



'Duke' No.3323 *Mendip* as originally built in 1899 with round-top boiler: what Hamilton Ellis described as the 'Olde English' style. It received a Belpaire boiler in 1907, reverted to a round-top boiler in 1910 (the only one to do so) and gained another Belpaire version in 1912. It was withdrawn as No.3288 in 1936. (Pendragon Collection)

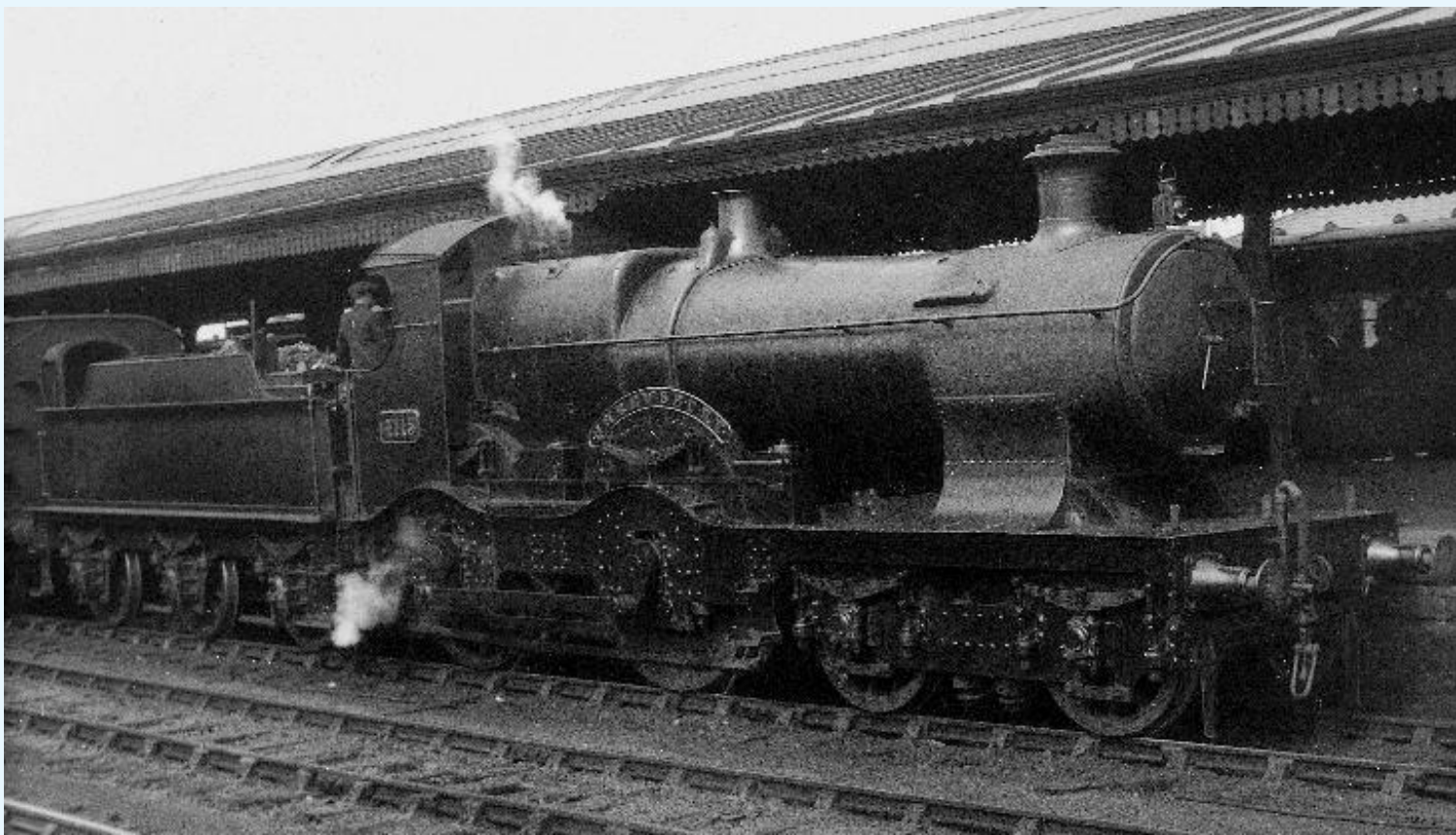
At Cardiff General 'Badminton' Class No.4115 *Shrewsbury* is waiting to depart with a stopping train. The date is around 1922, when the engine had been thoroughly updated. The standard No.2 boiler is superheated and equipped with top feed. The extra six inches in the wheelbase is quite obvious when comparing this shot with photographs of the other classes. Unusually, the front coupling has been left hanging down. This engine had previously been numbered 3307, but its name was not removed until 1927. It was destined to be the last 'Badminton' in service. (LCGB/Ken Nunn Collection H3396)

