THE LOCOMOTIVE
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Diesel Vehicle Repairs

A CONSIDERATION of the maintenance and repair methods of diesel locomotives and railcars compared with those of steam locomotives indicates that the life of either type of unit may be virtually unlimited. It has not been uncommon practice to glorify the performance of steam locomotives 30, 40 and 50 years old, regardless of the fact that at such an age there is little of the original locomotive left except the spaces between the wheels. Similar methods may be applied to the engines and mechanical portions of diesel locomotives and railcars by routine renewals, and by building-up through welding and by metal deposition.

This possible similarity of the methods applied to steam and diesel power on railways was not featured in the remarkably comprehensive paper on the repair of railway oil engines on the Central Argentine Railway presented recently by Mr. C. A. Parker, of that line, to the Diesel Engine Users' Association, and read in London, on November 5, before a joint meeting of that Association, and the Institution of Locomotive Engineers. But that paper did result in an appreciation of the way and degree in which the proportions of a maintenance-and-repair programme may vary. For example, with the Chicago-California and other long-distance diesel-powered trains in the United States, the travelling-fitter system and the work done during a few hours of lie-over time at each end of the run, mean that say, 75 or 80 per cent. of all maintenance and repair work comes under the heading of maintenance, and that repair work " within the meaning of the Act " is undertaken only at infrequent intervals. On the other hand, the method practised on the Central Argentine Railway for the power plants of the 12 twin-car 640 b.h.p. Ganz diesel sets incorporates the minimum of shed work, and the running department has been relieved of the responsibility for engine maintenance except for odd details, practically all of the necessary work being carried out in the course of visits to the central repair shops.

The claim is made that this Central Argentine Railway practice in no way invalidates " preventive " maintenance and repair, which is probably the key to the successful running of motive power of all types. On the Central Argentine system the power plants are taken to the repair establishment for a light overhaul every 43,000 miles, and for heavy repairs every 125,000/140,000 miles, and it is judged that these mileages enable attention to be given to all the major and minor constituents before they begin to give trouble either through excessive wear, fatigue, or deterioration. Nevertheless, the extent to which the Central Argentine Railway has relieved the running department of much minor work and tuning-up the engines is greater than found on the majority of railways owning diesel stock, and possibly the success with which this has been done may be traced in a large measure to the fact that these twin-car trains are concentrated in one area and work on certain definite services without variation. For more widely-scattered vehicles it would seem that the shed staffs would still have to be entrusted with a greater proportion of the total maintenance-and-repair work. These remarks, of course, apply to medium and large-sized railways, for on the smaller lines maintenance and repair are usually undertaken in the same shed by the same men just as they happen to be needed.

Although a certain amount of trouble has been experienced with the main constituents of these oil engines on the Central Argentine Railway—the shopping periods, for instance, seem to be governed by the mileage which can be expected before trouble is given by the inverted main bearings bolted to the light-alloy crankcase—Mr. Parker's paper emphasised the feature which has been found in practically all diesel railcars designed and built from about 1937 onwards, and that is the great majority of failures booked against the vehicles are not due to the engines or to the gearboxes themselves, but to the auxiliaries associated with those two main constituents. Many of these troubles are trifling, and may result in the loss of only a few minutes on schedule, or a day laid off. On the other hand, the consequential damage resulting from the failure of a relatively unimportant part may be great, and that is one of the principal reasons for the necessity of an immediate advance in the standard of design and construction of all ancillary equipment. Far too often the standards have been almost nonsensical, and if found in conjunction with a conscientious running department officer who books every defect, however small, may give a totally incorrect impression as to what modern diesel locomotives and railcars can do in the way of performance.

The first consignment of American built locomotives for service in this country recently arrived at a British port. These engines will be used principally for shunting and hauling short distance freight trains.

Ministry of Supply "Austerity" Locomotive

The new 2-8-0 "Austerity" locomotive to be built in large numbers by British firms is of a special design, and is largely governed by availability of materials and labour. The employment of steel castings is limited, and complicated forgings avoided wherever possible; constructional details are reduced in number to the lowest limit consistent with efficient working and as far as possible, renewable parts are duplicate with those of L.M.S.R. standard locomotives. Simplicity and robustness have been the main considerations of those officers of the Ministry of Supply responsible for the design.

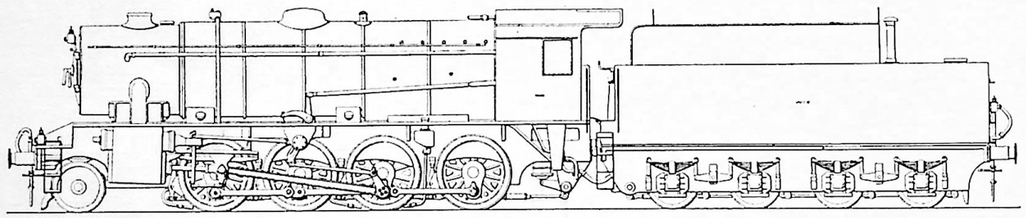
The boiler barrel which is parallel and the firebox casing are made from steel plates. The inner firebox, of copper, is stayed to the outer casing by steel water space stays riveted over on the inside only, also by copper stays in the breaking zone, riveted over both inside and outside. The crown of the firebox is supported by steel direct stays screwed and riveted over at both ends.

The large tender is of the 8-wheeled non-bogie type having ample fuel and water capacity so that the locomotives can work in districts where refuelling facilities may be far apart. The frame is constructed of steel plates stayed together with plates and fabricated stretchers. The tanks are built up of welded steel plates. When necessary water pick up gear can be fitted.

The first of these locomotives will probably be seen on our railways by the end of this year. They will be painted a khaki colour and will be marked on the tender "W.D." with a number.

L.N.E.R.—The 1,942nd locomotive to be built at the Doncaster Works of the L.N.E.R. has just been completed. The works number plate on the smoke box of the engine therefore bears 1942 both as the registration number and the year of completion and it is unlikely that such a coincidence can ever occur again.

The 1,942nd engine is No. 3844 and she is one of the series of 2-8-0 freight locomotives now under construction by the L.N.E.R.



MINISTRY OF SUPPLY "AUSTERITY" LOCOMOTIVE

Cylinders (2)..... 19" Diam. × 28" stroke.		Tank Capacity.....5000 Gallons.		Height, 12' 10 9/16". Width, 8' 11"	
Coupled Wheels.....	4' 8½" dia.	Coal Capacity.....9 tons.		Boiler, maximum outside diameter	5' 8½"
Truck Wheels.....	3' 2" dia.	Tender Wheels.....3' 2" dia.		Boiler, length of Barrel	11' 7½"
Wheel Base, Coupled...	16' 3"	Tender Wheel Base.....	15' 9"	Firebox, length outside	9' 4"
Wheel Base, Total.....	24' 10"	Wheel Base, Engine and Tender	53' 1¼"	Length between Tube Plates	12' 0"
Length over Buffers.....	63' 6"			Superheater, 28 elements 1⅜" dia.	
				Grate .....8' 7 7/16" × 3' 3⅜"	
				Boiler Pressure 225 lb. per sq. in.	

Heating Surface:		
Large Tubes.....	451	Sq. ft.
Small Tubes.....	1061	do.
Firebox	168	do.
Total	1680	do.
Superheater Surface	338	do.
Grate Area	28.6	do.
Tractive Force (85% B.P.)	34,215	lb.

Weights: Engine, 72 tons; Tender: 56 tons; Engine and Tender, 128 tons; Adhesive Weight, 62 tons. Engine, Light, 65 tons. Tender, Light, 24½ tons.

The tubes are of steel. The ashpan is of welded steel plate construction.

The main frames are of steel plate and the frame stretchers are of flanged plates and fabrications, while the smokebox saddle is of cast iron.

The cylinders are of the piston valve type, and Walschaerts gear is arranged for operating the valves.

The driving wheel centres are steel castings, and those of the leading, intermediate and trailing wheels, cast iron, all with balance weights incorporated in the castings.

A steam brake is fitted to the engine, also Westinghouse and vacuum automatic brake apparatus for train working. Carriage heating apparatus will be fitted to some of the engines.

It is expected some of the engines will soon be in service hauling heavy trains. They will be employed for military and freight traffic of various kinds.

THE REAL TEAM SPIRIT

Rail, Road, Army and Others Worked as One after Raid on Middlesbrough Station

There was a typical war-time scene at Middlesbrough L.N.E.R. Station one morning recently. Not so many regular travellers perhaps, and certainly none of the huge crowds of pre-war days.

Some bombs hit the station and besides smashing part of the buildings and severing the four through lines, caused a fair amount of damage to a waiting train. The front of the locomotive was badly mauled, carriage bodies were torn and windows smashed.

A guard and a boy messenger from the refreshment rooms were killed outright. The driver and fireman of the train and a lavatory attendant were injured, the last two so badly that they died later in hospital. A ticket collector at his barrier, two refreshment room attendants, some passengers and other members of the public were also injured.

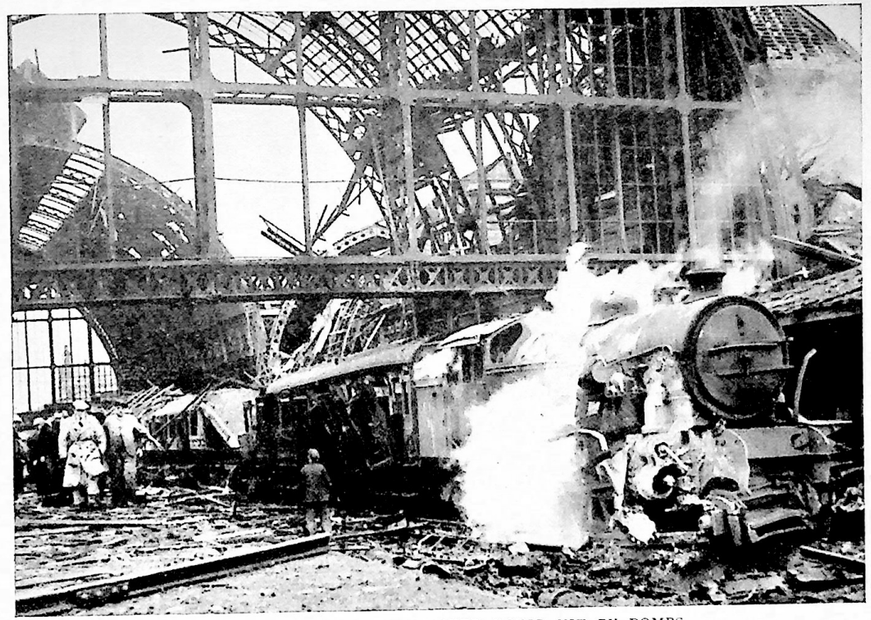
Almost before the noise of the explosions and falling masonry had ceased there began a series of events, of which for sheer teamwork Middlesbrough may always be proud.

