THE SPLENDID BOOK OF LOCOMOTIVES

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THE SPLENDID BOOK OF LOCOMOTIVES

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THE SPLENDID BOOK OF LOCOMOTIVES

I

THE BEGINNING OF THE RAILWAY LOCOMOTIVE

In a quiet spot not very far from West Camborne is the hamlet of Penponds. The average motorist or walker would pass the place with just the comment that it was pleasantly rural, but if he turned aside and looked carefully at a small thatched cottage, he would regret that it was apparently tumbling fast to ruin; yet it was the home of the real father of the locomotive—Richard Trevithick.

There are many claimants to this honour, and the average school history almost invariably gives it to George Stephenson. Yet George Stephenson would have been

the last to have claimed to have been the father of the iron horse. What he might have claimed, and no one would ever dispute it, was that he became the foster-father of the locomotive, he brought up a rather puling infant to full maturity in his own lifetime.

It is tolerably certain that Trevithick made his first experiments in this old cottage; it is certainly on record that he spoke to Gilbert Davies as to what was in his mind regarding the possibilities of steam. This was at last as far back as 1796, six or seven years before he made what is usually allowed to have been the first railway locomotive.

It was a happy chance that led Trevithick to leave Camborne and live at Redruth, for here was another pioneer of steam: this was Murdoch, a Scotsman, employed by Boulton & Watt, of Birmingham, and he had been sent down to Redruth to superintend the working of some mining machinery. It is quite possible that Trevithick was interested in the steam

locomotive some years before Murdoch began his quite successful experiments with a model engine. There is some doubt about this; what is known definitely is that both men were working at the same idea, with the same conviction, and at the same period.

Records have recently been unearthed which show that Trevithick had ordered certain engine parts as far back as 1800–1. There are notes of the cost of boiler plates and castings, which were apparently bought from the Hayle foundry near St. Ives. Trevithick appears to have built the engine at John Tyack's smithy, near Camborne.

It is a thousand pities that data of this period is so scanty, for while many writers ascribe three locomotives to Trevithick in these years, it cannot be said definitely what kind they were, or whether there were as many as three. It is history now that this clever designer had a road locomotive at work before 1800. The story of how he startled the toll-gate keeper near

Camborne rings true, and it is supported by records left by Captain Vivian, a cousin of Trevithick, and one who backed him financially and by other encouragement, for many years.

The most remarkable of the tests carried out with this road locomotive is that which was run on the Christmas Eve of 1801. This took place from the smithy where the engine was apparently erected towards Camborne, in which Beacon Hill was climbed. This has a very severe gradient running from 1 in 15 to 1 in 20. The story goes that the engine having mounted part of the incline came to a stop, and the designer then ran it back to the smithy.

On the footplate on this historic occasion there were probably seven or eight people, one of whom, a Mr. Newton, was a pupil of Trevithick.

There is another record of this engine. It seems that Trevithick ran it to Tehidy Park on the north Cornwall coast, in order that Lord Dedunstanville might go for a

ride upon the footplate. As is usual in the early days of the locomotive, there was the inevitable breakdown, and the engineer and his friends repaired to a wayside inn, leaving the locomotive to its own devices. It would seem that the water level fell too low, and the boiler became red hot, so hot indeed, that it set fire to the shed wherein it had been placed.

Either this engine, or another one resembling it was often seen in the principal street of Camborne. An interesting feature of this machine was the double bellows, which was operated from the motion to help the steam blast from the cylinder.

Richard Trevithick was really a mining engineer, and without doubt he was a successful one, but he could no more keep from the study and the design of the locomotive than his friend Murdoch. While Murdoch turned to another hobby, that of coal-gas making, and the perfecting of plant used in the various processes, Trevithick remained true to his locomotives.

His first successful colliery engine was at work in 1804. There could be no question as to its utility, and it pulled some remarkable loads upon a tram road which had been designed for lighter weights.

All through the story of the early locomotive we find its chances of success prejudiced by the fact that it was invariably tried on existing tram or rail roads. These had been laid down in a very haphazard fashion in the main, and only here and there were they able to carry the locomotive at all. The wear and tear which they sustained by the use of even a lightweight steam locomotive played havoc with the plates or rails which formed them.

It is not remarkable, therefore, that the first locomotives, especially those of Trevithick's, were turned down, and their builders became discouraged because it was cheaper to employ horses on existing tram roads than to build entirely new tracks upon which the locomotive would treble the work of a horse. It is a fact

that a colliery owner in Durham bought one of Trevithick's engines because he was so impressed with what he had heard and probably seen. Yet, when it got there, the enterprising colliery proprietor was persuaded to let it stand idle. His subordinates told him dreadful tales of what they had heard of broken tramways. But Trevithick's engine in the north started a train of events, of which the last has not yet been seen. It started George Stephenson on the road to locomotive building, and when this great pioneer had achieved a fairly satisfactory engine, he looked around for railways upon which it could be employed.

Thus from the useless locomotive of Richard Trevithick's design, standing idle in a Durham colliery yard, came the Stockton and Darlington Railway, and from this came the whole network of British railways, which so quickly began to cover the country.

Not only were railways built throughout Great Britain, but other countries, and particularly the U.S.A., were quick to seize

upon the new invention. Thus it came about that British-built locomotives were seen all over the world.

Is it not worth while to preserve that little thatched cottage which housed so great a genius?

AN EARLY COLLIERY LOCOMOTIVE

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THE "ROCKET" CONTRASTED WITH THE LOST TYPE OF 4–4–0
Built for London and North Western Railway

II

THE DEVELOPMENT OF THE LOCOMOTIVE

THE Great Western opened their broad-gauge railway with a curious lot of locomotives. Soon afterwards they appointed to the care of the iron steeds a young man who was to help to make locomotive history, and finally end his career as chairman of the big system, which he saw grow up from quite small beginnings. This was Daniel Gooch, afterwards Sir Daniel Gooch.

When he took charge there were no great works at Swindon; what locomotives there were often broke down. Gooch mentions in his diary that he had not only to be about all hours of daylight to keep his iron horses at work, but at night he used to sleep in a carriage in the repair shops, so that he could be on call for the

repairs which had to be undertaken to fit them for duty next day.

Gooch soon obtained permission to scrap practically the whole of the first engines on the condition that he designed, and had built, some better machines. This he proceeded to do at once. Soon he had running some really splendid single-drivers, with names that were very fitting. Thus, there was the " Firefly ", " Fire King ", " Sun ", and " Fury ", to mention a few. These fine little machines soon brought the name of the Great Western to the fore as the line where speed might be found. The narrow-gauge protagonists were troubled; it did seem, after all, that there was something in the boast of the seven-foot railway. A son of the Trevithick, whom we can truly call the " father of the locomotive ", was in charge at Crewe, the headquarters of the northern section of the recently formed London and North-Western Railway. He decided that the broad gauge should not have it all their own way. Trevithick, therefore, designed

and built an engine which it was hoped would equal, if not surpass, the speed at which Gooch's fliers travelled. The new engine was called the "Cornwall", and it was given larger driving wheels than any engine then running on the Great Western. These were 8½ feet in diameter, but whilst the broad-gauge champions built their engines in the usual way, Trevithick was so afraid of his new machine being top-heavy that he slung his boiler below the axles of the driving wheels! A speed of 117 miles an hour was claimed for this freak of an engine, but, as the careful timing of to-day was not then thought of, the claim may be dismissed. The "Cornwall" was afterwards tried repeatedly by an expert to reach this speed, but the best records secured was far below the claim made.

The chief interest for us in the "Cornwall" is that she may be seen to-day *at work*. Think of it—this old locomotive of over 80 is still in harness, though the London, Midland and Scottish, like kindly

human beings, has given its oldest horse a comfortable light duty—that of taking the engineer's saloon about the big system. Having proved unsuitable in her original form, the "Cornwall" was soon rebuilt to the usual practice. Since her first rebuilding she has had several new boilers and other working parts, thus the cynic would say there was very little of the original "Cornwall" left. Still, outwardly she is much as she appeared in the 'fifties of the last century with her long chimney, small boiler, and huge driving wheels.

The next type of locomotive for consideration was that produced by the well-known engineer Crampton. His locomotives are always spoken of as "Cramptons", and they were extremely popular in their day. In some respects they followed the "Cornwall", as they depended on large driving wheels for their efficiency. They, too, had that curious daschund look, due to their length and their low-pitched boilers. The main features were that the driving wheels were placed at the rear of the fire-

box, the cylinders halfway down the frames, and two or three pairs of carrying wheels were used to carry the weight of the long boiler. Quite a number of the Cramptons were sent to the continent. One of them, intended for Belgium and called the "Namur", was tried on the North-Western. So excellently did she acquit herself, taking twice and thrice as great a load as the engines already in use, that the big railway ordered two like her. These were named the "London" and the "Liverpool". They did very good work, but, the pounding of their big driving wheels, upon which rested so much of the weight of the engine, played havoc with the light-weight metals of that day. The North-Western engineers said, "we like the Cramptons, they are fine little fellows, but do you realise that if they remain, or are added to, there will be no North-Western Railway for them to run upon?"

The directors made enquiries, and found that the charge brought against the Cramptons was only too true, so they went.

We now pass, to Patrick Stirling who came down from Scotland to take charge of the engines of the Great Northern in 1867.

The Great Northern as a rather late comer, depended more on the speed of its locomotives than any other big system. Stirling appreciated that point at once, and he set to work to design what is probably the best known type of express engine ever seen on British (or foreign) metals. This was his famous " eight-footer " which, for thirty years, held its own against all comers.

Every detail of their design was carefully thought out before even the drawings were made; Stirling was a master of his craft, he knew exactly what he wanted, he knew exactly what his railway needed, and in the outside cylinder " eight-footer " he arrived at his goal.

Although these engines had what would now be called midget boilers, and a wheel formula which is now obsolete, they romped along with any load then available. For thirty years, without any substantial change

in plan or detail, Stirling worked to his first machine, which bore the historic number " 1 ". She is now in the L.N.E.R. museum at York.

Right through the years when the West Coast lines were throwing out speed challenges to the East Coast route, the " eight-footers " took the Great Northern racing trains. Whilst the West Coast partners were striving their hardest, often using two engines to help in speed, the magnificent green-coated " singles " on the Great Northern ran without turning a hair, ready to sprint at any speed required. Nor was there need to reduce their loads to get this speed.

Had trains remained fairly light, we might still have seen these racehorses of the rail in all their glory, but, alas, the trains would persist in growing up as well as the locomotives. This type of engine could not grow because the limit of weight which might be placed upon a single axle was almost reached when the " eight-footers " first showed their speed in 1870.

By 1900 the trains had so increased in weight that the "single driver" was doomed and soon after, in 1901 in fact, the last batch was built—these on the Great Northern.

A word here on locomotive wheel formula. The first engines were all of the four-wheeled variety. We may conveniently take a small o for the leading or trailing wheels, and a large O for the driving wheels. Thus the "Rocket's" formula was O o, then we find designers deciding that if they coupled the four wheels of the engines intended for coal or goods traffic, greater loads could be taken. These were expressed as O O. The next step was found when we get to the Great Western's opening in 1838. Here the boiler of the engine had grown in length, as well as diameter, so another pair of wheels, to take some of the weight, was added. Thus the "North Stars" wheel formula was expressed as o O o.

By the time the "eight-footer" came along the leading bogie had been added for

express engines. This was another pair of small wheels added at the front of the engine, the formula now being oo O o.

A bogie is really a four-wheeled truck, with a pivot which allows the bogie sufficient play to go round curves quite easily.

The coupling of the wheels for goods traffic led to such good results that they were tried for express locomotives. The first were expressed as o O O, when the leading bogie was used it became oo O O, meanwhile the goods engine had become six-coupled, thus O O O. The next step in the growing up of the passenger engine was the introduction of what is called the "Atlantic" type, expressed as oo OO o, and this was followed very quickly by the six-coupled giant, expressed as oo OOO, and later, by the "Pacific" type, which reads oo O O O o.

Whilst this method of expression is quite easy on paper to indicate the wheel formula of a locomotive, it was found rather awkward in speech. An American, named

Whyte, introduced the mode of expressing the wheel formula by figures. The system now bears its inventor's name, and is extensively used. Whyte says that you must reckon upon an engine having three sets of wheels, viz., leading, driving and trailing. If any of the sets are not used, we must use an o. For example, the usual type of goods engine has six-coupled wheels. To express this Whyte uses the figures O–6–O. For the " Atlantic " type of express engine it becomes 4–4–2, which means, four leading wheels, that is a leading bogie, four driving wheels coupled together, and a pair of trailing wheels under the huge fire-box.

The single-drivers were the most graceful of all locomotives; because their weight was limited it was possible to make them graceful, and their big single driving wheels gave them a most majestic look. How they ran! The Midland drivers called theirs the " spinners ", because they travelled so quickly and with so little punching—the latter meaning that the movement was regular and the engine steady.

Many of the " singles " had inside cylinders, such as the Midland, the later Great Northern, the North-Eastern, and the Great Central. In all cases they were beautifully painted and kept in splendid condition. It is generally agreed that the most pleasing engines, as regards uniform and neatness, were the famous 80 Great Western " singles", which were built on the passing of the broad gauge. The last of these disappeared early in the war period.

The " singles " gave place to the four-coupled engine, usually with a leading bogie, though there were scores without until quite recent years. As a go-between the " singles " and the four-coupler, came the " double single " which flourished for a time on the North-Western, and later, to the number of six, on the South-Western.

Here we have four large driving wheels, that is two pairs, driven by separate sets of cylinders, the idea being that the engine will run with all the freedom of the " single", with something of the greater power of the four-coupled engine. On the North-Western

there were just 100, and they were all built upon the compound principle, which, briefly explained, means the use of the steam a second time after it has already passed through one set of cylinders. The compounds were not altogether a success on the North-Western, and when their designer retired, in 1903, his successor made sad havoc in their ranks, especially the "double single" type, of which, in a few years, there was not a member left.

The development of the locomotive on the North-Western up to a certain point is really the story of the iron steed on all our railways.

We had the famous "singles" of the "Problem" class (wheel formula 2–2–2), which, for forty years, numbered sixty, and they did remarkable work for such midgets. Their place was taken by the "Precedent" (formula 2–4–0), and no better engine was ever built, that is for their size and weight. Some of these hefty little engines still run to and fro on the North-Western section of the L.M.S., but the last of the "Problems"

went to the scrap heap in 1907. Notice the name of these classes; here we have another reason for naming the locomotives. The " Problem " and the " Precedent " were the first engines of their type, and so we find it easy to remember what they stand for.

Then, on the North-Western, we found the full trial of compounding, first with two, then with three, and finally with four cylinders.

This phase passed with its introducer, Mr. Webb, who held the reins at Crewe for nearly forty years. When Mr. Whale came along he designed his " Precursors " (wheel formula 4–4–0), fine engines, which were to all intents and purposes, greatly enlarged editions of the famous " Precedents ". Not quite content with his fine machines Mr. Whale copied the idea already being tried on many of our big railways in adapting what had always been considered the wheel formula of the goods engine for passenger work. That was, of course, the six-coupled engine, plus a leading bogie. Thus we find what were called the

"Experiments" (wheel formula 4–6–0). At that formula the North-Western have stopped though the newer engines are much bigger than the "Experiments".

To follow up our brief sketch of the development of the express engine, let us now wing our way to the big rival of the North-Western, the Great Northern. Here we found Stirling's gallant single-wheeler overpowered by the big increase in loads. The Great Northern went straight from the single-wheeler to the "Atlantic" (wheel formula 4–4–2). For twenty years these fine machines reigned supreme, now they are giving place to what may easily prove the final development of the steam locomotive before electricity takes charge of our main lines. This is the "Pacific" type, which came out in 1922 on the Great Northern, though in the "Great Bear", on the Great Western, came the first example built in Britain, in 1908. The wheel formula of the "Pacific" type is 4–6–2.

Already there are many running on the London and North-Eastern of the Great

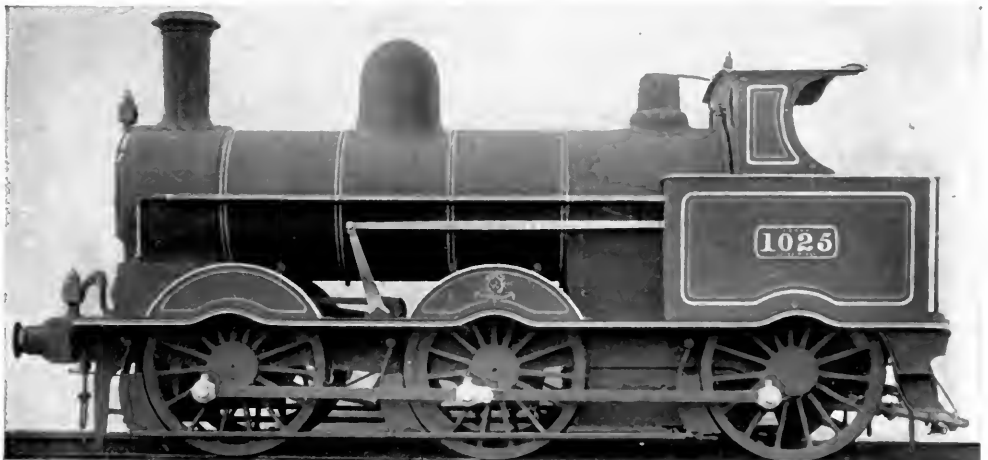
Northern type and also a few of the North Eastern type. One must be careful to add that the " Pacific " type *may* not be the final wheel development of the express engine on British metals, though at the moment it seems likely. Abroad the eight-coupled express engine has arrived. Although a wheel formula of 4–8–0, or even 4–8–2, seems unlikely here, we must admit the possibility. Without doubt a great increase in load pulling is achieved by coupling still another pair of wheels. On the other hand the speed does not appear to suffer. There is still this point, however, that the huge " Pacifics " on the London and North-Eastern and the " Kings " of the 4–6–0 wheel formula on the Great Western can manage any reasonable train, and to work longer trains means considerable expense in lengthening platforms. It is probably better to divide a train when it gets so long.

" Mixed traffic " types differ considerably on various lines. Thus, on the old North-Western you would have searched in vain

for such a title or class. Instead, we find what was termed " express goods ", which were, in fact, of ordinary goods design with larger coupled wheels and, of course, fitted with the continuous brake.

On the South-Western and the London, Brighton and South Coast we find not only goods engines fitted with the passenger brake, but entirely separate classes for " mixed traffic " with a distinct wheel formula, now almost extinct; this was the 0–4–2. There are many of them still running on the Southern, and a few on other systems. The idea of this curious wheel formula was to get an easy-running engine, whose big leading wheels would take the junction points quite easily, and, by having a small pair of trailing wheels under the fire-box, the latter could be very wide.

There were until recently no less than 90 of these " mixed traffic " engines at work on the western section of the Southern, and they are still employed on duties for which they were built more than thirty years ago. Thus, in the early morning they will be



WEBB'S CELEBRATED "CAULIFLOWER" EXPRESS GOODS ENGINE

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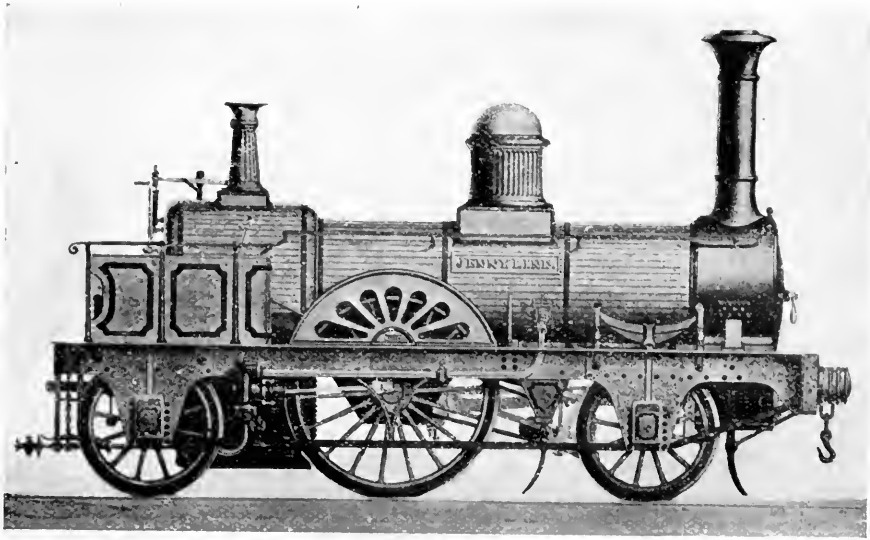


MIDLAND RAILWAY: THE FAMOUS "JENNY LIND"

running heavy passenger trains up to town; the middle part of the day dealing with goods traffic, including shunting, and at night they are bearing tired London workers back to their homes in the country. The newer " mixed traffics " on this system, and others, are so similar to the 4–4–0 and 4–6–0 passenger types that few would detect the difference unless a glance were taken at the coupled wheels; these are usually much smaller.

Then we come to the goods engine, and these vary from the powerful 2–8–2, sometimes called by the American term " Mikado", to the more numerous 0–6–0 already mentioned. For heavy work most of our railways prefer the eight-coupled type, since there is greater adhesion. But we should have looked in vain for such an engine on the old Midland, owing to the fact that very heavy engines could not be regularly employed on that system until certain strengthening operations had been undertaken. That did not prevent the Midland building a ten-coupled tender engine—a

huge fellow—whose duty is simply to push trains up the Lickey incline near Bromsgrove. Here he takes the places of the 0–6–0 tanks.

