UNIVERSITY AND EDUCATIONAL NOTES

THE total of funds to the credit of the $17,500,000 development program of the University of Chicago, according to an announcement by Robert P. Lamont, chairman of the committee on development, is $6,508,752. In addition, $2,134,763 has been given to the university during the campaign for other than campaign purposes, so that the total of subscriptions made to the university during the period of the campaign is $8,643,515.

WITH the gift of $1,000,000 to Washington University by Mr. Charles Rebstock, of St. Louis, will be erected a building for biology, costing $300,000; the remainder of the gift will be used for general endowment. This is one of the largest gifts the university has ever received from an individual and differs from the usual donation in that no stipulations are attached.

THE trustees of Gettysburg College have appropriated $100,000 for the construction of a new chemical laboratory.

DR. W. L. HOWARD, of the University of California, has been appointed director of the branch of the College of Agriculture at Davis in addition to his previous duties as head of the division of pomology in the university.

DR. CHARLES H. KEENE, director of health education in the department of public instruction at Harrisburg, Pa., has been appointed professor of hygiene and director of physical education at the University of Buffalo.

DR. A. K. ALDINGER, for twenty years supervisor of physical education in the schools of New York, has been appointed professor of physical education at the University of Vermont.

DR. VASIL OBRESHCOVE, associate professor of zoology at Syracuse University, has been made head of the biology department at St. Stephen's College, Annandale-on-the-Hudson.

DR. A. B. DAWSON has recently resigned his position with Loyola University School of Medicine, Chicago, to accept an appointment as associate professor of biology at New York University.

C. I. REED (Ph.D., '25, Chicago), formerly associate professor of physiology in the University of Kansas and for the past year fellow in medicine of the National Research Council, has accepted the position of associate professor of physiology in Baylor University Medical School, Dallas, Texas.

NEW appointments at the Carnegie Institute of Technology include the following: Arthur C. Jewett, formerly head of the department of mechanical engineering at the University of Maine and more recently with the Winchester Repeating Arms Co., to be director of the college of industries; William T. Crandell, of Kansas, assistant professor of commercial engineering, and Dr. Borden P. Hoover, formerly of the University of Illinois, assistant professor of mathematics.

DR. W. H. MAXWELL TELLING, who has occupied the chair of therapeutics in the University of Leeds for the past two years, has been elected professor of medicine and head of the department of medicine on the retirement from that office of Dr. T. Wardrop Griffith. Dr. R. A. Veale has been elected to the chair of therapeutics in place of Professor Telling and Dr. G. W. Watson has been elected to the chair of clinical medicine, which has been vacant since the retirement of Dr. A. G. Barrs.

DISCUSSION AND CORRESPONDENCE

BERNOUILLI'S PRINCIPLE AS CONSERVATION OF ENERGY

WHILE clearing up a doubt in the mind of a bright undergraduate the writer learned to his surprise that the old notion of "pressure energy" had reappeared in a recent edition of a popular college text on physics, with the usual application to Bernouilli's Principle. Now it is absurdly easy to show that such energy does not exist; for instance, if the pressure on a cubic centimeter of water is raised from zero to one atmosphere or 1.031×10^6 dynes per cm^2, the water is compressed by 0.000045 cc and the work done is only 46 ergs: how then can the water have acquired energy numerically equal to the pressure or equal to 1'031'000 ergs? But when a persistent error admits of such easy refutation, it usually contains a grain of truth. The only way to destroy the pressure-energy complex for good and all is probably to direct greater attention to the *correct* interpretation of Bernouilli's Equation as an energy equation and to urge the general adoption of this interpretation in elementary texts on physics.

