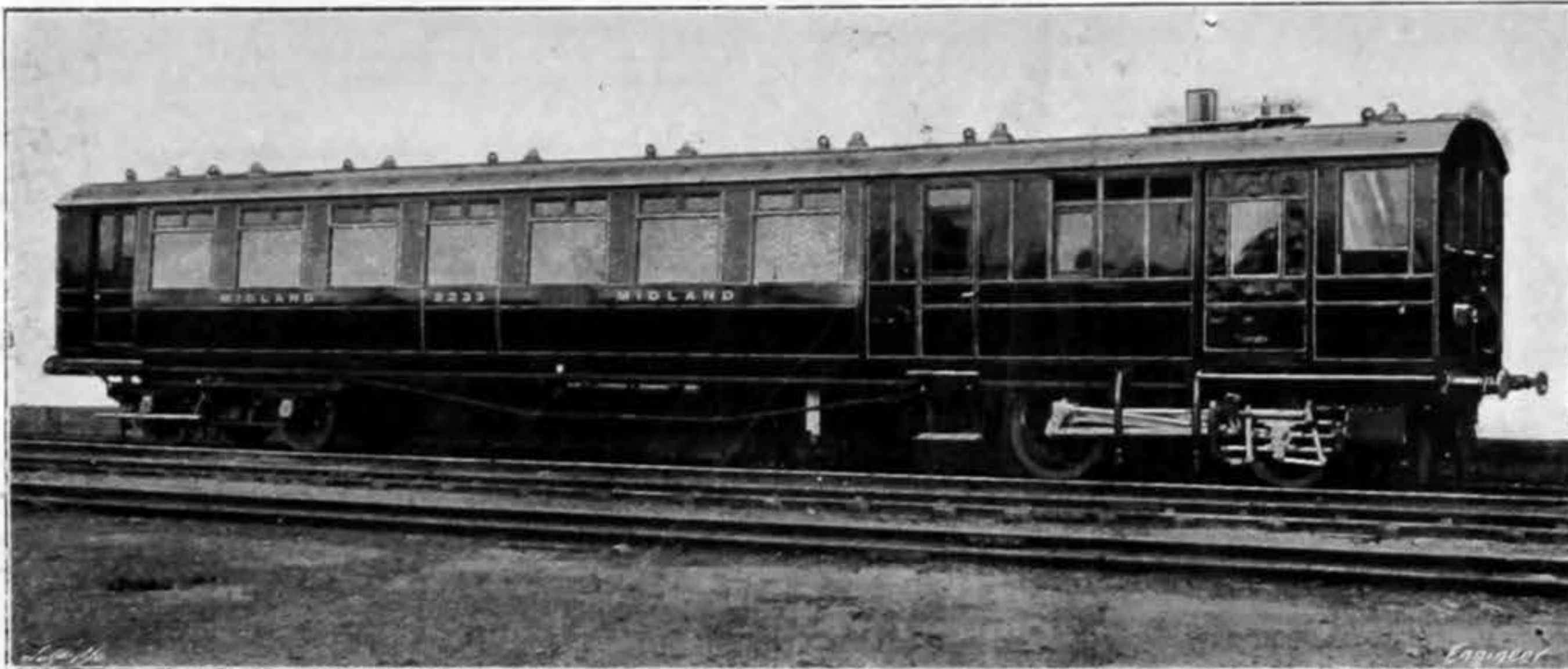


STEAM MOTOR COACHES, MIDLAND RAILWAY.

On July 4th the Midland Railway Company put into service the first of the self-propelling steam railway coaches that are to run between Morecambe and Heysham, and in this week's issue, through the courtesy of Mr. Deeley, the locomotive superintendent, and Mr. Bain, the carriage and wagon superintendent, of that railway, we are able to publish several illustrations and give the leading particulars of one of these vehicles. Two of these coaches have been constructed in the company's works at Derby, and both are now running on the branch of line referred to.

The coach body is divided into four sections, viz., the engine-room, 13ft. long; a luggage compartment, arranged with folding seats to accommodate eight passengers, 6ft. 6in. long; a saloon, 35ft. long, with seating accommodation for



MIDLAND RAILWAY STEAM COACH

fifty-six passengers, and a vestibule, 4ft. 6in. long, the total length of the coach being 60ft. over the end panels. The extreme width outside the saloon is 9ft., and outside the engine-room, luggage compartment and vestibule, 8ft. 6in.

