



LOOK OUT BILLY!

# SCREEECH

I'VE GOT IT!

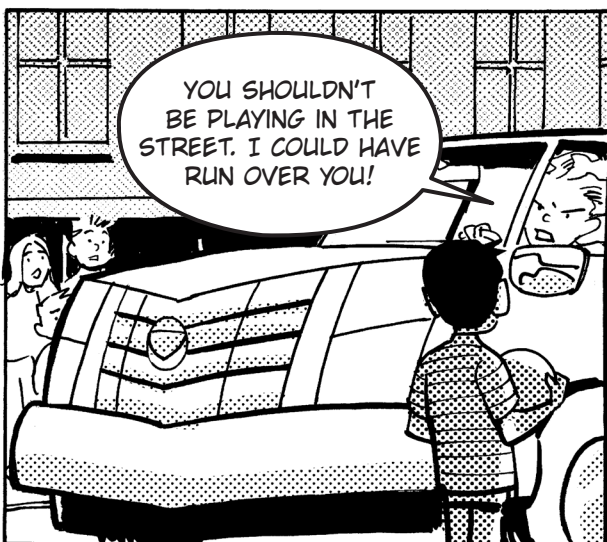
OH NO-!

BOING



THAT DIDN'T SOUND GOOD, TUCKER!

I HOPE EVERYONE'S OKAY!



YOU SHOULDN'T BE PLAYING IN THE STREET. I COULD HAVE RUN OVER YOU!

WE SHOULD JUST SOLVE THIS PROBLEM ONCE AND FOR ALL.

I THINK WE HAVE TO INVENT THE SOLUTION, IN A BIGGER WAY THAN WE EVER HAVE BEFORE. THIS NEIGHBORHOOD NEEDS A -

PRESENTED BY **HOWTOONS** AND **THE LEMELSON-MIT INVENTEAMS.**

# PLAYGROUND

WRITTEN BY JEFF PARKER, ART BY SANDY JARREL, EDITS BY LEIGH ESTABROOKS



NOW, IF WE INVENT OUR OWN PLAYGROUND, WHAT COULD IT HAVE?

WHAT WOULDN'T IT HAVE? IT COULD BE THE MOST AWESOME PLAYGROUND IN HISTORY!

TIME TO DO SOME FIELD RESEARCH AND CHECK OUT SOME PLAYGROUNDS!

THE BEST EXCUSE EVER TO GO AND PLAY!

"FIRST LET'S INTERVIEW SOME USERS".

WHAT DO YOU WANT IN A PLAYGROUND?

A SPACE FOR THE FAMILY TO SIT.

A PLACE TO CLIMB!

I AM GOING TO TAKE SOME PICTURES OF SOME GREAT PLAYGROUND FEATURES.

I'LL SKETCH OUT IDEAS!

HERE ARE A COUPLE OF WAYS TO BUILD SOME OF OUR IDEAS.

PLAYGRO D.I.Y.

STABLE PLA STRUCTURE





UH OH.  
WHAT ARE YOU  
TWO PLANNING  
NOW?

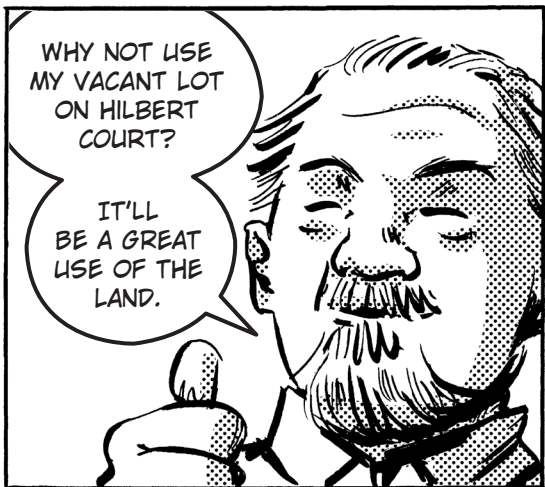
A PLAYGROUND FOR  
THE NEIGHBORHOOD  
KIDS, MR. HAMA!

THIS WILL BE AN  
IMPROVEMENT OVER  
THE STREET, FOR  
SURE.



WE'VE GOT GREAT PLANS.  
NOW WE JUST NEED TO  
FIND A PLACE TO BUILD  
IT.

HMMM...



WHY NOT USE  
MY VACANT LOT  
ON HILBERT  
COURT?

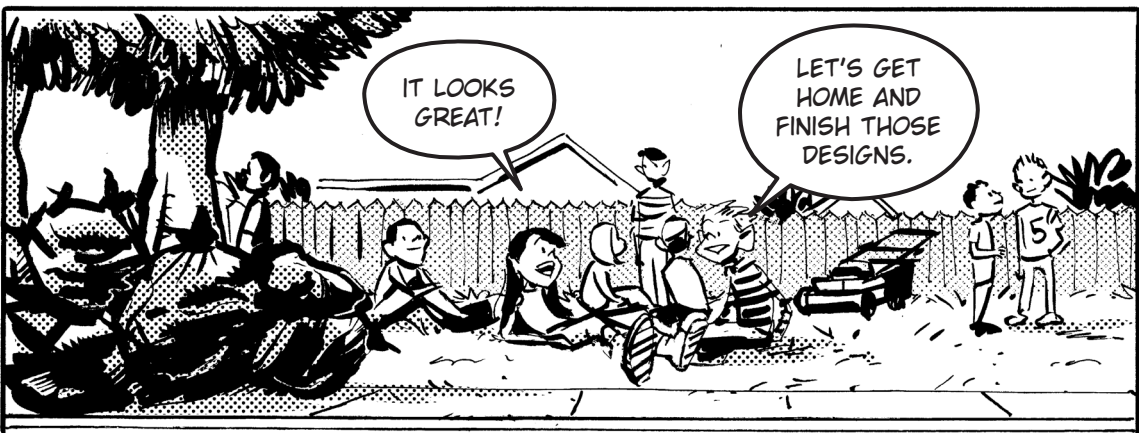
IT'LL  
BE A GREAT  
USE OF THE  
LAND.



AT THE LOT!

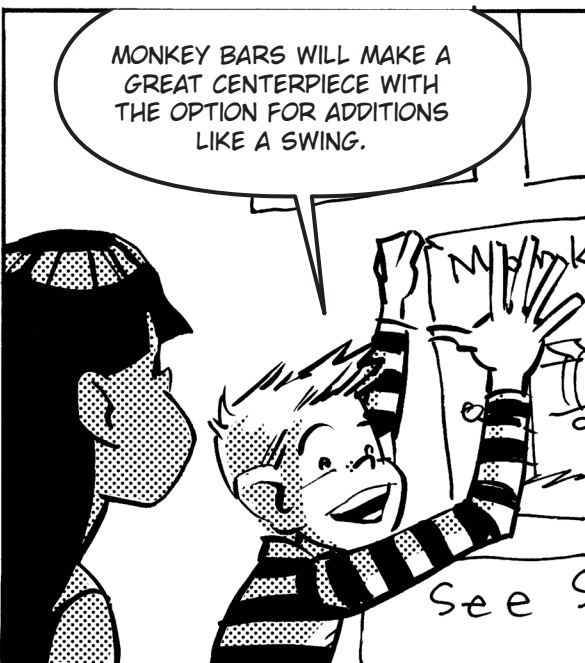
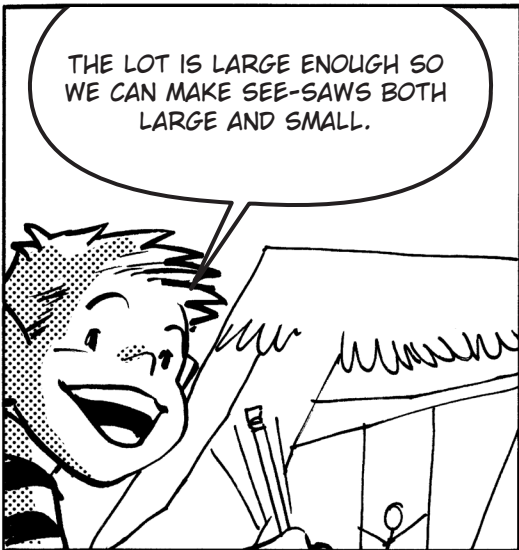
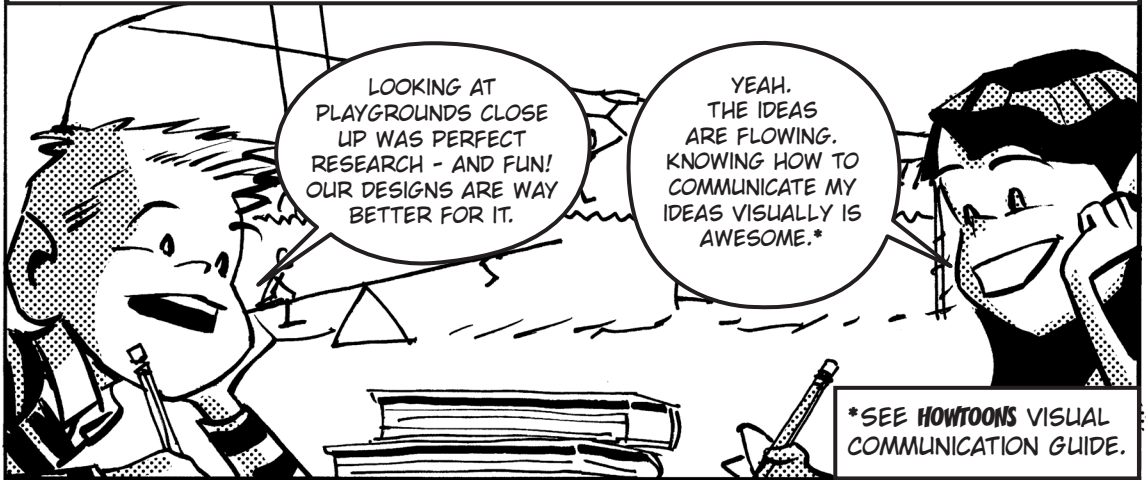
WOW! THIS IS  
GREAT! I MEAN, IT'S  
GOING TO BE.

