mechanical devices used in the production of coal, and are of material value to the coal industry in this region, as well as to electrical and kindred industries.

When the Underwriters' Association introduced rules governing electrical work, inspectors were employed to see that the work was done in keeping with the standard suggested by their code. Formerly these inspections covered all work done where insurance was carried, but as the workmen became more skilled the inspections were less comprehensive, and under certain conditions were omitted entirely.

For a period of time it will be necessary to employ a certain number of electrical inspectors for underground work to see that the rules are complied with. An inspector would be of little value unless he had a definite set of rules on which to base his recommendations. His duty will be to act largely in an advisory capacity and to interpret the rules laid down. The mining departments of the different States employ a certain number of mine inspectors, who can take care of the electrical work after they get entirely familiar with the rules and application, except where new schemes or unusual installations are involved. It may require some little time for these inspectors to become sufficiently familiar with electrical equipment and its operation, but a knowledge of this phase of the situation will be just as essential and as readily acquired as that of ventilation.

In the bituminous fields of Pennsylvania the mine inspectors paid very little attention to the electrical equipment so long as the use of electricity was simply tolerated, but just as soon as its use was authorized, and rules formulated covering the work, they familiarized themselves with the rules and their application, and in the average installation they are able to judge intelligently as to the safety of the equipment.

It is not within the province of this paper to suggest who should work out a proper set of rules or how they should be applied. The increased safety that would be secured would fully warrant the co-operation of the government. Electrical manufacturing companies should be very much interested because of the commercial advantages gained by reducing the hazard, thereby popularizing the use of electrically operated devices. The mining companies should also be interested because of the reduced hazard to employees and property that would naturally follow. A more extended application of electricity would be warranted with reduction in costs of operation. All safety organizations, as well as engineering societies, would be interested.

Taken in its entirety, considering the increased safety that would naturally follow, the commercial advantages to be gained, and the large number of interests involved, the expenditure of the necessary time, labor and money is fully warranted in the formation of a proper set of rules covering this work.

MANGANESE.

For commercial purposes materials containing manganese are separated into four classes—(1) manganese ores, (2) manganiferous iron ores, (3) manganiferous silver ores, and (4) manganiferous zinc residuum. Though manganese forms a part of about a hundred minerals and is a relatively widespread element, practically all the manganese of commerce is derived from material containing one or more of the minerals polianite, pyrolusite, psilomelane, wad, manganite, braunite and franklinite.

Manganese ore is mined in Canada at New Ross, Nova Scotia.

TESTING OIL SHALES

According to E. G. Woodruff and David T. Day in a bulletin published by the U. S. Geological Survey, it has been known for many years that highly bituminous shale, or oil shale, occurs in the Green River formation of the Uinta Basin in Colorado and Utah. Eldridge, who studied the gilsonite veins in this region in 1901, incidentally mentions the shale. He states that the Green River formation includes "shales and limestones, bituminous, locally in a degree to be of economic value." Since the publication of that paper reports have been current from time to time that this shale is rich in petroleum, and that it compares favorably with the Scotch oil shale which has been successfully utilized in the commercial manufacture of petroleum products for half a century.

In order to determine the geographic distribution and thickness of the shale E. G. Woodruff, assisted by W. P. Woodring, carried on in the summer of 1913 a reconnaissance survey of a part of the area occupied by the Green River formation in Utah and Colorado and in collaboration with D. T. Day made field tests to determine the amount of oil and other distillation products that can be obtained from the shale. Later Mr. Day made laboratory tests of some of the same shale and also examined the oil obtained in the field in order to determine its quality and to see if by better methods of distillation its quality could be improved.

Field tests were made in a portable still designed by Mr. Day and operations were at first carried on under his immediate supervision. The basic principle of the operation was to heat the shale, thus vaporizing the volatile hydrocarbons and destructively distilling the other forms of organic matter present in the shale. The distillation products were conducted through a pipe to a condensing coil, where the heavier products were liquefied and conducted into receivers and the gases permitted to escape.

The retort into which the shale was charged consisted of a section of 12-inch iron casing pipe 4 ft. long, having flanges screwed on the ends and a removable iron plate with asbestos gaskets fitted to each end of the retort. On one side of the retort there was fitted a small steam dome a pressure gauge, and a safety valve. From the top of the dome a pipe led to a block-tin condensing coil in a small water-filled tank. The coil discharged into Wolff bottles set in series and provided with stopcocks so that the liquids could be drawn off without interfering with the operation of the condenser. During the operation the retort was suspended from iron supports in a narrow trench, covered with iron plates and earth, and a flue erected at the back. Heat was obtained from a wood fire placed under the retort.

The operation consisted of removing the head, charging the retort with shale broken into pieces not larger than 4 in. in diameter, and replacing the head. Fire was started to give a gentle heat at first and was gradually increased until the lower part of the retort became red hot; then the fire was held constant until near the close of the process, when it was increased for a short time and then allowed to subside. Water vapor, gas, oil and gas, and finally only gas was the order in which the products were obtained. From seven to eight hours' heating was required for a charge. The liquid products were sealed in cans and shipped to the Washington laboratory.

The amount of oil obtained in the various tests ranged from 10.4 gl. to 61.2 gl. to the ton.