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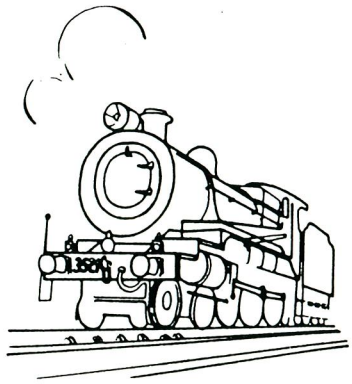

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The Progressive Development Of The Steam Locomotive (and its equipment) On The New South Wales Railways
by Mr. C.A.Cardew, M.I. Mech., M.I. Loco. E. (London)

Alan Austin has provided a copy of the address given by Mr. Cardew on the occasion of his retirement as Chairman of the Northern Sub-Branch of the Australian Branch of the Institution of Mechanical Engineers in February 1965. It makes interesting reading and I hope you do not mind it running over a few Newsletters.....

And now, turning to consider the subject matter of my address, it may be as well to remind you that, the first public railway, the Stockton and Darlington line, was opened in England in the year 1825, with the firm establishment of railways as a means of transportation, and the operation of them by steam locomotive power, then following upon the completion of the more ambitious enterprise of the Liverpool and Manchester railway in September 1830. Glancing at the early Australian scene, the first practical steps towards the construction of a railway to be operated by steam locomotives, and the introduction of such locomotives to Australia. was taken as a result of the formation of the Sydney Railway Company in the year 1848, which had as the objective the building of a railway from Sydney to Parramatta, and which initiated that project by the turning of the first sod near the site of the subsequently built old Redfern railway terminus, located in what is now Sydney Yard, on the 3rd. July 1850. But, a few weeks before that, the Board of Directors of the Company had directed their Engineer to prepare an indent for ordering the engines that he considered it would be desirable to procure from England, which been done, it was forwarded to the English Agents for the Company. Final decision for ordering, however, was not reached until, by letter sent early in 1853, the Agents were advised that the original instructions were to be amended to have the gauge altered from 5' 3" to 4' 8 1/2", and they were to be " four locomotives each four wheels coupled with six wheel tenders", and stating that the Company's new Engineer recommended that they should be obtained, if possible, from either Messrs. Robert Stephenson and Co., Messrs Fairbairn, or Messrs. Sharp, Roberts and Co.

For about, the same time, also, Mr. J. E. McConnell, the Locomotive Superintendent of the Southern Division of the London and North-Western Railway Company, and the locomotives that were ultimately obtained, and which were built by Messrs. Robert Stephenson and Co. at their famous Forth St., works, Newcastle-on-Tyne were to his designs. (It is noted that James Edward McConnell was responsible for the move to set up the Institution for Mechanical Engineers. At the inaugural Meeting in 1847 he made way for the newly elected President, George Stephenson.) In Great Britain at the time McConnel was acting as consulting Engineer for the Sydney Railway Company, it could be said that he was regarded as perhaps the most noted designer of locomotives in the Kingdom, and one whose ideas were much ahead of all others. The locomotives that were built under his direction for the Sydney to Parramatta railway (and which, when they were delivered early in 1855 , became the first locomotives of the New South Wales Gov't Railways, the Government shortly before the opening of the line having taken over the affairs of the Sydney Railway Co.) were, with one important exception, practically identical with his well known 0-6-0 type fast goods locomotive, first built in 1854 by Kitson and Co., of Leeds for the Southern Division of the London and North-Western Railway Co., of which he was Locomotive Superintendent. The difference lay in the substitution for the trailing pair of coupled wheels of the L & NW engines of a pair of carrying in the case of those for N.S.W.. and it would appear that the only reason for making this alteration was to conform with the indent issued by the Sydney Company. They would very likely have been built by Kitson's, except for the specific instructions in the original indent.

