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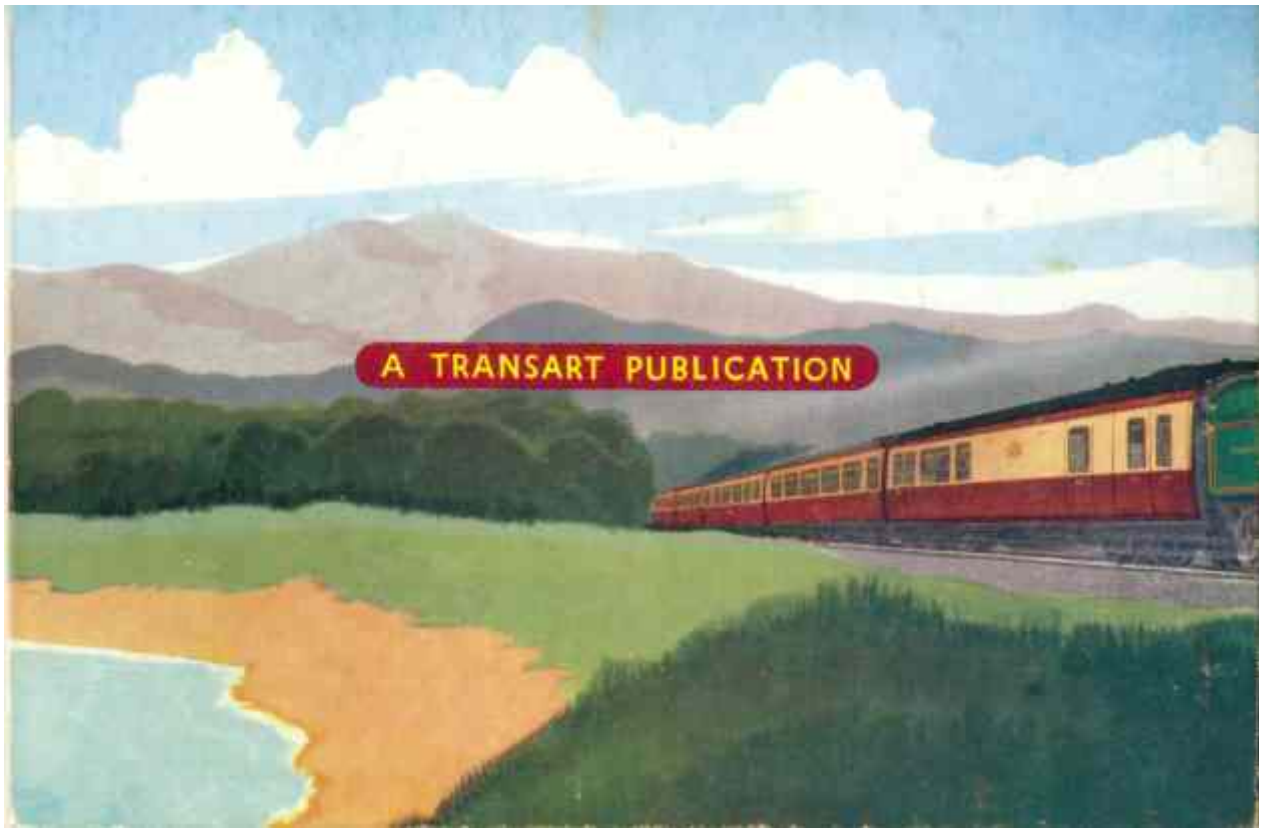
KING GEORGE V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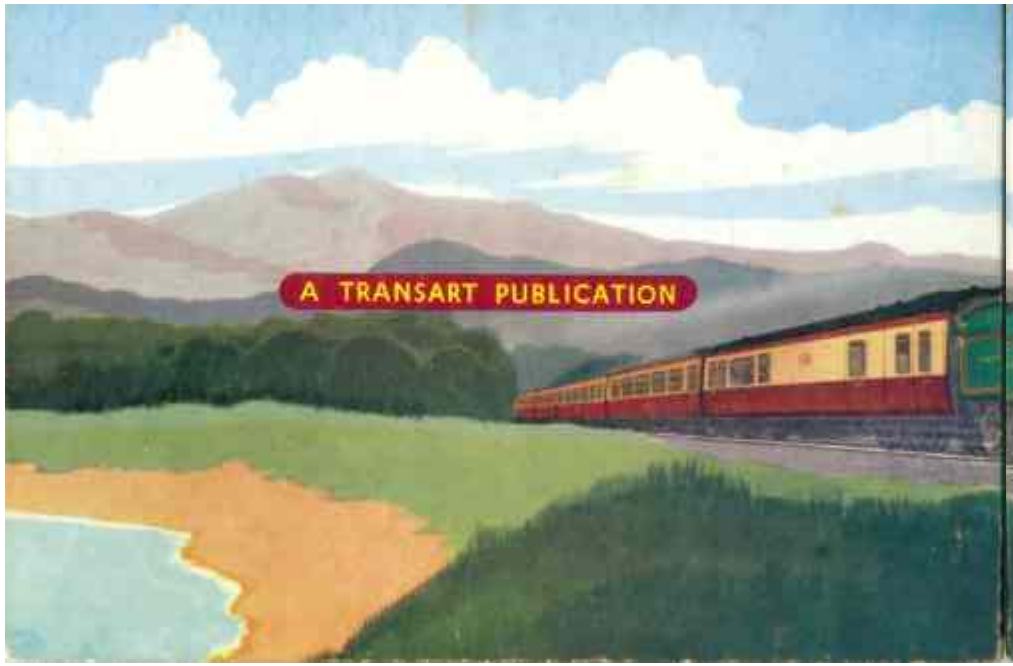
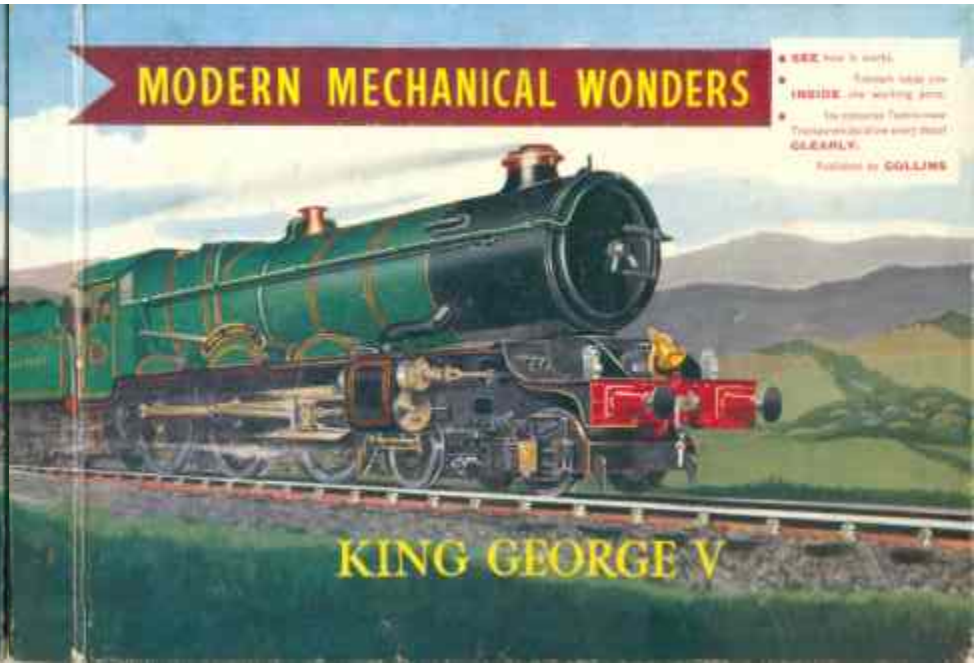
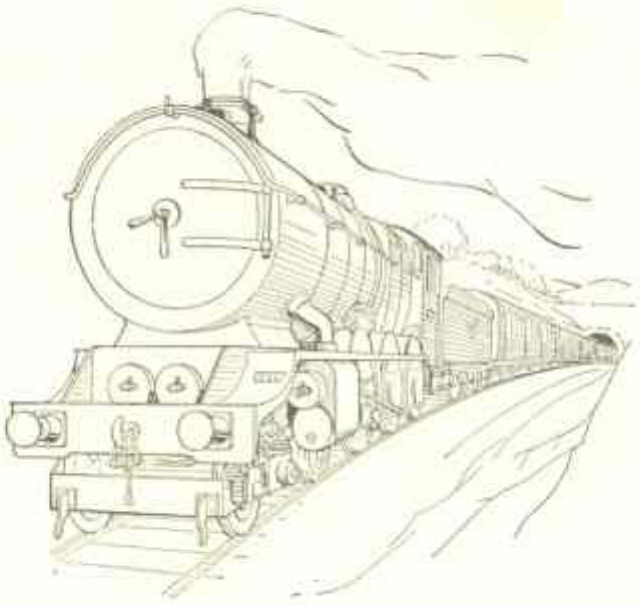




