All the children were fed on the same kind of milk, and given approximately the same quantities per day. This milk was not a single cow's milk but a milk prepared by the "Gaertner Mother Milk" method from the average milk of a large number of cows, and care was taken to have the milk as near as possible of the same composition. The analysis of the milk was approximately

| | Per cent. |
|---|---|
| Fat | 3.05 |
| Casein | 2.09 |
| Lactose | 6.00 |

Specific gravity, 1.0275.
Reaction, faintly alkaline.

The milk was sterilized perfectly and did not become sour after standing exposed for three days.

Each child consumed from one to one and one-third liters daily and hence ingested

| | Grams. |
|---|---|
| Fat | 30.5 to 40.67 |
| Casein | 20.9 to 27.87 |
| Lactose | 60.0 to 80.0 |

Cases I and II were well cared for throughout the investigation and the results obtained may be considered as reliable as possible from such cases. The others are given to show the range of results obtained, but from reasons beyond the control of the investigation, modifying influences were present; and, while the analytical results are individually correct, the connection between the food ingested and the excreta cannot be traced.

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## ELECTRIC FURNACES FOR THE 110-VOLT CIRCUIT.[1]

By Nevil Monroe Hopkins.

Received August 29, 1898.

It occurred to the writer in wiring a couple of experimental arc lamps across the feeders of an incandescent lighting system, that a laboratory electric furnace could be operated on a series carbon plan, without disturbing the protecting fuses of the circuit. The idea of focusing a pair of arcs within a small crucible, or furnace, using only the amount of resistance located in the tops of typical series lamps, proved, however, to be unsatis-

[1] Read at the Boston meeting of the American Chemical Society, August, 1898.

factory, the current absorbed becoming abnormal, upon introducing a charge for fusion, when its character embodied fair electrical conductivity. To obviate this difficulty, as well as to compensate for the lowering of resistance due to eddy currents between the poles when run in combination with a charge rich in carbon, or graphite, as in the making of calcium carbide, a third pair of electrodes was placed in series, together with a variable rheostat in place of the resistance wire of the lamps. With this arrangement, calcium carbide was readily prepared on a laboratory scale, using only a twelve ampère fuse wire in each leg of the feeding conductors, and allowing the separation of the electrodes through a distance of three and one-half inches. The charge of lime and coke was finely ground together in an iron mill before feeding into the furnace, insuring a homogeneous body. It may be of interest to state in connection with this work that lime and charcoal are poorly adapted for the purpose, the charcoal, because of its floury nature, oxidizing rapidly away from the lime without combining with it. Fig. 1 illus-

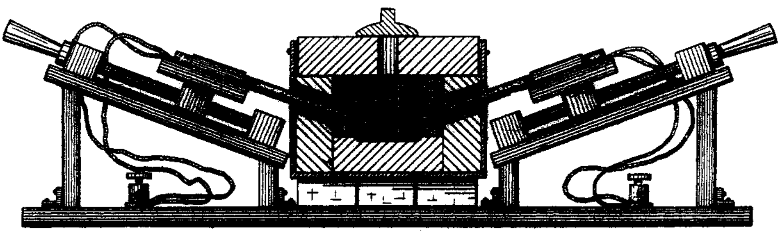

FIG. 1.—Elevation of "Series Carbon" Laboratory Electric Furnace.

trates the "series carbon" furnace in elevation and partial section, showing a simple construction. Fig. 2 gives a plan view

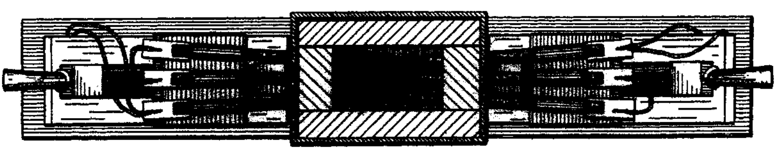

FIG. 2.—Plan View of Furnace with Cover Removed.

of the apparatus with the cover of the furnace proper removed. This furnace, which consists of an iron shell, lined with fire-clay, should not be over twelve inches long if intended for use with ordinary electric light carbons, because of their limited reach. The screw mechanism of this "plant" is readily put together by cutting into sections a large furniture-maker's clamp, using the unthreaded portions for the end bearings, and the two threaded sections for the center pieces, which travel back and forth. The carbon electrodes are conveniently mounted on a block by means of tightly-fitting brass tubes, attached in turn with staples or "straps" and screws. Contact is made with the ends of the carbons by pushing brass spring jacks under their ends, to which the connections are soldered. These pieces of spring brass allow of the rapid adjustment of the carbon pencils, or their removal when too short for further use. To start the furnace, when properly connected, it is necessary to feed the electrodes into the furnace until they are all in good contact, and strike the wooden incline planes with a mallet, which causes the ends of the carbons to vibrate or rub together, and make good contact. When the arc has once formed the furnace may be handled like an ordinary single carbon equipment. The method of wiring is given in Fig. 3, where M represents the

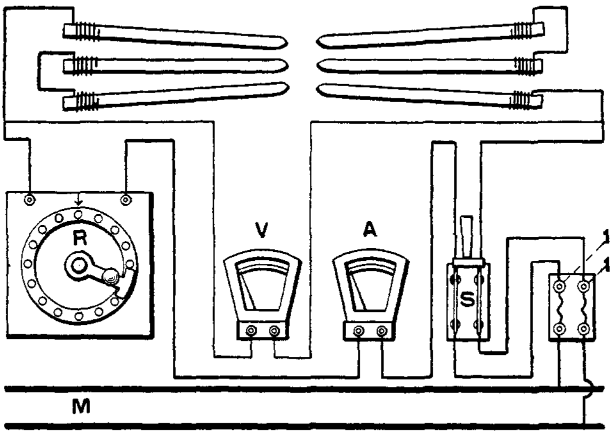


FIG. 3.—Diagram of Connections with 55- or 110-Volt Lighting Circuit, with Ammeter and Voltmeter Arranged for Studying the Behavior of Bodies within the Arc.

