

Efficiency: Design: Administration

Having reviewed the history of the firm, and dealt briefly with the results obtained by some of the modern steamers constructed by them, we propose now to describe the Works in order to indicate the measures adopted to secure efficiency in design and construction of all types of ships and machinery. Organisation and administration are as important factors towards this end as the mechanical methods and appliances adopted, and it may be well, therefore, to deal first with these.

The firm have been responsible for the design of almost every merchant ship constructed by them. Success has been rendered more certain by the possession of carefully-collated records, the product of an organised system of working up all data, of tackling new problems, of making calculations regarding any scientific question, and of studying contemporaneous work as described in the technical press and in papers read at technical institutions. This continuous investigation produces a wealth of suggestion, which enables the chiefs of the respective departments to determine how far practice may be improved; and thus there is steady progress not only in design but in constructional methods. A well-selected technical library, from which the staff can borrow books, also contributes to the same end.



Admiralty and merchant work is initiated in separate drawing-offices. The Printed Instructions to Draughtsmen throws light on the general principles which influence design, and one or two quotations may be made: — every machine or structure is designed with a certain object in view; therefore, in designing, keep that object always to the front. Go straight to the point, and let the object be attained in as simple a manner as possible. Avoid all curves and indirect lines, except those conceived to give uniform strength or stiffness, or required for some definite purpose. There should be a reason for the contour and shape of every detail. It should be remembered that designs made in this way, requiring least material for the work to be done, usually look best. Besides keeping the object clearly to the front, it is necessary in designing to remember that certain facilities must be attended to for moulding, machining, and erecting. It is also necessary to keep in view the circumstances in which the structure or machine is to be used. Every little detail should be definitely attended to on the drawings, and not left to the judgment of the men in the shops; remember that it is usually the unexpected which happens, and that even the want of a split pin may cause a breakdown. In making drawings or sketches for ordering material or for the shops, assume that those who have to interpret the instructions have no knowledge of, or information concerning, the work in question, except what is contained in the drawing or order you are making out. This will ensure that all

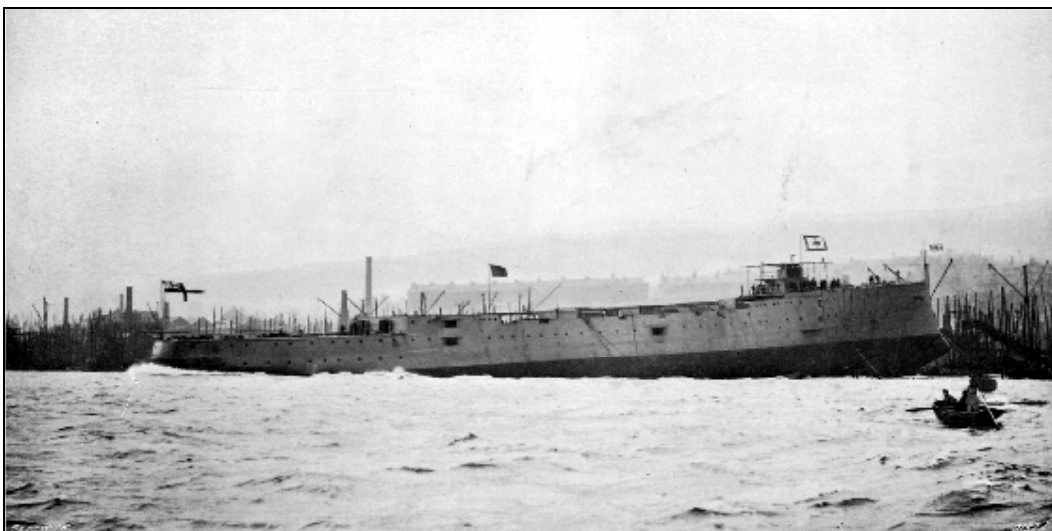
information issuing from the drawing-office is complete, and that no work is done in the shops without drawing-office instructions.

The draughtsman, in designing work, must so arrange details as to fully utilise, as far as is compatible with progress, the special machine tools available, the system of gauges, templates, and jigs extensively applied in the shops, and existing- patterns. Bonuses are paid for improvements in design whereby economy may be effected in machine operations, etc.

There is a large estimating department, where records of costs, rates, wages, etc., are of the most complete description. The card system adopted is admirably suited for enabling references to be made at any time as to the cost of units in any contract. Here also it is possible, by the simple process of comparison, to effectually check the economy of design and manufacture, without which a high premium is placed against efficiency.

