terminal voltage, for the ratio of 500 to 600 is 0.833. It follows, then, that if the resistance of a motor is known, the characteristic curves at any desired voltage can be readily calculated from the curves available.

Some graphical methods for determining the speed ratio for different changes in terminal voltage were given in the issues of the ELECTRIC RAILWAY JOURNAL for March 13 and Sept. 18, 1915, and serve to illustrate these relations very clearly.

The tractive effort produced by the motor is independent of the voltage, being determined by the current alone. Hence, as long as the motor is drawing a given current the torque and resulting tractive effort will be essentially the same regardless of the voltage at its terminals.

## Speed-Time Curves Show Motor Performance for a Particular Service

Before making a comparison of the service furnished by different motors, I shall discuss briefly a method for calculating and constructing the speed-time curves. The data for the duty cycle were given in the previous article in the ELECTRIC RAILWAY JOURNAL of April 20. The characteristic curves of a tapped field motor, to be used in the present calculations are shown in Fig. 1.

In starting a car resistance is placed in series with the motors, and this is gradually cut out by the action of the controller until finally the full line voltage is applied to the motors. This period of the operating cycle is known as the rheostatic accelerating period. Assume an average acceleration for this period of 1 1/2 m.p.h.p.s. To produce an acceleration of 1 m.p.h.p.s. requires 100 lb. per ton, so that 150 lb. per ton will be required to give the acceleration desired. As the car with seated load weighs 23.56 tons, there must be 150 x 23.56 or 3534 lb. net tractive effort for the car or 1767 lb. per motor to give the required acceleration. In addition to this, the motor must produce the tractive effort necessary to overcome the train resistance, as shown by the graphs shown in Fig. 6 of my article in the issue of April 20.

In order to determine the point on the speed-time curve at which all of the starting resistance is cut out and the motors have full line voltage applied to them, it is most convenient to use an auxiliary curve sheet of the form shown in Fig. 2.

This method was first brought to my attention in an article by W. S. Valentine in the STREET RAILWAY JOURNAL of Sept. 6, 1902. It has been described several times since in various handbooks and technical papers.

These graphs, Fig. 2, are constructed as follows: A scale of pounds net tractive effort per motor is laid off along the horizontal axis and scales of speed and acceleration are laid off along the vertical axis. The train resistance graph, RR, is first plotted, showing train resistance per motor for the different speeds. The graphs of net tractive effort, LS and MN, are obtained by taking the tractive effort at any speed from the motor characteristic curves Fig 1, and subtracting the train resistance for that speed from this.

Thus at 12 m.p.h. the tractive effort with full field is 1060 lb., less 262 lb. train resistance, which leaves

at the proper angle will be the graph of acceleration on straight level track. In our case it required 1767 lb. per motor to give an acceleration of 1 1/2 m.p.h.p.s. This locates the point Q, and the line OQ gives the acceleration for different values of net tractive effort. From the curve LS we see that 1767 lb. net tractive effort is obtained at a speed of 9.9 m.p.h. Hence the car will accelerate at the rate of 1 1/2 m.p.h.p.s. until this speed is reached, when full line voltage will be applied to the motor.

There are many graphical methods used for plotting speed-time curves, and all possess considerable merit. My experience has shown that the step-by-step process gives a clearer understanding than others of the actual mechanics of car performance and a firmer grasp on the theory underlying the construction of the curves. After such an understanding has been obtained graphical methods are of great assistance in reducing the labor involved, especially when it is necessary to plot many curves.

In the following table are tabulated values for each step of the speed-time-curve construction. As the motor characteristic curves give tractive effort for a single motor it is more convenient to figure the pounds train resistance and net tractive effort per motor instead of per car.



Better to Sweat Over a Motor Characteristic than Over the Motors

Miles per Hour	Per Motor					Rate of Acceleration	Seconds from Start
	Amperes	Train Resistance	Net Tractive Effort	Tractive Effort	Tractive Effort		
9.9	90	F.F.	2,018	251	1,767	1.50	6.6
10.35	80	F.F.	1,735	253	1,482	1.26	6.93
10.35	120	T.F.	2,580	253	2,327	1.98	6.93
11.00	106	T.F.	2,160	256	1,904	1.62	7.29
12.00	88	T.F.	1,660	261	1,399	1.19	8.00
13.00	74	T.F.	1,300	265	1,035	0.87	8.97
14.00	64	T.F.	1,040	270	770	0.65	10.29
15.00	57	T.F.	870	275	595	0.51	12.01
16.00	51	T.F.	750	280	470	0.40	14.23
17.00	47	T.F.	650	286	364	0.31	17.09
18.00	44	T.F.	580	292	288	0.245	20.70
19.00	42	T.F.	510	297	213	0.180	25.41
20.00	39	T.F.	460	303	157	0.134	31.78

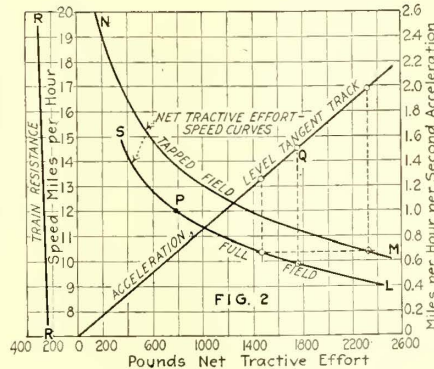
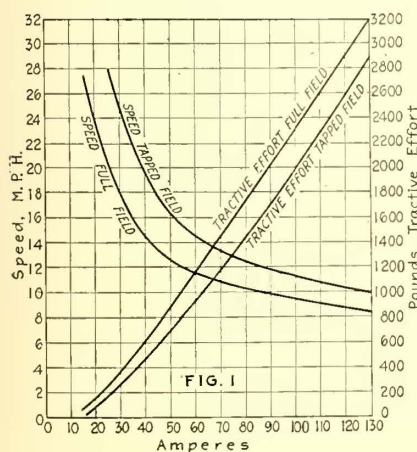
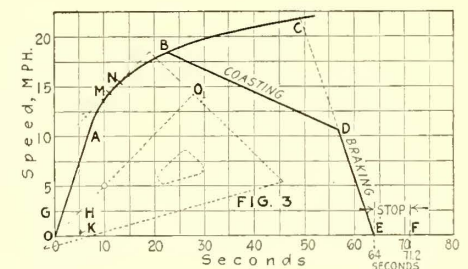


Fig. 1—Typical Motor Characteristic Curves

Fig. 2—Acceleration and Tractive Effort Graphs

Fig. 3—Typical Speed-Time-Curve Construction



GRAPHS USED IN SPEED-TIME-CURVE CONSTRUCTION

798 lb. net tractive effort. These values are then laid off and the point P on the graph is determined. Other points are obtained in a similar manner. With tapped-field motors two graphs are obtained as shown. Since the rate of acceleration is directly proportional to the net tractive effort, a straight line drawn through zero

A speed of 9.9 m.p.h. corresponds to a current of 90 amp. I have assumed a lower current limit setting of 80 amp. so that the motors operate with full field until the current falls to this value, when the change to tapped field is made. This will occur at a speed of 10.35 m.p.h. as will be seen from the characteristic curves Fig. 1.

To construct the speed-time curve of Fig. 3, we use the figures in the table as follows: As the car accelerates at a rate of  $1\frac{1}{2}$  m.p.h.p.s. up to 9.9 m.p.h., the time required to reach this speed is  $9.9/1.5 = 6.6$  seconds. This determines the point *A* on the curve, and the line *OA* represents the straight line or rheostatic accelerating period.

As the car increases its speed the current, tractive effort and rate of acceleration decrease and at a speed of 10.35 m.p.h. the current will have fallen to 80 amp. and the rate of acceleration will be 1.26 m.p.h.p.s. Since the tractive effort and acceleration decrease uniformly as the car increases in speed, we may assume without serious error that the average acceleration during this period is the average of the initial and final accelerations. The average rate of acceleration between 9.9 and 10.35 m.p.h. is  $\frac{1}{2}(1.5 + 1.26) = 1.38$  m.p.h.p.s.

In using this method speed intervals greater than 3 m.p.h. should not be used. Usually an interval of 1 m.p.h. will be found very convenient. To increase the speed from 9.9 to 10.35 m.p.h., a difference of 0.45 m.p.h., at a rate of 1.38 m.p.h.p.s. requires  $0.45/1.38 = 0.326$  second, and the car reaches the speed of 10.35 m.p.h. in  $6.6 + 0.326 = 6.926$  seconds from the start. This gives another point on the speed-time curve, and at this point the change from full to tapped field is made, and a sudden increase in acceleration takes place. This increase in acceleration can best be followed by referring to the graphs shown in Fig. 2. From an acceleration rate of 1.26 m.p.h.p.s. with a net tractive effort of 1482 lb. on full field we reach 2327 lb. net tractive-effort and an acceleration of 1.98 m.p.h.p.s. with tapped field. A study of these graphs shows the desirability of limiting the current swing when changing to tapped field. Above this point the values of tractive effort are taken from the tapped-field tractive-effort curve. At 15 m.p.h. the current is 57 amp., the tractive effort 870 lb. per motor, the train resistance 275 lb. per motor and the net tractive effort  $870 - 275 = 595$  lb. per motor. Therefore the rate of acceleration at 15 m.p.h. is  $595/1178$  or 0.505 m.p.h.p.s. Other points are found in the same manner and the curve *AC* is thus determined.

### Short-Cuts in Making Speed-Time Curves

In order to save time and labor in constructing speed-time curves I make use of several modifications of the preceding methods and the following has been found especially convenient:

By taking speed intervals of 1 m.p.h. and by assuming that the acceleration for any speed starts  $\frac{1}{2}$  m.p.h. below and continuous for  $\frac{1}{2}$  m.p.h. above this speed, we can omit figuring the time given in the table preceding. To illustrate this let us take the speed of 15 m.p.h., with its corresponding acceleration of 0.505 m.p.h.p.s. as found above. The slope of the speed-time curve through 15 m.p.h. is determined by drawing the line *OO*<sub>1</sub>, starting from *O* and passing through the 5.05 m.p.h. point at 10 seconds. This corresponds to an acceleration of 0.505 m.p.h.p.s. To plot the curve take a triangle and lay one edge along the line *OO*<sub>1</sub>, then slide the triangle along so as to draw the line *MN* for the speed-time curve parallel to *OO*<sub>1</sub>, starting at  $14\frac{1}{2}$  m.p.h. and continuing to  $15\frac{1}{2}$  m.p.h. The slope for the acceleration at 16 m.p.h. starts at  $15\frac{1}{2}$  m.p.h. and continues to  $16\frac{1}{2}$  m.p.h. and so

the curve is constructed with short straight lines. This provides a very rapid as well as accurate method of constructing the curve.

### What Coasting and Braking Periods Mean

The speed-time curve as calculated so far shows the performance of the car while the motors are propelling it. In order to stop at a given point power must be shut off and the brakes applied. To complete the coasting and braking periods of the speed-time curve consider a run of 1200 ft. at a schedule speed of  $11\frac{1}{2}$  m.p.h. with a 7.2 second stop. The time required to make such a run will be  $(1200 \times 3600) / (5280 \times 11.5) = 71.2$  seconds. This time includes the 7.2 second stop, so that the running time, not including stop, is 64 seconds. An average braking rate of  $1\frac{1}{2}$  m.p.h.p.s. was specified. To construct the braking part of the curve, start at the 64 second point on the base line and draw a line through the 15 m.p.h. point at 54 seconds. The slope of this line will then be correct for the braking rate assumed. This line cuts the accelerating part of the curve at *C*. The curve *OABC* is the accelerating portion with power on, *CE* is the braking line and *EF* is the stop.

### The Area Under the Speed-Time Curve Is a Measure of the Distance Traveled

The distance which the car travels is most conveniently found by measuring the area under the speed-time curve. To illustrate how this area is a measure of the distance traveled, let us consider one of the cross-section squares. The area of such a square is  $2\frac{1}{2}$  m.p.h.  $\times$  5 seconds, and if the car could be started instantly at a speed of  $2\frac{1}{2}$  m.p.h. and run for 5 seconds and then stopped instantly, the speed curve would be the square *OGHK* and the car would have traveled  $(2.5 \times 5280 \times 5) / 3600 = 18\frac{1}{3}$  ft. Each of these square, therefore, represents  $18\frac{1}{3}$  ft. As the car is to travel 1200 ft., for this run the area under the speed-time curve must be  $1200/18\frac{1}{3} = 65.46$  squares.

The part of the curve *OAB* with power on, *DE* the braking line and *EF* the stop, are fixed so that the only part that can be varied to get the correct area is the position of the coasting line *BD*. This is first drawn in a trial position and the inclosed area is obtained by counting the squares or measuring with a planimeter. If the area is found too great, the coast line is moved down, and if too small, the line is moved up and this cut and try method continued until the inclosed area is found to be correct.

To determine the slope of the coasting line, take the train resistance for the average coasting speed and compute the rate of retardation from this. In Fig. 3, the average speed for the coasting line *BD* is  $14\frac{1}{2}$  m.p.h., the train resistance is 275 lb. per motor and the rate of retardation  $275/1178 = 0.23$  m.p.h.p.s., that is, 10 seconds after power has been shut off, the speed of the car will be reduced 2.3 m.p.h. This method assumes that the coasting line is straight, which is not entirely correct, since the train resistance varies with the speed of the car and the coasting line will have a slight curvature. This curvature is so small, however, that no serious error is introduced by assuming the coasting line as straight and the slope drawn to correspond with the train resistance at the average speed.

# Selecting and Caring for Hand Tools Used by Way Department

By *R. C. Cram*

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

**Tools and Labor Are So Intimately Related in This Department that Good Tools Well Maintained Will Pay for Themselves Many Times Over in Labor Saving Alone**

THE constant effort which is being made to effect economies in track maintenance work has caused a searching inquiry to be made into many divisions of the work which in normal times have been subjected to rather superficial and desultory consideration. The subject of small hand tools used by the way department may be placed in this class.

## Poor Tools Cause Waste of High-Priced Labor

Ordinarily one would not think it worth while to pay much attention to such matters as tool sharpening, control of supply of tools, overstocking, extra handling and cost of tool supply service. We have all known in a

general way that we are using a great many hacksaw blades, or that our picks seem constantly to be on the way to or from the blacksmith shop, but we have not been required to economize because of a lack of an adequate supply of new tools at reasonable prices. Wartime prices for tools and supplies have put these articles upon a higher plane and we are beginning to realize how essential they are. It is brought home to us that we cannot do without the pick and shovel, or the lining bar and spiking maul any more than we can dispense with the men who use them. Consequently the fact becomes evident that it is the very antithesis of economy to pay high prices for labor and then equip it with poor tools. On the contrary, the tools and their condition should receive expert attention with the object of seeing that they are in every way fit to assist in getting full value from the laborers who use them. This point is emphasized by statistics which indicate that more than 60 per cent of the cost of track or maintenance work is spent in payrolls, for labor, and nearly all the time is spent in using tools.

There are also numerous small supplies which are in common use, the consumption of which during a year's work is astonishingly large in quantity. A casual examination of the list of such small things as sandpaper, emery cloth, hacksaw blades, folding rules, lantern and lantern globes, kerosene oil and red flags, which have been used by the average track department in a season, will be an eye-opener to anyone who has not paid much attention to details in this regard.

Before considering either tools or supplies further it will be of interest to inquire into the practice as to the issuing of tools and accounting therefor. In the first place, there should be uniformity in practice and

the entire procedure should be carefully outlined. Comparatively simple record systems should be used which will cover the progress of all tools and supplies from the storeroom to the tool box, and thence by monthly checking of the latter until the tools are returned for sharpening or replacement due to loss or breakage and until supplies are exhausted.

Each foreman should be made responsible for the economical use of tools and supplies and for all loss, breakage and misuse. Any extraordinary consumption of tools or supplies, or reported breakage of certain tools, should receive prompt attention with the view of determining whether the consumption may be due not to wear or extra work but to theft or misuse. Continued breakages may mean poor quality of material. Extra large returns of tools for sharpening, particularly from a gang confined to one class of work where use to which tools are put is uniform, should be a cause for study as to whether the tool steel is poor or whether the blacksmith work is being done poorly.

Each foreman should be required to report once a month on the contents of his tool box. The report should be on a printed form of the simplest character upon which are listed all the standard tools, with space for the few odd,

little-used tools which are occasionally supplied. Such a form of tool report is shown in Fig. 1 on page 960.

On large city systems it has been found advisable to employ a tool foreman, one of whose duties is to check up the contents of tool boxes at least once a month. When such a man is employed the form of tool record shown in Fig. 2 has been found useful. In addition to this form the one shown in Fig. 4 is used to make a record of delivery for tools and supplies which are handled and consumed in large quantities during each month of a busy season. A similar form is used to make a record of tools picked up by tool cars. These forms serve to protect the foreman and the motormen and chauffeurs who make the deliveries and collections.

## A Simple Order System Prevents Loss of Tools

It is not generally good practice to permit foremen to order tools directly, except in case of emergency. They should make their wants known to the roadmaster or supervisor, and no tools should be given out except on proper storeroom order signed by persons authorized to sign orders. A form of storeroom order used for this purpose is shown in Fig. 3. When foremen sign they are usually shop foremen authorized to do so. Also, some roads make a rule that no new tool shall be given



Worn shovels may be easy on the men but are hard on the management

out unless an old tool of like character be returned. This simple rule makes it necessary to account for losses where the old tool is not available for return and tends to create more careful use and to insure return of tools to the tool box at night.

The tool foreman occupies a position of considerable importance. Besides his duty in checking up tool boxes he generally handles the tool requisitions and secures the tools and supplies from the storeroom, sending them out to the various groups either by the regular tool-car ser-

PUBLIC SERVICE RAILWAY COMPANY				
TOOL REPORT				
No.	Tools on Hand	191	No.	DATE
	Adze.			
	Adze Handles.			
	Axe Handles.			
	Brace and Bit.			
	Block Pounder.			
	Brick Paving Hammer.			
	Water Pails.			
	Wrenches for 1 inch Track Bolts.			
	" " " " " "			
	" " " " " "			
	" " " " " "			
	" " " " " "			
	" " " " " "			

Location of Tool Box at present time \_\_\_\_\_

I Certify the above to be correct \_\_\_\_\_ Foreman

Approved \_\_\_\_\_ Roadmaster

Fig. 1. This Form Is Useful in Reporting Contents of Tool Boxes and Provides a Record of Any Tool Transfers Made

Form No. S. 373 TRIPPLICATE Δ 131 Books 13443 0-4002

T. D. CO. Storeroom Order 39th ST. STOREROOM Date 191

Supplies chargeable to one account only to appear on same order. Book No. 4966 Order No. 18

Quantity	Unit	DESCRIPTION	Bin No.	Price	Amount
TOTAL					

Account No. \_\_\_\_\_ M. S. O. No. \_\_\_\_\_ Request No. \_\_\_\_\_ Authorization No. \_\_\_\_\_

Where used \_\_\_\_\_ Foreman \_\_\_\_\_

Fig. 3. This Form Is Used for Drawing Supplies from the Storeroom and Prevents Unauthorized Use by Unauthorized Persons

contractors who may have gangs working near truck gangs. For instance, the marking of shovels is of particular importance in some cities where the contractors' custom still prevails of requiring the laborer to provide his own shovel.

The number of different tools used in track work alone is quite large, as will be seen from a glance at those listed for an ordinary tool box in Fig. 2. This list contains eighty different items. Besides special tools not listed there are also the several special tools used by

TRANSIT DEVELOPMENT COMPANY				
WAY AND STRUCTURE DEPARTMENT				
GANG TOOL RECORD				
BOX No.	TYPE	DATE	FOREMAN	
	Adzes		Drills	in.
	Augers		Files—Hand	" Tamp.
	Axes		" Rail	Plows
	Barrels—Water		File Holder—Rail	Punches—Center
	Bars—Claw		Frames—H.S.	" Track
	" Lining		Gauges—Track	" Thread
	" Tamping		Hammers—Track	Rammers—Sand
	Bedders—Rail		Hoes	" Paving
	Boots—Hubber		Hooks—Grass	Rasps
	Erooms—Switch		" Timber	Rat-bats
	" Corp. Push		Hose ft.	Reamers
	Brushes—Wire		Jacks—Track	Rules—6 ft.
	Cars—Hand		" Wrecking	Saws—X-cut
	" Push		Lanterns	" Hand
	Chains		" Signal	Scythes
	Chisels—Cold		Level—Boards	Shovels—T.
	" Track		" Pocket	" L.H.
	Compressors—Bond		Lights—Clusters	" Scoop
	Dippers—Yar		Mattocks	" Wood
	Drills	in.	Mauls—Spike	Sledges
	"	in.	Oilers—Steel	Squeegees
	"	in.	Old—Men	Tapes—Linen
	"	in.	Pails	" Steel

Fig. 2. A Convenient Form for Recording the Tools in Use by Different Gangs

TRANSIT DEVELOPMENT COMPANY			
WAY AND STRUCTURE DEPARTMENT			
			DATE
FOREMAN	MOTORMAN	CHAUFFEUR	
LOCATION			
MATERIAL, TOOLS, DELIVERED TO GANG			
FOREMAN SIGN HERE			
TIME RECEIVED			

Fig. 4. Delivery of Tools and Supplies Can Be Effectively Recorded by Means of This Form

GROUP OF RECORD FORMS FOUND USEFUL IN THE WAY DEPARTMENT

vice or by auto truck. The proper routing of a tool supply car or truck is no mean task. He also keeps a watch on the tool and supply stock in the storeroom, keeping his superior advised of conditions of stock so that they may be replenished in time to prevent delays to the work.

On moderate sized roads and those having widely separated divisions, the roadmaster generally performs many of the duties of the tool man, acting in direct conjunction with the storekeeper. In such cases tools are usually sent to the job and picked up by regular work cars when making other deliveries.

It is almost imperative that all tools be marked by stamping or branding with some form of distinguishing mark such as the name of the company and the department. Such markings should be done in a manner which will render their removal as difficult as possible, as they serve to prevent theft and interchange with tools of

pavers, bonders, special-work repair men, blacksmiths, grinder men and bridge men.

There are at least eighteen distinct tools in regular use by a blacksmith, not including his anvil, forge, water keg and several types of tongs for handling the hot metal. The blacksmith, by the way, is a very important individual in any track organization, not only because of his work in joint repair and preparation of compromise joints in the field but also because of his usefulness in the repair of tools. For these reasons and because of the rather general unfamiliarity with the tools he uses, it is worth while to show them in Fig. 5.

The work of special-work repairmen calls for several special tools, particularly chipping tools for use in re-setting hard centers. These are shown in Fig. 6. In addition to these the hard-center gang uses a special torch for heating babbitt or spelter to permit removal of



centers, and another for heating these metals preparatory to pouring them around the centers.

Lists of the general run of track tools are given in the gang tool records shown in Figs. 1 and 2. Each gang should have a complete outfit of standard tools in sufficient number to supply every man in the gang. Extra tools and parts are also required to take the places of those which break or which must be sent to the shop for repair. Where the gangs are in cities, close to sources of supply, but a few extra tools need be carried, as those needing replacement can usually be exchanged quite readily. The section gang which is liable to be a long way from supplies naturally needs to have some extra tools to fill in until replacements can be made.

The equipment of gangs will vary considerably, depending upon the size of the gang, upon the general nature of the work, and upon whether the gang is a section gang employed upon T-rail only or whether it may be employed on girder rail in paved streets.

### Special Tools Need Special Handling

The list of tools given in Table I is indicative of the average equipment for city gangs of (1) sixty men on construction work; (2) of ten men on repair work, (3) of sixteen to eighteen men on special work; and

quarters and sent out, as needed, by the roadmaster. Exception is made at times to this rule for particular special-work gangs and section gangs which have to cover a large yard of T-rail track. Where a section gang has rock cuts on its portion of the line, slides are liable to occur. Such a gang must have rock drills, striking hammers, powder and fuse for emergency use.

### Small Tool Standardization Has Several Advantages

The importance of having all gangs equipped with one style of each tool is worth noting. This is particularly advantageous because it allays any petty jealousies which may develop between gangs through real or fancied superiority of one style of the same tool (jacks, for instance) over another. Furthermore, if gangs are doubled up in emergencies there will be less tendency for borrowing the other fellow's good tools and returning poorer tools in their places.

It is very desirable to have standard plans of all tools. These plans will be found of great value in purchasing and inspecting them. If the making of such plans appears burdensome or unnecessary it is still possible and worth while to select them by number or description from the catalogs of the reliable supply houses and always to order the same makes and styles of those tools

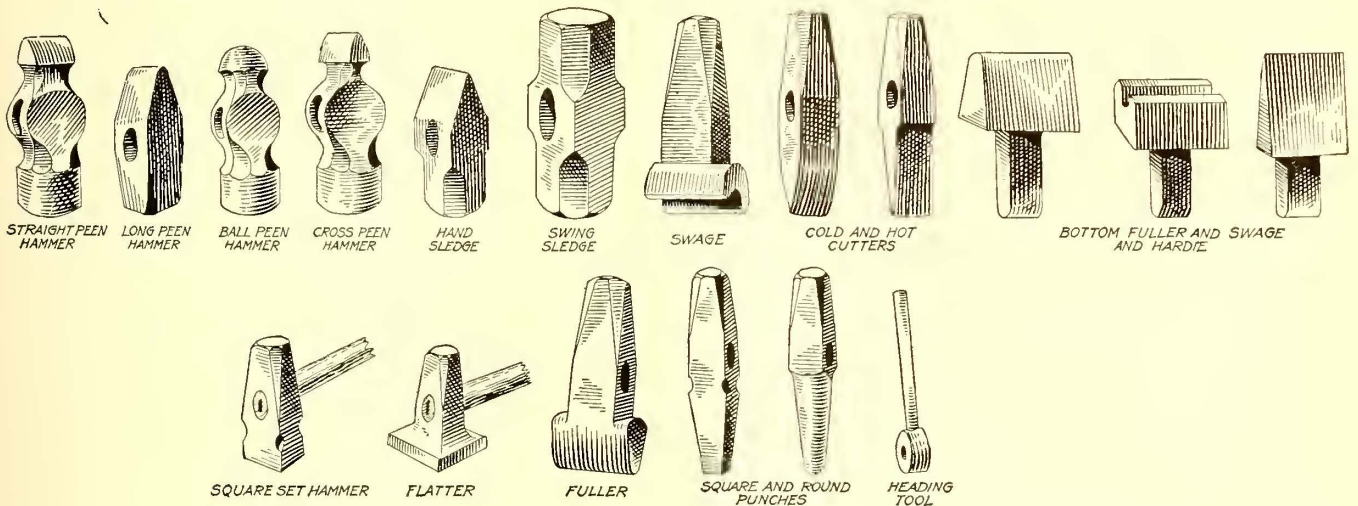


FIG. 5. THE WAY DEPARTMENT BLACKSMITH USES A WIDE VARIETY OF TOOLS

(4) of six men on section work on T-rail track. The list covers certain conditions and will be varied by roadmasters more or less in accord with local practice. For instance, roads having several divisions will be found to have at least one electric track drill as a part of each roadmaster's tool equipment. On the other hand, some large city systems prefer to control these machines from headquarters, sending them from gang to gang as occasion warrants, usually by auto trucks. Again, snow shovels are kept at headquarters and distributed only in the winter season. Even then but few gangs carry more than a half-dozen or so because it is necessary to provide hundreds of them during big snowstorms when gangs are rapidly increased for such emergencies and large numbers of shovels can best be stored and distributed from headquarters.

It is not the custom to provide all gangs with rail benders or jim crows. These are usually kept at head-

known to be most efficient. Standard plans of tools have another use in furnishing details for the repair and local manufacture of tools such as level boards and track gages. The standard tool plan shown in Fig. 7 is made up upon a sheet 4 in. x 6 in. with a 1-in. margin at one end for binding in loose-leaf book form.

### Specifications for Tool Steel Are Important

In the selection of tools made of steel, more attention should be paid to the quality of the steel and its suitability for the work. The steam roads have given more study to this than the electric roads. For instance, the Pennsylvania Railroad has its picks made of open-hearth steel having from 0.55 to 0.75 per cent carbon, not more than 0.04 per cent each of phosphor and sulphur, and about 0.40 per cent manganese. Similarly its track chisels and track punches are made of crucible steel

having from 0.80 to 0.90 per cent carbon, not more than 0.04 per cent each of phosphor and sulphur and 0.30 to 0.40 per cent manganese.

The further advantage of study of the proper quality of steel for track-tool use is illustrated by the experience of one electric railway which found in 1915 that it could substitute "Black Diamond" crucible steel at 7½ cents per pound for Jessup tool steel at 16 cents per pound and secure equally good results from tools, such as pick points, track chisels and punches, made therefrom. The saving thus effected amounted to a considerable sum in the course of a year.

**The Shovel Question Will Bear Investigation**

Again, the quality of steel in track shovels will bear attention, especially where the men are required to furnish their own shovels, although this practice is consid-

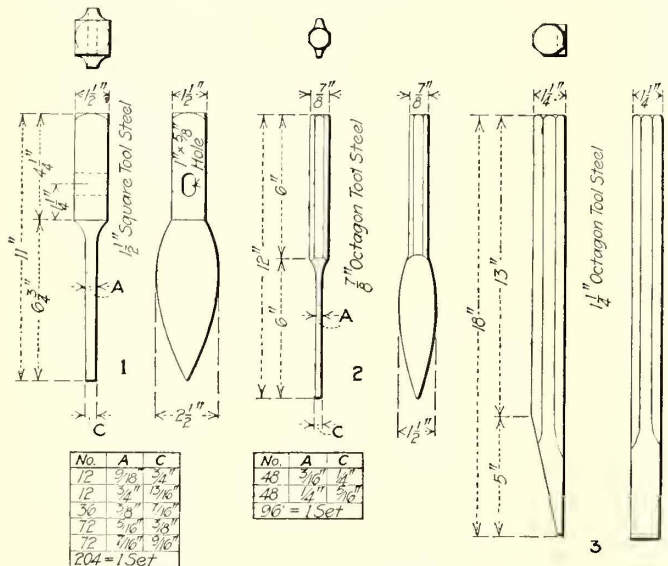


FIG. 6. THESE CHIPPING TOOLS ARE USED IN RESETTING HARD CENTERS

four or five to one. The introduction of special grades of alloy steel in shovel manufacture has again proved the value of selecting the best of steel for tool uses.

**Worn and Broken Track Tools Can Be Repaired Profitably**

The cost of new track tools has steadily increased to such an extent that the subject of the repair of worn and broken tools has become one of considerable importance. The general procedure has been very well described in an article in the ELECTRIC RAILWAY JOURNAL for March 25, 1916, from which much of the following is taken.

Ordinary track hand tools, as a rule, are not reclaimed when they become badly worn or broken, and only such repairs are made as can be readily handled by an ordinary laborer. This is particularly true of large construction jobs where a considerable item of their cost is expended in track hand tools; yet when a job is completed comparatively few of the tools are found to be good enough to turn over to the maintenance forces. Many of these worn and broken hand tools, which are discarded as useless, can be repaired profitably. Experience on some roads has demonstrated this fact, and the ease of making repairs has been considerably facilitated by the introduction of portable welding outfits. While it has been found economical to repair tools, it

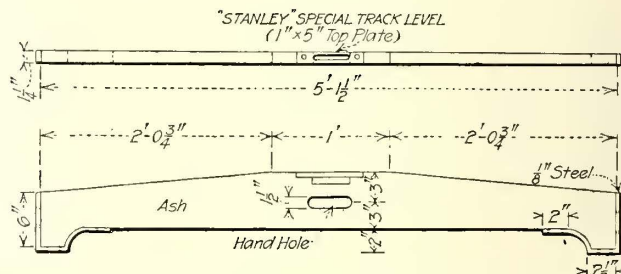


FIG. 7. A SAMPLE STANDARD TOOL PLAN FOR THE LOOSE-LEAF NOTEBOOK

ered poor policy. The usual effective depth of a shovel blade is about 10 in. An inch of wear reduces its capacity nearly 10 per cent. Men have been known to take shovels off the job and deliberately have them cut down an inch or so in order to lessen the labor of using them.

