INDUSTRIAL LOCOMOTIVES

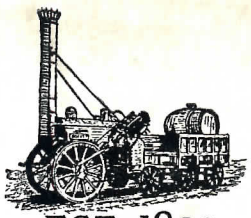
ROBERT STEPHENSON & HAWTHORNS, Ltd.

FORTH BANKS WORKS,

G.P.O. BOX No. 12,

NEWCASTLE - UPON - TYNE, 1.

JLW/RH



EST: 1823

STANDARD
INDUSTRIAL LOCOMOTIVES
STEAM - DIESEL - ELECTRIC - FIRELESS

Please retain for reference

THE FOLLOWING PAGES ILLUSTRATE OUR LEADING TYPES OF INDUSTRIAL LOCOMOTIVES. MANY OTHER DESIGNS ARE AVAILABLE AND SPECIAL DESIGNS ARE UNDERTAKEN TO MEET CUSTOMERS' REQUIREMENTS

WE OFFER OUR EXPERIENCE OBTAINED SINCE 1823 IN THE DESIGN AND MANUFACTURE OF MAIN LINE AND ALL TYPES OF INDUSTRIAL LOCOMOTIVES

ROBERT STEPHENSON & HAWTHORNS, LIMITED
FORTH BANKS WORKS,
NEWCASTLE UPON TYNE, ENGLAND

Telegrams : Locomotive Newcastle. *Telephone :* Newcastle 22431

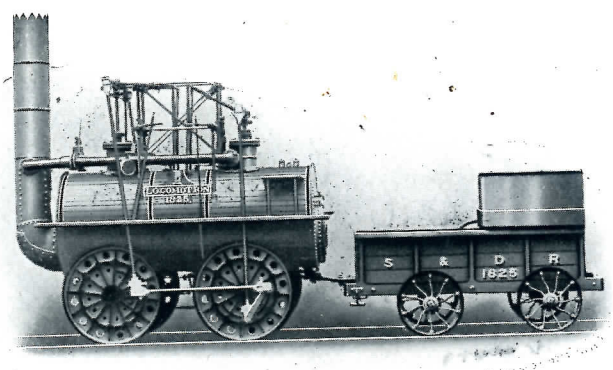
Registered Office :
LOCOMOTIVE WORKS,
DARLINGTON, CO. DURHAM.
Telephone : Darlington 5331.

London Office :
82, VICTORIA STREET,
WESTMINSTER, S.W.1.
Telephone : London Victoria 5572.

THE OLDEST ESTABLISHED LOCOMOTIVE WORKS IN THE WORLD.

A Brief History of the Works

The composite title "Robert Stephenson & Hawthorns, Limited," was assumed in 1937, and records the fusion of the locomotive interests of Robert Stephenson & Co. Ltd., of Darlington, and Messrs. R. & W. Hawthorn Leslie & Co. Ltd., Newcastle upon Tyne. This step was noteworthy as both firms were pioneers in the locomotive world, and both intimately associated with the early history and development of the locomotive.



"Locomotion No. 1." Year 1825

The firm of R. & W. Hawthorn, as it was originally called, founded in 1817 by Robert Hawthorn, joined later by his brother William, occupied a site close to the River Tyne known as Forth Banks, where they carried on a business of Marine and other Steam Engine Builders and Engineers.

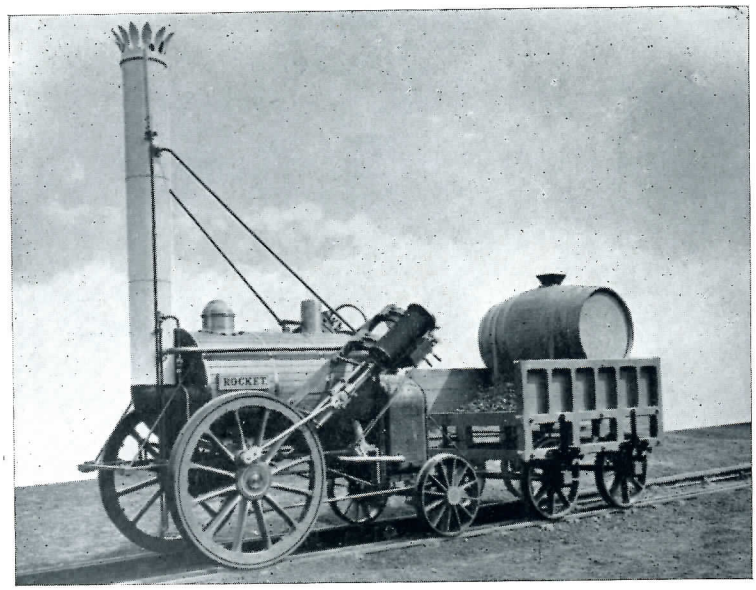
When in 1823, the firm of Robert Stephenson & Co., was formed with George and Robert Stephenson, Edward Pease and Michael Longridge as partners, the site chosen for their works was one in South Street, Newcastle upon Tyne, adjoining the existing Hawthorn Works. It was here in 1825 that the first locomotive used on a public railway was produced, the old "Locomotion No. 1" of the Stockton & Darlington Railway. During the next four years a total of fifteen locomotives were built, after which came the famous "Rocket," the parent of the present day locomotive, followed by many other engines now of historic interest, but, too numerous to mention here.

It should of course be remembered that George Stephenson had since 1813 been occupied, particularly at Killingworth Colliery, in developing and manufacturing locomotives, and by 1823 had been mainly instrumental in establishing beyond all question, their commercial success, and what is more, his enlightened vision had foreseen their great future possibilities; hence doubtless the decision to establish, what was in fact, the first locomotive building works in the world.

The brothers Hawthorn entered the locomotive business in 1831 when they delivered their first engine "The Coronation," to the Stockton and Darlington Railway. In 1835 they produced the celebrated "Comet" for the Newcastle and Carlisle Railway, the striking feature of this engine being the employment of four fixed eccentrics instead of two loose eccentrics hitherto in general use with the old 'Gab' reversing motion. It may well be that this happy invention of Hawthorns paved the way to that stroke of genius, the well-known "Link Motion" introduced by Stephensons seven years later, and in use to the present day. It is interesting to note that at Forth Banks the first Steam Crane for hoisting ballast on ships was built and installed on St. Anthony's Quay on the Tyne in 1820 and in this same period their Marine Engineering Branch was started. In December 1822 steam power was introduced into Forth Banks Works for driving the lathes. Between 1852 and 1870 a total of 185 sets of marine engines were built here by Messrs. Hawthorn. In 1882 the whole of the marine work was transferred to St. Peter's, Newcastle upon Tyne, and the works at Forth Banks were devoted to the construction of locomotives, though at a later date circumstances made it desirable to build water tube boilers at Forth Banks and this continued until 1945, during which time boilers were built for many famous vessels.

In 1901 the works of Robert Stephenson & Co., having been close neighbours of Hawthorns for nearly eighty years, were moved to Darlington. During their long period as neighbours, the employees of both firms appear to have been on the best of terms, indeed it is recorded by some of our older members, that in times of stress they were always ready to extend a helping hand to each other. It seems only fitting, therefore, that the two friendly rivals should now be working as one Company. The removal of the Stephenson works gave Hawthorns the opportunity to extend and improve their own factory, part of the Stephenson premises being taken over for this purpose.

