

# MANUFACTURING ACTIVITY BOOK

*Coloring, puzzles, activities, and experiments for kids!*





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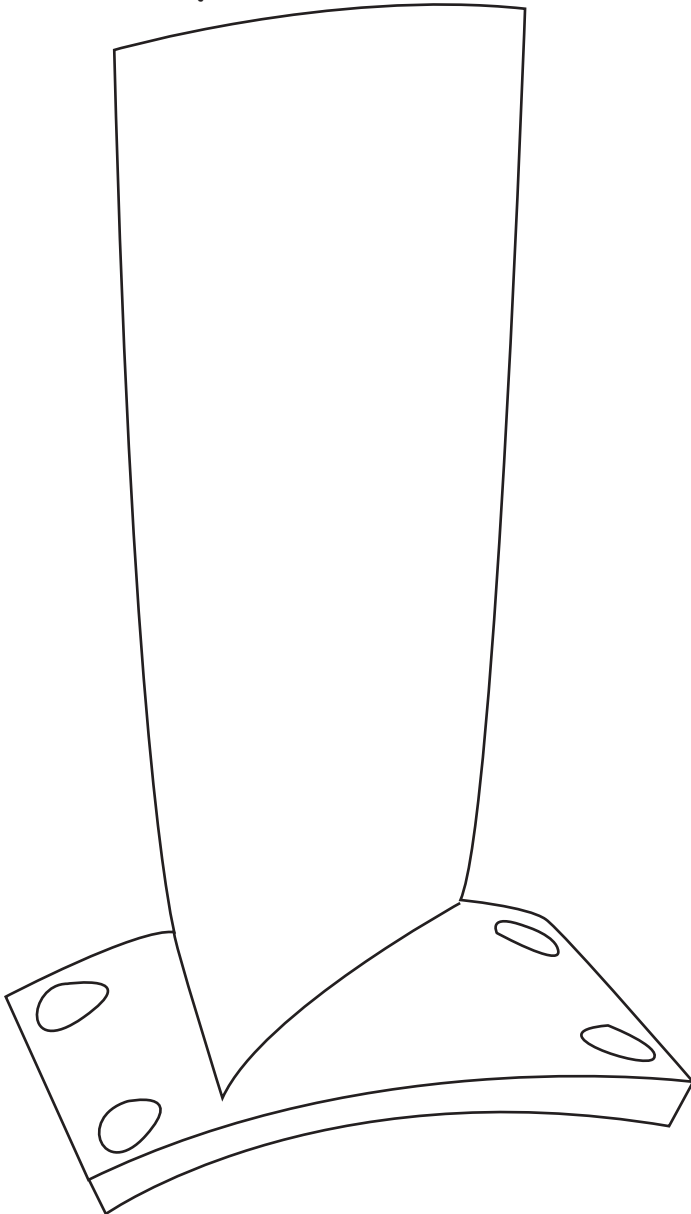
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Appropriate and reasonable caution should be used when activities call for the use of materials that could potentially be harmful, including but not limited to scissors, ovens, slow cookers, and/or any food items that a child could be allergic to. Observe caution and safety at all times. Appropriate safety gear, including eye protection, should be worn at all times. Batesville Products, Inc. disclaims any and all liability or responsibility for any damage, mishap, or injury that may occur from engaging in any of these activities in this publication.

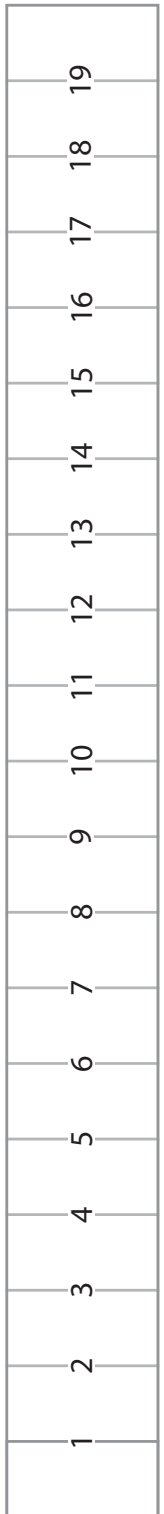
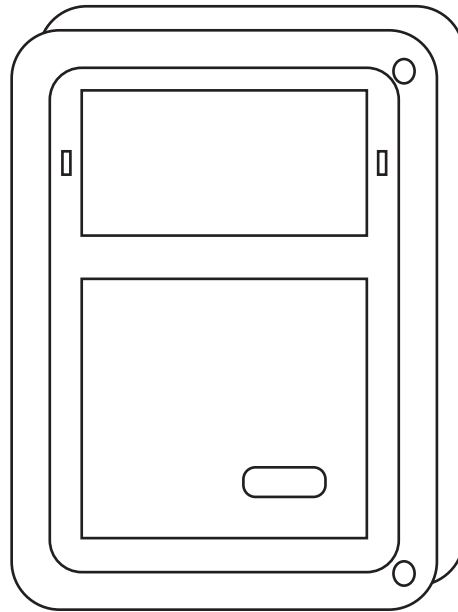
# BLUEPRINTS

CUT OUT THE RULER AND USE IT TO MEASURE EACH CASTING TO THE NEAREST CENTIMETER.

FAN BLADE



ELECTRICAL BOX



# WORD HUNT

R R P I B F D S G T F M M M M S A E Q H  
S J E F P V L L N N X A S A Z E C L N S  
D E W E I G Y U E J N N Z P F Q X T J V  
Z Q V D N A H J S U S U C L J A E J K E  
U F H E V I Y M F E Y F Z B C G U J W H  
D O B R R K G A J N Y A I Y K V F C V W  
I U S F U Y C N W R E C A L U M I N U M  
P N P H V T W C E O E T A W Q A D A H N  
K D W N U X L H R U V U E S V A K N I Q  
S R F R Y L Q C E F J R X D T J O J B E  
G Y I T A M D E J D W I C I U I A Q Z A  
C N C H U C E B B P E N A D M D N U K U  
G T L X N J C G X I R G Z O P L Y G I S  
N H L M E T A L F R O K P Z A E K G T A  
D B D L C P W Q V I E H F O F A S N H E  
Y I L C M T O B P N A W E V D I D E E R  
R G Y R B I P I R A T E V Y G E K M H T  
P Q A N V K R F R E N G I N E E R B W I  
H Q B M E R A S B H L H E A K R D U F E  
P U X S G L F K X X C Q W U D E P I K T

