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One Two-Page Plate.—THE DEPTFORD WEST GENERATING STATION OF THE LONDON POWER COMPANY.

ENGINEERING

FRIDAY, JANUARY 22, 1932.

VOL. CXXXIII. No. 3445.

THE MARINE ENGINE.

IN view of the severe competition which now confronts the ordinary reliable, but by to-day's standards uneconomical, marine engine, it is of interest to have authoritative estimates as to how far it is practicable to improve it. Of course, great economies can be effected by coupling it up in one way or another with an exhaust steam turbine, but it is of very considerable interest to ascertain what is possible without the introduction of innovations of this kind. With the object of obtaining reliable data on this head, the North East Coast Institution of Engineers and Shipbuilders recently organised a discussion on improved marine steam reciprocating engines, and whether their performance justified their extra cost. Written contributions were invited from a number of leading firms, who agreed to submit estimates in accordance with an outline specification drawn up by the Institution. This provided that the engine should be capable of developing 1,800 i.h.p. when running at 65 r.p.m., and be suitable for fitting aboard a ship 375 ft. long, with a block coefficient of 0·77. While the type of boiler was not specified, it was provided that the average rate of heat transfer should not exceed 4,800 B.Th.U. per square foot per hour, which would represent at most something less than an evaporation of 5 lb. per sq. foot of heating surface per hour. The fact that more than treble this rate is to-day attained in power station practice and with efficiences of 85 per cent. and more would seem to raise the question as to whether there is not more room for improvement in the marine boiler than in the marine engine. The specification further provided for a condenser with regenerative heating of the condensate, and with an air cooling section. No vacuum was specified, but the rate of condensation was not to exceed 8 lb. per square foot per hour. To secure reasonable uniformity in the conditions on which estimates might be based, the auxiliary machinery was specified in some detail, and in view of the prejudices of a past generation of marine engineers, it is of interest to note that the thrust block is required to be of the Michell type. In making estimates of coal consumption, the calorific value of this was specified as 13,500 B.Th.U., and the following allowances were permitted for the steam consumption of certain of the auxiliaries: 250 lb. per hour for the dynamo; 450 lb. per hour for the steering engine; and 200 lb. per watch for ash hoist.

Two firms sent in estimates based on this general specification, whilst a general discussion of the whole question was contributed by Mr. J. N. Hendry, who reviewed the more authoritative tests which have been made in the past, and noted, incidentally, that much of the credit for the lower fuel consumption, now recorded in service, is to be credited to the naval architect rather than to the engineer, since, during the past ten years, shipbuilders have developed forms of hull, which, though costing little more for the same cargo capacity, are easier to drive than were the great bluff forms of the past.

One of the points Mr. Hendry brings out is the somewhat wide gap between the performance of the standard marine engine and the land engine. He notes, for example, that a Bellis engine of 2,000 brake horse-power has a steam rate of 9·65 lb. per indicated horse-power hour when supplied with steam superheated by 150 deg. F. This figure is very distinctly lower than what has hitherto been authoritatively recorded in marine engine trials. It is also better than the estimated steam consumption of an engine of the normal type, which is discussed in the instructive paper submitted by the Wallsend Slipway and Engineering Company, Limited, in which the main engines, working with steam supplied at 225 lb. per square inch (absolute), and at a superheat of 150 deg. F., are credited with a steam rate of 10·9 lb. per indicated horse-power-hour. Provision was made in this instance for preheating of the air supply to the furnaces, and alternative estimates got out for feeding the auxiliaries with saturated or with superheated steam, the latter arrangement showing a small saving. With a boiler efficiency of 75 per cent., the estimated coal rate (calorific value 13,500 B.Th.U.) is 1·375 per horse-power per indicated horse-power for all purposes. About 10 per cent. of this total is debited to the auxiliaries. This estimate of what can be expected from the ordinary marine engine without wide departures from the normal type, and using coal in the boilers, is stated to be confirmed by figures recorded in actual voyages. No estimate is given of the total machinery cost or of its weight.