According to Bernouilli's Equation

$$E = 1/2\ \varrho v^2 + \varrho g h + p = \text{constant}$$

along a tube of steady flow in a frictionless liquid, where ϱ = density, v = speed, h = height, p = pressure. To deduce this equation from the law of the conservation of energy, consider a section of a tube of flow with ends at A and B, respectively. For every cubic centimeter of the liquid that enters

the section at A, another cubic centimeter leaves it at B. The entering liquid carries into the section kinetic energy $\varrho v^2/2$ and potential energy ϱgh. But it also does work on the liquid ahead of it equal to the pressure times its volume or to p, while at the same time the liquid behind does an equal amount of work upon the cubic centimeter itself in pushing it into the section; thus an amount of energy equal to p is transmitted past A through the entering liquid into the section, in addition to the kinetic and potential energy which is simply carried in. The total energy transferred past A as one cubic centimeter enters the section is thus $E_A = \varrho v_A^2/ + \varrho gh_A + p_A$. At the same time an amount of energy $E = \varrho v_B^2/2 + \varrho gh_B + p_B$ is transferred out of the section at B; while no energy at all is transferred across the sides. The total amount of energy inside the section must, however, remain constant, for the flow is steady. Hence $E_A = E_B$ and Bernouilli's Principle follows.

This deduction brings out the true meaning of the quantity E that is constant along a tube of flow; it represents, not the energy that is stored in each unit volume of the liquid and carried along with it, but rather the total amount of energy that is transferred past any point as each unit volume of the liquid moves past that point. The first two terms in the expression for E represent what we may call a convection current of energy, in which the energy is simply carried along by moving matter. The last term, p, then represents an additional current of energy that is transmitted through the liquid.

If we wish, we can imagine the transmission current of energy, represented by p, to arise from a streaming through the liquid of the energy of compression. The latter energy is never quite zero, but it is always small, and so we shall have to suppose it to move enormously faster than the liquid. A similar current of energy flows along a moving belt, only there the energy moves in one direction while the matter through which it streams is moving in the opposite direction.

In gases the energy of compression need not move so fast in order to account for the transmitted stream of energy, but in this case the energy of compression contributes appreciably to the convection current as well.

This view of the Bernouilli Equation would seem to be just as useful and suggestive as any other, and it seems quite simple enough for presentation in a freshman text. As a matter of fact, examination of a number of elementary engineering books shows that most of the ideas here presented are actually to be found in one or two of those!

E. H. KENNARD

CORNELL UNIVERSITY

CAMPBELL'S DEFINITIVE UNITS

REFERRING to the paper of Dr. George A. Campbell, "A system of 'definitive units' proposed for universal use," published in the issue of SCIENCE for April 3, 1925, the writer realizes that there are many advocates of alternative universal systems of units and is therefore hesitant about entering the lists. It would appear, however, that two modifications of Dr. Campbell's proposal would be of great assistance in the practical introduction of such a system of definitive units. These are:

The retention of the C.G.S. unit of length, the centimeter, instead of the meter; and the use of the true ohm (or "practical" ohm, as Dr. Campbell calls it) instead of the international ohm. These modifications are independent of one another, and will be considered separately below.

USE OF THE CENTIMETER

It is believed that in scientific and engineering work a unit, such as the centimeter, which is smaller than most pieces of apparatus, is more convenient than the meter. It is already in such wide use and has been the basis of so many physical data that a great saving in labor and mental effort would be occasioned if it were retained. The consequence of its retention would be that the unit of force would become 10^7 dynes and the unit of mass would be 10^7 grams. This unit of force has been used in certain[1] texts for a number of years. Being approximately equal to 22.5 lb., this unit is fully as convenient as the value 10^5 dynes proposed by Dr. Campbell, which is approximately equal to 0.225 lb. The writer recognizes that the corresponding unit of mass, 10 metric tons, is not so convenient as the kilogram, but in this connection it should be pointed out that mass in its direct aspect as a measure of inertia enters into relatively few practical and scientific calculations. Mass as a measure of the quantity of matter—that is, mass from the chemist's point of view—is a distinct idea and can continue to be measured in grams or kilograms with little confusion. These latter units of mass may be considered as derived from the large unit by the factors 10^{-7} and 10^{-4}, in much the same way that the customary electrical unit, the microfarad, is derived from the farad by the factor 10^{-6}. All electrical engineers are quite reconciled to the fact that the farad is an enormous unit and are not con-

[1] See Karapetoff, "The Electric Circuit" (1912), p. 217: "*Force ought to be measured in joules per centimeter length,* to avoid the old multiplier. Such a unit is equal to about 10.2 kg. and could be properly called the *joulcen* ($=10^7$ dynes)."