L.N.E.R. men and women resumed their duties at once, some of them to put in unbroken spells of 33 hours. Doctors, nurses, ambulances and A.R.P. rescue workers were at their tasks within a few minutes. They were accompanied by a Salvation Army mobile canteen from which railway staffs, civilian workers, troops and the public were freely served with tea and food.

The Middlesbrough Corporation and the United Automobile Services Ltd. immediately offered alternative transport facilities and within 15 minutes of the conclusion of the raid arrangements had been made for shuttle services of buses. Ten minutes later these bus services were in operation, this being simultaneously announced to the public by loud speaker vans loaned by the local Information Committee and by the despatch of a railwayman on a cycle to display an advice on the many L.N.E.R. handbill boards in the town and suburbs.

Arrangements were made for newspapers, mails and milk, and other perishable traffic for delivery in Middlesbrough to be dealt with by road from Stockton Station, forwarded parcels being accepted at Middlesbrough in a temporary office at one end of the station.

Within an hour of the raid 200 troops were hard at work helping L.N.E.R. engineers to clear the debris and restore the tracks. The damaged locomotive and train were removed in a few hours and by the early afternoon of the following day the goods lines were cleared for traffic. Passenger train services were resumed less than 48 hours after the raid.



MIDDLESBROUGH STATION AFTER BEING HIT BY BOMBS

KING'S CROSS STATION.

Built on the site of the old small-pox and fever hospital, King's Cross was the largest London station and possessed the biggest roof in this country when it was opened on 14th October, 1852. The roof was constructed by the architect, Lewis Cubitt, on the same principle as that of the Czar's Riding School at Moscow, the ribs being bundles of planks which overlapped each other endways, forming a built-up bow kept in position by the containing walls. As can be imagined, the walls had to be of great strength to resist the thrust. These wooden supports were afterwards replaced by iron girders.

The history of King's Cross contains milestones in the history of British Railways. In 1879 the first railway dining car left the station, provided with foodstuffs from the King's Cross cellars. In 1888 the station was the starting point for the expresses of the East Coast companies in their race against those of the West Coast to Edinburgh. The year 1894 saw the installation in the tunnels outside the station of the first British "track circuit," a simple electrical contrivance upon which modern power signalling is dependent. The East and West Coast routes were again in conflict over the Scottish traffic in 1895 with the advent of the 522¾-miles race to Aberdeen, the longest railway race ever likely to take place in these islands. Before a truce was called, King's Cross witnessed the departure of an express which cut down the original timing to Aberdeen of 11 hours 35 minutes to no less than 8 hours 40 minutes—a throughout speed of over 60 m.p.h., despite the fact that engines were changed at six points en route. In 1921 the first restaurant car in the world to be fitted with an electric kitchen left King's Cross on a Leeds express; the year 1927 saw a new world's record in non-stop train running set up by the 9.50 a.m. from King's Cross, which covered the 268½ miles non-stop to Newcastle; in May, 1928, this record was broken by the "Flying Scotsman," which from then (during the summer months) until the outbreak of the war made a world's record non-stop run between King's Cross and Edinburgh—a distance of 392¼ miles.

On 30th September, 1935, King's Cross witnessed the commencement of the regular working of Britain's first streamline train, the *Silver Jubilee*, between London and Newcastle. The new train covered the 232.3 miles between London and Darlington at an average speed of 70.4 m.p.h. in both directions, the first railway run in the world of over 200 miles in length to be booked non-stop at over 70 m.p.h. for the whole distance. On 5th July, 1937, King's Cross saw the introduction of another streamline train, the *Coronation*, which brought London and Edinburgh, 392¼ miles apart, within 6 hours of each other by rail for the first time. Yet a third streamline train service was introduced on 27th September of the same year, namely the *West Riding Limited* (London, Leeds and Bradford).

At the present time King's Cross covers 15¼ acres. Trains arrive and depart over six lines of metals, and the thirteen daily departures of 1852 had grown to 250 or thereabouts at the outbreak of war.

The Steam Locomotive in Traffic

By E. A. PHILLIPSON, Assoc.M.Inst.C.E., A.M.I.Mech.E., M.I.Loco.E.

(*Continued from page* 200).

XI. BREAKDOWN WORK AND EQUIPMENT.

The general principles for the interior lay-out of the tool van must also be observed when arranging the stowage of packing in the van provided for this material. Suitable dimensions for hardwood packing are:—

Sections from 11in. x 2in. to 11in. x 6in., the thicknesses, increasing by 1 inch, in various lengths from 2ft. 0in. to 4ft. 6in.

A few baulks, about 9in. square, from 3ft. 0in. to 4ft. 0in. in length.

A good supply of wedges, both small and large, and of scotches is also required, together with some steel skid plates, steel packing for axle boxes, old fishplates and some scrap rail, ranging from 1ft. 0in. to 12ft. 0in. in length, the shorter lengths being most frequently required. Convenient dimensions for the wooden wedges are 11in. x 2½in. x 3in., and 15in. x 5¼in. x 3in. respectively. The steel skid plates may be ½in. and ⅝in. thick.

The travelling van must be well lighted and ventilated, with provision for heating in cold weather, and partitioned off into three compartments. Of these the largest comprises the travelling quarters for the gang, the others being for the guard and officers respectively. Either the gang's quarters or the guard's compartment may be at one end, the former order, being in some respects the better arrangement, and the officers' compartment at the other end of the vehicle.

The quarters for the gang must incorporate sufficient table and bench accommodation to enable all of them to feed simultaneously, or relax when travelling, in a reasonable degree of comfort. To economise in space the seats may form the lids of lockers. Cylinders of oxygen and acetylene, if unavoidably stored in the travelling van, must be securely racked and insulated from the effects of vibration. As it is not usual to provide washing facilities, ablutions are usually performed with the aid of hot water from the engine; a suitable floor space should therefore be plated, provided with a drain and its boundary continuously kerbed, to control the overflow of soapy, greasy water from the bucket. The pegs for protective clothing, e.g., oilskins and reefer jackets, must be so located that there is no likelihood of the men making contact with it when seated, as it is frequently very wet when removed on completion of breakdown work.

The guard's compartment, apart from the usual fittings for continuous and for hand brakes, may conveniently house the cooking range, which should be of sufficient capacity to enable hot drinks to be served at short notice, together with the crockery and supplies of tea, coffee, sugar, condensed milk, tinned beef, condiments and biscuits. It should be possible to serve meals at intervals of four hours, and hot drinks more frequently in severe weather, although it will often be found that the gang elects to complete the breakdown work, if not too extensive, before feeding.

The officer's compartment must be sufficiently large to seat the maximum number likely to attend a breakdown and must be provided with generously proportioned lights at the end and both sides. Loading and clearance gauge diagrams should be exhibited and copies of current working timetables and appendices provided. In all cases communicating doors and food serving hatches must be arranged in the partitions between the compartments, and each compartment fitted with exit doors on both sides of the vehicle.

Steam cranes are usually required to undertake bridge and track work in addition to breakdown work. They must be reliable and robust, as they are subjected to rough usage, and must be capable of self propulsion when on the site, in addition to being suitable for high speed running with the breakdown train. Loading gauge restrictions affect the design generally, as with other rolling stock, and care must be exercised that the jib does not foul the gauge when traversing curves in the "down" position, and that when travelling in this position the tail of the crane does not project over the heads of the buffers; a detent must also be arranged to prevent excessive raising of the jib.

Buffers, drawgear, axles, axleboxes and wheels should as far as possible conform to the standards of the running railway. Outside axleboxes are preferable; they are then more accessible for blocking down and for the changing of springs and brasses. The spring hangers should be long; they are then less liable to fracture in the event of the screwing down of the boxes being overlooked before lifting. The load on the springs during lifting may be relieved either by screws or wedges; the former are preferable, provided they can be locked in the disengaged position when the crane is running with the train, as they ensure a finer adjustment and are less likely to jam.

The outward swinging type of blocking girder is sometimes preferred to the telescopic arrangement, on the grounds that it is inherently more rigid and quicker to operate. The girder centres should be as close as possible, in order to minimise the bending movement on the carriage main frames and, seen in plan, should form a square. The carriage must be as short as possible in order that the crane may have great availability.

Restrictions of weight per foot run and axle load limitations necessitate the provision of relieving bogies with high capacity cranes, but their use materially increases the time required to prepare a crane for lifting, although the increase is small and more than fully compensated in other directions.

It is usual to provide two axles with the travelling drive, and either two or three are braked, limitations in this case being imposed by the brake gear which would otherwise foul the blocking girders. It is desirable that automatic brakes be provided in addition to an either side hand brake. The weights of pulleys, blocks and hooks must be minimised, in the first two instances partly by keeping the pulley diameters within reasonable limits. The pulleys must be guarded to prevent the ropes, which have superseded chains, from leaving the tracks arranged for them.