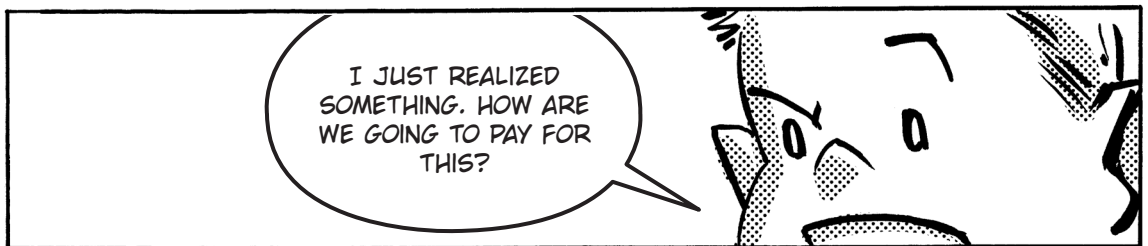
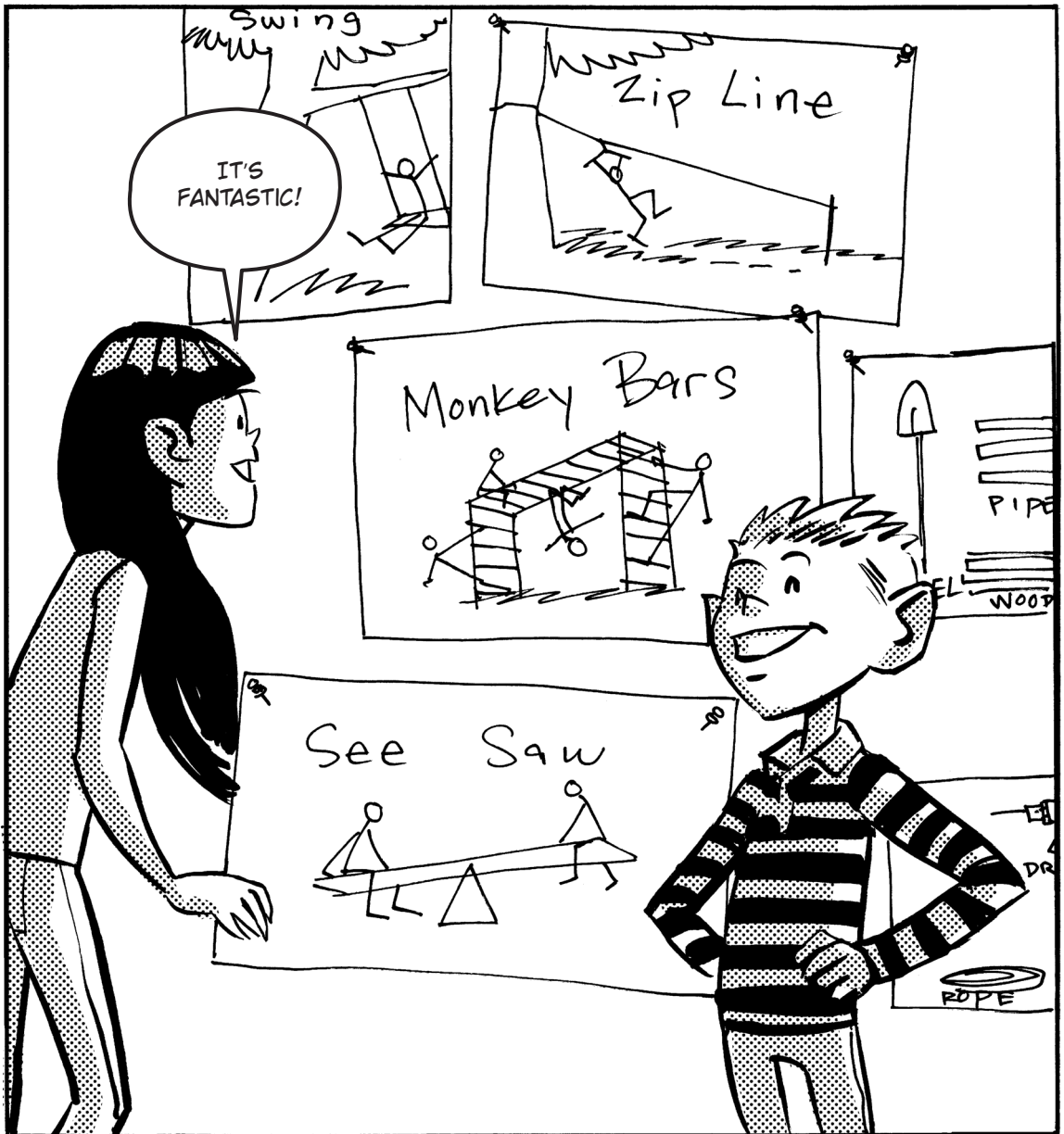
IT'S  
PERFECT.





LATER... AN EVENING OF FURIOUS BRAINSTORMING AND RE-IMAGINING!









# TOOL SAFETY!



A FEW WORDS TO REMIND YOU TO STAY SAFE.

FIRST, DON'T BE IN A RUSH! ACCIDENTS HAPPEN WHEN YOU GO TOO FAST.



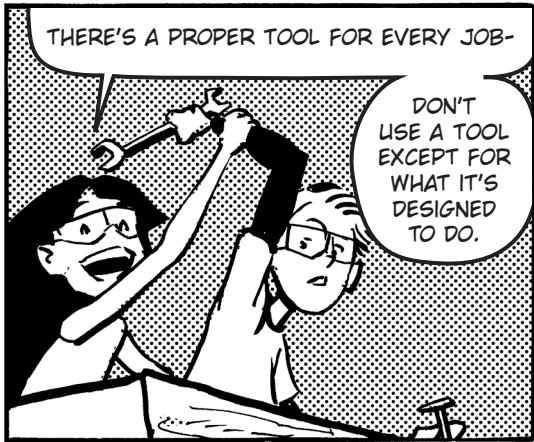
BRING A PARENT OR GUARDIAN!

YOUR PROJECT NEEDS ADULT SUPERVISION!

I'M HERE TO HELP.



CERTIFIED PROTECTIVE EYEWEAR IS A MUST!



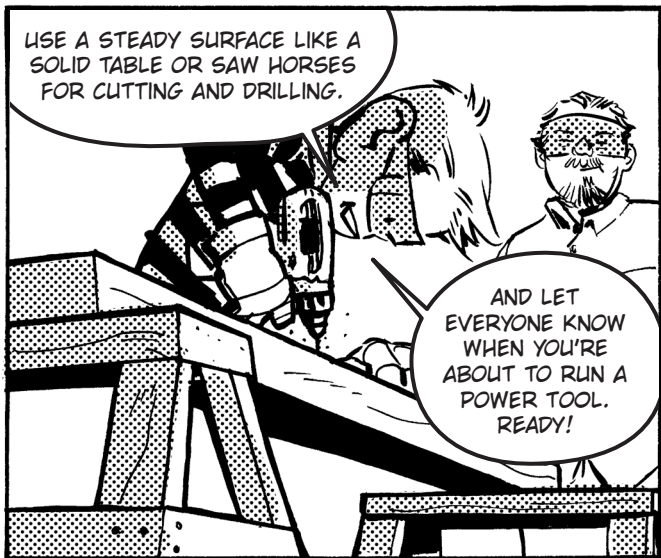
THERE'S A PROPER TOOL FOR EVERY JOB-

DON'T USE A TOOL EXCEPT FOR WHAT IT'S DESIGNED TO DO.



PROTECT YOUR HANDS WITH THICK WORK GLOVES!

BUT MAKE SURE THEY STILL LET YOU MOVE YOUR FINGERS.



USE A STEADY SURFACE LIKE A SOLID TABLE OR SAW HORSES FOR CUTTING AND DRILLING.

AND LET EVERYONE KNOW WHEN YOU'RE ABOUT TO RUN A POWER TOOL. READY!



GIVE MOTORS A CHANCE TO COOL DOWN - RUNNING A POWER TOOL TOO HARD CAN OVERHEAT IT...

... DAMAGING THE EQUIPMENT AND MAYBE YOU.



DRILL HOLES AND DRIVE SCREWS WITH THE...

