BROAD GAUGE ENGINES.

By A. H. MALAN.[1]

With Illustrations from Photographs by the Author.

IT is improbable that any width between the rails other than that which goes by the name of the narrow gauge would ever have been adopted by any important English company, had it not been for Mr. Brunel. Upon the proposal that a railway from London to Bristol should be constructed—one, as it then appeared, likely to be quite independent of other lines—Mr. Brunel, the engineer to the new company, came to the conclusion that the ordinary tramway gauge was, for railway purposes, not so desirable as might be. He foresaw that the tendency would be towards increased speed, and that increased speed would necessitate more powerful engines; while he rightly judged that if ample width of support were given, not only would such engines have more room for the free play of their machinery, and the safety and comfort of passengers be more assured, but also that if a seven-feet gauge were adopted, any future contingencies of development in regard to size of wheels and carriages would be provided against in advance. He also considered that smoothness of motion would be increased if the rails were laid upon continuous longitudinal sleepers, instead of being supported only at intervals, as had hitherto been done.

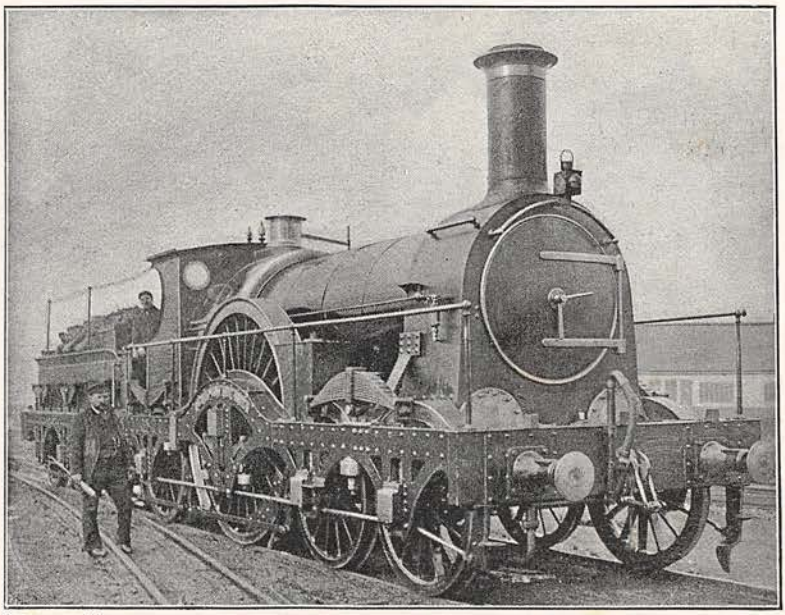
These features in Mr. Brunel's scheme, though great innovations, and considerably raising the primary cost of construction above that of an ordinary line, yet were accepted by the Directors, who thought that the first-class traffic would certainly increase as the public became aware of the extra speed of the new departure. And so Mr. Brunel had his way, and matters proceeded. Want of funds, however, prevented the line being made continuously from London to Bristol, and accordingly Parliament was, in 1834, asked to grant permission for the work to be begun by two disjointed sections, from London to Reading, and from Bath to Bristol. To this suggestion the Commons consented, but the Lords objected, it being said among other things, that the project would be a head and tail without a body, neither Great nor Western, nor even a railway, but a fraud and deception upon the public. The following year, however, the Bill passed, and by 1838 the line was open from Paddington to Maidenhead, and the broad gauge became a tentative experiment. Soon trouble began to be experienced with the permanent way, as both timbers and rails were found to be too small in section for the weight and speed of the trains, and certain shareholders looking askance at the cost of construction, the Directors

[1] My thanks are due to the Secretary's office at Paddington, and to Mr. W. Dean, Swindon, for information supplied.—A. H. M.

requested two independent engineers (Mr. N. Wood and Mr. Hawkshaw) to inspect the piece of line in question. Their report was somewhat unfavourable, but it was overruled by Mr. Brunel's reply, and in the following year the Directors told their shareholders that "they unanimously acquiesced in retaining the width of gauge with the continuous bearings, as most conducive to the interests of the Company," but added that "heavier rails and longitudinals should in future be employed." Thus the broad gauge became an established fact.

By 1840 the line was continued to Reading, and, operations having been carried on simultaneously at the other end, in 1841 it was complete to Bristol, affording a piece of road eminently suited for high speed, with curves of large radius, and no gradient steeper than 1 in 660 except two inclines of 1 in 100, on which additional engine power was to be used.

