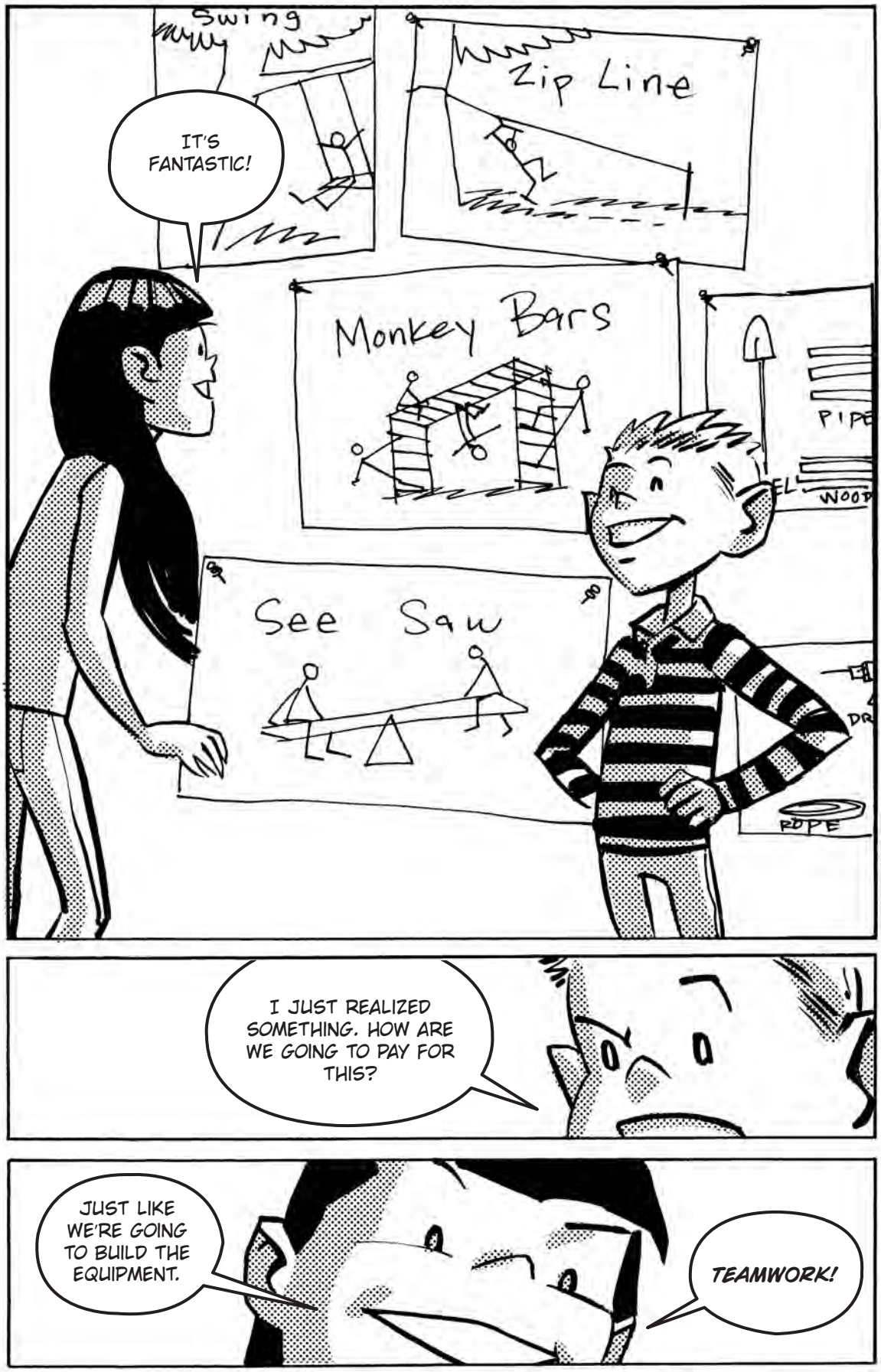

LOOK OUT BILLY!
SCREECH
I'VE GOT IT!
OH NO-!
BOING.
THAT DIDN'T SOUND GOOD, TUCKER!
I HOPE EVERYONE'S OKAY!
YOU SHOULDN'T BE PLAYING IN THE STREET. I COULD HAVE RUN OVER YOU!
WE SHOULD JUST SOLVE THIS PROBLEM ONCE AND FOR ALL.
I THINK *WE* HAVE TO *INVENT* THE SOLUTION, IN A BIGGER WAY THAN WE EVER HAVE 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.