THE KING GEORGE V

Described by John S. B. Wright



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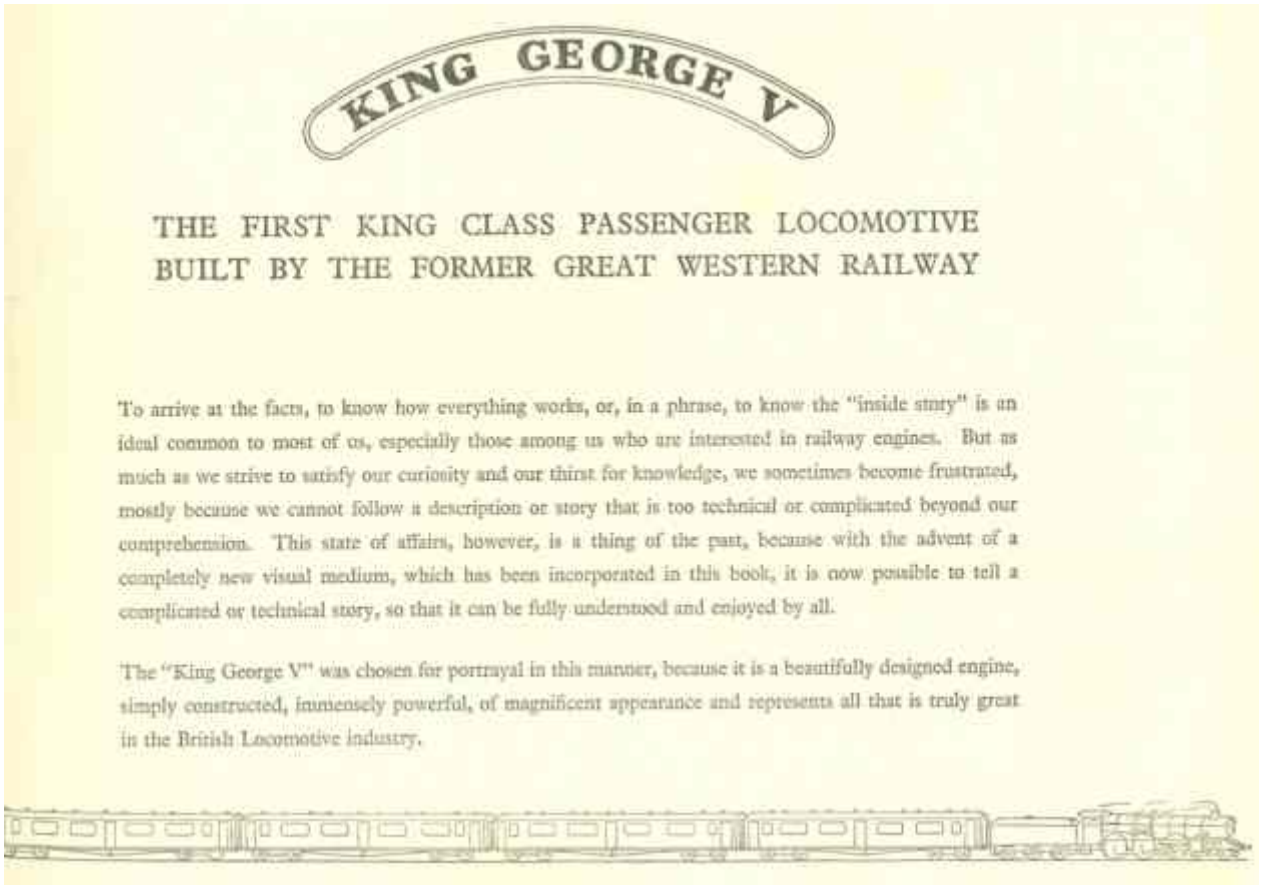


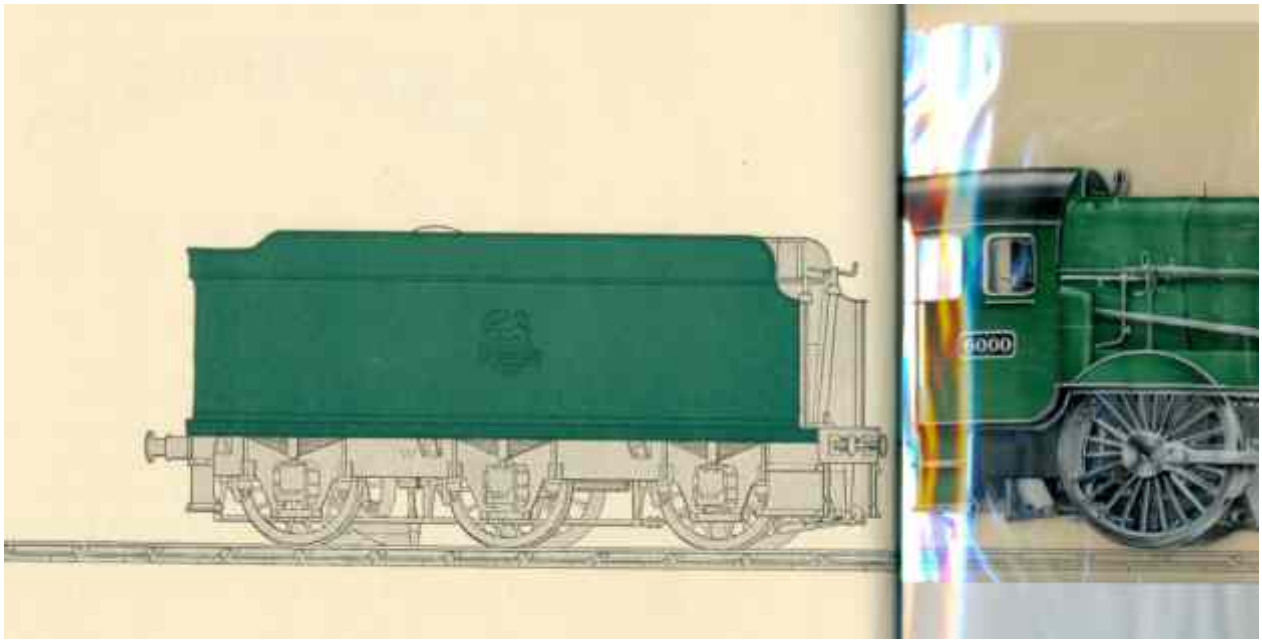
THE FIRST KING CLASS PASSENGER LOCOMOTIVE
BUILT BY THE FORMER GREAT WESTERN RAILWAY

To arrive at the facts, to know how everything works, or, in a phrase, to know the "inside story" is an ideal common to most of us, especially those among us who are interested in railway engines. But as much as we strive to satisfy our curiosity and our thirst for knowledge, we sometimes become frustrated, mostly because we cannot follow a description or story that is too technical or complicated beyond our comprehension. This state of affairs, however, is a thing of the past, because with the advent of a completely new visual medium, which has been incorporated in this book, it is now possible to tell a complicated or technical story, so that it can be fully understood and enjoyed by all.

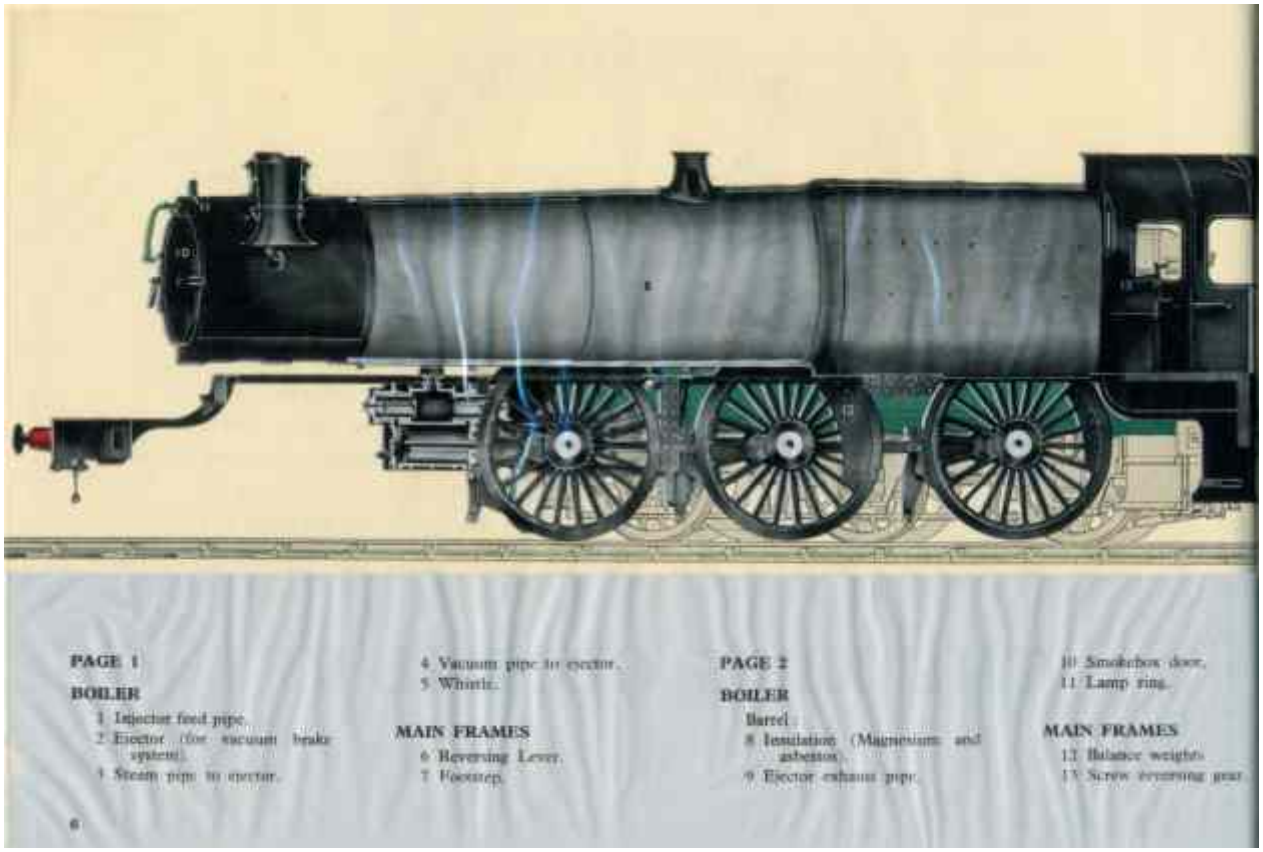
The "King George V" was chosen for portrayal in this manner, because it is a beautifully designed engine, simply constructed, immensely powerful, of magnificent appearance and represents all that is truly great in the British Locomotive industry.

Auf 22 Seiten wird die berühmte Lok „King George V“ beschrieben, „Transart“ nimmt den Betrachter auch mit in die „Innereien“ der Dampflokomotive auf sechs farbigen „Techni-view“-Transparentseiten, die jedes Detail aufzeigen. Das Büchlein von John Stewart Bell Wright wurde um 1953 bei Collins in London und Glasgow aufgelegt. „King George V“ war die erste Lok der „King“-Baureihe, die für die frühere Great Western Railway gebaut wurde.

Ihre Loknummer „6000” weist für die Kenner der britischen Bahnszene gleich unmißverständlich auf „King George V“ hin.



Auf dem dreiachsigen Tender trägt sie das Emblem der British Railways nach 1948, als die großen vier englischen Bahngesellschaften verstaatlicht wurden.



