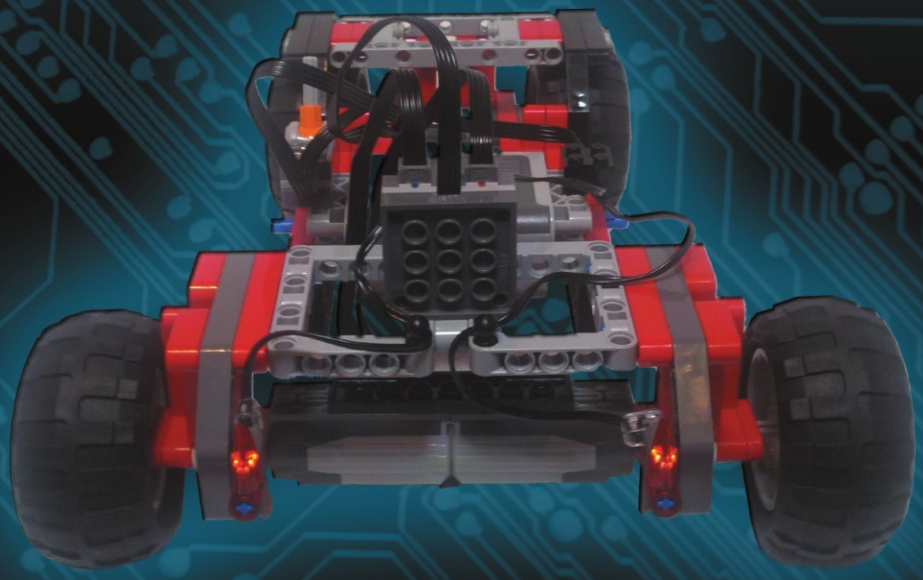
TECHNOLOGY IN ACTION™

Practical LEGO Technics

Bring Your LEGO Creations to Life



Mark Rollins

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Apress®

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Dedicated to all LEGO builders of all ages.

—Mark Rollins

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About the Author

Mark Rollins was born in Seattle in 1971, and attended Washington State University in Pullman, Washington. After four years, he graduated in 1994 with a degree in English. After college, he began to write skits for college-age groups. After four years working for Wal-Mart and another five years working for Schweitzer Engineering Laboratories (SEL), Mark decided to pursue a full-time career in writing, beginning in 2005.

Since then, he has written for many tech and gadget blogs including `www.screenhead.com`, `www.image-acquire.com`, `www.cybertheater.com`, `www.mobilewhack.com`, `carbuyersnotebook.com`, `www.gearlive.com`, `www.zmogo.com`, `gadgetell.com`, `www.gadgets-weblog.com`, `www.androidedge.com`, and `www.coolest-gadgets.com`. He has also written for video game blogs such as `www.gamertell.com` and `www.digitalbattle.com`.

In 2009, Mark decided to create his own tech and gadget blog known as `www.TheGeekChurch.com`. The purpose of the blog was to report on the latest in technology, as well as to inform the church-going crowd (who are often not very technically adept) on the benefits of using more technology in the ministry. Since 2012, Mark has completed devoted his time to this blog and considers it his ministry and mission.

Mark currently resides in Pullman, Washington with his wife and three children.

About the Technical Reviewer

Jon Lazar is a freelance developer and social media consultant with 10+ years of experience in the technology field. He started his career at AT&T and has since helped a number of startups in the NYC area in building their digital presences and digital infrastructures. In his free time, he is an accomplished builder of LEGO sculptures. He regularly writes about LEGO, social media, technology, and other related topics on `www.justjon.net`.

Acknowledgments

I remember when I first discovered LEGO again. It was in the summer of 1984, I was fresh out of sixth grade, and I was visiting my friend's house. My friend showed me this Lego spaceship he had made that was 4.5 feet long, resting on a pool table. I thought it was one of the coolest things that I had ever seen; it was quite detailed. At that time, it had been a year or so since I had played with my LEGO bricks. I had a handful of sets that were just kept in a boxes and I thought that I had outgrown them. After visiting my friend's place, I started building again.

I kept building with LEGO, and I am now 40 years old. Now I have accrued many sets and have filled two large boxes with pieces. I have kids of my own, but if I wasn't so busy writing and being a father, I would create worlds for LEGO minifigs and build just about every machine that I could with these bricks.

This book is for any LEGO builder that dares to dream and then build what they can imagine.

I would also like to dedicate this book to my wife, who showed me how to do a "photobox" that helped me to photograph my LEGO creations.

Also helpful were Katie Sullivan and James Markham, the editorial team from Apress who made this project much easier.

—Mark Rollins

Introduction

During the 1980s, the LEGO company used the phrase "Toys to Grow Up With" as their slogan. While many play with these "toys" at a young age, most stop playing with LEGO as they reach adolescence. I stopped playing when I was 12, simply because I thought this is what a person of my age was "supposed" to do. Even though I had "quit" LEGO building, I never got rid of my old LEGO sets. Eventually, I remembered the joy that building with LEGO had brought me and went back to building.

Like it or not, LEGO is one of the easiest ways that a child or adult can create. A LEGO user is not required to draw or sculpt in order to make masterpieces, and the only tools required are their bare hands with very standardized pieces. The LEGO medium snaps together quite easily and can come apart just as easily. Originally, LEGO pieces were square and rectangular, but the company has made their bricks much more advanced, and an experienced LEGO builder can create something as curvaceous as the F-14 jet in Figure A-1.

