Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

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Association Standards Are Gaining a Foothold

THERE are good reasons for the belief that the American Association standards are gaining in use and popularity. As evidence of this, a recent visit by the writer to a large plant where special trackwork is manufactured disclosed the fact that the association standard girder guard rails are being specified for the major portion of the current orders passing through the plant. Incidentally, it was noted that the 7-in., 140-lb. section predominated.

Our talks with manufacturers representing other lines indicate that a similar situation exists with respect to the use of many other standards which bear the approval of the association. The long-standing tendency toward individual design seems, at last, to be giving way to the publicity which has been given to the standards. With this foothold gained in the strongholds of "personality" and "local conditions," the association should quicken its efforts to sell its standards to the industry, and the aid of the manufacturers should be asked to a greater degree. They should be reminded that their catalogs and advertisements should place emphasis upon every product which bears the approval of the association. There should be no let-up in the campaign of education which the committee on standards organized at last year's convention to advertise and popularize the several standards of the association.

"Count Ten. You're Blowing Up"

AS a maker of phrases Mr. Curran, president of the Borough of Manhattan, New York, is getting quite a reputation. In the early stages of the New York investigation Mr. Curran remained quiescent. As the investigation continued on its interminable way the thing began to get under Mr. Curran's skin. One day he arose and wrote himself down in local history by saying, "While the Mayor talks, the people walk." More recently in the traction inquiry he suggested to one of his fellows on the board that the alderman "Count ten. You're blowing up."

These are not weasel words. We know some people not in public life who could afford to count ten occasionally. One such is the manager of an electric railway who said in a newspaper interview that it was no further from the Mayor's office to the general manager's office than it was from the manager's office to the Mayor's. Of course, things which are the same distance apart are equally distant from each other. The Mayor to whom this quip was addressed probably didn't know the difference between Euclid and Mary Garden. Mayors don't have to be discriminating; managers do.

The manager's statement was foolish. It was not foolish because it was a fact, but because it was a fact it was foolish. That, perhaps, sounds Shavian, but it is not so Shavian as it sounds. The manager's act was courageous but foolhardy. The Mayor didn't count ten. He didn't have to.

Mr. Curran's advice is like that given by old Gorgon Graham. Summed up, old man Graham said that when you're in the right you can afford to keep your head and when you're in the wrong you can't afford to lose it. It would pay some electric railway men as well as others to paste this truism in their hats for reference. A man may be right in the convictions which he holds, but his attitude may be wrong. Count ten, gentle reader. You, too, may be blowing up.

Communities Are Acquiring the Sense of Responsibility

THE present strike of certain steam railroad employees may be worth all that it has cost and is costing the country if it establishes a proper sense of responsibility by the community for its own welfare.

The present day is eminently one of specialization in industry. This plan has many advantages, but it brings about a condition where a small group in any essential service can seriously inconvenience every one else by suddenly refusing to work. This is what is happening now, because while the firing of locomotives is only a very small part of our industrial life, reckoned in number of men employed compared with the total, yet it is a necessary cog in the machinery of industry.

How then can the community protect itself in this age of specialization from the unreasonable demands of a small but essential group of workers? It must obviously do something, because otherwise it would be completely at the mercy of any group anxious to increase its proportion of returns for services rendered.

One remedy is compulsory arbitration, but another, which was initiated during the Boston policemen's strike, continued in some parts of the Central West during the soft coal strike and is being extensively employed by the commuters about New York during the present firemen's strike, is the continuation of the work by volunteers.

All of us have specialized for so large a portion of our lives that we sometimes think it difficult or impossible to carry out any radically different task, even if only temporarily. But this difficulty has been found to be largely imaginary during this past week about New York, where prominent business men have been acting as volunteer firemen and crews on trains placed at their disposal by the steam railroad companies. Needless to say the affair has had a tremendous influence in developing a sense of community responsibility for its own welfare and there has been no scarcity of volunteers, either among the professional and business men or the students at the neighboring

technical schools and colleges. The attitude taken by these citizens is that transportation is a necessity which must be continued during the time that the strikers and the railroads take to settle the points at issue.

The average American citizen is pretty adaptable and the war has developed a knowledge of the power of community action. It has also shown the reserve strength at its command and that the organization of this strength is not a difficult task. If unions are wise they will see the meaning of all this.

Rolling-Stock Equipment Suffers From Severe Weather Conditions

THIS is the time of year when the mechanical man wishes the equipment of the cars under his charge could be mounted inside the cars or on the roof. Few persons outside of the operating and maintaining forces of an electric railway realize the great amount of work that is necessary in order to keep the equipment on the road during the winter season. To keep the tracks clear from snow is a large task added to the usual work of running the road, but probably the greatest difficulties from the equipment man's standpoint come when the snow commences to melt and spring rains cause high water all along the line. To keep the tracks clear of ice the water must actually be swept off before it freezes. Frequently cars are required to operate through water from a foot to two feet in depth. Of course, part of this water enters the motors, carrying with it large quantities of dirt and other refuse.

Water produces harmful effects on the motors in two ways. One of these is by weakening the insulation. The damp mud remaining inside the shell soon deteriorates the field windings and grounds and short circuits continue for a considerable time after the extreme conditions cease.

The second way in which harm results is from ice. Some of the water which enters the shell freezes. This ice reaches the armature and even the commutator. In addition constant effort is required to keep the bearings from becoming hot, as water gets into the bearings and waste and this freezes and entirely prevents lubrication. Hot armature bearings inevitably result in rubbing of armatures on the pole faces, with resulting serious damage to windings and wire bands. It sometimes happens that the tracks on which cars are laid up out of service become flooded and freeze overnight, so that the cars actually "freeze in" and cannot be moved. Not only does this water and ice cover the tracks and form ice around the wheels, but it also enters the motors, so that they are also firmly frozen in.

The department of electrical repairs of a railway is a very busy place at this season. Hundreds of armatures come in for repairs and field coils are sent in on account of grounds due to water conditions. Many are water soaked so that they require drying out before repairs can be made. The motors are not the only part of the equipment to suffer either. Grid resistors become overheated from slow and severe operation and then they are suddenly splashed with water or slush. This causes the grids to break and an open-circuited grid usually means a "dead car." During storms and sudden thaws of the present winter some roads have reported a majority of their cars as crippled at one time. No wonder the repair men are busy fellows.

Illumination Has Close Relation to Maintenance Costs

A CONTINUAL question is, "Am I doing all I can to reduce maintenance costs?" In this connection, a topic often overlooked is the relation of good illumination of repair shops and carhouses to the subject of maintenance cost. If it were shown that by doubling the lighting costs a railway company could save from three to twenty times the added expense in reduced maintenance charges there is no master mechanic but would be interested. Yet this condition may exist in any shop.

Good illumination for mechanical work does not mean merely enough light to see objects worked on and tools worked with. It means that illumination which will allow the most efficient use of time, equipment and material in doing a certain job. Many elements enter into good illumination, and in this connection illuminating engineers have been getting some new results, due to their researches. One of these is that ability to see satisfactorily for work is a function, not of amount of light alone, but of amount of light multiplied by time, at least up to a certain "saturation point." That is to say, by changing the illumination from 5 foot-candles to 10 foot-candles, for example, the operator can select the correct tool twice as quickly, he can locate various parts of the machinery more quickly, can move about the shop faster. In short, equipment can be put through the shop in less time and that means at less cost. And, too, better vision means less equipment going out poorly or not fully repaired, only to fail again in service.

Another effect of improved illumination is a physiological or psychological reaction upon the workers in the shop, causing them to be in better spirits, to want to move faster. It invigorates or instills "pep." The beneficial effects of improved illumination are cumulative. Of course, the lighting units must be installed with judgment as to intensity and distribution to get the best effects. An illuminating engineer can help, but much can be done by trying.

Take a look at your own shop. It may be that you can do something in this line to reduce its costs.

More "Bouquets" for the Givers of Good Electric Railway Service

AS THESE words are written, steam railroad transportation in several parts of the country is badly tied up. Fortunately the electric railways have been "on the job" and have demonstrated their ability to handle a vast emergency traffic and thus to perform an unusual public service. This is the second occasion within a few weeks on which the electric railways have justly earned the praise of their patrons, the earlier one being the occurrence of the heavy snowstorms which visited several sections during the past winter. The writer happens to live on one of the lines of the Public Service Railway of New Jersey and can speak from experience of the splendid way in which that utility has helped to fill in the transportation breach caused by the defection of railroad switchmen, brakemen and others in the vicinity of New York City. Although reasonably familiar with the local transportation system he has gained much new information as to the possibilities of getting about at very creditable speed, even with the suburban steam lines in a state of almost complete paralysis. And the same fact is illustrated by other

electric railways in the New York territory and in other parts of the country as well.

The bus has also played an important part in relieving congestion, often at prices which are several times the electric railway fares for the same lengths of ride. While the buses have done good service (at very profitable rates) they could have done much better for the public, and at lower cost, if they had formed a part of the rolling stock of the electric railway systems. A combined railway and bus system would prove to be a wonderful transportation machine, especially in times of stress, but also under normal conditions.

This paper has referred before to the essentiality of electric railway service. The point cannot be overemphasized. Under ordinary conditions the service is taken as a matter of course like air and water, except as a target for occasional shots of criticism. When trying times come round and transportation deprivation is the order of the day, then the inherent virtues of the service stand out prominently. And the people generally are becoming less reticent in expressing their encomiums. "Hurrah for the trolleys!" they say. "With all their faults we're glad they are still with us."

Tilting at Pavement Windmills Is Quixotic but Impractical!

CAN it be that our ever zealous civic officials are getting afraid that the goose which has so long laid the golden eggs of free pavements and perpetually free maintenance thereof is about to die an untimely death, strangled, as it were, by the generosity of the public officials in their refusal to grant a sufficient fare?

Can it be possible that they realize how proportionally large is the railroad "free" pavement area as compared with the total paved areas in their cities? We ask this question because in some cities the railways pave from 10 to 20 per cent of all the paved area in service, and were these cities to add such areas to those already maintained by them there would be a burden of cost which would surely make the taxpayers howl. For every mile of track in a paved street it is safe to say that the railroad pavement area now costs about $25,000, and in some large cities railroad pavements have been valued as high as $6,000,000.

These comments are elicited because of a statement which has recently come to our attention in which the argument is put forth by a city engineer that the common charge against the railway company for paving is just, and should even be increased, in spite of the fact that the car wheels do not touch the paving. As the thoughts expressed may be held elsewhere it is worth while to answer them in some detail.

To begin with, he says that car weights have vastly increased since horse car days and that these increases cause more vibration, which is detrimental to pavements. We grant the weight increases, but we can show him tracks and pavements over which 40-ton cars are operated without a tremor in the rails or pavement. He cites the fact that many roads are required by law to operate cars continuously, which prevents their cessation while pavements are under construction, as being detrimental to pavements. That all depends upon circumstances. Again, we can show him first-class track pavements over ten years old which were laid under constant car operation of say a 5-minute headway.

Our champion states that pavement surfaces should be impervious to water and that water cannot be prevented from getting down to the foundation in track pavements. Well, we can take him on a trip to many cities where the street railway engineers have succeeded in doing that very thing.

Our Sir Galahad then takes a tilt at costs. He says the presence of tracks requires a special and more expensive pavement construction. We can show him track pavements which are in far better condition than adjacent roadway pavements, and these track pavements not only did not require any more concrete than that in the roadways, but the track pavement actually cost less than the roadway pavement laid by the city. In connection with the special construction he claims, as necessary, he says the rails require special types of brick at the gage side of the rails. Not so. Regular brick, properly laid, will serve as well or better.

Our expert, who hails from a rural city of 12,000 souls, calmly states that the presence of tracks requires an increased width of pavement in order to provide for the traffic on both sides of a car. He wants a 36-ft. curb width for a single track street. Well and good, but many real cities here in the East, where there are almost as many traffic cops as there are inhabitants in our up-state city, find that a great deal of business is done under dense traffic in streets of from 34 to 36 ft. curb width, and these streets have two car tracks.

He says a 24-ft. curb width is plenty for his borough, if car tracks be omitted. Very likely. But he misses the point when he says that his 36-ft. street, widened, as he says, for car tracks, costs the city any more for pavement. He forgets that the railway, with two tracks in the street, could be called on to pay for 18 ft. of pavement, leaving 18 ft. for the town, which is 6 ft. less than the 24-ft. width which he says is needed for a street without tracks and for which the town must pay all.

Next, on any street where there are tracks the burden of maintenance is partly, and in some cases almost wholly, borne by the railway companies. Railroad streets are usually main arteries and they attract traffic to them, which in turn takes greater toll in wear over the whole street. To that extent the city must suffer with the railroad and be glad that it does not have to maintain all of the pavement.

As a final argument in favor of the perpetuation of the uneconomic Section 178 of the New York railroad law, which requires the installation and maintenance of pavements by the street railroads, our gladsome knight solemnly affirms that the life of pavements on streets where tracks are located will be reduced 50 per cent. This is a broad statement to be based on such a large sphere of action as a town of 12,000. Again, we can show him pavements in tracks which will outlast the tracks and pavements laid fifteen years ago.

We have commented on this subject in a somewhat facetious vein the more to emphasize the principal fallacies in the views of so many engineers who are in charge of pavements in small cities. They do not get around enough to know what is going on elsewhere, and their opinions, formed from improper local conditions of track and pavement construction, are very apt to be wide of the mark. Yet our railway companies have to pay the price of such provincialism. It seems that there is a need for a campaign of education for the benefit of city engineers, with the object of proving to them that tracks and pavements can be made to work together successfully.

Safety Devices of the Safety Car*

Facts Regarding the Fundamental Characteristics of Safety Devices and the Principles of Operation of the Various Air-Operated Parts That Constitute the Equipment

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Foreword to the Series

THE extension of the use of safety cars and the constant broadening of the field for them suggest the importance of familiarity with the various parts that constitute an equipment. Safety devices are essential to insure easy, safe and efficient operation of the one-man type of car. The cost of maintenance and the number of irritating troubles and delays which occur when such cars are introduced are influenced to a large extent by the familiarity which the operator and maintainer have with the new equipment. Most railways are unfamiliar with the new types of apparatus developed for this service until they actually have them as an addition to their rolling stock.

The subject of safety car equipment is therefore timely, hence with a view of giving the present or prospective user as clear an idea as possible of the functions of the various parts and the care that should be exercised in their use and maintenance the *Electric Railway Journal* has arranged for a series of articles covering this subject. This, the first of the series, takes up the fundamental characteristics of safety devices. Others will deal with the care necessary in the equipment installation, troubles that may occur and their remedies and a systematic outline of the best maintenance practice, together with equipment tests.—*Eds.*

SAFETY devices which include the air brake and safety car control equipment have universally been accepted as necessary for the Birney safety car. But the necessity for safety devices does not arise from the structural features of such a car nor from any conditions of car construction, but rather from conditions of car operation. The fact that a car is double truck or single truck, light or heavy, single or double end does not in itself indicate whether safety devices are essential, but it is the method of car operation, whether the car is operated by one or by two persons, that determines this. Safety devices should be considered as a means whereby car operation by one person is made feasible and practicable. Probably such operation will be most successful both from an operating and a financial viewpoint with the standard Birney safety car.

Safety devices are demanded fundamentally because complete reliance cannot be placed upon human capabilities. If the mental man functioned correctly in every instance, automatic devices could be omitted; if the physical man had greater capacity, labor-saving devices would be superfluous; if mental and physical functions were properly co-related invariably, interlocking of operations could be dispensed with. But since some of these contingencies exist actually, the conditions of operation must be such that provision is made not only for outright man failure but also for the ordinary physical limitations. It is the function of the safety devices to furnish such provision.

To sum up, the safety devices provide for successful operation of the safety car because they insure that the operation shall be safe, proper and easy; safe, because man failure is provided for; proper, because the operator's movements are so interlocked that they must be taken in the proper sequence, and easy, because the operator's labors are reduced to the minimum by the use of air-operated devices.

The particular features that make operation safe, proper and easy are:

1.—The car cannot be started with the doors open because the brakes cannot then be released.

2.—The doors cannot be opened without causing a brake application sufficient to stop the car.

3.—Unintentional removal of the operator's hand from the controller handle will cause an emergency brake application.

4.—The brakes cannot "leak off" while the car is standing with the doors open.

5.—An automatic emergency application results if either of two pipes (emergency and safety control), running from platform to platform, is ruptured.

6.—The doors are changed from air-operated to hand-operated whenever an emergency application is made by the brake valve.

7.—The power is cut off, sand is applied and doors become hand-operated whenever an emergency application is caused by releasing the controller handle.

8.—If excessive cylinder leakage causes a service application to "leak off" while changing ends an emergency application will result.

9.—If the platform piping be ruptured by a collision an automatic emergency application will be obtained and the damaged piping will be so cut off as to prevent exhaustion of the main reservoir.

10.—After a stop the controller handle must be pressed down before the brakes are released.

11.—Ends cannot be changed without making a brake application before the operator leaves the operative end, or an automatic emergency application results.

12.—The sand is automatically applied in an emergency.

13.—The safety features are obtained without increase in the number of manipulative handles.

14.—The doors are air-operated.

15.—Sanding is accomplished by air without the use of a special handle.

16.—Provision is made for intentional and temporary release of the controller handle without emergency application resulting.

To determine how these various features are secured the principle of brake operation should be first understood.

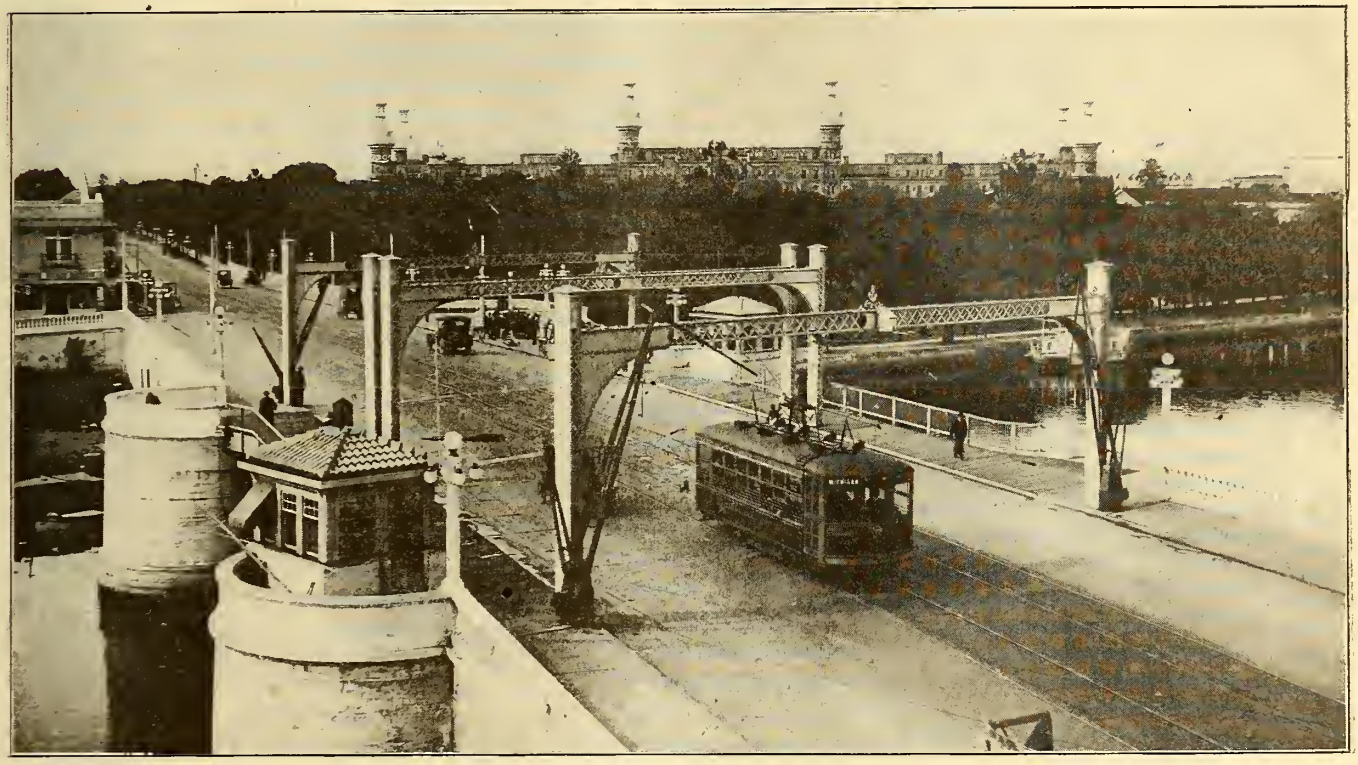
It is believed that an explanation of the principle of

*The writer desires to express his appreciation of the courtesies tendered him by the Safety Car Devices Company and the Westinghouse Traction Brake Company.

operation will contribute to the reader's ease of understanding the detailed description to follow. All know that an air brake stops a car because compressed air admitted to a brake cylinder forces out the brake cylinder piston, which piston, through the medium of the levers making up the foundation brake rigging, presses the brakeshoes against the car wheels and so develops a retarding force which brings the car under control or to rest. If the brake equipment is such that air is admitted directly to the brake cylinder from the reservoir by means of a brake valve and no other means for such admission exist, then the equipment is said to be "straight-air" equipment. That is, the distinguishing characteristic of straight-air equipment is that the brake can only be applied by conscious manipulation by the operator. If, however, the brake is automatically applied under certain conditions, independent of the operator, then the equipment becomes an "automatic equipment." For an automatic brake the triple-valve principle is employed.

A triple valve is a device in which a piston operates in a bushed cylinder. To the stem of the piston is attached a slide valve which travels back and forth over a flat slide-valve seat, covering and uncovering various ports in its movements. The slide-valve side of the piston is connected to a reservoir. The other side of the piston is connected to a pipe leading to a source of air supply. When air is admitted to this pipe the pressure built up on the pipe side of the triple valve piston forces the piston to move toward the reservoir until it encounters a stop. This position is known as "release," and in release position the reservoir and pipe are connected by a small feed groove in the piston bush. Consequently air flows by the feed groove and eventually pipe and reservoir are brought to the same pressure. Now if the pressure in the pipe be reduced very rapidly by allowing air to escape from it, since the pressure in the reservoir reduces less rapidly because of the slower rate at which reservoir air flows by the feed groove into the pipe, a pressure differential is built up upon the piston, which forces it and its attached slide valve away from the reservoir. This movement connects the slide-valve ports in a different way from that existing in release position and thereby causes the brakes to apply.

From this explanation it is evident that when the pressure in the pipe is reduced with sufficient rapidity the brakes will apply, whether or not this be brought about by the operator. That is, the brakes apply automatically whenever a rapid reduction of pressure in the pipe is obtained. If both service and emergency application are brought about by reductions in pipe pressure the equipment is said to be "automatic" brake equipment. If, however, only the emergency applications are so brought about the equipment is "semi-automatic." An emergency application is distinguished from a service application by the inability of the operator to limit the cylinder pressure attained.



SAFETY CAR CROSSING DRAWBRIDGE IN TAMPA

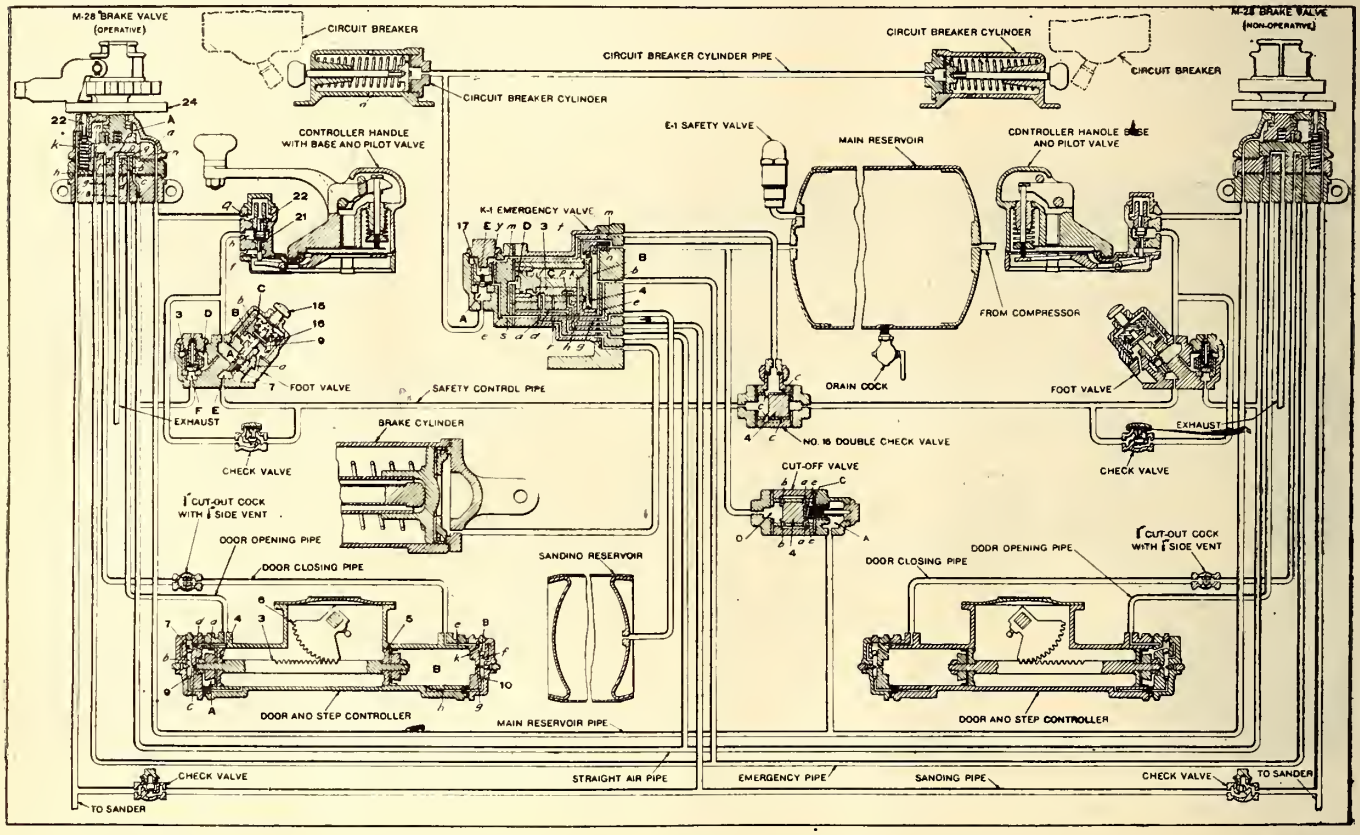
The equipment on the safety car is semi-automatic. Obviously it requires a valve of triple-valve type, this valve being designated the "emergency valve," and a pipe, called the "emergency pipe," normally charged to reservoir pressure, connected to it. It should be noted for use later in the description that when the pressure in the emergency pipe is rapidly reduced, regardless of how the reduction is brought about, an emergency brake application will be obtained. With the general principle that the reduction of pressure in a charged pipe may be utilized to cause movement of a piston, as explained above, in mind, the operation of the individual devices will now be explained.

Operating Principles of the Safety Devices

The safety devices, by which throughout the description is intended the air brake and safety car control equipment, comprise the following (see diagram):

(1) One motor-driven air compressor, (2) two main reservoirs, (3) one safety valve, (4) one compressor governor, (5) two brake valves, (6) one emergency valve, (7) two controller bases with pilot valves and controller handle, (8) two combined foot and cut-off valves, (9) one double check valve, (10) one main reservoir cut-off valve, (11) one sanding reservoir, (12) two circuit-breaker cylinders, (13) one brake cylinder, (14) two door and step controllers and (15) sundry cocks and check valves. In addition to these devices, there should be mentioned five pipes running the length of the car: (1) The main reservoir pipe, (2) the emergency pipe, (3) the safety control pipe, (4) the straight air pipe and (5) the sand pipe.

Of the above devices it is considered that, since they are so well known, the compressor, safety valve, governor and brake cylinder require no description. The other devices will be taken up in order. When reference is made to the diagram it should be remembered that this is simply an illustrative drawing and does not show the true construction of the parts.



PIPING DIAGRAM OF AIR BRAKE AND SAFETY CAR CONTROL EQUIPMENT—RELEASE POSITION, DOORS CLOSED

The brake valve has six positions: (1) Release, (2) lap, (3) service, (4) handle-off, (5) door-opening and (6) emergency. To the brake valve are connected seven pipes (the numbers referring to raised figures cast on the pipe bracket): (1) door-opening, (2) emergency, (3) door-closing, (4) straight-air, (5) sanding, (6) brake-valve-exhaust and (7) main reservoir. To realize how these pipes are connected in the various brake-valve positions it is first necessary to understand their functions. A constant supply of air at the brake valve is required. This is provided by the main reservoir pipe, which makes permanent connection between the main reservoir and the chamber above the rotary valve in each brake valve. Pressure is required to open and to close the doors, as explained later. Consequently air flows into the door-opening pipe when doors are to be opened and into the door-closing pipe when doors are to be closed. The function of the emergency pipe has been explained. The pipe is normally at reservoir pressure. Since the equipment is semi-automatic, air in a service application is admitted directly to the brake cylinder by the brake valve. The pipe by which this air is conducted is the straight-air pipe. The function of the sanding pipe and of the brake-valve exhaust pipe is self-evident.

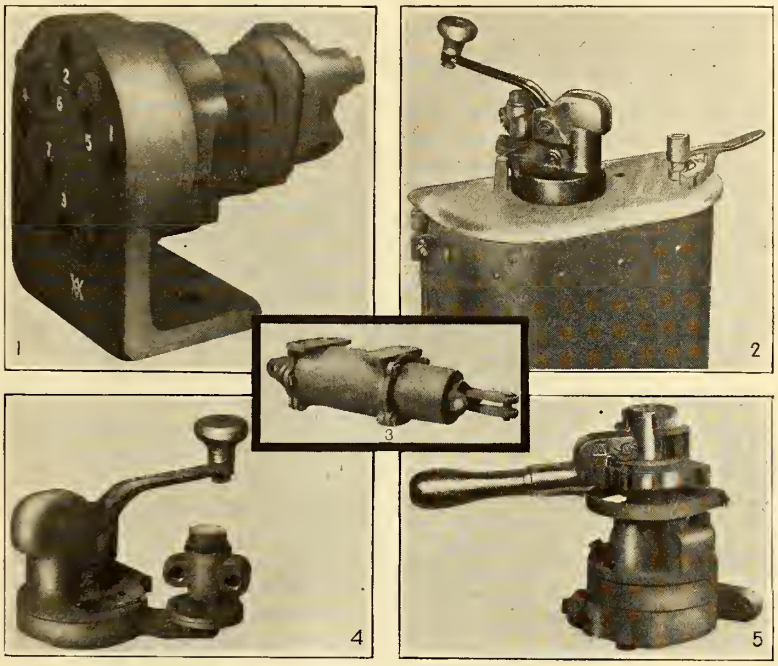
Three conditions should be noted in considering the brake valve. First, pressure to hold the doors closed is obtained from the emergency pipe rather than the main reservoir pipe, in order that the doors may be made hand-operated in an emergency, the manner in which this is accomplished being described later. Second, as a safety provision the doors are held closed by air pressure in all brake-valve positions except door-opening and emergency. Third, the emergency pipe must be cut off from chamber *A*, above the rotary valve, whenever air is flowing from this chamber. If the emergency pipe is not cut off, since the air in the pipe is at reservoir pressure, it will flow into chamber *A* and thence by whatever outlet the rotary valve has opened. This will bring about a reduction of emergency pipe pressure and possibly at a sufficiently rapid rate to cause an emergency application. To prevent such an occurrence the pipe must be cut off by the rotary valve. With these three conditions given it is apparent that: (1) In release the emergency pipe is open to the main reservoir, the door-closing pipe is connected to the emergency pipe and the door opening and straight-air pipes are connected to atmosphere (brake-valve exhaust pipe). (2) In lap the emergency and straight-air pipes are lapped, the door-opening and closing pipes remaining as in release. (3) In service the emergency pipe

is lapped, the straight-air pipe is opened to the main reservoir, the door-opening and closing pipes remaining as in release. (4) In handle-off, same as lap. (5) In door-opening the emergency pipe is lapped, the door-closing pipe connected to the atmosphere and the door-opening and straight-air pipes to the main reservoir. (6) In emergency, the emergency door-closing and door-opening pipes are all connected to the atmosphere and the straight-air pipe to the main reservoir.

It has been stated that the door cannot be opened without obtaining a brake application and that the cylinder pressure is maintained so long as the door is open. By referring to the above it will be noted that when the brake valve is in the position (door-opening) which will open the door by air the straight-air pipe is connected to the main reservoir, so that the compressor pumps directly into the brake cylinder.

In normal operation the piston 4 and the slide valve 3 of the emergency valve are in the position shown in the diagram. That is, the emergency piston does not move except in emergency operation. That this is so will be evident when it is considered that the pressure in chamber *B*, connected to the emergency pipe, is not reduced during a service application. Consequently, pressure differential sufficient to move the piston is not built up. The pressure on the piston is balanced, in so far as minor fluctuations in the emergency pipe are concerned, by means of passages *n* and *t*. The choke *n*, since it checks the flow of main reservoir air into the emergency pipe, permits the building up of a differential on the piston when the emergency pipe pressure is rapidly reduced. Chamber *D* is permanently connected to the atmosphere by passage *s*. Since chamber *C* is always at main reservoir pressure, a pressure differential, tending to hold the piston in release position, always acts on the small end of the emergency piston. This arrangement provides that slight differentials on the piston will not move it to emergency position, which is desirable in that it prevents undesired emergency application. In the ordinary service application air admitted to the straight-air pipe by movement of the brake valve to service position flows to the brake cylinder by the straight-air pipe and passage *d*, cavity *f* and passage *a* in the emergency valve. That is, as noted, the emergency valve does not operate in service operation, air to and from the brake cylinder merely passing under the slide valve.

In an emergency application, however, the pressure in the emergency pipe is very rapidly reduced. This means that the pressure in chamber *C* becomes considerably greater than that in chamber *B*, which obviously results in the piston with its attached slide valve moving toward the right. Main reservoir air then flows directly through the emergency valve into the brake cylinder by means of passage *t*, chamber *C* and passage *a*, and thereby applies the brake. Evidently the brake-cylinder pressure will be immediately built up almost to that of the main reservoir, and since connection between reservoir and cylinder is not cut off the capacity of the compressor is available toward preventing the brakes "leaking off." At the same time the sanding reservoir (which is normally maintained at reservoir pressure by means of passage *t*, chamber *C* and passage *g*) is connected to the sanding pipe by cavity *p* and passage *h*, which causes air to flow to all sand traps. Moreover, since pressure for holding the doors closed is obtained from the emergency pipe and since the air in the emergency pipe has been vented to the atmosphere the pressure on the doors is removed, which allows them to be opened by hand. Relay valve *E* is the valve by which an emergency application is brought about upon releasing the controller handle. As will be explained later, chamber *E*, connected to the safety-control pipe, is normally maintained at reservoir pressure. The annular space on the lower side of the valve is likewise maintained at reservoir pressure because it is connected to the emergency pipe through passage *e*. Chamber *A* is normally at atmospheric pressure because it is connected to the circuit-breaker cylinders, in which pressure cannot long be maintained because of the drilled opening in the circuit-breaker cylinder piston. If, therefore, the pressure in the safety-control pipe and chamber *E* is suddenly reduced the higher pressure acting upon the annular space on the lower side will force the relay valve upward. The emergency pipe is then connected to the circuit-breaker cylinders by passage *e*. A sudden drop in emergency pipe pressure results, with a consequent emergency brake application. In addition, the air vented to the circuit-breaker cylinder builds up a pressure therein which moves the pistons outwardly, causing them to strike the circuit-breaker handle and open the circuit breaker. Of course the power is then cut off. It will be noted then that a sudden drop in safety-control pipe pressure opens the relay valve, which causes an emergency application of the brakes, the sanding of all wheels, the cutting off of power and the release of air pressure on the doors. That the relay valve may not be opened by slight differences in safety control and emergency pipe pressures passage *y* through the relay



SAFETY CAR CONTROL EQUIPMENT

No. 1—Emergency valve. No. 2—Safety control group. No. 3—Brake cylinder. No. 4—Controller handle with base and pilot valve. No. 5—Motorman's brake valve.

valve is provided. which permits the equalization of such differences.

The reader should observe that to cut off power it is necessary that the relay valve open. It may be caused to open by "letting go" the controller handle. On the other hand, if the emergency application be brought about by the brake valve (reduction in emergency, but not in safety-control pipe pressure) the relay valve does not open. The first operation assumes an automatic emergency application because of man-failure, the second a conscious emergency application by the operator. In the former case the power must be cut off automatically; in the latter, it is done by the operator. Consequently, since no need exists, power is not automatically cut off when an emergency application is obtained with the brake valve.

