

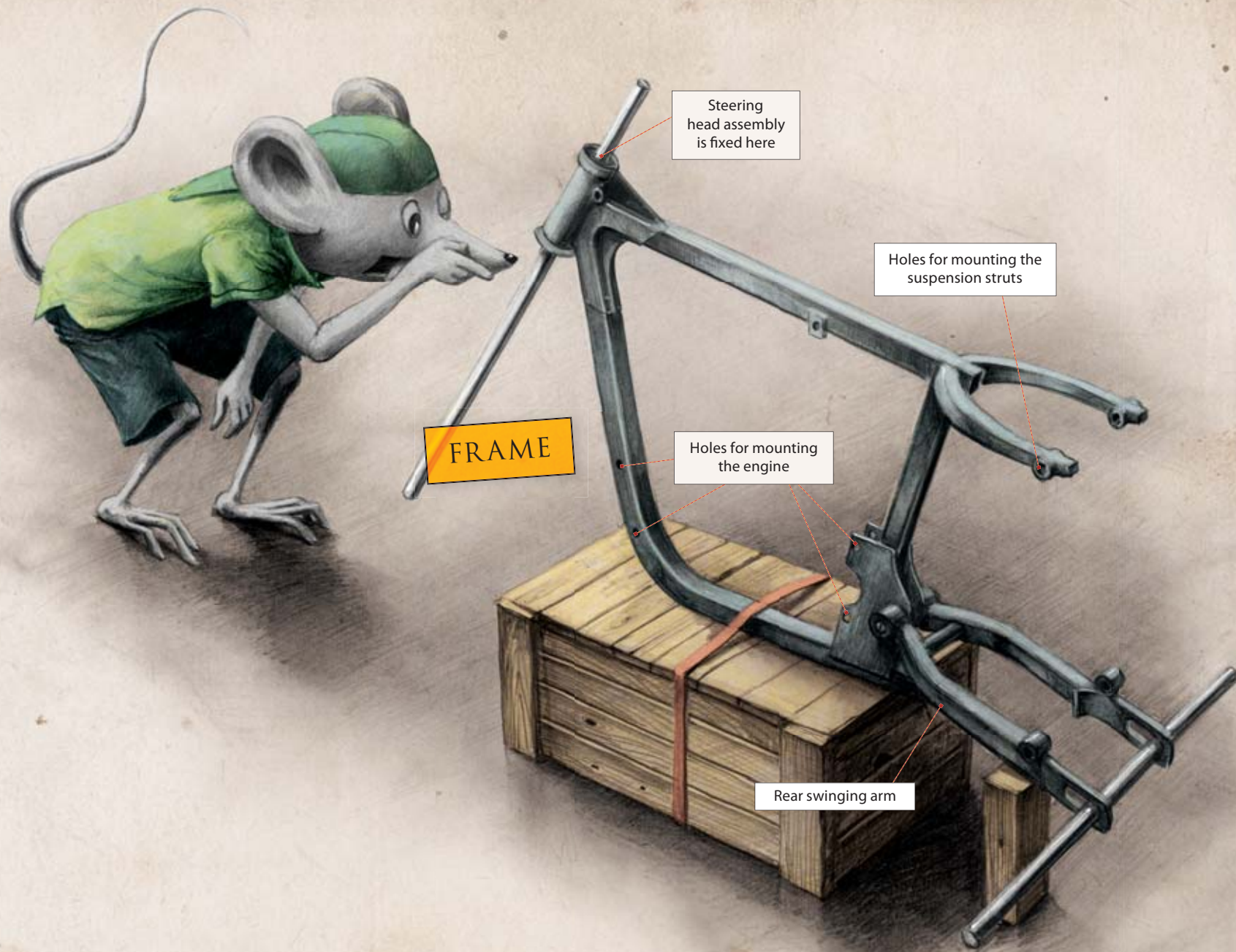
Martin Sodomka

How to build a motorbike



TECHNICAL
FAIRY TALES
EDITION





‘Is that the frame you were raving about? Do you know for sure that it isn’t twisted? It looks a bit of a botch-up,’ Arnie said, evaluating professionally Fred and Titch’s find that they had brought into the workshop on Monday morning.

‘We put posts through the holes in the rear forks and into the steering head so that we could check if they were at right angles to each other. It seemed all right, looking at it,’ replied Titch.

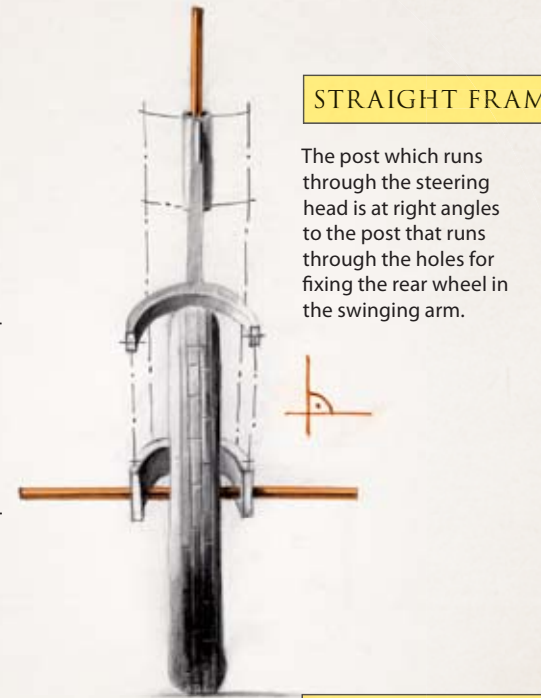
‘All right then, hopefully. Otherwise they’ll be out of alignment. Did you get that off old Moody?’