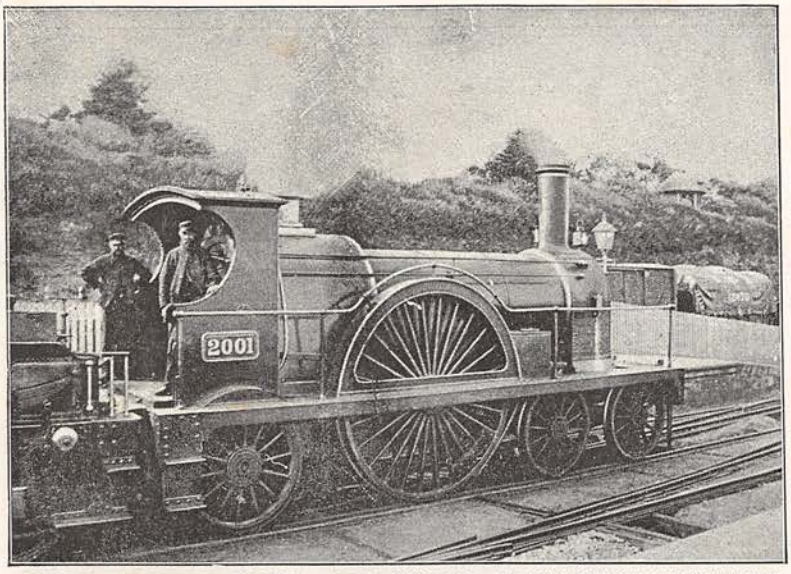
At this date the difficulty in running at a great speed lay not so much in the engines as in the primitive signalling arrangements. An average of thirty-three miles an hour was about the best performance possible, until the electric telegraph was matured in 1844, when the Great Western at once went ahead. From the first the broad gauge stood alone, with enormous odds against its adoption by other Companies, while its own ramifications soon began to upset the preconceived idea that, as a railway, it would be independent of other lines. Branching out boldly to the north it came into competition for goods-traffic with the London and Birmingham line, when the conflicting interests proved formidable enough to demand a Royal Commission to consider the matter. To the question whether break of gauge was an inconvenience requiring legislative control, the Commission reported, in 1846, that the narrow gauge was preferable for general convenience, and that if it were imperative to produce uniformity, it should be obtained by altering the broad to the narrow gauge, and not *vice versâ;* though it was also very justly remarked that on the Great Western the motion was generally more easy at high velocities, and that in respect of speed, the advantages were also with the same Company. The Board of Trade could not, taking all the bearings of the dispute, see their way to recommend that the Great Western should be narrowed throughout, nor that a mixed gauge should be added over all their rails, and accordingly it appeared to Parliament that the case would be met by passing an Act to the effect that no new railways should be made in England otherwise than of 4ft. 8½in. gauge. This decision, coming as it did just at a time when great activity was being shown in the railway world, was virtually the death-blow of the broad gauge; although shortly after a strong request from Birmingham, that a contemplated line from Oxford thereto might be broad gauge brought about another Act in 1848 authorizing the proposed extension. Meanwhile, however, narrow gauge lines had been increasing throughout the Midlands, and the more the Great Western Railway spread its tentacles, the more the break of gauge became irritat-



"ROVER," A FAVOURITE ENGINE. TAKEN AT BRISTOL BEFORE JOINING THE "DUTCHMAN," NOVEMBER 5, 1890. ("LORD OF THE ISLES" CLASS.)

ing at different points, so that by 1861 it appeared hopeless to contend against fate, or attempt to carry the wider gauge any further, amid surrounding competitors. At this date, when Mr. Brunel's scheme had been carried to what were to be its utmost limits, the map shows, besides the main line from London to Cornwall, broad-gauge routes as far north as Wolverhampton, and west over the whole South Wales district; together with a large extent of territory between Reading, Devizes, and Weymouth, with sundry offshoots.

Then followed the inevitable retrogression, and at the present time, out of seventy-eight regular passenger trains working daily out of London on the Great Western main lines, only seven are broad gauge. By this time next year the broad gauge will be extinct. This is indeed a great pity, as the superintendent of the locomotive office at Bristol recently remarked to me; and if the Board at Paddington could see their way to content themselves with adding a third rail (*i.e.* making a mixed gauge) west of Exeter, the grumbling at the break of gauge at Bristol, to the north, would be removed, while a large bulk of the travelling public, at least in the western-most counties, would rejoice and give thanks.

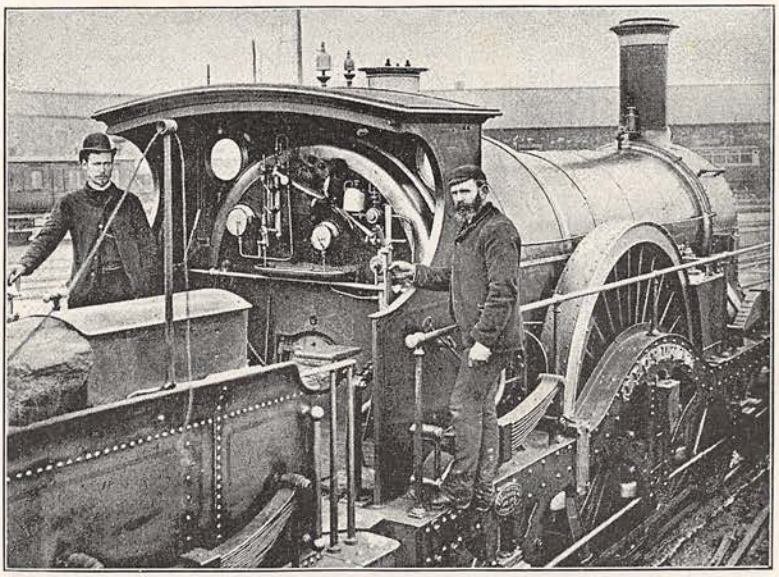


BRISTOL AND EXETER ENGINE. RIGID FRAMING. EIGHT-FEET DRIVING WHEELS.

