

**SUPPLEMENT TO A
HANDBOOK
OF CHEMICAL
MANIPULATION**

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Supplement to a Handbook of Chemical Manipulation by C. Greville Williams

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BY
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INTRODUCTION.

In the Preface to the original work I remarked that "Chemistry is doubtless in a transition state;" but I think that, at that time, few chemists were aware of the astonishing rapidity with which its whole face would be changed. Thanks to the profound sagacity of a resolute band of workers and thinkers, an almost chaotic mass of facts has been systematized and arranged, so that we may now be said to be rapidly on the way to that chief end of research—a complete theory. But to build a complete theory presupposes an equally complete knowledge of the constitution of substances, which can only be obtained by rigorous analytical and synthetical investigation. This involves the discovery of an immense number of new substances, all of which require to have their products of decomposition studied; and in doing so fresh substances are discovered, and so on almost *ad infinitum*. If processes were not shortened without loss of precision, even the most energetic investigators would find themselves unable to overtake the mass of labour lying before them. New methods have therefore to be devised; and it is with the view of placing a few of the more important of these before the Student that this Supplement has been written.

I have found it very difficult to determine what to select and what to reject, especially as the space at my disposal was limited. It is hoped, therefore, that those who think I have given too much attention to some subjects and too little to others will see

how impossible it is in so few pages to introduce all that I could wish.

Fortunately for the student of the present day, he is not in the position of the chemist at the time the original work was written. Apparatus of every description can be obtained cheaply and economically. In fact some of the catalogues of the principal English and Continental instrument-makers are almost encyclopædic in their completeness.

At the outset I was placed in a dilemma. Should I sacrifice advance to uniformity, or uniformity to advance? It did not take me long to decide in favour of the latter. I have therefore, in this Supplement, used the modern notation and nomenclature—first, because I believe it to be nearer the truth than the old; and secondly, because my experience of the intelligence of the students of the present day convinces me that they will, at a glance, be able to convert the old formulæ of the original work into the new.

Once more I must apologize for omissions; but where I have not been able fully to describe some new and valuable manipulations, I have at least given references to the works where they may be found.

Much of what is contained in this Supplement belongs rather to Physics than Chemistry; I am too profoundly impressed with "the connexion of the physical sciences" to allow this to trouble me. A chemist who is no physicist, or a physicist who is no chemist, is, in the present day, an anomaly.

SUPPLEMENT.

FURNACES.

Since this work was written, great changes have been effected in the apparatus used by chemists for obtaining high temperatures. Instead of using brick or fire-clay furnaces, which take up much space and require vigilant attention, all the ordinary operations of the laboratory may now be performed with gas. Mr. J. J. Griffin, of Garrick Street, Covent Garden, London, and Mr. Thomas Fletcher, of Muscum Street, Warrington, have invented so many contrivances that it is difficult to make a selection from them. The student should procure Mr. Griffin's 'Chemical Handicraft' and Mr. Fletcher's Catalogues, where he will find all that he is likely to require, and the prices are extremely low.

Fusions at moderate temperatures.—Mr. Griffin has constructed a gas-furnace which will melt 30 lbs. of lead, or 24 lbs. of zinc, with a very small consumption of gas. The arrangement is so contrived that the pot of melted metal can be used as a bath.

Fusion of Silicates.—Another of Mr. Griffin's gas-furnaces will fuse 1000 grains of anhydrous carbonate of sodium in ten minutes. I can speak confidently of the extreme usefulness of this arrangement, as I have used it constantly, for months together, in the analysis of emeralds and beryls.

Fusions at high temperatures.—Mr. Griffin has also constructed a furnace for operations at a white heat, which leaves little or

nothing to be desired. The power of these furnaces is extraordinary. One which only consumes 20 cubic feet of gas per hour, and having a chimney only 4 feet high, will melt half a pound of cast iron in 35 minutes from the time of lighting the gas.

Mr. Fletcher has also a small furnace which, with a gas supply-pipe of only half an inch diameter, will melt silver in three minutes, cast iron in eight minutes, and cast steel in twenty-five minutes.

At page 20 of the original work a process is mentioned for the preparation of nitrite of potassium. The nitrites are now very largely employed in commerce in the preparation of certain colours. The sodium salt is that always used, and it is generally formed by the method of M. A. Girard, which consists in fusing at a low red heat nitrate of sodium with the sulphite of that metal. The sulphate produced in the reaction is removed by crystallization.

Cupellation.—Furnaces for heating muffles by gas can now be obtained, and are exceedingly convenient in many operations.

Furnaces for heating Platinum Crucibles.—It is to be observed that Remington's and Beale's furnaces are now generally superseded by those invented and sold by Griffin and Fletcher.

Methylated Spirit.—Wherever wood spirit is alluded to as a fuel or solvent in the body of the work, it is to be remembered that methylated spirit is now invariably substituted.

LAMPS.

Lamps for Illuminating the Laboratory.—Where gas cannot be obtained for lighting purposes, I employ a Duplex or Silber lamp. The fuel is kerosene or paraffin-oil.

BLOWPIPE APPARATUS.

In the 'Pyrology' of Lieut.-Colonel Ross will be found numerous contrivances of interest and value to the student. Mr. Fletcher's improved Herapath and hot-blast blowpipes are also of great value.

Foot Blower for Blowpipes.—Mr. Fletcher has invented a blower which for convenience, simplicity, and cheapness leaves nothing to be desired. On working the stop

for the foot at *a* (fig. 1) the air is compressed and acts on a sheet of vulcanized india-rubber; this causes it to expand into a globular form as seen at *b*. The tendency of the elastic material to return to its original size causes a steady pressure upon the air of about ten ounces to the square inch. The blast is exceedingly steady. A net prevents the india-rubber from bursting.



Fig. 1.

Kemp's Regulator for Water-baths, &c.—Several modifications of this useful apparatus can now be obtained from the dealers in chemical apparatus.

OPERATIONS PREPARATORY TO WEIGHING.

Desiccation over Sulphuric Acid.—Where a number of precipitates are to be dried over sulphuric acid, the student will find the apparatus represented in fig. 2 very convenient. It can easily be constructed in the laboratory. The shallow glass pan *a a* contains the sulphuric acid. The disks *b b b* may be made of sheet metal, or very coarse brass gauze or netting. Holes are cut to allow the funnels to be placed in position if sheet metal be used for the disks; if very coarse netting be used this will generally be unnecessary. In the one I employ, the vertical support was

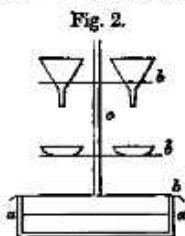


Fig. 2.

made from a piece of brass tube, and it was attached to the disks by soldering. Many different forms of this apparatus can be procured from the instrument-makers. When in use a large glass shade or bell-glass, similar to that used with an air-pump, is placed over all. The bottom edge may be ground to fit the plate of the pump, or a separate plate may be employed if it be not desired to dry the substances *in vacuo*.