Beginning as an 0–4–0 engine, the goods quickly went to 2–4–0, and then almost at once to 0–6–0. The latter formula remained standard for quite half a century before greater power was needed, given in the addition of another pair of wheels. Usually these were of the same size as the rest of the driving wheels, and were coupled to them, making an 0–8–0. These began to be seen on several lines in the closing years of the last century. Another type seen in England, about the same time, was the American " Mogul ", or 2–6–0 design. The increase in power in this type was gained by having a longer boiler. Despised at first, the " Moguls " are now known as one of the most economical and popular locomotive types at present running. They are often classed as " mixed traffic ", and are especially useful with semi-fast and heavy passenger trains. The " Consolidation " type 2–8–0

was a development of the o–8–o, and a very efficient type it has proved, particularly on the Great Western and old Great Northern.

Designers are always anxious to produce locomotives of great power, and yet not be too heavy for the railway upon which they are to run.

Some years ago the locomotive engineer of the Great Eastern was asked whether he could build an engine which would get up speed very quickly from a station stop, run at a good rate, and haul a good load. There had been difficulty and delay upon the crowded Great Eastern metals near London. The time was not ripe for electrification, so the old steam locomotive was to have another chance. The designer produced a wonderful engine, of the tank variety, with ten coupled wheels. It did all that was wanted in the matter of quick starting, speed, and haulage. But it was never allowed to run because it proved too heavy for the rails; not so much the rails, in reality, certain bridges. So the curious looking, "Decapod", as it was called, was sent back

to the works, and came out later as an eight-coupled tender goods engine.

The same sort of problem in the matter of a powerful engine to run upon rails, which were not too well laid, had to be faced on the railways of Asiatic Turkey. Here the strange device of placing small carrying wheels between the coupled drivers was tried, and so we get a very curious engine, which, though never likely to be seen in Britain, nevertheless did well on the lightly laid track in Asia Minor.

Many attempts have been made to get two sets of machinery operated from a single boiler. By doing so a very powerful engine is obtained, and the weight of a heavy machine is more equally distributed. This type of locomotive is known as an " articulated " engine, the best known types of which are the " Mallet " and the " Garratt ", the latter now rather more popular than the earlier class.

In the " Mallet " articulated engine two sets of driving wheels and cylinders are used under the boiler, each set being quite dis-

tinct in action. They are pivoted in such a way that the locomotive swings easily round a curve. In the "Mallet" compounds the high-pressure steam will be used in one set of cylinders, and then, by means of flexible pipes, the steam will be conveyed to the low-pressure cylinders on the other set of machinery. A very economical locomotive results, especially suitable for freight trains.

The "Garratt" has also two sets of machinery, and they may be compound or simple. But here there is a great difference found in the design of the engine generally. The boiler is usually very big, and is carried upon the two ends of the carriage which contains the cylinders, etc. The space between the two carriages is left open so that anyone could scramble underneath the boiler. A very powerful engine is possible on the Garratt plan because the boiler can be made to almost any size; there are no wheels to interfere with its dimensions, and a very large fire-box is possible. These engines have been used a good deal in

countries overseas, especially in the British Empire, and now we find them at work in England, particularly upon the London and North-Eastern and the London, Midland and Scottish.

Passing for a moment from the consideration of the steam locomotive let us look at one depending upon electricity, taking one of several employed upon the Great Indian Peninsula Railway for dealing with goods traffic. Equally large engines depending upon electricity are in service for passenger work.

It may seem strange to find the electric locomotive making greater progress in the Dominions than at home but with the steel highway India is setting the pace for many countries and has the best railway system in Asia. The authorities believe that the steam locomotive has about reached its limit unless made an unduly complicated machine which would not be suitable for native drivers even if evolved. They are therefore turning to electricity to ensure further steps forward on the road to a high efficiency.

Switzerland has established a reputation for all electric gear, and it is not surprising therefore to find that this fine looking machine comes from that small country.

Although intended for goods traffic this locomotive can quickly attain 35 miles an hour and retain that speed with a heavy load. The engine weighs 120 tons, which is approximately the weight of the biggest goods engine under steam in Britain. It has a horse-power of 2,400, which is double that of a fairly large six-coupled British goods engine.

III

THE SINGLE-DRIVER LOCOMOTIVE

WHILST turning over the pages of a railway journal of the Diamond Jubilee year, I came across a statement which takes one back at a bound to what has been called " the golden days of British locomotive." It ran, " With the addition of the Holt steam-sanding apparatus the single-driver has now taken on a fresh, and we believe, a very long lease of life. The free running of this favourite type has always been its chief asset, and now that adequate boilers have been given, we shall look to see this favourite wheel arrangement in charge of all the best expresses on the lines which boast the finest running. The single-driver is already in charge of the best trains upon the Great Western, the Great Eastern, the Great Northern, and the Midland, and it will prob-

ably be found on the fliers of the new London extension line of the Manchester, Sheffield and Lincoln, when opened. We also expect to see shortly the 4–2–2 at the head of the fastest expresses on the North-Eastern."

That was the considered view of a writer who knew something of his subject, since he was contributing a regular causerie on the locomotive, month by month, to that particular journal. But how hopelessly wrong was he when he predicted long life to the graceful single-driver, surely the best looking type of engine ever evolved! The ink could scarcely have been dry from his pen when the big 4–4–0 was being designed on the Caledonian and North-Eastern, and the "Atlantic" on the Lancashire and Yorkshire and Great Northern railways. These were the two wheel types which dealt the single-wheeler its deathblow, but the ever increasing loads had already made the fate of the 4–2–2 practically certain. At the moment of writing there are no single-drivers regularly at work on British railways;

those which actually survive are utilised for purely nominal duties. In a few years it will be impossible to find the type, save in a museum, of which that formed by the London and North-Eastern railway at York within recent years boasts already perhaps the most famous engine of the long race of singles; this is the No. 1, an eight-footer first introduced upon the Great Northern in 1870, of which more anon.

During the last century the single-driver was always a favourite type, the famous "Rocket" of Stephenson design and building being the real precursor of the class so far as public railways were concerned. The story of the "Rocket" and her victory at the Rainhill trials of 1829 is doubtless so familiar to my readers that I need not dwell upon it here; rather are we concerned with the descendants of this remarkable old engine. The "Rocket", like most of the engines of her day, was a four-wheeler, and the next step in the evolution of the express locomotive was the addition of a pair of leading wheels; so came the wheel formula

2–2–2. The additional wheels were necessary because the boiler had been lengthened to secure more power.

For fifty years the 2–2–2 was the favourite express type on many of the British railways, and many very famous types were evolved. The " North Star ", built for the Great Western's opening of the broad gauge, was typical of many of the six-wheeled single-drivers. She was one of the best of the early locomotives; easily the best of the strange collection which opened the remarkable broad-gauge line, which was the particular child of Brunel. The " North Star " was preserved at Swindon until about twenty years ago, then some vandal broke her up as so much scrap. In the railway centenary celebrations the Great Western went to the trouble of getting the original drawings, and having an exact replica made of the engine which was so ruthlessly scrapped.

The original " North Star " had seven-foot driving wheels, operated by cylinders having a diameter of 16 inches and a similar

length stroke. Writing upon locomotives it will be well to have a cylinder as well as a wheel formula, therefore, I shall use 16×16, which means that the cylinders were 16 inches in diameter with a stroke of 16 inches.

The "North Star" had a sister, "Morning Star", but, owing probably to her smaller driving wheels (6½ feet), she was not considered nearly such a good engine. It will be found that for good work with uncoupled wheels the best results have almost always been obtained with wheels between 7 and 8 feet diameter.

The "Jenny Linds" were the natural reply of the narrow gauge to the stalwarts of the broad. These were very numerous as a class, and were found on different railways, mainly because they were the product of private builders. A typical engine of the class had the wheel formula 2–2–2 with cylinders (inside) 15×24, and in the late 'forties many of the best expresses on the Midland and London, Brighton and South Coast railways were hauled by this class.

The six-wheeled single-driver probably reached its zenith on the Great Northern, where it continued to be built right up to the last decade of the nineteenth century. Stirling, who did so much for the English locomotive generally and on the Great Northern in particular, produced his final 2–2–2 design in 1885. They were cheap to construct, splendid in service, and extraordinarily light on repairs. With single driving wheels, there is always less wear and tear, but in this final batch of 2–2–2s, based largely on much earlier models, Stirling seemed to have evolved the beau ideal type of express engine for light trains.

Up to 250 tons the 2–2–2s were as good as could be; strangely enough they persistently gained time on uphill gradients, and never required to be thrashed so long as the loads were kept within bounds. Ivatt thought so well of them that long after Stirling had joined the great majority his successor rebuilt them with domes, and rather more power for the boiler. They handled the

same trains as their most costly brethren of the eight-footer class, and it is said that in the point of speed they were rather more fleet. Their $7\frac{1}{2}$-foot drivers, with inside cylinders $18\frac{1}{2}\times26$, proved an ideal combination: when Ivatt himself wanted to build a dozen singles for use on his lighter expresses he took the general form of the Stirling machines, gave the type a leading bogie, a much bigger boiler, and found that they did better than his own four-coupled engines, but necessarily not so well with heavy trains as the much stronger "Atlantics", which he also placed in service soon after taking charge at Doncaster.

These fine machines were lined up as a whole and scrapped in the last year of the War. As a class they were the last singles to be built in Britain, the final engine coming out in 1901. They must have had years of good work in front of them, but a new locomotive chief had no time for what he considered a truly obsolete class, which numbered so few engines, and yet were

difficult to fit into a link. These Ivatt singles had cylinders (inside)1 8×26.

Whilst dealing with the Great Northern, a great line for the single-driver, we must again mention the famous eight-footer, with outside cylinders, dimensions 18×28, and, of course, the leading bogie. The first engine started a series, which, with few variations, was built for twenty-five years, and lasted in service not far short of fifty. Such a type must have been superlatively good. Whilst in charge at Doncaster Stirling would never allow his splendid machines a pilot: when loads got beyond them he considered that there was good reason for splitting the train, and giving an extra service to the patrons of the line—a good policy perhaps so long as the metals would take the additional schedules, but difficult for the running department in the height of summer.

On the Great Western the single-driver persisted until 1900 as the express type, yet, by 1915, there was not one of a very large family left. The broad-gauge eight-footers

of Gooch and Dean passed with the abolition of the final section of the seven foot metals in 1892. But from their ashes, as it were, arose the splendid 7 ft. 8½ in. inside cylindered singles, which numbered eighty in number. There were also some almost equally good singles with 18-in. cylinders and driving wheels 7 feet in diameter. All Great Western 2–2–2s and 4–2–2s had inside cylinders.

There is now the last phase to note briefly. The bulk of the singles left were found on the Midland section of the L.M.S. Not so long ago there were more than forty taking regular duty on the all-red line. Now all have disappeared from active service.

These last splendid inside cylindered machines (dimensions 19½×26) were about thirty years old, the last of the series appearing in 1900. They were perhaps the easiest running engines on any road, and when a pilot was required for the 4–4–0s no better assistant could be found. The driving wheels were mainly 7 feet 9 inches but some of smaller diameter were used.

These, and a stray one or two which survived until recent years on the L.N.E.R. (Great Central built), complete the story of a most wonderful and graceful type of British express engine.

IV

THE 4–4–0 AND 4–6–0 LOCOMOTIVES

So far as express locomotives are concerned in Britain we have two distinct methods of driving wheel arrangement, viz., the very popular four-coupled engine, and the rapidly increasing six-coupled type. There may be many variations of these classes, especially when the classes are further divided into tender and tanks.

For trains up to 300 tons, on lines not too heavily graded, the 4–4–0 is ideal, and although experts have frequently stated that, as a type, it is doomed, yet the four-coupler has a knack of coming to the front. Thus, of the four big groups, the Great Western is the only one which has ceased to build the 4–4–0.

Again the 4–6–0, which is the six-coupled evolution from the 4–4–0, is still by far the

most popular type of big engine which must deal with trains of over 300 tons; it is cheaper to build than the "Pacific" type, and whilst it is common on all four groups, at present the "Pacific" is built only on the London and North-Eastern.

The "Atlantic" may be regarded as obsolete. None have been built since the grouping, whilst on the L.M.S. the Lancashire and Yorkshire type, though not thirty years old, have begun their procession to the scrap heap.

Until the 'seventies the leading bogie was rarely used on British engines. There was no real reason for this aid to easy running since the express engines up to then had been relatively small. Two typical machines of the pre-bogie era come readily to mind, and as showing the longevity of the locomotive in Britain, it should be mentioned that specimens of both classes are still at work. The first are the North-Western "Precedents", which came out in the early 'seventies, soon after Mr. Webb

took charge at Crewe. They were largely copied from Ramsbottom's "Newtons", which were first built in 1866; these Mr. Webb later rebuilt to conform to his 2–4–0 "Precedents".

If ever engines deserved a word of praise these small 2–4–0s are the machines. It is not claiming too much when we contend that, for their size, they were the very best locomotive ever found on British metals. They tackled trains on the North-Western main line in the 'seventies and 'eighties which seemed a mere impertinence for them to back down to; they kept times and ran freely and well uphill and down.

In the races to Scotland it was one of these tiny 2–4–0s that averaged 67 miles an hour up the stiff climbs between Preston and Carlisle; true, the load was a mere featherweight compared to present-day trains; even so it was magnificent work.

When the later built Webb compounds proved undependable, it was the old 2–4–0s

which came to their rescue as pilots, and often they took the whole of the 300-ton train themselves when the compound had to be taken off. They had driving wheels 6½ feet in diameter, with cylinders 17×24, and in their glossy black uniform, with its neat lining out, and company's crest on centre splasher they were good looking machines. Now those which remain in service have been given an all-over dull black coat, as used for the goods engines of Britain's greatest railway—a small point perhaps, but one never cares to see the least sign of falling off in the care of the best machines man has yet produced. A locomotive uniform has a publicity value not always allowed for.

On the Midland Mr. Kirtley produced his famous "800" class about the same time as the "Newtons" began to come into service, and it would be difficult to say which were the better engines were it not for the fact that speed and loads were relatively higher on the North-Western.

Very soon after Mr. Johnson succeeded to the reins at Derby he introduced the leading bogie as the standard equipment of Midland express engines. These 4–4–0s were graceful machines, with $6\frac{1}{2}$-ft. driving wheels, and inside cylinders $17\frac{1}{2} \times 26$. Subsequently, in the late 'seventies, some seven-foot coupled wheels were used, a free running engine of considerable power resulting.

The 'eighties saw a continued growth in the dimensions of the 4–4–0, which was the most popular type, if numbers count, of express engine of that period. So we pass rapidly to the mid-'nineties, when the increasing loads were making heavy demands on the 4–2–2 and the four-coupled classes. The introduction of the corridor coach, which added considerable weight without providing additional accommodation, was one of the chief causes of a sudden leap in train weights.

McIntosh, on the Caledonian, seems to have been the first to realise that the answer to this challenge of the coach was a big

increase in boiler dimensions. He set to work and produced his exceedingly fine " Dunalastairs ". In all, three series of these blue-coated steeds were placed in service, and gave excellent results.

It is on record that the pioneer of the type persistently took on trains weighing up to 350 tons on the exceptionally heavy section of the West Coast route to Scotland; these trains had been double-headed as far as Carlisle by the North-Western.

On the North-Eastern, very soon after the first batch of " Dunalastairs " were in service on the Caledonian, Mr. Worsdell brought out his famous " R " class of very similar machines. With big boilers, inside cylinders, driving 6 ft. 10 in. coupled wheels, these engines have always been consistently good.

At the same time the first challenge came to the 4–4–0 in the shape of the " Atlantic ", and soon after the 4–6–0 proved a doughty challenger also. But for the ordinary express work the 4–4–0 was found the ideal type, being the happy medium between the

single driver in its last phase and the 4–6–0.

Whale, on the North-Western, gave us his famous 4–4–0 " Precursors " in 1904, with boilers and other details following close on the type last mentioned. On the Great Western Mr. Dean produced his famed " Atbaras ", with inside cylinders and coned boilers, and from these have come the outside-cylindered " Counties ", arriving the same year as the " Precursors " on the North-Western, but vastly different engines in appearance. Then came a reversion in the 4–4–0 upon the Great Western to the inside cylindered " Flower " class; these ended the 4–4–0 building in 1909 on what was then our longest railway.

Very similar engines to the North-Western " George the Fifths ", which appeared in 1910 (differing very slightly in boiler and cylinder details from the " Precursors "), were added on the Midland, Great Eastern, South-Western, London, Brighton and South Coast and the North British, whilst

on the South-Eastern and Chatham railway nothing bigger than the 4–4–0 was found until the grouping saw some of the new "King Arthur" 4–6–0s tried there. Also the latest 4–4–0 design in Britain, Mr. Maunsell's fine three-cylindered "School" class machines are being introduced.

The Midland compounds, of the 4–4–0 wheel type, have been greatly multiplied upon the London, Midland and Scottish, and the Great Central "Director" class has been added to on the London and North-Eastern though the three-cylindered "Shire" class of 4–4–0 is now standard.

Therefore the 4–4–0 persists and is likely to persist on British railways.

In considering locomotive practice, it is remarkable how persistently the influence of the goods engine has been felt in passenger practice. The express single-driver gave over the struggle to the four-coupled class, which, in its earliest days, had been considered a goods type, pure and simple. But a good many miles were to be run, under great handicaps, before our engineers

were to discover that the six-coupler was as useful for express duties as it had been found for goods working.

It is usual to allow the United States first honours in bringing the six-coupled wheels to express traffic, but it is doubtful, so far as Britain was concerned, whether it was not really the failure of the Webb three-cylinder compounds that led to the adoption of the wheel formula we are considering.

Had the "double-singles" kept their reputation it is practically certain that the two famous classes of six-coupled express goods engines on the North-Western would not have made theirs. Strangely enough, the North-Western were one of the last of the big systems definitely to allot their best express work to the six-coupled machines; on the other hand, Webb certainly had express work in view over the heavy Shap summit, on the northern section of the main line, when he produced his last batch of 4–6–0 compounds, ostensibly, for express goods work.

Very similar engines to these of Webb's, but not compound, were introduced for express goods work on the Highland in the early 'nineties. Naturally on such a railway, with heavy gradients, and an enormous summer traffic, the 4–6–0s were pressed into passenger service. They did excellent work, and as a result another batch for passenger work was put in hand, and given rather larger driving wheels. So to Scotland must go the honour of introducing the six-coupled passenger engine as far as Britain is concerned.

The lead of the north was soon followed, and the North-Eastern and the Great Western both had six-coupled express engines at work at the beginning of the present century.

William Dean, on the latter system, produced his nameless giant, and having done so he resigned, and left Mr. Churchward to add to this fine type, incidentally giving the precursor the name of its designer.

So began a long and robust Great Western tradition. The coming of the "William

Dean " helped largely to seal the fate of the " Singles " and later their four-coupled successors. By their splendid performances, the 4–6–0s led to the discontinuance of 4–4–0 building, and also secured the conversion of all existing " Atlantics " to six-couplers, excepting always the fine trio of De Glehn compounds of the 4–4–2 formula, which having been rebuilt remained in service till the years 1926–1928.

For some time the Great Western 4–6–0s were two-cylindered machines, but later, when four cylinders were tried with the " Star " class, they showed such superiority over the earlier locomotives that four cylinders became standard on the Great Western for the 4–6–0 express machines. This does not mean that the building of the two cylinder locomotives was ceased at once.

So we come up, through many sub-classifications, via the " Abbeys " to the now world-famed " Castles " and " Kings ", the latter considered by many good judges the best 4–6–0 engines now running in

Britain. That represents, in a few words, the development of the 4–6–0 on the Great Western. As the older four-cylindered machines come in for heavy repairs they are given larger boilers, and so become, in reality, additions to the "Castle" class.

Harking back for a moment to the other English pioneer of the 4–6–0, the North-Eastern, here took place a complete reversal of the policy adopted on the Great Western. This is all the more surprising, since the pioneer six-couplers on the North-Eastern, known as the "S" class, were a decided success, and really better engines than contemporary machines of the same formula on the Great Western. Instead of adding to the "S" class, the North-Eastern turned to the "Atlantic"—compound and simple—and gave them the best express work on their metals, including the heavy Scotch expresses which the Great Northern hauled up to York from King's Cross. It is more than probable that the fine work of similar machines on the Great Northern

influenced the brothers Worsdell, and later Sir Vincent Raven, in favour of the 4–4–2.

It is remarkable that the 4–6–0 was never seen on the Great Northern, nor was the 4–4–0 ever employed save for minor express duties. The " Speedy Line ", as it liked to be called, passed straight from the 4–2–2 to the 4–4–2, and from the latter straight to the 4–6–2. Of these types we shall speak later.

The 4–6–0 having been well tried for roughly five years on the Scotch and two English lines mentioned, we find a distinct swing on the part of British designers to this useful type. Within a comparatively short space of time the London and North-Western, Great Eastern, London and South-Western, Lancashire and Yorkshire, Great Central, Caledonian, and the Glasgow and South-Western turned to the new type of express engine, and all these railways produced magnificent machines, well suited to what was necessarily a varied range of traffic.