When a man furnishes his own shovel he will naturally buy the cheapest he can find. He will use it just as long as there is a plausible remnant of the blade left unless required to discard it after a certain wear is reached. He will not drop his shovel to do other work but will walk 500 ft. or more to his coat and hide it. He thus consumes the employer's time without result. The operating cost of a shovel is at least \$2 per day. If the man is permitted to use a shovel of half the full blade length the operating cost is the same but the efficiency is decreased by one-half.

Shovels are abused by being thrown about carelessly, by having heavy tools and materials thrown upon them and by being driven into ties to pull the latter about under the rails. Only the best grade of steel will long withstand the lack of care and heavy duty thus imposed.

A shovel of fair-looking quality may be purchased for 40 or 50 cents but a shovel made from an alloy steel of exceptionally good quality may be had for 90 cents or so, and this will out-wear the cheaper shovel at least

is also very important that the repairs be properly made to accomplish the best results. It is as essential to good workmanship and efficiency that tools should be kept in proper condition as it is to buy first quality tools. In other words, tool repairs should be concentrated at a single point where one or more men may be regularly employed in putting them in serviceable condition.

A first-class blacksmith is best qualified to do this kind of work, but it must be borne in mind that not every blacksmith can repair these tools. Experience in making repairs to hand tools is a necessary requisite, hence it is better to employ one man on work of this kind and hold him responsible for the quality of the repairs made.

**New Handles Can Be Put on Old Shovels**

Specific cases of repairs to hand tools that pay include reclaiming good shovel blades, in which the handles have been broken, by supplying new handles. Handles in good condition may often be had by taking them from blades that are completely worn out. Another method consists in supplying a new cast-iron D-handle to replace wooden D-handles. Such a casting is shown in Fig. 8. These cost about 16 cents each.

Claw bars badly worn, or with one of the claws broken, may be reclaimed by dressing the bar down to form a new claw, or if there is not sufficient stock remaining, a new claw may be welded on. It is also important, and has now become general practice, to keep picks sharp and properly tempered. The cost of the pick was once considered so small that reclaiming the old one was not worth while, but it is now considered economical to do so by welding on new points as needed. Lining bars and tamping bars may be readily restored to good condition by straightening, redressing and tempering.

**Accurate Jack and Drill Repairs Pay Handsomely**

Accurate workmanship when repairing spike mauls is very important. An untrue surface makes it impossible to strike a true blow, and an improperly struck blow may bend a spike or cause an accident. An improperly tempered maul soon becomes untrue when the metal is too soft, or if it is too hard pieces map chip off and cause an accident. The same requisites apply to track chisels which primarily must be purchased with steel of proper quality. A poor chisel delays the work and increases the cost of any operation. It is also very important to keep track jacks in perfect operating condition. Where several extra ones are not on hand a bad-order jack may tie up a gang. The track jack, like the track drill, is more expensive than the average hand tool, and it is not general practice to have an unlimited supply of extra ones. It is therefore important that jacks and drills not only be in good order but that they

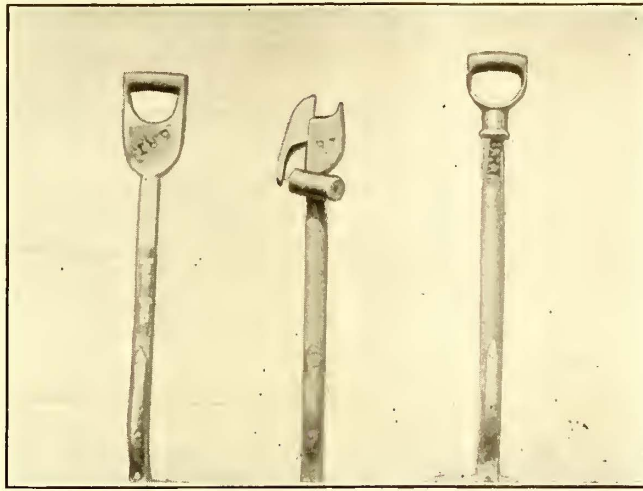


FIG. 8. DAMAGED D-HANDLES OF SHOVELS CAN BE REPLACED WITH IRON ONES

be inspected for defects occasionally, and when repairs are necessary they should be made by an expert mechanic in order to insure results. However, drill bits may be accurately sharpened on the job by the average laborer if the gang tool box is supplied with a Keystone tool grinder.

With no other track hand tools are accuracy and good repair so important as with the usual track gage and level. When these become damaged for any reason the

utmost care should be exercised to see that the repairs are made properly, and after the work is completed their accuracy should be checked before they are actually used in track work. Repairs to either of these tools are difficult to make because accuracy is so essential, hence it is especially advisable to have this work done by an experienced repairman. In other words, the repairing of most track hand tools is a job for a specialist if the best results and maximum economy are to be obtained.

**Repairing 10,000 Picks at Six Cents Each**

As an indication of the comparatively small cost for tool sharpening and repair, it will be of interest to note that the records of one railway covering repairs to picks, lining bars and track jacks for one season show that more than 10,000 picks were repaired at a cost of about 6 cents each, while 6900 lining bars were restored to service at an average cost of 5 cents each and 186 jacks were refitted for service at a cost of 70 cents each. The records further indicate that each jack went to the shop five times during the season. The type of jacks used in

TABLE I. STANDARD LIST OF TOOLS FOR TRACK MAINTENANCE GANGS OF SEVERAL SIZES

Tools	Construction				Tools	Special				Tools	Special			
	Gang	Repair	Work	Section		Gang	Repair	Work	Section		Gang	Repair	Work	Section
	60	10	16 to 18	6	60	10	16 to 18	6	60	10	16 to 18	6		
	Men	Men	Men	Men	Men	Men	Men	Men	Men	Men	Men	Men		
Adzes	2	1	2	2	Files—Hand—Rail	1	1	1	..	Punches—Center	2	1	1	2
Axes	1	1	1	1	File holder—Rail	1	1	1	..	Punches—Track	..	..	5	..
Bars—Claw	5	2	6	3	Flags (furnish as needed)	..	..	..	..	Punches—Thread	2	2	..	..
Bars—Lining	20	8	12	4	Frames—Hacksaw (at least 1 doz. blades to each frame)	4	4	6	2	Rammers—Sand	6	2	4	..
Bars—Tamping	20	4	12	4	Gages—Track	4	4	6	2	Rammers—Paving	1	1	..	..
Benders—Rail (furnish as needed)	..	..	..	..	Gages—Wood (insulated)	2	1	3	3	Rasps	..	..	3	..
Boots (furnish as needed)	..	..	..	..	Grinder—Keystone tool	1	1	1	1	Ratchets	4	3	6	2
Brooms—Switch	4	1	4	3	Hoes	4	1	2	..	Reamers	2	2	8	..
Brooms—Corporation	..	..	..	..	Hooks—Grass	..	..	..	..	Rules—6 ft., folding	1	1	1	1
Push	3	2	2	2	Hose—Rubber	100 ft.	15 ft.	30 ft.	..	Saws—Crosscut	1	..	2	1
Brushes—Wire	2	1	1	..	Hydrant connection	1	..	..	..	Saws—Hand	1	1	1	1
Cars—Hand	..	..	..	1	Jack—Track	6	2	5	3	Scythes	..	..	..	2
Cars—Push	1	..	..	..	Jack—Wrecking	2	..	..	..	Shovels—Track sq. pt.	20	6	10	12
Chains	2	..	2	..	Jim Crows	..	..	1	..	Shovels—L-H	..	..	..	4
Chisels—Cold	2	..	..	..	Lanterns	50	12	35	15	Shovels—Scoop	8	..	..	4
Chisels—Track	20	8	20	2	Lanterns—Signal	..	..	..	3	Shovels—Wood	..	..	..	2
Chisels—Asphalt	6	2	2	..	Level—Boards	2	1	2	1	Sledges	10	3	10	1
Compressors—Bond	1	1	1	1	Level—Pocket	2	1	2	1	Spike pullers	..	..	2	1
Dippers—Water	2	1	1	1	Light clusters	..	..	2	1	Tongs—Rail	12	4	10	8
Drills—½ in. (minimum number)	4	4	5	4	Mattocks	1	..	2	1	Tongs—Tie	..	..	1	1
Drills—¾ in. (minimum number)	4	4	5	2	Mauls—Spike	8	4	8	4	Tapes—Linen	..	..	1	1
Drills—1 in. (minimum number)	4	4	5	2	Oilers—Steel	1	..	1	..	Tapes—Steel	1	1	1	1
Drills—1½ in. (minimum number)	4	4	5	2	Old men	2	3	2	2	Tarpaulins	1	..	1	..
Drift pins	4	4	3	..	Pails	6	2	4	3	Tie Rod—Square	1	1	..	1
Files—Hand—Round	1	1	..	3	Picks	20	8	16	10	Wrenches—Hydrant	1	1	1	1
Files—Hand—Flat	1	..	..	..	Picks—Tamp	..	..	..	4	Wrenches—Monkey	1	..	1	1
					Pipe—Water	250 ft.	..	..	..	Wrenches—Stillson	1	..	..	..
					Plows	..	..	..	..	Wrenches—Compressor	1	1	1	1
										Wrenches—Track	10	4	12	6
										Wrenches—Tie Rod	4	1	4	1
										Wheelbarrows	6	3	6	2
										Water barrels	..	1	2	..

this instance cost \$8.35 in 1914, hence it is beyond question that the repair was economical.

The cost of tools, supplies, repairs and delivery service varies greatly. Much depends upon the size of the road and its characteristics, particularly as to whether it be a city property with much pavement or a road operating largely in private right-of-way. Furthermore, if a large amount of reconstruction is undertaken in any one season, the cost for tools and supplies will increase accordingly. Consequently there is no measure by which the tool expenses of one system may be safely compared with another. Nevertheless it is worth while to keep track of these expenses with the purpose of being sure that they do not get out of bounds. It may be of interest to state that the cost of tools and supplies may run as high as \$100 per mile of single track per year in a busy season, if the costs listed in Table II from the tool accounts for 1917 of a 550-mile city prop-

erty led to an important economy through the use of white globes dipped in a special red coloring preparation. This preparation could be purchased before the war at \$3 per gallon. It is now worth \$8.75 per gallon. Under these conditions the tool foreman rose to the occasion and consulted with the boss painter who made some experiments and finally produced a red color at a cost of \$2.75 per gallon. This holds its color even better than the material formerly purchased and also covers more globes per gallon of color. The former color covered about 350 globes per gallon while the new color covers about 500. This color is made from the following formula: 3 lb. deep permanent red, No. 171 dry, St. George Chemical Company, 25 cents per pound; 1 gal. bronze liquid, \$1.75; labor to mix, 25 cents; total, \$2.75 per gallon.

Similarly, when the price of high-speed drill bits rose skyward the tool man set about using the arc welder for repairing broken bit shanks and began to get the fullest possible use of the bit points by welding on an added length of shank.

A study of the consumption of kerosene oil on one road recently developed a discrepancy of over 30 per cent between the amount of the oil which should be used for the number of lanterns in daily service and that

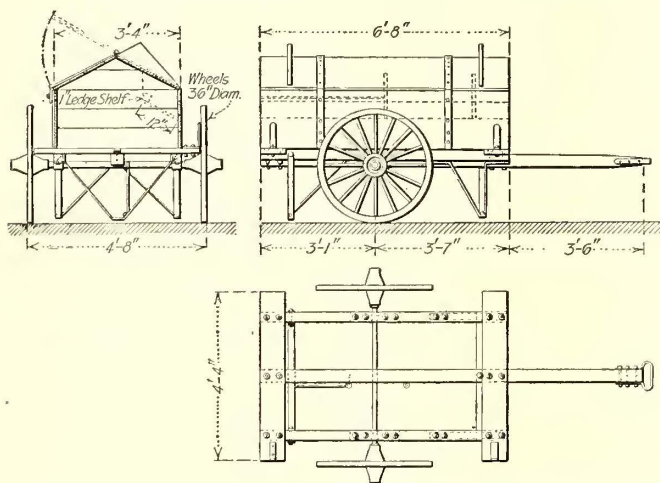
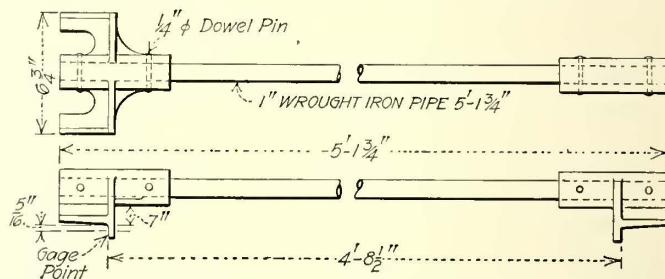


FIG. 9. A TOOL WAGON WHICH CAN BE MADE AT REASONABLE COST



THIS STANDARD TRACK GAGE IS FOR USE ON TRACKS WITH GUARD RAIL

erty can be taken as a guide. (The year 1917, by the way, can be considered a very "light" year due to sharp decreases in amount of work done).

Small tools and supplies, it will be noted from Table II, account for the larger portion of the tool and supply service. The supply list reads like a stock sheet of a regular hardware store, and everyone knows that small hardware is expensive.

Some of the cheapest things that are used cost a great deal in the aggregate. Lantern globes, for instance, are comparatively cheap in first cost but they are consumed in large quantities. White globes are worth about 6 cents each, while red globes cost about 20 cents each. In city work red globes are used to a much greater extent than white ones. The difference in cost

actually drawn from stock every day. This led to the discovery that some of the oil was going to the homes of the men by devious routes, particularly during the period when oil became very scarce and high in cost. It was also found that there was much waste due to the method of distribution; to carelessness in filling lanterns; to leaky containers and to leaky wells in the lanterns. These discoveries naturally led to a radical change in the whole procedure and effected a large saving.

### Good Tool Houses and Tool Boxes Help in Tool Conservation

On long interurban lines, the track tools are usually kept in section tool houses similar to those used by steam roads, in which case the tools are transported on the section hand cars. The latter are being displaced by gas-driven cars which have many advantages. Where the section is comparatively short or runs out from city or other headquarters, the tools and the section gang are more apt to be transported upon a regular motor flat car, which may remain on the job at the nearest siding during the day. In such cases the car is available for hauling ballast and other needed materials.

It is not practicable in city work to maintain tool

TABLE II. EXPENDITURE FOR ROADWAY TOOLS AND SUPPLIES SEASON OF 1917, ON A 550-MILE CITY RAILWAY SYSTEM

Total expenditure for 1917	\$48,000.00
Average monthly expense	4,000.00
Cost of tools and supplies	30,100.00
Cost of tool-car service	10,600.00
Cost of tool repairs	7,300.00
Cost per mile single track—tools and supplies	\$54.70
Cost per mile single-track—tool-car service	19.30
Cost per mile single track—tool repairs	13.30
Cost per mile single track—total	\$87.30

NOTE—Tool-car service was furnished by two tool cars at a charge of \$25 per day per car. Tool repairs include repairs to large machines, such as mixers, grinders, arc welders and electric drills.

(Continued on page 965)

# Steel Car Body Is Well Adapted To Resist Unusual Stresses

By Norman Litchfield

**The Roof, Posts and Carlines, Side Girder and Underframe All Combine to Make a Box Girder of the Modern Car, a Form of Mechanical Structure Which With Minimum Weight Will Give the Requisite Resistance to Shock**

IN THE writer's recent article on types of side frame construction it was pointed out that side frames in general could be divided into four classes: (1) sill and truss rod; (2) fish-belly girder below floor level; (3) side plate girder formed by sill, belt rail and sheathing; (4) truss formed by side sill as bottom member, side plate as top member, and window and door posts as verticals, the place of ordinary bridge truss diagonals being taken by the sheathing and the resistance to cross-bending of the posts.

## Center Side Doors Impose Special Design Problems

Where center side doors are used, a modification of the plate girder is sometimes resorted to, this consisting of a patching or splicing of the two halves of the girder either by a short fish-belly girder under the door or

(Concluded from page 964)

houses, and as a substitute each foreman is usually supplied with a tool box or a tool wagon. These should be substantially made and must be provided with exceptionally good locks. The tool boxes are moved from job to job by work cars, usually at night, so as to be ready on the new job when the gang arrives in the morning at a new location.

The tool wagon has the advantage of portability as it can be moved by the men if necessary; it can be towed behind a motor truck or work car, and it can be quite easily loaded upon a work car by the men if skids are provided. A form of tool wagon is illustrated in Fig. 9.

Tool boxes should not be made too large in size with the view of getting all the tools for a gang of fifty or sixty men into them. Where this is attempted it will be found that it is practically impossible for the men to lift them when loaded and it requires a derrick to place them upon cars for transportation. In consequence the box must often be unloaded and loaded upon the cars when empty, which necessitates much rough handling of tools, greatly increasing breakage and consuming valuable time as well. It is far better to provide two or three boxes of moderate size, each suitable for the average sized repair gang of say twelve to twenty men.

Where tool boxes are used it is customary in city work to keep a watchman at the box at all times. He keeps track of the tools, fills lanterns and puts them out on the work and he can make himself useful in sharpening tools on the portable tool grinder. The use of the watchman should not relieve the foreman of his responsibility for the tools and their fitness for service.

a stiff rectangular frame around the doorway. In the latter case the center-door posts are subjected to severe bending strains, and it may be of interest to study some points in connection therewith.

From the bending moment diagram for the case cited in the previous article, the stress in the top and bottom chords at the doorway is seen to be 8571 lb. The figure on page 966 shows diagrammatically the frame members and the stresses, the assumption being made first that the frame is strictly rectangular and, second, that the rivets at the top connection of the post to the side plate are fairly close together so that the top corner may be said to approximate a pin joint in a true truss.

The doorpost then becomes in effect a beam supported at the ends *A* and *B* with a concentrated load of 24,000 lb. applied at the belt rail *C*. Hence the maximum bending moment is at the belt rail and amounts to  $8571 \times 54 = 462,834$  in.-lb. requiring, for a fiber stress of 16,000 lb. per square inch a section modulus of 28.92. This is the equivalent of a standard 12-in. 35-lb. rolled channel. This section has a flange width of 3.3 in. and, as is pointed out in the handbook of the Cambria Steel Company, "in order to prevent undue strains in the compression flange, considered as a column, the beams should be supported laterally at distances not exceeding twenty times the flange width, this ratio being determined by the following formula, which gives the safe load for solid columns of soft steel:

$$p = \frac{18,000}{1 + \frac{l^2}{3000b^2}}$$

in which

*p* = allowable stress in pounds per square inch.

*l* = length between lateral supports in inches.

*b* = width of flange in inches.

Substituting 16,000 for *p* in the above formula it is found that the ratio  $l/b = 19.37$ , from which it may be seen that the compression flange should be supported laterally at distances not exceeding twenty times the flange width as stated above."

To follow this practice with the channel in question would require it to be supported sidewise at a distance of 66 in. between supports. While it is possible to brace the striking post sideways by a diagonal from the floor frame it is obviously impossible to do so on the pocket side as the door has to slide past the post in opening.

As the post is 84 in. long, the only resort is to the reduction in the fiber stress. Substituting in the formula  $l = 84$  in., and assuming still a flange width of 3.3 in.,

$$p = \frac{18,000}{1 + \frac{84^2}{3000 \times 3.3^2}} = 10,514 \text{ lb. per square inch.}$$

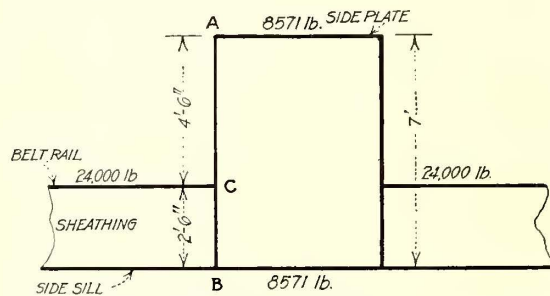
This would require a section modulus of 44 or a 15-in., 40-lb. channel.

This is a heavy section and it is not always possible or desirable to use as great a width as 15 in. for a door post. Further study is therefore required for the most desirable post construction.

Assuming that it is desired to keep the width within a maximum of say 12 in., and the depth  $3\frac{1}{2}$  in., the possibilities of increased section modulus consist in the use of a built-up beam of heavy angles riveted to a web plate or box section pressed from steel plate. But the post even so remains undesirably heavy.

### Saving Steel in Offsetting Effect of Side-Door Frame

In the foregoing calculations we have assumed throughout that the post was to be considered as a beam loaded at one point, the belt rail, and supported freely at each end. With regard to the lower support this assumption is not entirely fair inasmuch as the post is riveted to the sill and to the side sheathing all the way from the sill to the belt rail and, therefore,



FRAME MEMBERS AND STRESSES IN CENTER SIDE DOOR CONSTRUCTION

so far as the lower support is concerned, the post may be considered as a fixed beam. By special construction, such as making one flange of the built-up post a continuous piece from sill to side plate and back to sill again, thus forming an arched doorway, and providing a stiff web plate overhead riveted securely to the vertical webs of the posts, the condition of a beam fixed at both ends is approximated and the bending moment is thereby reduced one-half. This makes possible the use of a much lighter section, and the construction adds to the general stiffness of the structure and gives good results.

### Instantaneous Braking Rate May Reach 15 m.p.h.p.s.

Another consideration which enters into the design of the side posts is the bending strain to which they are subjected by the fore and aft lurch of the roof in starting and stopping, and more particularly in coupling up to another car. As already pointed out, the amount of any such force is equal to the product of the mass by the acceleration.

Repeated observations of high-speed braking rates indicate that the maximum rate of retardation is somewhere about 8 m.p.h.p.s., making it probably safe to assume for ordinary running service a rate of from 12 to 15 m.p.h.p.s. The stress figured on this basis should be added to the working stress calculated as already outlined. In coupling up, this rate will, of course, be considerably higher, the exact amount depending upon the handling of the car by the motorman and the design of the spring draft gear. These stresses occur, however, only with empty cars. They are of short duration

and so do not need the same consideration as those induced by regular service operation.

The effects of these stresses are very noticeable in many old wooden cars which were built with a very heavy roof, and with the window posts cut nearly in half at the window sill in order to let the rails set in flush with the face of the post. With steel construction their effects are less noticeable, as ordinarily the sections used for window and door posts are necessarily of such depth that they automatically provide sufficient strength to resist this lurching.

Much ingenuity has been shown in the development of window posts and appliances, the merits of which cannot be discussed here. The fundamental choice is between the use of some standard rolled shape, such as a T or an angle, with wooden or steel moldings bolted thereto, and a pressed box section either with moldings or pressed from one piece. The pressed section gives the better section modulus, but on the other hand the standard section has advantages, which to some designers have appealed more strongly than the feature of strength.

### The Steel Roof Had an Independent Structural Function

Practically all of the earlier types of cars were built with the so-called monitor deck, familiar to everyone. This was designed primarily to give ventilation through the use of windows set in the walls of the upper deck, which were sufficiently high above the heads of the passengers to permit of their being opened without any great discomfort.

The desire for a simpler, lighter and cheaper car construction led later to the use of the plain arch roof, with special ventilators of one type or another designed to exhaust the air from the car, fresh air being furnished either through special intakes or through the opening of doors and leakage around windows and doors.

A third type of roof is that developed by the designers of the Howe truss side frame, before mentioned, in which a sort of secondary arch is sprung from what would be the deck sills of the ordinary monitor roof. This construction gives an interior which is free from any projections to catch dirt, and at the same time it provides great stiffness and preserves the appearance of height in the interior of the car, which to some extent is lost in the plain arch roof car.

The use of steel members for the roof framing started with the first steel cars, but it was not until somewhat later that steel sheets were used for the roof itself. A little consideration will show this added very largely to the stiffness of the car, as the roof thus forms a sort of tubular structure which in itself is a girder capable of carrying considerable load. The roof also ties the two side trusses together, making together with the floor and end framing a complete steel box which is so stiff that it can be jacked up at one corner with practically no distortion.

The question of the desirable strength for the carlines is covered in the postal car specifications referred to in a preceding article, the main provisions being as follows:

"The projected area of the portion of roof in square feet supported by carlines divided by the sum of the section moduli of the carlines must be not more than 100."

In using the above as a guide it should be remembered that these specifications were drawn up to cover the severest kind of high-speed service, and that therefore it is perfectly permissible to deviate therefrom for less severe features after careful study and analysis of the existing conditions has been made. On the other hand, special conditions, such as trolley pole supports, will require even stronger construction. The specification quoted is therefore cited merely as a guide or basis from which to work out the necessary design.

In the carline construction three general types have been followed. Nearly all of these are covered by patents, a statement which is also true of many of the detail points of construction already mentioned. It is the writer's purpose throughout this series of articles to point out the general underlying principles of construction, citing such examples as may throw light on the general subject, regardless of the patent situation.

The three types of construction are: (1) The combination of window posts running from the side sills to the side plates and carlines of rolled or pressed sections running from the post on one side to that on the other, the posts thus acting as abutments on which the arched carlines rest. This construction applies to both the monitor deck and the plain arch roof, and is in general use. (2) In an arch roof, a post running continuous from side sill to side sill, forming its own arch carline.

This construction has been largely used on the one-man cars referred to by the writer in previous articles. (3) The use of a post running straight from the side sill to the side plate and then bent over to follow the curve of the lower deck to the point of the monitor deck sill. On the ends of these cantilever posts rest castings which support the short carlines of the upper deck. This construction is that of the Pennsylvania Railroad in some of its trunk line coaches.

#### What Is the Best Joint for Steel Roof Plates?

Reference has been made to the increasing use of steel plate for the roof. The chief difficulty encountered in its use has been that of making satisfactorily tight joints at the splices and the eaves. In the earlier cars the designers resorted to the use of sheets tinned or leaded at the edges. The sheets were riveted to the roof member and then the joints were soldered. While this practice provided the desired degree of watertightness, the sweating of the joints proved a slow and expensive matter. Some trouble has also been experienced from the corrosion of the sheets along the lines marking the division between the tinned and untinned portion of the sheets. This is due either to corrosive action of the original soldering flux or possibly to some electrolytic action. This method has now been largely discarded, the choice at present lying between a flame-welded joint and one formed with a gasket of heavy building paper of special type laid between the two metal parts, cold-driven rivets being employed therewith. The welded joint is probably the more desirable but has the obvious disadvantage that it is difficult to

remove any one sheet which for any reason has become corroded or otherwise damaged. It is also a rather expensive process and for this reason the gasketed joint has received considerable favor. The latter has been in use sufficiently long to give good indications of its general serviceability.

#### It's the Car End That Takes the Buffing Stresses First

Our consideration of the various parts of car construction now leads us to a very important part, namely, the end construction. For high-speed trunk-line service we may again turn to the postal specifications, a quotation from which has already been published in a previous article. For convenience, however, it may be repeated that for electric cars where the weight of the train does not exceed 600,000 lb. it is required that the sum of the section moduli of the vertical end members shall not be less than 40, and the section moduli of the main members either forming or adjacent to the door posts shall be not less than 75 per cent of this amount.

Here again it should be borne in mind that for ordinary electric service the weight of trains above referred to is considerably greater than is customary, and for that reason due allowance may be made in the design to suit the known conditions.

To resist end blows resulting from collisions it is necessary to



What a Joy There Is in a Well-Designed Car

give consideration to the climbing effect of one car over the other. That is to say, it would be comparatively simple with the average light electric car to provide against collision effect if the floor frames met exactly in line and remained so, but unfortunately it is a familiar fact that one car practically invariably slides upward on the face of the buffer of the other car and then travels forward over the floor frame. This therefore requires either very heavy post construction as provided for in the postal car specifications or some means for preventing the sliding of one car upon the other.

This tendency to climb has been met either by the use of heavy castings set back of the buffer tending to interlock if one car climbs the other, or else by the use of transverse ribs on the face of the buffer forming channel-shaped grooves which interlock and prevent climbing. Such have proved their worth, especially in the minor collisions which are apt to occur in handling cars in storage yards.

Other means which are taken to minimize collision effects are to provide a cushioning feature, such as a wooden block back of the buffer face, or else purposely to design the steel construction of the floor to collapse slightly just back of the buffer. In this case the final shock is resisted by wide plates, known as anti-telescoping plates, set edgewise and riveted to the sills. Such plates serve to bind all the sills together and to distribute the end shocks equally among the latter.

These features are exclusive of the special spring buffing devices in general use on trunk-line service, and the use of which are not usual on cars for electric service.

# Zone System for the Distribution of Bituminous Coal

**T**HE factor that loomed largest in the fuel crisis of last winter was the lack of adequate transportation facilities. Under the plan of distribution then followed, a consumer in any part of the country was free to order his coal supply from any producing district, regardless of the length of haul involved. As a consequence, it often happened that cars and locomotives were engaged in delivering coal to distant regions that could have been served far more quickly from fields near by.

Obviously, this complete freedom of choice as to the source of coal used led to cross-hauling in addition to the utilization of railroad equipment in unnecessarily long hauls, the result being a great waste of transportation power. To prevent this needless waste and make possible an increased production to meet the war demands, the United States Fuel Administration, in conjunction with the Director General of Railroads, has announced a zone system for the control of bituminous-coal distribution for the year which began on April 1, 1918.

The zone system was adopted only after prolonged conferences with coal producers, jobbers and consumers, as well as with the traffic and operating officials of the railroads. Briefly explained, it divides the country into a number of zones, each of which must obtain its coal supply from mines that are relatively near, thus preventing abnormal and wasteful transportation movements and insuring more nearly equal distribution of cars to the mines and more steady employment of mine labor.

Of course, so radical a change in the methods of conducting the coal business will cause some inconvenience to producers and consumers and will involve additional expense in some cases. For example, the producers of Pocahontas coal may no longer ship their output to Chicago and Western points by rail; instead, they must find new markets in the East. Those plants in and around Chicago that have been burning West Virginia coal will be compelled to substitute Illinois coal, which can be obtained with less than half as long a haul. As the two fuels are of very different characters, changes in the boiler settings and methods of firing will have to be made, which will entail expense.

It is the hope of the Fuel Administration, however, that the consumer and the producer will bear these unavoidable inconveniences in the realization that the readjustment of the distribution of coal is for the welfare of the nation. In other words, they are appealed to on the grounds of patriotism.

There are exceptions to the conditions imposed by the zone system. Certain industries require coals of par-

**By order of the Fuel Administration, the distribution of bituminous coal for the year which began on April 1, 1918, will be controlled by a zone system, which is intended to reduce the burden on the railroads, facilitate shipment of coal and keep all the mines working at full capacity. The insert map which accompanies this number shows the zones into which the country has been divided for this purpose.**

ticular quality or characteristics, as, for example, byproduct, gas, blacksmith and metallurgical coals. If a consumer needs coal of one of these kinds and is unable to obtain it from the producing districts that are permitted to ship into the zone in which he is located, permits will be issued to allow the special-purpose fuel to be brought in from other districts.

The zone system does not affect the following bituminous coal:

1. Coal for railroad fuel, for which special arrangements will be made by the Fuel Administrator and the Director General of Railroads.

2. Coal for movement on inland waterways, which is in no way restricted by the system.

3. Coal delivered to Canada, which is subject to regulations of the Fuel Administrator.

To enable the consumer of bituminous coal to determine the districts from which he may obtain his fuel and to show the producer the zones in which he may sell his output, the accompanying map has been prepared.

It will be seen that the entire territory of the United States has been divided into a large number of irregular zones or sections, colored differently so that they may readily be distinguished one from another, and each marked with a key number. Each of these separately numbered zones has certain definite boundary lines and is restricted to the use of coals from certain districts. The Key to Consuming Zones gives a complete list of all the zones shown on the map and states the districts from which they may obtain coal. The zone boundaries when not state lines are usually through route steam railroads. These railroad lines are lettered on the insert map.

