DeAGOSTINI MODEL SPACE™

Red Bull Racing
FORMULA ONE TEAM

RB7

RADIO CONTROLLED • BUILD IT YOURSELF • NITRO ENGINE

Pack 19

Stages 73-76

DeAGOSTINI MODEL SPACE™

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RB7

Contents

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DeAGOSTINI MODEL SPACE™

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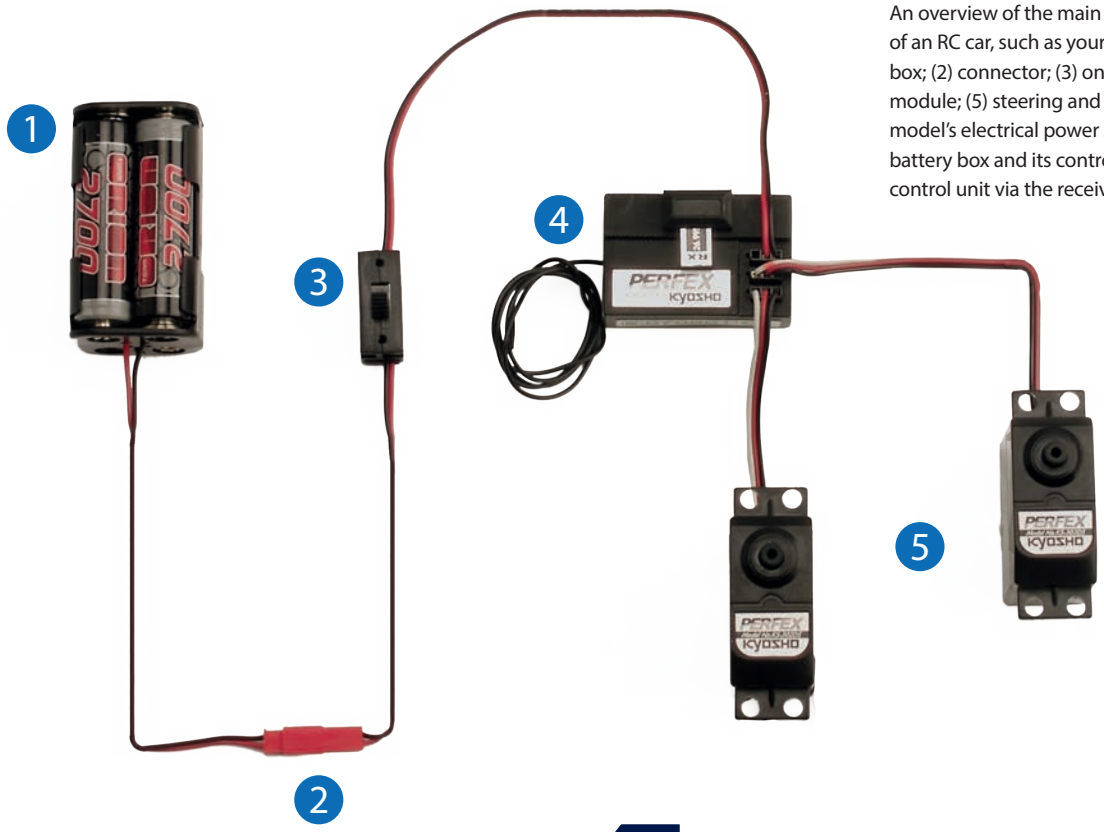
RED BULL RACING RB7 complies with CE regulations.
NOT SUITABLE FOR CHILDREN UNDER THE AGE OF 14. THIS PRODUCT IS NOT A TOY AND IS NOT DESIGNED OR INTENDED FOR USE IN PLAY. ITEMS MAY VARY FROM THOSE SHOWN.

BATTERIES AND BATTERY PACKS

YOU CAN USE EITHER DISPOSABLE OR RECHARGEABLE BATTERIES TO POWER THE ELECTRICAL AND ELECTRONIC COMPONENTS OF YOUR RB7 RACER. HERE'S HOW THESE COMPACT ENERGY STORAGE DEVICES WORK, ALONG WITH THEIR PROS AND CONS.

Before you can use your RB7 racer, you will have to decide whether to use disposable or rechargeable batteries to power its receiver and servos and your remote control unit. Each type of battery, or cell, has its advantages and disadvantages.

Your RB7 gets its electrical power from four size AA batteries. These are carried in its battery box, shown as (1) in the photograph below. From there, cables take the current via a connector (2) to the on-off switch (3). The receiver module (4) then distributes the current to the two servos (5). Whether the battery box is fitted with disposables or rechargeables, the principle of operation is the same. And although a rechargeable provides a slightly lower voltage (nominally 1.2V) than a disposable (1.5V), the electronics of your model are designed to work perfectly well with either 4.8V (from four 1.2V cells) or with 6V (from four 1.5V cells). Please note, however, that you must not use disposables and rechargeables together in the battery box:

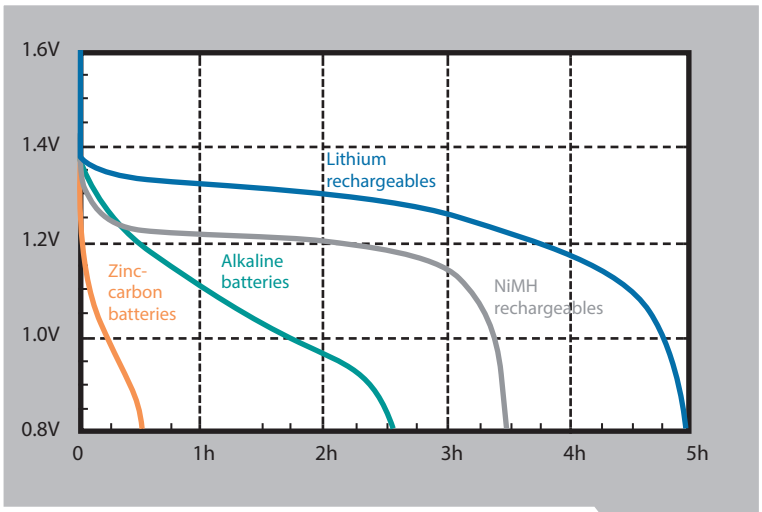


An overview of the main electrical components of an RC car, such as your RB7 racer: (1) battery box; (2) connector; (3) on-off switch; (4) receiver module; (5) steering and throttle servos. The model's electrical power supply comes from the battery box and its control signals from the remote control unit via the receiver module.

An alkaline battery has an alkaline electrolyte, in this case potassium hydroxide. The casing of this mercury- and cadmium-free battery is coated internally with manganese dioxide, which forms the cathode, and the anode at the core is made of zinc.

only ever use one type or the other. The same rule applies to your remote control unit.

Besides the voltage, the major difference between the two types of cells is, of course, that disposables have to be discarded (recycled, preferably) when they run down, but rechargeables can be recharged up to a 1,000 times. Another difference is that rechargeables are generally more expensive than disposable batteries, and you also need to buy a charger, which is an additional cost. However, if you run your model fairly frequently – say at least once a week – then using rechargeables will work out much cheaper.



DISCHARGE CURVES

The graph above shows the discharge curves of some typical batteries. With a constant load of 600mA, zinc-carbon batteries run down much more quickly than lithium rechargeables, which deliver a steady voltage for three hours or more.

HOW A BATTERY WORKS

A typical small battery, such as an AA cell, has a cylindrical metal casing with a positive (+) terminal at the top and a negative (–) terminal at the base. Inside the battery are a pair of components called electrodes, each made of a different material, such as copper or zinc. Sometimes, the casing of the battery itself acts as one of the electrodes. For example, the zinc casing of a zinc-carbon battery also acts as an electrode.

The electrodes are immersed in a chemically active liquid or gel called an electrolyte. When the battery is in use, chemical reactions between the electrodes and the electrolyte result in electrons being released from one of the electrodes, the cathode, and building up on the other electrode, the anode. The anode is connected to the negative terminal of the battery and the cathode to the positive terminal.

When an external electrical circuit is connected to the battery (and switched on, if necessary), the electrons from the anode flow through the circuit to reach the cathode. This flow of electrons – an electric current – will continue for as long as the external circuit is connected because the chemical reactions within the battery will keep it going. Over time, though, these reactions gradually get weaker and eventually the battery will no longer function. If it's a disposable battery, that will be the end of its working life, but if it's a rechargeable, the carefully controlled current from a charger will reverse the chemical reactions and restore the battery to almost its former state and it can then be reused. In effect, the battery 'stores' the recharging current and releases it again when it is used. These batteries can be recharged hundreds of time before they finally die.

A nickel-metal hydride (NiMH) rechargeable cut open. A perforated metal plate coated with metal hydride powder forms the anode (top left), while a rolled-up sheet of nickel oxide (far right) forms the cathode. Between them is an electrolyte-soaked separator (centre).