Metal  
Casting  
Aluminum

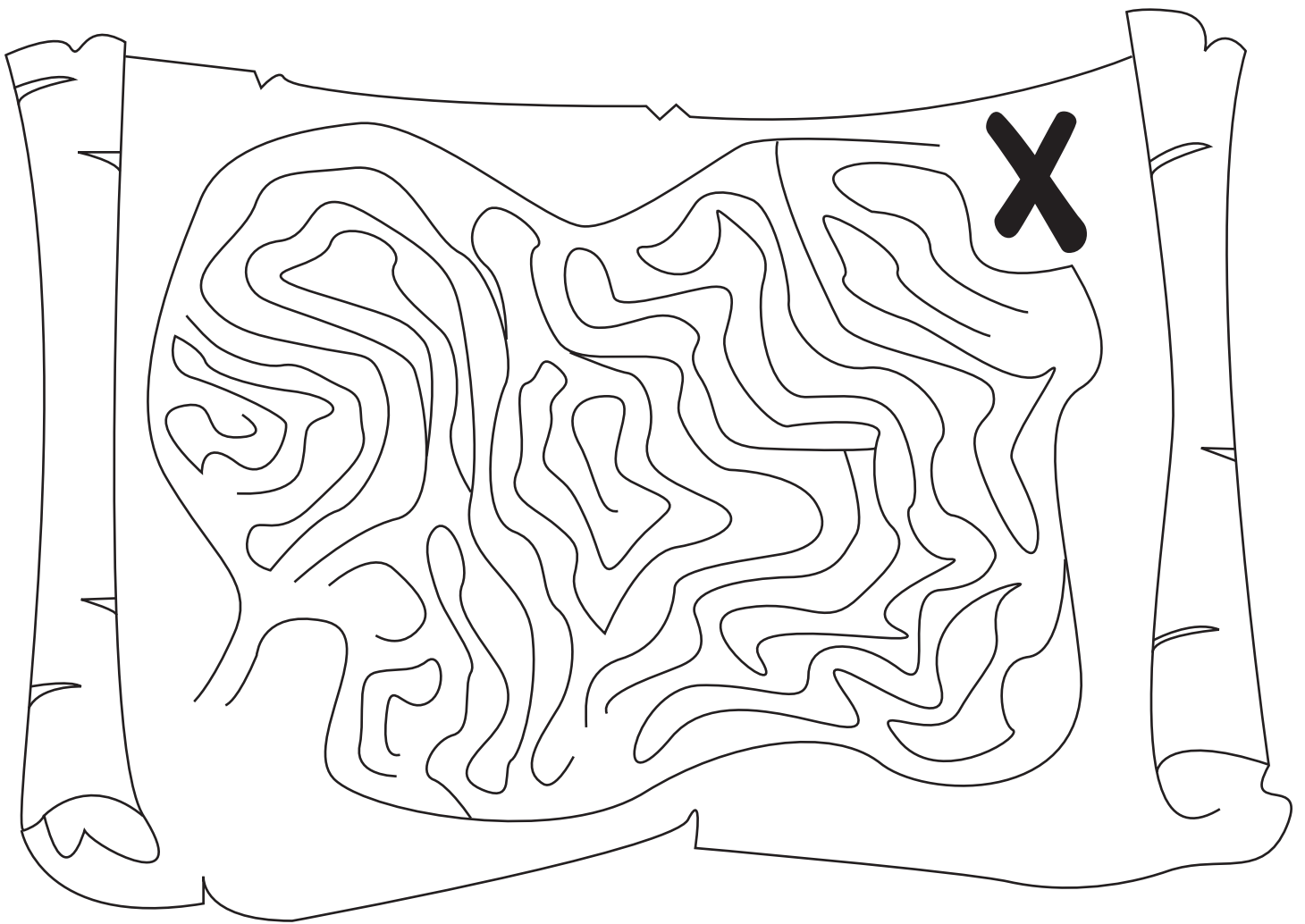
Foundry  
Manufacturing  
Engineer

Treasure  
Hunt  
Pirate

**BONUS: BPI**

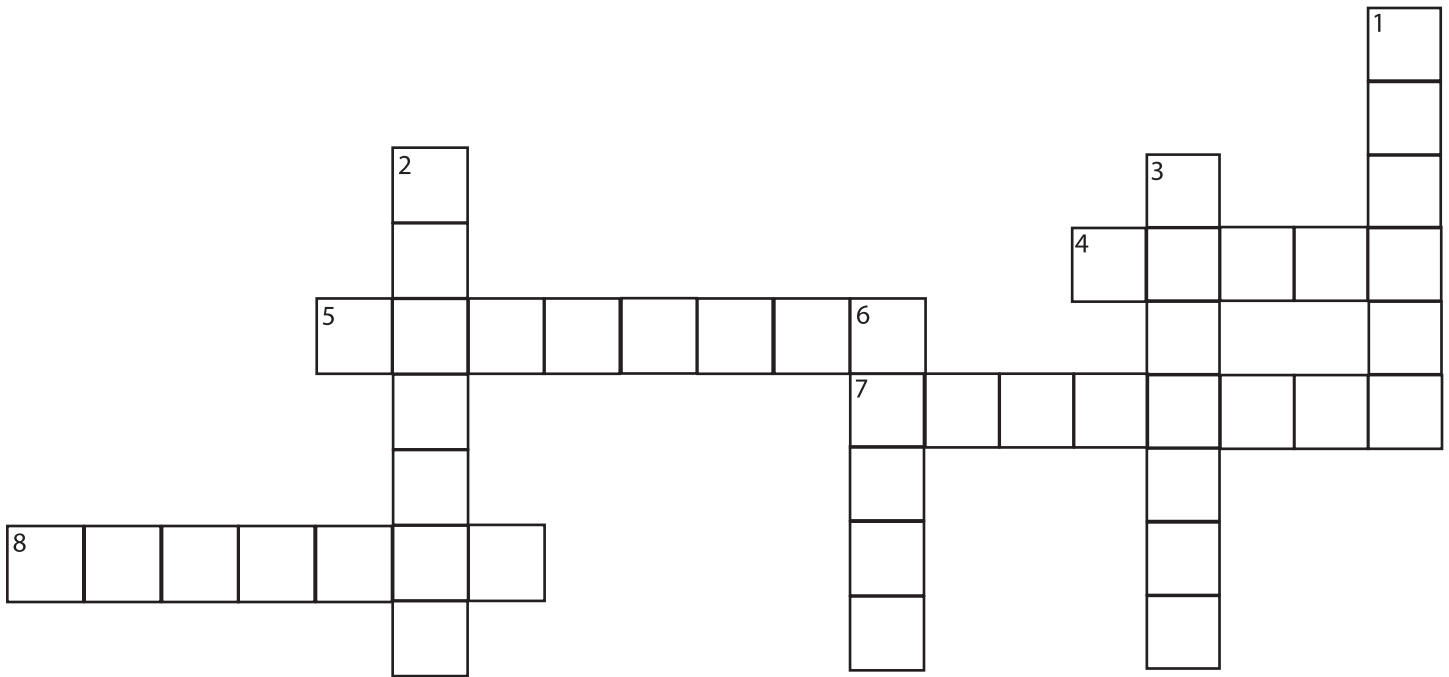
# MAP MAZE

X MARKS THE SPOT! HELP THE PIRATES NAVIGATE THROUGH THE MAZE ON THE MAP.



# CROSSWORD

USE THE STORY TO ANSWER EACH CLUE WITH ONE WORD!



## DOWN

1. \_\_\_\_\_ coating or painting makes metal castings colorful.
2. The process of joining two pieces of metal together, creating a bumpy line.
3. A place that makes metal castings.
6. A material that is heavier than plastic, naturally shiny and reflective, and makes a DING when you knock on it.