If an electric railway company wishes to find out what coals are available for its use, it should find from the map the zone in which its power station is located and note the number of the zone. Then, in the Key to Consuming Zones, under that zone number, will be found the list of producing districts from which coal can be obtained. Following this key is a list of the meanings of the terms used in the key, such as "summer" and "winter" and division of states.

The Key to Producing Districts is intended to show the producer the several zones in which he may market his product. He knows the district in which his mine is located, and on referring to this key he finds the number of the zones, as shown on the map, into which the output from his mine may be sent.

A wall map of large size, showing the same zoning in fuller detail, may be obtained from the Coal Zone Map Company, Glen Echo, Md.



## Key to Consuming Zones

**Zone No. 1** is restricted to coal from North Dakota, South Dakota, and that received at docks.

**Zone No. 2** is restricted to coal from Illinois (summer only), North Dakota, South Dakota and Iowa (the latter to points in Iowa only), and that received at docks.

**Zone No. 3** is restricted to coal from Illinois, western Kentucky and Indiana and that received at docks.

**Zone No. 4** is restricted to coal from Illinois and that received at docks.

**Zone No. 5** is restricted to coal from Iowa, Kansas, Illinois, Missouri, Oklahoma and Arkansas.

**Zone No. 6** is restricted to coal from Illinois and western Kentucky.

**Zone No. 6A** is restricted to coal from Illinois, western Kentucky and that received at docks.

**Zone No. 7** is restricted to coal from Illinois, Iowa (the latter to points in Iowa only).

**Zone No. 8** is restricted to coal from Illinois and Indiana.

**Zone No. 9** is restricted to coal from Illinois, Indiana and western Kentucky.

**Zone No. 10** is restricted to coal from Indiana, Illinois (from the Danville district on the Wabash Ry. only), western Kentucky (goes to Jeffersonville and New Albany only).

**Zone No. 11** is restricted to coal from Virginia (on L. & N. R.R.), Tennessee (from M. R. R.), West Virginia (southern), Illinois, Indiana, Kentucky.

**Zone No. 12** is restricted to coal from Indiana and Illinois (Danville district on Wabash Ry. only).

**Zone No. 13** is restricted to coal from western Kentucky.

**Zone No. 14** is restricted to coal from Indiana, eastern Kentucky, West Virginia (northern and southern), Virginia points on L. & N. R.R., Tennessee points on M. R.R., Michigan, Ohio points on G. R. & I. Ry.

**Zone No. 15** is restricted to coal from Illinois, Indiana, Kentucky, West Virginia (northern and southern), Virginia points on L. & N. R.R., Tennessee points on M. R.R., and Michigan.

**Zone No. 16** is restricted to coal from Indiana, Illinois (Danville district on Wabash Ry. only), eastern Kentucky, southern West Virginia.

**Zone No. 17** is restricted to coal from Virginia points on L. & N. R.R., eastern Kentucky, Tennessee points on M. R.R., southern West Virginia.

**Zone No. 18** is restricted to coal from Virginia points on L. & N. R.R., southern Kentucky and Tennessee points on M. R.R.

**Zone No. 19** is restricted to coal from eastern Kentucky, Tennessee points on M. R.R., western Virginia (southern, also eastern, to points on C. & O. Ry. from Catlettsburg, Ky., to Cincinnati, Ohio).

**Zone No. 20** is restricted to coal from Virginia points on L. & N. R.R., eastern Kentucky, Tennessee points on M. R.R., West Virginia (northern and southern), Indiana, Illinois (from Danville district on Wabash Ry. to points in Indiana only), Ohio and Michigan.

**Zone No. 21** is restricted to coal from Virginia points on L. & N. R.R., eastern Kentucky, Tennessee points on M. R.R., West Virginia (northern and southern), Ohio and Michigan.

**Zone No. 22** is restricted to coal from Virginia points on L. & N. R.R., eastern Kentucky, Tennessee points on M. R.R., southern West Virginia and Ohio.

**Zone No. 23** is restricted to coal from northeastern Kentucky, West Virginia (northern and southern, also eastern, along main lines of C. & O. Ry. and N. & W. Ry. to Columbus and Cincinnati, Ohio) and Ohio.

**Zone No. 24** is restricted to coal from northeastern Kentucky, West Virginia (southern, also eastern, along main lines of C. & O. Ry. and N. & W. Ry. to Columbus and Cincinnati, Ohio), and Ohio.

**Zone No. 25** is restricted to coal from West Virginia (northern, also eastern, along main lines of C. & O. Ry. and N. & W. Ry. to Columbus and Cincinnati, Ohio), and Ohio.

**Zone No. 26** is restricted to coal from Pennsylvania and Ohio.

**Zone No. 27** is restricted to coal from Pennsylvania and Ohio.

**Zone No. 28** can continue to get coal as formerly except that low-volatile coal in the Pocahontas, Tug River and New River districts on the N. & W. R. R. and the C. & O. Ry. and the Virginia Ry., and Clinch Valley districts in Tazewell and eastern Russell Counties along the N. & W. R. R., also high-volatile east of Charleston, W.

Va., on C. & O. Ry. and east of Jaeger, W. Va., on N. & W. R. R. will be restricted to the District of Columbia, (except points on C. & O. Ry.), Virginia, (including tide-water terminals) and points in West Virginia on the direct line of the C. & O. Ry. and N. & W. R. R. east and west bound and Virginia Ry. east bound.

**Zone No. 29** is restricted to coal from Ohio, West Virginia (northern, also eastern, to points on the direct lines of the C. & O. Ry. and N. & W. Ry.).

**Zone No. 30** can continue to get coal as formerly.

**Zone No. 31** is restricted to coal from North Dakota, Wyoming, Montana and other fields east of the Rocky Mountains and that received at docks.

**Zone No. 32** is restricted to coal from North Dakota, South Dakota, Wyoming and Montana and that received at docks.

**Zone No. 33** is restricted to coal from South Dakota, Wyoming, Montana and other fields east of the Rocky Mountains, North Dakota and that received at docks.

**Zone No. 34** is restricted to coal from North Dakota, South Dakota, Wyoming, Montana, Illinois (in summer), and that received at docks.

**Zone No. 35** is restricted to coal from Iowa, Kansas, Missouri, Arkansas, Oklahoma, Colorado and other fields east of the Rocky Mountains, and from Wyoming.

**Zone No. 36** is restricted to coal from Kansas, Missouri, Iowa, Arkansas, Oklahoma and southern Colorado.

**Zone No. 37** is restricted to coal from Oklahoma, Missouri, Arkansas, Kansas, Colorado, New Mexico and Texas.

**Zone No. 38** is restricted to coal from New Mexico, Colorado and Texas.

**Zone No. 39** is restricted to coal from Colorado, New Mexico, Arkansas, Oklahoma and Texas.

**Zone No. 40** is restricted to coal from western Kentucky, Alabama and Texas.

**Zone No. 41** is restricted to coal from Arkansas, Illinois (in summer), Iowa, Kansas, Missouri and Oklahoma and to that received at docks.

**Zone No. 42** is restricted to coal from Arkansas, Iowa, Kansas, Missouri and Oklahoma.

**Zone No. 43** is restricted to coal from Iowa, Arkansas, Kansas, Missouri and Oklahoma.

**Zone No. 44** is restricted to coal from Arkansas, Illinois, Kansas, Missouri, Oklahoma and Texas.

**Zone No. 45** is restricted to coal from Alabama, Arkansas, Illinois (only on lines of St. L. S. W. Ry. and St. L. I. M. & S. Ry.), Kansas, Missouri, Oklahoma, western Kentucky and Texas.

**Zone No. 47** is restricted to coal from western Kentucky.

**Zone No. 48** is restricted to coal from Alabama.

**Zone No. 49** is restricted to coal from Alabama, and western Kentucky.

**Zone No. 50** is restricted to coal from southern Kentucky, Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), western Kentucky, Tennessee and Georgia.

**Zone No. 51** is restricted to coal from Alabama, southern Kentucky, Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Tennessee and Georgia.

**Zone No. 52** is restricted to coal from Alabama.

**Zone No. 53** is restricted to coal from Kentucky (southern, also western, to points on N. C. & St. L. and T. C. R.R. Nashville to Old Hickory and Hermitage, Tenn., inclusive), Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), eastern, also southern on C. & O. Ry. east of Charleston and N. & W. Ry. east of Jaeger, W. Va.), Georgia and Tennessee.

**Zone No. 54** is restricted to coal from southern Kentucky, Tennessee, Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Alabama and Georgia.

**Zone No. 55** is restricted to coal from southern Kentucky, Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), Tennessee, Georgia and eastern West Virginia.

**Zone No. 56** is restricted to coal from southern Kentucky, Tennessee, Virginia (all Black Mountain and Stonega districts in Lee, Dickenson, Wise and western Russell Counties of Virginia), and Clinch Valley districts in Tazewell and eastern Russell Counties along the N. & W. R. R. (West Vir-

ginia (eastern, on C. & O. Ry. and N. & W. Ry. and Virginian Ry.).

**Zone No. 57** can continue to get coal as formerly except that coal is to be supplied generally from low-volatile fields.

## DEFINITIONS

In this key the word "summer" is used to denote time from April 1 to and including Sept. 30, and "winter" from Oct. 1 to March 31.

Divisions of Kentucky are as follows: "Eastern" means all mines in eastern Kentucky on the Southern Railway (Q. & C.), L. & N., C. & O., N. & W. and Long Fork; "northeastern" means sections reached by the Sandy Valley & Elkhorn Ry., Long Fork, C. & O., and N. & W. Railroads in the Thacker, Big Sandy and Elkhorn districts; "northern" means the L. & N. sections in Hazard and Elkhorn districts; "southern" means those reached by the Southern Railway (Q. & C.) and L. & N. in Harlan, Jellico and Southern Appalachian districts; and "western" means those sections reached by L. & N. and I. C. west of Louisville, Ky.

Similarly the three districts of West Virginia are as follows: "Eastern" means those sections reached by the C. & O. and N. & W. in low-volatile fields of Pocahontas, Tug River and New River districts; "northern" those reached by the K. & M., K. & W. V. and C. & C. west of Dundon; and "southern" those reached by the C. & O. and N. & W. in Kanawha, Kenova and Thacker districts.

## KEY TO PRODUCING DISTRICTS

Producing Districts	Location of Producing Districts	Numbers of Consuming Zones to which restricted
Alabama	.....	40, 45, 46, 48, 49, 51, 52, 54.
Arkansas	.....	5, 35, 36, 37, 39, 41, 42, 43, 44, 45, 46.
California	.....	30.
Colorado	.....	30, 31, 33, 35, 36, 37, 38, 39.
Docks <sup>1</sup>	.....	1, 2, 3, 4, 4A, 6A, 31, 32, 33, 34, 41.
Georgia	.....	50, 51, 53, 54, 55.
Illinois (summer)	.....	2, 34, 41.
Illinois	.....	3, 4, 4A, 5, 6, 6A, 7, 8, 9, 10 <sup>2</sup> , 11, 12 <sup>2</sup> , 15, 16 <sup>2</sup> , 20 <sup>2</sup> , 44, 45 <sup>2</sup> , 46 <sup>2</sup> .
Indiana	.....	3, 8, 9, 10, 11, 12, 14, 15, 16, 20.
Iowa	.....	2 <sup>4</sup> , 5, 7 <sup>1</sup> , 35, 36, 41, 42, 43.
Kansas	.....	5, 35, 36, 37, 41, 42, 43, 44, 45.
Kentucky:		
Eastern	.....	11, 14, 15, 16, 17, 19, 20, 21, 22.
Northeastern	.....	23, 24.
Southern	.....	18, 50, 51, 53, 54, 55, 56.
Western	.....	3, 4, 6A, 9, 10, 11, 13, 15, 40, 45, 46, 47, 49, 50, 53 <sup>2</sup> .
Maryland	.....	57.
Michigan	.....	14, 15, 20, 21.
Missouri	.....	5, 35, 36, 37, 41, 42, 43, 44, 45.
Montana	.....	30, 31, 32, 33, 34, 35.
New Mexico	.....	20, 35, 37, 38, 39.
North Dakota	.....	1, 2, 31, 32, 33, 31.
Ohio	.....	14 <sup>6</sup> , 20, 21, 22, 23, 24, 25, 26, 27, 28 <sup>7</sup> , 29.
Oklahoma	.....	5, 35, 36, 37, 39, 41, 42, 43, 44, 45.
Oregon	.....	30.
Pennsylvania	.....	27, 28, 57.
South Dakota	.....	1, 2, 32, 33, 34.
Tennessee	.....	(M. R. R.)..... 11, 14, 15, 17, 18, 19, 20, 21, 22.
Tennessee	.....	50, 51, 53, 54, 55, 56.
Texas	.....	37, 38, 39, 40, 44, 45, 46.
Utah	.....	30, 31, 33, 35, 36.
Virginia (L. & N.)	.....	11, 14, 15, 17, 18, 20, 21, 22.
Virginia <sup>8</sup>	.....	50, 51, 53, 54, 55, 56.
Virginia <sup>9</sup>	.....	53, 56.
West Virginia:		
Eastern	.....	19, 23 <sup>10</sup> , 24 <sup>10</sup> , 25 <sup>10</sup> , 29 <sup>10</sup> , 53, 55, 56.
Northern	.....	14, 15, 20, 21, 22, 25, 29.
Southern	.....	11, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 53.
Wyoming	.....	30, 31, 32, 33, 34, 35.

<sup>1</sup>South bank Lake Superior and west bank Lake Michigan.

<sup>2</sup>From Danville district on Wabash Ry. only.

<sup>3</sup>Only on lines of St. L. I. M. & S. and St. L. S. W. Rys.

<sup>4</sup>To points in Iowa only.

<sup>5</sup>To points on N. C. & St. L. and T. C. Nashville to Hermitage and Old Hickory, Tenn., inclusive.

<sup>6</sup>On G. R. & I. only.

<sup>7</sup>From mines in Columbiana County, Ohio, only.

<sup>8</sup>All Black Mountain and Stonega districts in Lee, Wise, Dickenson, and western Russell Counties.

<sup>9</sup>Clinch Valley districts in Tazewell and eastern Russell Counties.

<sup>10</sup>Along lines of C. & O. and N. & W. to Cincinnati and Columbus, Ohio.

# No Sudden Decline in Price Level\*

Data of a Century Show That Fall of Prices Will Be Slow Even When Peace Is Declared—  
Increased Utility Rates, To Be Just, Must Extend Beyond War Period

BY WILLIAM J. HAGENAH

WE ARE seeing at the present time a most important development growing out of our disturbed economic and political conditions—one which is destined to have a most far-reaching effect on the operations of public utilities. There is hardly an individual or an enterprise that has not already felt this staggering force or is not destined to feel it in the near future, but among all forms of industry which are struggling to effect a readjustment none has suffered so acutely as have the public utilities. I refer to the steadily rising level of prices, to which such decided impetus has been given by our entry into the great European war.

## HOW THE UTILITY CRISIS CAME ABOUT

For more than fifteen years before the opening of the European war this country saw a gradually rising price level. Although this tendency has had several brief reversals, subsequent events have shown that these declines were merely fluctuations in the persistent movement to a higher level of wages and commodity prices. Coincident with this movement was our great industrial and commercial development. Private capital grew rich and strong on the unearned increment of a rising market.

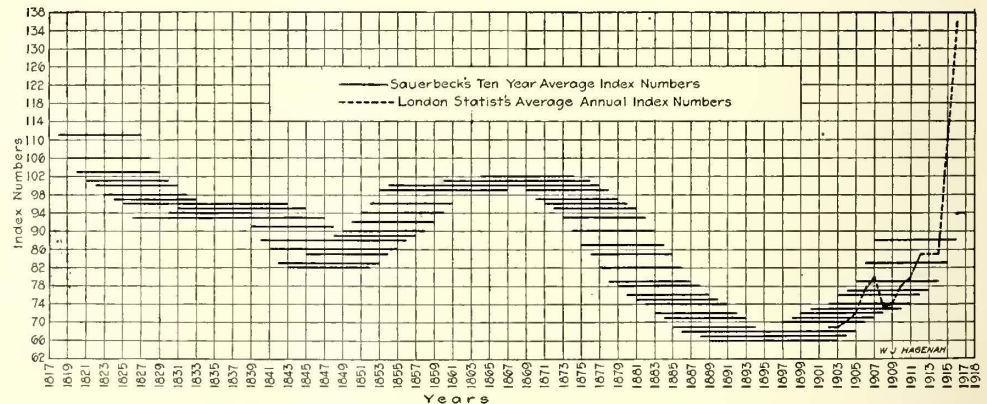
The effect of these conditions on the public utilities is now generally known. With the rapid growth of urban population streets were extended in every direction and many new suburbs opened. But while the increased labor and commodity prices, interest rates and taxes caused increases in the operating expenses which were giving concern to the managements, the rates for utility service remained stationary or in many instances were reduced by public action. Moreover, these rates were being paid in a medium of exchange which was suffering a gradually diminishing purchasing power.

So long, however, as the utility had not yet reached the reasonable limit of its technical development and while the territory which it served was still far from being saturated, these increasing costs were largely offset by improvements in apparatus and methods. In fact, there are many instances where net earnings, because of especially favorable local conditions, showed annual increases. When relatively high efficiency had been realized, however, and the increase in the price level appeared to be gaining in momentum, the trend of net

earnings in most instances turned definitely downward. With the reasonable limit of expansion reached, the crisis in the history of the utility industry approached. Between the pressure of increasing costs and the declining purchasing power of the dollar of income, net earnings were threatened with extinction.

This, in brief, was the condition of the utility industry when in 1914 the storm of the European war burst on the world—a war which each year has enveloped additional peoples and has gained in fury and destructiveness. With the coming of this war the level of prices, which was already at the highest point reached in a generation, turned abruptly and violently upward. Such a tendency it has maintained to this time. There is to-day scarcely an article of commerce or a form of human service which has not experienced such a great increase in price as to extend beyond every measure of comparison in the experience of men born since the close of the Civil War.

The chart reproduced with this article shows Sauer-



PRICE MOVEMENTS DURING THE LAST CENTURY

beck's ten-year average index prices for the years from 1817 to 1916; on which I have superimposed the annual index prices of the London Statist in order to show what has taken place beyond the period covered by the Sauerbeck data and what the extension of the Sauerbeck data for the next few years will reveal. This is the most complete study of price movements with which I am familiar. As it covers the full period during which modern business methods have been developed and extended, it offers the most comprehensive diagram of what has happened under specific conditions and further serves as a guide to what we may look forward to as a result of the recurrence of those conditions.

From the high-price level following the Napoleonic wars to the high level of the Civil War period was approximately fifty years. Moreover, after the low point reached in about 1846, it was again fifty years before the low level after the Civil War was reached. Singularly, it is now just fifty years since the high level of

\*Abstract of revised transcript of informal talk before Wisconsin Gas & Electrical Association at Milwaukee, Wis., March 27.

prices in the Civil War period. In view of these events of the last century, covering two complete major economic cycles, in each case growing out of conditions similar to those with which the world is confronted at this time, can it be expected that following the declaration of peace in this war prices will quickly decline to the pre-war level or lower?

In spite of prevailing conditions, we appear very prosperous at this time, but let us not be deceived. This is a war prosperity, and both England and Germany report the same kind of business activity. It would be more correct to say that we are extremely busy rather than extremely prosperous, since we are not creating wealth. From this period of intense activity, of strained production and increasing consumption, we shall enter a period after the war when this destruction must be paid for by the hard labor and economies of the people. The reaction will be as great as was the action, but it will be extended over a much longer period of time.

#### OLD PRICE LEVEL MAY NOT BE REACHED IN FIFTEEN YEARS

This does not mean that we shall at once have a serious depression. On the contrary, the necessity for urgent reconstruction and the accumulation of deferred work, together with the sentimental effect of the return of peace, will lead to considerable activity for a year or more after the close of the war. But the period of readjustment and of producing from the soil and other natural resources and by hard labor the wealth to pay for these struggles will cover many years. During this time we shall undoubtedly experience a relatively high level of prices, but with a gradually declining tendency the world over.

According to the course of the price movement after periods of great world wars in the past and in view of the special conditions with respect to the currency and banking systems at the present time, we may look forward to a considerable period of high prices, a period of business readjustment and a period of new social legislation. What this means in its full significance to individuals, to business in general and especially to public utilities, can be readily understood. The price level under which plants were built, under which franchise obligations were established and on which rate schedules were established, may not again be reached in fifteen years or even longer. It is not difficult to believe that many utility operators will not live to see the return to the price level of 1914.

#### UTILITIES LOOK TO COMMISSIONS FOR JUSTICE

As a result of the present violent movement the work of the utility commissions has been enormously increased. During the decade of commission activity extending from 1907 to 1917 the almost universal results of commission investigations were reductions in rates. For the larger part of this period the rise in prices was gradual but extremely moderate in comparison with the last two years, but these increases were in many instances offset by the increased efficiency in utility operations and the great extension in service. So elastic was the industry and so quick its response to reasonable rate reductions that these years which represent an almost unbroken record of rate reductions at

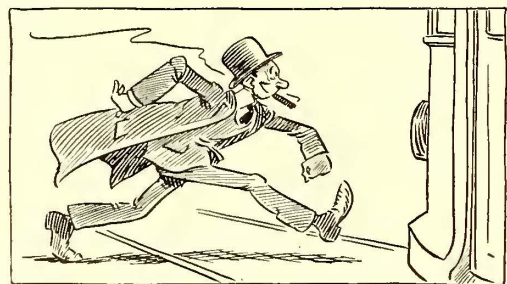
the same time mark the golden years of utility growth.

At the present time, however, the commissions which were quick to take advantage for the public of every economy in operation or profit resulting from improvements, are now foremost in granting relief from the pressure of high prices. Nearly 500 public utilities have received increases in rates or have been relieved from burdensome obligations by state utility commissions and by city councils within the last fifteen months. If the present tendency to permit increases in rates to offset rising costs continues, the year 1918 will see a practical cancellation of much of the work for rate reduction accomplished by these same authorities after many years of labor. It will also show that the original conception of a public utility commission as a continuing investigating body created to do justice to investor and public alike was correct, and that even in the midst of this great war, wherein every element of our national life is strained to the utmost, the desire for justice and fair play to all interests is still firmly grounded in the heart of the American public.

Growing out of the rapid increase in commodity prices are two important problems which should be developed and properly presented to the regulatory authorities. The justice and necessity of these are apparent from a study of the price movement. They are, first, the necessity of departing from the use of the five-year and ten-year average prices as a basis for rate-making appraisals and, second, the necessity for a larger return on the fair value of the property.

#### "His Name Is Legion"

**LOOK OUT FOR THE "SAVE-A-SECOND" FELLOW**



**He always tries to slip across in front of your car just as you are starting.**

**He may stumble, fall and be run over.**

**Give Him Warning**

**Sound Your Gong As You Start**

A GOOD SUGGESTION FROM THE N. S. C.

**I**N the special electric railway poster reproduced here with the National Safety Council calls attention to a class of citizens whose actions are exasperating to the conscientious motorman. If the man depicted in the sketch was injured, he probably filed damage claims.



TRANSPORTATION DEPARTMENT'S OFFICE ACROSS FROM CARHOUSE



SIDE AND ENTRANCE TO CARHOUSE FROM CLEVELAND AVENUE

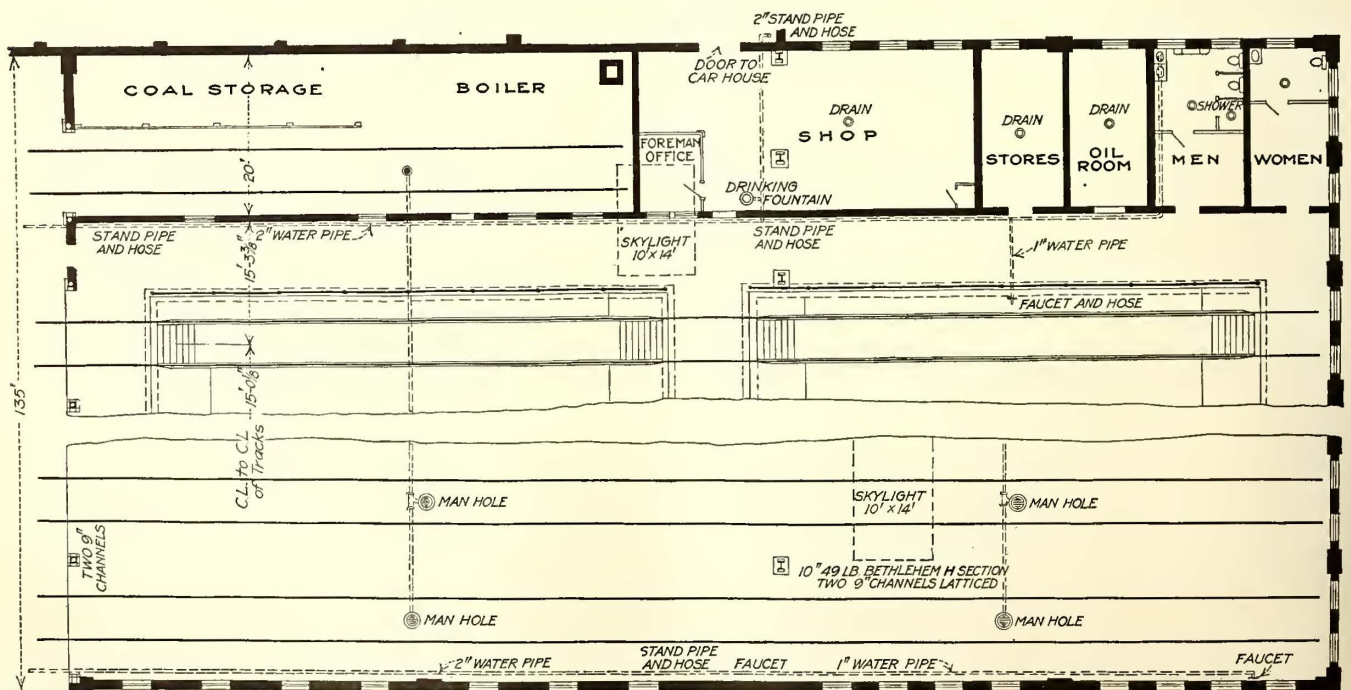
# Columbus Inspection Shop Rebuilt As Unit, and Track Layout Improved

Inspection Shop and Track Changes at Milo Carhouse of the Columbus Railway, Power & Light Company—Car Movement Facilitated by Substituting Direct Connecting Tracks for Transfer Table

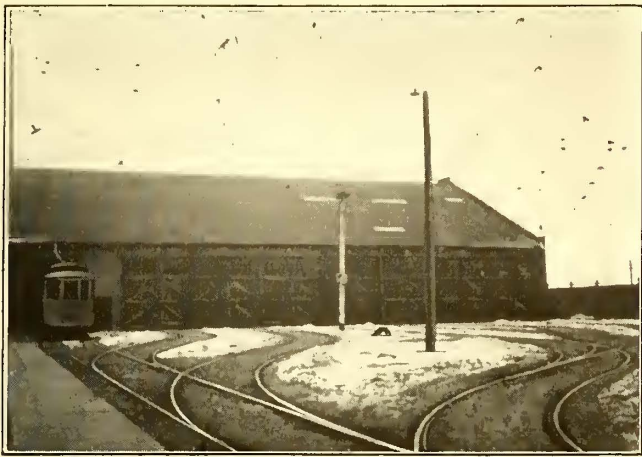
IN LINE with the present tendency among electric railways to arrange their carhouses and yards so that the handling of cars is facilitated and the most favorable and efficient working conditions are secured for making inspections and repairs, the Columbus Railway, Power & Light Company, Columbus, Ohio, has reconstructed and modernized its antiquated inspection shed at Milo. The track layout leading to this shop has also been improved. This property, which originally belonged to the Columbus Central Railroad, is the largest of the five carhouses of the present Columbus

system, as nearly one-third of its transportation men work from this point. The buildings at Milo include a carhouse and an inspection shop, located as shown in one of the accompanying illustrations. The inspection shop adjoins the carhouse, about 200 ft. back from the street, and in front of the shop and switching tracks is a substation building which was formerly used for a power house.

The changes in track layout were made to give easier access to the inspection shop. The cars formerly pulled in over a track laid alongside the substation away from



FLOOR PLAN OF INSPECTION SHOP



ENTRANCE TO INSPECTION SHOP OVER NEW TRACK LAYOUT



END AND PART OF ENTRANCE TO INSPECTION SHOP

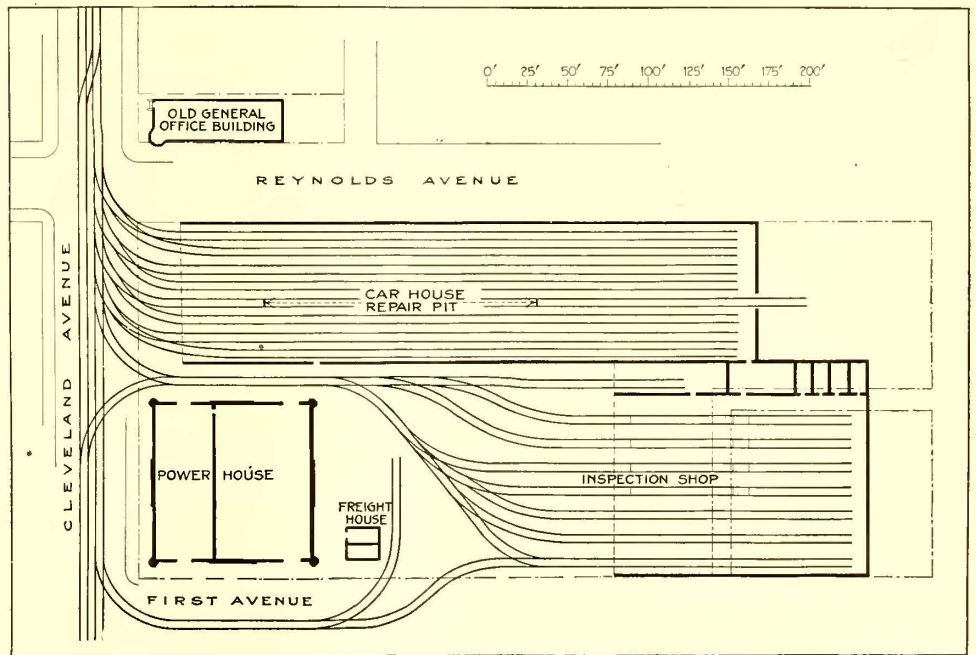
the carhouse, and it had only one switch at the street. With the present layout the cars pull in from either direction over a new track laid between the carhouse and the substation and across the site of a building which adjoined the former and was used for the platform men's room.

The principal building changes were made in the building now forming the inspection shop, which consists of two brick structures placed side by side. The common wall or partition, at right angles to the direction of the tracks, was replaced with a row of steel columns to support the roof, which was renewed. Sections of the front wall were also removed and steel columns with swinging doors were added to give a direct connection to all of the eight tracks entering the building. Previous to these changes a direct connection was provided for but three of the tracks, and in order to use the others it was necessary to shift the cars by means of a transfer table.

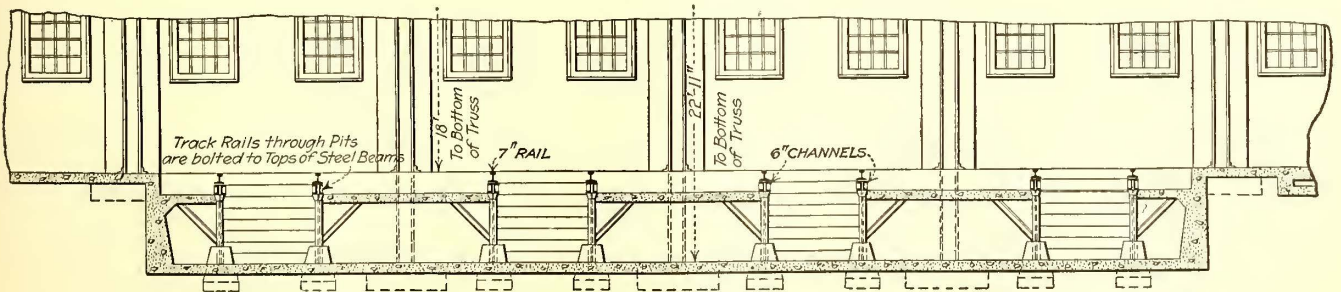
As seen from the accompanying layout, the inspection shop contains seven tracks running the entire length of the building, and several small rooms along one side. The track room is 160 ft. long and 135 ft. wide. Four tracks are constructed over pits for mak-

ing inspections and repairs, and the remaining three tracks are used when cars are being washed. The entire floor is constructed of concrete, reinforced over the pits. A walk 10 ft. wide and on a level with the rail tops extends across the pits at the middle of the building.