Four estimates were submitted by the North Eastern Marine Engineering Company, Limited. Since the general specification prepared by the North East Coast Institution contained requirements in advance of normal practice, an estimate was first got out for a triple-expansion engine of the ordinary type using saturated steam. In a second proposal, smoke-tube superheaters, are provided for and the condensing and feed-heating arrangements are in accord with the general specification. In the third proposal, greater provision is made for superheat, the steam temperature being raised to 650 deg. F, and to deal with this the engines have poppet valves in the high-pressure cylinder. In the fourth proposal, the steam pressure is increased up to 225 lb. per square inch and quadruple-expansion are adopted. The gross result is that with this arrangement the coal consumption would, it is stated, amount to about 22 tons per day as against the 30½ tons per day required by the standard triple-expansion engine. Attention is drawn to the fact that there is a definite saving in weight by an increase of steam temperature, mainly on account of the smaller boiler required. The condenser is also affected in a similar way. On the other hand, higher pressures involve higher weights. The machinery weight is least in the case of the third proposal, the estimated figure being 365 tons. Both the ordinary triple- and the quadruple-expansion

spindle turbine placed well above the waterline. With regard to air supply plant, designers had been greatly assisted by the closer attention now given to the reduction of losses in intake shafts, &c. Formerly, these accounted for 50 per cent. of the total energy supplied to the fans. The reduction of such losses to a minimum was now-a-days of very great moment when installations on board might be required to supply 320,000 cub. ft. per minute against stokehold pressures of 3½ to 4 in.

Engineering Standardisation in Australia.

On Thursday, January 14, a joint meeting of the British Standards Institution and the Standards Association of Australia, was held, the two parties to the gathering being assembled at the Board of Trade, London, and at Science House, Sydney, respectively. On this side, the meeting was addressed by the Right Honourable Walter Runciman, President of the Board of Trade, by Mr. Maurice Wilson, chairman of the British Standards Institution, and by Sir William Larke, chairman of the Iron and Steel Industry Committee, while on the other, the speakers were Sir George Julius, chairman of the Standards Association of Australia, Sir Henry Barraclough, dean of the Faculty of Engineering, University of Sydney, and Mr. C. Le Maistre, Director of the British Standards Institution, who is at present in Australia. Mr. Runciman pointed out that the development of standardisation in the various parts of the Empire, upon the basis of close co-operation in establishing uniform standard specifications, would contribute to the growth of inter-Imperial trade, while Sir George Julius emphasised the growing realisation of the interdependence of the two countries, and the need that Great Britain should further extend her Empire markets. Not the least of the efforts being made towards that end was, he said, the work of the two Standards Associations, which for many years had been studying each other's needs with a view to securing at a maximum efficiency and minimum cost the article or material, which would satisfy the user. Failure in this direction on the part of the British manufacturer had resulted in the loss of much possible trade in Australia, while primary producers in the latter country had equally failed to understand the markets in the Mother Country and had, therefore, found it difficult to meet competition from others. This position could only be rectified by a whole-hearted and co-operative survey of imperial market requirements and manufacturing possibilities, so that, as far as possible, those requirements could be met by products from within the Empire. It was the intention of the Commonwealth Government to assist in the conduct of the work of the Standards Association of Australia. Sir Henry Barraclough stated that in that country there were 500 committees dealing with various aspects of standardisation. That number might appear large, but it must be remembered that they were scattered over a continent the size of Europe, which was divided into six self-governing states. Mr. Le Maistre uttered a warning to British manufacturers on the necessity of adapting their products to the special requirements of Australia, and added the good advice that they should visit the country to see for themselves, if possible. We commend this advice to our manufacturers.

Irrigation Works in Madras.

