Cast Glass Rails.

Friedrich Siemens, of Dresden, has succeeded in casting glass in the same way as metal is cast, and obtaining an article corresponding to cast metal. This cast glass is hard, not dearer in production than cast iron, and has the advantage of transparency, so that all flaws can be detected before it is applied to practical use. It will be much less exposed to injury from atmospheric influences than iron. The process of production is not difficult, the chief feature being rapid cooling. The hardness and resisting power of this cast glass are so great that experiments are being just now carried out at the Siemens glass foundry at Dresden with the purpose of ascertaining whether the material could be employed for rails on railways.

A sample of these glass sleepers recently tested at the Anderston Foundry Company (Limited), Glasgow, resisted a falling weight of 3¾ cwt., falling upon a rail placed upon the sleeper set in sand ballast, commencing at 6 inches and rising by succeeding increments of 6 inches up to 9 feet 6 inches—the *maximum* elevation to which the test ram could be elevated—without effect until the blow had been repeated for the sixth time. Cast iron sleepers are expected to withstand a similar test up to 7 feet only. The cost of glass sleepers will be considerably less than that of either cast iron or steel, while the material is practically imperishable as regards climatic changes and influences, or the ravages of such insects as the white ant.

FLOODS IN INDIA.

West of the River Jumna, the Northwestern State Railway runs parallel to the Himalayas for some hundreds of miles, and crosses all the five rivers of the Punjab. The country between the hills and the railway is more or less subject to floods throughout the whole of this distance. In the neighborhood of Umballa there are several mountain torrents whose wide sandy beds are dry for nine months of the year, but during the remaining months, whenever there is heavy rain in the lower ranges of the Himalayas, they become broad, rapid rivers, which are eventually lost in the sands of the Bikanir deserts.

The railway crosses the beds of these streams on iron girder bridges, apparently wide enough to carry off the waters of any flood. On the 3d of July an extraordinary spate came down the Markunda and other neighboring rivers between Umballa and the Jumna, and as the bridges were unable to pass all the water, the floods spread all over the country. The railway embankment, which is generally eight or ten feet high, acted as a dam and kept the water back, so that it accumulated, and at last ran over the top of the bank in places. Wherever this happened, a breach in the embankment was invariably caused. Some of the smaller bridges, and culverts, too, were washed away, and holes twenty feet deep scoured out in the places where they had been. In one place there was an almost continuous breach in the railway for more than a mile; ten miles further on there were others very nearly as extensive, and lesser breaches between these two points. But, although the bank was gone in so many places, the rails, with their cast iron sleepers, were left hanging in festoons in the air, and were only actually broken in one spot. Of course, all running of trains was suspended; but the mails had to be got through. The sketch represents the English mail *en route* for Simla being carried on trollies over the damaged portions of the line. The railway was not the only sufferer; the Grand Trunk Road, which runs parallel to it, was destroyed in places, and many villages were wholly or partially washed away.

To restore through traffic, it has been necessary to construct an entirely new portion of line to one side of the breaches, the repair of which will take a considerable time. The above account is by Captain William Pitt, R.E., who has also furnished the sketch.—*London Graphic.*