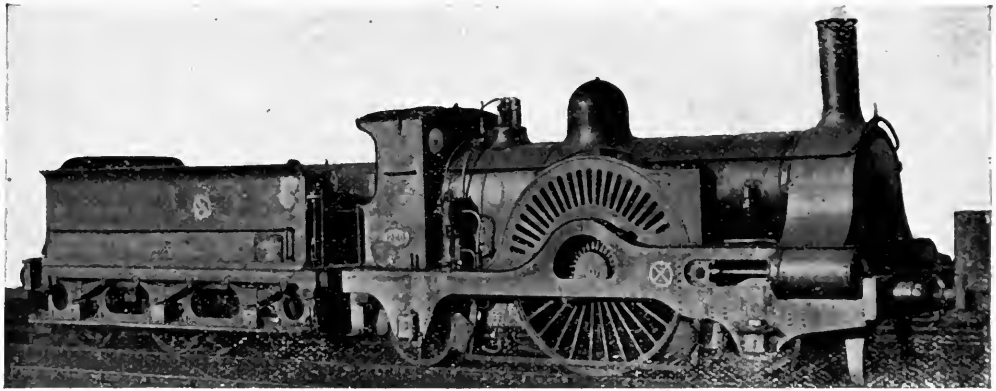
The Midland, South-Eastern and Chatham, London, Brighton and South Coast, and the North British are the remaining principal pre-group British railways upon which the six-coupled tender express engine was not seen. In the case of the two first-named lines certain permanent way difficulties existed, and these could not be overcome without a great deal of expenditure; the Brighton line turned first to " Atlantics ", and then to the heavy tanks, many of them six-coupled, whilst the North British, as a partner in the East Coast route, appears to have found the huge " Atlantics ", as on the North-Eastern and Great Northern—the other partners—equal to all calls made upon locomotive power.

We can now deal briefly with the various examples of six-coupled express engines on the lines mentioned as adopting them. The North-Western began with Whale's " Experiment " class of inside 4–6–0s; wonderfully efficient engines, but rather heavy on their fuel. This was particularly noticeable from the fact that they were

given trains which had been previously double-headed. This led to " thrashing ", and as the locomotives were not superheated, the coal bill was a large one. But there was no question of their splendid hauling capabilities, and to the surprise of many locomotive men, the six-couplers beat the famous 4–4–0 " Precursors " in the matter of speed, despite smaller driving wheels.

When Mr. Bowen Cooke succeeded Mr. Whale he copied the " Experiments " in his " Prince of Wales " class, giving slightly larger cylinders and adding the superheater. Then he went on to the four-cylinder " Claughtons ", which in their later years are doing even better than when they first came out in 1914, especially those which have been rebuilt.

The Great Eastern turned to the 4–6–0 the same year as the London and North-Western—in 1905—and their fine inside-cylindered 4–6–0s had much in common with the " Experiments " and " Prince of Wales " classes. Up to and beyond the



[Face page 64

AN EIGHT-FOOTER MARKED FOR THE DERELICT ROAD
CALEDONIAN RAILWAY

Face page 65]

A Fine "Mixed Traffic" Type, Great Northern Railway

grouping they have done splendid work on the heavy expresses in the Eastern Counties, especially upon sections which are not adequately laid for larger engines. Mr. Gresley added some of this type in 1928 and then turned to his "Sandringhams" which are 4–6–0s with three cylinders.

Then comes the London and South-Western, which joined the ranks of the six-couplers in the same year, leading off with some very big four-cylindered machines, with the Drummond water tubes for the fire-box. This feature was not altogether successful we imagine, as few of the locomotives which had them, if any, at their building now retain them. Nor were the six-coupled Drummonds altogether successful, ten at least have not reached the re-boilering stage, their numbers having been filled by new engines. Others have had a re-arrangement made of their valves and gained somewhat in the process. But they were not numerous to begin with, and what remain now take only secondary express trains. With Mr. Urie's "736"

class, which came out in the closing months of the War, two cylinders were reverted to, and, in many respects, the big boilered two-cylinder machines on the Great Western were copied. These engines are now counted in with the famous " King Arthurs " of Mr. Maunsell's design, also two-cylindered. These latter are fine locomotives in every way, and they will not be entirely superseded by the still bigger and later " Lord Nelsons ".

The " Lord Nelsons " are amongst Britain's most powerful express engines, and they successfully deal with 460-ton trains at high speed. The pioneer has already touched the 80-mile-an-hour pace which marks the fleet locomotive, and later with a 600-ton train she gained time quite easily on a fairly tight schedule. The " Lord Nelsons " may be taken to be the nearest approach to the Great Western " Castles " yet seen, the tractive effort of these engines being within a few pounds of each other. The Lancashire and Yorkshire were another convert to the six-coupler in 1905, and they

produced a four-cylinder engine which, with a little enlargement, in later series, are amongst the most powerful engines on the L.M.S.

The Great Central also came to the six-coupled express engine in the early part of the century, and conducted some useful experiments by building two series of engines, whose only difference was in the matter of coupled wheels. In the long trials which followed there was little to chose between the 4–4–2s and the 4–6–0s, but later practice showed a tendency to the latter type, some fine outside and inside cylindered engines being brought out.

The Caledonian brought out their celebrated "Cardeans" rather more than twenty years ago, and although the class was limited in numbers, with coupled wheels of relatively small diameter, some splendid work was done with them. Later the wheel diameter and boiler dimensions were increased, and a further batch of the latest Caledonian design was added to the L.M.S. stock after the grouping.

Finally, we have the Glasgow and South-Western's handsome 4–6–0s which still do good work in the uniform of the L.M.S.

Without question the six-coupled engine is the predominant British express type, and so long as trains increase in weight, largely due to the greater comfort given to the passenger, the 4–4–0 and 4–4–2 must be allotted the secondary expresses.

V

THE ATLANTIC AND PACIFIC LOCOMOTIVES

WHAT gave us the "Atlantic", and in what way does the type mark an improvement on the cheaper four-coupler? I think we shall be safe in saying that our engineers realised that if the four-coupler was to hold its own (this before the merits of the six-coupled express engine were even guessed at) it must be given a much larger boiler. To do this an extra pair of carrying wheels must be given, since the extra weight could not be added to the coupled wheels. So the trailing wheels were added, and by their small diameter they allowed the fire-box to be greatly enlarged. In the four-coupler the fire-box had to be placed between the last pair of coupled wheels—thus restricting the width of the fire-box, but in the "Atlantic" the fire-box could

be brought right out over the frames, with the trailing wheels well below it.

The "Atlantic" type came from the States, and they were in use there long before our designers thought they would be suitable for British railways. As regards this country we owe their introduction to Mr. Ivatt, on the Great Northern, who brought out his famous "990" class in 1898.

Mr. Ivatt had come to the Great Northern from an Irish railway, and he found that wonderful locomotive tradition in full being of which the foundations had been laid by Archibald Sturrock, and then built up by Patrick Stirling. The fine eight-footers were taking loads which on the rival North-Western were being given to two engines, but it was obvious that their limit was reached if not passed.

Ivatt tried to improve the fine stud of "singles" by re-building them with larger boilers, incidentally giving them domes in place of the perforated collecting pipe. Then he turned round to see what else

could be done, and he built three distinct types; these were the fine inside cylindered " singles ", the four-coupled class which though good engines were never intended for first class work; and finally the third type, which we are about to consider.

This first " Atlantic " in Britain is noteworthy in many respects, so we will take particular notice of its leading dimensions. Outside cylinders, $18\frac{3}{4} \times 24$, were employed, and they were placed in a slightly inclined position. They drove on to the second pair of coupled wheels. This meant a very long connecting rod, having a length of 10 feet between the centres. The coupled wheels had a diameter of 6 feet $7\frac{1}{2}$ inches.

The boiler was a decided novelty on the Great Northern, being 14 feet $8\frac{1}{2}$ inches long, with a diameter of 4 feet 8 inches. The engine weighed 58 tons without its tender. Unique amongst Great Northern locomotives of that day it was given a name " Henry Oakley ", that of a popular general manager.

For two years Mr. Ivatt watched his experimental engine and then finding it had more than justified itself, he built ten similar machines. A further ten brought the class up to twenty-one, and it was seen that the locomotive problem was solved on the Great Northern for some years.

Unfortunately, the coming of the " Atlantic " meant the doom of the " single " and as each new monster appeared it was certain that one of the eight-footers would reach her long home.

Still the loads went on growing, but Mr. Ivatt did not find it necessary to alter his type—all that was wanted was a larger boiler.

In the " 251 " class an ample boiler was provided, but even with the greater boiler, the cylinder dimensions of the " 990 " class were slightly reduced. The new boilers were 16 feet 2 inches with a girth of $5\frac{1}{2}$ feet. An immense heating surface is provided with the wide fire-box and numerous tubes, totalling in all 2,500 square feet whilst a steam pressure of 175 lb. is used.

For more than twenty years the " Atlantics " answered all calls made on them, although on practically every other great railway the six-coupler had been adopted as being something better still. As we shall see the Great Northern took another forward step, which meant that the " Atlantics " were, in 1923, in the same position as the " singles " were twenty years earlier.

The great feature of the " Atlantics " had been the steaming properties of their huge boilers; thus very large trains had been hauled without assistance, whereas on other lines piloting had been freely resorted to with similar loads.

A year after the " Atlantic " appeared on the Great Northern an extremely fine specimen of this type appeared on the Lancashire and Yorkshire, unique amongst " Atlantics " in that it had inside cylinders. These had massive boilers with cylinders 19×26, and large driving wheels 7¼ feet in diameter. The boilers were 15 feet long with a girth of 4 feet 10 inches. As the tenders of these engines were fitted with

water pick-up apparatus the total weight of engine and tender was of the moderate total of 89 tons. These engines are now considered obsolete and their scrapping has been commenced.

The Great Western tried the " Atlantic " soon after the Great Northern had made it their standard express engine, but here it did not find much favour and the engines of this type were rebuilt to the 4–6–0 formula as opportunity offered.

The " Atlantic " first appeared on the North-Eastern in 1904, and in seven years several distinct types appeared—all of them good. One of the last came from the hands of Sir Vincent Raven who retired under the grouping system. In the engine referred to we find three cylinders, $15\frac{1}{2}\times26$. The coupled wheels of this class were 6 feet 10 inches with a high-pitched boiler 15 feet 10 inches long; girth 5 feet 6 inches.

The Great Central was another line on which the " Atlantic " made a distinct impression, three types appearing within a space of five years. The first of these came

out soon after the London extension was opened, and displaced the " singles " and the four-couplers on some of the best trains.

It seemed absurd to see huge " Atlantics " hauling four coach trains which a small " single " would have rejoiced in. But the new trunk line was looking ahead, and its directors knew that the speed at which these lightweights were booked would ultimately attract sufficient traffic to make them something like the trains then running on rival routes. " Better to be ready ", said the locomotive chief, and ready they always were.

In all the classes of " Atlantics " the same size has been kept for the four-coupled wheels, i.e. $6\frac{3}{4}$ feet diameter, but the cylinders, their arrangement and dimensions, have varied considerably.

In addition to the big companies already mentioned, the London, Brighton and South Coast have also tried the " Atlantic ".

When Mr. Marsh came from Doncaster to take charge of the Brighton locomotive

stud he was so impressed by the excellent work done by Ivatt's " Atlantics " that he brought out a few engines so similar that, save for their uniform, we might think the London and North-Eastern had really reached Brighton and the South Coast generally. Actually, when we come to look for details, there are differences between Marsh's " Atlantics " and those which first saw light at Doncaster. The coupled wheels are smaller by about half a foot, since harder running is found on the Southern Railway. And there are other minor points into which we need not go.

On one Scotch railway the " Atlantic " was a most popular type; this was the North British, the greatest of the pre-group railways in the land of the Thistle.

The principal type was introduced by Mr. Reid some years ago, with outside cylinders, 20×28 inches, driving coupled wheels $6\frac{3}{4}$ feet in diameter. These huge machines weigh nearly 120 tons, including, of course, their tenders. Mr. Chalmers brought out an even larger edition, equipped

with super-heater, with an inch larger cylinder diameter and an increase in weight of about two tons.

That brings us to the end of the " Atlantic " type—a very popular and useful one, possessing all the advantages of the 4–4–0 with the added efficiency due to larger boilers and fire-boxes.

A good deal of controversy raged round their introduction, several well-known experts arguing that, in view of the much greater expense involved in building them, the results obtained were not worth while. This, I think, accounts for the fact that such pre-group companies as the North-Western, Midland, Great Eastern and South-Western never possessed an " Atlantic ". Certainly, the coming of the 4–6–0, whose arrival on the North-Eastern coincided with the advent of the " Atlantic " on the Great Northern, put a very powerful antagonist in the field.

In a sense the " Pacific " is as much the successor of the " Atlantic " as it is of the 4–6–0, and we may claim that it embodies

the advantages found in both. The six-coupled wheels of 4–6–0 are retained and there is also the gain of the larger boiler, with the huge fire-box of the " Atlantic ". And in addition we get proper weight division for such a huge engine as the " Pacific " must necessarily be.

The latter type appeared first on the Great Western—in 1908, one engine only being built. It was subsequently found that the fine 4–6–0s of the various classes can do what is required, and they are cheaper to build; also the engineers of the Great Western were rather afraid of the " Great Bear's " overall dimensions. This meant that her activities were confined to certain sections of the line, which is uneconomical.

The " Great Bear " was virtually scrapped a few years ago and her major fittings utilised for a " Castle " type of engine named " Viscount Churchill ".

Fourteen years had to pass before any rival " Pacifics " were at work in England, and then, within a few months, we find a

couple of fine fellows appearing on two railways which had long held a reputation second to none for locomotives. These were the Great Northern and North-Eastern respectively. Between the former and the Great Western there has always been considerable locomotive competition, because both lines began with speed ambitions. Brunel looked to speed to justify his more expensive broad-gauge metals, and the Great Northern came along in the teeth of opposition from the North-Western and kindred companies.

It follows, then, that their locomotives have always been just a little in advance of current practice.

Doubtless the war years stayed Mr. Gresley's hands on the Great Northern, and he had to be content with the " Atlantic " tradition which he found when taking over on Mr. Ivatt's retirement. But he was quickly at work when the Armistice came, and allowed plans which he had made for better goods and " mixed traffic " engines to mature.

Very soon after his first " mixed traffic " engines were running there occurred the disastrous coal strike of April 1921, and the question of running adequate train services was a problem for the railways. On the Great Northern it was tackled by running huge trains, loading up to 600 tons, with the big " Mogul " mixed traffic engines. On these trains they acquitted themselves like heroes, and probably their performances finally decided Mr. Gresley on the building of " Pacifics ". His first engine was appropriately named " Great Northern", having been put in service in the closing months of this railway's existence as a separate company. Her leading dimensions are: three cylinders, 20×26 inches, driving coupled wheels 6 feet 8 inches; steam pressure 180 lb.; heating surface 3,455 square feet; total weight of engine and tender 148¾ tons.

The other section of the London and North-Eastern—the old North-Eastern—also adopted the " Pacific " a few months after the monster of Mr. Gresley's design

L.B.S.C. "Pacific" Type of Tank, War Commemoration Engine

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[*Photo : G.W.R.*

THE BOILER SHOP, LOCOMOTIVE WORKS, SWINDON

came out. In general outlines it follows the Great Northern engines, but one is particularly struck with the very neat planning. As a rule the bigger the engine the uglier, this is not so in the " Pacific " type.

Even the neat brass beading was kept at a time when rigid economy has banished it from the engines of former users.

Her leading dimensions are as follows: Three cylinders 19×26, the cylinders and steam chests being in one casting. Coupled wheels have a diameter of 6 feet 8 inches, three safety valves of the Ross type are fitted to the boiler, which has a steam pressure of 200 lb. per square inch. Like similar engines on the Great Northern section of the L.N.E.R., superheating was adopted with great success. The weight of the engine and tender is officially given as 148 tons 2 cwt.

No new engines have been added to the first batch, though recent rebuilding of some of them with improved boilers has increased their efficiency. On the other hand the Great Northern type of " Pacific "

has been largely added to until more than fifty are at work. Some of the earlier engines have had new boilers with higher steam pressure, thus increasing their efficiency, whilst all new engines will have the improved boiler and the corridor tender for non-stop running.

VI

HIGH-PRESSURE COMPOUND LOCOMOTIVES

THE coming of the L.N.E.R. high-pressure compound 4–6–4 marked the greatest departure from current practice ever seen on a British railway. It is quite evident, in the new engine, that Mr. Gresley is well satisfied with his present design of what we call chassis.

He carried it forward nto the newi model, and this is the first great point for notice. Should " No. 10,000 " (we hope the designer will give it a name ere long) prove successful in all major respects, it will not be difficult to rebuild the present " Pacifics " to conform to it. It is mainly a question of a new boiler.

The boiler is the greatest departure from anything seen in Britain, and Mr. Gresley was not afraid to take a step about which

many of his compeers might have hesitated; he went right outside for his design and its construction. The success of the water-tube boiler has been demonstrated so clearly in naval ships that it is now becoming the standard on certain types of commercial craft. What then more reasonable than that this clever engineer should consider the question of applying it to the locomotive?

But he did not go farther with the idea until he had ascertained beyond all manner of doubt that there was a reasonable chance of its success on wheels. We must never overlook that as regards stationary, marine, and locomotive boilers each presents an entirely different problem, particularly when, as in the first two cases, the demand for steam is more or less regular, whereas in the case of the locomotive it varies with every mile that the engine runs.

After experiment Mr. Gresley determined that his water-tube boiler should be pressed to 450 lb. which, observe, is exactly double that of the highest regularly used on any number of British engines. This huge

boiler has two water drums on either side of the fire-box, and these are connected by a series of tubes to a single upper steam drum.

It should be stressed here that Mr. Gresley is after economical steaming capacity rather than mere power increase. The heavy cost of coal necessitates this step, and the general Press in their announcements have rather overlooked this important factor, and stressed that "No. 10,000" was for faster trains, one paper even going so far as to state that speeds of 100 miles per hour were aimed at. Most certainly Mr. Gresley has no such intentions, and we would wager that no increase of speed will be found on the L.N.E.R. because of this innovation in locomotive design.

The following are brief details of this fine engine: diameter of driving wheels, 6 feet 8 inches; cylinders, (2) high-pressure, 12×26, (2) low pressure, 20×26 inches; total weight of engine and tender, 166 tons (all on); length over buffers, 75 feet 4 inches. The engine was constructed at the

Darlington Works of the London and North-Eastern Railway, the home of many famous engines of which perhaps "No. 10,000" may one day be written down as the most famous.

The experimental high-pressure locomotive which the London, Midland and Scottish Railway decided to build in conjunction with the Superheater Co. Ltd., at the works of the North British Locomotive Company is now running.

The design of this locomotive follows the "Royal Scot" class with regard to the frame, but in this case the engine is a three-cylinder compound, the high-pressure cylinder being situated between the frames and the two low-pressure cylinders outside the frames. The boiler provided is of the Schmidt high-pressure type. The design of the latter is based on that of the experimental boiler which was built for one of the Continental Railways the trials of which were entirely satisfactory.

The Schmidt high-pressure boiler consists of three distinct systems of boilers,

each carrying a different pressure. The system having the highest pressure, 1,400 —1,800 lb. per square inch, the variation in pressure depending on the rate of firing, is in the form of a " closed circuit " consisting of a number of pipes which form the sides, roof and back end of the fire-box. These pipes are connected at the bottom to a foundation ring, and at the top to equalizing drums being expanded thereinto. From the equalizing drums, pipes are led to evaporating elements which are situated in the high-pressure drum.

This closed circuit is initially filled to a pre-determined level with pure water, and this latter is the medium by means of which heat is transmitted from the fire-box to the evaporating elements in the high-pressure drum, which furnishes steam at 900 lb. per square inch for the high-pressure cylinder of the locomotive. This drum is of nickel steel, but is not in contact in any way with the fire. It is fed by water drawn as required from the low-pressure boiler by means of a pump.

The low-pressure boiler occupies the same position as the barrel of the normal locomotive boiler, and the water is evaporated by the gases passing through the boiler tubes. The barrel on this low-pressure boiler is also of nickel steel, but both tube plates are of mild steel.

An ordinary live steam injector is provided on the driver's side and an exhaust steam injector on the fireman's side of the engine to feed the low-pressure boiler.

As steam is raised much more quickly in the high-pressure drum than in the low-pressure boiler, arrangements are made to deflect, by means of an intercepting valve, any excess steam from the high-pressure drum into the low-pressure boiler, thus avoiding waste through blowing-off.

The method of working this locomotive is more or less normal. The regulator handle works both the high-pressure and the low-pressure regulator simultaneously. On opening the regulator, steam is admitted into the high-pressure cylinder after passing through the high-pressure superheater,

situated in the lower boiler tubes. Exhausting from the high-pressure cylinder the steam enters a mixing chamber where it is met by low-pressure steam at 250 lb. pressure, which has previously passed through a low-pressure superheater situated in the upper boiler tubes. From the mixing chamber steam enters the two outside cylinders and thence to the exhaust.

