ENGINEERING RESEARCH AT CAMBRIDGE

THE report of the head of the Department of Engineering, University of Cambridge, on the work of his Department for the year 1946–47, was published in the *University Reporter* of April 27.

The report is divided into three sections under the headings teaching, research and workshops. The first section is of interest because it deals with the transition period when some men were reading for the old undivided Mechanical Sciences Tripos, held for the last time in 1947, and others for the new two-part Tripos which was held for the first time in that year. The new Part 2 course, in spite of starting under difficult conditions due to heavy numbers and shortage of staff, ran surprisingly smoothly. In all, 265 candidates sat for Tripos examinations in 1947. The report points out that while the number of undergraduates in the Department (658) was 117 less than the average in 1920–21, the corresponding year after the First World War, no less than 574 of them were reading for honours as compared with 447 in 1920–21. The difference in research activity is even more marked; during 1946–47, in addition to the members of the teaching staff, 23 postgraduate students were engaged in research work as compared with 3 in 1920–21.

In its second section the report deals briefly with some thirty-five projects being carried out in nine laboratories of the Department. In aeronautics the study has been begun of the behaviour of air as it flows past a solid porous surface through which some of the air is sucked, and theoretical work was continued on the prediction of aerodynamic reactions on wings when account is taken of the boundary layers which form on their surfaces. Other investigations involving fluid motion, carried out in the Hydraulics Laboratory, included the protection of a pumping main by admitting air through a valve as an alternative to the air-bottle method, the actions of whirlpools, a theoretical investigation giving an approximate method of dealing with the equations governing the oscillations in a surge tank fitted to a pipe line, and the instability of a fluid surface when accelerated in a direction normal to its plane.

The main effort in the Electrical Laboratory was centred on re-equipment and on setting up a Magnetic Laboratory, but five main projects in electronics were undertaken, namely, the construction of an automatic plotter for trajectories in an axially symmetric electrostatic system, the construction of a new type of mass spectrograph, the investigation of the modulation of an electron beam, and also of shot noise in thermionic valves, and the construction of an experimental electrostatic electron microscope.

In the Heat Engines Laboratory, new methods have been used to examine the scavenging process in a two-stroke engine. An investigation, supported by the Motor Industries Research Association, was also embarked upon to record the movement of a piston ring relative to its groove in an engine running under its own power. Other projects, supported by the Ministry of Supply, concerned gas turbine problems, including the investigation of the flow through cascades of axial-flow compressor blades, and a study of the turbulent boundary layer break-away of air from the flat boundary surface of diffusers and from the curved surfaces of blades. Work was also begun on the heat-flow characteristics of liquid metals and on the development of a magnetic pump for pumping a liquid metal.

Considerable work was in hand in the Materials Laboratory. Since 1943 a team of workers, supported by the Admiralty, has been investigating the causes of fracture in welded ships. It has been shown that while residual stresses and reaction forces can be high, neither is the chief cause of fractures in welded ships; the trouble can, however, be attributed to a property of mild steel known as 'notch brittleness'. Two other investigations aimed at determining the effects of high rates of strain on mild steel and the effects of low rates on aluminium and other materials. A third was concerned with distribution of stress and strain in real materials having non-Hookean properties.

In the Mechanics Laboratory, the solution has been obtained to the problem of the stresses caused by a suddenly applied load on a beam supported in various ways; a number of direct verifications of the theoretical predictions of stress have been obtained experimentally. An investigation, supported by the London, Midland and Scottish Railway Company, of the motion of a single railway axle and a pair of wheels was completed. A special photo-elastic bench equipped with stroboscopic light sources has been constructed, with the help of a grant from the Institution of Mechanical Engineers, for the determination of the dynamic stresses in gear teeth. An attempt, assisted by the British Iron and Steel Research Association, is being made to determine theoretically and experimentally the relative distribution of useful and frictional work in the wire-drawing process.

A number of problems relating to pressure vessels have been investigated. Methods were devised for the solution of the differential equation governing the stresses and deflexions in drumheads of any rotationally symmetrical form with the aid of a mechanical analogue apparatus; help with this project has been given by the Research Department of Messrs. Babcock and Wilcox. Tests, supported by the British Welding Research Association, have been made on the pipe-bend portions of welded pipe lines, and it has been shown that the greatest surface strain occurring in the cross-section is the transverse strain inside.

With the support of the Nuffield Foundation, a start was made on the problem of tillage by measuring the component soil forces on a simple implement in motion.

In addition to the work on brittle fracture, the Department has been collaborating in other investigations on ships. Full-scale trials were conducted by the Admiralty during the years 1945–47, and the work being carried out in the Department is the reduction of the experimental data to a form suitable for interpretation into practical design recommendations. Work similar in aim though very different in scale has been undertaken on a 14-ft. sailing boat.

Much research into the behaviour of other structures was carried out. An investigation, supported by the British Welding Research Association and the Department of Scientific and Industrial Research, to find the true load-carrying capacity of rigidly jointed steel frame structures was continued. The behaviour up to collapse of a length of continuous stanchion bent in double curvature was investigated experimentally and a theoretical analysis of the same problem was completed. A successful start in developing a method of design taking account of

plastic deformations was made by dealing with single-bay rectangular portal frames; the lateral instability of steel beams bent until they had partially yielded was studied, and a considerable programme of tests on battened struts was carried out.