As might be expected from McConnell , these locomotives as introduced for initiating railway operation in N.S.W. were very advanced for their time and, indeed, quite large engines which, also, could quite well run up to a speed of 50 mph., or so, provided they had good permanent way to permit of this. They were inside cylinder locomotives and, as with all locomotives of the period , they burned coke as fuel. As an indication of the design being good, and even advanced for

the time, it is worth recording that some fifteen years later four engines, in all essentials the same in design, were built for the N.S.W. Railways by Mort and Company in Sydney, and a few years later again , in 1876, the N.S.W. Railways themselves, at the Railway Works, Redfern, built four to replace the original four, though repairing and using the original tenders. (one of these is preserved at Thirlmere.)

Before leaving consideration of the first locomotives introduced here, and the connection with McConnell, and the L & NW Railway in England, it is not inappropriate to mention that for many years thereafter the N.S.W. Railways remained, in one way or another, in close touch with that railway and, both in engineering practice, and through the ideas of engineering and administrative staff who came to N.S.W. from it, was much influenced thereby."

On the introduction of the Class 13, 2-4-0 mixed traffic locomotives. " it will be seen that, contrary to McConnell's standard practice of inside cylinders, these locomotives (as was the case with all of Alexander Allan's L & NW designs) had outside cylinders, a feature on which later there was to be conflict in principle on the N.S.W. Railways, which (as on Railways elsewhere) swayed first one way, and then the other, for many years. There were only two of these locomotives, about the introduction of which here there was nothing, as compared with the first locomotives, very noteworthy in design other, perhaps, than the rather interesting fact that they were the first in N.S.W. to have weights placed at the rims of the driving wheels additional to those required for completely balancing the revolving masses there, which would in part balance the forces set up by the inertia of the reciprocating parts (pistons etc.,) of the engine."

"..... what might be regarded as the first major change in locomotive practice to be applied following experiments and trials carried out in N.S.W., occurred when, in the year 1861, one of four of a class of single driving wheel locomotives, the first of which had been put into service some three years after the opening of the Sydney to Parramatta line, was successfully adapted to the burning of coal as fuel, instead of coke (and often wood billets) that until then had been used. As a result of the successful outcome of the trials with this engine all the locomotives were thereafter converted for burning coal, to be obtained from our own coal fields then only just beginning to be opened up. The means by which the result was obtained was by the employment of the sloping brick arch in the firebox, a simple device which had been developed in England, and had been successful in superseding the many complicated internal firebox arrangements which had been tried there, and elsewhere, in an attempt to achieve this objective over a period of 10 to 20 years preceding. Actually, it was only in the year 1859 that the brick arch system (although originated some years earlier) was established by a long series of experiments and trials as a successful solution of the problem of satisfactorily burning bituminous coals under the high draft conditions of a locomotive firebox, and the introduction of the principle, with the development necessary to make it a success here in the then remote Colony of N.S.W., where railway experience had only so recently begun, with in only two years of the completion of the English trials, indicating that responsible engineers in N.S.W. (and especially Mr. John Whitton, the Engineer-in-Chief for Railways) were very much abreast of locomotive developments abroad, and prepared with initiative promptly to take them up, and adapt them to meet any special operating and other conditions that were to be formed here."

On the 2nd. 10 Class, 2-4-0 tender type locomotive, 1870. " .... it may be appropriate briefly to direct attention to a locomotive of which only one was built, not because of any outstanding feature, but because it was the first to go into service which (ostensibly at least) was of local design and construction. The production locally of the locomotive in question was intended significantly to mark the centenary of the discovery of the east coast of Australia by Captain Cook in 1770 and, being completed in time, it was one of the chief exhibits displayed in the Exhibition Building in Prince Alfred Park at the Inter-Colonial Exhibition, which was held in Sydney to commemorate that event in the year 1870. Designed under the direction of Mr. John Whitton, Engineer-in- Chief for Railways, it was built at the then main Railway Works, Redfern (now Sydney Yard) and being finished as it was in June 1870, was not only the first locomotive to be built by the N.S.W. Railways but, preceding by just a few months the first to be built by a private engineering firm, was the first locomotive engine ever to be built in the then Colony of N.S.W."

On the need for improved locomotive performance to cope with the expansion of the N.S.W. Railway system to 1895. " ....the task developing the locomotive power from the various nondescript types which, either singly, or only in very few numbers in any one case, constituted a class, and that had until then, sufficed for the duties required, into a limited number of types suitable for the new conditions, but with each class of a reasonable numerical strength, began. This process of development of classes and, as well, of details and equipment was, subsequently continued, more especially later to meet increased traffic demands , all down the years.