## ACROSS

4. Just like how water freezes from a liquid to ice, molten metal hardens from a liquid to a \_\_\_\_\_.
5. A type of metal that is easy to clean and x-ray safe. It's often used in medical or dental equipment.
7. The job of a person who works with blueprints.
8. A part made by melting metal and shaping it with a mold.

# WORD SCRAMBLE

UNSCRAMBLE THE LETTERS TO MAKE A WORD.

HINT: EACH WORD IS RELATED TO "THE HUNT FOR  
METAL TREASURE" BOOK!

GINCTAS

-----

RIPEAT

-----

MANUILMU

-----

REINGNEE

-----

EARESRUT

-----

YOURFND

-----

LMEAT

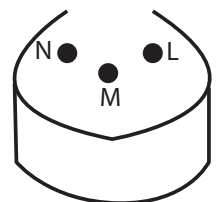
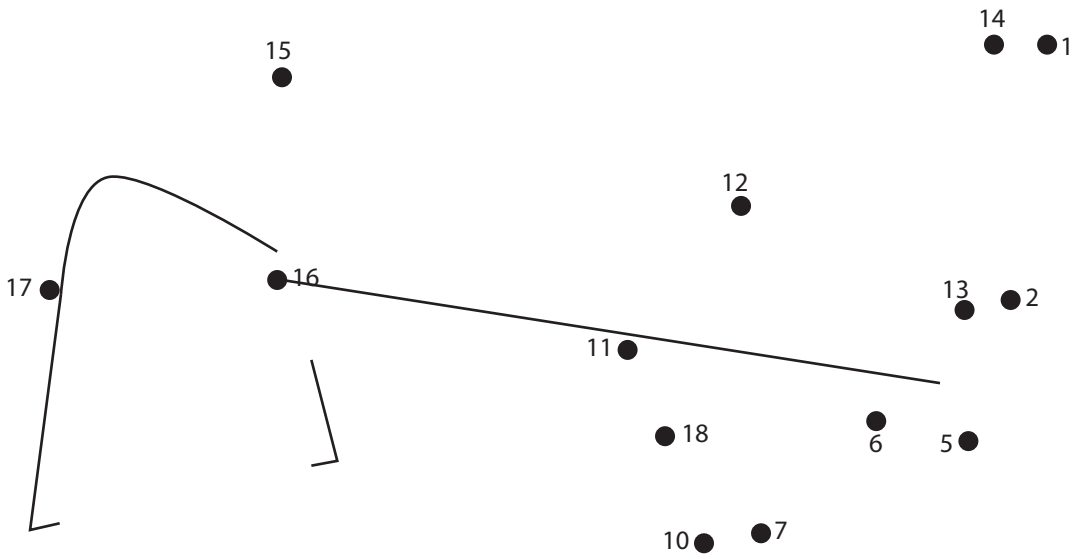
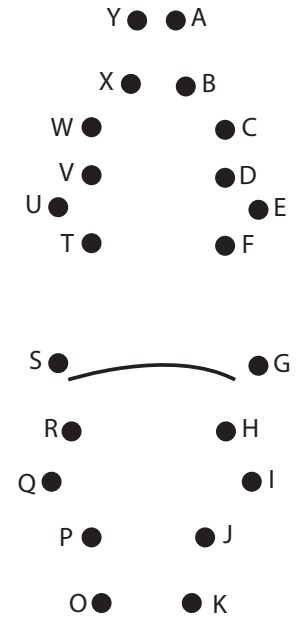
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FUNMARTGUICAN

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# CONNECT THE DOTS

REVEAL TWO METAL CASTINGS IN THE PARK!





# NUMBER PUZZLE

FILL IN THE SQUARES SO THAT EACH COLUMN, ROW, AND BOX CONTAINS ONE OF EVERY NUMBER

EXAMPLE

1	2	3	4
4	3	1	2
2	1	4	3
3	4	2	1

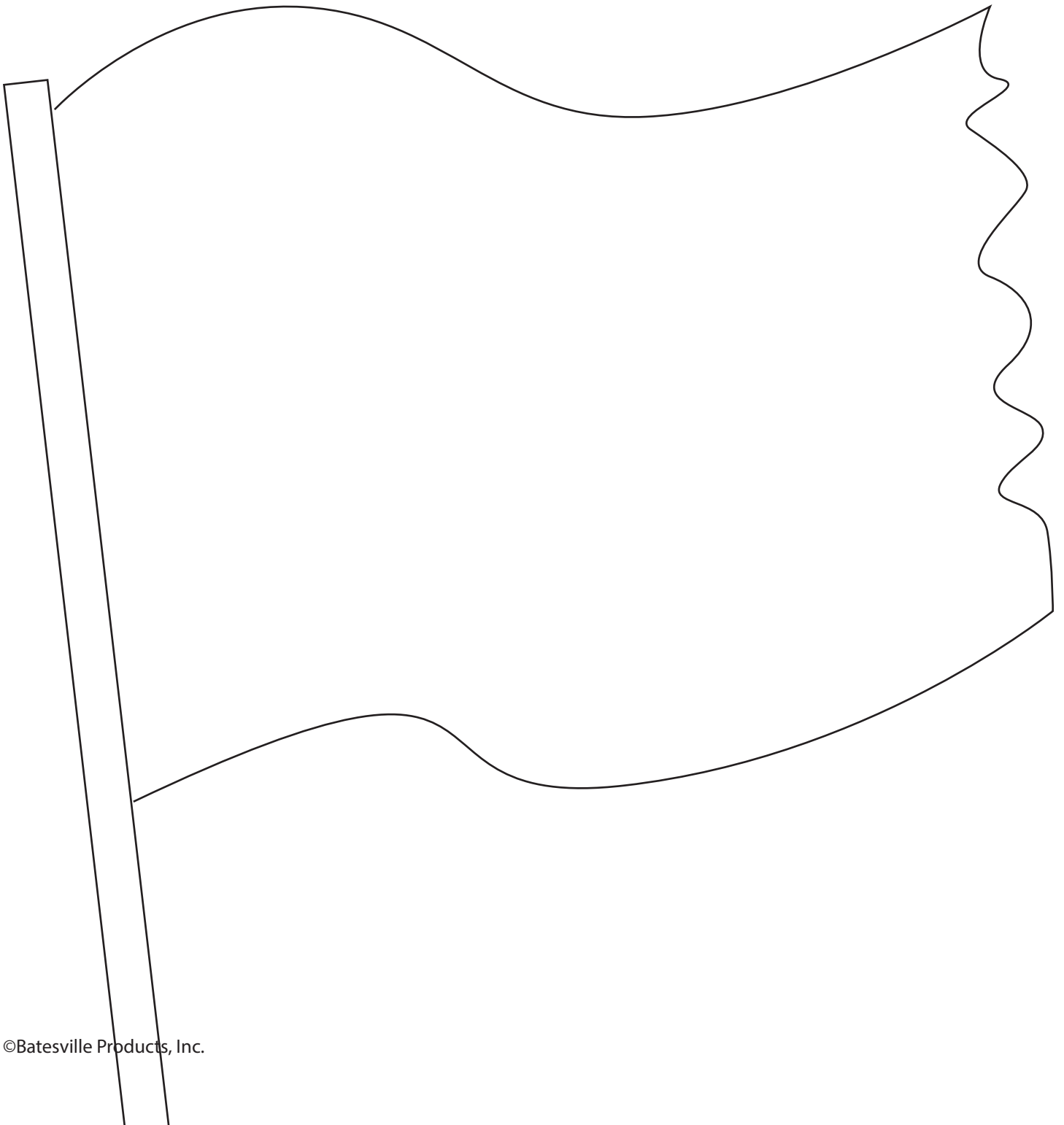
YOUR TURN!