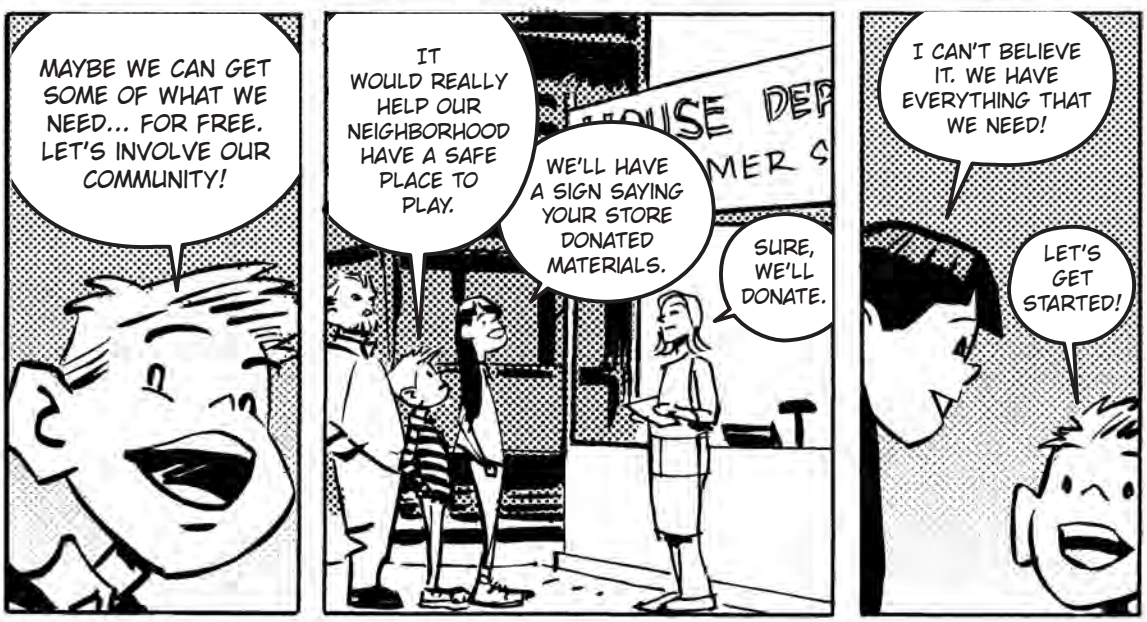

THIS PLACE NEEDS A LOT OF CLEANUP.
DON'T WORRY MR. HAMA. WE HAVE A CREW COMING.
LOOKS LIKE HELP HAS ARRIVED.
WE ARE HERE TO HELP!
...AND YOU BROUGHT YOUR CLEAN UP TOOLS TOO!
IT LOOKS GREAT!
LET'S GET HOME AND FINISH THOSE DESIGNS.


LATER... AN EVENING OF FURIOUS BRAINSTORMING AND RE-IMAGINING!
LOOKING AT PLAYGROUNDS CLOSE UP WAS PERFECT RESEARCH - AND FUN! OUR DESIGNS ARE WAY BETTER FOR IT.
YEAH. THE IDEAS ARE FLOWING. KNOWING HOW TO COMMUNICATE MY IDEAS VISUALLY IS AWESOME.*
*SEE HOWTOONS VISUAL COMMUNICATION GUIDE.
THE LOT IS LARGE ENOUGH SO WE CAN MAKE SEE-SAWS BOTH LARGE AND SMALL.
I LOVE THE TREE! IT WILL MAKE AN EXCELLENT FOUNDATION FOR A ZIPLINE.
MONKEY BARS WILL MAKE A GREAT CENTERPIECE WITH THE OPTION FOR ADDITIONS LIKE A SWING.
WOW, THIS PLAYGROUND IS GONNA BE AMAZING!
Monkey
See Saw


Swing
Zip Line
IT'S FANTASTIC!
Monkey Bars
See Saw
PIPE
WOOD
ROPE
I JUST REALIZED SOMETHING. HOW ARE WE GOING TO PAY FOR THIS?
JUST LIKE WE'RE GOING TO BUILD THE EQUIPMENT.
TEAMWORK!


SOON
WE NEED TO RAISE MONEY FOR BUILDING MATERIALS!
YARD SALE!
FRESH LEMONADE!
COOKIES!
ONATE
HELP US BUILD A PLAYGROUND!
CAR WASH!


WOW! MR. HAMA, YOU HAVE A LOT OF TOOLS.
ALWAYS THE LAST WORDS I HEAR BEFORE THEY'RE NEVER RETURNED.


MAYBE WE CAN GET SOME OF WHAT WE NEED... FOR FREE. LET'S INVOLVE OUR COMMUNITY!
IT WOULD REALLY HELP OUR NEIGHBORHOOD HAVE A SAFE PLACE TO PLAY.
WE'LL HAVE A SIGN SAYING YOUR STORE DONATED MATERIALS.
SURE, WE'LL DONATE.
I CAN'T BELIEVE IT. WE HAVE EVERYTHING THAT WE NEED!
LET'S GET STARTED!


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.

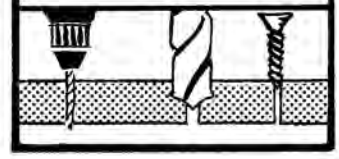
DRILL HOLES AND DRIVE SCREWS WITH THE...

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.