The engine-room is separated from the compartment next to it by an iron partition fitted with a hinged door, and the partition between the luggage compartment and the saloon is also fitted with a hinged door. Access to the saloon from the vestibule is obtained through a sliding door. The vestibule is provided with composite doors on either side, consisting of a lower half in one piece and two glazed doors above, both of which can be opened independently of the lower half. At each end of the coach a door and gangway are arranged to provide through communication for the guard when a trailing coach is attached. Passengers enter or leave the coach either at the vestibule or by the doors in the compartment next to the engine-room. In the saloon the seats are arranged transversely on each side, leaving a central gangway between them from end to end. The seats are framed in oak and the bottoms and backs are made of perforated sycamore, the sides of the saloon being match-boarded in birch and finished to match the seats. The roof is panelled with millboard and finished with white enamel. The lighting of the saloon is provided for by seven windows

the tread. At the vestibule end a bogie of the Midland Railway standard carriage type is employed. The other bogie has been specially constructed, and forms the motor part of the coach. On this bogie a boiler of the vertical multitubular fire-tube type is securely bolted between the frames, and midway between the axles, so that it forms the bogie centre. Rubbing pieces are secured to the front and back of the boiler, which fit in between transoms on the coach underframe, and through these parts the propelling force is transmitted from the engine to the coach. The transverse movement of the boiler and bogie is controlled by side check springs placed between the bogie frames and the coach sole bar on each side. The weight of the coach at the engine end is transmitted to the bogie through a combination of steel and rubber springs, and the carrying arrangement of compression pillars and suspension links is similar to that usually employed on the Great Western Railway carriage stock. The whole of the weight carried by the motor wheels is borne

through leaf springs placed inside the bogie frames—one over each axle-box. The engine is fitted with two cylinders, 11in. diameter by 15in. stroke, placed outside the frames in front of the leading pair of wheels. The connecting-rod drives on to the trailing pair of wheels, and the four wheels are coupled together by side rods. The steam distribution valve is placed on top of the cylinder and actuated by a Walschaert valve motion. All the motion joints are lined with gun-metal bushes, and the pins and other working parts are furnished with ample wearing surfaces. The gear is reversed by means of a screw arrangement, and the operating handle is situated on the side of the boiler. The driving crank-pin and lazy crank are forged in one piece, and the end of the connecting-rod and side rod is forked and provided with end blocks, which permits of their being readily fitted to the respective pins. The connecting rod big-end brasses are made adjustable. The plates and flue tubes used in the construction of the boiler are made throughout of mild steel, and the boiler is designed to work at a pressure of 160 lb. per square inch. The fire-door and the following fittings—regulator, injectors, vacuum brake ejector, safety valves, water gauge, sanding valve, and whistle gear—are fixed on the front of the boiler,

through leaf springs placed inside the bogie frames—one over each axle-box.

The engine is fitted with two cylinders, 11in. diameter by 15in. stroke, placed outside the frames in front of the leading pair of wheels. The connecting-rod drives on to the trailing pair of wheels, and the four wheels are coupled together by side rods.

The steam distribution valve is placed on top of the cylinder and actuated by a Walschaert valve motion. All the motion joints are lined with gun-metal bushes, and the pins and other working parts are furnished with ample wearing surfaces. The gear is reversed by means of a screw arrangement, and the operating handle is situated on the side of the boiler. The driving crank-pin and lazy crank are forged in one piece, and the end of the connecting-rod and side rod is forked and provided with end blocks, which permits of their being readily fitted to the respective pins. The connecting rod big-end brasses are made adjustable.

The plates and flue tubes used in the construction of the boiler are made throughout of mild steel, and the boiler is designed to work at a pressure of 160 lb. per square inch.

The fire-door and the following fittings—regulator, injectors, vacuum brake ejector, safety valves, water gauge, sanding valve, and whistle gear—are fixed on the front of the boiler,