The jib must be as straight as possible in order to minimise bending stresses and to reduce weight. In most designs the crane centre pin is a fixture on the carriage, the superstructure revolving round it. It is most important that the crane shall be capable of sluing at very slow speeds; the ability to "inch" is as necessary with this operation as

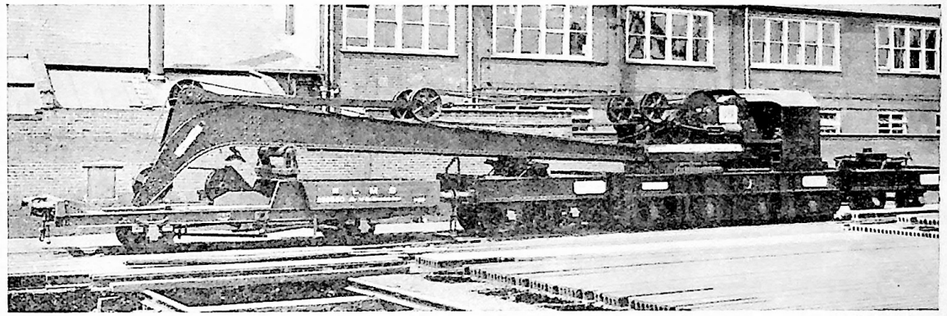


FIG. 111. RAPIER 36-TON BREAKDOWN CRANE (L.M.S.R.)

with lifting for the duties under consideration. By placing the crane engine cylinders outside the frames they are made accessible and also enable the maximum working length of winding drum to be accommodated between the frames. Owing to the intermittent nature of the work, the cylinders must be provided with large clearance volumes to reduce the risk of damage by water. The exhaust is usually too wet to act as a blast for the boiler, and must be baffled before being discharged in order that there may be no risk of personnel in the vicinity being scalded.

The boiler must be able to meet intermittent heavy demands and, at the same time, raise steam quickly from cold. The mountings should conform, as far as possible, to the railways standards. The feed may be either by injectors or pumps, although the latter are more liable to burst in frost. A hand pump should also be provided in those cases where the boiler cannot be filled rapidly in the shed. The bunker and tank capacities, particularly the latter, must be liberal.

The crane controls must be centralised and located well forward in order to ensure the maximum range of vision for the driver. It is advantageous to arrange flood lighting on the jib at both sides.

By the courtesy of the makers, Messrs. Ransomes & Rapier Ltd., of Ipswich, Fig. 111 shows a Rapier 36-ton breakdown crane with Stokes patent relieving braces in train order. These bogies may be either four-wheeled, as in the example under notice, or six-wheeled. A spring-borne coupling girder is permanently attached, by a ball and socket joint at one end to each bogie, the latter swivelling about this point. These coupling girders are attached to, and hinge about the headstocks of the crane carriage by means of two short pins, the removal of which enables the bogie to be detached.

Fig. 112 illustrates a crane by the same makers, for a working load of 105 tons at 20ft. radius. It will be observed that in this case the bogies have been removed to enable the crane to deal with a test load of 126 tons. Fig. 113 shows one of the six-wheeled relieving bogies for this crane in position. One man is dropping the coupling pins which connect the coupling girder with the crane carriage. The other end of this girder is supported at the centre of the relieving bogie on a worm and screw gear. When the coupling pins are home the man seen at the centre of the bogie will hoist the coupling girder by means of this gear until a predetermined amount of the dead weight of the crane is supported by the relieving bogie; an automatic stop prevents the increase of the load beyond the stipulated amount. The process of coupling or uncoupling a bogie occupies from three to five minutes.

It will be noted that with these bogies the necessary length of the guard truck is reduced. The crane itself may be used to remove the guard truck and bogies subsequent to arrival at the site, if desired, and this operation can be performed without using the blocking girders. With this construction, further the crane can always be located centrally on its carriage, thus giving equal clearance when lifting over either headstock. When the crane is in train order the distribution of weight over the axles is very uniform and is about 33⅓ per

FIG. 112. RAPIER 105-TON CRANE WITH TEST LOAD OF 126 TONS

cent less than that for a similar crane without relieving bogies. The crane can operate unpropped and with bogies attached, thus maintaining a low axle load; this feature is particularly of value in connection with bridge work. The reduction in the length of the crane carriage is advantageous for breakdown work and in practically all cases, with this type of crane, only two sets of blocking girders are necessary, thus eliminating the excessive loads which may otherwise arise with a third set disposed intermediately.

(To be continued)

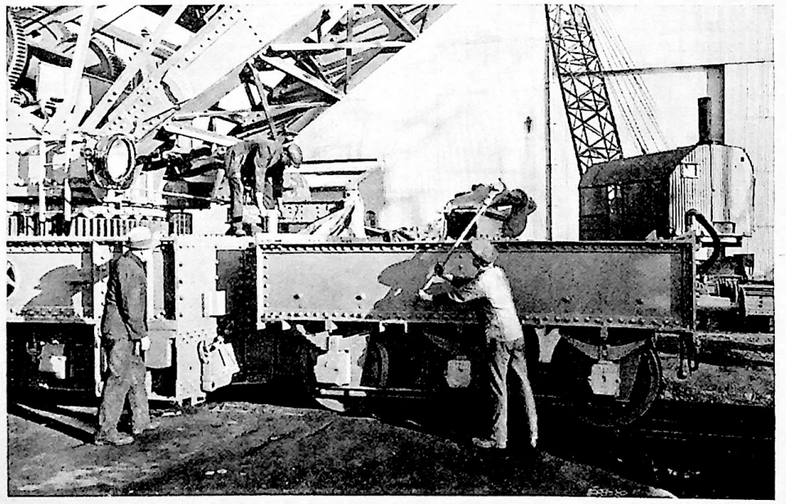


FIG. 113. SIX WHEELED RELIEVING BOGIE, RAPIER 105-TON CRANE.

NETHERLANDS RAILWAYS.—All of the forty articulated diesel units of the Netherlands Railways have gone to Germany. Each unit consists of three cars—having second and third class accommodation with luggage compartment. They were withdrawn from service in Holland after the German invasion owing to scarcity of diesel oil fuel.

Mr. G. A. R. Mead, Assistant Managing Director of the Skefko Ball Bearing Co. Ltd., has been appointed Managing Director.

Mr. Gilbert S. Szlumper, C.B.E., has been appointed Director-General of Supply Services, at the Ministry of Supply.

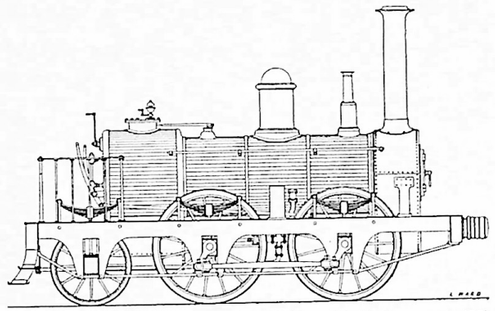
SOUTHERN RAILWAY.—Ten engines of the "King Arthur" class 4-6-0 passenger engines have been lent to the L.N.E.R. They are Nos. 739, 740, 742, 744, 747-751 and 754, and are at present working in the North Eastern Area.

The Locomotives of the Caledonian Railway

By JAS. F. McEWAN.

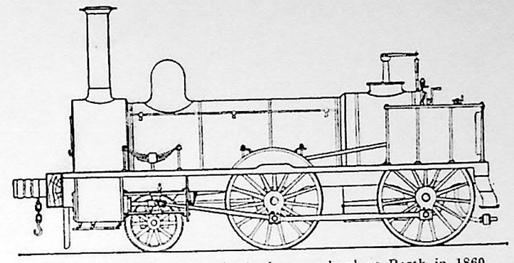
(*Continued from page* 175)

In March, 1850, the group broke up and a distribution of rolling stock was made between the two companies. After the share out the D.P. & A. Jct. (which title was retained by the Dundee and Perth line) had twelve locomotives and the Dundee and Arbroath had nine, the *Trotter* having been scrapped in September, 1849. Continuing the history of the Dundee and Perth section after the disruption, the engines were renumbered so as to close the gaps left. Nos. 1, 2 and 4 became 10 to 12, No. 8 *Wallace* retained its number, Nos. 11 to 16 became Nos. 2 to 7, No. 17 *Kinnaird* became No. 1, and the small tank *Eclipse* No. 9.



D.P. & A. (*later* D. & A. sect.) 0-4-2 Nos. 20, 21 (see page 175).

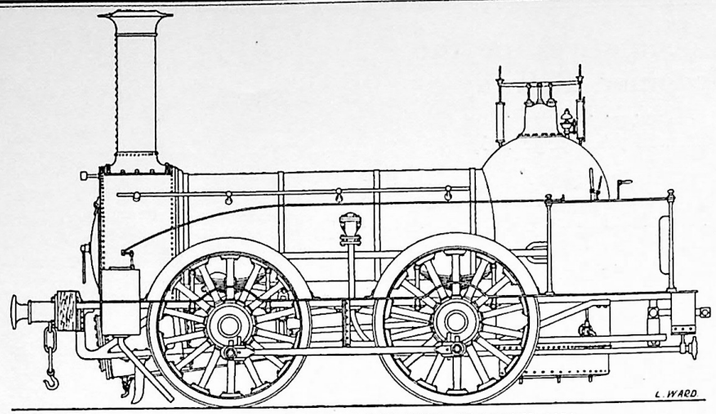
No further additions were made until 1854 when three engines were obtained to replace the three original Dundee and Newtyle ones which were withdrawn at that time. The replacements were second-hand Bury type 0-4-0 tender engines, locally known as "Toads," which appear to have been built about 1840 by Bury, Curtis & Kennedy. It has been suggested that these came from the L. & N.W. Railway, Southern Division, as this section were disposing of a number of similar engines at the time. The cylinders were 14in. diameter by 20in. stroke and wheels 5ft. in diameter, wheelbase 7ft. 0in. Weight: leading axle 7 ton 15 cwt., driving axle 10 ton 10 cwt., total 18 ton 5 cwt. The Scottish Central overhauled and partially rebuilt the engines before they were put to work on the Dundee and Newtyle section of the D.P. & A. Jct. These three engines took the numbers 10 to 12 of the Newtyle section and appear to have carried the names *Balbeuchly*, *Hatton* and *Law*, but order is unknown. At one period the Dundee and Arbroath line was very short of locomotive power (circa 1855) and one of these engines was sent to Broughty Ferry to operate the Pier line. Nos. 13 and 14 were two 2-4-0 type tender locomotives made by George England & Co. They were acquired in 1855 but