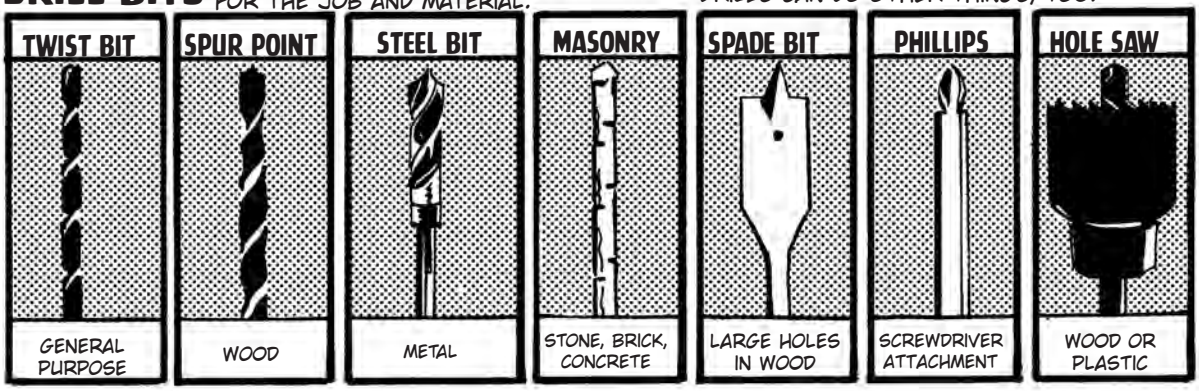


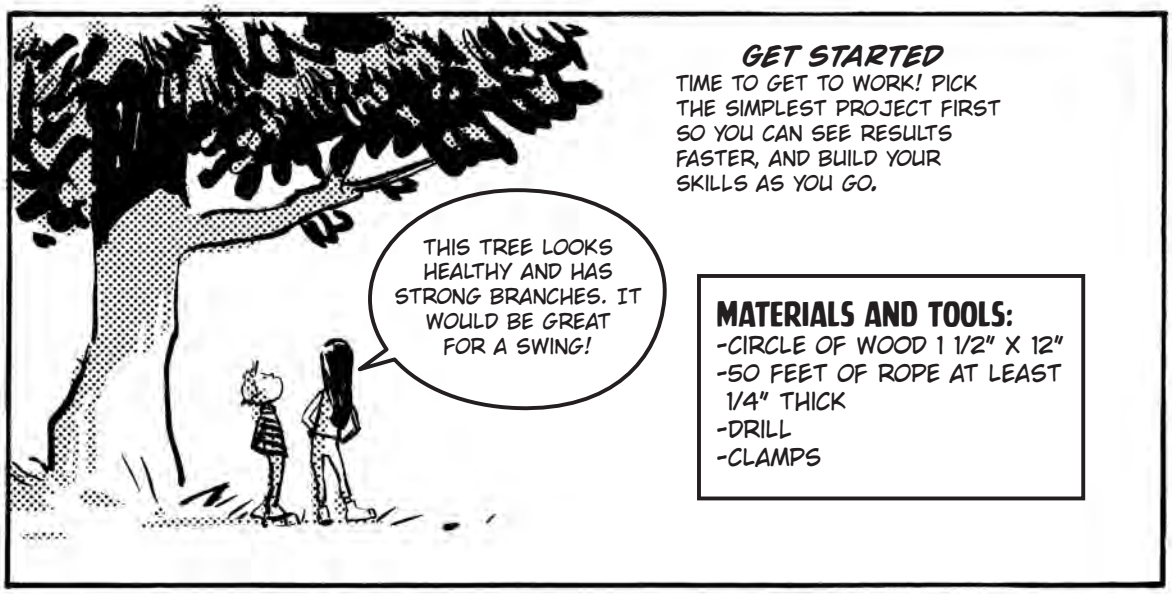
TORQUE: IS THE TYPE OF FORCE PRODUCED BY A DRILL. THIS FORCE TURNS THE BIT. YOU WILL NEED MORE TORQUE AND SPEED TO DRILL THROUGH HARDER MATERIAL. YOU WANT LOW TORQUE AND SPEED TO DRIVE SCREWS.

DRILL BITS

CHOOSE THE DRILL BIT FOR THE JOB AND MATERIAL.

DRILLS CAN DO OTHER THINGS, TOO.



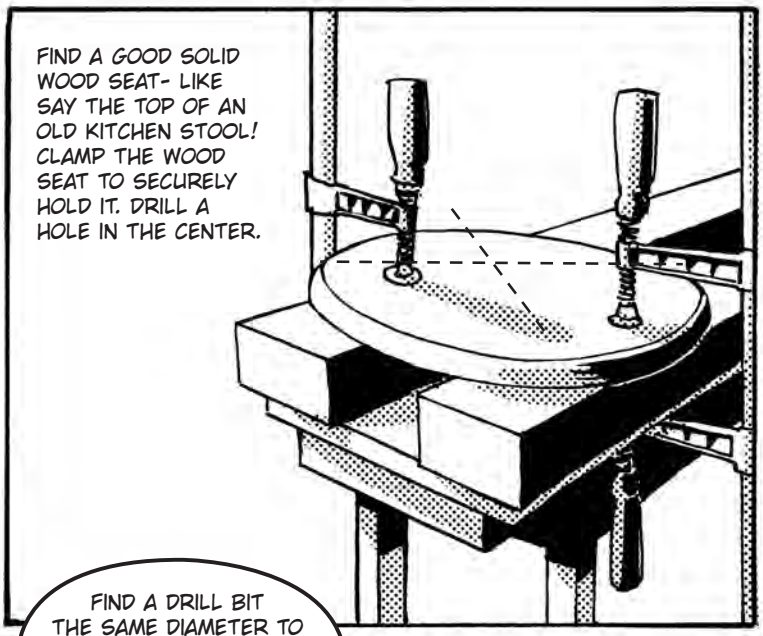


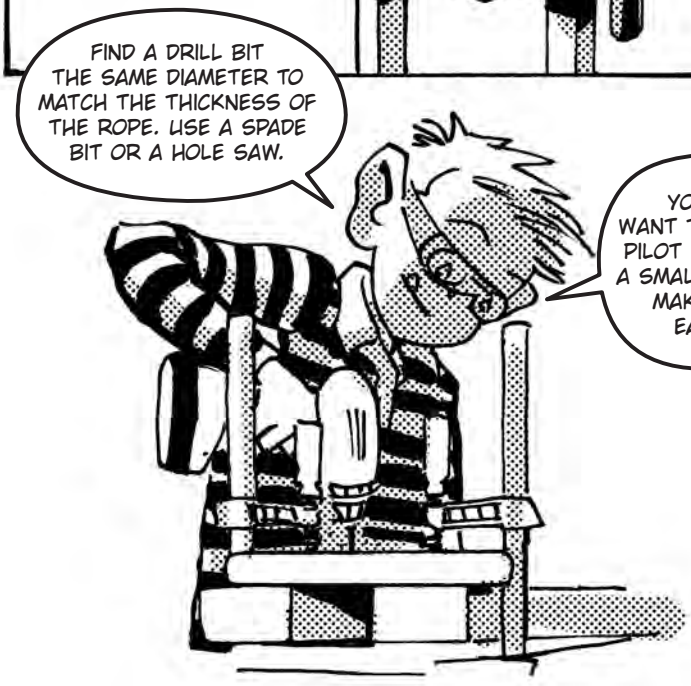
GET STARTED

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






TIE A FIGURE-8 DOUBLE KNOT
MAKE A LOOP AT THE END OF THE ROPE.
CONTINUE AROUND AND THEN OVER THE ROPE.
AND PULL THROUGH.
THROW THE KNOT OVER THE BRANCH.
PULL THE ROPE THROUGH THE HOLE AND PULL TO TIGHTEN.
TIE A FIGURE-8 DOUBLE KNOT UNDERNEATH SO THE SEAT IS A COUPLE OF FEET OFF THE GROUND.
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
RATCHET STRAP
QUICK LINK
1/4" WIRE WITH ALUMINUM WIRE SWAGE
LOOP WIRE THROUGH SWAGE AND HAMMER TO FLATTEN.
THREAD WEBBING THROUGH RATCHET
OPEN AND CLOSE THE RATCHET TO TIGHTEN THE STRAP
OPEN
CLOSE
REPURPOSED BIKE HANDLE-BARS
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.

