The First "Garratt" Locomotive.

The special type of locomotive now so well-known as the "Garratt" Patent Articulated Locomotive was invented in the year 1907. At this time Mr. H. W. Garratt, the inventor, was in close touch with Beyer, Peacock & Co. Ltd. as Inspecting Engineer for Locomotives then under construction at Gorton Foundry for the New South Wales Goverment and it was during this period

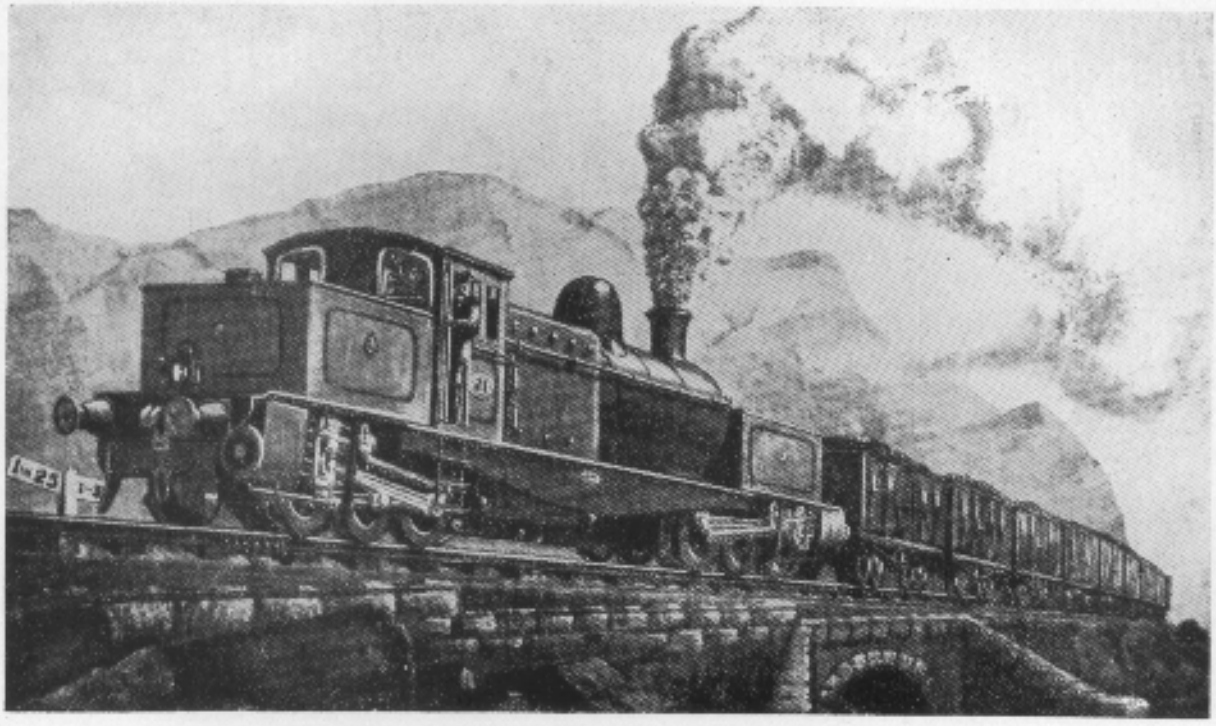

Figure 1.

that he outlined his ideas for a new type of locomotive to our Management. It was agreed to develop a design embodying Mr. Garratt's proposals and, in accordance with this design, the patent was subsequently obtained. Recognizing the vast possibilities of the new type of locomotive, the firm purchased the invention and became the sole licencees for its exploitation.

