



THE MESS

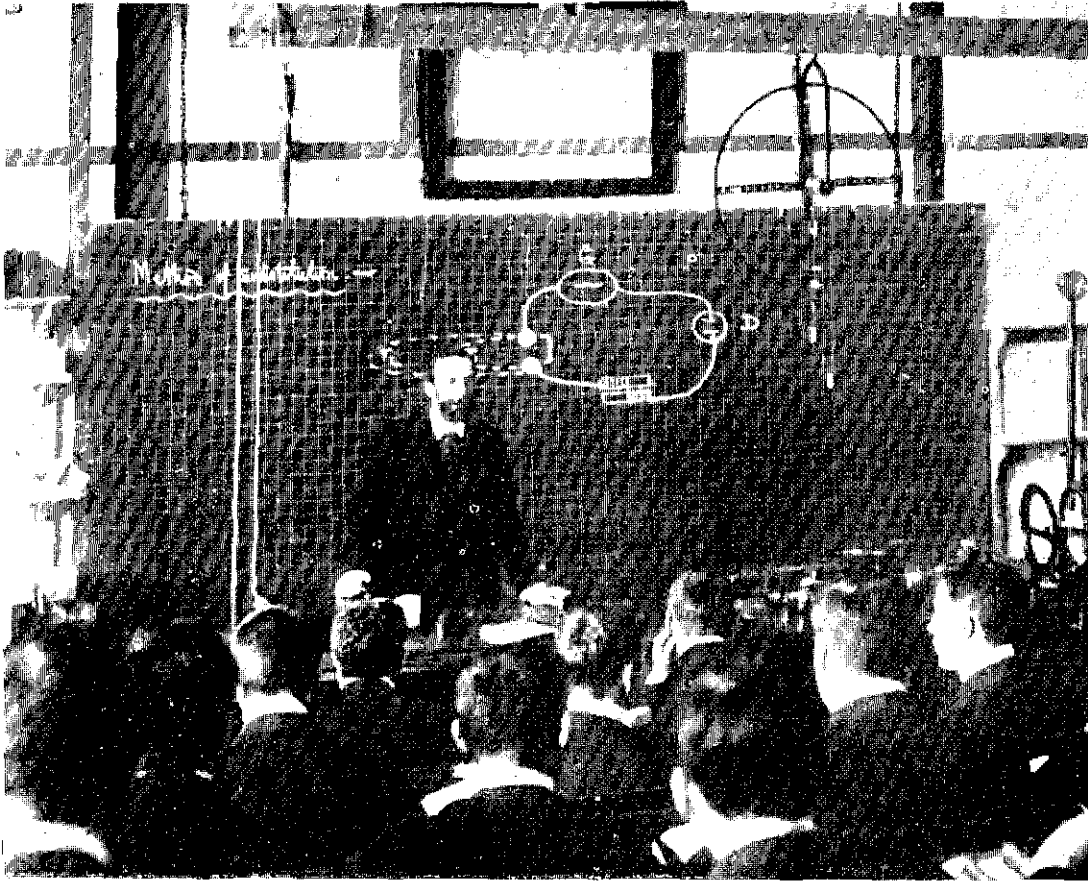
KEYHAM 50 YEARS AGO

Accounts of H.M.S. Thunderer at Manadon, have recently appeared in the press. It is sometimes salutary to compare what is being done now with what was done in the past. To provide a basis of comparison, the following article by C. Alfred Smith, B.Sc. (late R.N.) is reprinted from Page's Magazine of 1904.

It is an axiom with the British public that the security of our commerce and the safety of our Empire depend entirely upon the efficiency of the Royal Navy. But what the public do not fully appreciate is the fact, patent to all the technical readers of this journal, that the efficiency of the Royal Navy as a fighting machine is very largely dependent upon the men who control, coax, and alone understand, the terribly intricate and absorbingly interesting machinery upon which depends the speed of the ship, her manœuvring powers, the health of the whole of the officers and crew, and even the very fighting capacity of the vessel in action. Almost every weapon of warfare, from the huge turret guns to the deadly torpedo, are in fact to some extent dependent upon the engineer officer.