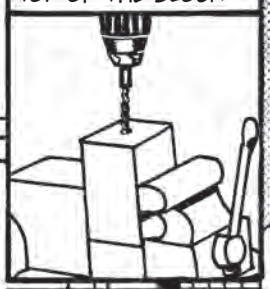
LIVE (LONG) END

DEAD (SHORT) END

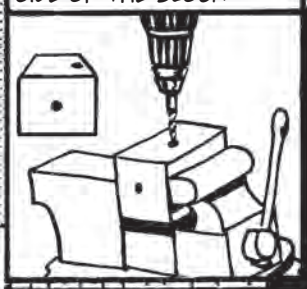
WOOD STOPPING BLOCK

BUNGEE CORD

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

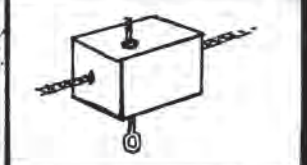


DRILL A 1/4" HOLE TO THE SIDE OF THE BLOCK



INSERT EYELET BOLT INTO THE SIDE HOLE

THREAD CABLE WIRE THROUGH THE BLOCK



TIE BUNGEE TO BOLT USING A FIGURE-8 KNOT

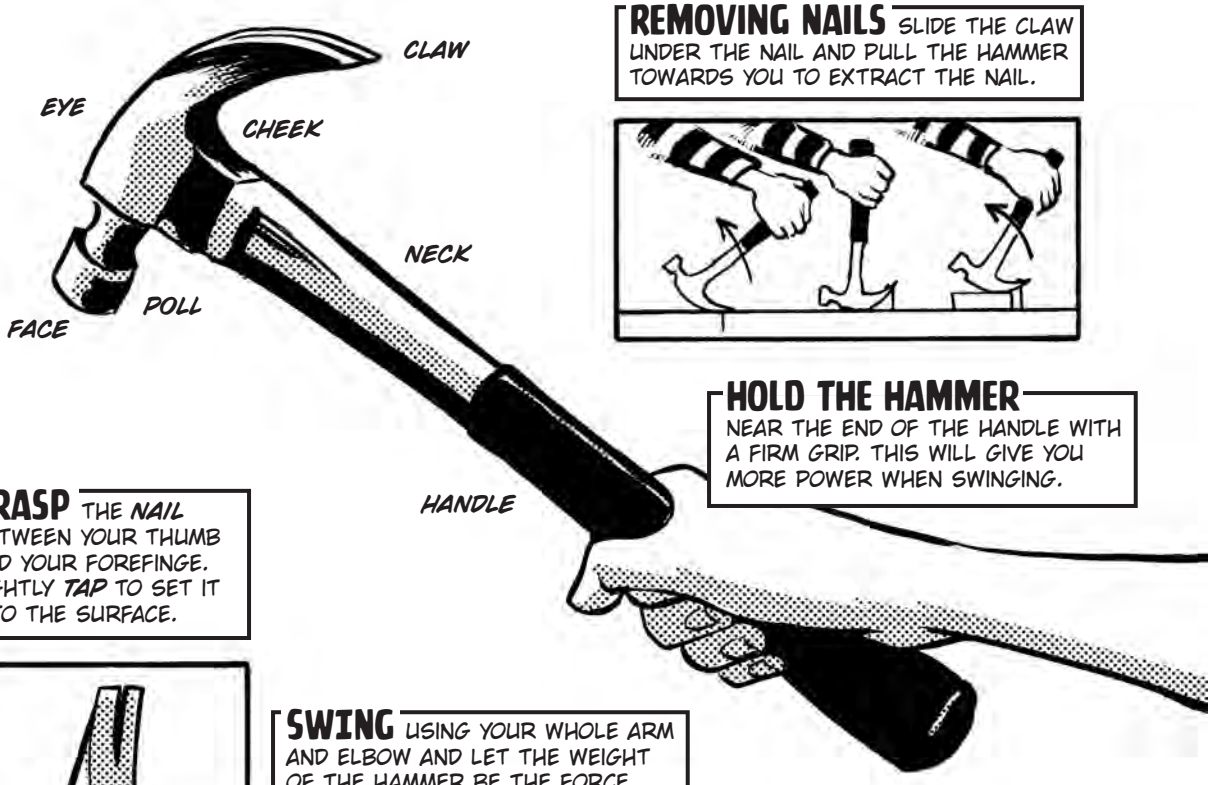
TIE BUNGEE TO STAKE USING A FIGURE-8 KNOT

DRIVE STAKE IN WITH MALLET

HAMMER TIME

HIT THE NAIL ON THE HEAD!

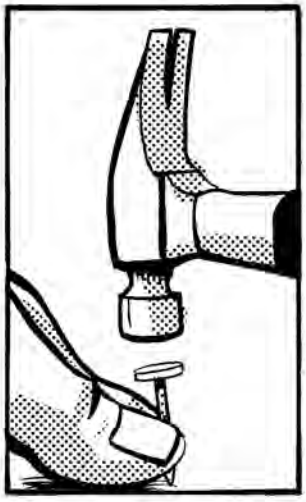
THE HAMMER IS A TOOL MEANT TO DELIVER FORCE. ALWAYS WEAR YOUR SAFETY GLASSES!



