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### THE RHODESIA RAILWAYS IN SOUTH AFRICA.\*

By FRANK C. PERKINS.

THE construction of railways in South Africa has been of the greatest importance in the development of the country, the same as in every other newly-settled land, particularly as there are absolutely no navigable streams, and the great expense of building roads on the vast sandy tracts of land has made the railways of still greater value than in other newly-developed countries.

In 1903 the Bulawayo-Zambesi line was placed in operation to Wankie coal-field from Cape Town, a distance of 1,572 miles. At this point there is an abundance of coal, which is necessary in railway operations. During the past year the construction was carried on to Victoria Falls, 1,640 miles from Cape Town. It is stated that the rails are now laid a hundred miles or more beyond Zambesi and several hundred miles

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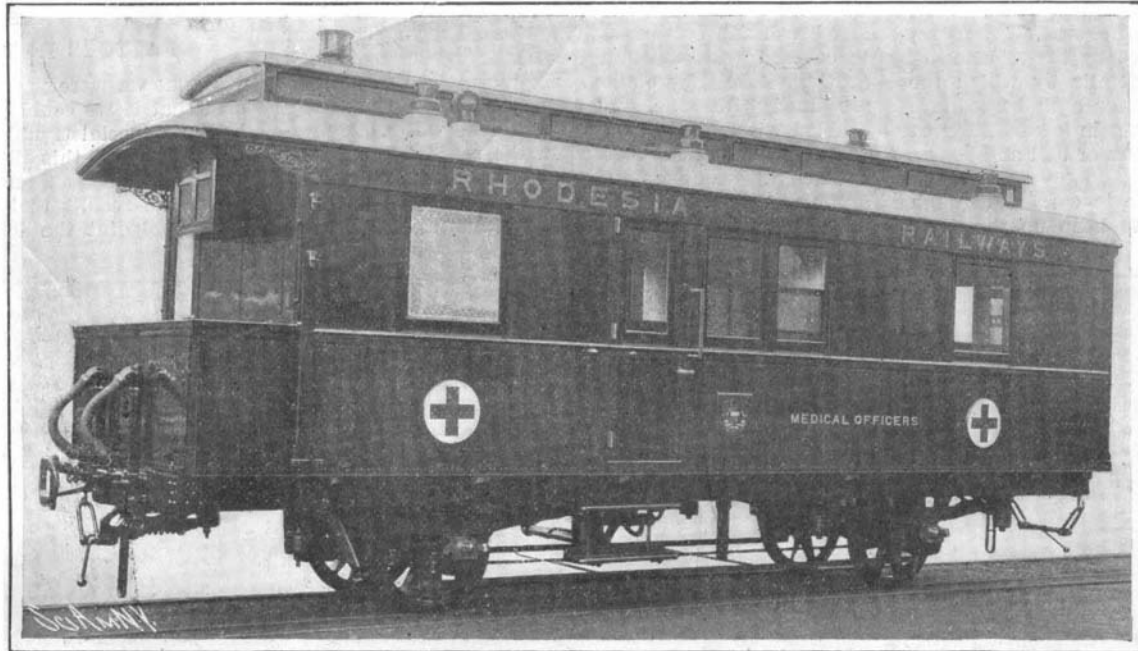
into the interior, completing two thousand miles of unbroken railway lines in the great "Cape to Cairo" construction.

It is said that the railway from Bulawayo to Mafeking is operated by the Cape government railways, and those north of Bulawayo are run by the Beira and Mashonaland railways. The accompanying illustrations show the type of cars used on the Rhodesia railways in South Africa, and an interesting type of locomotive constructed in England for the Rhodesia lines by Kitson & Co., Ltd., of Leeds. The cab is especially large and roomy, for the comfort of the engineers and firemen in this hot country. The engine is divided into three portions, the superstructure and two steam-driven bogies.

With this locomotive on the Rhodesia lines, the boiler is one of "Belpaire" type, thus providing a specially large steam capacity and the usual advantages for washing out.