The Presidency of Madras is essentially an agricultural region, 71 per cent. of its population being engaged in tilling the soil. The total area of the province is 142,260 sq. miles and over 42 per cent. of this, namely, 39,260,000 acres, is under cultivation; a fair proportion of the remainder is forest land. The fertility of the soil is greatly increased by irrigation, and this has long been recognised by the industrious Madrasi agriculturist. About a quarter of the sown area is systematically irrigated and does not, therefore, depend on the adequacy of the monsoons. For many years past a large proportion of the irrigation works have been in the hands of the Madras Government and the annual administration report of the Public Works Department of the Presidency shows that 7,380,867 acres of land, representing 18·8 per cent. of the total cropped area, were irrigated by Government works during the twelve months ending June 30, 1930. This total was greater by 118,771 acres than the previous year's figure. The total revenue derived was Rs. 3,02,53,263 and the net revenue, after deducting working expenses, was Rs. 1,36,23,889. Some idea of the scale upon which the operations were carried on will be gained when it is stated that the total length of the main and branch canals of the irrigation works was 4,447 miles, some 1,180 miles of which were utilised for navigation as well as for irrigation purposes; the length of the distributing channels reached the large total of 10,320 miles. A good deal of the report is naturally devoted to particulars regarding the now well-known Cauvery-Metur irrigation project. Work on the main dam at Metur is shown to be progressing satisfactorily; 310,000 tons of masonry had been placed in position on the dam site during the year ending June 30, 1930, and this had been increased to 429,000 tons by the end of December, representing an average of 1,050 tons per working day. The line from Salem on the South Indian Railway to Metur was opened in April, 1929, and materials are now conveyed direct to Metur Dam station. The project includes a hydro-electric power scheme, by which it is hoped to generate 30,000-h.p. continuously all the year round. The insertion into the dam of four rows of 8-ft. 6-in. diameter pipes, for the purpose, was begun in November, 1930. We hope to deal with this subject at length shortly. Another important portion of the work of the Department is in connection with the restoration of the derelict tanks distributed over a wide area within the Presidency. The total area of land coming within the scope of the tank restoration scheme is 102,500 square miles, which, as will be seen, is two-thirds of the area of the Presidency itself. Up till the end of March, 1930, restoration works had been completed over an area of 83,137 sq. miles, and, in addition, works had been put in hand, or were about to be commenced, on a further 4,493 sq. miles of land. Consequently, some 85·49 per cent. of the total area comprised in the scheme had been dealt with by March 31, 1930.

Regulations for the Asbestos Industry.

The Home Secretary has issued a pamphlet of regulations relating to the Asbestos Industry, under Section 79 of the Factory and Workshop Act, 1901, three pages of which are concerned with the responsibilities of occupiers and one-half a page with the duties of persons employed, the remainder being taken up by familiar perambulatory matter. Assuming that brevity is more effective than diffuseness, there is no objection to this. Indeed, the whole pith of these regulations is comprised in the statement that the occupier is to provide mechanical means for preventing the escape of asbestos dust from the various machines into the room, and a breathing apparatus for each person employed in chambers where loose material is prevalent, while the persons employed are to wear that apparatus. If we regard the last stipulation as being the most important, it is because a long study of the reports of H.M. Inspector of Factories has convinced us that there are few, if any, of the methods proposed for increasing the safety of workmen, which these workmen will not exercise the greatest ingenuity to circumvent, when they feel so disposed. That this view is also held by the authorities is shown by the fact that another stipulation animadverts against the misuse of, or interference with, any appliance provided in pursuance of these regulations. The processes covered include the breaking, crushing, disintegrating and grinding of asbestos, the manufacture of asbestos textiles and insulating materials, and the cleaning of the equipment used for the collection of the dust. The regulations are published by H.M. Stationery Office, as *Statutory Rules and Orders*, 1931, No. 1140, at a price of 2*d.* net.