# DRILL

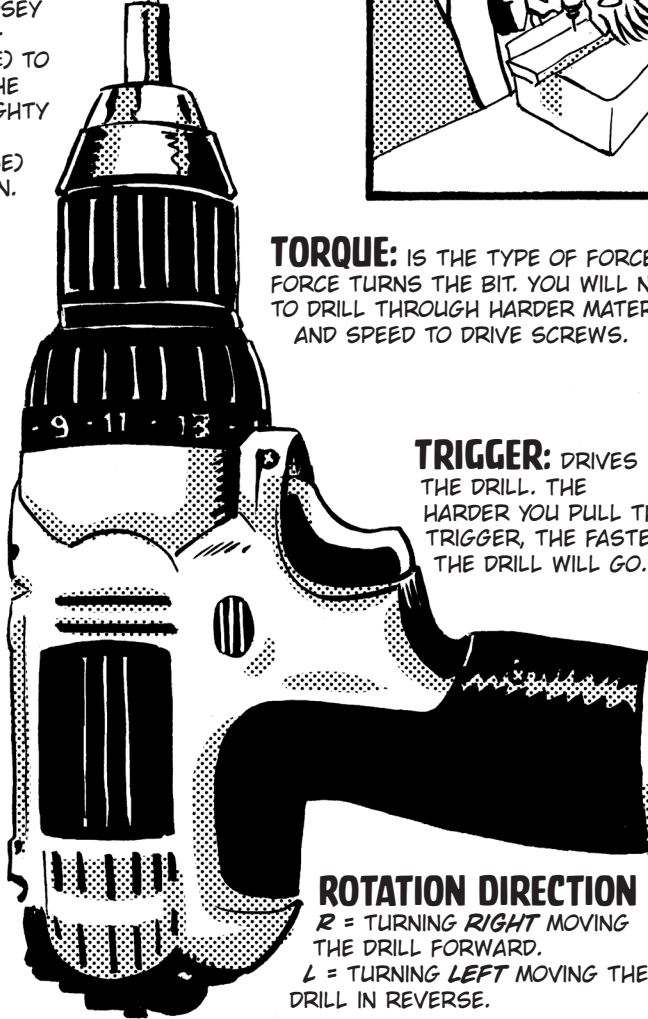
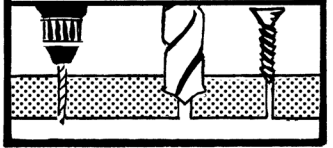
**CHUCK:** IS THE CLAMP THAT HOLDS THE DRILL BIT. LEFTY LOOSEY (COUNTER-CLOCKWISE) TO LOOSEN THE CHUCK. RIGHTY TIGHTY (CLOCKWISE) TO TIGHTEN.



## HOLD DRILL

PERPENDICULAR TO WORK TO KEEP THE HOLE STRAIGHT.

**PILOT HOLE:** ON REALLY TOUGH MATERIALS, MAKE A PILOT HOLE WITH A SMALLER BIT FIRST, AND THEN INCREASE THE SIZE OF THE BITS TO GET TO THE DIAMETER YOU NEED.



**TORQUE:** IS THE TYPE OF FORCE PRODUCED BY A DRILL. THIS FORCE TURNS THE BIT. YOU WILL NEED MORE TORQUE AND SPEED TO DRILL THROUGH HARDER MATERIAL. YOU WANT LOW TORQUE AND SPEED TO DRIVE SCREWS.

**TRIGGER:** DRIVES THE DRILL. THE HARDER YOU PULL THE TRIGGER, THE FASTER THE DRILL WILL GO.








**ROTATION DIRECTION**  
**R** = TURNING RIGHT MOVING THE DRILL FORWARD.  
**L** = TURNING LEFT MOVING THE DRILL IN REVERSE.

**BATTERY**

## DRILL BITS

CHOOSE THE DRILL BIT FOR THE JOB AND MATERIAL.

DRILLS CAN DO OTHER THINGS, TOO.

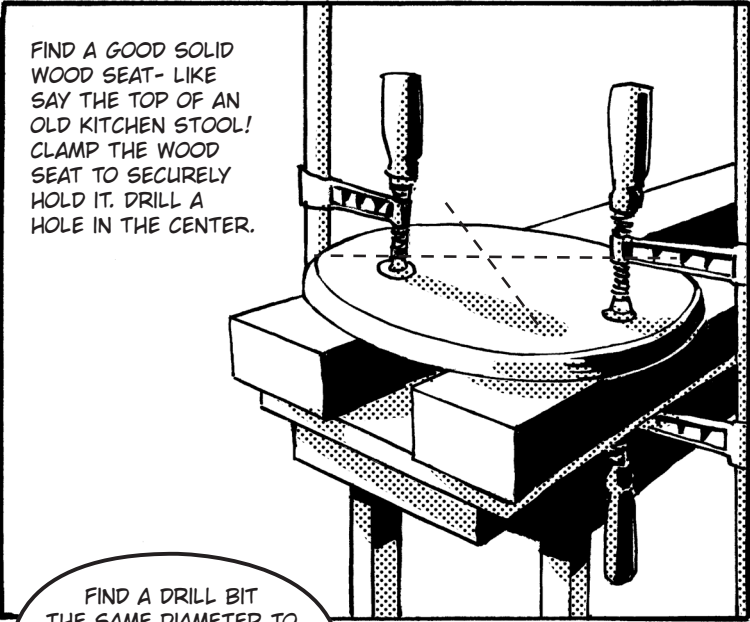
<p><b>TWIST BIT</b></p>  <p>GENERAL PURPOSE</p>	<p><b>SPUR POINT</b></p>  <p>WOOD</p>	<p><b>STEEL BIT</b></p>  <p>METAL</p>	<p><b>MASONRY</b></p>  <p>STONE, BRICK, CONCRETE</p>	<p><b>SPADE BIT</b></p>  <p>LARGE HOLES IN WOOD</p>	<p><b>PHILLIPS</b></p>  <p>SCREWDRIVER ATTACHMENT</p>	<p><b>HOLE SAW</b></p>  <p>WOOD OR PLASTIC</p>
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THIS TREE LOOKS HEALTHY AND HAS STRONG BRANCHES. IT WOULD BE GREAT FOR A SWING!

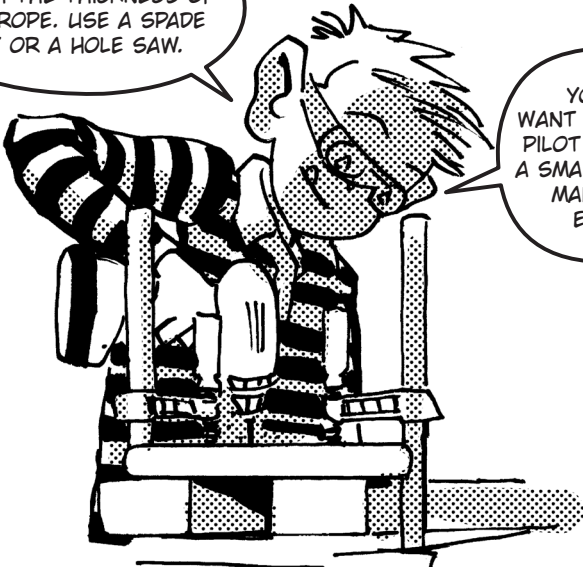
**GET STARTED**  
 TIME TO GET TO WORK! PICK THE SIMPLEST PROJECT FIRST SO YOU CAN SEE RESULTS FASTER, AND BUILD YOUR SKILLS AS YOU GO.

- MATERIALS AND TOOLS:**
- CIRCLE OF WOOD 1 1/2" X 12"
  - 50 FEET OF ROPE AT LEAST 1/4" THICK
  - DRILL
  - CLAMPS



FIND A GOOD SOLID WOOD SEAT- LIKE SAY THE TOP OF AN OLD KITCHEN STOOL! CLAMP THE WOOD SEAT TO SECURELY HOLD IT. DRILL A HOLE IN THE CENTER.

FIND A DRILL BIT THE SAME DIAMETER TO MATCH THE THICKNESS OF THE ROPE. USE A SPADE BIT OR A HOLE SAW.

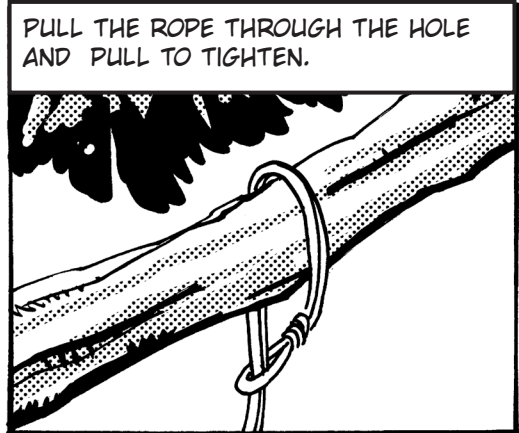
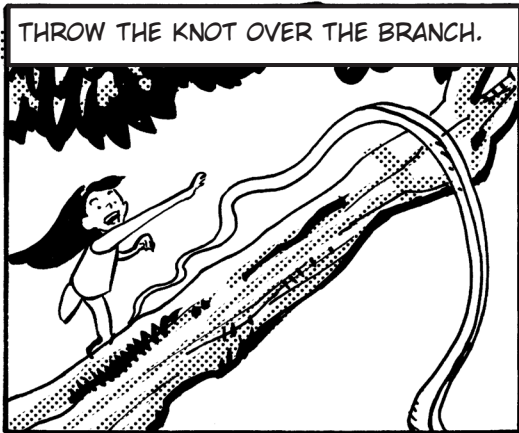
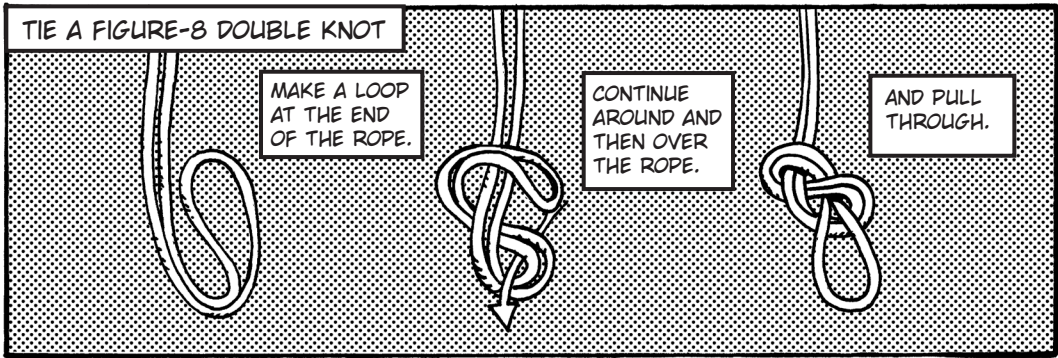