The first design included all the essential features of the modern "Garratt" locomotive—the large boiler entirely free from the restriction ordinarily imposed upon locomotive boilers by the proximity of the wheels and in the case of tank engines by the water tanks, the mounting of the fuel and water tanks directly on the frames of the steam units or bogies in order to provide steadiness in running and a system of articulation enabling the engine to take sharp curves with ease. The most recent "Garratt" locomotives—such for example as that built for the Nitrate Railways and illustrated in this issue—show the tremendous development made since 1907 and the enormous potentialities this type of locomotive possesses. The extensive adoption of the "Garratt" locomotive has fully justified all that was originally claimed for it. It was recognized that this new engine would eliminate the unsatisfactory features of existing articulated locomotives which had prevented them from being more generally

adopted and would allow of the development of this form of locomotive construction almost without limit, not only by providing greater tractive power than is possible with orthodox engines but by enabling that extra power to be obtained without increasing the axle-load permitted by the permanent way. In fact, the "Garratt" locomotive, possessing the great advantage of being lighter than any other type of locomotive per unit of length, offers to Railways a solution of the problem of obtaining greater hauling power by a method much cheaper than the alternative one of re-laying the track with heavier rails and strengthening the bridges.

While it was seen that the main advantages of the "Garratt" type lay in its capacity to provide great power, the articulation of the units also offered a great advantage as locomotives of great power could thereby be put on to tracks abounding with sharp curves on which a rigid type of engine would be at great disadvantage.

The development of a really practical design called for a great amount of technical work in the solution of many problems and to the technical staff of our company is due entirely the credit for the successful development of the new articulated locomotive. It was, moreover, necessary to bring this type of locomotive to the notice of the various Railway Authorities and to arouse interest in it a booklet in the form of a questionnaire with accompanying illustrations—painted by the inventor himself—depicting the "Garratt" locomotive in action (See Fig. 1.), was circulated amongst Railway Companies throughout the world.

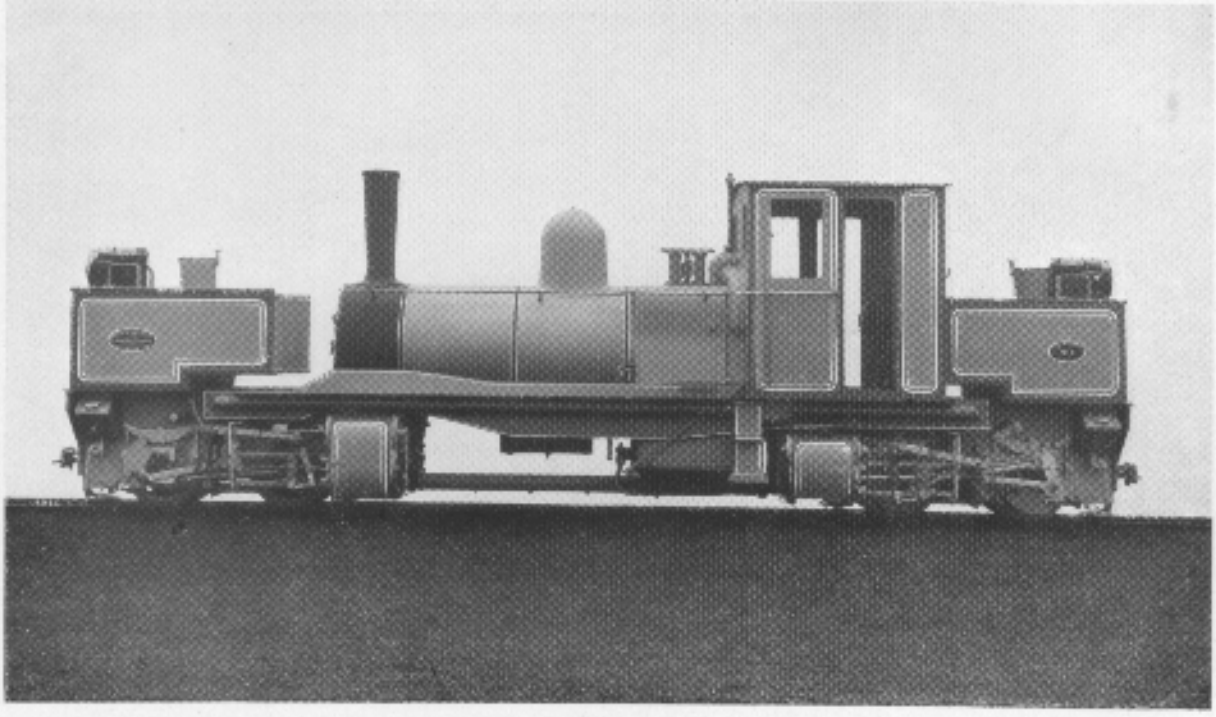

Figure 2.