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

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

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



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.

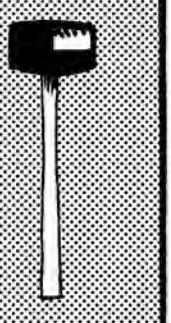
BASIC CLAW

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

BALL PEEN

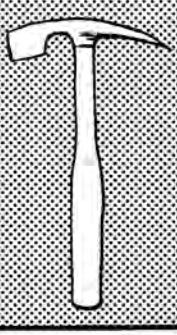
FOR DRIVING A CHISEL OR A PUNCH.

MALLET



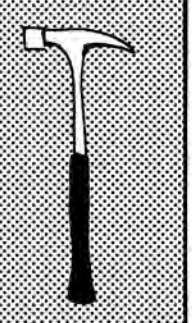
FOR DELICATE WORK WITH WOOD AND METAL.

STONE MASONRY



FOR CHIPPING AND CHISELING STONE, BRICK, AND CONCRETE.

LIGHTWEIGHT



FOR SMALL PROJECTS AND CRAFTS.

CUT TO THE POINT

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.

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

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.

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.

CUTTING

LINE OF ACTION

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.

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

ALWAYS PROTECT YOUR EYES!

THE HACKSAW

CUTS PLASTIC / METAL / WOOD

MOST VERSATILE OF ALL SAWS

CUTTING ANGLES?

30°

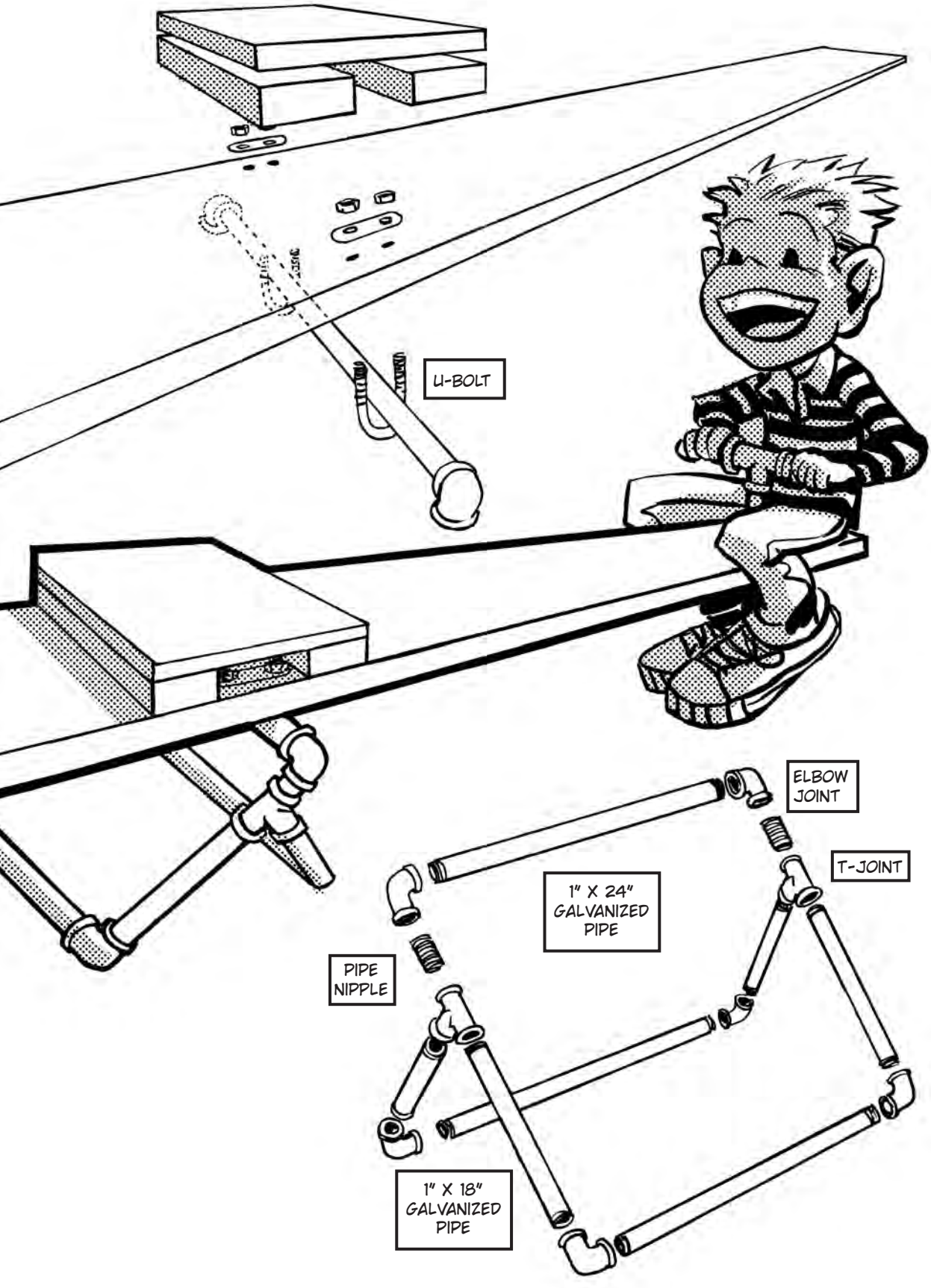
USE A MITER BOX!

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.