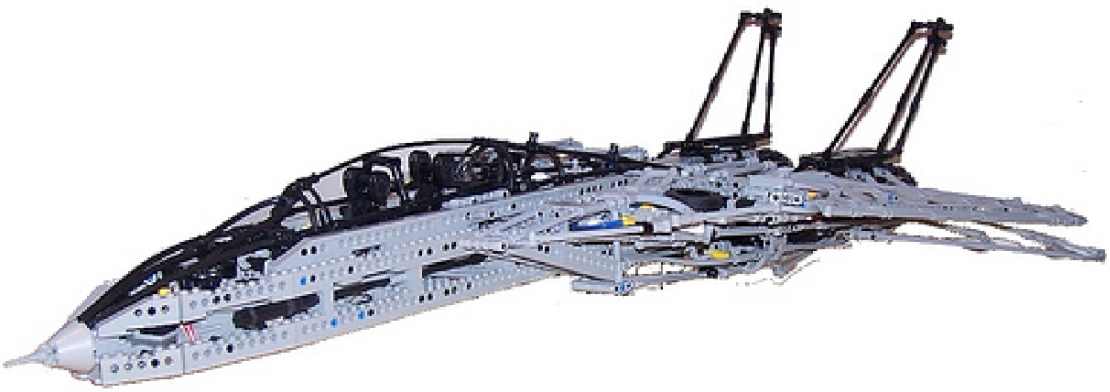

Figure A-1. *According to the Raw art Weblog site (*`www.rawartint.com`*), this F-14 jet helped LEGO designer Jeroen Ottens land a job as a LEGO Technic designer. I too would have welcomed him aboard.*

This book is for everyone like me who will never stop playing with LEGO, even though some might think that we are not "acting our age." My response to that crowd is, "it isn't playing, it is building" and "if it is child's play, then let's see you build that F-14." Man, would I love to give these naysayers the correct amount of bricks and watch them attempt to create some of the LEGO wonders that can be seen at various

LEGO theme parks in Florida and California. I'll bet many of them couldn't build a complex structure like the Sydney Opera House, even with a proper set of instructions.

The LEGO Technic or "Expert Builder" Collection

In Christmas of 1982, I received my first LEGO Technic set, 948 (the Go-Kart). I was about 10 at the time, and the suggested age for these LEGO sets was 9 and up. Before that, I was playing with a few modeling kits, including some of the first Space LEGO sets. I considered this Expert Builder set to be a challenge, and it was.

The Technic kits were a quantum leap from what I had been playing with before. Even though they used a lot of the usual bricks that I was used to, many of the bricks had holes in the sides. Other pieces, such as the axles, connector pins, and gears, looked strange to me. Considering that the basic LEGO construction is from the bottom up, the LEGO Technic allows the user to build out from the sides, which allows for a lot of "out-of-the-box" thinking.

LEGO Technic is able to be an educational toy while still remaining fun at the same time. And when I say "fun," I am not talking about mindless amusement like watching bad television, but the type of fun that involves the brain, like Sudoku or crossword puzzles. LEGO actually makes children think more, and the Technic sets teach a lot about basic machinery. Children are often quite curious about how things like automobiles and other technological wonders work, but as adults, we don't care about *how* machines work but rather *that* our machines work. With LEGO Technic, my technological curiosity was well-sated.

With LEGO Technic, I learned that steering is not just turning the wheel and the tires just move. I saw that a steering mechanism was no longer magic, but the simple application of rack and pinion technology. I even found that the steering wheel in my LEGO Go-Kart was not too different from what most cars actually use to steer.

Over the years, these expert sets became increasingly more complex. LEGO Technic is not to be confused with the LEGO Mindstorms series, although there are a lot of similarities. Apress has published many books about that particular series if you are interested in building more programmable LEGO Creations, such as:

- *Winning Design! LEGO MINDSTORMS NXT Design Patterns for Fun and Competition* by James Jeffrey Trobaugh (Apress, 2010).
- *LEGO Spybotics Secret Agent Training Manual* by Ralph Hempel (Apress, 2002).
- *LEGO MINDSTORMS NXT: Mars Base Command* by James Floyd Kelly (Apress, 2006).
- *LEGO MINDSTORMS NXT-G Programming Guide* (First and Second Editions) by James Floyd Kelly (Apress, 2007 and 2011).
- *LEGO MINDSTORMS NXT 2.0 The King's Treasure* by James Floyd Kelly (Apress, 2009).
- *LEGO MINDSTORMS NXT The Mayan Adventure* by James Floyd Kelly (Apress, 2006).
- *Extreme NXT: Extending the LEGO MINDSTORMS NXT to the Next Level* (First and Second Editions) by Michael Gasperi and Philippe E. Hurbain (Apress, 2007 and 2009).
- *Extreme MINDSTORMS An Advanced Guide to LEGO MINDSTORMS* by Michael Gasperi, Ralph Hempel, Luis Villa, and Dave Baum (Apress, 2000).
- *Creating Cool MINDSTORMS NXT Robots* by Daniele Benedettelli (Apress, 2008).

- *Dave Baum's Definitive Guide to LEGO MINDSTORMS*, Second Edition by Dave Baum (Apress, 2002).
- *Competitive MINDSTORMS, A Complete Guide to Robotic Sumo Using LEGO MINDSTORMS* by David J. Perdue (Apress, 2004).