Safety Control Group and Combined Foot and Cut-Off Valve

The pilot valve of the controller base is the actuating agency of the "dead-man feature," whereby an emergency brake application results whenever the hand is removed from the controller handle. The controller handle is pivoted in a casting which rotates with the handle's movement. It will be evident from the diagram that so long as the handle is held down the bolt, upheld by the handle. will compress the spring. If the handle be released the compressed spring will cause the bolt to move downward and strike the lever in the bottom of the controller base, which in turn will unseat valve 21 and seat valve 22. Now when the controller handle is held down (the spring being compressed) valve 22 is unseated, which permits main reservoir air to flow into the safety-control pipe by passages *a* and *h*. As explained in the description of the emergency valve, when the safety-control pipe is at main reservoir pressure the relay valve *E* is seated. If the controller handle be released valve 22 is seated and valve 21 unseated. The seating of valve 22 cuts off main reservoir pressure, while the unseating of valve 21 connects the safety-control pipe to atmosphere by passage *f*. The sudden reduction in safety-control pipe pressure resulting causes the relay valve to open and brings about an emergency application with a cutting off of power, a sanding of the rails and a release of door pressure, as explained above.

Any unintentional release of the controller handle will cut off the supply of main reservoir air to the safety-control pipe and at the same time connect the pipe to atmosphere. The resultant drop in safety-control pipe pressure will of course cause an emergency application. That the operator may at times desire to release the controller handle is obvious, in which case an emergency application is not desired. The emergency application is prevented in such an event by the combined foot and cut-off valve. Before the hand is released from the controller handle knob 15 (see diagram) is pressed in by the operator's foot. This causes valve 7 to seat and cut off the safety-control pipe from the pilot valve. Therefore, when valve 21 opens upon the release of the controller handle escape of safety-control pipe air does not result. It is consequently obvious that the operator's foot may relieve his hand whenever desired.

In the above description the case considered was where the operator held his foot on the knob while the car was in motion until such time as he again desired to press down the controller handle. At a stop where the operator is occupied in collecting fares it would be inconvenient for him to be compelled to hold down knob 15 continuously. Such a necessity is obviated by cut-off valve 3. When a brake application has been made brake-cylinder air enters chamber *F* and when a pressure of approximately 30 lb. has been attained valve 3 is forced upward, permitting brake-cylinder air to flow to the top of valve 16 and force it downward. This downward movement seats valve 7 and thus cuts off the safety-control pipe precisely as though knob 15 had been pressed in by the operator's foot. When the cylinder pressure has been reduced during the release to about 12 lb. the compressed spring above valve 3 will cause it to close. Chamber *C* is then immediately exhausted to atmosphere by way of passage *b* and the vent port above valve 3. Safety-control pipe pressure acting on valve 7 causes it to move to its upper seat and again connect the safety-control pipe to the pilot valve.

In addition to the function described above, cut-off valve 3 enables the operator to change ends without an "emergency" resulting when the controller handle is removed. Before leaving the operative end the operator makes a service brake application. This application results in valve 7 closing, as previously explained, so that an "emergency" does not occur when the controller handle is released. If the brakes "leak off" before the operator assumes control at what has been the non-operative end valve 3 closes, which causes valve 7 to open. Since the controller handle is not held down safety-control pipe pressure is exhausted to atmosphere by valve 21, thereby causing an emergency brake application.

The function of the double check valve is to cut off the non-operative end of the safety-control pipe, since the pilot valve on this end is open to atmosphere. The check valve is moved from one seat to the other, depending upon which section is charged and which connected to atmosphere.

The purpose of the main reservoir cut-off valve is to conserve main reservoir pressure in the event of a ruptured main reservoir pipe beyond the cut-off valve itself, as, for instance, a ruptured platform pipe. Without this valve a main reservoir pipe rupture would involve a very serious drain on main reservoir pressure. In service, air flows by passages *b* and *a* (see diagram) at such a rate that sufficient differential is not built up on valve 4 to compress the spring. In the event of a broken pipe, however, pressure in chamber *A* is so rapidly reduced compared with that in chamber *D* that a differential is built up sufficient to move valve 4 to the right and thereby cut off further outflow. The broken pipe is in this way disconnected from the main reservoir.

Door and Step Controller

The sanding reservoirs and circuit-breaker cylinders require no special description. The door and step controller (see diagram) is of the double-acting piston type with the pistons connected by a rack. The rack operates a segmental gear attached to a shaft, which shaft in turn actuates the rods and levers which open and close the doors and steps. With this type of controller the door is held closed by air pressure. When it is to be opened the door-closing pipe is connected to atmosphere and the door-opening pipe to the main reservoir. When it is to be closed the process is reversed, except that the emergency pipe is substituted for the main reservoir. Slamming is prevented by a cushioning effect, produced by a special porting arrangement. Air is admitted to

the double-acting controller cylinder by large ports such as passages *f* and *k*; exhausted by smaller ports, *h* and *g*, reduced to *g* only after the piston has traveled about half of its stroke. Passage *g* may be regulated by the choke plug to make the door closing that desired.

A special §-in. cut-out cock with side vent, in connection with which the brake-valve handle is used, is located in the door-closing pipe so that the motorman may, independently of his brake valve, take the air pressure off the door, thus making it hand-operated. This arrangement provides for those cases where the motorman may be forced to leave his car to turn a switch, etc.

The foregoing description applies to the latest design of safety devices. Many cars are in operation equipped with safety devices which do not include all those shown in the diagram, or perhaps may include some of the devices in different form. From the operation as explained, however, it is hoped that no difficulty will be encountered in understanding the functioning of these slightly different devices, since it has been the aim of the writer to explain the principles of operation rather than the particular detailed functioning of a specific device. He trusts that this exposition of principles has been of interest to the reader.

Maintaining Electric Railway Motors—I

Rewinding Armatures, Smoothing and Slotting Commutators and Correct Brush Methods Are Discussed in Detail

By JOHN S. DEAN
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IF SYSTEMATIC inspection and maintenance of car motors was ever necessary for the successful operation of an electric railway, it certainly is a paramount issue now. In fact, every piece of apparatus must be fully utilized if the railway is to give adequate service at the lowest possible cost.

The very nature of the service to which electric cars are subjected entails considerable wear and tear on the various parts of the car and constant and systematic care and attention are required to keep it in good operating condition. This is especially true of the motor, due to its position under the car, where it is exposed to outdoor weather conditions, and also on account of its rigid mounting on the car axle it is subjected to very severe mechanical shocks and vibration. Some of the precautions taken and methods used to keep the apparatus in good condition are outlined below.

TESTING STRENGTH OF BRUSH SPRINGS BY MEANS OF AN INDICATING SPRING BALANCE

Care Necessary In Winding Armatures

To insure the best life from an armature extreme care should be used when rewinding to see that every point that might cause failure is guarded against in a satisfactory manner. First of all, any sharp corners and any roughness in the slots that might damage the coils should be filed down and all chips and filings removed from the slots before the insulating material is applied to the core. The coils should fit tightly in the slot and be wound so that the tops of the coils are $\frac{1}{32}$ in. above the band groove. Fillers should be used between the coils if necessary to meet the above conditions. The core bands will then pull the coils down to a tight fit on the iron, which reduces the movement of the coils in the slot to a minimum. If the coils are wound too high the bands will not rest on the iron, and when the insulation dries out in service looseness of the bands will result. Care should be used not to twist, bend or abuse the coils any more than necessary during the process of winding. The necessary crossing of coil leads, if not properly arranged, will cause short circuits when the pressure of the band is applied. The coils on the end windings should have a solid foundation for the bands, but pounding should not be carried to the extent that the coils or leads become damaged. Protecting pieces of insulating material should be inserted at all points where the coils cross and where there is danger of short circuits occurring. It is good practice to weave braid between the leads directly back of the commutator, on both top and bottom layers.

All leads should be tinned in such a manner that there will be no untinned copper in the commutator neck. The cotton sleeves on coil leads should not be permitted to extend into the commutator slot, as they may obstruct the flow of solder, which will result in poor commutation. The tool used in driving the leads into place should be free from sharp corners and edges, for a nicked wire might be the cause of a broken lead.

The following winding facts and rules will be of assistance:

The wave or two-circuit winding always requires an odd number of commutator bars.

When an even number of coils per slot is used there will always be an idle or dead lead.

When an odd number of coils per slot is used and there is an even number of slots in the armature there will always be an idle or dead lead.

When an odd number of coils per slot is used and there is an odd number of slots in the armature there will never be an idle or a dead lead.

CARE OF COMMUTATORS

The band over the front V-ring of a commutator should be wiped off clean every month. After cleaning, painting with an air-drying varnish makes cleaning easier the next time. Painting every six months is advisable.

Flat spots, high or low bars, ridges, burned spots, etc., should be smoothed up. Where these are not bad the motor need not be removed from the car. A tool can be made by mounting a block of wood on a stick, one face of the block being cut to the radius of the commutator and lined with sandpaper or stone. As the car is run by the other motors this tool, held against the commutator, will smooth the rough spots.

The armature should be removed from the car and placed in a lathe for the turning of the commutator if its face is very rough. After turning, the grinding of the surface with a fine abrasive stone gives a very smooth and true surface and improves commutation. Holes left by defective mica or pits in the side of bars can be filled with commutator cement.

In removing leads from the commuator neck a thin "drift," driven toward the armature shaft between the side of the commutator neck and the filling piece or wedge, will loosen the filling piece so that it can be easily forced out with a gouge. A similar operation on the leads will remove them from the first bar. Then with one commutator neck free of leads clearance space is available for the bending of each commutator neck consecutively, permitting the removal of all the remaining coil leads by means of the gouge. By this method no heating of the soldered joints is required.

The commutator slots should be kept well undercut, $\frac{3}{64}$ in. maximum; $\frac{1}{64}$ in. minimum; the front V-ring clean and well painted; the edges of commutator face rounded, $\frac{3}{16}$ in. radius front, $\frac{1}{16}$ in. radius rear; the commutator free from oil, grounds or short circuits; the rear of commutator sealed from dirt and moisture; the commutator tight; the face of commutator smooth; the neck full width, and the mica extending $\frac{1}{16}$ in. at rear.

The commutator should be re-undercut before it is worn flush, since the groove left will guide the saw and make the work much easier. After slotting is completed the face of the commutator should be thoroughly polished and cleaned of all particles of copper by means of sandpaper.

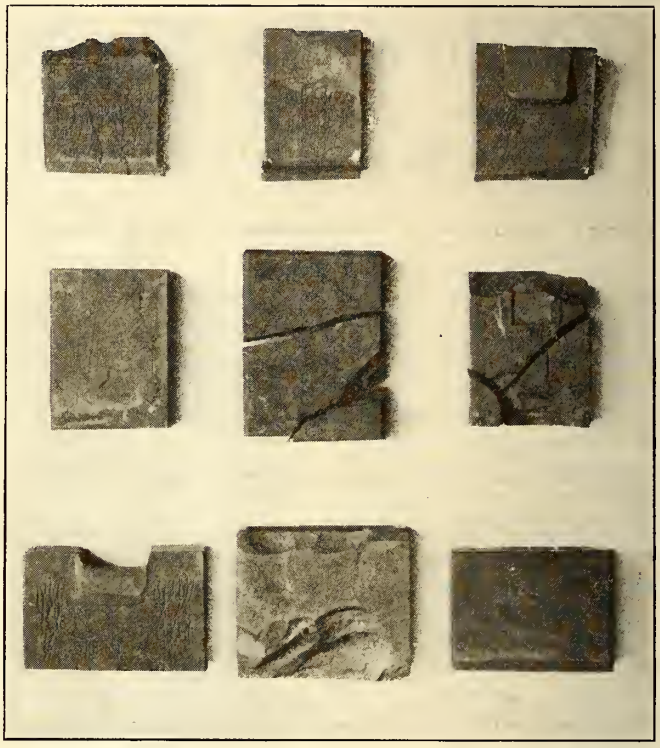
It is essential that all particles of mica be removed from between the segments by this operation, so that it is advisable to use a saw about 0.005 in. thicker than the thickness of the mica to be undercut. A small-diameter saw must be used in order to cut the slot to the proper depth and at the same time not cut into the neck of the commutator. After the slots are sawed it is sometimes necessary to go over them with a small hand-cutter, or scraper, to remove all remaining particles of mica.

Where commutation trouble is frequent it is good practice to use a V-shaped hand tool to round the edges of the under-cut grooves between bars to about $\frac{1}{32}$ in. radius. This can be done without removing the motors from the car.

Clean undercutting of commutators eliminates high mica, thus reducing burning of the commutator bars and giving extended life to carbon brushes. By this means practically all flashing is prevented and maintenance costs are greatly decreased.

MAKING BRUSHHOLDER REPAIR

To care for the brushholders of the railway motors intelligently it is necessary for the maintainer to be familiar with the construction and purposes of their parts. In repairing and replacing a modern railway



CONDITION OF RAILWAY MOTOR CARBON BRUSHES AFTER BEING USED IN VARIOUS TYPES OF SERVICE

motor brushholder of the insulated-pin type the following points should be considered:

The brushholder castings and mechanism should have at least $\frac{3}{4}$ in. air clearance from the motor frame.

The porcelain insulators give sufficient creepage distance over smooth corrugated surfaces to keep the brushholders from becoming grounded to the frame and should always be kept tight on the pin by putting pieces of treated linen between the porcelain and tube. They should be kept free from carbon dust and dirt to prevent current from leaking over the surface. It is a question if porcelain insulators are necessary, and in some cases they have been left off with satisfactory results in service.

Railway motor frames, as built today, have machined pads for supporting the clamping blocks of the brushholders exactly in the neutral position. On replacing brushholders the clamping blocks must be seated properly. The carbon box should be parallel with the commutator bars and the distance from the center line of one box to the center line of the other box on a four-pole machine should be equal to one-fourth the number of commutator bars. The coil short-circuited by the brush should be midway between the main poles. Ordinarily

this means that the brush will be opposite the middle of the main poles. Brush spacing is adjusted by the manufacturer and will be correct if the clamping blocks are always seated properly. Care should be exercised to see that the brushholders are those belonging to the motor and that they are not damaged.

The underside of the carbon box should be kept within ⅛ in. to 1/16 in. of the commutator surface, so as to prevent breakage of carbons. This adjustment is made by loosening the clamping block which allows the brushholder to move until the correct setting is obtained. The nut which holds the clamping block should be carefully tightened so that the brushholder will not come loose. A piece of fiber, tapered from ¼ in. to 1/16 in. thick, makes a handy gage for use in securing the desired setting.

About 5 lb. of spring pressure per square inch of contact surface is generally considered good practice. This will give a range of pressure on carbons from 4 lb. to 7 lb., depending upon the size and grade of carbon. Other factors that govern this pressure are the amount of sparking, the play in the armature bearings and the track conditions.

To prevent breakage and side wear of the carbons the fit in the box must be made as snug as possible without binding. This clearance should never be allowed to exceed 1/32 in.

The shunt formerly used on the carbon has been replaced by a shunt on the brushholder which connects the contact tip on the finger and the main casting. This shunt must be large enough to carry the current, and the connections at the ends of the shunt where fastened must make good contact and be made permanently secure. The ends may be brazed, soldered or riveted. If a good electrical path is established for the current through the shunt much of the side wear of the carbons and burning of the carbon box is prevented. Therefore it is very important to keep the shunts in good condition.

The object of the contact tip is not only to transmit the pressure to the top of the carbon, but to conduct current from the shunt to the carbon or from the carbon to the shunt. The shape of the contact tip should be such that it will do the least damage to the top of the carbon and provide a large contact area to carry the current. A flat tip about 1/16 in. thick gives very good results in service.

Cable leads should be supplied with sleeves or terminals and connections should be kept tight by means of jam nuts and lock washers on the set screws to secure a good electrical as well as mechanical contact.

Carbon dust and dirt in the working parts of a brushholder usually cause it to work stiffly. These parts should, therefore, be kept clean and occasionally lubricated. If neglected they either become tight and do not provide enough pressure or they become so badly worn that the parts get out of line, causing the tips to press on the carbon box instead of the carbon.

Carbon Brush Selection Is Difficult

It is difficult to select a grade of carbon brush for railway motors by a casual inspection or any simple tests. To secure the right brushes requires a thorough knowledge of the various grades of carbon, backed up by long experience in service, and even then unsatisfactory applications are sometimes made. When a selection is being made a few fundamental operating conditions should be considered, such as commutation, life of commutators, life of brushes, frequency of inspection, current density and cost per car mile.

These factors will vary more or less with the design of the motor, the brush tension, the design of the brushholder, the location and spacing of the brushes, the condition of the roadbed, the condition of the equipment, armature bearings and commutator surface, the weight of the car, the number of motors per car, the scheduled speed and many other conditions.

Since all of these factors must be taken into consideration, the best and most reliable results are obtained by making a test of recommended grades in service under actual operating conditions. Carbon brush manufacturers generally are willing to assist the operator in making such service tests. The following general information regarding carbons will help the operating man more intelligently to select carbons for service tests.

Classes of Carbon Brushes

By the use of carbon in the form of graphite and coke the following general classes of brushes are manufactured and available for railway work: Carbon brushes made of crushed coke and binder, graphitized brushes made of carbon and then electrographitized, and graphite brushes with natural graphite and binder.

For the modern commutating-pole railway motor having commutators undercut, with due consideration of costs per car-mile, brush end wear, side wear, breakage, life, commutation, life and maintenance of commutator, etc., the brushes which are best suited for railway motor service are graphitized brushes, which give the best all-around results. Carbon brushes are next best, while graphite brushes have very special and limited uses.

For use in the more modern brushholders the carbons should not be over 2 in. long when new and they should not extend above the top of the carbon box. If longer they are subjected to a greater side pressure, due to the action of the contact tip, which increases the side wear, tends to bind the carbon in the box and reduces the direct pressure on the surface of the commutator. This excessive side wear causes them to be discarded before the added length can be used up in end wear. Approximately the same mileage can be secured from the shorter carbon, and hence, since the carbons are bought on a cubic-inch basis, the first cost is less.

The width of brushes is not so important; they can have as much as 1/16 in. clearance in the box without causing any trouble in service. The thickness, however, is very important, for if the initial clearance between carbon and carbon box is much less than approximately 0.006 to 0.008 in. the carbon will tend to stick in the box and bind. If it is greater, rattling in the box will ensue, quickly wearing away the sides of the carbon, which will also tend to chip and break, thus reducing its life.

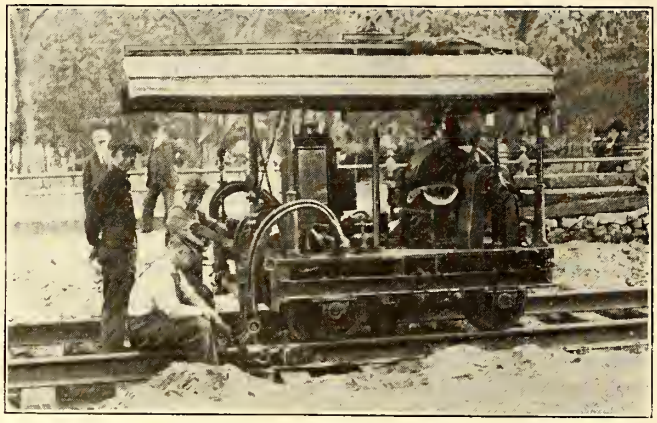
Mr. Masuda, the newly appointed chief of the street car section of the Municipal Electrical Bureau of Tokyo, Japan, is having his hands full of labor problems. The men want improved working conditions, but so far the proceedings have consisted largely in exchange of words, and demonstrations by the men.

Using Brazed and Welded Bonds

The Various Methods Used with Contact Resistance, Arc Weld and Gas Weld Rail Bonding Are Described and Some of the Troubles Experienced Are Detailed

BY G. H. McKELWAY
Engineer of Distribution Brooklyn Rapid Transit Company

WHILE the troubles experienced with bonds have been many and varied, few if any of them can be laid to high resistance of the conductor. That trouble disappeared with the general use of copper as the metal from which the bonds are made. The breaking of the strands or ribbons of the bonds is still a source of considerable trouble, but in most cases this is due to poor design of bonds which are necessary to fit some special condition, due to unsuitable joint plates or drilling, or to the installation of bonds of proper design on poorly maintained rails. Excessive movement causes breakage, but it is necessary to protect the bonds from theft, and so they must be placed under the plates.



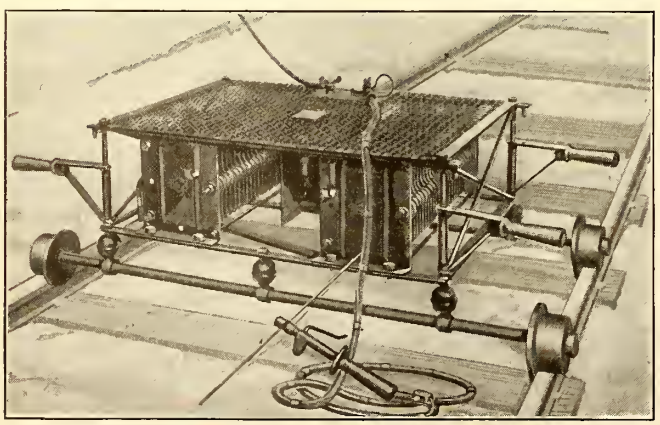
WELDING BONDS WITH ROTARY CONVERTER MOUNTED ON CAR

The strands of some bonds are broken soon after installation, because although the bonds have been suitably designed for normal conditions they are used on installations where the bond holes cannot be drilled the proper distance apart, and as a result the bonds have to be squeezed into all sorts of queer shapes to make them fit into the space assigned to them. An accompanying illustration shows one such installation where, on account of its temporary nature, it was not thought worth while to purchase bonds of the right length, but instead those that were in stock were used.

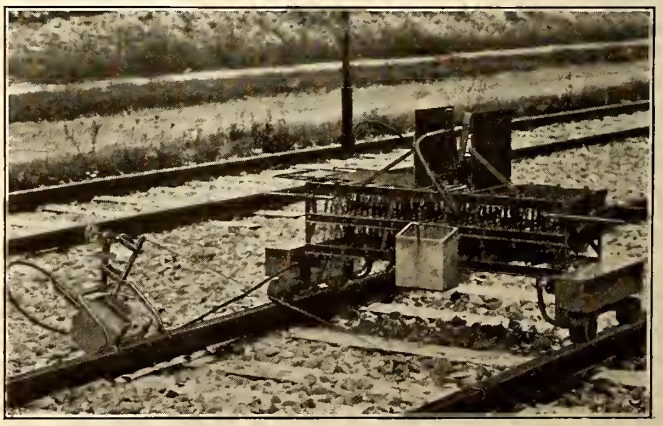
The great trouble, however, has not been with the conductors connecting the two terminals of the bond nor with the terminals themselves, but rather with the deterioration of the contact between the terminals and the rails. The most intimate contacts are obtained by fusing or welding the terminals to the rail. This results in what is practically an alloy of the two metals where they touch each other and an attachment is produced which is almost impossible to separate. If the bond is pulled away from the rail it will be damaged and part if not all of the terminal will be left adhering to the rail.

Such a connection would appear, at first thought, to be the ideal one, but, like all other methods of bonding, it is not perfect, although for much work it is more nearly perfect than any of the other forms. In the first place the equipment required to install the bonds is much more bulky than that needed for any of the other bonding processes. The class of labor represented by the bonders must be at least as high and preferably higher than that required for the installation of the soldered bonds and much higher than that needed for putting on the expanded terminal bonds. Furthermore the temperature to which the bond and the rail both have to be raised is much higher than that needed for sweating on the soldered bonds, and there is danger of overheating and making either the copper in the bond brittle or the steel of the rail so soft that it may be deformed by the blows from the wheels passing over the joint. The head of the rail receives hard service under any condition, and where the receiving ends of the rails are low conditions are rapidly aggravated if the composition of the steel is changed by overheating.

There is, however, no danger of overheating if care-



600-VOLT RESISTOR OUTFIT FOR ARC WELD RAIL BONDING



RESISTANCE GRID MOUNTING FOR USE IN CONTACT WELDING

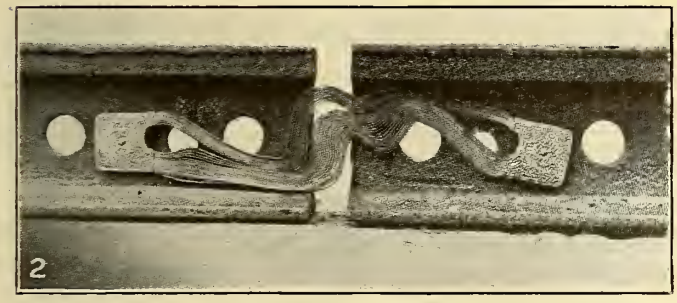
ful, competent bonders are employed, as has been proven by results from many thousands of bonds installed by this process. The danger, however, is always there.

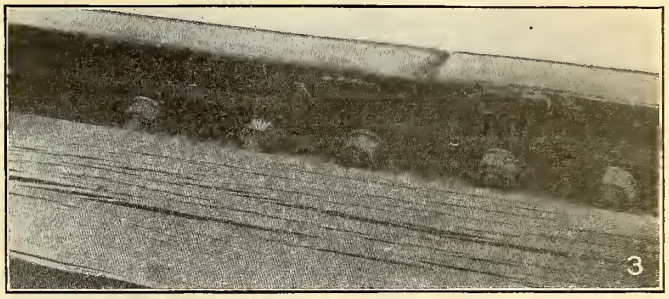
There are two general ways of generating the heat needed to apply the bonds. In one the passing of current at low voltage through the bond and the rail heats both of them to such an extent that the copper bond can be brazed to the steel rail. In the other method the heat is applied by means of an arc, the arc being made either with electric current or with burning gases.

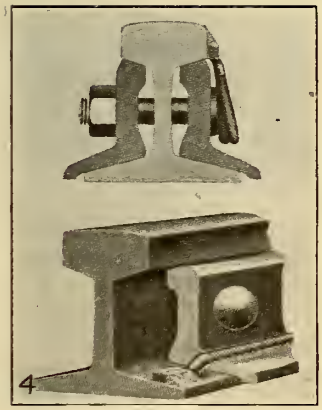
Of the two methods the one using the resistance of the contact between the rail and the bond is the older, but requires more cumbersome apparatus than the arc method, especially when the low-voltage current is produced by an "inverted" rotary converter mounted on a car. This changes direct current at railway voltage into single-phase alternating current at a voltage which is reduced through a step-down transformer.

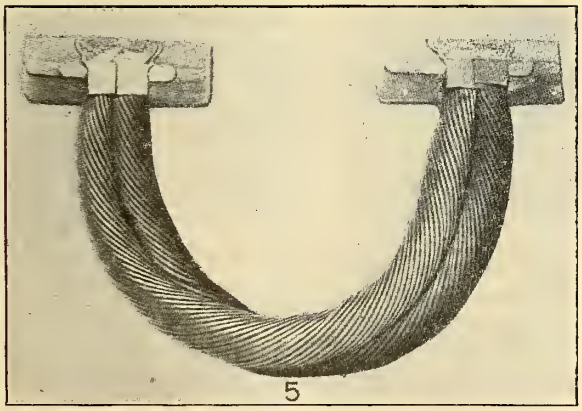
Two sizes of rotary converters are used, one of 18-kw. capacity and capable of welding bonds up to 350,000 circ.mil section and the other of 30-kw. capacity, which can be used with 500,000 circ.mil bonds or with bonds of even greater section. When it is desired to move the car from point to point the rotary can be used as a motor, a clutch and chain being provided for transmitting the power to the wheels. For covering long distances it is claimed that speeds up to 30 m.p.h. can be obtained. With such speeds there is no reason why the line should be blocked or traffic delayed while the car is traveling to and from the point where it is working.

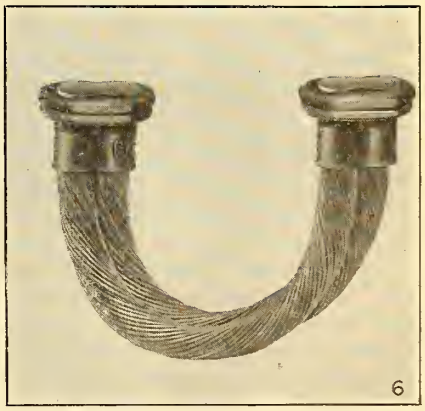
While welded bonds can of course be applied to any portion of the rail, it is much more common to install them on the head than anywhere else. Those portions of the head against which the terminals rest are first cleaned with a motor-driven grinder. The terminals, covered with a piece of sheet brass folded around each one, are first painted with borax and then placed against the rail and held there by being clamped between the carbons. Current is then applied, heating the rail and the bond terminal and also melting away the piece of strip brass which is used for brazing the terminal to the rail. To fasten one terminal of an ordinary No. 0000 bond securely to a rail requires about 2,000 amp. at 5 volts for a period of approximately one minute. The time taken for welding both terminals is two minutes plus an allowance for the time spent in moving from one bond to the next and in getting the carbons accurately located at the points where the terminals are to be installed. There is also a little time lost in clamping the bond onto the rail. As a result, the time required to put on a bond will vary from four to six minutes and the latter rate of











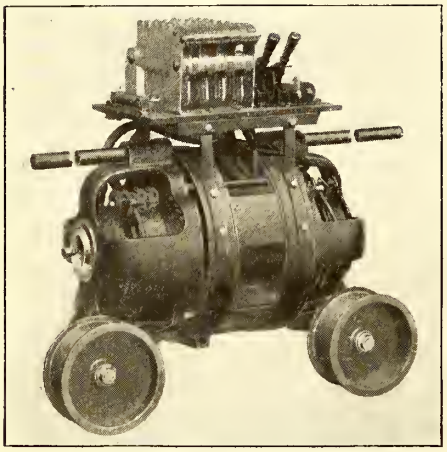
No. 1—Clamp for holding bond in position while it is being welded.
No. 2—Bond shaped to meet special conditions in temporary track.
No. 3—Welded terminals adhering to rail after conductors have been torn away.
No. 4—Installation of bonds on ball and base of rail.
Nos. 5 and 6—Gas-weld bonds with steel terminals.

TYPES OF WELDED AND BRAZED BONDS

ten bonds per hour is a good standard for straight undisturbed work covering several hours.

The welding cars are equipped with a turntable jack attached under them, so that, if necessary, bonding can be done under traffic and the car can be removed from the tracks when a passenger car approaches. When bonding is done by this method only about half the number of bonds can be applied in the same time that can be put on if the car is worked continuously. To remove the car from the tracks it is jacked up, turned at right angles and then pushed off the track by using two pieces of channel iron as temporary rails. Large cars, however, are too heavy to be handled in such a manner by their ordinary crew, so that they must work continuously.

When this outfit is used on lines that have not as yet been electrified and that are being bonded in anticipation of such electrification, instead of the rotary converter being mounted on the car its place is taken by a low-voltage generator driven by a gasoline engine. In order to render the welding outfit lighter and more easily handled, one company has designed a welding equipment with resistance grids mounted on a frame running on four wheels of small diameter or placed on a cart. The frame is light enough to be lifted off the track and the clamps are not attached directly to it, but receive the current through flexible leads running from the grids to them. This arrangement makes it unnecessary for the frame to be kept on the tracks while the terminals are being welded to the rail.



DYNAMOTOR FOR APPLYING BONDS TO RAIL

This apparatus has the great advantage of lightness, but has the disadvantage of wasting much power in the resistance and of being liable to damage the trolley wire by overheating, on account of the heavy current being drawn from the single wire at a single point by means of a contact that is not always a good one.

TWO METHODS OF ARC WELD BONDING

The methods of welding the bond terminals to the rails by the use of an arc can be divided into two general classes, depending upon whether the arc is made by electricity or by the flame from a gas torch. The electrical method can be still further subdivided into arcs drawn from current supplied by a low-voltage dynamotor or motor generator and those in which the trolley current is used and resistance is placed in series with the welding terminals.

When the dynamotor is used a specially constructed light-weight type furnishes the current. This machine is mounted either on a light cart or on a low carriage normally resting on the rails, but so light that it can be picked up and placed at one side of the track out of the way of traffic when desired.

The bonds are merely copper ribbons bent into U-shape, with the ends of the ribbons surrounded by strips of copper to hold them in place. Bonds are applied vertically to the head of the rail, being held there temporarily before and during the process of welding by clamps which act as both clamps and molds and are kept in place on the rail by a thin steel strap which acts as a spring. An arc is drawn between the rail and the carbon electrode. The copper terminal of the bond is fused with the steel of the rail and additional copper besides that in the bond itself. The heat not only welds the copper to the rail but melts the copper in the ends of the ribbons into a solid mass, so that when the mold is removed there is a lump of copper at each end of the bond fused directly to the rail and into which all of the ribbons are fused.

When neither a rotary converter nor a dynamotor is used for reducing the voltage the reduction is obtained by placing resistance in series with the arc and so cutting down the voltage that at the arc it is only a small proportion of the trolley voltage, although even then at the arc the voltage, with the use of resistance in series, is much higher than when the dynamotor is used. A typical resistor is shown in one of the accompanying illustrations.

The bonds for arc welding by this method are much similar to the ones made for use with the dynamotor, but are made in two general types, one all copper and the other with copper strands but with steel or steel-covered terminals. If the all-copper bonds are used they are brazed to the rail by means of a special flux wire, as is done when the revolving machinery is used to transform the current. However, the better method is to make use of the steel or steel-covered terminal and then to attach the terminal to the rail by melting down an iron rod used as a welding terminal and combining that iron with the steel of both the rail and the bond terminal. A pure iron rod, such as the "Armco" iron, is needed and the rod should be about $\frac{3}{16}$ in. in diameter. With such a rod a current of approximately 150 amp. will give the best results.

CLEANING IS ESSENTIAL

The rail is first cleaned with a grinder or a wire brush and then the bond is clamped in position with either an ordinary C-clamp or one shaped like that shown in one of the illustrations. The bond manufactured by one of the large bond companies consists of copper terminals surrounded by Armco iron shells brazed to the terminals and with sleeves of the same material to protect the wires where they leave the terminals. The welding of the copper to the steel is done at the factory, which insures a better job than when the work is attempted in the field. After the bond has been clamped to the rail it is welded there by the arc and the metal melted from the rod is deposited so as to form a triangular mass above the top of the terminal. The sloping form of the metal above the terminal not only adds strength to the attachment of the bond to the rail but prevents the bond from being sheared off if struck by the wheels of wagons or automobiles, and is a patented feature of this bond.

The electric arc is not the only one used for attaching bonds to the rail and many bonds are put on by the use of oxy-acetylene torches. These torches do not make so hot an arc as does the electric current, but it is hot enough for bond welding, and as it is more easily

controlled than the electric arc it is for that reason preferred by many engineers, even when they can use electricity for welding. It is, of course, the only type of arc welding that can be used on new track before it has been electrified, unless one of the few gasoline engine driven units which have been manufactured is used.

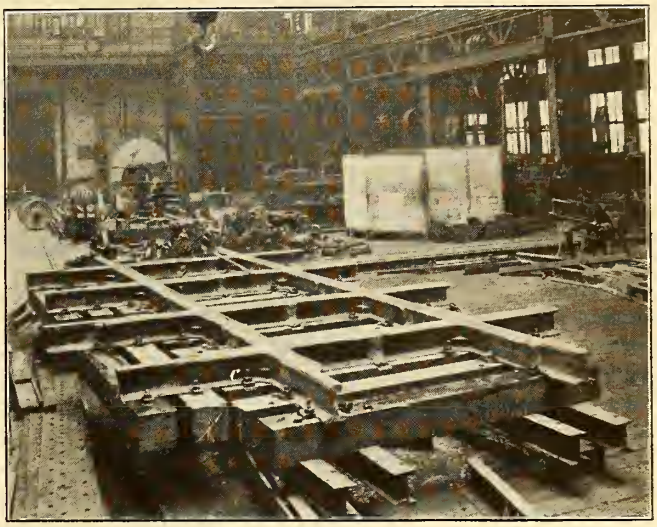
With this equipment the scale on the rail is first burned off with the arc or removed with a grinder or brush, and then one end of the bond is clamped to the rail by means of a C-clamp. While the scale can be burned off very quickly, probably a cheaper job can be made if a grinder is used. Both all-copper bonds and copper bonds with steel terminals are applied by this method and both types of one make are so shaped that there will be a little room between most of the terminals and the rail so that the fused metal can run down between the rail and the terminal and join them. This also permits the gases to escape.