main feeders, with a fuse block connected at the right, carrying a pair of twelve ampère fuses. The knife switch S is an important feature, and should be within easy reach of the furnace. The ammeter A and the voltmeter V are included as a matter of interest, and afford a ready means of watching the behavior of different bodies with the arcs. The variable rheostat, R, completes the equipment, which must also be in easy reach of the furnace. In order to avoid annoyance from intermediate fuses, the apparatus should be connected, as near the meter as possible, if the current is sold on this plan. Should one of the twelve ampère fuses melt out, it should be replaced by another of the same capacity, and a little more resistance put in by means of the variable rheostat. Of course, fifteen and twenty ampère fuses may be used if desired, the twelve ampère size being about the smallest for the fusion of compounds possessing carbon as one of the ingredients. Should the variable rheostat at hand prove of too low a resistance for the preservation of the twelve ampère fuses, a second rheostat may be placed in series with it, although with the triple arc arrangement this will seldom be necessary. Fig. 4 illustrates a method for using a sin-

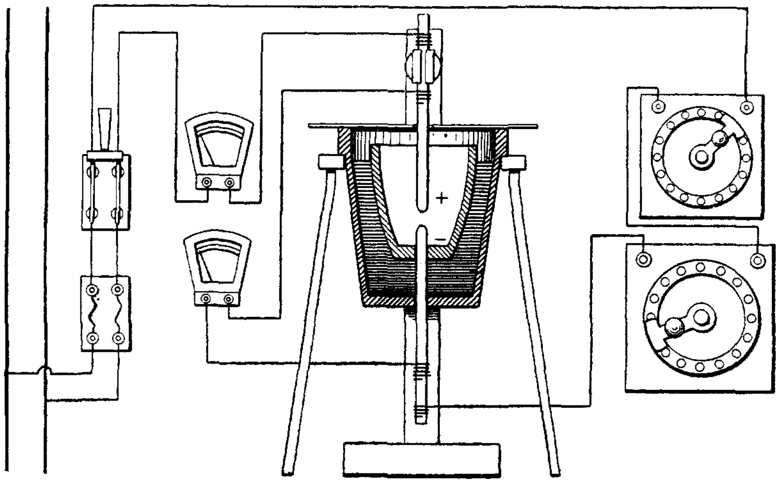


FIG. 4.—Method of Using Single Carbons for making Alloys and Small Fusions. 55- or 110-Volt Circuits.

gle pair of carbons for making alloys and other small fusions. Here, at least, two large rheostats will be necessary, and fuses of larger capacity must be employed. The small crucible is drilled through the bottom, receiving the lower electrode with a tight fit. The outer casing of the furnace in this instance consists simply of a large flower-pot filled in with some poor conductor of heat. The ammeter gives the total current absorbed, and the voltmeter the electromotive force at the arc. With this simple arrangement, copper and brass are easily melted, as well as iron and steel. As to the adjustment of the carbons, it is only necessary to feed the upper one down a fraction of an inch every two or three minutes. Should rheostats not be at hand, a bank of thirty-two C. P. lamps arranged in multiple and joined in with the furnace, answer the purpose for smaller fusions, and for metals possessing lower melting-points. By using ten 32 C. P. lamps in parallel, a good arc may be maintained, sufficient for small reductions, etc. Should three of these "flower-pot" furnaces be placed in series, the principle of the large furnace will obviously be brought into play, if some means is devised for controlling the upper carbons simultaneously.

## ON TETRAPHENYLMETHANE.[1]

BY M. GOMBERG.

Received August 29, 1898.

ABOUT a year ago[2] I reported a method by which small quantities of tetraphenylmethane were obtained, a substance which it had been proved impossible to prepare by the usual reactions.[3] The method consisted in oxidizing triphenylmethanehydrazobenzene to the corresponding azo-compound, and heating the latter to 110°–120° C. The reactions can be summarized by the following equations:

$$(1)\quad (C_6H_5)_3CBr + 2C_6H_5NHNH_2 = (C_6H_5)_3C.NH.NH.C_6H_5 + C_6H_5NHNH_2.HBr.$$

$$(2)\quad (C_6H_5)_3C.NH.NH.C_6H_5 + O = (C_6H_5)_3C.N:N.C_6H_5 + H_2O.$$

$$(3)\quad (C_6H_5)_3C.N:N.C_6H_5 = N_2 + (C_6H_5)_3C.C_6H_5.$$

Unfortunately, the yield was very small, and even then the substance could be obtained only with difficulty.

The work has since been subjected to a revision, but with no better results in so far as the yield of tetraphenylmethane is concerned.

1 Read at the Boston meeting of the American Chemical Society, August, 1898.

2 *Ber. d. chem. Ges.*, **30**, 2043, *1897*.

3 Haemilian, *1874*: *Ber. d. chem. Ges.*, **7**, 1209; Friedel and Crafts: *Compt. rend.*, *1877*, 153; *Ann. chim. phys.*, *1884*, **1**, 497; E. and O. Fischer, *1878*: *Ann. Chem.* (Liebig), **194**, 254; Magati, *1879*: *Ber. d. chem. Ges.*, **12**, 1468; Schwartz, *1881*: *Ber. d. chem. Ges.*, **14**, 1523; Waga, *1894*: *Ann. Chem.* (Liebig), **282**, 330; Weisse, *1895*: *Ber. d. chem. Ges.*, **28**, 1537.