Next come repairs in Marine Engineering, which are mostly successes obtained by Mr. Des Anges, Superintendent, Floating Equipment of the Long Island R. R.

A 12" crank shaft (135%" at point of fracture) of the ferry-boat "Manhattan Beach" was welded with 400 lbs. of Thermit. The break was in the "wheel centre," necessitating



Welding Spoke of Locomotive Driving Wheel.

the shifting of the centre to a new position and shortening the paddle boxes. The shaft was pre-heated by a charcoal fire and hand-blower, to black heat. To protect the woodwork of the ferry-boat, an asbestos curtain was hung around the crucible, which served its purpose admirably. The ferry-boat has been in uninterrupted service for nearly three months, and continues so now.

A rudder-stock, 5" in diameter, was welded with 50 lbs. of Thermit and 10 lbs. of punchings. The collar in this case had to be entirely removed, but the welded rudder-stock has now been in service for eight months.

On the Great Lakes, through the enterprise of Capt. Johnson, at that time with the Dunham Towing & Wreek-



Weld of Crank Shaft "Manhattan Beach."

ing Co., the rudder-shoe of the tug boat "Schenck" was welded, 125 lbs. of Thermit being used. The weld was sound—in replacing the propeller, a chain broke and the propeller dropped on the weld shoe without injuring it.

Some important repairs of gray iron castings are also reported. At the Renovo shops of the Pennsylvania R. R. a hydraulic wheel press was repaired, the part welded having to stand a pressure of 60 tons per square inch. The original "strong back" holding the wheel against which the axle was pressed was not strong enough for the purpose until repaired by Thermit.

Cylinder covers are also repaired by Thermit, and have been made as good as new.

Work with gray iron castings requires more experience, in regard to pre-heating and cooling down gradually-more Thermit is necessary to effect the weld on account of a hard, glassy scale on such castings, which resists fusion, and an addition of Ferro-Silicon (about 2%) is advisable to prevent hard spots at the lines of junction between Thermit Steel and cast iron.

The most important application of the Thermit Process is for making a continuous rail. The process having been brought to a high state of perfection in Europe before coming here, there was little room for



Weld of 5-in. Rudder-Stock.

changes in practice. About 30 different cities are investigating the process in actual operation and about 5,000 joints have been put in up to date. All these roads recognize in the Thermit Process the best and simplest means of joining rails for electric traction, as long as care is taken to do small and simple things right. Competitors in the field of railwelding may send out fanciful blue-prints about broken joints, to create unfavorable impressions, but such manœuvres prove nothing beyond the fact that they admit the success of the Thermit Process in this field.

Some tests may be of interest. A heavy double trolley car was taken over a welded joint with supports 13 feet away, without breaking it.

To decide whether the head of the rail got softer, Micrometer Caliper measurements were taken of depressions made under equal blows of a steam hammer, by a blunt tool hardened at the head,  $\frac{1}{4}$ " in diameter.

 $\frac{1}{2}$ " away from the joint the depression was 0.1432".

3' away from the joint the depression was 0.1596". The electric conductivity of the Thermit joint is recognized to be higher than that of the rail, due to increase of area, and is permanent.



Welded Rudder Shoe Tugboat "Schenck."