A number of designs were prepared in the years 1907, 1908 and 1909 but the first design to materialize into an order was the result of an enquiry received from the Tasmanian Government Railways in January 1909. This Railway had, for many years, placed its orders for locomotives with our Company and its locomotive Engineer at that time certainly deserves every praise for

his initiative and foresight. The actual service for which he desired to have a "Garratt" engine was in the operation of the North East Dundas Tramway, a 2-ft. Gauge line subsidiary to the Main Line of 3ft.-6ins. Gauge.

This little line has numerous gradients of 1 in 25 with many curves of 99-ft. radius and it was specified that speeds from 8 to 12 m.p.h. should be maintained on these curves and grades.

An additional difficulty involved in the design of this first "Garratt" locomotive was that the specification called for the cylinders to be arranged on the compound expansion system, the two high pressure cylinders being on one unit and the two low pressure cylinders on the other—an arrangement obviously requiring variations in the valve gears of the two sets of cylinders and the provision of intercepting valves, etc. etc.

Two of these engines (*see Fig. 2*) were ordered and built in 1909. From the commencement they worked well and have given continuously satisfactory service. To-day they are still in service on the line for which they were originally ordered.

The wheel arrangement of these engines is of the 0-4-4-0 type. At each end there is a four-wheeled steam-driven bogie, the hind bogie or unit carrying the high pressure and the front unit the low pressure cylinders. To facilitate construction and shorten the length of the steam piping, it was considered desirable to have both sets of cylinders arranged on the inner ends of the bogies, an arrangement which has not since been adopted in the "Garratt" locomotive.

The steam is conveyed from the hind to the front bogie by the steam pipe which can be seen on the photograph and which acts as the receiver. A special intercepting valve is fitted, enabling high pressure live steam to be admitted to the low pressure cylinders and at the same time diverting the exhaust steam from the high pressure cylinders direct to the blast pipe. By this arrangement the engine is able to work as a non-compound when starting and for short periods as required. The boiler is of very considerable dimensions for a 2-ft. gauge of railway, the barrel being 3-ft. 6-ins. diameter, and the firebox 4-ft. long by 4-ft. 10½-ins. wide, with a grate area of 14·8 sq. feet.

It is carried in a girder frame consisting of steel plates suitably braced and having at each end the top member of the pivot centres, the design of which demanded very careful consideration in view of the many sharp reverse curves.

Another feature calling for special consideration was the development of the steam ball joints—a common source of trouble in all previous articulated locomotives—and a design was eventually evolved which has proved to be absolutely satisfactory and has been incorporated in all subsequent "Garratt" engines.

The principal dimensions are as follows:

Cylinders H.P.	11" × 16"
" L.P.	17" × 16"
Coupled Wheels	2' 7½"
Total Wheel Base	26' 9"
Bogie Wheel Base	4' 0"
Boiler—Working pressure ...	195 lbs.
Heating surfaces—	
Tubes	568 sq. ft.
Firebox	60 sq. ft.
Total ...	628 sq. ft.
Grate Area	14·8 sq. ft.
Tank capacity	840 galls.
Bunker capacity	1 ton
Total Weight in working order	33½ tons.
Tractive power at 75% B.P.	14,378 lbs.

As will be seen from the photograph these engines have not the imposing appearance of later and much larger "Garratt" locomotives but they were the first of a type of motive power which has very greatly contributed to the increased efficiency of railways and the subsequent development of the "Garratt" engine is due entirely to the successful operation of these engines in service.

They were thoroughly tested before delivery and, for this purpose, a considerable

length of track, embodying the severe reverse curves which were specified to be negotiated, was laid in the yard of Gorton Foundry and, in September, 1909, the first engine was tried in steam on this track in the presence of the inventor and Inspecting Engineers of the Tasmanian Goverment Railways.

The results of the trials were eminently satisfactory and the construction of the first "Garratt" Patent Articulated Locomotive was an accomplished fact.