Canyon, Holly Canyon and Cool Spring House on Cajon Mesa. It is proposed that these groups be made a national monument.

THE agricultural appropriation bill, carrying $68,981,553, was passed on January 3 by the House of Representatives after Speaker Gillett had thrown out on a point of order a motion to send it back to committee with directions to include $360,000 for congressional free seed distribution.

AT the annual meeting in a joint program on the last day of the session of the societies composing the Federation of American Societies for Experimental Biology at Toronto, a very interesting scientific program consisting of ten papers on the newer discoveries of various laboratories in the United States and Canada, led by the laboratories of the University of Toronto, was held on the subject of the pancreas and the specific pancreatic secretion, insulin. At the annual dinner held on the one hundredth anniversary of the birth of Pasteur, December 27, 1922, lectures were delivered on the life and works of Pasteur by the following speakers: Sir Robert Faulkner, University of Toronto; Graham Lusk, Cornell University; Albert P. Mathews, University of Cincinnati; F. G. Novy, University of Michigan.

THE Cellulose Division of the American Chemical Society has been authorized as a permanent division of the society and wishes to enroll as members in the division all those who are interested in cellulose chemistry either from a scientific or practical standpoint. All members of the American Chemical Society wishing to become members of this division are requested to send their names and business connections together with one dollar for dues to the secretary, L. F. Hawley, Forest Products Laboratory, Madison, Wisconsin.

UNIVERSITY AND EDUCATIONAL NOTES

PLANS for a new chemical laboratory for the Johns Hopkins University, to be erected at Homewood, at a cost of about $600,000, have been completed. The details of the building have not been made public, but it is known that the type of architecture will conform to the colonial style of the Homewood group. Bids for contracts for the new $1,000,000 home of the Johns Hopkins School of Hygiene and Public Health, which will be on Monument and Wolfe Streets, as a part of the hospital group, will shortly be asked. The plans have been completed. This structure will be of Italian architecture of brick and stone, and is provided through a donation to the school by the Rockefeller Foundation.

A FUND amounting approximately to $3,800 has been subscribed in honor of Professor Appleton, of Brown University, to be known as the John Howard Appleton Lectureship Fund to provide annual lectures at Brown on pure or applied chemistry.

BROWN UNIVERSITY has received $50,000 from the estate of the late Robert P. Brown, to endow a professorship in biology. Albert Davis Mead, head of the department of biology in the university, has been appointed Robert Perkins Brown professor of biology.

DR. HARRY PRATT JUDSON, second president of the University of Chicago, holding that position for sixteen years, has resigned and will retire from active work on February 20. Dr. Ernest DeWitt Burton, head of the department of New Testament and early Christian literature and director of the libraries, has been elected acting president.

THOMAS B. BAINS has accepted a position as assistant professor of mining engineering at the University of Illinois.

HERBERT R. HANLEY has been appointed associate professor of metallurgy at the Missouri School of Mines.

DISCUSSION AND CORRESPONDENCE

BALANCING CHEMICAL EQUATIONS

IN the issue of SCIENCE for September 1 (page 258) there is an article describing an algebraic method of balancing chemical equations. The method, which assumes a knowledge of the formulas of the initial and final substances, consists in finding, algebraically, sets of values for the coefficients of the equations. The author seems to have discovered a nearly constant relation between the number of elements and of compounds represented in

the equation. To the writer the ratio does not seem to hold very strictly even in the equations cited in the articles; but this may be due to a lack of understanding on his part. When understood it may be assumed to be accurate, and may be useful and rapid in the hands of those whose minds readily run along mathematical channels. It may also be advantageous in commercial laboratories, where the end sought is simply the relative weights of materials taking part in reactions because, being mathematical, it suggests an element of certainty to the conclusions. It may be especially useful in those commercial laboratories where the workers have only a superficial knowledge of the principles underlying chemical changes and therefore can not, with certainty, apply chemical methods of balancing.

But where the end sought is a clear understanding of the principles of the subject the method described has in it, as in all mechanical methods, an element of danger, since it may lead the worker to the belief that the balancing of an equation is, *per se*, proof of a thorough understanding of the chemistry involved. To the writer it still seems uncertain whether the newer algebraic method has any advantage, either in certainty of conclusion or in rapidity of work, over the strictly chemical method of balancing. A comparison of the two methods may be made by considering the first equation introduced by the author of the article in question, *viz.*, the reduction of silver arsenate by the hydrogen produced by the action of zinc with sulfuric acid:

$$a\mathrm{Ag_3AsO_4} + b\mathrm{Zn} + c\mathrm{H_2SO_4} \rightarrow d\mathrm{AsH_3} + e\mathrm{Ag} + f\mathrm{ZnSO_4} - g\mathrm{H_2O}.$$

Since the equation shows that the salt is reduced to silver and arsine, it takes but a glance to see that for each molecule of the salt there is needed sufficient hydrogen (8 atoms) to combine with the four atoms of oxygen (forming 4 molecules of water) and additional hydrogen (3 atoms) to combine with the arsenic (forming one molecule of arsine). That is, 11 atoms of hydrogen are needed for each molecule of the salt. Since an odd number of atoms of hydrogen can not be made by the action of sulfuric acid on zinc the one molecule of salt must be multiplied by two, and these require 22 atoms of hydrogen (from 11 molecules each of zinc and sulfuric acid) and there are produced 6 atoms of silver, 2 molecules of arsine and 8 molecules of water. Thus the smallest coefficients necessary to balance the equation are easily found, and there is the added advantage that the principle and mechanism of the reaction are reviewed.

The other illustrations used by the author are as easily analyzed and balanced if there is kept in mind the additional thought that the salts behave as though they were composed of two oxides each ($2\mathrm{KMnO_4} \rightarrow \mathrm{K_2O}, \mathrm{Mn_2O_7}$ and $\mathrm{K_2Cr_2O_7} \rightarrow \mathrm{K_2O}, 2\mathrm{CrO_3}$), the latter oxide in each case being reduced to the lowest oxide. Finally all the oxides react with sulfuric acid to form sulfates.

In detail, two molecules of the permanganate must lose 5 atoms of oxygen and these combine with an equal number of atoms of the oxygen from 5 molecules of the hydrogen peroxide, forming five molecules each of oxygen and water. The three molecules of oxide ($\mathrm{K_2O}, 2\mathrm{MnO}$) then react with three molecules of sulfuric acid to form one molecule of potassium sulfate, two molecules of manganese sulfate and three additional molecules of water (eight in all). The equation can then be written with the proper coefficients.

The reduction of the dichromate is more complicated only in this, that two reducing agents are involved, both of which are assumed to be oxidized—an assumption which probably would not be verified by experiment.

This note is written, not to criticize the algebraic method of balancing equations, but rather as a caution to teachers (especially young and inexperienced teachers) and students who might adopt it as a means of partially solving a rather difficult teaching problem—the writing of equations. It might be a help in solving this problem, but only at the expense of most important and vital teaching points; for the proper writing of equations is not an end in itself, but only a means of enforcing important chemical facts and principles, of studying the mechanism of reactions, and of practicing clear chemical thinking. All mechanical methods of balancing equations disregard these important elements in education.

JAMES H. RANSOM

DECATUR, ILLINOIS