

## TRAINING FOR AN ENGINEER.

A GREAT number of people have a fairly good idea how men are trained up to the various professions. They know what sort of a career a clergyman or a lawyer has to go through before being fully qualified. They have pretty clear notions of the work of the embryo doctor, and can talk freely about "walking the hospitals," and so on. But when ordinary trades are under discussion, then the ideas somehow get more vague, although the training boys receive in those trades is more visible. Most people have very hazy notions, for instance, of the upbringing of the humble but necessary plumber, or the joiner. But of all trades that of engineering is probably the one of which least is known, at all events as regards the sea-going side of it. Before going any further it will be well to state that amongst engineers there is considerable doubt as to whether theirs is a trade or a profession; so that bracketing it with plumbing and joinery will in all probability cause offence to come. While, on the other hand, a professional man, properly so-called, might treat with scorn the idea that the sea-going engineer is his equal in that respect.

Nevertheless, a trade it is—to begin with, anyhow. Though as a man rises from the bottom of the engine-room ladder towards the chief's berth he has some cause to consider himself rather above the ordinary working mechanic. Be that as it may, the fact remains that the passenger in a steamship has often absolutely no idea of how the men who drive the ship along came to be what they are. The most general idea seems to be derived from written accounts of the training of locomotive drivers. They do rise from cleaners in the yard to be firemen, then drivers of goods engines, and finally may be promoted to drive some well-known express. So the general opinion of the passenger at sea, when he sees the watch come from below and go forward with sweat rags round their necks and coal dust round their eyes, is that he is gazing on future engineers. This is a very wrong idea. The engineer has his long period of apprenticeship to serve. And before he can have charge of a watch in a passenger ship the Board of Trade takes pains to see that he knows more than his bare trade. In days gone by, it is true, that sometimes a fireman was promoted to be an engineer. "Shovel Engineers" they were called, and right good men they were so far as their business was concerned. But ask them to write a report, or do a little sum, and they were lost. Many of them, indeed, could not write their names. Now, of course, that is all changed. The Board of Trade, before granting a certificate, requires a man to have served at least four years in an engineering shop, and it may be interesting to see how the time is put in. The young engineer starts his apprenticeship at the age of about 15 or 16, and, we will suppose, he is just beginning in a big firm of marine engine builders. In various firms, of course, methods differ considerably, but still the training is pretty much the same in all when taken as a whole. The lad would most likely be sent first of all to the boiler shop. Here he would be placed with a fitter, whom he would help to bolt the various cocks and valves on to the nearly completed boiler. Not being of very much use yet his work would not be very hard. Indeed, many of the boys spend the first two or three months of their time in having pranks played upon them. And our young friend would probably have his share of hunting for a "bucket of steam" or a "tin fire-bar," would learn to speak in a "boilermaker's whisper" (which is a yell), and would generally get smartened up. After about six months of this he would be transferred to the engine shop, where he would be given a small machine to work. Usually a small lathe or drilling machine, or perhaps a tiny plane or shaping machine. Here he would remain another six months, and he should take pains not to become too good at his machine, or he may perhaps be allowed to waste his time there for a year! At the end of six months or a little more, after pestering his foreman for a week or two, he would get the desired change into the erecting shop, and it is now that his education really begins. It is now that he sees for the first time all the various parts of the engine assembled together and built up into shape. Whether he learns little or much at this stage is a matter of luck. He may be sent to work with a trusted fitter who gets the pick of the work, or he may get a lazy mate who is an indifferent workman. For a little while he would not do much more than keep his mate's chisels and scrapers ground and in good order, and boil his tea for him as the meal times come round. But soon, if he is willing, he will be trusted more by his mate, and will do a little of exactly the same work as the fitter. He will learn to use his tools and make a neat and good job. And, above all, he will learn the value of that sixteenth of an inch which looks so small and yet means so much.

Suppose him to have been in the erecting shop for 2½ years. That leaves him 18 months to serve, for nearly all boys serve five years instead of the compulsory four. He has now several courses open to him if he wants a change. He may go to the "surface table," where all the rough castings and forgings come to be marked off for machining. Here he would learn to be very accurate. Working entirely to drawings he would get to understand the connection between the designing office and the works. And if he has been attending evening classes for drawing the work is doubly interesting. On the other hand he might get into the "break-down gang." Here he would be doing nothing but repairs to machinery, and so would learn more of the numerous machines and cranes and their various peculiarities. This is the best training for the boy if he wishes to become a fitter pure and simple. For he has to be quick as well as accurate, and never having two jobs exactly alike he learns to face pretty well any difficulty without hesitation. His third course would be to go outside to the ships. Here he would have much of his erecting shop work over again, except that the engines are now being fitted up for good. It is here that he gathers up the knowledge that will benefit him when he goes to sea, and it is here that he learns the difference between things afloat and things on a solid floor. In one new ship a lad was sent to bolt the small ballast donkey on to its seat. In order to have it nice and true he went back to the shop and borrowed a spirit level, and when on an even keel the lad set the pump up with that. He was quite oblivious of the fact that the ship had neither boilers nor funnel in her. Also her fore and main masts were not shipped, though the other two were. Naturally she went down by the stern, and some time later was noticed. It appeared to be diving off its seat! But it is here that the young engineer sees all the connections for the first time. Helping to put steam and exhaust and bilge and tank pipes in their places he cannot help getting an idea of their importance. And in gaining that experience he saves himself a lot of trouble when he first goes to sea. Here also he goes trial trips and gets some slight knowledge of moving machinery, with its attendant warm bearings and all other little troubles.