In addition to these investigations under static loading conditions, attention has been given to the fatigue strength of structures. Equipment was developed successfully for carrying out fatigue tests on full-scale structures and structural components by the resonance vibration method.

A comprehensive investigation into the behaviour of light alloy struts was made, and an experimental and theoretical study of the lateral instability of light alloy beams is also being undertaken with the help of the Aluminium Development Association.

RABELAIS ON SYPHILIS

IN a thesis for a doctorate in medicine at the University of Paris, Dr. Mottron has chosen to extract from the books of Gargantua and Pantagruel all the references to syphilis ("Rabelais et la Verole". By J. Mottron. Pp. 127. Tours: Arrault et Cie., 1947). The texts are quoted *in extenso* and the commentary thereon gives a study of syphilis as it was understood in the first half of the sixteenth century.

Rabelais was a contemporary of Fracastorius, but he did not use the term syphilis, which only became popular much later. In the prologue to Gargantua, Rabelais dedicates his writings to "Buveurs tres-illustres, et vous verolez tresprecieux". His references to the disease are all in terms that could be understood by his lay readers.

The epidemic of syphilis in Europe began in 1493, and when Rabelais was writing there was already a good descriptive knowledge of the disease. The chancre was recognized as the primary focus of infection and its characteristic induration had been described. Also known were the short latent period before the start of the secondary stage with its *croustelevés*, or rupial lesions, and all the other manifestations of secondary syphilis on the skin and in the nervous system.

It was fortunate that mercury, the only useful remedy of the times, was used almost at once, and by accident, in the treatment of the new disease and that its good effects were recognized. Mercury was first used by inunction, and there is an allusion to this method of treatment in Rabelais' prologue to the books of Pantagruel. The toxic effects of mercury are also mentioned. When mercury was shown to affect syphilis the dosage was increased to toxic levels, and the ill-effects were confused with the manifestations of the disease itself. This confusion resulted in the change to guaiacum which, for a short period, superseded mercury.

Although mercury was used orally as early as 1533, inunction long continued as the chief mode of application. Sweating baths were often associated with mercury inunctions. Gasparo Torrella (1497) recommends the "best way to treat syphilis is to sweat the patient for fifteen days, fasting, in a steam bath or oven". Jean Fernel (1557) writes of steam baths at high temperature for twenty days or more. Sarsaparilla, a sudorific agent used in conjunction with baths, is also mentioned by Rabelais. The vogue for sweating has continued ever since. Baths in mercury vapour were used by Langston Parker in 1850 and to-day we use more elaborate methods in the hypertherms. Rabelais seems to have intended his works to be read by the suffering *verolez* while they were sweating. It is doubtful whether even Rabelais could mitigate the sufferings of the modern sweating cabinet; but it is an idea which ought to be tried.

Dr. Mottron seems to favour the theory that syphilis existed in Europe in the pre-Columbian era and that the disease was unrecognized before 1493, or confused with leprosy, scabies, etc. He cites Broca's (1876) observation of the discovery of syphilitic lesions in bones from an ancient leprosorium, and quotes the monk Theodoric (thirteenth century), Gaddesden (fourteenth century) and Bernard Gordon (1305) on the transmission of 'leprosy' by sexual intercourse.

The evidence of contemporary observers such as Torrella and Ulrich von Hütten is, however, of a new, hitherto unknown disease which alarmed the doctors to the point where they fled from the presence of the sick. Public health measures were quickly enacted all over Europe. In Paris, in 1497, foreigners with the great pox were warned to leave the city under pain of the halter for disobedience, and citizens so affected had to stay always indoors. The next year, 1498, the penalty for the unfortunate syphilitic discovered at large in Paris was to be thrown into the river. In the city of Aberdeen, at the same time, to combat the French disease, it was ordained "that all licht weman be chargit and ordanit to decist fra their vicis and syne of venerie, and all their bothis and housais skalit". All these evidences suggest something absolutely new and terrifying.

In favour of the American origin for syphilis are many points unspecified by Dr. Mottron. He does not mention, for example, Ruy Diaz de Isla's "Tractado Contra el Mal Serpentina", in which is described the treatment, at Barcelona, of some of Columbus's men on their return from Haiti. Nor does he allude to more recent investigations on ancient bones which seem to show that syphilitic osteitis did not occur in Europe or Egypt before the sixteenth century. This controversy is, however, interminable and can be closed for the present with the observation that Rabelais talks of a case of the *verole* in 1420.

The entity of syphilis is recognized by Rabelais. He mentions gonorrhœa only rarely, but it is quite clear that he knew it as a separate disease. Syphilis was also distinguished from leprosy in Rabelais' day. Vibert speaks of lepers fearing contamination from syphilitics. Rabelais knew syphilis to be a contagious and venereal disease; but he does not seek, like some of his contemporaries, for causes in planetary disturbances, poisoned water, cannibalism, etc.

Dr. Mottron ascribes to Rabelais the tract "Triomphe de Très Haute et Puissante Dame Vérole". In this is cited, perhaps for the first time, a cause for venereal disease which is still occasionally suggested by patients:

> "Et notre fiffre a uriné
> Contre un mur dont mal lui en print".

Dr. Mottron is to be congratulated on his scholarly development of a very interesting theme. My only criticism is of his rather one-sided treatment of the theory of the American origin of syphilis; but as Rabelais is on his side I shall say no more.

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