But here, before proceeding to review by stages the progress made, it may be as well to refer to the views which are often heard expressed, even sometimes by Engineers (but who have not sufficiently studied the question) that it should

be possible to have not more than, say at the most, half a dozen, or so, standard locomotive designs, worked out by locomotive engineers, or by locomotive building firms, that would satisfactorily meet the requirements, if not of any railway in the world, at least the majority of them, and that, providing the gauge was the same, and the external dimensions relating to clearances from structures etc., conform to requirements (which, indeed, in most cases they would not) a steam locomotive giving satisfactory performance on a railway in one country should do the like if placed in service on a different railway in another. That such ideas are fallacious would be clear to those holding them if they did but consider all the questions involved. Thus, there are such factors affecting the design and arrangement of a locomotive as the tractive effort and power output required (and which it will be economical to provide) with this to be determined by such factors as the volume and character of the traffic offering, and the conditions under which it will be worked, along with the severity of the gradients that will be met, and the operating speeds that will be required. And then, the practicability of actually providing the requirements are governed by such considerations as the dimensional limitations imposed by the loading gauge, the maximum weight allowed on any single axle, and the ability of bridges and other under-track structure to carry the total weight, or the weight as it is practicable to have it distributed over the wheel base of the whole locomotive. Likewise, there must be considered the maximum length of rigid wheelbase that can be accommodated for negotiating the curves involved a factor that may be of little importance on a favourable aligned railway, but is severely restrictive on a line where many sharp curves exist, and the more so when a high tractive effort, but with only light axle loads on the driving wheels being permitted , is desired. In this, also, as a factor limiting the number of driving wheels that can be coupled together in order to provide the necessary rail adhesion (and permit the desired tractive effort being obtained) while keeping the rigid wheelbase within an acceptable length for curves, is the diameter fixed for these wheels themselves, a dimension with which the economical running speed, and the maximum attainable, by the locomotive are features intimately concerned. When it is added that the characteristics of the fuel available and, likewise, of the water supplies, the distance apart of watering and refuelling points, the effect of climatic conditions, the length of existing turntables, and the distance at dead ends, and in sidings, between point switches leading therefrom, and all matters that will have to be taken into account, along with others not mentioned, and the manner in which all these features will vary on different railways (and, indeed, very often on different sections of the same railway system) are considered, it will be abundantly clear way, in the case of a steam locomotive at least, it is not possible to provide a few designs built to an engineer's or maker's standards which will satisfactorily, and economically, be able to work on a large number of railways, even in one country much less successfully to apply the principle on a world wide basis.

..... to be continued..

Southern Railway Ps-4 Class 4-6-2. by Jim Leishman

Before the Mountaineer was complete I purchased two sets of drawings from Wildwood Publications U.S.A. Plans for the Southern Railway Ps-4 class Pacific 4-6-2 and the Union Pacific FEF-3 class 4-8-4.
After much consideration especially the size of the components to be machined I decided on the Ps-4 which is the smaller of the two. Peter Shiels borrowed the Union Pacific drawings and is well on the way with its construction.
With the help of Rank Xerox I had the drawings enlarged to the actual scale size 1 1/16" to 1' 0".
Patterns were made for cylinders, chimney, sand and steam domes. Driving wheels came from Ernie Winter. All other parts are fabricated.
The frames are profile cut from 3/4" thick mild steel which were then fully welded to resemble the cast frame.
Driving wheel axle boxes are machined from cast iron stock and fit directly into the frames, The axles run on torrington needle roller bearings, all other axles have bronze bushes.
The smoke box saddle is a welded fabrication with exhaust steam passages machined into it.
The boiler is of copper 3mm thick, the outline of the boiler was traced from the real boiler drawings. The boiler code applied and the drawings completed. Our Boiler Inspector, Jim Hyde nominated changes to make it fully comply and construction commenced. With assistance from my son Jamie the boiler was soon completed having been inspected by Jim Hyde at various stages.
Insulation is ceramic fibre and cladding is tinned sheet steel.
The engine cab and tender are from galvabond, the tender has a separate galvabond water tank.
The gold lettering, numbers and railway loggo are computer cut. The loggo was scanned into the computer, the letters and number are the nearest to the original that is available in the computer programme and cut from adhesive metallic gold plastic material, the same material used for automotive car stripes. This material is used to form the gold lines on the tender.
There were 64 Ps-4's built by builders : - Schenectady, Richmond and Baldwin. The first in 1923 the last in 1928.
Loco No. 1401 was retired and placed into the Smithsonian Museum in 1962. Four locomotives Nos. 1379, 1380, 1382, and 1385 were sold for scrap in 1953 when they were replaced by diesels.

