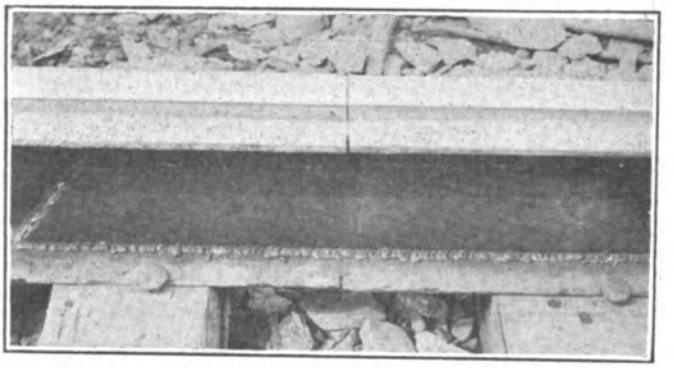
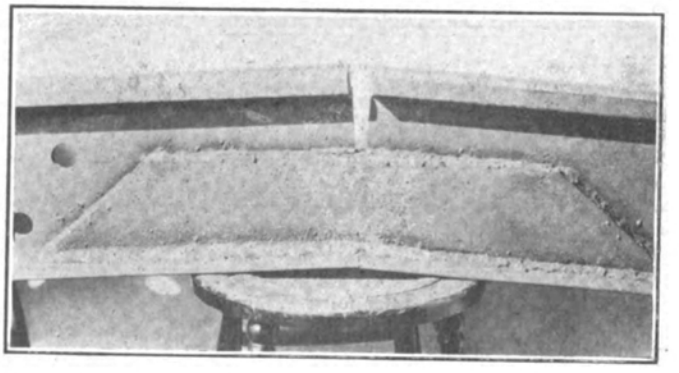
The officials of the United Railroads of San Francisco state that the welding can be done by any intelligent laborer after receiving reasonably thorough instructions, and that, in general, Greek laborers are being used for performing all the operations in the track department. In the repair shop the operators are developed from a similar class of labor for much of the work which is done.

On the Pacific Electric Railway Company a machine



Electric Arc Welding—Welded Fishplate Which Eliminates Necessity for Bonds

similar to those used in San Francisco was placed in service several months ago. This is reported to be kept busy almost all of the time since its purchase and is stated to have done exceedingly satisfactory work in building up cupped rails. It is stated to have prolonged the lives of crossings and special work from eight months to a year, and although there has been no occasion to use the machine on any manganese special work as yet, the operating officials consider that it will prove satisfactory for this service. It is in fact used at present to a considerable extent for cutting rails and boring holes in manganese steel. The operating cost to make a weld in a rail is reported to be



Electric Arc Welding—Welded Fishplate Joint After Test of Reversed Load of 140,000 Lb. with a 6-Ft. Span

approximately $3, Mexican labor being used, as it has been found that the apparatus does not require any special skill after the operators have been advised how to handle it.

This paper is indebted to Thomas Finigan, purchasing agent United Railroads of San Francisco, for the illustrations and the account of the work on that railway and to E. C. Johnson, assistant chief engineer Pacific Electric Railway Company, for the comments on its practice.

The mechanical department of the Metropolitan Street Railway, Kansas City, Mo., has decided to abandon all other methods of preparing exposed steel in car bodies for paint in favor of sand blasting. This method assures a complete removal of old paint scale, exposing a bright, pitted metal surface to which paint is sure to adhere. If compressed air is available, this is the cheapest of all methods.

ELECTRIFICATION PLAN OF THE CHICAGO, MILWAUKEE & PUGET SOUND RAILWAY

An important step in the electrification of the mountain divisions of transcontinental railroads between the Rocky Mountains and the Pacific Coast was made this week when President A. J. Earling of the Chicago, Milwaukee & Puget Sound Railway announced that that company expected to electrify its main line division from Harlowton, Mont., to Avery, Idaho, a distance of 440 miles. The electrification will be in operation within the next three years, and the number of electric locomotives required is estimated to be between 50 and 100. Nine separate water-power developments will supply the required energy for the full stretch of 440 miles, which traverses the Belt Mountains, Rocky Mountains and Bitter Root Mountains. No contracts have yet been placed, and no detailed plans have yet been made for the electrical equipment, but C. R. Goodnow, assistant to the president, in a recent interview, said that the plans in general provide for the handling of all of the traffic with electric locomotives and that probably the 2400-volt system will be used. Regeneration is being considered seriously and plans for the equipment and overhead construction are being pushed forward rapidly. The installation will be begun within eighteen months and the completion rushed.

Part of the railroad power will be supplied by the Great Falls Power Company, which has secured from the federal authorities for a term of fifty years the grant of a right-of-way across the public domain for a 150-mile transmission line. In fact, the first announcement of the proposed railway electrification was made through a statement by Walter L. Fisher, Secretary of the Interior, that this grant for a right-of-way had been made.

The grant embodies the fundamental principles of water-power policy which Secretary Fisher has been advocating for the past two years and the transmission line, in matter of fact, is already in operation, but it was built under a revocable permit issued in 1909. At that time no better right could be given for any power development, but the agricultural appropriation act of March 4, 1911, authorizing the making of fifty-year grants for transmission, telegraph and telephone lines, provides that the grants are to be made under general rules and regulations to be fixed by the Secretary of the Interior. The act further provides that old lines already constructed can have the benefit of the statute on like "terms and conditions" as new lines. In view of the importance of this application to travelers and shippers by rail, and in further view of the fact that only transmission lines, not water-power sites proper, are involved, Secretary Fisher felt justified in ruling that he has the power to grant the more permanent right obtained. The installation of the new system will involve the expenditure by the railroad of many million dollars and the railroad company was unwilling to invest so large a sum while the power company's rights were revocable in the discretion of the government. Therefore Secretary Fisher's grant is conditioned upon the power company's entering into and performing its obligations under a contract to supply electricity for the motive power of the railroad.

Energy at 110,000 volts and at 60,000 volts will be fed to the railroad company at eight different points on its right-of way, the minimum requirement for power being 25,000 kw and the maximum for the present 50,000 kw. Ultimately five stations of the Montana Power Transmission Company, three stations of the Great Falls Power Company and the station of the Thompson Falls Power Company will supply the load. The Thompson Falls Power Company is now constructing a 50,000-hp hydroelectric station at Thompson Falls, Mont., and the Great Falls Power Company has also under construction a 130,000-hp hydroelectric development on the Missouri, at Great Falls, Mont.