a text book for students and engineers. The title itself has been somewhat misapplied as the scope which the book includes is rather limited and does not cover the subject of hydraulics in any way exhaustively. It will be found, nevertheless, to be a concise, well-balanced text supplemented by a collection of very useful data for hydraulic engineers.

The chapters have the following arrangement: Introduction and principles of fluid pressure; liquids in motion; discharge through orifices, weirs, etc.; flow in pipes and channels; pressure of water and application to motors; pumps. The text is supplemented by 143 examples which can be strongly recommended to the student of hydraulics. The illustrations which the book contains are not well drawn, and are lacking in uniformity throughout. Otherwise they are of great value to the text.

The author has made free use of the Calculus, but his deductions have been carefully made and no engineer is apt to consider that he has over-rated its value to the subject at hand.

Practical Locomotive Operating.—By Clarence Roberts, Assistant Road Foreman of Engines P.R.R., and Russell M. Smith, Air-Brake Instructor P.R.R. Published by J. B. Lippincott Company, Philadelphia, Pa. 292 pages; fully indexed; 92 illustrations; 5 inserts. Cloth. Price, $2. Reviewed by Geo. S. Hodgins, Mechanical Engineer, Transcontinental Railway, Ottawa.

This book is a "practical" book written by practical men for practical men. The subjects taken up are those that locomotive enginemen ought to know, and those who take a lively interest in railroad work, ought also to know. In Part I., the classes of locomotives are given, and the processes involved in locomotive operating, the power of locomotives, train resistance and locomotive efficiency are explained.

The processes involved are combustion, the generation of steam, its utilization and the impulsion, by adhesion, of the driving wheels. Some remarks are made about mechanical stokers. The point is clearly brought out, that such a stoker is not intended to surpass hand-firing in the matter of economy, it takes its place, and it is a most important place, when it does work far beyond the physical ability of the fireman to do.

The whole rationale of steam generation is gone into and a table of the properties of saturated steam is given. The authors admit that it is not definitely known how fast heat transfer through the firebox plates takes place, but good practice has at least empirically (that is by trial and experience) found that if the heating surface goes below 60 or 65 times the grate area, heat will be lost, as there will be more than the plates can transfer to the water. If the ratio between the two is much greater, the additional efficiency gained will be too small to compensate for the extra weight and cost. Next comes tractive effort and horsepower. The correct formulas are given and the whole matter is very clearly set forth. The important part played by adhesion is explained. This matter of adhesion is not, as a rule, made to occupy the position that it should have, and that its close connection to tractive effort, entitles it to.

The friction of the locomotive itself receives attention, and train resistance formulas are given and examples worked out. There is one ratio constantly given in technical papers which needs explanation. It is that got by dividing the tractive effort by the heating surface. To many this seems like a meaningless performance, but its value becomes clear, when, as the authors point out, the available tractive effort decreases while the speed increases, because at high speeds the cut-off is early and the mean effective pressure in the cylinders is thereby reduced. Take a given locomotive for example. Its wheels and cylinders remain constant, and the mean effective pressure is the variable. As the mean effective pressure changes, the tractive effort changes also. Several curves are plotted on a diagram and these show how this takes place. When the horsepower is calculated, mean effective pressure and speed are the two variables, and so at the highest speeds the indicated horsepower is a maximum, though the tractive effort is quite small as compared with slow speed. Tractive effort is drawbar pull, less internal friction, but it does not of necessity imply motion, while horsepower is the rate of doing work, that is the drawbar pull actually producing motion. Work is spoken of here in the mathematical sense of pressure acting through space or against resistance.

It is not our purpose to give a close or complete analysis of the whole book, or go into every detail. We have instanced these points to emphasize the plain practical nature of the work. Under the head of Classification of Locomotives Part II., the ordinary types come in for definite treatment, and the compound is dealt with in detail. The subject is well illustrated and the reasons for the various operations involved are told in plain language. There is a table of dimensions and characteristics in which a large number of locomotives, running on many railways, are given.

Part III. opens with a general and easily-understood explanation of physics, mechanics, dynamics, heat, temperature, etc., etc. Under the head of chemistry coal is defined technically, and its composition, heat values, etc., are made clear. The meaning and use of the British Thermal Unit is important, as many fuels are bought on the basis of the heat units they will give. The volatile and solid constituents of coal are distinguished. It is easy to see that carbon mon-oxide (CO) is the result of incomplete combustion, and this results in the loss of heat which would otherwise be given off, if carbon di-oxide (CO_2) was formed. An interesting proof of this may sometimes be seen by looking at the top of chimneys of rolling mills, etc. When carbon mon-oxide is formed in the furnace it is carried up the flue as very hot smoke. At the top of the chimney when meeting the air, it bursts into flame, and CO burns to CO_2, thus completing the combustion without raising the temperature of the furnace. The loss thus becomes actually visible.

Part IV. deals with steam, states Boyle's or Mariott's law, and gives a comprehensive table of physical properties of saturated and superheated steam. The generation of steam and the work done in its formation are interesting subjects and the expansion of steam and cylinder condensation naturally follow in the book. The advantages of superheated steam are set forth and it easily becomes clear to the reader what happens and where economy comes in, with cylinders which may be supplied with superheated steam, approximately to a perfect gas with margin enough to meet inevitable cooling; and the same cylinders filled with saturated steam close to the dew point and which is little better than high pressure fog. Part V. is devoted to boilers, and in this section classes and types appear, construction features, superheaters, draft appliances, safety devices, parts and appurtenances; with boiler power data, and it concludes with remarks on injectors.

Part VI. takes up lubrication and lubricants. Part VII. follow with cylinders and valves and valve gear. Part VIII. is eminently practical and deals with running and firing. Here the rationale of the whole process of firing and running an engine with care and economy is brought out. The values of the volatile hydro-carbons and the fixed carbon are given, as they theoretically are, together with the results