D.P. & A. 2-4-0 No. 13 and 14 after overhaul at Perth in 1860.

certain records tend to indicate that these were made earlier than this (probably 1852), and it is possible that these were also part of the cancelled order for Russia already referred to in the early Caledonian part of the history. The names of these two engines were *Scorpion* and *Spitfire*. In April, 1860, both were sold to the S.C., who numbered them 6 and 22. Later they became C.R. numbers 353 and 352 respectively, being withdrawn in 1881 and 1882. The names were removed by the S.C. No. 15 *Sprite*, was of similar type but was close coupled. The cylinders were 15 in. diameter, by 22 in. stroke and the coupled wheels 5 ft. diameter. The boiler was similar to the ones fitted to *Scorpion* and *Spitfire*. The engine was purchased from George England & Co., in 1855. On becoming S.C. stock it was numbered 71, and when the S.C. was in turn taken over by the Caledonian Railway it became 351. The engine was rebuilt at Perth in 1864, but was not altered to 0-4-0 S.T. as has often been stated incorrectly. The engine was withdrawn in 1879, after working on the Carmyllie Railway.

In 1860, R. Stephenson & Co. supplied two 0-4-0 type inside cylinder engines (makers Nos. 1311 and 1312) with cylinders 15in. diameter by 22in. stroke. The coupled wheels were 4ft. 8in. diameter. The wheelbase was 7ft. 0in. These two engines do not appear to have been given names and when delivered were numbered 16 and 17, but in the following year became Nos. 13 and 14. These were in course taken over by the S.C. who numbered them 72 and 73, and later they became C.R. Nos. 350 and 349. Between 1863 and 1866 they had been in Perth shops and had the cylinders bored to 15¼in. diameter. No. 349 along with C.R. 0-4-2 No. 222, worked on the Broughty Ferry Pier branch between the period of the fall of the first Tay Bridge, in 1879, and the opening of the new one in 1888, when the C.R. and the N.B.R. were working the branch alternate years. Subsequently the engine No. 349 was yard pilot at Broughty Ferry, being replaced on the branch duty by No. 350, which had been used on the Perth Harbour branch and had been kept in this area in event of any special duty on the Errol branch which normally was horse operated. Owing to the short wheelbase these engines rolled very badly



D.P. & A. 0-4-0 Nos. 10-12 AS REBUILT AT PERTH, 1854.

when running. Both had the letter " A " suffixed to their number in 1883, and were withdrawn No. 349a in December, 1883, and 350a in May, 1892. No. 350a had been overhauled in November, 1883, when some of the good pieces from 349a were utilised.

On August 1st, 1863, the Scottish Central took over the D.P. & A. Jct. under an agreement reached on 13th September, 1862, and the fifteen locomotives were numbered S.C. 63 to 77. Three of these were replaced immediately and a further seven in the following year. A list is appended showing the stock taken over by the S.C., and the five engines which became C.R. stock. The two 0-4-2 type engines which were taken over were withdrawn in 1869.

Perth supplied the D.P. and A. Jct. with a pair of new cylinders for the Crampton engine *Kinnaird* in January, 1857, and new 15in. ones for No. 5 (2-2-2) in May, 1857, and in June, 1860, with a pair of Bailey's Patent buffers for No. 4. Whether or not the three engines went to Perth for these repairs is not known.

Most of the notes on the engines of the D. & N. were got from letters of the late David Lamond, who began on this section about the time steam traction was introduced, and who drove from Dundee for just over fifty years, and spent a further seventeen in retirement.

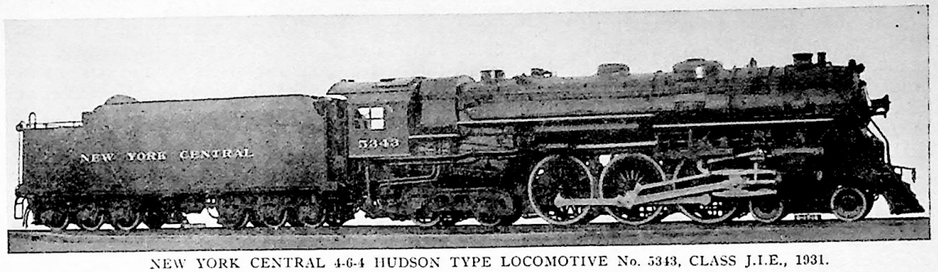
DPA No.	Maker	Date New	Type	S.C. No.	C.R. No.	Withdrawn
10	Bury	1840?	0-4-0	63	—	1863
11	Bury	1840?	0-4-0	64	—	1863
12	Bury	1840?	0-4-0	65	—	1863
1	Tulk & Ley	1847	4-2-0	66	—	1864
9	G. England	1849	2-2-2T	67	—	1864
2	K.H. & S.	1847	0-4-2	68	—	1864
3	K.H. & S.	1847	0-4-2	69	379	1869
4	K.H. & S.	1847	0-4-2	70	378	1869
15	G. England	1855	2-4-0	71	351	1879
13	R.S. & Co.	1860	0-4-0	72	350	1892
14	R.S. & Co.	1860	0-4-0	73	349	1883
5	K.H. & S.	1847	2-2-2	74	—	1864
6	K.H. & S.	1847	2-2-2	75	—	1864
7	K.H. & S.	1848	2-2-2	76	—	1864
8	K.H. & S.	1840	2-2-2	77	—	1864

(To be continued)

New York Central Locomotives

FURTHER NOTES BY E. C. POULTNEY

IN 1935 the writer contributed an article to " The Locomotive " under the title " Some Notes on the New York Central ' Hudsons ',' dealing with the earlier express passenger engines of the 4-6-4 or " Hudson " type, first introduced in 1927. The present article supplements the particulars then given by furnishing a description of the latest development of the type recently constructed to work the heavy and accelerated passenger services now operating between New York and Chicago, and other important points served by the New York Central. In addition, reference will be made to some new 4-8-2 type locomotives designed for fast freight and passenger trains. Since the first of the original " Hudsons " was delivered by The American Locomotive Co., in 1927, a total of 205 of these powerful engines were placed in traffic, and have successfully worked the main line passenger services. The last of the original " Hudson " type locomotives as constructed in 1931 is illustrated, and the tables of dimensions appearing underneath the plates will be found interesting for comparison. During the period these locomotives were being built several changes of note were incorporated, chief of which was the fitting of roller bearing journal boxes to the leading truck axles, while some of the type also received roller bearing boxes for the coupled axles. Further, while the earlier engines had the conventional form of built up cast steel bar type main frames, those of later construction were equipped with cast steel frames with integral cylinders, valve chambers and saddles. Subsequently some of these engines were fitted with new boilers of nickel steel, and one was experimentally fitted with light weight roller bearing connecting and coupling rods, at the same time the boiler working pressure was increased from 225 to 250 lb. per sq. in. and the cylinders bushed to preserve the same tractive effort and



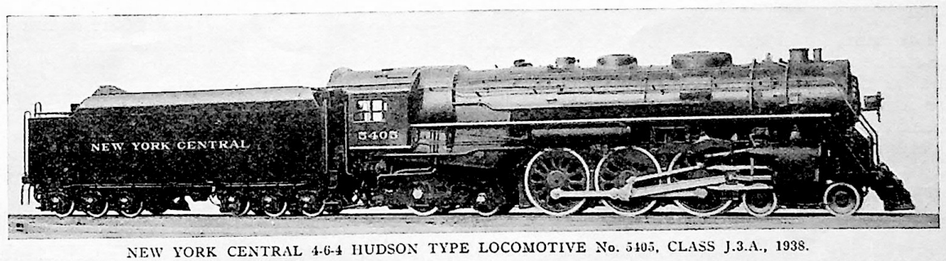
NEW YORK CENTRAL 4-6-4 HUDSON TYPE LOCOMOTIVE No. 5343, CLASS J.1.E., 1931.

Cylinders 25 in. dia. × 28 in. stroke; Driving Wheels dia. in. 79; Boiler steam pressure 225lb. per sq. in.; Heating surfaces sq. ft.; Tubes and Flues 4203, Firebox 281, Total Evaporative 4484, Superheater 1951, Combined 6435; Grate Area 81.5 sq. ft.; Rated Tractive Force 42300 lb., with booster 53200 lb.; Weights in working order, lb. Engine: On coupled wheels 190700, Total 358600. Tender: water 14000 galls., Coal 28 tons, Weight 303000. Total locomotive 661,600.

factor of adhesion. These constituted significant changes introduced to gain experience, it being considered that modifications of the kind mentioned might be introduced as standard when engines of greater capacity became necessary. In 1932 when all the 205 " Hudsons " were in service, the scheduled timing of many of the important trains was sharply reduced, thus two hours was cut from the schedule of the *Twentieth Century Limited*, between New York and Chicago, and in succeeding years other important trains were speeded up, and in 1935 the *Century* schedule was further cut to 16½ hours, only to be again reduced in 1938 to 16 hours, and at the same time the running times of several other New York-Chicago trains was reduced as well as the schedules of trains operating between New York and other points on the New York Central System. The shortening of running schedules coupled with the heavy traffic to be handled made it necessary to provide still more powerful locomotives. To satisfy this requirement the original " Hudson " design has been further developed, with the result that the new class J.3 4-6-4 type engines were designed, 50 of which were constructed during the latter part of 1937 and early part of 1938. The engines as illustrated are generally similar to the previous design, being built on the same centres, and as closely as possible to the same over all dimensions on account of clearance limitations.