VII

LOCOMOTIVE PRACTICE AFTER THE GROUPING

At once it may be said that the prophecy of the experts before the grouping has largely come true—viz., that it has been a period of settling down without any far-reaching changes in locomotive designs. In each of the four groups we have chief mechanical engineers in charge who, at the grouping, were at the head of individual railways forming those groups. Thus, Sir Henry Fowler[1] of the London, Midland and Scottish, had long been in the chair at Derby, looking to the interests of that famous stud which ran under the Midland colours; Mr. Henry Gresley, who was chief of the Great Northern locomotive department, holds the wider sway on the London and North-Eastern; Mr. Maunsell was at Ashford in charge of the South-Eastern and Chatham

[1] Since promoted to a high executive post.

stud, and now he takes the more important chargeship of the Southern. Finally, Mr. Collett who had just taken his position at the head of the Great Western Works at Swindon, remained for the work of the greater Great Western. With all these well-tried locomotive designers retaining their positions, albeit with added responsibility, we should not expect to find them introducing revolutionary changes in designs. Already each had distinguished himself with the creation of efficient locomotives; in the settling down period it seemed desirable to concentrate upon the augmentation of these designs, and look carefully forward to probable traffic developments. Especially was it their task to complete the general overhaul of machines, which was so important a part of the post-war railway policy, and again to weed out any which age or loads had rendered unfit for the duty of the day.

In all these circumstances we may well appreciate the fact that nothing really startling has been done on any of the great railways. Perhaps the London, Midland

and Scottish have had the hardest task. Not only is it the biggest of the groups, embodying several first rank railways, but it may be said, on general lines, that here was the need for most careful policy. In the first place, the chief mechanical engineership went to a gentleman who was at the head of one of the smaller big companies—the Lancashire and Yorkshire—whose locomotive needs might conceivably not be those of the larger companies. But Mr. Hughes rose to the occasion, and though he introduced no startling new designs, he did strengthen the stud with many of his well-tried four cylinder 4–6–0s, whose only fault is that they were not really big enough for the task which they had to perform. These had cylinders (4) $16\frac{1}{2}\times26$ inches with $6\frac{1}{2}$ feet driving wheels. They are very good engines, but are not new in design, their fore-runners (slightly smaller and superheated) having come out as far back as 1908. The new machines were sent to displace some older North-Western locomotives of the " Claughton " and " Prince

of Wales " class upon the heavy gradients between Preston and Carlisle, and here, for a time, they were the heaviest engines at work. Mr. Hughes, as a swan song before his retirement, gave the L.M.S. a tank edition of these Horwich 4–6–0s—these were the large " Baltic " tanks, which are, at the moment of writing, still the biggest passenger tanks on the L.M.S. In all details which matter the " Baltic " tanks are simply the 4–6–0s with side tanks instead of tenders. They weigh within three cwt. of the level 100 tons, and are really magnificent machines, though not numerous as yet.

One distinctly new type appeared in the summer of 1926—this was a new " mixed traffic " engine of the " Mogul ", or 2–6–0 type. A huge machine, but distinctly ugly round the motion portion. Utility, not grace, is apparently the motto on the L.M.S., if the latest " mixed traffic " type is a criterion.

One hardly thinks of the Midland at all in this heavy looking engine, but we are assured that though the locomotives

have been built at Horwich, and resemble the output of those works in many details, such as boiler, etc., Sir Henry Fowler is really responsible for them. The new engines have two cylinders, fixed at an angle, with dimensions 21×26 inches, driving wheels 5½ feet in diameter. The valve gear seems unduly complicated, and is an adaption of the popular Walschaerts motion.

The boiler is of the telescopic, two plate type, carrying a working pressure of 180 lb. A superheater is fitted, and a capacious Belpaire fire-box, 9 feet in length, is a prominent feature, the grate area being 27½ square feet. The total heating surface, including that of the superheater, is 1,828 square feet. The engine weighs 66 tons, of which all but 11 are available for adhesion. The tender is of the Midland type, of the self-trimming variety, and it carries 5 tons of coal and 3,500 gallons of water. Its weight loaded is just over 42 tons. At 85 per cent of the boiler pressure, the tractive effort is 25,800 lbs.

Other interesting features of locomotive development on this railway, since the date of grouping, are the multiplication of the well set up 0–6–0s, of the Derby design, many of which have been built at Crewe; all are superheated, and they form a stud of essentially hard-working machines, simple in construction, and economical in upkeep.

A few of the 4–6–0 " Claughtons ", and a greater number of the inside-cylindered " Prince of Wales " express class, of the same wheel formula, have come out, but since 1923, engines of purely North-Western design have been pushed into the background by the fact that the two chief mechanical engineers have been Horwich and Derby men respectively. The Caledonian's 4–6–0s have been added to and some good tank engines of this railway's standard pattern have been placed in service.

The outstanding locomotive feature of the post-group development on the L.M.S. has been the rapid increase in the number of three-cylinder 4–4–0 compounds. Excellent engines in every respect, but scarcely

adequate for the very heavy trains found on the various main lines of this big group.

Sir Henry Fowler has been blamed, in some quarters, for adding so rapidly to a class of engine which lacks great tractive effort, especially when the vast number of powerful 4–4–0s of various designs are available for the medium and light-weight trains, especially, too, when the amount of double-heading on the L.M.S. is considered. But quite a good deal of the criticism is of the usual ill-informed variety, and has been largely based upon some garbled accounts of the working of the newer compounds.

In point of fact some of them were assigned to North-Western drivers, many of whom had a rooted objection to compounds, because of their vivid and painful recollections of the failure of the Webb three-cylindered machines, built on the compound plan. Mishandled, the fine Derby compounds could not achieve even moderate results. But those drivers who undertook duty upon them with an unbiased

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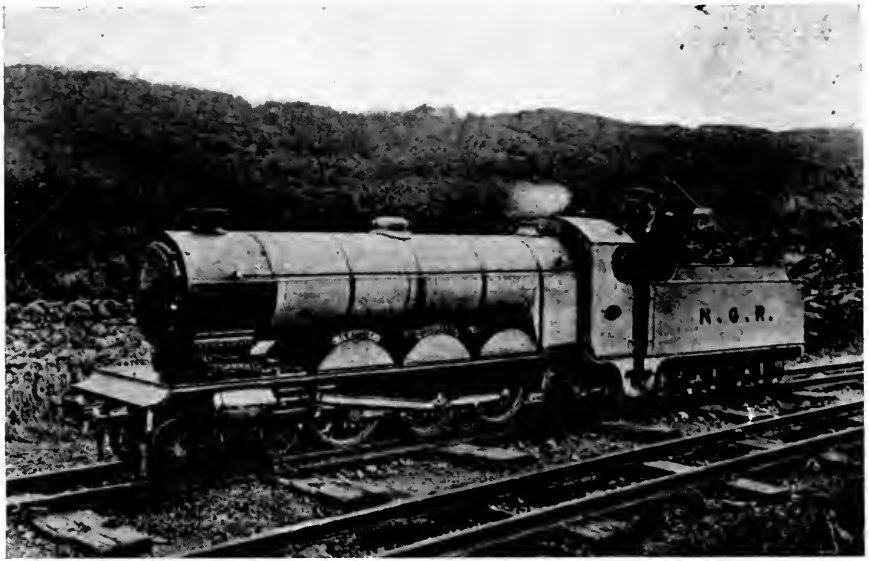

[*Courtesy of Eskdale Railway*

A Locomotive of the Ravenglass and Eskdale Railway

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THE DOWN "FLYING SCOTSMAN" PASSING RESTON [*Photo : L.N.E.R.*
Drawn by 4-6-2 Engine "Dick Turpin"

mind, and a desire to understand their working, have nothing but praise for the three-cylinder machines, some of which have put up really remarkable runs under capable handling. As to fuel economy, there can be no question, always supposing they are carefully fired.

So pleased is Sir Henry Fowler with the results attained with expresses deemed to be beyond the four-coupled engine, that he went on to design a three-cylinder 4–6–0 high-pressure compound. This after it was erroneously announced that a four-cylinder compound " Pacific " was building; the " Pacific " machine got only to the planning stage. But there are those who think it should go farther, and embody all the excellencies of the " Smith " compounds of the Midland design, with the load pulling and speed of the " Kings " of the Great Western, or be capable of the extremely fine work done by Gresley's " Pacifics ".

We may now pass to the London and North-Eastern. Elsewhere we have dealt with the two fine " Pacific " types found on

this famous railway. There is no need therefore to recapitulate their dimensions, etc. We may just add that these two types were introduced in the last year before the grouping took place, and that after the order for the Raven "Pacifics" had been executed, no other engines of this class have been added. But Mr. Gresley continues to add to his stud, and no suggestion is made that anything new is likely for the heavy expresses.[1]

"Atlantic" building has ceased, and the type may be regarded as practically obsolete. This does not mean that there is any scrapping yet of the splendid machines which ran upon four distinct sections of the present London and North-Eastern. Indeed, many of the best trains are still hauled by the classes which saw daylight at Doncaster, Darlington, Gorton (Great Central) and Cowlairs (North British). But it is significant that for the lighter expresses, the 4–4–0 Great Central type, known as the "Director," has been built in considerable numbers.

[1] Excluding of course the experimental high-pressure locomotives already noted.

These are remarkably fine inside-cylindered machines, and it may be said that Mr. Gresley has determined to reduce, as quickly as possible, the numerous classes on each of the amalgamating companies. Here the problem seems more simple of solution than on the L.M.S., due mainly to the fact that Mr. Gresley has been in charge right from the grouping date.

One innovation was tried by Mr. Gresley —this was the placing of a booster under the footplate of one of Ivatt's " Atlantics ". The experiment was found to be not worth while. So the " Atlantics " will finish their course unaltered possibly within the next ten years.

The most notable changes or rather experiments, introduced by Mr. Gresley are found upon the goods side. Here he has begun two experiments which may have far-reaching effects. First he set himself to get a more powerful goods engine, of what may be called the ordinary design —this as distinct from engines of what we may term out-size design,—such as articulated and turbo-electric types. Gresley

decided that the main thing was the boiler, and his desire is to keep his designs standard as regards boilers and motion. For this reason he has taken the " Pacific " boiler for his " Mikado " type of goods engine, whose wheel formula is expressed 2–8–2. These engines are specially designed for the heavy mineral trains in the Peterborough district, but when it is seen that the bigger engine is worth while, the class will be added to, and their activities extended also. In many respects they follow the 2–8–0 mineral engines of the same designer's building.

The other innovation is the introduction of the " Garratt " articulated engine, introduced for banking duties in place of a couple of smaller machines. The " Garratt " deserves more space than can be given here. Truth to tell, these British-built engines have secured greater recognition abroad than at home, but the L.M.S. are also turning to them and have over thirty in service.

The Great Western locomotive practice since the grouping can be dismissed in a

few words. Here there is one railway only to consider where locomotives are concerned, Mr. Collett knows his business thoroughly, and the "Castles" and "Kings" answer all the calls made upon them. The former have four cylinders 16×26 inches driving coupled wheels 6 feet 8½ inches, and possess a tractive effort of 31,625 lb., whilst a substantial increase has been attained in the later "Kings". Goods practice has not varied since the grouping, and no new types have been noted, the work being well done by 2–8–0 and 2–6–0 engines, which have been built in comparatively large numbers.

On the Southern we have the arrival of the "King Arthurs" in considerable numbers and in smaller numbers the larger "Lord Nelsons". These are found everywhere on the system, the newer engines having been given shorter chimneys and other minor details.

The "King Arthurs" have two cylinders, 20½×28 inches, driving wheels 6 feet 7 inches in diameter, and heating surface of

1,878 square feet. They have done, and are doing magnificent work. The later "Schools" class are at once the biggest and most powerful 4–4–0s in the kingdom. These have very similar boilers to the "King Arthurs".

They have been designed to run over lines where the 4–6–0 is not permitted.

The goods engines have also grown in size and therefore in power with wheel formulae of various kinds and the tank engines have largely followed the tender wheel formulae and dimensions of the passenger locomotives.

On the 1st of May, 1928, the London and North-Eastern Railway inaugurated the longest non-stop run, regularly performed either in this country or abroad. The distance between London and Edinburgh is 393 miles, and the time taken by the non-stop train is $8\frac{1}{4}$ hours, which is exactly the the schedule of the trains which make the usual stops.

During 1927, both the London, Midland and Scottish and the London and North-

Eastern ran non-stop trains for rather more than half their respective journeys, stops being made at Carlisle and Newcastle respectively. The runs were not spectacular in any way, no attempt being made to improve on the existing schedules. On the other hand they had a distinct publicity value, and it is more than probable that the railways concerned have considered this as the main factor in making the much longer non-stop run.

It is interesting to note that in 1928 the London, Midland and Scottish stole a march on their rivals by dividing the " Royal Scot " express, which leaves Euston daily at 10 a.m., running each portion non-stop. The Euston to Edinburgh portion was worked by " No. 1054 " of the Derby standard compound type of 4–4–0 express engine; the Glasgow portion was worked by one of the 4–6–0 " Royal Scot" class of locomotives. Both at Princes Street, Edinburgh, and at the Central Station, Glasgow, there were huge crowds assembled to witness the arrival of these non-stop

trains. In each case double crews were carried on the locomotives so that relief could be given from time to time on the approximately 400 miles of journey.

The London, Midland and Scottish demonstrated very clearly that, without going to the expense of corridor tenders, they could quite easily run competitive non-stop trains; on the other hand it is equally certain that the engine-men did not get the rest from their duties as on the London and North-Eastern.

The " Flying Scotsman ", easily the best known train in Britain, has also been divided. The non-stop portion leaves at the usual hour, i.e., 10 a.m., and is followed five minutes later by the train which calls at the usual intermediate stations always served by the " Flying Scotsman."

The writer was fortunate enough to make a trip on the non-stop portion of this famous train soon after its inauguration. Quite apart from the publicity value to the railway, there can be no question that the non-stop train has a definite advantage to the

passenger. Not only is it possible to book seats in advance, but assuming that the compartment is not filled, there is the knowledge that it will remain so throughout the journey.

The trip was made on a Saturday, when the train fills up far more than on the rest of the days of the week. One of the special features noted in connection with this journey was the huge crowd assembled at the platform to witness the "Pacific" locomotive backing down to its train. There can be no question but that public interest in our railways has been largely fostered by their post-group development; particularly is this true of the locomotives. It is almost impossible now to go to any big terminus without finding a group of interested people watching the locomotives at their work.

There was, on this Saturday in May, a far larger crowd to see the train go out than travelled upon it.

The make-up of the train was as follows: engine, "William Whitelaw", fitted with

corridor tender; composite coach, the first compartment of which was reserved for the resting engine-men; 3rd class coach; composite 1st and 3rd class; 3rd class restaurant car; kitchen car; 1st class restaurant car; 1st class coach; composite coach (containing hair-dressing saloon, ladies' retiring-room, and five 3rd class compartments); then followed two more 3rd class coaches and the brake-van. The length of the train including the engine exceeded 700 feet, and the weight 500 tons.

Promptly to the minute we got away from King's Cross and tackled the continuous and heavy climb through North London. It was obvious that the big engine, though having its train well in hand, had to go all out, but once up the incline the running became very steady. The margin saved by omitting the station stops is utilised for slower speeds. It is rather remarkable that neither of the rival companies has seen fit to make any reduction in the running time in view of the saving effected by the omission of the intermediate stops. The time

is not as good as many years ago, and there would not be the slightest difficulty in bringing the schedule to 7 hours 45 minutes instead of the present $8\frac{1}{4}$ hours occupied between London and Edinburgh.

It should be mentioned here that the corresponding trains leave Edinburgh at 10 a.m. and 10.5 a.m., for London.

From a working point of view it is doubtful whether the double manning of an engine, and the running of it such a great distance without a stop, is a good policy; in the first place there is the double crew, a serious item in these days when economy is the first thought in the minds of railway directors.

It may, of course, be argued that in any case four men would have to handle the train if an intermediate stop were made and the engine changed. Against this, however, it may be contended that as the double crews are employed for more than eight hours there is a certain wastage here, whereas with shorter trips it would be possible for the men to return to their

headquarters each day. Assuming for the moment that it is desirable to maintain the non-stop, i.e. to miss intermediate stations, it could still have been possible to change engines outside a half-way stop, and still secure to the passengers the freedom from interference which is such a valued asset at the present moment.

Several of Mr. Gresley's powerful "Pacifics" have now been fitted with the corridor tender which has the same fuel and water capacity as those of the usual description. To secure this, it has been necessary to lengthen and heighten the tender. Access from the tender to the corridor of the first coach is gained by a side passage which has a width of 18 inches and a height of 5 feet. Steps at each end of the tender afford access from the end of the gangway or corridor to that of the engine footplate at the front and the vestibuled coach at the rear.

Circular windows are provided, one at each end of the corridor for lighting the interior. This arrangement is a singularly

neat one. The tender is carried on eight wheels with rigid axles and weighs 62½ tons which is about 6 tons heavier than that of the standard variety. On some of the new tenders, the coal capacity has been increased by one ton and a door is provided at each end of the corridor on the tender.

The original arrangement for the relief of the driver and fireman was timed as the train passed Tollerton, which is as near as possible half-way between King's Cross and Edinburgh. It is thought, however, that in practice the engine crew will change over twice during the run.

New trains have been designed and built for this non-stop service. The addition of a hairdressing saloon was well worth while and during the writer's trip it was well patronised.

In connection with the hairdressing saloon it was observed that a waiting-room was provided, this enabled prospective customers to wait their turn without having to go back to their compartments.

A newspaper and book service is also provided, and this was of great assistance to the traveller who could get through a good deal of reading on such a long journey. The meals served from an electrically-fitted kitchen were quite up to the standard one has learned to expect from the London and North-Eastern. If any criticism is possible, it is that our coach designers should endeavour to get more even travel for the restaurant cars. My own impression is that they are far too heavy and because of this are given 6-wheeled bogies which always seem to give a bumpy journey. It was quite impossible to drink liquids at certain parts of the trip; on the other hand the ease of travelling on the ordinary passenger coaches was remarked upon by all users. It should be made clear that the criticism is not levelled at the London and North-Eastern only, for the same trouble is experienced on the London, Midland and Scottish and other railways.

The running was persistently before time and the train finally drew up seven minutes

early at Princes Street, Edinburgh. This was very creditable as there were several permanent-way checks during the early part of the run.

It was noticed as the train ran through stations that there were groups of interested onlookers keen on seeing the famous " Flying Scotsman " in its new guise. About 7 tons of coal were consumed en route, and six times the water scoop was let down for replenishing the tanks. On the whole the engine-men favour the new arrangement and all of them were loud in their expression of approval of the remarkably fine engines employed on these heavy trains.

It was learned that good class coal has been specially stipulated for use on these runs, although the " Pacifics " have the reputation of burning anything; they have also been provided with shaking grates.

In conclusion there can be no question that the renewed competition between East and West Coast routes has stimulated

intensely the interest in these railways, and the spectacular runs here described are almost certain to help them in their fight against the increasing competition of the motor coaches, several of which now run between London and Scotland.

[Face page 112

[Courtesy of S. & D.R.

ONE OF THE TWO "SENTINEL" SHUNTING ENGINES WHICH SHUNT THE COLLIERY SIDINGS AT RADSTOCK

Face page 113]

[*Photo : L.M.S.*

THE IRISH MAIL LEAVING THE MENAI BRIDGE

VIII

THE LOCOMOTIVE IN THE ISLE OF WIGHT

THE greatest change, since the Southern took over the Island Railways is found in the locomotive stud.

An attempt at standardization has been made, which could never have been effected whilst three companies served the island. No fewer than sixteen 0–4–4 Adams tanks are now in service, some of them apparently rebuilt with Drummond boilers, since most of them have the two pop valves upon the dome—a feature long familiar upon the old South-Western. These are numbered from 17–32 but there are many blanks in the preceding numbers.

When the Southern took over, they filled 1 and 2 vacant in the Central list by numbering the 0–6–0 saddle tank and the Brighton "terrier" taken over from the

Freshwater company. The terrier has a long record already and is still going strong.

One of Mr. Stroudley's famous band of fifty, she passed to the South-Western, and by that company was rebuilt with a Drummond boiler; then, after service on the Lyme Regis and other small branches, she was acquired by the Freshwater line when it decided to work its own trains in 1913.

The old terrier celebrated her jubilee in 1926, and was originally No. 46 "Newington" on the Brighton system, becoming 734 when sold to the L.S.W.R. in 1903.

The saddle-tank was built in 1902 by Manning Wardle of Leeds, and I fancy she was re-boilered soon after the Armistice.

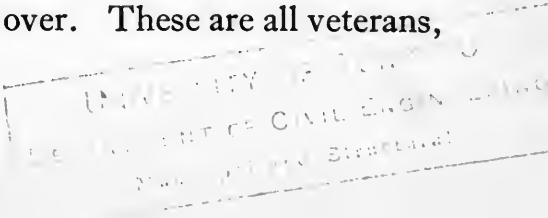
No. 3 is named "Carisbrooke" and No. 4 "Bembridge", both of them terriers. Nos. 5–8, 14 and 15 are vacant, the Central and Isle of Wight companies' engines which bore them have all been scrapped.

The old 4 and 5 were built in 1876 for the opening of the Newport and Ryde Railway, and bore the names " Cowes " and " Osborne ".

No. 6 was easily the biggest engine running in the island until the Southern took charge, and it had the wheel formula 4–4–0. She was also the only outside-cylindered engine seen on Wight metals within recent years.