Another type of steel terminal bond used has the head beveled off. With this type the apex and not the base of the triangle is placed next to the rail and metal is filled in until the terminal assumes a rectangular shape. When a bond of this later type is used there is no necessity of having two kinds of bonds in stock, one to be attached vertically and the other horizontally to the head of the rail, as the one bond can be placed in either position, which permits of bonding "Weber" joints as well as those with the other types of joint plates.

Solid Chrome Nickel Steel Special Trackwork

Milwaukee Company Developed This Type of Construction During the War as a Substitute for Solid Manganese—It Has Some Advantages and Apparently Good Wearing Qualities

ASSEMBLING THE CHROME NICKEL STEEL CAST CROSSES, AFTER MACHINING, FOR WELDING THE JOINTS



A HALF DOUBLE-TRACK, DOUBLE-TRACK CROSSING WELDED IN ONE PIECE AND MOUNTED ON FOUNDATION TIMBERS AND RAILS AT THE SHOP

DURING the war, when solid manganese steel special work became very expensive and very difficult to get at any price the Milwaukee Electric Railway & Light Company undertook to develop a substitute. The investigation was carried through considerable experimentation, out of which was evolved a chrome nickel steel having a composition which seemed to offer the desired qualities. To date three double-track crossings made up from solid chrome nickel steel castings have been installed and a fourth one is now being made. These embody a number of unique features in connection with the method of construction and installation.

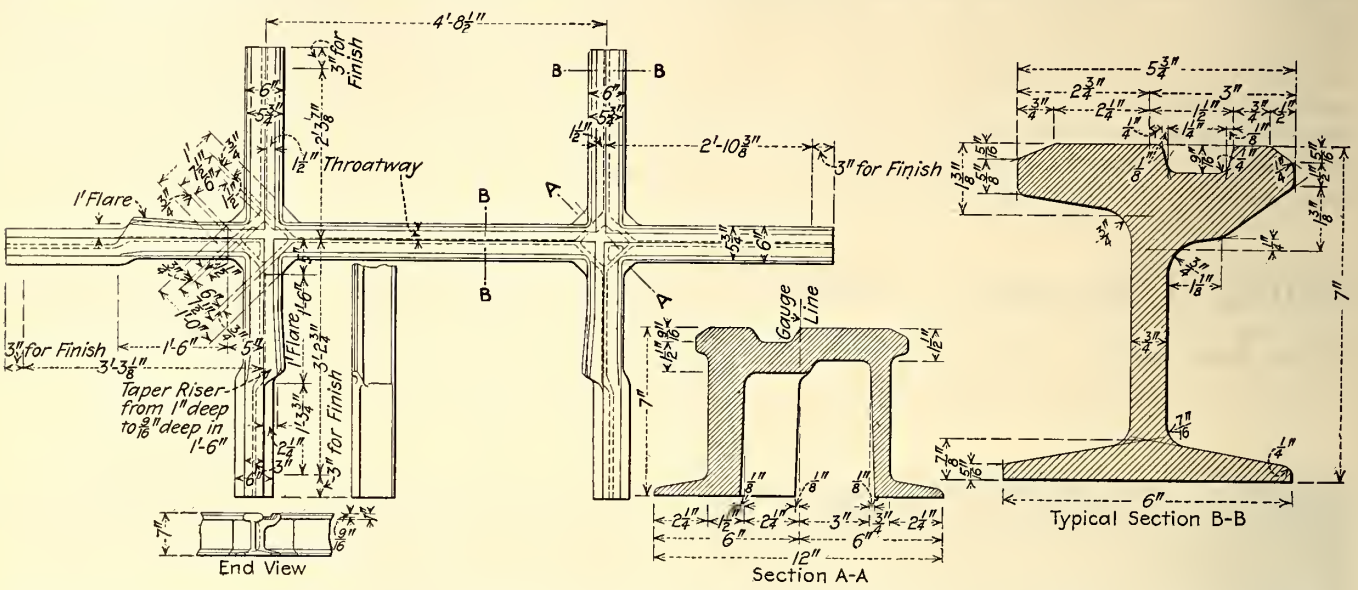
The formula finally determined upon for this special work steel was as follows: Carbon, 0.35 per cent; manganese, 1.00 per cent; phosphorus, 0.03 per cent (max.); sulphur, 0.04 per cent (max.); silicon, 0.15 per cent; chromium, 0.55 to 0.60 per cent; nickel, 2.30 to 2.50 per cent.

The crossing for each single track was cast in four pieces (four crosses) in order that the machining could be done on the largest planer available in the company's shops. If a large enough planer were available it would be desirable to cast each single-track crossing in only two pieces, thus avoiding two joints. The castings were made in a local steel foundry in basic electric furnaces and all machine work was done in the company's own shops, though now that the development work has been completed an effort will be made to have future special work built by manufacturers.

After the machine work was completed the four pieces for one single-track crossing were thermit welded together in the shop at the four joints and then two of these complete crossings welded together at their two joints. This half-double crossing was then through-bolted in the shop to 8-in. x 8-in. and 8-in. x 12-in. white oak timbers, the larger timbers being used for those positions coming directly under the rails, in order to give a width outside the rail base sufficient for the bolt holes and rail clips. A double-

track, double-track crossing with its foundation was thus made up and transported to the location at which it was to be installed in two pieces, so that of the forty joint welds to be made only twenty had to be made in the field.

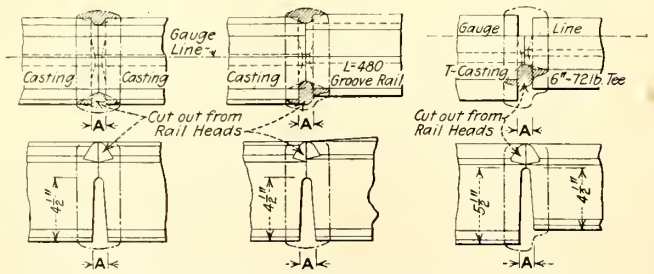
Upon reaching the job the two pieces forming the complete intersection were set in place by means of a derrick car, blocked up to grade and alignment and Sufficient metal was left in the flangeway to permit a wear of ¼ in. before the tread of the standard wheel will touch the rail head. One of these crossings installed at West Water and Sycamore Streets, which is one of the heaviest intersections in the city, showed a wear in the flangeway of 3/32 in. after being in service eight months. It will be noted from an accompanying drawing that the cast rail section used in the special



DRAWING SHOWING STRUCTURAL MAKE-UP OF THE SPECIAL WORK CASTING AND SECTIONS THROUGH THE ACTUAL INTERSECTION AND THE GROOVE RAIL

concreted in. On some of the intersections thus made up additional foundation strength was provided by bolting several sections of old rail, inverted, to the bottom of the timbers, fastening them by means of separate through bolts and clips. Where these were used they were also bolted in place before the special work left the shop.

It will be noted that all joints were thermit welded and that no bolted joints whatever were used. This is considered one of the material advantages offered by this new type of solid special work, for it has been the experience of the Milwaukee company that the difficulty of matching up and grinding joints between solid manganese special work and the adjoining rails



METHOD OF PREPARING RAIL ENDS FOR THERMIT WELDING TO ELIMINATE THE INSERT

in order to secure a perfect joint, and, further, the dependence on heat-treated bolts to hold the joints in place are the principal sources of trouble. In other words, it is necessary to use materials in the joints that are inferior to those in the special work.

An interesting feature in connection with the chrome nickel steel crossing is that the crossings were made with flange bearings entirely across the special work. work casting is not standard, but is reinforced under the flangeway to provide for the stresses incurred through the flange bearing.

While these nickel chrome steel layouts have not been in service long enough to determine their wearing qualities relative to those of solid manganese steel special work, the first one having been installed in April, 1919, there are certain observations which may be made now in comparing the two. The nickel chrome steel special work has the threefold advantage that it can be machined instead of ground, that it can be welded at the joints instead of bolted and that it may be built up with an electric welder at the intersections without destroying the hardness of the metal and producing brittleness, if repair work becomes necessary. As to the relative cost, that for the metal alone is about the same. There is probably some saving to be realized in the machining process as compared with grinding. And if the wearing qualities of the nickel chrome steel prove to be somewhere near as good as those of the manganese steel, it may be assumed that the maintenance cost will be materially lower because of the elimination of the bolted joints.

CHROME NICKEL STEEL SPECIAL WORK SHOWING COMPLETE FLANGE BEARING AND NO BEARING ON RAIL HEAD

With the adoption of the nickel chrome steel special

work for heavy traffic locations the Milwaukee company will have standardized upon two types of construction. Cast steel-bound special work without manganese plates is made use of very generally except at the heaviest traffic locations, where the solid-steel crossings are used. Very good success has been had with the steel-bound type, not a single break having occurred in three and one-half years, with a good many installations in use. The Milwaukee company is using thermit welds to a limited extent in making repairs to special work and has made up some frogs by this method, as described in the ELECTRIC RAILWAY JOURNAL for Dec. 20, 1919, but it is continuing to use the steel-bound construction for the bulk of its replacements.

In conection with the use of the thermit process of welding joints in special work an interesting scheme has been devised to eliminate the necessity for the insert which is commonly employed. The need for this insert has been overcome by cutting away the ends of the two rails at the base and underneath the head, as shown in an accompanying drawing. This permits the metal to flow into and become an integral part of the web, assuring a positive weld without the insert.

Illinois Utilities Committee Report on Valuation and Return

IN ORDER to encourage the necessary investment in public utility securities two things must obtain: First, a fair valuation of property and, second, rates sufficient to pay an adequate return over and above expenses. This is the fundamental statement of the committee on valuation and return of the Illinois State Electric Association, Illinois Electric Railways Association and Illinois Gas Association, acting jointly. It is claimed that more than $40,000,000 is needed to pay for the extensions and improvements which should be expected from purely local public utilities of Illinois, and if the cities and communities are to thrive and prosper the public utilities must expand to meet the increased demand made upon them.

In making recommendations the committee starts with commendation for the report of the valuation committee of the American Electric Railway Association. It states as a necessary fundamental that a utility is entitled to a just and reasonable, as distinguished from a merely non-confiscatory, rate, and urges the development of this point in the presentation of all public utility rate cases.

The other recommendations of the committee are that in all cases the evidence be fully presented; that utilities should submit appraisals of physical property based on the cost to reproduce new at prices prevailing at the date of inventory, and that the commission be urged to adopt the same as the present value of such physical property; that if the commission or any other party submits an appraisal based on the original cost or cost to reproduce at any other period than the present, the utility should produce evidence showing the difference between the purchasing power of the dollar used in such appraisal and the purchasing power of the dollar current at the present time; that there should be no deduction for accrued theoretical depreciation; that a full and fair allowance should be made for going value; that the item of income taxes be considered a deductible expense; that all valuations should be itemized and that commissions should itemize their findings accordingly; that a sufficient amount of working capital should be shown necessary and that replacements and contingent reserves be set up.

The committee also suggests that each utility file copies of all briefs submitted to commissions with the secretary of the Public Utility Association, in order to encourage full co-operation and also a complete understanding.

Storms Increase Motor Failures

A General Analysis of Some Equipment Failures Occurring in Parts of New England Visited by Heavy Storms of Past Winter

BELIEVING that the experiences of a few typical electric railways as to the effects of the recent snowstorms upon equipment would be of assistance and interest to master mechanics and others, the editors of the ELECTRIC RAILWAY JOURNAL have made a special effort to obtain such information. The reports received indicate that the equipment failures in those parts of the country which were visited by the heavy storms were most severe. Many railway properties have tabulated the various equipment failures for the purpose of study, and in the accompanying table the numbers of armature failures that occurred on four New England electric railways are given. The total number of failures for the several weeks from Jan. 3 to March 6 are given, with the ratio per cent that this number of failures bears to the total number of armatures in service. The total number of failures for this period varies from 24.5 per cent to 52 per cent. Perhaps the most interesting feature brought out by this comparison is that, while the first trouble is due to overload and the roasting of insulation, by far the greatest trouble comes from the fact that the deteriorated insulation becomes wet and easily breaks down, thus causing grounds and short circuits.

The greatest number of failures occurred during February. At the beginning of the month there was in the New England district a considerable accumulation of snow and ice on the ground, which had resulted from the weather conditions during January. No unusual difficulties, however, were experienced on account of the January storms, but the storm which commenced Feb. 4 and continued all through the next day and until the middle of the afternoon of Feb. 6 resulted in the greatest percentage of failures. Several other storms which were not quite so severe but which added greatly to the difficulties of operation followed this initial storm. The storm which began on the night of Feb. 4 consisted of semi-frozen slush which became saturated shortly after falling. Before nightfall on Feb. 6 the snow turned to a cold rain and then froze to almost solid ice. This storm was accompanied by a wind of nearly 32 m.p.h. velocity, and in spite of its wet condition the snow drifted badly.

FAILURES OCCURRED WITH ALL TYPES

In the tabulated results which have been received by the ELECTRIC RAILWAY JOURNAL so far the number of troubles with each type of motor is given. An attempt was made to group these failures according to the age of the equipment, but this did not bring out any information which would lead to definite conclusions. The number of failures even with the same general type of equipment varies through a wide range, due to the various conditions which are encountered. Thus one

road or even one line of a particular road may have used up its motors and burned out the windings by bucking snow. Another line or road may have been forced to operate its equipment through water to an excessive depth, and this, entering the motors and bearings, causes grounds and short circuits. When cold weather follows the thaw the water which has entered the bearings becomes frozen and shuts off lubrication. This results in the bearings becoming hot and the armatures are let down so as to rub the pole faces, thus damaging the windings and tearing off the bands.

Another factor which ultimately makes itself evident in the number of equipment failures is the amount and type of vehicular traffic which operates on the car tracks. In removing snow some roads clear to the pavement, while others prepare a snow roadway. The effect on the equipment must necessarily be different in the two cases. The drainage conditions of the various railways also have an important bearing upon the amount of water which accumulates on the tracks through which the equipment must operate. Some roads experience difficulty with the lifting of the tracks or pavements by frost. This results in damage to the motors and gear cases from rubbing. Other roads do not encounter this trouble. The diameter of the wheels on the cars is another factor which must be considered in connection with the failures resulting from snow conditions. One road reports no trouble on cars with 33-in. wheels, while it had considerable trouble with motors on cars with 26-in. wheels. In this case it was found that the insulation on the motor windings was roasted out. This was caused by bucking snow, but more particularly by the dragging of the motors over the high surface of ice that accumulated between the rails.

In considering the troubles which have occurred to the ventilated motors of the latest type it appears that several roads have had considerable trouble due to drawing in of snow by the fans. This snow is deposited in the motor frame and around the brushholders. After a thaw the accumulation freezes and forms a solid cover of ice. The application of covers to the motor in several instances has proved of great advantage. By far the greatest trouble experienced with ventilated motors, however, has been caused while bucking snow. The ventilated motor does not have the same capacity for overloads as the older non-ventilated motors, and as most snow bucking is done at low speed the advantages of the fan ventilation are lost. There is no doubt that the amount and quality of snow-clearing equipment which the various railways have in operation has a considerable effect on the number of failures which occur in the operating equipment. If railways can keep their lines properly cleared of snow the resulting equipment troubles are not excessive.

Severe Problem of Keeping Lines Open

The problem of keeping a line free from snow and keeping cars running during a storm on most systems resolves itself into keeping the snow-clearing equipment in operation. In the storm which began in the New England section on Feb. 5 the snow contained considerable moisture and packed readily. Even the breaking down of a truck on the track in front of a snowplow for a short time was sufficient to cause the snow ahead of the snowplow to become packed by vehicular traffic, so that its removal could only be accomplished by the use of picks in the hands of a gang of laborers. Another one of the storms was accompanied by a storm of sleet and rain which froze as it fell. The trolley wires became laden with this ice and a large number of breaks occurred, so that power was actually cut off from the line and the snow-clearing equipment could not operate. Such conditions as these give the operating companies the greatest amount of trouble.

ARMATURE FAILURES CAUSED BY EXTREME WEATHER CONDITIONS

	Road No. 1		Road No. 2		Road No. 3		Road No. 4	
	Number Armatures	Per Cent Failure to Total	Number Armatures	Per Cent Failure to Total	Number Armatures	Per Cent Failure to Total	Number Armatures	Per Cent Failure to Total
Armature in service	4,297	.....	2,554	.....	1,324	.....	1,012	.....
Failures for Weeks Ending: Jan. 3	32	0.75	26	1.0	18	1.35	8	0.79
Jan. 10	111	2.6	32	1.24	21	1.58	26	2.6
Jan. 17	79	1.85	26	1.0	41	3.1	29	2.9
Jan. 24	189	4.4	45	1.75	72	5.4	36	3.6
Jan. 31	216	5.0	48	1.87	77	5.8	43	4.3
Feb. 7	168	3.9	52	2.03	124	9.3	41	4.1
Feb. 14	182	4.2	94	3.65	99	7.5	55	5.5
Feb. 21	260	6.1	107	4.15	84	6.3	69	6.9
Feb. 28	303	7.1	92	3.58	91	6.9	92	9.2
Mar. 6	293	6.8	105	4.1	69	5.2	55	5.5
Total failures, Jan. 1 to Mar. 6	1,833	43.0	627	24.5	696	52.0	454	45.0

While the damage done to armatures is the most expensive to repair, still the trouble caused by grounded or short-circuited field coils is quite as annoying. In this connection road No. 3, which is shown in the accompanying table as operating 1,324 motors, used 1,263 field coils during January, February and March, and road No. 4 with 1,012 motors used 900 field coils. This is nearly a field coil for each motor.

In connection with other equipment defects one road reports a large amount of trouble from grid resistors becoming open-circuited, caused by the overheating of the grids from the slow and severe operation and consequent splashing with water or slush. This causes the grids to break and the open circuit occurs, usually resulting in a "dead car," which has to be pushed to the terminal with overloading of the equipment of another car. The breakage of gears, pinions, axles and wheels during cold weather is also considerably increased and adds to operating difficulties.

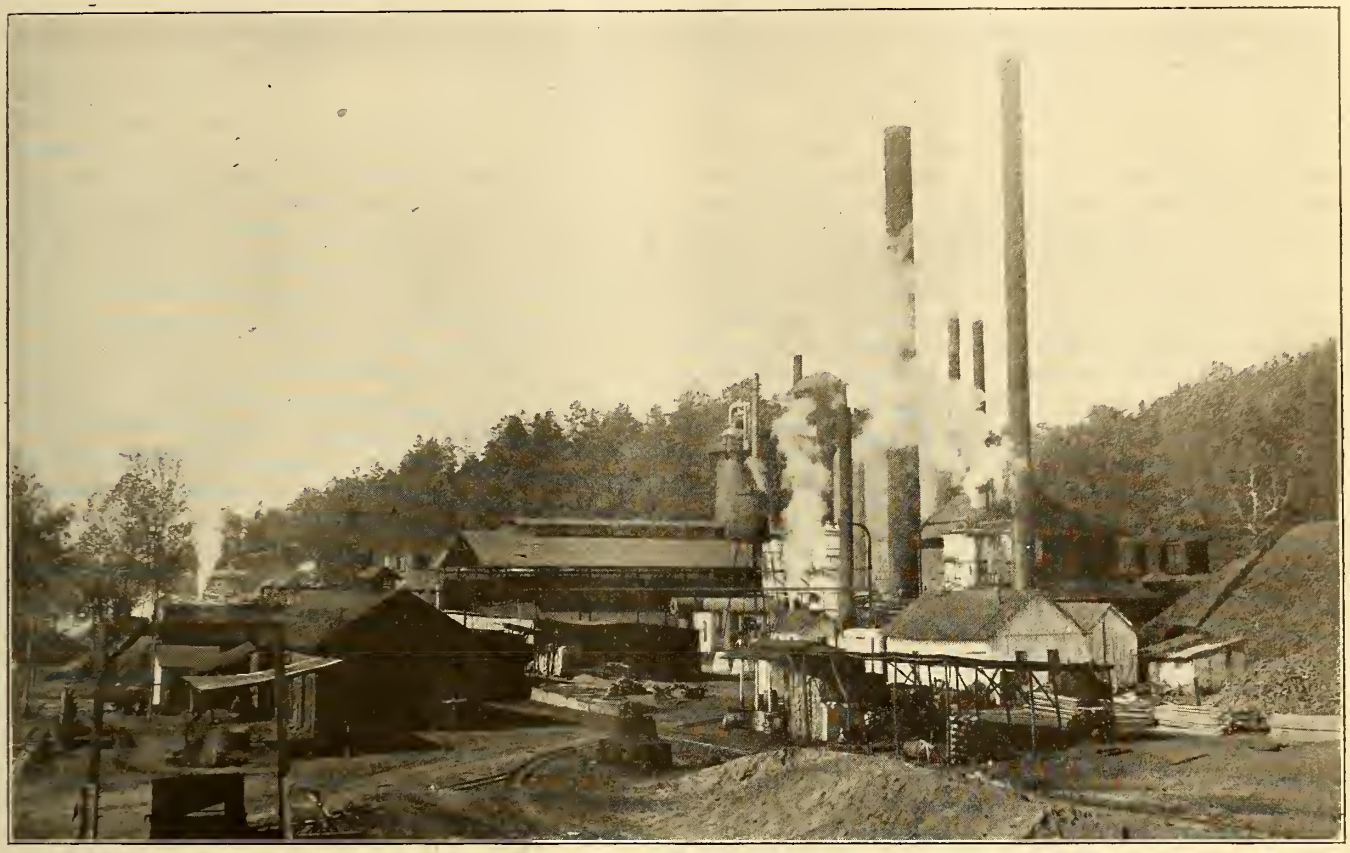
If benefit is to be derived from the experiences of the past winter it must come in the nature of improvements which will prevent the various parts from failing under the extreme conditions of winter service. While a mere enumeration of the troubles that have resulted and a knowledge that others have had as much or even greater trouble may be consoling to some roads, still if desirable results or improvements are to be obtained they must come through the electrical manufacturers.

No Labor Shortage in Kansas City

IN THE trainmen's instruction school of the Kansas City (Mo.) Railway there are from 150 to 200 men at all times to care for the turnover among the 2,600 employees of the transportation department. The labor turnover for the period from December, 1919, to April, 1920, inclusive, following the last strike, was about 300 per cent. Records show that 5,128 men entered the service and 2,881 left. The turnover has now gone back to a point as low as, if not lower than, that in most of the large industries in the city. The present wage, which provides a maximum of 50 cents per hour in the fourth year of service, is attracting men from other industries and there is practically no shortage of man-power to operate the cars.

Railway Car Materials—Steel—I

By NORMAN LITCHFIELD



STEEL MANUFACTURE BEGINS AT THE BLAST FURNACE

A Comprehensive Statement of the Standard Steel-Making Processes Is Given to Promote a Better Understanding of the Qualities to Be Expected in Steel

The Manufacture of Steel

THE mechanical man of a railroad upon turning to the ordinary text-books for information on the nature and properties of iron and steel finds himself confronted with a mass of information which is confusing. This confusion is unavoidable, because a text-book must cover all of the various fields so that the general student may become informed, or rather that he may be provided, as it were, with a reservoir of knowledge from which he may draw as occasion demands.

There are a number of other sources to which the reader may turn if he desires a more intimate knowledge of the subject, but the writer has felt that a fairly clear idea of the salient characteristics of these materials could be presented briefly and in such a way that the information would be of interest and have reference value. This article is the result. It is not designed to present any strictly new matter but simply to review the subject of steel and to present a general picture of the present situation regarding its production and its utilization in the electric railway field.

To obtain a clear understanding of what is commonly known as iron and steel, it should be borne in mind that all of the varieties of iron and steel, whether cast iron, cast steel, wrought iron, steel in the form of plates, bars and structural shapes, however complex, all start fundamentally from the same source. The initial stage of manufacture of all is the same, namely, the iron ore, which of course is not metallic iron, but the oxide of iron mixed with silica, sulphur, phosphorus, etc., is heated in a blast furnace with coke and limestone. Here the high temperature breaks up the oxide of iron into metallic iron and oxygen gas, the latter immediately combining with the sulphur and other elements. Mixed in with the pure metallic iron are the impurities that were present in the ore, sulphur, phosphorus, etc., although not in as large quantities. Some of these have been given off as gases and others have been fused and, being lighter than the iron, float on top of the molten iron and are drawn off before the iron is poured into molds. The iron so cast contains from 3 to 4 per cent of carbon and is known as "pig iron."

It is impossible to "run" the material in this state, and it is from this point on that the methods of manufacture of the various commercial materials begin to differ. Here the reader should remember that iron and

steel get their various qualities not inherently, as in case of the woods, treated in a previous article, but through the processes to which they are subjected during manufacture.

These processes have been worked out by centuries of experiment, the earliest process of which we have knowledge being that of making wrought iron and small quantities of high-grade steel directly from the ore without the production first of pig iron as above described. This goes back many hundreds of years before the Christian era.

Cast iron is thought to have been made first about the time of the discovery of America by Columbus, but the modern pig-iron products, such as wrought iron and steel, were not produced commercially until the latter half of the eighteenth century. Then in 1856 came the world-shaking discovery by Sir Henry Bessemer of the process now named in his honor for making steel. When we realize what this discovery has made possible the wonder of that achievement stands out as simply colossal. Since that time the advance in the art has been rapid and has made possible the marvelous structures of the last century.

Making Wrought Iron From Pig Iron

In the manufacture of wrought iron from pig iron of proper grade, the latter is heated in a reverberatory furnace with a fluxing cinder (oxide of iron) until both iron and flux melt into a pasty mass. The flame of the reverberatory furnace impinges upon the contents and oxidizes the impurities. The purified metal collects in globular masses which are turned over and assembled by the puddler, then removed from the furnace and a portion of the slag squeezed out. It is then rolled into bars, which are called "muck bars." These bars still contain a great deal of slag and hence are never used commercially, but they are cut up and the pieces are piled and bound together with wires, the bundles being reheated to a white heat (not melted) and again rolled into bars, known as "merchant bars." This is the usual "bar iron" of commerce. When a purer metal is desired, the merchant bars are cut up, repiled, reheated and rerolled into bars, thus forming "double-refined" iron.

To review, then, it will be seen that wrought iron is essentially a material that has been produced by melting the iron to a pasty state in a bath of slag, then removing the pasty iron and rolling it before it solidifies. It consists of practically pure iron mechanically mixed with slag. As it is rolled out into bars the slag is also rolled and gives to the wrought iron its characteristic fibrous appearance.

Steel Is Made in "57 Varieties"

While wrought iron is a simple substance, consisting, as above stated, of pure iron with which a certain amount of slag is mechanically mixed, steel is a complex material consisting mainly, of course, of iron, but this iron has crystals of various other substances imbedded in it, and in some cases the iron is chemically combined with these foreign materials. Furthermore, while in wrought iron the slag is practically inert, in steel the foreign substances exercise a controlling effect on the qualities, which will be considered later. But at the outset we would impress upon the reader the fact that whereas when we say that an article is made of wrought iron the name itself signifies a material whose properties are fairly well defined, on the other hand to merely assert that an object is made of steel means little or nothing, inasmuch as there are as many varieties of steel as there are of pie, and the effect of a poor variety of one is about as deleterious as the other.

In steels which contain but a small amount of the foreign substances, the chemical composition and the physical properties begin to resemble those of wrought iron. We may then differentiate steel from wrought iron by its process of manufacture.

Stripped of all qualifying and explanatory phrases, steel may be considered essentially as a material made by melting pig iron to a liquid state and then adding to it other substances which have been found to increase its strength. The pig iron contained originally about 3½ per cent of carbon. This is burned out during the liquefying process and carbon in the final steel is obtained by direct addition while the iron is fluid.

Bessemer vs. Open Hearth with Respect to Quality

The chief two processes of producing commercial steel are the bessemer and the open-hearth processes.

In the bessemer process the carbon is burnt out of the melted pig iron by blowing air through it at high pressure, until the iron contains practically no carbon at all. The desired percentage of carbon is obtained by adding "spiegeleisen," after the metal is decarbonized. This process does not remove any of the phosphorus and sulphur in the iron, and bessemer steel can only be used in places where a fairly high percentage of these impurities will not matter. On the other hand the bessemer process is the cheapest and the quickest method of making steel.

In the open-hearth process a mixture of pig iron, wrought iron, cast iron and steel is melted in a so-called "regenerative" furnace, for the details of which the reader is referred to any standard works on metallurgy. In this furnace a flame impinges upon the surface of the mixture of metals, melting them but not burning out the carbon except to a limited extent, which may be controlled more or less at will by varying the temperature in the furnace. As the heat progresses samples are drawn off from time to time and the percentage of carbon present is determined either by visual examination of the fracture or by quick analysis in the laboratory. The amount of phosphorus in the finished steel, while not reduced in any way by the burning out process of the open-hearth furnace, can be controlled by selecting the proper proportions of steel, cast iron, etc., in relation to the pig iron. However, by adding lime to the charge the amount of phosphorus can be reduced, and when this is done the operation is termed the "basic open-hearth process," and merely as a matter of distinction (for otherwise the term is meaningless) the process in which lime is not used is called the "acid open-hearth process."

At the present writing it is becoming somewhat the practice of steel manufacturers to use what is known as the "duplex process," in which the process is first started in a bessemer converter and then, before decarbonization is complete, the molten liquid is discharged into the regenerative furnace and the making of the steel is completed by the usual open-hearth process. This cuts down the total time of the melt considerably and thereby reduces the cost of the steel.

Experience with the chief two processes, bessemer and open-hearth, has conclusively shown that the latter is much more reliable in every way than the former, and hence bessemer steel is used only in places where the

conditions do not require a high-grade material. As between the basic and acid open-hearth processes there is probably but little inherent difference, as it is possible to produce good steel by either process.

The foregoing gives but the barest outline of the main features of the manufacture of steel, and is offered simply to indicate in the most general way that ordinary steel is divided roughly into two classes, first, that made by the bessemer process and, second, that made by the open-hearth process, and further that the inherent nature of the processes is such that the open-hearth produces a better and more reliable grade of steel than can be produced by the bessemer process. A considerable amount of electric furnace steel is now being produced, but the large bulk is still open hearth or bessemer or one of its varieties.

Certain factors influence the character of the steel, no matter what the process of manufacture. These are: 1. Chemical composition. 2. Care taken in the manufacturing process. 3. Heat treatment.

Chemical Treatment Is Only One Factor

It will be noted that chemical composition is listed as only one of these fundamentals of the character of steel. We emphasize this point on account of the tendency of many to assume that a mere statement of the composition will define the characteristics of the steel, which is not the fact. It is, however, the basic factor. From a chemical standpoint steels are grouped roughly into two classes; carbon (or ordinary) steels and alloy steels.

By "carbon steels" are meant those steels whose physical properties are determined largely by the proportion of carbon which they contain, while "alloy steels" are those in which the effect of the carbon is replaced or supplemented by that of other metallic elements such as nickel, chromium, manganese, vanadium, tungsten, etc.

Considering first the carbon steels, it must be recognized at the outset that the presence of carbon plays a part totally disproportionate to its numerical content. That is to say, the total percentage of carbon even in the so-called "high carbon" steels will not run, except in rare instances, over 1 per cent, whereas the tensile strength of the material will have been increased from about 45,000 lb. per square inch at 0.05 of 1 per cent carbon to more than 150,000 lb. at 1 per cent.

In all carbon steels there is present a small amount of manganese from 0.3 to 0.6 of one per cent, which has been added during the process of manufacture to prevent what is known as "red-shortness," or brittleness of the steel when hot. It further has the effect of causing an increase of about 10,000 lb. per square inch in the tensile strength with the high percentages, but this effect is somewhat incidental. Hence the steel is called "carbon steel" on account of the preponderating effect of the carbon on the strength of the steel.

Silicon from the slag is always present in carbon steel up to a maximum of about 0.4 per cent. It has the effect of increasing the fluidity of the steel, and in small quantities has but little effect on the physical qualities of the steel. Except in some particular instances, such as springs, therefore, the user is not particularly concerned in the amount of silicon which is present.

We now come to the question of the so-called "impurities," sulphur and phosphorus, the presence of which in any large quantity is very undesirable.

Sulphur makes the steel "red-short," causing small, fine cracks in the process of forging, which remain when the metal becomes cold. For this reason manganese is added to the steel, which combines with the sulphur, forming manganese sulphide. While this overcomes the red-shortness, it introduces a new danger, in that the sulphide is apt to collect in streaks which, as it were, break up the continuity of the steel and impair its strength. Hence it is desirable that the sulphur content be kept reasonably low, and fortunately for the user the manufacturer is as a general thing anxious to do so in order to avoid difficulty in the forging and rolling of the material into its finished shape.

Phosphorus, the other impurity, is one in which the user is vitally interested in that any considerable quantity of it reduces the ductility of the metal and lessens the resistance of the steel to shock.

Granting that both sulphur and phosphorus are objectionable elements in steel, the next question is to determine how much or how little can be allowed in the steel without hurting it.

The A. S. T. M. specifications for structural steel for cars, A-11-16, require as follows:

		Structural Steel and Plates for Cold Pressing	Rivet Steel
Phosphorus	Acid	Not over 0.06 per cent	Not over 0.04 per cent
	Basic	Not over 0.04 per cent	Not over 0.04 per cent
Sulphur		Not over 0.05 per cent	Not over 0.045 per cent

The foregoing all apply to open-hearth steel, the use of bessemer steel not being permitted by the specification for car material. In such specifications as those for structural steel for buildings, which allow bessemer steel, the limit for phosphorus is 0.1 per cent, there being no specified limit for sulphur.

Just how the limits given for open-hearth steel were arrived at is not entirely clear, although it seems probable that they were the results of commercial rivalry. It had become evident that the high percentage of impurities as found in bessemer steel was bad from the users' standpoint, and as each improvement was made in the open-hearth steel art it gave the originating manufacturer an opportunity to offer to his customers a product which he and they felt was better than that of his competitors.

As time went on, these competitors made their own improvements, and so the limits of impurities were beaten down to the point where they now rest in the various existing standard specifications.

In fact, during times of slack demand for steel products, manufacturers have been able to offer a much lower limit of impurities, and users are sometimes tempted to feel that because they have been in the habit of receiving this high-quality material, they are justified in incorporating a very low limit for impurities in their specifications. The steel makers claim, and it would seem justly, that such a course is unfair, inasmuch as with an existing top limit of 0.04 per cent, it is necessary for them so to select their materials that they will "aim at," say, 0.03 or 0.35 per cent. In other words, if a specification calls for 0.04 per cent as a top limit, it is probable that a large part of the material will run down to 0.03 per cent or lower. This all requires care and attention in the process of making the steel and often the selection of certain heats or melts, as against others which must be thrown out. Hence, if the user pushes his prerogative too far, and demands a

very low upper limit for impurities, he is apt to force the manufacturer into a position where he must charge a higher price, and the user should therefore be quite certain in his own mind that his service demands an extra special grade before embodying excessive restrictions in his specifications.

War-Time Limits for Impurities

During the period of the war the tremendous shortage in materials made it well-nigh impossible for the manufacturer to maintain his previous standards, and therefore the upper limits of impurities were quite generally raised, the A. S. T. M. specifications in many instances bearing the following notation: "In view of the abnormal difficulty in obtaining materials in time of war, the rejection limits for sulphur in all steels and for phosphorus in acid steels shall be raised 0.01 per cent above the values given in these specifications. This shall be effective during the period of the war, and until otherwise ordered by the society."

It will be noted that, as far as phosphorus is concerned, this tolerance applied only to acid steels, and inasmuch as by far the greater proportion of steel made in this country is now made by the basic process, the matter really comes down to a consideration of the sulphur content.

During the last meeting of the American Society for Testing Materials considerable discussion was had in regard to this matter along two lines, on the one hand whether the time had not now arrived when it was entirely feasible to drop the war tolerance from the specifications of the society and on the other hand whether the extra point of sulphur did not harm the material. As a result of this discussion it was decided "that the forty-three specifications to which this note has applied be divided into two classes: (1) Those specifications from which the note is to be removed at the present annual meeting, as of July 1, 1919; (2) those specifications from which the note is not to be removed at this time, and consideration of its removal is to be deferred until the annual meeting in 1920."

Among the latter group is the specification for car material, and the tolerance therefore still stands.

The second question, that of a general study of the influence of sulphur and phosphorus in steel, is now the subject of joint investigation by a committee representing the A. S. T. M., the United States Bureau of Standards, and representatives of consumers and the railroads. It is planned to gather data both from the mill and laboratory and also from materials in service. This investigation, it is hoped, will throw some light on this subject, which has ever been one of doubt and often of dispute. For the present it may be said, however, that the A. S. T. M. specifications, even with the war tolerance, cover materials which if properly made are suitable for ordinary requirements.