It was remarked by a recent writer that "no engines in the world have so long and so famous a history as the old engines of Sir Daniel Gooch." This is high praise, but not overdrawn. It is indeed a surprising thing that a type decided upon so early as 1846 should be found capable of performing the duties of express engines in 1891, when the weight of the trains is at least double that which they were designed to draw. If with no material alteration in their structure they are still capable of the results we see, the question naturally arises, What would prevent new broad gauge engines—with ten feet driving wheels, larger cylinders and ports, and with boilers in proportion working up to say one hundred and eighty pounds—from covering the distance between London and Newton (only a few miles from Torquay) comfortably in three hours? True, Mr. Brunel once built an engine, the "Hurricane" (nicknamed "Grasshopper)," with ten-feet drivers, which was a failure; but then that was a monstrosity, with, it is said, the boiler beneath the crank-shaft.

The father of these express engines was the "North Star," a six-wheeled engine, built in 1837 at Newcastle, by Messrs. R. Stephenson & Co., from a working drawing bearing the signature of Mr. Daniel Gooch. Then followed after an interval the "Great Western," an eight-wheeled engine with eight feet driving wheels, built at Swindon in 1846, on precisely the same model as those now at work—barring the cab; while the "Lord of the Isles," which attracted considerable notice in the exhibition of 1851, and was exhibited again at Edinburgh last year, gave an admirable account of its merits by running close upon eight hundred thousand miles, before resting from its labours in 1881. The very names of these engines, Tornado, Lightning, Timour, Amazon, Swallow, Dragon, indicate the great or swift things of nature, and to see that expense has not been spared to make them appear worthy of the names they bear one has only to look at their polished brass domes, splashers, and

name letters ; their bright dark-green boilers picked out with bands of black and gold ; their warm Venetian red wheels and framings and their bright steel name-plates and axle-covers. Carping critics have affected to observe elements of weakness in the rise of the framing to clear the centre of the driving wheel, and at the break in the boiler at the firebox. To them it is a sufficient answer to point to the length of time many of these engines have been running, without any such weakness having ever made itself apparent. The secret of that steadiness of motion for which the broad gauge "eight feet singles" have so long been famous, lies primarily in the *framing*, and secondarily in the *length*. The gentle curves on the main line down to Newton permit the great rail-base of nineteen feet (*i.e.* the distance between the points where the tires of leading and trailing wheels touch the rail), without the necessity of employing bogie-wheels ; while the double sandwich frame, composed of two skins of iron with wood between, and the indiarubber cushions in connection with the several laminated springs, conduce to an elasticity of movement which has never been approached by any other class. Years ago the Directors were able to report that the "expense of locomotive repairs, especially on that heavy class of repairs which arises from lateral strains on the wheels and framing of the engines, have been materially less than on other lines," and further experience has probably in no way given them any reason to alter the statement then expressed. These remarks do not of course apply to the saddle-tank engines with low coupled wheels, nor to the Bristol and Exeter single-wheel engines, with eight- (formerly nine-) feet drivers. The latter had bogie-wheels in front, and single frames, and while not running so smoothly, required more repairs than the Lord of the Isles class ; while the former, though good for steep banks and sharp curves, are certainly not beautiful.

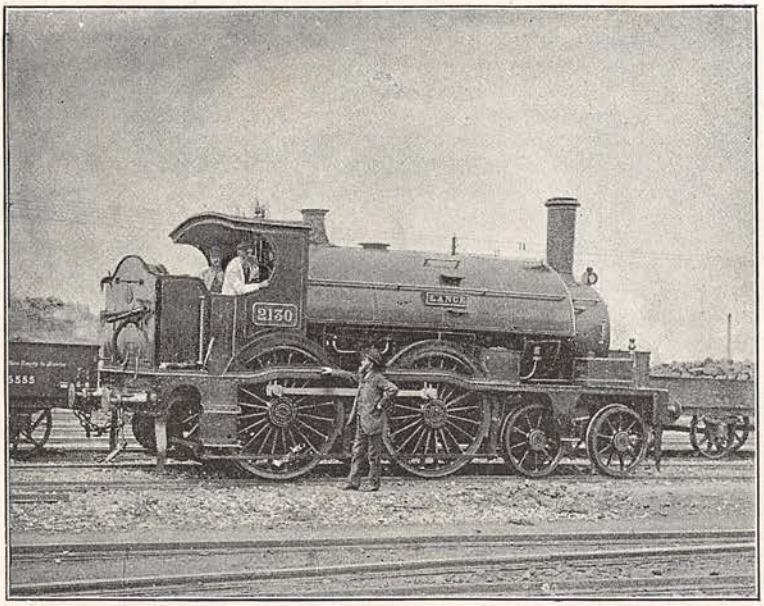


THE "IRON DUKE."

A Trip on a Broad Gauge Locomotive.