4		2	1
	1	3	
3			2
	2	4	

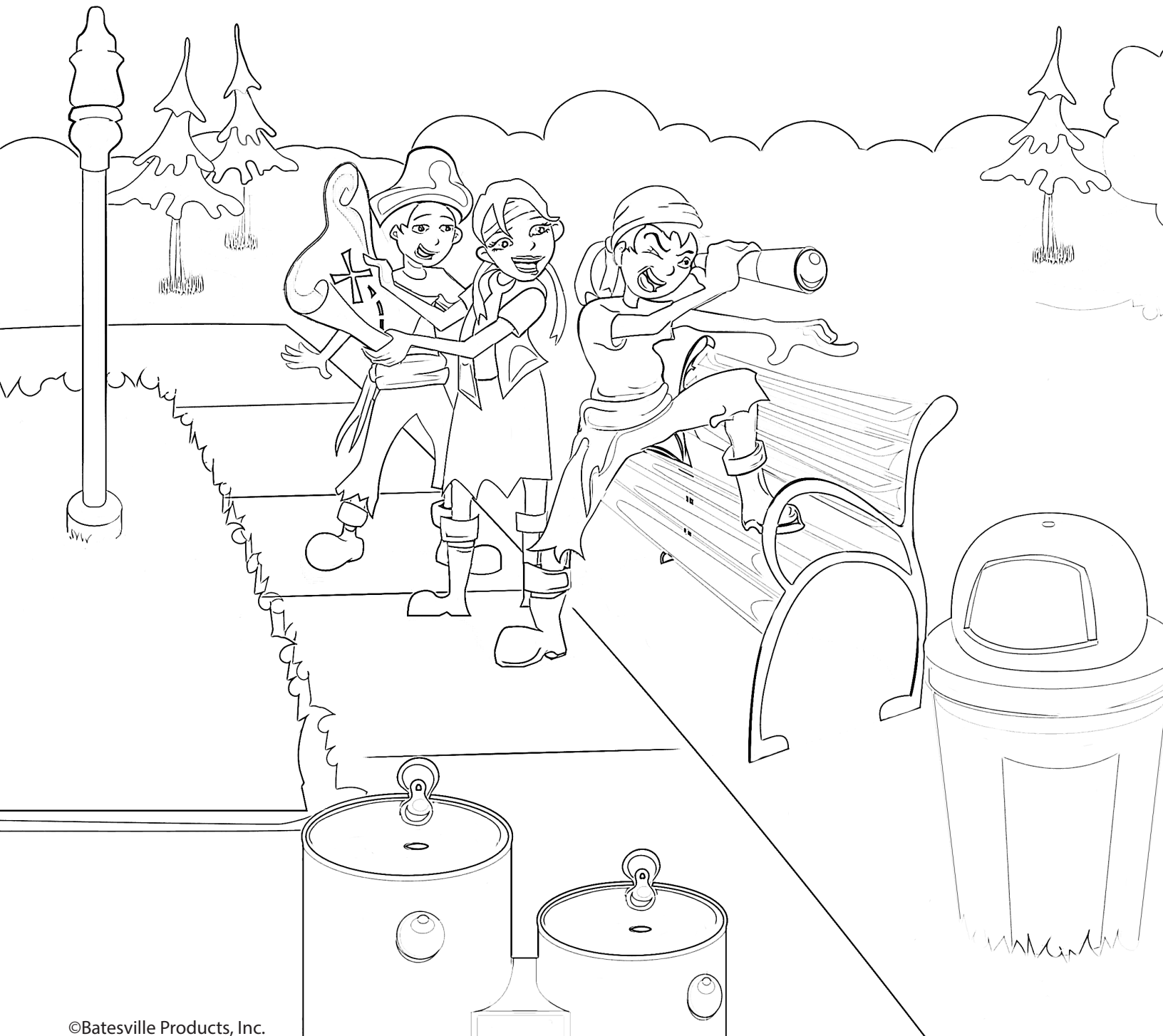
	3	4		7	8		1	2
6	7			9	5		4	8
1	9		3		2	5	6	
8	5	9	7	6	1			3
4	2	6				7	9	
	1	3		2	4	8	5	
			5	3		2		4
2	8	7	4	1	9	6	3	
		5		8	6	1	7	9

# DRAW

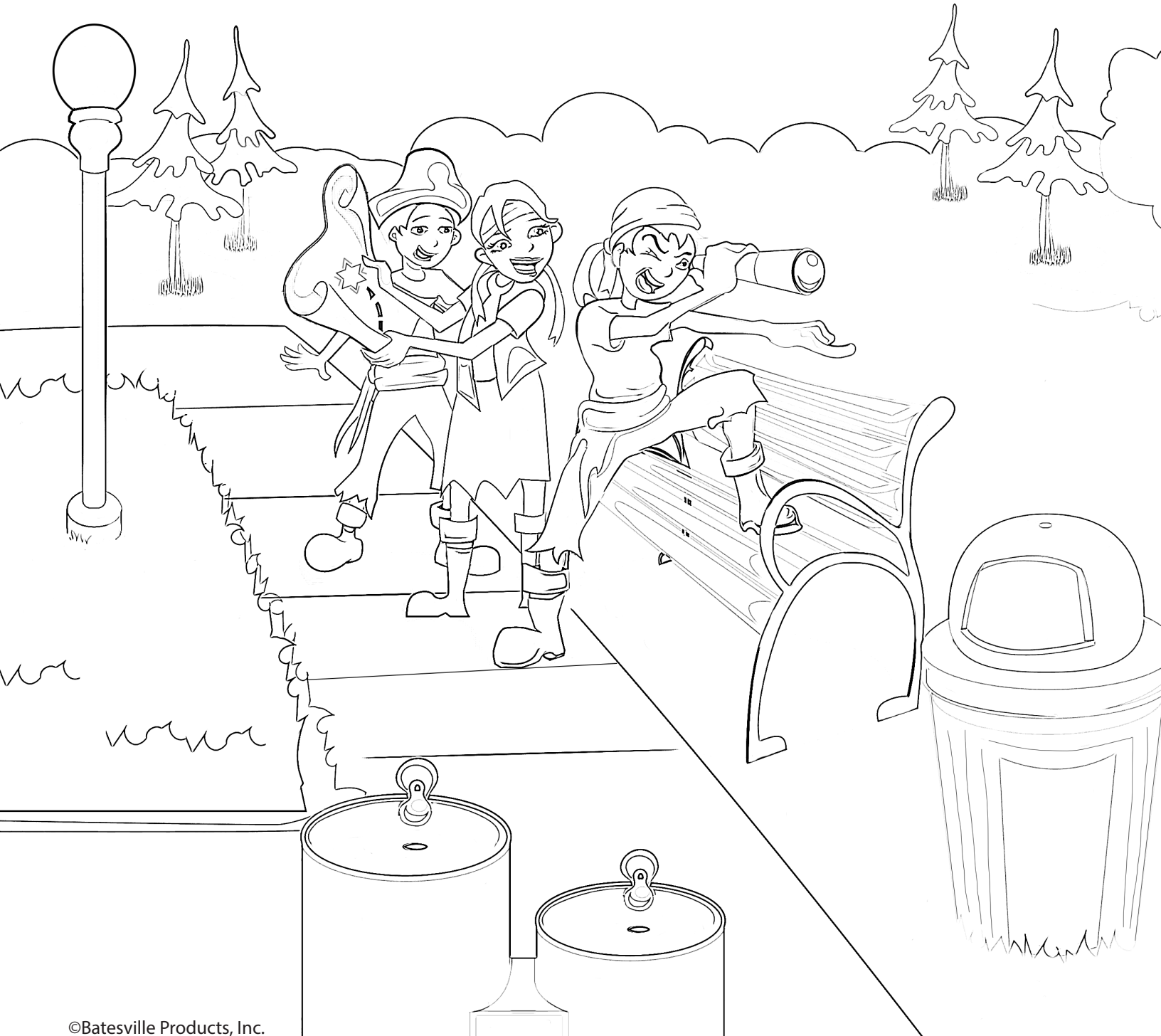
DESIGN YOUR OWN PIRATE FLAG!



