in the previous styles, but it was soon found that the high speed attained caused the body to oscillate to such a degree that it became very objectionable, and the different builders then modified their trucks by extending the side bars beyond the axle boxes a sufficient distance to allow an auxiliary spring to be added at each end. For this auxiliary support coil and elliptical springs have been used, both forms with marked success, and it is now possible to carry a car body twenty-eight feet over all practically without oscillation. This last modification has been a very great improvement and has settled the long car question on most street railways. I mean by this that but very few double truck cars will be used, though of course there are places where two trucks can be used to advantage, and in such places they will still be employed. But we are able to carry nearly as many people on four wheels as on eight, and to apply the power equally on each axle, so that as there is no possibility of lack of traction, there can be no gain to the railroad company in using eight wheels.

CARS.

The car bodies first employed were of the same style and proportions as those used for horse roads, and were not properly designed for electrical purposes; first the framing of the roof was too weak and would not support the trolley board properly; second, the framing of the floor was not adapted for the use to which the cars were put, for not only was the framing too weak, but it also was not well planned for putting in the trap doors which are required in order to inspect the machinery underneath the floor.

The car body which it seems to me is best adapted for the present service is one eighteen feet six inches long inside, with platforms three feet six inches long. The rafters should be strengthened with steel plates and the framing throughout should be heavier.

The coloring of cars and the necessary signs are attracting considerable attention from the different railway companies, but up to the present time I do not think any concerted action has been taken. For my part I believe that all the cars on a system should be painted the same color, that is to say, each separate line should not have a distinct color, but signs should be used to designate the different routes, preferably by means of the well-known reversible sign on the top of the car, both at the sides and front. All night the lines may be distinguished by the color of the ventilator glass, which would in each case be the same as the ground color of the reversible sign.

OVERHEAD CONSTRUCTION.

There has been a general improvement in all parts of the overhead material. We are using the stiffer poles, stronger span wires, better trolley wire insulators and handsomer curve fittings, so that the general appearance of the system is much pleasanter. The quality of insulation now in general use is far superior to what we had two years ago, and, as double insulation is now employed on the span wires, very little trouble from leakage is experienced.

The method of feeding the line is a very important matter and should receive careful attention. The best arrangement is to divide the system into several sections, so that in case of trouble along any portion of the line, such as fire, etc., that section can be cut out and the balance of the system run as usual.

A PERFECT OVERHEAD ELECTRIC CONSTRUCTION.*

By Charles H. Smith.

The president has appointed me a committee on "A Perfect Overhead Electric Construction." In thus selecting me to prepare a paper on this subject, he evidently intended to pay a passing compliment to my imaginative or inventive powers. He asks me to describe something that does not exist, something that I have never seen, although I have searched diligently for it. I can, therefore, give only my ideas of how an electric overhead line should be constructed, based upon facts and information derived from personal experience and observation.

Iron or steel poles have proved to be the most desirable. I would therefore recommend the following: the poles to be of tubular iron 32 feet in length, and made of three sections, in the usual way. The lower section should be at least 7 inches in diameter, and the other two sections 6 inches, and 5 inches, respectively. The poles should be set in concrete, and at least 6 feet in the ground, and should not be more than 125 feet apart. The top of the pole should have about 2 per cent. of rake away from the curb, and should be fitted with a suitable pole clamp, so that the span wire can be easily adjusted to the required height, which should be 22 feet above the track. On top of the pole should be a malleable iron cross arm to carry the feeder wires, and guard wire spans. This cross arm should be insulated from the pole by means of a wooden plug inserted in the top of the pole. The insertion of the joints of the pole should be at least 18 inches, and the joints should be made solid throughout their entire length by means of shims or other contrivances. If these joints are not properly made, the poles will not stand the strain. For curves or extra strain, there should be larger poles of the same make.

Span wires should be of No. 4 B. W. G. silicon bronze wire and should be fastened to pole clamps by means of insulated turn buckles. Great care should be taken in insulating these turn buckles from the poles.

All well-built lines should be sectional, and the trolley wire should not be of too great a size. I would therefore recommend No. 4 B. W. G. silicon bronze wire, which affords sufficient carrying capacity and has great strength and durability.

Sections should not be of a greater length than two miles, and should be separated by trolley breakers, of which there are now a number of good ones in the market. In cities and villages where there is great liability of fires it would be advisable to put trolley breakers at short intervals. Trolley wire hangers and pull-off brackets should be of the lightest make possible, and still have the required strength and the very best insulation. There is a variety of such hangers and brackets now in the market.

As it is important to have as small a number of joints as possible in the trolley wire, it should be put up in mile lengths, and twisted splice joints should be made and brass cones shaped slipped over the wire before the splice is made. After completing the splice, the larger ends of the tubes should be brought together over the splice and a little solder dropped through a small hole made in the tubes for that purpose, in order to keep the joint in place.

Overhead switches or switch pans, should be avoided, if possible, as they become a source of great annoyance. I would strongly recommend a double trolley wire for a single track road.

Great care should be taken in erecting the guard wire spans. They should be properly insulated from the cross arm by means of a strain insulator, or something equally as good, and should be of at least No. 6 best galvanized iron wire. There should be two guard wires over each trolley wire at least three feet apart and four feet above the trolley wire. The guard wire must be well insulated from the guard spans; in case of other wires falling, this would be of great importance. Pull-off and anchor guy wires, or other wires for the same purpose, must be of the very best material, and of at least No. 8 galvanized iron wire.

Feed in taps must not be more than five poles apart and should take the place of trolley span wire at that point. They should be of at least No. 0 insulated wire.

The trolley wire being sectional, it is necessary to run a feeder wire to each section. I would, therefore, recommend that the feeder wire be at least 30 per cent. larger than the occasion demands. It will be found that this is money well invested. The insulation on the feeder wire should be the best that can be procured, and I would advise using locust or iron pins with mica insulatiors or something equally as good, for the purpose of fastening the feeder wire to each pole, and great care must be taken to protect it from trees and other obstructions.

A cut-out box should be located on the pole at each trolley breaker, and should not carry a fuse. It should have the same wire running through it as there is on the outside. The fuses should be at the station, with ampere meter and cut-out switch for each section; then in case of trouble on any section, the location can be easily seen, and that section cut out, if necessary, until repaired.

Lightning arresters are of great importance on the line, and I would strongly recommend using them at least every thousand feet. They can easily be attached to the poles, and can be protected by means of a box.

In conclusion, I would say that no matter what expense is incurred for material, or care used in constructing, a good line cannot be insured without a thorough daily inspection.

*Report of a committee of the American Street Railway Association, read at their Cleveland meeting.