How To Use This Book

I have seen a lot of interesting books about LEGO, and many of these "idea books" show a model so you can imitate it yourself, piece by piece. There is nothing wrong with copying, as learning by repetition and the imitation of what has come before is the only way we can advance to build more original and improved models. After all, you cannot solve complex differential equations unless you have learned 2 + 2. However, true mathematics involves discovery of new problems, solutions, and equations—and textbook problems must be left behind for that to happen.

What I don't want to do is show how to create a Corvette, and then have you, the reader, just follow the numbered steps to create one of your own at home. Instead, I want to show you how to make a successful LEGO frame for a vehicle, how to motorize and take remote control of it with Power Functions, and how add other features onto your LEGO creation to make it as lifelike as possible (in a scale model a fraction of its size).

What you will see in this book are designs to help you create LEGO Technic masterpieces, and I will show you basic ways to do basic functions on a LEGO Technic creation. What you will see in this book are some models that were created with the help several programs, which include LEGO Digital Designer and LDraw. This is not meant to be a book with just fully completed models. I could have done so by creating a wordless book where all you do is just work LEGO steps one through whatever. To heck with that! The real challenge (and fun) of LEGO is to create something very new, something that no one has built before. I guarantee that you will feel quite a surge as you apply some new method of LEGO technology to your own creation. To me, nothing beats the rush of creating something new, and I hope to share that with you.

In other words, think of this book as an abridged LEGO cookbook. I will show you how to make complex ingredients, and you will need to decide how best to combine these complex ingredients together to make some terrific LEGO Technic recipes.

How This Book Is Ordered

I organized the chapters in a way that they build upon each other, and if you want to skip ahead to chapters because you feel that you have already mastered the ones that came before it, please don't feel that I would be somehow offended. I fully realize that most books don't recommend skipping chapters, but this book permits you to do whatever is valuable to you as far as LEGO Technic is concerned.

- **Chapter 1: Getting Started with LEGO Technic.** This is essentially a chapter for those who have never seen LEGO Technic before. I introduce readers to the Technic bricks and how they differ from traditional LEGO bricks. I also showcase various software programs so that you can design LEGO models on your computer before building them with real LEGO bricks, and where to order Technic bricks in case you need a fresh supply.
- **Chapter 2: Creating a Motorized LEGO Technic Vehicle.** In this chapter, I introduce how the LEGO Power Functions pieces can be used to create a basic model of a wheeled vehicle. I show how to create a frame for a LEGO automobile and how Power Functions can make it go.

- **Chapter 3: Steering and Controlling Your LEGO Technic Creation.** This chapter is about creating a steering mechanism on your Technic vehicle, so you can not only make it go but give it direction as well.
- **Chapter 4: Light it up with LEGO lights!** This chapter discusses how to use the light pieces to create the wonder of light on your LEGO vehicles and how to really make them illuminated.
- **Chapter 5: Creating an All-Terrain LEGO Technic Vehicle.** For a lot of LEGO wheeled models, it is about taking a wheeled vehicle over all terrains. For this, you will need steering pieces or even special spring loaded pieces that will be helpful for taking your LEGO creation over all kinds of LEGO bricks and more. This chapter also shows how to create a LEGO Technic vehicle that has four-wheel drive.
- **Chapter 6: Technic Construction Vehicles and Equipment.** In this chapter, I cover how to assemble features on a LEGO model that you would be used at a construction site. I'm talking about swivels, bulldozer scoops, cranes, and dump truck mechanisms.
- **Chapter 7: LEGO Technic Aviation: Airplanes and Helicopters.** This chapter is about creating airplanes with working propellers, building wings with flaps that can be adjusted by controls on the plane itself, and constructing stable landing gear and one that can retract. Sadly, I can't figure out how to make the planes fly, but perhaps in the future all LEGO models will.

CHAPTER 1

Getting Started with LEGO Technic

LEGO is no longer just for children, and the Technic series encourages both children and adults to build complex vehicles and machines from these simple bricks. The purpose of this book is to show you how to create interesting LEGO Technic creations, but I fully encourage your own creativity and improvisation.

I figure that there are two types of people reading this book. There are those folks who have been playing with LEGO for as long as they can remember (perhaps in their Duplo or Quattro days) and are quite familiar with traditional LEGO pieces. The second type is just starting with LEGO Technic. Ideally, I hope that you are an adult trying to teach a child or teenager how machines work via the power of LEGO.

If you are of the second type, you are probably wondering where to begin. You also probably can't wait to get started building some of the models you saw when you flipped through the printed book or previewed the e-book. It's fully possible to construct these models in a digital program, and there are a few programs devoted to LEGO building that I will detail later. However, if you are like me, then you want to build these LEGO models in real life—and even play with them. Yeah, you know what I'm talking about.

My first bit of advice is to make certain that you have all the pieces that you need before you begin building. This is why all the steps of my LEGO models include a list (with pictures) of the necessary parts. There is even a list of all the parts for each model in the Appendix. LEGO Technic bricks differ from that of traditional sets, and if you are looking for certain pieces, I recommend LEGO Pick a Brick or other online LEGO catalogs like BrickLink.com for getting the components you need. I will discuss those online catalogs later, but right now I want to discuss the different types of LEGO Technic pieces including bricks, beams, levers, gears, racks, axles, bushes, connector pegs, cross blocks, angle elements, steering parts, and more.

A Guide to Technic LEGO Pieces

Let's start with a basic introduction to Technic LEGO pieces.