Of late, a great deal has been written concerning class prejudices between the executive and the engineering branch in the senior service, but that is simply a relic of bygone days. For the last ten years, the students who have entered Keyham College have been, for the most part, public school boys, and have often formed friendships at school with those whom they have afterwards met again as midshipmen or sub-lieutenants in the gunroom of a warship. At the writer's own school, in Hampshire, there were, each year, entered into the Royal Navy about ten cadets to the *Britannia*, and about half a dozen engineer students (now cadets) to the Keyham College, or, as the Admiralty put it, 'entered on the books of H.M.S. *Vivid*, Devonport'.

It may be stated at the outset that the training at Keyham is a strenuous one. That is 'the price of Admiralty' that everyone in the senior service has to pay, from Tom Jones, A.B., to the Admiral of the Fleet; but one seldom hears a grumble concerning the strict discipline maintained. The senior students are



PROFESSOR WORTHINGTON, C.B., F.R.S.

commanding the college are usually only appointed for three years' service, but generation after generation of cadets come in close contact with the scholastic staff, and have ample reason to remember the kind, almost paternal, advice so generously given, as well as the keen interest taken in the individual progress of each and every cadet.

The Course—First Year

During the first year the lectures are in the following subjects: mathematics (algebra, mensuration, and trigonometry), heat, hydrostatics, mechanics, French, and chemistry. Lectures are given for three hours on two mornings of the week, preceded by an hour's preparation. On three evenings a week they are also given from six to eight o'clock. The afternoons are spent in the workshops, as well as four of the mornings. The engineer officers of the Dockyard give special lectures on steam and practical engineering subjects, amounting from about eighteen to twenty-four in the course of the year. At the end of each year, examinations are held in all the theoretical subjects, and it is necessary to obtain at least thirty per cent to pass successfully.

Second Year

For the second year the 'school routine' is very much the same as for the first year, no additional subjects being taken. But in the workshops the cadet now spends his time at work with the machine tools, lathes, drills, planing and shaping machines. The crank-shafts, brasses, engine-cylinders, and pump

used to it, and they take good care that the junior men are well broken in on arrival. Entrance is effected by competitive examination (and here it must be understood that the writer is describing throughout, the scheme of training which obtains until the new regulations come into force in 1906) and there are usually some two hundred candidates for about forty places. The entrance examination is of a similar standard to the ordinary University Matriculation examination. The successful candidates are required to pass a medical examination to satisfy the Admiralty regulations, which state, among other amusing details, that no candidates will be permitted to enter Keyham who 'are mentally deficient' ! For this they are medically examined after being successful at the above-mentioned examination !

Increased Accommodation

For the last fifteen years Keyham College has been the only Admiralty training ground for engineer officers R.N. Previously, H.M.S. *Marlborough*, at Portsmouth, was used for this purpose, but it was deemed advisable to do away with this depot. Five years ago a new wing was introduced to the College, which greatly conduced to the comfort of the students there by providing reading and billiard rooms, larger lecture rooms and laboratories. There are, at present, about two hundred 'engineer cadets' at Keyham. It is not intended to deal with the social life of the cadet, suffice it to say that 'my Lords' seem to realise the truth of the maxim that 'all work and no play makes Jack a dull boy', for there are provided football and cricket fields, tennis and fives courts, a small flotilla of various rowing and sailing boats, billiard and recreation rooms, while (at least twice a year) dances are held in the large dining hall, to which the cadets invite their friends. Keyham College is especially proud of its Rugby football team, which has on many occasions supplied players for the international contests.