PAGE 1

BOILER

1 Injector feed pipe.
2 Ejector (for vacuum brake system).
3 Steam pipe to ejector.
4 Vacuum pipe to ejector.
5 Whistle.

MAIN FRAMES

6 Reversing Lever.
7 Footstep.

PAGE 2

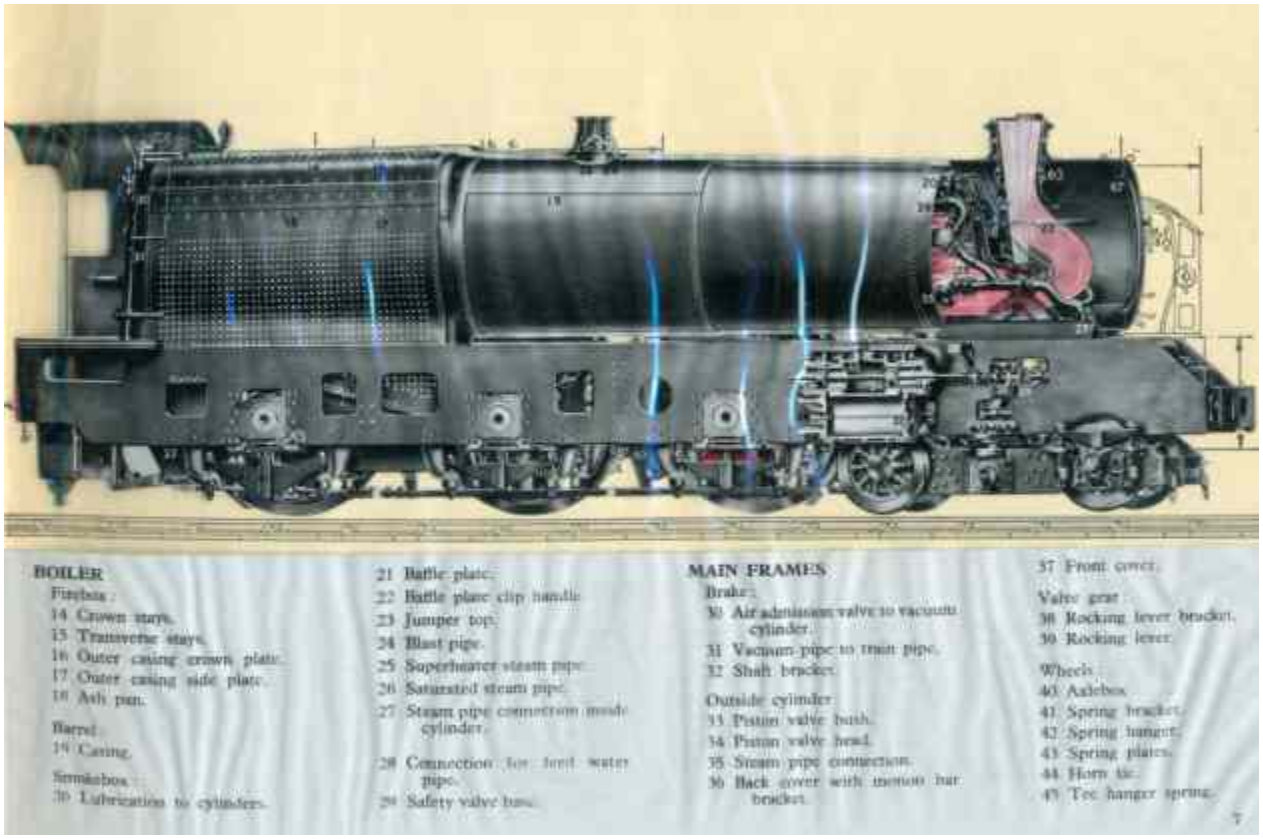
BOILER

Barrel:
8 Insulation (Magnesium and asbestos).
9 Ejector exhaust pipe.
10 Smokebox door.
11 Lamp ring.

MAIN FRAMES

12 Balance weights.
13 Screw reversing gear.

Ein Blick auf die Innenseite der großen Treibräder und den Dampfkessel



BOILER

Firebox:
14 Crown stays.
15 Transverse stays.
16 Outer casing crown plate.
17 Outer casing side plate.
18 Ash pan.

Barrel:
19 Casing.

Smokebox:
20 Lubrication to cylinders.
21 Baffle plate.
22 Baffle plate clip handle.
23 Jumper top.
24 Blast pipe.
25 Superheater steam pipe.
26 Saturated steam pipe.
27 Steam pipe connection inside cylinder.
28 Connection for feed water pipe.
29 Safety valve base.

MAIN FRAMES

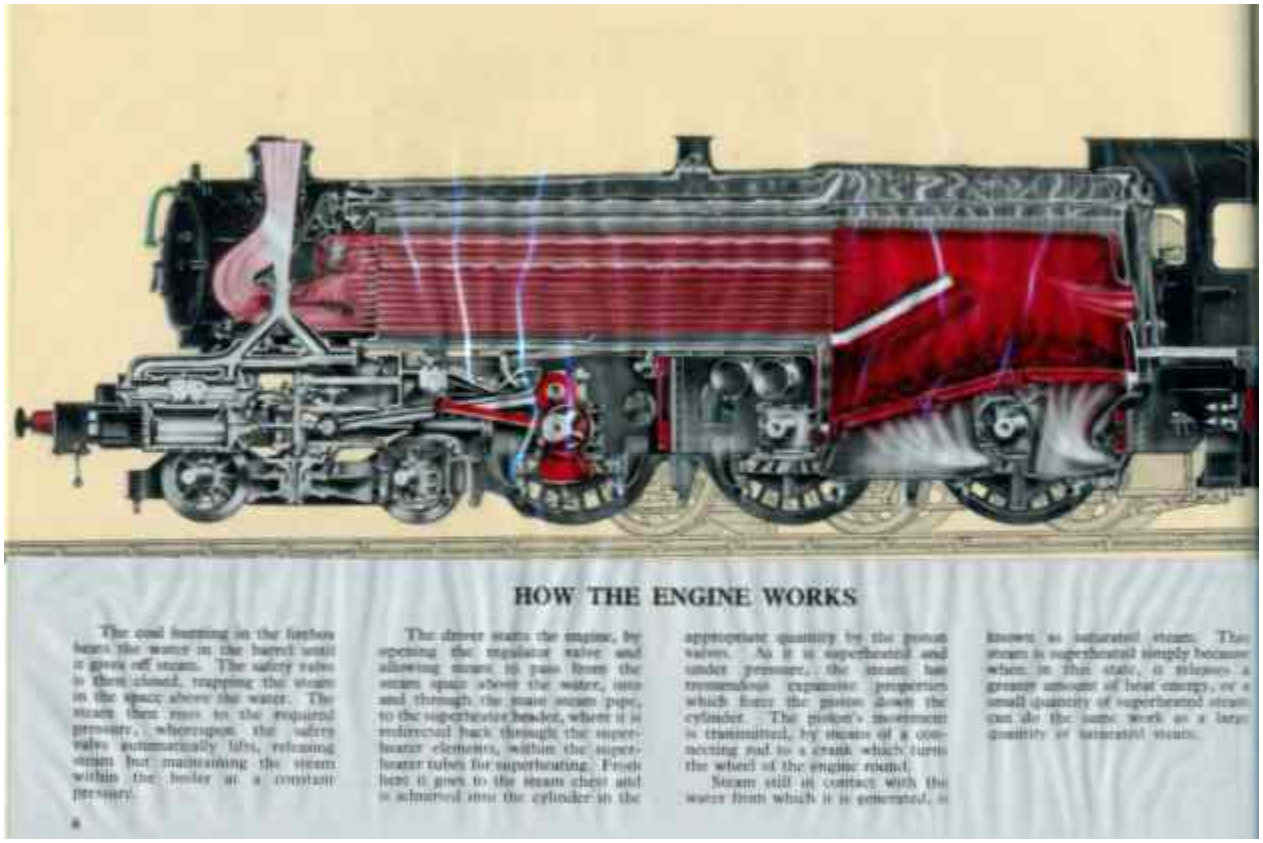
Brake:
30 Air admission valve to vacuum cylinder.
31 Vacuum pipe to train pipe.
32 Shaft bracket.

Outside cylinder:
33 Piston valve bush.
34 Piston valve head.
35 Steam pipe connection.
36 Back cover with motion bar bracket.
37 Front cover.

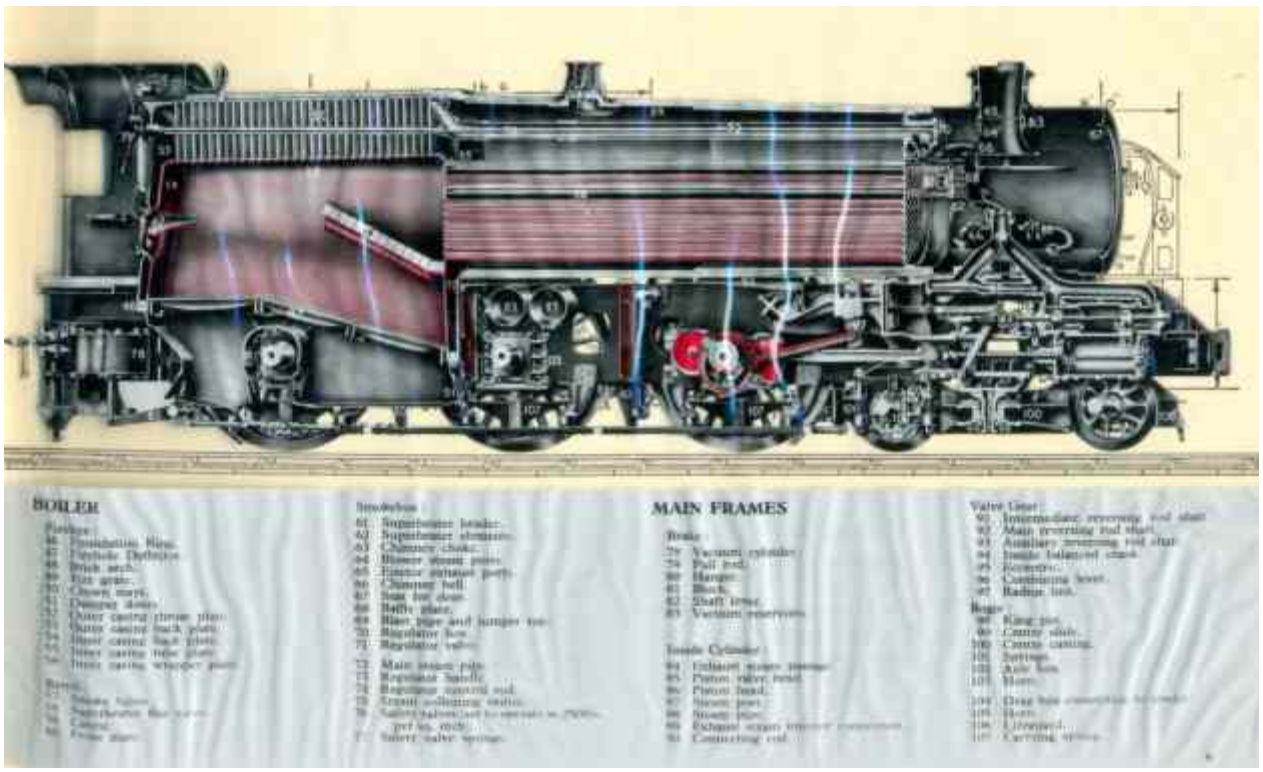
Valve gear:
38 Rocking lever bracket.
39 Rocking lever.