FLOWERS AND THE

An earlier article ('Twilight of the Dogs', Vol.21 No.5) traced the relationship of the small-wheeled 4-4-0 classes which culminated in the famous 'Dukedogs'. This was one strand of an intriguing lineage that had its origins in designs inspired by William Dean for the Great Western Railway at the end of the nineteenth century. The impetus at that time was to provide the railway with a fleet of competent locomotives which could carry it forward into a new era following its abandonment the broad gauge and conversion to standard gauge. Immediately prior to that act, which was completed in 1892, the GWR's locomotive policy had been somewhat sterile, stifled by the need to build locomotives which were adaptable and capable

of conversion from broad to narrow gauge. In resolving the problems associated with this peculiar requirement, the adaptability of double frames was exploited. In broad gauge mode the wheels were mounted outside the frames then moved to a position between the frames to convert them to narrow, or standard, gauge. That the results appeared ungainly might be thought an understatement, but photographic evidence suggests that many of these ugly ducklings did indeed fail to become swans. Fortunately a few did metamorphose with great success, yet even with the benefit of hindsight it is sometimes difficult to believe that gawky convertibles were transformed into the stately Dean Singles.

Double frames remained a feature of





CITY

JOHN REOHORN TRACES THE GENEALOGY OF THE GREAT WESTERN RAILWAY'S EXPRESS PASSENGER 4-4-0 CLASSES.

Swindon design long after the need for convertible engines had passed. Although they were not used in every design, it was a fact that during Dean's tenancy the company operated the largest fleet of double-framed engines in the world. What was once an expedient became a feature.

The Singles were double-framed, although this is not immediately obvious, there being no external motion. Their performance was brilliant and while trainloads remained modest they provided more than adequate power on the principal trains between Paddington and Newton Abbot. However, the Singles did not hold total sway. In 1894 four broad gauge oddities were taken into Swindon to emerge as

standard gauge express engines. Very little of the original engines remained after the rebuild and what resulted was a quartet of 4-4-0s of astonishing beauty. Frames matching the Singles' profile were fitted with the same 7ft 1in driving wheels to produce the 'Armstrong' Class, all named after legendary Great Western men: *Brunel*, *Gooch*, *Armstrong*¹ and *Charles Saunders*. In all other respects the construction employed components similar to the Singles. These four engines entered service numbered 7, 8, 14 and 16, but ended their lives as 4169-72 as a result of the 1912 scheme which attempted to put some sense of order into the numbering system. It is these post-1912 numbers that are

'Bulldog' No.3405 (ex-3467) *Empire of India*. Built in 1904, it was fitted with this long-coned boiler in 1907 and superheated in 1913. It was withdrawn in 1937. (Pendragon Collection)

used throughout this article.

It was not only numbers which underwent change: this foursome metamorphosed almost as many times as Doctor Who, yet managed to remain one of the most attractive locomotive designs ever to emerge from Swindon. These were powerful engines, but still double framed,

'Flower' Class No.4156 (previously 4105) *Gardenia* working a parcels train through Cardiff in 1922. Note the grand curve of the nameplate necessitated by the large diameter driving wheels and the deep frames adopted to resist the problem of cracking. (LCGB/Ken Nunn Collection H3407)





No.3373 *Atbara* as built, outside Westbourne Park machine shop. The first twenty of the 'Atbara' Class came out with combined name and number plates. (Pendragon Collection)

and were possibly an influence on what followed.

Four engines, no matter how splendid, could not dominate the day-to-day working pattern and the Singles continued to rule virtually unchallenged. What was good on the main line, however, did not suit the steep banks of Devon and Cornwall. In meeting this need Dean provided a machine which echoed the image of the Armstrongs without perpetuating their dimensions, selecting instead components which could provide the requisite hill-climbing power. Enter the 'Duke of Cornwall' Class.