ROBERT STEPHENSON & HAWTHORNS, LIMITED.



"The Rocket" Year 1829

The Stephenson shops were transferred to a new site at Darlington where an extensive modern factory was built and ample land acquired for future extension. The first locomotive to be built in the new factory was steamed in 1902.

Since the amalgamation of the two firms in 1937, the Company's policy has been to concentrate its main line Locomotive Products at Darlington, and to continue at Forth Banks the well-established business of the Hawthorn Industrial Locomotive. In recent years the Company has also engaged in the manufacture of Diesel Mechanical Locomotives, and in conjunction with the well-known electrical manufacturing firms, the building of all-electric main line and shunting locomotives.

The following pages include illustrations of a few of the principal present-day products of Forth Banks Works, as also photographs showing the present lay-out. It will be noted that an interesting addition to the locomotive work is the manufacture of "Spencer-Hopwood" Vertical Water Tube Boilers for our associated company Spencer-Hopwood Ltd.

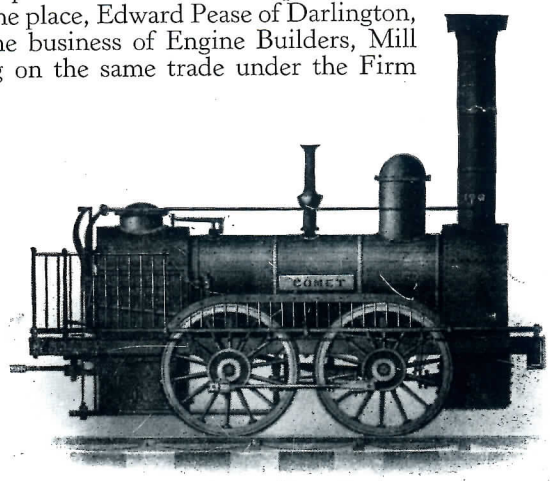
Extract from the first minute book of Robert Stephenson & Co., Dated June 23rd. 1823.

"MEMORANDUM for an Agreement of Co-partnership between Robert Stephenson of Killingworth near Newcastle, George Stephenson of the same place, Edward Pease of Darlington, and Michael Longridge of Bedlington, for carrying on the business of Engine Builders, Mill Wrights, etc., at Newcastle upon Tyne, and for carrying on the same trade under the Firm of Robert Stephenson & Co. :

1. The Capital to be Four Thousand Pounds and to be divided into ten Shares.

2. This Capital to be advanced in the following proportions when found necessary, viz. :—

Robert Stephenson	2 shares	£800
George Stephenson	2 shares	£800
Edward Pease	4 shares	£1,600
Michael Longridge	2 shares	£800
	10 shares	£4,000

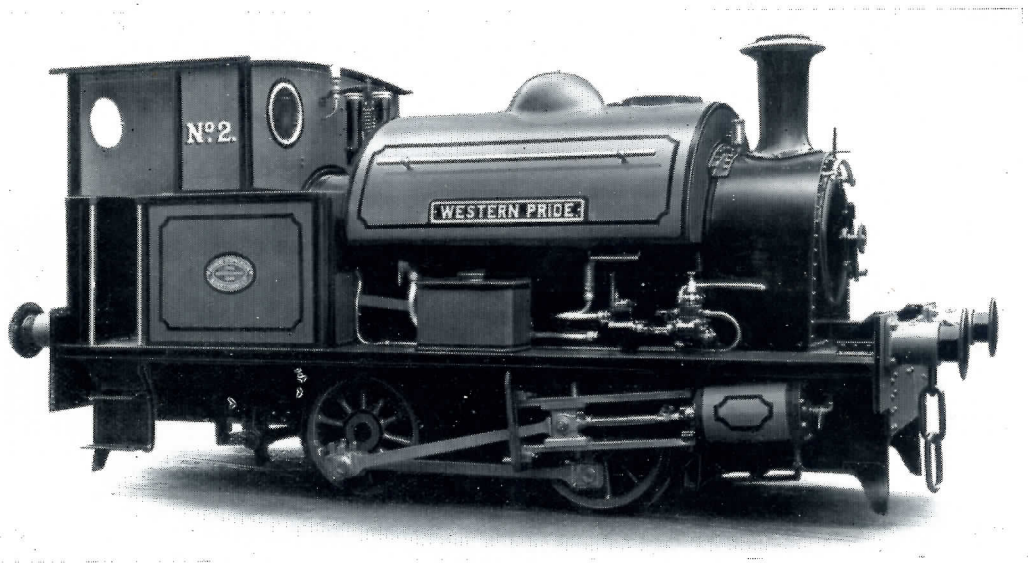


The "Comet"—Year 1835.

FORTH BANKS WORKS, NEWCASTLE UPON TYNE.

ROBERT STEPHENSON & HAWTHORNS, LIMITED

STANDARD 10″ × 15″ SADDLE TANK LOCOMOTIVE



Gauge of Railway : 4 ft. 8½ ins.

PRINCIPAL DIMENSIONS :—

Cylinders, diameter	10 ins.	Heating Surface	300 sq. ft.
,, stroke	15 ins.	Grate Area	5·45 sq. ft.
Wheels, diameter	2 ft. 10 ins.	Working Pressure	160 lbs. per sq. in.
Wheelbase	5 ft. 0 ins.	Tractive Effort at 85% W.P.	6000 lbs.
Tank Capacity	350 galls.	,, ,, 75% ,,	5294 lbs.
Bunker Capacity	·555 tons.	Weight in Working Order	17·75 tons.
Minimum Curve	34 ft.		

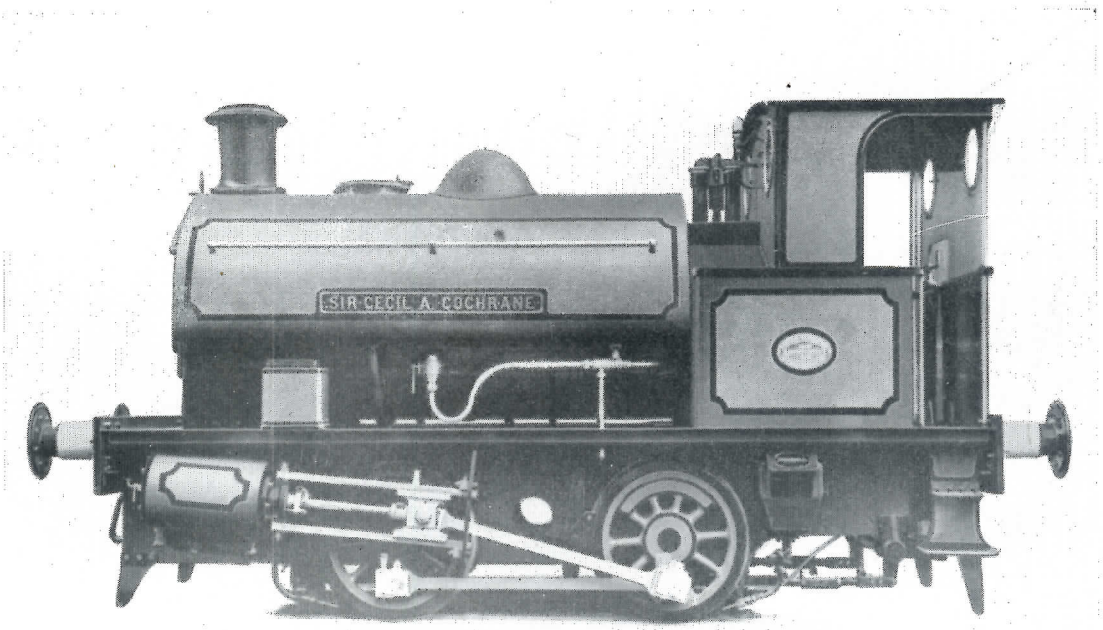
HAULING CAPACITY :—

On Level	483 tons.
Up 1 in 200	266 ,,
,, 1 in 100	168 ,,
,, 1 in 50	93 ,,
,, 1 in 33·3	61 ,,

Fitted with Mechanical Lubricator, Drop Grate, Power Reverse, or other Specialities, if required.