Wheels:
40 Axlebox.
41 Spring bracket.
42 Spring hanger.
43 Spring plates.
44 Horn tie.
45 Tee hanger spring.

Kessel und Rahmen, offengelegte Rauchkammer und Zylinder

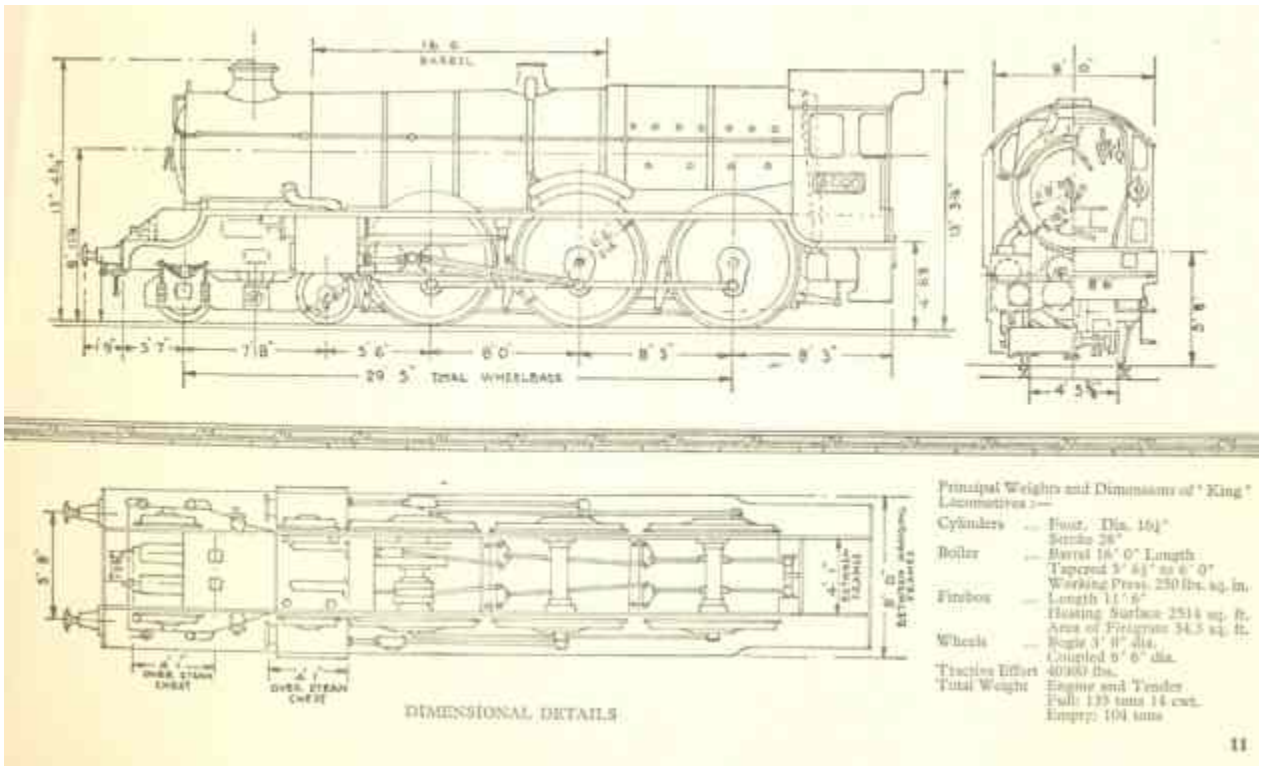


Wie die Maschine funktioniert



Vom Führerstand bis zum Innenzylinder

Kessel, Rahmen und Fahrwerk auf der Heizerseite



Abmessungen der Lok

MAIN PARTS OF THE ENGINE

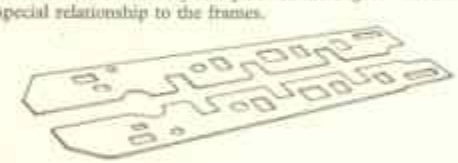
The preceding Transart pages have given us a detailed picture of the engine, and acquainted us with the various internal parts and their whereabouts. Now to amplify what has already been shown in these pages, let us take each of the main parts and describe them in some detail and then follow this with a brief description of how the engine is assembled.

Let us start our description of the main parts with those which go to make up the " chassis " of the engine or main frames, and follow this with the parts which go to make up the " body " of the engine or boiler unit, as by doing this it should be easier to understand.

THE CHASSIS

MAIN FRAMES

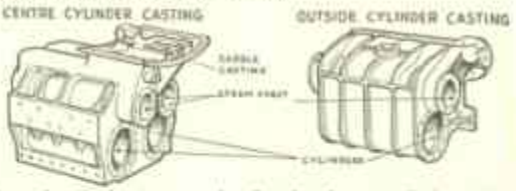
The frames are akin to the foundations of a house as the engine is built up on them. There are very few parts of the engine which do not have some special relationship to the frames.



The frames are uninteresting things in themselves, being made from long rectangular slabs of steel some 41 ft. 4 in. in length, 3 ft. 6 in. in width and 1½ in. in thickness, which are first of all punched into shape, annealed and levelled. The slabs are then slotted in a special machine and dished to provide the necessary clearance for the movement of the leading bogie wheels. The frames are then drilled in pairs, whereupon they are ready for the assembling.

THE CYLINDERS

Among the more important features of the engine are the cylinders, wherein the energy latent in the steam is converted into work. In all there are four cylinders positioned in three castings, meaning that two of the cylinders are housed in one casting.



Shown here is the centre casting, housing the two cylinders which drive on to the leading pair of wheels, and one of the two outside castings, housing the outside cylinder which drives on to the trailing wheels. Also built into the castings are steam chests, one for each cylinder, which house the piston valve bushes in which work the valves that regulate the flow of steam to the cylinders ; and a number of passage ways which are provided for tapping off a proportion of the exhaust steam for use in working the exhaust steam injector.

The cylinder castings are made by pouring specially selected close grained midiron iron into sand moulds, encased in strong iron boxes, which have previously been fashioned to simulate the external and internal shape of the cylinder casting.

Making the receptacle or mould in the sand for the molten iron is the most difficult part about making a casting. This is done by first constructing a copy of the casting in wood, and this wooden pattern is then placed within the iron strong box, and sand of a special type is put in to fill the gaps. The sand is then carefully rammed around the wooden pattern, which is then removed, revealing a receptacle or mould which represents the outside of the casting.

The interior shapes of the casting, such as the cylinder bore, are made by fashioning another type of special sand in wooden moulds in much the same way as for the outside of the casting, the result being a sand core. When all the internal passages or shapes have been made, they are assembled in their respective positions within the mould of the outside shape and molten iron is then poured in to fill up the spaces so left. When the iron has cooled and is hard, the casting is removed from the sand mould and

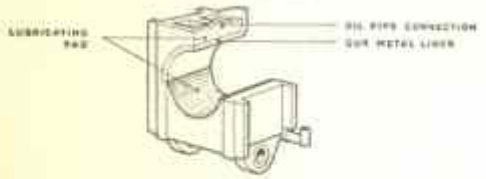
the cylinder and steam passages, cores, etc., are taken out.

Because the castings are cumbersome parts, the patterns are made in sections and moulded in strong iron boxes which are also in sections. About a fifth of the mould is made at a time, layer on layer so to speak, until complete.

The rough casting can now be machined down to the correct dimensions and all the bolt holes can be drilled. The stud holes can also be drilled and tapped as required.

AXLE BOXES

The weight of the engine is distributed evenly over the six coupled wheels and the bogie and it is the axle boxes on each which provide the necessary bearing surfaces. The boxes for the coupled wheels are steel castings, into which are pressed gun metal liners that are cast with an anti-friction metal on their bearing surfaces.



As it is necessary to lubricate these bearing surfaces, oil carried in small reservoirs in the frame is supplied through pipes which lead into the top of the axle box and feed oil directly on to the top part of the axle. The oil then seeps through to a spring-supported pad at the bottom of the axle box which presses against the bottom part of the axle, thus the main bearing surfaces are adequately lubricated.

It is as well to mention here that the horn cheeks which are attached to the frames and give support to the axle boxes, are lubricated in much the same way.

AXLES

Of the three axle-shafts for the six coupled wheels, the one for the leading driving wheels is the only one worth mentioning, as the other two, for the intermediate and trailing wheels, are simply straight axle-shafts.

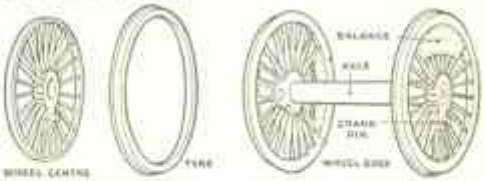
Now the leading driving wheels have what is known as a crank axle-shaft, which is built up from the highest quality carbon steel slabs and rolled bars. The slabs, when planed and bored, form the webs which are shrunk on to the bars, which, when turned, form the crank pins and shaft.

The crank pins for the intermediate and trailing wheels, to which the connecting rods from the outside cylinders are coupled, are pressed into the wheel bosses.

It is interesting to record here that all the coupled axle-shafts have holes through their centres, thus saving weight with very little sacrifice of strength.

WHEELS

The wheels comprise what are known as a wheel centre and tyre. The centres, or hub spokes and rim as one might refer to them in the case of a bicycle wheel, are made in one piece, in the same way as the cylinder castings, but instead of iron, steel is used. When the rough cast centres are received from the steel founders, the hubs are bored out to receive the axles, on to which they are forced by means of a hydraulic press. Then holes are bored to receive the coupling rod pins and great care is taken to make sure that the pin on one wheel is accurately placed with respect to the pin on the other wheel.



The tyres are likewise made of steel and are received from the rolling-mills as steel hoops, almost the correct size for fitting and with the flange profile roughly fashioned on the rim.

Die Hauptteile der Lokomotive

Now the process of putting a tyre on a wheel centre is extremely interesting and rather more complicated than one would imagine. In the first place, the inner diameter of the tyre is made smaller than the diameter of the wheel centre. It is then heated, whereupon it expands and actually becomes bigger than the wheel centre over which it is then placed and allowed to shrink, finally gripping the wheel very firmly. It is improbable that the tyre would ever come off if left in this state, but as a precaution retaining rings are fitted.