The pit tracks are of open construction, built on short 8-in. I-beam columns, spaced 8 ft. 1 1/2 in. apart. An 8 1/2 ft. space between tracks gives ample room for workmen when repairing cars. Across this space is a 6-in. slab of concrete 13 in. below the top of the rails



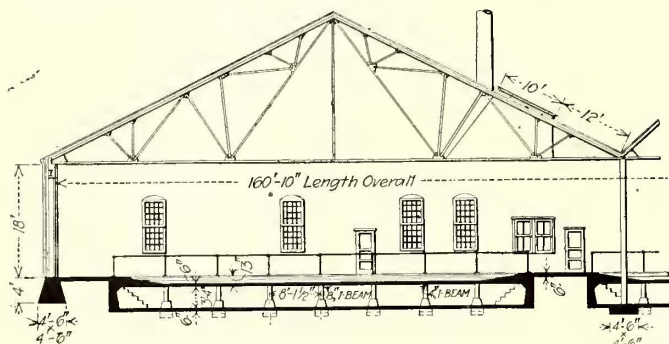
ARRANGEMENT OF BUILDINGS AT MILO AND PRESENT TRACK LAYOUT, COLUMBUS RAILWAY, POWER & LIGHT COMPANY



LONGITUDINAL SECTION THROUGH PITS IN INSPECTION SHOP

and held with 4-in. I-beams supported from the columns. At the ends these walks are ramped up to the tops of the rails. In the car-washing tracks the concrete is sloped to provide surface drainage.

A noteworthy feature of the arrangement of the smaller rooms along the side of the building is the location of a spacious boiler room and coal storage space, with a stub track on which fuel is brought into the building. There is also a hot-water heater in the boiler room for supplying water to the washrooms. One of the small rooms is used as a stockroom, one as a shop and one for oil storage. Special accommodations are provided for women, as it has been the practice of the



SECTIONAL ELEVATION OF INSPECTION SHOP, SHOWING PIT CONSTRUCTION

company for several years to employ them as car cleaners.

The remodeling of the inspection shop permitted the removal of a small shop in the main carhouse. The latter stood near the front of the building over one of the tracks, making it impracticable to use the rear portion of this track except for the storage of sweepers or other inactive equipment. With the maximum use of this track, the building now has a running capacity of about sixty-five cars.

Since the removal of the building containing the men's room to provide space for the pull-in track, as mentioned previously, the transportation foreman's office and quarters for the men are located in a two-story brick building just across the street from the main carhouse.

### Pneumatic Tie Tamping Saves on Reconstruction

THE United Railroads of San Francisco recently tried out and adopted a pneumatic tie-tamping outfit which has been found to afford a saving in cost and labor. As careful records were kept of items entering into both hand and pneumatic tamping methods it has been possible to compare the two methods in detail.

The equipment used is an 8-in. by 6-in. Ingersoll-Rand ER-1 compressor which has a piston displacement of 94 cu.ft. per minute. This compressor, sufficient for the operation of four tools, is driven by a 20-hp. motor operated by connection between trolley and rail.

An average of seven jobs in which 2692 ft. of single track was ballasted with hand tamping gave the figures as to this cost given in Table I.

Based on the same wage conditions and on the same track, namely 6-in. by 8-in. ties, 8 ft. long on 2-ft. cen-

ters, the costs shown in Table II were found typical for pneumatic tamping. These figures being based on a crew of seven men and four tampers making 180 ft. of single track per day.

TABLE I—COSTS WITH HAND TAMPING

Labor.....	\$0.257 per foot of single track
Tools, superintendence and overhead.....	0.017 per foot of single track
Total.....	\$0.274 per foot of single track
Or \$1,446.70 per mile.	

Thus the saving effected by the pneumatic equipment amounts to about \$686.40 per mile of single track. It is believed that a more compact roadbed can be secured by this method. Moreover, the fact that labor required is more than cut in half is considered a strong point in

TABLE II—COSTS WITH PNEUMATIC TAMPING

Labor, including moving.....	\$0.117 per foot of single track
Current.....	0.011 per foot of single track
Maintenance, oils, superintendence and overhead.....	0.010 per foot of single track
Depreciation and interest.....	0.006 per foot of single track
Total.....	\$0.144 per foot of single track
Or \$760.30 per mile.	

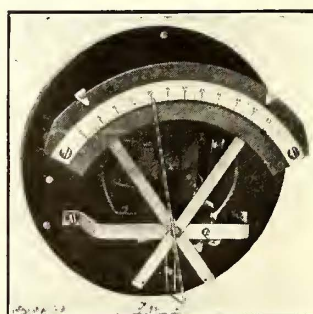
favor of the pneumatic method in times when the labor problem is acute.

The work on the United Railroad properties is under the direction of B. P. Legare, chief engineer of maintenance of way and construction.

### New Pressure-Governor for Gas and Liquid Systems

THE details of a new pressure governor for controlling selfstarters used with motor-operated compressors are shown in the accompanying illustration. A graduated pressure scale and indicating needle are used to indicate the pressure and as a guide in making adjustments.

The action of the governor is dependent on the



PRESSURE GOVERNOR WITH CASE REMOVED

Bourdon tube which is connected to an independent discharge pipe from the pressure tank. The free end of the tube is connected mechanically to the indicator needle referred to above. After the governor has been set to the pressure range desired, it will automatically maintain the pressure within those limits on any gas or liquid system, that will not corrode the Bourdon tube. It can be used on both a.c. and d.c. circuits, and will operate within settings of from 3 to 12 lb.

The device is made by the General Electric company, in sizes for rated pressures of 60, 100, 160, 300 and 500 lb. Governors for higher pressures can also be supplied if desired. Adjustments of the cutting-in and cutting-out pressures are made by moving the pointers shown at the top of the graduated scale. The case is tapped and drilled at the bottom for the pressure pipe and for making the electrical conduit connections.

## Trolley Ear Length Is a Factor in Wire-Wear

Tests Recently Made Show That the Life of the Wire Increases Proportionately With the Length of the Ear

BY G. H. BOLUS

Designing Engineer, Ohio Brass Company, Mansfield, Ohio

MANUFACTURERS of overhead line material list trolley ears in all lengths from 7 in. to 15 in. Sales records show that the railway companies of the United States and Canada are purchasing more 15-in. ears than those of any other length. The average railway man doubtless has standardized on the length of ear which he has found from experience works well on his line, but it is doubtful whether he directly associates the length of the trolley ear with the wear on the trolley wire.

Some railway properties make a practice of starting their installation with a 9-in. ear, operating it until worn out and replacing with a 12-in. ear to cover up the worn spots in the wire. The next renewal would be with a 15-in. ear and later renewals would either be made with this length ear until the wire is worn out, or the ear points would be shifted and the series would be gone through again. This may sound like an answer to the question as to how many trolley ears will be renewed before the wire has worn to such a degree that its renewal is necessary, but it is not intended as such. The writer has found that local conditions so affect results that what would apply on one road would not apply at all on another.

In some cases the wire wears most at the approach side of the ear, (double-track, traffic in one direction) while in others the wear is greatest in the center under the boss. In still others it is at the leaving side. Trolley-base tension, trolley-wire tension, tightness of cross-spans and car speeds all have a bearing on the problem.

The test described gives the results obtained on a line where the wire is worn on the leaving side of the ears.

Test samples were made up from extruded metal in 7-in., 9-in., 10-in., 11-in., 13-in. and 15-in. lengths. Extruded metal was selected as uniformity, smooth surface contact and freedom from blowholes and porous spots was essential to insure reliable results. As the extruded metal was produced in lengths of 5 ft. it was easy to alter to the special lengths required for the test ears.

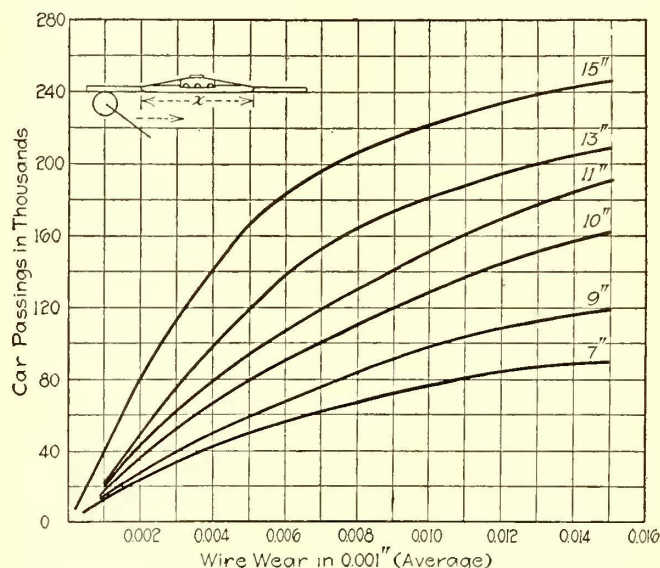
The trolley ears were installed in one of the large, Middle Western cities on No. 00 round Phono-Electric trolley wire which had been in use some time. Six sets of various lengths of ears were alternated on the trolley wire so as to subject them to conditions as nearly uniform as possible. The trolley tension was 1800 lb. with 100-ft. pole spacing. The road was double-track, with 40-ft. poles reinforced at the ground line. Micrometer readings were taken at frequent intervals of the wear on the trolley wire at both the approach and leaving ends of the ears until a wire wear of  $\frac{1}{16}$  in. (0.015 in.) on the leaving side of the ear was recorded. When any set of ears showed  $\frac{1}{16}$  in. wear they were disqualified and removed, as it was not desired to dam-

age the contact wire unduly in the test. An accurate count was kept of all car passings. The accompanying graphs show the results of the test.

It is interesting to note that the 7-in. ear gave only about one-third of the life, in car passings, of the 15-in. ear for the same wear.

The curves appear to flatten out after the 0.015-in. wear is recorded, but this should not be taken to mean that there would be no wear beyond this point.

The writer has personally inspected trolley ears under a great many operating conditions and it has been his experience that under certain conditions, such as taut trolley wire and slack cross-span wires, short ears of 7-in. or 9-in. length will give satisfactory performance. A number of such installations are in operation in this



CURVES OF TROLLEY WIRE WEAR WITH EARS OF DIFFERENT LENGTH

country, principally in the East. However, where slack trolley tensions are employed, producing considerable sag between supports, there is a hammer blow which causes the trolley wire to be hammered out at the approach of the ears. Also there is a tendency toward crystallization as the wave impulse set up by the on-coming trolley wheel is abruptly damped out at the short ear, producing a tendency towards hardening of the contact wire and early failure due to crystallization. Under this latter condition a longer ear would undoubtedly give better results.

The graphs are not submitted as being conclusive, but they are intended to show the tendency of the short ears to wear the wire on the property where the test was made. It is the intention to make further tests along similar lines in the near future.

## Fuel Conservation in Portland, Ore.

The City Council of Portland, Ore., recently passed ordinances granting permission to the Portland Railway, Light & Power Company and the Northwestern Electric Company to conserve fuel by the construction of large bins near their respective plants for storing refuse from the sawmills of the city. During the summer season when there is a shortage of water this material will probably be used in generating electrical energy.





## Foot Control Mechanism Makes One-Man Car Operation Easier

Control and Air Brake Operation by Foot Pedals Leaves Motorman's Hands Free for Cashier Service

TO SIMPLIFY still further the operation of one-man cars, J. S. McWhirter, superintendent of equipment Third Avenue Railway System, New York City, has designed a method of actuating controllers and air brakes by means of foot pedals. The original object of this invention was to enable the operator to control the car movement and still leave his hands free for making change, issuing transfers, operating doors and sanders, and caring for the general safety of the passengers.

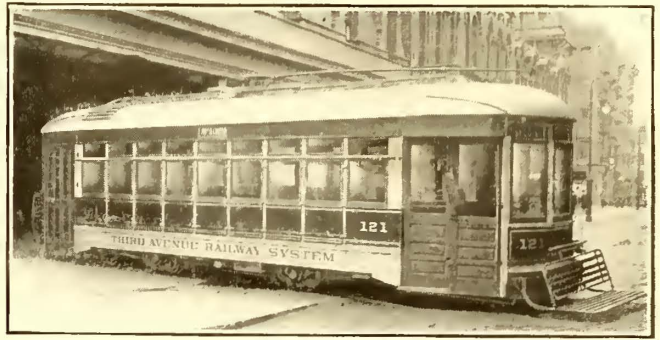
Since the device has been in operation other important advantages have been discovered. The first of these is increased safety, for a man using his hands in the operation of a car in the usual manner does not have the freedom of vision for watching the door and the boarding of passengers that is afforded when operating by the foot mechanism. Another is that when the foot pedal is in use the control and air brakes are automatically interlocked so that the motorman cannot apply power without releasing his brakes. This prevents the waste of energy that is frequently found when motormen apply power to bring a car up to the desired stopping point instead of releasing the brakes when they find that they have misjudged their stopping distance. It prevents also the rounding of curves with both power and brakes applied, for which practice some motormen also have a fondness. It further provides automatically for the proper sequence of operations in the control of the car. That is, power is dropped off before the brakes are applied and the brakes must be released before using power again.

Practical operation of the pedal equipment has shown that it promotes coasting, because the coasting position is a welcome change for the foot, and decreases waste of braking air as the operator is far less likely to "pump" on the pedal than to "fan" the brake handle.

Three cars have already been equipped with the pedal attachment and placed in service on the Chester Hill line of the Third Avenue Railway System. As this is a suburban line with a long headway, it lends itself readily to experiments in one-man car service. The cars equipped are the company's low-level type like the one illustrated. The control equipment on the cars is interlocked with the door operation so that the doors must be closed before the car can be started.

As shown in the cab views, car control is effected by operating the foot pedal which is connected by levers to the handle of the motorman's brake valve as originally installed. This operation also opens and closes the control circuit. Thus when the pedal is pressed down and released power is applied and cut off and the brakes operated in the same manner as is regularly done by the motorman operating the controller and brake valve.

With no foot pressure the pedal is in a raised position and an emergency application of the brakes results. So if the operator lifts his foot the effect of the deadman's handle is obtained. Motormen find it easier to keep the foot pedal depressed than to hold down a handle of the deadman type.



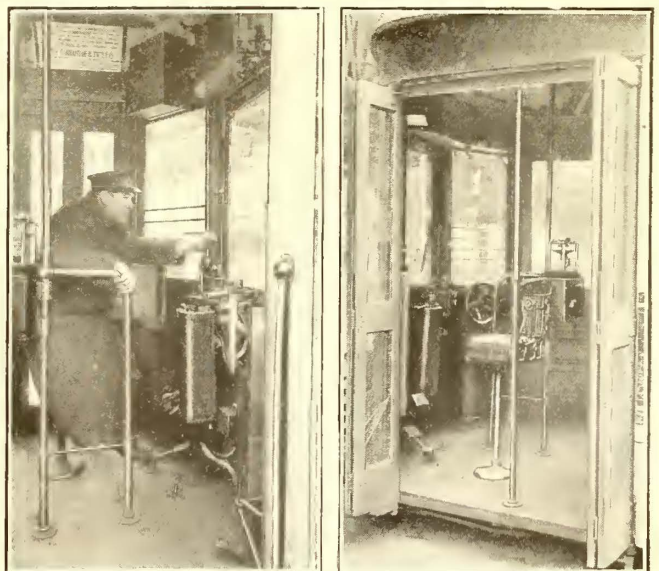
LOW-LEVEL CAR ARRANGED FOR ONE-MAN OPERATION

One of these cars has been in operation, breaking men in for service, since the middle of April. The men take readily to this mode of operation, and apparently find it easier to operate the car with one movement than by two, as is required for operating the control and brakes by hand. With very little practice the men are able to operate the car as smoothly and make stops as accurately as with hand operation and they find it less fatiguing. The present attachments do not interfere with hand operation in the usual manner if emergency should require it.

A swivel seat is arranged for the operator. This is an advantage, for it not only makes car operation by means of the foot pedal easier but it also permits the changing of position necessary to obtain a clear view of passengers boarding and alighting. Time can thus be saved at stops and additional safety to the passengers results.

It will be appreciated that in this pioneer apparatus the inventor has had to work with a controller and brake valve made for the usual hand operation. Eventually the platform controller will be eliminated entirely and the connections to the brake valve made less conspicuous. This will have an additional advantage of requiring less platform space.

Mr. McWhirter has patented his invention and negotiations are now under way with a view to making the devices standard in modern one-man car equipment with other time, labor and life-saving features.



PEDAL ATTACHMENT FOR FOOT OPERATION OF CONTROL AND BRAKES

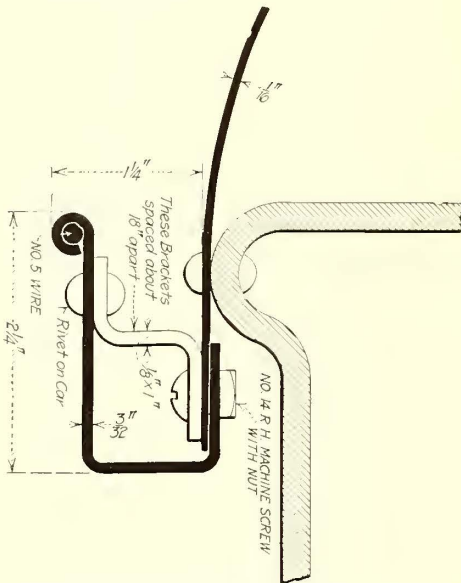
# Gutters on Cars Reduce Labor of Cleaning and Protect Passengers

## New Type of Gutter Applied to Cars of the New York, Westchester & Boston Railway

BY R. R. POTTER

Superintendent of Equipment

**D**URING the first years of operation of the cars of the New York, Westchester & Boston Railway a great deal of trouble was experienced with the rust and dirt from the roofs washing down over the windows and sides of the cars. A large part of this was due to the use of steel trolley wire and steel pantograph trolley shoes. Conditions were so bad that it was almost impossible to keep the windows clean and the sides of the cars in a respectable condition. Gutters have been applied to remedy the difficulty, as shown in the accompanying illustrations. These are formed of  $\frac{3}{8}$ -in. steel bent to proper shape and stiffened with No. 5 steel wire rolled into the rim. Stiffening brackets are installed every 18 inches.



GUTTERS APPLIED TO THE LOWER ROOF SHEETS ON WESTCHESTER CARS



CLEAR WINDOWS WHERE GUTTERS ARE APPLIED, AND STREAKED WINDOWS RESULTING FROM ABSENCE OF GUTTERS

During stormy weather the windows and sides of the car are protected from the dirty water from the roof. In addition passengers are afforded better protection when entering and leaving the side doors, as the gutters are much more efficient than the type generally applied over car doors. The illustrations indicate the trimness of appearance which the gutters give to the cars, and also the protection which they afford. The illustrations were made from photographs taken immediately after the cars had been in service during a rain-storm and before any cleaning had been done to the windows or sides of the car. The streaks left by the dirty water on the sides and windows of the cars without gutters are very noticeable. It now seems strange that all railroads do not have their cars equipped with this or similar type gutters.

# Reducing Lighting Maintenance Costs

BY W. C. WEFEL

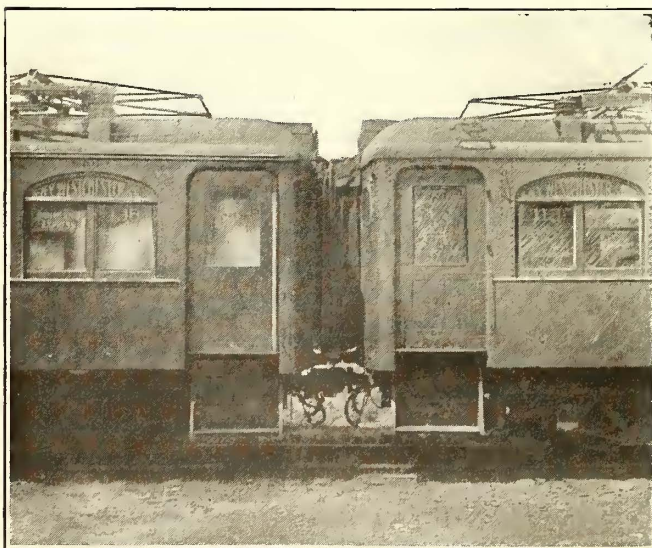
Light Foreman, Denver (Col.) Tramway

**T**HE series burning tungsten lamp has come into general use on electric railways and a substantial saving in power for the same illumination has resulted. It has been found, however, that tungsten lamps require more careful handling and burnt-out lamps are not as easily located as was the case with carbon lamps. This requires more time for their maintenance, which partly offsets the saving in power consumption.

In order to aid in locating burnt-out lamps we have made use of an original shunt or compensating device similar to that used with arc lamps. This has proved a great advantage, especially in one-man car operation. In these short cars but one or two circuits are necessary and by using the shunt device the operator can locate and replace a burnt-out lamp without causing an unnecessarily long delay. The use of this shunting device also permits the use of fewer and larger units for lighting other cars, thus enabling us to take advantage of the greater life given by the larger lamps.

We are contemplating making a change to larger units in some of our cars. These include the replacement of eighteen 23-watt lamps and a 46-watt headlight with nine 56-watt tungsten lamps and a 56-watt concentrated filament headlight. This arrangement requires more power, but we needed the increased illumination.

On some cars it has been the practice to connect the headlight in series with two circuits of lamps. This decreases the liability of having the headlight extinguished by the burning out of another lamp. By using the shunt device previously referred to we have found



TWO CARS IN SAME TRAIN, ONE WITH AND ONE WITHOUT GUTTERS

that this precaution is not necessary and the head-light can be connected in series with a single circuit.

At our eastern division carhouse we formerly used 230 16-cp. 60-watt carbon lamps grouped in five and ten-light clusters. These have been replaced with twenty-five 100-watt tungsten filament lamps which not only give us more candle power but save 41,245 kw.-hr. per year. There is also a saving in the labor required for the maintenance of these lamps which, taken with the saving in power, makes a total reduction in cost of about \$500 per year at this location.

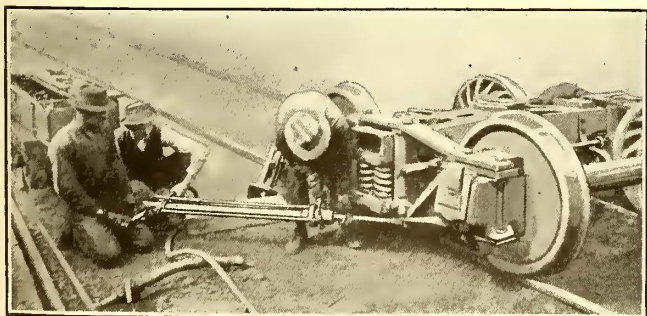
The time now consumed in making lamp repairs on our whole system is about twenty-five man-hours per day. With the changes we have made and contemplate making we expect to reduce this to ten man-hours per day. This reduced maintenance cost, together with the saving effected in power consumption, according to our estimate should produce a saving of more than \$7,000 annually on yard and line lighting alone.

### Air-Operated Cutting Gun Saves Time and Labor

THE Rivet Cutting Gun Company of Cincinnati, Ohio, has placed an air-operated cutting tool on the market which avoids the slow, expensive work usually done with a sledge and cutting bar. One of its principal features is its small size. It can be operated in very narrow cramped spaces and, by using a long tool, work can be done which would ordinarily require a scaffold to reach. It should prove a very useful tool in the repair shop for cutting off rivets or nuts that cannot be turned due to rust or the end of the bolts that are burred. Chipping can be done much more rapidly and with less danger to the workmen than with hammer and chisel. Where quick work, such as in clearing the track after a wreck or accident, is necessary, such a tool is of great value.

This air-operated cutting gun is most conveniently operated by three men. One guides the tool while the other two steady the extreme end. The gun weighs 65 lb. and can be operated with an air pressure of 60 lb., but from 90 to 110 lb. is desirable for heavy work.

The tool is operated by means of a handle located at the extreme end of the air cylinder. Three positions are provided for the handle: First, a cut-off position which closes the port so that the air connections can be made. Second, a return-stroke position which drives the piston to the rear end of the cylinder. Third, a forward stroke position which sends the piston forward to deliver the blow. For chipping work the valve handle is moved between the forward stroke and the return-stroke position at a convenient speed.



TAKING OFF A NUT THAT HAS BEEN BURRED

## LETTER TO THE EDITORS

### Safety Code Standards for Forces Acting Upon Transmission Lines

THE CONNECTICUT COMPANY

NEW HAVEN, CONN., May 11, 1918.

To the Editors:

The difficulty of "teaching an old dog new tricks" has been clearly shown in the case of the writer's article in the Feb. 23 issue of the *ELECTRIC RAILWAY JOURNAL* on "The Forces Which Act Upon a Transmission Line." To him the use of the wind pressure value of 8 lb. per square foot, the old standard, had become such a habit that this value was used repeatedly instead of the Safety Code values in the last paragraph of the first column on page 365, and in the example in the second column on page 366.

In the first instance, since the wind is not an element of the load considered, the fact that the value should have been 12 lb., instead of 8 lb., has little effect, but in the case of the example it is another matter. Using the correct value, the force becomes 213 lb. instead of 142 lb., the bending moments in pound-feet for the upper and lower sets of wires become 24,708 and 11,217 instead of 16,472 and 7478 respectively, and the total bending moment becomes 40,339 lb.-ft. instead of 28,364. The correction results finally in a fiber stress of 2220 lb. per square inch and factors of safety of  $2\frac{1}{2}$  and  $1\frac{3}{4}$  respectively for chestnut, cypress, Southern pine and Western red cedar, and for Northern white cedars.

Under the caption "How Geography Affects the Sleet Question" appear the values of transverse pressures for the three grades of construction—A, B, C of the Code, namely 12, 7, and 4 lb. per square foot instead of the values for the three districts of loading, which are 12, 8 and  $5\frac{1}{2}$  lb. per square foot. And in this connection, the use of the word "supports" was not entirely happy, for although the discussion was dealing with wood poles, at one point previously mention was made of other types of support, and for flat surfaces the Code calls for an increase in unit pressure over that for cylindrical surfaces of 60 per cent. This higher value of course would have to be used for square sawed poles.

I am indebted to Kenneth L. Wilkinson of New York City and to Dr. E. B. Rosa of the Bureau of Standards, for bringing these points to my attention. I had hoped to "pin them on the 'printer's devil'" but reference to the manuscript puts them squarely up to the writer. It is with pleasure, therefore, that I find that the apparently overlooked inversion of the equation for fiber stress, near the bottom of the second column on page 366, is up to the compositor; the fiber stress is found by dividing the bending moment by 0.0002638 times the grand circumference cubed.

CHARLES R. HARTE, Construction Engineer.

In order to impress upon employees the opportunity for saving in little things the Toledo Railways & Light Company, Toledo, Ohio, is using some leaflets which are full of human interest. The articles are signed by F. R. Coates, president, and they give practical details of losses and possible savings on the local property.

## AMERICAN ASSOCIATION NEWS

### War Board Pleased With Special Freight Issue

Headquarters Will Probably Remain At Munsey Building—The Next Meeting Will Be Held on June 7

The Electric Railway War Board held a well-attended meeting at Washington on May 10. Among other topics the board discussed the article by A. B. Cole, prepared with its active co-operation, and printed in the May 11 issue of the *ELECTRIC RAILWAY JOURNAL*. The board thought highly of the article and is arranging to give it a wide circulation. The board accepted from the Westinghouse Electric & Manufacturing Company, through M. B. Lambert, an offer of one-half of Mr. Cole's time for any investigation which the board desires him to make.

The board discussed the law to allow 3 cents per mile fare for steam roads and considered its relation to electric railway operation; and also the relation of electric railways and the War Finance Corporation. Mr. Gadsden stated that he had written Governor Harding suggesting that in case of any application by public utilities to the corporation the National Committee on Public Utilities be given an opportunity to appear. The work of the national committee was discussed and the statement was made that A. S. Hills will move the headquarters of the Utilities Publication Committee from New York to Washington. Among other matters the desirability of having prepared popular articles of high grade on the public utilities situation was discussed.

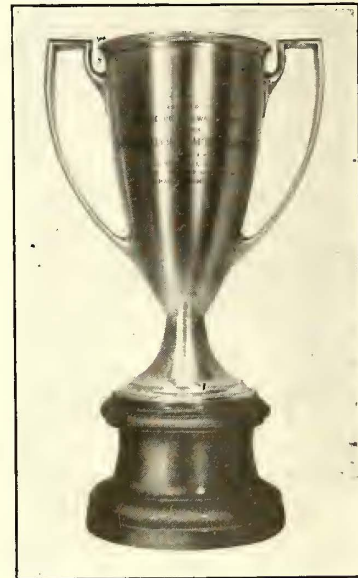
Mr. Gadsden reported on conferences with the Shipping Board and the Navy Department with reference to assistance for electric railways from construction plants by way of furnishing platform labor at times of peak load. He also explained that the resolution affecting public utilities recently adopted by the United States Chamber of Commerce was in the hands of its board of directors for further action.

Among other matters considered were these: Mr. Burritt was instructed to send to Washington the results of an investigation on the labor shortage. The use of electric railway lines for government passenger transportation service was taken up. Mr. Gadsden stated that permanent quarters can probably be secured in the Munsey Building, which was recently considered impossible. It was agreed that Bulletin No. 1 of the Return Load Bureau, Highway Transport Commission, Council of National Defense, should be sent to all member companies. Mr. Gadsden stated that he has under discussion with the council the adoption of a resolution with reference to facilitating the use of electric railways in handling freight. Mr. Burritt brought up the subject of the supply of ties for electric railways under the proposed plan of distribution among steam roads and Mr. Gadsden agreed to take up the matter with Hon. John Skelton Williams. It was suggested that in applying the skip-stop plan some railways are not using it in the most satisfactory manner. The board will take steps to furnish information which can be used in so selecting stops, as to produce the best possible results for the public and the railways.

### Rhode Island to Receive the Charter Membership Cup

IN ORDER to stimulate the company section movement to the greatest possible extent the *ELECTRIC RAILWAY JOURNAL* has presented to the association a silver cup to be awarded to the company section organized with the largest membership. The first to receive it will be the Rhode Island Company Section recently organized.

The following extracts from a letter sent by the *JOURNAL* to President J. J. Stanley explain the plan.



THE COMPANY SECTION CHARTER MEMBERSHIP CUP

In order to encourage the company section movement of the American Association, the *ELECTRIC RAILWAY JOURNAL* has decided to offer a silver cup to be awarded to the section having the largest number of charter members. The idea is that the cup should be passed from section to section as new sections with larger charter memberships are successively formed. After conference with Mr. Schreiber, chairman of the committee on company sections, and Messrs. Burritt and Clark of the association office, we have selected a solid silver cup, standing slightly over 11 in. high without the base and about 15½ in. high with the base.

It is proposed to letter on one side of the cup approximately the following:

“Presented by the *ELECTRIC RAILWAY JOURNAL* to the American Electric Railway Association to be held by the company section with the largest number of charter members.”

On the reverse side will appear substantially the following:

“Held by the Rhode Island Company Section, No. 12, organized on April 6, 1918, with 216 charter members.”

In accepting this cup on behalf of the Association President Stanley sent the following letter, dated May 13, 1918:

The American Electric Railway Association, through its secretary, Mr. Burritt, has already accepted the fine offer of the *ELECTRIC RAILWAY JOURNAL* of a trophy to be awarded to the company section organizing with the largest number of charter members, but I want to thank you personally for this further evidence of the *JOURNAL'S* interest in the association.