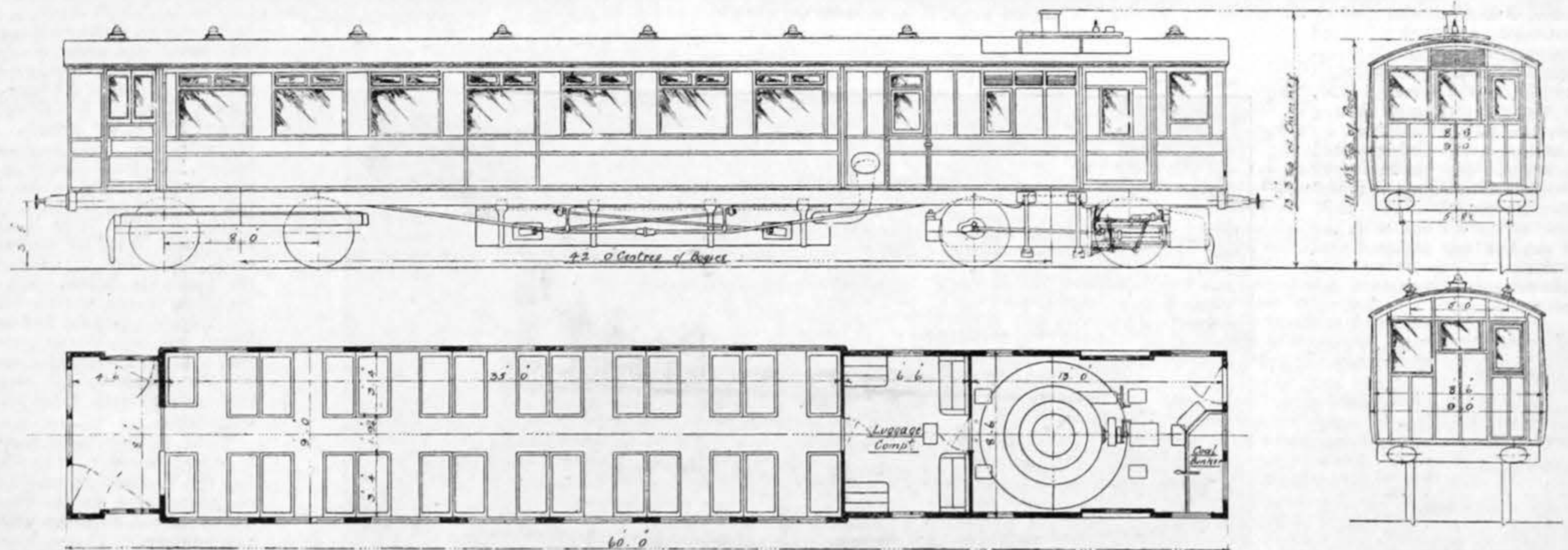
holes, when not in use, are covered up by sheet iron scutcheons. The boiler feed pipes pass from the tank bottom along under the coach body, and come up through the floor of the engine-room. From this point they are connected by flexible rubber hose to the pipes fixed on the side of the boiler, which lead to the injectors.

Brakes are arranged on both bogies to be operated by independent vacuum cylinders, and the brakes on the engine bogie can be controlled by hand gear. With regard to the manipulation of the coach, the steam regulator, vacuum and hand brakes, and the whistle, can be controlled from either end of the coach. The reversing gear can only be actuated in the engine-room, but its movements can be controlled from the vestibule end by a mechanical telegraph, similar in principle to the telegraph used between the bridge and engine-room of a steamer. The working of the regulator from the vestibule end is accomplished by a system of endless wire ropes, which are carried over pulleys outside on the roof of the coach. The handle of the regulator at the vestibule end is carried on a floating compensating lever, which automatically takes up the variations in the length of the rope caused by the rise and fall and the twisting of the engine bogie when going round curves. The compensating lever is so poised that, although the effort required to open or close the regulator may vary, yet there is no tendency for the pulley attached to the handle to rise on the rope in tension; the axis of rotation remains stable. When the coach is driven from the engine end there is practically no tension on the ropes. Provision is made for protecting the various handles fixed in the vestibule, so that they cannot be interfered with by passengers while the coach is being driven from the engine end.

