tion, those that are soft can be detected and put aside, and heated again with the next batch. Dies may be put in a box, and hardened after the same manner. I have found red-hot lead to be a convenient thing to heat many things in; but to be constantly employed at it, I believe to be very injurious to health. I have been employed at it for weeks together, and have felt very bad effects from it, and I always avoid using it except in cases of necessity. Still, there are many things that can be accomplished better by heating them in lead than in any other way; such things as long fluted rimers, and various other things that are a great length, for they will always keep straighter by heating them in lead to what they will if they are heated in a common furnace. If the article be very long, it must not be put into the lead too suddenly, or it will be sure to go crooked, for plunging a cold piece of steel too suddenly into red-hot lead causes it to go crooked, the same as if plunged too suddenly into cold water. They should be gradually put into the lead, and gradually into the water, with a little salt in the water to keep it from bubbling, for it is not everything that can be straightened again after it is hard without damaging it, or softening it. Care must always be taken never to have the lead too hot, or the articles will be spoiled, for they will be found to be full of little holes, if closely examined. Before putting the articles in the lead it is necessary to rub them over with a little soft soap, or mix a little black lead with water, and brush them over with it, or plumbers' size, and they will come out of the water clean, without the lead sticking to them. If the black lead is used, they must be dried before they are put in the lead, for the hot lead is likely to fly if they are put in damp. Soap does not require to be dried.

"Any quantity of articles, such as drills, bitts, &c., may be expeditiously hardened by dipping their points in the lead, and cooling them in water; a pair of tongs with long jaws is very convenient for holding a quantity at one time; if the articles are of an unequal thickness, and one jaw of the tongs be made hollow and one flat, a piece of soft wood may be put in the hollow jaw, the tongs will then grip them all; any quantity may be hardened as expeditiously as a single article, if there be sufficient lead. Another thing to be observed is, that the surface of melted lead becomes quickly covered with a skin, which is the effect of the air on the surface, and it wastes the lead so fast that it becomes an object of importance to those who use much to check its formation, or to convert it when formed into the metallic state again. Charcoal converts the dross into metal again; but if a covering of charcoal or cinders be kept on the lead, the dross will not form, for, if it is allowed to form, the lead is not only wasted, but it is a great obstruction in putting the articles in, and likewise in taking them out; lead is an excellent thing in which to heat any long plate of steel that requires hardening only on one edge; for it need not be heated any farther than where it is wanted hard, and it will then keep straight in hardening. But if it is heated all over in a furnace and put in the water all over, it will be warped all shapes and cause a deal of trouble in setting straight, especially to those who are unacquainted with the setting of hardened steel. If it is heated all over, and one edge only dipped in the water, the edge that goes in the water will be rounding, and the edge that does not go in the water will be hollow; this is owing to the steel expanding in hardening, for the steel expanding in hardening causes the edge that goes into the water to get longer, and the other edge being kept out of the water, and still hot, the hardened edge expanding lower pushes the other part of the steel round, causing the edge that is out of the water to be hollow. But if it is heated in red-hot lead, and the edge only that is required hard put in the lead, the other part will be quite cold; and when it is put in the water all over, the hot part will not have sufficient strength in it to alter the cold part, consequently the cold part keeps the hardened part true. The colder the water the more effectually it hardens the steel. Brinish liquids produce rather more hardness than common water, but in most cases common water answers the purpose. Water holding soap in solution prevents the steel from hardening, but as there are many things used in machinery that require to possess the greatest possible degree of hardness, it is necessary with such things to use a saline liquid. Gauges, burnishers, and certain kinds of dies, require to be very hard, also, a file requires a nice, hard tooth. When steel is required to be extremely hard it may be quenched in mercury. But this can only be done on a small scale."

The Corrosion of Boilers.

Nearly all of the large number of boiler explosions, the causes of which are annually investigated by the engineers of the Manchester and Midland Boiler Associations, are clearly found to have occured in consequence of either internal or external corrosion. In the case of locomotive boilers—and they are now exploding sufficiently often to cause considerable anxiety—"furrowing" along a seam of rivets, or rather under the line of an overlap, is found to be the usual malady. In many boilers, especially on those lines where the hydraulic test is regularly applied, "furrows" are discovered in time to prevent explosion. In other instances the plates become "pitted" on their inner surfaces as with small-pox. We have a photograph kindly sent us by Mr. Longridge, of a small portion of the inner surface of one of the plates of a boiler which exploded, with great loss of life, some time ago at Aberaman, South Wales. To compare the pits therein shown with the lunar seas disclosed in Mr. De la Rue's photographs of the moon would not do justice to the former. The iron is eaten away almost everywhere, not uniformly over the whole surface, but in numberless holes. Wherever very pure water is used, or peat water, or water containing sulphur, there is the same corrosion always going on, while, as for furrowing, there appears to be no effective precaution against it. So far as furrowing and other forms of corrosion are concerned, there can be no doubt that wrought-iron is the worst material that can be employed for a boiler. Whether steel better resists corrosion under the same circumstances has not been conclusively ascertained, but in other respects the attempts to employ steel as a material for boil-