steel, remains still suspended near the surface of the metal, in a pasty or semi-fluid condition, until it has either imbibed a sufficiency of carbon from the circumnatant steel, or till the temperature shall have been raised sufficiently to effect its fusion. When this has taken place, and the metal is poured, the ingot will be as perfectly sound as any ordinary casting, but slightly porous at the centre, from the shrinkage of the fluid, which, of course, sets first at the outside of the ingot, in contact with the comparatively cold iron of the mould. If any particles of infused, or imperfectly fused iron remain in the steel, when poured, the ingot will be found full of little cells or cavities, numerous and large, in proportion to the quantity of infused iron present; and as iron of the best quality is the most infusible, it follows that the steel prepared from it is more liable to the *bloom—i. e.*, full of cells or cavities—than cast-steel from an inferior kind of iron. In all cases with a sufficient heat, a perfect degree of sharpness and solidity may be given to castings from fused steel; but the intense temperature required to effect this, with fine cast steel, renders it a matter of experiment more than of practical utility. For the common uses for which cast steel is manufactured, the fusion is sufficient to adapt the ingot for tilting into bars, but insufficient to produce a fine and perfect casting. In the common refinery, or running out fire, an analogous phenomena is observable. A portion of the charge is malleabilised during the operation to a certain extent; and, floating to the surface of the denser and more carbonised metal, it forms the cellular face, so strongly developed in very high blown fine metal. In the blast furnace, where portions of the materials arrive at the zone of the fusion in a state of malleable iron, this iron mingles with the more carbonated pig-iron; and when present in excess, it floats to the surface of each pig of iron, occasioning honeycombs, of a depth proportioned to the amount of malleable alloy contained in the pig-iron. When cast-steel is prepared direct from the ore, the cellular structure is never developed, because the fusion is always homogenous, and there can be no particles of malleable iron present to disturb the consolidation of the fluid steel. When a piece of blistered steel is *first fused*, or liquified, in a small clay crucible, and then allowed to cool down, the surface of the cold metal will be found finely radiated, like a fan, with delicate ridges of steel; whilst the lower side of the ingot will be found full of deep hollows, scalloped out like skulls, and covered with a net-work of arborescent crystalization. When a much higher temperature is applied, and the fusion has become perfect and the division of the metallic particles more complete, the ingot will be found, when cooled down in the crucible, smooth upon its surface and sides, und exhibiting merely the linear edges of its crystalline structure.

From this it is clear, that without a full fusion the steel will not fill up even a heated mould with solidity; and, when perfectly fused and rendered liquid, it will, as far as I have seen, fill a mould with perfect solidity, even if the muold be only lukewarm. Of course, where fusion has barely taken place, and there is now great excess of spare temperature above the point of that fusion, the metal sets so speedily as to render it possible to execute any fine castings with it; and I may observe, that unless cast iron be heated very much beyond its melting point, it will not, more than cast steel, exhibit any degree of sharpness in the mould.

If cast-steel be poured into a shallow mould of cast-iron, and the jet of metal be made to fall continuously in one place, it will be found that the steel has penetrated the iron at that place, and a junction is formed, exhibiting the steel passing through every intermediate state into the cast-iron mould. When the mould is deep, the bottom is protected from the jet of steel by depth of the fluid mass; so that the moulds are uninjured; but, on the supposition that the moulds should be made previously red hot, I am of opinion that the steel would penetrate and unite with the iron of the moulds. This, however, would not prevent the adoption of red-hot moulds of a more infusible substance than cast-iron; but I do not think that the heating of the mould would at all influence the stability of the ingot.

Pig iron is an alloy of malleable iron, white cast-iron, steel, and grey cast-iron; for it is produced on the large scale by a simultaneous fusion of a multitude of pieces of iron-stone, whose metallic contents are existing in all those various states when they arrive at the zone of fusion above the blast; and of all the pig-irons of commerce, that which contains the greatest proportion of grey cast-iron will be the best suited for fine castings; but it will be also the weakest; whilst deeply honey-combed iron, containing a large alloy of malleable and steely iron, will prove suitable only for large castings, and where great strength is required.

The Scotch iron is a strong instance of the correctness of these views; for the iron-stone is rich, homogenous, and easily carbonated; the furnaces are capacious and lofty; and the hot-blast stoves are very effective and powerful; hence, the materials are nearly all carbonated before fusion, and a weak, but fluid cast-iron is produced, free, or almost free, from malleable alloy.—[New York Farmer and Mechanic.

MILK CLEAN.—The first drawn milk contains only 5, the second 8, and the fifth 17 per cent. of milk.