The Latest Hudsons.

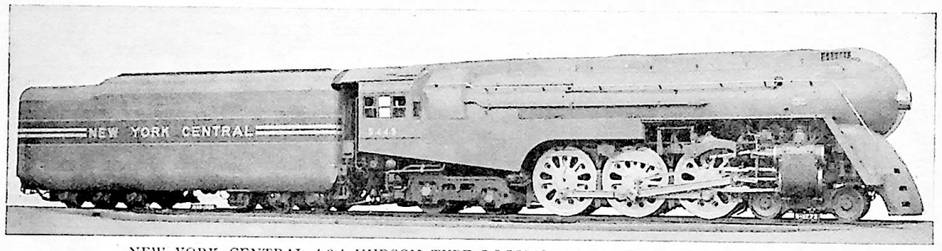
When working out the design for the new engines the objective in view was in the first place the provision of a large increase in the power available through the higher speed range required for high speed operation. At the same time a reliable locomotive was desired for extended runs, and one that would have reserve capacity to meet adverse conditions of working in the winter season. To meet these requirements a locomotive of the six coupled type was preferred similar to the previous engines in general design, but incorporating such modifications as had been shown to be advantageous when experimentally adopted in the case of certain of the earlier class as already indicated. The boilers for the new engines while of generally the same dimensions as for the previous locomotives have been modified by the addition of a combustion chamber to the firebox, thus increasing the direct heating surface. This change has shortened the tubes, and materially altered the disposition of the heating surfaces. The boiler steam pressure has been raised from 225 to 275 lb. per sq. in. and to provide the greater strength of construction necessary nickel steel plates are used. As re-designed, the total heating surface including the type E superheater is 5,932 sq. ft. The length over the tube plates is 19 ft. and there are 183 3½ in. flues for the superheater elements, and 59 2½in. tubes contributing 3,827 sq. ft. of heating surface



NEW YORK CENTRAL 4-6-4 HUDSON TYPE LOCOMOTIVE No. 5405, CLASS J.3.A., 1938.

Cylinders 22½in. dia. × 29in. stroke; Driving Wheels dia. in. 79; Boiler Steam pressure 275 lb. per sq. in.; Heating Surfaces, sq. ft.: Tubes and Flues 3827, Firebox 360, Total Evaporative 4187, Superheater 1745, Combined 5932; Grate Area 82 sq. ft.; Rated Tractive Force 43440 lb., with booster 55540; Weights in working order, lb., Engine: On coupled wheels 201500, Total 360000; Tender: Water 14000 galls., Coal 30 tons; Weight 314300. Total locomotive 674,300.

this with the firebox and combustion chamber giving a further 360 sq. ft. makes a total evaporative surface of 4,187 sq. ft. The grate has an area of 82 sq. ft. and the free area through the boiler is 8.91 sq. ft. equal to 10.7 per cent. of the grate area. The internal firebox is completely welded. The diameter of the boiler is 80⅝in. inside at the front end, and at the rear next the firebox the outside diameter is 91½in. The middle section of the barrel is tapered. The boiler equipment includes a multiple valve throttle housed in the superheater header, a feed water heater, Elesco type, steam separator on the main steam pipe and a standard stoker, the engine for which is placed on the engine framing below the foot plate. For the supply of secondary air to assist combustion four 2in. combustion tubes are fitted in each side of the firebox. The arch is carried on four arch tubes. During special standing tests this boiler attained a maximum actual evaporation of

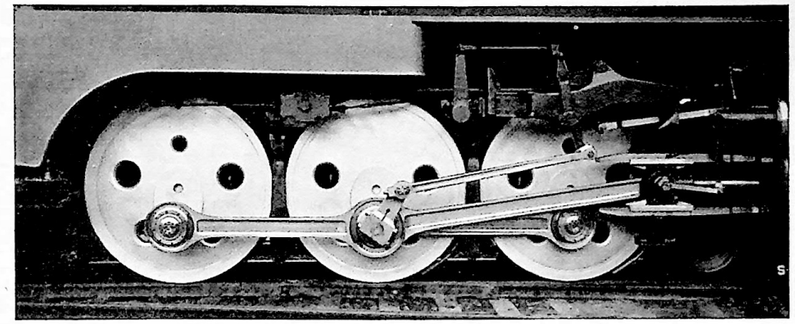


NEW YORK CENTRAL 4-6-4 HUDSON TYPE LOCOMOTIVE No. 5445, CLASS J.3.A., 1938.
STREAM LINED.
All general dimensions as for non-stream lined series except for the following: Engine weight in working order on coupled wheels 201800 lb. Total Engine 365500 lb. Tender: Water 13600 galls., Coal 28 tons, Weight 316300 lb. Total locomotive, 681800 lb.

87,500 lb. of water per hour at a firing rate of 179 lb. of coal per sq. ft. of grate per hour, and later after being equipped with an improved blast pipe and chimney arrangement the very high evaporation of 92,000 lb. of water per hour was attained when firing 173 lb. of coal per sq. ft. of grate per hour. This is equal to practically 22 lb. of water per sq. ft. of evaporative heating surface per hour. At this latter rate of working the combined efficiency of the boiler and superheater worked out at 56 per cent.

The Cylinders and Motion.

The original " Hudsons " had 25 in. cylinders, the stroke being 28 in. for the new locomotives in view of the greater steam pressure, the cylinder size adopted is 22½ in. by 29 in. which with 79 in. wheels as before, gives a rated tractive effort of 43,440 lb., increased at starting by 12,100 lb. by the booster applied to the trailing axle of the hind four wheeled truck. Care has been taken in the design of the main steam and exhaust passages, and piping, to obtain an easy steam flow, and ample steam chest volume has been provided by maintaining 14 in. valves as for the larger cylinders, while at the same time ensuring adequate port areas in comparison with the cylinder volume. For high speed operation attention has been given to the design of the revolving and more especially to the reciprocating parts of the motion in order to reduce impact loading between wheel and rail at maximum speeds. For forty-five of the engines the connecting and coupling rods are of the conventional design forged from normalized carbon vanadium steel with floating bushes at the main crank pins for both the connecting and coupling rod connections, and the remaining five have a complete installation of Timken roller bearing rods of special Timken alloy steel, and all the engines have pistons, piston rods, and crossheads, including gudgeon pins of Timken design and of special alloy steel. The piston rods are hollow and at the crosshead end are formed with a series of rings on collars having tapered sides. The crossheads, of the two bar type, are steel forgings in halves machined out at the piston rod fits to suit the collars which are integral with the rods. The crosshead shoes are of aluminium alloy faced with anti-friction metal, the whole being bolted together securing the shoes and clamping the rod in position, the latter being tightly held by the draw fit obtained by the tapered sides of the collars, and the corresponding fit in the crosshead. The gudgeon pins are a tight fit in the connecting rods, and work in roller bearing assemblies fitted in the two side pieces forming the crosshead. The steel used for these rods and cross-heads is a chrome-nickel molybdenum alloy, and by the use of this and the special design, together with the light weight connecting rods the reciprocating masses weigh only 1001 lb. comparing with 1971 lb. in the case of the former " Hudson " engines, an improvement more easily appreciated when it is realised that the maximum piston thrust per lb. weight of the reciprocating parts reaches the high value of 109 lb. comparing with 56.5 lb. for the previous engines. The revolving parts weigh 1397 lb. which are completely balanced, and of the reciprocating parts 41.8 per cent. are balanced. The dynamic augment at diameter speed, 79 miles per hour, is 2.81 tons, and at 90 miles per hour approximately 3.6 tons. The maximum permissible speed on the New York Central is now 80 miles per hour, so that in practice the " hammer blow " can

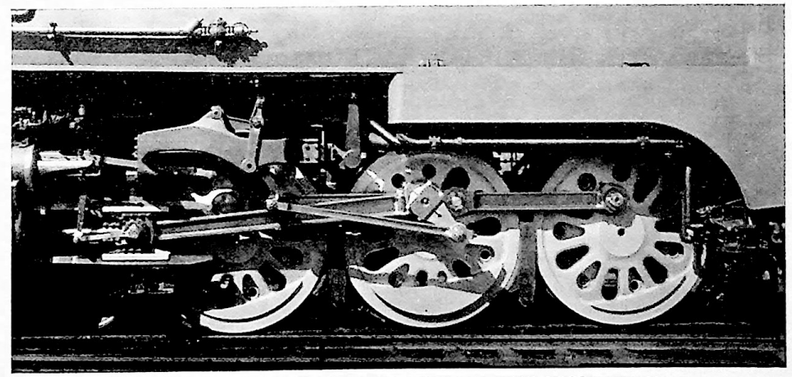


SCULLIN WHEEL CENTRES AND TIMKEN MAIN AND SIDE RODS, N.Y.C. 4-6-4 HUDSON TYPE LOCOMOTIVE.

be considered extremely moderate. Ten of the 50 engines are stream lined for working the *Century* trains, and of these the five having Timken rods also have needle bearings in the pin joints of the Baker valve gear, which is common to all the engines. Scullin wheel centres are fitted to 25 engines, and Boxpok centres are used for the remaining 25. All these locomotives are completely fitted with roller bearing journal boxes, for the engines Timken and for the 12 wheeled tenders S.K.F. equipment. The wheel diameters are: leading truck 36 in., coupled 79 in., trailing truck leading pair 36 in., hind 51 in. The 14 piston valves have a full gear travel of 8½ in. when the cut off is 85 per cent. The Franklin Precision reverse gear is used, this is mounted on the main frames in the centre of the engine, thus allowing of connection being made with the reversing shaft at the centre midway between the two sets of valve gear. In this way torsional strains in the reversing shafts are reduced and the valve gears more positively controlled than is the case when the reversing gear is placed outside bracketed to the boiler, as is usually the case. The engine main framing is made up of a steel casting comprising the cylinders with their valve chambers, the smoke box saddle, and the air pump brackets. In the interest of weight reduction aluminium alloy has been extensively used. The cabs and running boards of all but ten of the non stream lined engines have been made of this material and high tensile steel has been employed for the remaining locomotives. The ten stream lined engines also have aluminium alloy cabs, running boards and cylinder and valve cover casings. The hand rails are of aluminium tubing, aluminium is also used for the dome casings, safety valve and steam turret casings and the gauge boards in the cabs. The air brake equipment is by the New York Air Brake Co. Brake blocks are applied to the wheels of the leading truck, the coupled wheels and to the hind wheels of the four wheeled trailing truck, the braking ratios being 60 per cent. for the leading truck and coupled wheels and 45 per cent. on the trailer.