The Union of Theory and Practice

The readers of this journal, however, will be more interested in the actual daily life of the cadets in workshop, laboratory and lecture room, than in their exploits in the realm athletic. The course seems to have been devised in order to bring about what Sir Oliver Lodge describes as 'the wedding of theory and practice'. For the first three years, perhaps, there is more practical experience in the workshop than theoretical instruction in the lecture room, but the balance is made quite even during the last two years, for six months of which the cadet never enters the workshops, but spends his time in the drawing office on design work. For the first year's training, the practical work is done in the cadets' fitting shop in the Keyham Dockyard. The work here is of a very practical nature, and includes the building of such auxiliary machinery as fan engines, circulating pumps, steering engines, and steam fire and bilge pumps. The course is so arranged that a third-year cadet is usually given one of the above pieces of machinery to erect, and has a first-year cadet working under him. In charge of the shop are a certain number of engineer-lieutenants, under whom there are engine-room artificers, each of the latter having about a dozen students under him at a time.

The Scholastic Staff

The educational course is under the direct supervision of Professor Worthington, C.B., F.R.S., who also gives lectures to the more advanced cadets. It is impossible to express adequately the respect and affection which those who have gone through this somewhat Spartan-like training school have for the Professor and his deputy, John Crocker, Esq., R.N. The engineer officers and the Captain

barrels of the machinery which he will put together in his third year in the fitting shop are, during the second year, turned, bored, etc.—in fact, made ready for erection from rough forgings or castings which have been made by the fourth and fifth year cadets. Until this year (1904) it was the practice for the factory hours of the cadets to be from 7.30 a.m. till 12, and from 1.30 till 5 p.m., but now it has been considered advisable for them, each morning, to have one hour for preparation of theoretical work before entering the workshop. At the end of the second year an examination is held which has an important bearing upon the cadet's future. If he is among the first two or three on the list published as the result of the examination, he may, if he so chooses, study as a naval constructor. If he is among the first fifteen, he is in 'the upper division', and afterwards does much more advanced mathematical and design work than the remainder of the cadets in the 'lower division'. If he fails to get 35 per cent of the total, he is usually requested to resign—nor is this fate confined to the second year, but *all the yearly examinations*.

Third Year

The third year of his training means, for the engineer cadet, a change in his studies, as well as his naval uniform. In the workshops he spends eight months on engine fitting, one month in sketching machinery used for torpedo work, such as air-compressors and torpedo-engines, and the remaining three months repairing machinery afloat, running steam trials on the ships which have been in the Dockyard under repair, or steaming *H.M.S. Sharpshooter*, a special training vessel for the engineer cadets. This ship, which is a torpedo gunboat, is fitted with water-tube boilers, and is used solely for training the cadets. The studies now include higher mathematics, mechanical drawing, hydraulics, light, electricity, heat, strength of materials, machine design, dynamics, applied mechanics, metallurgy, and special courses in marine engineering. There is a large testing machine, which the third year cadets use, in the fitting shop, and upon which are made the Admiralty tests on the materials used for the machinery of the vessels fitted at the Devonport and Keyham Dockyards.

Fourth Year

In the fourth year's training there is included, as well as practice in fitting machinery afloat, one month in the coppersmith's shop, where the work done is of a very practical nature, and is under the direct supervision of a skilled coppersmith. In this and the other special shops in which the cadet spends a period of from one to two months, a group of from six to ten cadets work in pairs at a special bench provided for them. Should there be work in any other portion of the shop that is at all instructive to them, the instructor and the shop foreman take them either to watch or help in the work, the whole process being thoroughly explained to them. In the coppersmith's shops there are also special fires, etc., for the cadets. The work consists in fitting on patches, branches, and flanges, doing soldering and brazing, running white metal into bearings, and making sketches of the apparatus used in such a shop. Next, a month is spent in the smith's shop, where very practical work is done, such as welding, light forging, the making and tempering of chisels and drills, etc., after which a month is spent in the pattern shop and the brass foundry; then two months in the boiler shop, in which place the cadet does tube-rolling, rivetting, hydraulic tests, etc. During the writer's sojourn in this shop there were being built the Belleville boilers for the *Vestal*, Thornycroft, Yarrow, Mumford, and Blechynden boilers, as well as the ordinary cylindrical type. In this, as in all other shops, the foreman is instructed by the Chief Engineer (now Engineer-Captain) of the Dockyard to offer every facility to the cadets and their special instructor to



THE PATTERN SHOP

inspect and work on anything which will add to their general knowledge of marine engineering.

