now a connecting plate running down between the iron. The rail is steel above, and steel below, with the body of iron. It answers, we understand, perfectly, and its importance to railway companies may be estimated when we say that steel rails of this make will cost only £9 10s. to £10 per ton, or but £2 more than iron. Great economy will therefore be effected in the future working of railways with large traffics, where good iron rails used to be worn or knocked out in three or four months. Extending the life of the rail, as the steel rail does greatly, also means economy in the consumption of coal, and should be another warning to the croakers.—*Herapath's Journal.*

## Tempering Steel in the Lead Bath.

Every person accustomed to heating steel for hardening in the common forge fire, knows how difficult it is to heat evenly any article that has a thick and thin portion, so that the thick part shall be evenly and thoroughly heated without overheating the thin part. Now, if the lead bath, heated to a proper temperature, be used, anything immersed in it, no matter how thin or how uneven the thickness, will be equally heated throughout.

A cast-iron pan will do to make the receptacle of the molten lead of which the bath is composed; but a black-lead crucible is preferable, if it be handled with care to prevent breaking; vessels made of malleable iron, however, are preferable to either the cast-iron pan or black-lead crucible. To prepare the bath, put the necessary quantity of lead in the vessel and bring it to a molten state; continue the heat until it shows a blood-red glow. As lead slowly oxydizes at a red heat, some precaution may be taken to prevent it, and then the loss will be quite small. This precaution may consist of a plate of iron, say about one-fourth of an inch in thickness and laid carefully upon the surface of the lead. where it will be sustained; a hole may be made in the iron in which the articles may be introduced to reach the bath underneath it; or in place of the iron plate, the surface of the bath may be covered with a layer of charcoal in the form of dust, or a quantity of wood-ashes will answer quite a good purpose. The debris and scrapings of the charcoal bin are just the material, and the only cost would be the trouble of collection from the place of deposit.

For thin cutting blades, razors, surgical instruments, springs, etc., this bath is especially adapted. The only care required is to keep the bath at the proper temperature, and see that the articles immersed in it are sufficiently heated. From the lead bath they may be chilled in either water or oil, as may best suit the purpose for which they are intended.

In some kinds of work it is necessary that one end or a certain portion of the article should be left soft. This is generally done by only hardening the part or portion necessary to be tempered, but by so doing much risk is accompanied in the operation by the article cracking at the water-line of the article when immersed, in consequence of the sudden contraction of the chilled article. A much better way is to temper it without regard to the part to be left soft, and then immerse this part in the lead bath and *draw it*, as the term is, to the required state. An instance of this application is the end of steel ramrods for rifles, where the screw is cut for the purpose of screwing on the wiper with which to clean the rifle. The rod is tempered the entire length, and the end where the screw is to be cut is immersed in the molten lead about the depth of an inch and left to cool gradually, and then no trouble is experienced in cutting the screw, which would be impossible or attended with the destruction of the cutting dies. It is sometimes necessary to soften portions of hard-drawn brass wire or steel wire that is used for springs, and to soften the whole spring destroys the necessary elasticity. If the ends of the springs are to be bent or rivited, the lead bath presents the necessary means of softening for that purpose.

We recollect having seen a process of tempering the steel springs of crinoline, by first running the flattened wire from a reel through the fire, and then into a reservoir of oil to harden it, and then passing it direct from the oil through a bath of molten lead. A reel and winch was the means used to draw the spring from the reel on which it was wound direct from the rolls through the triple baths of fire, oil, and molten lead; the judgment of the operator regulating the heat of the necessary fires and reeling it faster or retarding it as was required for the necessary temper.—*American Artisan.*

## Staveless Barrels.

The *American Artisan* reports the following in the proceedings of the Polytechnic Association of the American Institute:—

"Mayo's patent staveless barrel was exhibited, and the mode of constructing it explained. It was made of thin slips of wood, similar to shavings, and laid up in form of cylinders; the slips crossing each other at right angles and running around a certain portion of the circumference of the barrel in a spiral manner, and fastened with glue and water-proof cement. This barrel was intended to hold coal oil, kerosene, gasoline, alcohol, etc., and had given proof of its efficacy, 12 or 14 thicknesses of the thin shavings-like slips being sufficient for the thickness of an ordinary barrel. Hoops were not necessary to hold the barrel together, but in some cases hoops were fastened to the inside circumference to strengthen it where much rough usage was anticipated. The inventor stated that a barrel had been filled with gasoline for several months, and it had not yet leaked a drop, there was no smell of oil, and it was almost impossible to tell that it contained gasoline. The weight of the old style of barrel is about 80 or 90 lbs., but this one weighed only 50 lbs. They had been subjected to a pressure of five tons across the bung, and a hydraulic pressure of 35 lbs. to the square inch, and did not give way. They were in fact about as strong as a steam boiler of the same size. They could be made for $2 50 per barrel. The inventor believed it to be the first great improvement in barrels, as no radical change had been made in a thousand years.

## Monster Iron Shaft.

A correspondent of the *Globe* says:—Saturday last witnessed the successful working of a monster iron shaft, which Messrs. Gooderham & Worts have introduced into the water-wheel driving their flour-