ROBERT STEPHENSON & HAWTHORNS, LTD.

STANDARD 12″ × 20″ 0-4-0 SADDLE TANK LOCOMOTIVE



Gauge of Railway : 4 ft. 8½ ins.

Also manufactured to suit other gauges.

PRINCIPAL DIMENSIONS

Cylinders, Diameter	12 ins.	Heating Surface	402·3 sq. ft.
,, Stroke	20 ins.	Grate Area	6·5 sq. ft.
Wheels, Diameter	3ft. 1 ins.	Working Pressure	160 lbs. per sq. in.
Wheelbase	5 ft. 6 ins.	Tractive Effort at 85% W.P.	10586 lbs.
Tank Capacity	500 galls.	,, ,, ,, 75% ,,	9340 lbs.
Bunker Capacity	0·525 tons.	Weight in Working Order	21 tons.
Minimum Curve	40 ft.		

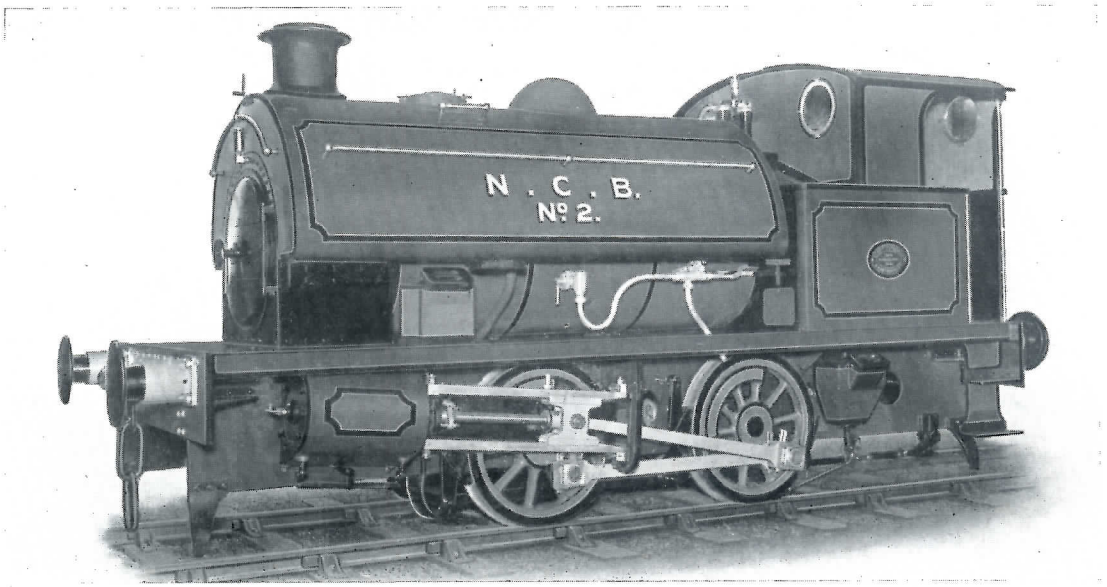
HAULING CAPACITY

On Level	861 tons.
Up 1 in 200	478 ,,
,, 1 in 100	306 ,,
,, 1 in 50	172 ,,
,, 1 in 33·3	116 ,,

Fitted with Mechanical Lubricator, Drop Grate, Power Reverse, or other Specialities, if required.

ROBERT STEPHENSON & HAWTHORNS, LTD.

STANDARD 14″ × 22″ SADDLE TANK LOCOMOTIVE



Gauge of Railway : 4 ft. 8½ ins.

PRINCIPAL DIMENSIONS :—

Cylinders, diameter	14 ins.	Heating Surface	621 sq. ft.
,, stroke	22 ins.	Grate Area	8·87 sq. ft.
Wheels, diameter	3 ft. 6 ins.	Working Pressure	165 lbs. per sq. in.
Wheelbase	5 ft. 6 ins.	Tractive Effort at 85% W.P.	14399 lbs.
Tank Capacity	700 galls.	,, ,, 75% ,,	12705 lbs.
Bunker Capacity	·85 tons.	Weight in Working Order	28·25 tons.
Minimum Curve	42 ft.		

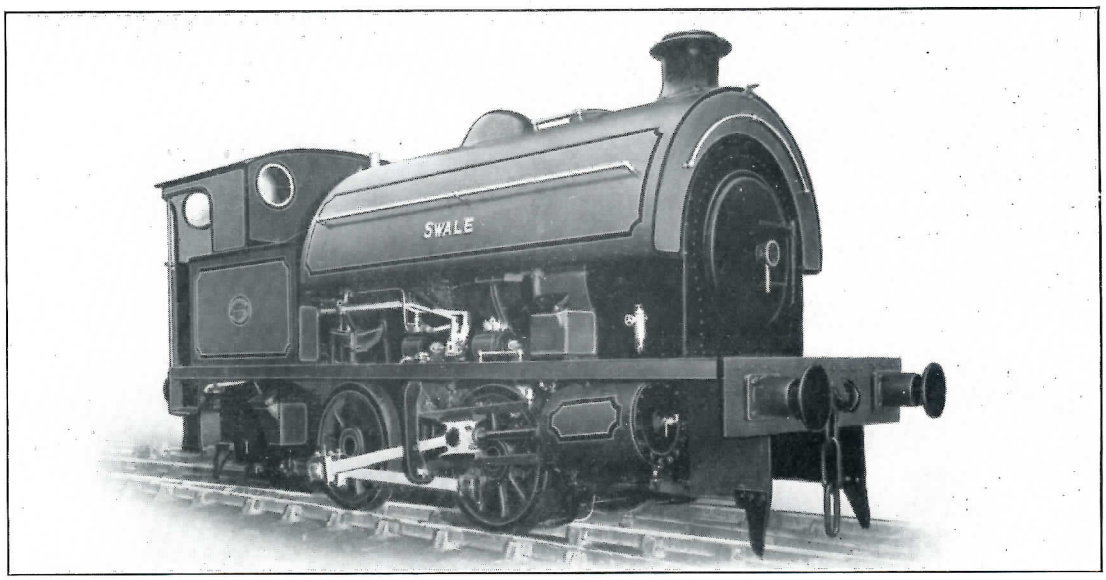
HAULING CAPACITY :—

On Level	1159 tons.
Up 1 in 200	643 ,,
,, 1 in 100	411 ,,
,, 1 in 50	231 ,,
,, 1 in 33·3	156 ,,

Fitted with Mechanical Lubricator, Drop Grate, Power Reverse, or other specialities, if required.