YOU MAY WANT TO START A PILOT HOLE WITH A SMALLER BIT TO MAKE IT GO EASIER.



TO FIND THE LENGTH OF THE ROPE, MEASURE THE DISTANCE OF THE BRANCH TO THE GROUND AND DOUBLE THE AMOUNT OF ROPE.





YOUR OWN WEIGHT WILL CINCH THE KNOT!



IT SEEMS LIKE WE SHOULD SAY SOMETHING ELSE HERE... OH YEAH.

WHEEE!!

NEXT... →

LET'S BUILD A

# ZIP LINE!

THIS LOOKS LIKE A GREAT SPOT TO PUT OUR ZIPLINE. NOT TOO MUCH INCLINE AND THE LAND IS FLAT AND FREE OF DEBRIS!



## MATERIALS:

### ZIPLINE:

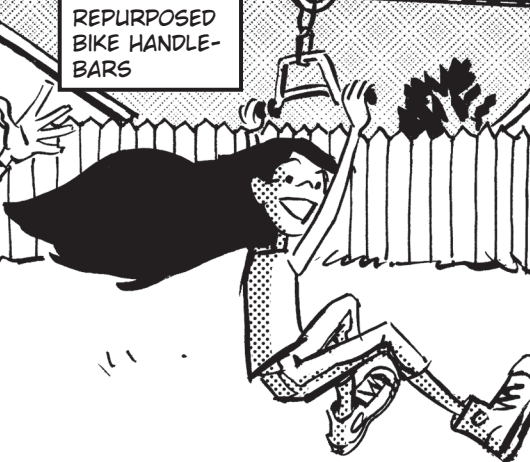
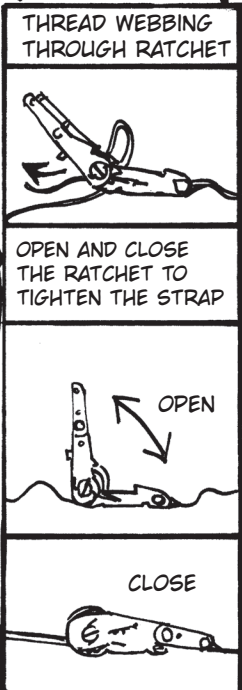
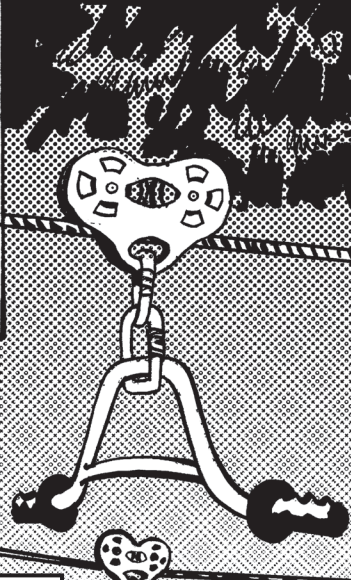
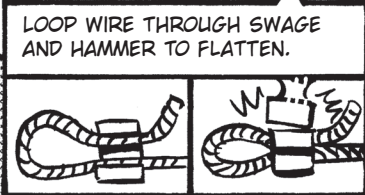
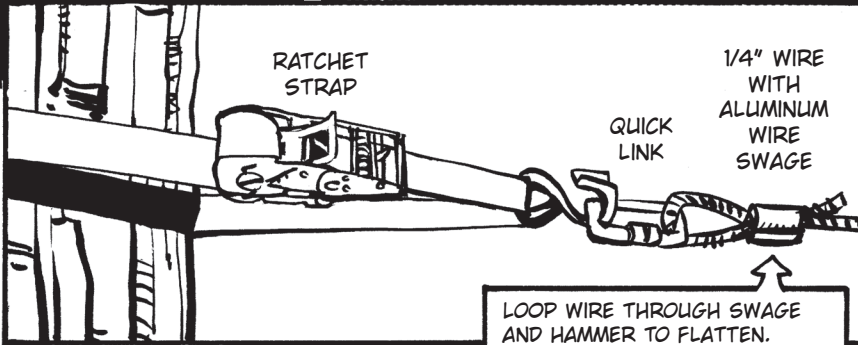
- 1/4" GALVANIZED WIRE CABLE (MEASURE BETWEEN TREES FOR LENGTH)
- 1 1/4" ALUMINUM WIRE SWAGE
- 3 1/4" CABLE CLAMPS
- 2 RATCHET STRAPS
- 2 QUICK LINK
- LADDER

### HANDLE:

- 2 WHEEL PULLEY
- STEEL CARABINER
- HANDLE BARS

### SAFETY:

- 4"X4"X6": WOODEN BLOCK
- 20 FT BUNGEE CORD
- 6" EYELET BOLT
- SAND OR MULCH



PLANT STAKE FOR GROUND ANCHOR SO BUNGEE STRETCHES TO SLOWLY STOP THE PULLEY





TREES ARE A GOOD SUPPORT FOR THE ZIPLINE BECAUSE THE WEIGHT GETS DISTRIBUTED THROUGH THE ROOTS MAKING THE ANCHORS STURDY AND SECURE.

FOR A SAFE SPEED, MAKE THE DECLINE 3 FEET FOR EVERY 50 FEET OF LENGTH.



USE 3 CABLE CLAMPS SPACED 3" APART TO CREATE A LOOP AND DOUBLE THE CABLE BACK ON ITSELF. THE BOLTS SHOULD ALL FACE THE LIVE END OF THE CABLE.

LIVE (LONG) END

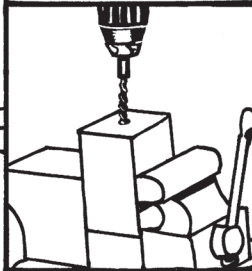


DEAD (SHORT) END

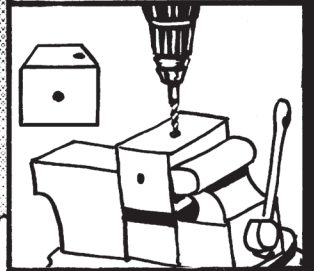
WOOD STOPPING BLOCK

BUNGEE CORD

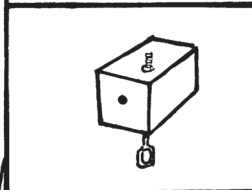
DRILL A 5/16" HOLE IN TOP OF THE BLOCK



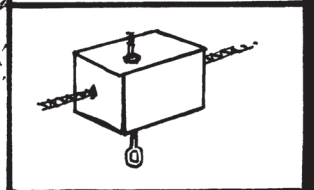
DRILL A 1/4" HOLE TO THE SIDE OF THE BLOCK



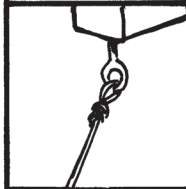
INSERT EYELET BOLT INTO THE SIDE HOLE



THREAD CABLE WIRE THROUGH THE BLOCK



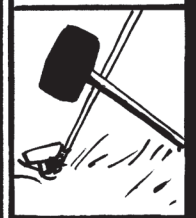
TIE BUNGEE TO BOLT USING A FIGURE-8 KNOT



TIE BUNGEE TO STAKE USING A FIGURE-8 KNOT



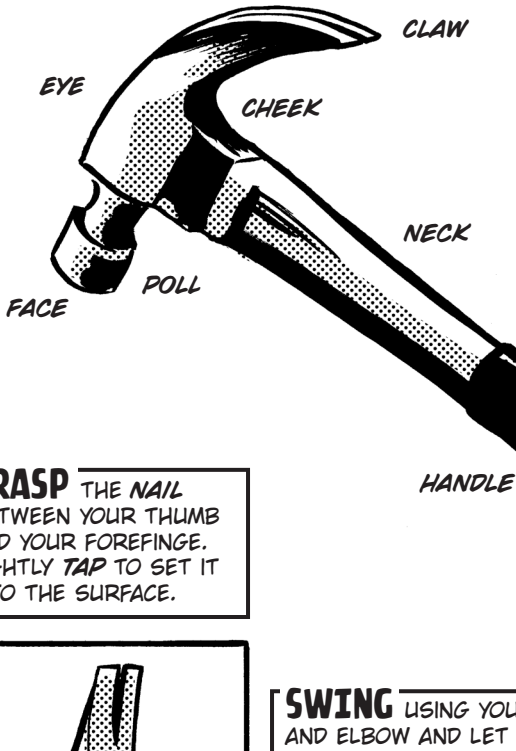
DRIVE STAKE IN WITH Mallet



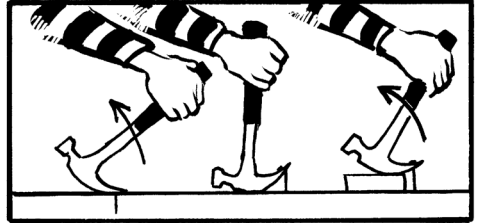
# HAMMER TIME

## HIT THE NAIL ON THE HEAD!

THE HAMMER IS A TOOL MEANT TO DELIVER FORCE. ALWAYS WEAR YOUR SAFETY GLASSES!

