

works, and generally the standard sleeper is available in any situation.

The two portions of the sleeper, for convenience of handling, are connected by rivets, which however have no strains to encounter, as all connections are attached to the solid rolled upper part, and there is no tendency for the parts to separate when once laid down, even if the rivetting were absent. The sleepers are conveniently made of the same length as the rails, but this is not strictly necessary, as the rail-joint may fall anywhere in the length of the sleeper. The weight per mile for a standard line, for steel sleepers and cross-ties is about 100 tons, and for the cast-iron jaws and keys, 51 tons.

THE DENHAM-OLPHERTS CAST IRON SLEEPERS.

We give engraving of three patterns of the Denham-Olpherts patent cast-iron plate sleepers, which are exhibited by Messrs. Thompson & Browning, of 3, Victoria-street, S. W. Of our illustrations, Figs. 1 and 2 show a pattern intended for English railways; Figs. 3 and 4 the type now in use on the Indian State Railways of metre gauge; and Figs. 5 and 6 another pattern wool cushions under the rails, also in use on the Indian State Railways. The whole construction of this permanent way is so clearly shown by our engravings that a detailed description is unnecessary, but we may state that these sleepers have been largely used in India and with very satisfactory results. At the Exhibition a short length of railway, to be the British Mekarski Improved Air Engine Company for running their passenger cars and engines, has been laid with the Denham-Olpherts sleepers.

THE CABLE SYSTEM IN PHILADELPHIA.

In a recent Philadelphia dispatch it was stated that the cable of the Philadelphia Traction Company, constructed through twelve miles of the principal streets of that city, had been found radically defective, after a cost of \$600,000 to the projectors, and that one of the engineers engaged upon the system had expressed the opinion that \$25,000 would be required to correct mistakes and make the road practicable for traffic in cold weather. When the iron conduits through which the cable passed were laid, iron rails were run through the stringers and bolted to the top of the conduits just below the slot where the grip passes down to the cable under the street. Every change of temperature affected the width of the slot and hindered the passage of the grip.

It is stated further that work had been begun to remedy this error, and the ground was to be torn up over the entire twelve miles of track laid and substantial new ties and iron braces put in place of the lighter and defective ones that have caused all the trouble. The projectors of this road visited Chicago about two years ago to examine the system in use here, but on their return they attempted improvements which would now cost a quarter of a million to perfect.

Superintendent Homes of the Chicago City Railway Company, who explained the workings of the Chicago cable system, to the Philadelphians when they were here, was asked what he thought of the failure of the system in the Quaker City. He said:

"The first piece of cable road constructed in Philadelphia was put in one year ago last summer and was something like a mile in length. The projectors of the road had previously visited this city and we made them familiar with our methods of construction and our various appliances; but they expressed the conviction that our expenditure of money had been too great, and they endeavored to construct an equally effective road at a cost of about half the money.

"Their first construction cost, I am told by their engineer, something in the neighborhood of \$146,000, and it proved an utter failure. It was taken up and thrown away. Last season the same company constructed from twelve to sixteen miles of cable track, which was in some respects an improvement on the first experimental mile, put in a year before, but the construction was altogether too light, and had no ability to resist the lateral pressure of frost, which is simply enormous. If our construction here had been made in the same way it would have given us even more trouble than they had, as our frost goes so much deeper and its pressure is so much greater.

"I notice in the papers that the cost of this road is stated to be \$600,000, but it is my impression, received from various sources, that the expenditure was much greater—probably over a million. This construction had no ability to resist the great

lateral pressure, and as soon as the frost came the slot closed. The engineer of the construction told me that they had taken up the pavement, inserted wedges in the slot, and forced the slot open, and had attempted to hold it open by inserting bolted rods between the slot-iron and the stringers upon which the rails are placed. But this afforded only temporary relief, for as soon as the temperature changed again the slot not only closed but drew the rails themselves toward the slot, so that in operating the cars with horses a large number of wheels and axles on the cars were broken.

"This information," said Superintendent Holmes, "was given me by the President of one of the companies in Philadelphia. We have never had the slightest trouble with our construction here in Chicago in the way of the slot closing, as we made special provision to guard against that, it being the thing to fear most. That feature of the construction was made perfectly secure. As is known to all the citizens of Chicago, the iron-work and the concrete which incloses the iron-work were made with special reference to intense frost.

"Statements have been made in the Eastern papers that the cable line here had been troubled with its slot closing up. These reports are wholly without foundation. The only thing that could have given rise to any such impression was the fact that in the construction of the road we received a few carloads of slot iron that had a ragged edge from imperfect rolling. The parties who furnished this iron instructed us to return it at their expense, but we had 1,500 men at work, and the streets torn up, and we could not afford to wait for new shipments of iron, but were obliged to use this, purposely placing the slot-irons, closer together than a finished state would permit, and afterwards chipping off the ragged edges. That was all, or nearly all, that was done before the cars commenced operating. A few spots were finished afterward, but with this exception there has been nothing to give any impression whatever that our slot had ever closed on us.

"There have been a few cases, especially in the early days of the system, when inexperienced drivers have held on to cables too long and thereby cut them, but experience has relieved us of all trouble of this sort. We have had two cases when minor portions of the machinery have proved of insufficient strength under the intense strain at times brought to bear upon them, but we have strengthened these parts by adopting much heavier machinery. In February one section of this heavy machinery was placed in position and now we have received the last of this heavy machinery. When occasion arises, or as soon as it is possible to do so, we shall remove the last portion of light work and insert this heavier construction in its place.

"The last winter has been an unprecedented one in severity of frost and volume of snow, but it has been of use to us in enabling us to discover wherein were the weak points of our construction, and so completely remedy them. The weak and imperfect construction adopted in Philadelphia should not weigh against the true merits of the cable system.

"It is absolutely necessary," said Mr. Holmes, in conclusion, "that the construction should be strong and stable to insure comfort to the public and to operators. When this is done there is no system yet devised which will compare in excellence with the cable system for transportation in large cities."

—*Ex.*

FUEL OF LARGE STEAMERS.

An English contemporary, in replying to a correspondent who asks how many tons of coal a large steamship consumes in a day, quotes the following facts from a pamphlet entitled "Bottled Sunshine," issued by T. B. Purnell & Sons, of Exeter: "Ocean steamers are large consumers of coal. The Orient line, with their fleet of ships running to Australia every two weeks, may be mentioned. The Steamship Austral went from London to Sydney in thirty-five days, and consumed on the voyage 3,641 tons of coal; her coal bunkers hold 2,750 tons. The steamship Oregon consumes over 330 tons per day on her passage from Liverpool to New York; her bunkers will hold nearly 4,000 tons. The Stirling Castle last year brought home in one cargo 2,200 tons of tea, and consumed 2,800 tons of coal in doing so. Immense stocks of coal are kept at various coaling stations, St Vincent, Madeira, Port Said, Singapore, and others; the reserve at the latter place is about 20,000 tons. It is remarkable with what rapidity these steamers are coaled; for instance, the Orient steamship last year took in over 1,100 tons at Port Said in five hours.—*Ex.*