The percentage of sulphur and phosphorus mentioned above are those obtained by analysis made from a test ingot taken during the pouring of the melt. It is generally specified that the purchaser may make analyses from finished material representing each melt. Some specifications, such as that for car material, allow the phosphorus and sulphur content so determined to exceed that of the ladle analysis by not more than 25 per cent. This means that steel made to a specification calling for 0.04 per cent phosphorus might contain in the finished material as high as 0.05 per cent and with the war tolerance of 0.01 per cent as high as 0.0625 per cent. Other specifications require the check analysis to agree with the ladle analysis. In making any comparison of the specifications, therefore, careful note should be taken as to this particular provision, for it is the check analysis which is really controlling.

Further treatment of the chemical composition and physical properties of steel will be given in an ensuing article.

Inspecting Contactors on Multiple-Unit Equipment

IN order properly to inspect the contactors of multiple-unit equipments it is necessary to operate them. This usually requires two men, one to operate the control from the master controller and the other, under the car, to inspect the operation of the various switches to insure that this is proper and in the right sequence. Where repairs or adjustments are necessary a considerable amount of time is wasted by requiring the presence of the operator when his services are not actually needed. Also on multiple-unit equipments which use line voltage in the operation of the contactors it is necessary to have the main switch in and to cut out both sets of motors to prevent the car from moving. Also, during work on the switches, if the main switch is kept in there is an unnecessary waste of power from the current passing through the resistors and an element of danger to the inspector, as the parts are "alive."

In this connection Rowland Hubbard, master mechanic Philadelphia & Western Railway, has found it convenient to have his inspectors operate the switches themselves without requiring the assistance of a man at the master controller. The holding-in circuit for the pick-up coils of the contactors is energized through the line relay contacts. In order to make operation possible without operating the master controller a 10-amp. knife switch has been installed alongside the No. 1 contactor arcing box. When this switch is closed it short circuits the contacts of the line relay so that the pick-up wire is energized for operating the contactors. The location of this switch is handy for the inspector when he is opening up the contactor covers. The line connection for operating the contactors is provided by tapping in on the trolley connection going to the line relay. With this arrangement operation will be accomplished with the main switch out and the motor cut-out switches left in. This arrangement of connections has now been in use for over three years and has proved very satisfactory, as well as providing an additional safety precaution for the inspector.

Paving Charges Keep Up Fares

PHILADELPHIA'S first modern pavement of consequence was provided at the expense of the car riders. Paving costs, including interest payments on the original cost, and maintenance and renewal payments under the agreement of 1907 now total $1,750,000 per annum. This is equal to a 6 per cent return on the outstanding capital stock and must be paid by the P. R. T. patrons as their contribution toward something they themselves never use as car riders. In other words each revenue passenger transported during the year 1919 paid 0.26 cent tax for paving.

Connecticut Zone System Revised

Commission Upholds Principle of Zone Fares, but Disregards Density of Traffic—Makes All Zones Equal—Raises Cash Fare 30 Per Cent and Establishes Two New Ticket Rates—Some Doubt as to the Financial Result

THE Connecticut Public Utilities Commission on April 9 decided that the present system of zone fares in use by the Connecticut Company is discriminatory. The commission pointed out that the zones are of unequal length and that all of the increase in revenue has been at the expense of the suburban rider, inasmuch as the minimum fare for the majority of riders in the larger cities had remained unchanged. This decision was handed down after public hearings extending over several months.

Under the decision the cash fare was increased to 3 cents per zone, with a minimum cash fare of 6 cents for two zones or less. Heretofore, the cash rate in the cities of Hartford, Waterbury, New Haven and Bridgeport averaged 2 cents per mile, while in the suburban and interurban territory the rate was 2.5 cents. The minimum fare for two zones or less was likewise 6 cents.

The order also provides for a reduced-rate zone ticket, which is to be sold in lots of fifty for $1, in order that the regular riders may obtain a lower rate than the casual patrons. These tickets, however, provide a minimum fare for a three-zone ride, but do not allow the passenger to ride at less than the minimum cash fare, because three coupons are the minimum that can be surrendered for a ride.

Commutation ticket rates likewise are established at 1.75 cents per zone between traffic centers having a population of at least 25,000 and the surrounding territory, providing, however, that the points are five zones or more distant.

Abstract of Decision

The decision was the outcome of thirteen petitions and protests from several cities, towns and community organizations. The primary questions involved were as to the reasonableness of the rates, the fairness or practicability of the particular zoning and the system of making fare collections thereunder as had been established and put into effect by the Connecticut Company on Nov. 8, 1919.

Prior to the establishment of the zone system the rate structure had been developed around a flat fare for the larger cities, with multiple zones on the suburban and interurban lines, the rate, however, being the same for all zones, which varied in length from 1.8 to 10.8 miles. On Oct. 1, 1917, the unit rate of fare per zone was increased from 5 to 6 cents, with a proportionate increase in commutation and school ticket rates.

On Nov. 2, 1919, the company established an entirely new schedule of rates based on the length of ride, and at the same time put into effect a new method of fare collection. All tickets, commutation and otherwise, with the exception of the half-fare school tickets, were abolished. Full details of this plan were given in the ELECTRIC RAILWAY JOURNAL for Nov. 8, 1919, page 852.

Petitioners' Claims

The petitioners claimed that the zone rates as established in certain cases increased the fare from 50 to 200 per cent over the previous rates; that these rates were discriminatory in the arbitrary establishment of unequal-length zones and caused abnormal and unequal increase in certain sections and to certain patrons over the long-established flat-rate system under which the communities were developed; that the necessary increase in revenues was undertaken to be collected and obtained from only 33 per cent of the company's total patronage; that the zoning system was inequitable and unfair, and that the method of fare collection was unnecessarily annoying and tended to delay and congest traffic.

The city of Bridgeport also claimed that the railway system should not be treated as a whole, but that the city lines should be segregated from and treated independently of the interurban lines on the assumption that the former were profitable and the latter otherwise.

The Company's Claims

The company controverted the several claims and maintained that it was necessary for the life of the company and to enable it to render proper service materially to increase its revenues over the previous flat 6-cent rate. While no attempt was made by the company to estimate the increase which the zone system would produce, it did maintain that but little if any more revenue would be secured than would be needed to meet the increased operating costs.

The company also raised several points of law, among which were: (1) That the burden of proof was upon the petitioners; (2) that in considering whether the rates are unreasonable it is necessary to consider the earnings of the company as a whole and not by segregated divisions or routes; (3) that the rate schedule is not unreasonable if the receipts are insufficient to pay the operating expenses, fixed charges and taxes, to set aside a proper sum for depreciation and renewals, and to pay a reasonable return upon the investment; (4) that a schedule of rates is not discriminatory if all patrons similarly circumstanced are treated alike; (5) that if by the imposition of the regular cash rates upon all patrons the receipts are or will be insufficient to violate this principle of reasonable rates then any reduction from the regular cash rate is confiscatory, and (6) that no evidence had been introduced before the commission to warrant a finding that the rates as inaugurated are unreasonable, inequitable or discriminatory against any portion of the system.

The Commission Comments

On the above the commission had this to say:

Burden of Proof. In the 6-cent fare case a similar point was raised in which it was held "that inasmuch as the old rates had been in effect for a considerable period prior to those now complained of, and as all of the material facts pertaining to the reasonableness of such rates were more or less exclusively within the knowledge and possession of the respondent, it should proceed by offering whatever evidence it had in justification of its present rates. While the burden of supplying the facts may be imposed upon the respondent, the burden

of establishing its material allegations from all the facts submitted still rests upon the petitioner. The very nature, origin and source of the evidential facts relative to the reasonableness of the rates must modify to an extent the rules of evidence and the burden of proof under the common law. This necessity has also been recognized by Congress in the enactment of the law terminating federal control, in which it is held that the burden of proof is upon the carrier to show that fare increases sought are just and reasonable."

The commission based its conclusions and finding on this theory, holding that inasmuch as the company had submitted without reservation evidence pertaining to the necessity for the increase in rates it should determine, after due consideration of all these facts, as to whether the rates complained of were just and reasonable, and if not to determine what were just and reasonable maximum rates and charges.

Rate Schedules. Claims 2 to 5 inclusive of the company, the commission held, may be fundamentally correct as abstract propositions, but were subject to modification by injection of conditions appearing in this case but apparently not contemplated in the specific claims presented. The sixth claim involved a conclusion of fact based upon all of the evidence submitted.

In the judgment of the commission it is not practicable or even desirable to segregate the several physically connected lines of the company for the purpose of establishing different rates, based upon the respective earning powers of such lines. The intercommunity of social, business and general industrial relations of the State requires that the paying lines should to a reasonable extent help to support the non-paying lines.

The non-paying lines, however, must of necessity have poorer or less frequent service, and a careful study of the traffic on such lines should be made with a view to service curtailment in keeping with the reasonable traffic demands. On certain lines that possibly never should have been built, however, the limited traffic demands and revenue returns may necessitate absolute abandonment unless the lines are subsidized by the towns and districts served.

Commutation or Reduced Rates. The company held that under the State law the commission could establish only a maximum passenger rate, because: (1) The former commutation rate was a privilege voluntarily granted by a predecessor company which the company was at liberty to withdraw at its discretion; (2) the power delegated to the commission to prescribe maximum rates did not include the right to grant any reduction from a reasonable maximum rate; (3) the Legislature itself has no such power; (4) no legal right ever existed on the part of the commuters to a retention of this rate; (5) so far as a moral right is involved, the equities are in favor of the rest of the system that never has enjoyed a cut rate; (6) the discrimination in favor of the commuters was properly abolished by the board of directors, and (7) if the regular rate charged to all is insufficient to pay a reasonable return, no reduction in rate or special privileges can be justified in favor of any particular community.

The commission ruled, however, that the powers and duties delegated by the State Legislature gave it the right to fix railway rates (Turner vs. Connecticut Company, 91 Conn., page 697) and that, under such conditions, it should have at least as much power, latitude and discretion as the company previously had in fixing its own rates. The right of transportation companies to establish reasonable commutation and special rates, unless discriminatory for the particular service, has long been recognized and is also followed by the Interstate Commerce Commission. The principle of commutation fares has also been approved by the State Legislature in the somewhat arbitrary provisions of Section 3,775 of the general statutes, which prohibit railway companies from altering or abolishing such fares after they have been in effect four years.

The United States Supreme Court, it was pointed out, had in several cases also approved of special or commutation rates (see P. R. R. vs. Towers, 245 U. S., page 6). The company contended that street railway service was short-haul transportation and provided a special service for short, almost daily rides, and that a uniform rate was in fact a special or commutation rate and, further, that there should be no cut rates for any class of service. The commission disagreed and held that whatever merit there may have been in this claim under the long-zone or flat-fare system, it was very largely eliminated by the adoption of straight mileage tariff.

Again, if the company's claim was correct, then the commission had no power other than to establish a single maximum rate, irrespective of the amount of service used, and the rate structures of practically every water, gas and electric company in the State would have to be changed, if passed upon by the commission. The commission, however, assumed that the statute did not prohibit the classification of service and for that reason interpreted the statute as authority to determine and prescribe just and reasonable maximum rates and charges for classified services affecting all persons similarly circumstanced, providing such classification was justifiable. The classification of passenger service and the application of a special maximum rate for each classification, it was held, was justified by custom of long standing. It was also in keeping with the principles applied to nearly every successful business enterprise to consider the daily rider, who depended upon the cars as a regular means of transportation, as the purchaser of service at wholesale. As a business proposition such patrons are entitled, the commission held, to better rates than the casual rider, the itinerant who infrequently utilizes the special service provided, or the man who travels in his private automobile or a jitney in good weather, but on stormy days and at times when the automobile is unable or unfitted to negotiate the journey is willing and only too glad to patronize a service that is bound to operate in all kinds of weather.

General Street Railway Conditions

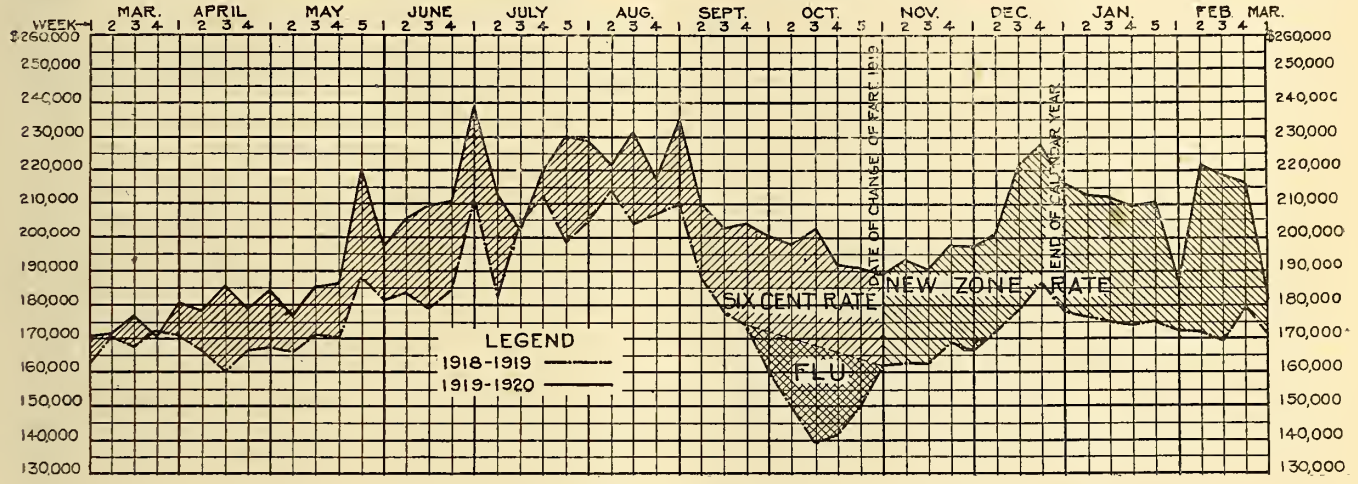
In discussing the question of a proper solution for the almost insurmountable problems confronting the industry the commission recognized that the respondent company had not wholly escaped the chain of circumstances and the countrywide difficulties which have driven many street railways into receivership and have even threatened the continued existence of others.

It was a recognized fact and admitted by evidence that street railways supply a necessary public service and that their suspension would be a public calamity. The commission also recognized that some of the elements that produced the precarious street railway situation in the State of Connecticut were beyond its present power and could only be remedied by special

legislation. Statutory burdens such as street paving, bridge assessments, taxes and unfair automobile competition were among those elements. The labor competition of industrial enterprises, it held, was an economic condition which the carriers must work out for themselves. The depreciated purchasing value of the dollar and the increasing cost of producing service, however, were factors which could and should naturally be met by corresponding increases in rates, but there was a limit at which increased rates would produce increased revenue.

The commission recognized that to perform the duty of any utility company to render good and adequate service the company must be sound financially and any order not based on this general policy would work an injustice not only to the company itself but to the public entitled to receive such service.

A street railway is of direct benefit not only to its patrons but to the communities, business industries and



WEEKLY PASSENGER REVENUES FROM MARCH 1, 1918, TO MARCH 1, 1920

property owners in the localities served, and yet it developed that under existing conditions the car riders were called upon to pay all of the expense of supplying such service. The more indirect taxes a company has to pay to the cities, the towns and the State the greater the fare that must be paid by the car rider. It was obviously unfair, the commission held, to demand that the car rider should assist in maintaining pavements for others when such users contribute little or nothing toward their own comfort and convenience.

To make a rate sufficiently high to cover all such present-day expenses and afford a fair return on the value of the property, taking into consideration the nature of existing competition, would have a tendency disastrously to lessen street railway traffic, even to destroy the usefulness of the carrier in supplying what should be a cheap, convenient and reliable form of transportation available to all the people.

The respondent company even disavowed that its rates were sufficiently high to afford a fair return on the value of its property or upon its investment, but claims it was necessary to increase its rates over the 6-cent flat fare to enable it to meet its present financial obligations, exclusive of dividends. While taking this position the company also claimed the legal right to establish rates that would produce a fair return on the value of the property, and any rate that would not do that could not be found to be unreasonable by the commission.

Rates established either by the company or the commission that fail to produce sufficient revenue to put the company on a paying basis should promptly be increased, assuming, of course, judicious and economical management. Undoubtedly the railway company's board of directors is best qualified to establish a system of rates and collections for its own property, for it has accurate knowledge of the company's needs and an estimate of the results to be obtained by the rates thus established. However, when such rates are admittedly established on an experimental basis, to be demonstrated by public patronage, the directors' prerogatives are materially lessened. Rates established by the commission under such conditions would be as favorable to the company as those established by the directors could lawfully be, for the commission has recognized that in order for a company to render good service it must be on a financially sound basis. Any rates, therefore, as established by the commission that are found to be insufficient should promptly be increased to a maximum such as the traffic will bear, and if such maximum then proves to be insufficient the only alternative is state or municipal aid or abandonment.

Reasonableness of Present Zone System

It cannot be found from the facts presented, the commission stated, that the present rates as a whole produce a greater revenue than the company is entitled to, although such a conclusion might theoretically be deduced, due to the fact that a surplus net income after paying interest charges on funded and unfunded debt is shown by the company for the past three years in its income exhibits.

While the company did not present any estimate of the percentage increase in revenue due to the new zone rates for the entire system, it did show that on certain lines and in certain sections it was more than 100 per cent, whereas in other sections there was a loss.

In the mind of the commission, it is a question as to what increase in gross revenue, if any, the present increase in rates has produced over the corresponding period of the previous year, when the 6-cent flat fare was effective. An analysis of the accompanying graph indicates that the 20 per cent increase in fare on Oct. 1, 1917, from 5 to 6 cents, resulted in practically no increase in passenger revenue for the first year. During the second year, however, a gradual increase in revenue is recorded and for the two months just prior to the

adoption of the present rates the chart indicates that the 6-cent fare was producing nearly as great an increase over the previous year (eliminating the effect of the influenza epidemic) as the first three months of the present zone rates.

The commission, therefore, holds that the present increase in revenue is not commensurate with the increase in rates and that the added burden on the public is not relieving the company of its financial embarrassment. Hence, there is no question but that the company must have a greater revenue than is now being obtained. However, in establishing higher rates for the purpose of increasing revenues, the effect upon the public as to the usefulness and reasonableness of the service provided, as well as the interest of the company, must be taken into consideration.

Notwithstanding that the present rates fail to provide a reasonable return for the entire system, the commission holds that they are inequitable and discriminatory and to that extent unreasonable. They are inequitable (1) by reason of failing to give any concession to the daily rider who travels beyond the initial fare; (2) by reason of attempting to obtain the greater part of the necessary increased revenue from a comparatively small percentage of its patrons in suburban sections, (3) and by reason of abnormally high increases to certain of the patrons over and above the system of rates that has been maintained during the past history of the company and upon which they were led to rely as being the more or less universal system which was maintained by nearly all street railways in the country.

The rates are held to be discriminatory by reason of the establishment of unequal-length zones under a distance tariff, particularly the second and third zones, on lines radiating from the same city, and by reason of attempting to measure certain arbitrarily selected suburban zones by the density of traffic while treating the system as a whole and opposing the right or policy of segregation.

Zones. The commission held that the most equitable policy thus far suggested or adopted for street railway fares is the zone or distance tariff system, and accordingly will retain the general basic principle adopted by the company. The evidence, however, presented in the hearings showed considerable dissatisfaction with the zone system, not so much as a measure of rates as the annoyance and delay to traffic. It was admitted, however, that the annoyance and delays were gradually decreasing as the system became more familiar to the trainmen and the traveling public. Most witnesses also testified that the basic principle of charging on the mileage basis for the amount of service actually rendered was more equitable and on a sounder basis than the old flat-rate system with its flagrant inequalities and numerous long-haul rides at an absolute loss to the company. It is true that the long-zone or flat-fare system was more popular and convenient and that it had contributed materially in the past to the building up of suburban sections. The inability of the company longer to continue such a system makes it imperative for the preservation of service to adopt a more businesslike policy, unless the State or municipalities served extend aid. Such aid is not forthcoming at present, and it, therefore, becomes necessary to adopt some other system or a radical modification of the old system.

Opposition to the pay-leave system of fare collection now in effect is based on the theory that it takes longer to unload passengers by reason of the time required in making change, with consequent holding up of street traffic and disarranging of the railway's schedules. Any new and improved system of fare collection is liable to cause annoyance and delay at first, but if practicable will ultimately iron out the minor defects and meet with general approval. Such appears to be the history of the respondent's present system, although the complaint relative to making change still remains to a modified extent. If passengers but knew the correct fare and would have it ready when leaving the car all unnecessary delay would be eliminated.

Statistics as to loading and unloading times per passenger for the pay-enter and pay-leave systems were submitted by the company and these were favorable to the pay-leave plan. The commission is of the opinion that the use of its zone tickets instead of actual cash would very materially expedite the unloading of passengers and assist in the better maintenance of schedules. Comment is also made that under a distance-tariff system no policy of collection thus far adopted or suggested appears to be as practicable as the single collection for the whole ride at the time the passenger is leaving the car.

CONCLUSIONS

Claims are advanced that the increased use of the internal-combustion engine for motive power foreshadows the disuse of the electric street railways in the near future. Even if this were literally true, that time is not at hand, and during such a transition period the absolute needs of the traveling public must be taken care of and the investor safeguarded. The commission, however, has reached the conclusion that even although the motive power may change, as it has in the past, the essential features of a street railway will remain.

Motor vehicles, moving at the will of an operator over the entire surface of the already congested streets, have not yet been recognized or even demonstrated to provide a satisfactory system for carrying all or the maximum number of persons desiring public transportation through the city streets. Consideration must also be given to the fact that such streets are public ways and must be used for other purposes. The public inconvenience and serious consequences resulting from the abandonment of street railway service during the past two years have clearly demonstrated the absolute necessity of preserving and protecting the street railway industry, especially for urban transportation. The commission is, therefore, thoroughly convinced that the street railways render a necessary public service and that any determination of the issues should be made with a view to the proper maintenance of such service, having in mind the respective rights of both the company and the public.

To meet the rapidly changing conditions promptly it is important to have a flexible system of rates that can be varied on short notice without a radical change in the rate structure itself. The commission believes also that the casual rider should pay a greater percentage of the "standby" charge than he now does, and further that the regular rider should be able to purchase transportation at a discount. The sale of tickets at a substantial discount in moderate quantities should invite increased riding, improve the service and promote the interest, usefulness and good will of the company, increase its revenues and bring to its treasury more

nearly 100 per cent of the actual transportation charges.

In establishing a commutation rate, care should be taken not to discriminate, and in no case should the rate be less than the initial cash fare, nor greater than the regular ticket fare for the same distance. To avoid conflict with this theory no low-rate tickets can be sold for short riding. One of the principal reasons for a commutation rate is to enable people working in the larger centers to live outside of the congested area and enjoy the benefits of healthful environment for domestic life. For this reason the commission holds that commutation rates should be limited to lines that radiate from populous, incorporated manufacturing and employment centers of 25,000 population or more. These rates will apply to all points on such lines more than five zones from such traffic centers. The commuter is also entitled to ride, on connecting routes leaving the traffic center, one or more zones in either direction for the regular zone cash fare, irrespective of the initial fare.

Proposed Zoning and Rates

The new rate structure prescribed by the commission contains four different rates applying to zones, each one mile in length. The order follows in full:

Zone System. Establish all zones one mile in length as the track runs, starting from traffic centers and varying the length of the zones only to the extent necessary to absorb or equitably to adjust, by neutral zones or otherwise, a fractional part of a mile occurring in measurements between traffic centers or to line terminals; any dispute as to such variation or adjustment to be referred to the commission.

Cash Fares. Initial cash fare for two zones or less 6 cents, and each additional zone 3 cents.

Zone Tickets. Good on all lines, sold in lots of fifty for $1 or in larger quantities at the same rate if desired. Not fewer than three tickets to be collected for a ride of three zones or less and one ticket for each additional zone in excess of three zones.

Commutation Tickets. Good for a round trip daily between the traffic center of any incorporated city or borough having a population of 25,000 or more and points more than five zones distant therefrom on all lines radiating from such traffic center, for the number of days in any month less Sundays and legal holidays; said commutation tickets to be sold at the rate of 1.75 cents per zone, to be issued to the individual commuter, to be non-transferable and to expire at the end of each month. The rate beyond such traffic center to or from the commuter's place of business as one continuous journey to be at the regular zone rate.

School Tickets. To be issued at the rate of 1 cent per zone, not fewer than three tickets for three zones or less and one ticket for each additional zone. Other conditions relative to school tickets to remain the same as at present established by the company.

Transfers. Free directional transfers shall be issued: (1) On cash fare, entitling the passenger to ride through two zones for the initial cash fare of 6 cents without additional charge and the regular cash fare for each additional zone. If the cash fare passenger has ridden through two or more zones before transferring, he shall be entitled to a transfer entitling him to ride through the next zone or zones at the regular rate of 3 cents each. (2) On zone tickets entitling the passenger to ride through three zones for the initial fare of three tickets without additional charge and the regular ticket fare for each additional zone. If such passenger has ridden through three or more zones before transferring he shall be entitled to a transfer, allowing him to ride through the next zone or zones at the regular ticket-zone rate.

In no case shall a transfer entitle a passenger to ride through more than two zones on such transfer.

To relieve the shortage of rolling stock likely to be caused by the inability to operate the pay-leave system of fare collection on cross-bench open cars, the commission advocates the use in summer of such open cars for special holiday and peak service only, first on lines not exceeding two zones in length having only the initial fare charge; secondly, when these cars are used for special service on runs exceeding the initial fare, a flat rate may be charged not exceeding the maximum fares under the zone ticket rate for such runs. Transfer privileges may also be eliminated at the discretion of the company when open cars are operated.

The commission asks for full co-operation on the part of the company employees and good will on the part of the public, and states that if at the end of a reasonable period of time it is demonstrated that the rates or system are unfair either to the company or to the traveling public it will, upon proper presentation, unhesitatingly and without prejudice, by reason of anything herein stated or decreed, consider and revise such rates or system in accordance with facts there presented.

New Car Arrives in Seattle

THE sample car ordered for trial by the Seattle Municipal Street Railway has been placed in service. This is a single-end, double-truck, front and center-entrance car for one-man, two-man or multiple-unit train operation. It weighs 34,600 lb. equipped and has a seating capacity of sixty-eight. The equipment consists of four Westinghouse 40-hp. interpole motors, type

TRYING OUT SEATTLE'S NEW CAR

514, with Westinghouse H.L. control. Helical gearing is used, with a gear ratio of 15 to 58. The wheels are 24 in. in diameter and of rolled steel. The airbrake equipment is straight air, with emergency and safety features.

In an attempt to prevent trouble in operation due to unfamiliarity with the equipment special instructions have been issued regarding the handling of the equipment.

Motor Trucks Used for Conveying Freight

A system of conveying l.c.l. freight between different railroad terminals in Cincinnati, by means of motor trucks and containers of 5-tons capacity each, has recently been put in operation in that city by the Motor Terminals Company. In May, 1917, the Cleve'and, Cincinnati, Chicago & St. Louis Railroad made a trial installation of the system, which proved so successful that it has now been extended to the other terminals. The containers are brought to the railroad freight houses by automobile. When they reach there they are lifted by electric hoists and carried close to the freight cars, where they can be loaded at minimum cost. They are returned by mechanical means to the automobile, then carried to destination. A material saving over former methods is claimed.

Philadelphia Fares Analyzed

Reports Give Statistics for Last Nine Years—Deadlock Over Operation of Frankford Elevated Line — New Capital Required

RECENT transportation history in Philadelphia in connection with the proposed lease of the municipally built Frankford Elevated Railway to the Philadelphia Rapid Transit Company is summed up in two reports just issued by William S. Twining, Director of the Department of City Transit, Philadelphia. Various proposals and counter-proposals have been made by the city and the company for the operation of this line by the company, the last proposal of the company, that it pay a nominal rental only for the structure, being withdrawn last November because of opposition to it in the Council.

Construction on the Frankford Elevated Line was begun in 1916 and the city's present investment is shown in the following statement:

FRANKFORD ELEVATED RAILWAY — FIRST OPERATING SECTION

Class of Outlay	Total Estimated Cost	Money Expended by City Cost to March 1, 1920	Per Cent of Present Cost to Final Cost
Real Estate	$600,000	$291,607	48.5
Construction contracts (including tracks)	5,720,660	3,632,841	63.5
Equipment	3,285,000	.....	0
Engineering and miscellaneous	600,000	493,615	82.3
Interest	900,000	160,000	17.8
Totals	$11,105,660	$4,578,063	41.0

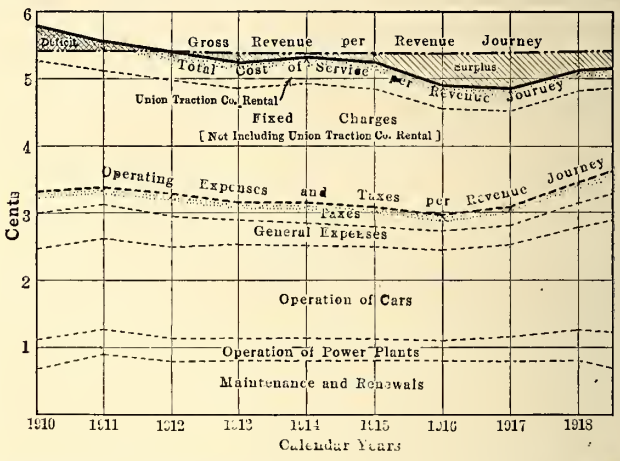
In the opinion of the Director of City Transit much of the difficulty which the railway company now finds in undertaking to carry out the rapid transit proposals of the city lies in the rentals which it has agreed to pay to its sub-companies, which even prevents the furnishing of adequate surface transportation facilities at present.

According to Mr. Twining, the company's management deserves great credit for its "skillful steering between the Scylla of increased fares and Charybdis of bankruptcy," but the limit has now been reached, and to provide the facilities urgently needed either the present fares must be increased or there must be a scaling down of the fixed charges. A diagram is then shown of the cost of transporting a passenger in Philadelphia from 1910 to 1918 inclusive and during the first six months of 1919.

COST OF TRANSPORTING A PASSENGER IN PHILADELPHIA

In commenting on this diagram the Director points out that during the first six months of 1919 the operating cost, including taxes, was 3.62 cents per revenue passenger and the fixed charges 1.5 cents, making the total cost 5.12 cents per revenue passenger. On the other hand, if the company's gross revenue for the period be divided by the number of revenue passengers it will be found to equal 5.39 cents per revenue passenger. The surplus available for dividends, support of new capital, reserve, etc., amounts to only 0.27 cent per revenue passenger, an amount declared by Mr. Twining entirely too small for the purpose. Continuing, he says:

"The mere fact that the cost of service at the present time is over 5 cents per revenue journey shows that on a free transfer basis the flat 5-cent fare would not alone meet the costs of the company. The company's 5-cent fare earnings are now supplemented by the sale of 3-cent exchange tickets, the revenue from freight, express, milk, advertising, etc., and income from other sources. . . . The diagram shows that since 1910 (except in 1916 and 1917) the average cost of carrying revenue passengers has exceeded 5 cents. The diagram also shows that the low point in operating expenses was in 1916, and that there has been a rapid increase in the item of cost per passenger since that time. The fixed charges have dropped from 1.92 cents to 1.50 cents per passenger since 1916, because very little new capital has been employed and because the "fixed charge" on earlier capital is a fixed sum, the aggregate amount of which has not been changed appreciably in recent years. As the number of passengers carried has increased nearly 30 per cent during this period, the fixed charges per passenger have naturally come down proportionately. Had the ratio of fixed passengers to



THIS CHART SHOWS REVENUE AND DISTRIBUTION OF EXPENSES PER REVENUE PASSENGER, PHILADELPHIA

operating expenses remained what it was in 1916 the cost per passenger would now be 5.54 cents and the company would be showing a deficit in place of a surplus."

In conclusion Mr. Twining says that the saving made during the last few years is to be attributed primarily to the minimum investment in new facilities, a course made possible by the "complacency" of the public under "heart-breaking" conditions.

According to the report, facilities required today to render adequate service will approximate $20,000,000 to be put in service immediately, and within the next ten years at least $50,000,000 more should be supplied. About half of the $20,000,000 of facilities needed immediately is represented by the Frankford line and one-half by necessary surface line extensions.

Short-Circuit Tests Prove Interesting

AS A RESULT of short-circuit tests of a 10,000-kva. turbine alternator E. S. Henningsen, of the engineering staff of the General Electric Company, draws some interesting conclusions. These are reported in the March, 1920, issue of the *General Electric Review.* Among other things he says that adding external reactance in a generator circuit equal to the internal reactance of the machine reduces to one-half the instantaneous short-circuit current. At the end of one second, however, the current is practically the same whether the external reactance is connected in or not, if the leakage reactance of the machine is small compared with the synchronous reactance.

Some Mysterious Car Ailments

Little but Important Troubles That Tend to Keep Equipment Men Interested in Their Work

CONTRIBUTIONS ARE INVITED FROM THE FIELD

Is There a Remedy for Carelessness?

ON A LARGE electric railway property operating multiple-unit trains it was the practice to reduce the length of the trains after rush hour by cutting cars off at the terminal, according to the requirements of the service. On one occasion the drill crew, after making the necessary uncoupling, was told to back the car away, so the link could be removed. The car was started, but when the motorman tried to apply his brakes, to his surprise he found that they did not respond. A glance at the air brake gage showed that he had full reservoir and train line pressure, so there was obviously something wrong with the brake apparatus. The motorman then tried to reverse his train by applying power, but this also failed. As the car was on a grade it gained momentum rapidly, so that when the motorman tried to stop the car with hand brakes, these were useless. Seeing a train approaching at the foot of the grade, he realized that disaster was inevitable, and accordingly jumped from the car, leaving it to proceed without an operator. A collision resulted which badly damaged several cars. Fortunately, there were no passengers on the train with which the car collided and the motorman was not badly injured.

The runaway car was examined to determine the cause of the failure of the brakes, and it was found that the triple valve had been cut out. A previous crew had found the car giving trouble, due to the sticking of the "triple" and had cut out the "triple," allowing the train to operate with this one car in this condition. Due to carelessness the defect was not reported and the accident resulted.

Weeding Out Weak Spots in Jumpers

THE breaking of wires in jumpers on roads which employ multiple-unit train operation is a continual source of annoyance and many roads have taken heroic measures to reduce their troubles from this source. The telephone rings in the office of the foreman of inspection and an excited voice yells: "Send an electrician to the incline on the main line and have him bring a new jumper." In such cases the electrician usually does not have to look for the trouble, as the train crew has already located an open circuit in one of the jumpers by the time he reaches the scene.

The mechanical department of one large elevated railway system has succeeded in reducing the number of failures in jumper cables by 75 per cent through a systematic testing, which eliminates all weak cables before they break down in service and an actual open circuit occurs. All jumpers are tested once a month and the back end of the head is painted a new color each time, so that any jumper which may have been missed can be readily picked out and sent in for this periodic test. In making this test a number of jumpers are connected together to form the external circuit and these are connected across the terminals of a 500-amp. storage battery. Sufficient cells are connected in the circuit to secure a current of from 80 to 110 amp. The object of the test is to put enough current through the jumpers so that if there is a wire in one of the circuits which has a few strands broken the remaining strands will be burned out, and thus any partially broken jumpers will be weeded out. Each wire in the jumpers used is equivalent to about a No. 13 wire. Through this process of frequent tests the failures of jumpers on this road have become comparatively rare.

A similar current breakdown test for jumpers in which 50 amp. at 550 volts is passed through the jumper wires in series was described in the ELECTRIC RAILWAY JOURNAL for March 15, 1915, page 487.

Blowing Circuit Breaker Gives No Indication of Location of Trouble

ONE of the cars in city service on a large railway property was reported for "blowing" its circuit breaker day after day and all shop tests failed to locate the trouble. Commutator bar tests were made as well as open-circuit tests, checks on the winding, high-potential tests and resistance tests with a millivoltmeter, but all were of no avail. The connections of the motors were carefully checked and tested, brush-holders inspected and the brush tension adjusted, but still the car continued to give trouble.

The men responsible for the maintenance of the equipment began to get somewhat "peeved" and many felt sure that the motormen were to be blamed for the difficulty. In a final effort to determine the cause, it was decided to have a crew of shopmen take the car over the line and operate it in test service. The covers were removed from the motors to permit inspection during operation. The circuit breaker was given a special adjustment and the tripping mechanism was set up so that the current necessary for tripping it would be increased somewhat. The car operated perfectly for a considerable time when suddenly, while operating at high speed with the control equipment in

full parallel, one of the motors flashed over. Another start was made and again this motor flashed. The part giving the trouble had been located, but still all were in the dark as to its cause. The car was returned to the shop and the motor was opened up and entirely dismantled, but there was no outward sign to indicate the cause of the trouble.