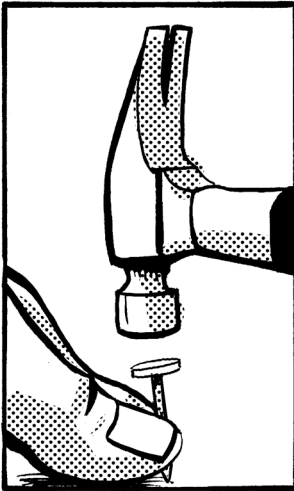


**REMOVING NAILS** SLIDE THE CLAW UNDER THE NAIL AND PULL THE HAMMER TOWARDS YOU TO EXTRACT THE NAIL.

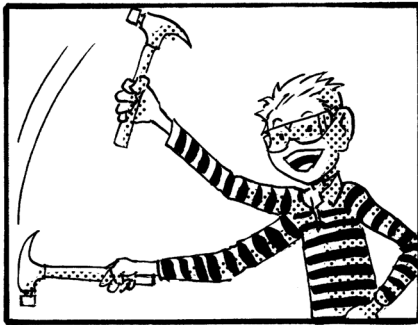


**GRASP** THE NAIL BETWEEN YOUR THUMB AND YOUR FOREFINGER. LIGHTLY **TAP** TO SET IT INTO THE SURFACE.

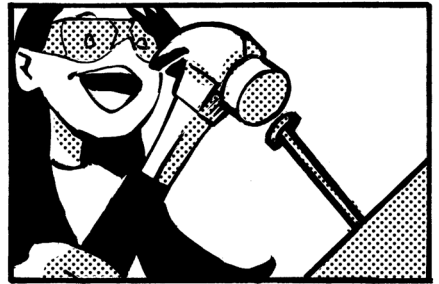
**HOLD THE HAMMER** NEAR THE END OF THE HANDLE WITH A FIRM GRIP. THIS WILL GIVE YOU MORE POWER WHEN SWINGING.



**SWING** USING YOUR WHOLE ARM AND ELBOW AND LET THE WEIGHT OF THE HAMMER BE THE FORCE.



**CONTACT** THE NAIL HEAD SQUARELY WITH THE HAMMER.



**BASIC CLAW**

FOR POUNDING NAILS. THE CLAW PART IS USED FOR PULLING NAILS OUT.

**BALL PEEN**

FOR DRIVING A CHISEL OR A PUNCH.

**MALLET**

FOR DELICATE WORK WITH WOOD AND METAL.

**STONE MASONRY**

FOR CHIPPING AND CHISELING STONE, BRICK, AND CONCRETE.

**LIGHTWEIGHT**

FOR SMALL PROJECTS AND CRAFTS.



# CUT TO THE POINT

## CUTTING

### DOVETAIL SAWS



CLEAN, STURDY CUTS, GREAT FOR FRAMES CABINETS AND TOYS.

### BACK SAWS



THICK BLADED WITH REINFORCED BACK FOR PRECISION CUTS.

### BOW SAWS



STEEL FRAME AND BLADE FOR ROUGH-CUTS OF WOOD.

### CROSSCUT SAWS



FOR CUTTING AGAINST THE GRAIN. CAN BE USED FOR MANY PURPOSES FROM LOGGING TO DETAILED CARPENTRY.

### RIP SAWS



FOR CUTTING WITH THE GRAIN. THE RIPPING ACTION OF THE SAW PRODUCES A COARSE RAGGED CUT WHICH MAKES THE SAW UNSATISFACTORY TO FINISH.

**CROSS CUT TEETH** CROSSCUT TEETH ARE SMALL TEETH USED TO SEVER WOOD WHEN CUTTING ACROSS THE GRAIN.



**RIP TEETH** RIP TEETH ARE MEDIUM-SIZED TEETH DESIGNED TO SCOOP OUT WOOD FIBERS WHEN CUTTING WITH THE GRAIN.



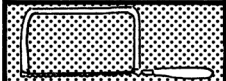
**COMPASS SAWS** SMALL BLADE USED FOR CUTTING CURVED OR STRAIGHT HOLES.

### KEYHOLE SAWS

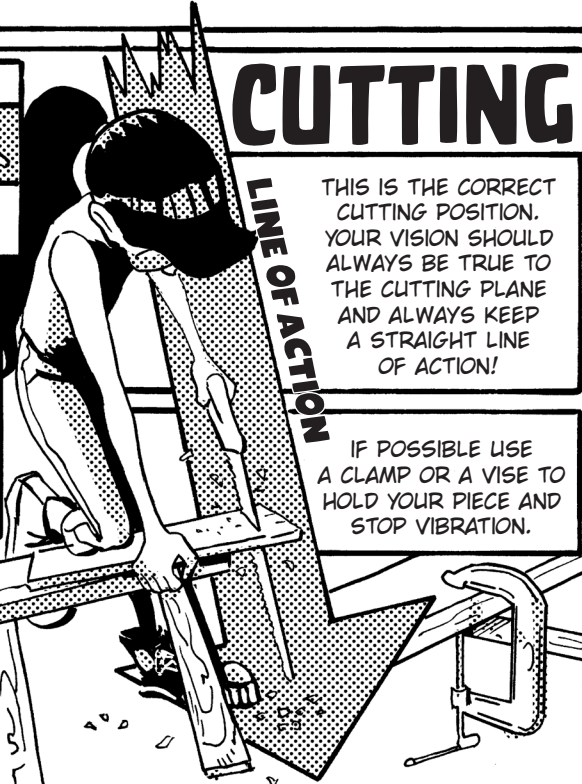


INTRICATE CLOSE INSIDE WORK FOR SPECIALTY JOBS.

### COPING SAWS



CUTS IRREGULAR SHAPES AND INTRICATE PATTERNS.



THIS IS THE CORRECT CUTTING POSITION. YOUR VISION SHOULD ALWAYS BE TRUE TO THE CUTTING PLANE AND ALWAYS KEEP A STRAIGHT LINE OF ACTION!

IF POSSIBLE USE A CLAMP OR A VISE TO HOLD YOUR PIECE AND STOP VIBRATION.

1" 4 T.P.I.

ALWAYS PROTECT YOUR EYES!

T.P.I. STANDS FOR TEETH PER INCH! RULE OF THUMB: THE MORE T.P.I. THE HARDER THE MATERIAL THE SAW CAN CUT!



**THE HACKSAW**

CUTS PLASTIC / METAL / WOOD

MOST VERSATILE OF ALL SAWS

CUTTING ANGLES?

30°

USE A MITER BOX!