Technic Bricks

Technic Bricks are just like traditional LEGO bricks but with holes on the sides for axles and connector pegs (see Figure 1-1). Bricks, like most LEGO pieces, are measured by the amount of studs (the round bumpy parts atop a normal LEGO brick) on them, and this measurement is often abbreviated to M. Generally, the number of side holes is always one less than the studs, but there are some, like the 1 x 1 x 1 and 2 x 1 x 1, with the same amount of side holes as studs. There are some interesting methods to these pieces; for instance, the 2 x 1 x 1 has an axle or a cross-shaped hole. Note the variations with the Technic

fork and wing sections. There are even more interesting forms with the Angular Brick 5 x 5, 4 x 4, 4 x 6, and 6 x 8 pieces.

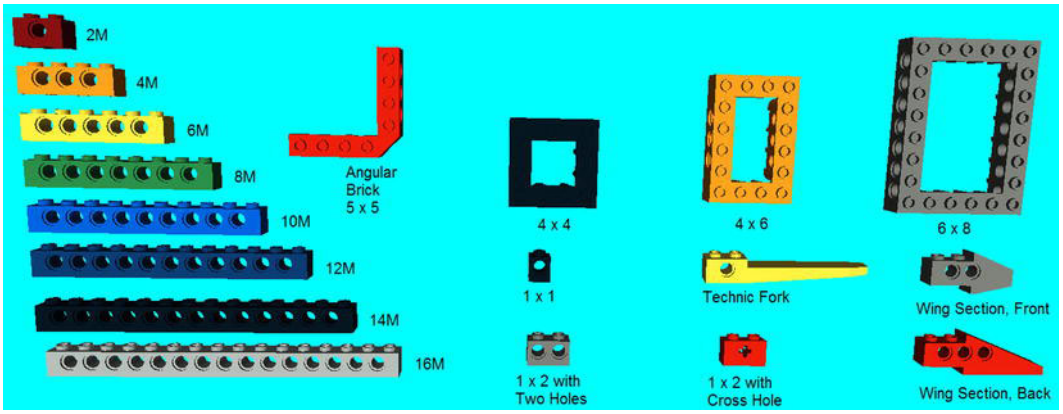

Figure 1-1. *Some traditional LEGO Technic bricks*

These bricks are not included in the recent Technic sets since the switch to more "studless" forms, but they were the groundbreaking bricks of the first generation of Technic, the Expert Builders. This book is full of LEGO Technic models, but very few will be using this type of LEGO Technic pieces. The majority of models in this book will be made with studless beams.

Beams

Circa 2000, Technic became less about actual bricks with studs and more about beams. Many of the Technic sets do not have any traditional studded bricks. Some people have stated that the studless construction makes it harder to build a LEGO Technic model, and I will have to say that I agree with them.

The issue with the studless beams and other parts is that you must have a good idea of the shape of your finished product before you begin to build. Fortunately, there is always room for improving your model, and in some cases studless bricks can be replaced more easily than traditional top-down traditional LEGO bricks. Each beam is about as thick as a 1 x 1 brick, and they are measured just like their studded counterparts: based on the number of studs they take up. The difference between studded bricks and studless beams is that the measurement of a beam is always equal to the number of holes on it. The straight beams in Figure 1-2 are designated with a number; this is so you can quickly determine the beam that you need without doing too much hole counting. While LEGO Technic studded bricks are usually even-numbered, LEGO beams are usually odd-numbered, with the exception of the 2M.

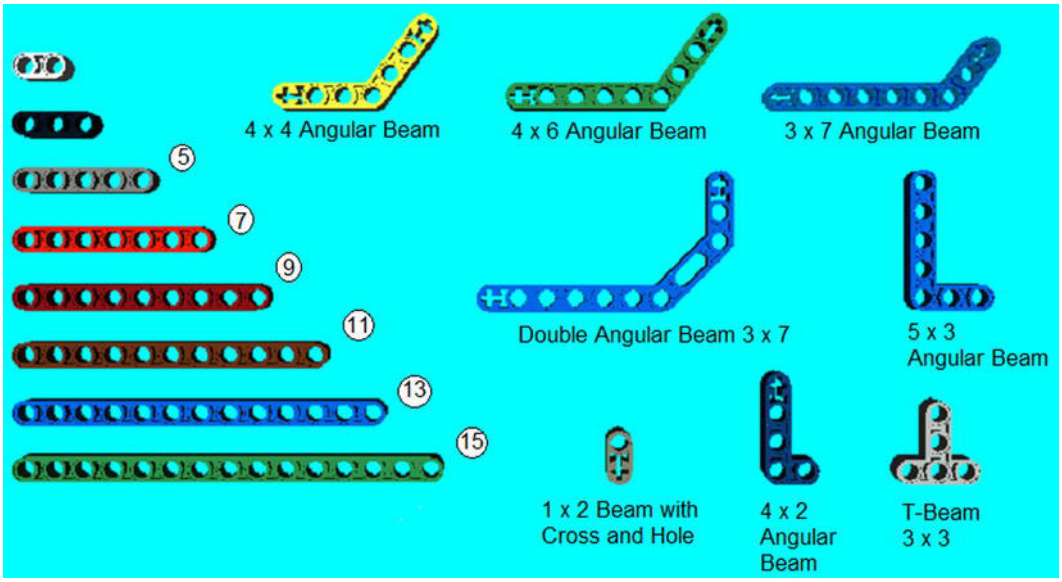

Figure 1-2. *LEGO Technic beams including straight, angled, and right angled*

You will notice that the beams come in a variety of angles. The 4 x 4 Angular Beam, 4 x 6 Angular Beam, and 3 x 7 Angular Beam are at 53.1 degrees, and the Double Angular Beam 3 x 7 offers two angles. The 90 degree angle pieces include the 3 x 5, 4 x 2, and the 3 x 3 T-Beam.