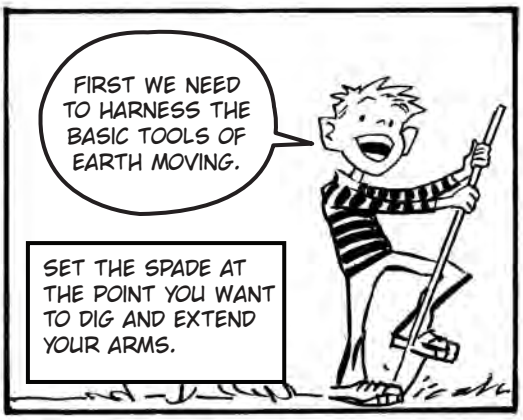
OIL

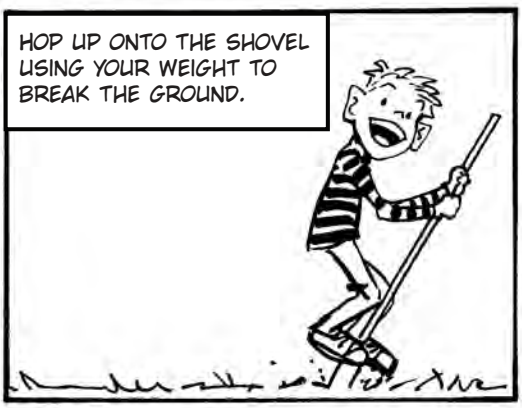
SEE SAW

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.


U-BOLT
ELBOW JOINT
T-JOINT
1" X 24" GALVANIZED PIPE
PIPE NIPPLE
1" X 18" GALVANIZED PIPE

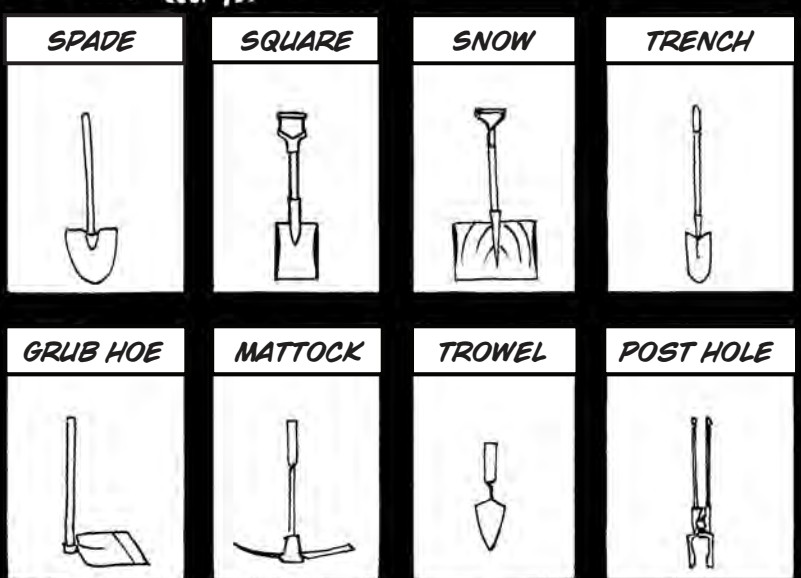

LET'S BREAK NEW GROUND!
SHOVELING 101
WE'RE GOING TO USE THE EARTH ITSELF TO KEEP THIS PLAYGROUND STEADY.
A SHOVEL CONCENTRATES A MAXIMUM AMOUNT OF FORCE INTO A SMALL AREA.