It was then decided to rewind the armature. When the windings were removed it was found that the laminations were bent and the slots forced out of line from their true position, so that the tops of the laminations were out nearly the width of a coil. At some previous time this armature had been rubbing on the pole faces and this damage was the result. The armature was then rebuilt and a new set of windings were installed. It was then put back into the motor and the car returned to service, after which it gave no further trouble.

Auxiliary Devices May Cause Failure of Main Equipment

ONE car on a system operating high speed local service between cities gave trouble by frequently "going dead" without any apparent reason for it. Motormen reported that the control equipment would be inoperative for as many as five or six times on a single trip, but after waiting a short time the equipment would again operate satisfactorily. The car was equipped with the electro-pneumatic switch-group type of control. On several occasions the motorman got out and opened up the switch group in an endeavor to determine the cause, but could find nothing out of the ordinary. The car was turned in at the shop and tested out in the usual manner, also without locating the defect, but in the course of the inspection it was found that one of the switches of the line switch was somewhat sluggish. The line switch consisted of two separate switches connected in series and the inspector decided that the sluggish operation of one of the switches might be the cause for the open circuit.

The wiring and connections were tested for improper contact, but these proved to be satisfactory. The car was then operated by the shopman, who found that after repeated operation he was able to cause the sluggish switch to stay open. The air pressure used for closing the switch was less than the main reservoir pressure, being reduced by a reducing valve. By checking up the air pressure at the time the switch refused to operate it was found that this was low due to the repeated operation. Ordinarily the pressure used for the switch group operation was 70 lb., and it was found that if the pressure dropped to 50 lb. this sluggish switch would not operate. In examining this switch it was found that the spring for opening the switch was somewhat stronger than that in the other switch and a leak in air pressure was also found at some of the valves.

This leak, together with the air used for operating the switch group, kept the pressure from increasing, so that it stayed at 50 lb. for a considerable time. The different parts of the switch were cleaned carefully and oiled and the switch was then found satisfactory and it could be operated at air pressure considerably under 50 lb. By tightening the leaky connections the danger of failure was also lessened considerably and the car operated well in service.

Why Do Commutator Leads Break?

AN INTERURBAN road operating about forty miles of track experienced a great deal of trouble due to armature leads breaking. At first it was thought that the armature cores were loose, but a careful investigation showed that these were in good condition and tight in all cases. The men responsible for the rewinding of the armatures were very careful and produced a fine looking job, so that it was thought the trouble could not lie in that direction. One of the engineers of the company, however, spent considerable time in the armature room watching the method used in rewinding armatures and he found that in order to give a neat appearance to the leads as they were brought down they were being bent quite sharply. While this gave a very neat appearing job when completed, it was evident that the wearing qualities were being sacrificed by this method. The method of bringing these leads down to the commutator was changed somewhat and further investigation showed that there was also considerable vibration of the leads between the end of the armature slots and the points where they were fastened to the commutator. No doubt this vibration was also responsible for some of the broken leads. In order to remedy the condition the space under the leads was filled in with a mixture of powdered asbestos and shellac. This hardened so that after the leads were in place they were held firmly.

Additional support was also provided for the leads where possible by taping two or more leads together. Previous to the change the leads left the coils at the corners and had no support till the commutator was reached. The change consisted of bringing the leads out farther around on the end of the coil, and then by taping them in, the distance to the commutator was shortened considerably. On armatures with leads going in opposite directions this could not be followed to any great extent, but leads going in the same direction were taped together so as to form a support for each other and make a more rigid construction.

These changes effectively did away with the trouble of breaking of the leads.

The *Electric Journal* for February, 1920, gives the following suggestions for preventing broken leads:

The windings should have a solid foundation and should be solidly built up between the top and bottom leads.

Small wire leads should be shellacked back of the neck while winding.

The complete armature should be dipped in a baking varnish and baked.

The laminations of the core should be a tight driving fit on the spider or shaft and should be held tightly together by a ring nut.

The commutator should be clamped under pressure while hot, should be held securely and should make a good press fit on the shaft or spider.

The coil supports should be of rigid construction and securely held from movement.

All armatures should be temporarily banded while hot to pull the windings down solidly. The permanent bands should be made of a good grade of hardened steel wire soldered with pure tin solder. Strips of tin should be placed under the core bands before soldering, to make a more compact band. At the front end the band should be placed out near the commutator neck to hold the windings securely in place at this point.

Excessive currents, such as are produced by too rapid acceleration or through faulty handling of cars, should be avoided.

Overspeeding, whether on the level or down grades, should be avoided.

All detail parts of the armature, as well as the completed armature, should be in balance.

Placing a steel wire band on the bottom leads before connecting the top leads has been tried, with but little success.

The armature bearing should be kept tight in the housings and renewed when worn to the allowable limit.

The bearing housings should be kept tight in the motor frame.

The axle bearings should be kept tight in their seats and removed when worn.

The axle cap bolts should be kept drawn up tightly and defective caps should be removed.

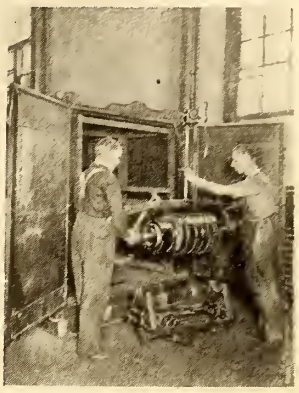
The gear case bolts should be kept tight and broken gear cases replaced.

Gears and pinions when badly worn, out of mesh or bottoming should be replaced by new ones, preferably of the helical type.

Tracks, special work and roadbed should be kept in good condition.

Shop, Track, Power and Line

These Articles and Ideas Are From Men on the Job Who Find Special Applications and New Methods an Incentive for Greater Effort — If You Have Something Good Pass It Along



Pacific Electric Opens New Shop

Thirteen Buildings, Covering More Than Nine Acres, Have Been Placed in Service for Maintenance and Building of Electric Cars

BY CLIFFORD A. ELLIOTT
Cost Engineer, Maintenance of Way Department, Pacific Electric Railway, Los Angeles, Cal.

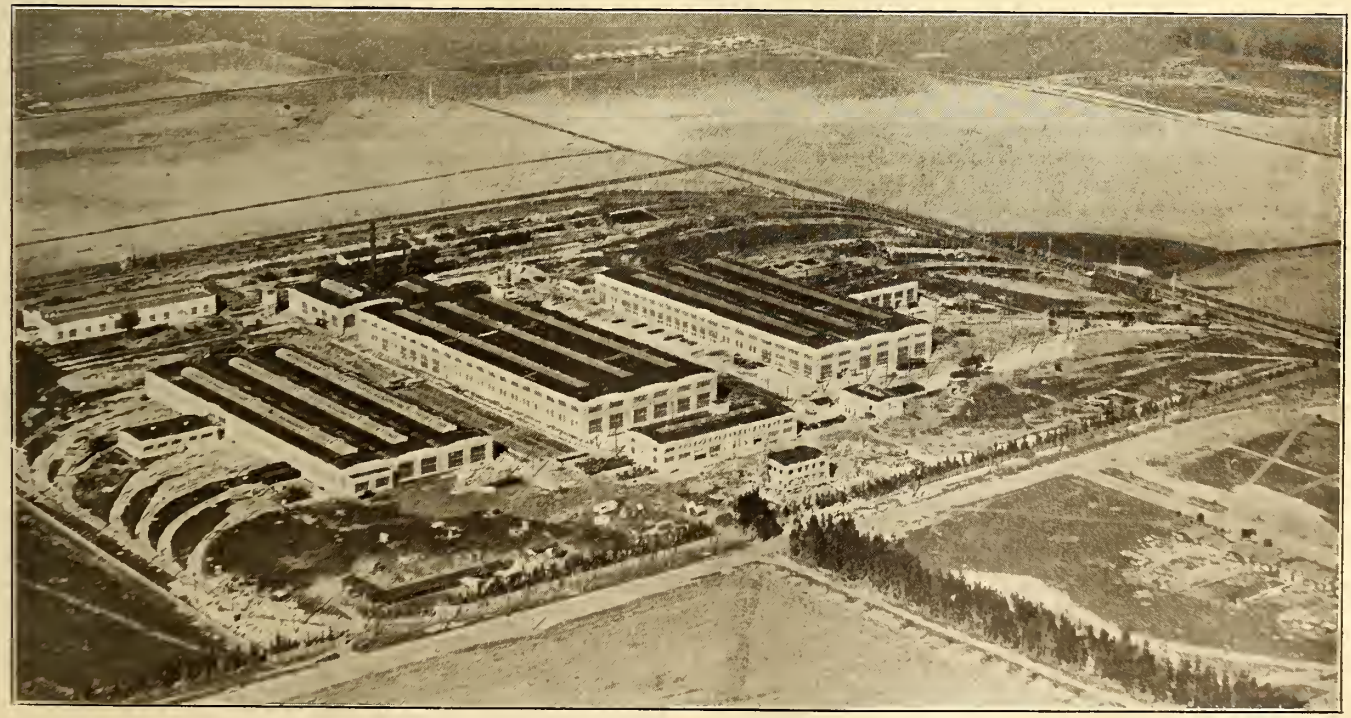
THE accompanying view of the new Torrance shop of the Pacific Electric Railway, which was taken from an aeroplane, shows in a very striking manner the large accommodations provided and the splendid construction of the buildings for their work. The plans and proposed construction of these shops were described in the issue of the ELECTRIC RAILWAY JOURNAL for July 21, 1917, page 95. To provide for future expansion, grounds have been acquired with an area of 125 acres.

Referring to the accompanying view, the building in the immediate foreground is the mechanical department office. Directly behind this is the store department building, and the small building to the right of this is an oil storehouse. The three large buildings which constitute the central group from left to right are the woodwork and paint shop, the electrical repair shop and the electrical winding and machine shop, respectively. The small building on the right, which in the view appears like an addition to the large shop, but which is in reality a separate building, is the blacksmith shop and forge room. The small addition to the paint shop, on the extreme left, is used for paint storage and mixing. In the rear of the central large building are the power plant, cornice works, welding rooms and other workshops. A total of thirteen new shop buildings have been erected. These are of steel-frame construction with concrete foundations, brick and concrete walls and concrete-slab roofs. Special attention has been given to the number and location of the windows so as to provide the maximum amount of evenly distributed daylight.

SOME INTERESTING DETAILS OF CONSTRUCTION

In the motor shop and heavy machine shop the floors are made of 4-in. x 6-in. redwood blocks laid on sand cushion. These blocks were previously treated by boiling in asphalt. The principal machines now in use in these shops were moved from the general shops at Los Angeles, but some additional tools, together with cranes, hoists, etc., have been installed.

In the paint shop steam coils have been located in



AEROPLANE VIEW OF THE PACIFIC ELECTRIC RAILWAY'S TORRANCE SHOPS

each pit for drying freshly painted equipment. It is expected that this will result in a considerable saving in the time necessary for drying the paint. The lamps in the inspection pits are installed in niches and are staggered 21 ft. center to center. Two lighting receptacles are installed in each niche; one contains the lamp and the other is used for emergency purposes so that an extension cord can be inserted and a drop line used where light at the work is needed. An Otis 5-ton self-operated electric freight elevator is installed in the wood mill and a similar type of 2-ton capacity is used in the storehouse. The top floor of the storehouse is used for motor parts and miscellaneous electrical supplies. All air brakes, switch groups and control material are located on this floor. The material cases for small parts on this floor are 6 ft. high and of an open type, so that each bulkhead can be clearly seen without the use of step ladders or boxes. The main floor is used for storing both hardware and miscellaneous supplies. In addition to these two stories the storehouse also contains a basement, where material used in the electrical department is kept.

The oil storehouse previously referred to is located adjacent to the main storehouse and has large steel oil storage tanks in the basement. These are connected with Bowser oil pumps for drawing the oil for distribution at the new shops.

One section of the power house is used for the substation equipment necessary to take care of the local car shops and freight car movement. A 1,000-ft. motor-driven air compressor and a 150-hp., 2,200-volt, three-phase alternating-current motor are installed in this section. A 750-gal. capacity motor-driven air pump for operating the fire equipment is also installed in the power house. This will be relieved by an auxiliary 500-gal. capacity Duplex steam-driven fire pump. Fuel for the power house is supplied from two 8,500-gal. concrete underground fuel oil storage tanks.

New Drill Steel Sharpener

A NEW compressed air operated drill steel sharpener machine, known as the I-R No. 50 Sharpener, has been developed by the Ingersoll-Rand Company, New York. This machine was designed primarily to rapidly and exactly sharpen and shank drill steel such as cruciform steel up to 2 in. in diameter or round, hexagon, octagon, quarter-octagon, auger or spiral steel up to 1⅞ in. in diameter. When fitted with special devices it will forge bolt heads, pins, stanchions, etc., and nearly 200 different products have been made by this machine.

The single lever, which controls all of the operations of the machine, is fitted with a safety-locking device. This prevents accidents due to the impossibility of operating the machine unless the lock is released. The throttle valve is of the balance spool type. The hammer cylinder is an improved valveless type. This construction permits the free-moving hammer to deliver fast and powerful blows against the end of the dolly, upsetting the steel and so forming the bits and shanks rapidly, which greatly increases the capacity of the machine.

Positive lubrication is provided for the entire machine by the "Heartbeat" lubricator. This is embodied in the throttle valve chest casting and works automatically whenever the machine is in action. It is provided with adjustment for regulating the quantity of oil desired. All parts are made for hard service and all cup leathers have been eliminated from the design.

Oscillating Motor Crossing Flagman

New Design Has No Gears or Toggles and Swings Through Any Arc in Any Quadrant Without Vibration

A NEW automatic flagman or crossing signal which differs widely in many respects from any similar device formerly available has been placed on the market by the Thompson Signal Company, Los Angeles, Cal. It comprises a 26-in. disk fastened to an arm or arrow 46 in. long having a red light mounted in the end opposite from the disk, the whole oscillating, not as a pendulum but pivoting about its center of gravity. The driving mechanism is a four-pole direct current motor which for steam-road service operates on a 10-volt circuit supplied by primary cells. Where other voltages are available, as in electric railway service, the motor can be wound for the trolley voltage. The disk and arm are mounted directly on the armature shaft, thus avoiding any gearing. The motor is of the external armature type and is made up of eight field coils and twenty-two armature coils which have windings about four times heavier than necessary in order that heating and danger of burnout may be minimized. These coils are so connected in the armature that one or more could burn out without affecting the operation except proportionately to weaken the torque. During a test run of 2,500 hours' continuous operation the temperature rise in the motor was only 10 deg.

INSTALLATION OF AUTOMATIC CROSSING FLAGMAN WITH BELL AUXILIARY

The oscillating movement of the armature and signal is secured by reversing the direction of current. This change in direction of current flow is secured through two fingers mounted on the armature shaft which have a steel roller mounted at their outer ends. As the armature revolves these fingers come into mechanical contact with two switches, producing a cam action, which first closes the switch on one side of the shaft and then that on the other, these two switches alternately closing a circuit through two pairs of magnet coils, which in turn throw the main motor switch first in one direction and then in the other. The fingers of this main switch are laminated and as they are pulled into contact the laminations spread, giving a wiping contact, which tends to keep the surfaces clean.

The driving motor is made in two types, one with a commutator and one without. With the type having a commutator the two fingers which operate the control switches may be shifted relative to each other, so that the armature and signal may be made to oscillate through any arc from 10 deg. to 360 deg., or to rotate continuously in either direction, and further, so that the signal will oscillate in any quadrant.

In the commutatorless type of motor connection to the armature coils is made by means of two spiral-coiled spring-brass leads, which act like the hair-spring in a watch, though not supplying any spring force, the springs merely being used to provide flexible contacts which will avoid brushes and rings and at the same time provide a practically non-breakable connection. On this motor the two fingers operating the control switches are usually permanently fastened together, so that the arc through which the disk oscillates is fixed. However, the quadrant in which the disk will oscillate can be changed if desired, to avoid an obstruction obscuring a clear view of the disk from a distance, by shifting the fingers radially on the shaft.

One of the principal claims for this new device is that there are no springs or rubber buffers employed to reverse the motion. The stopping of rotation in one direction and starting back in the other is accomplished simply by the magnetic cushion as the direction of the field is changed, thus avoiding any vibration and causing the motion of the disk to be very similar to that of a free swinging pendulum, slightly damped at each end of swing. The signal is so weighted that it is slightly out of balance in order that it will assume a normal position when it stops. This provision is made only for the sake of appearance, since the signal will begin its oscillation from any position, the torque being practically constant at all times.

The red light in the end of the signal arm which provides the night warning is connected with fixed connections in multiple with the armature circuit. With the armature type motor there are four flashes of the light during each oscillation, but with the commutatorless type motor the light is steady except for a slight flash as the polarity changes at the end of the oscillation.

New Type of Thermal Demand Meter

THE Westinghouse Electric & Manufacturing Company is now marketing a new type of demand meter employing the principle of thermal storage and indicating what has been termed the "logarithmic average demand." This line of instruments comprises indicating watt demand meters for alternating-current circuits and ampere demand meters for alternating and direct-current circuits.

THERMAL DEMAND METER

The moving element of the instrument consists of a shaft connected to two bimetallic spiral springs. These springs are attached to the shaft at their inner ends and to the cylindrical case at their outer ends and are wound in opposite directions. Thus an equal change of temperature of both springs does not produce any rotation of the shaft. However, if one spring is raised to a higher temperature than the other, it will deflect through a greater angle and the shaft will move through an angle proportional to the difference in temperature of the two springs. The cylindrical case contains a heating element which is connected in the electric circuit and is located in the case in such a way that one spiral spring is raised to a higher temperature than the other. This results in the shaft deflecting through an angle proportional to the load on the meter.

The wattmeter has two pointers, one of which, the indicating pointer, is fixed to the shaft, while the other, the maximum-demand pointer, is free to remain in the maximum position in which it is placed by the indicating pointer. By observing the indicating pointer, the logarithmic demand for the period immediately preceding the instant of observation can be determined. The maximum demand pointer can be reset at any time without removing the cover from the instrument.

The subject of thermal storage demand meters was featured in detail in the October, 1915, and February, 1918, issues of the Proceedings of the American Institute of Electrical Engineers.

Powdered Coal Plant with Compressed Air Transport

Some Details of the System That Will Be Applied in the Mount Vernon Street Plant of the P. R. T.

DURING the present spring the Philadelphia Rapid Transit Company will install in its Mount Vernon Street power plant an equipment for pulverizing and burning waste coal. Some details of the plan were given in the issue of this paper for Feb. 14, 1920, page 343. As the Quigley system, which is to be used in this plant, differs from other systems in several particulars, the accompanying illustration has been prepared to show the several parts of the system and how they are related. The drawing is merely a diagrammatic sketch, designed to show the general plan, but not in detail as it will be applied in Philadelphia. An account of the installation there will be given in due course.

The several parts of the apparatus have been lettered and the key which accompanies the illustration renders it practically self-explanatory. Briefly, the fuel is dumped from the car located on the siding, and, after passing through a crusher, where it is properly sized, it is elevated to a magnetic separator, where the tramp iron is removed. It then passes to the crushed fuel bin, from which it is automatically fed to a rotary drier and is then carried by a bucket elevator to the dry-fuel bin. From this bin it feeds automatically to the pulverizer, from which it is carried through a discharge pipe and a collector into the pulverized-fuel bin.

The pulverized fuel is fed from this bin into the blowing tank in the desired quantities, a quick-reading scale dial indicating at all times the amount of fuel in the tank. The fuel is thus automatically weighed and the amount required to fill the bins at the furnace is forced by compressed air through the transport line. Switching valves divert the flow of fuel to each bin as desired. The fuel supplied to each burner is governed by a controller, regulated by means of a hand wheel. Combustion air is controlled by a blast gate.

The transport system in this equipment differs essentially from the screw-conveyor and high-pressure blast systems in that the fuel is transported in bulk from the pulverizing plant through small wrought or steel pipe without the use of return piping. It is not carried in

suspension, but its movement is analogous to the flow of a liquid. The fuel pulverizing plant may be located at the point most convenient for the fuel supply and the powdered fuel can be economically distributed to furnace hoppers at widely separated points. Delivery has been effected by this method for distances exceeding 1,500 ft. The Quigley Furnace Specialties Company has a record of 2,800 lb. of pulverized fuel having been carried 600 ft. through a 4-in. pipe in one minute under air pressure averaging 15 lb. gage.

From the furnace bins the fuel passes through a dust-tight gate into an especially designed fuel feed controller, which regulates the fuel feed into a low pressure siphon. This siphon carries it, with about one-seventh of the air necessary for combustion, into the burner, where it is mixed at very low pressure with the quantity of air necessary to effect proper combustion.

A feature of interest is the blowing-tank unit, which consists of special equipment for storing, feeding and weighing the powdered fuel and transporting it to the points of consumption.

The tank is of cylindrical steel construction, and it is

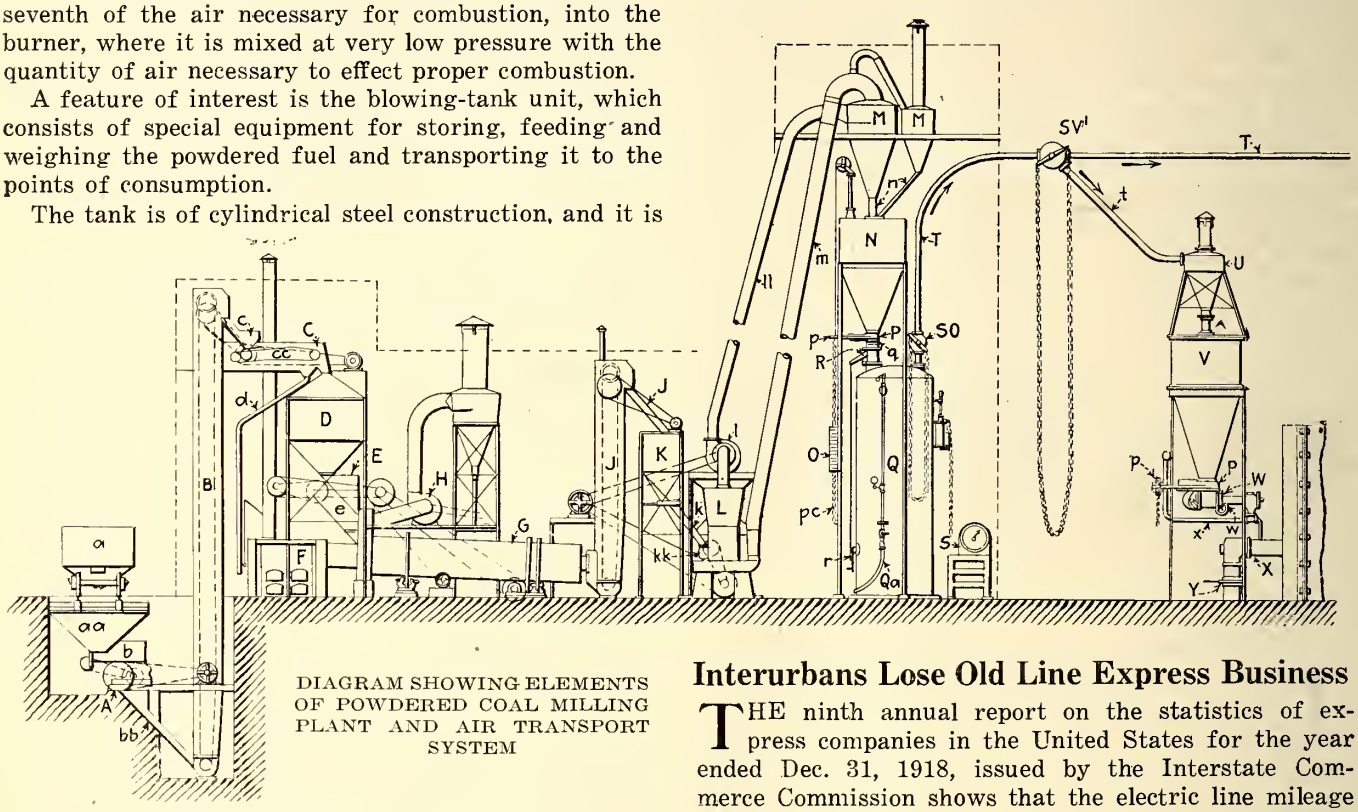


DIAGRAM SHOWING ELEMENTS OF POWDERED COAL MILLING PLANT AND AIR TRANSPORT SYSTEM

KEY TO LETTERS ON DIAGRAM

a	Coal car	m	Return air pipe
aa	Track hopper	N	Pulverized fuel bin
b	Regulating feeder	O	Fuel bin gage indicator
A	Coal crusher	P	Dust-tight gate
bb	Chute	p	Hand chain-wheel
B	Elevator	pc	Hand chain
c	Hopper	Q	Blowing tank
cc	Conveyor	Qa	Compressed air supply
C	Magnetic separator	q	Flexible connection
d	Reject pipe	R	Inlet valve
D	Crushed fuel bin	S	Scale dial
E	Regulating feeder	SO	Shut-off valve
e	Chute	SV	Switching valves
F	Drier furnace	T	Transport line
G	Drier	t	Branch fuel line
H	Exhauster	U	Collector
J	Elevator	V	Furnace bins
K	Dried coal bin	W	Fuel feed controller
kk	Rotary feeder	w	Fuel regulating wheel
L	Pulverizer	X	Burner
l	Exhauster	x	Primary air pipe to burner
ll	Discharge pipe	Y	Combustion air-blast gate
M	Collector		

connected with the pulverized-fuel bin by means of a flexible connection. A control gate located immediately below the bin is now operated from the floor by means of a hand chain.

A valve in the head of the tank admits the pulverized fuel in any quantity desired and is operated by a conveniently placed lever. As mentioned before, the scale upon which the tank is mounted is provided with a quick-reading dial. When the desired amount of fuel has been let into the tank, the charging valve is closed, compressed air is admitted and a shut-off valve on the transport line is opened, after which the fuel begins to flow through the line.

The controller consists primarily of a cast-iron box containing a feed screw, driven at constant speed by a gear or pulley, and adjustable shutters operated by a handwheel which give a suitable opening, under control, leading to the discharge head. The primary air supply at low pressure carries the fuel from the discharge head to the burner, where it mingles with the combustion air, also at low pressure and under separate control. The proper relative supply of each can thus be accurately controlled so that any condition of flame desired may be secured.

Interurbans Lose Old Line Express Business

THE ninth annual report on the statistics of express companies in the United States for the year ended Dec. 31, 1918, issued by the Interstate Commerce Commission shows that the electric line mileage covered by operations had decreased from 8,802 on Dec. 31, 1917, to 6,951 a year later. This is equivalent to a loss of 21 per cent. The accompanying table gives the mileage under contract by each of the operating express companies.

CLASSIFICATION OF MILEAGE COVERED BY OPERATIONS ON ELECTRIC LINES.

	Electric Line Mileage			Per Cent of Total Mileage of Operations		
Carrier	12/31 1918	6/30 1918	12/31 17	12/31 1918	6/30 1918	12/31 18
Total mileage of operations.....	6,951	8,690	8,802	2.42	2.81	2.86
American Railway Express Company.....	6,951	....	....	2.42	....	....
Adams Express Company.....	....	2,637	2,739	....	5.45	5.63
American Express Company.....	....	1,064	1,064	....	1.45	1.45
Canadian Express Company.....	....	113	113	....	0.91	0.91
Great Northern Express Company.....	....	335	335	....	3.69	3.68
Northern Express Company.....	....	14	14	....	0.17	0.17
Southern Express Company.....	....	77	77	....	0.22	0.22
Wells Fargo Express Company...	....	4,422	4,431	....	3.73	3.83
Western Express Company.....	....	28	28	....	0.53	0.53

The fortieth anniversary of the piercing of the Gothard tunnel between Switzerland and Italy was celebrated on Feb. 27. This important artery of travel is now doubly interesting because it is in process of electrification.

Forms Used with Sand Drier Test

For Tabulating the Data Obtained in Tests of This Nature Conveniently Arranged Forms Are Essential

THERE was published in the March 20 issue of the ELECTRIC RAILWAY JOURNAL a description by Howard H. George of the wet sand-handling machinery installed at the sand-drying plant of the Public Service Railway at Newark, N. J. In this article reference was made to forms which were used in the tabulation of the data secured from long-period efficiency tests of the plant both before and after the installation of the wet sand hopper. As other railways operating similar plants may desire to run tests of their own equipment, these forms are now published with some additional data and descriptive matter.

In computing the total labor cost of operating the plant the salary of the engineer running the tests was not included. In gaging the bins and for the purpose of aiding the laborers in quickly leveling the sand in the bins with a reasonable degree of accuracy the walls of the bins were carefully marked with level lines spaced at convenient intervals and three gage rods graduated to tenths of feet were installed at convenient points for interpolation. With the cross-section of the bins once determined, the calculation of the amount of sand in the bins at any time was easy.

The same procedure applies to the measuring of sand removed in bags. A large number of bags were dumped into a smaller measuring box until it was filled, and the average quantity per bag thus obtained was used in determining the total amount of dry sand distributed in bags.

The record of the temperature and weather conditions was made because of their effect on the percentage of moisture in the sand coming to the drier from the storage pile, the resulting increase or decrease in the output of the plant in a given time and the effect of this on the coal consumption.

Repairs were also noted, because they are always a factor that must be taken into consideration in the total cost of production in any plant. It may be argued that in tests of such a comparatively short duration as those described the amount of repairs will be so small as to be of little value. As a matter of fact, in this particular test it was found that they bore practically the same relation to the output as was generally true for the general operation of the plant, the repairs being limited to a replacement of a conveyor belt, broken link transmission chain, worn agitator blade or something of that character.

Form 1

RECORD OF SAND DRYER TEST

DATE _____ TEMPERATURE AT 7-A.M. _____
TEMPERATURE AT 12- M. _____
TEMPERATURE AT 5-P.M. _____

WEATHER _____

LABOR

CLASSIFICATION	HOURS	RATE	AMOUNT
SHOVELERS			
FIREMEN			
SAND BAGGERS			
TOTAL COST OF LABOR			

QUANTITIES OF DRY SAND

GAGE READINGS IN BINS AT BEGINNING OF DAY..... GAGE NO. 1 _____
GAGE NO. 2 _____
GAGE NO. 3 _____
GAGE READINGS IN BINS AT END OF DAY..... GAGE NO. 1 _____
GAGE NO. 2 _____
GAGE NO. 3 _____

NUMBER OF BAGS FILLED WITH SAND DURING DAY _____
NUMBER OF CUBIC YARDS OF SAND BAGGED DURING DAY _____

NUMBER OF CUBIC YARDS OF SAND REMOVED IN CARS

TIME	CAR NUMBER	CAR MEASUREMENTS	CUBIC YARDS IN LOAD

TOTAL DRY SAND REMOVED IN CARS _____
TOTAL CUBIC YARDS SAND DRIED DURING DAY _____

Form 2

COAL

NUMBER OF POUNDS OF COAL USED DURING DAY _____
CHARGE PER TON OF 2240 POUNDS _____
TOTAL COST OF COAL FOR DAY _____

OIL

AMOUNT OF OIL USED DURING DAY _____
UNIT COST OF OIL _____
TOTAL COST OF OIL FOR DAY _____

WASTE

WASTE USED DURING DAY _____
UNIT COST OF WASTE _____
TOTAL COST OF WASTE _____

POWER

WATTMETER READING AT END OF DAY _____
WATTMETER READING AT BEGINNING OF DAY _____
POWER CONSUMED DURING DAY _____
RATE PER KILOWATT HOUR _____
TOTAL COST OF POWER _____

REPAIRS

(MEMORANDUM IS TO BE MADE OF ALL MATERIALS AND LABOR USED IN MAKING REPAIRS, TOGETHER WITH TIME LOST ON ACCOUNT OF SAME.)

MISCELLANEOUS MATERIALS

Form 3

PERCENTAGE OF MOISTURE

SAMPLE TAKEN AT	WEIGHT OF MOIST SAND	WEIGHT AFTER DRYING	LOSS IN WEIGHT	PERCENTAGE OF MOISTURE
7-A.M.				
8-A.M.				
9-A.M.				
10-A.M.				
11-A.M.				
12-M.				
1-P.M.				
2-P.M.				
3-P.M.				
4-P.M.				
5-P.M.				
TOTALS:				
AVERAGE:				

MISCELLANEOUS REMARKS

(Under this heading note any occurrences which might in any way affect the results of the test.)

RECORD FORMS USED IN CARRYING OUT SAND DRYING TEST

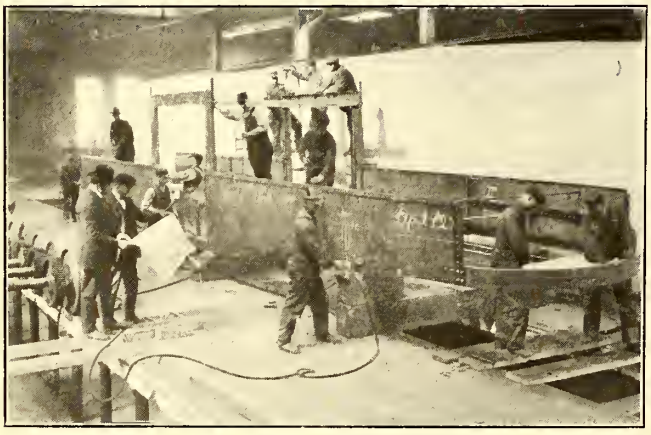
Several months ago the Indianapolis Street Railway sent ten of its summer cars to Dayton, Ohio, to be converted to the pay-as-you-enter type. Five of these have been returned for service. In remodeling the cars special attention has been given to providing a large platform space, to prevent crowding and to reduce the time required for boarding and alighting.

Chicago's First Trail Car Under Way

One Only to Be Built Now for Trial Purposes to Determine Feasibility from Traffic and Equipment Standpoints

CHICAGO will probably go to the use of trailers as the quickest and most logical way of amplifying its rolling stock facilities. As the first step in this probable plan, a sample trailer is being built in the west side shops of the Chicago Surface Lines, and Harry H. Adams, superintendent of shops and equipment, is making a drive to build this first car within sixty days' time, two weeks of which has elapsed at the time of this writing, with the progress made pictured herewith.

The use of trailers seems particularly desirable from the standpoint of facilitating the movement of cars through the congested loop district, for it is believed that a two-car train will lose less time in the loop than two single cars. As soon as this first car is completed thorough trials will be made to determine this point as well as to find out whether the public will like the idea of trailers and whether trailer operation is adaptable to Chicago traffic conditions. Observations will also



A TWO WEEKS' PROGRESS PICTURE OF CHICAGO'S NEW TRAILER

be made on the heating of the motors on the Pullman cars, which are proposed for use in hauling the trailers, both in rush-hour service only and for all-day service. The Pullman cars are equipped with four G.E.-216, 55-hp. motors, and while it is felt certain that they will haul trailers during the rush hour without serious overheating, there is some question about the all-day service. The trailer is to be a center-entrance car with an over-all length of 47 ft. 6 in., a width of 8 ft. 6 in. and an over-all height from rail to top of roof of 10 ft. 9½ in. Every effort is being made to produce a car which will weigh not more than 24,000 lb., although this may be influenced to a certain extent through the use of materials at hand that are slightly heavier than desired, for the sake of avoiding any delay in waiting for delivery of new materials.

There will be a 6 ft. 6 in. opening at the center on either side of the car, with pneumatically operated doors sliding into pockets—two doors on each side, requiring four door engines. There will be a level well 15½ in. above the rail, then a step of 10½ in. from the well to the car floor with a ramp of 5 in. in 9 ft. toward each bolster.

The body will be of arch-roof construction with a steel underframe and No. 12 gage steel side plates and a wood superstructure. The bumpers will be brought up to the average height of the motor cars and automatic air couplers installed, one on either end. Ample ventilation will be provided by the installation of eight utility exhaust ventilators in the roof and two compensating air intake and exhaust ventilators in each end of the car. At the forward end the two ventilators will act as intakes, while the two at the rear will act as exhaust ventilators.

There will be twenty cross seats of the walkover form-fit design, with rattan covering, and four short longitudinal seats at the well. These, with the circular seats at the two ends, will bring the total seating capacity up to sixty-two passengers.