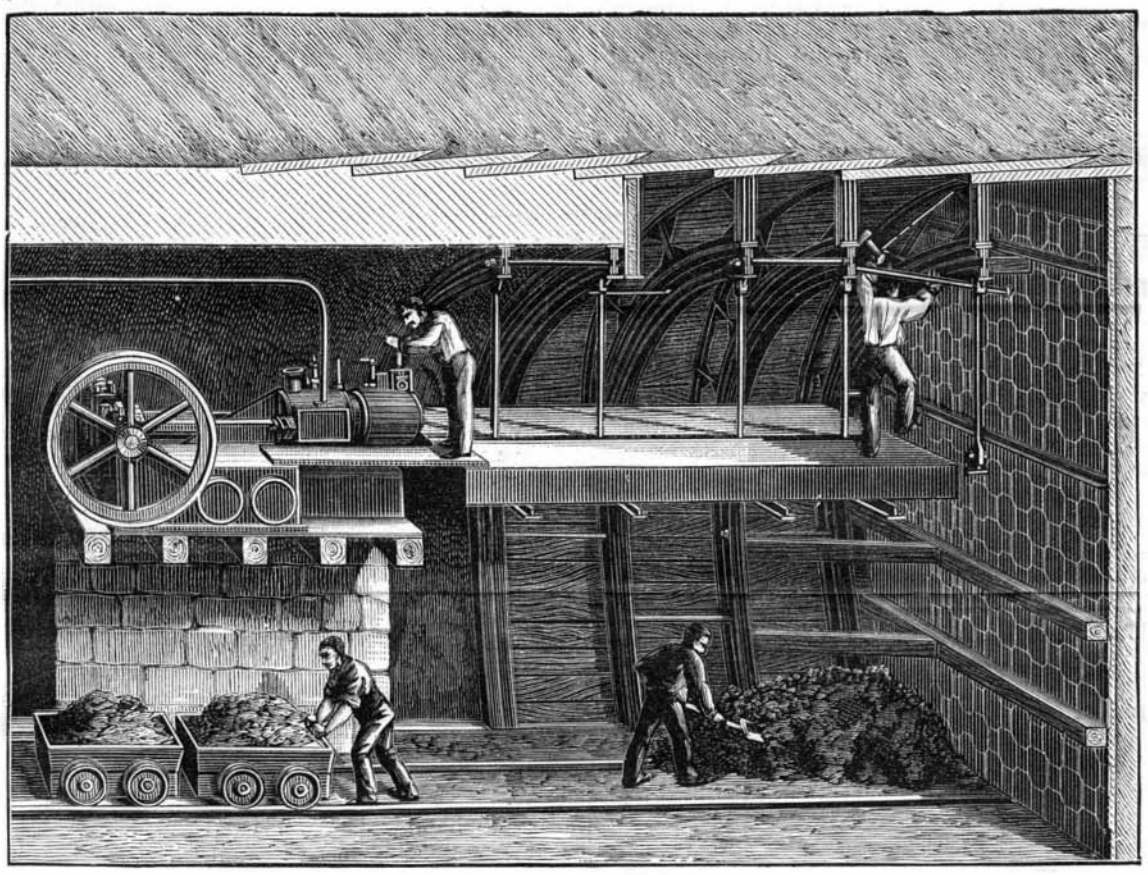


Fig. 1.—TUNNELING BY FREEZING.

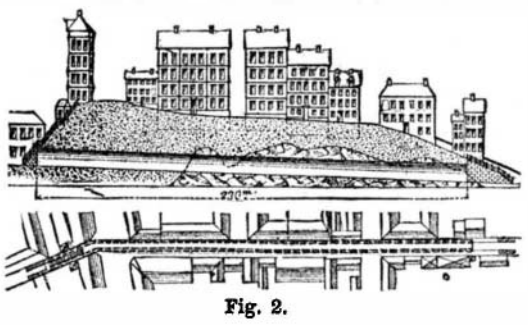


Fig. 2.