# SPOT THE DIFFERENCE

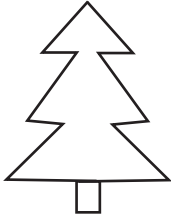


# FIND 8 DIFFERENCES BETWEEN THE TWO PICTURES.



# WHICH IS WHICH?

WHICH 1 OBJECT IS PROBABLY MADE OF METAL?



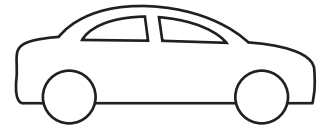
Tree



Pillows

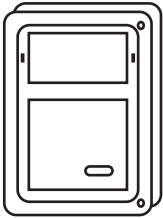


Milk Jug

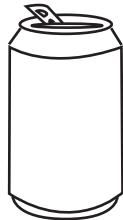


Car

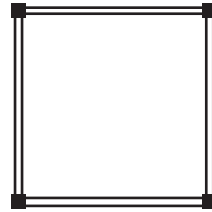
WHICH 1 OBJECT IS PROBABLY A METAL CASTING?



Electrical Box



Soda Can



Weldment



Cookie Cutter

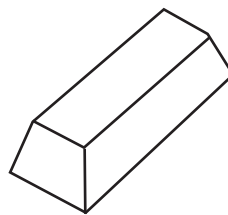
WHICH 1 OBJECT WOULD YOU PROBABLY FIND IN A FOUNDRY?



Boat



Flip Flops



Metal

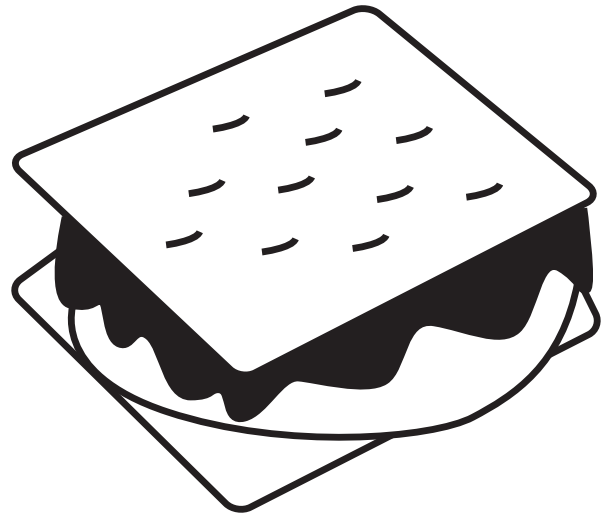


Doll

# BUILD YOUR OWN S'MORE FURNACE

## MANUFACTURING SKILL: CASTING

*Foundries use big 1,400F furnaces to melt metal. Build a solar-powered furnace to melt marshmallow and chocolate to make s'mores.*



## WHAT YOU'LL NEED

- Cardboard box with a lid (pizza box)
- Aluminum foil
- Plastic wrap
- Scissors
- Glue
- Tape
- Pencil
- S'mores ingredients! (graham cracker, marshmallow, chocolate)

**1** Have a parent help you cut a three-sided flap in the lid of the box. You want to be about 1 or 2 inches away from the edge of the box.

**2** Glue aluminum foil to the inside of the box. Foil should be on the underside of the lid flap to reflect sunlight into your oven, and the inner bottom of the box where your s'mores will go.

**3** Tape plastic wrap across the opening that you cut in lid of the box. Now, you can use markers to decorate your oven if you'd like.

**4** On a hot day, assemble your s'mores inside your oven.

**5** Set your oven outside. Use a pencil or stick to prop open the flap in the lid. Make sure the opening is facing the sun. The heat from the sun will make your furnace hot enough to melt the chocolate and puff the marshmallows!

**6** Let your s'mores bake in the sun for about an hour and enjoy!

# CHOCOLATE PERMANENT MOLD CASTING



## MANUFACTURING SKILL: CASTING

*In permanent mold casting, we melt metal and ladle it into a reusable mold. Let's do the same thing with chocolate!*

## WHAT YOU'LL NEED

- 1 bag chocolate chips
- 2 TBSP coconut oil
- Fillings! (Nuts, fruit, cereal, caramel, coconut, peanut butter, marshmallow, pretzels, etc.)
- Slow cooker
- Ice cube tray
- Spoon

**1** Melt the chocolate chips and coconut oil in your slow cooker on low heat. Use a spoon to stir occasionally. At BPI we melt aluminum in big furnaces, just like how you're melting chocolate in a slow cooker! But, while your "furnace" melts chocolate at 100 F, ours melts aluminum at 1,400 F!

**2** While your chocolate is melting, prepare your ice cube tray. Make sure it's clean and dry. This will be your "permanent mold." Your finished candies will be the shape of each divot in your mold. At BPI, we also have reusable molds. We use our permanent molds to shape aluminum into objects used everyday like handle bars, firetruck sirens, or electrical boxes.

**3** Once the chocolate is melted, use a spoon to scoop it out of your "furnace" and pour it into the ice cube tray. Only use half of the chocolate. Fill each cup just enough to cover the bottom, then use your spoon to cover the sides with chocolate. At BPI, we use big ladles (just like your spoon!) to scoop aluminum out of our furnace and pour it into our molds.