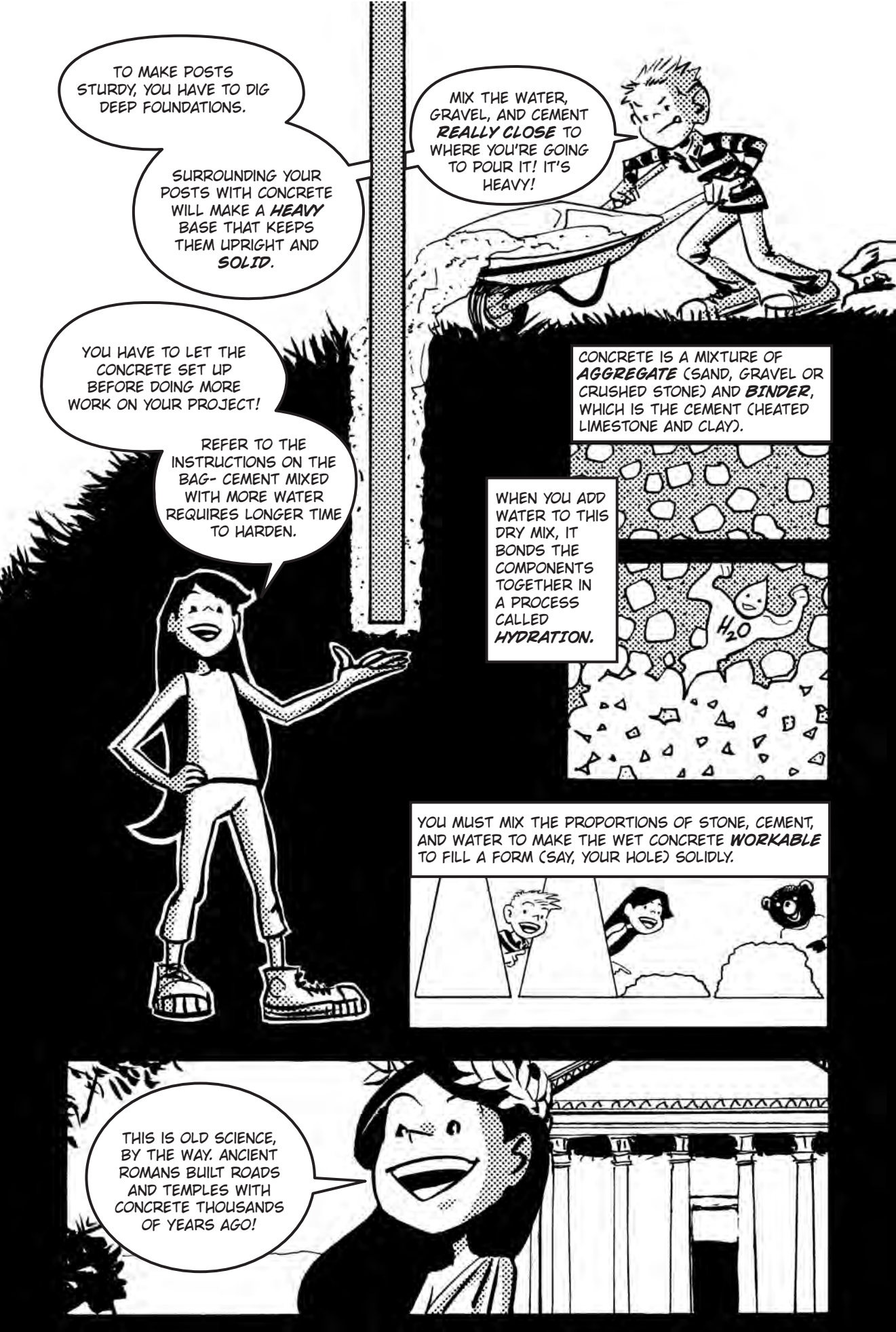

FIRST WE NEED TO HARNESS THE BASIC TOOLS OF EARTH MOVING.
SET THE SPADE AT THE POINT YOU WANT TO DIG AND EXTEND YOUR ARMS.


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.
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.
H_2O
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.
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!

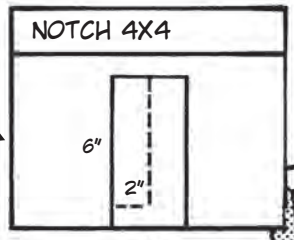
MONKEY BARS!

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

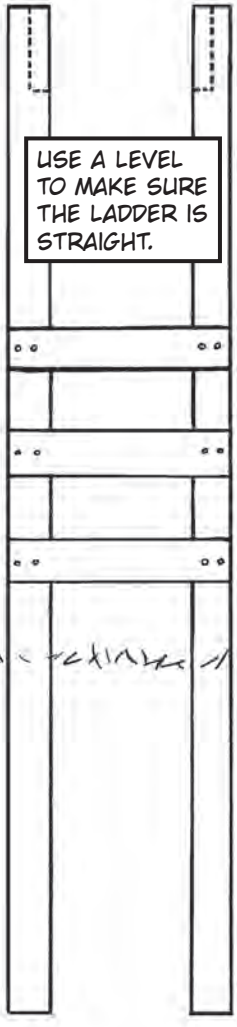
TOOLS:
- DRILLS AND BITS
- MALLET
- LEVEL

1 LADDER

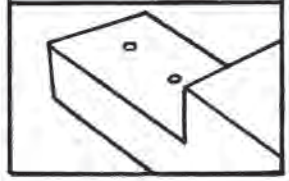
NOTCH 4X4



USE A LEVEL TO MAKE SURE THE LADDER IS STRAIGHT.



DRILL 2 1/2" HOLES INTO THE BOARDS

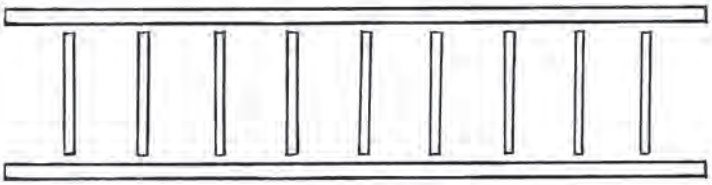


SAW THE STEPS FOR THE LADDER

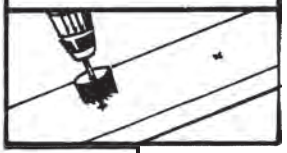
USING 3 1/2" WOOD SCREWS, USE THE SCREWDRIVER ATTACHMENT TO DRILL IN 2 SCREWS PER SIDE OF EACH STEP.

SPREAD MULCH UNDER THE MONKEY BARS FOR A SOFTER LANDING.

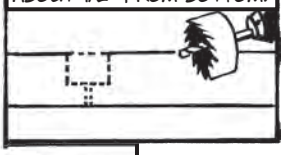
2 MONKEY BARS



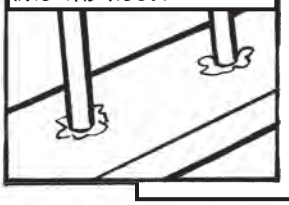
USING A 1 1/2" HOLE SAW, DRILL STRAIGHT DOWN INTO THE MARKED SPOTS.



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 RUNGS INTO THE WOOD.

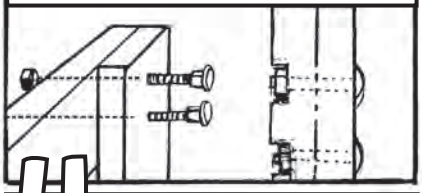


USING A MALLET, BANG THE METAL RUNGS TO FIT.

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

3 ATTACH

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



4 FOUNDATION

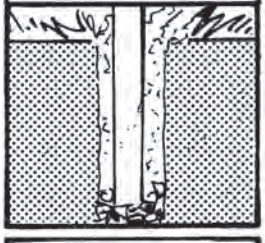
USING A POST HOLE DIGGER, DIG 4 HOLES 4 FEET DEEP INTO THE GROUND.

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

5 LIFT

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.

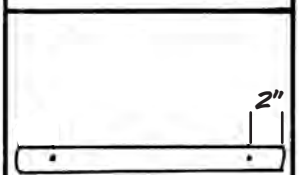
ROPE LADDER

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

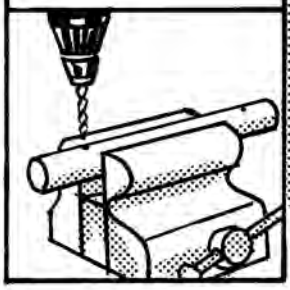
MATERIALS:

- 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.