About 18 months of outside work will carry the apprentice to the end of his time. At this point there are three courses open to him. If he is not an ambitious young man he may stay on with the firm he served his time with. Having been through the work of the various shops he ought to be a good fitter. So he may stay on in that capacity, first as an improver at about 20s. to 24s. per week and next rising to the full fitter's wage. Should the young engineer have some higher ambition than this he may get into the drawing office. Here he will have the whole thing to learn over again from a different point of view. And once he gets this far, and begins to get interested in the more theoretical side of engineering there is not much fear of him ever wishing to go back to the bench.

The third course open to him is to go to sea. If the young engineer decides to try this life he will make a start as fifth engineer perhaps in one of the ships his firm are fitting out. As fifth he is still a fitter to all intents and purposes. He keeps no watch. At sea he has all night in, and in the daytime works about the decks. He has so many winches allotted to him, and they have to be kept in good repair. The windlass is usually his also, and he must see that it is in good condition before entering or leaving port. In port his job is, as a rule, on the boiler tops, re-making leaky joints, packing glands and what not. In fact, he is the general factotum. After a trip or two he may be promoted. As 4th, he usually keeps the 8—12 watch with the Chief. If he is not to be trusted very far, the Chief will spend most of his time in the engine-room. But if he is, he will be left, more or less, alone, and will have to deal with many of the little difficulties that continually crop up. And, with the Chief somewhere behind him in support, he will learn to deal with the firemen, and that is precious knowledge. For a man who has the knack of getting on well with his watch has a much happier time of it, and often gets a greater number of revolutions per watch more than a colleague who is a tactless blusterer. After a year as 4th it is quite time for him to get the Board of Trade second-class certificate. For that all his old arithmetic must be brushed up again, and all the various breakdowns and mishaps he has seen must be thought over, that he may persuade the Board that he is a fit person to take charge of a watch. He must not be like one poor innocent who had safely got through his arithmetic paper. He was having the *viva voce* part of the examination, and the examiner asked "What would you do if you found the water too low in your boiler?" He answered fervently, "Rush on deck, sir, quick and lively!" He got no certificate, needless to say. If he gets his second-class certificate, or popularly, his "second's ticket," he has to serve another year in charge of a watch before going up for the coveted first class, or

"Chief's ticket." After that he has nothing to do but wait for promotion. As second he has to work twice as hard as he did before. He is then the chief's right hand—his foreman, as it were. He engages the men, and sees that they do their work. He is responsible for the stores, paint, and so on, and generally speaking, for the well-being of the engine room. Get an expert to take a casual glance through the engine-room door, and he will tell at once what sort of a second that ship has. Coming in and out of port the second works the engines; at sea he keeps the four o'clock to 8 o'clock watch and generally is the practical man holding the same position in relation to the Chief that the mate does to the captain.

Then after a time, perhaps one year, perhaps ten, he gets the step that makes him the full-blown chief. Then for the sea-going engineer, life has nothing further to offer.

## Accidents from Electricity.

In cities where electricity is largely employed for lighting, heating and traction, accidents are fairly common, and vary from slight burns up to apparent death from electric shock. The following is a list of the more common accidents in connection with electric apparatus, cables, conductors, dynamos, etc. —

(a) A slight burn may be produced from short circuiting at the terminals of a small switch or lamp-holder, or by the "blowing" of a fuse. This is to be treated on ordinary lines as a burn.

(b) When a workman puts a metal tool across two bare conductors of opposite polarity, the tool having less carrying capacity, or by bearing imperfectly on the "mains," forms an arc with resulting flash. Severe burning and electric shock may be caused in this way.

(c) An accident may occur in disconnecting the electrical circuit in a dynamo or other piece of apparatus in which there is a good deal of magnetic induction—e.g., in a broken shunt. This is all the more serious, as it causes great shock from the current being at very high pressure.

(d) If the insulation of a dynamo armature at a generating station breaks down, injury to bystanders may result from fused copper or solder being violently thrown out while the machine is in motion.

## The Dredging Industry.

The annual report of the New Zealand Mines Department shows the result of the work of 50 dredges for four years:—

	Gold. oz.	Capital Invested.	Dividends.
1901 ..	44,914	£472,076	£45,359
1902 ..	71,315	348,801	107,506
1903 ..	54,162	395,429	81,177
1904 ..	59,613	356,784	85,226

Last year's return thus averaged about 24 per cent. on capital invested. But the return was very irregular. Only 21 of the 50 dredges paid anything at all, while the Electric, on a capital of £26,000, paid £39,650, or over 150 per cent. After that the most profitable was the Roxburgh Jubilee, which paid £6750 on a capital of £7500. Both these co.'s have continued exceedingly profitable throughout the present year. The average profit to the shareholders of all dredges furnishing particulars to the department works out at about 28s. per oz. won.

## The Precursor of the Mono-Rail.

It would seem that the railway of the near future is to be on the mono-rail principle, the advantages which such a system offers in point of speed and, perhaps, of safety being a subject now occupying the minds of our most advanced railway engineers. The underlying principle of the mono-rail was, in a somewhat crude form, discovered as far back as 1824 by a Mr. H. R. Palmer. Mr. Palmer's idea was described and commended by the Editor of the *Register of the Arts and Sciences, Improvements and Discoveries* in the issue of that journal bearing the date Saturday, January 10, 1824. Mr. Palmer did not suggest steam as the motive power for his railway, his object being to make the fullest use possible of horse power for the traction of coal or other heavy merchandise across country, the question of quick passenger traffic being outside his scheme. The limited scope for which he designed his railway does not in the least detract from the credit due to Mr. Palmer for having been apparently the first man to conceive the mono-rail idea.—*Magazine of Commerce.*