The car will be equipped with Brill 67-F trucks mounted on 22-in. rolled-steel wheels, with a wheelbase of 4 ft. 4 in. These trucks have cast-steel side plates and a single coil spring over the journal box in addition to the long elliptic springs in the bolster.

For hauling the sample trailer, one of the Pullman cars will be equipped with double-folding, pneumatically operated doors on the rear platform, and probably some rearrangement of the car interior looking toward an increase in the number of seats from 40 to 48 or more will be made. The abandonment of smoking on the front platforms has made it possible to take out the bulkheads and this may be done in connection with the reconstruction for trailer service. The details of the Pullman alterations have not as yet been definitely decided upon. This would indicate that the trailer plan of operation in Chicago, if adopted, will include a reconstruction in some respects of all the Pullman cars. How many motor cars will be thus reconstructed and how many trailers will be purchased and built in the company's shops are as yet open questions.

Cattle Guard for Automobiles

SINCE the beginning of operation of the Municipal Railway through the Twin Peaks Tunnel in San Francisco there have been several instances of automobiles being driven through this tunnel, which is strictly a railway tunnel and is not paved.

In one instance the driver of the machine entered the tunnel at the west end and upon arriving at the Laguna Honda Station, about a half mile from the portal, he succeeded in turning his machine around over the car rails and went back through the tunnel, while one of the lady passengers jumped from the automobile, due to fright from an approaching street car, leaving her hat in the automobile. This lady was seen several hours later by the elevator operator in the tunnel still searching for her party and her hat. In three other instances which were reported to the superintendent of the Municipal Railway the persons in the machines went entirely through the tunnel.

To overcome this danger a concrete pit or cattle guard has been constructed under the car tracks at the entrance at each end of the tunnel. This pit is about 4 ft. wide and 2 ft. deep and will effectually prevent anybody in the future from driving an automobile through the tunnel.

Since 1911 the number of persons transported per accident by the Philadelphia Rapid Transit Company has increased from 18,640 to 50,043, equivalent to a gain in "safety efficiency" of 18.8 per cent per year.

New Alloy for Railway Use

Aluminum Castings That Are Claimed to Have the Strength of Mild Steel Offer Possibilities for Weight Reduction

A NEW alloy, known as Duralumin, having properties which will be of great interest to railway men in connection with their efforts to reduce the weight of rolling stock, has been developed by the Aluminum Company of America. Having the unique combination of the lightness of aluminum with the strength of mild steel, the significance of its application to rolling stock will at once be appreciated. The physical properties of the metal are as follows:

Tensile strength, depending on the amount of cold working and proper heat treatment	50,000 to 60,000 lb. per square inch
Elongation in 2 in.	15% to 20%
Brinell hardness, using 10-mm. diameter ball at 500-kg. pressure	85 to 100
Shore hardness magnifying hammer	30 to 45
Specific gravity	2.8 to 2.85
Weight	0.1 to 0.102 lb. per cubic inch
Melting point	650 deg. C.
Coefficient of linear expansion	0.0000226 per deg. C.
Young's modulus	4700 tons per square inch
Thermal conductivity (silver 100)	31

In addition to these very desirable physical properties Duralumin is claimed to be fully as resistant to corrosion as is pure aluminum.

The above values for tensile strength, elongation, elastic limit and modulus of elasticity are obtained through the combination of mechanical work put upon the metal and heat treatment and are, therefore, obtainable only in the wrought forms. They do not hold true for the cast metal.

The Aluminum Company has been engaged for about a year in experimental work looking toward the development of methods of manufacture of Duralumin on a commercial scale. The technique of sheet rolling has been established in an experimental mill, the capacity of which is, of course, limited. However, the company reports that the sheet-rolling capacity for this alloy probably will be large enough by the end of the current year to take care of any reasonable demand.

The problems of the commercial fabrication of bar, rod and tubing from this alloy are not yet solved, and it is probable that these shapes will not be put on the market for another six months at the very earliest. The fabrication of this alloy is slow and costly and a very special technique for handling had to be developed for every stage in the process. However, the prospects for the production and the use of this alloy are very promising and the manufacturer is developing it, having in mind its wide application to electric railway rolling stock construction.

The numerous small brass castings which are used on a car, when taken together, represent considerable weight. The development of light aluminum alloys offers a chance to reduce this weight.

The Aluminum Manufactures, Inc., Cleveland, Ohio, have developed aluminum alloy castings having a tensile strength of 27,500 lb. per square inch and an elongation of 4.5 per cent, yet weighing only four-tenths as much as cast iron.

Thus far, these aluminum alloys have been used almost exclusively in the automobile industry, the manufacturers having gone so far as to make rear axle housings for 5-ton trucks of this material. In this connection it is said that while the aluminum alloy casting is not as strong, section for section, as the malleable iron or steel casting usually employed for this purpose, yet by a slight increase of the section it is possible to secure a strength equal to that of the ferrous housing and still have a weight only one-half as great.

Mutilating the Fiber of Wood Ties

The accompanying illustration shows a section of a white cedar tie split open after having a common wedge point spike and a goldie spike driven into it. The mutilation of the fiber of the wood by the common wedge point spike, which is shown at the right in the illustration, is quite pronounced.

SECTION OF TIE WITH DRIVEN SPIKES

Ratchet Jacks Improved

THE Buda Company has recently developed some new jacks which have been designed for heavy duty. Two new double-acting trip track jacks, Nos. 201-B and 206-B, are improvements over the Nos. 1-B and 6-B jacks, and the No. 219-B single-acting automatic lowering car jack is an improvement over the No. 19-B jack. These have been strengthened by ribbing the frame and base, and the additional metal has been distributed in such a manner as not to increase the weight of the jack. An improvement which will tend to make the jacks practically indestructible, it is claimed, is the use of hardened steel inserts for pawl bearings for the socket levers and the use of high carbon spring steel fulcrum pins which are machined, tempered and ground.

Chilled Wheels in Europe

THE Secretary of the International Street Interurban Railway Association has issued a bulletin saying that it had received from one of its members the following letter:

On account of the high price of steel wheels and the difficulty of obtaining them during the war, we have tried for our cars chilled iron wheels purchased in America. We believe the results obtained by them so interesting as to communicate it to you.

One of our motor cars equipped on June 15, 1919, with chilled wheels had run up to Dec. 3, 1919, 16,814 km., and the wheels showed very little signs of wear. A second motor car was equipped on Nov. 15, 1919.

A number of trail cars have been equipped for a long time with these chilled wheels, and some of them have covered as much as 85,000 km. The wheels of these cars are apparently good for much additional mileage, the wear, in wheel diameter, being about 4 mm. One of these wheels having made 94,000 km. has been retired from service, because it developed a flat, probably on account of a fault in the casting. This wheel has been sent to the cupola and has given as good results as pig for recasting.

Up to the present we believe that the mileage service of cast wheels is not inferior to that obtained with steel tired wheels.

In view of this communication, the association is collecting information from its members as to the service records of wheels.

Association News

Data Sheet for Life of Wearing Parts of Lubricated Motors

SECRETARY E. B. Burritt, on behalf of the committee on equipment of the Engineering Association, has sent to representative companies data sheets to be filled in with information on the life obtained from armature bearings, axle bearings, gears, pinions and carbon brushes. The list includes twenty-six questions regarding the life and service conditions for these parts, and the committee hopes to secure information which when compiled will be of valuable assistance to the various member companies and equipment manufacturers.

Fare Collection Committee Meets

ON March 29, 1920, the first conference of the joint committee on collection and registration of fares was held at association headquarters, in New York, to organize and plan the work for the year. Those in attendance were: W. J. Harvie, Auburn, N. Y., and M. W. Glover, Pittsburgh, co-chairmen; J. J. Duck, Chicago; L. D. Pellissier, Holyoke; E. C. Spring, Allentown; R. A. Stevenson, representing I. A. May, New Haven; C. W. Stocks, New York, and F. E. Webster, Haverhill, Mass.

The committee believed that inasmuch as its report of last year covered in full the matter of collecting flat fares this subject should not be opened up again this year, but that its efforts should be confined to the question of collecting zone fares on urban and suburban lines. An outline for its report along these lines was consequently developed, together with a questionnaire to be answered by all members. Companies are urged upon the receipt of this request for information to give the matter prompt attention, so that the work of the committee will not be delayed to such an extent that a full report cannot be presented to the coming conventions.

Company Membership

THE personnel of the American Association committee on company membership has been increased to permit the carrying out of the plans outlined in the issue of this paper for April 10, 1920.

The commitee now comprises the following membership: F. R. Coates, Toledo Railways & Light Company, Toledo, Ohio, chairman; E. F. Wickwire, Ohio Brass Company, Mansfield, Ohio, secretary; Benjamin Adams, St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo.; J. P. Barnes, Schenectady (N.Y.) Railway; L. C. Bradley, Stone & Webster, Houston, Tex.; H. F. Dicke, Utah Light & Traction Company, Salt Lake City; C. R. Ellicott, Westinghouse Air Brake Company, New York, N. Y.; L. E. Gould, Economy Electric Devices Company, Chicago, Ill.; C. A. Hall, Eastern Pennsylvania Railways, Pottsville, Pa.; E. B. Moore, Monongahela Valley Traction Company, Fairmont, W. Va.; H. H. Norris, ELECTRIC RAILWAY JOURNAL, New York, N. Y.; R. T. Sullivan, Tacoma Railway & Power Company, Tacoma, Wash.; E. M. Walker, Terre Haute Traction & Light Company, Terre Haute, Ind., and E. P. Waller, General Electric Company, Schenectady, N. Y.

Information Bureau Reports

RECENT reports and compilations prepared by the Bureau of Information and Service of the American Electric Railway Association appear below. These reports are available to member companies upon request:

Analysis of Agreements on Working Conditions for Trainmen, dated April 1. This abstract covers a number of the larger electric railway properties and includes the following subjects: Parties to contract, arbitration, hours of labor, length and kinds of runs, overtime, extra compensation, minimum wages, methods of choosing runs, working the extra list, Sunday and holiday work, purchase of uniforms, arrangement of reliefs, special work, instructing students, securing time off, etc.

Recent Decisions on Apportionment of Costs Between Electric Railways, Railroads and Public Authorities for Joint Improvements, Changes in Grade, Elimination of Grade Crossings, etc., dated March 13.

Fatal and Total Accidents on Electric Railways, dated March 23, 1920.

Tabulation Showing the Shrinkage in Public Utility Securities During the Years 1914 to 1920, Subdivided Between Electric Railways and Other Public Utilities, and Showing Stocks and Bonds Separately, dated March 15, 1920.

A Supplement to Bulletin No. 123, on Working Conditions, dated Nov. 15, 1919, and bringing this report up to date.

Letter to the Editors

Safety Car Operation in Snowstorms

THE LEVIS COUNTY RAILWAY
LEVIS, QUE., CANADA, April 12, 1920.

To the Editors:

In reference to my article which you published in the issue of the JOURNAL for April 3, page 699, it appears from conversation with several railway men whom I have met that there is an impression that in a snowstorm we pull all our Birney safety cars into the carhouses. This impression is absolutely incorrect and I would appreciate having you take such steps as are necessary to correct it.

In any ordinary snowstorm, with a fall of from 6 to 12 in., the Birney safety cars operate even better than the double-truck cars which we have in use, and further we operate all through the storm. In a blizzard we cannot operate our double-truck four-motor cars; neither can our snow sweepers operate. We are therefore certainly not going to ask the new Birney safety cars to do so. In a blizzard or severe snowstorm, when the sweepers begin to have trouble themselves, we order both the sweepers and the cars into the carhouses, for our sweepers get snowed in just as much as the cars.

If we had the same winter conditions as Quebec, Montreal and other cities, together with good streets, the Birney safety car would operate as well as any four-motor double-truck car, and whenever any of these large cars can operate the Birney cars can.

The photographs reproduced with my article show what the Birneys can do during and immediately after a storm.

H. E. WEYMAN, Manager.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Lively Hearing at Albany

Proposed Service-at-Cost Measure Attacked and Defended—Prospects Not Promising

The hearing at Albany on April 13 on the Jenks service-at-cost street railway measures was attended by delegations from all over the State of New York. The first speech made was that of Mayor Hylan of New York. His remarks with some interpolations were almost identical with the editorial presumably written by Mr. Watson that appeared in the New York *American* on April 13. They well bore out the statement of Job E. Hedges, receiver of the New York Railways, in his opening statement: "The Mayor's remarks are always the same, and always written by the same pen. I have heard them often."

Dire Political Consequences Predicted

In general, legislators were threatened with political oblivion if they voted for any of the measures now pending. President La Guardia of the New York Board of Aldermen attacked the constitutionality of the measures. The corporation counsels of the cities and the representatives who appeared against the bills for New York City all deplored the fact that the measures had been introduced so late in the season without an ample opportunity having been afforded to the people and the corporations interested for their study. They also resented what they termed the attempt by the Legislature to interfere with the home-rule rights of the cities.

The principal persons representing the railway interests were Edward A. Maher, Jr., president of the New York Electric Railway Association; Job E. Hedges, receiver of the New York Railways; William Guthrie for the Brooklyn City Railroad; John D. Milburn for the Nassau Electric Railway, Brooklyn; Adrian H. Larkin, counsel for the Midland Road, Staten Island, and Charles E. Chalmers, receiver of the Second Avenue Railroad, New York.

Mr. Guthrie Opened for Roads

Mr. Guthrie opened the case for the passage of the bills. He confined his remarks strictly to the constitutionality of the proposed measures, quoting decisions of the Court of Appeals of New York and the Supreme Court of the United States to show that the final power to fix franchise conditions and to raise or lower rates of fare is invested in the Legislature of the State. He brought out the point that no municipality could bind the Legislature to a contract forever. He contended that the right conferred upon a Public Service Commission or a Legislature to lower a rate likewise carried with it a responsibility to raise a rate of fare if conditions warranted so doing.

Assemblyman Cuvillier of New York City contended that under the provisions of the rapid transit act as amended in 1912 the Legislature did give to the city of New York the power to enter into contracts for the operation of subways under a partnership agreement and that the Legislature having granted such power is without constitutional authority to pass any law changing the rate of fare so agreed upon by the city of New York as a part of the contract stipulation.

Mr. Hedges argued well for an increased fare for the surface lines of which he is receiver, stating that unless relief be granted some of them will be obliged to close down. Mr. Larkin told of the attempt of the Staten Island railways to obtain relief from the city of New York and the inability of the Public Service Commission to do anything for them under the existing statute. John D. Milburn brought out the fact that under the present arrangement, if nobody wants to agree, the matter can remain unadjusted for years, while the Jenks bills, if an agreement cannot be arrived at within six months' time, the Public Service Commission may compel a change in rate to meet conditions.

It is the consensus of opinion that the bills have little chance of passage. In the first place, they were introduced too late in the session. Had they been introduced earlier in the session it is possible some real solution of the problem might have been reached. It would seem now that the best the traction interests can hope for at this session of the Legislature is the appointment of a committee to study the entire situation in the State of New York and to report to the Legislature of 1921 the result of its findings, together with any suggested legislation to remedy the situation.

Railway Will Contest Detroit Election

Company Will Continue Its Program Unabated, but Will Ask Courts to Establish Its Rights

In a statement by officials of the Detroit (Mich.) United Railway in answer to the inquiry regarding the policy it is intended to follow since the people ratified Mayor Couzens' railway ordinance, they voice their intention to continue to operate the present system as a unified railway at the present rate of fare and with the present system of transfers. It is maintained that now, as before the recent vote, the company stands ready to carry out the terms of the ordinance which it recently made public. It is intended to continue to give all the service that it is possible under the adverse conditions of a shortage in car equipment and men. The company plans to contest the election.

AT THE CLOSE of the construction season the company had under way several important railway extensions under the so-called day-to-day agreement, which it was intended to rush to completion this year. Under present developments, however, the company is not decided as to what course will be followed with this work, since tracks on these streets come within the Mayor's piecemeal plan. In view of the Mayor's statement as to the value of track construction and what he proposes to allow the company for the day-to-day lines, the company officials do not feel justified in spending money for the extensions without some certainty as to the outcome.

The company has a considerable amount of construction work outside of Detroit, not only along interurban lines but in some other cities and towns served. This work will be carried on with all possible speed, and if the labor situation permits efforts that would have otherwise been given in part to construction work in Detroit will be concentrated on the work elsewhere.

Definite action was taken by the company on the Saturday following the election by the filing of two suits in the United States District Court. It is asked that the municipal railway ordinance be declared void and invalid and that the city be enjoined from proceeding under its authority. The company as plaintiff in one suit maintains that the ordinance is invalid in that it contemplates the seizure of part of the company's property without process of law. In the second case, action is brought in behalf of the New York Trust Company, the trustee under a mortgage given by the Detroit, Fort Wayne & Belle Isle Railway. This action is placed on the ground that the taking over of the present Fort Street line as part of the Mayor's municipal program at an estimated cost of $40,000 per mile will jeopardize the value of the property pledged as security for the mortgage held by the trust com-

pany. Mayor Couzens, City Controller Steffens, the three members of the street railway commission and the nine city Councilmen are named as defendants in both cases.

Company Appeals to Court

In the bill filed in behalf of the Detroit United Railway it is stated that the enforcement of the railway ordinance involves the sale of part of the company's property under conditions amounting to coercion, violating the due process clause of the Fourteenth Amendment to the Constitution. The charge is based on the assertions made by the Mayor and written into his campaign literature that the Fort Street and Woodward Avenue lines together with certain day-to-day agreement lines would be taken over at a price estimated at $40,000 per mile. Reconstruction costs of these lines, less depreciation, is set at $87,000 per mile.

It is also claimed that the city has lost its right to order the company to remove its tracks and equipment from Fort Street and Woodward Avenue by allowing the continued operation of these lines by the company since the granting of the ouster decision by the Supreme Court. It is claimed that no resolution or order to remove the tracks was ever passed by the city, but that reconstruction and extension of the Fort Street line had been authorized.

The street railway ordinance is attacked on the ground, it is claimed, that the measure was drawn in such a way as to mislead the voters; that only a portion of the voters were furnished with the sample ballots; that the bond issue authorized is inadequate to carry out all of the provisions of the ordinance, and that the city is bound by the terms of the measure to construct new lines while the actual plan contemplates the purchase of certain Detroit United Railway lines.

Petition for a recount of the ballots in the election was filed by the Detroit United Railway just before the returns were certified by the board of city canvassers. The petition signed by E. J. Burdick, general manager, charges that the ballots were so printed as to permit the inspectors to glance at the votes. The company alleges that the ballots were so thin that voters' marks could be seen, which is contrary to the law providing secret ballots.

In commenting on the company's actions, Mayor Couzens stated that they were indicative of the desperation of the Detroit United Railway in the situation.

Corporation Counsel Confident

The throwing out of ballots which the company claims have been exposed will be resisted by the Corporation Counsel. In commenting on the two suits filed by the Detroit United Railway the Corporation Counsel stated that inasmuch as the people have expressed themselves by means of the ballot, he is confident that he will be able to present their side of the question to the court.

A Whole City Walks to Work

Dubuque Cars Have Not Been Operated for Six Weeks— City Seeks to Force Service

Out of the election which was held in Dubuque, Iowa, on April 5 may come a settlement of the difficulty which has made it impossible for the Dubuque Electric Company to operate cars since March 1. It is a strike story with many elements entering into it, among them personal ambition, inborn and cultivated hatred of capital, political cowardice and the failure of the press to realize that it is under any obligation other than the protection of its subscription list. The fight was forced on the company. It could have escaped, perhaps, by sacrificing the property. This it flatly refused to do.

THE PRESENT situation had its beginning in the demand made in March, 1919, by the Amalgamated Association for a wage increase from the then existing base of 34 cents an hour to 50 cents an hour. The company pleaded its inability to pay and preserve its financial integrity.

Committee Investigates Matters

At the suggestion of the company the City Council in May, 1919, appointed a citizens' committee to investigate the books to ascertain what could be done to meet the situation. This committee reported the inability of the company to increase wages, but further stated that if the company was permitted to charge a 7-cent cash fare with four tickets for 25 cents it could pay a wage based on 42 cents an hour. These figures were found approximately to meet the increased payroll by an equal increase in receipts from traffic. To this arrangement the company agreed, and the fare increase was established by ordinance. The Council also later ordered an audit and appraisal of the accounts and property so as to ascertain whether the employees' wages could be further increased or the new fare reduced. This work was contracted for by the City Council with the C. B. Stiver Company, Des Moines, which called in, by consent of the City Council, the Rau Appraisal Company, Milwaukee, to make the appraisal. The city was to pay the cost of the audit and a certain sum toward the cost of the appraisal. The company was to assume the balance. The work has proceeded since October, 1919. It is expected that it will be completed and submitted to the City Council in a short time.

Company Appeals Against Special Tickets

Previous to September, 1919, there had been in effect during specified hours a fare rate of 2½ cents applicable to "mechanics, working women and working girls." The company regarded this as illegal because of occupational discrimination and these rates were discontinued by the United States Court of Appeals sitting at St. Paul. The trainmen then submitted a demand for a new wage scale based on 60 cents an hour. The company stood upon its agreement to await the completion of the audit and appraisal which was to disclose what change, if any, should be made in the agreed settlement of the previous May.

On Feb. 19, 1920, the company was notified that on March 1 the men would go out if their demand was not granted. The company asked the men to tell the Mayor of their intentions. The Council then appointed a representative committee which proceeded to examine the books and accounts of the company covering a period of three years up to Jan. 31, 1920. This committee reported that the company could not pay more under existing circumstances; that a further fare increase would not secure additional receipts, and that an increase in the wage base was only practical through operating economies.

To this end the committee recommended the adoption of the safety car on several lines. Cars of this type are forbidden on the city streets by ordinance, but the committee recommended that the prohibitory ordinance be repealed. The company agreed that if this plan was followed it would pay 52½ cents an hour until Sept. 15, 1920, and then 55 cents for two-man operation and 60 cents for one-man operation. The men immediately went to a demand for 60 cents two-man and 65 cents one-man operation. In refusing the company's proposition they went on strike at midnight on March 1.

Company Notified to Start Cars

Later the Council voted to visit cities where safety cars were being operated, but only four Aldermen reported when the train was to leave, the Mayor, City Attorney and three Aldermen dodging the responsibility. Gary and Terre Haute were visited by the four Aldermen and a representative of the Federation of Labor. One Alderman went only to Gary, returning because of illness. He gave to the local press unqualified approval of the safety car operation. When the others returned they declined to formulate a report until the other city authorities had made a similar inspection and could join in a recommendation. To the present time this has not been done.

On March 26, 1920, the City Council passed a resolution notifying the company to settle with the men and start the cars within twenty-four hours, and also directing the City Attorney to advise the Council what the city's rights were. As the franchise specifically states that failure to operate cars because of a strike shall not "work a forfeiture" the company has been content to await action of the City Attorney. If the city carries its case to the District Judge the court may await the report of the auditors and appraisers as a guide to his decision. There the matter rested just before the election.

Court Inquiry at Toledo to Start April 22

If Figures Submitted by Railway Are Upheld Fare at Toledo May Be 10 Cents

Federal Judge John M. Killits hopes to be able to keep the railway lines of the Toledo Railways & Light Company operating under the suspension of the "ouster" ordinance till a permanent settlement of the quarter century problem has been effected. Service was resumed in Toledo after a four-day strike when the court granted an increase in fare. The court is relying on the application of the Miller public utilities abandonment law to set aside the effect of the "ouster" after May 1, to which time it was extended by the City Council. Council in the recent negotiations, in which it refused to extend the "ouster" application or grant increased fare, has indicated that it will not grant any further privileges to the railway.

JUDGE KILLITS, at the time of granting the order restoring service, declared he would investigate the revenues and costs of the Toledo Railways & Light Company to ascertain whether or not the "7 and 2" fare was justified. His inquiry is scheduled to begin on April 22.

The order provided "that the rates of fare herein set forth shall be subject to revision upon the determination by the court, upon application by either party hereto, of the value of the street railway property and of what will constitute a reasonable rate of return thereon."

While the court will not be permitted to go very deeply into the question of valuation because of the pressure of other business, it is thought a temporary valuation can be arrived at from the recent city inventory and the books of the company.

Court Inquiry Planned

The Judge intends to look into the matter of the production and distribution of electric current by the Rail-Light and also by the Acme Power Company, owned by the same interests, but in no way related to the Toledo Railways & Light Company. It has been charged by city officials that the railway is paying "velvet" to the power company which earns revenue for the same stockholders.

If company figures submitted to the city, and approved by special accountants, are upheld by the court a 10-cent fare may become a possibility as a "reasonable return" on the investment in the railway.

The two commissions working on solutions for the problem of transportation for Toledo have about one month more in which to complete their work and submit it to the people of the city. The municipal ownership body will recommend that Council appropriate a sum sufficient to establish a modern transportation system; that it acquire by condemnation or otherwise such portions of the present street car lines as it deems necessary for a model system; that the Mayor shall name a commission to determine what lines shall be retained and what routes established, as its plan to secure public ownership of the street railway system in Toledo.

A resolution embodying these principles will be drawn up and presented to the Council within the next week.

The commissioners are in favor of building a new street railway system by using parts of the present lines. They have given up any idea of buying the entire property of the Toledo Railways & Light Company, because Henry L. Doherty has failed to quote them his absolute cash price on the property. He offered it for $11,000,000 on a part-time basis.

Commissioners Want New Lines

A comprehensive system of motor buses as an auxiliary to the basic railway system is a part of the scheme of the municipal ownership commission. The commission will name in its resolution what it deems a reasonable amount to be expended by the city for a transportation system.

Henry L. Doherty declared only last week that he would not listen to any proposal which would seek to take parts of the lines and leave other parts to be sold as junk.

City Law Director James S. Martin has advised the municipal ownership commission that there is very little legal precedent for a city to condemn only portions of a public utility. The railway is operating without franchise from the city.

The cost-of-service commission has begun the task of comparing its ordinance section by section with the Doherty corrections and in the consideration of the first twelve sections has adopted most of the Doherty suggestions.

The commission will submit its final draft, embodying changes, to several Toledo attorneys before again turning it back to the federal court for submission to Council.

It is planned to have the two measures ready for submission to Council about May 1 and these will probably be ready for a referendum about June 1.

Dallas Approves Interurban Road

The voters of Dallas, Tex., passed favorably at the city election there on April 6 on the question whether the proposed Dallas-Wichita Falls interurban line shall be substituted for two of the 30-mile interurban lines that must be built by the Strickland-Hobson interests which took over the railway lines of Dallas several years ago under the service-at-cost franchise. J. F. Strickland has indicated that his company would take over the Dallas-Wichita Falls proposition and build the line if this action will be accepted by the city as discharging its obligation to build two 30-mile lines and to guarantee which it is under bond to the city.

Mayor Frank W. Wozencraft said doubtless the City Commission had the authority to grant the substitution, but he believed the people of the city should have an opportunity to pass on the question. For this reason it was decided to submit the matter to a referendum. The Wichita Falls line will be 130 miles long and will touch Denton, Slidell, Gainesville, Decatur, Henrietta and several other smaller towns. Surveys have already been completed and estimates made.

Pittsburgh Will Discuss Service at Cost

A plan whereby the Pittsburgh (Pa.) Railways will give the city of Pittsburgh service at cost will be worked out with the reorganization of the company by representatives of the city and the company, it was announced, on April 1, following the final meeting for the present of the Mayor's traction conference. The plan, it is believed, will mean a revolutionary change in the relationship between the receivers of the Pittsburgh Railways and the city.

At the close of the conference the following statement was issued:

> Attorneys for the city and the Pittsburgh Railways, with Robert M. Feustel, consulting engineer for the city, will immediately begin negotiations with a view to attempting to establish a service-at-cost plan for the Pittsburgh district in the operation of the Pittsburgh Railways, such as has been worked out in other large cities, notably Cleveland and Cincinnati.
>
> This will be done in connection with the proposed rehabilitation and reorganization of the railways company.
>
> Details of the plan, when worked out, will be reported back to the Mayor and Council at the earliest possible date. In the meantime, attorneys for the city will take any steps believed necessary to protect the city's interest in case these negotiations fail.

Worcester-Springfield Demands Rejected

Identical demands for new working agreements, to become effective on June 1, when the present contracts expire have been made by the trainmen of the Springfield (Mass.) Street Railway and the men on the Worcester Consolidated, in a communication delivered to Clark V. Wood, president.

An increase from the present maximum of $5.13 for nine hours to $6.40 for eight hours for motormen and conductors and 40 per cent advance for miscellaneous help is demanded. According to the schedule proposed, the new rates of pay for platform help would be $5.20 a day for the first three months, $5.80 for the following nine months and $6.40 after a year. The present rates are $4.23, $4.68 and $5.13.

Mr. Wood intimated that a very substantial increase in fares would be necessary to carry out such a salary program.

New York Mayors for Home Rule

A declaration for home rule for the cities of New York State in the matter of regulating fares was voiced at Rochester on April 10 at a meeting of the special committee appointed by the New York State Conference of Mayors to study the railway situation as it affects the various cities. The particular purpose of the meeting was to lay plans for the aggressive opposition which the committee intends to wage for the Mayors' Conference against the Jenks bills now before the Legislature. After a session which lasted for several hours the special committee epitomized its attitude with regard to the Jenks bills in the statement which follows:

The committee is opposed to the bill to give to the Public Service Commission power to increase street railway fares irrespective of franchise restrictions, special statutes or agreement, because a franchise is a contract that has been made by a city with a company.

The need for increasing fares in those thirty-six cities which have franchises restricting rates of fare is a matter for each of these municipalities to determine for itself. The courts have repeatedly declared that the State has authorized these cities to exact fare restrictions when granting franchises, and the Constitution provides for the protection of these contractual provisions when made.

In twenty of these thirty-six cities the administrations have permitted the companies to increase these fares temporarily. In eight others the companies have not requested any increase in fares, and in the remainder, the authorities have refused to permit the companies to raise the fares because they are not satisfied with the reasonableness of the companies' claims. We believe that the action of these cities demonstrates conclusively that local authorities are able to arrange their traction affairs themselves.

We are opposed in its present form also to the so-called service-at-cost bill. If the measure simply gave to cities authority to enter into service-at-cost contracts with traction companies, we should approve it. Municipalities should have such power. This measure, however, provides that every city either must enter into a service-at-cost contract or must surrender its franchise rights by permitting the Public Service Commission to fix the rate of fare regardless of restrictions or agreements.

We are, therefore, opposed to the bill.

Akron Men Want $1 an Hour

Employees of the Northern Ohio Traction & Light Company at Akron, Canton, Massillon and other points, in addition to an increase of wages to $1 an hour, have included in their demands the requirement that 90 per cent of the runs be completed within the eight-hour period, an hour's additional pay for filling out accident reports, free transportation for the families of employees over the company's lines, discharge of any employee who violates the rules of the union, reinstatement of employees who resign if the application is made within six months, the reinstatement to be at the same wages the men received when they resigned. All new men are also to be required to become members of the union within thirty days after they begin work for the company.

Officials of the company say that to grant the demands would mean an addition of $1,560,000 annually to the payroll for the trainmen alone. Just what offer the company is prepared to make has not been stated. The contract with the union provides for arbitration of wage differences, the board to be made up of one man selected by the company, one selected by the men and the third by the Governor of the State.

Three-Cent Wage Increase in Philadelphia

Announcement was made on April 13 by the Philadelphia (Pa.) Rapid Transit Company that wages of motormen and conductors will be increased 3 cents an hour, making the maximum 61 cents an hour, effective on May 1. The wages of employees in other departments will be increased proportionately, effective the same date.

The co-operative plan provides a basis for determining the wages of the employees of the company, which shall be the average wage scale of four cities: Chicago, Cleveland, Detroit and Buffalo. Buffalo's trainmen's wages have been increased to 60 cents an hour, effective on May 1. This establishes the new maximum of 61 cents an hour for Philadelphia. The general committee of the Employees' Co-operative Welfare Association approved the new rate at a meeting held on April 13.

The gospel of thrift has been practiced by more than 70 per cent of the 9,400 employees eligible to membership in the saving fund. They have authorized the treasurer to make deductions from their pay envelopes each week. The average saving each month for each employee is $10. The aggregate savings exceed $780,000 annually.

It is expected that the men will increase their savings account, as the added weekly wage is about $1.65 to each employee. Officers of the saving fund are confident that at the annual picnic of the Co-operative Welfare Association the saving fund will exceed $1,000,000. Practical aid in saving is extended to employees through the Co-operative Welfare Association's simplified budget system for determining a household budget and keeping expense records.

Tugaloo Development to Be Pushed

The proposed Tugaloo hydro-electric development of the Georgia Railway & Power Company, Atlanta, Ga., will be located on the Tugaloo River, immediately below the junction of the Tallulah and Chattooga Rivers, where the Tugaloo is first formed.

A power house, 60 ft. by 190 ft., will be located immediately below the dam. It will have an installed capacity of approximately 75,000 hp. in water wheels. There will be four wheels of 18,750 hp. each, direct connected to 6,600-volt, three-phase, 60-cycle vertical type alternators of 12,500-kw. capacity each. The transformation from 6,600 volts to line voltage of 110,000 volts will be accomplished through two banks of power transformers of 25,000-kw. capacity each. Each bank of transformers will consist of three single-phase units. A new 110,000-volt transmission line, about 3 miles in length, will also be constructed for delivering the power from this plant to the present double circuit 110,000-volt steel tower line extending from the present Tallulah Falls plant to the city of Atlanta, Atlanta being the central distributing point for the transmission system of the Georgia Railway & Power Company. In addition to supplying current to Atlanta and other communities the company operates 230 miles of track.

Active construction work on this project was begun some two years ago. Contracts were then placed for the water wheels with the S. Morgan Smith Company, York, Pa., and for the generators with the General Electric Company. A part of the steel work and considerable other equipment have also been purchased. The construction was held up for the past eighteen months because of conditions resulting from the war. It will now be pushed as rapidly as possible.

All of the work on the project will be handled by day labor, under the company's own construction organization, of which Charles G. Adsit is chief engineer.

Wage Demands Rejected by Cleveland Railway

J. J. Stanley, president of the Cleveland (Ohio) Railway, on April 12 sent a communication to the officers of the local union, in which he stated that the company is compelled to refuse the demands of the men for an increase in wages to 90 cents an hour and new conditions as to time and runs. His letter contained the following proposals:

1. That all demands, whether of the company or the men, be submitted to arbitration immediately.
2. That both sides waive the privileges of the time in the present contract for naming representatives to the board of arbitration.
3. That C. Loomis Allen, vice-president and general manager of the Syracuse & Suburban Railroad, Syracuse, N. Y., be named forthwith to act for the Cleveland Railway.
4. That in case Mr. Allen and the arbitrator to be named by the men fail at their first session to agree on a third man, the Federal Judge of the District appoint the umpire.

The letter also contained counter demands, in effect as follows:

1. That restrictions as to sex of conductors and motormen on cars be removed.
2. That the clause which now provides that such employees "shall" become members of the union be changed to read only that they "may" join the union.
3. That compensation other than straight time rates (this affects split-shift runs) be abolished.
4. That there be a higher rate of pay for motormen than for conductors, if any pay changes be made at all.
5. That the present agreement remain in effect pending the results of arbitration.

Mr. Stanley said that, in fairness to the public, he feels that the increase should not be granted. The cost of living has not increased materially since last July, when the present terms were made, following the strike.

Officials of the union refused to express any opinion on Mr. Stanley's letter until they had taken time to study it thoroughly.

Wage Reduction in Denver

The Denver (Col.) Tramway has served notice on the local branch of the Amalgamated Association that effective June 1 the agreement between them will be canceled and the wage scales reduced from 58 cents an hour maximum for trainmen to the 48-cent scale established by the National War Labor Board. Jurisdiction over the case was assumed by the Colorado Industrial Commission on April 3.

Initiative petitions calling for the passage of an ordinance authorizing the collection of a 7-cent fare have been circulated by the company and will be filed with the municipal authorities. The City Council has thirty days within which to act after the petitions are certified to it and must either pass the measure or refer it to a vote of the people at the next regular municipal election, which will be held in the spring of 1921.

The company will make no campaign for the passage of the ordinance. It will limit its activities to the initiation of such measure and leave entirely to the municipal authorities the determination as to whether the rate of fare shall be 7 cents with the 58-cent wage scale or 6 cents with the 48-cent National War Labor Board wage scale.

A local board of arbitration on March 19 had granted the trainmen a 10-cent an hour increase, with corresponding increases for employees in other departments. This advance the company is unable to meet from the revenues derived from its present 6-cent fare.