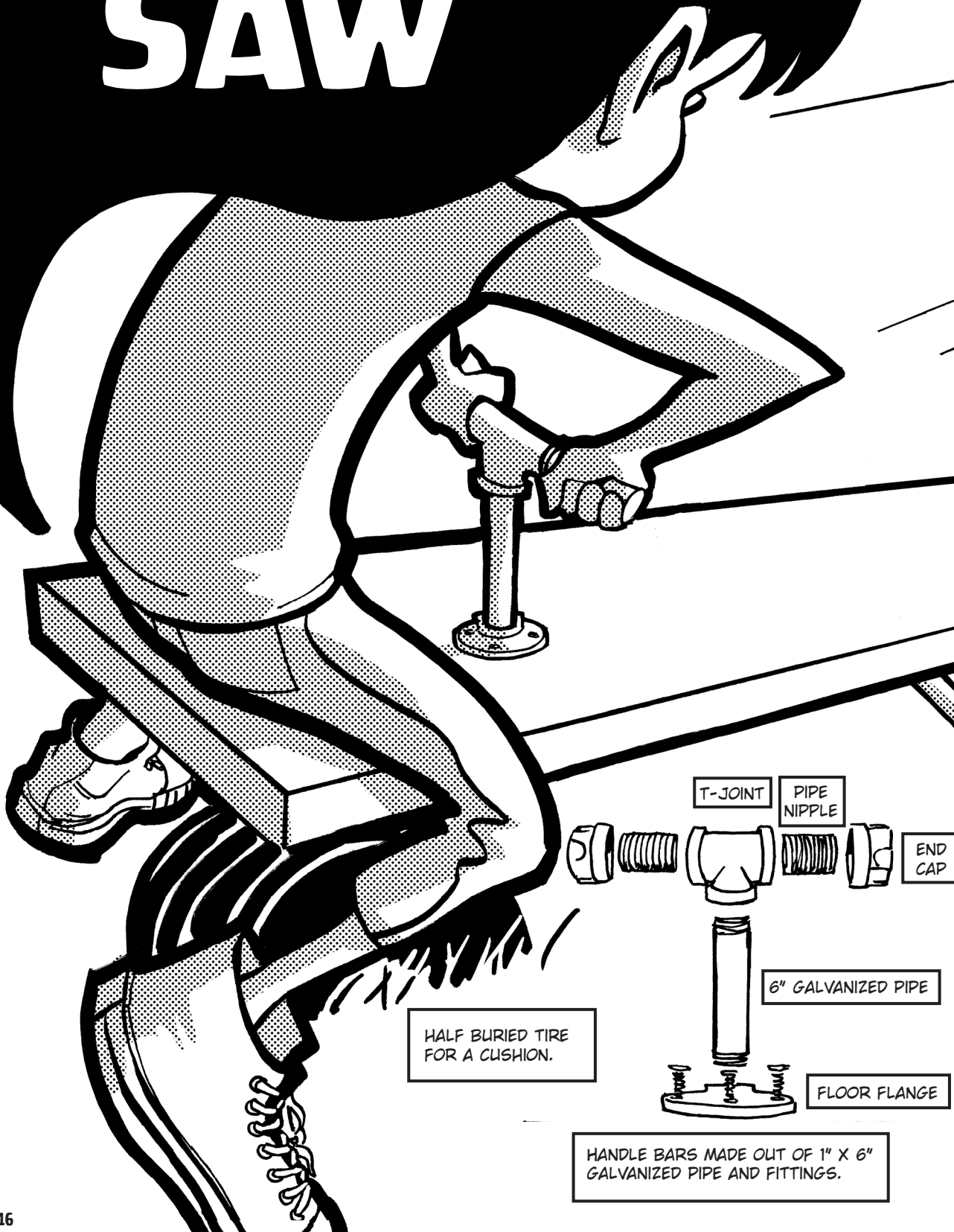
**UPKEEP** A LIGHT COATING OF OIL WILL MAKE BLADES LAST LONGER. BE CAREFUL NOT TO BEND YOUR SAWS. HANGING THEM UP IS A GOOD METHOD FOR STORAGE.



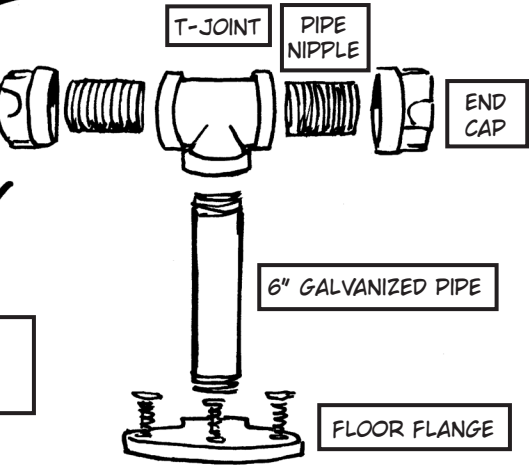


# SEE SAW

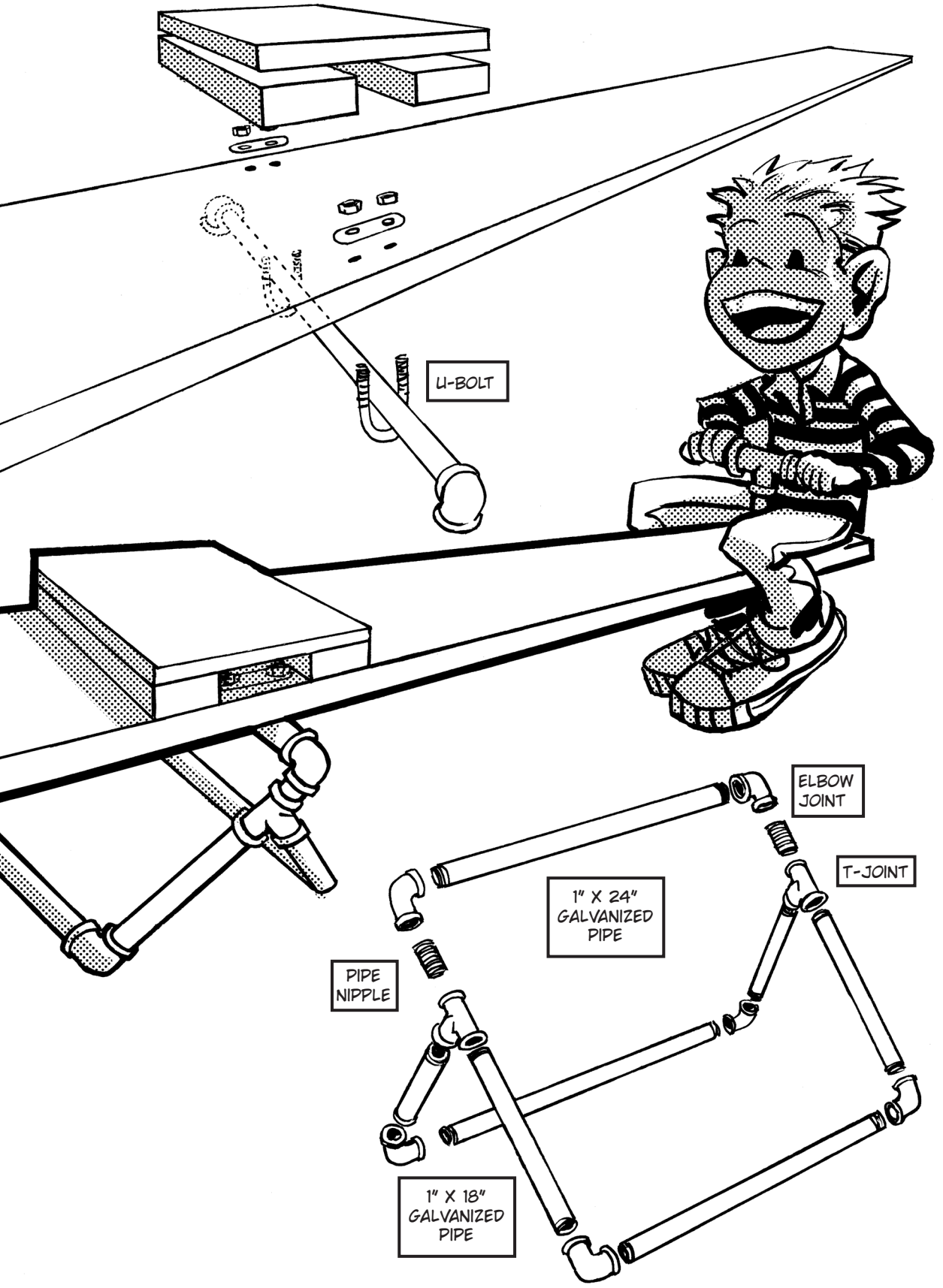
A SEE SAW IS A **LEVER**. THE LONG BOARD THAT HINGES ON A **PIVOT POINT** OF THE LEVER CALLED A **FULCRUM**. ALLOWING YOU TO LIFT OBJECTS THAT ARE MUCH HEAVIER THAN YOU COULD LIFT YOURSELF.



HALF BURIED TIRE FOR A CUSHION.



HANDLE BARS MADE OUT OF 1" X 6" GALVANIZED PIPE AND FITTINGS.



U-BOLT

ELBOW JOINT

T-JOINT

1" X 24" GALVANIZED PIPE

PIPE NIPPLE

1" X 18" GALVANIZED PIPE

LET'S BREAK  
NEW GROUND!

# SHOVELING 101

WE'RE GOING  
TO USE THE  
EARTH ITSELF  
TO KEEP THIS  
PLAYGROUND  
STEADY.

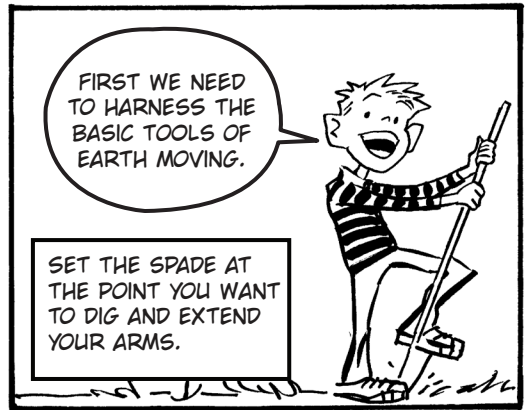
A SHOVEL  
CONCENTRATES A  
MAXIMUM AMOUNT  
OF FORCE INTO A  
SMALL AREA.

FIRST WE NEED  
TO HARNESS THE  
BASIC TOOLS OF  
EARTH MOVING.

SET THE SPADE AT  
THE POINT YOU WANT  
TO DIG AND EXTEND  
YOUR ARMS.

HOP UP ONTO THE SHOVEL  
USING YOUR WEIGHT TO  
BREAK THE GROUND.

PULL BACK AND LIFT WITH YOUR LEGS.



NO MATTER HOW BIG  
OR SMALL THE JOB IS,  
ALWAYS CHOOSE THE  
RIGHT SHOVEL!