ROBERT STEPHENSON & HAWTHORNS, LTD.

STANDARD 16″ × 24″ SADDLE TANK LOCOMOTIVE



Gauge of Railway: 4 ft. 8½ ins.

PRINCIPAL DIMENSIONS:—

Cylinders, diameter	16 ins.	Heating Surface	810·3 sq. ft.
,, stroke	24 ins.	Grate Area	12·6 sq. ft.
Wheels, diameter	3 ft. 8 ins.	Working Pressure	165 lbs. per sq. in.
Wheelbase	6 ft. 0 ins.	Tractive Effort at 85% W.P.	19584 lbs.
Tank Capacity	950 galls.	,, ,, ,, 75% ,,	17280 lbs.
Bunker Capacity	·9 tons.	Weight in Working Order	35·65 Tons.
Minimum Curve	47 ft.		

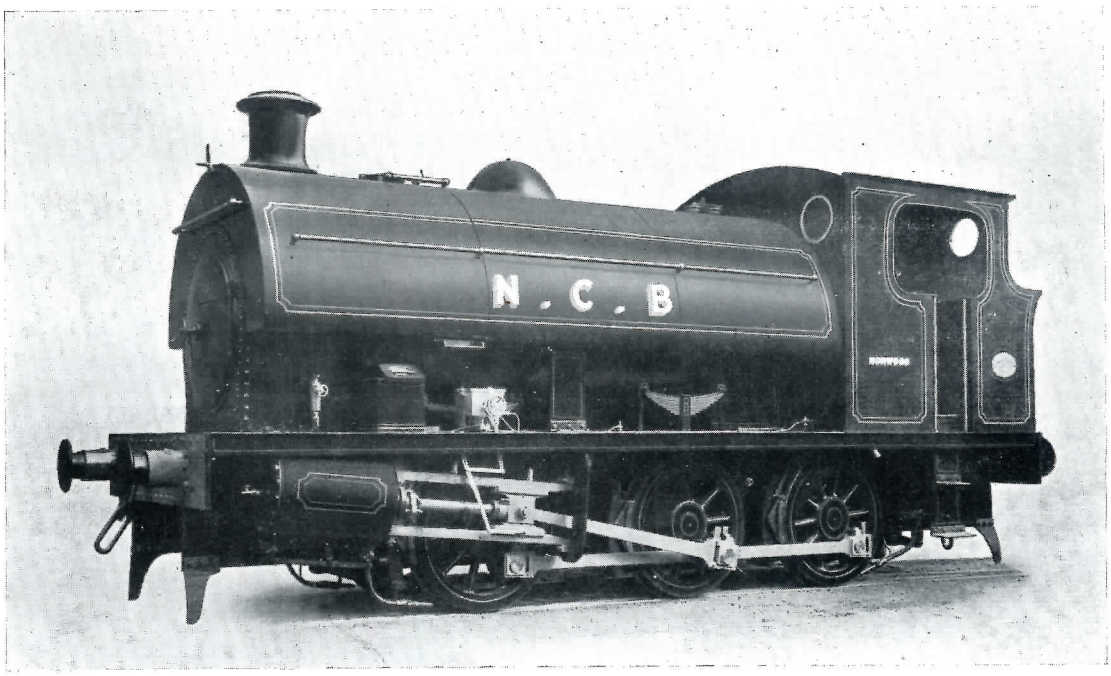
HAULING CAPACITY:—

On Level	1456 tons.
Up 1 in 200	810 ,,
,, 1 in 100	518 ,,
,, 1 in 50	293 ,,
,, 1 in 33·3	198 ,,

The locomotive illustrated is fitted with Mechanical Lubricator, Drop Grate and Power Reverse. These fittings are only included when required.

ROBERT STEPHENSON & HAWTHORNS, LTD.

STANDARD 16″ × 24″ SADDLE TANK LOCOMOTIVE



Gauge of Railway: 4 ft. 8½ ins.

PRINCIPAL DIMENSIONS:—

Cylinders, diameter	16 ins.	Heating Surface	810·3 sq. ft.
,, stroke	24 ins.	Grate Area	12·6 sq. ft.
Wheels, diameter	3 ft. 8 ins.	Working Pressure	180 lbs. per sq. in.
Wheelbase	11 ft. 0 ins.	Tractive Effort at 85% W.P.	21364 lbs.
Tank Capacity	1200 galls.	,, ,, 75% ,,	18850 lbs.
Bunker Capacity	1·67 tons.	Weight in Working Order	43·3 tons.

Minimum Curve:—All tyres with full flanges ..... 300 ft.
Thin flanges on intermediate tyres ..... 200 ft.
Intermediate tyres flangeless ..... 110 ft.

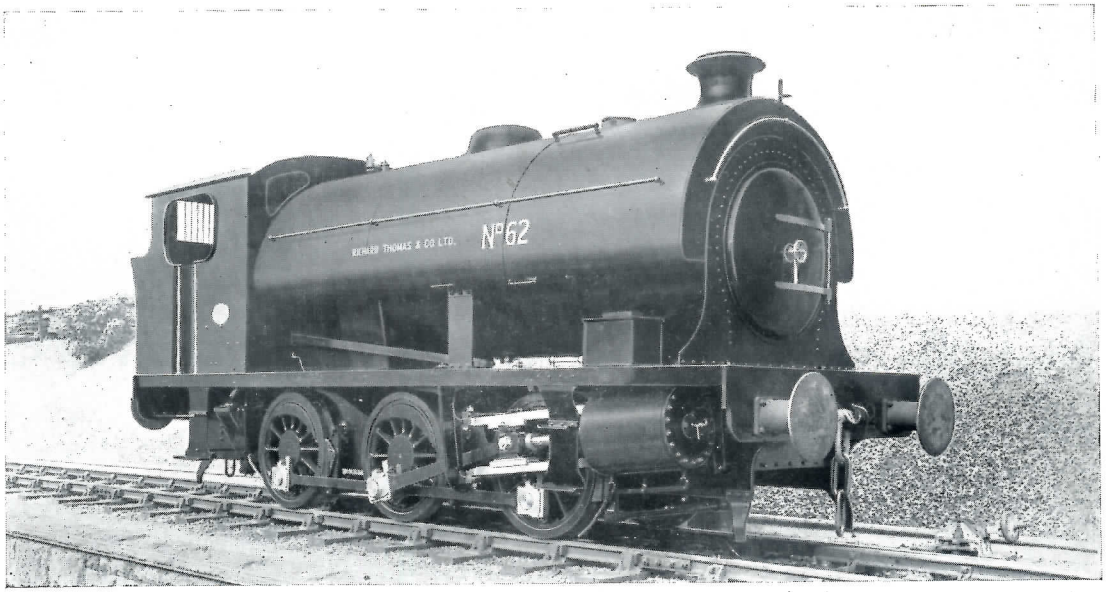
HAULING CAPACITY:—

On Level	1737 tons.
Up 1 in 200	964 ,,
,, 1 in 100	616 ,,
,, 1 in 50	346 ,,
,, 1 in 33·3	233 ,,

Fitted with Mechanical Lubricator, Drop Grate, Power Reverse, or other Specialities, if required.