The conception is splendid and I am sure will have the effect of giving the company section movement the impetus it needs and deserves.

The Rhode Island Company Section, No. 12, may indeed be proud to be the first holder of the cup, but I shall be surprised if it retains the honor permanently.

The cup, which was made by the Gorham Company, has the appearance shown in the accompanying half-tone.

# News of the Electric Railways

TRAFFIC AND TRANSPORTATION

FINANCIAL AND CORPORATE • PERSONAL MENTION • CONSTRUCTION NEWS

## Short Strike in Rochester

After They Had Been Out Three Days, Men Return on Basis of Original Settlement Offer

Motormen and conductors employed on the Rochester (N. Y.) lines of the New York State Railways went on strike on May 9 and returned to work three days later. At the time the men went out they were offered an advance in wages of 4 cents an hour, but this offer was rejected. They accepted the offer, however, after they tied up the company's lines for three days. It was also stipulated by James F. Hamilton, vice-president and general manager of the company, that if the Rochester municipal authorities allow the company to increase its rate of fare from 5 cents to 6 cents, an additional wage increase will be granted.

### WAGES RANGED FROM 27 TO 31 CENTS

At the time the men went on strike they were receiving a sliding scale of 27, 29 and 31 cents an hour according to the length of time they had been in the company's service. They demanded a wage increase to 40, 42 and 44 cents an hour. The company said it was unable to pay this, and Mr. Hamilton has offered to submit the company's books, records, etc., to the city to show that it cannot operate at a profit and pay the men higher wages with a 5-cent fare. This investigation has already been started by the municipal authorities.

About 1300 men were involved in the strike. The company admitted that the men should have more money, but told them that the company was not in a financial condition to pay a higher wage. Loyal employees advised against a strike at the time, maintaining that the wage question could be taken up with the company after the 6-cent fare question has been solved.

Feeling, however, that the employees should have a higher wage a tentative announcement was made by the New York State Railways that a 4-cent an hour increase would be granted to the platform men as of May 1, making the rate retroactive almost nine days. Even with that announcement, the men agreed to strike and they walked out, leaving the thousands of men employed in the city's war industries without transportation facilities. After a series of conferences between representatives of the men, the federal war department, the municipal authorities and the company, the men agreed to return to work under the 4-cent an hour advance in wages.

In addition to the wage advance, the regular run men are guaranteed ten

hours' work each day. Other changes in working conditions are subject to arbitration between the company and the men.

### INQUIRY INTO COMPANY'S FINANCES

M. & L. W. Scudder, New York, accountants, have been engaged by the Rochester municipal authorities to investigate the financial conditions of the company. Marvyn Scudder has already arrived in Rochester and has started work on the company's books. While there is some opposition to the 6-cent fare in Rochester, it is generally believed that it will be granted if the report of the accountants is favorable to the company.

The company made no effort to operate cars. There was no disorder.

## Mr. Beeler Retained in Dallas

The City Commission of Dallas, Tex., acting on the recommendation of M. N. Baker, supervisor of public utilities, has employed John A. Beeler, New York, to study its street railway transportation problems. Mr. Beeler is expected to arrive in Dallas about June 1. In the meantime Mr. Baker will study electric railway operation in Kansas City, Chicago, Toledo, Detroit, Buffalo, Dayton and Rochester, with a view to making recommendations that will improve conditions in Dallas. The Dallas Railway has also sent Richard Meriwether, general manager, to these cities. He will work with Mr. Baker on the railway traffic investigation. In announcing the employment of a traffic expert, Mr. Baker gave out a statement in part as follows:

"The rapid growth of Dallas during the last ten years has created new and complicated problems of railway operation and traffic management. Some of these problems have been solved by changes already made in the operative methods of our railways, some of them will be solved by the plans that have been made and approved for the new extensions and improvements now under way, but, allowing for the progress thus made, there are still some unsolved problems which demand study.

"It is the aim and purpose of the supervisor's department to assist the railway in finding a proper remedy for these conditions, to the end that Dallas may soon be the equal of any city in the United States with respect to the adequacy and efficiency of its traction system. With this object in view it has been decided to bring to Dallas some competent and recognized authority on traffic questions, to make a close study of the Dallas situation and prescribe the proper measures for its relief."

## Fares and Wages Coupled

P.R.T. Points Out Wherein Raise in First Is Necessary Before Second Becomes a Fact

The management has acknowledged the petition of the employees of the Philadelphia Rapid Transit Company asking for an increased wage and requesting the company to petition Councils for an increase in fare in order to make this wage increase possible.

Of the 9714 employees of the company on duty 9388 have signed their names in approval of the petition, while only 326 have not signed. Thus 96.6 per cent of all the employees are working in accord with the plan.

The fact that these signatures were obtained in the face of the protests of professional trouble-makers who are seeking to serve their own ends is pointed to in a statement to the men as proof that those who have been working under the co-operative plan for the past seven years are, as they state in the petition, satisfied with working conditions and wish the present plan of representation continued.

This expression of loyalty and satisfaction from the men has been laid before the gentlemen representing the federal and State authorities to prove that there are no questions between the company and its employees requiring their services. The scope and working of the co-operative plan have been explained in detail to the public authorities, particularly the fact that the trainmen are represented at all times by a committee of their own choosing who could take up with the management all matters requiring discussion or adjustment.

The federal and State authorities have been advised that the company will deal only with the duly-elected committeemen, and that the co-operative plan will continue effective as at present administered until two-thirds of the men ask that a change be made.

The company has expressed to the men its appreciation of their willingness to co-operate in securing the increased fare necessary to make the advance of 5 cents per hour to meet the increased cost of living.

Without any increase in fare the company has already increased its wage scale so that at present it amounts to \$1,750,000 a year more than it did at the time the country entered the war. Belief is expressed by the company to the men that the appeal by them to their representatives in Councils will be recognized as fair and reasonable, and that the company will be able to secure the advance in fare necessary to make possible the increased wage.

## Tentative Chicago Franchise Settlement Terms

Council Committee Approves Them—  
Brief Review of the Proposed  
Provisions of Grant

Tentative approval of terms for a new franchise for the surface and elevated railways of Chicago was given by the City Council committee on May 11. The terms which were under discussion were outlined in the issue of the ELECTRIC RAILWAY JOURNAL for May 4. The provisions favored by the Aldermen were a compromise of three plans submitted previously. They are to be drafted in ordinance form for final consideration.

As they now stand, the provisions for rate of return and life of franchise do not agree with the companies' views. Neither does the proposed grant meet with the approval of the committee's special attorney, who had recommended a plan of municipal ownership and operation through a "trustee corporation." This apparently was not received seriously by the Aldermen, and there were some objections by representatives of organized labor.

The committee had previously approved an outline of physical construction for the companies under the proposed grant. This would call for the expenditure of about \$100,000,000 in six years. This program has not been changed. The tentative provisions for life of franchise, rate of return and method of control are as follows:

The proposed unified corporation is to receive a franchise for thirty years, subject to city purchase at any time or taking over by the city at the end of this period subject to outstanding indebtedness. The city may also designate a licensee to take over the property after thirty years subject to outstanding liens. If neither the city nor another licensee takes over the property after thirty years the company may continue to operate without profit other than interest on the investment.

The company is to be allowed a maximum return of 6 per cent on the initial purchase price and, if earned, an additional amount ranging from two-tenths to five-tenths of 1 per cent on the capital account. In refunding outstanding bonds the company is to be allowed the cost of such refunding up to a limit of 5 per cent, this to be governed by the board of regulation and control. The company is to be allowed a return on new money only at cost, and the city's traction fund is to receive the same rate of return as this new money.

A body similar to the state public utility commission and having similar power over Chicago traction lines is to be created and called the board of regulation and control. Members are to be appointed by the City Council.

The rate of fare is to be 5 cents, with a transfer charge between surface and rapid transit lines not exceeding 2 cents. Increases and decreases in fare and transfer charges are to be authorized when necessary, but before putting

into effect any increase the company may be relieved of non-transportation charges such as cleaning and sprinkling right-of-way and contributing to the cost of paving streets where it operates.

Preparation of the ordinance will be hastened with a view to getting action by the City Council before adjournment. If the ordinance is passed it will be submitted to the voters next November, and if approved by them it will go to the State Legislature for legislation which is necessary before it can become effective.

## Six-Cent Wage Advance

With it Goes an Increase in Fare  
Backed by an Injunction Preventing  
Interference by City

The employees of the Toledo Railways & Light Company, Toledo, Ohio, on May 10 agreed to accept an increase of 6 cents an hour in wages. An injunction will prevent the city from interfering with the increase in the rate of fare to meet the increased wages.

The restraining order granted by Federal Judge John M. Killits to prevent the city from interfering with the company in raising its rate of fare to meet the expense of increasing wages went into effect on May 10. It was to hold until May 15, and May 14 was set as the date for hearing the case. Immediately upon being served with notice of the order Cornell Schreiber, Mayor, issued a statement in which he asked the people to abide by the court's decision.

H. L. Doherty & Company, New York, filed the case in the Federal District Court, but Frank Coates, president of the Toledo Railways & Light Company, entered a separate motion, asking for a temporary restraining order. R. H. Brunning, expert accountant, who examined the books of the company for A. L. Faulkner, representative of the United States Department of Labor, made an affidavit to the effect that it would be impossible for the company to increase the wages of the men without suffering a loss unless the rate of fare was increased. He gave the court the result of the audit he had made to support his assertions.

In granting the order the court said that it was necessary to secure the operation of the cars and to keep the complaining company from loss and the public from irreparable injury.

The rate of fare will be 5 cents straight, with a 1-cent charge for each transfer. Children under eight years of age are to ride for 1 cent. The restraining order would have allowed the company to make the fare 6 cents, if it had so desired.

According to Henry L. Doherty, chairman of the board of the company, an increase of 6 cents an hour in the wages of the men would mean an additional expense of \$400,000 a year to the company, while the increase in the rate of fare made, together with the car fund which has been paid to the Federal District Court, would amount to only about \$200,000 annually.

## Milwaukee Trainmen's Wages Adjusted

Announcement Is Made of Ratification  
of Agreement for Advance of Ten  
Cents an Hour

It was announced on May 4 that the trainmen in the employ of The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., had ratified the agreement entered into on April 30 between the company and the labor adjustment committee of the Employees' Mutual Benefit Association. As a result of this agreement the wages of the men have been increased 10 cents an hour from May 1.

### PROBLEMS DISCUSSED AMICABLY

The questions of wages, hours and working conditions had been under discussion some time prior to May 1. The labor adjustment committee of the Employees' Association was acting under the general labor contract executed between the company and the association on April 10, 1918. Under this contract the company agreed to recognize the right of the members of the association to deal collectively with the company in the matter of wages, hours and working conditions. Both parties agreed to submit to arbitration any differences which could not be settled by negotiation. The company agreed to maintain wages in accordance with the relative cost of living referred back to 1914 as soon as it was provided with the revenues necessary therefor. The labor adjustment committee conferred with the Railroad Commission of Wisconsin and ascertained that it was the commission's intention so to adjust fares as to permit fair wages to be paid and this led up to the settlement of the subject announced on April 30.

One by one differences between the committee and the company were removed, but with the approach of May 1 and the prospect not certain that all subjects in disagreement could be adjusted by that time, it was decided to continue with the meetings and go to arbitration with such matters as had not been settled by negotiation by May 3. The understanding on this point, reached on April 29, was as follows:

### POINTS OF AGREEMENT

1. Consideration of plans for an eight-hour work day shall be postponed until it becomes more generally adopted in the electric railway industry, and the government's requirements for labor are less urgent.

2. The schedules shall be so arranged that the maximum possible number of runs shall be completed in twelve hours spread-of-duty. The committee may investigate the schedules and suggest changes.

3. The wage increase shall be effective from May 1.

4. All of the wage increase to become effective May 1 shall be paid as an increase in the hourly wage scale.

5. Negotiations shall be continued and an agreement arrived at if possible

by May 1; if an agreement is not reached by May 3, the matter shall be arbitrated under the provisions of section 10 of the contract of April 10, 1918.

It was in accordance with the spirit of this preliminary understanding that the wage adjustment was effected on April 30 without the need of going to arbitration. The agreement was thereafter ratified by the members of the association.

### Eight-Hour Day on Coast

The Puget Sound Traction, Light & Power Company, Seattle, Wash., has established the basic eight-hour day for the 1800 railway employees in Seattle. The order, however, requires the trainmen to work ten hours daily, overtime being paid after eight and one-half hours. The new schedule went into effect on April 27.

A. W. Leonard, president of the company, states that the purpose in adopting the principle of the eight-hour day was the betterment of service. A labor shortage existed, and the company believed that the recognition of the eight-hour day would make employment with the company more attractive. Mr. Leonard asserts that the company could ill afford to pay time and a half for overtime, but it was forced by the present emergency in the transportation situation in Seattle to make this concession.

J. S. Wallace, secretary of the union of employees, stated that while the adoption of the eight-hour principle was one of the concessions for which the men were working, the methods by which the company proposed to apply it was not satisfactory, and would not be accepted as a settlement with the company of the present disagreements.

The Tacoma Railway & Power Company, Tacoma, Wash., has also established the eight-hour day, following the order in Seattle.

### Men Object to Women on Cars

It was announced during the week ended May 11 by R. J. Fleming, general manager of the Toronto (Ont.) Railway, that on account of the scarcity of men the company intended to employ women. A meeting of the employees of the company was held on the evening of May 11 to discuss this proposal, at which meeting the men passed a resolution which was concluded as follows:

"Therefore, be it resolved that, if the company insist on employing women, we will refuse to instruct or operate a car on which women are placed for the reasons set forth. And any attempt on the part of the company to discipline or discharge motormen or conductors for so doing will be met with by prompt action by members."

The company's announcement said that women would be employed and that it was intended to use pay-as-you-enter cars. It was pointed out that special provision was being made to take care

of women employees, who would have special quarters and a matron in charge, and that the women would be treated the same as the men with respect to pay and hours. The women are to be required to train for two weeks, after which they will receive 30 cents an hour for the first six months, 32 for the next six months and after that 35 cents up to two years' service. They will then receive 37 cents an hour. It was stated that the project had been under discussion for some time and that the board of directors had given its sanction.

The matter is before the Ontario Railway & Municipal Board. If the board gives its approval the company will commence the reconstruction of cars to the pay-as-you-enter type. A model of the proposed type is already in the city for experimental purposes. The folding doors will be worked by air and the signal to start will be automatically given to the motorman by the showing of a light as soon as the doors are closed.

Protests against employing women workers have been received from the men employees by the company, but Mr. Fleming stated that the company would sooner employ patriotic women than the number of foreigners it now employs.

### Naval Training for Technical Men

Two courses for service in the navy in steam engineering, electrical engineering and radio duties have just been announced. The first is offered by the Bureau of Navigation, Navy Department, for applicants with the following qualifications: (1) An engineering degree from a college of recognized standing; (2) Two and one-half years' practical experience subsequent to graduation; (3) Not more than thirty-five years of age; (4) Good physical condition. Tuition will be given at Annapolis for four months, after which those who finish the course successfully will receive further training ashore or afloat.

The second course is offered by the Navy Department in steam engineering only and has been established with headquarters at the Stevens Institute of Technology, Hoboken, under the guidance of Dean F. L. Pryor as civilian director. It will consist of five months' training, part of which will be given at Pelham and part on board ship and will lead to the commission of ensign. The school is open to men between twenty-one and thirty years of age who are physically qualified, of thorough ability and officer-like character and have completed the engineering course at any recognized technical school. Information in regard to this course can be obtained from Stevens Institute or of both courses from the Engineering Council, 29 West Thirty-ninth Street, New York.

The Aurora, Elgin & Chicago Railroad, Wheaton, Ill., has restored parlor and buffet car service between Aurora and Chicago.

## News Notes

**Wage Increase in Binghamton.**—The Binghamton (N. Y.) Railway has announced an increase of 2 cents an hour in wages.

**Wage Raise in Rockford.**—The Rockford & Interurban Railway, Rockford, Ill., has extended to all employees a flat increase of 3 cents an hour, effective May 1.

**Wage Increase in Wilkes-Barre.**—The trainmen in the employ of the Wilkes-Barre (Pa.) Railway have received increases in wages to 28, 30 and 32 cents an hour, adding \$56,000 to the annual payroll.

**Ask Receiver for Wage Raise.**—Platform men employed by the Buffalo (N. Y.) Southern Railway have made application to the receiver for an increase in wages of 2 cents an hour. The men now receive 28 cents.

**City System for Peking.**—Petitions for a street railway system in Peking signed by a number of Shanghai merchants are now before the Chinese government for sanction. Tientsin and Shanghai have city railway systems.

**Wage Increase in Topeka.**—The Topeka (Kan.) Railway has granted an increase of 5 cents an hour to each trainman and 3 cents to each job and carhouse man. The former scale for trainmen was 21 to 26 cents an hour. In addition a bonus of 10 per cent is provided.

**Peoria Men Want Increase.**—Employees of the Peoria (Ill.) Railway have asked the company for 40 cents an hour the first year and 45 cents an hour thereafter. The present scale is 20 cents an hour the first year, 29 cents the second year and 33 cents thereafter.

**Wage Bonus During War.**—The Texas Electric Railway, Dallas, Tex., announced a salary increase of 3 cents an hour for all employees, effective on May 1. The advance will be paid as a war bonus, but will in no way interfere with the regular salary increases which recently became effective.

**Wage Increase in Dallas.**—The Dallas (Tex.) Railway announced a wage increase of 3 cents an hour effective on May 1. According to the announcement it will remain in effect during the war. The men of the line department will get an increase of 2 cents an hour and the trackmen an increase of 2½ cents an hour. The trackmen's raise went into effect thirty days ago.

**Looking Toward Municipal Ownership.**—At a meeting of representatives of the five border municipalities held in Windsor, Ont., on May 8, a resolution was adopted requesting the Ontario Hydro-Electric Commission to make a

survey of the local electric railway system with a view to control of the lines being assumed by the municipalities in 1922, when the present franchises expire.

**Labor Administrator Appointed.**—President Wilson, on May 11, placed in the hands of Felix Frankfurter, New York and Washington, the task of whipping into definite form a national labor policy for the war. Mr. Frankfurter's appointment makes him "labor administrator" under Secretary of Labor Wilson. He will immediately co-ordinate under his direction the work of all the numerous labor adjustment bodies now existing in the government.

**Dubuque Wage Board's Findings.**—The Union Electric Company, Dubuque, Ia., has granted a flat wage increase of 5 cents an hour to all trainmen except those who have been employed more than four years. The latter receives a flat increase of 6 cents an hour. The increase is in accordance with the wage award of a board acting for both the men and the company. The demands of the men were for slightly higher rates than those granted by the board.

**Increase for Cairo Men.**—The Cairo Electric & Traction Company, Cairo, Ill., included in the Illinois Traction System, has increased the wages of first-year trainmen on city cars to 27½ cents an hour and for men serving beyond their first year to 30 cents an hour. Wages for first-year men on interurban lines have been increased to 26 cents an hour and for men beyond their first year to 32 cents an hour. This is an increase of 7½ cents for all men concerned.

**War-Time Conference With Governor.**—Representatives of the public utilities operating in Tennessee conferred recently at Nashville with Governor T. C. Rye in regard to the problems that confront the electric railways, electric light companies and the gas interests. It was brought out that the present extraordinary service demands, war conditions and other needs make imperative higher rates and larger resources if the companies are to work at maximum efficiency.

**Exit the Squealing Brakeshoe.**—The Interborough Rapid Transit Company, New York, N. Y., has been ordered to substitute a lubricating brakeshoe on all cars not equipped with this type. The motor cars of the "L" trains have the flanged shoes now, but a non-flanged shoe with no lubricant device, is used on most of the trail cars. No order was issued with respect to Brooklyn trains owing to the fact that within the next two years the Brooklyn Rapid Transit Company is planning to put new steel cars in operation, equipped with non-squealing brakeshoe.

**Buffalo Agitators Active.**—Two days before the petition of the International Railway, Buffalo, N. Y., seeking an increase in fare was filed with the City Council several hundred employees of the company made an effort to bring about a strike but without success. International officers of the carmen's

union came to Buffalo and the majority of the men agreed to remain loyal to the company pending the outcome of the application for increased fares. The company has offered to increase the wages of the men 6 cents an hour if the 6-cent fare is granted.

**Additional Municipal Bus Service.**—An extension of municipal auto bus service in San Francisco has been ordered by city officials to serve new territory in the western addition. Fred Boeken, superintendent of the Municipal Railway, will direct the installation of the new service. The first municipal buses which were put in operation on Jan. 15 to serve as feeders to the Geary Street line were described in the *ELECTRIC RAILWAY JOURNAL* for Feb. 16, page 327. They cover two routes across Golden Gate Park, rendering service in what is known as the Sunset District.

**Texas Companies Increase Wages.**—A salary increase of 3 cents an hour was granted on May 1, to all employees of the Houston (Tex.) Electric Company, Galveston Electric Company, Galveston-Houston Interurban Railway, Beaumont Electric Company, the Port Arthur Electric Company and the Beaumont-Port Arthur Interurban. The announcement was made from the office of L. C. Bradley, Houston, district representative in Texas of Stone & Webster. The increase makes the maximum salary for city railway employees 35 cents an hour and for interurban trainmen 39 cents an hour.

**Arbitration in Wheeling.**—Officials of the Wheeling (W. Va.) Traction Company, West Virginia Traction Company, of the Pan Handle Traction Company and of the Steubenville Traction Company and employees of those companies have been in conference in an effort to reach an agreement on wages and other terms of service. The employees, who are receiving from 30 to 33 cents an hour demand an increase to 55 cents an hour as a maximum. Inasmuch as it has been impossible to reach an agreement it has been decided to submit the differences to arbitration. Both sides have selected arbitrators who have agreed upon a third arbitrator to be assigned by the Department of Labor.

**Fuel Engineer for Pittsburgh District.**—On May 8 the United States Fuel Administration announced the appointment of Thomas R. Brown, Pittsburgh, Pa., as administrative engineer for the Pittsburgh district. This appointment was made as a preliminary step toward putting into operation a general plan for fuel conservation in power plants. The program at present in effect in Pittsburgh, which will be used as a model, comprises personal inspection of every power plant, its classification and rating, based on the thoroughness with which the owner conforms to the recommendations of the Fuel Administration, and an administrative engineer in charge of the work in each state or district. It is expected that from 10 to 20 per cent of the coal used annually in industrial plants will be saved by this plan.

## Programs of Meetings

### Missouri Association of Public Utilities

The annual meeting of the Missouri Association of Public Utilities is scheduled to be held at St. Joseph, Mo., on May 17 and 18. The program of papers is as follows:

"Work of National Utilities Association," by Philip J. Kealy, president of the Kansas City (Mo.) Railways.

"How War Conditions Have Affected the Utilities of the State and the Nation," by H. Wurdack, president and general manager of the Light & Development Company, St. Louis, Mo.

"Problem of Manufacturing Under War Conditions," by J. S. Tritle.

"Taxes Affecting Public Utilities," by H. Spoehrer, secretary and treasurer of the Union Electric Light & Power Company, St. Louis, Mo.

### New England Street Railway Club

The New England Street Railway Club will hold its monthly meeting on May 23 at the Hotel Brunswick, Boston, Mass. It will be the last get-together for the season. The speakers will be Lieut. Godfrey L. Cabot, N.R.F.C., president of the Aero Club of New England, and Lieut. Parker H. Kemble, N.R.F.C. The subject will be military aviation. Lieutenant Cabot is one of the most active promoters of the development of aerial navigation and engineering. He is vice-president of the Aero Club of America, and a member of the contest committee and marine flying committee of that organization. Lieutenant Kemble is an officer in the Naval Reserve Flying Corps. He will give a stereopticon talk, presenting a most interesting collection of airplane views, showing their development, the different kinds and how they look in action.

### Arkansas Association of Public Utility Operators

The Arkansas Association of Public Utility Operators will meet in the eleventh annual convention at the Arlington Hotel, Hot Springs, Ark., on May 21, 22 and 23. The program of papers includes the following:

"Transmission Line Construction," by William Crooks, manager of the Arkansas Light & Power Company.

"Present-Day Fuel Situation," by J. F. Christy, manager of the Jonesboro Water & Light Company.

"War-Time Costs vs. Rates," by A. Patterson, superintendent of the electric department of the Southwestern Gas & Electric Company.

"Courteous Attention to Traveling Salesmen," by W. R. Herstein of the Electric Supply Company, Memphis, Tenn.

George R. Belden, S. E. Dillon, U. N. Gladson, dean of the College of Engineering of the Arkansas State University; Rev. Dr. W. N. Waldrip and Charles A. Brough, Governor of Kansas, will address the delegates.

There will be a patriotic dinner at the Arlington Hotel on the evening of May 22.



# Financial and Corporate

this policy of capital conservation throughout the country will give to the nation that financial strength which will enable it to shorten to a material degree the period within which the war can be ended with victory for democracy.

## 1917 Increase Ten Per Cent

Banking House Summarizes Reports of Gross Earnings for 100 Utilities—  
Net Falls Off 2.8 Per Cent

In a tabulation of earnings of 100 public utilities Harris, Forbes & Company, New York, N. Y., submit statistics which, because of the abnormal conditions prevailing in the public utility industry during 1917, should be of unusual interest to investors. The reports from these companies show an average increase of 10.3 per cent in gross earnings in 1917 over 1916. This is a larger percentage of increase than the average during the last ten years. The reports cover operations in thirty-nine states and in two provinces of Canada.

The banking firm's records for the last ten years show the following increases in gross earnings:

60 companies in 1908 over 1907 by	7.3%
61 companies in 1909 over 1908 by	11.3%
66 companies in 1910 over 1909 by	12.0%
70 companies in 1911 over 1910 by	9.3%
73 companies in 1912 over 1911 by	8.6%
83 companies in 1913 over 1912 by	7.4%
84 companies in 1914 over 1913 by	2.9%
86 companies in 1915 over 1914 by	2.8%
90 companies in 1916 over 1915 by	10.4%
100 companies in 1917 over 1916 by	10.3%

In commenting upon this showing the bankers say:

"It will be observed that the foregoing record shows uninterrupted annual increases in the aggregate gross earnings of these companies during the past ten years, the average annual increase being more than 8 per cent. In normal times, this tabulation alone might serve as an illustration of the stability of earnings of the well-established public utilities which, to speak generally, supply a service that is essential to the economic life of the communities in which they operate.

### NET EARNINGS DECREASE ONLY 2.8 PER CENT

"Under present conditions, however, the statement is incomplete without the facts as to net earnings. These companies, in common with practically all others, have been confronted during the past year with the problems of increasing costs of labor and material and higher taxes. It is therefore most gratifying that the aggregate net earnings of the 100 companies from which we have received reports show a falling off during 1917 as compared with 1916 of less than 2.8 per cent. Furthermore, the aggregate 1917 net earnings amounted to more than two and three-quarters times the aggregate annual bond interest charges of these companies. We feel that this showing of earnings under adverse conditions is one of the most dependable indications of the desirability of public utility bonds for investment when selected with care."

## Valuation Hearing Closed

Washington and Idaho Commissioners Close Case to Determine Spokane Values for Rate-Making

The direct testimony before the Washington and Idaho Public Service Commissions in the valuation case of the Washington Water Power Company, Spokane, Wash., was concluded at the hearing on April 25. Henry L. Gray of Seattle, consulting engineer, was called as the first witness for the company. According to the figures of Mr. Gray, the total valuation of the Washington Water Power Company, with due allowance made for necessary overhead charges, was \$29,938,660, of which the generating system, valued at \$15,754,216, was the largest item. He valued the combined city and interurban railway at \$5,068,512.

Engineer McCurrach, for the Washington Commission, on April 25 presented a supplemental report, bringing the appraisal of the Washington Water Power Company to December, 1916, as compared with June 30, 1915, the date covered in his first report. This subsequent appraisal is based on additions actually made to the property since June 30, 1915, as shown by the books of the company. Prices are based on the five-year average from 1910 to 1915. Following are the figures:

### WASHINGTON PROPERTY

	June 30, 1915	Dec., 1916
Railway system.....	\$5,502,422	\$5,593,214
Light and power system..	13,505,694	13,814,977
Non-operating property..	893,855	893,785
Totals.....	\$19,901,971	\$20,301,976
Lands—railway.....	\$447,004	\$438,453
Lands—light and power..	1,114,904	1,114,232
Totals.....	\$1,561,908	\$1,552,685

### IDAHO PROPERTY

Light and power system..	\$2,326,669	\$2,478,890
Non-operating property..	42,586	42,586
Totals.....	\$2,369,255	\$2,521,476
Lands—light and power..	123,560	143,203
Grand totals, Washington and Idaho.....	\$23,956,694	\$24,519,340

Another table of appraisal values was presented by Engineer McCurrach, prepared at the request of Attorney F. T. Post for the company, based on prices prevailing from 1912 to 1916, a period in which materials and labor cost more. These figures showed:

Washington totals.....	\$23,490,484
Idaho totals.....	2,839,626
Grand total.....	\$26,330,110
Increase over regular appraisal figures..	\$1,820,770

The appraisal of Engineer McCurrach on the railway property of the company to December, 1916, on the 1910-1915 basis shows:

### RAILWAY PROPERTIES VALUES

Spokane street railway.....	\$4,732,521
Interurban system.....	860,693
Lands—Spokane railway.....	259,761
Lands—Interurban.....	178,692
Total.....	\$6,031,667

A calculation of what he thought was a fair system of annual depreciation allowances to be made on the property of the Washington Water Power Company was presented by Mr. McCurrach, showing:

	Per Cent	Amount
Spokane street railway.....	3.99	\$191,185
Interurban railway.....	3.85	32,613
Light and power, Washington..	3.51	480,862
Light and power, Idaho.....	3.49	86,067
Total annual depreciation....	3.62	\$790,727

The case was concluded on April 26. Fifteen days were allowed in which to file briefs. It is expected that a decision will be rendered by June 1. This case was referred to previously in the ELECTRIC RAILWAY JOURNAL for March 23, page 584.

## \$22,676,277 in Bond Issues Sanctioned

The Capital Issues Committee announced on May 13 that the number of applications considered during the week ended May 11 was greater than in any previous week of its existence. The committee determined thirty-seven cases, aggregating \$27,487,277, of which \$4,811,000 was disapproved. In addition to the amount formally disapproved, postponement for the period of the war was secured informally of issues aggregating \$4,990,000. The \$22,676,277 approved included \$6,777,084 of refunding obligations, so that the new issues approved aggregated \$15,899,193. New issues for the corresponding period last year amounted to \$14,196,500.

The committee stated that spread of the knowledge of its aims and purposes continued to be reflected in voluntary postponement of security issues, that case being cited in the city of St. Louis, Mo., which has adopted a policy of financial preparedness consistent with the national welfare. The city has notified the committee that it is going ahead with securing local authority to create certain debts and advertising the issues of bonds therefor so that they may be marketed readily at the proper time, but that it will submit for approval by the committee only such issues as are for urgent and essential purposes. The city is at present advertising some \$14,000,000 of bonds which it does not propose to market until the conclusion of the war. Other municipalities in Federal Reserve District No. 8 are adopting the same patriotic course. The Milwaukee member of the sub-committee of the Minneapolis Federal Reserve District reports that the city of Milwaukee, in bringing its needs into conformity with the national interests, has reduced presently contemplated bond issues from \$5,740,000 to \$1,050,000.

It is pointed out that the pursuit of

## Twin Cities Suffer from Higher Costs

Net Income Is Reduced More Than Thirty Per Cent By Rise in Operating Expenses and Taxes

The operating ratio, including taxes, of the Twin City Rapid Transit Company, Minneapolis, Minn., was 74.84 per cent for the calendar year 1917 as compared to 68.17 per cent in 1916. This change was due almost entirely to the increase in operating costs. The total revenues showed a slight decrease, but the operating expenses rose \$468,876 or 7.5 per cent. As a result the net operating revenue decreased \$475,064 or 12.1 per cent. This loss was enhanced by the increase of \$208,099 or more than 29 per cent in taxes. The final result for the year was a loss of \$699,497 or 31 per cent in net income. The full details are given in the accompanying statement.