This engine was placed in operation in 1903 by the Rhodesia Railway Company, and has been found to handle twice the loads of the largest engine previously in use on the lines.

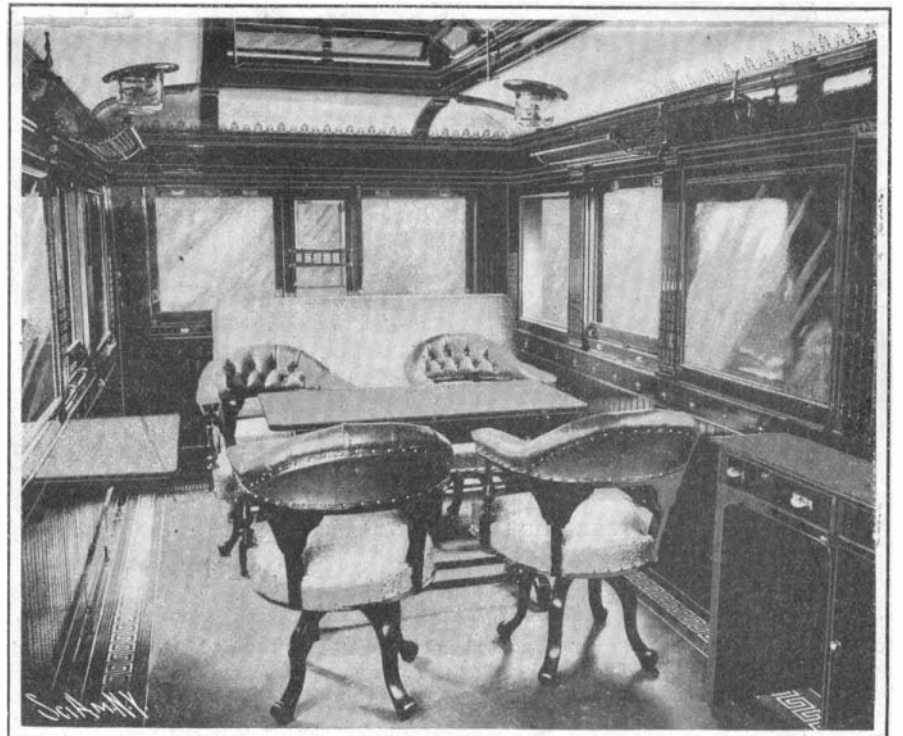
The success obtained by the "Kitson Mayer" engine has been found to be equally great on lines in Chili and



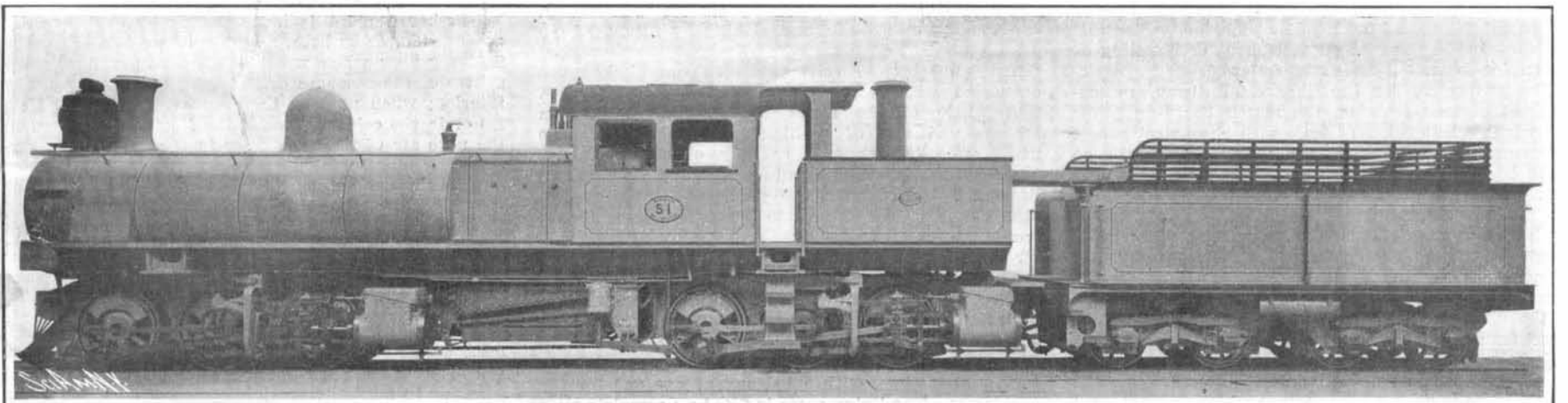
THE MEDICAL OFFICER'S CAR.