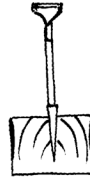
SPADE



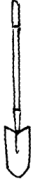
SQUARE



SNOW



TRENCH



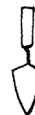
GRUB HOE



MATTOCK



TROWEL



POST HOLE



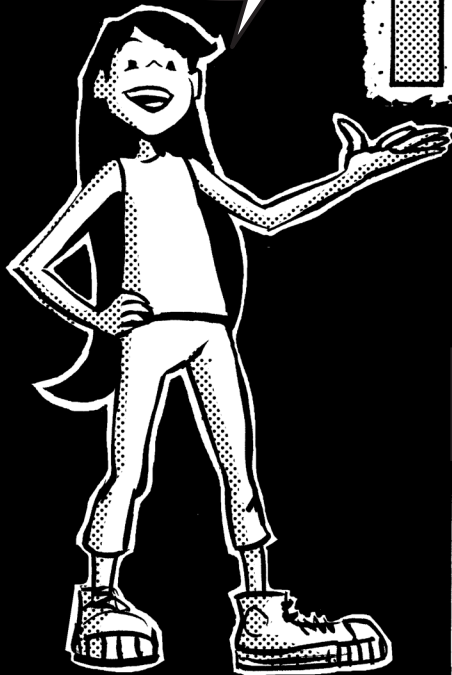


TO MAKE POSTS STURDY, YOU HAVE TO DIG DEEP FOUNDATIONS.

SURROUNDING YOUR POSTS WITH CONCRETE WILL MAKE A **HEAVY** BASE THAT KEEPS THEM UPRIGHT AND **SOLID**.

YOU HAVE TO LET THE CONCRETE SET UP BEFORE DOING MORE WORK ON YOUR PROJECT!

REFER TO THE INSTRUCTIONS ON THE BAG- CEMENT MIXED WITH MORE WATER REQUIRES LONGER TIME TO HARDEN.

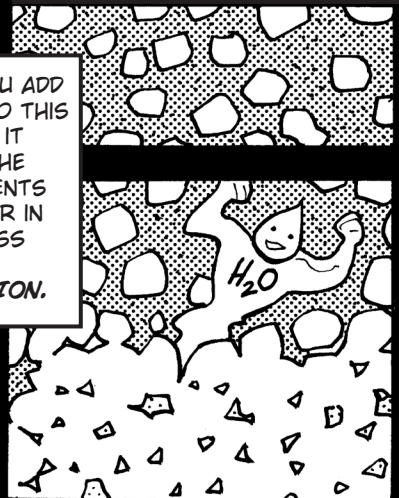


MIX THE WATER, GRAVEL, AND CEMENT **REALLY CLOSE** TO WHERE YOU'RE GOING TO POUR IT! IT'S **HEAVY!**



CONCRETE IS A MIXTURE OF **AGGREGATE** (SAND, GRAVEL OR CRUSHED STONE) AND **BINDER**, WHICH IS THE CEMENT (HEATED LIMESTONE AND CLAY).

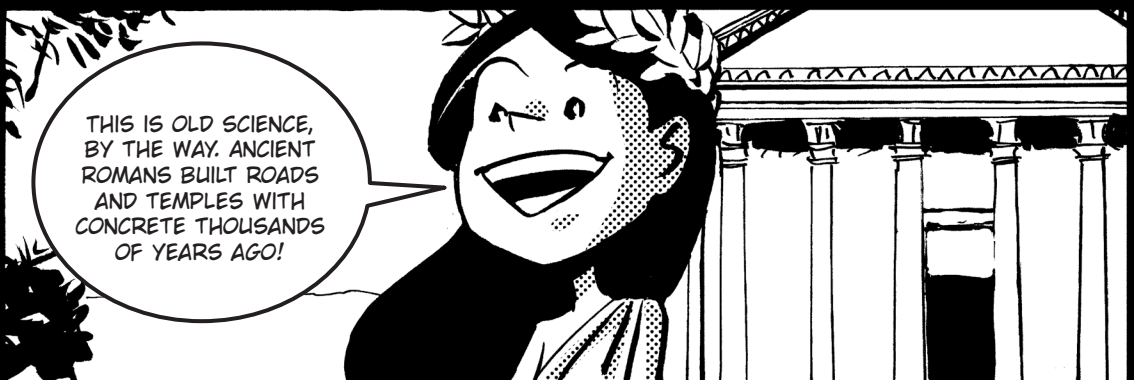
WHEN YOU ADD WATER TO THIS DRY MIX, IT BONDS THE COMPONENTS TOGETHER IN A PROCESS CALLED **HYDRATION**.



YOU MUST MIX THE PROPORTIONS OF STONE, CEMENT, AND WATER TO MAKE THE WET CONCRETE **WORKABLE** TO FILL A FORM (SAY, YOUR HOLE) SOLIDLY.



THIS IS OLD SCIENCE, BY THE WAY. ANCIENT ROMANS BUILT ROADS AND TEMPLES WITH CONCRETE THOUSANDS OF YEARS AGO!



# MONKEY BARS!

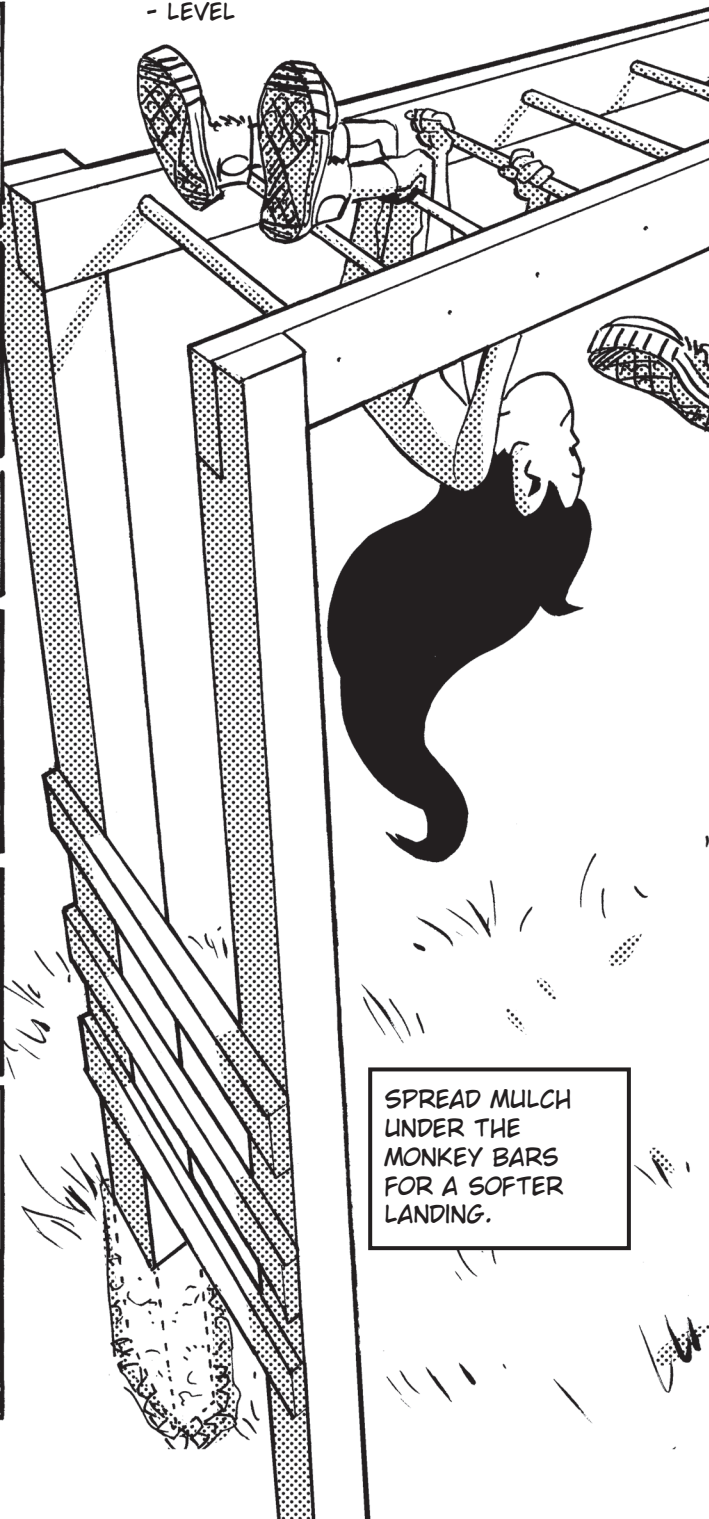
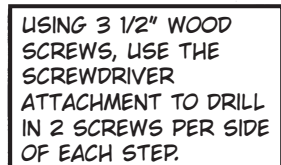
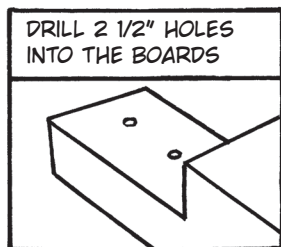
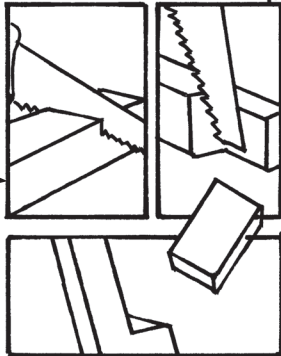
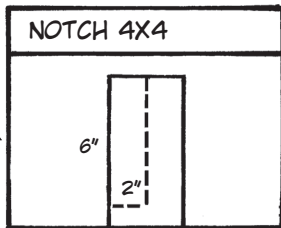
# 1 STEP

## MATERIALS:

- (4) 4"x4"x10'
- (2) 2"x6"x10'
- (2) 2"x4"x8'
- (9) 20" 1" GALVANIZED METAL PIPE
- EPOXY ADHESIVE
- (24) 3 1/2" WOOD SCREWS
- (8) CARRIAGE BOLTS
- PREMIXED BAGGED CONCRETE
- MULCH

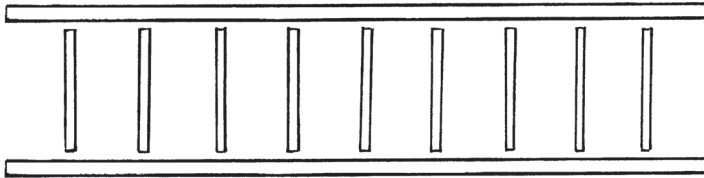
## TOOLS:

- DRILLS AND BITS
- MALLET
- LEVEL

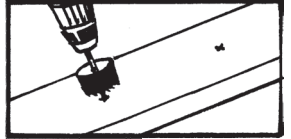


USE A LEVEL TO MAKE SURE THE LADDER IS STRAIGHT.