PS-4 details.
Cylinders. 2 x 50 bore x 35 stroke. Piston valves. 22 diameter.
Driving wheels. 160.
Boiler. max. dia. 216. min. dia. 180. length. 850. firebox 246 x 187.
Rod stays. 152. Height. 400. Width. 300.
Length. loco. 1400. tender. 800. over all . 2250.
And for those who like to count rivets there were 320 in the cab, 1036 in the tender there were 24 smokebox door clamps and 82 smokebox nuts and bolts.

Club News.
August Inter-Club Day. I did not have room in the last Newsletter to report on this day which was well attended by our members and representatives from eleven other Societies. A good lunch was provided and some relaxed running was experienced. Some visitors stayed on into the evening to enjoy the spectacle of the signal lights in operation, both full size and miniature. Special thanks to the BBQ cooks and the ladies who served in the canteen.

Charity Day. Fortunately, the November running day was not spoilt by rain as was each other running day in the last third of 1995. The crowd was very good and the Treasurer was able to dispatch a very worthwhile cheque to the Malcolm Sargent Cancer Fund For Children.

Christmas BBQ. The early part of the December running day was wet enough to limit the public participation, but, however, the afternoon improved, the sun came out and a good number of members and family and friends enjoyed their meal, some loco. running and the evening in general.

Locomotive News. Last club running day Alan Cotteral had his newly finished 3 1/2" gauge Britannia at the grounds, from what I have been told it is a fine piece of model engineering, well done Alan.
Ken Baker and Brian Kilgour with their respective locomotives ran trials with a five car train on the elevated , loaded with half cwt. weights. The trial was successful as they were able to get underway from a standing start at many of the testing locations on the track. This running will probably be trialed with live passengers on the February running day.

Works Report. The railing around the signal box deck on top of the carriage shed has been completed and looks a very professional job.
The new sections of track for the ground level railway are now stored under the steps of the foot bridge over the ground level station..
Last Saturday some concrete work was carried out near the compressor house and at the top end of the g.l. loco.depot.

Ground Level Running. At the February meeting some concerns were raised re. problems on the January running a very hot and un-pleasant afternoon. It was thought that these problems could be avoided in future with more communication between the drivers and the track superintendent so that all may work in a co-operative manner.

Duty Roster.
Mar. '96. J.L.Hurst, J.B.Hurst, A.Cottrell, J.Lyons, P.Lyons, B.Peake, M.Yule.
April.'96. B.Hurst, J.Davies, A.Eyre, J.Hyde, K.McMahon, D.Mullholland, B.Rawlinson, J.Tulloch, B.Tulloch.
May. '96. W.Richards, K.Baker, R.Larkin, S.Larkin, R.Lee, M.Lee, J.Leishman, J.Ranford, M.Tyson.
June .'96. R.W.Allison, R.Barlow, H.Brammer, T.Geraghty, B.Greenfield, J.Hulholland, L.Pascoe.

Gate Roster.
March. G.Robinson. April. V.Scicluna. May. P.Sharp. June. P.Shiels.

Train Day. Saturday 1st. June. At the last meeting it was proposed on Mike Tysons behalf that he organise a run on that date. A Tall Chimney Day, Bernie's breakfast about 8.00am, train running 10.45am. to 3.15pm.
Any comments about this day at the April meeting and more details in the May Newsletter.

Congratulations to Stuart Larkin on his excellent result in the 1995 Higher School Certificate.

Please keep in mind that items for the Newsletter are always welcome. John Lyons.