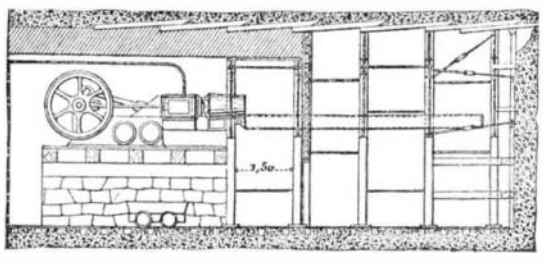


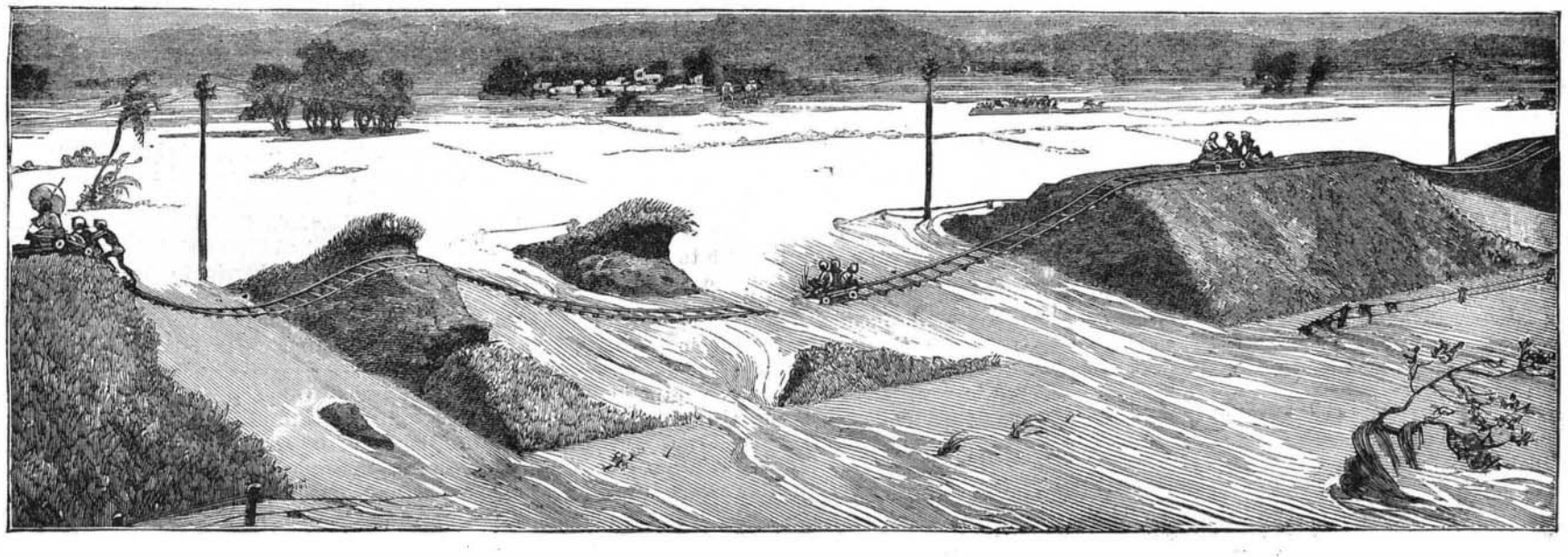
Fig. 3.

TUNNELING BY FREEZING.

Pœtsch's ingenious system of sinking mine shafts through watery earth by freezing the latter is already known to our readers. An attentive examination of the frozen strata having shown that their respective slopes had but little influence upon the total hold of the mass, it was concluded that no special difficulty would be met with in applying this method of the driving of a tunnel. This opinion has held good in practice, and, although merely the principle of the method has been employed in the tunnel that has just been opened at Stockholm (Fig. 1), we have here an interesting example of the practical solution of the question of tunneling in shifting earth. The tunnel in question is designed to unite two quarters of the northern part of the city that are separated by the crest of a hill which renders communication between them particularly difficult. In order to overcome this difficulty, Capt. Lindmark, of the Swedish Engineers, proposed to tunnel the hill. The total length of the work is 755 feet, the width is 13 feet at the springings, and the height 12½ feet under the key. In order to avoid taking possession of private property at the approaches to the mouths, the line was carried in the direction of the axis of a street; but this latter was already laid out and was quite narrow, and in certain parts, especially near the western extremity, the foundations of the tunnel came under those of the houses (Fig. 2). Such a work therefore presented peculiar features, and required the greatest precaution in order to prevent the subsidence of the structures above.

The direction heading at the base of the tunnel was for the most part excavated in granite by means of dynamite. The widening out of the western part of the work met with no serious obstacles, but it was entirely otherwise with the eastern. The ground met with near the mouth consisted of coarse gravel intermingled with blocks of stone and cemented with a clay that became liquid through infiltrations of water, and caused the sand to flow through even the smallest apertures. Moreover, at fifteen yards from the mouth, the line passed under two five-story houses (Fig. 2), built upon the opposite sides of the hill, and at so slight a distance from each other that the archbutments of the tunnel had to be built under their foundations, which latter extended down to within ten feet of the arch.

Mr. Lindmark, in the first place, thought of the method devised by the Austrian engineer Rziha, which consists in supporting the sides of the excavation with two centerings, one consisting of voussoirs of Vignole rails connected by bolts and stays, and the other of cast iron, formed of pieces of double T section, upon



CARRYING MAILS ACROSS THE NORTHWESTERN STATE RAILWAY, INDIA, DURING THE RECENT FLOODS.