

## BRANCH DISCUSSIONS.

DISCUSSION AT PITTSBURG, MARCH 12, 1903

*Programme:—*

The meeting was called to order by Chairman P. M. Lincoln, at 8.15 P. M.

The following papers were presented:

1. "An Electric Car Lighting System," by Wm. L. Bliss. abstracted by N. W. Storer.
2. "Axle Lighting," by Elmer A. Sperry, abstracted by B. B. Abry.
3. "An Axle Light System of Train Lighting," by Arthur J. Farnsworth, abstracted by S. M. Kier.
4. Resumé of New York Discussion, by Miles Walker.

The discussion was participated in by Messrs. P. M. Lincoln, J. S. Peck, N. W. Storer, A. H. Masters. B. B. Abry, J. M. Campbell.

MR. LINCOLN:—I note that Mr. Walker, in classifying the papers discussed at the New York meeting, divides them in two classes: Class 1, did not know anything about it; and Class 2, knew all about it but said nothing. I suppose if we were classified we would come under the first class.

MR. PECK:—I think, after striving to follow through the diagrams of connection before us, we feel with Mr. Lockwood that no complicated system can live. I understand that Mr. Storer has a system which is extremely simple as compared with these, and if Mr. Storer is not in the hands of his attorneys we should like to have him explain his system.

MR. STORER:—It is a great surprise to me to be called on in this way, but as my attorneys have not commanded silence I will give a brief description of a generator which I once designed for a train lighting system. It is, of course, in common with all the other systems that have been presented to-night, much better than anything else that was ever proposed.

The systems which have been presented here to-night remind me very strongly of the time I attempted to study out the connections of a well-known multiple-unit control system. There was such a maze of wires, connections, solenoids, etc., as almost to make one's head swim. This, of course, does not necessarily mean that the system would not work, for there is no doubt that a system, whether of control or train lighting, may work satisfactorily and still be extremely complicated; but it is an undoubted fact that the more parts there are in any system, the more likelihood there is for that system giving trouble. The great criticism which everyone must make on the systems which have been presented to-night is that they are very complicated. In this as in other branches of electrical engineering every endeavor should be made to simplify and reduce the number of parts.

The generator which I designed some eight or ten years ago

was a small 4-pole machine, designed to give a constant current of approximately 20 amperes and an electromotive force of approximately 50 volts over a wide range of speed, corresponding to a train speed of from 20 to 60 or more miles per hour. It was designed for gearing direct to the axle like an ordinary street car motor. The regulation of the machine was obtained in the same way as the regulation of the Westinghouse direct current arc generator system, which was introduced at that time. The field was separately excited and the armature reaction was so proportioned as to keep the current practically constant over a wide range of voltage, if run at constant speed; or a constant current over a wide range of speed if run at a constant voltage. The machine being connected to the battery terminals, the voltage was practically fixed and therefore the speed might change from the minimum at which the machine will give the battery voltage, to the maximum speed that the car will run, and the generator would still deliver 20 amperes. I may say that this system was never entirely worked out, as it was not thought advisable by the company with which I was connected to go into the train lighting business, at that time. Consequently the matter was dropped. But the advantages which I could claim for this system are the inherent regulation of the generator, which I believe would obviate much the larger part of the automatic apparatus which is found in the systems which have thus far been presented. The fluctuations in voltage would certainly be very much reduced, as from the time the generator is cut into the circuit until it is cut out again, it will deliver a constant current. The minimum voltage would therefore be supplied when the generator is cut out of circuit and the battery delivering the entire current required. The maximum voltage on the lamps would be obtained when the load is reduced to a single lamp, and the remainder of the current used in charging the battery.

In any well-regulated system, the generator should not furnish much more current than that required for operating the lamps, motors, etc., which form its load. The battery should be charged, for the most part, at times when the load is off. Consequently, there need not be such wide fluctuations of voltage on the system, and there would be no use for the "bucker" or the series resistance.

The system described by Mr. Bliss is admirably worked out and will doubtless give excellent results over the range of speed for which it is adjusted, but there is too much apparatus. The system employing the series resistance must be placed in much the same class. Until Mr. Sperry's system is placed in operation, we must take his word for it that it is a perfect system. Personally, the lighting of the train from a single generating unit placed in the baggage car or on the locomotive appeals to me most strongly. The system is extremely simple and the apparatus is at all times under the control of an expert attendant. All

of the apparatus but the storage battery is removed from the car; the battery must be used to supply the lights when the car is cut off from the generator.

MR. MASTERS:—I am familiar with the system of car lighting adopted several years ago by the Consolidated Car Heating Company, of Albany, N. Y. No mention has been made of it tonight, possibly for commercial reasons. At that time this company had cars in operation between Albany and Montreal, on which they were experimenting. They took the same stand that has been taken here,—that complicated systems are not at all likely to succeed, and less likely from a commercial point of view than from any other.

There seem to be diverse opinions regarding automatic qualifications for the successful operation of an axle system. Viewing it commercially, I understand the Consolidated Car Heating Company to maintain that an equipment costing more than \$700 or \$800 would be objectionable to railway interests. They stated that so far as they were able to observe, the road for which they were then experimenting would approve any system that would not cost more than \$800 per equipment. Complicated systems, involving many automatic principles, are, it seems to me, so expensive that they would probably not be considered at all.

Speaking about storage batteries, I think the same remarks hold good, not only in the equipment but in the maintenance of these batteries. Many arguments are advanced by the electric storage battery companies that their batteries are giving good life. My experience with storage batteries in the past has been that they do very well at start, but when you work them for transportation purposes, troubles arise which runs up the expense of maintenance very materially.