Another thing that you will notice about some of the angular pieces is that they end with cross holes. These are made to hold axles, and any axle inserted in these cross holes is well anchored. The 1 x 2 beam has a cross and hole, making it useful in all manner of ways.

Levers

This is a very broad category of Technic pieces, and the first thing you should know about them is that a lever is half has thick as a beam. In other words, you must stack two levers together to form something the width of a beam.

The levers in sizes 4M and below have cross-shaped openings that accommodate an axle (also known as a cross hole) at their ends, while the 5M half beams are made for loosely accepting connector pins and axles. Levers are often used for joining two beams together. Note the other odd shapes like the Comb Wheel, 3 x 120, and the Triangle. They also come in a simple 3 x 3 90 degree formation as well as some fancy half beam curves that also do a 90 degree angle with three different measurements (see Figure 1-3). Note the variation of the 4M Technic Lever that has a notch in it, which is about 1M thick.

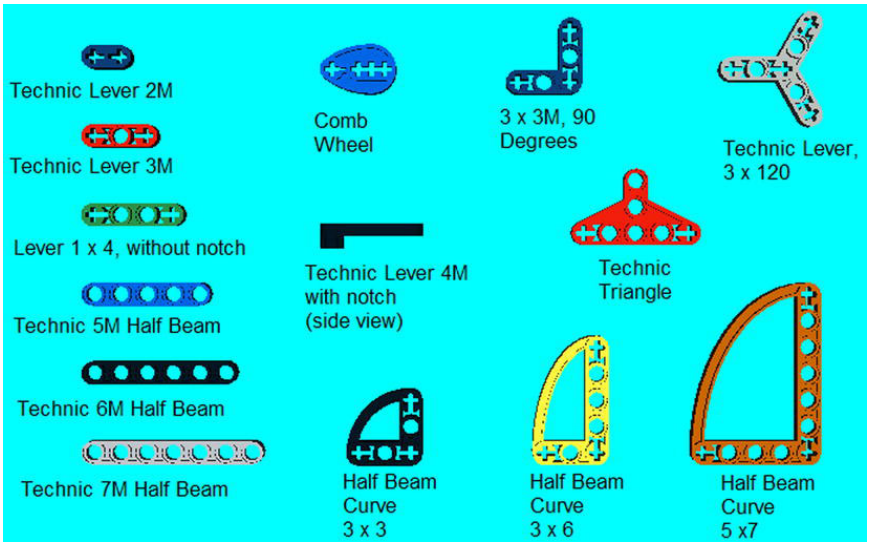

Figure 1-3. *Technic levers*

Gears

Where would any machine be without the gears that set other gears into motion? These pieces most certainly set the Technic world apart from the usual sets. They come in many forms, as you can see in Figure 1-4.

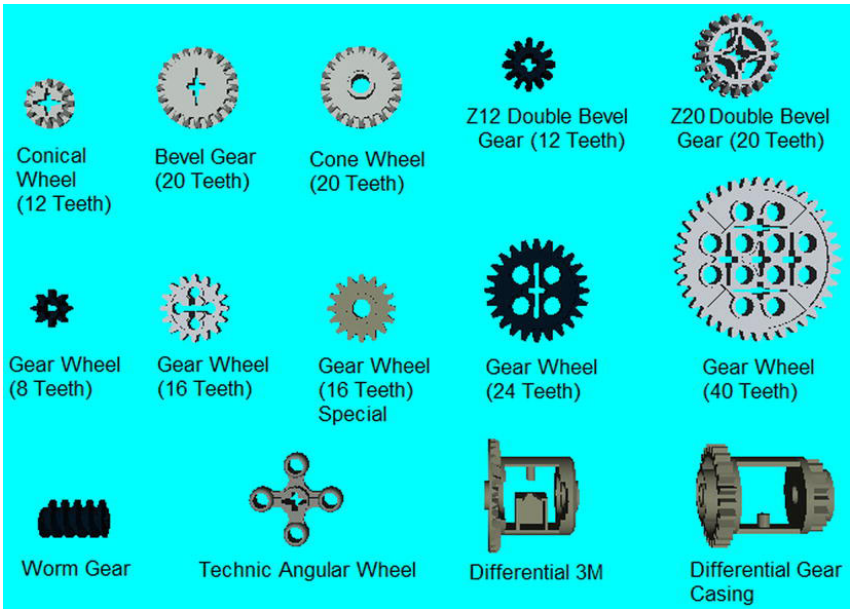

Figure 1-4. *A sample of the many gears that work with LEGO Technic*

The conical wheels, also known as bevel gears, are flat on one side but toothed around the edges. There are two types: both have 20 teeth but one has an axle and the other has a regular connector hole. The Double Conical Wheel (available in 12 and 20 teeth) has teeth on both sides. The Conical and Double Conical Wheels can work in a parallel and perpendicular fashion. This means you can place two Double or Single Conical Wheels at 90 degrees to each other, and one will turn another.

The regular gear wheels can only turn in parallel to each other, and they come in 8, 16, 24, and 40 tooth versions. The 16 tooth version comes in two forms: an axle hole and connector pin hole (similar to the conical wheel gears).