These 4-4-0s of roughly the same size as the Singles bore just a passing resemblance to the 'Armstrongs'. The new engines, eventually abbreviated to 'Dukes',² were double-framed with Stephenson-type valve gear between the inner frames driving slide valves situated beneath inside cylinders. Driving wheels of 5ft 8ins were mounted between the frames with fly-cranks and coupling rods on the outside. Those smaller wheels and greater adhesion provided the capacity to haul loads up hill. To modern eyes grown accustomed to Gresley elegance or the purposeful Stanier/Riddles style, the 'Dukes' can appear quaint and peculiar. They perpetuated a style which Hamilton Ellis affectionately labelled 'Olde English',³ a style that would have seemed ornate even to contemporary observers who were accustomed to the clean elegance favoured by Dugald Drummond and Samuel W. Johnson, or the simple austerity of F. W. Webb.

But handsome is as handsome does and the 'Dukes' must be judged against contemporary standards and on the basis of their performance. The evidence suggests that they were efficient and respected machines, used with effect throughout the GWR system.

The decades spanning the turn of the nineteenth and twentieth centuries saw a hotbed of development, with all kinds of permutations emerging as new ideas were tested, improved, discarded or adopted. Swindon was no exception, for the evidence portrays Dean as an adventurous designer in his own right complemented by Churchward's focussed objectivity. All the types emerging from Swindon in those years underwent progressive development with individual machines being used as vehicles for experimentation.

At some stage the notion of using the

'Duke' geometry to produce an improved 'Armstrong' was born. The result was the creation of an engine which applied 6ft 8ins drivers to a 'Duke'-style chassis, but carrying a boiler which was similar in size and shape to that fitted to No.3211 *Bulldog*, effectively the BR4 type. The first built was No.4100 (3392) *Badminton*, appearing in 1897, with nineteen more following quickly. Being express engines they received names, but not adhering to any obvious theme. The new class was known as 'Badmintons', following the then current GWR policy of adopting the first constructed as the class designator. In their original form with domed boiler and narrow cab set within the overhung springing, they closely resembled the 'Dukes', albeit with large wheels and a driving wheel-base of 9ft, the only members of the 4-4-0 family to use this dimension. *Badminton* was unique in having small windows set in the cab side sheets.

Two other members of the class displayed significant differences. The penultimate engine, No.4119 (3310) *Waterford*, was fitted from new with a domeless boiler after the fashion of *Camel*, completed in the same year. And just as *Camel* was the prototype for a new class, so did No.4119 presage a further change.

The other 'Badminton' involved in experimentation was No.4105 *Earl Cawdor*. Initially this was paired with a special high-capacity tender to equip it for use on the Royal Train. A suggestion by one of GJC's assistants saw the engine fitted with a large diameter boiler incorporating a round top firebox with a view to increasing the steam capacity, echoing the trends then being advocated by J. F. McIntosh with startling results on the

Caledonian Railway. To accommodate this massive boiler the engine was fitted with a large side-windowed cab of distinctly North Eastern Railway profile. This was not apparently popular with the Great Western enginemasters; their complaints are alleged to have provoked Churchward's wrath, forthrightly expressed in the comment, "Then let the buggers freeze." Large cabs did not appear again until Collett's day. The large boiler showed no definite advantage over Churchward's free-steaming design and so these experiments with boiler and cab were terminated and *Earl Cawdor* was subsequently refitted to conform to the rest of the class.

In service the 'Badmintons' quickly established themselves as fast, dependable engines, taking on the working of the heavier principal trains, supplementing the bogie Singles. However, this was only the opening paragraph in an unfolding saga.

Waterford's special boiler was one of the stage developments in the programme leading to the Standard No.2 boiler. By 1903 the design had reached an advanced stage, including the iconic taper, but development did not stop there. A larger version, the Standard No.4, was in production. In November 1903 *Waterford's* original boiler was replaced by one of these larger types, possibly to provide comparison with *Earl Cawdor*. In the years following, all but three⁴ of the class were fitted with the Standard No.4 boiler, making the class effectively equivalent to the later 'Cities'. Subsequently the larger boilers were removed and replaced by long-coned Standard No.2, which leads us naturally into the next development.