The Brothers Haworth and Carron Works.—Messrs. Carron Company, Carron, Falkirk, have recently published the eighth of their attractive little pamphlets in the "Famous Men and Carron Works" series. This deals with the work of William and Henry Haworth, who were designers and wood carvers at Carron. Illustrations of several outstanding examples of their ornamental carvings, and of the castings made from them in the foundry, are included in the pamphlet.

THE ENGINEERING OUTLOOK.

IV.—The Motor Industry.

Official employment statistics do not distinguish between the private car industry and commercial vehicle industry. In Table I accordingly a general summary is given covering the group of industries centred round the internal combustion engine.

Table I.—*Number of Workpeople Employed.*

Year.	Motors, Cycles and Aircraft.*			
	Number Insured.	Number Unemployed.	Number Employed.	Index 1923 = 100.
1923	191,830	16,108	175,722	100·0
1924	203,340	16,145	187,195	106·5
1925	214,340	14,100	200,740	114·2
1926	224,040	21,609	202,431	115·6
1927	232,860	18,339	214,531	122·5
1928	236,830	22,015	212,815	121·1
1929	246,410	17,614	227,796	129·6
1930	247,140	40,647	206,493	117·5
1931	251,320	57,462	193,858	110·3

* Figures relate only to the month of July in each year.

As explained in previous articles, the Ministry of Labour figures in respect of 1928 to 1931 are not strictly comparable with those for previous years, in that they leave out of account all workpeople 65 years of age and over, and youths under 16. Possibly, an addition of some 2,000 workpeople employed should be made on this account. The adjustment does not, however, affect materially the very decided recession shown in the above table. None of this recession is probably allocable to the aircraft industry, and a small amount only in the aggregate to the motor cycle and cycle industries. Although there was still a net influx of workpeople into the industry, it was on a smaller scale than in recent years, and it was insufficient to compensate the large increase in the number unemployed. The resulting figure of employment is lower than any year since 1924, and even allowing for the rapid technical advance in productive processes, indicates a marked decline in production as compared with 1929.

Private Cars.—The revised figures of private-car production, published by the Society of Motor Manufacturers and Traders, Limited, in their annual review for the years up to and including 1928, and the figures for the years ending September, 1929, 1930 and 1931, are given in Table II.

Table II.—*Output of Cars.*

1923	...	71,396	1927	...	... 164,553
1924...	...	116,600	1928	...	... 165,352
1925...	...	132,000	1929	...	... 182,256*
1926...	...	153,500	1930	...	... 171,052*
			1931	...	... 158,298*

* Year ending September 30.

The production year of the motor industry is from October 1 to September 30, owing to the necessity of regulating production in accordance with the seasonal movement of demand and to the impetus given to the production of new models by the annual Motor Exhibition at Olympia, which is held at the beginning of October. Since the necessary data have been available, it has, therefore, been more useful to collate production figures on the basis of the production year. Apart from the slight overlap in 1928-29, this method does not vitiate comparison, and even in the year of transition little difference would be made where the calendar year figures substituted for those of the production year. The decline in production in this section of the motor industry is in line with the decreased employment noted above, and was progressive throughout the year. Twelve monthly totals, however, show that since October, 1931, the decline has been arrested. Both as regards the magnitude of the decline and the recent improvement, these results are highly satisfactory, especially if comparison is made with the position of the motor industries of other countries. Indeed, during some weeks of November, 1931, it was not impossible that British production exceeded the production of the U.S.A., which was then, owing to shut-downs, running at some 7,000 units per week. Such a position is certainly unprecedented, and perhaps unlikely to recur, but it is sufficiently striking to be noticed, and would not have been considered within the bounds of possibility three years ago. The new

EXHIBITS AT THE PUBLIC HEALTH EXHIBITION.