The lectures in this fourth year are on the same subjects as those of the third year, but more advanced. Special courses on electrical machinery are also given. It becomes almost compulsory for those cadets who wish to retain premier positions to attend lectures or exercise classes every evening of the week, although the official syllabus only mentions three evenings a week.

Fifth Year

In the first month of the fifth year's training there is field gunnery training for the cadets, and it is safe to say that, with the majority of them, this is the most popular item of the whole of their training. There are no lectures, no workshops, but the whole of the month of July out in the open air at the Naval Gunnery Grounds overlooking Mount Edgcumbe Park and the Hamoaze. They row across this tidal estuary every morning in the great cutters, or are towed by a Dockyard pinnace, and remain there till 4 p.m., doing squad drill, rifle, Morris tube, or pistol practice, cutlass exercise, or engaging in a single-stick *mêlée*. As a proof of the Spartan-like traditions which they still retain in the senior service, it may be mentioned that in connection with the single-stick practice, each cadet stands alone in an open space, armed only with his stick and helmet, while the remaining half squad—i.e., twenty-four cadets—engage in turn in single combat with him! After this month's gunnery training is over, the ordinary routine of the engineering training is resumed, two months being spent in the chief constructor's drawing office to learn something of the construction and under-water fittings of warships; one month in the dynamo repair shop; three months on daily trials of main engines afloat, or taking cruises in the *Sharpshooter* along the Devon and Cornish coasts. These cruises are especially instructive, for, in turn, the cadet does stoking, indicating, log-keeping, works the starting and reversing gear for the whole cruise, bringing the vessel to her moorings at night by keeping one eye on his levers, the other on the engine-room telegraph. On certain days he must turn out very early and go aboard to lay and light fires, getting up steam, and opening and regulating various valves, so that the vessel may be ready for sea at 8 a.m., on the arrival of the other

cadets. In order that there shall be no confusion, the steaming classes are small in number, there being usually about ten to a dozen cadets for each party. For the remaining five months the cadet is in the drawing office doing engine design. He must make a complete working drawing of some auxiliary machinery : some will select a dynamo engine, others a fan or circulating pump and engine. Then follows the final examination, lasting more than a fortnight, upon which his commission and subsequent promotion depends. An oral examination by the Chief Inspector of Machinery (now Engineer Rear-Admiral) and two Engineer-Captains is not the least trying of the ordeals of his last year. It is on record, however, that even this awesome tribunal did not prevent one cadet from making an amusing reply. He was asked ' what steps would you take if the main stop-valve of your boiler became disconnected ? ' His reply was ' the stokehold steps, sir ! '

The Status of Keyham

The tremendous complications of a modern man-o'-war are hazily, though well, realized by those on land, so that any comment by the author is needless. In the words of Engineer-Captain Robert Mayston, R.N., who was for many years Chief Engineer of the Keyham Dockyard, and directly responsible to the Commander-in-Chief at Devonport for the training of the engineer-cadets, ' the facilities afforded at Keyham for the acquirement of a thoroughly practical training, place the Royal Naval Engineering College in the foremost rank as an institution for obtaining a sound knowledge of mechanical engineering. The fact that, as soon as possible after entry, the student is employed on useful work, the various courses of instruction which are arranged to render the knowledge of marine engineering obtained as complete and as comprehensive as possible, the facilities afforded for acquaintance with running machinery, the constant contact throughout the training with experienced workmen, the frequent opportunities afforded for obtaining information from the officers who have charge of the training, all go to indicate that nothing is spared to make the training of the engineer student as complete as possible '.

During the last two years the College has been honoured by visits from H.M. the King and T.R.H. the Prince and Princess of Wales, all of whom have carefully inspected the buildings and the cadets, whom they addressed. A pleasing reminder of the visit of the latter are their large autographed photographs, to be seen in the cadets' dining hall.