The driver is oiling round 'Atbara' Class No.4148 (previously 3417) *Singapore* before departure from Cardiff with an express. The 4-4-0 passenger classes were strongly represented in South Wales at this date, 1922. (LCGB/Ken Nunn Collection H3403)





70 years ago 'Bulldog' No.3383 leaves Dawlish with an eastbound stopper. The date is 2nd September 1936 when the engine was fitted with a Standard No.3 boiler which necessitated the fitting of an extended smokebox; it reverted to the No.2 type in 1941 and remained in service until 1949, being withdrawn from Newton Abbot. The engine was built in 1903 as No. 3444 *Ilfracombe*, losing its name in 1930. (LCGB/Ken Nunn Collection 6673)

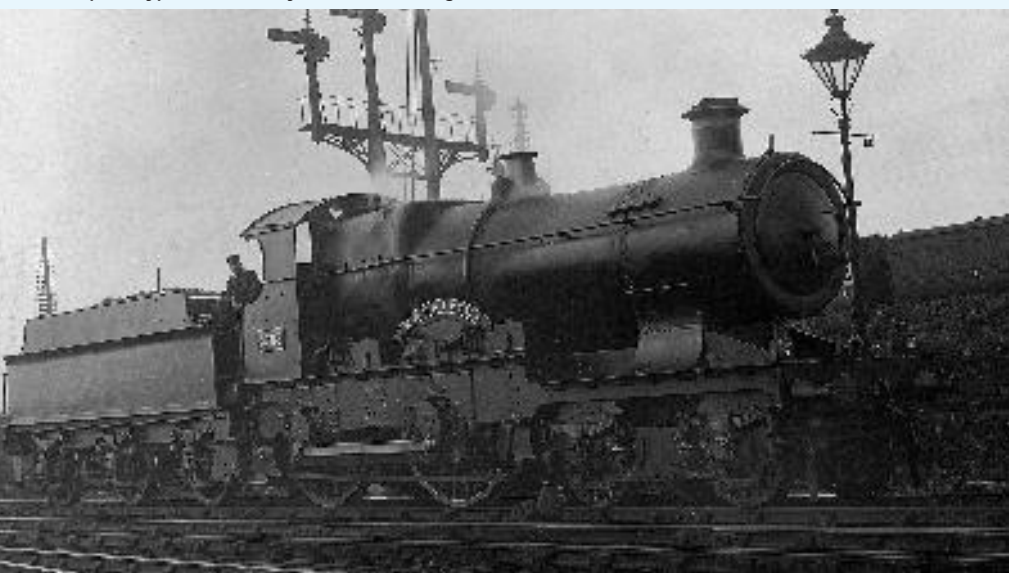
The success of the 'Badmintons' resulted in further building of 6ft 8ins engines with Standard No.2 boilers, commencing in 1900 with a series of 40 engines under Lot Nos. 125 and 126 all carrying the parallel version of the boiler. The date and specification made them contemporary with the Lot 124 'Bulldogs' to which they were similar except in terms of the driving wheel diameter. These engines therefore differed from the true 'Badmintons' in having straight frames and an 8ft 6ins wheelbase. The first engine to be constructed, No.4120, Works No.1826, was allocated the name *Atbara*. This also became the class name and derives from the name of a river which flows into the Nile near the township of the same name in Sudan, the locality being associated with Lord Kitchener's campaign of 1898. By 1900 Kitchener was engaged in the Boer War in South Africa and the naming of the first batch drew strongly upon the places and personalities involved in both conflicts. The names selected for Lot 126, however, were those of ports associated with Empire trade.

Although the wheelbase dimensions remain

consistent for all of Swindon's double frame 4-4-0s, namely 6ft 6ins + 7ft 6ins + 8ft 6ins, there were detail differences in the profiles of the frames used on the 5ft 8ins and the 6ft 8ins versions resulting from the need to accommodate the different diameters.