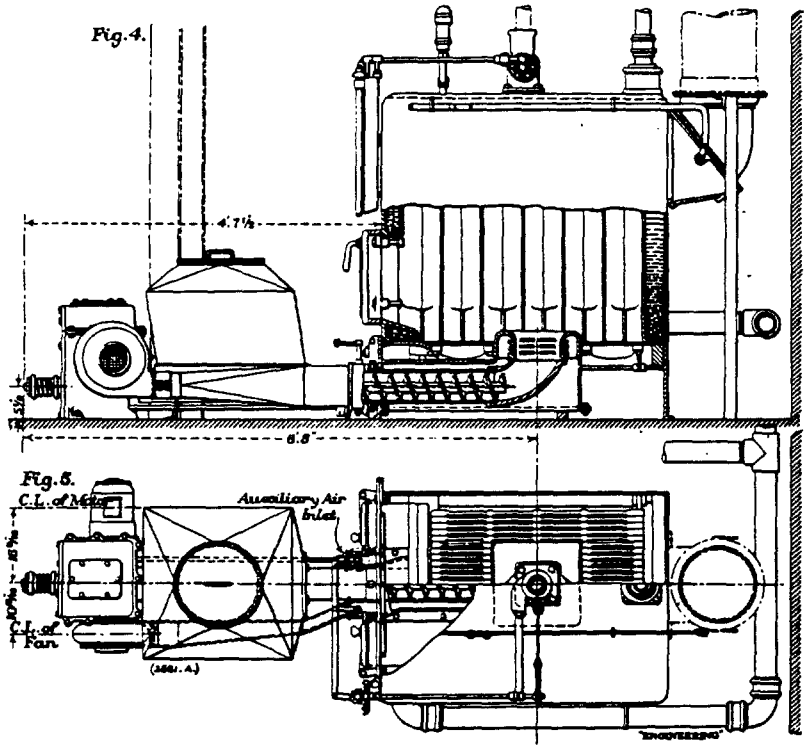

FIG. 6.

FIGS. 4 TO 6. MECHANICAL STOKER FOR HEATING BOILERS; MESSRS. COMBUSTION ENGINEERING, LIMITED.

or compresses as required. The machine is designed for street watering, in addition to gully emptying, and fittings can be supplied to enable it to be used as a gutter flusher, sewer flusher or cesspool emptier. Finally, the tank can be lifted away in a few minutes as a complete unit, and a hydraulically-operated end-tipping lorry body substituted. The change-over does not call for special equipment, as the hydraulic tipping gear is employed to raise the tank bodily.

The engine is a four-cylinder model with a cylinder bore of 100 mm. and a piston stroke of 150 mm., and develops 55 brake horse-power. It is mounted on three-point suspension, and is insulated from the frame by coil springs at the front and rubber mounting at the rear. Side-by-side valves are employed, with pump circulation for the cooling water and magneto ignition. The clutch is of the external-cone type faced with fabric, and a double universal joint of the fabric-disc type is fitted between the clutch and gear box. The latter is arranged for four forward speeds, the ratios being 4·5, 2·76, 1·75 and 1 to 1. The reverse ratio is 3·73 to 1. The shafts are of large diameter, and run on ball bearings, while the gears are of chrome-nickel steel. A separate external oil filler is provided. There is a universal joint at each end of the propeller shaft, and the final transmission is by worm gearing. The top cover of the rear-axle casing carries the worm and differential assembly, which can be removed without taking down the axle or removing the wheels. The live axles can also be withdrawn without removing the latter. A hand brake of the contracting type operates on a drum behind the gearbox, and the servo-assisted foot brake, of the internal-expanding type, operates on drums on the rear wheels. The springs are of chrome-nickel steel, and pressure-gun lubricators are provided.