Having photographed broad gauge engines at odd times, in every possible attitude, and having seen how they looked from the line, the wish was natural to see how the line looked from the engines, and to gain some practical acquaintance with the routine of engine-driving. Accordingly, permission being granted from Swindon, I boarded the Iron Duke one morning last autumn, in Newton yard, as it awaited the up Dutchman's arrival from Plymouth. When we hooked on, there happened to be another engine behind us, and so there was no need for the display of much enginemanship on the journey to Bristol. The first problem that presented itself was where it would be advisable to take up one's position, with the likelihood of being least in the men's way : and a seat on the front of the tender seemed about as good a place as any. But as we bowled along by the estuary of Teign, with Shaldon nestling away under the Ness on the right, and the pretty ivied Tower of Bishopsteignton

peeping out of its trees on the left, the discovery was quickly made that such a position was a particularly unpleasant one. Hold as one might, by tender-rail and tender seat, and with feet wide apart, the oscillation between engine and tender was so great that the first stop at Teignmouth was thankfully welcomed as an opportunity of abandoning once for all any notion of sitting down. The driver suggested gripping the head end of the regulator with one hand, and the cab-edge with the other; and the remainder of the trip was comfortably performed in that attitude. In this position there was the advantage of an uninterrupted view through the right hand glass—the driver standing close behind, and watching the signals through such portions of the glass as were not obscured by the cap and head of his visitor. The men, in fact, are bound to *stand* during the whole of their run on quick trains, because they could not sit down much without being shaken to pieces; and if they did sit down, the signals would be invisible unless they looked out over the cab, which would be unbearable for any length of time. But, as might be conjectured, such protracted standing makes them subject to various complaints of the leg, whereby they are not infrequently placed temporarily on the sick list.



SOUTH DEVON SADDLE-TANK ENGINE, "LANCE."

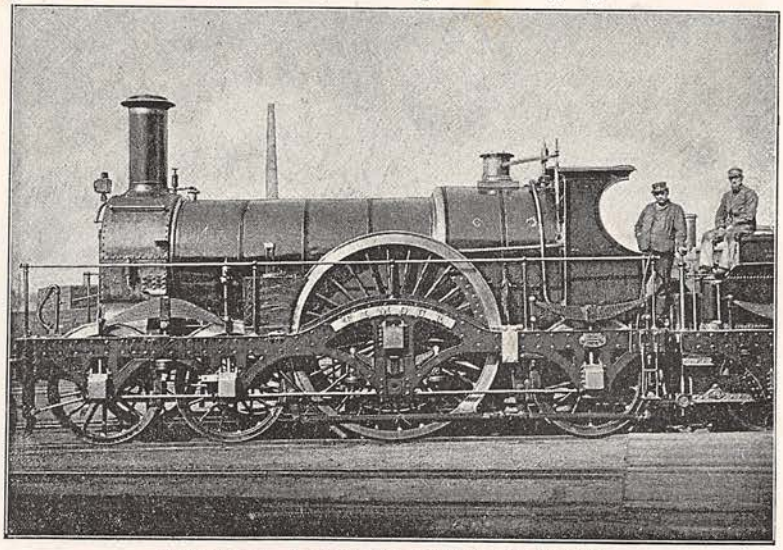
It was in passing the oaken glades of Powderham, when it became apparent that the footplate of an express is by no means so good a place from which to study the scenery, as might be supposed. A novice has enough to do to keep his balance, when holding tight with both hands far apart; he cannot venture to let go one hand and turn round his body, or he would be infallibly precipitated head-first among the coal; the vibration is far too severe to permit of his facing backwards; to keep leaning over the shelter of the cab would make his eyes run, to say nothing of smuts and grit; and the view inside the cab, through the glass, is very much circumscribed, like that of a horse with his blinkers on: save for a pretty peep here and there, he does not see half so much of the view on either side, as from a carriage window.

Such being the case, the scenery had to be given up, and the attention concentrated upon the signals, the work of the shovel, the index of the pressure-gauge, the manipulation of the regulator and lever, and the system of firing. And there was so much to interest in these ways, and the endeavour to see everything all at once proved so absorbing, that the run came to an end far too soon. The signals soon became a fascinating study. Everything—our very lives—depended upon their being seen, and their being right; it was surprising how far off one was able to detect them; and, caring only for those on the left side of the posts, to tell at a glance whether the arm was up or down; it was wonderful too how close one distant signal seemed to the next as we flew along after passing Exeter at a mile a minute. "Enginemen are at all times to exercise the greatest watchfulness; they are to be ever on the alert, and while on duty, to keep their minds entirely fixed on that which is required to be done." This instruction was carried out to the very letter; never for an instant, from Newton to Bristol, were the eyes of the driver (and those of fireman also, except

when firing or working the injector), otherwise occupied than in keenly and penetratingly scanning the road ahead ; while the same was the case on the journey back. Their ears also were constantly on the alert, to catch the beat of the engine which indicates that all is right with the "motion" ; though how they could tell, amid the multitude of noises, was altogether beyond my comprehension.

