of jumping to conclusions in obedience to some phrase of authority, such as: "Now clearly . . ." Various matters on which the physicists of former generations had serious doubts, which they settled by prolonged experimentation and argument, tend to be presented to the war-time student as if they were intuitively obvious. Of course, the transition from original notebook, through research pamphlet, to text-book must always involve an enormous rejection and much compression. But let us hope that, when conditions are favourable, there may be a return to the style in which more of the romance and discipline of past researches and controversies is retained.

The dogmatism of Dr. Champion's otherwise clear and readable text will be remedied, so far as the mathematical aspect of the subject is concerned, if the student will work through the hundred examples at the end of the book. As for the habit of judging experimental evidence, it is well that the universities insist on laboratory work. L. F. RICHARDSON.

PAPER MILL LABORATORY TECHNIQUE

A Laboratory Handbook of Pulp and Paper Manufacture

Incorporating the fourth edition of Stevens's "Paper Mill Chemist". By Dr. Julius Grant. Pp. viii+320+8 plates. (London: Edward Arnold and Co., 1942.) 28s. net.

MUCH of the technique of the paper mill laboratory is specialized and described only in papers distributed throughout an extensive literature: it is therefore useful to have in this single volume short descriptions of the most reliable methods of procedure, and references for those who wish to study any particular subject in detail. Probably because of an attempt to keep down the bulk of the volume, many of these descriptions are unfortunately rather sketchy and it is doubtful whether the mill chemist, approaching a given determination for the first time, could in all cases complete it successfully from the brief instructions given. For the same reason, the text is not very critical, nor does it discuss fully the difficulties which one is apt to encounter in practice; so that in general it conveys the impression that the determinations are easier to carry out than they really are. This book, then, should be regarded not as a substitute for a library, nor as a collection of instructions to be followed blindly on all occasions, but rather as a guide to methods and a pointer to sources of information.

In the first chapter, Dr. Julius Grant describes how the scientific worker in a paper mill has to have a good working knowledge of general chemistry, physics and chemical engineering, combined with a personality capable of winning and retaining the respect and confidence of the mill operatives. He has three main tasks. First, he has to examine thoroughly all new raw materials, and check deliveries from usual sources; unsatisfactory batches must not be allowed to reach the mill, and he will be expected to advise on the best way of utilizing materials which, though not up to standard, are nevertheless still usable. Secondly, he has to check the various stages of manufacture in order to guide

the operatives in their work and ascertain whether the processes have been carried out efficiently. The third part of his duties is to examine customers' complaints; and, where time and resources permit, to conduct original research on paper problems. Certainly a wide field.

The second chapter deals with the processes of isolating reasonably pure cellulose fibres from the raw materials, with sections on 'cooking', bleaching and the evaluation of cellulose, lignin, etc. Non-fibrous raw materials, such as lime and caustic soda, and the recovery of spent liquors, are discussed in the next chapter. Chapter 4 deals with the preparation and examination of standard test sheets made from the 'half-stuff' and the determination of its 'freeness', moisture content, etc. In Chapter 5, the various operations which take place in the beater house are considered, with special reference to the effect of beating, loading, sizing and colouring on the properties of the resulting paper. The final stages in the conversion to paper are described in Chapter 6. Here are sections on the care of the machine wire, drying cylinders and felts, and the examination of 'backwater'. The 'after-processes' considered include calendering, tub sizing, 'conditioning', coating, waxing and gumming. Paper testing by physical methods is described in Chapter 7. The importance of proper sampling and testing at a definite relative humidity and temperature is stressed, and most of the current tests for thickness, strength, colour, gloss, etc., are outlined. Testing by chemical and microscopical means is dealt with in the next chapter, which includes sections on loading and pigments, ash, acidity and pH, metals and acid radicals, cellulose and mechanical wood content, resins, and starch. The main microscopical tests are for fibre identification and furnish, and the determination and identification of dirt particles. The last chapter deals with tests for papers for special purposes, and contains short sections on statistical analysis of data and testing of water and fuel. A number of useful tables are contained in an appendix.

The text is clearly written apart from a few loosely constructed sentences, and there are a few grammatical errors: for example, "to 50 ml. of this are added sufficient ammonia" (p. 45); "papers which must lay flat" (p. 164). How far the use of numerals in text matter is permissible is always difficult to decide, but contractions like "between 2 rolls", "into 3 main categories" (p. 174) are surely unnecessary and ugly, except in abstracts. What few misprints there are seem to occur mainly among the numerals. The mean wave-length of white light is not 0.05 μ (p. 117); for a "narrow spectral range" 10 A., and not 1000 A., is intended (p. 204); and the "160 mm. objective" on p. 246 should read "16 mm. objective". It is unnecessary to give the viscosity of glycerol as 871.700 centipoises (p. 84) when it is to be used for calibrating a simple flow viscometer; three significant figures would have been ample.

The make-up of the volume is good, except in a few places. For example, Fig. 22, referred to on p. 194, is not inserted until facing p. 258, and the reader is given no indication where it may be found. With the general reservation that the book tends to suffer from over-condensation, it can be recommended. One hopes that the day is not far distant when it will again be possible to test butchers' wrapping paper (p. 272) with "slices of beef liver (2 x 4 x 0.5 in.)" ! V. G. W. HARRISON.