MR. ABRY:—I have been very much interested in the discussion of train lighting this evening. A comparison of the axle-lighting system with other systems and the disadvantages, particularly of the axle-lighting system, recall to my mind some difficulties we had to overcome in the measurement of speeds in some tests that we made on the Union Traction Company of Indiana. For measuring the speed, we employed a magneto-generator which was driven from the axle of the car by means of a belt. The magneto was first placed on a small platform, bolted to and extending directly out under the car from the yoke of the truck. This inclined the belt at about an angle of 45°. The results obtained were not very satisfactory. Finally, we suspended the magneto on a bracket still bolted to the yoke, but so arranged that the travel of the belt was nearly parallel to the track. We calculated the size of pulley needed on the car axle to give the required speed of the generator; this pulley was turned with a small flange and with a face slightly wider than the width of the belt, which was one inch. Upon making a trial run under these conditions, we soon found difficulty in keeping the

belt in place, and, as Mr. Walker said, there were belts all along the line. We found there was a lateral play in the car axle of two inches, more or less, besides the vertical motion due to irregularities in the track. The belt would not stay on. There was a continual tendency to climb over the flange of the pulley whenever the side play of the car axle became excessive.

We also had trouble at first with moisture softening the cement and the belt coming apart. We overcame the difficulty incident to the belt jumping by having a new pulley made with a flange about an inch in height, and the face of the pulley about twice as wide as the belt itself. After properly aligning the apparatus and mounting the magneto on springs, we finally obtained fairly satisfactory results.

The simple experiment of measuring speed on an interurban car seems to me to point very conclusively to the disadvantages of an axle-lighting system. I have observed on three of the principal roads of the West, the C. M. & St. P., the C. B. & Q., and I think the Santa Fe, the use of the system which is employed on the Pennsylvania Limited trains: viz., a generating unit with auxiliary batteries. In view of this fact, that system certainly must have some good features.

MR. CAMPBELL:—In general, it might be a good deal better to have a separate engine and generator in the baggage car, but what about lines where you have only a few cars electrically lighted? It would be out of the question to equip every baggage car or every passenger engine with a generator outfit of a capacity large enough to supply any combination of cars that may be attached to a train, for the sake of a few cars electrically lighted that may from time to time be used. Axle lighting is also preferable for a class of cars known as private cars or official cars, of which there are not a few. These frequently leave the home road and therefore should be self-contained, as it is not likely that all lighting systems would have the same voltage. On one road running out of Pittsburg they have the system discussed in Mr. Farnsworth's paper and the generator works very well. We had trouble for awhile with belts not staying on; they would get loose and slippy. That trouble was very largely overcome by changing the belt from a flat one to a V-shaped, short lengths of V-shaped pieces of leather are fastened to a flat belt and fit into V-shaped pulleys. These belts work well. We have had them last as long as a year, which seems a reasonable time. We found one trouble with the system; the adjustment of the main solenoid seemed somewhat delicate, but after being once set would maintain a nearly constant current. On cars running from 20 to 70 miles per hour, I have seen the current remain at about 32 amperes. The voltage does not remain altogether constant; it appears to vary more than 5 per cent. The resistance marked "E," in the diagram, seems to be too limited in extent, as a very short motion of the regulator cuts all this resistance in or out, with a consequent noticeable change in the lights.

MR. LINCOLN:—In discussing one paper, the question of expense was referred to, it being said that these systems would be too expensive. It seems to me that the public demands that trains should be electrically lighted, especially well-equipped trains. The fact that these complicated systems outlined here on the board have not only been proposed, but have been actually used, is the very best evidence that expense is not being considered.

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#### DISCUSSION AT SCHENECTADY, MARCH 17, 1903.

##### *Programme:—*

The meeting was called to order by Past-President C. P. Steinmetz. The report of the Committee on Organization was read and adopted, after which the following papers were presented:

1. "Axle Lighting," by E. A. Sperry, read by H. G. Reist.
2. "An Electric Car Lighting System," by W. L. Bliss, read by W. I. Slichter.
3. "An Axle Light System of Train Lighting," by A. J. Farnsworth, read by A. H. Armstrong.
4. "Electric Train Lighting Problems," by George D. Shephardson, read by R. Neil Williams.

Prominent part was taken in the discussion by W. I. Slichter, A. H. Armstrong and C. P. Steinmetz. A communication after adjournment was submitted by R. Neil Williams.

MR. A. H. ARMSTRONG:—In the attempt to perfect the car lighting system, I believe many of the inventors have lost sight of the broad issue involved. I think that President Scott has touched on the right thing in proposing the substitution of electric locomotives for steam locomotives. By doing this the train lighting question is solved to the satisfaction of everybody. Many of our larger steam railway systems are seriously considering the electrical equipment of their lines, for local service at least, and in the east this local service extends over a considerable distance. In fact, the eastern travel consists of a series of local runs, and when once the question is taken up, it will not be too much to expect that the limits of local travel of neighboring cities should overlap and form a continuous electrified railway system, say from New York to Albany or from Jersey City to Washington.

All the papers read to-night advocate the car unit system involving some form of axle-driven generator and making each car independent of the composition of the rest of the train. This pre-supposes that the train will be composed of mixed Pullman and day coaches, the latter not being necessarily lighted electrically. Such trains, however, are more or less local in character and will be taken care of within a few years electrically, both for lighting and motive power. The through trains composed of similar units could either be lighted from third-rail shoes bearing