Hele and Silverton flashed by, and Collumpton quickly came in view. Here the whistle was sounded long and loud, to warn some rash person on the platform to retire before being demolished. Then a whiz, rattle and bang through Tiverton Junction, and so on towards Burlescombe and the Whiteball Tunnel. With two engines, there was no difficulty in mounting the bank ; in fact the lever was pretty well in the seventh notch (one next the centre of the sector plate) all through the run.

There is this distinct advantage in being on the engine in going through this tunnel, that the other end shows a small speck of light from the first, and therefore one can be sure the line is clear. The broken lumps of rock in the top make it look like a great black cave ; the roar, shaking, and bumping, are of course echoed and intensified. There comes to mind the remark of one of the witnesses in the House of Commons when the Box Tunnel was contemplated: —"The noise of two trains passing in a tunnel would shake the nerves of this assembly." But had the witness ever been through a tunnel on an engine, he would have modified his opinion about the other train, as his own locomotive would effectually drown any noises but those made by itself.



"TIMOUR." ("LORD OF THE ISLES" CLASS.)

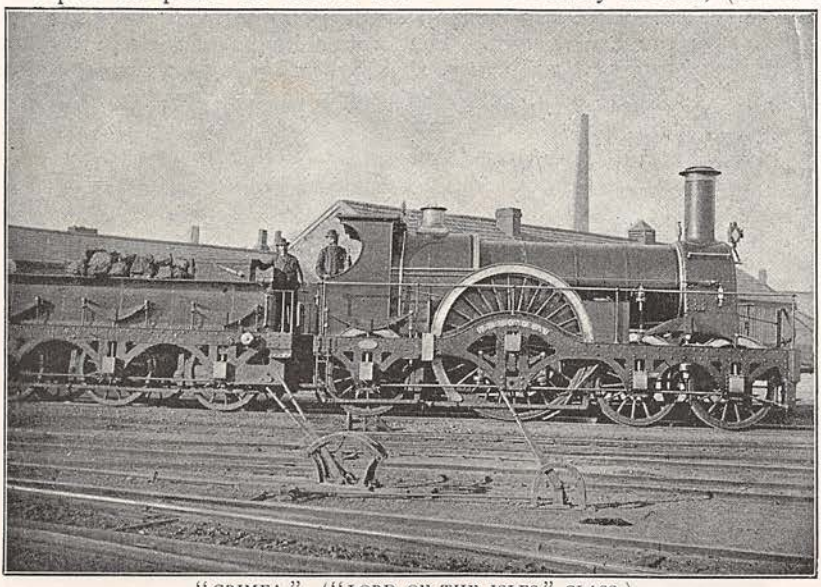
As a matter of fact, being in almost total darkness, going through a tunnel was not half such a risky sensation as dashing past platforms, or through a network of points. This trip served indeed to correct several wrong impressions. Some one has written somewhere, that in going round sharp curves the feeling is frightful, as though the engine were actually off the line. But nothing of the sort was experienced ; the engine then, on the contrary, seemed unusually steady ; in consequence, no doubt, of the flanges all pressing against that rail which bore the centrifugal force ; and moreover the lines are hidden for some distance ahead, on account of the length of the boiler. A long stretch of straight line was infinitely worse ; for a bad length of rail here and there would cause the wheels to bang against the metals, first on one side then the other, with a series of jerks, and deafening crashes, like the united blows of many hammers breaking up iron plates in a foundry yard.[1] It seemed, on these occasions, as if the tires of the wheels, especially the big driving wheels, were bound to snap, or the spokes to break off at the axles. Let the metal be of the very best, it is well known that constant vibration quite alters its character, rendering it crystalline instead of fibrous, and surely such tremendous strains must influence its nature, if anything in the world can. The sensation at these times was indescribable —"terrific" being the only word suggesting itself. If this be "steadiness of motion," one thinks, is it possible for any one to conceive the state of unstable equilibrium in which a narrow gauge engine must find itself under the circumstances? What may

[1] It is right to add that when any of the drivers report a bad piece of line, the platelayers are at once set to work to rectify matters.

be the length of life of the driving-wheels is unknown, but at least their tires would need regrinding about every fifteen months.

The tunnel past, we began to rush down the Wellington bank, which, as every one knows, is the fastest bit of line between Exeter and Bristol. And here it became necessary to hold on in grim earnest. The regulator was not touched, nor the lever either. "Enginemen must on no account attempt to make up lost time in going down inclined places." Whether they must or not, "You are going seventy miles an hour," shouted the driver, as we sped our way past the cutting and into the open; through the pretty station of Wellington, and the Victory Crossing, and Norton, until Taunton, with its many churches appeared ahead, and the steam was shut off, vacuum brake intermittently set to work, and we pulled up at the water-tank, to replenish the tender.

Up to this point the shovel had been constantly worked, (about three shovelfuls at a time) and the needle had stood steady at 120—*i.e.*, just blowing off; the fire had been well up to the bottom of the fire door, and the door had been kept closed.[1]



"CRIMEA." ("LORD OF THE ISLES" CLASS.)

Besides the pressure gauge, an eye was kept on the glass tube. The injector was constantly being opened, and it was a strange thing to see how quickly the water was consumed, and how great shovelfuls of coal vanished. The water in the tube would keep fairly still for a time, so that the shrinkage could be observed, and then would rise and fall with the oscillation; but the practised eye of the fireman could judge of the mean between the jumps of the water, and so know how many inches he had above the lead plug.