WARDROBE END OF LIVING ROOM. MEDICAL OFFICER'S CAR



LIVING ROOM OF DISTRICT OFFICER'S CAR.



KITSON LOCOMOTIVE USED ON THE RHODESIA RAILWAYS.

CARS AND ENGINES USED ON THE RHODESIA RAILWAYS IN SOUTH AFRICA.

Brazil, and it is likely that engines of this particular type will be further adopted in countries where heavy loads are required, where the grades are arduous, and the curves severe.

The superstructure consists of boiler, coal bunker, water tanks, and cab, which rest on two long girders, that are themselves carried at two pivot points on the six-wheel-coupled bogies. By this means the whole weight of the engine is upon the coupled wheels, and is on that account available for adhesion. It can be accurately adjusted by means of a special spring connection introduced at a selected position away from the center of the bogie, and as the wheel base of each bogie is not more than 8 feet 6 inches, the very large engine here illustrated, weighing as much as 72 tons, can pass round curves of 3 chains radius without injury to the permanent way.

In addition to the advantage of traversing these severe curves, the line of pull from the engine itself is kept in a position less likely to cause side resistance at the pulling end. Each bogie is complete in itself, being an engine with a pair of cylinders, valve motion, brake gear, sanding gear, etc., and bearing the weight of half of the superstructure on a recessed steel casting.

There are bolts passing through slot holes in these castings which form a connection between the bogies and the superstructure, and a further security against an excess of movement is provided by the addition of check chains. The mechanical details by which the power is supplied and controlled for each bogie have been carefully designed, and the steam is carried from the front end of the boiler by means of ball and socket joints to each pair of cylinders.

The exhaust of the front bogie is carried through the smokebox, and is sufficient to keep up the draft

partments, consisting of living rooms, bedrooms, lavatory, kitchen, and a balcony at each end. The living room is provided with a woven rattan spring couch, sliding seat with reversible back, three removable arm-chairs, and flap tables. The general finish of this compartment is rich mahogany from the millboard panels and carved teak moldings and pilasters, while the floor is finished with linoleum.

The side ventilators in the car roof are operated with quadrant fixtures. Bronze basket racks are placed over the side windows, as shown. A Boyers speed recorder, placed in this compartment, is connected to the axle with a flexible metal belt. The recorder not only indicates at what speed the carriage is moving, but records the speed also.

A corridor divides this compartment with the bedroom. This room is provided with a rattan couch similar to the living room. Over this is an upper berth, arranged to fold up against the roof with a spring pulley acting as balances. A dressing table finished with mirrors and drawers, besides a wardrobe with mirror door and small chair, are provided. The interior finish is similar to the living room. The lavatory compartment is fitted up complete with water closet having balanced lid and flushing tank, folding wash-hand basin, Pasteur filter, mirror, towel rail, and brush and comb rack, also sponge rack. The floor is covered with 3-pound lead, over which is a teak grating. The sides of the compartment to granish rail are lined with zinc, and above this to the roof are paneled with mill-board enameled dead white. A fifty-gallon water tank is located in the roof. The kitchen is fitted with an open and closed coal stove having two ovens and water boiler complete. The sink is provided with hot and cold water taps, and has a coal box be-

