in policy and encourage interchange of students. More important still as an actual need of the day seems to be this: that universities which associate themselves with technological institutions of originally independent growth shall bring the studies, teachers, and students effectively into the precincts and life of the university. Equally important does it seem that this should be done so far, and only so far, as these studies, teachers, and students can be rightly regarded as conforming to the standards of a university. It is to be feared that there lie here practical problems of grave difficulty, and that we may be entering upon a troubled time. The difficulties for the universities lie mainly in the suspicion, which they so easily incur, of possessing all those failings that are apt to beset aristocracies, and when they are prescribing restrictions in the light of experience and with a disinterested desire for the common good, they may easily enough be regarded as acting merely in a disdainful spirit of exclusiveness. Another danger, of course, lies in an eager spirit of accommodation, a disposition to please the multitude, and a love of peace, amid which essentials may be sacrificed to gain the mere semblance of success.

In the restlessness of our present world it is difficult to gauge the currents of opinion that will mould or remould the institutions of our country. But so far as education is concerned it seems clear that, if we are to accept their spokesmen, the rank and file of the teeming world of labour have set their heart in something like clear purpose to the ends that shall be sought. They will not have it that their new and increased education shall be permeated and dominated by a sordid or material aim. They begin to suspect the agencies that make their chief promise a cleverer performance of the daily task or the earning of a larger wage. In their revulsion from such an object they threaten to repudiate what in truth in its proper place, among other things, will lighten and enlighten their labours.

There is no sign of the times that to me seems more hopeful, for I see in it the promise of an end to the far-reaching and incalculable mischief that has come of a false distinction between useful and useless knowledge. But there are opposing forces to contend with.

It seems to me that there is no service of universities more needed now than to exhibit in the centres of highest education, which can so easily lead the way, the true intellectual nurture of industrial life—the embodiment of technology in full and fruitful fellowship and interplay with accepted liberal studies.

New Apparatus for Showing the Tracks of α-, β-, and X-rays.

IT will be remembered that Mr. C. T. R. Wilson described his original cloud expansion apparatus as used for showing the tracks of α- and β-rays and of X-rays before the Royal Society in April, 1911, and at that time the Cambridge Scientific Instrument Co., Ltd. (now the Cambridge and Paul Instrument Co., Ltd.), took up the manufacture of this apparatus. The manufacture of apparatus of this class was, however, entirely stopped by the war.

Lately Mr. Takeo Shimizu, of Japan, working at the Cavendish Laboratory, Cambridge, has considerably modified Mr. Wilson's original apparatus, and the Cambridge and Paul Instrument Co., Ltd., is now putting the improved design upon the market. In Mr. Wilson's original apparatus only a single expansion was obtained. It was thought to be necessary to give a comparatively rapid expansion in the working chamber, and this was obtained by connecting the space under the moving piston to another space which was previously evacuated. The moving piston was, in consequence, suddenly sucked down against a rubber stop. Mr. Shimizu has found that the sudden expansion is not necessary, and has, therefore, arranged for a reciprocating piston, and he obtains cloud tracks of the rays at each expansion, which may be timed to occur at rates from about 50 to 200 per minute. The instrument thus designed is extremely simple, but there are several important points to which attention must be given for successful operation.

The apparatus is shown in Fig. 1. The crank (not seen in the illustration), which is driven either from the hand-wheel B or by means of a small motor, drives an upright connecting rod, which in turn drives a horizontal connecting rod D. The far end of D slides in a sleeve E, which is free to rock in the piece F. The piece F can be adjusted in a horizontal direction by means of the screw G. The piston-rod H is connected near the middle of this latter connecting-rod. Since the crank is of constant length, the horizontal adjustment of the piece F alters the length of the stroke given to the piston-rod H. By this means the expansion ratio at each stroke in the working chamber K can be adjusted while the instrument is in operation.

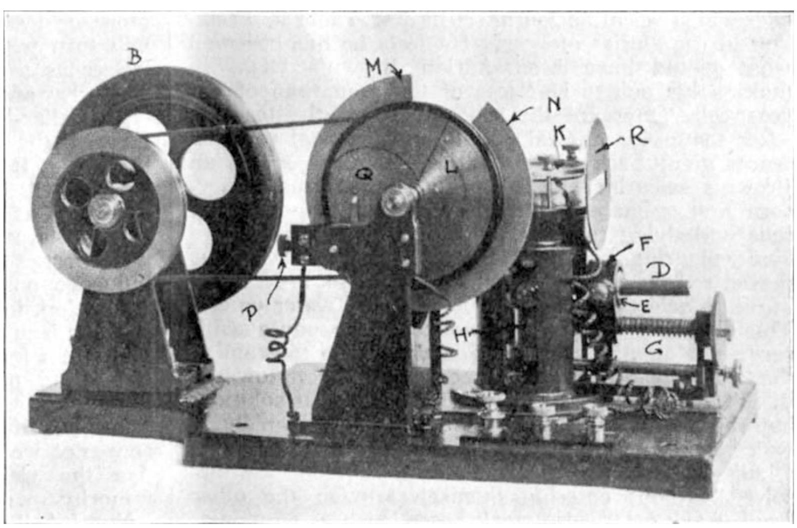

FIG. 1.—Shimizu expansion apparatus.