It is impossible to attempt to criticize this admirable training school or the far-sighted policy of the Admiralty advisers. The best proof of its great superiority for training mechanical engineers is that the American universities have had this place as their model for forming their present system. And now the Birmingham University is offering to educate engineers on the American plan !

But there are obvious disadvantages which any university labours under when compared with Keyham. None others than the Admiralty could possibly give the engineer student, *at any fee*, such a training : they could not provide the workshops and the special vessels for steaming practice : perhaps, more than anything, no other training school for engineers could enforce the strict naval discipline so noticeable at Keyham, and which is so greatly responsible for its efficiency.

Physical Training

It has been impossible to speak fully of the purely physical side of the training - the compulsory swimming and gymnasium, the athletic sports and the swimming regatta, or of the many trophies won by teams for boating, football, and cricket, etc. But it is hard to resist suggesting that many of our educational



THE BRASS FOUNDRY

experts, who have so assiduously studied the technical training obtainable abroad, might have cast their eyes around in their own country and studied the methods employed by that most efficient branch of the public service—the Admiralty. The greatest proof of this great efficiency is that, in two or three years, the scheme outlined above will have become obsolete, and an eight years' course of training substituted in its stead. But Keyham College (the R.N.E.C.), as it is called throughout Devonshire and Cornwall, where the cadets are very popular) will still remain the centre of the advanced portion of the engineering education of the naval engineer cadet. The work done there is very real, the scientific instruction sound.

Output of Machinery

It has been stated that the value of the machinery turned out by the cadets and their instructors exceeds in value the total expenses of the training. The practical portion of the training is superior to that obtainable by any 'premium' or apprenticeship system, for it is under the direct supervision of specially selected engineer officers and instruction is given by selected mechanics, while the work done bears the tests of actual practice. In 1895–8 the engines of H.M.S. *Psyche* were built at Keyham; the cadets did a considerable amount of work in connection with the main engines, and the following work was carried out in their fitting-shop by them: two fire and bilge engines, eight fan engines, two hot-well engines and pumps, two circulating engines and pumps with auxiliary air-pumps, and the two reversing engines were all completely fitted up from the rough forgings and castings, including all marking off, machining, and fitting. A large number of the smaller castings, such as brasses and valves, were made by the senior students, while a large number of minor fittings for the ships *Psyche* and *Proserpine* were done by them. The work done by engineering students in any of our university colleges at present cannot compare with this record.

The Lectures

The theoretical instruction, it is maintained, is superior to that given in engineering at any university. The whole of the staff of lecturers in mathematics,

mechanics, etc., are of the Cambridge School. But the strength of the lecturing system lies in the fact that those given on various engineering subjects are by men who are recognised experts on that particular branch of engineering. For instance, the engineer-commander in charge of the boiler section of the Engineer-Captain's department would give a special course on water-tube boilers. He had been selected by the Admiralty for his responsible position because of his expert knowledge of the subject. The officer representing the Admiralty on all contractors' steam trials would give a special course on 'Steam Engine Trials and Indicating'. Right throughout, the instruction in engineering is given by men who are in daily contact with the work they lecture on. Can this be said of any university, where the heat engine expert is usually called upon to lecture also on strength of materials, and perhaps civil engineering subjects as well?

Conclusion

Finally, the Admiralty have adopted 'the sandwich system', with the slices so thin that mental indigestion is almost impossible. By taking alternate mornings in lecture room and workshop, the cadet obtains a welcome and an exhilarating change of method of learning the one subject - engineering. It is very different to spending alternate half years at college and the works. Keyham possesses all the many advantages of a residential college, added to which is the *esprit-de-corps* and the splendid naval discipline of the place. This is where the Admiralty train those whom Kipling, in the blunt but poetical phrases which have made him so famous, calls 'an amazing breed, these quiet, rather pale men in whose hands lie the strength and power of the ship'.