TYPES OF RECHARGEABLES

One of the oldest types of rechargeable is the nickel-cadmium (NiCd) battery, which can deliver a high current for a short time and can be recharged very quickly. The big disadvantages of NiCd batteries are that they lose part of their storage capacity if they are recharged before they are fully discharged, and they contain environmentally hazardous and highly toxic substances, so their use has greatly declined.

Nickel-metal hydride (NiMH) batteries have replaced NiCd cells for many purposes, and because they do not contain cadmium they are not such a health hazard. Nevertheless, they must not be disposed of with the household waste. Compared to NiCd batteries, NiMH cells have a higher capacity and they are also lighter, but after several recharging sessions, they too can begin losing part of their storage capacity, although to a lesser extent than NiCd batteries.

One of the newest types of rechargeable is the lithium-polymer (LiPo) battery, which evolved from the lithium-ion cells that are commonly used in consumer electronics. LiPo cells have several advantages, one being that they are absolutely leakproof because they contain no liquid. Instead, the electrolyte is contained in sheets of a polymer, such as polyethylene oxide, which are less than 100 micrometres thick. This construction enables the cells to be made in various shapes, and their extremely small components make it possible for them to have a greater power capacity for their size.

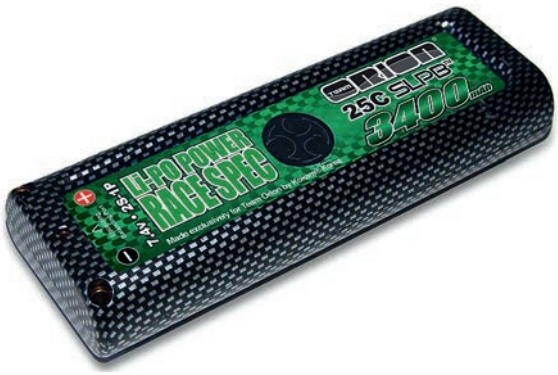
The maximum capacity of a rechargeable battery in milliampere-hours (mAh) is printed both on its casing and on the packaging.

A rechargeable battery pack containing five AA cells produces the same voltage (6V) as four 1.5V disposable batteries.

A battery pack is labelled with its voltage as well as with its capacity. Never use a battery pack whose voltage is higher than the working voltage of your RC model.

One disadvantage of lithium-polymer cells is their high price, the result of their expensive manufacturing costs. Another is that they can be quickly and irreparably damaged by overcharging, or by charging or discharging with too high a current. This is why they have to be fitted with electronic protection systems that minimise these risks, and need specially designed chargers that keep the current and voltage constant and also monitor the batteries at all times to avoid overcharging them.

Lithium-polymer rechargeables contain no fluids, because their electrolytes are contained in sheets of polymer.



BATTERY PACKS

Rechargeable battery packs are another way of supplying your RC car with the necessary power. These consist of two to 10 rechargeable cells that are connected in parallel and held together in a plastic pouch or casing. The pack is inserted in the battery compartment of your model in place of the battery box. It is then connected directly by a plug and socket connector to the on-off switch. The total power capacity of the pack, in milliampere-hours (mAh), is the combined capacity of the individual cells.

Compared to using individual cells to power your model's electrics, battery packs are quicker and easier to change. In addition, the pack can be charged as a single entity, so you don't have to recharge its cells individually. The voltage of a battery pack depends on the number of cells it contains, so when buying one, make sure that the one you choose has the correct operating voltage, which is 4.8V for your model and 9.6V for the remote control unit.

Lithium-polymer rechargeables can be irreparably damaged both by overcharging and by discharging them too much. In order to avoid this, they are fitted with electronic protection systems that interrupt the current if necessary.

HOW TO CHANGE A WHEEL

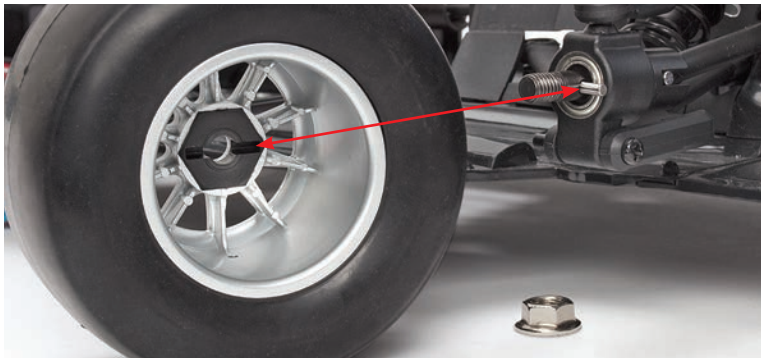
IN EVERYDAY RC CAR RACING, THE TYRES AND WHEELS ARE AMONG THE PARTS THAT ARE MOST SUBJECTED TO WEAR AND TEAR. TO MAKE SURE THAT EVERYTHING GOES SMOOTHLY WHEN YOU CHANGE A WHEEL FOR THE FIRST TIME, HERE ARE A FEW TIPS ON HOW TO DO IT.

Unlike drivers of real Formula 1 cars, you need have no fear of punctures with your RB7 racer because the tyres of the model are filled with plastic foam and not with air. Nonetheless, the tyres and wheels of an RC car can still be damaged when it's out on the track. For instance, the treads wear away over time and hard impacts can dent or damage the rims.

This is why serious RC car drivers – just like the pitcrew of a Formula 1 team – always have a set of fresh wheels and tyres ready to replace any that are worn or damaged as and when required. In the case of your RB7 model, it's important to remember that the front and rear wheels differ from each other not only in size (the wheels on the rear axle are about 5mm wider than those on the front axle) but also in the way they are mounted (only the rear wheels are driven). So it is important to make sure that you have the correct spares in your toolbox.

As well as carrying spare wheels, you will also need the

Your RB7 racer will only perform at its best if all its wheels and tyres are in good condition. You should replace them if they start to show signs of damage or excessive wear.



Top: When replacing the rear wheels, remember that the hexagonal drive washer that transmits the drive from the wheel shaft must be repositioned in the new wheel rim.

Middle: When changing the front wheel, you must remove the two ball bearings from the old wheel and press them firmly into place in the new one.

Bottom: Use your cross wrench to unscrew and tighten the wheel nuts. The socket of the wrench to use for this is the one with the number '10' next to it.

ROUTINE CHECKS

Unlike those of some RC cars, the wheel rims of your RB7 racer are made of nylon, which is such a strong material that you needn't worry that the rim might break or become deformed in normal use. But there are crucial parts of the tyres and wheels that need to be checked regularly.

Firstly, there is the fit of the tyres on the rims. The tyre lips must fit firmly in the grooves around the sides of the wheel. If this is not the case, apply a small amount of superglue to the groove to hold the lip in place. Secondly, now and again you must also check the hexagonal drive washer on the inside of each rear wheel for damage. There must be no play at all between the washer and the wheel. Sometimes, strong impacts out on track can damage the fit of the washer and the wheel will begin to 'flutter'. If this happens, you will need a new wheel, a replacement drive washer, or both.

right tools for fitting them. Always have your cross wrench with you at races – the socket you need is the one marked with the number '10', and it fits both the front and the rear wheel nuts. You should also make sure that you take along a suitable tool to act as a lever or prying implement, for instance, a flat-ended screwdriver or angled long-nose pliers.

CHANGING A WHEEL

To change a wheel, first remove its retaining nut and put it safely to one side. What you do next depends on whether you are changing a front or a rear wheel.

Because the rear wheels are driven, there is a hexagonal drive washer on each axle that fits into a corresponding recess inside the centre of each rear wheel. When removing a rear wheel, it can sometimes happen that this drive washer will come off with it, and there is the risk that you might throw it away with the old wheel. This is where the flat-ended screwdriver or angled pliers will come in useful. With one or the other, you can prise the drive washer out of the wheel and fit it immediately either into the new rear wheel or onto the driving pin on the wheel shaft.

Each front wheel runs on a pair of ball bearings, and, like the drive washers, these will be re-used when you fit new front wheels. Because they fit tightly into the wheels, again you will need a screwdriver or pliers to remove them. Fit each new front wheel only when you have pushed the two bearings all the way into place at its centre. Then fit the wheel onto the axle and secure it with the wheel nut as usual.

CLUTCH COMPONENTS

THE CLUTCH TRANSFERS THE POWER OF YOUR RB7's ENGINE TO THE MAIN DRIVE SHAFT. THE PINION GEAR ON THE CLUTCH BELL ENGAGES WITH THE SPUR GEAR ON THE MAIN SHAFT, AND ENSURES A SLIP-FREE ENGAGEMENT BETWEEN THE TWO.

With this pack, you received the first components of your model's clutch assembly, and you will find out how to put them together in the assembly sections. Meanwhile, to give you an overall view of the function and construction of the clutch, we will take a closer look at the individual components of this sophisticated mechanism.