The staff in these departments is largely recruited from the shops, and thus there is an incentive to the willing apprentice to excel. The great majority of the vacancies in the technical staff are filled by apprentices who have spent three and a-half years in the shops, and who are chosen as a result of examination and of a satisfactory record in the shops. Financial facilities are afforded to boys and to progressive workmen to attend special classes, not only in Greenock but in Glasgow. Competitions are instituted at intervals to encourage expertness in some branch of work—for instance, in the use of the slide-rule, etc. Thus in many ways the growth of an active esprit de corps is encouraged, apart altogether from the influence which the historical and present-day success of the firm engenders.

The same broad policy is pursued in the shops. Payment by merit to the tradesman is adopted as far as possible. In the engine works the bonus system—first adopted in 1902—is extensively applied. The arrangement is satisfactory from the point of view of tradesman, employer, and client.



The Launch of H.M.S. Argyll

Long experience has enabled the firm to set equitable standard times for many operations, and there was from the beginning the guarantee that this standard would not be altered unless entirely new machines were introduced to greatly influence the rate of production. Now if a workman requires the full time, or more than the time set as a standard for a job, he is still paid his full-time wage as under the old conditions: but should he complete the work in less than the standard time, his rate of wage per hour is increased in direct proportion to the saving in time; the shorter the time taken, the greater the rate of bonus. The bonuses earned range as a rule from 20 to 30 per cent, over the time-rate wage. To quote actual cases, a workman who saves 26 hours on a job for which the standard time is 134 hours, increases his wage for the fortnight by 14s., while the money saved to the employer is only 2s. 9d. He who saves 30 per cent, on the time adds 21s. to his fortnight's wage.

Such reduction in the time taken is not attained at the expense of efficiency; the premium job is carefully inspected, and unless it is of the highest standard the bonus is forfeited; so that the workman is continuously careful to avoid any risk which will result in the loss of the reward for his extra work. The reduction in time taken is, in a large measure, due to the exercise of foresight and ingenuity on the part of the workman. He is ever on the alert to ensure that he will not be kept waiting for material to enable work to progress. The machine-man makes certain that before one unit is out of his machine the casting, forging, or bar for the next is alongside. This is further facilitated by a man in each shop whose only duty is to see that there is a supply of work for every tool. Encouragement is always accorded to those who suggest modifications to increase the output from any machine.

Again, in the erecting of engines, considerable economy has been attained, owing to similar foresight being exercised to ensure that each unit is machined before it is wanted by the erector.

To the employer also there is gain in the increased production, from a given number of machines and men, for a constant establishment expenditure—rent, rates, taxes, etc. While the wage paid to the men is increased, there is a reduction in the cost of production, which of itself encourages capital expenditure on improved methods and appliances. Concurrently with the adoption of the bonus system there has been a great increase in the cutting speed of tools, which has also augmented the rate of production. This speeding-up is partly due to the fitting of new machines, to the substitution of forged steel machine-cut gear for cast spur - wheels, to the strengthening of lathe headstocks, to wider belts, to the application of reversible motors to some machines, and to quicker return speeds.



Engine Construction

Some indication may be given of the increased economy resulting from the bonus system and from the speeding-up of tools, as compared with the former system, with slower speeds and piece-work rates. A typical job, which had formerly occupied eighty hours, was, after experience, given a standard time of sixty hours. When first carried out under the bonus system the time actually taken was forty-five hours, the labour cost being reduced from £2 13s. 4d. at piece-work rate to £1 17s. 6d. under the bonus system, while the wage of the worker was increased by 2d. per hour. Subsequently, a repeat of this job was machined by the same man, who, having confidence that the time allowed would not be reduced, finished the work in thirty - nine hours, saving twenty - one hours on the standard time, reducing the cost to £1 15s. 0d., and increasing his rate of pay by 2.8d. per hour. Other comparisons might be given to show the advantage over the piece-work. In successive fortnights after the introduction of the system, the percentage of time saved on the time taken on piece-work in one department steadily advanced from 16 per cent, to 47 per cent., and ultimately the pay of the men per hour was increased 75 per cent., while the saving to the employer was 50 per cent.

The client profits, as the contract price is reduced without any diminution in the satisfactory character of the work done; indeed it is probable that this is improved because of the special inspection to ascertain if the bonus has been conscientiously earned. A lower contract price, therefore, is possible; and this places the firm, both directly and indirectly, in a better position in competition in shipbuilding. There is more work obtainable, more constant employment for the workmen, with the additional inducement of higher wages to capable and diligent men.

