

THE SAFETY OF UNDERGROUND ELECTRICAL INSTALLATIONS*

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Considering the hazard involved in mining operations, statistics show that a very small percentage of accidents is chargeable to electricity. These accidents do represent quite a large percentage of those that are preventable and they are the direct result of the introduction, for purely economical reasons, of a dangerous element. The introduction of electricity in mines should decrease the hazard, and in no case should electricity be applied to the mechanical operation of equipment if by so doing the dangers incidental to mining are increased.

The greater number of accidents are the result of persons coming in contact with exposed conductors at potentials varying from 250 to 500 volts direct current. The use of alternating current at higher potentials than these is quite common in large mines, but it is very rare that an accident happens from this source. This is explained by the fact that where these high voltages are warranted, proper precautions are taken, and the installations are directed by those who fully appreciate the dangers incidental to the work. Direct current is in much more general use than alternating current because of its adaptability to haulage locomotives and the low cost of installation in small operations. We are, however, coming to a more extended application of alternating current for the operation of mechanical devices used in connection with mining.

Our underground direct-current wiring system is an evolution from the surface trolley and feeder systems. This is probably due to the fact that our earlier successful applications were electric locomotives, which required the use of a trolley wire. The trolley current has been almost banished from industrial establishments on the surface because of the hazard involved, yet we use it indiscriminately underground, where the dangers from accidental contact or fire are infinitely greater. This does not mean that the underground trolley systems should be eliminated, but it does imply the proper safeguarding of such equipment as is necessarily a part of the trolley systems.

It is a fact that the men now employed in the installation and maintenance of mining equipment may be in many cases incompetent or not thoroughly familiar with the work, but they are the men who must do the work and, in order to do it properly, it is necessary that they be educated and guided in their task. Men who have been trained in industrial plants on the surface do not care to take up mining work, and the men to do underground electrical work must be recruited from men actually working in the mines. These men have no training except that gained from association with men engaged in the work. The result is, they do their work in such a manner as seems to them the most expedient with the results to be attained, and not in keeping with any clearly defined method or studied system.

For all electrical work on the surface we have the rules of the Underwriters' Association. Electricians and wiremen familiarize themselves with all requirements of the Underwriters, and the result is that their work is done in a thorough and safe manner. A complete set of electrical rules similar to those of the Underwriters' Association, but made applicable to underground work, would go a long way toward solv-

ing the problem, if they were made suitable for, and received, general application.

These rules would naturally be evolved from all data available and an investigation of all electrical accidents over a period of time; and a complete analysis should be made of causes, as well as methods to prevent a recurrence in the future. We have available the rules contained in the bituminous mine law of Pennsylvania and other States, rules of the Underwriters' Association, and rules of certain mining corporations and municipalities, that could be used for a basis. Any set of rules, no matter how carefully compiled, will naturally meet with a considerable amount of opposition and criticism, and a large part of the criticism will be warranted. This very feature will result in devising a set of rules that will meet the situation in its entirety, and make it possible to almost eliminate this class of accidents.

The problem of working out such a set of rules is a very formidable one, but no more difficult of solution than that which the Underwriters' Association has already solved or is successfully solving. It is fully apparent that additions or changes must be made from time to time to keep pace with an industry that is continually being developed and expanded.

The electrical rules contained in the bituminous mine law of Pennsylvania have been in effect something over two years, but last year represented the first opportunity we have had to judge the operation and effect on fatalities resulting from the use of electricity. While the exact records are not available, it is safe to say there will be a material decrease in the number of fatalities resulting from the use of electricity in this district, and this in face of the fact of a very material increase in the use of electrically driven devices used in the production and transportation of coal.

These rules represent a first step in the standardization of electrical equipment and wiring as applied to underground workings, and the results stated are conclusive proof of what can be done along this line. These rules have resulted in the education of the men who do the work, and they now know, in a general way, what they are required to do. Prior to the enactment of this law, the use of electricity in mines was tolerated but not authorized, and not subjected to any rules or regulations. It is only natural to suppose that this resulted in installations of all kinds. Some installations represented an unnecessary expense in doing everything possible to meet every restriction that might later be placed on the work, but a large number of the plants were put in simply to do the work, with very little regard to the safety of the employees. This is all changed now, and each operator knows what is required, and, wherever possible, meets all of the provisions contained in these rules.

These rules met with more or less opposition when first incorporated in the mining law, but they now meet with the favor of all progressive mining companies and have been of material value to all concerned.

Instead of restricting the use of electricity, these rules have caused a very material increase in this method of transmitting power to operate the different

*A paper presented at the New York meeting, A.I.M.E., February, 1914.