**4** Put your ice cube tray in the freezer for 3 minutes to solidify. Our aluminum castings also take around 3 minutes to go from a liquid to a solid!

**5** After 3 minutes, take out your ice cubes and add toppings of your choice! Repeat the process of scooping and pouring the remaining chocolate to cover your fillings. You can also add sprinkles or put pieces on top to decorate each candy.

**6** Freeze for 20 minutes or until completely set. Then, pop each candy out of your ice cube tray. Enjoy your chocolate castings!

# RAIN GAUGE

## MANUFACTURING SKILL: INSPECTION

*We measure and inspect castings to make sure they're the right dimensions. Build a rain gauge that you can inspect after storms to measure the rainfall!*

### WHAT YOU'LL NEED

- Empty plastic soda bottle
- Scissors
- Tape
- Rocks
- Water

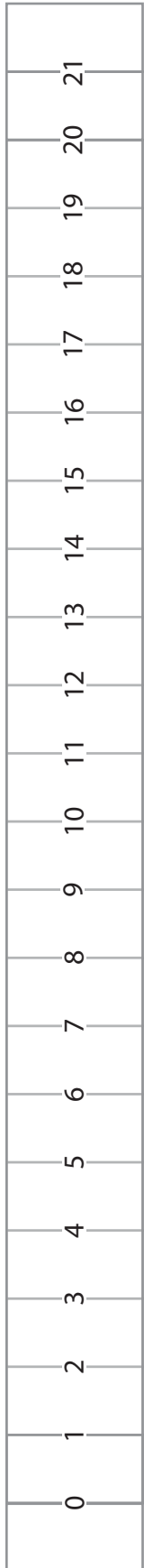
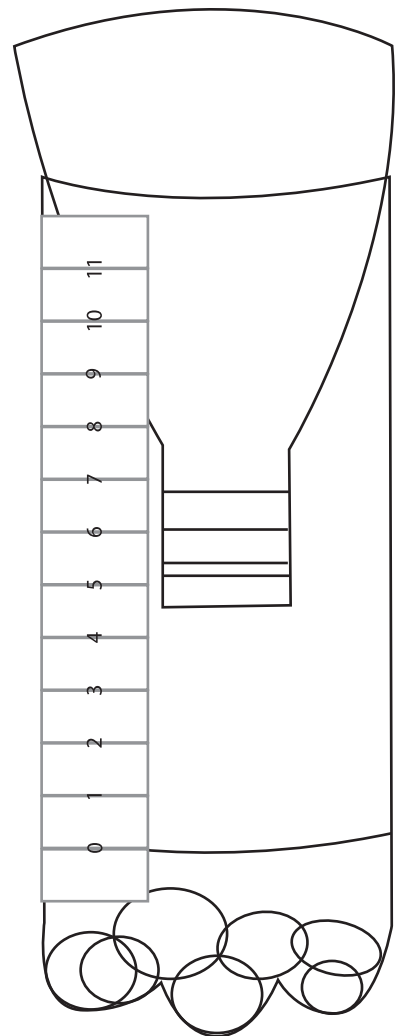
**1** Have a parent help you cut the top off an empty plastic soda bottle. Cut just below where the bottle begins to narrow. Save this for later.

**2** Use scissors to cut out the ruler. Tape this ruler to the bottom piece of your bottle.

**3** Put gravel in the bottom of the bottle to weigh it down.

**4** Take the top piece of your bottle. Remove the lid. Set it upside down in the bottom section of the bottle, creating a funnel. Use tape to secure it.

**5** Fill your rain gauge with water until the water level reaches the 0 mark. Now it's ready to measure! Before a storm, set it outside away from trees or shelter. After the storm, check your gauge to see how many centimeters it rained!

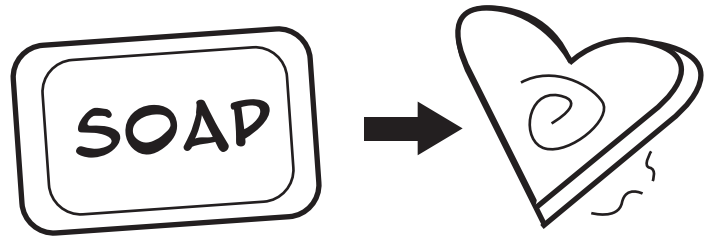




# SOAP CARVING

## MANUFACTURING SKILL: MACHINING

*CNC machines use computer programs to precisely cut and drill into castings. Just like CNC machines, you'll use tools to precisely cut and shape a bar of soap.*



**1** You're going to use tools to chip away pieces of this bar of soap. What will you make? Will you carve shapes and letters into the bar? Will you change the bar into a heart shape? Use the paper and pencil to draw a blueprint of your design.

**2** Carefully chip away small pieces of the soap to carve your design. Does your soap match the blueprint?

## WHAT YOU'LL NEED

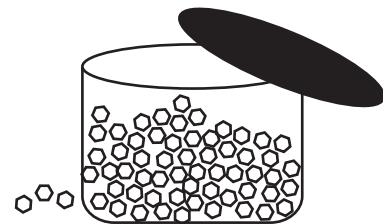
- Paper
- Pencil
- 1 Bar of soft ivory soap
- Carving tools: spoon, popsicle stick, toothpick, or plastic knife (be careful!)

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# SUGAR SCRUB

## MANUFACTURING SKILL: POLISHING

*Polishers make castings smooth and shiny by rubbing them with gritty belts. Let's make a gritty sugar scrub that makes skin smooth!*



**1** In a bowl, combine sugar and oil.

**2** Pack into your small container with a lid. This makes a perfect gift! The scrub can be used once a week in the shower or bath. Scoop a small amount into your hand. Gently rub on damp skin in circular motions. Avoid sensitive skin, like your face. Rinse.

## WHAT YOU'LL NEED

- 1/2 cup granulated sugar
- 3 tablespoons oil (olive, coconut, grapeseed etc.)
- Bowl
- Spoon
- Small container with a lid

# POWDER COATED COOKIES

## WHAT YOU'LL NEED

- Oven
- Baking sheet
- Cookie dough
- Small bowl
- Powder (sprinkles, sugar, powdered sugar, or cinnamon sugar)

## CLEANING & PREPARING

Before powder coating, castings are cleaned to remove any contaminants. Then, they are prepared with a treatment that helps adhesion.

**1** Preheat the oven to 350 degrees Fahrenheit. Wash your hands to remove any contaminants. Use a nonstick baking sheet or line a clean baking sheet with parchment paper or lightly grease with oil to prevent sticking.

**2** Take out your pre-made cookie dough, or mix the ingredients to make cookie dough. Roll your cookie dough into small, equally-sized balls. These will be your "castings."

## COATING

A special spray gun covers the casting in colored powder.

**3** Dump 1/2 cup of your "powder" into a bowl. You can use sprinkles, granulated sugar, powdered sugar, or cinnamon sugar.

**4** Apply the "powder coating" to your "castings." Roll each cookie dough ball in the powder. Make sure the entire surface is coated.