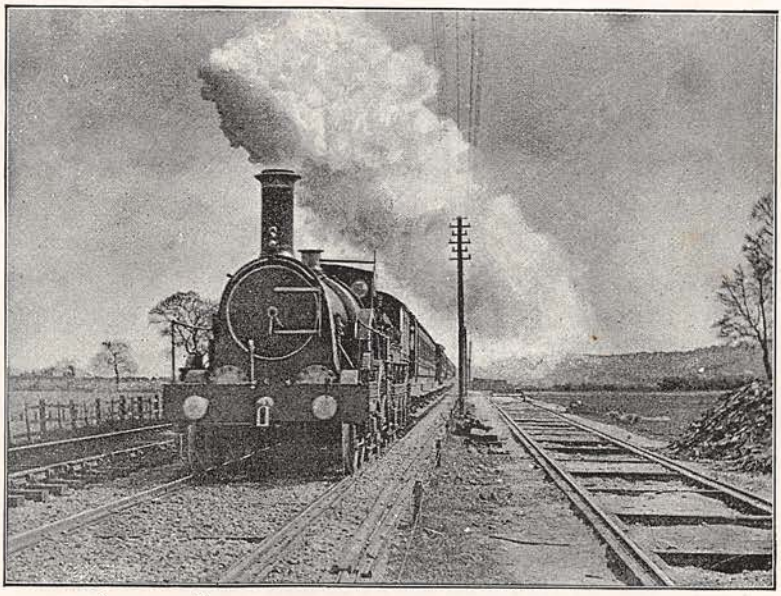
Having at length gained one's "sea-legs," the speed could now be thoroughly enjoyed. Looking through the glass, the "Iron Duke" seemed to be bobbing up and down like a horse's forequarters, when trotting, as seen from the box-seat; while a glance behind showed the other engine following our movements, like a boat towing astern in a lively sea. One curious optical illusion repeatedly occurred. In approaching and passing under the bridges, it looked as if the chimney were going to be knocked clean off by the arch—so much so that the appearance was ridiculously realistic.

As to the system of firing, it was certainly not that recommended in a certain text book, where it is stated—"That the fire should maintain steam under all circumstances, . . . it requires to be made in the beginning, and maintained to a form almost resembling the inside of a tea-saucer—shallow and concave, where the thinnest part is in the centre." Both drivers said they liked the fire high in the middle, as the engines steamed better that way; the fireman certainly placed his coal in definite places, near the door, and on either side, according to his discretion, but at no time did the fire appear hollow, or concave. It was astonishing to notice how soon, after firing, all appearance of smoke ceased. The coal would be shovelled in, where one could see it, and the door closed; and then when the door was opened, two or three minutes later,

[1] The fireman does not begin to let his fire down till after Highbridge.

the black, wet lumps had become melted, welded, and disintegrated, into one even mass of white hot flame, without a suspicion of carbon or smoke.

All too soon, we passed Durston, Bridgwater and Highbridge, with miles and miles of straight line, the Burnham lighthouse close on the left, and Brent Knoll away on the right. Here the driver repeated the tale of some old inhabitant remembering there being nothing but sea, where the line now is, and that the nearest land was up the Knoll, where a battle was once fought! This information, conveyed amid a deafening tumult, had to be accepted unconditionally, but probably the old inhabitant meant marshy ground, covered at spring tides. Then Bleadon, with the Steep Holm (and Flat Holm?) showed up across the level tract, and one began to notice that the firing was less frequent, and the fire getting low down. And presently, or a few seconds after as it seemed, there appeared suddenly a charming peep of the Clifton Bridge; and then, before one knew it, we entered Bristol; the needle standing at eighty, the fire glowing brilliantly, but well burnt down. Here the engines came off, and a London engine took their place. We had to wait some time outside the station, as all engines have to back by the main down line, and local trains are constantly occupying the platform.



UP "JUBILEE," 1.40 P.M., GOING THROUGH EXMINSTER. ENGINE "SEBASTOPOL," MAY 5, 1891.

"I wonder you don't get a block with all the engines that come off having to back out by one line," I remarked to the driver.

"So we do, sir, sometimes; we are nearly always delayed at this Box," he replied.

Another wrong impression had been relegated to the limbo of departed mistakes; and this was that it would be cold and draughty. Far from it, it was quite comfortable, and decidedly warm; rather too much so, when the fire door was opened. Legs and body were always over warm, and even if the wind had been blowing a gale right into the cab, probably it would not have made itself unpleasantly felt, when running fast. Wet feet were certainly possible from the constant play of the hose on the coal, but there was scarcely any grit or dust.

The two hours of waiting were spent in having a look in at the engineman's cabin, inspecting the Running Sheds, and having a chat with an engineman standing pilot:—"A horrid job, doing nothing all day, have to keep steam up, and then at five p.m., perhaps be told I have to go to London and sleep there." On being asked how it happens that the drivers so frequently change their engines, even though the former ones they used to drive may be still at work, he explained it thus:—"An engine, after running so many thousand miles, goes to Swindon to be over-hauled; and when it comes back, if it be a favourite, it is assigned to the most deserving man." Every one in the link is looking out for the best engines, and in this way changes often take place, not without a certain amount of jealousy, or at least of wholesome rivalry.