THREE MAIN COMPONENTS

The clutch assembly has three main sections: the clutch shoes, which are held together by a spring; the clutch bell, which carries the pinion gear; and a needle bearing that ensures that the clutch bell can rotate with as little friction as possible. The clutch bell itself has a smooth outer surface with a diameter of 27mm, and a small hole in its centre. This hole is for the small screw that fixes the clutch bell onto the front end of the pilot shaft. The rear end of the bell, which is open and hollow, goes over the pilot shaft and is pushed along it until it abuts the flywheel. It then encloses both the 5 x 20mm shim and the two clutch shoes (all supplied with this pack).

The larger, lower part of the clutch bell encloses the clutch shoes, and the 14-tooth pinion gear on top of it engages with the spur gear on the main shaft.

The clutch bearing on which the bell is mounted contains eight needle rollers. Its inner diameter is 5mm, the same as the outer diameter of the pilot shaft that is inserted into it during assembly.

One face of each clutch shoe is offset by about 1mm from the outer edge by a bevel, and the holes are slightly further in. The other faces of the shoes are completely flat, with no bevels.

The flat face of each clutch shoe is in direct contact with the flywheel. The two small holes in the shoes fit onto the mounting pins on the face of the flywheel.

The inside of the clutch bell. The lipped hole in the centre will accommodate the clutch bearing (supplied with this pack) together with the pilot shaft.

The pinion gear is firmly fixed to the front end of the clutch bell, and both are made of black anodised steel. The pinion gear teeth are bevelled so that they will engage smoothly with the teeth of the spur gear.

THE CLUTCH SHOES

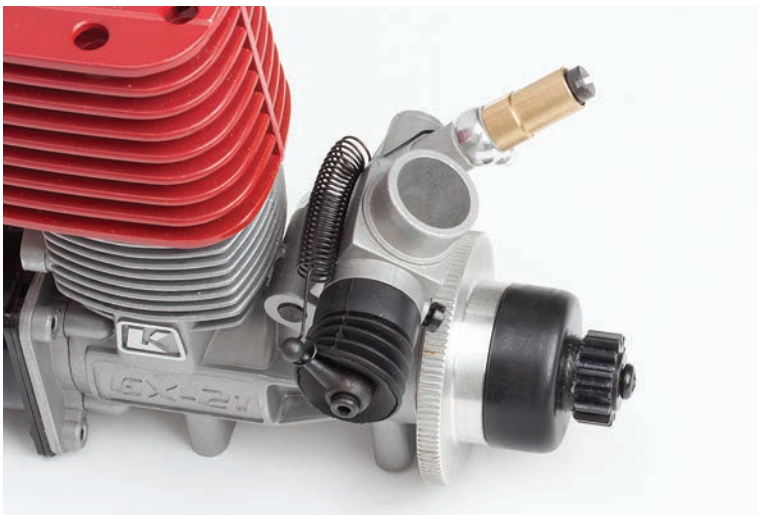
The purpose of the clutch shoes is to transfer the engine power from the pilot shaft to the clutch bell when the model is accelerating, and to disconnect the shaft from the bell when the car is decelerating. Details of how these components operate can be seen on pages 357-362.

The clutch shoes are a pair of semi-circular aluminium components that together form a ring, and are held together by a spring (see the bottom photograph on the previous page). The small holes, one near one end of each shoe, will fit onto the pins on the face of the flywheel, while the other ends of the shoes will be held in position by the spring. This arrangement means that the ends of the shoes can pivot outwards under centrifugal force when the speed of the engine increases, as the force overcomes the tension of the spring.

Two other components ensure that the shoes exert no traction on the clutch bell when the engine is idling. One of these components is the clutch bearing, a needle bearing that fits onto the pilot shaft and carries the clutch bell. The other component is the 5 x 20mm shim.

The shim is fitted onto the pilot shaft, between the clutch shoes and the inner end wall of the clutch bell. Its function is to prevent the power from being transferred to the end wall of the bell by the front faces of the clutch shoes, so that it is transferred only through the outer edges of the shoes when they pivot outwards against the inside of the bell.

When the clutch is assembled, the back of the bell rests flat against the flange of the flywheel. The bell is secured to the pilot shaft by the dome-headed screw supplied with this pack.



REPLACING THE CLUTCH SPRING

IF THE SPRING THAT HOLDS THE CLUTCH SHOES IS DEFECTIVE, YOU SHOULD REPLACE IT AS SOON AS POSSIBLE. SPRINGS OF DIFFERENT TENSIONS CAN BE FITTED TO MODIFY THE CLUTCH'S RESPONSE.

Your RB7's clutch spring is permanently under tension when the car is being driven. As the car speeds up, the spring is stretched, and when the power is removed, it contracts again. With time, the clutch spring loses its elasticity, and, especially at the points where the clutch shoes move apart, there is a risk that the spring may become permanently stretched or excessively bent. The effect of this will be to reduce the tension of the spring, and because of that, the clutch will engage too soon and the car will start abruptly instead of pulling away smoothly. When that starts to happen, you should dismantle the clutch and change the clutch spring. It's easy to do and doesn't take very long.

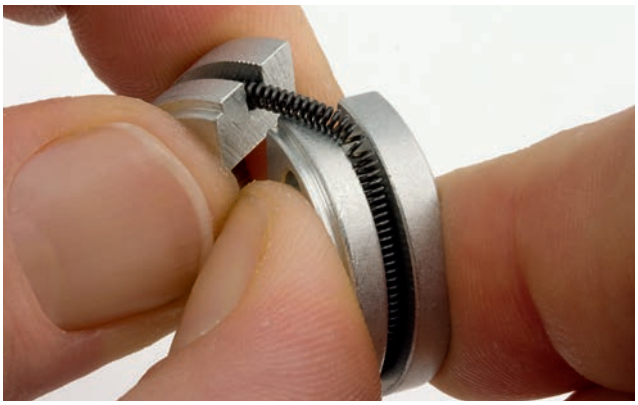
Replacement springs are available in packs of four, and can be bought in model stores. For the two-shoe clutch used in your model, you need springs about 45mm long. These can also be used in simple three-shoe systems. To change the spring, follow the steps described in the sequence of illustrations on page 356.

CLUTCH TUNING

In RC racing, optimising the clutch response is one of the many set-up details that will, in the end, decide who has the edge. The clutches used by professional racers are much more complex in construction and offer more adjustment options than the type used in your RB7 model,

It's easy to tune the clutch by fitting springs with higher tensions. You can also improve performance by using a three-shoe clutch (plus a suitable flywheel) instead of the standard two-shoe version.

An overstretched clutch spring (highlighted by the red circle) leads to an uneven distribution of force on the clutch shoes, and you should replace it as soon as possible.



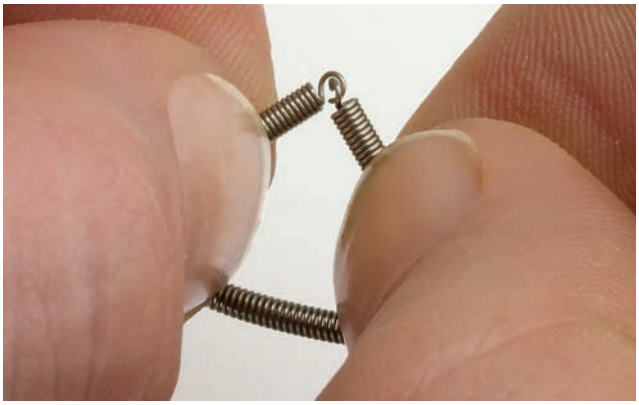
To release the old spring, twist the clutch shoes carefully apart so that one of them slips out of the spring.

Place the first clutch shoe on your work surface so that it doesn't get lost, then gently pull the spring off the second shoe.

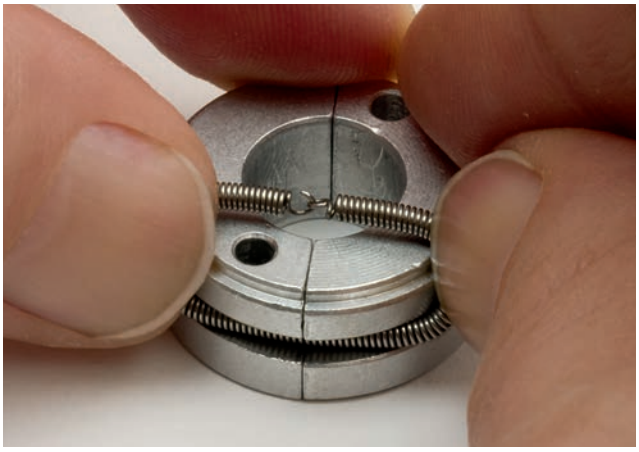
but if you develop racing ambitions, you can upgrade your car's clutch. Some high-performance commercial clutches are suitable for its standard quarter-inch (6.3mm) diameter crankshaft. However, to install such a clutch on your RB7 model, you will have to replace the entire clutch assembly, including the flywheel, and you may even have to alter the position of the engine a little.

HIGHER TENSION

It is, however, quite simple to upgrade the performance of your model's clutch without having to replace it. The model's manufacturer, Kyosho, sells suitable clutch springs with higher tensions. When you fit such a spring, the bite point of the clutch shifts so that it engages later, and so traction will begin at higher engine speeds than when using the original spring. Depending on your driving style, this can have a positive effect on the acceleration performance of your RB7 racer.



Hook the eyelets of the new spring together, being careful to not bend or stretch the coils.



Place the shoes together, flat on your work surface. Hook the spring into the groove, and slide it evenly over the shoes with your thumbs until it slips fully into place.

HOW THE CLUTCH WORKS

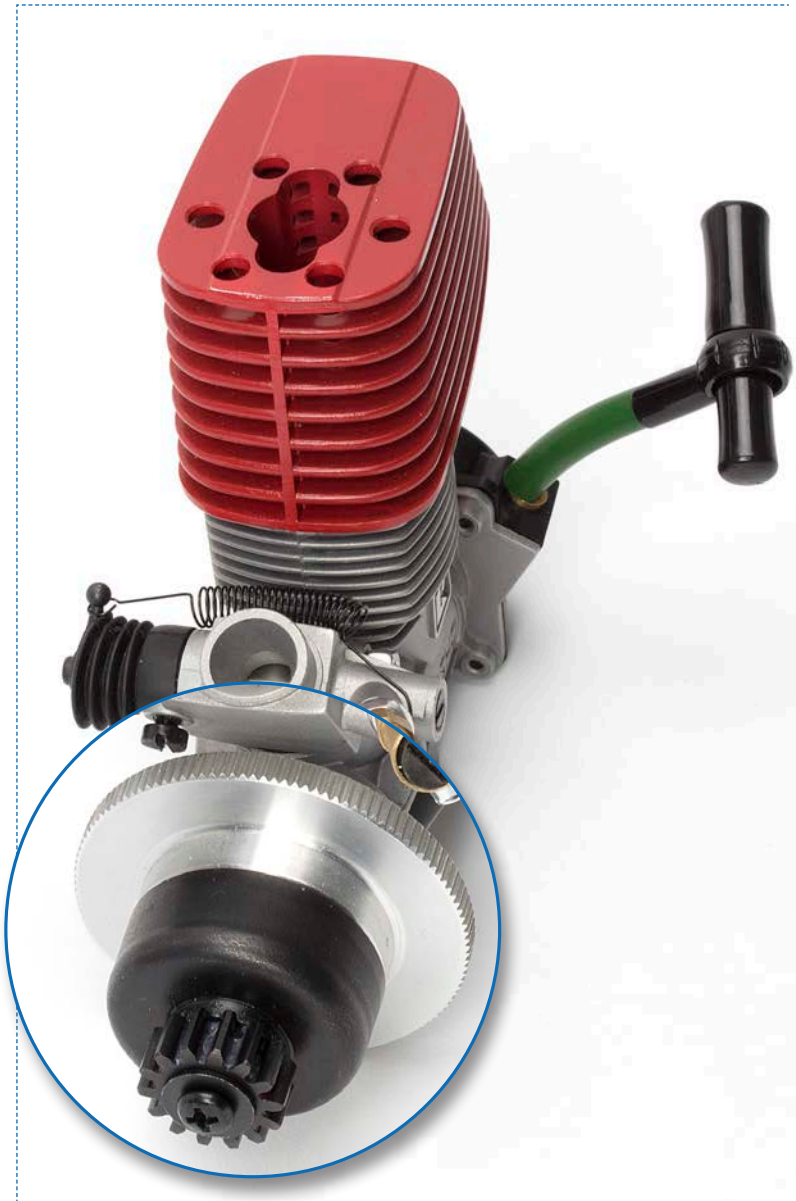
THE CLUTCH OF YOUR RB7 RACER TRANSMITS THE POWER OF THE ENGINE TO THE DRIVETRAIN, BUT THE POWER MUST BE DELIVERED ONLY WHEN THE ACCELERATOR IS PRESSED. FIND OUT MORE ABOUT THE FUNCTION OF THIS ASSEMBLY.

In addition to the engine and steering gear, the clutch is one of the main components of the chassis of your Red Bull Racing RB7 model. Its role is to isolate the engine from the drivetrain when it is idling. Only when the speed of the engine is increased will the clutch transfer its power to the car's transmission.

BASIC STRUCTURE

The clutch, which is fitted to the front end of the GX21 engine, is divided into two parts. One part is rigidly connected to the flywheel and consists of the pilot shaft, the two clutch shoes and their surrounding spring, and a Phillips screw and a washer. The other part includes the shim, the clutch bearing and the clutch bell. These parts move independently of the crankshaft, as you can see by rotating the clutch bell by hand.

The link between the two parts of the assembly consists of the two clutch shoes and a spring. These function in such a way that the clutch bell will only start rotating with the other components of the engine when the engine speed reaches 5,000rpm.



The clutch mechanism is attached to the flywheel at the front end of the engine block. Depending on the engine's rotational speed, it either connects the engine and drivetrain or separates them.

When the engine, and with it the flywheel, is rotating at low speed, the ends of the clutch shoes are close together.

As the engine and flywheel speed increases, centrifugal force causes the free ends of the two clutch shoes to move outwards.

Without this speed-dependent link, the clutch bell would always be rotating at the same speed as the crankshaft. And since the pinion gear of the clutch bell is always engaged with the spur gear on the main shaft, this rotation would be continuously transmitted to the wheels. It would therefore be impossible to bring the car to a stop without stalling the engine. Likewise, if the brakes were applied abruptly, the force of the flywheel and the engine would fight against the slowing down. To prevent this from happening, the car needs a device that automatically detects when the drivetrain should be connected to the engine and when it should be disconnected.

THE HEART OF THE CLUTCH

Although what the clutch has to do sounds like a complicated task, its engagement and disengagement can be controlled by purely mechanical means. To understand how this is done, we need to look at the heart of the clutch in more detail.

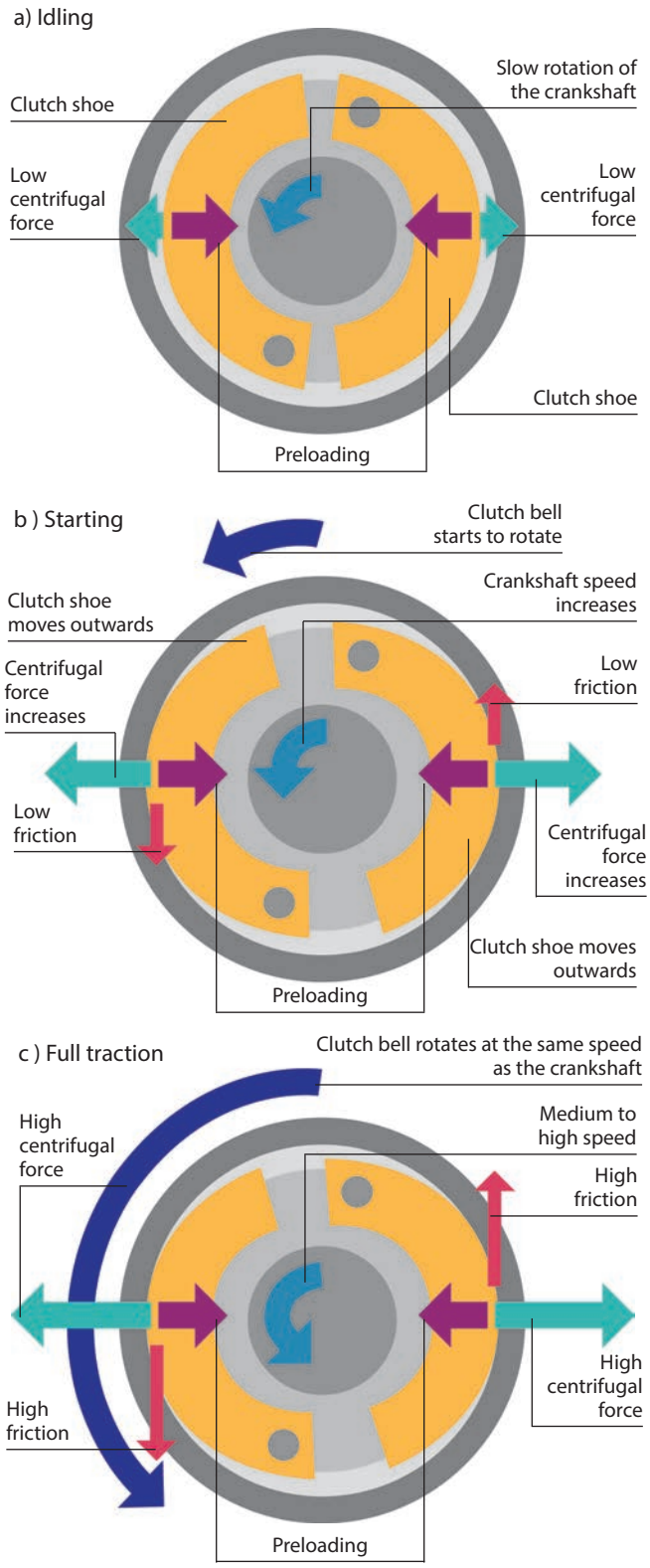
Together, the clutch shoes and spring (supplied with Stage 75) form a circular assembly. Each of the shoes is a semi-circular aluminium block, with a small hole drilled near one end. The holes fix the assembly to the two pins that protrude from the front of the flywheel (supplied with Stage 74), and their positions mean that the other end of each shoe can pivot outwards. As this should happen only after the engine has reached a certain speed, and not as soon as the crankshaft starts to turn, the shoes are enclosed by a spring. This sits in a groove that runs round the perimeter of the clutch shoes, and it presses the two shoes together.

On the left are the two clutch shoes, seen from the side that faces the flywheel. On the right is the inside of the clutch bell, with which the clutch shoes engage to transmit the drive.

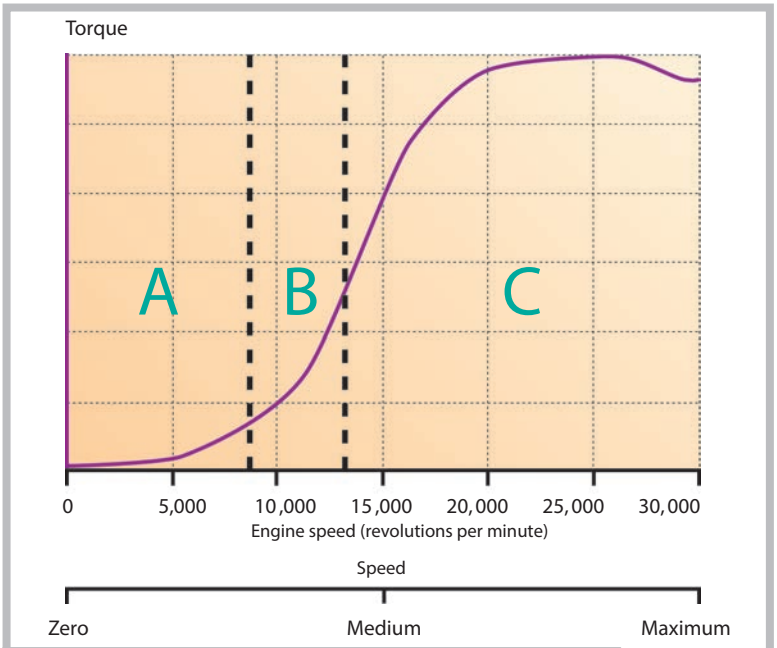
CENTRIFUGAL FORCE

When the motor is started, the crankshaft begins to rotate and turn the flywheel, to the front of which the two clutch shoes are fixed. As the flywheel rotates, a force acts on the clutch shoes in such a way that their free ends tend to move outwards against the enclosing spring. This effect is known as centrifugal force, and it is what makes objects moving on a circular path around an axis of rotation tend to move outwards. Another example of the effect of centrifugal force is the fairground chair ride. When stationary, the seats hang down vertically on their chains. When the ride begins to rotate, the individual seats fly outwards, restrained only by their chains.

When the ends of the clutch shoes first begin to move outwards, they must overcome friction before they encounter the resistance of the spring. Friction occurs when two objects that are touching are moved against each other. The degree of friction depends partly upon the force with which the parts are pressed together, for instance by weight, and partly on the material of which they are made. Smooth materials have low friction, and those with rough or uneven surfaces will have high friction. For example, if you put a sheet of paper on a wooden plate, it is easy to slide it back and forth. If you replace the paper with sandpaper, rough side down, the force needed to move it increases significantly, because the surface of the sandpaper is rough and catches on the plate.



The diagrams illustrate the relationship between rotational speed, centrifugal force and friction on an RC car with a centrifugal clutch.



THE STAGES OF ACCELERATION

In stage A, the motor is idling. The rotational speed of the crankshaft is not enough to make the clutch shoes engage with the clutch bell, so the model doesn't move. In stage B, the clutch shoes begin to rotate the clutch bell and the model begins to move. In stage C, complete traction is taking place.

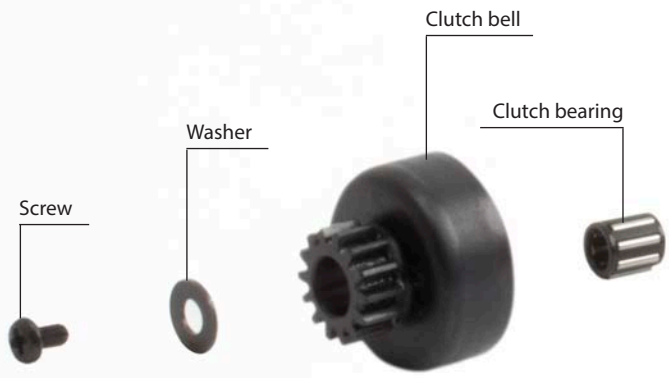
When the frictional resistance of the clutch shoes is overcome, their loose ends move outwards and press increasingly firmly against the spring that surrounds them. At first, the initial force of the spring – called the preloading – keeps the clutch shoes in place. The preloading has a crucial role to play, because it determines when the clutch shoes will begin to move outwards from their rest positions.

TRACTION

The spring of the GX21 engine's clutch mechanism is designed so that it starts allowing the shoes to move outwards when the crankshaft reaches a speed of about 5,000rpm. As the crankshaft speed increases towards this value, the free ends of the clutch shoes move further outwards, until they are touching the clutch bell. When the friction between the shoes and the clutch bell is large enough, the shoes start to turn the bell. The pinion on the clutch bell will turn the spur gear on the main shaft, and so the engine will now be transmitting some of its power to the drivetrain. This process is known in mechanics as traction. The graph on the left shows how the torque (turning force) delivered to the drivetrain via the clutch increases as the engine speed rises, and the diagrams on page 359, which are explained below, illustrate what happens inside the clutch bell as the engine speed increases.

a) Idling: The engine speed is below 5,000rpm. The rotational speed is too small to overcome the resistance of the spring and force the clutch shoes against the bell. This is a key feature of the operation of a clutch of this type: the preloading of the spring means that the rotational speed must be increased beyond to a certain value before the wheels of the model will begin to rotate. Were it not for this, the car would start moving as soon as the starter cord was pulled, and a standing start would be impossible. Also,

The components of the clutch mechanism for the GX21 engine of your RB7 racer. The pilot shaft and the clutch shoes rotate with the flywheel, independently of the washer, the clutch bearing and the clutch bell with its attached pinion.



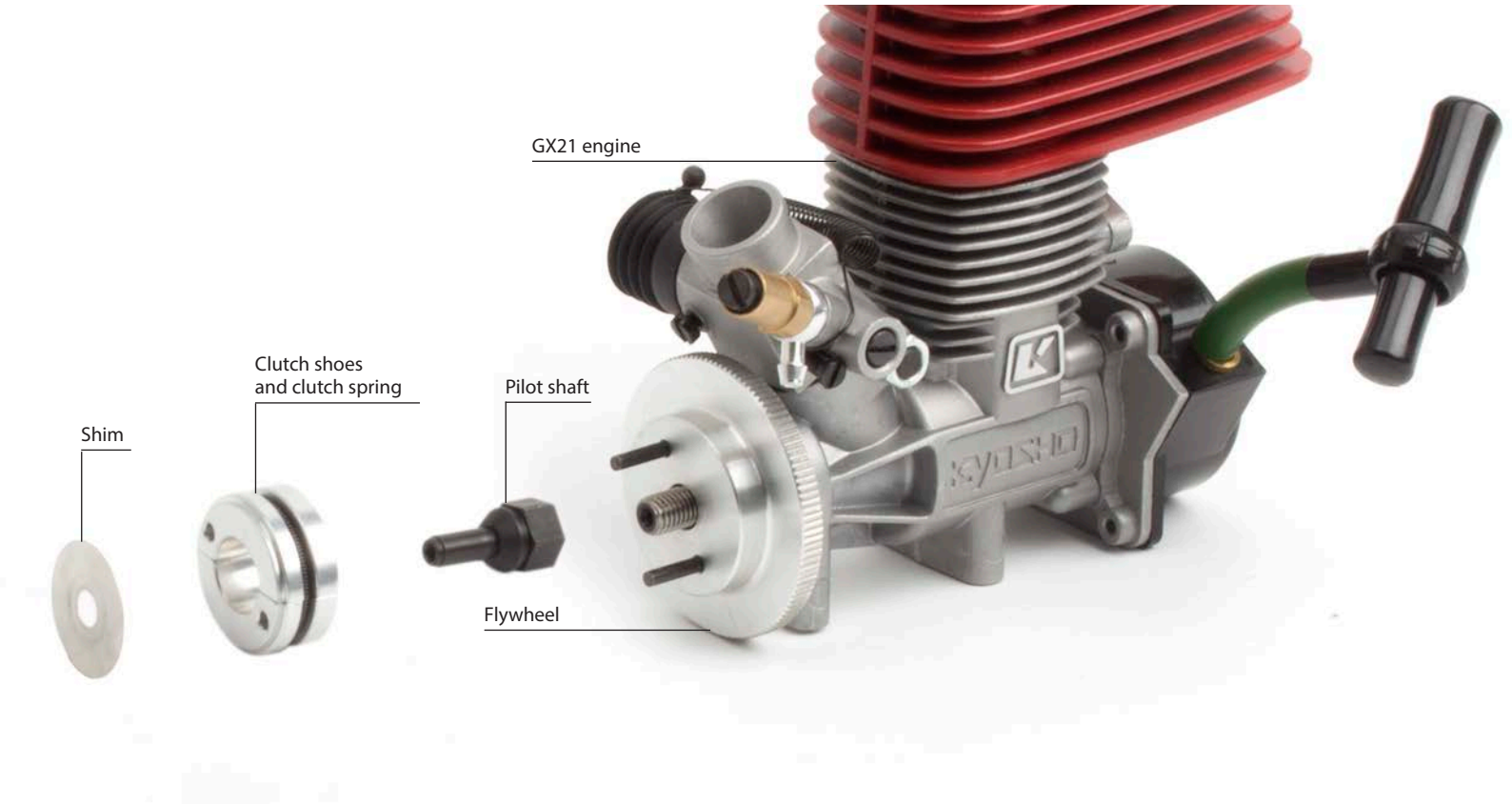
the car could only be brought to a halt by switching off the engine.

b) Starting: The engine speed is between 5,000rpm and 13,000rpm. During this phase, the centrifugal force becomes greater than the spring preloading. Both clutch shoes now move outwards and they are forced against the inside of the clutch bell. From a speed of about 8,000rpm onwards, the clutch shoes press strongly enough against the clutch bell to make it begin to rotate with them – although with a certain amount of slippage – because of the friction between it and the shoes. Because the clutch bell is connected to the drivetrain by its pinion gear, the wheels of the model will begin to rotate. As the speed continues to increase, the clutch shoes press increasingly firmly against the clutch bell, so the friction between them and the clutch bell also increases and they continue to drive it, with increasingly less slippage.

c) Full traction: The engine speed has now risen above 13,000rpm. The force with which the clutch shoes are pushed against the clutch bell is now so great that the shoes and the bell are effectively locked together and rotate as one unit. There is no more slippage between them, so from now on there are no friction losses. The engine power is transmitted directly to the drive train, and the car's speed increases until the engine reaches its maximum of about 34,000rpm.

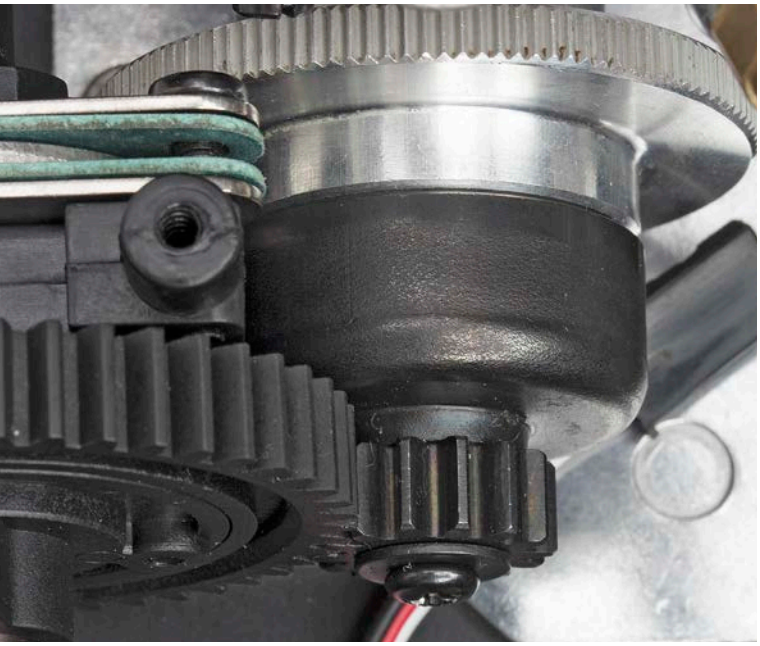
THE CLUTCH SPRING

The speed at which the clutch transfers the engine power to the drivetrain is of great importance for the operation, performance and acceleration of your RB7 racer. In particular, the preloading of the spring enclosing the two clutch shoes is an important factor. If the spring releases the clutch shoes at too low a speed, perhaps because it is too weak or is damaged, the motor will be connected to the drivetrain too soon. In this case, the power will not be enough to start the car moving, and the engine will stall. If, however, the spring releases the clutch shoes too late,



The pilot shaft goes through the centre of the two clutch shoes.

The shaft runs through the clutch bearing, so that it can rotate freely and independently of the clutch bell.



In this photograph, the clutch bell is visible behind the flywheel. The pinion gear on the front end of the bell is permanently engaged with the teeth of the spur gear on the end of the main shaft.

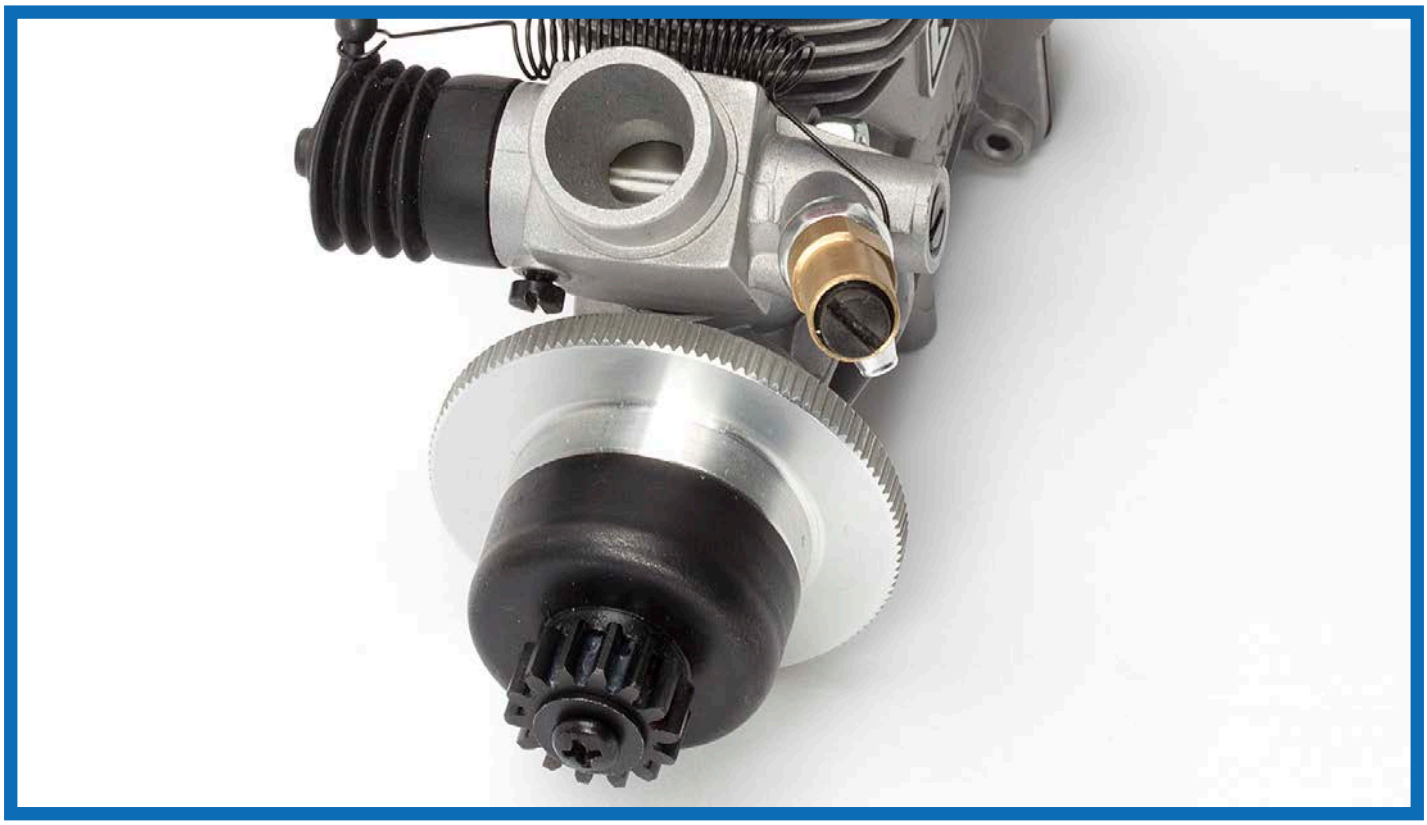
it will have a negative effect on the model's performance. The clutch shoes will have to overcome a higher spring resistance before they contact the wall of the clutch bell and set it in motion, so the engine will have to be running at a higher speed before the clutch shoes engage with the bell and begin to transmit the drive. As a result, there will be a significant delay before the car responds to a command to accelerate, and a severe loss of performance.

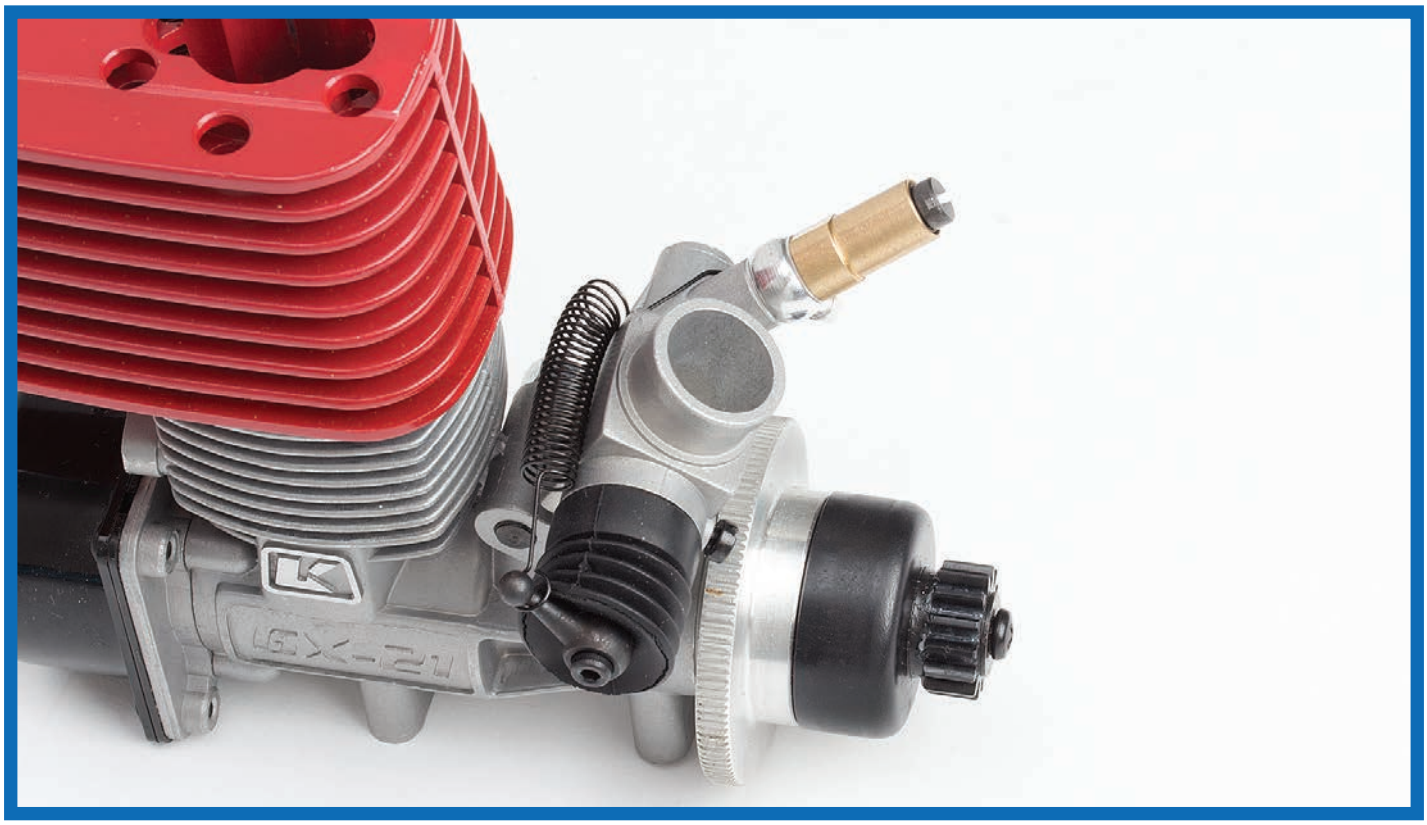
The clutch spring of your RB7 is optimally tuned for the GX21 engine by the manufacturer. The preloading has been set so that the clutch shoes do not come into contact with the clutch bell at idling speeds. As the speed approaches 8,000rpm, the engine's power is great enough to start the car moving, and the traction continues to drive it. If the spring wears out over time or becomes damaged, you should replace it as soon as possible. You can read how to do this on pages 355-356.

THE CLUTCH BEARING

Finally, an important component of the clutch that must not be ignored is the clutch bearing. This not only reduces friction in the system to maximise the transfer of power from the engine to the transmission, it also assists in the clean separation of the engine from the transmission when drive is no longer required.

When the engine is idling, and during heavy braking, the rotation of the pilot shaft connected to the engine's flywheel must be as frictionless as possible, so that the flywheel and clutch shoe assembly can rotate freely while the clutch bell is stationary. For this reason, great emphasis is placed on the smoothness of the clutch bearing, which has eight needle rollers to minimise rotational friction.




GX-21

Stage 73

THE FLYWHEEL WRENCH

THE LAST ASSEMBLY GROUP/MODULE STILL MISSING IN THE ENGINE OF YOUR GX21 POWER UNIT IS THE FLYWHEEL, WHICH IS RESPONSIBLE FOR TRANSFERRING THE ROTATION OF THE CRANKSHAFT TO THE TRANSMISSION. IN THIS STAGE, YOU WILL FAMILIARISE YOURSELF WITH THE SPECIAL TOOL USED TO FIT THIS PART: THE FLYWHEEL WRENCH.

The transition from the crankshaft to the clutch assembly is critical. To ensure as little loss of power as possible, the rotation must be conveyed smoothly, regularly and without any imbalance. The flywheel of the engine plays an important part in achieving this (Stage 74). It absorbs the moving mass of the crankshaft and so evens out the vibrations which result from the reciprocating movement of the piston. Having said this, it will only do this if the solid metal disc is perfectly centred on the crankshaft and mounted accurately at the correct angle to the rotating shaft. Even very small inaccuracies can cause the flywheel to 'wobble' or 'flutter'.

AN INDISPENSABLE TOOL

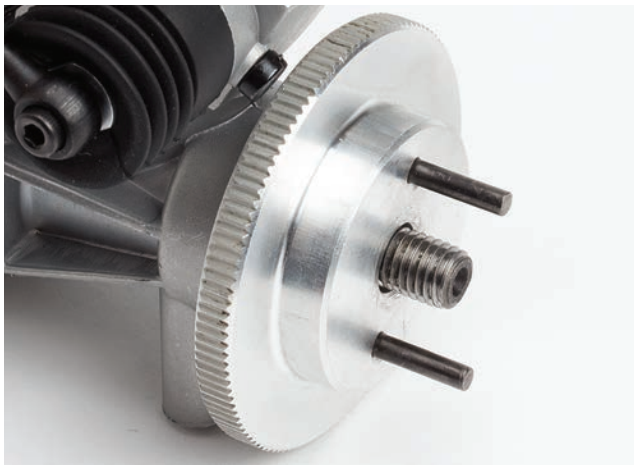
In order to avoid this problem, with this stage you have received a flywheel wrench, a tool you cannot do without. Its design allows it to be placed flat against the flywheel and to hold it firmly without damaging its surface. This is

The diameter of the hole and the outer diameter of the key head are such that they fit the raised part of the flywheel which will later engage with the clutch shoes. The flywheel of the clutch has a raised section in which the two bearing pins for each clutch shoe have been fitted.

1

Tools & Materials

1 Flywheel wrench



First, the flywheel is fitted with its central hole on the end of the crankshaft. A metal tapered collet (not seen in the picture) ensures that it is perfectly centred.

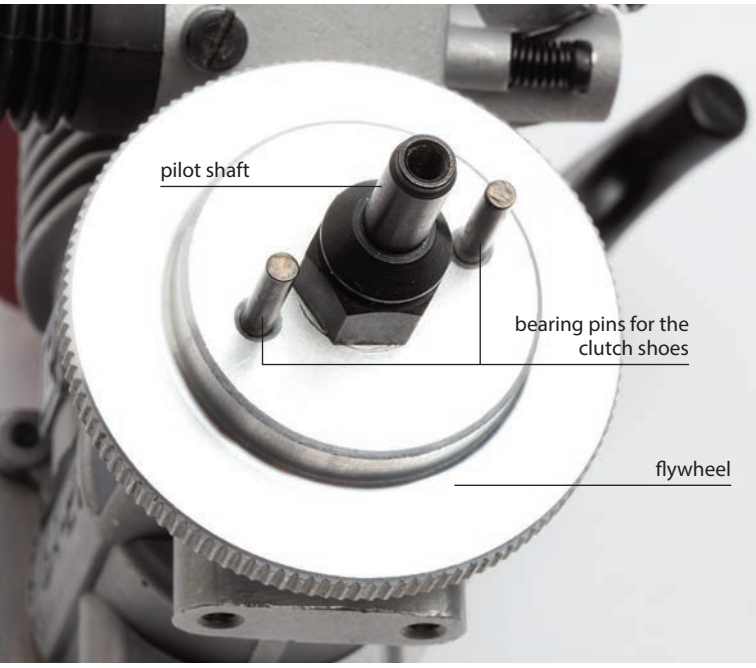
particularly important because the flywheel will later be in contact with the clutch flange and a scratched surface would cause problems.