The Tenders.

The tenders are carried on two 6-wheeled trucks with Commonwealth cast steel frames, and the underframes are also of cast steel by the same makers. The water capacity is 14,000 U.S. gallons for the non-stream-lined, and 13,500 gallons for the stream-lined engines. In like manner there is also a small difference in the coal carried which is 30 and 28 tons (2,000 lb.) for each design respectively. All tenders have water scoops and coal pushers. Clasp brakes are applied to all wheels.



BOXPOK WHEEL CENTRES, N.Y.C. 4-6-4 HUDSON TYPE LOCOMOTIVES.

the cylinders are mounted on the truck frames. The tender wheels are of rolled steel, as are also those for the engine leading truck and for the leading pair of the hind truck, the trailing wheels for which have steel centres with separate tyres.

Performance and Capacity Tests.

A complete series of trials have been carried out with Engine No. 5408, made soon after delivery by the builders, The American Locomotive Co., Schenectady, N.Y., and before the modified blast air pipe and chimney arrangement was applied. When tested for capacity operation the maximum power reached the high figure of 4,725 I.H.P. at 75 m.p.h., and a maximum of 3,880 D.B.H.P. was attained at 65 m.p.h. Between speeds ranging from 50 to 80 miles the D.B.H.P. exceeded 3,600. Based on an engine weight of 360,000 lb. the engine weight per cylinder horse power is 76 lb. and per sq. ft. of evaporative heating surface the power developed is 1.14 I.H.P. With a train of 1,253 tons (2,000 lb.) and at a mean speed of 59 miles per hour over the test length of 140 miles the engine developed an average of approximately 3,290 I.H.P. During the run the actual evaporation was 54,900 lb. and the coal fired 6,590 lb. per hour. The steam rate per I.H.P. hour, cylinder feed only, was 14.76 lb. and including auxiliaries 16.89 lb., and on the same basis the coal consumption worked out at 1.84 lb. and 2.03 lb. respectively. The combined efficiency boiler, feed heater and superheater was 76.3 per cent.

(To be concluded)

DIESEL LOCOMOTIVES FOR TUNNELS

It will be readily appreciated that an undertaking as vast as the Delaware Aqueduct involved considerable transport problems. By no means the least of these was the carriage of concrete for tunnel lining, involving 800,000 tons of concrete and movement in tunnel up to a maximum distance of five miles.

Storage battery locomotives were utilised for the excavation work but their use for the haulage of lining material was ruled out by their inability to handle the large quantity at the speed required to fulfil the contract to time. Electric trolley locomotives were considered dangerous as the sparking would ignite any methane gas escaping into the tunnel. Accordingly after careful deliberation the contractors decided that oil-driven locomotives would best suit the particular conditions, assuming that the New York State Department of Labour—who had previously prohibited the use of this type of locomotive for such duties—would grant permission. The Department agreed to this subject to certain stipulations and having regard to the very efficient ventilating arrangements in force in the tunnel.

The locomotives evolved were of 160 h.p., capable of 18 m.p.h., and have the following flame-proof, exhaust-scrubbing and safety features. The main fuel injection pump is set and permanently sealed for a ratio of air to fuel of not less than 20 to 1 to assure maximum combustion of fuel and a minimum CO content of the exhaust gases. Fuel for the injection pump is supplied by a fuel transfer pump on the engine and taken from a supply tank placed between frames at the front end of the locomotive. The fuel system has proper filters and the fuel tank has a "Protectoseal" fuel filler cap, and the fuel line has a safety shut-off valve that can be tripped from the operator's station in an emergency. Air for the engine intake passes through a double unit bath type air filter that is mounted on the manifold labyrinth, which, in turn, connects directly with the air intake manifold of the engine. The purpose of the labyrinth is to arrest flames induced by any back-firing of the engine, and this feature is made up of a heavy cast flameproof chamber that is equipped with clean-out and inspection covers. In the chamber are mounted thin brass discs spaced to form a labyrinth which will smother any back-fire flames before they can reach the atmosphere. This unit can be readily removed for cleaning. The engine exhaust is carried from the engine through a water-cooled manifold and onward to scrubbing and cooling tanks by way of heavy steel piping, and still through steel piping the exhaust travels through the labyrinth and onward to a fan chamber, where it is mixed with air drawn through the radiators of the engine cooling system. The diluted exhaust is finally discharged to the atmosphere through a rectangular opening in one side of the locomotive hood opposite the operator's position. The foregoing apparatus serves to quench any possible sparks or flames, and cools, dilutes, and cleans to the required degree the engine exhaust. The sulphur content of the engine fuel is required to be not more than 0.5 per cent.; the temperature of the exhaust gas at the point of discharge from the engine must not exceed 160 deg. Fah., and those gases are required to be diluted with at least ten times their volume of air before being released into the underground atmosphere. The contractor has been obliged, before placing a diesel locomotive in service, to provide primary exhaust ventilation underground at the rate of 10,000 cubic feet a minute or more per engine and a minimum air velocity of thirty linear feet a minute in a tunnel section, with the end of the vent pipe intake not more than 150ft. from the face nor less than 25ft. beyond the car changer.

"THE ENGINEER."

Mr. Harry R. Ricardo, B.A., M.I.Mech.E., F.R.S., a Vice-President of the Institution of Mechanical Engineers, has been elected an Honorary Member of the American Society of Mechanical Engineers, New York. This honour is a further link in the association which has existed for many years between the American Society and the Institution, and will be appreciated by his fellow members as well as by his colleagues on the Council. Mr. Ricardo is well known for his outstanding work in connection with internal combustion engines, and is the author of a number of technical papers on the same subject.

OBITUARY

We regret to record the death, on November 19, after a brief illness, of Mr. Charles S. Lake, for many years on the editorial staff of *The Railway Gazette*. He was born on January 26, 1872. His father was the late Mr. Henry H. Lake, one of the principal partners in the firm of Haseltine, Lake & Company, chartered patent agents and consulting engineers.

Mr. Lake served his time at Melton Constable under the late William Marriott in the shops of the old Eastern & Midlands Railway. In 1901 he started writing for the technical press and continued to contribute numerous valuable articles covering a period of over forty years. He was also the author of a number of useful textbooks including "The World's Locomotives."

Mr. Lake was a member of the Institution of Mechanical Engineers also Institution of Locomotive Engineers and in private life was greatly interested in music.

We also record with regret the passing of Mr. T. S. Finlayson. He was formerly with the North British Locomotive Co., and was appointed Chief Locomotive Draughtsman of the old L. & S.W.R. in 1913, continuing in a similar position with the Southern Railway from 1923-1937. He was elected a member of the Institution of Locomotive Engineers in 1925.

Crampton's Patents

(*Continued from page* 189).

We now come to some "improvements" in the relative location of the boiler and wheels, which are of importance in that they adumbrate features that later were incorporated in the famous "Cornwall," or were distinctive of the "Crampton" locomotive as generally known. Figs. 10 and 11 are designs for locomotives on six or four wheels, in which the barrel A is below the level of the axle C of the driving wheels D with carrying wheels E and F beyond the ends of the boiler. The barrel is so formed as to allow the axle to be placed as low as possible above the tubes, but as the inventor remarks, this would be unnecessary with wheels of increased size. This arrangement constitutes the seventh improvement, and the eighth is likewise shown by Fig. 10 in which the cylindrical portion A is attached to the firebox B nearly level with the bottom of the ash pan. Across the firebox is a bridge M (fitted with water tubes from the boiler) to prevent the fuel from choking the lower tubes. A communication is required between the upper part of the barrel and the firebox. Fig. 12 depicts another way of lowering the centre of gravity in which G is a boiler of normal construction, with the axle of the driving wheel K placed beyond the rear of the boiler, and Fig. 13 is a further modification in which the boiler, similar to that shown in Figs. 10 and 11 except for the spaces formed for the driving axle, is situated between the driving and carrying axles. This last figure also shows a means of supporting the weight of the engine should either of the leading or trailing wheels fail, the weight of the engine being then taken by the four small wheels (" or sledges may be substituted, either provided with a flange or not ") which are adjusted to be above the rails at a distance rather more than the play of the springs attached to the larger carrying wheels.

The last improvement cited in his patent which calls for attention is said to consist of " the application to locomotive engines and railway carriages of cylindrical wheels, with outside flanges fitted to axles, which will allow each wheel to run independently of the other." We quote the claim in full below: " Our ninth improvement is represented in Fig. 14, which is a section through two wheels, and a compound or double axle, N,N, (and the tires cylindrical instead of coned), one of which is fastened to the tube and the other axle passing through it, for which axle a Patent was granted to one Edmund Taylor on the eleventh day of May, 1841. Any other description of axle which will allow one wheel to travel at a different speed may be substituted for the one shown." Here it will be noted that nothing is said as to any reason for the outside flanges, and although specific mention is made of cylindrical tyres, the drawing shows them to have the usual conical contour. The citation of the Taylor Patent seems to cut away the ground for any claim to originality, but the device is included as a matter of interest.

