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## Norris's Railway Joint Chair.\*

The following paper on Mr. Norris's new joint chair was read at the last meeting of the Institution of Mechanical Engineers at Birmingham:—

In bringing before the Institution a plan for a new kind of joint chair for railways, it will be unnecessary to expatiate on the advantages of a *firm joint*, as regards economy of maintenance of the road and rolling stock, and safety.

The object of this paper is to describe a method which has been in use on a crowded part of the London and North Western Railway for above eighteen months, during which time it has stood well, and is now being extensively used on the same line.

The plan is to cast a chair or coupling on the rails at the joints as they lie in the line, by means of chills and a portable cupola. The hot metal flowing freely into the chill is allowed to come in close contact with the rails, and in cooling contracts so as to grip the ends of the rails firmly together. The great object to be attained is the converting of the rail into a continuous girder, which shall not deflect at the joint more than at any other part; every successive year's experience having forced the attention of engineers and others to this point, to attain which many plans have been tried with more or less success.

Whatever mode of joint is adopted, or whatever method of jointing the ends of rails, it is necessary that a certain allowance should be made for the longitudinal motion caused by the expansion and contraction of the rail. This object is attained, wherever necessary, by putting the chills, previously heated, on the ends of the rails for a short time, until they become hot, when they are taken off, and a thin wash of loam and blacking is laid upon the rail end, which instantly dries on, and when the melted iron is poured against it, absolute contact with the rail is prevented. Although provision is thus made for the expansive and contractile force of the rail, the cavity in the chair being parallel to the rail, clips it sufficiently tight to prevent any vertical or lateral motion of the rails; the amount of surface of contact between the rail and chair is about 100 square inches, being 50 square inches to each rail end.

This great surface prevents any perceptible wear taking place on rail-ends from the longitudinal motion of expansion; and as no motion can take place vertically or laterally, no shock can take place by the action of the wheels, so that the joint will remain good for years, which has been confirmed by practice, so far as it has gone.

The operation of casting is very simple, and is performed without hindering the pacing of trains during the execution of the work.

The apparatus consists of chills and a portable cupola, and the process is as follows, when operating on a line already laid:—Each joint-sleeper or block is first lowered by the plate-layers about three inches, so as to give room for the application of the

chills, or is removed altogether for the time, and the old chair being taken off the joint, the chills are applied, consisting of a bed plate with two lips, one on each side, holding down the side-chills, which slide in the grooves; these are put to the rail and held together by screw-clips, forming a mould for casting the chair. This operation is quickly performed, and the chill is then packed under temporarily with loose metal plates: the moment this is done a train may pass over it without hindrance.

Two steel pins are then put in their places in the chills, so as to form the cores for the holes of the holding-down spikes. The chill mould being thus fastened in its place is ready for the melted metal, which is run into it at the lip, until it is level with the top of the sides, where a large open space is left for the escape of air, which prevents all possibility of blowing.

The chills are made to fit the rails by projections at each end, which grip the rail firmly, and a little loam is applied on the outside, to prevent the hot metal making its way out of the chill-mould.

After a lapse of about five minutes the mould is taken off, which is done in an instant, leaving the chair perfect, and closely embracing the contiguous ends of the rail. The form of this chair is such as to make it a strong and rigid clip, closely fitting the two ends of the rail along its whole length. Chairs may by this method be cast of any form. When the chair is cold enough, the sleeper or block is replaced, and the chair spiked to it.

The operation is the same in relaying new roads, only that the expense of lowering or removing the block or sleeper is saved.

The metal used up to the present time has consisted of old chairs, mixed with a little new iron. This is melted in a portable cupola, formed of a cylinder of sheet-iron 1-16th of an inch thick, 2 feet 3 inches in diameter, and 4 feet 6 inches high, lined with fire bricks and clay in the usual manner, 4 inches thick.

The cupola weighs about 6 cwt., and is easily lifted by the workmen on to a plate-layer's lorry, and taken to the place required, when it is lifted off, and placed on a few sleepers laid on the slope of a cutting or embankment. When once so placed it will serve for a half a mile of road without moving again, as the metal is so hot as to enable its being taken, in a moulder's ladle, on a lorry, to the chills at a quarter of a mile on each side the cupola.

The cupola has a belt or air chamber, into which passes the air from the fan, and it has four tuyeres of two inches orifice to admit the air to the fire. The fan consists of a chamber 1 foot 10 inches inside in diameter and 9 inches wide, and weighs about 3 cwt.; it is detached from the cupola by drawing out the nozzle from the entrance to the air belt, and can then be lifted separately into its place. The fan is either turned by hand-winch, or, when the operations are extensive, by a small steam-engine, weighing about 10 cwt., and can be lifted by eight men, and placed on and off a lorry, and on the slope, in the same manner as the cupola.

The yield of metal from so small a cupola is very great: as much as 3½ tons has been run down in seven hours, by two men turning the handles of the fan, and nearly 4½ tons by the use of the engine in the same time. A smaller cupola, weighing about 2 cwt., is used for repairs of the line.

A good fastening is made for middle chairs by taking out the wooden key from the common middle chair, and casting an iron

\* From the London Mechanics' Magazine, October, 1853.