# 2 MONKEY BARS



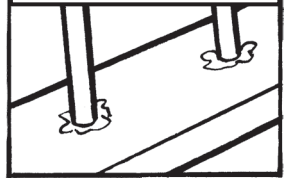
USING A 1 1/2" HOLE SAW, DRILL STRAIGHT DOWN INTO THE MARKED SPOTS.



DRILL DOWN UNTIL THE END OF THE DRILL GOES THROUGH THE OTHER SIDE. ABOUT 1/2" FROM BOTTOM.

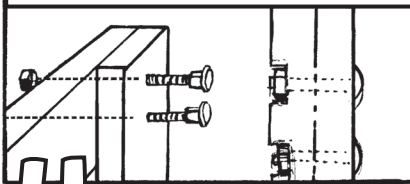


EPOXY BOTH ENDS AND INSERT THE METAL RINGS INTO THE WOOD.



## 3 ATTACH

USING CARRIAGE BOLTS, ASSEMBLE THE MONKEY BARS TO THE FOUR POSTS. COUNTERSINK THE POST.



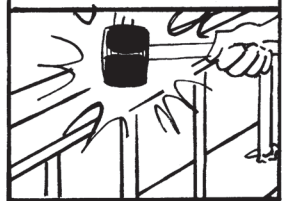
## 4 FOUNDATION

USING A POST HOLE DIGGER, DIG 4 HOLES 4 FEET DEEP INTO THE GROUND.

POUR GRAVEL INTO EACH OF THE 4 HOLES, TO HELP EVEN OUT THE SURFACE.



USING A Mallet, BANG THE METAL RINGS TO FIT.



AFTER THE MONKEY BARS ARE FULLY SET, DO A SAFETY INSPECTION AND CHECK THAT EVERYTHING IS SECURE.

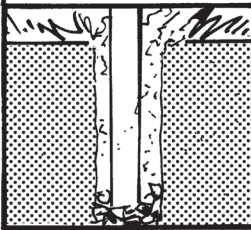


## 5

LINE THE FRONT POLES WITH THE FRONT HOLES AND LET THE POSTS SLIDE INTO PLACE.

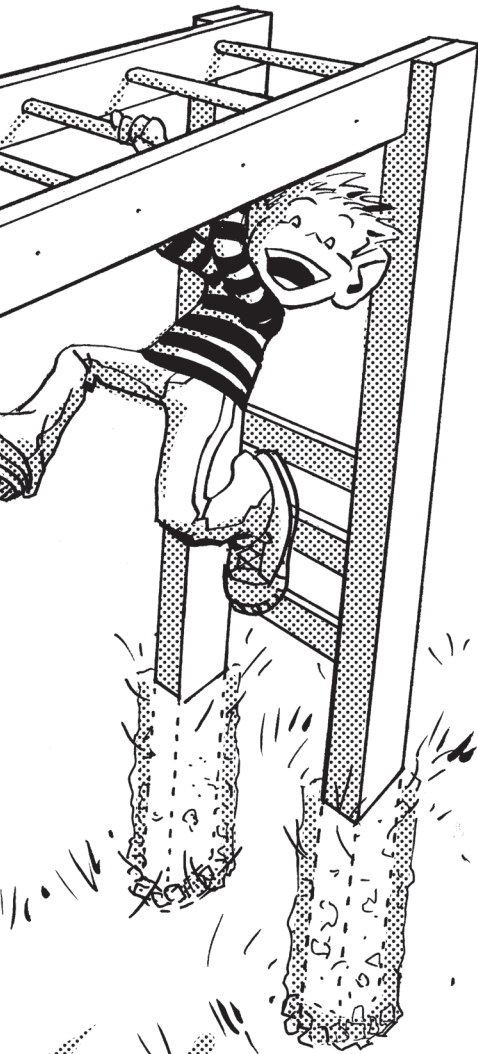


## 6 SET



USE PREMIXED CONCRETE FROM THE HARDWARE STORE AND FOLLOW PACKAGE INSTRUCTIONS.

# LIFT





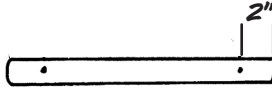
# ROPE LADDER

NOW THAT OUR MONKEY BARS ARE BUILT LET'S ADD A LADDER!

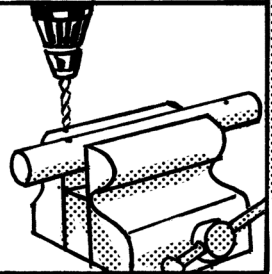
## MATERIALS:

- 24 FEET OF 1/4" ROPE
- (8) 18"x1 1/2" HARDWOOD
- WOODEN RODS
- (2) EYELET SCREWS
- DUCT TAPE

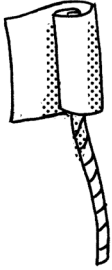
MEASURE AND MARK 2" FROM EACH END OF THE WOODEN RODS.



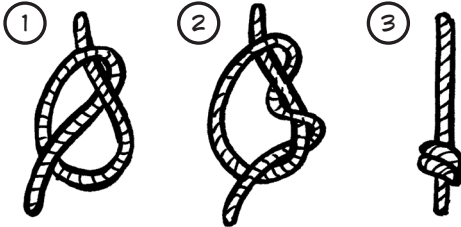
DRILL 1/4" HOLE IN EACH END OF THE RODS.



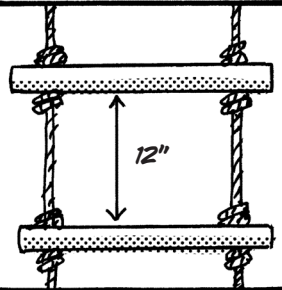
WRAP BOTH ENDS OF ROPE TIGHTLY WITH DUCT TAPE.



TIE A *DOUBLE OVERHAND STOPPER KNOT*.

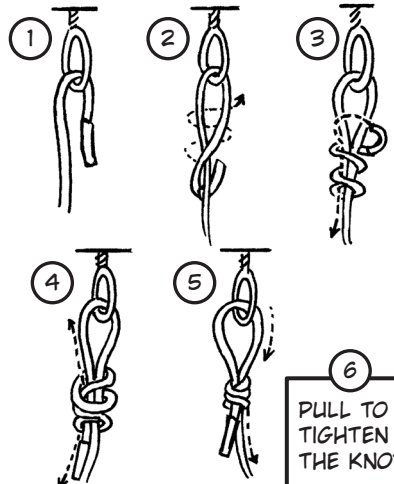


TIE KNOTS SO THAT THE CENTER OF THE RODS ARE 12" APART.

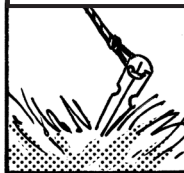


LET'S CONNECT THE LADDER USING A *SCAFFOLD KNOT*.

TIE A *SCAFFOLD KNOT*



SECURE BOTTOM OF THE LADDER USING STAKES.



PULL TO TIGHTEN THE KNOT

OPENING DAY!

NEVER...  
BEEN..

...SO...  
SORE!

NOT  
SURPRISED, YOU  
KIDS DID A LOT  
OF WORK.

THIS WAS  
THE BIGGEST  
PROJECT YET.

I FEEL LIKE I  
HAVE A ZILLION  
NEW SKILLS NOW.

YOU CERTAINLY  
DO, AFTER MAKING  
A SEE-SAW, A ZIP  
LINE...

LEVERS.  
FULCRUMS.

... HYDRATION  
AND FORCE...

...ANCHORING.  
...SUPPORT...  
FOUNDATIONS.

YOU CAN BOTH BE  
PROUD. FINISHING A  
PROJECT IS REWARDING  
AND FUN.

SPEAKING  
OF FUN...!

NOW IT REALLY  
BEGINS- COME  
ON, TUCKER!





WOO  
HOO!

IT'S TIME  
TO PLAY ON THE  
PLAYGROUND!!!

IT'S EVEN  
BETTER THAN WE  
IMAGINED!

WAIT FOR  
US!

THE END-  
(OF PLAYING  
IN THE STREET!)