We have no record of any further inventions until the year 1845, at which date a Patent (Oct. 6th, No. 10854) was granted to Crampton. This claimed four improvements in the locomotive engine as follows: " First, the combination of an upright boiler with tender having outside cylinders on one frame." This conception is illustrated by Fig. 15, which is so self-explanatory that we need hardly quote his detailed description. This drawing also depicts the matter of his second claim, which reads: " Secondly, the use of returned eccentrics projecting from the crank pin or main connecting rod bearings for the purpose of working the slide valves of locomotive engines as before

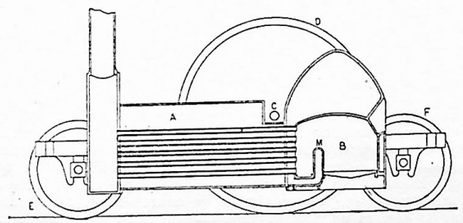


FIG. 10

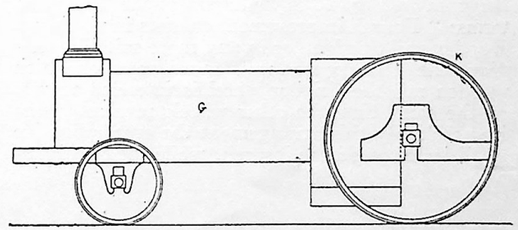


FIG. 12

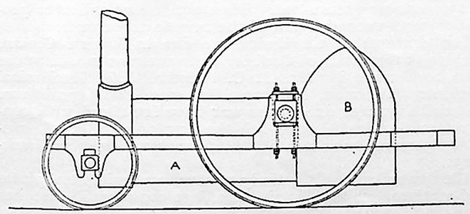


FIG. 11

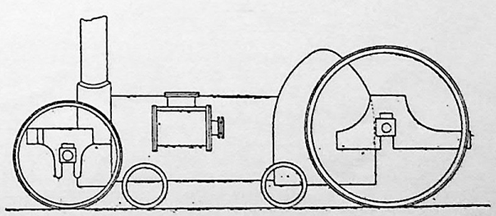


FIG. 13

described." As the drawing clearly shows, this arrangement is simply a double return crank, such as later came into great favour on the Continent, but was almost unknown in this country. One example is, however, to be found in the engine "Courier," built at Crewe by Alexander Allen,

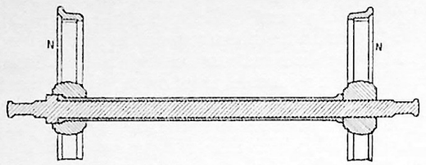


FIG. 14.

and illustrated in our issues for March, 1940, p. 68, and February, 1941, p. 33. Crampton also mentions the alternative of two small eccentrics. It therefore appears that Crampton was the first to recognise the advantages of external valve gear, both on the score of accessibility, and for the reduction in size of the eccentrics or their elimination by the use of return cranks. These advantages found little recognition here—probably for pseudo-aesthetic reasons—but they were eagerly accepted abroad and were most extensively adopted some years later.

The third claim is for "the means of increasing the length of the tubes by bringing them into the firebox, as well as extending the bottom of the firebox." Once again the diagrams in Fig. 16 are self-explanatory and require no further description.

The fourth and final claim is rather surprising, for it harks back to the old superstition that the metallic contact of rail and wheels gives an adhesion inferior to that obtainable by wheels running upon surfaces of wood, etc. The third diagram in Fig. 16 is described in the following terms: "Fourth Improvement consists in placing a wooden rail outside (or in any more suitable position) the ordinary iron rails on railways, on which wooden rail the driving wheel is intended to run at the same time the other wheels revolve on the iron rail. By this arrangement the great adhesive qualities of wood are insured, while the disadvantages arising from the increased friction from the whole of the wheels moving upon wood is obviated. A is part of a driving wheel of a locomotive engine showing the tire sufficiently increased in width to bear upon the wooden rail B, the other wheels as before remarked run upon the iron rails C, as heretofore; the height of the wooden rails should be somewhat higher (say a quarter of an inch) than the iron rail which is contiguous thereto."

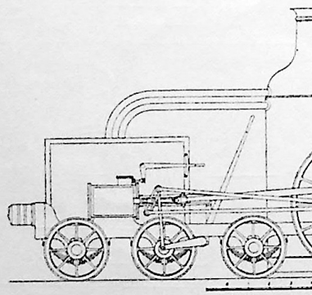


FIG. 15.

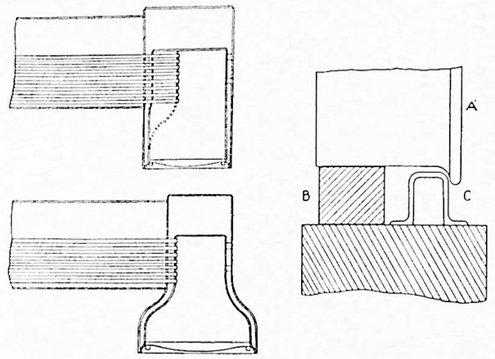


FIG. 16.

The fallacies and objections to the foregoing require no stressing, but it may be recalled that years later this notion again cropped up, though in a somewhat different form, in the case of the Larmanjat system wherein driving wheels ran upon an ordinary road (on a Portuguese line wooden baulks were laid down for the driving wheels) upon either side of a single rail of metal, upon which most of the weight of the train was borne.

(To be continued)

60 TON BREAKDOWN CRANES

VICTORIAN RAILWAYS

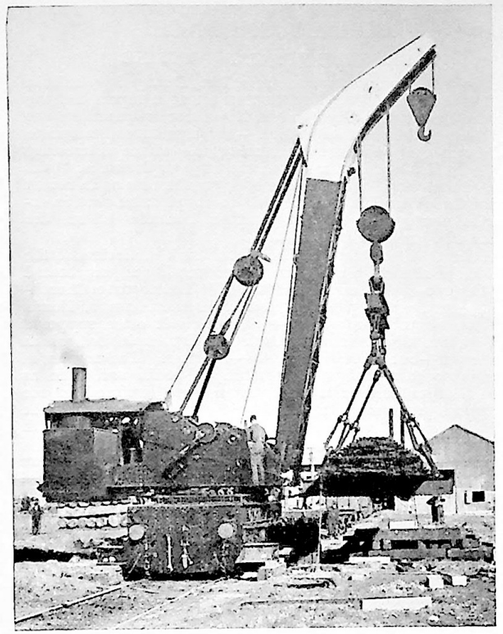
The Victorian Railways have recently constructed at their Newport Workshops, two 60 ton breakdown cranes.

In 1911 a 30 ton crane was built at Newport, followed by another in 1914. On the rare occasions when these cranes were called out they handled the work demanded of them very well, but when, in 1928, the first S class heavy "Pacific" type passenger locomotive having an empty engine weight of 100 tons was delivered the necessity for cranes of greater capacity than 30 tons became apparent.

From 1929 onwards, the X class heavy "Mikado" type freight locomotives began to make their appearance, these had an empty engine weight of 93 tons. Soon after, the design of the H class "Pocono" type of heavy passenger locomotives was begun for which an empty engine weight of 130 tons was estimated. Then action was taken to proceed with the construction of the new 60 ton cranes.

The elements of the design are due to Messrs. Cowans Sheldon & Co. Ltd., of Carlisle, but numerous modifications have been made by Mr. A. C. Ahlston, Chief Mechanical Engineer, Victorian Railways, to suit local conditions. Material shortages due to the war have interfered with construction, but last August 4th the first crane, No. 18, successfully carried out test lifts of 75 tons at Newport Workshops.

The frames are built entirely of structural mild steel plates and sections, mainly by riveting, but considerable use has been made of arc welding. The boiler is a Spencer Hopwood No. 14 Squat Type having 52 2¼ inch external diameter



VICTORIAN RAILWAYS 60 TON CRANE

tubes 10 S.W.G. thick, and 14 2¼ inch external diameter stay tubes 5/16 inch thick screwed 9 threads per inch each end. Tube heating surface is 107.5 square feet, and the firebox contributes 53.5 square feet to the total of 161 square feet. Grate area is 12.56 square feet. The working pressure is 130 lb. per square inch and the boiler is fitted with two 2 inch diameter Ross Pop safety valves, two Klinger Water gauge glasses, two simple injectors, and a 6 inch diameter pressure gauge. Power is provided by two cylinders 8 inches diameter by 12 inches stroke, with Stephenson Valve Gear operating D slide valves having a travel of 1¾ inches; 1/16 inch lead; ⅜ inch steam lap; and a maximum cut-off in full gear, of 75 per cent. of the stroke.

Each crane is carried on two bogies each of 6 feet 6 inches wheelbase, with cast steel side-frames, and having wheels 37 7/16 inches diameter with cast steel spoked centres and separate rolled steel tyres shrunk on and secured with set screws. Journals are 12 inches long by 6½ inches diameter, with plain bearings, and axleboxes packed with wool waste, oil lubricated. Westinghouse automatic air brakes are provided, with two triple valves, two 13 inch diameter brake cylinders operating one brake block per wheel are fitted, and two hand brake wheels are provided on each side of the underframe.

At an engine speed of 250 revs. per minute 60 tons may be lifted at 10 feet per minute on the main block, or 16 tons at 40 feet per minute on the auxiliary hoist; 60 tons may be slewed through one complete turn in 1½ minutes; and the main block may be derricked from 30 feet radius to 17 feet radius in 1½ minutes. Travelling is accomplished by bevel and spur gearing driving on to the inner axles of the two bogies, the travelling speed being 4 m.p.h. with no load.

The maximum speed allowed when the crane is being hauled in a train is 30 m.p.h.