Ex-Governor Compiling History of Union Crimes

Ex-Governor Joseph M. Brown of Georgia, whose protest to the President against union domination was noted in the ELECTRIC RAILWAY JOURNAL for March 13, page 535, wrote to the Atlanta *Journal* during the recent strike of the trainmen of the Georgia Railway & Power Company advising against resort by labor or its sympathizers to such tactics of frightfulness as characterized the railway strike in October, 1916. Mr. Brown is the avowed foe of force as exemplified in the labor bomb thrower. Among other things he said in the *Journal*:

> I will add that I am now making research into the course of the Amalgamated Association in "enforcing its demands" upon the public, and up to the present date have secured record of more than forty cities in which riots, with destruction of property and unlawful wounding and killing of people, were the accompaniment of strikes by this Amalgamated Association. These states include Maine, New York, New Jersey, North Carolina and Georgia on the Atlantic Ocean and Washington and California on the Pacific Ocean, with various states between the two oceans.
>
> When this record has been completed I shall lay it before Congress and before the Georgia Legislature and I shall ask Congress if, while it is holding on the statute books laws to control corporations which conduct interstate commerce, it will continue concurrently to leave non-incorporated organizations of men free to conduct at their pleasure interstate crime. And I shall ask the Legislature of Georgia some pertinent questions and make some suggestions to that body for protecting the people.

News Notes

$450,000 Carhouse Fire.—The Winnipeg (Man.) Electric Railway lost its Main Street carhouse in a fire on April 7. On account of the lateness of the receipt of this news, it is found necessary to include this item in the department Manufacturers and the Markets.

Boston Wages to Be Arbitrated.—The new wage demands of union employees of the Boston (Mass.) Elevated Railway will go to arbitration, according to a decision reached at a conference between the trustees and the men's representatives on April 9.

Dayton Road Increases Wages.—On April 6 the Dayton, Covington & Piqua Traction Company, Dayton, Ohio, increased the wages of its trainmen 3 cents an hour. This is the fourth 3-cent increase within a year. Employees in Dayton and Hamilton will now receive 50 cents an hour, while members of interurban crews will receive 51 cents an hour.

Commissioners Complain Franchises Are Violated.—Commissioners of Stark County have prepared charges against the Northern Ohio Traction & Light Company, Akron, Ohio, to the effect that the terms of the franchises are being violated in respect to rates of fare between Canton and Massillon and Massillon and Navarre. Application will be made to the Public Utilities Commission to adjust the matter.

Peoria Men Want More.—Trainmen of the Peoria (Ill.) Railway are asking for the wage scale of 80, 83 and 85 cents an hour with a basic nine-hour day. The present agreement of the men with the company expires on April 30. Arbitration is provided in the event of failure of the men and company to agree. Officials of the company state that if an increase of pay is granted to the men an advance in fare will be essential.

Conference on One-Man Car Operation.—Pending a conference between union representatives and officials of the Connecticut Company, the local employees of the company at Bridgeport on April 10 decided to assume runs on "one-man" cars on April 11, when the new service schedule of the company became effective. The men had protested the operation of "one-man" cars where zone fares are collected on the ground that it puts too much work on the motorman.

New Youngstown Scale Accepted.—Acceptance of the increase in wages offered by the Pennsylvania-Ohio Electric Company, Youngstown, Ohio, has probably averted a strike of 800 motormen and conductors in Sharon, Youngstown, Newcastle and Warren. The employees demanded that they be paid 70, 73 and 75 cents an hour according to the length of service. The company refused the demand and a compromise rate of 60, 63 and 68 cents was accepted. The scale will date from April 1.

Sioux City Men Want More.—Demands of a 60 per cent increase in wages, a nine-hour day and a "closed shop" were made on the Sioux City (Iowa) Service Company by the trainmen's union, forecasting a fight that eventually may culminate in a movement for increased fares. When the present scale of wages was agreed on a year ago Service Company officials announced that company finances had reached the "breaking point." No further increase would be granted, it was intimated, without reciprocal action for a 6 or 7-cent fare.

Strike in Spartanburg.—Union trainmen in the employ of the South Carolina Light, Power & Railway Company at Spartanburg, S. C., went on strike on April 1. They want an increase in wages and a change in working conditions. The men charge discrimination against members of the union. An advance in pay of 5 cents an hour was made by the company recently, but the men say that the advance was negatived by other company modifications. On April 5 service had been restored in part with non-union men.

This "Ghost" Doesn't Walk Regularly.—Employees of the Norton & Taunton Street Railway, which is owned by the cities of Taunton and Attleboro, and the towns of Mansfield and Norton, in Massachusetts, were authority for the statement on April 5 that they had not "seen the ghost walk" for three weeks and that unless money was forthcoming soon they would be forced to quit the cars and get the wherewithal for daily maintenance from other sources. The men claimed that money is still due them for work done shoveling snow during the big storm. The men tell of one conductor who turned in his receipts with a note informing the company that he was $10 short simply because he needed the money.

Group Insurance for Key Route Men.—The directors of the San Francisco-Oakland Terminal Railways, Oakland, Cal., have arranged to insure the lives of all the regular employees without cost to them and without medical examination. This consideration is thus extended in recognition of service faithfully and loyally performed and to be performed. In announcing the plan the company said: "It is extended in the expectation that it will provide a means through which any dependent will be protected against immediate need and even afforded an opportunity to start anew. It is extended to the end that the employee will find satisfaction and contentment in the knowledge that whatever may befall, so long as he renders faithful and efficient service, something will be left for the protection of those dependent upon him.

Financial and Corporate

Surplus Account Up

Earnings of Holding Company Materially Increased—North American Company Has Prosperous Year

The annual report for the year 1919 of the North American Company, New York, indicates increased revenues and decreased expenses, thereby giving a material increase in the surplus account even after the payment of four quarterly dividends, each of 1.25 per cent on the $29,793,300 of outstanding capital stock.

No changes are noted in the valuations of the stocks and bonds of street railway, electric light and gas companies owned by the company. Loans and advances consist of money advanced to subsidiary companies. The only important change during the year is the reduction in notes payable from $4,177,500 to $500,000, which since has been reduced one-half. The reduction in loans of $3,677,500 and the payment of dividends aggregating $1,499,665, involving total cash disbursements of $5,167,165 during the year, were accomplished through repayment by subsidiary companies of moneys previously advanced to them, and the receipt in cash of interest and dividends from earnings of subsidiary companies. The accompanying table, gives in detail a comparison between the income and undivided profits for the past two years.

INCOME AND UNDIVIDED PROFITS ACCOUNTS OF THE NORTH AMERICAN COMPANY

Year Ended Dec. 31	1919	1918	Per Cent Change + Inc. — Dec.
Interest received or accrued	$483,331	$573,608	— 15.75
Dividends received or accrued	2,279,318	1,390,435	+ 63.90
Profits and compensations for services	33,592	33,837	— 0.72
Total revenues	$2,796,241	$1,997,880	+ 40.00
Salaries, legal expenses, net rentals and all other administration expenses and taxes	$130,422	$131,341	— 0.70
Interest paid or accrued	119,152	262,465	— 54.60
Sundry accounts written off	700	.....	.....
Total expenses	$250,274	$393,806	— 48.90
Net income	$2,545,967	$1,604,074	+ 58.60
Dividends paid and accrued during year	1,489,665	1,489,665	.....
Balance carried to undivided profits account	$1,056,302	$114,409	+ 822.00

Shore Line Lease Abrogated

The New London division of the Shore Line Electric Railway, Norwich, Conn., has reverted to the Connecticut Company, New Haven, Conn. This division includes the New London and Norwich local lines. It extends through New London and Windham Counties to the Massachusetts State line at Wilsonville and includes the Putnam line. The division has been operated by the Shore Line Electric Railway under a ninety-nine year lease from the Connecticut Company, but the Shore Line is now able to give up this lease by permission of the Superior Court since it went into the hands of a receiver.

In a statement, Robert W. Perkins, the receiver, says in part:

> With a little margin over actual operating expenses the Connecticut Company will be able to spend a little more money on maintenance of roadway and rolling stock, give addifional service and provide some more modern equipment, but it should be borne in mind that in order to provide adequate service, and a reasonable return on the investment, the gross revenue must be increased and any change in passenger fares which the Connecticut Company may find it necessary to adopt should be accepted as an inveitable consequence of the increased cost of producing the service, for, after all, the community should be more interested in service than in the price it pays for it provided that price does not give to the owners of the property a return above that common to other industries. If operations do not result in such a return, service will have to terminate.

The Connecticut Company has also issued a statement in which it says in part:

> The direction of affairs will be under the local supervision of Samuel Anderson, who filled the position of manager of the same properties during the period of operation by the Connecticut Company.
>
> It is the intention to install safety cars for local service in both New London and Norwich as soon as such cars, now on order, can be delivered and operation of all lines will be continued for the present and until we have had an opportunity to determine what changes must be made to meet the patronage accorded the service.
>
> The prevailing rates of fare will be continued for a time in order to allow a complete study to be made of conditions and revenues in various localities. Ample notice will be given in advance of any changes which may be required.
>
> We hope that we may be able to provide a character of service that will invite the patronage of a sufficiently large number of passengers at such rates of fare as will provide us with funds required to keep the service going, and as the communities depend largely upon the means of transportation we appeal to the public for cooperation in our effort to solve the problem of your street railway.

City Must Pay Appeal Cost

The United States Supreme Court has denied the request of Kansas City that the Kansas City Railways be compelled to pay for printing part of the record in the recent unsuccessful legal attempt of the city to set aside the order of the State Public Utilities Commission in allowing higher fares.

Pittsburgh Valuation Protested

City Considers Recent Commission Decision Misleading—Thirteen Objections Specified

The Pennsylvania State Public Service Commission's decision valuing the properties of the Pittsburgh Railways at $62,500,000 is branded as "misleading and prejudicial to the rights" of the city. The commission is asked to "set forth" definitely and clearly that its decision was solely for reorganization purposes and is not to be accepted as a basis for fares in Pittsburgh in a petition for a rehearing in the matter filed on April 8 in behalf of the city of Pittsburgh.

The city filed the petition as a "safeguard" against any attempt that might be made to advance the present fare to a 10-cent flat rate, in view of the demands of the motormen and conductors for an increase in wages to a maximum of 91 cents an hour.

A number of other municipalities and the committee on better service of the allied boards of trade also are filing petitions for a rehearing on the commission's valuation decision, which Special City Counsel Robinson has declared means, if it stands, a straight 10-cent fare in Pittsburgh.

CITY'S OBJECTIONS SUMMARIZED

In thirteen specific instances, the city in its petition for a rehearing charges, the commission erred in its valuation decision, and these "thirteen counts," as the city sets them forth, summarized, are as follows:

1. The commission erred in finding the value of the properties for reorganizing and refinancing upon a complaint alleging unreasonable rate of fare.
2. The commission was without jurisdiction in acting as though the evidence had been taken upon an application for a certificate of valuation.
3. The commission erred in attempting to set a valuation without having evidence of the market value of the stocks and bonds of the companies.
4. Interest on debenture bonds amounting to $600,000 and interest and principal on car trusts, amounting to $312,471 for 1920, are not chargeable to fixed expense, as was done in the commission's report, and should be deducted from the annual fixed charges of $4,200,000.

ERROR IN AVERAGING PRICES

5. The commission erred in taking as the basis for reproduction cost range of prices from 1914 to 1918, when prices were abnormally high.
6. The commission erred in not deducting cost of financing from the capital account.
7. Depreciation was not deducted from reproduction cost.
8. Superseded property and depreciation was not deducted from historic cost, to the extent that past earnings were in excess of 7 per cent.
9. Excessive sums were allowed for consolidation costs and consolidation values.
10. Properties not used or useful for street railway purposes were included in the valuation.
11. The commission should have ascertained actual gross income of the company during recent months, which naturally exceeded returns of September and October.
12. Its action in placing a valuation upon the property when it was not asked for by the petitioners is misleading and prejudicial to the rights of the complainant and not a proper basis for rate making purposes.
13. The commission erred in approving fare increase when such session set aside ordinances fixing the rate of fare.

$5,154,332 Duluth Value

Local Railway Appraised in Connection with Fare Vote Which Is to Be Held on June 21

The Duluth (Minn.) Street Railway has been appraised by Hagenah & Erickson, Chicago, Ill., in connection with the fare matter referred to elsewhere in this issue. Three sets of figures are presented, varying considerably with the level of prices used. The appraisal based on the average of labor and material prices which prevailed during the five-year period ended Dec. 31, 1919, follows:

	Reproduction Cost New	Reproduction Cost Less Depreciation
Physical property	$4,930,539	$4,362,332
Working capital	192,000	192,000
Going concern value	600,000	600,000
Total	$5,722,539	$5,154,322

The appraisal based on the level of labor and material prices indicated by the trend of prices as reflected by the continuation from 1914 to 1919 of the normal price movement which was established during the period from 1896 to the beginning of the European war, follows:

	Reproduction Cost New	Reproduction Cost Less Depreciation
Physical property	$4,383,069	$3,886,023
Working capital	192,000	192,000
Going concern value	600,000	600,000
Total	$5,175,069	$4,678,023

The appraisal based on the level of labor and material prices which prevailed during 1918 and 1919 and which reflects the level of prices which will probably continue for a number of years in the future, follows:

	Reproduction Cost New	Reproduction Cost Less Depreciation
Physical property	$5,638,093	$4,977,894
Working capital	192,000	192,000
Going concern value	600,000	600,000
Total	$6,430,093	$5,769,894

The figures are as of Dec. 31, 1919.

Under the conditions which have prevailed for several years and which will undoubtedly exist for a number of years in the future the appraisers reported that the results based on the normal trend of prices were indicative of a lower value than can be justly considered, and against that they submitted the appraisal results based on the present level of prices, which reflect that level to which all business and private industries are now seeking to adjust themselves. They said:

> Between the two extremes we believe that the appraisal results based on the average of the labor and material prices which have prevailed during the last five years more nearly represent a just basis for rate-making purposes, and from a consideration of all of the facts it is our conclusion that the fair value of the property represented by the Duluth division of your company is not less than $5,154,322, and that such amount should be considered as the minimum valuation on which your company is entitled to receive that measure of return contemplated by law.

Mayor C. R. Magney objected to one item in the valuation figures. The company claimed $600,000 as its "going concern value." The Mayor contended that if the company claims that it is on the verge of bankruptcy, it is ridiculous to suppose that it has an "intangible going concern value of more than $500,000" on which to expect a return in the shape of dividends.

In arriving at this item the company's appraisers said they were guided by facts obtained from the history of the company and by a consideration of the actual investment in property and the earnings and operating expenses over a period of thirty years. They also determined what would be the normal cost to reproduce the present business of the company and further considered the provisions which have been made by the courts and public service commissions covering this item of property in the appraisals of public utility companies.

Extent of Property Reviewed

The Duluth Street Railway serves a population of approximately 100,000. It owns and operates a total of 76.83 miles of track, measured as single track. The company owns no power plant, but purchases electric power from the Great Northern Power Company, measured to the Duluth Street Railway on the direct current side of the station, the power company thus bearing the loss in transmission. As a part of its property in Duluth the company owns and operates an inclined railway for carrying passengers from the main business thoroughfare to the heights and bluffs. This inclined railway consists of 2,971.3 ft. of track, of which amount 2,749.9 ft. are located on steel trestles while 221.4 ft. are on masonary foundation. The equipment devoted to the operation of this inclined railway embraces two cars operated from control apparatus located at the top of the incline, the cars being operated so as to serve seven waiting rooms and large upper and lower loading and unloading platforms.

In addition, the company owns a substantial modern brick office building. This adjoins its principal carhouse and repair shops. The company owns two substations in Duluth. The rolling stock consists of 160 revenue passenger cars.

Texas Road Reports Increase

Gross earnings of the Northern Texas Traction Company, operating in Fort Worth, Tex., and between Fort Worth and Dallas, for the calendar year of 1919 amounted to $3,264,565. The operating expenses during this period were $2,631,093. During the year extensions costing $276,224 were made. The maintenance cost was $233,935. Miscellaneous expense is listed at $217,329, labor $931,840 and fixed charges and interest, $380,433. Fares in Fort Worth are 5 cents for adults, or twenty-two tickets for $1, with a 2½-cent fare for children and students or forty tickets for $1. Interurban tickets sell for 2 cents a mile. Of the total income reported, $2,977,851 was derived from fares and tickets.

Abandonment Protested

It was stated at the hearing before Chairman Hill of the Public Service Commission for the Second District of New York, on April 3, that the Port Jervis (N. Y.) Traction Company had taken steps for abandonment of its franchises in Port Jervis. This statement was by John B. Knox, New York, representing the company, on the hearing of an order to show cause why the railway abandoned operations in Port Jervis.

Mr. Knox admitted all the city's claims about non-operation, but denied that the company had violated the law. The company was operating at a deficit, he said; it had paid no interest on bonds for six years; it had borrowed money to pay taxes, and it was absolutely impossible for the company to run. The company, he said, is insolvent.

Corporation Counsel William A. Parshall objected to the company's abrogating terms of its franchise. He expressed surprise at the company's declared intention to abandon its road. This position, he maintained, was untenable. The company's ceasing operations was indefensible and Port Jervis, he told Chairman Hill, went further than any other city to help the company, even waiving all fare restriction and consenting to the commission's determination of a reasonable rate. Mr. Parshall asked that the commission direct the company to resume operations, saying the Port Jervis authorities were not "corporation baiters." He contended the company could not abandon operations.

Mr. Knox said the company had taken steps for dissolution. He said: "We are getting ready to go out of business."

Mayor George E. Hornbook, William M. Tuscan and P. E. Rutan represented the Chamber of Commerce.

Chairman Hill said an early decision will be rendered.

New Plan for Service in Hyde Park District

At a meeting of the trustees of the Boston (Mass.) Elevated Railway and the Eastern Massachusetts Street Railway a new plan for the service in the Hyde Park District was adopted. The plan provides for the operation of the cars on the Hyde Park division as far as the boundary lines of Hyde Park as they existed before being incorporated in the city of Boston by the Eastern Massachusetts Street Railway. Within this line, included in the city of Boston, the Boston Elevated Railway will operate.

The Hyde Park district will be relieved of the obligation of contributing to the cost of operation of the Boston Elevated Railway or sharing in the assessments necessary to meet any deficit. On the other hand, this district will be called upon to pay over to the Eastern Massachusetts Street Railway an equivalent amount toward any deficit this company may incur.

Fare Increase Beneficial

Traffic Losses in Lexington Not Sufficient to Show a Decrease in Gross

The annual report of the Kentucky Securities Corporation for the year ended June 30, 1919, gives the following information concerning the Kentucky Traction & Terminal Company, one of its subsidiaries:

PROSPEROUS CONDITION SHOWN

The railway gross earnings reflect the generally prosperous business conditions that prevail and receipts show an increase of $37,172. This increase is largely due to the fare increase on the interurban lines, for in April, 1918, the cash fares were increased from 2.5 to 3 cents per mile and through fares from Lexington to Frankfort, Georgetown, Paris and Nicholsville were increased 5 cents on each one-way ticket. In September, 1918, the unit rate of fare on all city lines was increased from 5 to 6 cents.

The total number of passengers carried, both cash and transfers, however, decreased 8.12 per cent, this being due in many respects to the increase in fare and to the restricted riding during the influenza epidemic in the fall of 1918, as well as the discontinuance during the war of the several annual county fairs. The largest traffic loss was 14.7 on the Lexington city lines.

In the city of Lexington one-man operation of cars was inaugurated during the year on all local city lines.

The accompanying table gives information as to the extent of the system, the rolling stock and the traffic handled:

TRACK MILEAGE

Interurban system:		
Main line	65.87	
Sidings and spurs	1.80	67.67
City lines:		
In Lexington	16.02	
In Frankfort	7.64	
In Georgetown	1.26	
In Winchester	1.20	26.12
Total track mileage		93.79

Rolling stock:	Total
Passenger city cars	*47
Passenger interurban cars	15
Freight cars	4
Service cars	6
Total cars owned	72

*Includes 14 cross-bend open cars.

Year ended June 30

	1919	1918	Per Cent Change +Inc. —Dec.
Passenger traffic—cash and transfers—	1,415,989	1,660,133	—14.70
Lexington city lines	388,065	426,624	— 9.04
Other city lines	3,751,883	3,959,734	— 5.25
Interurban lines			
Total passengers	5,555,937	6,046,491	— 8.12

$1,447,363 Refused on Principle

The city authorities of Chicago on April 10 refused to accept $1,447,363 from the Chicago Surface Lines. This was the total of two checks, one from the Chicago Railways for $1,004,372 and the other from the Chicago City Railway for $442,991—each representing 55 per cent of the net receipts of the companies for the fiscal year ended Jan. 31, 1920.

Tender of the checks was made by M. B. Orde, treasurer of the Surface Lines, under the terms of the 1907 ordinances which require that payment be made by April 10 of each year. The city law department has contended that when the surface companies abandoned the ordinance rate of fare and began collecting 6 cents under authority of the State Utilities Commission they forfeited all rights under the city franchise. Therefore, when the checks were offered to the city comptroller he called upon Special Counsel Cleveland for an opinion, and the latter said the money should not be accepted unless the companies would enter a stipulation that this would not be construed as an admission by the city that the 6-cent fare was legal. This the companies refused to do.

Paving Charges Withdrawn

The City Council of Wausau, Wis., has adopted an ordinance permitting the construction of extensions to the existing system operated by the Wisconsin Valley Electric Company, in Wausau, which provided for the replacement of track torn up by the company in its construction work, but relieving the company of the obligations to repave or to maintain the pavement. In the ordinance appears this section:

Whereas, the statutes for the regulation of rates, service and operation of street railways that have been enacted since the granting of the existing franchises of the said street railway company by said ordinances placing street railway companies under the control and supervision of the Railroad Commission make ample provision for the protection of the interests of the public and cause the burdens as to street paving imposed by said franchises upon the said street railway company to result in increased cost to that portion of the public who use said street railways.

The adoption of the ordinance followed the report of a committee of the Council appointed to investigate the matter. In its report to the Council, the committee said, among other things:

The original street railroad franchises were adopted prior to the enactment of the present public utility laws, which place the control of the rates and of the service of all street railroads in this state under the exclusive control of the railroad commission of Wisconsin. This condition did not exist at the time that these franchises were granted.

Under this law a reduction of operating expenses tends to result in improved service and reduced fares or both, whereas increased operating expenses of the company tend to increase the fares, or curtail the service rendered, or both. And whereas the street railroad is being patronized by working men and women who cannot afford automobiles, it seems proper that no unnecessary expenses be now imposed upon street car lines so that adequate service and reasonable rates of fare can be put into effect and so maintained.

The committee further recommended the passage of an ordinance shifting the cost of paving maintenance, hitherto borne by the company, from the abutting property owners to the city.

Financial News Notes

Abandonment Announced. — The Southern Railway & Light Company announced the abandonment of service on its railway lines in Natchez, Miss., on April 5. The tracks will be torn up and the equipment sold.

Subway's Transfer to State Approved.—The sale and conveyance to the State of Massachusetts of the Cambridge subway for $7,868,000 was formally approval at the annual meeting of stockholders of the Boston Elevated Railway on April 5.

Contribution to the Cost of Operation.—The town of Deerfield, Mass., has been authorized by the Massachusetts Department of Public Utilities to contribute $200 to the Connecticut Valley Street Railway to aid in the cost of operation of the road for the year 1920.

Interest Passed on Income Bonds.—The directors of the Chicago (Ill.) Railways have decided that the year's interest on the company's $2,500,000 of adjustment income bonds was not earned. Consequently no payment will be made May 1. Interest on these bonds was not paid for the previous year.

Receiver for Ohio Interurban—Common Pleas Judge Dan B. Cull at Cleveland, Ohio, on April 4 named Attorney Milton C. Portmann receiver for the Cleveland, Alliance & Mahoning Valley Railroad, Ravenna, Ohio. The company operates 46.5 miles of road. It is said to have defaulted in the payment of $25,000 of interest due on April 1.

Offer to Rehabilitate Abilene Line.—A. Hardgrave, Dallas, Tex., vice-president and general manager of the American Public Service Company, has submitted an offer to the city of Abilene, Tex., whereby the American Public Service Company would take over, rehabilitate and operate the railway system of Abilene. The company proposes to spend $50,000 on improvements if the deal goes through.

Earnings Are Insufficient.—It is expected that the Tri-City Railway will petition the Public Utilities Commission of Illinois for an increase in fare on the Illinois side of the Mississippi. Officials of the company state that it is no longer possible for the company to operate at a 7-cent fare. According to the ruling of the commission, the company is entitled to earnings in Illinois amounting to 7 per cent on $2,900,000. The earnings at present are only 4 per cent on this amount. If the petition is approved by the commission and higher fares are put in effect on the Illinois side the company will probably ask the City Council of Davenport, Iowa, to consider a similar increase in fares in that city.

Traffic and Transportation

Louisville Committee Back

City Considers Recent Commission Decision Misleading—Thirteen Objections Specified

Mayor Smith of Louisville, Ky., and Louisville Railway officials returned to that city recently, after studying electric railway conditions in Cincinnati, Cleveland, Philadelphia, New York and Newark. Mayor Smith stated that no city in the country has as much trackage as Louisville in proportion to the population. Another fact noted was that the rolling stock in Louisville appears to be in better physical condition than that in most other cities. In Cleveland it was noted that through an ordinance prohibiting the use of tracks by traffic other than street cars better time is made by 2 m.p.h. than in Louisville.

Suggestions Opposed

Mayor Smith stated on his return that he favored (a) the elimination of automobile parking on Fourth Street from Main to Broadway; (b) installation of modified zone system of fares, with a 5-cent fare as a basis, and a limited transfer system; (c) freeing car tracks of all other traffic; (d) prevention of looping of cars in the business district.

Already the Retail Merchants' Association, the Automobile Club and other organizations have attacked the suggestion of no parking on Fourth Street. They are also opposed to routing cars one way on Fourth Street. The auto club is especially opposed to suggested non-allowance of tracks for vehicles. The Market Street Merchants' Association is endeavoring to increase looping in the downtown district to bring more business to Market Street, and is consequently opposed to the no-looping plan.

Labor organizations and general consumers are opposed to the zone system, modifications of transfers or anything that would increase expenses for the rider. The City Council has fought every effort made to raise prices. The City Council, however, cannot control transfers to any extent or the elimination of paralleled lines or zoning outside of the city limits on some lines, so that the Mayor may have his way.

Mayor Favors Nickel Fare

Mayor Smith apparently is in favor of the retention of the 5-cent fare, with charges for transfers, modification of routes and improved city co-operation in keeping tracks clear for rapid transit.

The Mayor, upon his return, gave out an interview in which the following impressions were stated relative to traction conditions in the cities visited:

> I discovered that the burdens on most of the traction companies in Cincinnati, Cleveland, Philadelphia and New Jersey cities were much greater than those of the Louisville Railway. In nearly all of these cities the cost of labor, coal and everything that goes to make the running of a railway is more than it is here.
>
> Nearly every one of these cities compels its railway to pay a certain amount for the repair and the use of the streets. All of these cities, which are much larger than Louisville, have a separate branch of the city government which costs considerable to look after street car traffic.
>
> In every city the tendency is toward doing things that will improve traffic conditions. This was particularly noted in Cleveland, where all traffic is barred from the street car tracks. This is done in order that the cars can make more miles in a day, thus necessitating fewer cars and a faster mode of travel. The system of the Philadelphia Rapid Transit Company impressed me as more progressive than any of the others.
>
> Thomas N. McCarter, president of the Public Service Railway, Newark, N. J., explained the zone system. He thinks it will work out finally, but when he first applied it it lowered property values and had to be abandoned for the time being. Mr. McCarter thinks it will solve the problem to a great extent when the public takes more kindly to it. While I am not committed to this plan, I still maintain it would be a step in the right direction.

Members of the party who went on the trip besides Mayor Smith were: Board of Public Safety Chairman Burlingame, Councilman Isrigg, Alderman Wills and the Louisville Railway's executive committee, W. S. Speed, John W. Barr, Jr., and W. H. Kaye.

Mr. Kirwan, president of the Board of Aldermen, who acted as Mayor during the period that Mayor Smith was in the East, is hostile to any effort to advance fares over a 5-cent basis. His attitude toward higher carfares is shown in the following statement:

> What the company probably needs is more short hauls. I believe that the present General Council is opposed to a raise in fares, at least it was a little while back. Of course, that body will listen to the recommendations of the Mayor and other city officials, but it probably will be stubborn in the matter of increased fares.

Philadelphia Committee Named

A committee representing business and civic organizations of Philadelphia, Pa., has been appointed by Mayor J. Hampton Moore to investigate the transit situation in that city. The committee, named at the suggestion of the Philadelphia Chamber of Commerce, is asked to inquire into the nature of the service furnished by the Philadelphia Rapid Transit Company and to suggest improvements. It will also report on the rights of the city to require the company to operate the Frankford elevated and the Byberry lines, now nearing completion. The membership includes Alba Johnson, president of the Chamber of Commerce; William P. Barba, Dr. Thomas Conway, and others.

Thomas E. Mitten, president of the Philadelphia Rapid Transit Company, has notified Mayor Moore that the company will operate the Frankford line only if the city will furnish all equipment, including trains.

Conciliation Board Ruling

Continuance of Higher Fare in Kenosha Made Contingent Upon Improved Service

The Railroad Commission of Wisconsin has handed down a decision confirming the award of the State Board of Conciliation in the matter of wages of railway employees of the Wisconsin Gas & Electric Company, Kenosha. In addition it has granted the company an increase in the rate of fare to provide for the increase in wages. The new rate of fare is 6 cents cash or nine tickets for 50 cents. Whether or not this rate will be continued after the temporary order expires on July 31 depends upon the service rendered by the company.

In its decision the commission commented upon the rapid growth of Kenosha and the inadequacy of the present street railway system for taking care of the present transportation needs of the city. It pointed out that some double tracking and considerable further line extensions were absolutely necessary, as are also additional cars. The commission did not order any definite amount of improvement or extensions to be made, but stated that the people of the city were as vitally interested in the adequacy of the service as they were in the rate of fare, and that while the company is entitled to a reasonable return upon its investment, it is also under a primary obligation to provide facilities to meet the reasonable public transportation demands.

If the company makes these needed improvements, there will result a considerable increase in the investment and a possibly longer average length of haul. These two considerations make it impossible for the commission to determine what the reasonable rate of fare would then be. When the question of the rate of fare again comes before the commission it states that it will give full consideration to the adequacy of the service and the efforts made to improve it.

The Board of Conciliation granted an increase of 9 cents an hour in the wage scale, making the maximum for the fifth year's service and thereafter 55 cents an hour. This increase will cost the company $18,000 a year. The company operates about 7 miles of railway in Kenosha. It suffered severely from jitney competition until recently, when the jitneys were eliminated by a City Council ordinance.

May Abolish Transfer Charge

The city manager of Norfolk, Va., has started negotiations with officials of the Virginia Railway & Power Company, Richmond, looking to the discontinuance of the 2-cent transfer charge now in effect on the company's lines in Norfolk. The charge for transfers became effective at the time when the fare was raised from 5 cents to 6 cents several months ago.

Duluth to Vote on Fares

Some Measures of Relief Contained in 6-Cent Fare Ordinance—Company Wanted More

Citizens of Duluth, Minn., will on June 21 next vote on an ordinance providing that the Duluth Street Railway may increase its fare from 5 cents to 6 cents. This is the result of the City Council on April 8 having agreed to submit the proposition to the voters by referendum at the June primary election.

The railway asked the Council for a referendum ordinance providing for a fare of 7 cents or four rides for 25 cents, but the City Council turned down the proposition. Later the 6-cent rate ordinance was proposed by the company and accepted by the Council.

A. M. Robertson, Minneapolis, president of the company, declared that with a 6-cent rate the company would be unable to do as much as it would like to do in the way of extensions, but that it would be in a position to meet all reasonable demands. He said:

> We believe that a cash fare of 7 cents and four rides for 25 cents is the lowest fare which will yield the revenue vitally necessary to enable the company to finance extensions, buy new cars, rebuild present cars to the "pay as you enter" type and make other needed improvements, and in accepting the 6-cent rate at this time the company wishes it clearly understood that it is relieved only in part from the difficulties it must overcome in supplying service. We will do the best under the conditions to furnish the people with good service, and with complete co-operation of the city officials and the people we hope to succeed.

Now that the matter of a 6-cent rate is to go before the voters at the June election, the company is in a position, Mr. Robertson said, to place orders for material which will be needed this summer. In the event that the increase is defeated the orders can be canceled without the company losing its priority rights.

Before the ordinance was accepted by the Council there was a series of conferences between the city officials and the company officers at which the necessity was discussed for raising the fare now charged. The company recently had its property appraised by Hagenah & Erickson, Chicago, and according to their figures the fair value of the property in Duluth was not less than $5,154,322. It was contended this was the minimum amount that should be considered on which the company is entitled to receive the measure of return contemplated by law.

Seven Cents in Buffalo

The 7-cent fare authorized by the Public Service Commission will be put into effect on the Buffalo, N. Y., lines of the International Railway at 6 a.m. on April 18. Four tickets will be sold for 25 cents. All outstanding 5-cent tickets will be redeemed by the company at their face value. A show cause order to stay the proposed fare increase was granted on April 14 by Supreme Court Justice Cole. A writ of certiorari was also obtained by counsel representing the city.

George Clinton, Jr., special counsel retained by the municipal authorities to fight the fare increase, made application for the order, which directs the Public Service Commission to show cause in Albany on April 17 why the order for a higher rate of fare should not be stayed pending the determination of the proceedings begun by the city to review the commission's action in granting the 7-cent fare.

The writ of certiorari provides for a review of all proceedings resulting in the commission's 7-cent fare order, papers and other material having to do with the case to be produced within twenty days. If the city is unsuccessful in having the 7-cent fare put off until a later day, the city will ask that the International Railway be required to give 2-cent rebate slips to all passengers.

Zone System Likely

This Plan Appears Best Suited to Meet Needs of Local Company at Houston —Master's Report Approved

The report of Judge Otis Hamblin, special master in chancery, who heard the case of the city of Houston, Tex., versus the Houston Electric Company, wherein the company is seeking authority to charge higher fares in Houston than now permitted, has been approved by Judge J. C. Hutcheson of the United States District Court for the Southern District of Texas.

Immediately upon approval of the report of Judge Hamblin, which fixed the valuation of the company's properties at $6,000,000 and held that the present fares of 5 cents for adults and 2½ cents for children were confiscatory, Judge Hutcheson issued an injunction restraining the city from interfering with the company in levying higher fares than those now charged. The order of the court provides, however, that the city shall have the right to apply to the court for a further decree whenever it shall appear that the railway is earning a sufficient compensa- in granting the 7-cent fare. The 7-cent fare order was issued by the commission several months ago.

Luke C. Bradley, district representative of Stone & Webster, owners of the railway, and city officials have entered into negotiations looking toward an agreement fixing fares. It seems certain that a zone system of fares will be put into effect, whereby 5 cents and 2½ cents will be charged within the business district, with 6 cents and 3 cents within the first zone outside the business district and 7 cents and 3½ cents for the most remote places. The report of Judge Hamblin fixed 8 per cent as a just rate of return on the fixed valuation, and it is believed that the zone system with the graduated fares will yield this return.

Negotiations looking to an agreement between the city and the railway regarding the increased fare to be charged are continuing with satisfactory results.

Portland Relief Plan Declared Illegal

Portland, Ore., is legally unable to carry out recommendations made by the Oregon Public Service Commission for the solution of its transit problems. City Attorney La Roche has filed an opinion to the effect that the city is prohibited by the State constitution from acquiring the trackage or any other part of the physical properties of the Portland Railway, Light & Power Company, with the intent of allowing the corporation to use such properties after the purchase by the city.

Under this opinion the Public Service Commission's suggestion that the city purchase the trackage of the company for the purpose of leasing such tracks to the company at a nominal rental fee becomes impossible unless the State constitution is amended. The opinion is based on Section 9 of Article XI, which reads as follows:

> No county, city, town or other municipal corporation by vote of its citizens or otherwise shall become a stockholder in any joint company, corporation or association whatever, or raise money for, or loan its credit to or in aid of any such company, corporation or association.

The City Attorney's opinion was submitted to a special committee, composed of Commissioners Mann, Barbur and Bigelow, and was supplemented by a later statement reviewing Supreme Court cases in Oregon dealing with similar subjects.