The down "Dutchman" was timed to leave Bristol at 2.2 p.m., but came in a few minutes late. The "Rover," bright and clean as a new pin, backed down to the

platform, and Sansom, the driver, looked along the platform, counted the carriages and chafed at delay.

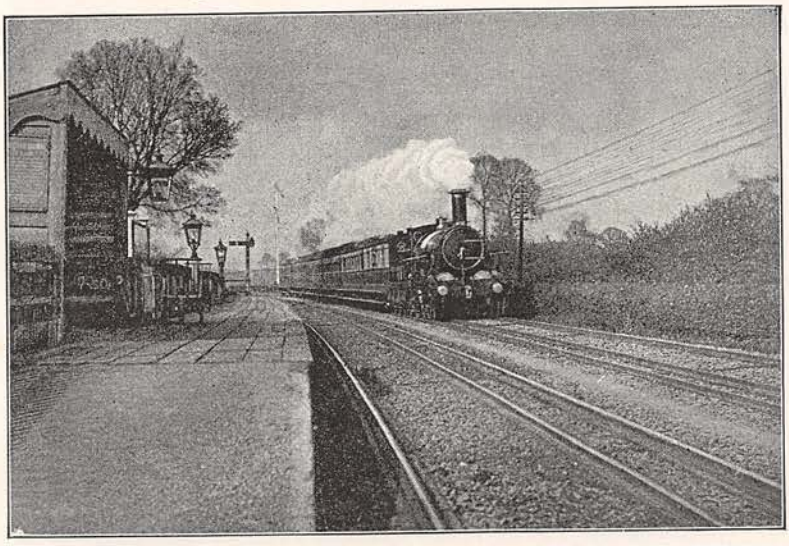
"Heavy load?" I remarked.

"Seven eight-wheeled coaches, sir, each weighing twenty-one tons; third class compartments choke full. This train used to have no third class, fewer carriages, and was allowed the same time."

"Shall you save any coal to-day?"

"No coal to be saved by this train," he replied.

And so it appeared. From start to finish the fire-door was perpetually opened, and dripping coal shovelled in. Cook, the fireman, did his work well, never missed shooting the coal (chiefly placed in the centre of the fire) without dropping any of it outside; and when a speck of dust got on the footplate, promptly sweeping it up with his brush. He was a model fireman, always at work, and silent, and never in the way; which is a good deal more than he might have said of his passenger. Of course though coal may be placed in the centre it is obvious that the jolting of the engine will soon shake the several lumps into any hollow in the fire where there may be a lodging place for them, so that the molten mass quickly appears as a level homogeneous layer. We started with the needle at 140, and ended at Teignmouth with the same pressure, as the "Rover" was to work its way back, with a stopping train, shortly after reaching Newton.



"DUTCHMAN" AT FULL SPEED DOWN GRADIENT, PASSING STOKE CANON STATION, 3.50 P.M., MAY 9, 1891.

The injector, a more modern one than that of the "Iron Duke," was immediately below the pin of the regulator; it was kept gently "on" the whole way, replenishing the boiler by the amount of exhaustion, and keeping the water in the glass tubes wonderfully steady.

It was a fine, sunny afternoon. The ground rises the first six miles to Bourton, and this has to be done in nine minutes, to keep time. The regulator was full open, and the lever in four-and-a-half notch to the top of the bank. Posted at the left hand glass, it was the fireman's turn this time to have his observations interfered with. The most dangerous part seemed, as before, crashing past the platforms; there was just time in many cases, but not in all, to spell out the names of the stations; one's whole attention was concentrated once more on the signals. And here an unforeseen difficulty presented itself. The sun was getting low (3 p.m., November) and shone full in our faces right up to sunset; the farther we proceeded the worse the dazzle; it was utterly impossible for one unused to the work to see whether many of the signals were on or off, right in the glare and against the sun, and this must be a great strain on the men's eyes. When questioned about it, the driver confessed that it was "bad enough," but remarked that after all it was not half so trying as snowstorms, when the snow would darken the glass so that scarcely anything at all could be seen.

At Taunton the tug of war was to begin, it being a steep pull from here right up to the Whiteball.

"You generally take a bank engine here, don't you?" I observed to Sansom.

"Yes, generally, but I shall try and get through to-day," he answered.

This was good news indeed, seeing that an engine in front would smother us with its smoke, and prevent one seeing how the "Rover" would mount the long bank single-handed. On this point Sansom was evidently of the same opinion as one of his former comrades, an ex-driver of the Lightning, who told me:—"You must start at Taunton if you are going to get up the bank in time, and not put the lever back in the seventh notch, but after getting away let it stop in the sixth, until after passing Wellington, then give it another notch or two, and not wait until the speed has got too slow. With a big wheel you must keep them going, if you don't, and your engine should start slipping, you would be very soon brought to a stand. I have had many a hard struggle up the banks with heavy trains, though I always got through with them both up through Box Tunnel and Wellington bank; but I always started *at the bottom* for them."