## CURING

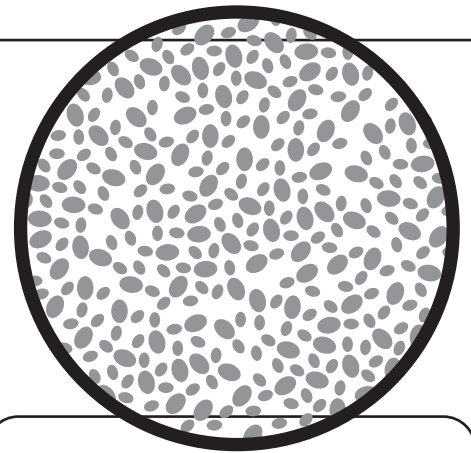
The coated parts go in an oven. The powder becomes a smooth, uniform layer on the casting. Once removed from the oven and cooled, it's ready to go to the customer!

**5** Arrange the powder-coated cookie dough balls on your prepared baking sheet. Leave enough space them to allow for spreading.

**6** Place the baking in the preheated oven and bake for about 10 minutes or until set. Once baked, remove from the oven. Let cool. And enjoy!

## MANUFACTURING SKILL: POWDER COATING

*Powder coating is a popular way to make metal castings colorful. There are 3 steps to powder coating: cleaning and preparing, applying the coating, and curing.*



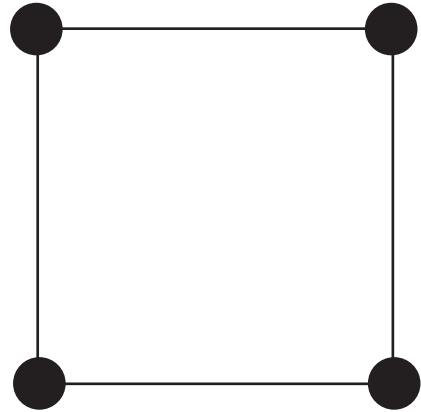
### SUGAR COOKIE DOUGH

- 1 cup softened butter
- 1/2 cups granulated sugar
- 1 large egg
- 1 teaspoon vanilla extract
- 2 3/4 cup all purpose flour
- 1 teaspoon baking soda
- 1/2 teaspoon baking powder

# FOLLOW THE BLUEPRINT

## MANUFACTURING SKILL: ENGINEERING

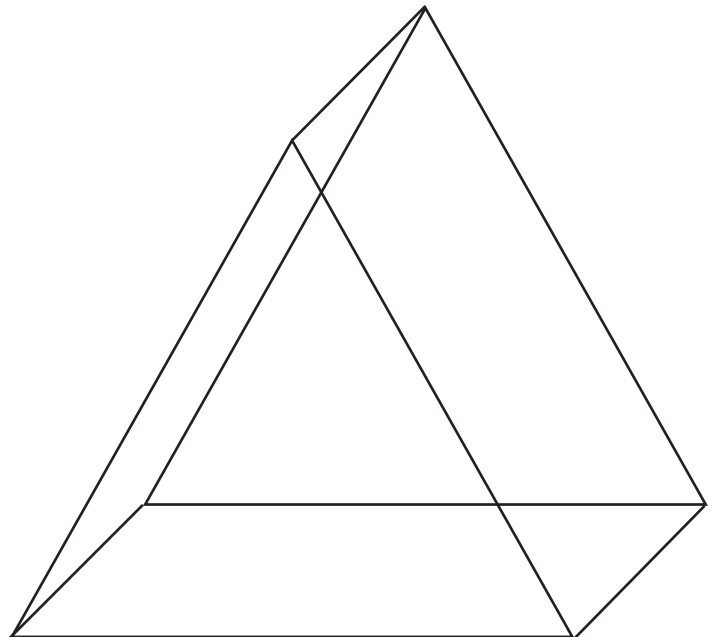
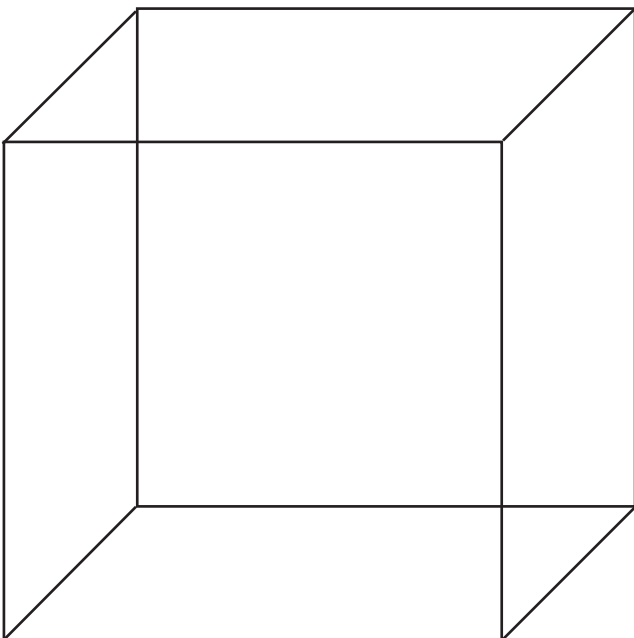
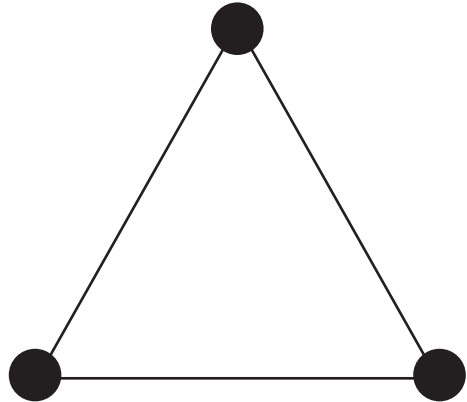
*Engineers follow blueprints, or maps, of what they are going to manufacture, or build. Can you use marshmallows and toothpicks to build the objects in the blueprint?*



## WHAT YOU'LL NEED

- Mini marshmallows
- Toothpicks

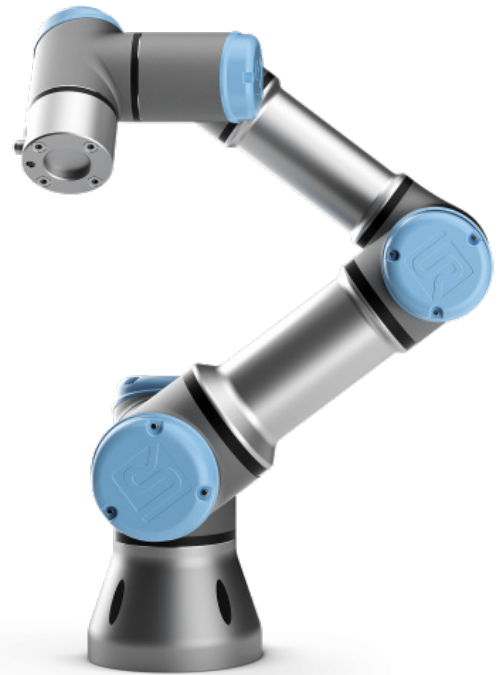
Below is a blueprint, or map, of what you need to build. Use the materials to build a square, cube, triangle, and prism.