Initially the 'Atbaras' were set to work alongside the 'Badmintons' running the principal West Country trains, but roaming further afield into South Wales, up to Wolverhampton and on to the North and West route to Shrewsbury, thus reflecting the greater flexibility in rostering afforded by a larger number of powerful express locomotives. Their interim parallel boilers were rapidly substituted by the more advanced coned versions: short cone and long cone being used as available. These modifications took place between 1904 and 1916. Piston valves were generally fitted from 1915 onwards but, as with the 'Bulldogs', not every engine was modified in this way. Accounts suggest the 'Atbaras' to be free-running locomotives, achieving fame for their sparkling performances. As such they were much favoured for special workings in the

'Atbara' No.3705 *Mauritius* was rebuilt with a Standard No.4 boiler in 1903, becoming the prototype for the 'City' Class. (Pendragon Collection)



course of which several engines acquired new, more appropriate names.⁵

While the 'Atbaras' and 'Badmintons' had together set the tone for the resurgence of the GWR as a premier railway, it must be remembered that the 4-4-0 types were in the way of being an expedient, pending the finalisation of Churchward's standard locomotive range which lay a few years in the future. Yet it can be imagined that GJC would not be content with second-rate performances even from a stop-gap. This was the high zenith of railways with demand for speed keeping pace with expanding traffic; there was a need for even greater output.

In 1903 'Atbara' No.3705 *Mauritius* was taken into the works to be fitted with a Standard No.4 boiler, exploring the proposition to make the class the equal of the re-boilered Badmintons'. This rebuild became the prototype of the legendary 'Cities'. In 1904 ten engines were newly constructed to the same specification under Lot 141 to emerge carrying the names of cities served by the Great Western. Then, between 1907 and 1909, nine further 'Atbaras' were converted to bring the total of 'Cities' to twenty. The conversions retained their original names.

For a brief period the 'Cities' held sway on the fastest and best passenger trains. The exploits of *City of Truro* have been long debated and examined to prove and disprove the claimed record. The evidence reveals that the overall run was very fast and coupling this to the knowledge that the 'Cities' regularly turned in dramatic performances suggests that it was conceivably possible. There can be no doubt that the engine's speed down Wellington bank must have been very high indeed and given this, the question of one mph more or less becomes academic. Quite remarkable is the fact that at that time *Truro* was without superheating. Like the rest of the family, that modification was applied only slowly and haphazardly to the class between 1910 and 1925, as were piston valves.

As before, the West Country main line provided the arena for the debut of the 'Cities', but it was a short-lived glory. Churchward's new 4-6-0s were issuing from Swindon in a steady stream, supplemented by the 'County' 4-4-0s. Thus the days of the elegant double-framers were numbered and the 'Cities' soon found themselves relegated to the outer fringes of the GWR empire. *City of Truro* ended its career in South Wales working out of Radyr, an ex-Taff Vale shed.

There was a final chapter in the 4-4-0 story. In 1909 two further Lots, 176 and 177, were put in hand at Swindon. Both lots employed frames of deeper section, lending the engines a much sturdier, heavier appearance. The twenty engines of Lot 176 were essentially 'Atbaras' with Standard No.2 boilers on 6ft 8ins wheels, being named after popular garden flower varieties. Lot 177 on 5ft 8ins wheels provided the fifteen 'Bird' series of the 'Bulldog' Class. Even at this late date the 'Flowers' were built without superheat, the majority receiving it when undergoing routine boiler changes from 1910 onwards. Piston valves were also applied post-construction, four of the batch never attaining this modification.

In due course all the remaining double-framed 6ft 8ins 4-4-0s, with the exception of



'City' No.3712 *City of Bristol* (built 1903). When introduced the 'Cities' took over the West of England expresses, then moved to the Birmingham and South Wales routes, on all of which they gave way to the 'County' 4-4-0s, Atlantics and 4-6-0s. They were the last of the double-framed line, withdrawal of the class being completed in 1931. (T. J. Edgington Collection)

the 'Cities', were consolidated into one class known as the 'Flower' Class numbered 4100-4172. This consisted of the 'Badmintons', converted back to Standard No.2 boilers, the remaining 'Atbaras', the 'Flowers' proper and, amazingly, the four 'Armstrongs' now re-wheeled to 6ft 8ins diameter and sporting Standard No.2 taper boilers! In this way this honourable cohort laboured, filling unglamorous but essential duties on the secondary cross-country routes. This sort of work suited the smaller 5ft 8ins engines and they recorded many more years of useful life. However, the 'fast ladies', the high-stepping express engines, quickly became redundant and were retired in the late 1920s. The last 'Badminton' was No.4115 *Shrewsbury*⁶ from Tyseley in March 1931 and the last 'Atbara' was No.4148 *Singapore* from Severn Tunnel Junction in May the same year. The last

'Flower' was No.4150 *Begonia* from Didcot in April 1931, the last 'Armstrong' was No.4169 *Charles Saunders* from Cardiff in July 1930 and the last 'City' was No.3712 *City of Bristol* from Reading in May 1931.