No. 7 was a second-hand 2–4–0 from the Midland and South-Western Junction Railway, and she gave twenty years' good service to the Central, getting in forty-four altogether, before she went to the scrap heap at Ryde. She was built by Beyer Peacock & Co., also No. 8, which was one of the last engines to be scrapped, came from those famous works, having been purchased new by the Central in 1898.

She was employed in her last days on the branch line services, sharing them with 9, 10, 11 and 12, the remaining engines of the Central to be taken over. These are all veterans,



four of Stroudley's terriers—possibly the finest tank engines—for their size—which have run upon rails.

No. 9 was scrapped and replaced by a similar machine bearing the name "Fishbourne".

No. 11, now "Newport", formerly 40 L.B.S.C., and named "Brighton", gained the Gold Medal at the Paris Exposition of 1878 and incidentally ran at 50 miles an hour on the Ouest Railway of France, proving to our French friends, despite their disclaimers, that such a speed was possible, especially when run by a six-coupled engine with only 4 feet diameter driving wheels.

No. 10 is named "Cowes" and No. 12 "Ventnor". These seven famous terriers not only do a great deal of the passenger work on the branch lines of the island system, but they do most of the shunting and goods work.

The Isle of Wight Railway handed over seven engines to the Southern, all of the veterans of the 2–4–0 wheel formula, all

from Beyer & Peacock. The newest was the " Bonchurch ", (they were not numbered until the transfer) which was built as far back as 1882, whilst the " Ryde ", " Sandown " and " Shanklin " were actually turned out in 1864 when the railway was opened.

The " Ventnor " followed in 1868, the " Wroxall " in 1872 and the " Brading " in 1879. Of the oldest batch only the " Ryde ", No. 13, remains and she is probably the oldest passenger now at work, if we rule out a few machines which have been so completely rebuilt that their original form is no longer distinguishable.

Of the rest only the " Wroxall " has so far escaped the breaker-up. The " Sandown" was broken up soon after the transfer and did not take a Southern number, but the rest took numbers 13–18 in the " W " series. " Wroxall " and " Ryde " share the Bembridge trains.

It is doubtful if any engines were worked at a greater pitch than these veterans who look somewhat strange

since they changed their red coats for green.

In conclusion one may fairly add that the island has greatly benefited from a railway point of view by the change in ownership.

IX

THE BUILDING OF A LOCOMOTIVE

BEFORE anything else is done, the locomotive engineer in charge of the iron steeds of a railway puts on his thinking cap. If the new type is to be employed on express work certain facts will have to be borne in mind if, on what is called " mixed traffic ", that is taking turns on goods and passenger trains as required, there will be other factors to be considered.

If the new engine (or engines, it is usual to build them in batches) are for goods traffic, the problem is less difficult. Improvements in various ways are always being made. Can any of them be included in the new design? That is a problem to consider, because some of the improvements made in recent years have vitally affected the well-being of a locomotive. Well, first

our engineer puts down in writing some of the things which matter for his new machine. Then, having sketched out his ideas, the papers go to the drawing office, where first drawings are made. These are looked at carefully and any errors or additions dealt with. Then the blue prints are made from the drawings, usually these are made on a very large scale, often to actual scale.

Then the material required, say, for a batch of ten engines, is ordered. In the smaller works much of the locomotive will come already made, in sections; in the large ones, like Crewe or Swindon, practically everything is made from raw material.

Now we must visit the various "shops" where the different sections of locomotive building are under weigh. Suppose we start with the boiler shop? Here there are big sheets of steel being passed to and fro through rollers. We watch this with interest, wondering why so much trouble is taken. At last a plate is ready and we see that the rolling has brought it almost to

the rounded shape with which we are so familiar. The engine we are interested in is one of a batch of ten goods engines of the usual wheel formula o–6–o, but quite a modern one you may be sure. While many railways have the eight-coupled goods, the old six-coupler is still made in large quantities. If a census of engines were taken and classified according to their wheel formula, the o–6–o would easily be on top.

The boiler of the engines we are to inspect is made in three sections and we note with surprise that this boiler is built up on end, so that it towers right above us, the fire-box end being at the bottom of the boiler tower. The centre section seems quite simply made, but a glance at the fire-box end shows many curious things.

Very great care has to be taken with this important section of the locomotive. There are really two sections—the inner and the outer fire-box. Before copper was so dear the inner fire-box was always made of this useful metal, now, however, steel is largely used. We are told that the inner fire-box

is surrounded with water. From the fire-box run numerous tubes, they number anything from 150 to 350. At the smoke-box they come to an end, and as we examine this end of the boiler our attention is drawn to something which we think must be a trumpet—that is judging by its shape. That small trumpet is the lung of the locomotive; without it little could be done. The hot gases, which we have mentioned as rushing through those numerous pipes from the fire-box to the smoke-box have a double duty to perform.

Not only do they add to the boiling capacity of the fire, but they are the chief means of getting that fire to burn fiercely; the tubes would be practically useless if it were not for that trumpet. If we look at it closely we notice that it is placed so that the mouthpiece of the trumpet comes right under the chimney, the bell mouth being at the bottom. The real name of the trumpet is the blast-pipe, through which the waste steam from the cylinders is discharged to the chimney. As the steam rushes up the blast

it draws the hot gases from the fire-box up the chimney as it goes, thus creating a powerful draught. That is why the fire of a locomotive is always seen at a glowing heat, instead of like most of our fires, rather smoky and often dull. Timothy Hackworth was probably the first engineer to use the steam blast in the early days of the Stockton and Darlington, though Trevithick had in his first locomotive, turned his waste steam into the chimney to get rid of it.

The puff-puff of the locomotive is so familiar to us as the exhausted steam gets to the open air that it comes as something of a shock to find that the new experimental turbine engines, which are being tried out in various directions, are puffless—if such a word may be allowed.

It is necessary to have some means of forced draught in most of the turbine types so far evolved and the steam fan is frequently employed for this purpose.

The difficulty found with the steam blast throughout all the years which have passed has been its liability to take up and expel

red-hot cinders. From this cause has sprung many a fire, both on the railway and off; there are several cases on record where a whole train load of coaches or trucks has been set alight through a red hot discharge from the locomotive chimney, and many efforts have been made to intercept the sparks, but only with partial success.

With this short description of the boiler in its shop, we will hurry on to another department in this birthplace of the locomotive. Let us now go to the cylinder shop and see how another part of the locomotive is fashioned from shapeless steel. The pair of cylinders for our six-coupled goods engine is cast in one block of steel. Then the cylinders are bored by wonderful tools, which work just as easily as if they were working a piece of soft wood with a gimlet. Once the cylinders are bored there comes a great deal of work in fitting them with pistons, piston rods and connecting rods. Careful packing has to be done in order that they shall not leak. The cylinders

are then sent to the erecting shop, where we will follow them. Here, from many centres, various parts of our new engine have been sent. Already the frames are being set into position on trestles. We notice particularly this operation as the greatest care is taken in getting the frames absolutely square. On asking why this is done so carefully, we are told that the slightest error in this respect would probably result in the locomotive being unsatisfactory for the whole of her life. It is, indeed, a fact that in a batch of ten engines one has often been found whose work was always inferior to her comrades, and the only reason which has been advanced for this difference is that, in her building, the frames were not well and truly laid. While watching this careful frame setting we become aware of a stir near us, and a tiny little locomotive comes bustling along with a bogie truck, on which is the huge boiler that we left not so long ago in its shop receiving the finishing touches. We notice that the little engine, on its narrow-gauge

railway, has a name-plate, the name very suitable for the midget " Billy ".

An overhead crane is at work and the cylinders are lifted into the frames and made good, then comes the big boiler to be dropped into position and also made good. On come the boiler fittings, such as the chimney, dome, safety valve, cab and the many fittings of the foot-plate, such as gauges for water and so on. Then comes the boiler casing, which consists of thin sheets of steel which later on will take the livery in which the locomotive is to work.

The tender is added, and after a few more very necessary details have received attention, our newly-born engine is ready to take her first run round the sidings before she ventures too far abroad in case she stumbles. This apparently useless running about the sidings is to work the bearings into order. Then comes the trial proper when our friend is sent out with her first load, usually fairly light at first, and growing steadily heavier until she is pronounced fit for regular duties. Then she goes to the

paint shop and here, alas, she secures far different treatment to her friends employed on passenger trains—a most unfair proceeding.

What I have recorded reads as if we saw all this locomotive building accomplished in a single day, really, of course, it would be spread over weeks, though on two occasions, on the North-Western and on the Great Eastern, a six-coupled goods engine, which is the simplest kind to build, was completed in a working day.

" What is the average life of an engine? " is a question that has been asked very frequently. Strangely enough the reply would be different on most of our railways. So much depends upon the chief mechanical engineer. And of course a great deal depends upon the class of engine. I know many classes which have been rebuilt two and even three times. But the modern tendency is not to rebuild more than once; sometimes not even once.

In the last year of the War a whole class of engine was lined up in the derelict yard

and broken up at one swoop. True, there were only 12 machines in the class, but they were practically new as engines go; actually seventeen years old. Yet engines of the same type, on a neighbouring line, were retained in service ten years beyond this and some of them were doing good work until recently, though of a secondary nature. The class referred to were of the 4–2–2 wheel formula, which is now obsolete, unfortunately, for these were the most graceful and the easiest travelling locomotives ever built. It was a rare treat to ride upon their footplates.

Taking locomotives generally and upon all lines, excluding special classes which may be largely experimental, we should say that thirty years is a fair average life.

By this time a third boiler will probably be due and it is not worth while to strip an old engine for this third boiler—so she goes to the derelict road.

X

THE RUNNING OF A LOCOMOTIVE

When quite ready for regular duty a locomotive will be allotted to a shed, a shed being the railway name for a locomotive depot. Here there will be stabled many engines of different classes, from the neat tank engine to the huge express monster, though there are some sheds which stable goods engines only. Locomotive sheds are placed at important centres on the main and branch lines, and they have a number which the locomotives bear. The North-Western engines used to carry their shed numbers on the edge of the cab roof, but if you saw the Rugby shed number on an engine, say, at Coventry, it would not follow that the engine was actually stabled at Rugby. What happens is that the big sheds have little sheds under their

care and the latter all bear the mother shed number.

This particular engine whose work we will follow has a flexible brake pipe at either end of the frames, so that she can, when required, take her corner on passenger traffic. This makes the six-coupler the most useful engine on the line, for while a passenger engine can and does work goods trains, her bigger driving wheels are at a disadvantage, since they are inclined to slip with a heavy load behind the tender. In the case of the goods engine, despite rather small driving wheels, there is nothing to prevent her employment on really fast trains, and on the slower stopping passenger trains she does as well as the express engine.

Now the fact that our engine has the passenger brake affects her future straight away after leaving the works. She is placed in what is called a "link" and because she can do good work on either class of traffic, she is put in what we will call a "mixed traffic" link; that is, her duties

are mapped out for her so that she will take a share of each.

We realise how useful such an engine is when we see what she does. Let us suppose she had had a rest on Sunday, having had her clean down late on Saturday night, by the men appointed for this important work. The cleaner of to-day is the fireman of to-morrow, and the fireman of to-morrow will doubtless be the driver a few years hence—that is how they progress. Very early on Monday morning the fire of " No. 600 " is started.

At five o'clock the driver and his mate sign on duty and before doing anything else they note the traffic orders of the day, so far as they affect them. There will be a slowing over a bridge under repair, the water column at Puddleton will be out of order for a couple of days, and so on.

Then they go to the shed and look over their steed, noticing how much water there is in the tanks of the tender; the coal is already loaded upon it, having been weighed

out to them on Saturday. While our driver goes very carefully over every part of his trusty steed to see that nothing is wrong, our fireman is busy getting his coal into trim, probably breaking it up and bringing it down within easy reach of his shovel.

If it is very small stuff, he will probably use a hose upon it to dampen it. These and many other little details, too numerous to mention, receive attention and we puff slowly out into a siding. Possessing the continuous brake, " No. 600 " is naturally in a " mixed traffic " link, so now we learn that her first trip is to take a colliers' train from A—— to B——. Our shed is at C—— so we start off when our signal allows us, and run light to A—— to pick up the train of very dingy looking coaches, which have no upholstery.

The run without any train was rather exciting because our driver gave " the old lady her head." How she rocked as her rather small coupled wheels whirled round! The coupling-rods kept up a steady chant,

which seemed to rise and fall according as we dashed over bridges and embankments, or through cuttings. You must often have heard this clanking; to our surprise the driver, who seemed to know all sorts of things about his steed, confessed ignorance as to the origin of this strange noise.

"You never hear it when we have a rare good load on, but always do so when we run light, or with only a wee bit behind the tender," said he. While the driver and fireman were quite steady on their feet, just as sailors are, we swayed about and twice fell upon the coal, getting up not only sore, but more than a little grimy.

It was an autumn morning and just getting light when at 6.10 we backed down to the grubby looking coaches already mentioned.

We remarked to the driver that they seemed anything but modern. "You are right," he replied, "they were built more than fifty years ago and when they were

new, before my time, of course, they were thought the finest coaches in the country, as indeed they were."

"You will notice they have six wheels, at the time they were built, most had only four." The driver had to break off hurriedly and with his hand on the regulator waited the guard's signal to start from the station platform into which we had backed our train. What a strange looking lot of fellows these miners were, what curious passengers, and how would soft cushioned seats have fared with their coal dust laden clothes! Fine, cheery fellows, glad to have finished their spell underground while you and I have been sound asleep. No one who has lived and worked amongst them will begrudge them whatever wages are paid for their dangerous and unpleasant task.

With just a small jerk we are off and once more our five-foot coupled wheels whizz round merrily with hardly a clank of the coupling rod now. We ran downhill to A——, now we are panting up quite a stiff incline which our driver says is 1 in 95.

For a moment we pause to think what 1 in 95 can be, then, of course, we know that it means that in every 95 feet the line rises 1 foot. This is a stiff gradient for the locomotive with a heavy load, one that "Old George" would have ruled out, if at all possible.

In nine minutes we have run the five miles between A—— and B——, the miners rush out of the train and homewards, the coaches are shunted into a siding until another shift of miners will need them about noon. Off comes the gallant "600" and there is now just a wisp of steam escaping from her safety valves, which means that she has plenty of breath after her hard climb. What next? No need to ask, for already we are backing down to a coal train and in less than ten minutes we are off back to C—— where we arrive just after seven.

No rest for "No. 600", we are to take the heavy local passenger up to D——, a run of 19 miles with seven stops. We take rather a long while on these nineteen miles,

but it is not the fault of our engine, for whenever she could "get her head" she ran freely and well, at a speed nearing fifty miles an hour. But we were dead on time in the huge glass-roofed station, despite those wearisome station delays. One thing we should have noticed even had our driver failed to draw our attention to it—that was the marvellous manner our fine engine picked up speed from a stop. "That is where six-coupled wheels count," said the driver. The poor old 'single-driver' with damp rails under her, like they were this morning, would need to have travelled at sixty miles an hour between stations to make up the time lost getting into her stride from a stop. Her wheels would have gone whizzing round without getting any sort of a grip on the metals."

"But she would have used her sand surely," we queried, keen on the defence of a favourite locomotive type. "Sand, or no sand, she would have lost time," said our driver with decision. He took the practical view, leaving to us all the sentiment.

We came back with a semi-fast to C——, which means that we stopped at only two stations in the nineteen miles instead of seven, and we did some splendid running—we wanted to lean over the boiler of "No. 600" to pat her, but remembered in time that the boiler was hot and the driver practical—he would have thought us lunatics!

At C—— we had forty minutes to ourselves and our friends of the iron steed fetched out their tea bottles, cold bacon and bread.

Then came a morning of shunting coal trucks to and fro, with a little run out to a neighbouring colliery to fetch a train along for sorting the trucks in the sidings at this big junction. The trucks were handed over to the tender mercies of some squat-looking saddle-tanks, who puffed about with an air of "watch me hit this truck as far as you can see." And generally the tank did, the truck groaning at the blow, spilling some of its coal, in what seemed tears of protest.

We filled up our tender tanks again and then my good friends got their baskets and said " good-bye," their eight hours were done and a new crew had turned up to relieve them. As much of the work still to be done by " No. 600 " was just a repetition of that already described, we leave too, with a hand-wave to a splendid horse which seemed almost as much alive as the shunting animal which blinked at us as we passed from the one of iron.

To come back for a moment to the " link ", the link is composed of at least one more engine than is necessary to be in steam. This is in order that " No. 600 " can have her weekly rest day, without which she would surely refuse her work. She must have her weekly boiler wash-out. Like the inside of a kettle the boiler and tubes collect a deposit from the continuous boiling of water. Just as the " fur " in the kettle hampers it in boiling, so does the deposit on the boiler's inside. Thus, the job is done properly once weekly and any other little repairs which are needed but

have not been too urgent, are also undertaken.

That is something of the daily work of one of our lowliest iron steeds, work that is just as valuable as that performed by the more imposing express locomotive.

XI

FUEL AND WATER

THE summer of 1927 will always be memorable in British Railway annals because of the non-stop runs successfully attempted on the two great systems which link England with Scotland. It was often stated then, quite erroneously, that these were the world's longest non-stop runs. In point of fact the old North-Western, in pre-war days, occasionally accomplished the Euston-Carlisle run without a stop, thus also accomplishing the longest possible run on their own metals, almost exactly 300 miles. Then abroad there are several instances where even this 300 miles burst has been exceeded.

What are the constituent factors necessary for long non-stop runs? Mainly they are those which head our chapter, with special

emphasis on water. Only by using water-troughs are such long non-stops possible, though it is worth noting that the water-troughs have been *in situ* for many years on both the routes to Scotland. Of late another feature has made the new schedules worth while.

Despite the keen rivalry of the motor coach, which does not now disdain the long journey to Scotland, the loading of the principal trains has been steadily growing, largely because of the extra dining facilities demanded by the public. It is thus found that, not only is the train getting beyond the capacity of a single locomotive (it had already done so on the L.M.S.), but there is a sufficient number of passengers for an entirely through service. Many of the big Scottish expresses depended a good deal on the passengers picked up en route at the larger stations at which calls were made. Without withdrawing these facilities it is possible to divide the " Flying Scotsman ", for instance, and send on the front portion five minutes earlier with a first stop at

Newcastle, thence onwards direct to Edinburgh, and now non-stop all the way, sufficient passengers being available for these cities to make up a 300-ton train at least. This gives a really good relief to the "Flying Scotsman" proper, bringing that very big train well within the capacity of those magnificent "Pacifics" of which the L.N.E.R. are justly proud. It is significant of the way our trains have grown in weight, despite the intense competition of the motor, when we realise that thirty years ago the splendid old eight-footers were hauling, unaided, the "Flying Scotsman" of that day. From 250 tons the weight has gone up to nearer 600, and even with the relief indicated, this famous train often exceeds 400 tons.

We come then, to the position that long distance running is often more a matter of tender than locomotive economics, if we may so divide the machine. Certainly, without a water scoop, the engine could not manage the 236 miles on the L.M.S. and the 268 non-stop on the L.N.E.R. The day

of the heavy tender should be over, though, paradoxically, we find them in increased size on the Great Western and the L.N.E.R., whilst they are very much smaller than they used to be on the Southern. Strange that the latter should be so, seeing that this company has no water-troughs because of the hilly nature of the various routes. But the larger tenders on the engines of the railways mentioned is explained by the greater needs of the locomotives attached to them, not the least being the greater amount of coal required for the same number of miles given by smaller engines.

Thirty years ago a tender was considered of fair or even substantial proportions if it carried 1,700 gallons of water and three tons of coal. Now, even on railways possessing water-troughs, we find a tank capacity of 4,000 to 5,000 gallons, and a fuel capacity of six to seven tons.

The evolution of the tender is almost as interesting as the locomotive. Beginning with a rough wooden truck, with a wooden barrel, placed vertically or horizontally, we

watch its gradual evolution, by steady degrees, until, on all lines, it was a substantial affair, carried on six wheels. On the London and North-Western, right until the beginning of the present century, the standard tenders were built up on wooden frames. Mr. Webb was once asked why this practice was persisted in, when all the other railways had introduced steel frames. His reply was typical of the man, "My predecessor (Ramsbottom) always held that the tender should be a weak link in the make up of a train; by using wooden frames we ensure that, in the event of a collision, the tender will crumple up, and so save the rest of the train."

It is difficult to say how far this theory held in practice; certainly collisions on the North-Western were not less disastrous than on other railways.

Other attempts at gaining stability, for what, after all, is a very heavy section of the locomotive's make up, was attempted by using double frames. A vexed point in regard to springs has never secured a definite

AN EARLY BROAD GAUGE TRAIN [Photo: G.W.R.
Great Western Railway

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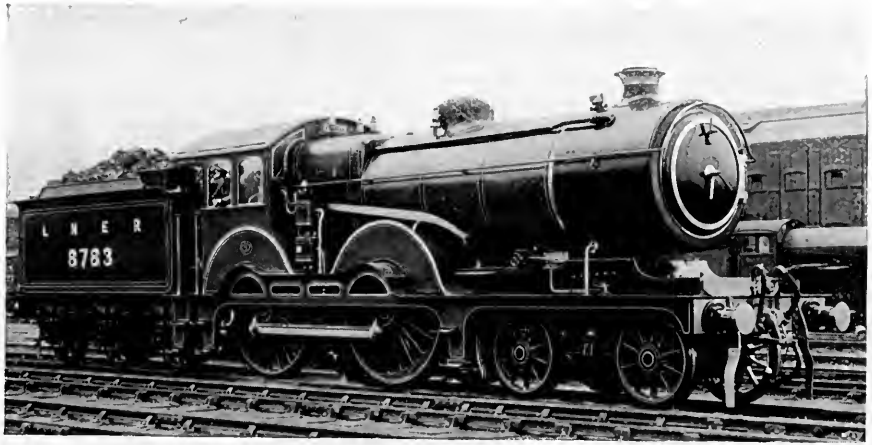

GREAT EASTERN TYPE 4–4–0 IN SPECIAL LIVERY FOR ROYAL TRAINS

solution. Thus, many designers prefer to have their springs under-hung, beneath the outside axle-boxes. This secures a neater looking tender, but it has the disadvantage that the springs are not readily accessible.