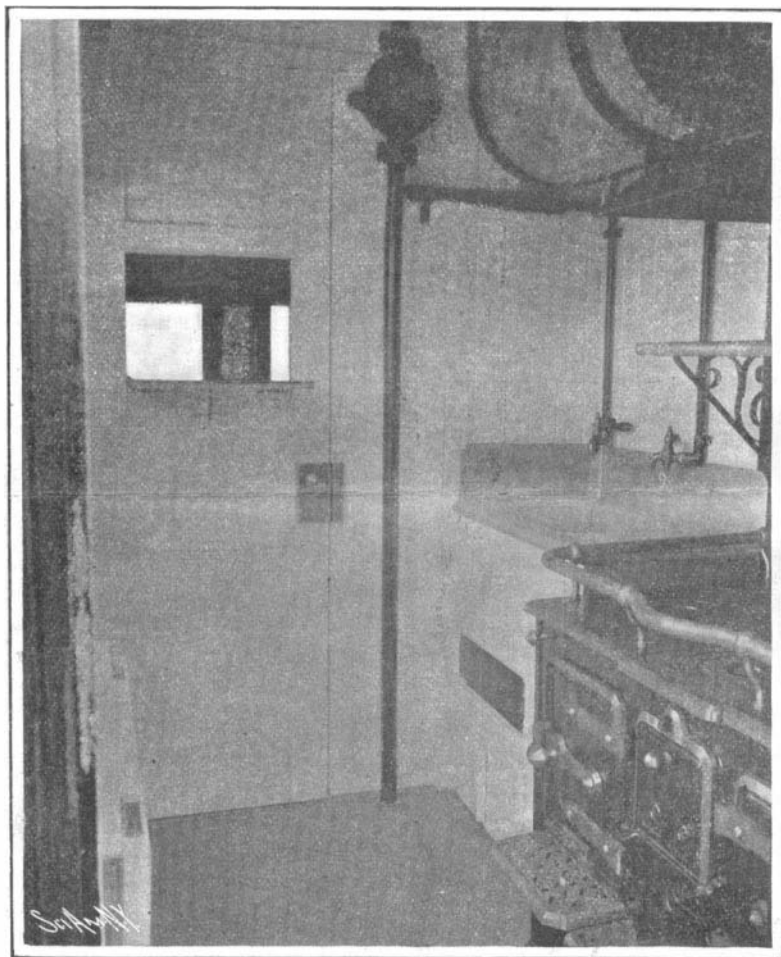
compartment is in rich mahogany, with millboard panels having carved teak moldings and pilasters.

The surgery is fitted up with hooks and rings in the roof. The vacuum brake valve and handbrake spindle are here also. The whole of this compartment is enameled white. The fitting up of tables, cupboards, racks, etc., is left in abeyance, so that the medical officer can have this done to suit his convenience. The lavatory compartment and kitchen are in complete accordance with that described for the six-wheeled saloon. Each compartment is provided with oil lamps of the most approved type. The district officer's carriage is exactly the same as the medical officer's, excepting that the "surgery" is omitted and the living room carried through to the kitchen partition.