ROBERT STEPHENSON & HAWTHORNS, LTD.

STANDARD 18″ × 24″ SADDLE TANK LOCOMOTIVE



Gauge of Railway : 4 ft. 8½ ins.

PRINCIPAL DIMENSIONS :—

Cylinders, Diameter	18 ins.	Heating Surface	1092 sq. ft.
,, Stroke	24 ins.	Grate Area	18 sq. ft.
Wheels, Diameter	4 ft. 0 ins.	Working Pressure	180 lbs. per sq. in.
Wheelbase	12 ft. 0 ins.	Tractive Effort at 85% W.P.	24786 lbs.
Tank Capacity	1300 galls.	,, ,, 75% ,,	21870 lbs.
Bunker Capacity	2 tons.	Weight, Working Order	53 tons.

Minimum Curve :—All tyres with full flanges ..... 350 ft.
Thin flanges on intermediate tyres ..... 235 ft.
Intermediate tyres flangeless ..... 125 ft.

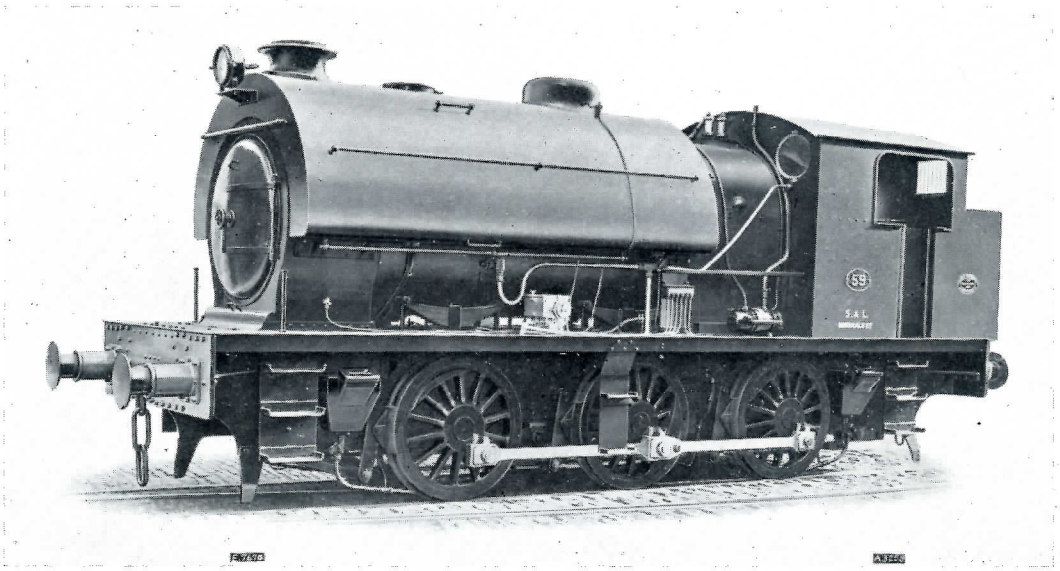
HAULING CAPACITY :—

On Level	2012 tons.
Up 1 in 200	1116 ,,
,, 1 in 100	712 ,,
,, 1 in 50	399 ,,
,, 1 in 33·3	268 ,,

Fitted with Mechanical Lubricator, Drop Grate, Power Reverse, or other Specialities, if required.

ROBERT STEPHENSON & HAWTHORNS, LIMITED

18″ × 26″ (INSIDE CYL.) 0-6-0 SADDLE TANK LOCOMOTIVE



Gauge of Railway: 4 ft. 8½ ins.

PRINCIPAL DIMENSIONS.

Cylinders, Diameter	18 ins.	Heating Surface	1140 sq. ft.
,, Stroke	26 ins.	Grate Area	18 sq. ft.
Wheels, Diameter	4 ft. 0½ ins.	Working Pressure	180 lbs. per sq. in.
Wheelbase	12 ft. 0 ins.	Tractive Effort at 85% W.P.	26574 lbs.
Tank Capacity	1100 galls.	,, ,, 75% ,,	23448 lbs.
Bunker Capacity	2 tons.	Weight, in Working Order	52·75 tons.

Minimum Curve :—All tyres with full flanges .... 350 ft.
Thin flanges on intermediate tyres ..... 235 ft.
Intermediate tyres flangeless .... 125 ft.

HAULING CAPACITY

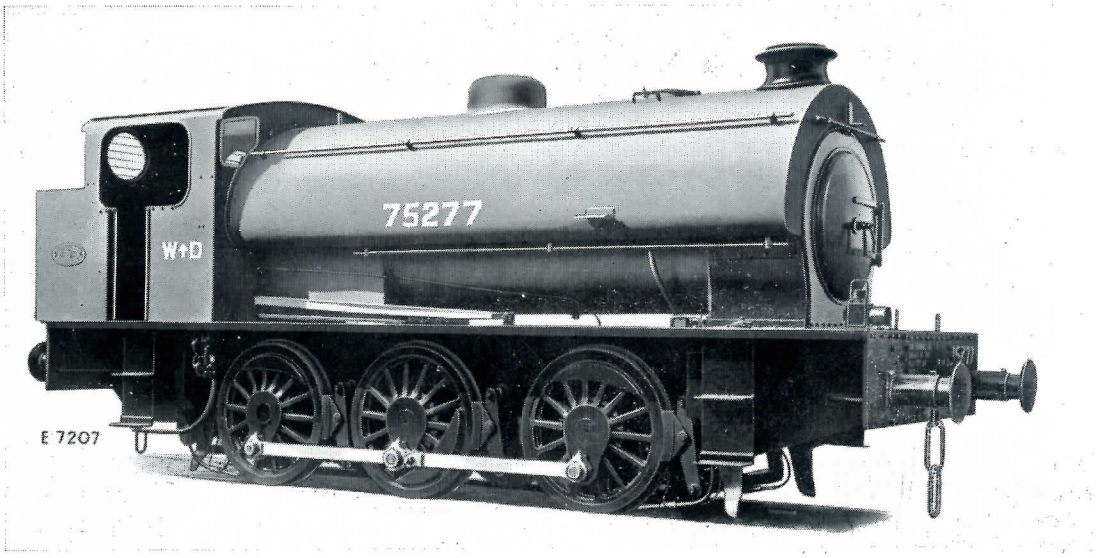
On Level	2161 tons.
Up 1 in 200	1200 ,,
,, 1 in 100	767 ,,
,, 1 in 50	432 ,,
,, 1 in 33·3	290 ,,

Fitted with Mechanical Lubricator, Drop Grate, Power Reverse, or other Specialities, if required.

ROBERT STEPHENSON & HAWTHORNS, LIMITED

AUSTERITY TYPE

18″ × 26″ (INSIDE CYL.) 0-6-0 SADDLE TANK LOCOMOTIVE



Gauge of Railway : 4 ft. 8½ ins.

PRINCIPAL DIMENSIONS.