During 1917 the company declared and paid the regular quarterly dividends aggregating \$1,530,000, being at the rate of 7 per cent on the preferred stock and 6 per cent on the common stock. The balance carried forward on Dec. 31, 1917, was \$1,285,804 as compared to \$1,368,762 the year before.

The expenditures for additions and replacements during the year 1917 totaled \$1,435,687. The gross passenger revenue per mile of single track operated was \$22,519. The revenue passengers carried numbered 199,621,160, a slight decrease from the 199,848,096 in 1916; and the transfers redeemed were 73,678,873, a decrease from 74,425,935 the year before.

The city of Minneapolis in 1917 completed the valuation of the local property, and later had this valuation reviewed by another expert. On account of the generally disturbed conditions, however, the city is moving slowly with the franchise negotiations, but it is felt that progress is being made.

# Financial News Notes

**Receiver for Florida Road.**—On May 3 the United States District Court in and for the Southern District of Florida appointed Charles M. Allen receiver for the St. Petersburg & Gulf Railway, St. Petersburg, Fla.

**Seeks New Security Issues.**—The Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, has applied to the Public Service Commission for authority to issue \$600,000 of bonds, to be sold at 90; and \$200,000 of 7 per cent preferred stock.

**Additions to Toronto Board.**—The board of directors of the Toronto (Ont.) Railway was enlarged recently to provide for the addition of two new members and the president, Sir William Mackenzie, announced that Hugh Mackay, Montreal, and H. H. Pitts, Ottawa, have been appointed to fill the places.

**Seeks Help to Meet Maturing Obligations.**—Richard McCulloch, president and general manager of the United Railways, St. Louis, Mo., is reported to have left St. Louis for Washington to appeal to the capital issues committee, formed under the war finance corporation act, to assist the company in meeting \$3,500,000 of Union Depot bonds, which are to mature on June 1.

**Additions to Capital Account.**—The East St. Louis (Ill.) Railway has filed with the Illinois Public Utilities Commission a petition asking for permission to increase the capital stock \$210,300 and to issue \$188,000 of first mortgage bonds. The proposed increase in capital stock is to reimburse the com-

pany for improvements made during the last two years.

**Paid in Full.**—Out of the proceeds of the sales of the collateral on Jan. 28 the holders of the \$1,164,000 of 6 per cent five-year gold notes of 1914 of the Fort Wayne & Northern Indiana Traction Company, Fort Wayne, Ind. received at the Central Trust Company, New York, \$1,060.50 on each note, being payment in full of principal and accrued interest after payment of all costs and expenses.

**Preferred Stock Offered.**—Richter & Company, Hartford, Conn., are offering for subscription 7 per cent cumulative preferred stock of the Wisconsin-Minnesota Light & Power Company. The company has outstanding \$4,622,000 of cumulative preferred stock, \$2,500,000 of common stock, owned by the American Public Utilities Company and \$8,925,000 of first and refunding 5 per cent bonds, including those reserved to retire underlying issues. There are also \$808,000 of closed mortgage bonds outstanding issued against acquired properties.

**New Accounting Classification Proposed.**—Chairman Hill, of the Public Service Commission for the Second District of New York, has announced a conference on May 22 at 10 a. m. at the commission's office in Albany on the proposed new accounting classification for electric railways. The executive committee of the New York Electric Railway Association has requested a hearing, principally on requirements relating to depreciation accounting, and it is expected that some fundamental questions will be raised regarding the commission's policy in this important matter.

**Dividend in Scrip.**—The Middle West utilities Company, Chicago, Ill., has declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable on June 1 to stock of record of May 20. The dividend is in scrip, payable in ten years, bearing interest at 6 per cent. The reason assigned for paying the preferred dividend in scrip is that inability to secure funds, except at prohibitive rates of interest, makes the conservation of the company's cash resources necessary to meet the expenditures for a constantly increasing gross business. The regular quarterly dividend of 1½ per cent was paid in cash on March 1.

**Partial Abandonment.**—Work has been finished tearing up 2½ miles of track of the Rutland Railway, Light & Power Company, Rutland, Vt., running from Castleton Corners to Lake Bomoseen. This material has been sold. The line was a summer line and has been operated in the past at a considerable loss, and it was decided after last season closed that it would be best to discontinue it entirely. This means a return to production of more than 300 tons of steel and the release of six or eight men for war purposes. The overhead wire will be taken down and used on worn-out portions of the local system, or transferred to other systems, as the wire is practically new.

INCOME STATEMENT OF TWIN CITY RAPID TRANSIT COMPANY FOR 1916 AND 1917

	1917		1916	
	Amount	Per Cent	Amount	Per Cent
Revenue from transportation.....	\$10,119,755	99.4	\$10,130,112	99.5
Revenue from other railway operations.....	62,111	0.6	57,941	0.5
<b>Total railway operating revenue.....</b>	<b>\$10,181,866</b>	<b>100.0</b>	<b>\$10,188,054</b>	<b>100.0</b>
Way and structures.....	\$1,031,215	10.1	\$1,057,234	10.4
Equipment.....	781,663	7.6	780,235	7.7
Power.....	1,047,484	10.3	860,081	8.6
Conducting transportation.....	3,031,122	29.8	2,725,760	26.8
Traffic.....	57,137	0.6	45,550	0.4
General and miscellaneous.....	816,845	8.0	808,472	7.9
Transportation and investment—credit.....	41,950	0.4	42,691	0.4
<b>Total railway operating expenses.....</b>	<b>\$ 6,723,519</b>	<b>66.0</b>	<b>\$ 6,254,643</b>	<b>60.4</b>
Net operating revenue.....	\$3,458,346	34.0	\$3,933,410	38.6
Taxes assignable to railway operation.....	916,196	8.0	708,097	6.9
<b>Operating income.....</b>	<b>\$2,542,150</b>	<b>25.0</b>	<b>\$3,225,312</b>	<b>31.7</b>
Income from unfunded securities and accounts.....	\$24,145	0.0	\$26,051	0.2
Miscellaneous income.....	1,700	0.0	373	0.0
<b>Total operating income.....</b>	<b>\$25,846</b>	<b>0.2</b>	<b>\$26,425</b>	<b>0.2</b>
Gross income.....	\$2,567,996	25.2	\$3,251,738	31.9
Rent for leased roads.....	3,000	0.0	3,000	0.0
Interest on funded debt.....	989,724	9.7	984,557	9.7
Net loss miscellaneous physical property.....	25,586	0.3	18,621	0.2
Miscellaneous debits.....	11,635	0.1	8,011	0.1
<b>Total deductions from gross income.....</b>	<b>\$1,029,946</b>	<b>10.1</b>	<b>\$1,014,190</b>	<b>10.0</b>
<b>Net income.....</b>	<b>\$1,538,050</b>	<b>15.1</b>	<b>\$2,237,547</b>	<b>21.9</b>

**Would Borrow \$1,500,000.**—The New York State Railways, Rochester, has filed with the Public Service Commission for the Second District, a petition in which it asks authority to negotiate a loan from the War Finance Corporation of an amount not to exceed \$1,500,000 for five years or less upon such terms and subject to such rules and regulations as may be prescribed by the War Finance Corporation's directors. The company also asks permission to issue its fifty-year first consolidated mortgage gold bonds, bearing interest at 4½ per cent, to an amount sufficient to realize \$2,230,905 at such price as may hereafter be approved by the commission, and that permission be granted to issue and pledge as collateral security to its loans, with the War Finance Corporation or others, \$2,500,000 par value of the bonds.

**St. Louis Tax Value Fixed.**—The taxable valuation of the United Railways, St. Louis, Mo., was placed at \$54,086,648 in a return made on April 13 to the State Tax Commission at Jefferson City. The company also made returns on the property of the St. Louis & Meramac River Railroad at \$2,318,915 and the Missouri Electric Company—St. Charles Line—at \$989,532. The total assessable property, including the subsidiary companies, amounts to \$57,395,095. The return was more than double the valuation of last year, which was fixed by the State Board of Equalization at \$21,925,786. That figure included the valuation of the company's franchise, which is not taxable and was not included in the latest return. The mileage of the company was placed at 423.1. The new valuation of the St. Louis & Meramac River Railroad quadrupled the return of last year. The return gave the mileage at 31.7. The taxable valuation of the St. Charles line last year was placed by the State board at \$571,108. The United Railways had \$1,619,000 of unassessable bonds.

## New Publications

### Financial Statements Made Plain

By Earl A. Saliers. Magazine of Wall Street, 42 Broadway, New York, N. Y. 96 pages. Cloth, \$1.06 postpaid.

This is not an exhaustive study in regard to the technical analysis of financial statements, but it is a very readable discussion of the general principles of income-statement and balance-sheet interpretation which ought to be known by investors. Upon the mind of the average investor the book should have a clarifying and a stimulating effect. Particular attention should be directed to one observation by Mr. Saliers, i.e., that the investor should enlighten himself as to the general policy on depreciation followed by the company whose securities he contemplates buying. This is true, of course, but on this point it might be added that the public should realize more fully the need of providing rates sufficient to permit adequate treatment of depreciation.

### A Bibliography of Municipal Regulation and Municipal Ownership

By Don Lorenzo Stevens. Harvard University Press, Cambridge, Mass. 410 pages. Cloth, \$4 net.

This volume makes readily available to busy men information regarding the best books and articles up to Jan. 1, 1917, on the subject of regulation and municipal ownership. Covering as it does traction, electric, gas and water utilities in all their numerous regulatory phases, the book should be a valuable *vade mecum* to commissioners,

operators, lawyers and others interested in the public utility industries of the country. The amount of literature on utility topics has grown to such an enormous size that some special classified index to it has become a necessity. Mr. Stevens' compilation fills the need very well. Not a little credit is due to him because of his reading of all the works listed and his insertion of brief critical annotations to facilitate the selection of material.

### Cost Accounting—Theory and Practice

By J. Lee Nicholson. Ronald Press Company, 20 Vesey Street, New York, N. Y. 341 pages. Half leather, \$4.

This book is most commendable because of the clear-cut way in which it charts the whole structure of cost accounting. In the midst of so many dissertations on the benefits of organization and efficiency, it is a distinct pleasure to read a book which tells so simply *how* to secure these results through cost accounting.

Mr. Nicholson conceives all cost accounting systems, no matter how involved, to be reducible to four types, as follows: the special order system, using the productive labor method; the special order system, using the process or machine cost method; the product system, using the productive labor method, and the product system, using the process or machine cost method. What differentiates these systems; when and how they are used; how they should be combined under special conditions—all this information Mr. Nicholson presents.

The author also explains how a plant should be examined before a cost system is installed, and he includes eighty basic forms as suggestive material. The book is well organized, and the reader can hardly fail to secure a better knowledge of the mechanism of cost accounting.

## Electric Railway Monthly Earnings

### BANGOR RAILWAY & ELECTRIC COMPANY, BANGOR, ME.

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Mar., '18	\$76,107	*\$47,448	\$28,659	\$19,621	\$9,038
1m., Mar., '17	71,203	*40,566	30,637	18,646	11,991
12m., Mar., '18	892,825	*527,164	365,661	231,360	134,301
12m., Mar., '17	852,166	*480,146	372,020	218,071	153,949

### CHATTANOOGA RAILWAY & LIGHT COMPANY, CHATTANOOGA, TENN.

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Mar., '18	\$151,533	*\$112,174	\$39,359	\$30,747	\$8,612
1m., Mar., '17	106,691	*74,631	32,060	29,753	2,307
12m., Mar., '18	1,467,675	*1,249,296	218,379	362,665	†144,286
12m., Mar., '17	1,248,917	*858,529	390,388	358,238	32,150

### COLUMBUS RAILWAY, POWER & LIGHT COMPANY, COLUMBUS, OHIO

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Mar., '18	\$362,526	*\$250,474	\$112,052	\$55,779	\$56,273
1m., Mar., '17	332,389	*237,777	94,612	45,109	49,503
12m., Mar., '18	4,115,470	*3,068,439	1,047,031	586,892	460,139
12m., Mar., '17	3,657,467	*2,287,687	1,369,780	520,841	848,939

### COMMONWEALTH POWER, RAILWAY & LIGHT COMPANY, GRAND RAPIDS, MICH.

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Mar., '18	\$1,756,688	*\$1,176,802	\$579,886	\$488,934	\$90,952
1m., Mar., '17	1,558,538	*971,164	587,374	431,079	156,295
12m., Mar., '18	20,093,104	*13,099,519	6,993,585	5,440,473	1,553,112
12m., Mar., '17	17,545,338	*9,939,686	7,605,652	5,084,279	2,521,373

### GRAND RAPIDS (MICH.) RAILWAY

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Mar., '18	\$108,918	*\$82,553	\$26,365	\$19,148	\$7,217
1m., Mar., '17	112,733	*75,658	37,075	17,456	19,619
12m., Mar., '18	1,292,745	*924,762	367,983	224,178	143,805
12m., Mar., '17	1,310,494	*855,330	455,164	196,711	258,453

### HUDSON & MANHATTAN RAILROAD, NEW YORK, N. Y.

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Mar., '18	\$587,791	*\$284,257	\$303,534	\$217,937	\$85,597
1m., Mar., '17	544,365	*244,614	299,751	182,865	80,886
3m., Mar., '18	1,702,657	*855,716	846,941	652,621	194,320
3m., Mar., '17	1,583,460	*710,273	873,187	651,299	221,888

### NASHVILLE RAILWAY & LIGHT COMPANY, NASHVILLE, TENN.

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Mar., '18	\$218,584	*\$141,476	\$77,108	\$40,980	\$36,128
1m., Mar., '17	201,328	*137,091	64,237	40,906	23,331
12m., Mar., '18	2,471,564	*1,600,615	870,949	489,600	381,349
12m., Mar., '17	2,415,890	*1,494,407	921,483	503,298	418,185

### NEW YORK (N. Y.) RAILWAYS

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Mar., '18	\$982,684	*\$793,913	\$188,771	\$285,331	†\$46,726
1m., Mar., '17	1,051,492	*884,491	167,001	284,261	††69,959
9m., Mar., '18	8,984,526	*6,898,075	2,086,451	2,548,203	††46,338
9m., Mar., '17	8,356,205	*6,763,177	1,593,028	2,556,386	††464,271

### PORTLAND RAILWAY, LIGHT & POWER COMPANY, PORTLAND, ORE.

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Mar., '18	\$621,145	*\$372,058	\$249,087	\$178,148	\$70,939
1m., Mar., '17	474,478	*262,377	212,101	184,024	28,077
12m., Mar., '18	6,387,407	*3,855,196	2,532,211	2,139,509	392,702
12m., Mar., '17	5,592,604	*3,038,892	2,553,712	2,180,643	373,069

### PUGET SOUND TRACTION, LIGHT & POWER COMPANY, SEATTLE, WASH.

Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Feb., '18	\$919,288	*\$568,365	\$350,923	\$206,221	\$144,702
1m., Feb., '17	720,177	*440,390	279,787	189,142	90,645
12m., Feb., '18	9,826,191	*6,098,760	3,727,431	2,380,832	1,346,599
12m., Feb., '17	8,348,610	*5,168,424	3,180,186	2,227,602	952,584

\*Includes taxes. † Deficit. †† Includes non-operating income. ††† For one month \$18,732 and for twelve months \$234,320 included for depreciation.

# Traffic and Transportation

## Skip Stop for Bay State

Fuel Administrator Recommends It and Public Service Commission Promptly Indorses the Plan

James J. Storrow, fuel administrator for New England, has requested all the electric railways of Massachusetts to eliminate all unnecessary stopping places on their lines by the adoption, as a war measure, of the skip-stop plan. The maximum number of stops per mile permitted under ordinary conditions will be eight in urban districts, six in suburban and four in interurban territory. It is estimated that a possible yearly saving of more than 100,000 tons of coal can be made in Massachusetts by this plan. The fuel administrators of the other New England States are in sympathy with the skip-stop program and it is expected that they will issue similar requests to their local companies.

### TEXT OF MR. STORROW'S LETTER

The text of Mr. Storrow's letter, addressed to the heads of the electric railways in Massachusetts is as follows: "Improved weather conditions have temporarily relieved the acute coal shortage of last winter. We must all realize, however, that the outlook for next winter's steam coal supply is extremely serious and that there is likely to be an insufficient supply of coal throughout the war.

"To meet this situation all steam coal users should do their utmost to get the maximum efficiency from the coal that is available, and the electric railways must do their share.

"Every time a car is stopped and started much power is used. We therefore request all electric railways, in so far as local conditions may reasonably permit, to reduce the number of stopping places in urban districts to not more than eight to a mile, in suburban districts to not more than six to the mile, and in interurban districts to not more than four to the mile.

"This so-called skip-stop system has already been put into effect on several large electric railway lines with excellent results. In many cases it has reduced the total amount of coal consumed by these companies more than 20 per cent. At the same time the service to the public has been actually improved as it has resulted in materially speeding up the cars, reduced delays, and in general increased the efficiency of the service. This has been especially so in rush hours and in crowded districts.

"City and town officials will be urged through our local fuel committees to co-operate with the electric railways in putting this measure into effect."

Chairman Macleod's letter addressed

to Mr. Storrow expresses the attitude of the Public Service Commission with respect to the proposal of the Massachusetts Fuel Administration. It reads:

"In response to your inquiry I take pleasure in saying that this commission approves of the general principle of reducing the number of stopping places on electric railway lines, provided such reduction is confined within reasonable limits. It has been amply demonstrated not only in other parts of the country but in this State, that the limitation of stops will result in a substantial saving of power, and hence of fuel, and that it may actually improve, rather than impair, service. This has been the case in Cleveland and other cities where it has been tried. Frequent stops mean slow service. By limiting the number of stops, running time can be reduced and people carried more quickly to their destinations. By the use of the skip or staggered stop system any inconvenience from such limitation can be minimized. The commission is of the opinion that on many electric railways in this Commonwealth a reduction in the number of stopping places, if reasonably and carefully made, is desirable, especially under existing conditions."

## Would Charge Six Cents in Trenton

The Trenton & Mercer County Traction Corporation on May 10 petitioned the Board of Public Utility Commissioners of New Jersey for the right to increase its fares from 5 cents to 6 cents on all the Trenton divisions and the suburban lines. The company has been seeking for some time to do away with the sale of tickets at the rate of six for a quarter and charge a straight 5-cent fare, but has been unsuccessful.

The petition sets forth that, based upon the cost of operation at present prices for labor and materials, the deficit for this year will be \$212,160. With contemplated additions to capital expenditures, wage increases, etc., the deficit would be further increased for the present year by \$85,000, making the total deficit \$297,160, at the present rate of fare, in case the additional expenditures are made.

The company declares that in case the appeal for increased fare rates is granted, it is the desire of the corporation to further increase the amount set aside annually for depreciation by \$25,000, making its total appropriation for this purpose \$175,000.

Statements of the company affixed to the petition show that the total wages to be paid to employees from the superintendent down for the present year will amount to \$402,244 and exceed by \$109,086 the total expended in wages in 1914.

## Six-Cent Fare for St. Louis

Missouri Commission Split Three to Two on Questions of Jurisdiction and Adequacy of Fare

The State Public Service Commission of Missouri at Jefferson City, on May 11, by a vote of three to two ordered fares on the lines of the United Railways in St. Louis to be raised from 5 cents to 6 cents.

### NEW RATE EFFECTIVE ON JUNE 1

The new rate goes into effect on June 1 and will continue for one year unless changed by a subsequent order of the commission, or by an appeal by the city of St. Louis to the courts. Universal transfers will be issued, as at present, without additional cost. Half-fare tickets will be sold at the present rate of 2½ cents each. The company is required to place tickets on sale at convenient points throughout the city, in blocks of five, ten and 100 individual fares.

The opinion and order of the commission contain about 20,000 words. The majority opinion concerns itself with two points. The first is whether the commission has the authority, under the constitution, to act in the case, and the second is whether the United Railways operating with the present fares would be able to meet its operating expenses, pay its debts and grant a wage increase to its employees. On the question of jurisdiction the opinion holds that the commission has the power to act and cites authorities.

In considering the second point, namely, the inadequacy of the fare that has been in effect, the financial and physical condition of the property, as shown by the reports of City Engineer Smith, officials of the United Railways and experts of the Public Service Commission, is analyzed and the conclusion is reached that the revenues of the company, on the present basis, would be insufficient during the coming year, especially in view of the fact that no relief would be afforded by the so-called compromise franchise ordinance recently passed and approved, within the year that the fare increase is to remain in effect.

### COMMISSION RETAINS JURISDICTION

The company is ordered to make monthly reports to the commission, showing its gross earnings and operating expenses under the new system. The commission retains jurisdiction of the case, and may change the fare schedule after its engineers and accountants complete a valuation of the property. The commission has determined to make such a valuation during the coming year. In the present case the commission took \$52,800,000 as the value of the property.

Richard McCulloch, president and general manager of the company, said that he would make no statement whatever in regard to the decision of the commission until he had received an official copy of the opinion and had time to read and digest it.

## Winnipeg Abolishes the Jitneys

### Details Are Given of the Resolution Adopted by the Council and of the Proposal of the Winnipeg Electric Railway

The jitney in Winnipeg (Man.) is no more. By a vote of twelve to five the City Council decided during March on its abolition, but several weeks elapsed before the motion was put into effect. This delay was caused by extreme amendments being proposed to the by-law, which was to eliminate jitneys by May 1. These amendments the company could not accept. The by-law was finally passed on April 29, and 200 jitney-men sought new occupations the following day.

#### SETTLEMENT AT FIRST DELAYED

The jitneys would have been abolished a month earlier, but certain Aldermen pressed for the insertion of a clause in the agreement accompanying the by-law, to the effect that "at no future time shall the company apply for an increase in fares." The company declared it would let the whole negotiations fall through rather than submit to that clause, and finally a clause was inserted which left the situation as it was before the fares clause question was raised. Many other amendments, such as "no seat no fare," "abolition of all running boards on cars," etc., were proposed by Aldermen, but all these were finally defeated. The by-law went through Council by a vote of ten to eight.

In one district, Westminster Avenue, which is at present not served by the Winnipeg Electric Railway, the company offered to run a motor bus service. A clause was also inserted in the agreement permitting the company to do this and to run motor buses in other parts of the city where railway lines have been ordered by the City Council.

#### RAILWAY BETTERS SERVICE

Following the elimination of the jitneys the railway has placed a new type of car in service. It is a remodelled car, provided with safety step, front exit, and lower car body. It is the intention of the company to remodel all its cars along these lines. The company is also putting into service immediately four trail cars, remodeled from old rolling stock. Other trail cars will be purchased in the near future.

The course run by the jitney in Winnipeg varied very little from that of the vehicle in other cities where it received a free hand. Electric railway traffic suffered severely and the matter took on a serious aspect for the Winnipeg Electric Railway. Much discussion followed in regard to the respective right of the railway and the jitneys, and finally suit was brought by the electric railway claiming \$1,000,000 damages. As one of the conditions of the present settlement the company has agreed to withdraw that suit.

The text of the settlement motion as adopted by the Council is as follows:

"That the city solicitor be instructed

to prepare a by-law prohibiting the operation of jitneys in the city.

"That the city solicitor prepare an agreement between the city and the Winnipeg Electric Railway binding the company to fulfill the conditions set forth in the manager's letter of March 25 to the City Council, such agreement to contain a provision for the payment of at least \$25,000 per month to the credit of a joint account of the city and the company in the Bank of Montreal to be checked out on the joint authority of both the city and the company and to be used for the purpose of:

"1. Providing adequate and efficient electric railway service.

"2. Meeting expense of grounding secondaries.

"3. Clearing streets of useless poles.

"4. Protecting high potential wires to prevent accidents.

"5. Eliminating electrolysis damage, and any other expense or outlay to carry out the terms of the agreement.

"The payment in to such fund is to continue until it is decided by the public utilities commissioner that the company's obligations under the agreement have been carried out.

"It is distinctly understood, however, that the company under the terms of any agreement shall not have the right to operate within the city a system of motor busses without the consent of the Council and upon such streets as the Council may prescribe, such service shall be supplementary to the service of the company as a temporary means of giving the public adequate facilities, but shall in no sense be exclusive, it being distinctly understood that the company is not to have any greater privileges or rights than already given it by by-law 543, any contract not to extend beyond Feb. 1, 1927.

"The license inspector is directed to issue no licenses in respect to automobiles for hire pending negotiations with the Winnipeg Electric Railway, and the details of preparation and revision of contract with the said company are referred to the board of control."

#### THE COMPANY'S LETTER

The letter of the company dated March 25, to which reference is made in the resolution of the Council, was as follows:

"Upon the elimination of jitneys in the city of Winnipeg the company agrees as follows:

"1. Service: The company will furnish the citizens of Winnipeg adequate transportation facilities, and will at once proceed to remodel its present rolling stock, making the cars modern in every respect, with folding steps, proper front exits, latest type of lighting and improved route signs.

"2. Trailers: Center entrance, modern trail cars will be used in conjunc-

tion with extra cars during the rush hour periods.

"3. Motor buses and extensions: The company will forthwith put on motor buses to provide service on Westminster Avenue as part of its system, with the same rates of fares, transfer privileges, and will continue to operate same until it extends its car lines to serve this community and will also extend the Sargent Avenue line, 2200 ft.

"4. Percentages: The company will forthwith pay the city the 1917 percentages of gross earnings and car tax, amounting to \$105,777.

"5. Million dollar suit: The company will withdraw the letter written to the city on April 4, 1917, claiming \$1,000,000.

"6. Electrolysis: The company will proceed to institute and carry out the system of insulated return feeders in accordance with the recommendation of Professor Ganz, as embodied in the act passed by the Legislative Assembly.

"7. Electrolysis damages: The company will settle the action now pending by the city against the company for damages claimed to the city's water mains and underground structures by electrolysis, caused by the operation of the company's system in Winnipeg, by consenting to judgment being given in favor of the city for such an amount as shall be found to be due to the city by the company, such amount to be fixed by a referee to be appointed by the court.

"8. Grounding of secondaries: The company will perform and carry out order No. 105 of the Public Utilities Commission of Manitoba relating to the grounding of secondaries.

"9. Abandoned poles: The company will remove at its own expense from the streets of the city all poles which it may have abandoned.

"10. Span wires: The company will, in the business section of the city, wherever there are suitable buildings for the purpose, and permission can be obtained from the owners, transfer its span wires to such buildings.

"11. Steel poles: Wherever, in the business section of the city, wooden poles are worn out or have to be replaced, the same will be replaced with steel poles."

Although there were nearly 200 jitneys in operation in Winnipeg prior to May 1 their elimination has not caused any outcry, and transportation matters have adjusted themselves quickly to the new conditions.

#### Final Schedule Order Issued

The Public Service Commission for the First District has adopted a final order directing the Brooklyn Heights Railroad and other companies of the Brooklyn Rapid Transit System operating surface car lines, to file operating schedules with the commission and to post in the cars placards giving the "headway" and service called for in the schedule. These schedules must show the route, the car run numbers, the terminals and car depots.

## Public Service Hearings Progressing

### City Counsel Cross-Examines Company Witnesses on Various Points —Commission Counsel Interested in Modified Zone Systems

Hearings on the application of the Public Service Railway, Newark, N. J., for a 7-cent fare, a 2-cent charge for transfers and a 1-cent charge for second transfers were continued on May 11, 13 and 15. The resumption of the hearings was noted in the *ELECTRIC RAILWAY JOURNAL* of May 11.

Prof. Roswell C. McCrea of Columbia University, upon cross-examination by city counsel, explained the labor situation throughout New Jersey. He said that two interesting studies of increased living costs of workmen in the Newark and Camden shipbuilding districts had recently been completed, and that the data collected showed a rise of 40 per cent in the family cost of living.

Professor McCrea was of the opinion that the estimated decrease in traffic under higher fares would not be due to any inability on the part of some workmen to pay the higher rates out of their higher wages, but to their unwillingness to do so. He stated that the amount disbursed by workmen for transportation is a very small percentage of their income. As for the possibility of holding men in electric railway employment, the witness felt that the wages could be somewhat lower than those paid in shipyard work, on account of the permanency of railway employment.

#### QUERIES ABOUT ZONE SYSTEMS

Under examination by counsel for the Board of Public Utility Commissioners the next witness, Prof. Albert S. Richey, of Worcester Polytechnic Institute, outlined the physical features of the zone or mileage systems used by the Springfield Street Railway, the Rhode Island Company and the Massachusetts Northeastern Street Railway, and proposed for the Bay State Street Railway.

Regarding the success of the 6-cent fare in Massachusetts, Professor Richey stated that the flat increase had in some cases been disappointing. In the case of the Bay State Street Railway it did not give sufficient revenue. It would have given enough at the time the application was made, but when relief was granted after a year unanticipated rising prices had become prevalent. Now it is believed that the proposed mileage system will give more revenue. A 6-cent fare on the Boston & Worcester Street Railway took care of the company for a year, but in the last year the prices rose and additional revenue was needed. The company went to a mileage system because it felt that this would give more revenue than a 7 or 8-cent fare.

Professor Richey expressed his belief in the general idea of a service-at-cost plan, but stated that he did not agree with every detail of specific plans. In his opinion, an increase in fare is absolutely necessary, and a

single adjustment of fares will not settle the matter permanently.

As to the practicability of a modified zone system in Public Service territory, Professor Richey remarked that the institution of such a system would not be impossible, and that it would be more equitable and ideal when fully developed. Serious difficulties, however, would have to be overcome in working out such a system, first in relation to fare collection and second in relation to the establishment of zone boundaries. The fare collection problem on congested lines in urban territory would be particularly difficult to solve.

#### PRESIDENT McCARTER TESTIFIES

Thomas N. McCarter, president of the company, was then examined at length concerning various phases of the application. He explained that the relief desired was for emergency use only, and that the question of terminating the higher rates should be left to the commission for decision in the light of the then existing conditions.

Marshall Van Winkle, city counsel, questioned Mr. McCarter in detail regarding the organization and functions of the Electric Railway War Board and other utility committees in Washington, and asked whether the recent letters of President Wilson and Secretary McAdoo on the subject of needed utility relief had not been "promoted" by utility representatives. Mr. McCarter deprecated the insinuation and said that the letters were the patriotic expression of deliberate judgment based on accurate data.

Mr. Van Winkle stated that Jersey municipalities did not disagree with the letters but would not consent to the granting of relief to the Public Service Railway when it had refused to place its case before the "local" authorities. Mr. McCarter explained that formerly it would have been a waste of time to try to secure concerted action from the 146 communities served, and that now, with the recent Collingswood decision giving the State commission control over franchise rates, the only sensible emergency procedure was to apply to this board for relief.

Mr. McCarter said that the new line to the Port Newark shipyard is under construction. At first there was a slight misunderstanding, on the part of the Shipping Board in regard to this matter. The contract with the government was based upon the securing of a franchise with certain conditions, but upon application to Newark officials the latter wanted the company to proceed with construction without any guarantee that a franchise upon the stipulated terms would be forthcoming. Upon learning the full details of this, however, Admiral Bowles straightened matters out with the city officials; the desired franchise is in process of being granted, and the construction of the

line has been begun. Mr. McCarter added that a contract has now been signed for the railway development for the Camden shipyard district.

#### Geneva Hearing Is Closed

The Public Service Commission for the Second District of New York on May 1 heard the application of the Geneva, Seneca Falls & Auburn Railroad Company, Inc., for permission to increase its rate of fare from 5 to 6 cents in the zone including Geneva and a part of Waterloo. This is one of the company's five fare zones. L. G. Haskins, secretary of the railway, testified that franchises in Geneva and Waterloo contain no fare restrictions. T. H. Werry, auditor, presented a series of statements relating to the affairs of the company from 1913 to 1917.