The Worm Gear works by using another regular gear on it. Turning the Worm Gear will turn the regular gear wheel, but turning the regular gear will not turn the Worm Gear. Models in later chapters will demonstrate the usefulness of a Worm Gear.

The Angular Wheel is very handy for doing a perpendicular gear method. To get them to mesh together, you need one in a plus shape and one in an X shape but they work in closer quarters than the Double Conical Wheels. The Differential uses three Conical Wheels (12 Teeth) that are meshed together perfectly, and it comes in handy for a free spinning axle.

Racks

Since we are on the subject of gears, let's talk about racks, as they require a gear to really work together for steering and other kinds of functions. Figure 1-5 shows many varieties. The 7M, 8M, 10M, and 13M racks have two holes so they can be linked to a beam or Technic LEGO brick. What you can't see is that the 7M and 13M racks have two cross holes in the sides for axles. The Rack with Ball comes in one size, about 2M wide. The Toothed Bar 4M is made to be linked to studded LEGO pieces.

Figure 1-5. *Samples of different LEGO Technic racks*

Axles

Axles come in many different sizes, as you can see in Figure 1-6. Their numerical size is equal to the brick size (measured in studs). Some have a knob at the end, which is essentially a stud (like the 3M), and some have an end stop so it can stick in somewhere and not go any further (like the 4M and 8M). The most unusual is the 5M which has a stop 1M along the way.

The axles that have an odd-numbered measurement are usually gray while the even-numbered measurements are black. Usually, this is the case when they come in the sets, but they can also come in many colors. For some reason, the 2M axles generally come in a red color.

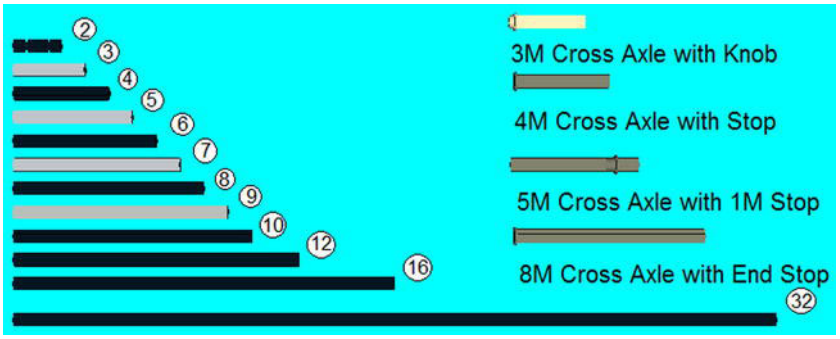

Figure 1-6. *Various types of axles*

Axle pieces can do more than just join two wheels together, but these particular cross-shaped rods really bring the world of Technic LEGO to life. You will see how handy they are later in the book.

Bushes

I have no idea how these pieces got their name, but if axles are the bolts of the Technic kingdom, bushes are the nuts (see Figure 1-7). They are designed to cap off axle pieces in a way that makes them snug where they are. You will see many demonstrations of this in the models of later chapters. Like axles, Technic creations would not be possible without bushes.

There are two sizes: the more circular one is a 1/2 Bush, and it is half the size of the 1M Bush for Cross Axle.

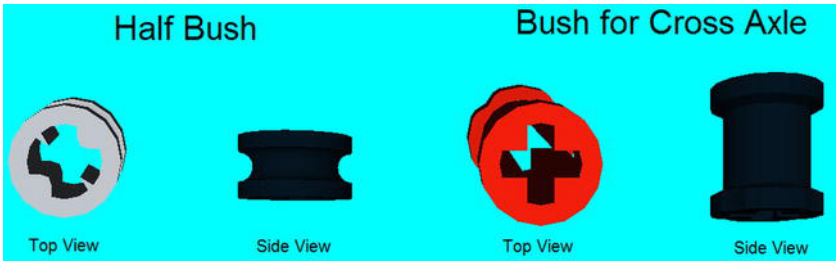

Figure 1-7. *Technic bushes*

Connector Pegs

Connector pegs stick into side holes of Technic bricks, beams, or two levels of levers. Many of these come in two types (see Figure 1-8). The first is the basic and will allow two linked pieces to spin freely about. The ones with friction allow for movement, but not so freely.

The 3M Connector Peg can take up 2M worth of space, but there is a stop on the 1M. The Connector Peg/Cross Axle is one way to join a Cross Hole piece with a Connector Peg hole, and the 2M Snap with Cross Axle can join an axle with a connector hole. Other unique pieces include the Module Bush, Double Bush 3M, and the Beam 3M with Double Snaps.