‘Yeah, and he also promised us the parts for the front forks and rear suspension. And, for that matter, where’s Christian - I still haven’t seen him since you landed,’ Fred said, concerned.

Arnie smiled. ‘I know what you mean,’ he said. ‘I called on him yesterday, but it was only a short visit. He didn’t want to see anyone, didn’t want to hear anything about flying, or about travelling. He said he just longed to sit at home in peace and quiet, look at the wall, and have his legs soaking in water. See, I didn’t even get around to the motorbike.’

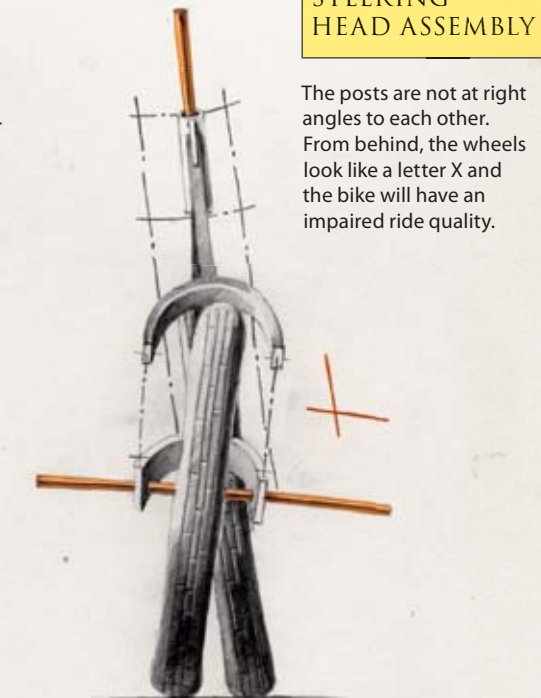
‘So, that’s it then, we’ve had it, haven’t we?’ Fred.

‘No way! He’ll soon get over it. For the moment we’ll have to rely on old Moody.’



STRAIGHT FRAME

The post which runs through the steering head is at right angles to the post that runs through the holes for fixing the rear wheel in the swinging arm.



STEERING HEAD ASSEMBLY

The posts are not at right angles to each other. From behind, the wheels look like a letter X and the bike will have an impaired ride quality.



‘Long live the amphibians! Welcome Chris! We’ve missed your good-natured humour,’ Arnie shouted cheerfully.

‘One of these days I’ll make mice pâté out of you, ratty!’ said Christian, shaking hands in turn with Arnie, Fred, and Titch.

‘What have you got there?’ asked Fred eyeing inquisitively the trailer that Christian was pulling behind him.

‘Don’t say it’s an engine! That would be like Christmas!’

‘A little token of the business, but it’s nothing to get excited about, it’s completely worn out. If we want to use it, it won’t do without a complete overhaul. And also without Bill’s help. Where is he anyway?’

‘He’s flying about somewhere. It seems to me that just recently he’s not been much interested in technical subjects: he’s turned himself into a philosopher. He’ll be interested in the engine though, I’ve no fear of that,’ replied Arnie.

‘Maybe the trip changed him,’ said Christian. ‘I’m so pleased to be back home lads. You wouldn’t believe it – entrancing countryside, the sun shining, the air smells good, and I missed my dusty old scrap heap. Well, can you understand that?’

'Hi Tony!'

'Well, I never. Arnie! Hello there. Good to see you again, you old rascal. Are you on a reconnaissance mission?'

'Well, actually, why not. I'd like to have a look at that beautiful machine of yours. I heard that you managed to track down a four-stroke engine.'

'What are you doing here Hoppy? Are you looking over our machine? It's your last opportuni-

ty, because on the road you'll only see it from behind,' resounded the cracked voice of Lanky Jack.

'That's an old joke, Jack. I see as usual that you're not weighed down by any new ideas. I'll just say hello to Tony here and then be off.'

'I might have just one good idea,' said Lanky Jack. 'Why don't we hold a race? That will prove who's the best. No quips will help you there. What's up, what are you worried about? Are you afraid, you chicken?'

'Yeah, all right then, why not. We'll agree a time and a place and then go for it.'

'Agreed! Bye then Hoppy, and make the most of your last few days basking in glory before I put you out of action completely.'

'Why did he call you Hoppy?' asked Tony when Jack had gone.

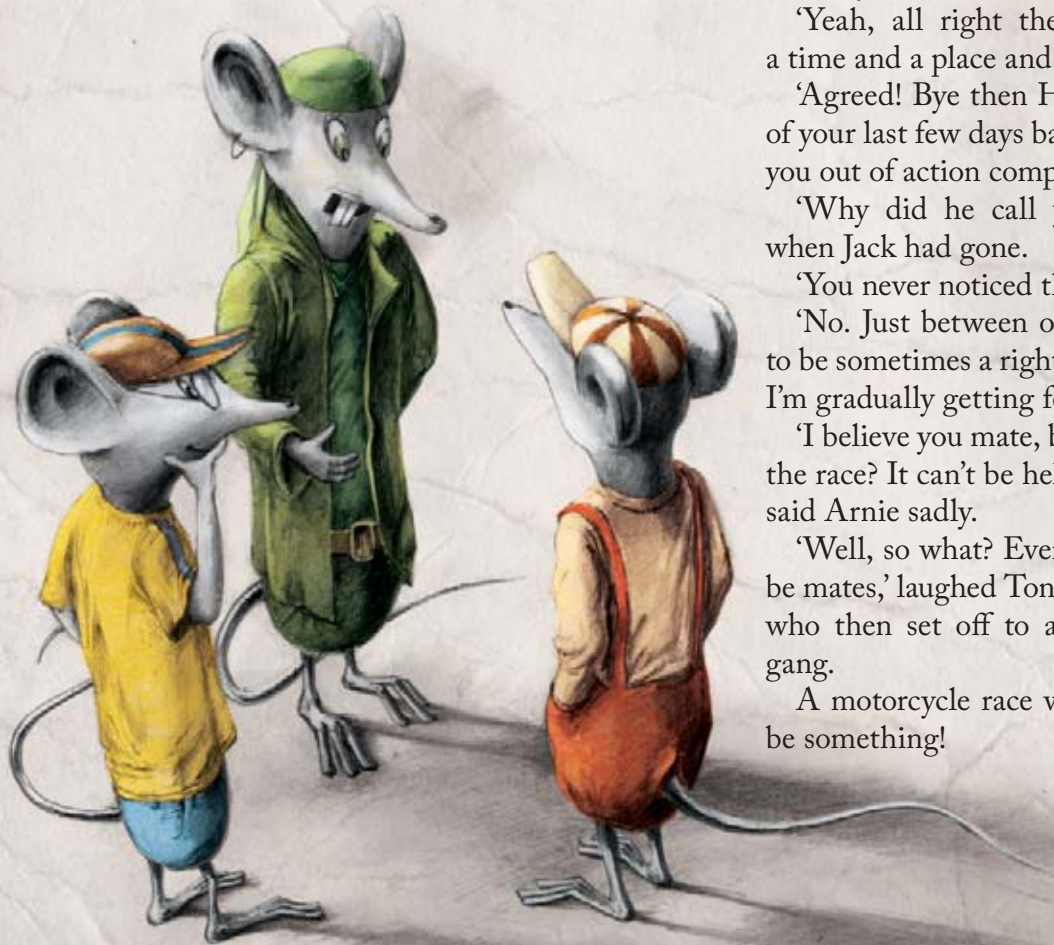
'You never noticed that I've got a limp?'

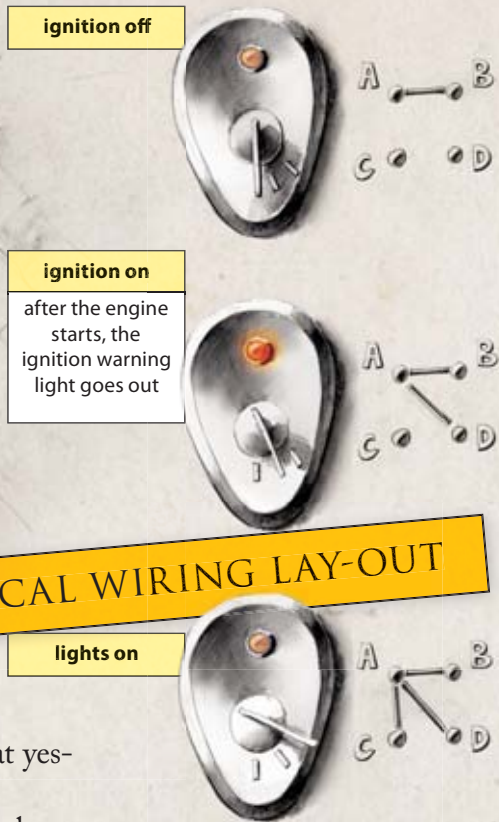
'No. Just between ourselves Arnie, Jack tends to be sometimes a right old country bumpkin and I'm gradually getting fed up with him.'

'I believe you mate, but did you hear that about the race? It can't be helped, Tony, we'll be rivals,' said Arnie sadly.

'Well, so what? Even then we'll hopefully still be mates,' laughed Tony, giving Arnie a high five, who then set off to announce the news to his gang.

A motorcycle race with Lanky Jack, that will be something!





ELECTRICAL WIRING LAY-OUT

'Hi Arnie'

'Hi Bill. Look Bill, I'm sorry I flew off the handle at you like that yesterday. I...'

'...no, Arnie, I apologise. You were right yesterday. I was thinking about what you said and I realised that we must win the race at all costs.'

'Really?'

'Yes, we must.'

'Good, fine, but listen Bill. There's one thing you must know,' said Arnie. 'I can't stand races, nor competitions, matches, championships, contests, and similar nonsense. Personally, I don't fancy doing any racing, but as I was trying to explain to you yesterday - there was no getting out of it.'

'All right, I see. But how else do you want to find out who's the best?' objected Bill.

'Why should I find out who's the best? That way you'll also actually find out who's the worst. So tell me now then, what's all that hard work good for?'

'I won't tell you now. We must start working flat out and get ready for the race. How far have we got with the bike?'

'The electrics - that could be a problem. We didn't have much trouble with it on the car, but then Bill advised us,' said Titch in the workshop in the afternoon.

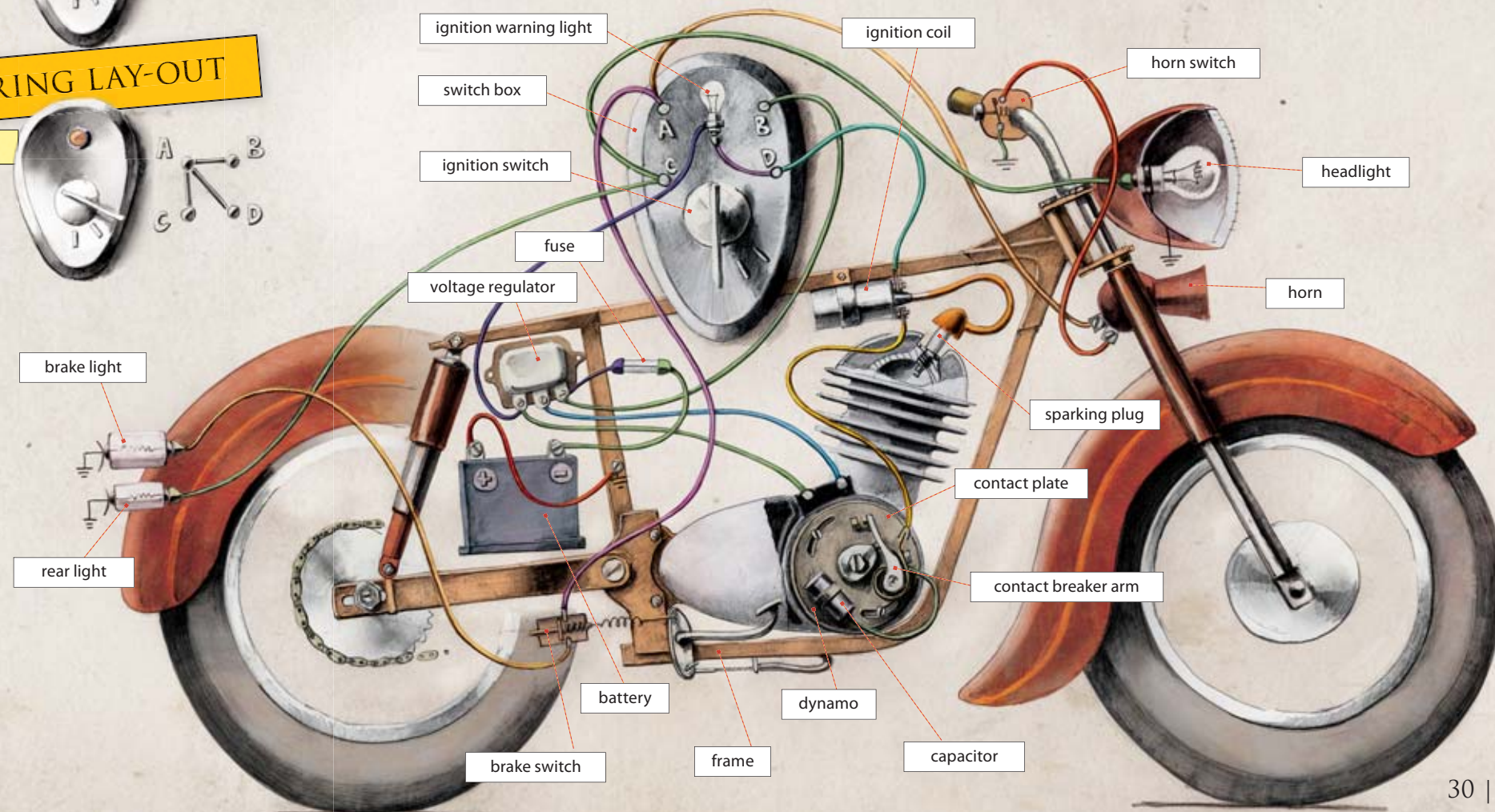
'Don't worry. Bill will be here in a minute and he'll also have the wiring diagram with him,' said Arnie.

'Have you two made it up then?' asked Fred

'Yeah, and now there'll be a lot of flying about all over the place. Bill wants to win the race at all costs.'

'That's at least two of us who want to win. And how is it that he's come round at last? Last time I had the vague impression, as if he was slightly hinting that motorcycle racing went against the grain with him, or against the feathers, or whatever he's covered with,' said Fred, surprised.

'Well, now things are different,' said Arnie, 'but we'd still better keep quiet in front of Bill about the betting that the mafia has started to organise.'





‘Christian, my old mate, I need to confide in you about something.’

‘Oh yeah? I believe you pal.’

‘No, really, listen. Can you imagine, mate, that I don’t know how to ride a bike?’

‘You’re pulling my leg!’

‘No, I’m not, and at the end of the summer I’m supposed be racing Lanky Jack on the motorbike.’

‘Well, then let Fred ride. Look, he’s mad about the whole thing anyway.’

‘That’s not possible though. What would everyone think of me?’

‘Don’t worry about that, Arnie. You built yourself a car, you flew over half the world in a self-made aeroplane; you no longer have to prove anything to anyone. The motorbike, compared

with all that, is surely just a sort of savoury morsel. Let Fred or Titch ride, depending on who will be the better rider.’

‘Originally I also thought that the motorbike would be just a pleasant diversion,’ said Arnie, ‘but gradually like this it has absorbed me.’

‘Well, as I say,’ continued Christian, ‘if I were you I wouldn’t worry about it. Just tell the truth normally. So you don’t know how to ride a bike, so what?’

‘Do you think so?’

‘Of course! I must admit though, Arnie, that it’s a nice change to see a whizz-kid sometimes also in a bit of a tight spot.’

‘Thanks anyway for the advice you old frog-face.’



GETTING READY TO GO

'It's not exactly an ugly means of transport, is it? Lucy, you painted those gold lines magnificently. You know I praise you all the time, so now I don't even know how I can elevate your ingenuity even more.'

'Thanks Fred. I'm glad you've noticed my work for the first time in your life.'

'How much oil shall we put in the petrol?' asked Arnie.

'The engine has just been rebored and so far we've only gone a couple of kilometres, by way of a trial. The engine's therefore still running in,' said Bill. 'Put in one part oil to twenty-five parts petrol. Later we can change it to one to thirty-five. That's the disadvantage with two-strokes, that the petrol has to be lubricated with oil. It smells terrible and smokes.'

'Don't be a little madam Bill,' said Christian, immediately adding, 'Sorry Lucy. Your speaking about these ratios,' he went on, 'reminded me that my brother, when he found out that Fred would be racing for our team, had the odds changed to two to one on in our favour and...'

'Brother? What odds? Betting?' shrieked Bill. 'Don't tell me that the mafia has got involved in the holding of the race. Ye Gods! What kind of gang is this I've got myself into?'

'Well, well, well!' said Fred, exultant, without taking any notice at all of Bill's wailing. 'See how my fame has spread? Call me Alfred the First Unbeatable.'

'Well Christian, you've caused some mischief here,' sighed Arnie. 'Bill might get over this, but from now on with this nutter it's truly going to be unbearable.'



‘Lads, it seems to me that the engine is somehow not responding today as it should,’ said Fred.

‘That’s quite possible, because that would explain why you’re doing worse times than a week ago,’ replied Titch.

‘Are there no funny sounds coming out of the exhaust?’ asked Bill, who had just flown in.

‘Well, I was just going to ask about that – what are those bangs? They go off mainly when I throttle back,’ said Fred.

‘I would guess that that was a slight ignition advance. We’ll try setting it greater,’ said Bill, thinking.

‘And how do we do that?’ asked Arnie.

‘We’ll turn the ignition plate slightly anti-clockwise,’ said Bill. ‘The sparking plug will then spark earlier and the petrol mixture will fire before top dead centre. In this way the power of the explosion is maximised. You’ll see that the engine will run better but you need to take your time with it.’

‘And how does the ignition work exactly?’ asked Fred. ‘I’ve never actually ever properly understood it.’

‘You have to study it all in my textbook, the one I got only after some difficulty and that you have now just stolen from me.’

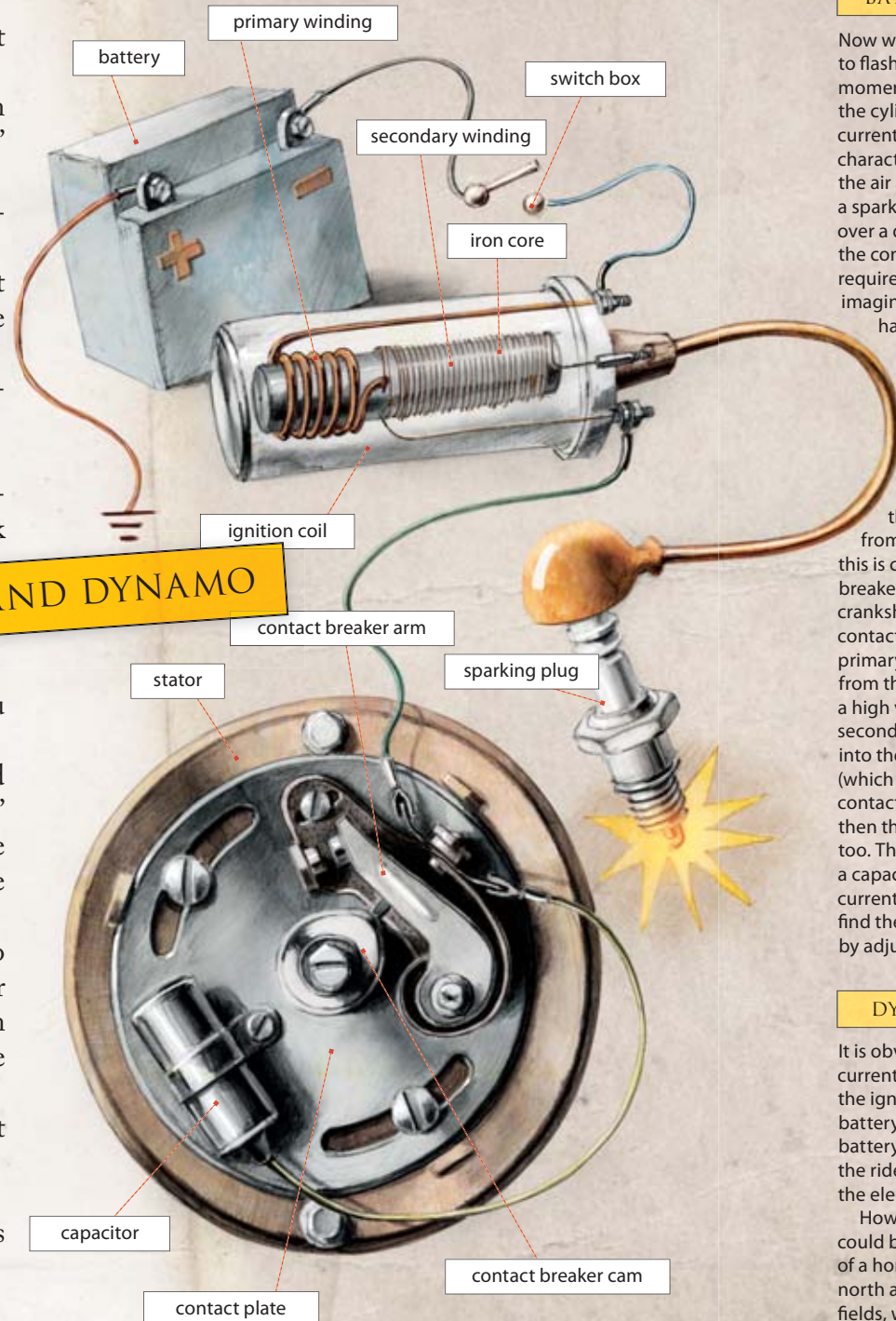
‘Come off it. I borrowed it from you, and I’ll also give it back to you. You stole it, just like those other books that you’ve got.’ protested Fred and, to give an extra dig: ‘Although you’re a sparrow, you act like a magpie.’

‘Fred, I strongly request that you take back that what you just said!’ cried Bill, upset.

‘Get lost!’

‘Shall we go for elevenses Titch?’ said Arnie. ‘This will take a long time.’

IGNITION AND DYNAMO



BATTERY IGNITION SYSTEM

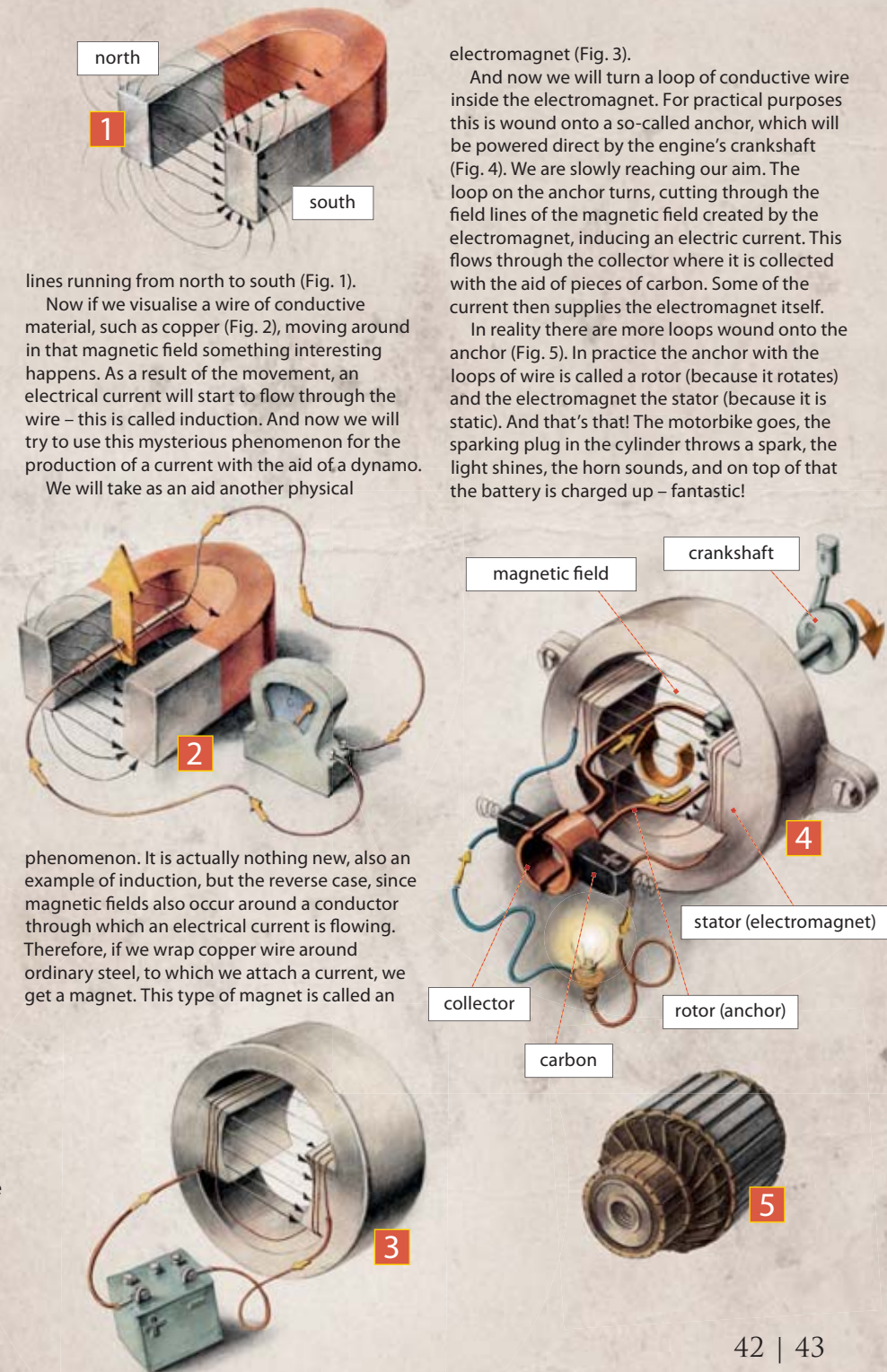
Now we will show how a spark can be produced to flash over the sparking plug at the correct moment and ignite the air-fuel mixture in the cylinder. Above all we need an electric current with a very high voltage. This has the characteristic of being able to be carried through the air across two contacts, thereby producing a spark. For our purposes it is enough to get over a distance of half a millimetre between the contacts in the sparking plug. Even so that requires a voltage of 35,000 volts. Can you imagine what voltage lightning in a storm must have when it could quite well pass over several kilometres between a cloud and the ground?

A high voltage can be achieved with the aid of a coil. The coil contains an iron core on which two windings are wound. One is from thick copper wire and has about 2000 loops – this is called the primary winding. The other is formed from thin wire with about 18,000 loops and this is called the secondary winding. The contact breaker cam which is attached to the end of the crankshaft, and turns together with it, raises the contact breaker arm. The current that flows to the primary winding of the coil (from the battery or from the dynamo) is interrupted at the moment a high voltage current is induced in the coil's secondary winding. Some of this current flows into the sparking plug and produces a spark (which is needed), and some of it flows into the contact breaker, which is undesirable because then the contact breaker would produce sparks too. The problem is resolved, however, with a capacitor, which consumes the undesirable current. By turning the ignition plate we can then find the optimum moment of spark ignition, or by adjusting the advance.

DYNAMO

It is obvious that we need enough electrical current to facilitate the correct functioning of the ignition system. If we took this only from the battery, then after a couple of kilometres the battery would run down and that's that, end of the ride. The engine itself must therefore produce the electricity and now we shall see just how.

How is electrical current actually produced? It could be like this: picture a magnet in the shape of a horseshoe. Every magnet has two poles – north and south. These poles create magnetic fields, which we can show with magnetic field



electromagnet (Fig. 3).

And now we will turn a loop of conductive wire inside the electromagnet. For practical purposes this is wound onto a so-called anchor, which will be powered direct by the engine's crankshaft (Fig. 4). We are slowly reaching our aim. The loop on the anchor turns, cutting through the field lines of the magnetic field created by the electromagnet, inducing an electric current. This flows through the collector where it is collected with the aid of pieces of carbon. Some of the current then supplies the electromagnet itself.

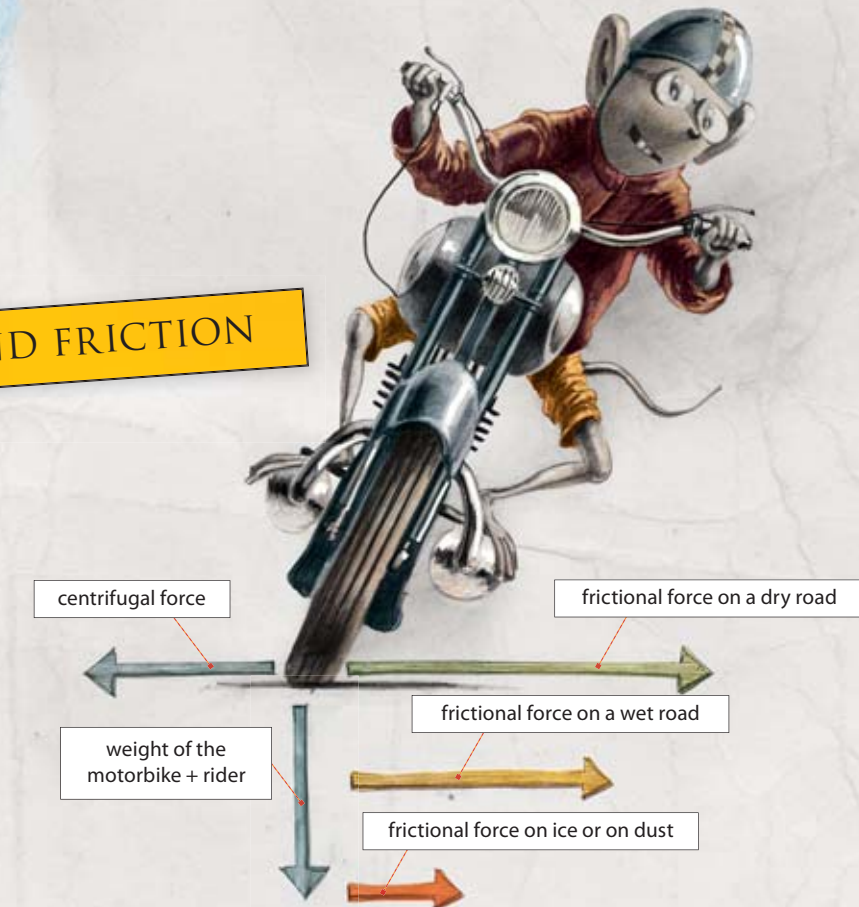
In reality there are more loops wound onto the anchor (Fig. 5). In practice the anchor with the loops of wire is called a rotor (because it rotates) and the electromagnet the stator (because it is static). And that's that! The motorbike goes, the sparking plug in the cylinder throws a spark, the light shines, the horn sounds, and on top of that the battery is charged up – fantastic!

‘... after the fifth lap Titch takes the lead with an incredible manoeuvre. Ladies and gentlemen, you’ll definitely agree with me when I say that this is an extraordinary spectacle. Let’s hope that Fred doesn’t leave it at that, but will try to get back in the lead and...’



CENTRIFUGAL FORCE AND FRICTION

On a motorbike it is a good idea to ride so as not to have an accident. Above all we must concentrate on the ride. Not that we would want to rack our brains over what was knocking in the engine while at the same time riding into a wall. It is also very useful to know how to estimate how fast to go round a bend. Let’s have a look at the forces that act on a motorbike when negotiating a bend. So first of all there is centrifugal force. This tries to throw you away from the bend. Its magnitude is greater the faster you go, the heavier the motorbike is, the heavier we are, and the sharper the bend is. For a comparison of a motorbike’s centrifugal force, if we bend over we have no choice but to depend on something to hold us up. What saves us from falling off a motorbike is nothing other than the frictional force between the tyres and the road. The magnitude of the frictional force must always be greater than the magnitude of the centrifugal force, otherwise a slightly unpleasant situation could arise where, for example, the front wheel might slip and we would be one small step from a nasty accident. The frictional force is as great as the weight of the motorbike plus the rider (it’s an advantage here to be a bit on the heavy side), but above all it depends how rough, or alternatively, how slippery the surface is that we are riding on.





'Fred, I bet that if it hadn't been for the accident I would have beaten you,' said Titch. 'You rode all right considering you had the better bike,' rejoined Fred.

'I wouldn't say that my bike was worse,' protested Tony, who was visiting Titch in hospital along with the other friends. 'After the race loads of people came up to me wanting me to make them a bike like that too. I think I could have at least ten orders.'

'I don't wish to dampen your enthusiasm Tony,' said Arnie, 'but we might have nineteen such orders.'

'If we then built a factory for these motor cycles - that really would be a challenge at last,' said Bill, absorbed in reverie.

'I may as well join you in that,' said Tony.

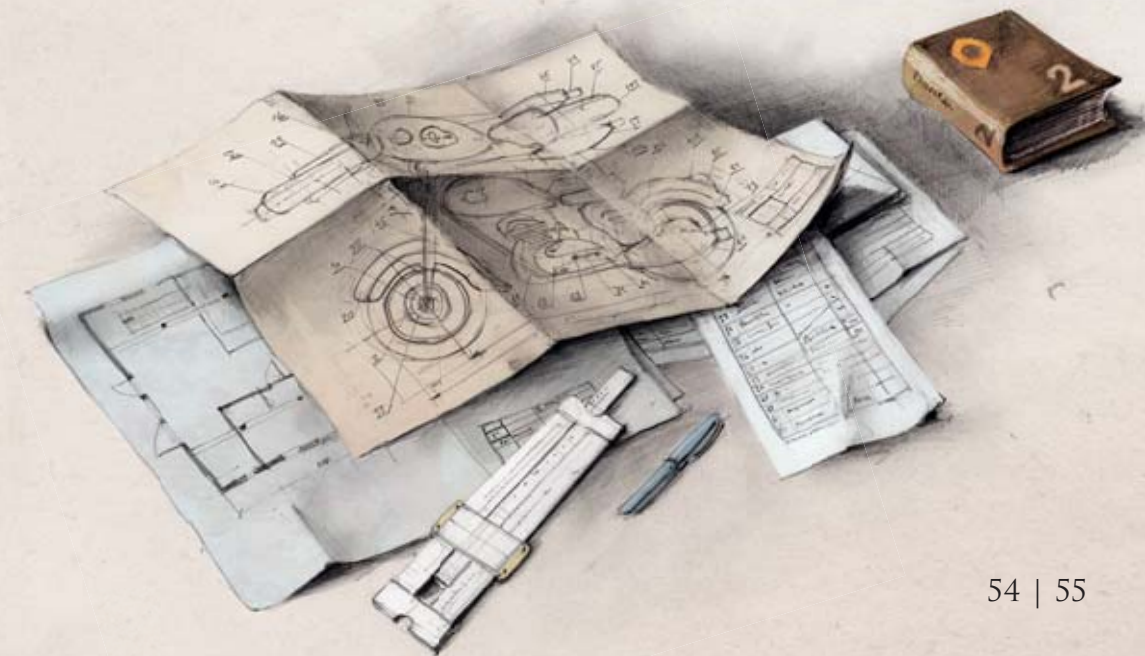
'And for my part I think that we're at the hospital bed of a sick man and not at a constituent meeting of a new company,' scowled Lucy.

'And do you know when you're going home yet Titch,' asked Christian.

'Soon now,' replied Titch. 'And do you know what's great about all this? The doctor said that I'll probably have a permanent limp with that leg. So own up Arnie, it'll be fantastic - I'll limp just like you!'

Arnie blushed a little and said: 'Well then Titch we really are a first-class gang!'

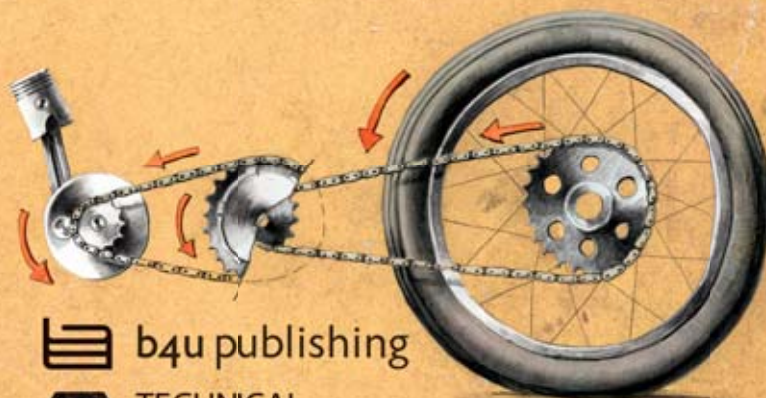
Everyone laughed and Lucy then leant over to Arnie and whispered: 'I should say that you're a great gang.'



It is early spring and three intrepid travellers - Arnie the rat, Bill the sparrow, and Christian the frog - have just come back from the distant south in their self-made aeroplane. The journey has worn them out and their new experiences have perhaps changed their view of the world.

Waiting for them at home, however, are their friends Titch and Fred and, above all, a new challenge. Arnie does not really feel like getting involved in anything new, and would rather spend time with his girlfriend Lucy. The course of events, however, cause him to change his plans. Unexpected ups and downs continue unabated and in the end everything turns out completely to the contrary. The only thing in the book that can be safely relied upon is that the reader will gain the opportunity of understanding how a motorbike is put together and how it works.

For children from the age of 7



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ISBN