Fortunately, No.3717 *City of Truro* was not scrapped. It retired in 1931 to an honourable home in distant York from where it emerged to be restored to running order in 1957. In resurrection it was popular as power for enthusiasts' specials, but also operated service trains out of Didcot. After a sojourn at Swindon it eventually returned to York as an exhibit in the National Railway Museum and has recently been returned to active duty once again.

A remarkable feature of the double-framed family was the extent to which standard components were picked and mixed to provide a range of locomotives suited to differing traffic demands. Any backward look

at GWR locomotive history tends to be overshadowed by Churchward and it is easy to mistakenly conclude that he was responsible for introducing the concept of standardisation. Churchward's contribution was to exploit the concept established under Armstrong's regime by applying it as a planning strategy within a comprehensive analysis and projection of the company's motive power requirements. William Dean had moments of inspired genius. The range of designs produced under his supervision was enormous and the best were outstanding. One of the strengths of his work was the development and use of carefully tailored standard components which offered ease of maintenance coupled with economical manufacture: an application of economy of scale. Modern thinking is tempted to seek signs of tension between Dean and Churchward. However, it is unlikely that GJC could have flourished so readily unless he had enjoyed the full confidence of his chief and the ability to exercise great tact in return.

While Dean's designs can appear small compared with Churchward's, they have to be viewed within the context of their age and in direct comparison with the work of his contemporaries, Dean's best engines were strong and efficient as well as being works of art. *City of Truro's* achievement was Dean's triumph as much as Churchward's: a free-running chassis and engine (Dean), supplied by a free-steaming boiler (Churchward). While attention naturally focuses on the Exeter to Bristol leg of the record run, equal merit must be given to the astonishing final leg into Paddington by *Duke of Connaught*, a Dean Single, one of the most elegant designs ever to grace Great Western rails. Now *there's* a thought for a new build project.

References

1. Which of the 'Armstrongs' was not defined.
2. Initially the class was referred to as the 'Pendennis Castle' Class. In one of Swindon's moments it was the second engine of the Lot, *Pendennis Castle*, which was released first into service. *Duke of Cornwall* followed later.
3. C. Hamilton Ellis: *Some Classic Locomotives*. London, 1949. Allen & Unwin Ltd. Ch.5.
4. The engines excluded were Nos.4109 *Monarch*, 4110 *Charles Mortimer*, 4112 *Oxford*.
5. For example, *Atbara* was renamed *Maine* for a military special in 1900 and *Queen Sovereign* when hauling Queen Victoria's funeral train in 1901. Some renamings remained fixed, eg *Ophir* to *Killarney* in 1907.
6. The name had been removed to avoid confusion.

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TABLE A — Construction dates of the Express Passenger 4-4-0 classes

Lot Number	Completion dates	Running Nos.**	Works Nos.	Remarks
	1894	4169-72	—	'Armstrong' class
109	1897	4100	1592	<i>Badminton</i>
109	1898	4101-17	1593-1609	'Badminton' Class
109	1899	4118/9	1610/1	'Badminton' Class
125	1900	4120-38	1826-45	'Atbara' Class
126	1901	4139-48	1846-65	'Atbara' Class
	1902	3705		<i>Mauritius</i> rebuilt
141	1903	3710-19	1993-2002	'City' Class
	1907-8	3700-3709		'City' Class
				Rebuilt from 'Atbara'
176	1908	4149-68	2330-49	'Flower' Class
177	1909/10	3441-55	2350-64	'Bird' Series

**Post-1912 numbering.

TABLE B — Relationships within the Dean/Churchward 4-4-0 dynasty

S: fitted throughout life — I: fitted initially — L: fitted subsequently.

Class	Frames			Drivers		Boiler type				
	Curved	Straight	Deep	5'8"	6'8"	S4	Domed Belpaire	Domeless Belpaire	Std. No.2	Std. No.4
'Duke'	S			S		I	L			
'Badminton'	S				S		I		L 2nd	L 1st
'Camel' series	S			S				I	L	
'Bulldog'		S		S				I (some)	S	
'Atbara'		S			S			I	S	
'City'		S			S					S
'Flower'			S		S				S	
'Bird' series			S	S					S	
'Dukedog'		S		S			S			