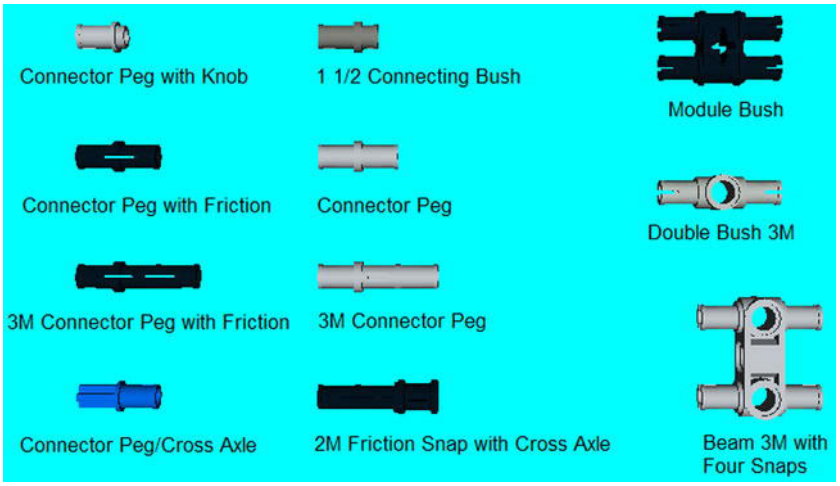

Figure 1-8. *Connector pegs*

Cross Blocks

The one thing you will discover as you build with LEGO Technic is how the connector peg holes on the beams only go in one direction, but your model may call for you to place another beam at 90 degrees. Fortunately, LEGO has all kinds of pieces designed to link pieces together in odd ways; these are the cross blocks. Figure 1-9 shows some examples. I put them at an angle so you can see their unique abilities. Generally, these pieces have an odd mix of connector peg holes and cross or axle holes, each of them at 90 degrees from the other. You will use them in various models featured throughout this book. The most common ones are the Cross Block 90 Degrees, the Double Cross Block, and the Cross Block 3M.

Figure 1-9. *LEGO Technic cross blocks*

Angle Elements

Angle elements are essentially a way of linking two axle pieces together at a certain angle. Each one is a different angle, and they have a numerical designation printed on them (but this isn't visible in Figure 1-10).

1. 0 Degrees
2. 180 Degrees
3. 157.5 Degrees
4. 135 Degrees
5. 112.5 Degrees
6. 90 Degrees

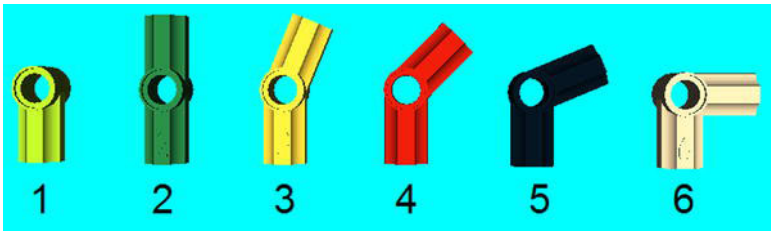

Figure 1-10. *Various samples of angle pieces. Note that the number designates a certain angle.*

With Angle Elements, you can make all kinds of designs at various angles. For example, if you have eight #4 angle pieces and eight 2M axles, you can make a perfect octagon. If you have sixteen #5 pieces and 16 axles of identical measurement, you can link them together to form something that almost resembles a perfect circle. If you don't believe me, try it.

Steering Pieces

I don't really know how to classify the steering pieces (see Figure 1-11), but they come into play in Chapter 3. You will need them if you want to build a car with some suspension.

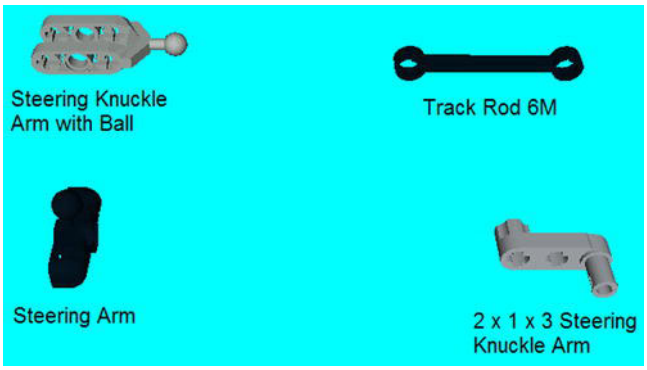

Figure 1-11. *Technic pieces used for steering*

Panels

These panels are essentially large pieces that can fill up a lot of space, but they add a realistic looks to your LEGO Technic model. A lot of them are wing-shaped; the wing-shaped ones have a number that is actually on the part itself (like the angle elements).

In addition to these wing-shaped panel pieces, LEGO Technic also has several panels and frames that take up a lot of space but are very handy as they have through-holes for connector pegs and axles on all sides.

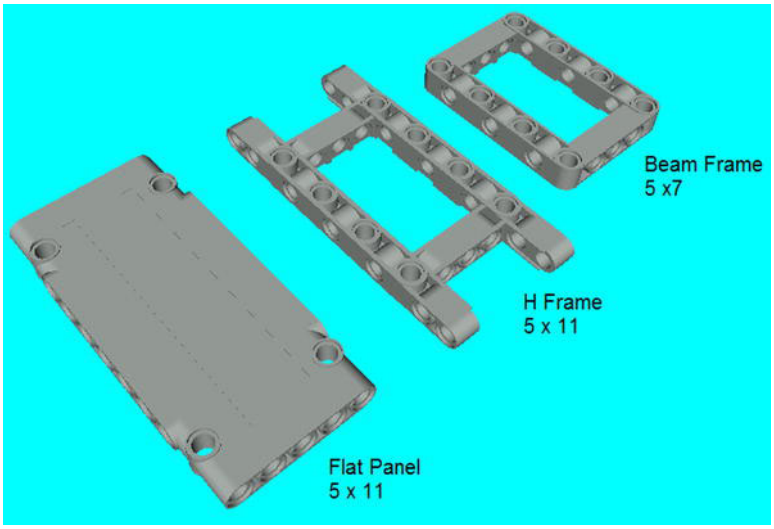

Figure 1-12. *Examples of panels and beam frames in LEGO Technic*

Extensions, Catches, and Other Miscellaneous Technic Pieces

The extensions link two axles together. Of the two types, the one with ribs holds the two axles together more firmly. A standard Catch is just an axle with a cross hole attached to the end, and the catch with the cross hole has a Bush attached in lieu of the axle. The Change-Over Catch is an excellent piece with some interesting features. The Toggle Joint is a way of joining two axles together at an angle you select, provided there is a connector peg in the through-hole. The Universal Joint is a very handy piece as it allows an axle to freely spin and bend at any angle, provided it is less than 90 degrees. See Figure 1-13.