Cylinders, Diameter	18 ins.	Heating Surface	960 sq. ft.
,, Stroke	26 ins.	Grate Area	16·82 sq. ft.
Wheels, Diameter	4 ft. 3 ins.	Working Pressure	170 lbs. per sq. in.
Wheelbase	11 ft. 0 ins.	Tractive Effort at 85% W.P.	23870 lbs.
Tank Capacity	1200 galls.	,, ,, 75% ,,	21060 lbs.
Bunker Capacity	2·25 tons.	Weight, in Working Order	48·187 tons.

Minimum Curve :—All tyres with full flanges ..... 350 ft.
Thin flanges on intermediate tyres ..... 235 ft.
Intermediate tyres flangeless ..... 125 ft.

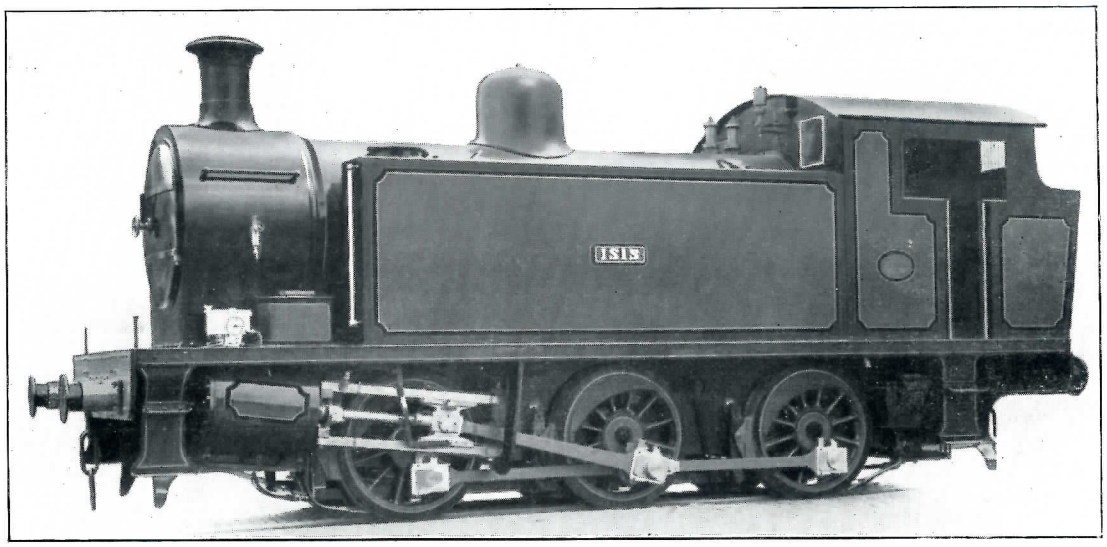
HAULING CAPACITY

On Level	1941 tons.
Up 1 in 200	1077 ,,
,, 1 in 100	688 ,,
,, 1 in 50	387 ,,
,, 1 in 33·3	260 ,,

Fitted with Mechanical Lubricator, Drop Grate, Power Reverse, or other Specialities, if required.

ROBERT STEPHENSON & HAWTHORNS, LTD.

STANDARD 18″ × 24″ SIDE TANK LOCOMOTIVE



Gauge of Railway: 4 ft. 8½ ins.

PRINCIPAL DIMENSIONS :—

Cylinders, Diameter	18 ins.	Heating Surface	1092 sq. ft.
,, Stroke	24 ins.	Grate Area	18 sq. ft.
Wheelbase	12 ft. 0 ins.	Working Pressire	180 lbs. per sq. in.
Tank Capacity	1200 galls.	Bunker Capacity	2 tons.

Minimum Curve :—All tyres with full flanges ..... 350 ft.
Thin flanges on intermediate tyres ..... 235 ft.
Intermediate tyres flangeless ..... 125 ft.

Wheels, diameter	3 ft. 8 in.	4 ft. 0 in.
Tractive Effort at 85% W.P.	27039 lbs.	24786 lbs.
,, ,, 75% ,,	23858 lbs.	21870 lbs.
Weight in Working Order	52·6 tons.	53 tons.
Hauling Capacity :—		
On level	2200 ,,	2012 ,,
Up 1 in 200	1222 ,,	1116 ,,
,, 1 in 100	781 ,,	712 ,,
,, 1 in 50	440 ,,	399 ,,
,, 1 in 33·3	296 ,,	268 ,,

Fitted with Mechanical Lubricator, Drop Grate, Power Reverse, or other Specialities, if required.

ROBERT STEPHENSON & HAWTHORNS, LIMITED

THE STEPHENSON - CROSSLEY

300/330 H.P. HEAVY DUTY

DIESEL SHUNTING LOCOMOTIVE

WITH

MECHANICAL TRANSMISSION

AND

DIRECT REVERSING OIL ENGINE

STEAM ENGINE RELIABILITY WITH DIESEL ECONOMY

Head Office : DARLINGTON.
London Office : 82, VICTORIA STREET, S.W.1.
Works : DARLINGTON AND NEWCASTLE-UPON-TYNE.

Telephones :
NEWCASTLE 22431
DARLINGTON 5331
LONDON VICTORIA 5572

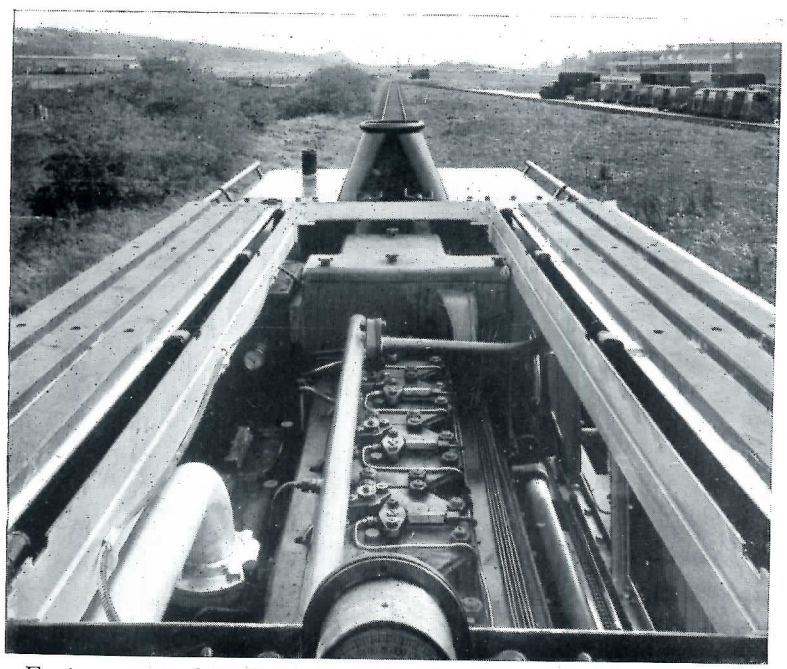
Telegrams :
LOCOMOTIVE, NEWCASTLE-ON-TYNE
ROCKET, DARLINGTON
LOCOENGIN, SOWEST, LONDON

FORTH BANKS WORKS, (G.P.O. BOX 12), NEWCASTLE-ON-TYNE, 1.

(Reprint from *Diesel Railway Traction*) JUNE, 1949.