The complete wheel assemblies are next machined down to their finished dimensions. That is to say the rough "as rolled" tyres are given their correct profiles and the tread diameters of all the coupled wheels are machined down to the same dimensions.

The wheel assemblies are then put through a balancing test on a specially designed machine, after which they are ready for the wheeling operation.

THE BOGIE

The bogie is simply a plate framed four-wheeled truck serving two essential functions; it supports the weight of the front part of the engine assembly and acts as a steering device by sliding the engine when taking a curve.

The weight of the front portion of the engine is transferred to the bogie by two sliding cup-and-ball joints. The ball parts of the joints are fixed on either side of the underside of the front engine assembly and fit into two cups which can slide in the floor of the bogie, thus the bogie is free to slide sideways in respect of the frame as it would do when the engine is taking a curve.

To make certain that the bogie returns to its proper position after the engine has taken a curve, a stiff vertical king pin is fixed to the centre of the underside of the engine assembly and fits into a strong hollow casting let into the floor of the bogie. On either side of this casting is a very powerful spring which maintains the casting, and so the king pin and the engine assembly, in the central position.

Unlike a motor car the actual steering of the engine is automatic. On entering a curve the wheel flange of the left or right leading bogie wheel strikes the outside curving rail. As the rail is a fixture, it in effect applies a force to this wheel flange which makes the whole bogie assembly twist around the king pin, or makes the bogie take up a different direction to the engine assembly. Now immediately this happens the springs on either side of the casting come into play and force against the king pin, so making the engine assembly follow the path of the bogie. As the axle boxes on the coupled wheels are free to move in a sideways direction, and as the rails act against the coupled wheel flanges, the remainder of the engine has no difficulty in moving in and around a curve.

The action is exactly the same when the engine is coming out of a curve on to the straight, except that the springs assist in centring the bogie.

CROSSHEADS

The crosshead is an important feature of the driving unit assembly—acting as a link between the piston rod and the connecting rod—and moves up and down between guides, which are fixed to the frames, immediately behind the cylinder castings. Its main function is to ensure that the full force of the piston stroke is transmitted by way of the connecting rod to the driving wheels and *vice versa*.

The crosshead itself is made of steel and is fitted with anti-friction slippers which fit into the grooves in the top and bottom of the crosshead. These slippers are lined with "anti-friction" or white metal which is held in position by corrugations which have been machined on the body of the crosshead. Bronze metal strips are let into the face of the slippers to prevent damage to the crosshead in the event of the white metal running out, as it would do if the engine was overtaxed.

When assembling, the crosshead is forced on to the piston rod, and a slotted hole in both crosshead and rod, previously made slightly smaller than required, is broached out to the exact size to receive the cotter which

Laufrad-Drehgestell, Kreuzkopf

further secures the piston and acts as a coupling for the connecting rod.

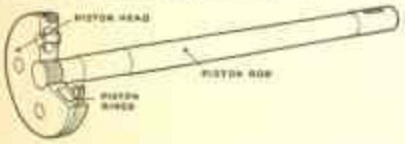
CONNECTING AND COUPLING RODS

It is through the connecting rods that the force exerted by the steam on the piston is transmitted to the wheels. They are made from high grade carbon steel forgings and are then machined to an "I" shape, in order to make the rods as light as possible without affecting their strength. After this, the holes at each end of the rods—which house the bushes into which the gudgeon pins and crank pins are fitted—are ground out to the correct dimensions and centres.

The coupling rods distribute the force exerted by the steam on the piston to each of the large driving wheels. They are likewise made of carbon steel, but are rectangular in shape because these rods require greater lateral strength.

PISTONS

The engine is fitted with what are known as hollow "box type" piston heads. In each head are two spring type piston rings which maintain an even pressure against the cylinder walls as the piston head moves up and down and are there simply to stop the steam from escaping to the other side of the piston or to exhaust, so preventing any loss of power.



The piston rods are secured to the piston heads by means of a tapered screw thread and dowel. This presents a flat face to the front of the piston head, thus making it possible for the front covers of the cylinders to be of strong and simple construction.

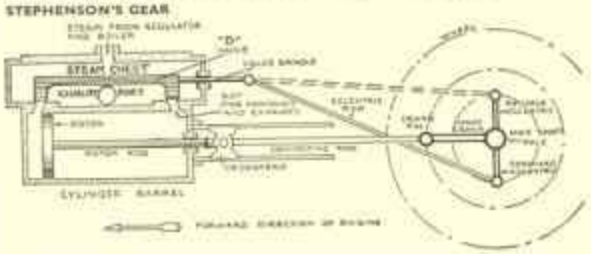
To effect steam tightness when the piston rod is passing through the back cylinder cover, a stuffing box and gland is attached to the outside of the cover. The stuffing box is tightly packed with strands of flexible metal packing, covered with a graphite paste.

VALVE GEAR

So as to make the wheels turn in the right direction and at the required speed and power or make the engine perform a specific job of work, some means of controlling the amount and sequence of steam, admitted into and from the cylinders, is essential, and this is done by a system of levers and valves known as the "valve gear."

Now to understand the underlying principles of this most important part of the engine, let us first look at a simple type of gear—Stephenson's Valve Gear—and then make comparisons with Walschaert's Valve Gear, which is the type of gear fitted to all "King" class engines.

STEPHENSON'S GEAR



It will be seen that from each end of the cylinder a port leads up to a slot in a flat face, and between the two slots there is a central port—this leads to the atmosphere by way of the blast pipe and chimney. Bridging the outer edges of the two slots is a D-shaped valve which moves backwards and forwards on the flat face. Steam fills the steam chest—when the driver opens the regulator—and presses the D-valve on the flat face. The D-valve is connected by means of a rod to a small crank or eccentric, which is fixed on to the main shaft, or axle, of the engine at 90° to the main crank, which in turn is joined to the piston by the connecting rod.

Now to make the engine go forward, or to the left in our case, the crank shaft must first of all be rotated in an anti-clockwise direction. If this is done the eccentric marked "forward" will automatically turn in an anti-clockwise direction and will move the D-valve to the right slightly before the main crank moves the piston to the right. What is happening, in effect, is that the D-valve is opening up the left-hand port, so admitting steam to the part of the cylinder on the left-hand side of the piston head, and opening the right-hand port to exhaust, thus allowing the steam on the right-hand side of the piston head to escape to the atmosphere.

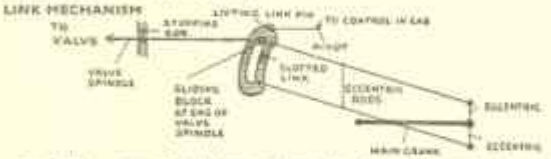
Now the superheated steam which has entered the cylinder from the steam chest expands and in doing so drives the piston to the other end of the cylinder, or to the other end of its stroke, where continued anti-clockwise motion of the main shaft will cause the process to take place

Treib- und Kuppelräder

in the right-hand end of the cylinder, and so on.

To make the engine go backward, the crank shaft must be rotated in a clockwise direction and the D-valve motion in relation to the piston must be changed, or the D-valve must be driven from the eccentric marked "reverse," which is positioned at 90° to the main crank but on the other side of the crank shaft.

Since the forward and backward movement of the engine depends entirely on which eccentric is driving the D-valve, it follows that some means of selecting the appropriate eccentric is essential to the driver. To facilitate this selection, a link mechanism, as shown in the following diagram, is incorporated in the valve gear.



It will be seen that lifting or lowering of the link, which incidentally is done by turning the reversing screw handle in the driver's cab, causes the sliding block to move from the end opposite one eccentric rod to the end opposite the other rod, so changing the motion derived from one eccentric to the motion derived from the other.

Stopping the block at a position between the end of the slot and the mid-position will automatically shorten the D-valve stroke, and in effect will shut off the supply of steam to the cylinder at an early stage in the stroke of the piston. This is an important function of the valve gear in economising in the use of steam.

The piston and valve gear arrangement of the first diagram is not altogether practical, as it will be seen that when the piston is at the extreme ends of its stroke, it will not function unless, of course, some external force turns the crank shaft. Railway engines are fitted with two, three or four cylinders and each piston and valve has a different phase from the other. This in effect ensures that there is always a piston in the right position to start the engine moving.

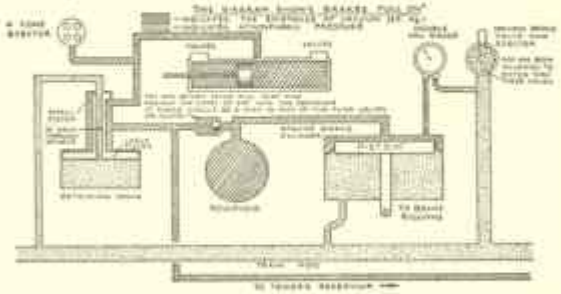
Another thing, the valves of an engine are usually adjusted to allow a slight admission of steam into the cylinders, before the commencement of each piston stroke. This is done to assist in arresting the momentum of the heavy piston, piston rod, crosshead and connecting rod, which is considerable when the engine is travelling at speed, and without which the engine would tend to "knock."

The main difference between Stephenson's Valve Gear and Walschaert's Valve Gear is that instead of using two eccentrics, only one is used, this being coupled with a motion derived from the main crosshead, and combined to the slot link mechanism by levers. Also, piston-shaped valves working in ported barrels take the place of the D-shaped valve working on the flat valve face.

Although the "King" is a four-cylinder engine, it has only two sets of Walschaert's Gear, each driving the valves of an inside and outside cylinder.

BRAKES

Most of us know that the atmospheric pressure at sea level is 14¾ lbs. per square inch, and this means that on each square inch of the earth's surface there is virtually a weight of 14¾ lbs. It is important to appreciate this point as it is this weight or force which is used to operate the brakes on the engine.



From the diagram it will be seen that there is a cylinder, and in this cylinder there is a piston, and connected to this piston is a system of levers, which are joined to the brake blocks on each of the six coupled wheels of the engine. Now if the air in the portion of the cylinder above the piston is removed, the piston will be forced upwards in the cylinder by the air remaining in the bottom portion, or by this air pressing against the underside of the piston face. When the piston is forced upwards in the cylinder, the piston rod actuates the levers and the brake blocks are forced on to the steel treads of the tyres on each of the wheels.