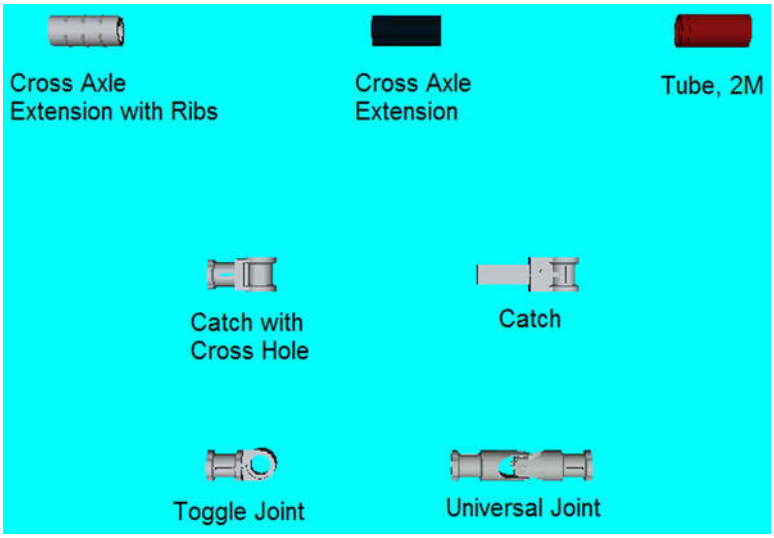

Figure 1-13. *Various extensions and catches*

Obtaining LEGO Pieces for Your Models

In your current LEGO collection you may find every piece that you need to build some of these models. If not, then it becomes a matter of improvising. I will show you that there are several ways of doing any one thing in Technic. If you can't do it with the pieces that you have, I highly recommend finding another way of doing it. For example, if you do not have a beam frame, you might be able to construct what you need with some beams and a few cross blocks.

Pick a Brick is one way of getting Technic pieces for specific LEGO projects, but it is not an exhaustive catalog. In other words, you will probably find that it doesn't have every piece you require, even though you know the proper name or element ID. I also recommend using BrickLink, an unofficial LEGO site that has an extensive catalog so you can order pieces or even sets. Speaking of sets, Peeron and Brickfactory are two other sites you may find helpful if you want to build a particular LEGO set that existed in the past.

LEGO Pick a Brick

If you are like me, then you have arbitrarily named your LEGO pieces over the years. I remember playing with my sister and asking if she had any "black flat one-by-twos" or "blue two-by-fours." After a while, you start to develop a language to describe pieces, but it may be difficult for an outsider to translate.

Let me give you another example. I once worked at a factory that made integrated circuit boards. One of the reasons I liked the work was that it reminded me of building with LEGO; the electric components were often very colorful and had to be placed on a green circuit board reminiscent of a LEGO baseplate. As you may have guessed, it was necessary to give each of the thousands of electrical components a specific identifying number just so we could keep them in some sort of order. The company decided to give the components a seven-digit number that was kind of like a phone number. The first three digits designated the type of part (resistor, capacitor, diode, transformer, or other). The last four digits represented the specific type of part from that group (for example, all the resistors had a different number that also signified its number of Ohms, the unit of resistance).

In the same manner, every LEGO piece has an official name and number as designated by the company. You can go on the LEGO site and purchase individual LEGO bricks just like you can purchase sets.

The official LEGO site (`http://shop.LEGO.com/en-US/Pick-A-Brick-ByTheme`) lets you pick your LEGO order piece by piece. The brick search window allows you to choose a category. The categories range from accessories to windows and doors. I won't bother listing the many categories, but there are eight pages in the Technic category. You can also do a search by color (black, blue, green, grey, orange-brown, purple, red, white, and yellow). The category and color family are mutually exclusive choices. In other words, you cannot pick "Technic" as the category and "Grey" as the color and see a list of all the grey Technic pieces available; you must pick "Technic" or "grey." Yeah, someone should probably do something about that, and I hope it's fixed before you read this.

From here, it's like going to the hardware store and collecting nails, screws, and other parts that you need for a construction job. When you find the piece you require, click the "Add To Bag" button and it will automatically appear in the "Brick Bag" column. If you want more than one of this type of piece, then simply type the amount you desire. Deleting an order is as simple as clicking the "X Remove" option. To negate the whole order, click "X Remove All" on the bottom.

Clicking the "Update Bag" button allows you to add these parts to your shopping cart. If I want to see your shopping cart, you can click that button and see your order. Keep in mind that you must set up a LEGO account on the site to make this happen, so, as they say on infomercials, have your credit card ready.

If you are looking for a specific brick, you can do an advanced search using the brick name, which is the formal name for the brick. I found that it produced mixed results. You can also search by element ID, design ID, and exact color. To get more information on a piece, simply select it to reveal the details. Also listed are several categories, which include the following: