With regard to this principal object of the book, we must confess to a little disappointment; for, since its author is an acknowledged expert in steam-engineering, we should naturally have expected him to institute experimental comparisons between this instrument and whatever other indicator is regarded as the best in market.

The improved form of the Thomson indicator, made by the American steam-gauge company, we believe to be in high favor with the profession. Mr. Barrus may, for aught we know, have compared the Tabor indicator with this or some other good modern indicator; but the only comparisons here published are with older instruments. The special mechanical advantage claimed for the Tabor indicator is the greater lightness of its moving parts. The pencil-arm (which has the highest velocity) is substantially the same in this and other instruments, and the reduction of weight is in parts having a less velocity. Still there is, we think, substantial truth in the claim of lightness. It would seem that any of these instruments might use aluminium to advantage to save weight in the moving parts.

From a curious little loop which is found just at the beginning of the stroke, after the admission-valve is opened, and which is not seen in the Richards and Thomson cards taken at the same time, we suspect that possibly the pencil lags behind its true position in other parts of the diagram, as it certainly must in some part of the loop, and that there are consequently unknown distortions of the card.

While great efforts have been put forth to make the parts carried by the spring light, and to give the spring as much firmness as possible, because its vibrations show with great distinctness upon the card, it does not appear that equal care and ingenuity have been expended to secure a positive to-and-fro motion of the card, which shall exactly correspond to the stroke of the piston. The exactness of this correspondence is of the first importance, but all errors of this nature are so masked in the indicator card as almost to defy detection. Since the typical steam-engine of to-day runs at a very high speed, and the indicator in its present form is essentially a low-speed instrument, the results which it gives are, to say the least, liable to uncertainties. For example: at speeds of six hundred to eight hundred revolutions per minute, the Tabor cards show vibrations which are probably as large as those in the Richards and Thomson at three hundred or four hundred revolutions per minute; and it appears as though no improvements could make any indicator of such a form work well at the highest speeds.

It seems possible, however, that a recent improvement in a new direction, made by Prof. J. Burkitt Webb of Cornell university, may overcome this difficulty;[1] and, as any improvement in instruments of precision is of importance to science, we may here briefly explain its nature. Were a pin so placed as to block the piston of the indicator just as it reached its highest point, it is obvious that the vibrations which then usually appear would be stopped; and, were another pin so placed that the piston could return only a small fraction of the whole distance to the zero line, then the pencil would describe only that part of the diagram between two lines near together, and parallel to the zero line. If during the next stroke these stops be moved one step nearer the zero line, the pencil will then describe another part of the diagram; and the process may go on until the diagram is completed. Since vibration is completely destroyed by this device, Professor Webb is enabled to use long and flexible springs, instead of the short, thick ones now in vogue, and so discard the parallel motion entirely.

RECENT WORKS ON THE MICRO-CHEMISTRY OF PLANTS.

Vegetable histology. By D. P. Penhallow. Boston, *Cassino*, 1882. 40 p. 8°.

Botanical micro-chemistry: an introduction to the study of vegetable histology. By V. A. Poulsen. Translated with the assistance of the author, and considerably enlarged, by William Trelease. Boston, *Cassino*, 1884. 118 p. 8°.

Hilfsbuch zur ausfuhrung mikroskopischer untersuchungen im botanischen laboratorium. Von Wilhelm Behrens. Braunschweig, *Schwetschke*, 1883. 398 p., 127 figs. 8°.

A translation of Schacht's little treatise on the microscope as applied to vegetable physiology, now out of date and out of print, has long been the only handy book in English, available to our students of histology who are unfamiliar with French and German. To be sure, all the better works on microscopic manipulation devote a few well-considered pages to directions for the manipulation of vegetable sections and to the principal reagents. But a convenient special work has long been felt to be a desideratum, especially in this country, where the exchange of microscopic specimens, and the interchange of hints by systematized correspondence, have never received the full

[1] See figure and brief description in the *Trans. Amer. soc. mech. eng.*, 1883, reprinted in *Cotton, wool, and iron*, Feb. 2, 1884.

development which the utility of the exchange system warrants. Partly to meet this want of a handy guide for his own students, Professor Penhallow, now of McGill college, Montreal, prepared a work under the somewhat misleading title, 'Vegetable histology.' This little treatise deals only indirectly with histology. Its real design is to furnish a student, whether working alone or under guidance, with suggestions as to the use of the principal media in which to examine objects, the reagents for detecting the more common contents of cells and for recognizing the chief modifications which the cell-wall undergoes. In this it succeeds. The directions are clear, and sufficiently full to satisfy any beginner.

To meet the same demand among students in his own country, Poulsen of Denmark has published a handbook, which has been received with marked favor. The translations into German and French are widely known as useful laboratory guides. The recent translation into English, by Professor Trelease, has been neatly and carefully done, and embodies various suggestions by the translator, most of which are improvements. The work treats first of the reagents, their preparation, impurities, and employment. To this part is added a useful chapter on the media for mounting, and the safest cements. The directions for using the newer staining-agents are not always so explicit as to leave no room for further questions on the part of the student who is working by himself, but they are full enough to indicate the wide applicability of this group of chemicals. It is interesting to note how important a part staining-processes — which, within the memory of some of us, were wholly relegated to amateurs who desired to make pretty specimens for the sake of exhibiting their skill in manipulation — now play in the most recondite researches as to the behavior of the nucleus, and the growth of the cell-wall. It is doubtful whether these methods are not capable of much wider development.

Part second of Poulsen's book is devoted to the examination of vegetable substances. The author has included in his work upon this, some substances which might as well have been left out as some which do not find a place; but, as will be seen by a glance at the comprehensive treatises of Ebermeyer and of Husemann and Hilger, the task of selection is not an easy one. Professor Trelease has placed American teachers under obligations by the excellent translation which he has given them.

With a much wider scope, but covering within its range the materials made use of both by Penhallow and by Poulsen, Behrens's work upon the microscope and its use in laboratories of vegetable physiology, is a welcome addition to botanical literature. It is rather fussy in some of its particularities, but even this extreme of minuteness will be useful to many people into whose hands it is likely to fall. The *naïve* honesty of the author is well shown in some of the striking cuts: for instance, a couple of finished slides are delineated with cover-glass and cement and labels all in place; but the cement, instead of being laid on as evenly as an engraver would naturally depict it, has been represented with a charming and comforting irregularity which will be sure to be followed. In this work Behrens has given exhaustive details as to the selection and employment of all the appliances required in the histological laboratory, and has, for the most part, expressed his critical views with clearness and decision. The references to the literature of the subject are very copious. It is to be earnestly hoped that the announcement is true that the book is soon to be translated into English by a competent person, who has evinced much enthusiasm in microscopical matters. In such a translation it might be well to incorporate a part of the material which was intrusted to the more ephemeral microscopical journals, and which, useful at the time, is in danger of being lost. And such a translation would, doubtless, give less prominence to a few of the excerpts which Behrens himself has made from such journals.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

U. S. geological survey.

Work in West Virginia. — The wisdom of the general government in lending its aid to the development of the wealth and natural resources of the country is nowhere, perhaps, better illustrated than in the work being carried on by the survey in that portion of the Alleghany coal-field that lies between the Great Kanawha and Chattarawha (or Big Sandy) Rivers in West Virginia. Topographical work in this section has been in charge of Mr. W. A. Shumway.