



LIII. Description of a new method of forming crucibles

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equal to the expansion occasioned by 3° of Fah. It is not necessary that the scale of the lactometer should extend to 35° below 0, as in fig. 1. In some of the instruments which have been made for the markets, the scale has only reached to 25° , which seems quite sufficient.

I have found a considerable degree of uniformity in the density of a number of specimens of new milk, which I examined. I have made several experiments in the hope of being able to apply a similar instrument to detect the frauds practised in the sale of new milk; but I fear this is impracticable, because both water and skimmed milk are employed to adulterate new milk; and as the one is lighter and the other heavier than new milk, there would be no difficulty in so proportioning both, as to make the adulterated correspond with genuine new milk in density.

Royal Cork Institution, Sept. 17, 1821.

LIII. *Description of a new Method of forming Crucibles.* By
Mr. CHARLES CAMERON, Glasgow*.

THE Dutch have long enjoyed an almost exclusive monopoly in the manufacture of the small melting-pot, or clay crucible, used by the jeweller and silversmith. The English potter has hitherto failed in imitating those imported from Holland, either in point of shape or quality, in sustaining the sudden transitions of temperature to which they are subjected. In consequence of their superiority, they were an article of great interest to the jeweller during the period of the late war; sometimes they could not be procured, and at other times they sold at five and six times their present price. The English melting-pot was then in request from necessity; it is now entirely out of the market. About two years ago I was led, by a curious train of reasoning, to conceive the practicability of forming crucibles similar to the Dutch, by a simple method, that of moulds made of sulphate of lime or stucco, which would easily give any required form.

I established a small manufactory of them, and carried it on for some time; but owing to particular circumstances, I was obliged to relinquish it, after it had arrived at a state of perfection. Having found it to be the opinion of my friends that the process should not be lost, I have been induced to draw up the following account of it for the Edinburgh Philosophical Journal.

For each of the different sizes of the crucibles, I formed ten or twelve dozen of moulds of stucco, burnt and powdered in the usual manner. For the first mould of each size, I formed a piece

* From the Edinburgh Philosophical Journal.

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of soft pipe clay into the shape of the intended crucible, and laid it with its mouth downwards on a flat surface, and inclosed it with a cylinder of white-iron, distant about half an inch from the angular points of the crucible, and about an inch and a half higher than its bottom; then mixing the stucco with water, poured it into the cylinder. When the stucco was sufficiently set, I removed the white-iron, picked out the clay, and dried the mould; I then squeezed soft clay into the mould, which on standing a few minutes, easily came out again. It was inclosed in the cylinder, and stucco poured round it, which formed a second mould, continuing to do so until I had procured the number wanted. They were then all put into a stove, and completely dried ready for use.

In the preparation of the fire-clay for the crucibles, I followed precisely the same process used at the potteries, by mixing it with a very large quantity of water, and putting the whole through a No. 9 silk searce. On allowing the whole to stand a few hours, the clay subsided, and in pouring off the clear water, I procured the clay or slip of the consistence of thick cream. On weighing a gallon of it, I found the proportion of clay it contained, and added sand to the whole, in the proportion of seven of sand to seventeen of clay; I then stirred and mixed the whole completely, when it was ready for use. I next took my moulds, previously dried, and arranged them in parallel rows on a table, and successively filled them with the prepared slip. By the time I had filled four or five dozen, I returned to the one first filled, and began alternately to pour the slip out of them, leaving a small quantity unpoured out, which subsided, and gave the requisite thickness to the bottom. In each of the moulds so filled, a crucible is completely formed by the abstraction of the water of the slip, in contact with, and adjoining to, the porous substance of the stucco mould. The crucible will be either thicker or thinner in proportion to the time the slip has remained in it. Five or six dozen will not require more than fifteen minutes in being formed. The moulds with their contents are then removed to a stove, placed on their side and built one above the other. In a short time, from the contraction of the clay, the crucibles easily part from the moulds, and are removed by introducing the finger into them. The moulds are allowed to remain in their situation until the water they had absorbed is completely evaporated, when they are again ready for refilling, and will last for years. The crucibles remain in the stove until dry, after which they are burned in a kiln in the usual manner.

The process is simple, and combines the advantages of forming them with great facility, and giving them the required shape,
which

which cannot be accomplished at once on the potter's wheel. One man and a boy are capable of making from ten to twelve hundred per day. The principle is peculiarly adapted for the formation of a number of chemical apparatus, muffles, retorts, tubes, &c.

LIV. On Refraction. By J. READE, M.D.

To Dr. Tilloch.

SIR, — A VERY common experiment, no less interesting than surprising, is shown in lecture-rooms for the purpose of illustrating the theory of refraction. A piece of money is placed at the bottom of an empty basin, the experimenter retiring until the edge intercepts the object: an assistant then pours in water; the piece of money seems to rise over the edge, becoming perfectly visible and well defined. This experiment seldom fails to surprise the audience, handed down from one generation to another, even from the days of Aristotle; yet I am led to believe the real cause is little understood. Mr. Harris gives the following explanation in his *Optics*, page 25:

"Hence (says this writer) we have the common phenomenon of a shilling or other object placed in an empty vessel, appearing to be elevated higher and higher as the vessel is filled with water. Suppose the vessel empty, B K its side, and Q the object at the bottom; if the eye be at c, the object will be hid by the side B K, but by filling the vessel it will become visible and be seen at G; the ray Q B being refracted or bent into B c; and if the eye be so placed as to see the object at Q when the vessel was empty; while it is filling the object will appear to rise gradually in the line Q G. Hence the piece of money appears one quarter nearer the eye than it really is: and on the same principle a river is one quarter deeper than it appears. $Q A : G A :: 4 : 3$." Independently of those experiments, there are insurmountable objections to this reasoning. How can any bending of the rays of light bring the object nearer to the eye? If we bend a piece of iron wire, we certainly shorten the length it extended; but if the rays of light were so bent, they would fall short of the object: besides, if the rays were bent at B, on passing from water into air, a tube bent in the same direction should enable us to see the object; which is never the case. However, it is unnecessary to bring forward more objections than the following experiment.