The tank is divided into two compartments, the forward one, of 200 gallons capacity, being for clean water to reseal the gullies after they have been emptied, and the rear compartment, of 350 gallons capacity, for carrying the sludge. Provision is made for connecting the two compartments to form a single tank for watering or sewer flushing. The tipping gear is of the hydraulic-ram type, operated from the engine through a power take-off on the gear box, and gives an elevating angle of 40 degrees. An automatic cut-out valve is provided to eliminate the risk of over-tipping. The air pump is of the rotary type, and is fitted with a two-way reversing valve, which enables it to be used either as an exhauster or compressor. It is driven from the engine and is quiet running and automatically lubricated. The suction hose, which is clearly visible in the figure, is mounted on the near side of the tank, and is fitted with a steel pipe and valve. It is carried on a balanced arm, as shown, to facilitate raising and lowering. A large gauge glass is provided on the top half of the sludge compartment, and a full-length gauge glass on the clean water compartment, together with a compound pressure and vacuum gauge connected to the air pump, and located behind the cab.

The sprinkler heads, when fitted, are of gunmetal, and are independently controlled, both for width of spray and quantity of water delivered. The spray will cover a total width of from 30 ft. to 35 ft. at a single passage of the machine. A 3-in. quick-acting valve for sewer flushing, connected to a suitable length of copper-riveted hose, is fitted under the rear of the tank, and a 2-in. gutter-flushing valve is located under the near side of the driver's seat. The latter valve is operated by a hand lever in the cab. The cesspool-emptying equipment consists of a 3-in. quick-acting valve and a gunmetal adaptor for connecting the hose. It is fitted on the near side of the tank, with a steel pipe connecting it to the dome. This enables compressed air to be passed through the hose for cleaning it, and also for stirring up the solid matter in the pits. The 3-in. cesspool suction hose is armoured, and is supplied in 17-ft. 6-in. lengths.

The wide extension in central heating, which has occurred in recent years, has led to considerable improvements in the design of boilers of the type used in private and public buildings for obtaining a constant supply of hot water. The majority of these boilers, however, still require to be fired with a relatively expensive fuel, and as they are normally hand-fired, a certain wastage of fuel is almost inevitable. To overcome these defects, Messrs. Combustion Engineering, Limited, Aldwych House, Aldwych, W.C.2, have introduced the mechanical stoker illustrated in Figs. 4 to 6, on this page, and shown at the Exhibition. This stoker, which is known as the "Robot Fireman," is constructed on the same principles as the larger mechanical stokers manufactured by the Company, and previously described in our columns. The use of one of these appliances on a hot-water boiler enables a cheap coal to be employed, since the fuel is in a continual state of movement, thus ensuring an intimate mixture of fuel and air. In addition, it entirely eliminates labour, with the exception of about 10 minutes' attention required every 12 to 18 hours to fill the fuel hopper and to remove the clinker, and, finally, there is no intermittent fall in temperature caused by opening the furnace doors, and no objectionable fumes reaching the stokehold.

The fuel is placed in the hopper shown in all three figures, and falls into a trough, from which it is fed into the furnace by the conveyor screw shown in Figs. 4 and 5. The fire is lit in the usual way with sticks, and the machine is started with a slow feed, power being supplied by the small motor visible in Figs. 5 and 6. When the fire is well alight, the fuel supply is increased. The motor drives a crank through worm and spur gearing, the crank being connected to an arm carrying a pawl, and the arm being pivoted concentric with a rachet wheel. This rachet wheel drives the conveyor screw through a slipping clutch, visible to the left in Figs. 4 and 5, which forms a safety device in the event of foreign matter being mixed with the coal. A shield is so arranged that it can be interposed between the pawl and the rachet wheel to hold the former out of engagement for a lesser or greater portion of its stroke, thus regulating the feed rate. This shield is connected to a horizontal shaft running beside the conveyor casing, and visible in Fig. 5. At its inner end, the shaft is connected through bevel gearing to a system of levers controlling the dampers for the forced and induced air supply, and this system of levers is again connected through bevel gearing and a vertical and horizontal shaft to a thermostat placed in the boiler water outlet. The arrangement can be followed from the three figures, and it will be clear that the thermostat will automatically reduce or increase both the fuel and air supplies, as required. The forced draught is supplied