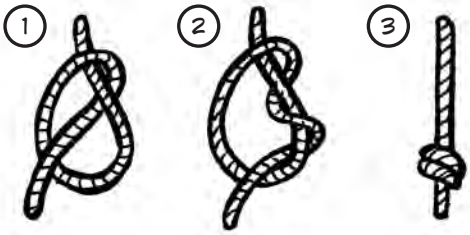


DRILL 1/4" HOLE IN EACH END OF THE RODS.

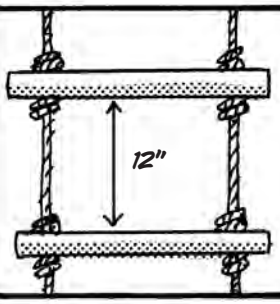


WRAP BOTH ENDS OF ROPE TIGHTLY WITH DUCT TAPE.

TIE A ***DOUBLE OVERHAND STOPPER KNOT.***



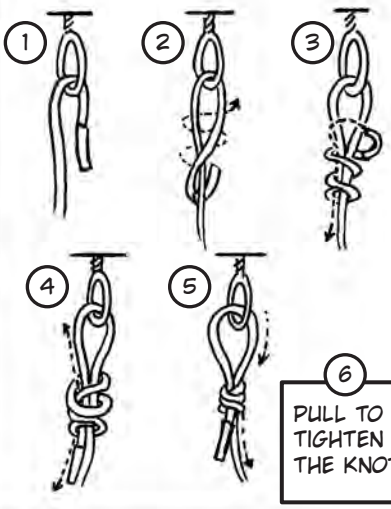
TIE KNOTS SO THAT THE CENTER OF THE RODS ARE 12" APART.

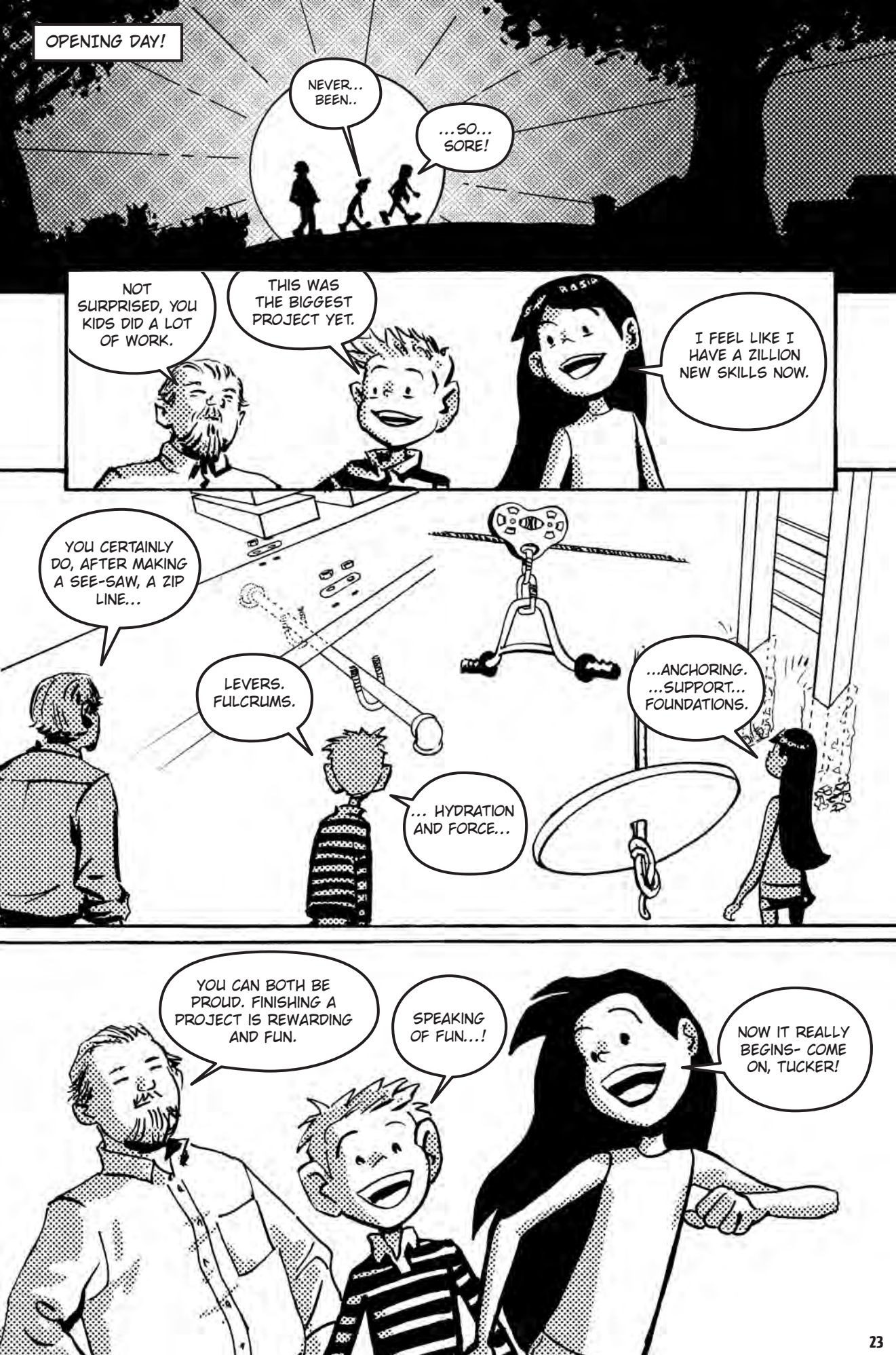


LET'S CONNECT THE LADDER USING A ***SCAFFOLD KNOT.***

SECURE BOTTOM OF THE LADDER USING STAKES.

TIE A ***SCAFFOLD 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!)