LVII. AN INEXPENSIVE FURNACE FOR ASHING FOOD AND EXCRETA IN PORCELAIN CRUCIBLES.

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IN connection with metabolism experiments in my laboratory it has been required to incinerate numerous samples of about 100 g. of food and excreta with a view to the determination of calcium and phosphate in the ash.

Large platinum basins and an electric muffle being unavailable, the little furnace described below was improvised. It has proved satisfactory and may help others to get over similar difficulties.

The ashing takes place in a large porcelain crucible and the furnace is constructed of simple materials available to any laboratory.

The requisites for combustion in porcelain are

(i) uniform temperature well below that sufficient to fuse the ash or the glaze, or to vaporise any constituent of the ash which it is proposed to determine;

(ii) adequate air supply.

From the sketch, which is drawn to scale, the principle and construction of the furnace will be obvious.

The crucible is surrounded by a short length of so-called asbestos flue-pipe 5 ins. in diameter. This pipe is made of a mixture of asbestos and cement. It is a common article of commerce and procurable in various sizes. At one-third of its length, holes are bored to support three pieces of $\frac{3}{16}$ " iron rod, inserted so as to furnish a triangle on which the crucible rests.

Below the crucible is a solid rose burner and below this a diaphragm of metal resting on three pins and supporting a ring of asbestos.

Half an inch above the crucible, also resting on three pins, is a disc of silica $\frac{1}{2}$ " thick with a central hole¹.

The hot gases thus completely enclose the crucible, and the roof, floor and sides of the furnace attain a uniform bright or dull red heat as required. The top of the rose burner also becomes red hot but the stem is kept cool by the draught of cold air.

To economise heat the furnace is surrounded by a thin metal cylinder (a large tin with the bottom removed) leaving about $\frac{1}{2}$ " air space between, and

¹ Made for me by the Thermal Syndicate, Walsend-on-Tyne, for a few shillings each.

the tin is wrapped around with asbestos. This outer insulation is fixed to the furnace at the top and bottom by a ring of asbestos packing and secured by small stove-bolts and nuts.

On the top is placed a piece of "Poilite" with a central hole, for further insulation.

It is important to keep to approximately the proportions shown to obtain a satisfactory draught.

The furnace is supported on a tripod stand with circular ring by three projecting pins (copper rivets).

The arrangement satisfies the first requirement stated and with a surprisingly small gas flame, once the furnace is heated. It does not, however, supply oxygen, for the crucible is enveloped in the products of the combustion of the gas, diluted with air. To secure a supply of oxygen, a silica tube of about 1 cm. bore is inserted from above until within about 1 cm. of the ash and a steady current of air supplied from a Bunsen filter pump at the rate of 1-2 litres per minute. This gives a current at the mouth of the tube of 25-50 cm. per second. The rate of combustion is almost entirely dependent on the volume of air delivered. A brisker current than that mentioned above is permissible with most materials.

The silica tube is joined to a piece of glass tubing, bent to an elbow, by a metal tube with asbestos packing. It is held in position by a clamp and retort stand.

To adjust the air supply it is useful to bubble through water and control the rate by counting the bubbles. Oxygen can be used instead of air provided there is little carbon left, otherwise the action is too fierce and melts the mouth of the silica tube. The preliminary burning is best done without the silica roof to the furnace as it can be more easily controlled.