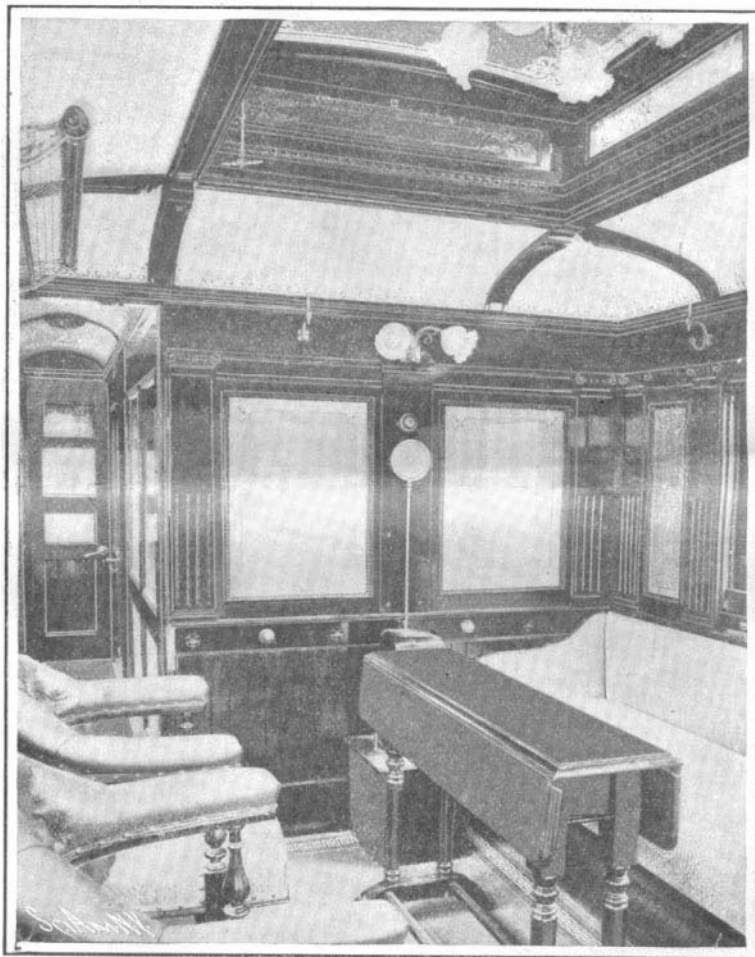
These private cars were constructed by the Electric Railway and Tramway Carriage Works, Ltd., of Preston, Lancashire, England, and a special saloon car is now being constructed at this plant for the Rhodesia Railways which is 60 feet long and is fitted up in the most modern style with hot and cold water baths, shower baths, kitchen, bedrooms, electric fans, and electric lighting, while the compartments are to be heated by an independent hot-water system, and the berths are to close up out of sight.

#### FACTORS IN PAINTING WOODWORK.\*

WHEN we were young in the paint business we fancied that if we could produce good material we would have no special troubles with it. However, experience soon dispelled this illusion and taught us that there are other things than the quality of the paint which affect the results to be obtained from its use. From our standpoint the following factors affect results in



KITCHEN OF MEDICAL OFFICER'S CAR.



CORRIDOR AND LIVING ROOM OF PRIVATE CAR.

#### INTERIOR VIEWS OF CARS USED ON THE RHODESIA RAILWAYS OF SOUTH AFRICA.

through the firebox and so maintain steam. The exhaust steam of the hind bogie is passed into the atmosphere, but could be utilized either for the purpose of increasing the draft or for an exhaust steam injector if required.

The engineer supplies steam to both sets of cylinders by one movement of the throttle lever. In the same manner he is enabled to reverse both engines, apply the brakes, and actuate the sanding gear by one movement of each of the handles concerned. There is no difference in the method of lookout or handling of the engine from that ordinarily followed.

The private cars on the Rhodesia Railway are constructed of teak framing, the match boarding below the window belt being of teak with sheet-steel panels above grained teak. They are designed especially so as to be suitable for the South African climate. The floor boards are laid diagonally and in two thicknesses, the space between being filled with teak sawdust to deaden the sounds. Each window is fitted with a plate of glass, wire gauze screen, and a blind in separate frames. The accompanying photographs illustrate the construction of the agent's private car, as well as that of the district officer's and the medical officer's. The glass frame of the window is provided with spring sash balances, and the blind and gauze frames are finished with springs and catches. The independent gauze frame is quite a new feature which is considered to be absolutely necessary for comfort, owing to the sand and dust storms which are prevalent in South Africa.