The company has never paid a dividend on its stock, said Mr. Werry, and it is difficult to pay interest on the bonds from the present earnings. The wages of the men were recently increased from 28 to 30 cents, and it is understood that the men intend to ask for 35 or 40 cents about July 1, when the present agreement expires. Just now, too, there is a lack of ballast, and the company has been ordered to repave one street in Geneva.

There was no opposition to the petition of the company, and Chairman Bill declared the hearing closed. Immediate action will probably be taken by the commission.

#### Six-Cent Fare Wanted for Hudson

The Public Service Commission for the Second District of New York on April 25 held a hearing on the question of the dismissal of the Albany Southern Railroad fare petition under the recent decision of the Court of Appeals. James E. Hewes, general manager, appeared for the company and Corporation Counsel Boothby represented Rensselaer.

Mr. Hewes announced that the company had abandoned its application as far as it related to Rensselaer. He said the company was operating in Rensselaer and Albany on the tracks of the United Traction Company under a contract. He argued, however, for a 6-cent fare in Hudson, stating that the company was not making an adequate return upon its investment there.

The company's books showed a deficit of \$4,000. On the basis of a charge of one-half of the physical valuation of the company's property in Hudson, he said that there was a net deficit of \$2,000. This, with a 2.6 per cent depreciation, made a deficit of \$4,600.

Mr. Hewes said he did not anticipate that an increased fare would cause a falling off in the revenue, as the Hudson line was largely an accommodation line, the majority of the people there walking. There is only one small industry on the car lines. There was no appearance on the part of Hudson before the commission.

### Unique Car Crew in Unique Service

Ever since the start of the campaign by the government for the sale of thrift stamps the Manhattan & Queens Traction Corporation has been one of the leading boosters of the scheme among the electric railways. It would seem, however, that the company has about



UNCLE SAM AND MISS COLUMBIA

reached the ultimate in its work of selling the stamps by the introduction of a red, white and blue car whose motorman, Uncle Sam, and conductor, Miss Columbia, sold \$1,500 in thrift stamps in one day recently.

The Manhattan & Queens Traction Corporation operates 22 miles of road

the enterprise of the company has been commented upon favorably by the local public and by New York and out-of-town newspapers. The accompanying illustrations of the thrift car and its crew give an idea of the lengths to which the company has gone in its effort to help the government in the thrift-stamp campaign.

### Housing and Service Departments of E. F. C. Merged

Announcement was made on May 13 of the abolition of the housing department of the division of general service, and the passenger transportation service section as distinct units of the Emergency Fleet Corporation and their consolidation into one department to be known as the division of passenger transportation and housing.

A. Merritt Taylor has been named director of the new division of passenger transportation and housing. He has appointed J. Willison Smith as assistant director of housing and J. Rogers Flannery as associate director of housing, to act with him in connection with the housing problems. Garrett T. Seely, formerly assistant manager of passenger transportation, has been appointed assistant director of passenger transportation by Mr. Taylor, to act with him in handling the passenger transportation problems of the division.

The jurisdiction of the new division is as follows:

1. To determine upon and take such measures as may be necessary to relieve deficiencies in passenger transportation facilities serving shipyards and plants throughout the United States, which hold contracts with the Emergency Fleet Corporation.

2. To determine what housing developments are required to expedite

such land, property, franchises and facilities as may be required for those purposes.

### Second Kansas City Hearing Held

Another hearing of the Kansas City (Mo.) Railways fare case on May 9, before the Public Service Commission, was occupied chiefly with the presentation of the city's opposition to the company's application. The purpose of the city was obviously to minimize the influence of figures presented by the company. The net effect, however, was to give the city officials very explicit information as to the many unexpected burdens which the company has to bear.

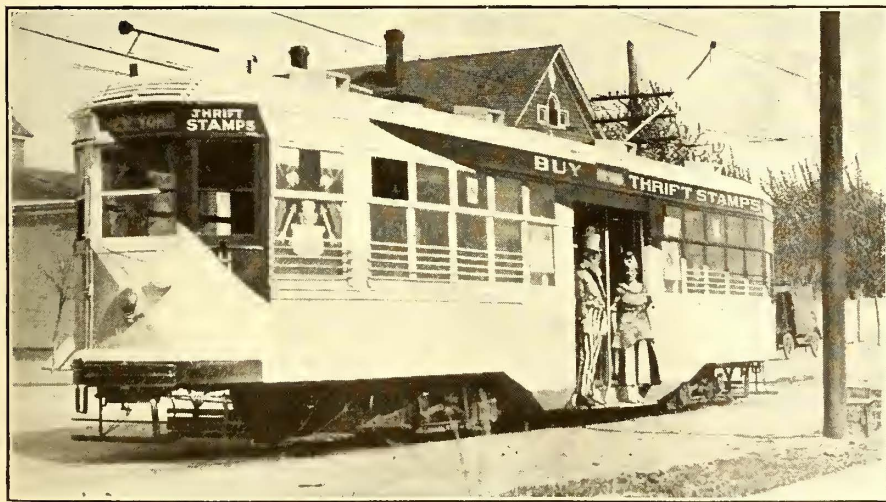
The city attorneys particularly asked P. J. Kealy, president of the company, in what way resources might be increased besides by a flat increase in fare. Colonel Kealy related the many studies made by the company on this subject. He mentioned the studies of zoning, for instance, and pointed out that with a 4-mile zone for a 5-cent fare only \$90,000 would be realized by collecting an extra cent from those outside the zone. Even a 25-cent fare on owl cars, he said, would make no appreciable difference, since the revenue from some of the owl lines was only \$2 a week each. As for a transfer charge, Kansas City is not laid out in such a way as to distribute the burden equitably on the public by this means. Colonel Kealy said that eventually electric railway operation must come to the zone system, so that each passenger will pay for the service he receives.

Colonel Kealy stated that the company had not estimated the amount of increase in fare necessary, but it is putting the evidence before the commission for decision. The question was asked as to whether the increased fare would continue if the war should end soon and conditions be restored to normal. He answered that the experience of the last few months had discouraged anybody from making predictions. He declared, however, that the company had to forego a fair return on the investment during the period of the war; but that, as the franchise provides, if better times should come, the stockholders would be entitled to receive the dividends foregone.

The company introduced a copy of resolutions adopted by several civic organizations. Some of the organizations made the resolutions stronger, but most adopted these conclusions:

"We recommend that such decisive action be taken as will permit an increase of the wage scale and the continuance of good service and leave it to the judgment of the Public Service Commission, to whom all facts will be presented, as to whether these ends can be accomplished by other than an increase in the revenue, and if not, we believe the revenue should be increased."

Briefs will be exchanged, and the next hearing, which may be the final one, will be held at Jefferson City on May 27.



FULL VIEW OF THE CAR AND ITS CREW

between the Manhattan end of the Queensboro bridge at Fifty-ninth Street, New York, and Jamaica, L. I. The car on which Uncle Sam and Miss Columbia serve has naturally attracted an immense amount of attention, and

ship construction for the Emergency Fleet Corporation, to designate the character thereof and to establish the same.

3. To secure, either by purchase, condemnation, requisition or otherwise,

### Wants Fare Increase in Buffalo

Application has been made to the City Council of Buffalo, N. Y., by the International Railway for permission to increase fares on its lines within the city. The company fixes no tentative rate, but in an interview Henry W. Killeen, of Penney, Killeen & Nye, of counsel for the railway, says a 6-cent fare is absolutely essential.

The company operates under a franchise known as the Milburn agreement. This was made at the time the railway properties of the city were consolidated. Included in the agreement is the provision that a 5-cent fare must be charged with free transfers. In order to obtain permission to increase its rate of fare, the company must secure the consent of the City Council and the new rate must be ratified by the voters of Buffalo at a general or special election. The rate is also subject to review by the Public Service Commission.

The company started a publicity campaign in advance of the filing of the formal petition with the Council. This publicity held that the value of the nickel is now less than 50 per cent of what it was before the war and therefore the company is carrying passengers for about 2 cents.

The Mayor was elected a year ago on the platform of railway reform and has attacked the company on many occasions. In replying to these attacks, the railway closed one of its advertisements with this paragraph:

"And yet some men, whose motives seem to be revenge rather than civic betterment, have apparently learned nothing by reading of the conditions Lenine and Trotzky have brought in Petrograd."

Henry W. Killeen, of counsel for the company, says that unless the company is granted an increase in fare, it will be forced into the hands of a receiver.

### Zones the Only Way Out

C. V. Wood, vice-president of the Milford, Attleboro & Woonsocket Street Railway, appeared before the Public Service Commission of Massachusetts at Boston on May 6 in support of a zone system of fares. He informed the commission that unless the company was permitted to increase its revenue it would be necessary to tear up the road and sell it for junk. The company needed \$170,000 a year more revenue. Mr. Wood said that it would be necessary to charge a flat rate of 8½ cents if the company were to maintain the system of a single fare unit. It was believed that a zone system offered a better solution of the problem. F. H. Dewey, president of the company, said that the company was doing a fair freight business but no great amount of revenue was in sight from this service. Commissioner Eastman suggested that higher freight rates were to be expected on electric railways. He recommended that the company sell a park valued at \$28,000 because the capital invested was yielding no return.

## Transportation News Notes

**Canadian Road Wants Increase.**—The Moncton Tramways, Electricity & Gas Company, Moncton, N. B., has applied to the City Council for permission to increase the fares charged on the electric railway.

**Increase for West Virginia Road.**—The Union Traction Company, Sistersville, W. Va., has been granted authority by the Public Service Commission to increase its rates between Sistersville and New Martinsville from 20 cents to 25 cents each way.

**Passenger Rates Increased.**—The Public Utilities Commission of Ohio has approved an increase from 2 cents to 2½ cents a mile on the Cleveland & Chagrin Falls and the Cincinnati, Milford & Loveland Traction lines. The increases became effective as of May 1.

**Amends Fare Plea.**—The West Penn Traction Company, Pittsburgh, Pa., has filed a petition with the Public Service Commission for permission to amend the new tariffs at McKeesport, Pa., so that in addition to straight 5-cent fares, six tickets may be sold for 25 cents, without transfer privilege.

**Omaha to Ask Six Cents.**—The Omaha & Council Bluffs Street Railway, Omaha, Neb., has announced that it will apply to the Railroad Commission of Nebraska for permission to charge a 6-cent fare in Omaha. The 1-cent increase, if granted, will make the fare to Council Bluffs 11 cents instead of 10 cents.

**Receiver Sees the Light.**—C. A. Fagan, one of the receivers of the Pittsburgh (Pa.) Railways, favors a new rate of fares based upon the zone system. In a statement, Mr. Fagan pointed out the unfairness in the present fare system. He said it was absurd to charge the same fare for a ride to Soho as to Wilkinsburg. Fares in Pittsburgh are now 5½ and 6 cents.

**Merchants Favor Increased Fare.**—The Merchants' Association of New York announced on May 12 that it favored 6-cent fares on the subway lines of New York City. Its decision was based on the report of the committee on city traffic of the association, of which H. H. Porter is chairman, which asserted that the present fare was resulting in deficits greatly reducing the city's ability to borrow.

**Fits the Service to the Fare.**—The Southwestern Traction & Power Company, operating between New Iberia and Jeanerette, La., has filed with the Railroad Commission of that State a petition for authority to reduce its operations 50 per cent by having its cars leave each of these towns every two hours instead of every hour, as

heretofore. The company pleads poor business and very high operating costs.

**Inquiry Into Recent Accidents.**—The Public Service Commission of the First District of New York announced on May 13 that it would begin on May 17 an investigation into the accidents that have recently occurred at various places in the city, and that special attention would be paid to the Union Railway lines, where one person was killed and several seriously injured a few days ago.

**Skip Stops in Downtown Dallas.**—The Dallas (Tex.) Railway on May 6 inaugurated the skip-stop system on all lines in the downtown business district and on Ervay Street and Colonial Avenue. If the plan is found to work satisfactorily, it will be extended to other lines. Signs have been placed at corners, and large display advertisements were published in the Dallas newspapers telling patrons how the plan would be carried out.

**Hartford's Appeal Presented.**—The city of Hartford, Conn., on May 7 filed with the Superior Court its appeal from the action of the Public Utilities Commission in denying the petition of the city for an order requiring the Connecticut Company to restore fares to 5 cents within the limits of Hartford and the towns immediately adjoining. The points made by the company are largely the same as those reviewed in the ELECTRIC RAILWAY JOURNAL for April 27, page 830.

**Rules for Women Employees in Wisconsin.**—A decision in the case brought by labor organizations to prevent the employment of women as drivers and conductors on street cars has been rendered by the Wisconsin Industrial Commission, ordering that no woman be employed on night runs and that under no circumstances shall their employment continue for more than eight hours a day. The runs on which women are employed must begin after 8 a.m. and terminate before 5 p.m., or within a period of nine hours.

**From Five to Seven-Cent Zones.**—A hearing will be held on May 21 before the Public Service Commission of Maine on the application of the Lewiston, Augusta & Waterville Street Railway for permission to increase its zone charges from 5 cents to 7 cents. This is an emergency application. The company did not earn its operating expenses for the first quarter of 1918. It is also beset by the prospect of higher interest on obligations maturing in 1918 and a new wage scale. Some time ago the property was re-zoned, ten 5-cent fares being substituted for seven 5-cent zones in one instance.

**Fare Petition Withdrawn.**—The Public Service Commission for the Second District of New York has closed the matter of the petition of the Elmira Water, Light & Railroad Company for permission to increase passenger fares in Elmira. Ross M. Lovell, attorney for the company, filed a letter with the commission withdrawing the petition and asking that the proceeding be dis-



continued. The petition asked authority to increase a 5-cent fare to 6 cents in cities and villages. No special hearing was held on the merits of the Elmira petition, but on April 18, after the decision of the Court of Appeals in the Rochester case, a hearing was held in relation to whether or not there is a franchise limitation in Elmira with respect to the rate of fare to be charged there by the company.

**Fare Conferences in Albany.**—At the conference on May 11 of representatives of the Chambers of Commerce or Boards of Trade of Albany, Rensselaer, Troy, Watervliet, Cohoes, Green Island and Waterford with officials of the United Traction Company negotiations were opened with a view to adjusting the differences that have arisen over the company's new schedule of intercity rates recently filed with the Public Service Commission. It was agreed temporarily to take up the question of 6-cent fares for all communities. In return for this, if the additional 1-cent fare can be instituted, H. B. Weatherwax, representing the United Traction Company, agreed to withdraw the tariffs filed recently imposing 10-cent and 15-cent fares on nearly all interurban trips.

**Atlanta Committee Opposed to Rate Advances.**—The committee of council members and citizens appointed by the City Council to investigate the petition of the Georgia Railway & Power Company, Atlanta, Ga., to the Railroad Commission for increased rates in all departments submitted its initial report to the Council on May 5. After reviewing the capitalization, corporate history and earnings of the company the committee says that the table of earnings which it presents "shows a healthy growth and one that should be wholly satisfactory to those who own and operate the power company." In conclusion it says that "should there be any change in present fares and charges, there should be reduction rather than increases." It recommends that the committee be continued and empowered to take steps to prevent any increases.

**Skip Stop in Preparation at Charleston, S. C.**—Preliminary to inaugurating the skip stop on all its lines, the Charleston Consolidated Railway & Lighting Company, Charleston, S. C., has painted its poles with broad white bands. These poles are spaced as recommended by the Fuel Administration—eight to the mile in the city and six in the suburbs. This means that the suburban practice is practically unchanged, while city stops are cut two or more to the mile. During the winter the company met the request to save fuel by curtailing service, six, eight, nine and ten-minute headways being increased to twelve. This meant five single-truck cars less in city service. The curtailment, however, probably cost the company more than it saved owing to the rapid increase of the riding population in consequence of war activities.

## Personal Mention

A. J. Davies has been appointed general superintendent of the Kansas City-Western Railway, Kansas City, Kan., succeeding J. G. Herrin, who resigned recently. Mr. Herrin had been with the company twenty-five years. He is in ill health.

I. G. Walborn has resigned as electrical engineer of the Eastern Pennsylvania Railways, Pottsville, Pa., to go into the business of scientific farming on a large scale in partnership with his father at Orwigsburg, the ancient county seat of Schuylkill, now the center of a large agricultural district.

F. L. Butler has assumed the position of general superintendent of the Winnipeg (Man.) Electric Railway, succeeding Wilson Phillips, who remains with the company in an advisory capacity. Prior to going to Winnipeg Mr. Butler was general manager of the Chicago & West Towns Railway and the Suburban Railroad, Chicago.

F. W. Arthur has resigned from the Westinghouse Electric & Manufacturing Company, to become superintendent of sales of the Northern Ohio Traction & Light Company at Akron, Ohio. Mr. Arthur has been connected with the Westinghouse Company for seven years in the railway and power department of the Cincinnati office.

George A. Mills has been appointed electrical engineer of the Winnipeg (Man.) Electric Railway. For six years Mr. Mills has been electrical engineer for the Waterloo, Cedar Falls & Northern Railway, Waterloo, Iowa, and while in this capacity installed a system designed to take care of electrolysis. Prior to this he was electrical engineering instructor at the University of Pennsylvania.

Ralph W. E. Donges, president of the Board of Public Utility Commissioners of New Jersey, has been commissioned a lieutenant-colonel in the National Army. Governor Edge of New Jersey has requested Secretary of War Baker to permit the continuance of Mr. Donges' commissionership until pending important rate cases are decided. Lieutenant-Colonel Donges has been a commissioned officer in the New Jersey National Guard for the last seventeen years. He has been a member of the State board since 1913, when he was appointed by Woodrow Wilson, then Governor.

George W. Schmidt has been appointed chief engineer of the Northern Ohio Traction & Light Company's power plant at Akron. Mr. Schmidt began his career in the electrical industry in the mechanical department of the Union Electric Light & Power Company, St. Louis, where he remained for eight years. He was then appointed chief engineer of the power station of

the company and served in that capacity for five and one-half years. Mr. Schmidt resigned from the company in St. Louis on March 1 to become connected with the Northern Ohio Traction & Light Company.

J. E. Hester, formerly general foreman of the car building, repair and painting department of the Union Traction Company of Indiana, Anderson, Ind., has been advanced to the position of acting master mechanic, succeeding M. F. Skouden, who has been appointed acting superintendent of motive power of the company. Mr. Hester entered electric railway work on Sept. 26, 1900, with the Union Traction Company in the carpenter repair department and has been in the service of the company continuously since that time except for two and one-half years he was with the Winona Interurban Railway at Winona Lake, Ind., in charge of the shop at Winona Lake. For the last six years Mr. Hester has been in charge of the woodworking and painting department of the Union Traction Company as general foreman.

W. C. Stockman, who has been acting superintendent of transportation of the Mobile Light & Railroad Company, Mobile, Ala., has been designated as permanent superintendent of transportation of the company. In this position he succeeds W. J. Sherwood, who resigned more than a year ago to become connected with the Motor Bus Company, Chicago, Ill. Mr. Stockman entered railroad work with the Louisville & Nashville Railroad. He went to work for the Mobile Street Railroad in 1892, while that line was still operated with horses, and remained with the company as conductor and later as motorman until 1901, when the Mobile Street Railroad was consolidated with the Mobile Light & Railroad Company. In 1902 Mr. Stockman was appointed inspector for the Mobile Light & Railroad Company, and in 1907 he was made chief inspector, which position he has held until the present time.

## Obituary

Allan H. Royce, vice-president of the Toronto (Ont.) Suburban Railway, is dead. Mr. Royce was a member of the firm of Royce, Henderson & Boyd, barristers, Toronto, and was solicitor for the Toronto Suburban Railway for many years. He was elected secretary-treasurer of the Canadian Street Railway Association at the organization meeting in 1904 and retained the position until July 31, 1907.

# Construction News

Construction News Notes are classified under each heading alphabetically by States.

An asterick (\*) indicates a project not previously reported.

## Recent Incorporation

**\*Emergency Transportation Company, Oakland, Cal.**—Application for a charter has been made by the Emergency Transportation Company to operate street railways either with electricity or any other power, in Oakland, Alameda, Berkeley, Emeryville, San Leandro and Hayward. The incorporators are the following officers of the San Francisco-Oakland Terminal Railways: W. R. Alberger, vice-president and general manager; F. W. Frost, secretary and treasurer; B. W. Fernald, auditor; George H. Harris, general superintendent, and W. H. Smith, attorney.

**\*Colonial Traction Corporation, Williamsburg, Va.**—Incorporated to construct a line from Williamsburg to Yorktown, Newport News, etc., about 50 miles. Capital stock, \$25,000. Officers: William S. Gribble, president, and Lawrence P. Gribble, secretary, both of Williamsburg.

## Franchises

**East St. Louis, Ill.**—The East St. Louis & Suburban Railway has received a franchise from the City Council of East St. Louis to construct a line on Twentieth Street between Ridge Avenue and Henrietta Avenue.

**Baltimore, Md.**—The United Railways & Electric Company has received a franchise from the Anne Arundel County, Commissioners to extend its Curtis Bay line through Fairfield and the surrounding community as far as Wagner's Point. Some of the county roads will be widened as part of the agreement.

**Toronto, Ont.**—The Toronto, Niagara & Western Railway, which proposes to construct an electric line between Toronto and the Canadian-Niagara frontier, via Hamilton, with a branch line along the Canadian shore of Lake Erie between Port Colborne and St. Catharines, Ont., has made application to the railway committee of the city of St. Catharines for permission to extend the time within which to begin construction. Abnormal cost of all railway construction supplies, shortage of labor due to the war, etc., are given as causes for the delay. The municipality has reported favorably on the application and the time has been extended but the date has not been fixed. [Jan. 22, '16.]

**Chester, Pa.**—The City Council of Chester at a special meeting recently called by Mayor McDowell, granted the Philadelphia Rapid Transit Company permission to make the changes asked for in its ordinance to facilitate the transportation of workmen to the munition and shipyard plants in Chester and Eddystone. The ordinance was passed as a war measure and will remain effective during the war and two years after peace is declared. The changes provide for double tracks for a distance in Fourth Street, single tracks in Fourth Street from Morton Avenue to Crosby Street, and in Crosby Street to Third Street, and a double curve at Third and Crosby Streets. The changes are in compliance with a letter received by the Mayor from A. Merritt Taylor, manager of transportation for the Emergency Fleet Corporation.

**Charleston, S. C.**—The City Council of Charleston has granted the Charleston & Summerville Interurban Railway, which proposes to construct a line between Charleston and Summerville, about 22 miles, a one year's extension of time on its franchise in which to make the necessary arrangements to begin construction. J. L. David, Charleston, president. [Nov. 4, '16.]

## Track and Roadway

**Alabama Interurban Corporation, Birmingham, Ala.**—Work will be begun by the Alabama Interurban Corporation within the next sixty days on its proposed line from Birmingham to the Warrior River. The City Council of Bessemer recently granted the company a franchise over some of the principal streets, and at that time 90 per cent of the right-of-way and terminals at Warrior River had been secured. Thomas L. Cannon, Birmingham, president. [April 13, '18.]

**Calgary (Alta.) Municipal Railway.**—It is reported that the Calgary Municipal Railway has awarded a contract to the Birnie Lumber Company for the supply of 10,000 ties for replacement.

**United Railroads of San Francisco, San Francisco, Cal.**—The Railroad Commission of the State of California has granted permission to the United Railroads of San Francisco to use \$170,900 of the moneys deposited in its depreciation fund to pay for the construction of the Army Street line and other improvements.

**Pensacola (Fla.) Electric Company.**—The Pensacola Electric Company has made application to the War Finance Board for financial assistance in extensive improvements which the company is planning relating to the Bay-

shore line, additions to the power plant and the purchase of new equipment in order to meet the needs of the army and navy and shipbuilding plants.

**Detroit (Mich.) United Railway.**—Active work was resumed recently by the Detroit United Railway on the construction of a double-track line on Linwood Avenue from Ferry Park Avenue to Joy Road. It is expected that the line will be ready for operation this summer.

**Kansas City (Mo.) Railways.**—The directors of the Kansas City Railways have approved the construction of a double-track extension from Prospect Avenue west to Troost Avenue, with provision for a single track on Twenty-seventh Street from Troost Avenue west to Main Street. This single track would be used in conjunction with a single track already laid on Twenty-fifth Street. Owing to war conditions, the times for building the line was left indefinite.

**Public Service Railway, Newark, N. J.**—The Board of Public Utility Commissioners has issued an order directing the Public Service Railway to make various repairs to property and equipment on the Union line and the Newark and Elizabeth line and directed that the service be otherwise improved. The board gave the company until Sept. 1 to make certain specified repairs to its tracks in North Broad Street, Broad Street, East Grand Street, Smith and East Jersey Street.

**Trenton & Mercer County Traction Corporation, Trenton, N. J.**—Improvements have been begun by the Trenton & Mercer County Traction Corporation on its lines in the West State Street section, as well as on the Princeton, Lawrenceville, Pennington, Hopewell and Yardville divisions.

**New York Municipal Railway, Brooklyn, N. Y.**—The Public Service Commission for the First District has under consideration the awarding of a contract to the Bethlehem Steel Bridge Corporation, the lowest bidder, for furnishing and erecting the steel for Section 3 of Route 49, being that portion of the Culver Rapid Transit Railroad between Avenue X and Coney Island. The commission on May 21 will receive bids for the construction of column foundations in connection with the above contract. The commission has awarded to Holbrook, Cabot & Rollins and G. W. McNulty, jointly, the lowest bidders, at \$600,134, the contract for the installation of tracks on the Flatbush Avenue and Eastern Parkway subway line in Brooklyn, on the Nostrand Avenue branch of the same line and also on the Brighton Beach connection in Flatbush Avenue and St. Felix Street. The commission is also advertising for the receipt of bids for a supply of broken stone to be used as ballast on new rapid transit lines. This bid, will be received at the commission's new offices, 49 Lafayette Street, on May 21.

**Corning & Painted Post Street Railway, Corning, N. Y.**—An extension will

be built by the Corning & Painted Post Street Railway to North Corning, provided the city will amend the franchise granted the company so as to permit the building and maintenance of the line on the same basis that the company built and now maintains and operates its main line, and providing the city will permit express packages and freight to be carried in and out of the city on trolley cars.

**New York & Queens County Railway, New York, N. Y.**—The Public Service Commission for the First District of New York approving an opinion by Commissioner Charles Buckley Hubbell, has issued an order permitting the New York & Queens County Railway to suspend for two years longer, from July 29, 1917, to July 29, 1919, the operation of cars across the Flushing Meadows between Summit Avenue and Jackson Avenue during the period required for filling in the meadows and changing the grade thereof. The commission granted a similar application on July 29, 1915, for a period of two years. Inasmuch as the filling in of the meadows was not completed within the two years specified in the previous order, an extension has been granted.

**Tidewater Power Company, Wilmington, N. C.**—Construction has been begun by the Tidewater Power Company on an extension about 1 mile long to the new shipyard plant.

**Sapulpa (Okla.) Electric Interurban Company.**—The Corporation Commission of Oklahoma has sustained the contention of the Sapulpa Electric Interurban Company of its right to take up 1 mile of its track in the city of Sapulpa to provide steel for an extension from Sapulpa to Tulsa. The company, finding it difficult to get new steel for the construction of the Tulsa line, some time ago started to take up a mile of its track, but was asked to delay until the matter could be considered by the Corporation Commission. The company maintained that a better purpose could be served by the steel in the Tulsa-Sapulpa interurban, than for local traffic, and the commission sustained this contention.

**Brantford (Ont.) Municipal Railway.**—The construction of an extension to the Terrace Hill district is being contemplated by the Brantford Municipal Railway.

**Grand River Railway, Galt, Ont.**—It is reported that the tracks of the Grand River Railway along the river in Hespeler will be relocated. Surveys are said to have been completed which will do away with a number of curves and give a practically straight route.

**Nipissing Central Railway, North Cobalt, Ont.**—Application has been made by the Nipissing Central Railway to the Dominion Parliament for a five-years' extension of time within which it may build a line from Latchford, Ont., to the Grand Trunk Pacific Railway near the Matagami River, Que.; from Latchford along the Montreal River, to the Grand Trunk Pacific Rail-

way in Ontario; from Latchford southerly to Timagami station; an extension of the present line from Liskeard westerly to meet the last mentioned line; a line from Liskeard to Charlton; a line from the first mentioned line, starting at Wendego Lake, westerly to the Temiskaming & Northern Ontario Railway, and a branch line from the first mentioned line, starting in Casey Township to North Temiskaming, on the Des Quinze River.

**Toronto, Ont.**—A petition has been made to the Ontario Railway Board to suspend the order for the construction of the Pape Avenue extension by the Toronto Railway in order that the rails may be used in building the municipal line over the Bloor Street Viaduct, which is regarded as a more important work at the present time. The application was made jointly by Works Commissioner Harris and Assistant City Solicitor Fairty, acting for the city, and F. L. Hubbard acting for the Toronto Railway.

**Cumberland Valley Railroad, Chambersburg, Pa.**—Several trial trips have been made with a storage battery car on the lines of the Cumberland Valley Railroad between Mechanicsburg and Dillsburg.

**Dallas (Tex.) Railway.**—Work has been begun by the Dallas Railway on the construction of a line on Second Avenue. After the tracks have been laid on Second Avenue those on Exposition Avenue will be removed and the terminals at the entrance to Fair Park will be rearranged. When the Second Avenue line is opened for operation it will be combined with the present North Loop line, forming a crosstown service from the city limits on Second Avenue to Jefferson Avenue and Tyler Street in Oak Cliff. With the removal of the tracks on Exposition Avenue, Gaston Park will be made part of Fair Park, and the added property will be used for quartering the cadets and officers at Camp Dick during the State Fair next fall.

**\*Tacoma, Wash.**—It is reported that the construction of an electric railway between Tacoma and Camp Lewis is being contemplated. Jay W. McCune, Traffic and Transportation Bureau, may give information.

## Shops and Buildings

**Pacific Electric Railway, Los Angeles, Cal.**—Work will be begun at once by the Pacific Electric Railway on the construction of a new station at San Pedro.

**Lehigh Valley Transit Company, Allentown, Pa.**—A contract has recently been awarded by the Lehigh Valley Transit Company to Robert S. Rathbun, Bethlehem, for the construction of a new one-story freight house, about 60 ft. x 75 ft., to be located in the South Side section of Bethlehem. It is estimated that the proposed new structure will cost about \$10,000.

## Power Houses and Substations

**Pacific Electric Railway, Los Angeles, Cal.**—A contract has recently been awarded by the Pacific Electric Railway to Houghton & Anderson, Los Angeles, for the construction of a brick substation, about 35 ft. x 45 ft., to be located in the Wilmington district.

**Wilmington & Philadelphia Traction Company, Wilmington, Del.**—The Levy Court of Wilmington has granted the Wilmington & Philadelphia Traction Company, perpetual permission to erect and maintain poles and wires for electric light and power in New Castle. John F. Neary, attorney for the company, stated that the purpose is to maintain a high-tension line from the electric plant in the city to the Baldt steel plant at New Castle. He said the Wilmington City Electric Company had the authority, but did not have the necessary funds, and the Wilmington & Philadelphia Traction Company would provide the funds.

**United Light & Railways Company, Grand Rapids, Mich.**—Work is under way on the installation of a 22,500-kw. turbine at the Moline, Ill., power house of the United Light & Railways Company.

**Manchester Traction, Light & Power Company, Manchester, N. H.**—The Manchester Traction, Light & Power Company has completed its dam on the Piscataquog River at Gregg's Falls. Two generators of 1500 kw. each will be installed in the new power station. Electricity will be transmitted at 33,000 volts to the Kelley's Falls station. The main generating room of the power station, not yet completed, will be 85 ft. by 40 ft.; the transformer room will be 25 ft. by 74 ft., and will be equipped with three transformers, each having a rating of 1250 kva. A permit has been granted to the Manchester Traction, Light & Power Company for the purpose of erecting a boiler house near Mast Street.

**Interborough Rapid Transit Company, New York, N. Y.**—A new one-story transformer station is being built by the Interborough Rapid Transit Company at 154 West Sixteenth Street, to cost about \$40,000.