Bremsen

Again, if the air is removed from both sides of the piston, a partial vacuum is created in the whole cylinder and the piston will fall to the bottom of the cylinder by virtue of its own weight. When the piston falls to the bottom of the cylinder the piston rod actuates the levers and the brake blocks are released from the wheels.

It follows that the most important feature of the brake system is the method of creating and maintaining the vacuum. This is done mainly by an ejector, which is a hollow container through which steam passes at high speed. Connected to the container, at right angles to the path of the steam, is a pipe from the system. This steam passing the mouth of the adjoining pipe at speed causes the air to be sucked out of the system and so creates a vacuum.

When the driver applies the brake in the cab, he actually stops the steam from entering the ejector and simultaneously opens an air valve which admits air into the system, and so to the underside of the piston. When the driver releases the brakes, he closes the air valve and simultaneously starts the ejector working which renews the vacuum in the whole system.

Included in the system and working with each other is a pump and an automatic retaining valve. The pump, driven from one of the crossheads, sucks air from the train pipe while the train is running or when the brakes are off, and sucks air from the reservoir, through the operation of the retaining valve, when the brakes are applied. The pump therefore saves valuable steam necessary for operating the ejector and improves the brake power by maintaining the low vacuum above the piston when the brakes are applied.

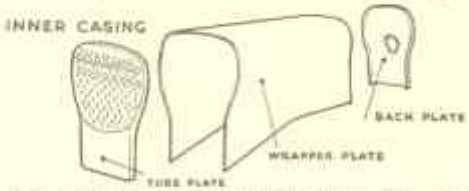
In practice only 80 per cent. of the available atmospheric pressure is used in the brake cylinder, which is equivalent to 11¾ lbs. per square inch. The diameter of the piston is 30 inches, therefore the area of the piston face is 707.8 square inches, and if this figure is multiplied by 11¾ lbs. the maximum force exerted by the atmosphere on the piston face can be ascertained. In actual fact, it is 8,140 lbs. The system of levers or brake linkage is so designed to double this force, so the brake blocks can be pressed on to the wheels with a maximum force of over 7 tons, making a total braking force for the six coupled wheels of over 42 tons.

The same brake system extends throughout the whole train; the engine, tender and carriages being linked together by a pipe. It is interesting to record here that vacuum brakes acting on a train travelling at 60 m.p.h. will reduce it to a standstill within 600 yards; such an abrupt stop, would of course, only be used in an emergency.

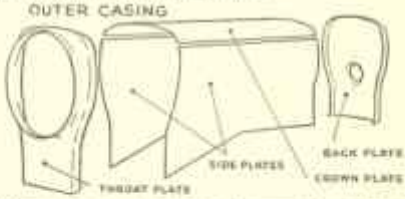
THE BOILER UNIT

FIREBOX

The firebox comprises of an inner and outer casing. The inner casing is built up from three parts, the back-plate, tube-plate and wrapper-plate, and is made from copper. This metal is used because it can resist the corrosive action of the fire and is able to withstand the excessively high temperatures developed within the box without becoming unduly distorted.



The outer casing is made from mild steel and consists of three main parts, namely, the throat-plate, into which the thick end of the barrel fits, the back-plate, which when flanged with the inner casing back-plate forms the fire-hole, and the wrapper-plate, which is itself made in three separate portions, a crown-plate and two side-plates.



In both the inner and outer casings, the respective plates are shaped by means of a very powerful hydraulic press, which can make a plate such as the throat-plate for the outer casing in one press.

FOUNDATION RING

The foundation ring or, as would be more appropriate, firebox foundation, is made from best Yorkshire iron, and is fitted at the base and between the inner and outer firebox casings to give them rigidity and support.

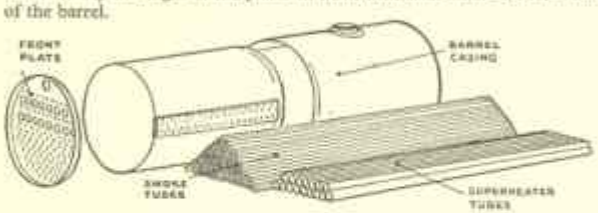
Although of simple construction the foundation ring is not an easy thing

Kessel mit Feuerkiste und Bodenring

to make, and has to be milled on a special machine to the same base measurements of the inner and outer firebox casings.

THE BARREL

The barrel is an important part of the boiler unit assembly. The actual casing consists of two distinct sections and each is built up from two mild steel plates, rolled to the desired cone shape and butt jointed together—that is to say the edges of the plates fit flush with each other—to form half of the barrel.

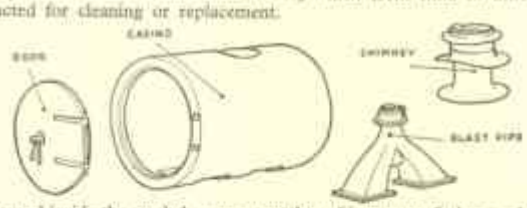


Now before the barrel sections are fitted together, the two joining ends have to be made parallel. This is done by putting the ends in a special press; whereupon the front section, which is the smaller part of the cone, is fitted to lap inside the rear section or larger part of the cone, and is secured by riveting the join.

The hollow tubes, which form part of the barrel—assembled after the boiler is in position—are supported at the rear end by the firebox tube plate and at the other by the barrel front plate. There are 171 small tubes 2¼ in. in diameter. In addition there are 16 superheater flue tubes* 5½ in. in diameter fitted to the top of the barrel, in which are the small U tubes through which the saturated steam travels in order to have its temperature raised and so dried, before passing into the regulator box for distribution into the cylinders.

SMOKEBOX

The smokebox itself is nothing more or less than a big hollow tube, one end of which is riveted to the barrel and on the other is hinged a heavy type of door. The purpose of the door is to form an airtight compartment at the front plate end of the barrel, into which the products of combustion can be drawn and subsequently emitted to the outside air, and at the same time provide access to the barrel tubes, which from time to time are extracted for cleaning or replacement.



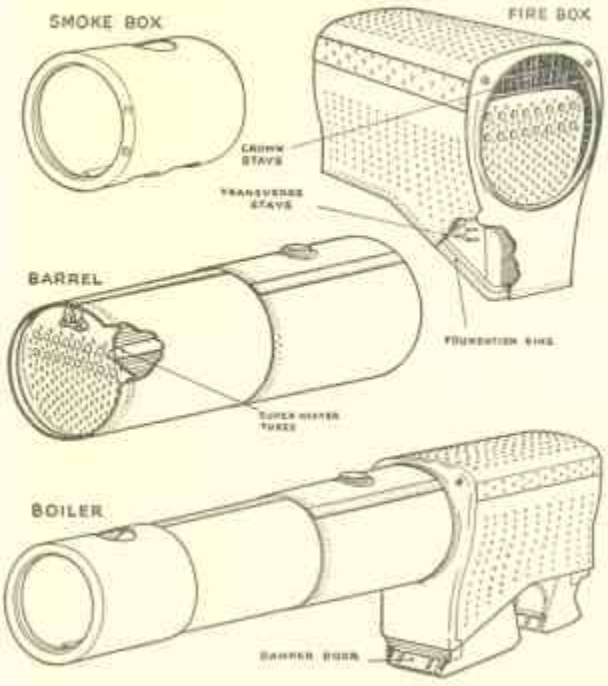
Housed inside the smokebox are a number of important fittings and they are :—

1. The Regulator Box, containing the main steam valve and its pilot valve which is attached to the barrel front plate and regulates the amount of steam admitted to the cylinders. This pilot valve is fitted to soften the flow of steam to the main valve and consequently makes it easier to open.
2. The Superheater Casing, in which there are two chambers, one alongside the other. Saturated steam, or steam still in contact with the water, passes through one of the chambers before entering the superheater tubes, wherein the steam is finally heated, and returns by way of the other chamber to the cylinders.
3. The Blast Pipe and combined Automatic Jumper Top, which provides the outlet for steam expended in the cylinders. When the engine is starting or ascending a gradient, it uses a lot of steam which if allowed to rush out of the blast pipe to the outside air would cause an intense draught, which would affect the fire and result in a wastage of fuel. The Jumper Top is fitted to prevent this happening by slowing down the rate of steam emitted.
4. A Baffle Plate which is simply a plate in the smokebox, fitted to give the gases from the firebox a downward trend and create an even draught throughout all the tubes and not just the top ones. It also prevents any sparks from being thrown from the chimney.
5. The Chimney Stack, which in itself needs no explaining, but which has at its base a blower and ejector exhaust ring, fitted to direct live steam from the boiler up the chimney. This attachment is used only when it is necessary to raise live steam quickly.

* *There have been modifications to the superheater design on subsequent "King" engines.*

Kessel mit Rauch- und Überhitzerrohren

ASSEMBLING THE ENGINE



If the foundations of a house were improperly laid, it would have serious effects on its strength, and consequently its useful life span. In much the same way, carelessness in the preliminary stages of the construction of an engine could mean a poor performance and a short existence. The utmost care and accuracy is therefore taken during the early stages of the erection.

Now let us make a start with the construction of the boiler. Firstly, the stay holes in the outer casing crown plates of the firebox are drilled out, together with a few tacking holes along the seams of the other plates which enables them to be temporarily bolted together in assembly.

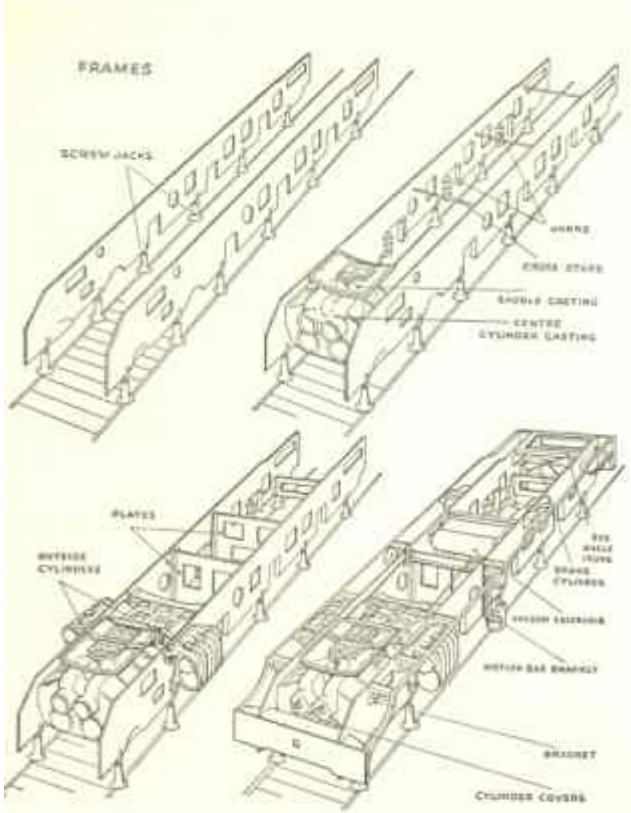
The inner and outer casings of the firebox are then assembled separately on special jigs, and, as mentioned, the casings are temporarily held together by means of tacking bolts. While the rivet holes along the seams of the inner casing can be drilled out on the jig, the outer casing holes have to be done on a special drilling machine. The casings are next riveted. When the inner one has been completed, it is temporarily fixed to the inner face of the foundation ring. The outer casing is completed except for the throat plate, which is left off so that the inner casing can be put inside.