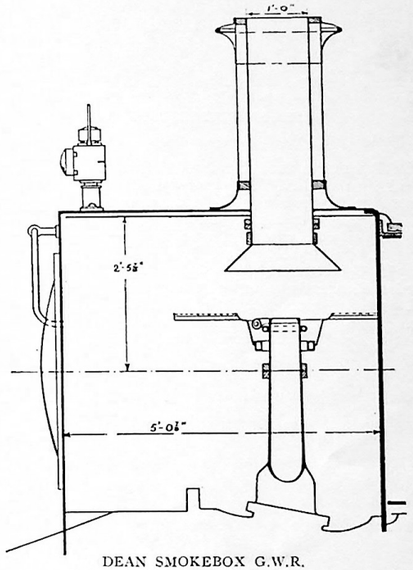
A Stones' 32 volt 500 watt turbo generator supplies current to cab lights and floodlights mounted at each end of the underframe for night working.

Draft gear of the Farlow type with temporary transition hooks and standard V.R. screw couplings together with side buffers which may be dropped clear, are fitted.

THE COMING OF THE EXTENDED SMOKEBOX

In these days of multiple blastpipes, and the almost universal employment of extended smokeboxes an experiment tried by F. W. Webb on the L.N.W.R. as far back as 1897 is not without interest. The extended smokebox, apart from one or two tentative efforts on the G. & S.W.R. and G.E.R. was first brought into regular use in England by William Dean, who, in 1895, provided his *Duke of Cornwall* class with this novelty.

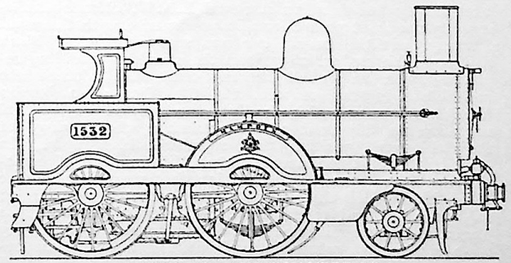
In America the idea had been adopted previous to this date, as it was found that an extended smokebox acted as a spark arrester, since there was both room for the provision of a wire net placed just below the level of the blastpipe orifice, as well as space to allow the hot cinders to settle on the floor of the box. This obviated the back pressure



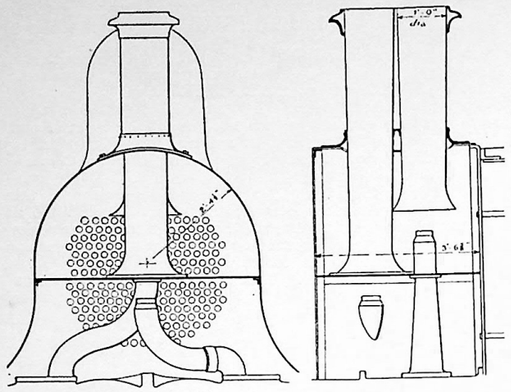
DEAN SMOKEBOX G.W.R.

caused by the earlier forms of spark-arresters placed in the chimney itself. On the G.W.R. engines Dean followed the American scheme, and with cylinders 18 by 26 in., 5ft. 7½in. driving wheels and 160lb. pressure, gave the smokebox a length of 5ft. 0¼in., and an internal diameter of 4ft. 11¾in. The chimney had a liner with the rather small diameter of 1ft. 0in., and the spark arresting grid was made of No. 16 B.W.G. wire.

As is well known, these engines proved a great success, burning an average of 30.8 lb. of coal over the heavy road

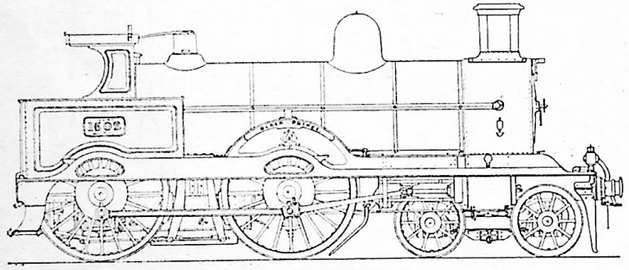


L.N.W.R. No. 1532 "HAMPDEN"



WEBB SMOKEBOX L.N.W.R.

between Plymouth and Exeter. When, on August 2nd, 1897, the new L.N.W.R. four-cylinder compound 4-4-0 *Black Prince* began her trial trips, it was seen that F. W. Webb had also given this engine and her non-compound sister, *Iron Duke*, extended smokeboxes. These were not so long as the G.W.R. examples, as they measured internally 3ft. 6⅛in., and had a diameter of 4ft. 9in. They were also differently planned, since they contained a horizontal partition placed slightly below the centre line of the boiler. The blast pipes from the low pressure cylinders did not unite, but discharged into separate chimneys each



L.N.W.R. No. 1502 BLACK PRINCE

11ft. 0in. in diameter. The right-hand low-pressure cylinder blast pipe exhausted the upper part of the smoke-box, and the left-hand low-pressure blast-pipe exhausted the lower compartment. The two chimneys were made less unsightly by having side-plates fitted, which made the external shape that of a flat box with rounded ends, the whole being surmounted by the familiar standard L.N.W. chimney heading. For a short period *Iron Duke* was tried with the usual chimney, but the double one was soon replaced. *Black Prince*, in November, 1897, had the standard moulding replaced by a half-round beading, and thus adorned she resembled, in this respect, the 6ft. 6in. 2-4-0 Jumbo *Hampden*, to which Webb had previously fitted a cylindrical extension on the front of the smokebox when trying out the horizontal position and separated blast-pipes. In January, 1898, these unusual ideas, like so many locomotive novelties, passed into oblivion, but nevertheless, once Webb had settled the size of the low pressure cylinders at 20½ by 24in., and raised the boiler pressure to 200lb., he placed the extended smokebox on the whole of the eighty 4-4-0 engines he subsequently built. From this time onwards, all L.N.W.R. and G.W.R. express engines carried these large boxes, and it was realised that the extended smokebox had become an essential part of the modern locomotive.

CORRESPONDENCE

DR. CHURCH'S TANK ENGINE

Sir,—The communication from Mr. Dendy Marshall in the June issue of THE LOCOMOTIVE citing a report bearing on the Bromsgrove explosion of November, 1840, raises the question of the relatively sparse—and sometimes inaccurate—information published concerning the above interesting engine. Mr. Marshall refers to the 1840 explosion as "the end of the story," but this is no longer the case as in recent years the writer has become able to supplement that information not only in respect to after, but also before, the event of November, 1840.

It should first be emphasized that it is the victims of the said November 1840 explosion whose memory is perpetuated by the two well-known tombstones in Bromsgrove Churchyard—upon which most excellent representations of Norris pattern locomotives appear—and not as it often supposed the victims of a Norris locomotive boiler explosion, which did occur—but of lesser gravity—in 1841. The results of this error have disfigured "railway" books and even as late as 1912 these two occurrences were confused in the technical press and with the added embellishment that the victims were "two of the American drivers sent with the engines"!

The engine was constructed during 1837 at Birmingham to the design of Dr. William Church for Mr. S. A. Goddard and it was placed on the London & Birmingham Railway in January, 1838, where it worked for a time as a ballast engine; later it went to the Grand Junction Railway, at that time having the name "Victoria," but it was not a success. It was a tank, not a tender engine.

In November, 1840—then named "Surprise"—it was sent for trial to the Birmingham & Gloucester Railway, but exploded at Bromsgrove before doing any service on that line. In 1842, by which time it had been re-named "Eclipse," the engine was again offered to the Birmingham & Gloucester Railway for trial but was declined, and later, in 1844, offered to the same railway a third time; on this occasion it was agreed to allow a trial to be made, but no record exists of such having actually taken place.

The next record of its "appearance" was in 1850, as according to D. K. Clark (1855) it "stood" at Camp Hill Station, Birmingham in that year, from which date nothing definite is known of it until 1861, when it was authoritatively stated to have then been in use upon the Swansea Valley Railway, since its rebuilding there into a 0-6-0 tank locomotive about 1857-8. In this rebuilding, the boiler, which had been supplied to "Eclipse" somewhere between 1842 and 1850 and differed entirely from the original boiler of 1837, was utilised and there is reason to believe that this rebuilt engine eventually came into the hands of the Midland Railway in 1874.

Yours faithfully,

P. C. DEWHURST.

Montevideo, August, 1942.

L.M.S.R.—Lt.-Col. Harold Rudgard, R.E. (Retd.), has been appointed to succeed Mr. D. C. Urie as Superintendent of Motive Power of the L.M.S. Railway.

Lt.-Col. Rudgard was a pupil of the late Samuel Waite Johnson, Locomotive Superintendent of the old Midland Railway. The position he held before being appointed Superintendent of Motive Power was Divisional Superintendent of Operation (Midland Division) of the Railway, which position he has held for over five years.

Since the war he has been acting with Mr. J. E. Kitching, Mineral Manager of the L.N.E. Railway as Liaison Officer with the Midland (Amalgamated) District Coal Mines Scheme and jointly there has been developed a very successful system of Block Coal Train working.

Mr. J. W. Watkins has been appointed Divisional Superintendent of Operation at Derby.

MISCELLANEOUS.

FOR SALE.—Acworth's "Railways and Traders" (1891) 2s. 6d.; G.W.R. Rules and Regulations (1923) 2s.; "Economics of Railway Transport" (1910) 1s. 6d.; "Railway Transportation" (1912) 1s. 6d.; Model "Steam Engines," "Boiler Making," "Turbines," "Locomotive Simply Explained," "German v. British Railways" (1907), "Combination Among Railway Companies," "State Railway Ownership," "Aluminium Facts and Figures," "Electro-Plating," 1s. each (Post extra, under 5s.)—B. BAYS, 40 Higher Drive, Purley, Surrey.

WANTED.—"Locomotive Magazines" January, February, March, May, 1926; complete set, bound or unbound, 1925, 1920-23. Pro forma invoice.—Box 398, THE LOCOMOTIVE.

ADVERTISER has clean bound copies of "Railway Engineer" 1926, 1927 and 1928, also bound editions of "Railway Magazine" July-December, 1897, Vol. I, and January-June, 1898, Vol 2. Would be prepared to exchange for bound copies of "The Locomotive" years between 1929-1935 inclusive, or subsequent to 1924. Box No. 399.

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