Another plan, and one much in favour with present day engineers, is to place the springs immediately above the axle-boxes but below the platforms. In this arrangement the springs are visible, and, of course, easy of access; in addition, the arrangement allows the tender itself to be brought right out in line with the rest of the locomotive, giving sufficient platform clearance, and securing at once the maximum tank capacity. This type seems to have been introduced as far back as 1851, by McConnell, when he was in charge of the locomotive building works of the Southern section of the London and North-Western at Wolverton.

From that date the plan has been largely adopted, and many improvements made, until to-day there are few railways in

Britain, where such tenders are not standard. An arrangement which persisted for many years, and may even now be seen on old engines, has the springs above the tender platform. As a result the space within the sides of the tender is largely encroached upon, and the arrangement always appears rather antiquated.

We have already noted the effects on the tender which the laying of water-troughs brought about. But, until 1887, the London and North-Western was the only company using the troughs with correspondingly small tenders. These latter were carrying something like 1,800 gallons, whilst on the Midland, which had no troughs until some years after this date, there were heavy tenders, containing over 3,000 gallons, at work. This extra weight must have told on the locomotive, since at that period, boilers were small, and the most popular types of engines for express work were of the single-driver classes. One important difficulty presented itself when the locomotive began to grow in real earnest; this

was the capacity of the turntables. Incidentally, this led some railways to decide upon water-troughs in order that they might shorten the length of their tenders, and thus save the reconstruction of turntables.

With the opening years of the present century the adoption of water-troughs became fairly general, though, as already noted, the railways south of the Thames were not able to use them, with the result that tenders on these lines are still very long and heavy.

To secure stability for long tenders many were fitted with eight wheels, either in the shape of a couple of bogies, or with the four sets of wheels arranged in pairs. Strangely enough the latter system seems to have been the better one, contrary to what one might expect.

It was found that the double bogies imparted a distinct swaying motion to the tenders, and that the wagon-wheeled type of eight pairs of small wheels was a better arrangement.

Perhaps the largest tender in regular use in these Islands is that fitted to Mr. Gresley's fine "Pacifics", which will hold 7,000 gallons of water and no less than nine tons of coal. On the other hand, the corresponding class of "Pacifics" on the old North-Eastern, i.e. of the "Raven" regime, have six-wheeled tenders with water capacity of 4,125 gallons and fuel of $5\frac{1}{2}$ tons. The Gresley "Pacifics" have eight-wheeled tenders—non-bogie.

It seems strange now to read that, by Act of Parliament, all locomotives must burn coke. It was not put quite so bluntly, but, that is what the early enactments meant. They were drawn up against the locomotive, and they were made so irksome that it is really a wonder that the early machines kept going. "The locomotive must consume its own smoke," said the Act, and there were serious penalties for the offending engine men.

In the pioneering days there was only one way of ensuring smoke consumption, viz., to use fuel which did not give off

smoke, which meant the burning of coke. As sufficient quantities were not available from the local gas works, it was necessary to erect coke ovens at various parts of the line, and there waste the most valuable product of the coal. Here and there the retorts were used and coal gas manufactured for railway purposes in order to secure the coke.

It was one of the tasks set our early engineers to find a means of burning coal, and so stop the very serious and costly waste of this valuable mineral. Beattie, on the London and South-Western, did a good deal of experimenting, and found means of adapting his stud to coal burning, but his process was expensive to instal, and rather difficult to work. The complications were often beyond the grasp of the engine-men then employed; possibly they were not too keen in mastering the details, anyway something simpler had to come along, and it was simple in the extreme when, at long last, the use of exhaust steam in the chimney did all that was really necessary. By this

time, too, opposition to the railways and the locomotives had largely died down; a new generation had grown up, who found the trains of the greatest use for both business and pleasure.

The failure to find a really satisfactory method of consuming smoke, steam, and fumes was the greatest difficulty with which the first underground railway in London was faced. Parliament had insisted upon the impossible, and although certain strides had been made towards abating the smoke nuisance in the open, it was realised that in tunnels there would be very grave drawbacks. The only method which seemed feasible to the engineers charged with the production of a smokeless locomotive, was to have constructed a very curious experimental machine. This was a single-driver, built by Stephensons, to the design of the engineer of the Metropolitan Railway. The principle was really a fireless locomotive with the water renewed at the end of each trip from stationary boilers at the two termini. To keep this water at practically

boiling point, white-hot firebricks were to be placed as a kind of outer coat to the steam chamber.

Under trial the fireless engine just managed to crawl into the termini. But it is only fair to say that it suffered under most grievous handicaps. Thus, although the distance was less than five miles, there were several station stops. And the gradients were often very severe. It fell to Gooch, of the Great Western, to supply the motive force when the fireless engine was found impracticable. These were ordinary tank engines, hastily fitted with condensing apparatus, by which the exhaust was turned into the tanks instead of reaching the outer air directly from the chimney.

Those who remember the old days on the Underground will not need to be told that none of the engines employed therein was ever free from the emission of smoke, fumes, and smuts. Here if anywhere, electricity was indeed a great improvement, and the Underground lines became freed from their worst drawbacks.

Fuel still remains one of the biggest of our railway problems in Britain. The success of the Great Western engines with their enormous loads is largely due, apart from their excellent design, to the use of the very best Welsh steam coal. Dear though it be, it is a real economy to use it freely for express work, and, when possible, for slower.

Oil has never been popular, and most of the engines fitted during the coal shortage, following the Strike of 1926, have now reverted to coal.

XII

THE YORK RAILWAY MUSEUM AND ITS LOCOMOTIVES

THE London and North-Eastern railway have placed all railwaymen, and also members of the general public interested in the iron road, under a deep obligation by the formation of their Railway Museum at York. True, it comes rather late in the day, and, alas, many remarkable links with the early days of the railways are necessarily lost to us. There were isolated attempts at preservation, some by the railways themselves, others by private individuals, such as the late Mr. Boulton. In too many instances, however, after the formation of a collection of railway objects a turn in the wheel saw them dispersed; too often broken up, and thus lost for all time.

The present museum owes its existence to the old North-Eastern railway, who, in the last year of its separate existence, made a start in some disused buildings at York. The collection originally formed has been constantly added to until it is now quite comprehensive, yet far from complete. It was largely helped by the Railway Centenary celebrations of 1925, when many interesting relics of the past were turned up by various firms and private individuals, not to speak of the railways themselves. After they had served their turn, many items were handed over to the museum authorities.

Mr. J. B. Harper, who retired from the position of assistant general superintendent of the North-Eastern railway at the time the grouping took place, must have first place in the credit list for the provision of this most interesting collection of railway curiosities. Long before there was any chance of a building allotted specially for the relics, Mr. Harper began his collection, and for 40 years he added steadily to it.

How he must have bewailed the passing to the scrap heap of many worthy engines and coaches, which would have preserved continuous links for us. It is fitting that this railway veteran should be the first chairman of a small, but energetic committee charged with the work of maintaining and adding to the collection. No attempt at final arrangement of the exhibits has been made, partly because there are so many gaps to be filled, and partly because the exact form the museum will eventually take is not yet determined. At the moment, the collection is allotted to two distinct buildings, the rolling-stock, etc., being housed in an old shed adjoining the engine sheds, whilst the smaller exhibits are found in a basement room of the North-Eastern area headquarters offices. It is hoped that steps will shortly be taken to bring the collection under a single roof, especially as many gifts are promised towards making the museum more comprehensive. Thus, a very valuable collection of old letters, prints, and drawings relating to early days on the

railways has been promised, and it will be necessary to accommodate them.

There is no regular admission to the museum to the outside public, but railwaymen and those of the public sufficiently interested may obtain admission, and a guide, by applying to the Curator of the museum, whose office is at the headquarters of the London and North-Eastern railway at York Station.

Visitors to Britain from abroad having to pass near York should make a special point of breaking their journey at the famous old city, and divide their time there between the lovely Minster and this unique collection of railway objects.

Undoubtedly the rolling-stock—veterans all—will most appeal to the visitor. At the outset Stephenson's famous Hetton Colliery locomotive will claim attention. This is a far greater relic of the past than even the "Rocket" at South Kensington. Not only is it seven years older, but it sustained the heat and burden of the day for no less than 90 years, and then it was pulled from

its retirement and placed in steam for the Centenary celebrations.

Like the "Rocket" she has been rebuilt—in 1857 and 1882—but whilst the better known engine is scarcely like the original, the Hetton locomotive did not lose much of her personality in the two rebuildings.

At the last rebuilding a new motion—the link—was fitted. Some very interesting points about the old engine may be mentioned here. The regulator is fitted beside the dome; adjacent is the reversing lever and handbrake. This unique arrangement of the controls meant that the driver stood, not on the footplate, but upon a running board at the side of the boiler, and just above the wheels. The principal dimensions of the veteran are:—Cylinders, $10\frac{1}{2} \times 24$ inches; driving wheels, 3 feet in diameter; boiler barrel 10 feet 2 inches long, with a diameter of 4 feet 4 inches; grate area $7\frac{3}{4}$ square feet, heating surface, $157\frac{1}{2}$ square feet; boiler pressure (much higher than the original boiler, of course), 80 lb. per square

inch; tractive effort 4,775 lb.; total weight of engine and tender 9¾ tons.

This old engine was presented by the Hetton and Joicey Collieries, with whom Sir Arthur Wood joined, and eventually it will stand on a section of the original track. This was laid upon stone blocks as being thought more durable than modern sleepers; it was, but the cost of maintenance was excessive especially upon those railways, apart from colliery lines, which tried it.

Another exhibit which claims early attention is the original No. 1—the famous eight-footer—built in 1870 by Patrick Stirling for the Great Northern. This engine ran 37 years, and upon its withdrawal had over a million miles to its credit—a record indeed. This class of engine, allowing for its size, of course, was the finest ever built; certainly there had never been a more graceful machine, nor a better, for they persistently handled loads far above the weight they were designed to haul. A type which, for thirty years can haul the fast "Flying Scotsman"—easily the most famous

of our British trains—is something out of the ordinary. What a terrible pity it would have been had No. 1 joined the rest of her fifty odd sisters in the derelict world! Yet she had a near escape! One Saturday I spent at King's Cross sheds, and came across old No. 1. The man in charge threw cold water on my words of praise for the veteran. Said he, " If I had my way—and I probably shall ere long—I'd break her up to-morrow."

I expostulated, very warmly too, and he replied: " Ah—it's all very well for you folk who have nothing but sentiment for the old machines. I'm responsible for running this establishment, and I want every inch of room. I've neither time nor sentiment to waste on an engine out of steam for all time. Why, she is only a shell." And climbing to the footplate I found that this was indeed true. Fortunately, for the Centenary celebrations, the old engine was restored to steam and, later under her own power, made what was stated to be her last journey to York. I decline to believe the

newspapers, for there will be many centenaries to celebrate during the next few years, and what can they be without the finest of the single-driver class? In any case I'm relieved to think she has reached that siding in the railway museum, and there I hope she is safe from such vandals as my good friend at King's Cross!

It is just possible that Stephenson's famous "Locomotion" and Hackworth's "Derwent", both at present end to end on pedestals at Bank Top Station, Darlington, may come here too, though there is no immediate intention of removing them. Then there is the Dandy Coach at Waverley Station, Edinburgh, an interesting relic indeed, used for many years to work the passenger traffic on the Port Carlisle branch of the old North British Railway. It was pulled by a horse, not a locomotive. Another locomotive which might one day come to York, too, is the "Billy" built in 1830, for the Killingworth Colliery, where George Stephenson did a great deal of his experimental work.

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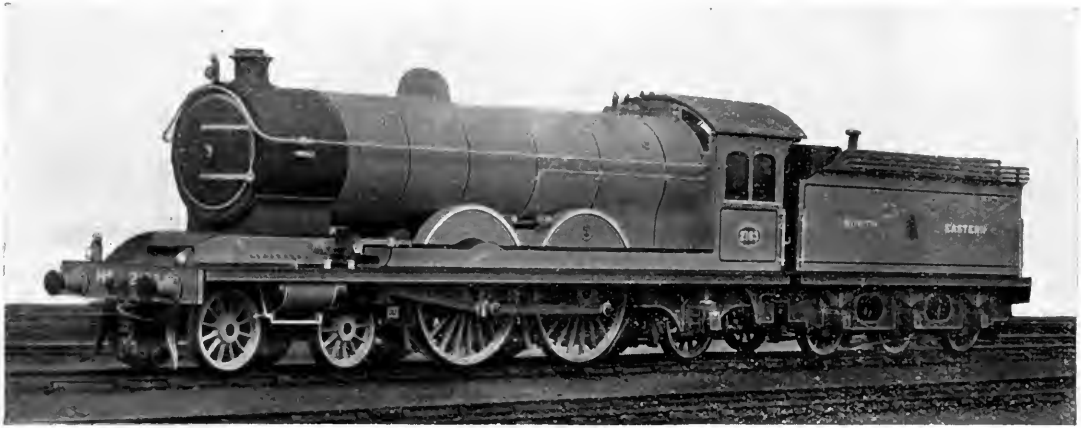
A Leading Express Type on the L.M.S.
The Rebuilt "Claughton"

Face page 161]



NORTH EASTERN RAILWAY: "ATLANTIC" TYPE

A fine machine of the 'seventies is the 0–6–0 Bouch engine, built for the Stockton and Darlington section of the North-Eastern. Because this line was sponsored by Quakers this name was usually applied to the Bouch's engines too. Only within recent years has the last of the type been withdrawn from service. Here we may deplore that there is a tremendous gap in locomotive design in the museum—extending as it does from 1870 to 1882. Yet in that period some of the most interesting locomotives ever seen on rails were built.

It is too late now to supply the original machines, but perhaps it may be suggested to those responsible that, where working drawings are in existence, the example of the Great Western should be followed and life-size models of famous engines be added to the museum. Even if only the outward form were maintained and the movement, etc., was absent, much would have been done to bridge this deplorable gap. In the Bouch engines the long boiler introduced

and championed so fiercely by the Stephensons was fitted.

Another famous North-Eastern locomotive type is also shown here. This is the 2–4–0 of Fletcher's design—a splendid express type of the days when loads were not too great. These engines belong also to the 'seventies, and did magnificent work in their prime. The engine has been restored to its original style of painting and lining out, with plenty of well polished brass. Very handsome these locomotive uniforms were, and though they seem rather elaborate to us there can be no question but that they served a good purpose in getting the men interested in their machines and their upkeep, besides having a very definite publicity value. Just before the War and during that trying period, the tendency was to leave out all unnecessary painting, including the lining out. Since the grouping, however, it has been realised that some return to the old standards are necessary, and thus some of the lining out, and even the brass work, has returned.

Unfortunately, this has all been done at the expense of the goods engines which, save on the Great Western, are all in funereal black, many unrelieved with lining out. Is the money saved on cleaning worth while? I doubt it! No great firm would send out their goods in a dirty delivery van, and usually they try to get an arresting colour scheme by which their vehicle may be recognised at a glance.

The Fletcher engine took her place in the famous Newark brake trials, when an effort was made to find some effectual brake system; from the trials emerged the efficient brake systems of to-day.

The most striking exhibit at York is undoubtedly the famous "Gladstone", added only in 1927, and restored to the splendid daffodil livery which her designer, William Stroudley, introduced on the London, Brighton and South Coast railway. This engine livery is now a thing of the past, but it was of striking publicity value. Though light in colour the engines were rarely dirty, for the men took an interest

in their splendidly painted steeds. They used spare minutes in giving the locomotives a rub over, and it is certain that, in the sheds, very little more time was given to those engines—if any—than at present when economy is the strict order of the day.

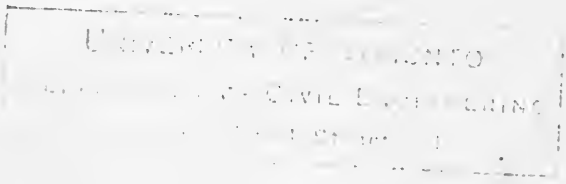
The " Gladstone " is intended ultimately for the South Kensington Museum, when the necessary extensions have been made there. This splendid machine was built in 1882, at a time when the six-wheeled engine was still the pre-dominant wheel type, and before the leading bogie was extensively used. Stroudley never would use the bogie, and it says much for the care he took in the design of his engines that many of them are still in service, some of them being of the " Gladstone " class. Stroudley died in 1889, so his machines are a long-lived race. Some of the innovations which he made, or ideas which he thought worthy of perpetuation, are still widely used; one of them is especially noticeable about the " Gladstone "—the copper-capped chimney; a

small item, perhaps, but one adding immensely to the careful finish of a locomotive.

It is the intention of the London and North-Eastern Company to add specimen engines of each well-known type as they go out of service. In this connection one of the " Tennant " class will probably have joined the Museum by the time this is in print. These belong to the 'eighties, being contemporary locomotives of Stroudley's " Gladstones ".

In 1931 the famous *City of Nuvo*, the Great Western flier, was sent to the York Museum.

There is a strong probability that other companies will hand over exceptional engines for the Museum, but it will be understood that a first consideration will be the accommodation of rolling-stock, etc., which belongs to the parent line.



XIII

VAGARIES OF THE LOCOMOTIVE

THE locomotive is a horse as we all know; it is not only that he hauls loads, working " on the collar " as the saying goes, but he eats and drinks, needs careful grooming and a rest day once a week. In addition, the locomotive has strange caprices; he has been known to bolt suddenly and in the day's work he will often display an uncanny resemblance to the steed of flesh and blood in the way his work is done.

In a team of horses there will always be one which does not pull his weight; in a batch of engines working in a link the very same characteristic will be found. A " link " by the way, is a section of duties upon which a certain number of engines will be

employed, the object sought is the distribution of the work as evenly as possible to the engines and to the men, also to ensure that weekly day of rest already mentioned.

If the link consisted of engines of varied design, we should naturally enough expect to find a variance in the quality and quantity performed. As a rule therefore the locomotives in a link are graded according to their power, so that too great extremes are not found. But it is a fact that when machines of exactly the same design, weight and building are grouped, there will be, as in the world of humans and horses, good and bad.

There are certain engines resembling each other so closely that even an expert could not tell which was which, save by their different names, or numbers. No. 266 will be the favourite because of her easy running and low coal consumption; No. 267 will be heavy on coal; No. 268 will be like the majority of her class, varying, if at all only the slightest from another

200 machines in her class. And there will be No. 269, which every man in the shed will tell you is the very worst engine that ever had a man on its footplate! Quite useless to ask why this should be so, the man will scratch his head and say, " There it is, and if you don't believe me ask old Bill there who has been with engines forty-five years—he'll tell you the same." It would appear that to give an engine a bad name seems to mean that she will earn it.

What is the secret of 269? The only reasonable explanation I have ever been able to glean is that when she was being built her frames were laid slightly out of truth, that the fact was not discovered in her trial runs, and so she has continued, probably getting a little worse each year.

Reports have been made upon her unsatisfactory work, she has been to the shops and come back again no better. So she is allowed to go on until she needs radical re-building; then the chances are that her

bad record will lead to her doom—she will be one of those engines which disappear after a very short life, no adequate reason being given for her early decease.

XIV

MINIATURE LOCOMOTIVES

THERE have been many railways laid down on the 15 inches gauge, but with two exceptions, the Ravenglass and Eskdale, and the Romney, Hythe and Dymchurch, they have been very short sections of line, mainly on the seashore at some pleasure resort. Even the Ravenglass and Eskdale was an adaption, as originally that line was laid out on a considerably wider gauge, closed down through lack of business, and then reconstructed to the 15-in. gauge, during the Great War, because of the ore traffic which had revived.

The Romney, Hythe and Dymchurch Railway, to give it its full and imposing title, really sprang from the experience gained upon the Cumberland line just mentioned. Here was a stretch of rich

marshland that somehow the big railways had managed to miss, and it is practically certain that if the 15-in. railway had not been built the shrill note of the locomotive would never have been heard in this corner of England.

The new line owes its birth to the love of things mechanical of Captain Howey. He has always been keen on railways and, having carried out experiments with many model systems, he wanted to prove to the world that the 15-in. gauge line would serve a big public and pay its way when one of the standard, or even what is termed narrow gauge light railways would fail. Romney Marsh was just the place for such an experiment, because, apart from the fact that it needed the iron road, it was level and thus suitable for a light railway. A "light" railway does not necessarily mean that it is really light in any way, but, under an Act passed in 1896 it is possible to build certain types of line without having to go to the big expense of getting a Bill through Parliament. A light

railway is allowed to cross the street on the level; indeed it is often allowed to run along a sufficiently wide street. But the miniature system with which we are dealing did not want to be considered in that way; it was prepared to lay its track in the orthodox manner, with double track, proper stations and an up-to-date signalling system.