Stephenson-Crossley Shunting Locomotive

Trial runs of a 330-b.h.p. heavy-duty shunter with mechanical transmission and fitted with a direct-reversing engine incorporating exhaust pulse pressure charging and loop scavenge



Engine covers of the Stephenson-Crossley shunter open for inspection of the cylinder heads

JUST over eleven years ago, the firm of Robert Stephenson & Hawthorns Limited, Forth Bank Works, Newcastle-on-Tyne, whose experience of railway and industrial locomotive manufacture goes back well over 100 years, built what is believed to have been the first successful diesel locomotive to be provided with a direct-reversing engine. This unit, designed with a low overall height for service in the steel works of Thos. Firth & John Brown Limited, Sheffield, was fitted with a Crossley four-cylinder engine of the DRL type, developing 140 b.h.p. and transmitting power to the driving wheels through a hydraulic coupling and two-speed gearbox and jackshaft.

Previous Experience

Since 1937, this locomotive has given such good service, and the maintenance costs have proved so low, that some time ago the manufacturers decided to develop units of a higher power on similar general lines. Recently the first of these larger locomotives has been completed for service at the Carrington Power Station, Manchester, of the British Electricity Authority, and other locomotive designs are in hand.

Power in the present case also is supplied by a direct-reversing engine built by Crossley Brothers Limited, Openshaw, Manchester, though in this instance the engine is of the six-cylinder ERT type developing 300 b.h.p. at 750 r.p.m. or 330 b.h.p. at one-hour rating. This is believed to be the largest diesel mechanical shunter to be built in this country so far.

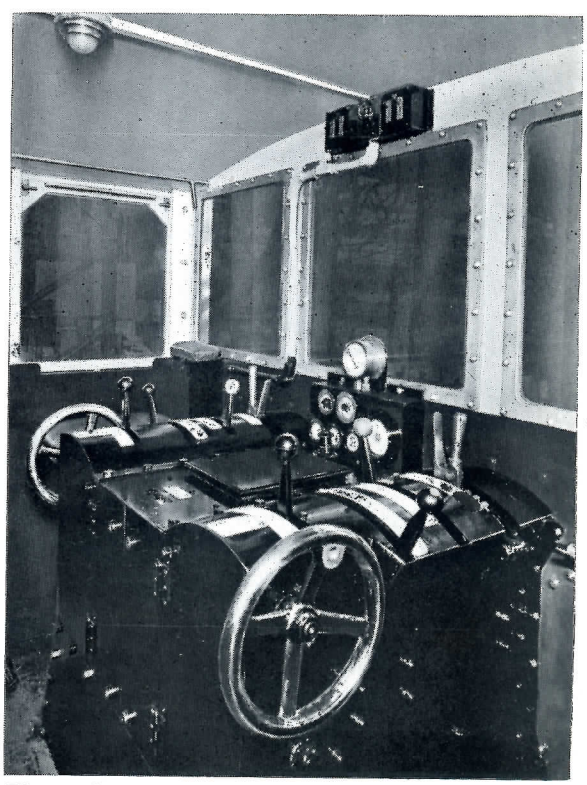
This engine, which we hope to describe in greater detail in a future issue, operates on the loop-scavenge principle, incorporating the Crossley system of exhaust pulse pressure charging. Starting and reversing are effected by compressed air injected direct to the cylinders, and, during normal shunting operations, the compressor equipment will easily maintain a pressure of 350 lb. per sq. in. in the two air receivers fitted below the radiator. There is also a Crossley petrol-paraffin air compressor unit for use in emergency only.

The engine drives the locomotive through a Vulcan-Sinclair scoop-control hydraulic coupling (Size 36) having quick-emptying centrifugal valves. This equipment is made by the Hydraulic Coupling & Engineering Co. Ltd., Isleworth, while the three-speed gearbox has been specially designed and manufactured by Bostock & Bramley Limited, Stalybridge, for heavy duties in conjunction with the Crossley direct-reversing engine to meet the requirements of Robert Stephenson & Hawthorns.

Briefly, the transmission in general consists of a right-angle bevel-drive input gear, first, second, and third gear trains, and a final spur gear driving direct on to the jackshaft. Rapid and smooth engagements of each of the three gear ratios is ensured, first, by the provision of large multiple dry-plate clutches on the first and third speed gears, and, second, by means of an involute tooth dog-clutch on the second gear with a Bostock & Bramley synchronising or baulking ring interposed between the driving and driven members to ensure engagement at synchronous speed. The clutches are of substantial design and those of the plate type are mounted externally to ensure accessibility and ease of maintenance.

HAULAGE CAPACITY OF STEPHENSON-CROSSLEY 300/330-h.p. LOCOMOTIVE

Speed (m.p.h.)	3·83	7·02	12·15
Level track (tons.)	2,022	1,085	610
1 in 200	1,080	596	327
1 in 100	723	376	200
1 in 50	411	206	101
1 in 33·3	280	134	60



View of the driving cab interior showing the dual controls

Each clutch is engaged (and disengaged in the case of the second-gear clutch) by means of compressed air. Thus gear changing becomes an operation requiring minimum skill and effort. An unusual feature of this system is the momentary application of the third-speed clutch when changing from first to second gear. This application is automatically controlled and has the effect of maintaining the drawbar pull during the gear change. During a demonstration run which took place on the North-Eastern Trading Estate at Gateshead on May 3, the smoothness of the gear engagement was very apparent.

brake, air sanding control, and electric horn. It will be noted that no change of position is required on the part of the driver whether the locomotive is travelling forward or in reverse.

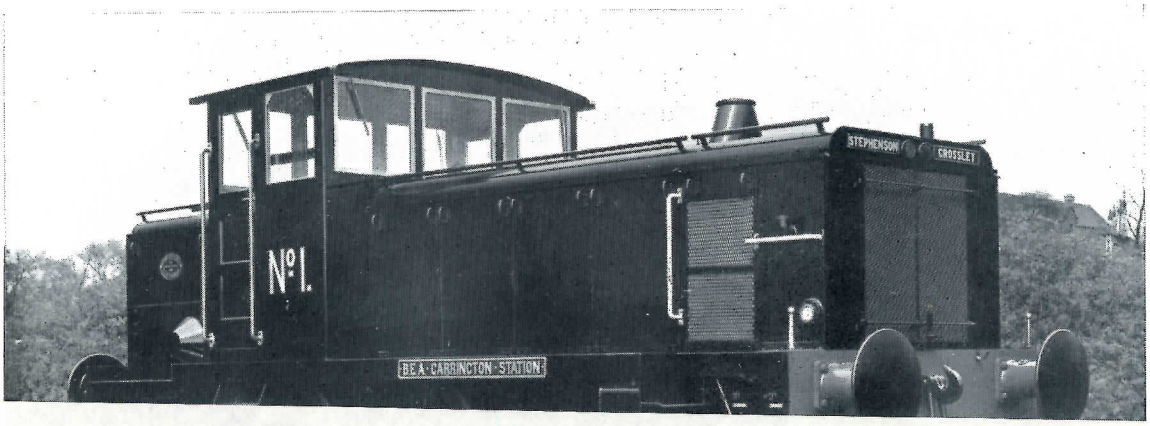
Both hand and Westinghouse air brakes are fitted, air for which is provided from the engine starting system through a reducing valve, and there are Serck sectional cooling elements for water and lubricating oil, bolted to headers built in with the body casing. The fan is driven from the engine.