The inner casing is next placed inside the outer casing and they are lined up in their proper positions, and temporarily secured to each other by a few crown stays and bolts. The stay holes for the inner casing are then drilled out and in order to ensure the alignment of these holes with those of the outside casing, the drill is first passed through each of the holes already made in the outside casing. All the stay holes are then tapped ready to receive the actual stays, which strengthen and support all the surfaces of the firebox.

It is now possible for the empty barrel to be lined up with the firebox. This is done with the aid of a special gauge, and it is then held temporarily in position with a few tacking bolts. In the meantime the throat plate is drilled ready for riveting. This done, the firebox and barrel are carried by means of a crane to a special riveting machine, and the throat plate is put in position and riveted to the firebox and barrel casing.

While foot stays and palm stays are connected to the barrel, the smokebox is temporarily riveted into position, it being finally secured after the boiler

Zusammenbau der Lok mit Rauchkammer, Langkessel und Stehkessel



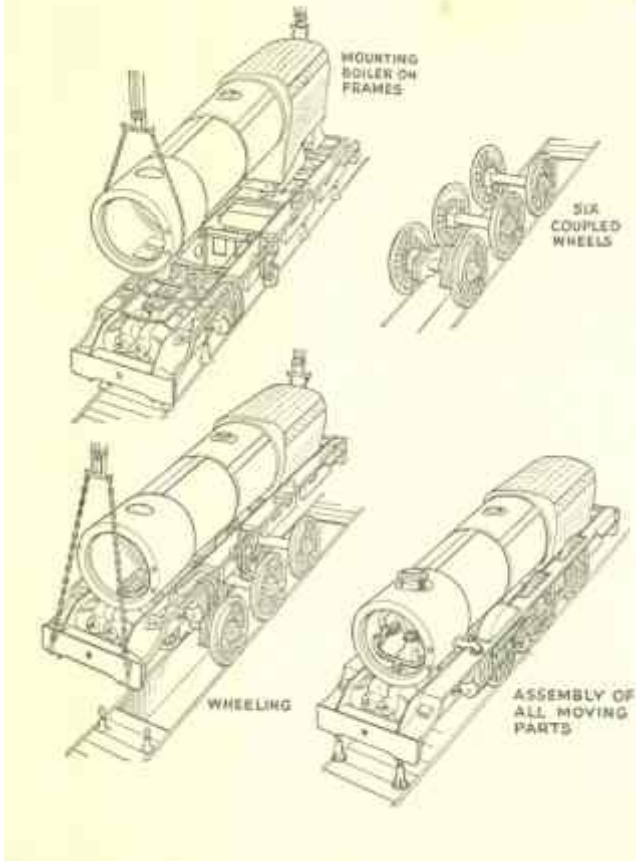
has been tried on the frames. There follows the work of inserting the barrel tubes from the smokebox end of the boiler and finally securing the front plate of the barrel to the firebox tube plates with longitudinal steel stays. Such things as the regulator box, blast pipe, superheater, water gauges, safety valves, brick arch, firegrate and ashpan are fitted to prepare the boiler for testing, after which it is given a coat of anti-corrosive paint, whereupon it is ready for mounting on the frame.

Simultaneously with the erection of the boiler, the frames are laid on low trestles, with the object of marking their inner faces with locating or guiding lines, for the centres of the inside cylinders, motion plates, saddle casting, valve gear casting, auxiliary shaft bearing, frame cross stays and drag box casting. They are then turned over for their outer surfaces to be marked with the centre lines for the outside cylinders, motion plates and the box angle irons which support the floorplate. This done, they are lifted into the vertical position and mounted on adjustable forked stands, six being used for each frame, whereupon cross stays are temporarily bolted into position. With the aid of a spirit level, the positions of the frames are checked to see if they are parallel and level with each other in the horizontal and vertical planes.

Further checks are made, by measuring the diagonal between the centre mark of the leading horns on one frame, with the centre mark of the intermediate horns on the other frame and comparing it with the diagonal of the opposite set of horns and moving the frames until the diagonals coincide.

Now the frames are ready to receive the horns, which require great skill and accuracy in fitting, as they are key parts on which the rest of the engine is set. The trailing cheeks of the leading horns are first fixed in their proper position and from them, with the aid of a special gauge, the position for the front cheeks are determined, the object being to ensure that the cheeks are parallel.

The inside cylinder casting and motion plates are temporarily bolted between the frames and their proper position is determined. That is to say, it is ascertained whether they are square with the frames and central



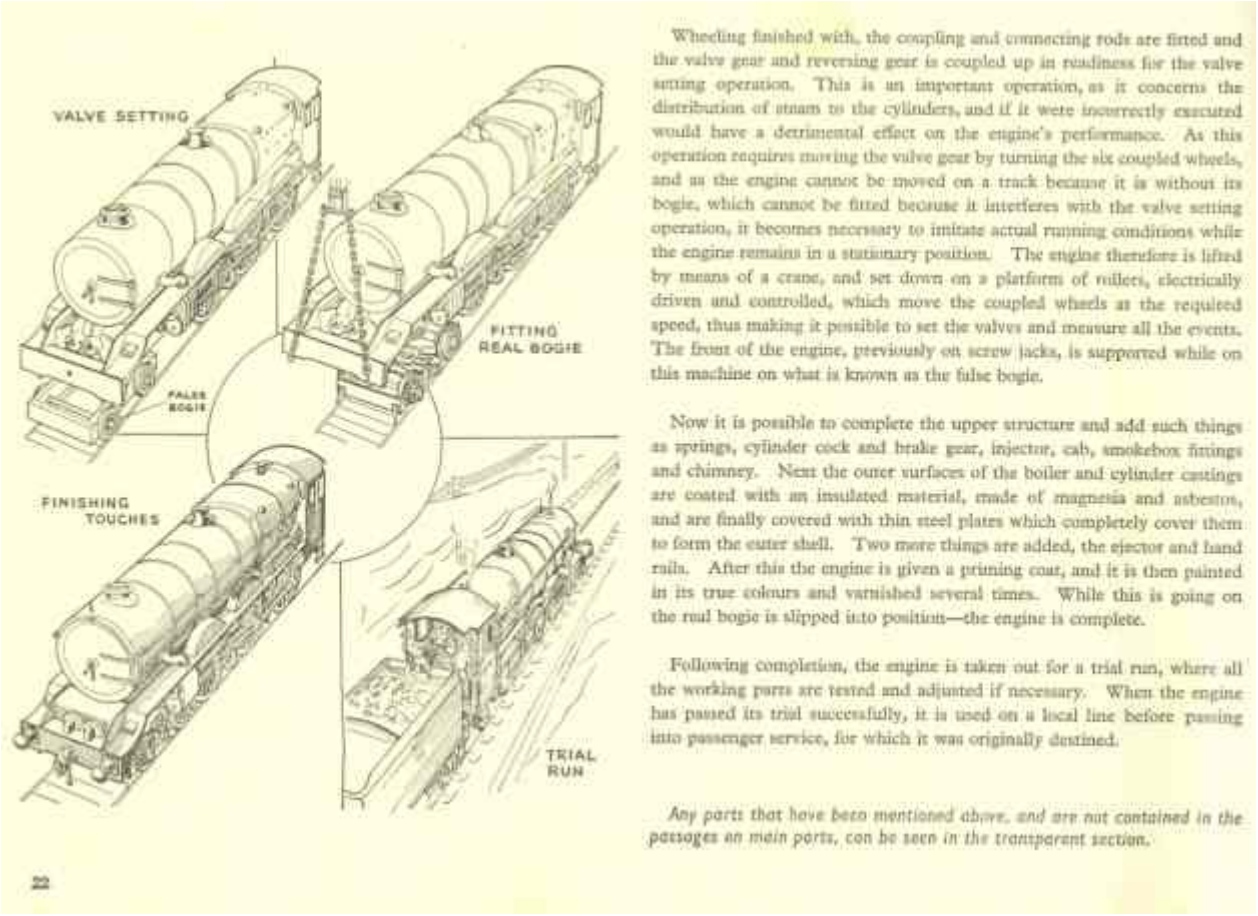
with the cylinders and motion plates, after which the various bolts and stud holes are drilled for securing the casting to the frames. The valve gear and saddle casting are tried in their positions, determined from the inside cylinders, and then the casting and motion plates are fixed to the frames.

The outside cylinder castings and motion plates are dealt with in exactly the same way, after which the inside cylinder covers, motion bars, reversing shaft brackets, quadrant and auxiliary levers, brake cylinders and reservoirs, brackets, and shafts are fitted together with anything else which would be difficult to assemble to the frames when the boiler is in position.

The boiler is carried by means of a crane and laid down on the frames and moved until its correct position is ascertained, then the holes for the smokebox casing are taken and marked off from the saddle casting; the positions for the carrying brackets are also marked on the outer casing of the firebox. Before finally securing the boiler to the frames, it is tried on again, this time to mark off on the underside of the carrying brackets a groove which houses the flat bearing spring. This spring lies between the frame and the bracket and is responsible for securing an even distribution of the boiler's weight throughout the frames.

While the boiler is being permanently secured to the saddle casting, the six coupled wheels are prepared to receive the combined boiler and the frames, and the axle boxes for each of the wheels are tested to see if they fit into their respective horns—which it will be remembered are all ready on the frames—prior to being fixed to the axle shafts. At the same time, more parts are added, such as the eccentrics, pistons, valves, crossheads, air pump, oiling gear, exhaust steam grease separator and injector pipe, and anything else which would be difficult to attach after the wheels have been added. The six coupled wheels are then put in position on a track, and with the aid of a crane the frames and boiler unit are lifted into a position above the wheels and then slowly lowered until the axle boxes, now on the wheels, have slipped into their respective horns. After the frames have been put on to the coupled wheels, the front part of the engine is supported on screw jacks until a bogie is fitted.