In order to obtain a good picture of the rays which become visible at each expansion by the formation of linear clouds on the ionised particles in the ray tracks, it is necessary that these clouds be dissipated during the compression stroke. This is done by forming a vertical electrostatic field in the expansion chamber. The upper glass plate of the expansion chamber, through which the tracks are observed or photographed, is covered on the inside with a gelatine film, which is made conducting. This film is charged negatively with reference to the metal piston, but by means of the commutator L, which rotates with the driving crank, the plate is discharged just before the occurrence of the cloud formation. In the same way as the expansion ratio can be adjusted while the instrument is running, so the length of the period during which the electric field is cut off can also be adjusted while the instrument is running by means of the screw P, which traverses the contact brush along the commutator L, which is shaped, as will clearly be seen in the illustration, in the manner required to give this adjustment. Also rotating with the crank are two adjustable lead segments, M and N, which can be used as shutters for admitting X-rays to the expansion chamber at the proper intervals. It is on the back of the disc carrying these segments that the commutator L, above described, is fitted.

The expansion chamber is fitted with a small tube, by means of which radio-active matter can be introduced into the chamber for the production of α- or β-rays. The present chamber is made 55 mm. in diameter, which is, of course, less than the length of the tracks of some of the α-rays in air, but the velocity of the α-rays can be reduced by passing them through a mica screen. A small screen can also be placed on the piston to cut off the α-rays, except at the moment of greatest expansion. The expansion chamber must be perfectly airtight, as the minutest lag produces eddy currents, which at once destroy the tracks. The instrument is very quickly set up and easily operated, as a few expansions serve to filter out any dust originally in the air. The piston forming the floor of the expansion chamber is covered with a comparatively thick layer of gelatine containing about 10 per cent. of Indian ink. This gives a good black background, against which the tracks show up brilliantly. For demonstration purposes a Pointolite lamp gives excellent results, but for photography a rather more brilliant lamp is desirable. The apparatus is illuminated by means of a parallel beam of light coming in on the left-hand side. The screen R cuts off all light, except a small rectangular pencil passing through the middle of the expansion chamber.

Mr. Shimizu has taken some stereoscopic pictures on kinematograph film with his original apparatus, and by means of these stereoscopic pictures the exact paths of the particles in space can be calculated. The Cambridge and Paul Instrument Co., Ltd., hopes shortly to bring out a suitable stereoscopic camera as an accessory to the expansion apparatus.

Scientific and other Aspects of Beer.

ADRIAN BROWN, the first professor of the first established university school of brewing in this country, died nearly two years ago, and no one more suitable than Prof. Armstrong could have been chosen to pay a tribute to his memory.[1] Prof. Armstrong's enthusiasm for the application of chemistry to biology is undimmed by age; his memories and friendships reach back further than most men's, and (may it be added in a scientific journal?) he has a fine appreciation of the glories of beer. He feels he has observed what would have been Adrian Brown's wish, in making his eulogy be "less of the man than of the yeast-cell," more of the school than of the teacher. After some biographical details and personal reminiscences going back to the 'sixties, he discusses Adrian Brown's scientific work, placing that on the barleycorn first. There is a variety with a blue layer of cells underlying the thin outer skin of the corn; the blue colouring matter behaves like litmus, and is turned red by acids; yet when the grains are soaked in dilute acid they remain blue, for only water enters. This discovery enabled Adrian Brown to study a semipermeable membrane in a living object and to examine the behaviour of a large number of substances towards it. Water is absorbed from a saturated salt solution, but the more dilute the solution the more rapidly is water taken up. Sugar, strong acids, and strong alkalis also give up the water in which they are dissolved without entering themselves. On the other hand, weak acids, also weak bases, such as ammonia, and chemically neutral substances, like alcohol and chloroform, readily pass through the membrane. Prof. Armstrong suggests that only the simple "hydrone" molecules of water, which alone are considered by him to have the formula H_2O, penetrate the membrane; complexes like H_4O_2 and H_6O_3 are held back. Cane-sugar is held back by the membrane of the barleycorn, yet it passes through the walls of the yeast-cell!

1 Adrian Brown Memorial Lecture, "The Particulate Nature of Enzymic and Zymic Change." By Henry E. Armstrong. Delivered at Birmingham University on February 18. (Journ. Inst. of Brewing, 1921, vol. xxvii., pp. 197–260.)

Brown's investigation of the oxidative action of *Mycoderma aceti* and *B. xylinum* leads Prof. Armstrong to an account of Bertrand's work on the bacterial oxidation of sugars; similarly his researches on enzymes lead to a review of older and newer work on heterogeneous catalysis, the kinetics of enzyme action, and the mechanism of alcoholic fermentation.

But chemists who know the lecturer and are already more or less acquainted with the ground he covers will turn with the greatest interest to the section on "Beer as a Dietetic." Fortified by quotations from Calverley and from Prof. Saintsbury's recent "Notes on a Cellar-Book," he inveighs against State regulation of the brewing industry and against prohibitionists. It may have been stern necessity, but Government control has rendered beer "little short of worthless as a drink." Lord D'Abernon's committee does not escape, and is accused of verbal quibbling in its report. "The most malign of the attempts to influence opinion is probably that of the Board of Education, in the form of the syllabus of 'Lessons on the Hygiene of Food and Drink for Use in Schools and Notes for the Assistance of Teachers,' issued over the name of Sir George Newman." Later Prof. Armstrong calls out: "Is all æsthetic pleasure to be taken out of life? Are we to treat our food with the contempt we show to the coal we cast upon the fire? Are the views of an entirely selfish, unthinking minority to prevail?" And then comes his answer: "No, I believe our philosophy to be summed up in the familiar lines:—

> Man wants but little here below,
> But likes that little good."

After this we go back once more to science, to a historical review of the science of brewing. The debt we owe to Pasteur is sympathetically explained to a general audience, but those who are already acquainted with the work of the great Frenchman will perhaps learn most from the survey of the "Burton period" and the author's reminiscences of Henry Böttinger, Horace and Adrian Brown, Peter Griess, and O'Sullivan. This chapter in the history of English chemis-