The following is a list of the leading particulars:—

Boiler (description: Vertical, multitubular, fire-tube)—				
Working pressure	..	..	160 lb. per sq. in.
Length between tube plates, inside	..	..	4ft.
Diameter outside top ring	..	..	5ft.
Diameter outside bottom ring	..	..	4ft. 4in.
Tubes, number	..	..	387
" external diameter	..	..	1 1/2 in.
" material	..	..	Steel
Cylinders—				
Diameter	..	..	11 in.
Stroke	..	..	15 in.
Centres	..	..	6ft. 7 in.
Fire-box—				
Height of shell, outside	..	..	3ft. 6 in.
Diameter of shell, inside	..	..	3ft. 9 1/2 in. at bottom
" " " " " " " "	..	..	3ft. 5 1/2 in. at top
Area of grate	..	..	11.3 sq. ft.
Heating surface—				
Fire-box	..	..	42 sq. ft.
Tubes	..	..	456 sq. ft.
Total	..	..	498 sq. ft.
Wheels, diameter on tread	..	..	3ft. 7 1/2 in.
Tires, thickness	..	..	2 1/2 in.
Journals, diameter	..	..	6 1/2 in.
" length	..	..	9 in.
Wheel base, each bogie	..	..	8ft.
" centre to centre of bogies	..	..	42ft.
Total	..	..	50ft.
Total length over buffers	..	..	63ft. 5 in.
Weight (including motor bogie, carriage bogie, and carriage body)—				
		Motor bogie.	Coach bogie.	Total.
Empty	T. c. q.	T. c. q.
In working order, tank full, boiler glass half full	21 13 0	..	10 13 1	.. 32 6 1
Tractive power	5,000 lb.
Adhesive power—				
With steam sand (607 lb. per ton)	14,750 lb.
Without steam sand (450 lb. per ton)	10,935 lb.

On page 206 is given a reproduction of a working drawing which shows clearly the way in which the engine and boiler are mounted on the bogie, and the general arrangement of the propelling machinery.



"THE ENGINEER"

MIDLAND RAILWAY MOTOR COACH

on each side measuring 3ft. 6in. by 2ft. 3 1/2 in., and by two hinged lights placed over each window. Artificial light, when required, is obtained throughout from gas lamps fixed in the roof. Ventilation is provided for by the hinged window lights, and by a number of torpedo ventilators arranged in the roof. The ventilation of the engine-room is provided in the following manner: On each side there are iron sliding doors fitted with fixed lights. These doors can be opened more or less as required, and when wide open a maximum opening of 6ft. by 8ft. 6in. wide is obtained. The roof over the boiler is made of sheet iron, having large openings through which the chimney, safety valve blow-off pipes, and whistle pass. These openings are covered by umbrella plates of light sheet iron attached to the chimney and safety valve blow-off pipes respectively, so that they stand 3 1/2 in. above the iron roof; "hit-and-miss" ventilators are also fixed on the front and sides close to the roof.

The coach underframe is built of steel channels and bulb angles, and is carried on two four-wheeled bogies, each having a wheel base of 8ft. and wheels 3ft. 7 1/2 in. diameter on

or the part which faces the rear end of the coach. The fire-door, which also serves as a baffle plate, is hinged at the top, and opens inside the fire-box. The amount of opening is regulated by a handle and notch plate fixed outside. The regulator consists of a light circular gun-metal sleeve working inside a casting of similar material. It is easily operated and is perfectly steam-tight. From the regulator steam is carried down in front of the boiler on one side of the fire-door by means of a 3in. copper steam pipe to the bogie, where it joins on to a breeches pipe which leads off to each cylinder. A similar arrangement of pipes passing up in front of the boiler on the other side of the fire-door is employed for carrying the exhaust steam from the cylinders to the exhaust nozzle in the smoke-box.

The water for the boiler is obtained from a tank having a capacity of 500 gallons. The tank is placed under the coach underframe between the two bogies, and can be filled from either side of the coach through a pipe connected with an opening arranged in the panel at the side of the doorway into the luggage compartment. The mouths of the filling

BOOKS RECEIVED.

Preliminary Practical Mathematics. By S. G. Starling, B.Sc. London: Edward Arnold, 41 and 43, Maddox-street. Price 1s. 6d.
Modern Engines and Power Generators. By Rankin Kennedy, C.E. London: The Caxton Publishing Company.
The Diseases of Electrical Machinery. By Ernst Schulz. London: E. and F. N. Spon, Limited, 125, Strand. Price 2s.
Jahrbuch der Automobil und Motorboot Industrie. By Ernst Newberg. Berlin, N.W. 7: Verlag von S. Calvary and Co.
Proceedings of the United States Naval Institute. By Philip R. Alger. Published quarterly by the Institute. Annapolis, M.D.
The Recent Development of Physical Science. By William Cecil Dampier Whetham. London: John Murray, Albemarle-street. Price 7s. 6d.
The Assuan Reservoir and Lake Moeris. By Sir William Willcocks, K.C.M.G., M.I.C.E. London: E. and F. N. Spon, Limited, 125, Strand. Price 5s.
All the World's Fighting Ships. By Fred. T. Jane. London: Sampson Low, Marston and Co., Limited, St. Dunstan's House, Fetter-lane, E.C.

SWAIN SC.