Verbindung von Kessel und Rahmen, Zusammenbau aller beweglichen Teile



Erledigen letzter Feinarbeiten, Versuchsfahrt

Das seltene, gut erhaltene Technikbuch fand sich bei einem Gang durch die Antiquariate der walisischen Bücherstadt Hay-on-Wye.
Das Büchlein der Reihe **„Modern mechanical Wonders. Transart publication“** im Format 16,9 x 25,2 cm mit seinen 22 geklammerten Seiten riecht stark nach Chemie. Kein Wunder bei den fast 70 Jahre alten sechs transparenten Kunststoffseiten. Es bietet technische Grundinformationen über die Lok *„King George V“*. Damals zählte die Dampflok noch zu den *„Modern mechanical wonders”*, den „Modernen Mechanischen Wunderwerken“.

Die 2’Ch4v-Lok „6000“ der GWR, später Western Region der British Railways, gehört dem National Railway Museum und blieb bis heute erhalten im Museum STEAM der Great Western Railway in Swindon. Nach den Plänen von Charles B. Collett wurde sie dort im Juni 1927 erbaut.

King George V

Ihren Namen erhielt die Lok „6000“ nach dem englischen König Georg V, gebürtig HRH Prince George Frederick Ernest Albert of Wales (*03.06.1865 in Marlborough House, City of Westminster, London; †20.01.1936 in Sandringham House, Norfolk) aus dem Haus Sachsen-Coburg und Gotha. Er war vom 06.05.1910 bis zu seinem Tod König des Vereinigten Königreichs von Großbritannien und Irland (seit 1927 Nordirland) sowie Kaiser von Indien. Aufgrund des innenpolitischen Drucks während des Ersten Weltkriegs änderte Georg V. am 17. Juli 1917 den anglisierten Namen seiner Dynastie Saxe-Coburg and Gotha in den bis heute verwendeten Namen Windsor.

Die Hauptabmessungen der Lokomotive (vgl. wikipedia):

Specifications	
Leading dia.	3 ft 0 in (0.914 m)
Driver dia.	6 ft 6 in (1.981 m)
Minimum curve	8 chains (530 ft; 160 m) normal, 7 chains (460 ft; 140 m) slow
Length:	
•**Over beams**	68 ft 2 in (20.78 m)

Width	8 ft 11 ½ in (2.73 m)
Height	13 ft 4 ¾ in (4.08 m)
Axle load	22 long tons 10 cwt (50,400 lb or 22.9 t) full
Adhesive weight	67 long tons 10 cwt (151,200 lb or 68.6 t) full
Loco weight	89 long tons 0 cwt (199,400 lb or 90.4 t) full
Tender weight	46 long tons 14 cwt (104,600 lb or 47.4 t) full
Total weight	135 long tons 14 cwt (304,000 lb or 137.9 t)
Fuel type	Coal
Fuel capacity	6 long tons 0 cwt (13,400 lb or 6.1 t)
Water cap	4,000 imp gal (18,000 l; 4,800 US gal)
Boiler:	
•Type	GWR Number 12
Boiler pressure	250 lbf/in^2 (1.72 MPa)
Heating surface: •Tubes	2,008 sq ft (186.5 m^2)
•Firebox	194 sq ft (18.0 m^2)
Superheater:	
•Heating area	313 sq ft (29.1 m^2)
Cylinders	Four, two inside, two outside
Cylinder size	16.25 in × 28 in (413 mm × 711 mm)
Valve gear	Inside cylinders: Walschaerts Outside cylinders: derived from inside cylinders via rocking bars
Performance figures	
Tractive effort	39,700 lbf (176.6 kN) currently
Power class	GWR: Special BR: 8P
Axle load class	GWR: Double Red

Nach der Entwicklung der „neuen“ GWR Star-Baureihe in Form der Castle-Baureihe sah sich der Chef-Maschinenbauingenieur Charles B. Collett mit der Notwendigkeit konfrontiert, eine noch leistungsstärkere Lokomotive für Schnellzüge mit mehr als 13 Wagen zu entwickeln. Collett rang erfolgreich mit dem General Manager der GWR, Sir Felix Pole, um die Achslastbegrenzung von 19,8 t der „Castle“-Baureihe auf das zulässige Maximum von 22,9 t für den „King“ anzuheben. Damit konnte eine

noch stärkere Lokomotive gebaut werden. Pole erklärte sich damit einverstanden, Collett die Erprobung eines solchen Entwurfs zu gestatten, sofern die Zugkraft mehr als 180.000 N betrug.

Collett entwarf die „King“-Baureihe mit den maximalen Abmessungen der ursprünglichen Breitspurmaße von 2.140 mm. Dies führte zum größten Lademaß aller Eisenbahnen in Großbritannien vor der Verstaatlichung, mit einer maximalen Höhe von 4,09 m. Infolgedessen waren die Lokomotiven bei der GWR wie auch später bei British Railways im Einsatz eingeschränkt.

Um den größtmöglichen Kessel unterzubringen und um die von Pole geforderte Zugkraft zu erreichen, wurde die „King“-Baureihe mit Treibrädern von 1,981 m, somit kleiner als die „Castle“-Baureihe ausgestattet. Dies führte zu der leistungsstärksten Lokomotivkonstruktion der GWR, vor allem aber zu einer höheren Zugkraft als bei den „Castles“. Diese Kombination ermöglichte es der „King“-Baureihe, die jetzt geforderten Expreßzüge mit einem höheren Zuggewicht bei 13 und mehr Wagen von London nach Bristol und weiter in das West Country zu befördern, dies zugleich mit höheren Geschwindigkeiten als im Fahrplan der „Castles“.

Zunächst sollte die Baureihe nach bemerkenswerten Kathedralen benannt werden, jedoch beschloß die GWR angesichts der Einladung, an den Hundertjahrfeierlichkeiten der Baltimore and Ohio Railroad in den USA teilzunehmen, die Maschinen durch die Benennung nach britischen Königen hervorzuheben.

6000 *King George V* in Swindon, nachdem sie gerade den letzten mit einem „King“ gezogenen Züge von Wolverhampton und Birmingham Snow Hill befördert hatte (1962). Die bemerkenswerte Glocke auf der Pufferbohle wurde der Maschine während ihrer Touren durch die USA gegeben.

Als erstes Exemplar der Baureihe wurde No.6000 speziell nach dem damaligen regierenden Monarchen des britischen Königreichs benannt. Die Lok wurde bei den Swindon Works gebaut und im Juni 1927 fertiggestellt.

Nach einer Erprobungsphase wurde sie im August 1927 in die Vereinigten Staaten

verschifft anläßlich des hundertjährigen Jubiläums von B & O. Während der Feierlichkeiten wurden ihr eine Glocke und eine Gedenktafel überreicht, die sie bis heute trägt. Dies führte dazu, daß sie liebevoll als *„The Bell“/“Die Glocke“* benannt wurde. Die Glocke trägt die Inschrift: „Überreicht an die Lokomotive König Georg V von der Baltimore and Ohio Railroad Company im Gedenken an ihre Hundertjahrfeier 24.09.- 15.10.1927.“
Nach ihrer Rückkehr aus den USA wurde sie dem Depot Old Oak Common zugeteilt. 1950 von British Railways nach Bristol überstellt, wechselte sie 1959 nach Old Oak Common zurück und wurde im Dezember 1962 von der Western Region der British Railways von der Ausbesserung zurückgestellt, nachdem sie 3.074.529 km zurückgelegt hatte.

Museale Erhaltung

Die Lokomotive blieb offiziell als Teil der nationalen Sammlung erhalten. Im Bulmer's Railway Centre wurde sie für den Betrieb auf Hauptstrecken wiederhergestellt. Bei dem Cidre-Unternehmen mit Sitz in Hereford untergebracht war sie seit 1971 die erste Dampflokomotive, die das seit dem „Fifteen Guinea Special“, der berühmten letzten Dampfsonderzugfahrt, von 1968 geltende Dampfverbot der British Railways auf Hauptstrecken durchbrach. Ihre Restaurierung für Hauptstreckenbetrieb und die anschließende Inbetriebnahme werden häufig angesehen als Türöffnung für die Rückkehr vom Dampf auf die Hauptstrecken des Vereinigten Königreichs.
Nach jahrelangem Betrieb wurde eine aufwendige Überholung der Lokomotive durch das Nationale Eisenbahnmuseum abgelehnt. Dies war zum Teil darauf zurückzuführen, daß seit ihrer zweiten Renovierung ein zweites Mitglied der Baureihe, King Edward I, für den Hauptstreckenbetrieb restauriert worden war. Darüber hinaus haben die seit Anfang der 1980er Jahre in der westlichen Region vorhandenen höheren Schotterbette, die den Hochgeschwindigkeitsverkehr der InterCity-125-Triebzüge ermöglichen, das Lademaß der ehemaligen GWR-Hauptstrecke - insbesondere unter Brücken - auf 3,99 m erheblich verringert, sodaß für den Hauptstreckenbetrieb der „King“-Baureihe die Höhe der originalen GWR-Schornstein-, Führerhaus- und Sicherheitsventilabdeckungen um 100 mm verringert werden mußte. Dies wurde anläßlich der Restaurierung von „King Edward I“ durchgeführt. Nr. 6000 ist die einzige der drei erhaltenen Lokomotiven der „King“-Baureihe, die ihre Originalteile in voller Höhe beibehalten hat.
Nach der Schließung des Bulmer's Steam Centre zog No.6000 in das Swindon

„Steam“ Railway Museum um. Im Jahr 2008 wurde sie im Tausch gegen die Lok der Einheitsbauart 9F 92220 „Evening Star“ nach York ins National Railway Museum verbracht.

GWR No.6000 King George V im STEAM–Museum der GWR, Swindon

Ende 2015 kehrte No. 6000 zusammen mit der No. 3717 „City of Truro“ zum STEAM-Museum der Great Western Railway, auf dem Gelände des alten Eisenbahnwerks in Swindon, zurück. Beide Maschinen wurden vorbereitet für die Ausstellung „Swindon 175“ im Jahr 2016, anläßlich des 175-jährigen Bestehens von Swindon als Eisenbahnstadt. Beide Lokomotiven werden voraussichtlich fünf Jahre in Swindon verbleiben.

Im Bulmer’s Railway Centre konnte der „King“ nur wenige Meter unter Dampf fahren

Treibräder und Außenzylinder von “King George V“