The two 3-mm holes in the head of the wrench are 15 millimetres apart and are sized in such a way that they can engage with each clutch shoe. The diameter of the central hole of the wrench is 12mm, so that is large enough to pass over the 10mm nut at the end of the crankshaft. The handle is about 8cm long to give the key the necessary leverage to turn the tool easily.

HANDLING THE WRENCH

To mount the flywheel, it is first attached to the crankshaft by the pilot shaft, which is hand-tightened – this will be done in Stage 75. This is then secured by using both the hex wrench and the flywheel wrench. The flywheel wrench holds the flywheel perpendicular to the crankshaft while the second tool gradually screws the pilot shaft further onto the thread at the end of the crankshaft. As a result, the flywheel is pressed ever closer to the crankcase and clamps onto a tapered collet on the crankshaft. Both the flywheel and the clutch shaft are now mounted centrally on the rotational axle of the power train.

The first clutch components will be supplied over the coming packs, so keep the flywheel wrench in your tool box until it is needed.



The pilot shaft forms the extension of the rotating axle of the power train. The hexagonal nut at its base secures the flywheel to the crankshaft. The two parts together must form a perfectly centred unit.

To secure the flywheel the wrench is used, as shown in the picture. The head of the wrench is engaged with the bearing pins and the pilot shaft. Consequently, the pivoting point of the wrench handle is centred on the axis of rotation.

Stage 74

THE FLYWHEEL

IN THIS SESSION, YOU WILL BEGIN THE FINAL STAGES OF THE ASSEMBLY OF YOUR RB7'S GX21 ENGINE. TO DO THIS, YOU WILL NEED THE FLYWHEEL WRENCH SUPPLIED WITH THE PREVIOUS STAGE.

Tools & Materials

Flywheel wrench
Cross wrench

1. Flywheel
2. Pilot shaft
3. Tapered collet

01 For this session, you will need the parts supplied with this stage, your GX21 engine assembly from previous stages and the flywheel wrench supplied with the previous stage.

02 With your engine lying flat on your work surface, slide the tapered collet over the tip of the crankshaft, wider side first, until it rests against the face of the bearing.

03 With the collet in place, slide the flywheel, positioned as shown, over the crankshaft (see red arrow).

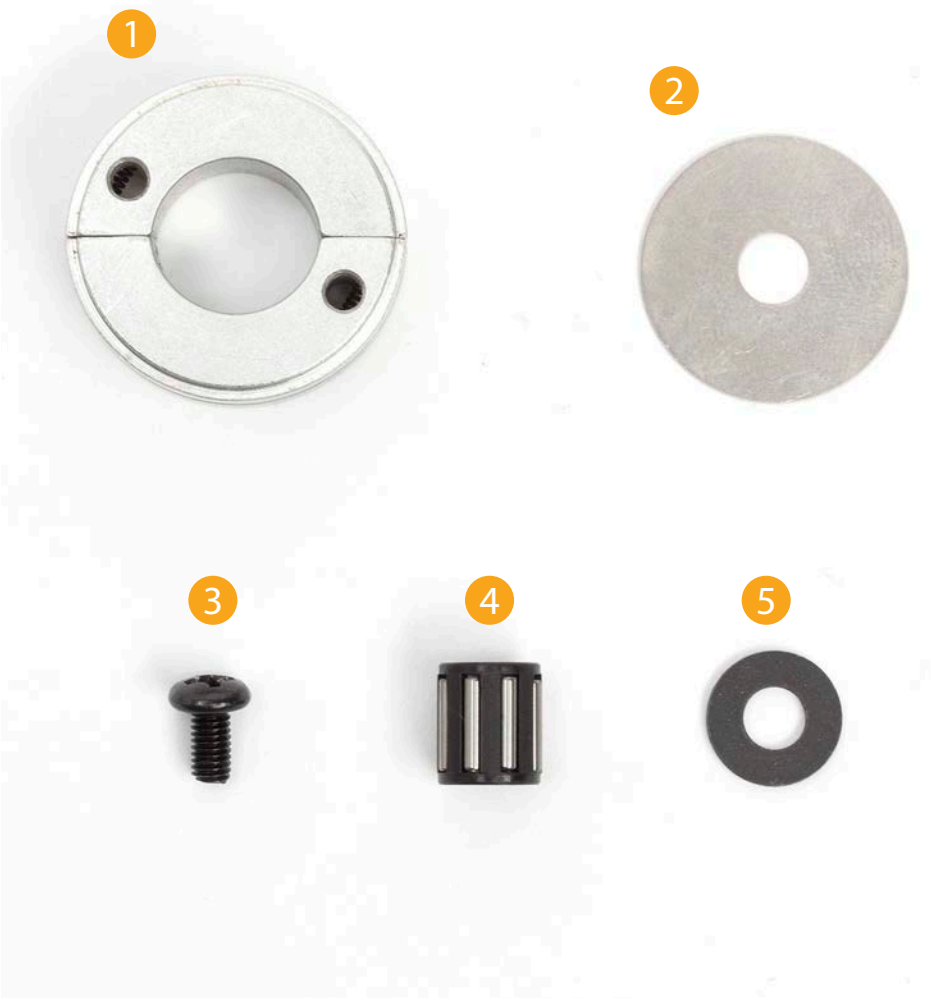
04 Next, place the hexagonal end of the pilot shaft over the remaining tip of the crankshaft and tighten by hand.

05 Hold the flywheel in place using the flywheel wrench, as shown. Then, place the end of the cross wrench marked '10' over the tip of the pilot shaft and turn until it is fully tightened.

Stage 75

INSTALLING THE CLUTCH SHOES

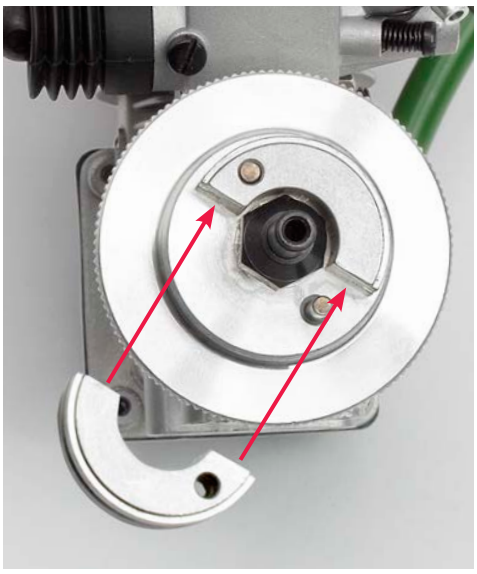
IN THIS SESSION, YOU WILL ASSEMBLE THEN MOUNT THE CLUTCH SHOES TO THE TIP OF THE PILOT SHAFT AND FLYWHEEL TO CONNECT THE PART TO THE ENGINE.



Tools & Materials

1. Clutch shoes and spring (pre-assembled)
2. Shim 5 x 20mm
3. Dome-headed screw 3 x 6mm
4. Clutch bearing
5. Washer 4.5 x 10mm

01 Carefully separate each clutch shoe from the pre-assembled unit.



02 Place each clutch shoe over the pins on the flywheel so that their flat ends meet (see arrows). The smooth face of the clutch shoes should rest against the flywheel, and the surface with the ridge around its edge should face upwards.

03 With the clutch shoes in place, pull the spring removed in Step 01 around the parts.

04 Place the shim over the tip of the pilot shaft fitted in the previous session.

05 Next, slide the clutch bearing over the shaft so that it rests snugly against the shim.

06 This stage is complete. To prevent the parts from sliding out of position, stick a layer of tape over the tip of the pilot shaft and store your assembly safely until next time.

Stage 76

THE CLUTCH BELL

IN THIS SESSION, YOU WILL COMPLETE THE ASSEMBLY OF YOUR RB7'S CLUTCH MECHANISM BY ENCLOSING THE PARTS WITHIN THE CLUTCH BELL.

1

Tools & Materials

Phillips screwdriver (size 02)
Shock absorber oil (Stage 4)

1 Clutch bell

01 For this session, you will need your GX21 engine assembly, along with the 4.5 x 10mm washer and 3 x 6mm dome-headed screw supplied with the previous stage. You will also be using the shock absorber oil supplied with Stage 4.

02 Apply some shock absorber oil to the clutch bearing and rotate a few times to distribute the oil. This will help reduce heat caused by friction when the clutch is spinning.

03 Slide the clutch bell over the pilot shaft and clutch bearing fitted in the previous stage. The clutch bell should cover the bearing and both clutch shoes completely.

04 Place the 4.5 x 10mm washer supplied with the previous stage over the tip of the pilot shaft at the front of the clutch bell.

05 To complete the work of this stage, place the 3 x 6mm screw also supplied with the previous stage into the hole at the tip of the shaft. Tighten fully with the screwdriver.

06 This stage is now complete, and your assembly should look like this. Store away safely until next time.

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