After Norton, the pace soon began to be less violent, and the panting of the engine showed that the resistance on the pistons was increasing. As Wellington was neared another notch was given the lever, and still another. Then began an anxious time. Having read in a certain work that "to climb a long bank, instead of the engine blowing off, it should rather be inclined to be short of steam, so that the steam can be allowed to push the pistons nearly to the end of the stroke, following it up with an even pressure," I thought that with a boiler full of steam, as ours was, some steps would be taken to partially close the regulator, or notch up the lever. But here, again, doctors obviously differ. The regulator was wide open, the lever in the second or third notch, and the intention evidently was to mount the bank as quickly as possible by the sheer force of high-pressure steam.

The driver and fireman "stood by" eagerly listening, and at the least suspicion of slipping, worked the sand-gear quickly. A little rain was falling, the rails were moist, and the sand-lever had to be worked more than once.

"Then you don't put down the damper, or check your steam in any way, up the bank?" I remarked.

"No, let her have it: the 'Iron Duke' stuck in the tunnel last week," answered Sansom.

I noticed as we laboured on how the fireman kept tending his fire with extreme care, selecting nothing but clean lumps without any small stuff and constantly feeding the furnace, keeping the needle well up to 140. There must be a tremendous blast in the furnace when the lever is well over. A great lump of coal does not get dull red first round the edges, as in a grate, but disintegrates uniformly and at once; fiery smoke comes from between the strata of the block; it seems all in a simmer and grows white hot almost in a moment.

And now the pace was at last really slow, but then here we were entering the tunnel, and our troubles were over. The lever was put back in the seventh notch, and away we started for Tiverton, Collumpton, and Silverton—here the speed is always great on down trains—and so on, in the waning light, through Stoke Canon, right into St. David's, without a single check from Bristol, and only one adverse distant signal, which, being observed far ahead, was "blown down" by the whistle without altering the speed.

Many trains had been passed, some broad, some narrow gauge; these did not look at all as if they would run into us, as one saw a long way off that the coming train was on its own line; and in every case the din and turmoil of our own engine entirely drowned all noise from the other; even as an express rushed past, no increase of sound whatever was perceived: it might have been a phantom train; or standing still.

At Exeter we went down under the engine but there was no need to oil anything as the "Rover" proved to be in tip-top trim; cranks of driving-wheels quite cool, bands of eccentrics just luke-warm. Between St. Thomas's and Exminster attention was drawn to the "new road," which was pronounced much better than the old, being "more springy"; this, like many other things, had to be taken on trust by one who could not detect the slightest difference in the vibration; anyway I am sorry to see the old longitudinals thus disappearing, which have always proved so safe, when an engine has gone off the rails. We flashed through Starcross at great speed; a nasty, risky piece of line, where it looked as if the engine would bump against the wall of the Hotel, and *ricochet* on to the pier; and so on in the gloaming, through the warm red cuttings and tunnels of Dawlish, by the sea-wall of

Holcombe, and on into Teignmouth, where the trip ended. And yet scarcely ended, for a brand new kind of nightmare was evolved from the run, and it soon transpired, from the vivid pictures of one's slumber, that the racket of the footplate could be well rehearsed in dreams.

GREAT WESTERN RAILWAY.

SECTIONS OF LINE CONVERTED TO NARROW GAUGE.

Date of conversion.	Section of Line.	No. of Miles.	Remarks.
1868	Princes-Risborough to Aylesbury	7	
1869	Oxford to Wolverhampton, with Stratford and Great Bridge Branches	89¾	
,,	Grange Court (near Gloucester) to Hereford	22½	
,,	Reading to Basingstoke	16	
1870	Maidenhead to Oxford	37	
1871	West Drayton to Uxbridge	2½	
,,	Whitland to Carmarthen	13¾	One line only.
1872	Swindon to Milford and all Branches	239½	
,,	Vale of Neath, Merthyr Branch and Cheltenham to Grange Court	60½	
,,	Radley to Abingdon	2	
,,	Didcot to Oxford	10¼	
1873	Bristol and South Wales Union	12	
1874	Thingley Junction to Dorchester; Westbury to Salisbury; Bathampton to Bradford Junction; North Somerset Junction (near Bristol) to Frome; Reading to Holt Junction, with Marlborough and other Branches	197¼	
,,	Dorchester to Weymouth	6½	
,,	Southcote Junction to Reading	1¾	
1875	Southall to Brentford	4	
1876	Twyford to Henley-on-Thames	4½	
1878	Uffington to Faringdon	3½	
1880	Yatton to Clevedon	3½	
,,	Durston to Yeovil (Pen Mill)	20¼	
1881	Norton Fitzwarren to Barnstaple	42¾	
1882	Norton Fitzwarren to Minehead	22¾	
1884	Tiverton Junction to Tiverton	4¾	
1891	Creech Junction to Chard	12	

The length of line between London and Penzance is 326 miles 24 chains, and between Mutley and Launceston 34 miles 25 chains. Of the former 100 miles and of the latter 12 miles 34 chains are exclusively broad gauge.