a great tendency to spark. To obviate this, the dynamo must be either very large for its purpose or of a special design.

The low voltages used in all these systems is no doubt an aid to the long life of the lamps, since a low voltage lamp of a given candlepower can stand a greater variation in voltage in per cent. than a high voltage lamp.

On a general application of these systems, we know that the direct connected unit is used on one of the trains of the New York Central and the Gould system, in which an axle-driven generator charges alternately two sets of storage batteries, one of which is connected to the lamps while the other is being charged.

(COMMUNICATION AFTER ADJOURNMENT OF SCHENECTADY MEETING, BY R. NEIL WILLIAMS.

In reading the papers on Railroad Train Lighting, discussed at the March meeting of the INSTITUTE, I notice that it seems to be generally taken for a foregone conclusion that no system of electric train lighting is possible that does not entail the use of a storage battery. The experience we have had in the past with stationery storage batteries has not been such as to warrant our making them the all-essential feature of a train lighting system, where the continual shaking and jolting must shorten the life and reduce the reliability of the most up-to-date battery.

It is also difficult to see what advantages axle-lighting systems have over the large unit steam dynamo or preferably turbine-dynamo on the locomotive, where it properly belongs. In the former case we have as many units as the train has cars and we have all kinds of difficulties in transmitting our power from locomotive through drawbars to axles and from these to the dynamos, where further complicated devices are required to regulate voltage or speed under widely varying conditions. A simple flexible connection from car to car is certainly cheaper and gives the right power whether train is standing or moving.

Furthermore, the jar from a comparatively small collision would probably be sufficient to demolish any storage battery, whereas, even though all the cars should be completely demolished and only the locomotive left intact, or partly intact, it would be easy to rig up temporary lights from the engine. The following arrangement contains nothing new in the way of engineering features, but at the same time has not been brought out, as far as I know, as a possible and very simple solution of the problem and one which avoids entirely the use of storage battery.

This would be simply to have the cars wired as they are on any electric railroad, but without regulating devices of any description. The tracks would be used for return circuit and power led into the car and from car to car by a flexible coupling, energy being supplied from turbine-dynamo set on the locomotive. This would give light at all times except when the locomotive was uncoupled from the train, which, though occurring frequently is never at any other place than where there are

stations or at least switches and sidings of some kind. If, wherever there is a switch or siding of any kind, in fact at any place where there could ever be any object in the locomotive being uncoupled, a third rail were provided of very modest dimensions and each locomotive as well as each car were provided with a simple shoe, then whether coupled or uncoupled the engine would itself feed the third rail and from it the cars would receive their energy at the same voltage they had been receiving and under exactly the same conditions. There is no apparent reason why cars should be lighted until sometime before the trains are ready to start and then there will always be a locomotive in the neighborhood. Of course, with Pullman sleepers which take on their passengers in the early part of the evening long before the train is ready to leave, it might occur that there was no locomotive in the vicinity. In this case it might be necessary to have a stationary storage battery at such points floating on the third rail, but this would be the exceptional case, and even here the storage battery would not be jolted to pieces. The expense of this third rail, even if it were laid at every switch and siding from New York to San Francisco, and of the one shoe per car and locomotive, would be extremely small, compared with the expense of the storage battery and the divers regulating devices required, if we were to attempt to light all our cars by the axle system.

At this stage of engineering advance in America, it is a poor showing that the railroads make with their flickering gas light and continually re-occurring fires, and it would seem as though the time were ripe for revolutionary changes.