The headquarters of the tiny line are at New Romney, where there is not only a fine station, and several sidings, but a big workshop where the engine can not only be repaired but new members of the stud can be built. There are carriage and wagon works too—in fact a miniature Swindon. Not content with making its own rolling stock the works turned out a couple of miniature locomotives for an even smaller gauge—12 inches. These were sent by their purchasers, the Canadian Pacific Co., to the exhibition at Philadelphia.

The line started at Romney, just opposite to the station of the Southern Railway Co.'s Lydd–Appledore branch. Thence it

enters the open marsh and makes its way across dyke after dyke, and now and then under a road. There is a big camp reached after a mile or two. This is the Duke of York's summer camp for boys and girls; to cater for the young folks there is a special siding laid right into the camp. This railway will be highly popular with the campers —there is no doubt of that—and possibly the boys and girls will be amongst its best supporters. Farther on comes Dymchurch, one of the five important stations of the miniature line. Then on to the terminus at Hythe, where motor buses will carry the traveller onwards, towards Folkestone, if he desires.

The stations are splendid reproductions of the best type of modern full-sized buildings; waiting rooms and booking offices quite big enough for all, but not out of keeping with a line which likes to be thought miniature.

The coaches are of two kinds; nice open ones for the summer and fine days and comfortable closed vehicles for the winter

and days when the sun won't shine at all. Trucks abound everywhere—tiny little fellows which are good for a ton apiece.

But it is the engines which will make every boy and girl miss the last bus home. They are just splendid, in their neat green uniform. And they have equally fine names too. There is " Green Goddess ", which helped in the making of the line by acting as ballast engine, " Typhoon " is another, whilst " Northern Chief! " and the " Southern Maid " are two cylinder " Pacifics ", very much like those huge fellows on the London and North-Eastern, from which they are in fact copied, though rather freely.

The three-cylinder machines have the names " Hurricane " and " Typhoon ", and because of the extra cylinder they are just a little more powerful than the rest of the passenger engines on this tiny line. Then there are two powerful goods engines named " Hercules " and " Samson "; these have the wheel formula 4–8–2, known as the " Mountain " type. Though designed

for goods working they will run on the passenger service during the season when excursions will be needed. Their extra pair of coupled wheels makes them more powerful, also they have a slightly longer boiler. In other respects they follow closely on the design of the passenger machines.

There is still another engine—a dumpty looking little chap who rejoices—or writhes—under the name of "The Bug". He has a distinctly foreign look and we are not a bit surprised to find that he was built in Munich. Brought over to help in the making of the line this curious engine has remained to act as an emergency machine with special duties in the shunting department.

The passenger engines weigh 8 tons, will pull quite 300 passengers and with a not too heavy load will race along at 30 miles an hour.

Be sure to see and travel on this fine little line; it beats anything we have yet seen in railways.

XV

THE FASTEST LOCOMOTIVE

A QUESTION often asked is "Which line has the speediest trains?" Of recent years, since the grouping the field of exploration has been narrowed considerably and we can place without hesitation the famous line of Brunel at the head of the list—the Great Western.

During the War all our fine expresses lost their records; it was sad but essential. Since the War most of the railways have tried their hardest to get back their best runs.

In this the Great Western have been more successful than the other lines both before and after the grouping. In the latter case the fortunes of the group melting pot have rather helped them because whilst the other big companies are having to

settle many things as a result of the amalgamation the Great Western have been able to go right ahead. They are the only big company in their group and not one of the smaller ones added to them has any pretensions to express train work. Then they are doubly fortunate in their locomotive stock. The policy upon which it has been built was framed twenty years ago and no vital change in design has taken place in those years—all these things help to the proud record the Great Western now bears as our speediest line. Another thing helps—their splendid permanent way and also the fact that the section of main line from London as far as Bristol is the best piece of galloping ground in Britain.

In 1921 when our railways began really to recover from the War years the Great Western had nine out of the ten best runs in Britain.

In last year's returns, so far as they are complete this famous railway is still at the head, both for the fastest run and the highest percentage at over 55 miles an

hour. Time was when an inclusive speed of 40 miles an hour was reckoned real express speed; those days have gone and the average would now exceed 50 whilst on the speediest lines there are many trains which run from point to point, including stops at well over 55 miles an hour. Only those who know what such speed means can appreciate the magnificent work our locomotives and the men in charge of them perform.

Leaving the Great Western for a moment let me give an illustration from the London, Midland and Scottish of their best run in order to show what is involved. This run is quite the best on that huge system when its distance and difficulties are taken into account.

For the 113 miles between Euston and Birmingham a level two hours have been allowed for some years now and quite a number of trains daily keep time. Since the War, however, an intermediate stop at Coventry has been given within the two hour schedule. The inclusive speed works

out at 56½ miles per hour. Fine though this may appear it is even better when it is looked into.

Let us look at the performance closely. The run begins with a stiff climb out of Euston right to Camden Town, a climb that was once considered beyond the power of a locomotive, recourse being had to a stationary engine and rope. Then comes fairly good gradients right up to Rugby—that is nothing to worry a present day express engine—but at Rugby the train has to be slowed for a mile or more to take the junction for Birmingham. Then comes a sprint, followed by a slow into Coventry, a wait of at least three minutes, a steady climb out on a rising gradient, another sprint and then a dead slow for the last mile into the huge station at Birmingham. You can see at once that the gallant steed is running at more than 60 miles an hour for the greater part of its trip.

The Great Western have a run of 77·3 miles which is done in 75 minutes as scheduled but often in less. Then the

London and North-Eastern has got back its snippet run between Darlington and York which works out at rather more than 60 miles an hour. These then are the speediest trains on the three greatest of our groups. On the fourth, the Southern such speed is not attempted, mainly because conditions are against sprinting. There is nothing wrong with the locomotives or the men behind them. For twenty miles out of London the road is congested with local traffic, and by the time that is cleared the opportunity for fine running is spoiled by the heavy country encountered.

XVI

THE TANK ENGINE

I AM sorry to confess it, but when I was a boy we rather looked down upon the tank engine. You see, he had no name—only a number—and was rarely employed upon fast trains.

On fine summer days we used to sit on a footbridge that crossed the old North-Western main line and take names—name-snatching we called it.

The result was that at first we took an interest only in named engines, which were, of course, the express locomotives of our greatest railway.

But even all those years ago we noticed that the busy little tank engines were making headway on a line that was not particularly partial to them.

And then we began to wonder why; from wondering we asked questions and, strangely enough, we found that the " tankers ", as we came to call them, were great favourites with drivers and firemen. Said one: " They are just as powerful and fast running as any other engine of the same size;—we don't have to take them to a turn-table each time we want to work in a different direction, and they are a good deal more comfortable in the cab."

So you see there were points in favour of the little 2–4–2s doing such splendid work out of the lime-light which seemed ever to be given to the express machines.

The North-Western engines of that day had rather poor cabs, and in bad weather the crews suffered considerably. The tanks having to run backwards and forwards had protection at the bunker end which was denied to the express machines.

Then we noticed another thing; it was, that whereas the tanks had at first been employed only on trains which stopped at our small stations, and on the branch lines

farther up the line, they began to appear on some of the non-stop trains.

Not the most important expresses, of course, but upon some which were running on a very sharp timing between stops. To us they seemed just a little unsteady, swaying rather more because their side tanks made them a trifle top-heavy, but the swaying was never dangerous, though the motion was sometimes felt behind the engine.

There were at this time two or three compound tank engines on the North-Western, and we just loved to travel behind them because, when they started, their complicated driving mechanism imparted a sort of row-boat motion to the whole train.

These were all side-tanks, which means that the water tanks were at the side of the boiler, the coal being contained in a bunker at the back of the foot-plate, thus getting rid of the tender.

It is not always realised that a good deal of the space in the tender of a locomotive is taken up by the water tanks which run round three sides of it.

The other kind of tank engines are known as well and saddle tanks respectively. The former are now rarely seen, but the earliest "tankers" were all of this description. The water was carried in well-tanks under the bunker.

They were usually quite small engines, and had to visit the water column rather frequently. One class on the old Bristol and Exeter Railway had three well-tanks disposed in different parts of the frame.

These were probably the fastest tank engines ever built, having nine-foot single driving wheels.

In later years the Great Western took over this famous railway, with its equally famous broad-gauge tanks.

Then one of them ran off the line, and smashed things up rather badly, so the whole batch was taken in hand, and rebuilt as tender engines, the driving wheels being cut down a foot in the process.

Saddle-tanks were once very popular on our railways, but now they are more often seen on shunting duties in private yards.

For small engines the saddle-tank (the tanks fit over the boiler like a saddle, hence the name), was an ideal arrangement, but when the locomotive began to grow, the first thing about him to increase in size was the boiler.

This grew in girth as well as in length, which meant that the saddle-tank over the boiler had to be reduced so much that the locomotive ran short of water.

In some types this was met by taking the tank the full length of the boiler, and giving it a different shape.

Such engines can still be seen on the Great Western, being rebuilds of some very fine old 0–6–0 saddle-tanks. These splendid engines used to be the real handy men of the Great Western—they were, in fact, all that a good tank should be.

Within recent years some new 0–6–0 tanks have been added and the whole are now classed as Pannier tanks.

During the present century the tank engine has grown up until, with a very

few exceptions, the tender engine does not surpass him in size or speed.

The huge " Baltic " tanks (wheel formula 4–6–4), on the Brighton section of the Southern, and also on the London, Midland and Scottish, are frequently seen on heavy express trains, running at a mile a minute with ease and safety.

Have I proved that the tank engine is worthy of our regard? Hats off to the tanker, and let us treat him with all respect to which he is due as the best and most hard working type in service!

XVII

SOME LOCOMOTIVE FREAKS

THERE have been many freaks in the locomotive world; though, for the most part, they belong to the earlier years rather than the later. You see, little was known about the locomotive, and much had to be learned by finding out what could and what could not be done with the iron horse.

For instance, the belief was fairly generally held that, as the rails were smooth and the wheels of the engine were also smooth, the locomotive could not possibly climb a gradient with anything of a load.

Men like Stephenson solved the difficulty by coupling the wheels of the engines; sometimes actually coupling the driving wheels of the locomotive to those of the tender to gain greater adhesion.

Other designers had other ideas. Thus, Blenkinsop thought that an engine would pull a load best on level or hilly routes if a cog-wheel on the locomotive engaged in a corrugated section of the line. Some of Blenkinsop's rails used with his engines can be seen in the South Kensington Museum.

Brunton was another inventor who felt that the engines could not run on smooth rails, but, instead of giving his machines a special track upon which they could run, he made them use their legs! "Legs? An engine with legs? You mean wheels!" I can almost hear a reader exclaim. Actually these curious, freakish locomotives had two legs, and they were thrust out behind them by the cylinders.

The feet of the legs met the track between the metals, and as one was withdrawn by its cylinder, the other touched the ground and gave a push forward. I have never seen it mentioned in any locomotive history, but I would like to know how Brunton's engines reversed!

Whilst engineers followed the lead of Stephenson in coupling as many wheels as possible, none followed Brunton with his walking engines. And only for mountainous tracks, such as the railways up Snowdon and the Alps, was Blenkinsop's idea of the cogged wheel on the locomotive, and the corrugation of the rail, employed.

The corrugation in the mountain lines was moved to the centre of the track, becoming a separate rail, instead of being cast with the running rails.

Those were the earlier types of freakish engines, and after our railways were fairly established, the development of the locomotive followed on definite lines. That is to say, the designers discovered what wheel formula suited the needs of their particular railway, and then proceeded to give the best engines possible to that formula. Thus, for express work on the more level routes the single-driver was the favourite type. On the hillier routes the four-coupled engine was prime favourite; and for goods work the six-coupled engine was practically supreme.

That is roughly the development on the big railways, but on privately owned lines, like those serving collieries and brickworks, there were still built some very freakish engines.

Many an old colliery engine of eighty years ago was at work within the memory of your fathers. Excellent fellows they were with a lot of top-hamper of beams and levers. How strange they looked!

Well, all the first locomotives had this arrangement, copied from the old beam engines, which pumped water from the mines, and did other work. The idea is to transmit the power from cylinder to wheels (in the case of the locomotives) without the direct drive on to the axle.

It was probably the case that the first builders were doubtful whether the axles would stand the direct drive, or it may be that they were not inclined to bold experiment. If we remember the intense opposition to the coming of the locomotive, we can well understand that the first builders would play for safety.

As it was, many of the earliest machines blew up through their boilers being too weak, which did not help matters.

But all the locomotive freaks do not belong to the earlier days. Indeed, there are some running now—big, hefty looking fellows these, which are largely experimental. Their drivers consider them freakish.

There were a hundred engines on the old North-Western which many railway men classed as freaks. These were the Webb three-cylinder compounds. The idea their designer had in mind was that he would save coal by using the steam twice, and that he would secure all the free running of single-drivers, with all the power of the four-coupled machines.

Now, compounding to save coal is excellent, and some of the best engines on the old North-Western metals to-day are compounds of Derby design: but these engines of Webbs were freakish in performance, if not in actual design. Some days they ran extraordinarily well, on others, all the

coaxing in the world would not get them going.

Then it was that an order came out that when the load was 180 tons, they must have an assistant engine. Think of an express of 180 tons to-day with two engines! Why, too often a single engine has to tackle three times that weight, and at the same speed as required of the compounds.

Sometimes it was necessary for the men to start a Webb compound with a crowbar in the wheel, and much valuable time was lost.

THE END

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Louisa M. Alcott

LITTLE WOMEN. This is one of the most delightful books for girls ever written. The girls are very amusing types, and their experiences are told in a way which appeals to all. The character of Jo is drawn very vividly, and we grow to love the girl who manages to get into so many scrapes and then get out of them cleverly.

LITTLE WOMEN WEDDED. This is a continuation of the life of "Little Women." Meg, happily married at the beginning of the book, experiences the many trials and amusing difficulties of a young wife. As the book draws to a close we see the "Little Women" changed into "Good Wives" and all ends happily.

LITTLE MEN. The further experiences of Jo are related in this entertaining book, for she sets up a school for poor neglected boys. Although a hard task, she and Professor Bhaer manage it well, and the boys all thought of "Mother" and "Father" Bhaer with thankful hearts. Of course, the lads get into scrapes, which helps to make the book most amusing.

UNDER THE LILACS. Ben and his dog Sancho run away from a circus and find a home with Bob and Betty in the old house under the lilacs, and his many adventures there with the children are described with humour and sympathy in Miss Alcott's typical style.

AN OLD-FASHIONED GIRL. A delightful study of a healthy country girl, who goes to stay with rich friends. Everybody learns to love her for her charm and unselfishness, and she proves a helpful person when her friends become bankrupt. She eventually marries the son and all ends happily.

EIGHT COUSINS. This is the story of a little girl, Rose, who has lost both her parents, and who goes to live with her aunts and seven boy cousins. Her Uncle Max, a breezy sea captain, who is also her guardian, and herself, are two very lovable characters.

ROSE IN BLOOM. The further story of "Rose." The charming bud of a girl blooms out into a beautiful and lovable maiden, the friend, the peacemaker, the beloved of all—especially of the one with whom she finds happiness.

JO'S BOYS. This delightful story deals with the "Little Men" when they grow up. The irrepressible Tommy Bangs still gets into his scrapes. Jo's own children help towards the making of the book, and in Teddy one can see the old Jo of "Little Women."

AUNT JO'S SCRAP-BAG AND SHAWL STRAPS. The Scrap-Bag is a real treasure house, and "Shawl-Straps" a delightful account of the run through Europe of a party of charming American girls. Brittany, France, Switzerland, Italy, are all pleasantly and cleverly treated, whimsical adventures told, and we get a quaint picture of London in the days of our mothers.

SILVER PITCHERS. Eight stories in Miss Alcott's best vein; jolly girls and equally jolly boys, full of life and spirits and delightful to spend an evening with. Letty's Tramp is particularly good, and Letty as tender as the Tramp is strong and true.

JACK AND JILL. A vivid portrayal of the home and school life of Jack and Jill, and their friends in a New England village. Jack and Jill commence with a spill but Jack soon recovers, though Jill is badly injured. However, with other children, they have a gloriously happy time doing all manner of interesting things.

R. D. Blackmore

LORNA DOONE. The Right Honourable Tom Shaw, writing in 1914 upon "Books That Have Helped me," said: "When I have seen and felt too much of the seamy side, I have always a friend who will help. 'Lorna Doone' will carry me to sweet meadows and wholesome country life, to deeds of modest courage and high endeavour."

Nancy Delves

THE FOURTH FORM. Mona Rhodes begins her life at school by hating and quarrelling with her popular cousin, Allison, but Nonie Shields the merry madcap of the Fourth Form becomes her inseparable chum, and Mona enters with zest into Nonie's hilarious schemes. Nonie is determined that the cousins shall be friends and at last the two are united, much to the delight of their chums.

WELL PLAYED SCOTTS. A fine story dealing with the struggle Micky Quellan and Audrey Harvard had to pull Scotts back to its old position of Cock House of Beverley College. Tennis, Cricket, Athletics, Swimming, Rambles, Picnics, and all the other things that make the summer term the jolliest of the year are here.

Irene Mossop

CHRIS IN COMMAND. Two sisters, Keith and Rosalie Renford, are forced, owing to lack of money, to leave an expensive school and to go to a day school. Chris is the games captain at the school who has a very difficult job, owing to the fact the school is all split up into various leagues. She does succeed in the end. There is plenty of sport and excitement in this fine story of life at a girls' school.

SYLVIA SWAYS THE SCHOOL. Pauline, the leader of the old girls, decides that the new girls must be made to obey the tradition of "Jo's" and kept in a secondary position in the school. But she did not know Sylvia Dare, who by her unfailing good humour, sportsmanship and unselfishness won for the new-comers the respect of all.

PRUNELLA PLAYS THE GAME. Prunella Prendergast was quite unlike the orthodox nervous new girl, and although her elder cousin welcomed her arrival, her younger cousin was jealous of her success at work and games. But the way in which she played the game, won her formmates' hearts and at the end of her first term one and all voted her a "good sport."

NICKY, NEW GIRL. It tells of Diamond Kenley, the captain of the Vikings House at St. Hilary's School and her young sister, Monica (Nicky, for short). Diamond is very jealous of her young sister, whom she regards as likely to supplant her in popularity. The story describes the rivalry between the sisters and is chock full of excitement and sport.

Mary Louise Parker

'MISS SPITFIRE' AT SCHOOL. "Miss Spitfire," or to be exact, Gay Hamilton, is a character that all readers will love. The story of her life at Rolsham Manor School and how she overcomes her unpopularity will appeal to all girls. This book is packed with excitement, fun and sport.

Marie Louise Parker

THE GIRLS OF ST. HILDA'S. Coming back from the Easter holidays, the girls found that their much loved and admired Captain was on her way to Canada for good. This causes great excitement as an election for a new captain has been decided. The result, however, is not satisfactory to all, but the new captain has many staunch pals and in the end wins through.

DIANA AND PAM—CHUMS. When Diana Templeton realised her heart's desire and went to school, she found Pam Weybridge just the chum she had been hoping to find. They were a gay-hearted pair of inseparables, and girls will much enjoy reading about the doings of themselves and their many friends.

A. E. Seymour

A SCHOOLGIRL'S SECRET. This is a story of a girl who paid for her own schooling by writing short stories. She had promised not to reveal her secret, and had to endure a good deal from the curiosity of the girls and the suspicion and measures of some of them. But she had some good staunch friends who stuck to her through thick and thin.

BOYS' BOOKS, 2/6 *net.*

R. M. Ballantyne

THE YOUNG FUR TRADERS. When he was a boy, sixteen years of age, Robert Michael Ballantyne was employed as a clerk by the Hudson Bay Fur Company. He went into Canada, to Rupert's Land, the name given on the formation of the Hudson Bay Company, in the year 1670, by Prince Rupert.

THE CORAL ISLAND. One of the finest boys' stories ever written. The thrilling and joyous adventures of the castaways, Ralph, Jack, and Peterkin on their romantic desert island will never be forgotten. No boy's reading is complete before he has discovered Ballantyne's wonderful yarn.

MARTIN RATTLER. Many of the adventures in this story befall the hero in the romantic forests of Brazil; but before these experiences there come a sea voyage, an encounter with pirates, a wreck, and other thrilling incidents. It has always been a favourite book with boys.

R. L. Bellamy

THE ADVENTURES OF SCOUT GREY. Scout Grey was a scout of the first water. He was more than a scout, he was also a clever amateur detective; and his pluck and ingenuity in unmasking "wrong 'uns," to say nothing of breathless adventures, will delight all boys, whether they are scouts or not.

SCOUT GREY: DETECTIVE. There is a baffling mystery about beautiful old Barnett Farm that nobody can unravel, and is the cause of a whole party of holiday guests having to leave precipitately. But Scout Grey is not easily scared, and stays on to solve the mystery once and for all.

Lucien Biart

FROM LABRADOR TO MEXICO. This story takes us into many lands, among all kinds of interesting and strange people. The young man had anything but a dull time, and encountered a great variety of experiences and adventures.

H. Turing Bruce

THE SCOURGE OF THE MOORS. Raoulf de Gyssage is a hunchback. When he is about 15 he sees his brother killed in a duel by one, Sir Nigel de Flers, and vows to be avenged on the slayer. He runs away from home, goes to the wars, and has many a marvellous adventure.