Mayor Baker is in sympathy with efforts to afford relief to the company. He maintains that some plan whereby the company can increase its revenue is essential if the city's transportation system is to remain intact. In a recent statement he pointed out that the city must choose one of three courses: A straight increase in fare, an operating agreement with the company, or municipal ownership. In his statement Mayor Baker said:

> Failure to adopt one of these three measures would send the street railway into the hands of receivers. It is a problem that cannot be evaded and should be the concern of every resident of Portland. Under the opinion given by the City Attorney, it would seem that the main proposal offered by the Public Service Commission cannot be carried out. It now devolves upon the Public Service Commission and the City Council to study the problem further and attempt to work out the proper solution.
>
> I am opposed to municipal ownership of street railways. The experience of Seattle is a lesson. But if increased fares will not give the required relief, and if the city is prohibited from entering into an operation agreement with the company which would bring relief, then acquisition of the entire street railway system in Portland by the city is inevitable.

Eight-Cent Fare Denied

Public Service Commissioner Lewis Nixon of the First District has denied a *pro forma* application by counsel for the receiver of three of the surface lines of the Brooklyn (N. Y.) Rapid Transit Company for permission to charge an 8-cent fare. Counsel for the company stated that the application was made for the purpose of providing grounds for an appeal to the higher courts, where the issue of an increased fare could be fairly tried out.

Transportation News Notes

Zone Fares Increased.—The Northern Massachusetts Street Railway, Athol, Mass., has raised its fare from 6 cents to 10 cents for a ride in two zones. The increase was authorized by the Massachusetts Department of Public Utilities.

Modifies Fare Request.—The Shreveport (La.) Railways has asked the Shreveport City Commission to grant it a 6-cent fare instead of one of 7 cents. The company some time ago petitioned for a 7-cent fare. The present rate is 5 cents.

Seven Cents Asked in Pensacola.—An application has been filed with the Florida Railroad Commission by the Pensacola Electric Company for a 7-cent fare in Pensacola. The State Supreme Court some time ago ruled that the commission had authority to grant fare increases.

Recommends 7-Cent Fare.—At a joint meeting on April 7, committees representing the City Councils of Hampton, Newport News and Phoebus, Va., recommended that the Newport News & Hampton Railway, Gas & Electric Company be permitted to raise its fare. The committees favored the adoption of a 7-cent fare with 3½-cent labor tickets.

Ten Cents in Nashua.—Cash fares of 10 cents became effective in Nashua, N. H., on April 1. The Nashua Street Railway had previously petitioned the State Public Utilities Commission for an increase from the 8-cent cash fare then being charged so as to stimulate the use of tokens. Tokens are sold as formerly at the rate of five for 35 cents.

Wants More in Elmira.—Application has been made to the Public Service Commission for the Second District by the Elmira Water, Light & Railroad Company, Elmira, N. Y., for permission to raise its fare from 5 cents to 6 cents. The Elmira city authorities oppose the granting of the company's petition on the ground that its franchise limits the fare to 5 cents.

Agree on Asheville Fare.—As the result of hearings before Judge Webb of the Superior Court of North Carolina, the Asheville Power & Light Company on April 1 began selling six tickets for 35 cents. Several months ago the State Corporation Commission authorized the company to raise its fare from 5 cents to 6 cents. The city appealed the case to the Superior Court. Judge Webb directed the company to reduce the fare by the sale of six tickets for 35 cents.

Eight Cents Asked in Morgantown.—A hearing has been set by the Public Service Commission of West Virginia for May 11 in the application of the West Virginia Traction & Electric Company, Morgantown, to increase its rates in Morgantown, effective May 15. The company asks the following rates: 8 cents to any point on the Loop division; 8 cents to any point on the Sabraton division. Passengers paying the 8-cent fare may purchase transfers to any point for 3 cents. The fares were last increased on Feb. 14, 1919.

New Transfer in Seattle.—The Seattle (Wash.) Municipal Railway has recently issued a new transfer, designed by Thomas F. Murphine, former superintendent of municipal railways, which it is believed will add considerable revenue to the system. The transfer consists of a ticket 1¼ in. wide by 3 in. high with detachable coupon 1¼ in. wide by 1¼ in. high. The conductor on the car that receives the transfer from the passenger detaches the coupon. Any effort by the holder to use the transfer on another line would come to grief. The transfer is punched for time and direction.

Asks 7 Cents Pending Decision.—The East St. Louis & Suburban Railway, East St. Louis, Ill., has filed a petition with the Illinois Public Utilities Commission for a temporary fare of 7 cents on its city lines pending final ruling of an application for an 8-cent fare. The application states that three tickets would be sold for 20 cents. The commission recently suspended the 8-cent fare until Aug. 23 while the petition was being considered. The company has been contending for more than a 6-cent fare since Sept. 1, 1918, and made application for an 8-cent fare on Sept. 1, 1919.

New York Inquiry Continues.—Despite the withdrawal of the representatives of the railway lines several weeks ago, the New York City Board of Estimate and Apportionment is going ahead with its investigation of the traction situation in the metropolis. The companies' representatives withdrew from participation in the inquiry at the direction of Federal Judge Mayer. At the board's session on April 8 Cornelius M. Sheehan, deputy water commissioner, presented arguments against allowing the Brooklyn Rapid Transit Company and the New York Railways to raise their fares.

Change Unlikely in Montreal Fares.—It is understood that the present tariff of fares in effect on the Montreal (Que.) Tramways, while put into force several months after the beginning of the fiscal year of the company, justifies a belief that it will not be necessary to raise rates on June 30, 1920, the end of the company year, unless abnormal circumstances should arise. The company started its present fiscal year with a deficit, but business is gradually improving, and even if at the end of the present fiscal year there should still be a deficit, it is not expected that it will be so large that it cannot be overcome in the following year without having resort to fare increases.

Eight Cents in Northport.—The Northport (N. Y.) Traction Company has been authorized by the Public Service Commission, Second District, to increase its rate of fare from 5 to 8 cents, the order to be effective until April 1, 1921, and thereafter until further order of the commission. The company, under authority of the commission, put a 6-cent fare in operation in November, 1917, but after the decision of the Court of Appeals in the Rochester case the company returned to the 5-cent rate. Franchise restrictions by Northport and the town of Huntington were waived. About 200,000 passengers are carried annually and a 3-cent fare increase will result in increased revenue of about $6,000.

Rochester Report Expected Soon.—The railway situation in Rochester, including the amount of the fare, is covered in a report prepared by Public Service Commissioner John A. Barhite, which was filed on April 6 with the Public Service Commission. That body is expected to take action on Judge Barhite's recommendations and suggestions this week. Judge Barhite said that he was not at liberty to divulge the contents of the report. The decision will be announced by the entire commission. Judge Barhite's report covers thirty-six typewritten pages. There is a supplementary report by Electrical Expert Charles R. Barnes, and this report is said to be in full accord with Judge Barhite's recommendations.

Wants More in Macon.—A petition asking an increase in fare from 6 cents to 7 cents has been presented to the City Council of Macon, Ga., by the Macon Railway & Light Company. The company states that unless relief is granted it will be forced into bankruptcy. It declares that the 1-cent fare increase allowed by the Council produced during the year 1919 $81,551 but that the increase in operating expenses consumed the entire additional revenue and $2,591 additional. In the year 1919 the earnings were $491,110 and the operating expenses $398,197, leaving the net income at $92,913. While the gross earnings of the company for the year increased $72,698 the expenses of the transportation department alone increased $84,143.

One Killed in "L" Wreck.—Running by a signal which had been set against it, a local train on the Ninth Avenue "L" line of the Interborough Rapid Transit Company, New York, on April 12 crashed into the rear of a seven-car express, derailing the latter. One of the wooden coaches of the express, catapulted over the side of the "L" structure, was shattered against the brick wall of an office building, its passengers being dumped into the street below. One man in the wrecked coach was so badly injured that he died shortly after the accident. Few of the other passengers were seriously hurt. Traffic on the portion of the Ninth Avenue line below Christopher Street was suspended for more than two hours as a result of the accident.

Personal Mention

Mr. Bleecker Resigns from New Orleans Company

John S. Bleecker, general manager for the receiver, New Orleans Railway & Light Company, New Orleans, La., has resigned to become general manager of the Myles Salt Company, owners and operators of the largest salt mine in the world, which is located near New Orleans. Mr. Bleecker went to New Orleans a little over a year ago from Columbus, Ga., where he was general manager for Stone & Webster of the Columbus Electric Company and Columbus Railroad Company. He undertook a task made difficult by the complications of a receivership, but has made an enviable record during his year with the New Orleans company. In speaking of Mr. Bleecker's resignation, J. D. O'Keefe, receiver, said:

> Mr. Bleecker has severed his connection with the property voluntarily and to my very great regret, as I believe the property is losing an able, conscientious and progressive operating official. Mr. Bleecker came to the property at a critical period in its history and he has done much, during his short tenure, to improve its physical condition and the service generally.

A portrait and a biography of Mr. Bleecker were published in the ELECTRIC RAILWAY JOURNAL at the time he took up his duties in New Orleans.

George I. Plummer has been appointed to the newly created position of superintendent of traffic of the Dallas (Tex.) Railway.

Benjamin B. Foss, for the past twelve years superintendent of the Lynn (Mass.) division of the Eastern Massachusetts Street Railway, has resigned.

Edward H. Sharpe has been appointed general passenger agent of the Pacific Electric Railway, Los Angeles, Cal. Mr. Sharpe succeeds Richard Kelly, who has been made general passenger agent of the Southern Pacific Company.

W. H. McAloney, superintendent of rolling stock of the Winnipeg (Man.) Electric Railway, has resigned. Mr. McAloney, who has been connected with the company for the past two years, will return to Denver, Col. Thirty department heads of the Winnipeg Electric Railway tendered him a farewell dinner on March 31. On that occasion Mr. McAloney was presented with a handsome wrist watch as a token of remembrance from his many friends in Winnipeg.

Samuel Anderson, who filled the position of manager of the electric railways at Norwich and New London, Conn., during the period of their operation by the Connecticut Company, has again taken up the direction of the affairs of the lines. For some time past the lines have been under lease from the Connecticut Company by the Shore Line Electric Railway, but they have reverted to the Connecticut Company from the Shore Line under court order.

F. H. Behrens has resigned from the business department of the ELECTRIC RAILWAY JOURNAL to join the staff of the Simmons-Boardman Publishing Company, New York, as eastern representative of the *Railway Electrical Engineer*. Mr. Behrens has been connected with the ELECTRIC RAILWAY JOURNAL since October, 1911. He entered the business department, and after spending about four years there was transferred to the editorial department, where he worked on the department "Manufactures and Markets," broadening his knowledge of the business as a whole and extending his acquaintanceship among the manufacturers of and dealers in electric railway equipment. After a year in this work he returned to the business department, where he has been since that time.

Promotions in Chicago Elevated

Reorganization of Personnel Announced—B. J. Fallon, Assistant General Manager—Others Step Up

Five members of the operating personnel of the Chicago (Ill.) Elevated Railways have been advanced to positions of greater responsibility in that organization. Under the new plan, as noted briefly in the ELECTRIC RAILWAY JOURNAL for April 10, Bernard J. Fallon becomes assistant general manager, filling the vacancy caused by the resignation of G. T. Seely several months ago, while Edward J. Blair is made assistant to the president. H. A. Johnson takes Mr. Blair's place as organization engineer. R. N. Wade succeeds Mr. Fallon as engineer maintenance of way, while Adolph H. Daus is appointed superintendent of shops and equipment, succeeding Mr. Johnson.

BERNARD J. FALLON, the new assistant general manager, held, until his recent promotion, the position of engineer maintenance of way. Mr. Fallon has been connected with the elevated railroads in Chicago for nearly thirteen years. He was appointed engineer maintenance of way of the old Metropolitan West Side Elevated Railroad in June, 1907. After two years in this capacity he was made assistant general manager of the same road under Britton I. Budd, then general manager. In 1911, when the several elevated railways of Chicago were consolidated and Mr. Budd became president of the combined system, Mr. Fallon was made engineer maintenance of way with jurisdiction over all roads. His jurisdiction was later extended to include the Chicago, North Shore & Milwaukee Railroad, the operation of which had been taken over by Mr. Budd for the Insull interests.

Mr. Fallon was born on Aug. 10, 1880, at Rutland, Ill. His schooling for his work with the elevated system was gained largely in the steam railroad field. After receiving a B. S. degree from La Salle Institute, Chicago, in 1898, he became a rodman with the Burlington Railroad. During the following eight years he held the positions of assistant engineer, division engineer, and finally engineer of track elevation in Chicago. Since his connection with the elevated system he has served on the American Electric Railway Engineering Association way committee. He is a member and a director of the Chicago Engineers' Club and a member of the Western Society of Engineers.

In his new position Mr. Fallon will have a large share of the responsibility of operating the elevated railways, the fast interurban service between Chicago and Milwaukee and the small street railway properties in Waukegan and Milwaukee.

Edward J. Blair, who becomes assistant to the president, was born in Chicago on Feb. 19, 1883. After completing a course of study at Lewis Institute, Chicago, he went to Cornell, receiving an M. E. degree from that university in 1905. In that year he began work in the Throop Street shops of the Metropolitan Railroad as a night helper. Two months later he was given a day job as pipe fitter foreman, and four months thereafter he went into the engineering department as a draftsman and inspector on track elevation work. In the fall of 1906 he was made a carpenter foreman in the maintenance of way department.

After eight months spent at this work, he was made a storage battery operator in the old Throop Street power house of the Metropolitan. In 1908 he was promoted to the position of engineer of substations and transmission lines, with jurisdiction over the entire distribution system of the company. He was again promoted in 1910, becoming electrical engineer of the Metropolitan lines. Upon the consolidation of the several elevated railroads he was made electrical engineer of the Chicago Elevated Railways.

Commissioned a captain of engineers in 1917, Mr. Blair was stationed at Camp Grant for nearly a year, at the end of which he was sent overseas with the rank of major. He was subsequently promoted to lieutenant-colonel. Upon his return to the Chicago Elevated Railways in August, 1919, he was given the title of organization engineer and the duty of studying operating conditions with a view to recom-

mending improvements in methods. Mr. Blair is well known to members of the American Electric Railway Engineering Association through his connection with several of its committees.

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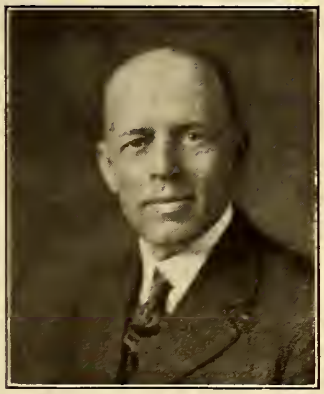
E. J. BLAIR

He is also a member of the committee on electrolysis of the American Electric Railway Association.

Harry A. Johnson, appointed organization engineer, was formerly superintendent of shops and equipment. Mr. Johnson was born at Ottumwa, Iowa, on Dec. 8, 1884. In 1905, shortly after his graduation from Purdue University with the degree of mechanical engineer, he went to work for the Metropolitan West Side Elevated Railroad, and for several months thereafter was engaged as a night helper in the Throop Street shop, as a field engineer on the Douglas Park extension, and on various other special jobs. He was then assigned to design work on equipment. Through 1906 and part of 1907, in addition to his work in this capacity, he served as an inspector of car construc-



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R. N. WADE

tion and later worked for a time in the transportation department on traffic surveys.

In June, 1907, he was made engineer of car equipment, and in the following year master mechanic of the system. In 1911, his jurisdiction was extended to include the three other elevated railroads of the city. When the Chicago, North Shore & Milwaukee Railroad was taken over, he became consulting mechanical engineer for this road in addition to his duties on the elevated lines. Early in 1917 his title was changed to superintendent of shops and equipment, with jurisdiction over the four elevated roads and the Chicago-Milwaukee interurban line. Mr. Johnson has been a member of the equipment committee of the American Electric Railway Engineering Association since 1915. He is also a member of the executive committee. He is a member of the American Institute of Electrical Engineers and the Western Society of Engineers.

Rex N. Wade, who succeeds Mr. Fallon as engineer maintenance of way and structures, formerly held the position of track engineer. Mr. Wade was born on April 30, 1882, in Brussels, Ont. In 1902 he entered the University

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B. J. FALLON

of Illinois, but left college in the winter of 1903. He then joined the Burlington Railroad as a back flagman with a construction force. He continued with the Burlington for several years in location, construction and maintenance work, becoming assistant division engineer in 1906 and later signal supervisor.

In 1908 he became connected with the Metropolitan West Side Elevated Railroad as assistant engineer maintenance of way. Two years later he became engineer maintenance of way of this road, continuing in this position until the consolidation of the elevated railways in 1911, when he was made track engineer of the combined system. He resigned in November, 1912, to become connected with the Pacific Great Eastern Railroad, which was then engaged in the construction of a line from Vancouver to Fort George, B. C. In 1915, however, he returned to the Chicago Elevated Railways, resuming his position as track engineer.

Adolph H. Daus, appointed superintendent of shops and equipment, has been connected with the shops department for some time as assistant superintendent. Mr. Daus entered the service of the Metropolitan West Side Elevated Railroad in 1898 as an armature winder in the Throop Street shop. In

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H. A. JOHNSON

1902 he was made foreman of the winding department, and in 1906 general foreman of electrical repair at the Throop Street shop. In 1912 he was advanced to general foreman of the shop and in 1913, after the operating consolidation of the city's four elevated systems, he was transferred to the downtown office as assistant to the master mechanic.

Mr. Daus' rise to the responsible position which he now holds is a mark of achievement which is all the more remarkable by reason of the fact that his entire knowledge of electrical equipment has been gained through self-education, his only schooling having been that secured in the grammar schools of Chicago and three years of night school. He is the inventor of the high-tension and the heavy-current, low-voltage, low-frequency methods of

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A. H. DAUS

testing motors for opens, shorts and weak insulation. He is also a joint inventor with H. A. Johnson and E. T. Munger of a safety interlocking device which has been installed on 125 elevated cars in Chicago.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Varnish and Enamel Prices Advance

Turpentine Advances to $3 a Gallon in New York Market Owing to Scarcity

Prices of varnishes and enamels have been increased on an average of from 5 to 10 per cent by several manufacturers. Paint, however, has not advanced.

Stocks of varnishes and enamels are badly broken and it is becoming more and more difficult to make deliveries. Demand in the railway field has been heavier than for many months past and is steadily increasing.

It has not been possible to make satisfactory shipments for a month and unless the transportation difficulties are removed immediately paint and varnish manufacturers will sustain heavy losses.

Turpentine is not to be had in New York owing to the coastwise shipping tie-up. Although quoted at $2.50 per gallon on April 10, turpentine is now $3 to $3.50 per gallon. One large manufacturer who has considerable business in the railway field, on Wednesday purchased a considerable amount at Philadelphia, the price being $3 per gallon f.o.b. at that point. No relief is expected until the shipping strike has been settled, after which the price will immediately drop, probably to $2 per gallon. According to reports, a considerable quantity of turpentine is held in the port of New York but cannot be unloaded. In several instances ships have cleared for Southern ports carrying large cargoes of turpentine which they were unable to discharge here.

Manufacturers Hold Good Stocks of Supplies

Many Able to Continue Production for Two Weeks Without Additional Supplies

Manufacturers of electric railway equipment and supplies for the most part have been plentifully supplied with raw materials. Stocks of finished apparatus, however, are piling up rapidly at the factories, and will cause much inconvenience unless some outgoing transportation can be secured.

At the offices of the General Electric Company it was stated that certain raw material stocks are already low and will give out in spots in ten days to two weeks. In general, however, it was stated, the factory can run along for several weeks. Good storage space is still available. The Westinghouse Electric & Manufacturing Company has plenty of raw materials for some weeks to come, it was stated in New York on Thursday. Finished material is piling up at East Pittsburgh, but it will be several weeks before warehouse space will be filled up to capacity. The company is working on its heavy bookings. Other manufacturers have reported fair amounts of raw materials but are unable to transact much business or even to send needed supplies by express. The combination of the railroad strike and the effective tie-up of express by the express company employees has put a premium on every means of transportation. The rush to the parcel post has so clogged the mails that even first-class mail is being seriously delayed in consequence. Up to this time, numerous railways have been receiving rail bonds and shipments of other supplies in 50-lb. packages.

G. E. Sales for 1919 Show Increase

Sales Billed During 1919 Largest in History of the Company—New Plants Acquired

During the past year the volume of business of the General Electric Company, Schenectady, N. Y., exceeded that of any previous year with the exception of 1917, when a considerable portion of the company's business consisted of orders for ship propulsion and other apparatus placed by the Government.

The value of orders received during 1919 was $237,623,932, compared with $234,134,037 for 1918. Sales billed, however, were $229,979,983, the largest in the history of the company, amounting to $13,164,705 more than in 1918 and $33,053,665 more than in 1917. Total figures for orders received and sales billed for the past three years are as follows:

	Orders Received	Sales Billed
1919	$237,623,932	$229,979,983
1918	234,134,037	216,815,277
1917	246,778,491	196,926,318

During the year $14,462,285 was expended for additional land, buildings, machinery and other equipment. The sum of $7,688,893 was charged against income and general plant reserve, making the net increase in book value for the year of plant and equipment $6,773,392.

GENERAL ELECTRIC INCOME STATEMENT FOR 1919

Net sales billed		$229,979,983
Cost of sales billed, including operating, maintenance and depreciation charges		196,855,683
		$33,124,299
Int. and discount	$1,938,391	
Income from securities	2,887,144	
Sundry revenue	405,384	5,230,920
Net income		$38,355,220
Interest on debentures	$571,685	
Int. and discount on notes payable	1,705,564	2,277,249
		$36,077,970
Federal income and excess profits taxes (estimated)		11,000,000
Profit available for dividends		$25,077,970
8 per cent cash dividends		9,545,469
Net surplus for the year		$15,532,501
Surplus January 1, 1919		53,250,661
		$68,783,163
4 per cent dividends payable in stock		4,772,918
Total surplus		$64,010,245

Profits were $25,077,970, equal to 20.8 per cent on $120,557,200 capital stock. In addition to the regular 8 per cent cash dividend which is paid quarterly, a semi-annual dividend of 2 per cent, or a total of 4 per cent, payable in stock at par, was declared on Dec. 1, 1919, by the board of directors. Federal income and excess profits taxes for the year are estimated at $11,000,000. For the sake of convenience, the assets and liabilities of the International General Electric Company are included with the above because of failure to complete all of the transfers, etc., by Dec. 31, 1919.

Owing to the increase in orders, the company has added substantially to its manufacturing capacity, partly by enlarging present plants and in part by purchasing or leasing, with option to purchase, factories already constructed which offer immediate available facilities. The total factory floor space has been increased to 20,681,000 sq.ft., as compared with 19,581,000 sq.ft. in 1918.

Lack of Coal May Force Shut-Downs

Railways Affected by "Outlaw" Strike Must Stop Operating Unless Coal Is Obtained

Lack of coal may force a number of railways to suspend service before the week is out. The Eastern seaboard, generally, is in fair shape, but where railways have had to depend on rail for coal shipments, shortages have appeared. The Mayor of Toledo, Ohio, on Monday ordered the confiscation of coal on the Pennsylvania Railroad tracks and its diversion to the Toledo Railways & Light Company in order to keep the railway in operation. The Columbus (Ohio) Railway, Power & Light Company reported on Tuesday only enough coal to last until this Saturday. Boston Elevated Railway has ten days' coal supply and ten more on the water. Interborough Rapid Transit Company, New York, N. Y., in a statement given

out the first of the week at that time had a normal supply. The Brooklyn (N. Y.) Rapid Transit Company on Thursday reported a six days' supply.

Companies in and about New York City are purchasers of tidewater coal, the supply of which is dependent on rail shipments. On April 15 these companies had on hand coal reserves sufficient for their full requirements for a period of from six days to two weeks. Should the condition continue beyond this time it will be necessary for these companies to establish a priority list of power users and apportion the amount of power available for each class of business.

Reports from different parts of the country indicate that conditions gradually are improving and that the strike is rapidly breaking up. Whether or not movements of freight within the next week will be sufficient to prevent shutdowns, is problemetical at this time, but as has happened previous to this time, embargoes against everything except foodstuffs and coal may be declared in order that coal may be had to keep railways, utilities and manufactures from closing down.

$450,000 Carhouse Fire

Fire which broke out on the night of April 7 in one of the cars of the Winnipeg (Man.) Electric Railway destroyed the Main Street carhouse of the company. The machine shop and the store rooms operated in connection with the carhouse were saved by the fire being confined to the carhouse proper by fire doors between the carhouse proper and the shops and by a fire wall between the carhouse and store rooms. The following cars were entirely destroyed: nineteen passenger cars, four single-truck sweepers, one single-truck line department construction car, and one Electric Railway Improvement bonding machine. In addition to the carhouse and the rolling stock that were destroyed, approximately $50,000 worth of tools, etc., was lost, the principal item being thirty-six General Electric 258 motors which the company had on hand for cars it was rehabilitating. The fire loss is estimated at approximately $450,000. The plant and contents were covered by insurance. The company proposes to rebuild the carhouse and replace the rolling stock immediately. The fire spread so rapidly it was possible only to get one car partly out of the carhouse before the overhead work fell. This car was only partly destroyed.

Gear Association to Meet at Detroit

Standardization in the manufacture of gears is one of the important subjects to be discussed at the fourth annual meeting of the American Gear Manufacturers' Association, which will be held in the Hotel Statler, Detroit, Mich., April 29, 30 and May 1. An entire day of the convention will be devoted to the various angles of this subject, and reports will be given by committees which have had it under consideration for months.

An interesting program has been arranged which will include papers on such subjects as "Gears from a Purchaser's Standpoint" by D. G. Stanbrough; "Routing of Gears and Machine Parts Through the Factory" by J. A. Urquhart, of the Brown & Sharpe Manufacturing Company; "The Science of Manufacturing" by Henry M. Leland; "Problems of the Gear User," "Mill Gearing from the User's Standpoint," and other phases of gear manufacturing. A visit to the plant of the Ford Motor Company will be an interesting event of the convention. The annual banquet will be held on Friday evening, April 30, at which F. W. Sinram, president of the association, will act as toastmaster.

Rolling Stock

Hudson & Manhattan Railroad, New York, N. Y., noted in the Feb. 7 issue of the ELECTRIC RAILWAY JOURNAL as inquiring for subway cars, has placed an order with the American Car & Foundry Company for twenty-five cars similar to the ones now in operation in the Hudson tubes.

Franchises

Pacific Electric Railway, Los Angeles, Cal.—An ordinance has been passed by the Los Angeles City Council granting the Pacific Electric Railway a franchise to build a spur track on Santa Monica Boulevard.

Track and Roadway

Birmingham Railway, Light & Power Company, Birmingham, Ala.—This company will build twelve blocks of track in the business section of Bessemer, Ala. The company will abandon its loop in First St. and will install a new double-track loop.

Eastern Massachusetts Street Railway, Boston, Mass.—The Eastern Massachusetts Street Railway has applied for permission to extend its line in Stafford Road, Fall River, Mass.

Southern Public Utilities Company, Charlotte, N. C.—The Southern Public Utilities Company contemplates an extension of its line in Anderson, S. C.

Trenton & Mercer County Traction Corporation, Trenton, N. J.—This company has started work on an extension of its Trenton Junction line. The work will cost $15,000.

Toronto (Ont.) Civic Railway.—It is planned to build a municipal railway line over the Prince Edward Viaduct, Toronto, at a cost of $168,378.

Montreal (Que.) Tramways. — The Montreal Tramways proposes to build a line on Mt. Royal, Montreal.

Dallas (Tex.) Railway.—The Dallas Railway has begun construction of its Lake Ave. extension out Fairmount St. The extension will cost approximately $22,000.

Dallas (Tex.) Railway.—The Dallas Railway has received permission to expend $10,200 in removing the single track from Colonial Ave. between Lenox and Pear Sts., replacing it with double tracks. The company will also remove the double tracks on State St., near Washington Ave.

Dallas (Tex.) Railway.—The Dallas Railway will shortly begin work on the Seventh St.-King's Highway extension. The line will extend from Seventh and Tyler out Seventh to Edgefield, thence on Edgefield to King's Highway, a distance of a little more than one mile, and will cost approximately $100,000.

Wichita Falls (Tex.) Traction Company.—The Wichita Falls Traction Company will shortly begin the construction of a 5-mile double track line to the Wichita Fair Grounds.

Power Houses, Shops and Buildings

Sacramento Northern Railroad, Sacramento, Cal.—The Sacramento Northern Railroad will build an addition to its warehouse at Durham, Cal., to cost $11,000.

Pacific Electric Railway, Los Angeles, Cal.—The Pacific Electric Railway has received a permit for the construction of a station at San Pedro, Cal. The building will cost approximately $50,000.

Terre Haute, Indianapolis & Eastern Traction Company, Indianapolis, Ind.—Plans are being worked out by the Terre Haute, Indianapolis & Eastern Traction Company, the Union Traction Company of Indiana and other interurban roads entering Indianapolis for the erection of a union freight terminal on Kentucky Ave., Indianapolis. The carrying out of the project would involve an expenditure of $1,000,000.

Winnipeg (Man.) Electric Railway.—Fire destroyed the main carhouse of the Winnipeg Electric Railway on Main St. South, Winnipeg, on April 7. The total loss is placed at $450,000 and is covered by insurance. Nineteen cars, four sweepers and one work car were destroyed.

Northern Ohio Traction & Light Company, Akron, Ohio.—Work on two new carhouses for the Northern Ohio Traction & Light Company was scheduled to begin on April 12. One of them will be located on Fulmer Ave., Akron, and the other on the Canton line, near Massillon. The Akron building will be 70 ft. x 130 ft. and will contain eight tracks of the open pit type. The first floor will be used for washing, inspection and workshop for minor repairs. About 100 cars can be stored, but plans call for an extension next year that will make the capacity 175 cars. The second floor will be used as clubrooms for the men, including a modern recreation room, gymnasium and shower baths. The Massillon house will be 52 ft. x 120 ft., with open pit tracks and storage room for twenty-six cars. It will contain clubrooms, lockers and baths.

Trade Notes

National Carbon Company, San Francisco, Cal., has awarded a contract for an addition to its plant, 175 ft. x 275 ft., to cost about $60,000.

Mitchell Rand Manufacturing Company, New York, N. Y., has elected Joseph H. Lecour treasurer of the company, succeeding in this capacity W. E. G. Mitchell, whose duties as vice-president require all of his attention.

Independent Pneumatic Tool Company, Chicago, Ill., has appointed Fred J. Passino to be assistant manager of the Eastern division with headquarters at 1463 Broadway, New York City. Mr. Passino for many years has covered the Southwest territory for the company.

Electric Storage Battery Company, New York, N. Y., through its manager, F. L. Kellogg, announces that on April 24, 1920, the New York office, which has been located for twenty-two years at 100 Broadway, will be removed to the National Association Building, 23-31 West 43d Street.

Kentucky Switch & Signal Company, Louisville, Ky., has been incorporated by R. V. and L. Cheatham of St. Matthews, W. S. Scoggan of Sanford, Fla., and R. R. Scoggan of Jeffersonville. The company is capitalized at $16,000 and proposes to manufacture appliances for electric and steam railroads.

Wellman-Seaver Morgan Company, Cleveland, Ohio, announces that its manufacturing sales department, which handles the company's sales of rubber equipment and machinery, and which is in charge of L. N. Ridenour, moved on March 31 from the company's Akron office to its general offices at 7000 Central Avenue, Cleveland, Ohio.

Chicago Pneumatic Tool Company recently held a general conference of executives, plant and branch managers and salesmen at its Detroit plant, Second Avenue and Amsterdam Street, on the occasion of the formal opening of a large five-story addition. It was reported that much of the proposed increase in production was already absorbed by orders for future deliveries.

W. H. Smaw, purchasing agent for the Georgia Railway & Power Company, Atlanta, resigned March 1 to become southern sales representative of the Electric Service Supplies Company, Philadelphia, manufacturer and jobber of electrical supplies and street railway specialties. Mr. Smaw joined the Georgia company in 1903 as assistant purchasing agent and in 1910 became purchasing agent.

Electric Storage Battery Company, Philadelphia, Pa., has appointed Godfrey H. Atkin as manager of its Western district, covering the sales offices, warehouses, service stations and all departments in Chicago, St. Louis, Kansas City, Minneapolis and Denver, with headquarters in the Marquette Building, Chicago. Taliaferro Milton is in charge of the Chicago office, succeeding Mr. Atkin. Both appointments were effective March 1.

Strauss Bascule Bridge Company, Chicago, Ill., has been appointed engineers to design the bascule span of a joint railway and highway bridge over Inner Harbor at Johnson Street by the city of Victoria, B. C. The cost of the bridge will be borne jointly by the city of Victoria, the provincial government of British Columbia and the Canadian Pacific Railroad Company. Preparation of plans and specifications will begin just as soon as all details regarding the requirements as to length of span, etc., are determined.

Roller-Smith Company, New York, N. Y., has appointed Hammond D. Baker as manager of its Detroit, Mich., office at 1202 Majestic Building. Mr. Baker, a graduate electrical engineer of Alabama Polytechnic Institute, after his discharge from the aviation service of the army, became connected with the United Motors Corporation as technical traveling representative. Later he joined the sales department of the Hoskins Manufacturing Company, Detroit, Mich., from which he resigned to accept the appointment with the Roller-Smith Company.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has appointed George Bailey, manager of the supply division of the Cincinnati district office of the company, to be assistant to manager J. J. Gibson of the supply department at the East Pittsburgh works. T. J. Pace, formerly industrial assistant to manager of supply department, has recently been appointed assistant manager of the supply department of the company. Mr. Pace has been actively identified with the electrical industry along supply lines with Westinghouse and allied interests for about twenty years.

National Conduit & Cable Company, Inc., Hastings-on-Hudson, N. Y., has recently opened two new branch offices. Frank T. Payne represents that company and its subsidiary, National Brass and Copper Tube Company, Inc., in the states of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, with headquarters in the Commercial Bank Building, New Orleans, La. Wallace M. Cutler, whose territory covers Ohio, a portion of Michigan and the states of Kentucky and Tennessee, has opened an office in the Hippodrome Building, Cleveland, Ohio.

J. H. Williams & Co., Brooklyn, N. Y., and Whitman & Barnes Manufacturing Company, Akron, Ohio, have called a meeting for the merging of the Chicago, Ill., and St. Catherines, Ontario, plants of the latter company with the J. H. Williams Company. This plan will contemplate the operation by J. H. Williams & Co. of drop forging and drop forged tool plants at Brooklyn, N. Y.; Buffalo, N. Y., and West Pullman, Ill., in the United States and at St. Catherines, Ontario, in Canada, which is located close to Buffalo, and the business will be operated by the individuals now connected with these plants. The Whitman & Barnes Manufacturing Company's Chicago plant includes the new forge shop, 100 x 500 ft., and power house, which has just been built by Stone & Webster at a cost, including complete equipment, of $1,250,000. The company will continue the manufacture of twist drills, reamers, etc., at Akron, Ohio.

New Advertising Literature

Monitor Controller Company, Baltimore, Md.: Bulletin 100, on the Monitor system of machine tool control.

E. B. Badger & Sons Company, Boston, Mass.: Bulletins Nos. 100 and 102, describing methods of cooling water and air by the spray system.

Standard Underground Cable Company, Pittsburgh, Pa.: Bulletin No. 100-1, describing its products, copper, brass tubes, rods and wires. Additional data is included.

Lapp Insulator Company, Le Roy, N. Y.: Bulletin No. 62, comparing designs of American and European high-voltage pin-type porcelain insulators. Curves are included.

Smooth-On Manufacturing Company, Jersey City, N. J.: A new thirty-one page booklet, entitled "Smooth-On Home Repairs," describing methods for the repair of boilers, radiators and furnaces.

International Steel Tie Company, Cleveland, Ohio. A booklet, "Maintenance of Way for Street Railways," in which the organization and methods employed on the work necessary for maintaining the tracks of the Connecticut Company are described.

Utilities Engineering and Accounting Company, Harrisburg, Pa., has opened an office in Harrisburg, Pa., 10 South Second Street, which is in charge of W. C. Rounnel, formerly rate expert for the Public Service Commission of Pennsylvania.

Bridgeport Brass Company, Bridgeport, Conn.: An eighty-page publication, "Seven Centuries of Brass Making," a brief history of the ancient art of brass making and its early and even recent method of production as contrasted with the twentieth century electric furnace process as made by this company. Sixty pages are devoted to modern methods in brass making, illustrating furnaces, showing crucibles and their preparation and also the pouring of molds. Difficulties in brass making, possibilities of the electric furnace, electric brass furnaces, casting shops, phono electric wire, brass and copper tubes, sheet brass, rods and wires are thoroughly covered under separate headings and illustrated with numbers of engravings. Additional chapters on the company's laboratory and research department, on the characteristics of brass and on additions and impurities are illustrated and described.