The body of the agent's car is divided into five com-

partments, consisting of living rooms, bedrooms, lavatory, kitchen, and a balcony at each end. The living room is provided with a woven rattan spring couch, sliding seat with reversible back, three removable arm-chairs, and flap tables. The general finish of this compartment is rich mahogany from the millboard panels and carved teak moldings and pilasters, while the floor is finished with linoleum. The side ventilators in the car roof are operated with quadrant fixtures. Bronze basket racks are placed over the side windows, as shown. A Boyers speed recorder, placed in this compartment, is connected to the axle with a flexible metal belt. The recorder not only indicates at what speed the carriage is moving, but records the speed also. A corridor divides this compartment with the bedroom. This room is provided with a rattan couch similar to the living room. Over this is an upper berth, arranged to fold up against the roof with a spring pulley acting as balances. A dressing table finished with mirrors and drawers, besides a wardrobe with mirror door and small chair, are provided. The interior finish is similar to the living room. The lavatory compartment is fitted up complete with water closet having balanced lid and flushing tank, folding wash-hand basin, Pasteur filter, mirror, towel rail, and brush and comb rack, also sponge rack. The floor is covered with 3-pound lead, over which is a teak grating. The sides of the compartment to granish rail are lined with zinc, and above this to the roof are paneled with mill-board enameled dead white. A fifty-gallon water tank is located in the roof. The kitchen is fitted with an open and closed coal stove having two ovens and water boiler complete. The sink is provided with hot and cold water taps, and has a coal box be-

neath it. Cupboards, plate racks, and shelves are also provided. A water tank in the roof has a capacity of fifty gallons. This is connected to a tank in the under-frame by a pipe and force pump having a bore of 1 1/4 inches. The floor panel work is made up of millboard and molded teak, neatly decorated to suit the internal finish. A zinc-lined refrigerator is fixed under the living-room floor. All the compartments are lit with electric light by Stone's system of driving a dynamo from the axle, and storing by means of accumulators having a capacity of about 15 hours' stationary lighting. Electric bells in the kitchen are connected with push buttons in all compartments. The whole of the metal fittings are finished in bronze, and are of a high-class description. The underframe is composed entirely of steel sections. Bogies, including wheels and axles, vacuum brake, and draw and buffing gear, are similar to the Rhodesia standard practice. The axle boxes are of malleable iron, and the bearing springs are of exceptional length for flexibility and to insure easy riding. The medical officer's carriage is similar in general outline to the agent's carriage, excepting that the underframe is mounted on four wheels only and that electric lighting is omitted. The body is divided into four compartments, viz., living room, surgery, lavatory, and kitchen, with a balcony at one end for the cook's use. The living room is fitted up complete with a woven rattan spring couch, two revolving arm chairs, flap tables, wardrobe with mirror front, writing desk with cupboards and drawers, and two basket racks over side windows. The general finish of the

painting, viz., (1) the location of the structure, e.g., seaboard or inland; (2) the kind and condition of the surface; (3) the quality of the paint; (4) the workmanship of the painters; (5) the number of coats applied; (6) the amount of time allowed to elapse between coats; (7) the atmospheric conditions when the painting is done.

#### LOCATION OF STRUCTURE.

Whether a paint is made to dry by oxidation, by evaporation, or by both, naturally there is a difference in its drying when used in the damp, saline atmosphere of the seashore or in the dry highlands of the interior; when used on the coast of the Gulf of Mexico or in the colder States of the North; when used in the pure air of the country or in the vitiated air surrounding structures in many towns and cities. Not only is the drying of paint affected by the location of the structure upon which it is used, but its working properties and durability as well. The viscosity of oil and varnish being affected by temperature, they will work more easily in warm climates than in cold. The durability will always be impaired by alternate exposure to wind and water; by exposure to sunshine and rainfall; deleterious gases, vapors and liquids; dampness, darkness, mechanical injury, etc. The paint for the finishing or top covering of any structure should be made to meet the special conditions of exposure to which it is to be subjected. Competent painters can readily make protective coverings to withstand any

\* From a paper read by Mr. Houston Lowe at a Pittsburg meeting of the Engineers' Society of Western Pennsylvania.