The cab is totally enclosed, though, as will be seen from the photograph repro-

Wheel arrangement	0-6-0
Gauge	4 ft. 8½ in.
Wheelbase	10 ft. 6 in.
Wheels, dia.	3 ft. 8 in.
Overall length	27 ft. 5 in.
Maximum width	8 ft. 6 in.
Height	11 ft. 3 in.
Weight in working order ...	40 tons
Fuel capacity	200 gals.
T.E. at 3·83 m.p.h.	24,750 lb.
T.E. at 7·02 m.p.h.	13,500 lb.
T.E. at 12·15 m.p.h.	7,800 lb.

The locomotive will negotiate curves of 176 ft. radius with thin flanges on tyres of intermediate wheels and 95 ft. radius with flangeless tyres.

The aim of Robert Stephenson & Hawthorns throughout has been to provide a



The "Stephenson-Crossley" Shunting Locomotives are also available with single direction engines and with reverse gears incorporated in an S.S.S. Powerflow gear box.

Shafts of maximum possible diameter are used. These are carried in roller bearings arranged to provide the greatest rigidity with a minimum of deflection. Ball-type thrust bearings are incorporated and the jackshaft is mounted on spherical roller bearings accommodated in separate housings. When mounted on the locomotive these housings form an integral part of the locomotive frame. The gearcase itself is of fabricated steel. Splash lubrication is used for the final gear train, while the layshaft gears, together with their bearings, are lubricated by means of a reversible pump.

The pneumatic control unit supplied with the gearbox consists of a series of cam-operated air valves and, in keeping with the gearbox, comprises a simple trouble-free unit which can be mounted at any point on the locomotive. This method of control ensures engagement of gears in the correct sequence by the air pressure and makes possible the provision of a simple cab control requiring little skill or effort on the part of the driver.

The controls, as can be seen from the photograph reproduced on page 99, are duplicated on each side of the cab. They are contained in a desk, and consist of engine throttle, gear change lever, engine starting and reversing hand wheel, air

pletely unobstructed view in all directions. Drop windows are provided at the sides, but the end windows are fixed, and are fitted with hand-operated wind-screen wipers. Seats and arm rests are provided at each side. The locomotive is equipped with C.A.V. electric lighting equipment, ensuring adequate illumination of the cab interior and the various instruments, and arrangement has been made whereby, when switched to the "on" position, head and tail lamps are reversed automatically in accordance with the direction in which the locomotive is travelling.

In designing the locomotive the builders paid special attention to accessibility, and should any part of the locomotive require attention, access can be had to it with the minimum of trouble. The illustration on page 99 shows the top covers open for inspection of the cylinder heads. Platforms are provided at both sides whereby a shunter can accompany it in safety.

Wheels, axleboxes, springs, etc., are designed in accordance with normal steam locomotive practice as used on heavy industrial units.

The principal dimensions and other particulars of the locomotive are as follows :—

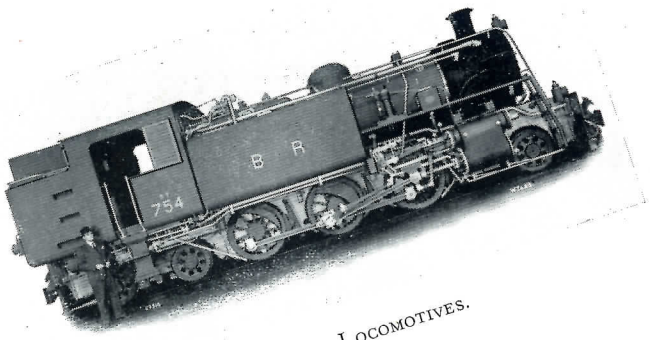
moderate speed, built on robust lines, with a minimum of complicated parts, and capable of standing up to the heaviest type of industrial service with little maintenance and attention. To this end the firm has drawn on its experience of railway and industrial locomotive construction since 1823.

On May 5, after the successful demonstration referred to above, the locomotive was inspected and submitted to test loading in the presence of representatives of the North-Western Division of the British Electricity Authority.

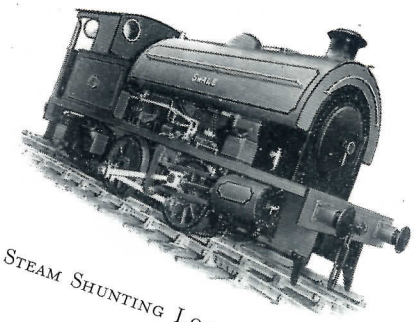
A train consisting of 30 loaded coal wagons, with a gross load, excluding locomotive, of 832 tons, was started without difficulty from rest, with tight couplings on a gradient of 1 in 125, over double turnout and on track which was not in good condition, when the first-gear speed of 4 m.p.h. was easily reached. The second test was made with a gross load of 400 tons, excluding the locomotive, which was handled and hauled without difficulty at 7 m.p.h. There was not sufficient length of track available to permit changing into third gear. As the loads mentioned are actually slightly in excess of calculations, the results obtained can be considered as very satisfactory.

ROBERT STEPHENSON & HAWTHORNS, LIMITED

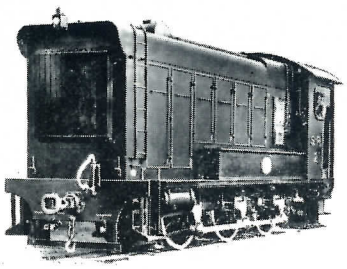
TYPICAL FORTH BANKS PRODUCTS



Railway Locomotives.

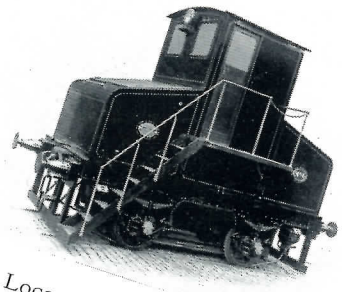


Steam Shunting Locomotives.

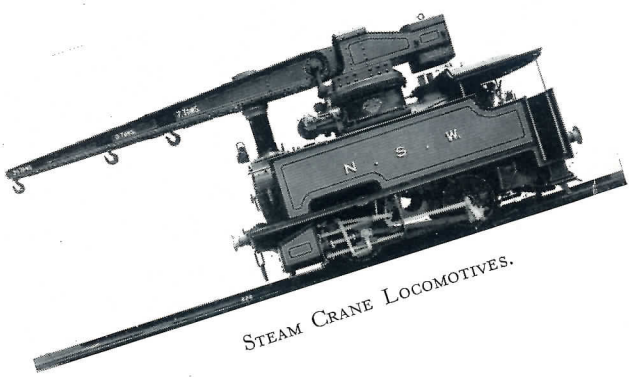


Diesel-Electric Shunting Locomotives.

Fireless Locomotives.



Electric Locomotives for Coke Ovens.



Steam Crane Locomotives.

For Main Line Locomotives - Darlington Works

FORTH BANKS WORKS, (G.P.O. BOX 12), NEWCASTLE-ON-TYNE, 1.