Harcourt Burrage

THREE CHUMS. The three inseparables were disgruntled because they had been moved from the cock house to a new house, and determined to slack both in work and games. But they grew sick of idling, and the new term found them inwardly rather ashamed of themselves.

D. M. Callow

TOBY IN THE SOUTH SEAS. Toby and Jerry were twins who went to live on a South Sea island with their parents and two sisters. The whole family fairly revelled in the very different life, and the adventures of the two boys make very exciting and interesting reading.

F. Carlton-Wiseman

ONE EXCITING TERM. And a truly thrilling term it was, with enough excitement to last most boys a lifetime. Boy Scouts (and all other lads, too) will revel in this story of mystery and pluck and adventure.

Harry Collingwood

UNDER THE METEOR FLAG. Ralph, the hero, is one of the most dashing midshipmen who ever breathed. His adventures on secret service among the Corsicans and French, and his cuteness in surprising forts and warships lead to early promotion.

George Cupples

THE GREEN HAND. Starting as a very green hand, he soon became as smart as paint. Later, when sailing as a passenger, he takes command in an emergency, and returns home in charge of a prize captured by himself.

Chas. Edwardes

THE NEW HOUSEMASTER. Who was he ? The boys didn't know, nor the headmaster, nor the police. But the gang of coiners knew, and used the boarding school to cover their operations. Eventually they made good their escape. How was it done ?

H. Elrington

THE OUTSIDE HOUSE. Harry Vereker's father having died, his rather mean uncle sends him to a big public school, but enters him at "Pugsleys." It is in rather bad odour, and most of its members feel themselves despised by the rest of the school, who call them "Pugsley's Paupers." But Harry brings a new spirit into it, and the story of how the outside house "makes good" is very interesting reading.

R. A. H. Goodyear

ALL OUT FOR THE SCHOOL. Much fun is caused by the arrival at Wolverton School of twin masters, who add zest to the life of the school. There is much fun in this tale and some stirring accounts of Soccer matches. Mr. Mellowship, a master known as "Ship Ahoy!" is most popular and proves a marvellous football coach.

STRICKLAND OF THE SIXTH. Owing to its comparative inaccessibility on top of a hill, Hanenhall School has fallen on bad days, there being only about a quarter of the number of boys it could accommodate. But "Strick," the captain, determines to make things hum. How he does it so that three hundred new boys are expected by the next term is a very interesting story.

THE HARDY BROCKDALE BOYS. Brockdale is proud of being known as one of the most robust public-schools in the country. It looks down with pitying contempt on a neighbouring school of delicate boys. Healthy sport and bright doings at Brockdale are spiced by a series of mysterious adventures, and a way is found in the end by which the Brockdale boys may meet the once-despised school on level terms.

J. Percy Groves

CHARMOUTH GRANGE. Philip Ruddock was a truly villainous villain. He caused his old kinsman to be poisoned, and tried his best to do away with the young heir so that he himself might own Charmouth Grange. But young Ronald Cathcart, with tremendous pluck (and no little luck), came into his own after many vicissitudes and hair-raising adventures.

Bernard Heldman

MUTINY ON BOARD THE "LEANDER". This book is packed with thrills of all kinds. The men of the "Leander" were a pretty rough lot, but their "coup" brought no good either to themselves or the few honest men on board. Fire, shipwreck, savages, pirates, slavery, and final escape all tend to make breathless interest for boy-readers.

G. A. Henty

THE CORNET OF HORSE. This fine story of the gallant days of old, traces the career of the hero from his first lesson in fencing until he becomes one of the finest swordsmen in Europe. He ruffles it with Marlborough in England, France and Germany.

JACK ARCHER. A midshipman in the Crimean War is captured by brigands at Gibraltar and held to ransom, but escapes. He takes part with a Naval Division at Balaclava and covers himself with glory.

WINNING HIS SPURS. The story of an English lad who won his spurs after many wonderful deeds and hairbreadth escapes during the Crusades. Not dry history, but a series of glorious adventures.

Kit Higson

THAT SURPRISING BOY, SPINKS. They were a jolly lot of youngsters, but harried by a big bully, until "that surprising boy" arrived; and the *most* surprised person was the bully, who found he had met his match. Jimmy Spinks and his special chum, Jack Taylor, are two fine little chaps, and their adventures will delight boys.

George Gibbard Jackson

THE QUEST OF THE OSPREY. The story of the hunt for a mine of fabulous value, both an English captain and a Frenchman being very keen. Two boys who stowed away on the Englishman's ship come in for any amount of excitement and danger and adventure. A thrilling story for boys.

Arthur L. Knight

IN JUNGLE AND KRAAL. The adventures of two young midshipmen in the jungles of Ceylon. Immediately on landing at Colombo from their ship, they fall into thrilling adventures, lose their horses and nearly their lives! An expedition into the jungle is planned, and, after many adventures they assist in the capturing alive of a herd of elephants.

Andrie Laurie

THE CRYSTAL CITY. "The Crystal City" is a fantastic tale of a young midshipman, who, washed overboard in a storm, finds himself in a wonderful glass city under the sea; its only occupants being an old man and his beautiful daughter. The mystery of their existence there, and the result of the young sailor's visit make a very interesting story.

J. Macgregor

ONE THOUSAND MILES IN THE ROB ROY CANOE. This is the log of a charming cruise in a small canoe, designed by the writer. With paddle and sails he traversed the rivers Thames, Sambre, Meuse, Rhine, Main, Danube, Aar, Ill, Moselle, Meurthe, Marne and Seine, and Lakes Titisee, Constance, Unter See, Zurich, Zug, and Lucerne, together with six canals in Belgium and France, and had two expeditions in the open sea of the British Channel.

Peter Mael

UNDER THE SEA TO THE NORTH POLE. A thrilling story of adventure in the Arctic regions, with hardships galore met with pluck and endurance. Mutiny and treachery have their part, and strenuous fights with polar bears, and dangers of all kinds.

Captain Marryat

MR. MIDSHIPMAN EASY. Before he began to write books, Captain Marryat had a share in many hard-fought battles at sea. He sailed as a midshipman under Lord Cochrane, and spent years in dangerous service off the French and Spanish coasts. Marryat served many years after this, and was the hero of many exploits that had been embodied in his works. Critics agree that "Mr. Midshipman Easy" ranks among Marryat's very best.

Herman Melville

MOBY DICK. Here we have a moving book which could have been written only by a writer of genius who had lived a life of peril. Such incidents as these could not have been invented. Herman Melville went upon a whaling expedition, and we have the result in these stirring pages. The sense of reality is wonderful, and the tale made the writer famous all over the world. It is now a classic.

Sam Noble

'TWEEN DECKS IN THE 'SEVENTIES. A book that any boy worth calling a boy will delight to read and have for his own. It is a truly fascinating account of life in the Navy when Sam Noble was young. Simply yet forcefully written, every line is a joy.

G. Norway

RALPH DENHAM'S ADVENTURES. A tale of the Burmese jungle. A boy sets out from his home to take up work in Burma. His adventures begin early, for his boat catches fire and sinks. The firm for whom he was to work in Burma fails, and he is cast upon his luck. He travels through the jungle, has many adventures, and finally makes good.

Michael Poole

UNDER RINGWOOD'S RULE. Jackson Wrexham, the son of an American millionaire, is sent to Ringwood School where he strongly resents the discipline imposed and quite fails to understand the team spirit. He has a great number of scrapes and even tries to run away from school. Eventually, being a good swimmer, he wins an event for the school and at last settles down happily.

Louis Rousselet

THE SERPENT CHARMER. A French gentleman and his boy and girl fall under the displeasure and into the power of a great Indian Prince. Andre, the son, escapes, and disguised as a young native has many adventures, and is finally reunited with his family.

J. G. Rowe

ROUND THE WORLD WITH DRAKE. A story of Sir Francis Drake's voyage round the world in "The Golden Hind," of the voyages, many and adventures, victories with the Spaniards, endurance, of storms and hardships and triumphant return to Plymouth, to say nothing of the special exploits of a charming young hero.

W. Clark Russell

THE FROZEN PIRATE. Paul, a sole survivor, finds, stuck fast in the ice, an old ship. On board is the frozen form of an eighteenth century pirate, whom Paul brings back to life for a while, and eventually gets both ship and treasure home intact.

THE SEA QUEEN. A tale of the sea and seafaring people, told by a girl, Jessie, who married Richard, a captain, and goes with him on an adventurous voyage. It includes a mutiny, a ship on fire, and the wonderful salving of another vessel that provides them with an ample reward.

W. Clark Russell

THE WRECK OF THE "GROSVENOR". Recognised as one of the greatest stories ever written. The unforgettable story of the mutiny on the "Grosvenor," out from England, the sailing of the mutineers for Florida, how the hero, with a couple of seamen, tricks them and takes the "Grosvenor" along till she sinks, the taking to the boats, and the final rescue.

A SAILOR'S SWEETHEART. Will goes off on his last voyage before becoming first mate. Unknown to him his sweetheart Nellie books a passage by the same boat. The captain goes mad and hangs himself, whilst Will, Nellie, and three sailors, are wrecked, but manage to bring home a valuable waterlogged vessel.

JACK'S COURTSHIP. Jack's girl friend is sent on a voyage. Disguised, he sails in the same ship. His rival is no sailor, and leaves the ship in disgrace. In dire peril, Jack takes charge so capably that he overcomes all opposition and wins his bride.

Michael Scott

TOM CRINGLE'S LOG. The author of these moving adventures was a University man who went to Jamaica and the West Indies as a planter. By his keen observation he collected the materials that he used in this sprightly book. The book is packed with incident, the style is lively and full of fire, so that this story has remained very popular ever since its appearance in 1833.

Jules Verne

THE ABANDONED. This is the story of the mysterious island upon which the castaways were "Dropped from the Clouds" and also the story of a neighbouring island that proved even more of a mystery. On this second island they find "The Abandoned," a man with a strange history, which the story relates.

ADRIFT IN THE PACIFIC. Just the book for boys! A party of school boys suddenly find themselves adrift on the mighty ocean. They are wrecked on a lonely island. How do they fare? What can they do? Read how they set up a little colony and governed it, how they hunted, fished, explored and finally overcame some murderous mutineers thrown ashore on the coast of their little island.

AROUND THE WORLD IN EIGHTY DAYS. Phineas Fogg, for a wager, attempts to make a circuit of the earth in eighty days. It is a case of whirlwind travel, and the story of the journey goes along with a rush of excitement. Adventures crowd upon Phineas ashore and afloat, enemies try to thwart him, accidents delay him, and he returns to London just too late, and yet in time! Therein lies a puzzle.

THE CLIPPER OF THE CLOUDS. The most wonderful aeroplane that ever navigated the air, and yet it was invented in Verne's magical brain long before the first airman set his propeller whirling. Captain Robur does what no airman can do to-day, and the story of this world-wide voyage is one continuous thrill.

THE CRYPTOGRAM. This was the secret document, written in a difficult cypher, which proclaimed the innocence of Joam Dacosta, a man condemned to death for a crime of which he was innocent. The story of the trial and the unravelling of the "Cryptogram" at the last moment makes an enthralling story.

Jules Verne

DROPPED FROM THE CLOUDS. Five men escaping by balloon from an American city in war-time, are carried out to sea by a hurricane. After the most acute perils they are cast upon a island far from land. Here the heroes settle, and provide themselves with clothes, food, weapons by a clever use of the natural products of their new home.

FLOATING ISLAND. An artificial island, four and a half miles long and three broad, is made by an American multi-millionaire. It contains mansions, parks, public buildings, water supply, etc. Moved under its own power, it travels to many parts of the world. The marvellous adventures of its inhabitants make an exciting story.

THE FUR COUNTRY. An exciting story of the wonderful land of the Midnight Sun. It tells of the perils and excitement of trapping in the Arctic Circle, and the hunting of wapiti and polar bears and silver fox, etc., varied with adventures among icebergs and the great rivers and lakes of the Fur Country.

THE MASTER OF THE WORLD. "Robin the Conqueror" he calls himself, because he considers that the wonderful flying machine he has invented and constructed gives him complete control of the destinies of all nations. But he comes up against John Stock and finds he is not so powerful as he thought he was.

FROM THE EARTH TO THE MOON AND A TRIP ROUND IT. An American determined to pay a visit to the moon; so he built an enormous gun, and a house like a shell, and tried. The results of his experiments are contained in this astonishing book.

GODFREY MORGAN. Godfrey Morgan has everything a young man can want, but he is weary of luxury and longs for adventure. His fond uncle allows him to go off on a voyage with his tutor, a most egregious fool. The ship sinks under them, and the two are thrown upon an island, and have just as much adventure and hardship as they can put up with.

EIGHT HUNDRED LEAGUES ON THE AMAZON. Not merely a description of a journey down the most wonderful river in the world, but the story of a brave gentleman wrongfully accused of a crime, and the schemes of a rascally adventurer to blackmail him and his family.

A FLOATING CITY & THE BLOCKADE RUNNERS. "The Blockade Runners" tells how a grave and handsome young skipper ran a cargo to the American ports during the Civil War, and how he had on board a winning little lady, so that he not only ran a cargo, but brought away an imprisoned father condemned to death, and so won himself a charming bride.

THE ADVENTURES OF THREE ENGLISHMEN AND THREE RUSSIANS. Three Englishmen and three Russians go on a joint scientific and exploring expedition to South Africa. They disagree and separate; natives attack them, and only after many perils do they re-unite in safety.

FIVE WEEKS IN A BALLOON. In a balloon, which had something of the airship about it, the inventor, his faithful servant, and a friend, cross Africa from East to West. Swamps, forests, deserts, savages, fierce beasts, hunger and thirst all assail the intrepid voyagers in turn; but they win through by skill, pluck and endurance.

Jules Verne

TRIBULATIONS OF A CHINAMAN. A rich young Chinaman, finding the future does not attract him, writes an order to his friend to kill him, choosing his own time and method. He then changes his mind and wants to live, but friend and paper have both disappeared, and a wild goose chase with endless set-backs follow.

TWENTY THOUSAND LEAGUES UNDER THE SEA. The masterpiece of all submarines was the one imagined by Jules Verne and constructed by Captain Nemo, the most mysterious sailor that ever sailed the sea. The voyages of this book and the astounding adventures of its crew make it one of the most fascinating stories ever published.

DICK SANDS. When a catastrophe deprives a sailing ship of its captain and nearly all the crew, the responsibility of bringing the ship safely to the end of its voyage devolves upon Dick Sands, a boy of fifteen. He does his best, but treachery results in landing them in Africa instead of the haven they desired, and many adventures befall him and his party.

THE END OF NANA SAHIB. A story of the time a few years after the Indian Mutiny. A party of men travel many miles in a wonderful moving house, drawn by a marvellous steam elephant. Their many adventures and the doings of Nana Sahib, the fiend of the Mutiny, and his final overthrow are very exciting.

THE FLIGHT TO FRANCE. An interesting story of a party of charming French people who are forced to flee from Germany when war is declared between the two countries. They pass through many vicissitudes on the journey. One of their number comes within an ace of being "shot at dawn."

HECTOR SERVADAC. A most astonishing story of the collision between a comet and the earth, full of adventure and excitement, and incidentally, full of information concerning certain heavenly bodies.

THE VANISHED DIAMOND. A fine story of the South African diamond fields and the adventures of a young engineer who attempted the dangerous experiment of trying to make a diamond. There was a diamond and it vanished; but how? Read the story.

THE SECRET OF THE ISLAND. This is a story of mystery, an unseen man who guards the castaways and provides for them. Their attempts to discover the secret are in vain, but at last the Unknown reveals himself as Captain Nemo, the hero of "Twenty Thousand Leagues Under the Sea."

WINTER AMID THE ICE. An ice-bound ship, two deadly enemies aboard, shortness of food, fights with men and polar bears, dangers of every kind possible in the Arctic Circle make an exciting and interesting book for boys and others.

THEIR ISLAND HOME. Jules Verne had such an admiration for the famous book, "The Swiss Family Robinson," that he himself wrote a sequel, and carries the history of the Zermatts considerably further. The book is at least as interesting as the one that inspired it.

THE CASTAWAYS OF THE FLAG. The final adventures of "The Swiss Family Robinson." Here some of the family having visited Europe are on their way back to their island home when they are shipwrecked. After many privations and adventures they get a very pleasant surprise.

Jules Verne

THE LIGHTHOUSE AT THE END OF THE WORLD. Three men are left in charge of a new lighthouse on a lonely island at the southern extremity of South America. A band of pirates have a lair near-by and most exciting happenings take place.

MICHAEL STROGOFF. The greatest romantic writer since Alexandre Dumas, Jules Verne's works have been translated into every language. Michael Strogoff is ranked by critics as one of the finest creations of his pen.

THE MYSTERY OF THE FRANKLYN. The story of Captain John Branican, who set sail for a voyage to the East, expecting to return to his home in six months. But he did nothing of the kind. The story of the various efforts to discover what had happened to him and his ship, with the final unmasking of a villain, will greatly interest boys.

Rowland Walker

THE LOST EXPEDITION. Two boys are allowed to go with a party to search for the members of an expedition that has been lost in the wilds of the Amazonian forests. They have glorious adventures and narrow escapes galore, but all ends well.

MASTER VALENTINE BUCKET. Valentine Bucket was a new boy, but not the ordinary retiring sort of new boy. They all thought at first, that he was a "lout" and a "mug-wump," but he soon showed he was nothing of the sort, and made the whole school "sit up and take notice" from the "Dominus" downwards, especially the school bully.

Lew Wallace

BEN HUR. A tale of Christ. The story tells of the experiences of Ben Hur in the East at the time of the birth of Christ, and the beginnings of Christianity. The tale is written in absorbing style and the daily life and atmosphere of the time are powerfully depicted.

GIRLS' SCHOOL STORIES AND TALES OF ADVENTURE, 2/- *net.*

Louisa M. Alcott

LITTLE WOMEN. This is one of the most delightfully homelike books for girls which have ever been written. The character of Jo is drawn very vividly, and we all grow to love the tom-boyish girl who manages to get into so many scrapes and awkward positions and then get out of them cleverly.

LITTLE WOMEN WEDDED. This is a continuation of the life of "Little Women." Meg, happily married at the beginning of the book, experiences the many trials and amusing difficulties of a young wife. As the book draws to a close we see the "Little Women" changed into "Good Wives" and all ends happily.

Marjorie Bevan

FIVE OF THE FOURTH. A very merry little quartette were gathered in the Recreation Room on the first day of the Summer Term ; and in discussing their plans were quite determined that no one should be allowed to share, or spoil, their companionship. But Peggy Lawson, a new, shy girl, intrudes, with the result that they have more fun and adventures than ever.

THE PRIORY LEAGUE. The old school is in danger of being sold because there is no money for repairs. There is an old legend that when the Danes invaded England and sacked the Priory, the founder had hidden some of her treasures. Several of the girls band themselves into a " League," determined to find the long-lost riches. Their adventures and what happened in the end make a truly exciting story.

Jennie Chappell

AILSA'S CHUM. A deeply-moving girl's story. Life proceeds happily and unevenly in the Brereton household until there comes a railway accident and a strange baby is thrust upon the family. Soon after complications begin, and a fine story is unravelled. The story closes with the reunion of two lovers long parted and lost to one another through misunderstanding.

GLADWYN. This book is described by the author as " a circle of fortune," and concerns the adventures of Gladwyn, heiress to a worthless estate. How she faces his difficulties and goes to London and finally finds much love and happiness is told with a swinging style.

M. De Witt

AN ONLY SISTER. Elizabeth and Marc, and Pierre and Henri, were the children of a French gentleman who fell on evil times. After his death the four had a desperate struggle to live, and it was the sister who bore the heaviest burden. But fortune smiled on them at last.

Enid Leigh Hunt

HAZELHURST. Here you have the story of a charming " nut-brown mayde," the youngest of a family, the others all being boys ; a delightful group of brothers, who make much of their young sister. There is also someone else, *not* a brother, but equally delightful and interesting. A book to charm and delight all girls.

THE ADVENT OF ARTHUR. Joyce Dayrell and her brother, Jocelyn, in the absence of their father abroad, have to live with relations, who are hard and unsympathetic. Sister and brother decide to go away and fend for themselves. Joyce becomes a teacher in a school, but life is often hard and dreary—until " Arthur " comes.

Bertha Leonard

THE HOUSE OF DOUG. Judith Douglas is the middle member of a lively, rollicking family. Full of life and spirit, and mischief, she is an incorrigible tease, but adored by all the others. There is tremendous excitement when their father inherits a lovely old mansion, with old oak, ancestral portraits, traditions and ghost all complete.

Bessie Marchant

CICELY FROME. The story of a girl, who, a captain's daughter, learns early in life that her father is missing. She goes to Ceylon and has many enthralling adventures, the chief of which is the tracing and rescuing of a stolen baby. Finally, the mystery surrounding her father's disappearance is cleared up.

Irene Mossop

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RUPERT Little Bear fell into the hands of Three Robbers. He is discovered by a kindly Wizard, and delivered from their power.

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RUPERT had invited his friend Edward Trunk, the Elephant, to stay with him. Together they help to rescue a Lady in distress.

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WHILE Rupert is out for a walk an Old Witch catches him, takes him to her home and locks him in an iron cage. He is rescued by his friend.

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