**Puget Sound Traction, Light & Power Company, Seattle, Wash.**—An addition will be built by the Puget Sound Traction, Light & Power Company to its power house at Fourteenth Street, South, to cost about \$30,000.

**Washington Water Power Company, Spokane, Wash.**—Application has been filed by the Washington Water Power Company for permission to construct a reservoir and store unappropriated waters of the Baker River, to the amount of 30,000 acre-feet, to be used for power development. The cost of the proposed project is estimated at about \$1,000,000.

# Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS

FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES • MARKET QUOTATIONS • BUSINESS ANNOUNCEMENTS

## Increasing Cost of Railway Operation and Equipment

Review of the Market from a South-eastern Standpoint—Advances in Cost of Material

Although the price of a few basic metals has dropped off slightly the general tendency is upwards, covering all commodities used in electric railway operation in the Southeast, as well as other sections of the country. Operating ratios are increasing with the continued and growing high price levels on materials, and the margins of net incomes are lessening each day, especially where no relief has been forthcoming through increased fares. Sheet brass, copper wire, aluminum and quicksilver prices for 1917 showed a decline over 1916, and 1918 quotations are holding close to the high marks of the past year. It is expected that the ever-soaring enhancement of cotton fabrics will be reflected in an expansion of insulated wire prices. Lightning arresters are up about 50 per cent over pre-war figures, a slight increase being recorded in the last six months. Hangers, ears, rail bonds and trolley wheels show little change for the last six months, closely following the basic metal market.

While air-brake equipment is up 75 to 100 per cent over normal, there has been no perceptible change lately to record. What can be said regarding air brakes holds true as well for motors, controllers and car cable. Very little second-hand apparatus is offered, but even transactions in this line are bringing unheard of figures. Quotations on rotaries remain firm, and no material variation has been observed since the 1916 advance, which was 40 to 50 per cent above normal. Transformers and associated equipment have enhanced somewhere in the neighborhood of 20 per cent in the last twelve months, and rumors are afloat that this class of apparatus is due for a further increase shortly. Since the war transformers have advanced 75 per cent and as much as 100 per cent in isolated cases. With regard to price changes armature coils can be put in the same class as transformers, with the exception that they have advanced only 10 per cent in the last year. Iron wire is up 33 per cent over early 1917 quotations.

A comparison of 1918 quotations with those of early 1917 indicates an average increase of 53 per cent on the following metals: foundry pig iron, sheet and steel bars, steel plates and shapes, spikes, cold-rolled shafting, rivets, common and refined bar iron, galvanized and black sheets and nails. It appears that the limit has not been

reached in the prices of axles and forgings, even though they have advanced more than 300 per cent over pre-war quotations. Car wheels are comparatively steady. Cross ties, chestnut and pine poles continue to advance.

## Pneumatic Door Control Growing in Favor

Adopted by Leading Railways—Ease of Operation for Women Conductors—Use on One-Man Cars

With the advent of women in ever-increasing numbers as conductors on electric cars, devices that contribute to ease of operation of cars are finding a wider market and readier sale. An illustration of this is furnished by air door engines, as they are described by one manufacturer; and pneumatic door and step control by another. Both of these mechanical improvements have been illustrated and given detailed treatment in the *ELECTRIC RAILWAY JOURNAL*. The engines or controls save in energy consumption, because stops are shortened through faster opening and closing of doors. Where women are employed on one-man cars the closing or opening of heavy car doors and the dropping or raising of weighty steps by mechanical means is being seriously considered.

Because one important Eastern road had placed 250 pneumatic engines on its subway cars, the employment of women guards has proved easy. The same company also has 100 surface cars so equipped and operated largely by women conductors. Simply by touching a push button the door engine, which can be adjusted for any speed of travel desired, is operated without the slightest physical effort. As further proof of their utility and popularity, these door controls or engines are being introduced on the leading traction systems all over the country.

In Washington, D. C., the new cars ordered are so equipped, and much of the old rolling stock is being rebuilt for the installation of the door control devices. Kansas City and companies in the South have recognized their worth and convenience and have placed orders for early delivery. And furthermore, the manufacturers declare shipments are ready whenever the car builders want them.

During a year there has been an advance in price of about 35 per cent due to natural conditions, but no further increase is anticipated unless scarcity of labor should impose conditions not now considered in the reckoning.

## Supply of Wood Handles for Tools Short

Curtailed of Production With Government Requirements Causing Sharp Advances

A shortage of wood handles for railway picks, shovels, hammers, sledges, axes, hatchets and all kinds of tools in this line is very acute, and manufacturers and jobbers are unable to get adequate stocks. The government is in the market for all the available hickory timber, for use in aeroplane and other construction, and also for larger quantities of ash timber, such as used in making handles for tools and implements. Some manufacturers of picks, shovels and handle tools are said to be held back in production because of their inability to get wood handles.

Stocks are in a very broken condition. At the same time the heavy operating expense has compelled many small handle factories to suspend operations. The heavy snows of last winter prevented the handle concerns from getting out the usual supply of timber and from hauling much that was cut. The government is also buying heavily of shovels and spades, which is further restricting the supply for commercial use. It is doubtful if the situation will show any improvement this summer.

### PRICE SITUATION

Prices are continually advancing. Pick, shovel, hammer and other hardwood tool handles are up again, while the shortage of mill shipments still continues. No particular item is affected, but all seem to be in about the same condition. A distributor handling a heavy business said he would be compelled to place an order for shovels at once, in view of the handle situation, if he wanted delivery by Oct. 15. Permits for carload shipments of different tool handles are given gingerly, and often after they are awarded the goods must be made.

The appended are jobbers' prices on hardwood handles: A. E. hammer handles, at \$1 per dozen; black hammer handles, 16-in., \$1 per dozen; 18-in., \$1.15 per dozen; machine hammer handles—14-in., \$1 per dozen; 18-in., \$1.25 per dozen; machine handles—14-in., 60 cents per dozen; 16-in., 65 cents per dozen; sledge handles—\$3 per dozen; 36-in., \$3.50 per dozen; extra 30-in. sledge handles, \$1.80 per dozen; extra railroad pick handles, \$3.25 per dozen; No. 1, \$2.60 per dozen; No. 2, \$2 per dozen; D handle, shovel, are 35 per cent from standard list.

## Traction Railway Credits Not Impaired

**Manufacturers and Supply Firms Report No Weakness Evident and Settlements Fairly Prompt**

No impairment of credit standing is reported in connection with the accounts of the traction railway companies. It was surmised that possibly a softening of conditions, due to reduced incomes, would have an effect in the buying capacity and credit rating of the electric roads. Diligent inquiry among the credit departments of leading manufacturers and sales agencies of equipment and accessories failed to reveal other than a very satisfactory state of affairs in the Eastern district.

Rail mills, which carry large accounts for traction properties, declare there is no change in the standardization of credits. No extra time is asked, nor are more notes negotiated by buyers. There is no great activity in rolling steel for rails, and none for stock accumulation. The market is therefore firm and comparatively short. Prices are f.o.b. mill at time of shipment and at the convenience of the shipper. Terms are 2 per cent ten days, but from twenty-five to thirty days are sometimes taken, with no objection on the part of the seller.

Where a miscellaneous account is in question settlements are made in thirty days, but occasionally the time is stretched to sixty and ninety days. A great many bills are cleared through the supply houses, but no complaints of delinquency are mentioned, other than that some companies, which are perfectly sound and safe, are naturally slow pay. It is their habit, though none of the credit men are inclined to have it emulated. Again, where thirty to sixty days is the rule, some debtors are letting it run to ninety and 120 days. These, however, are exceptions. It is generally admitted that the delays in the delivery of goods are responsible in a great many instances for slow or dilatory settlements. As was distinctly stated, no one could reasonably expect a buyer to pay for merchandise until it is received with the additional thirty days allowable from date of delivery for a chance to realize.

## Firm Market on Railway Hardware

**Orders Are Subject to Mill Acceptance and Shipping Convenience—Plants Are Running to Capacity**

Electric railway shops, accustomed to buying material in suitable quantities for reserve stock, are inclined to purchase in a hand-to-mouth way now, according to sales managers of supply houses as well as manufacturers. Spikes, tie plates, tie rods, fish and angle plates, angle bars, rail bolts and nuts, with few exceptions, are quoted on the government price base, f.o.b. mill, orders subject to mill acceptance

and shipment at its convenience. The usual practice, in order to obtain a favorable price, is to buy spikes in car lots, though quantities less than 200 kegs, with an advance of \$1 a hundred-weight, are by no means unknown. The market quotations are customarily made by the pound, minimum quantities named when specifications are supplied. Prices practically are stationary, with no recent change.

Manufacturers of nuts and bolts, as well as tie and fish plates, tie rods, angle plates and bars are now running their mills to full capacity and are turning over 100 per cent of their output to the government. This will likely last for sixty days or more, and, in the meantime, commercial consumers will have to get along as best they can. The general demand for some months has been very quiet, with stocks held by jobbers and dealers low. The gov-

ernment figures will be effective until June 30.

With railways always carrying sufficient supplies for current needs, the jobber and even the retailer is occasionally called upon for an emergency order. As a rule, however, jobbers do not find it profitable to carry much of a stock of the above-mentioned items. Traction roads for quite a period have wanted to buy as close as possible by going direct to the manufacturer. To this practice jobbing houses have raised no objection and consequently they are secondary factors in the business.

Deliveries range from two to three, six and eight months. One prominent house, which termed the present a seller's market, said on certain articles he would be obliged to place an order now so as to insure October delivery. The shipment is doubtful.

## Rolling Stock

Lehigh Valley Transit Company, Allentown, Pa., has asked for specifications and prices on four new cars of the interurban type.

Nipissing Central Railway, North Cobalt, Ont., Canada, is contemplating buying two car bodies.

McComb & Magnolia Light & Railway Company, McComb, Miss., will purchase two passenger cars in the near future.

Hull Electric Company, Hull, Que., Canada, has ordered one double-truck steel sweeper, 46 ft. long over all, equipped with brooms and plows for double-end operation, from the Ottawa Car Manufacturing Company.

Galt River Railway, Galt, Ont., Can., had an oil stove explosion in one of its electric locomotives while in the yards of the Canadian Pacific Railroad at Galt, practically destroying it. The locomotive will be rebuilt.

Shore Line Electric Railway, Norwich, Conn., in conjunction with the Worcester (Mass.) Consolidated Street Railway, is reported as about to construct six trailers. They are to be operated between Worcester and New London, Conn.

Charleston Consolidated Railway & Lighting Company, Charleston, S. C., has placed a contract with the Cincinnati Car Company for sixteen double-truck cars, six with motors and ten to be trailers. Also ten smaller cars of thirty-five-passenger capacity.

Manila Electric Railroad & Light Corporation, Manila, P. I., mentioned in the ELECTRIC RAILWAY JOURNAL of May 4 as contemplating the purchase of fifteen new cars, will have them built in their own shops in Manila. The motors and other equipment will be purchased in the United States. The last cars built for the Manila property, controlled by the J. G. White Management Corporation of New York, were built by the J. G. Brill Company.

Boston (Mass.) Elevated Railway is asking for bids on 300 new cars, 200 motor cars of the general design of which are to be center-entrance, the latest units of this type in service on the road; and 100 of which are to be center-entrance trail cars, also of standard type for Boston operation. Specifications have been completed for bodies and will probably be ready soon for motors and electrical equipment. New trucks and air-brake with accessory apparatus, will be required for this rolling stock.

New York State Railways (Syracuse Lines), Syracuse, N. Y., having ordered twenty-five new cars from the J. G. Brill Company, furnishes the following specifications:

Number of cars ordered.....	25
Name of road.....	New York State Railways, Syracuse Lines
Builder of car body.....	J. G. Brill Co.
Type of car.....	Front-entrance, center-exit
Seating capacity.....	51
Weight (total).....	35,000 lb.
Bolster centers, length.....	25 ft. 0 in.
Length over bumpers.....	47 ft. 7 in.
Length over vestibule.....	46 ft. 7 in.
Width over all.....	8 ft. 2 in.
Height, rail to trolley base.....	10 ft. 9 1/2 in.
Body.....	Semi-steel
Interior trim.....	Natural cherry
Headlining.....	Agasote
Roof.....	arch
Air brakes.....	Westinghouse
Axles.....	Laclede Steel Co.
Bumpers.....	Brill Car trimmings
Conduits and junction boxes.....	Bronze
Control, type.....	Westinghouse H. L. D.
Couplers.....	Tomlinson Car & Air
Designation signs.....	Hunter
Door operating mechanism.....	National
Fare boxes.....	Pneumatic Co.
Fenders or wheelguards.....	Johnson
Gears and pinions.....	Eclipse
Hand brakes.....	Tool Steel
Heaters.....	National Brake Co.
Headlights.....	Peter Smith forced ventilation
Journal boxes.....	Crouse-Hinds
Lightning arresters.....	Brill
Motors.....	Westinghouse
Paint, varnish or enamel.....	Four Westinghouse 506A, inside hung
Registers.....	F. & C. Simplex system
Sanders.....	International R-10
Sash fixtures.....	Ohio Brass Air
Seats, style.....	Brill
Seating material.....	Hale & Kiburn
Step treads.....	Cane
Trolley catchers or retrievers.....	Feralun
Trolley base.....	Earl retrievers
Trolley wheels or shoes.....	Ohio Brass Co.
Trucks, type.....	Star Brass Works
Ventilators.....	Brill No. 67 F
Wheels (type and size).....	Automatic Ventilator Co. 26-in. cast iron

**Trade Notes**

Larkin G. Mead, successor to Curran & Mead, New York, will remove his offices on June 1, 1918, from 55 Park Row to 110 West Fortieth Street.

The Electric Service Supplies Company has secured larger quarters in the Hudson Terminal Building, 50 Church Street, New York, N. Y., and is now occupying rooms 1771 and 1773.

Smith-Ward Brake Company, Brooklyn, N. Y., asks this paper to say that Herbert M. Weaver left its employ in August, 1915, and is not in any way connected with the company.

The Consolidated Car Heating Company has changed its offices in the Singer Building, New York City, from 2609 and 2610 to 1814 and 1815, where better quarters are secured.

C. F. Gailor, president and director of the Atlantic Welding Company, New York, since its incorporation in June, 1917, has resigned to accept a commission in the government service and will report in Washington immediately.

Brooklyn (N. Y.) Rapid Transit Company calls attention to the note appearing in the ELECTRIC RAILWAY JOURNAL of April 27 regarding an order for ventilators in connection with its recent purchase of fifty new center-entrance trail cars. The company says that it does not intend to use any type of automatic ventilators on these cars.

Bound Brook (N. J.) Oil-Less Bearing Company announce that after May

15, 1918, its Western office will be located at room 1723 Ford Building, Detroit, Mich. They were formerly located at 308 Moffat Building. This office is in charge of Harry J. Lindsley, Western sales manager.

Economy Electric Devices Company, Chicago, reports that it has received an order from the Galesburg & Kewanee Electric Railway, Kewanee, Ill., for Sangamo economy watt-hour meters for all of its cars. The Dubuque (Ia.) Electric Company has also ordered the economy meters for all of its active cars as the result of a service test.

D. C. & William B. Jackson, engineers, Boston and Chicago, announced that on account of two members of the firm having gone into the national service, and the third member expecting to do so as soon as practicable, they will close their offices and suspend business for the duration of the war as soon as the various pieces of work with which they are now occupied can be completed. They expect to resume business after the conclusion of the war.

E. E. Maher has been appointed by the Terry Steam Turbine Company, Hartford, Conn., manager for the Chicago district, with offices at 1328-29 McCormick Building, 322 South Michigan Avenue. John D. Stout has become manager of the New York office of the Terry company in charge of that district, with the exception of navy and marine installations which will now be handled by Mr. Herbert. Mr. Stout will now devote his entire time to navy and marine requirements.

**New Advertising Literature**

Buffalo Forge Company, Buffalo, N. Y.: An illustrated catalog describing the company's portable forges.

General Electric Company, Schenectady, N. Y.: Indexes to descriptive bulletins and sheets and also index of supply part bulletins.

Boone Scrymser Company, New York, N. Y.: Turbo machine oil as advertised in a circular being distributed by the company.

Link-Belt Company, Philadelphia, Pa.: Book No. 312 describing the Link-Belt silent chain drive for operating machine tools. The bulletin is profusely illustrated.

Mitchell-Rand Manufacturing Company, New York, N. Y.: One of the most comprehensive catalogs in this line recently distributed by the company entitled "Everything in Insulation." Not only are the many forms of insulation illustrated, but a detailed description is given of the treatment of the raw material, through the various process stages until the finished article is reached. Various tables of value to those interested in the meaning, purpose and application of these specialties are furnished, with carefully prepared chapters by an expert on insulating paints and varnishes, waxes and compounds. The cross-index gives additional value to this very complete publication, copies of which may be obtained free on application to the company.

**NEW YORK METAL MARKET PRICES**

	May 8	May 15
Copper, ingots, cents per lb.	23½	23½
Copper wire base, cents per lb.	26½ to 26¾	26½ to 26¾
Lead, cents per lb.	6.02½	6.90
Nickel, cents per lb.	50	50
Spelter, cents per lb.	7.32½	7.37½
Tin, Straits, cents per lb.	\$1.00	\$1.05
Aluminum, 98 to 99 per cent., cents per lb.	†32.10	†32.10

† Government price in 50-ton lots, f.o.b. plant.

**OLD METAL PRICES—NEW YORK**

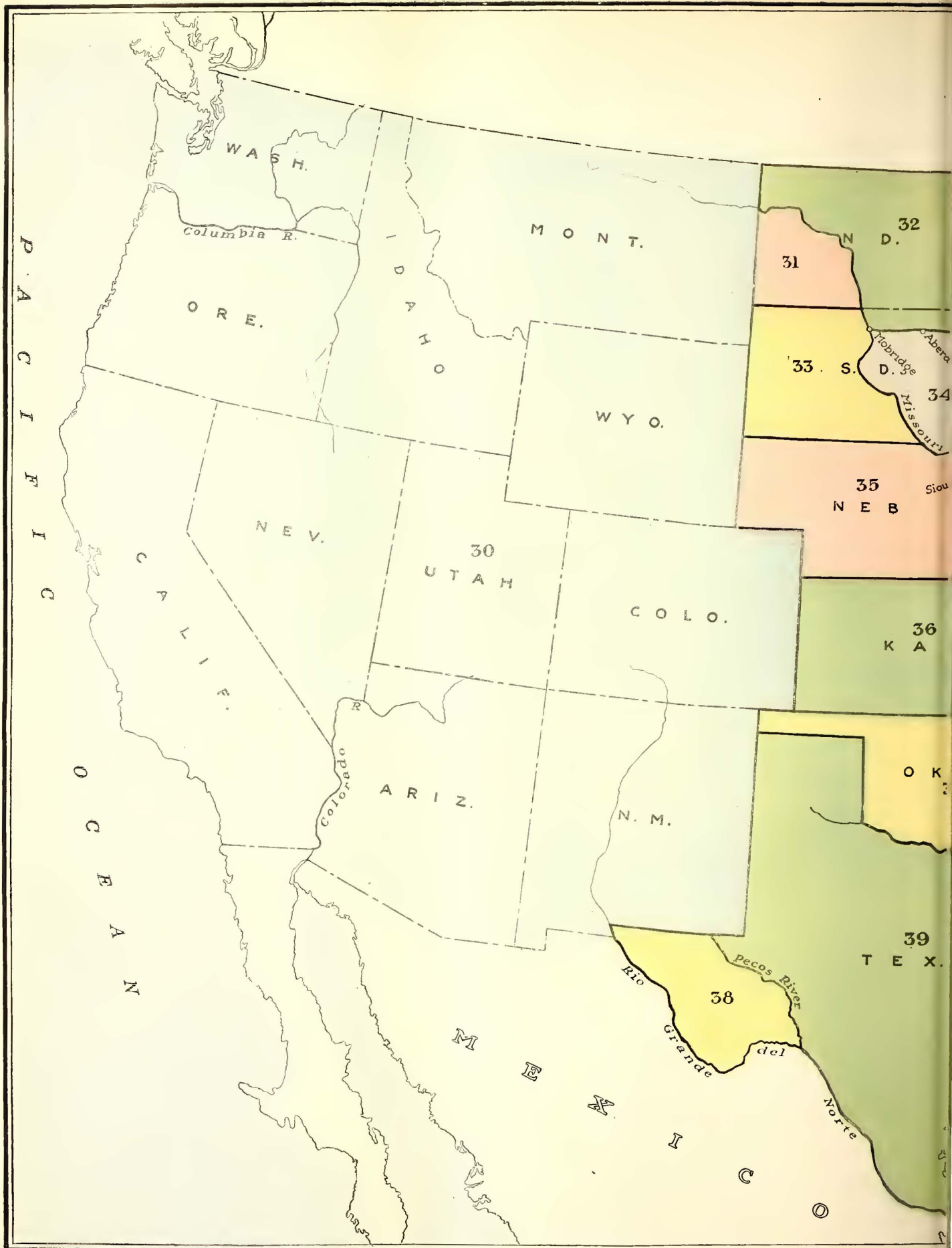
	May 8	May 15
Heavy copper, cents per lb.	22	22
Light copper, cents per lb.	19½	19½
Red brass, cents per lb.	18	18
Yellow brass, cents per lb.	13	13
Lead, heavy, cents per lb.	6½	6
Zinc, cents per lb.	5½	5½
Steel car axles, Chicago, per net ton.	\$41.52	\$41.52
Old carwheels, Chicago, per gross ton.	\$29.00	\$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.	\$16.00	\$16.00

**ELECTRIC RAILWAY MATERIAL PRICES**

	May 8	May 15		May 8	May 15
Rubber-covered wire base, New York, cents per lb.	27 to 30	27 to 34	Galvanized wire, ordinary, Pittsburgh, cents per lb.	3.95	3.95
Weatherproof wire (100 lb. lots), cents per lb., New York	30.40 to 34½	30.40 to 34½	Car window glass (single strength), first three brackets, A quality, New York, discount, F. O. B. factory.	80% to 82-3%	80%
Weatherproof wire (100 lb. lots), cents per lb., Chicago	33.42 to 38.35	33.42 to 38.35	Car window glass (single strength), first three brackets, B quality, New York, discount, F. O. B. factory.	79%	80%
T-rails (A. S. C. E. standard), per gross ton.	\$70.00 to \$80.00	\$70.00 to \$80.00	Car window glass (double strength), all sizes A quality, New York, discount, F. O. B. factory.	80%	82-3%
T-rails (A. S. C. E. standard), 500-ton lots, per gross ton.		\$60.00	Waste, wool (according to grade), cents per lb.	11½ to 22	11½ to 22
T-rails, high (Shanghai), cents per lb.	4½	4½	Waste, cotton (100 lb. bale), cents per lb.	13 to 13½	13 to 13½
Rails, girder (grooved), cents per lb.	4½	4½	Asphalt, hot (150 tons minimum), per ton delivered.	\$38.00	\$38.00
Wire nails, Pittsburgh, cents per lb.	3½	3½	Asphalt, cold (150 tons minimum, pkgs. weighed in, F. O. B. plant, Maurer, N. J.), per ton.	\$42.00	\$42.00
Railroad spikes, drive, Pittsburgh base, cents per lb.	4½	4½	Asphalt filler, per ton.	\$45.00	\$45.00
Railroad spikes, screw, Pittsburgh base, cents per lb.		8	Cement (truckload lots), New York, per bbl.	\$2.65	\$3.20
Tie plates (flat type), cents per lb.	*3½	*3½	Cement (carload lots), Chicago, per bbl.	\$2.71	\$3.26
Tie plates (brace type), cents per lb.	*3½	*3½	Cement (carload lots), Seattle, per bbl.	\$3.05	\$3.60
Tie rods, Pittsburgh base, cents per lb.	7	7	Linseed oil (raw, 5 bbl. lots), New York, per gal.	\$1.59	\$1.59
Fish plates, cents per lb.	*3½	*3½	Linseed oil (boiled, 5 bbl. lots), New York, per gal.	\$1.60	\$1.62
Angle plates, cents per lb.	*3½	*3½	White lead (100 lb. keg), New York, cents per lb.	10	10
Angle bars, cents per lb.	*3½	*3½	Turpentine (bbl. lots), New York, cents per gal.	44½	42½
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			

\* Government price.

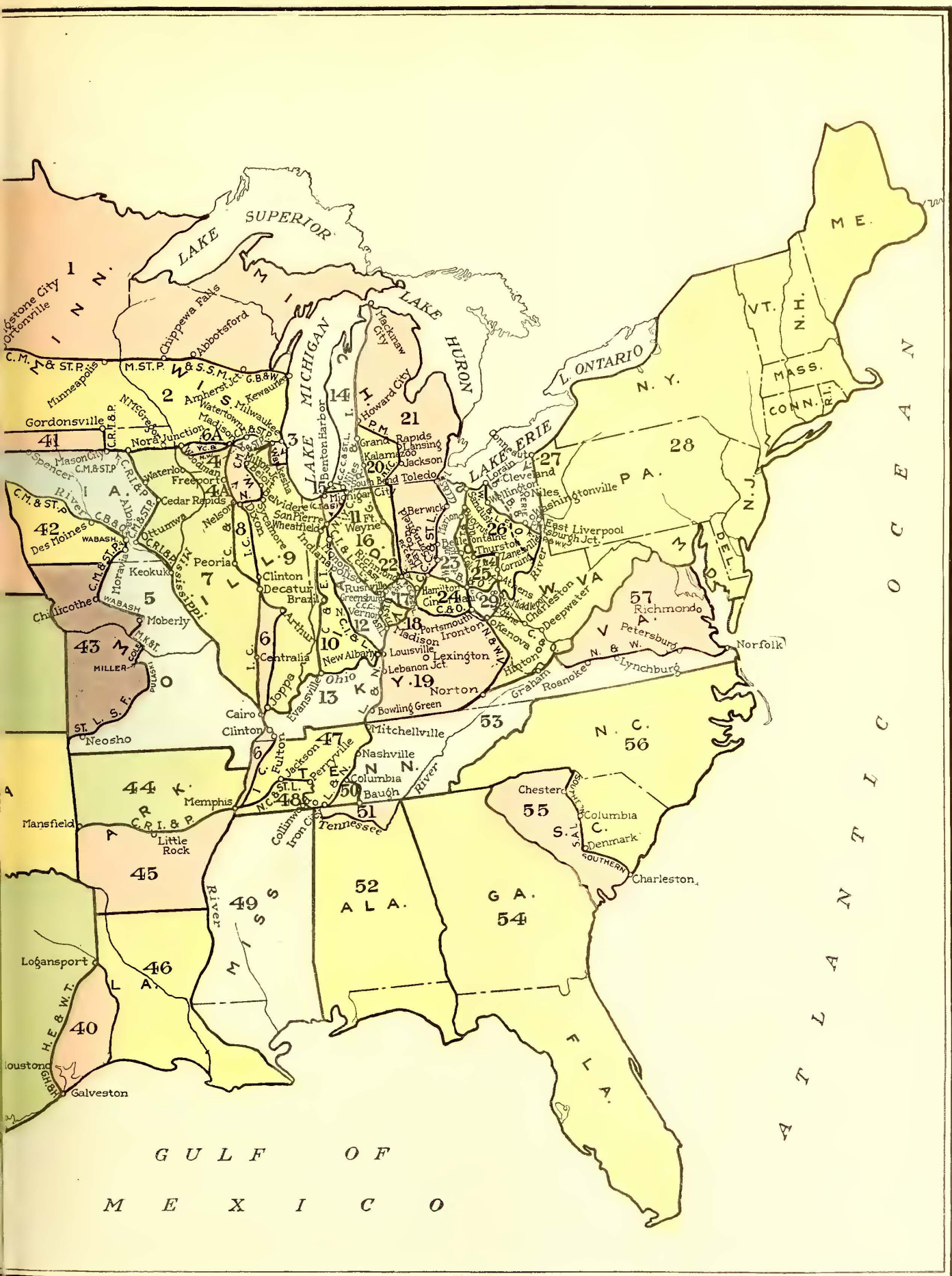




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Map Showing Districts in Which Co

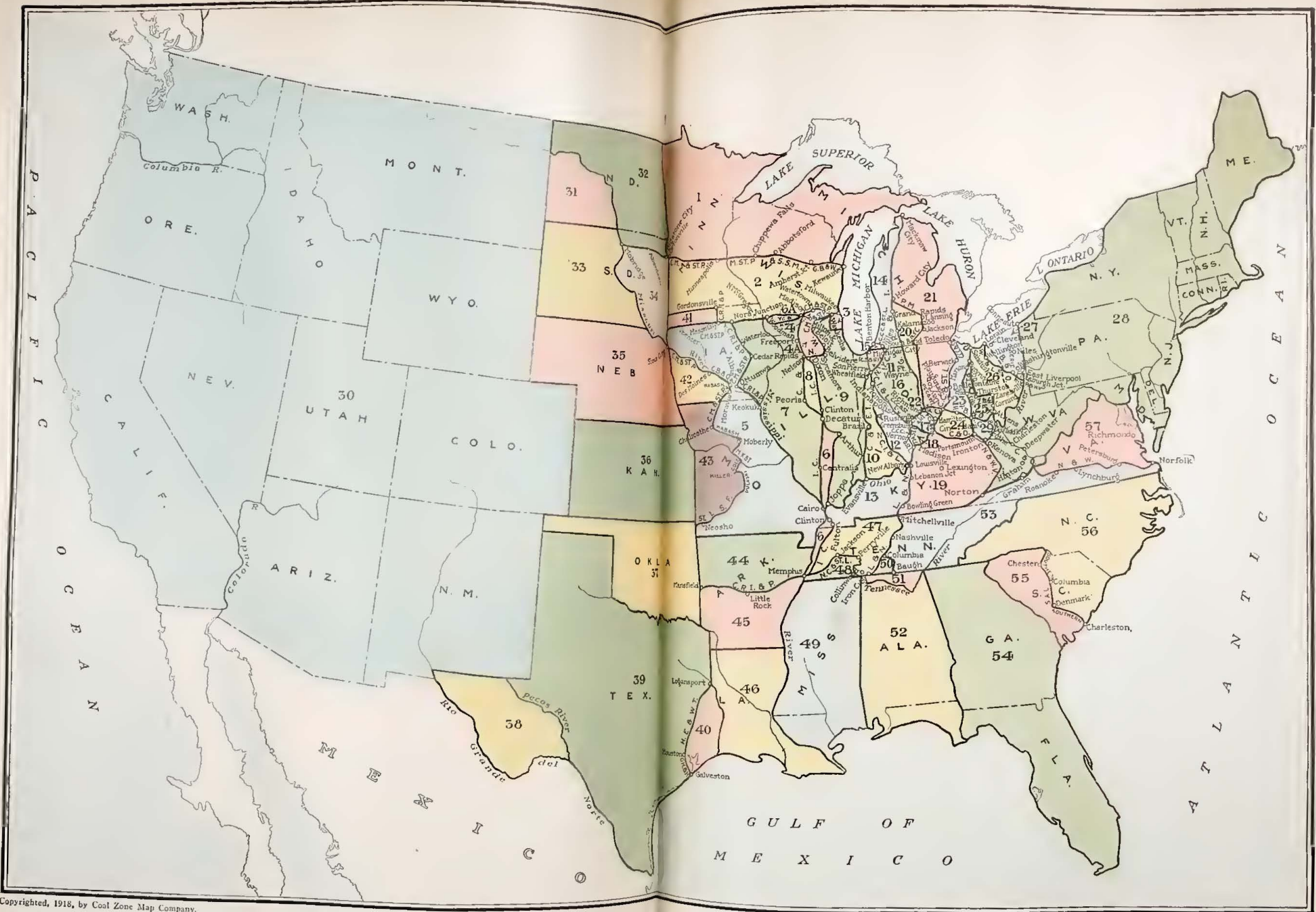




From Various Sources Is Available

Supplement to Electric Railway Journal, May 18, 1918





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Map Showing Districts in Which Coal From Various Sources Is Available