# BUILD A ROBOT

## MANUFACTURING SKILL: ENGINEERING

*Manufacturing facilities use robots to help produce castings. In BPI's machine shop, we have a robot that moves metal castings in and out of a CNC machine. Let's build your own robot that can move metal objects from one place to another!*



## WHAT YOU'LL NEED

- Coloring Materials
- Scissors
- Glue
- Tape
- Small Magnet
- Fastener Pins (or carefully use push pins)
- Paper clips or other small magnetic objects
- Use the next two pages of this book!

**1** Color pieces A, B, and C.

**2** Cut out pieces A, B, and C along the dotted lines. You should have 3 ovals.

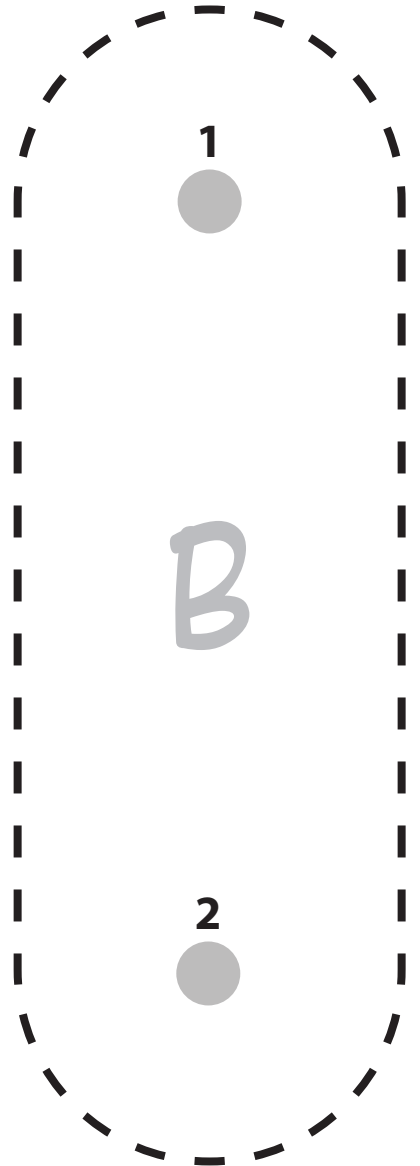
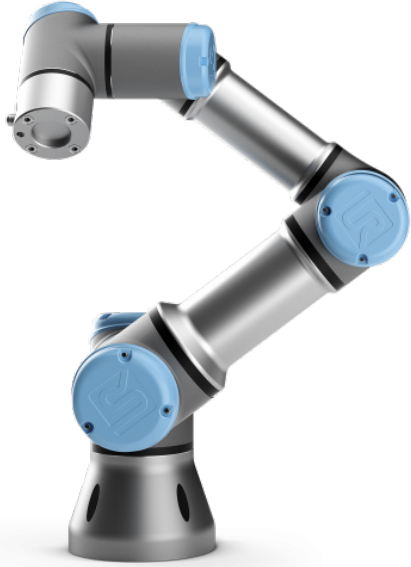
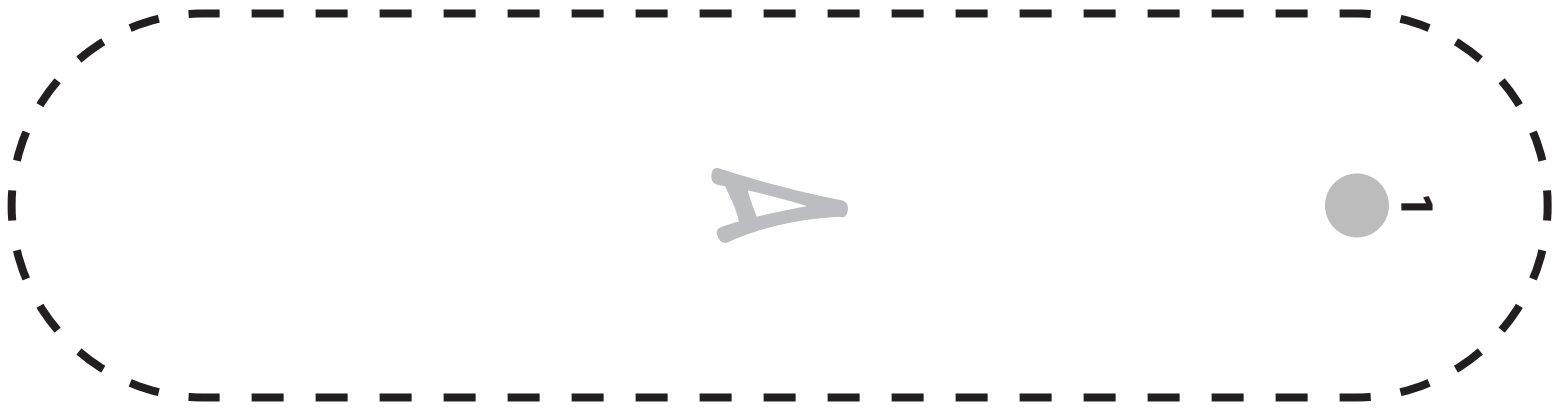
**3** Find hole #1 on piece A (the longest oval). Find hole #1 on piece B. Put B on top of A. Line up holes #1, put your pin through, and secure it. (PIECE B SHOULD BE ON TOP!)

**4** Find hole #2 on piece B. Find hole #2 on piece C (smallest oval). Line up these holes and put your pin through.






**5** Find the magnet picture on piece C. Tape your magnet on top of the picture.

**6** On your next piece of paper, use your glue stick to glue piece A where it says "GLUE." Make sure you line it up on the dotted lines, and ONLY glue piece A.

**7** Place a paper clip in the circle with a paper clip icon. Use your robot to move paper clips from one circle to the other!

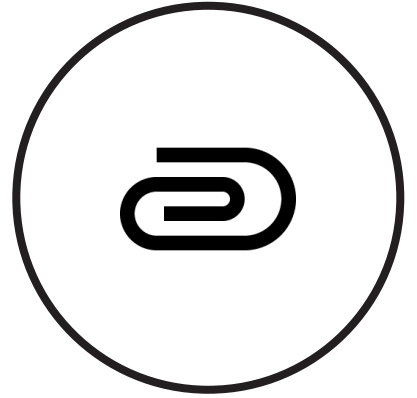


# BUILD A ROBOT

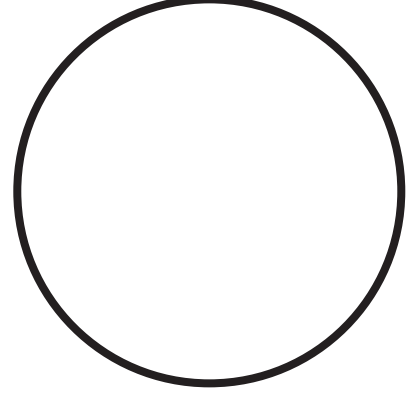
1. Color 
2. Cut 
3. Pin 
4. Magnet 
5. Glue (A only!) 
6. Play! 



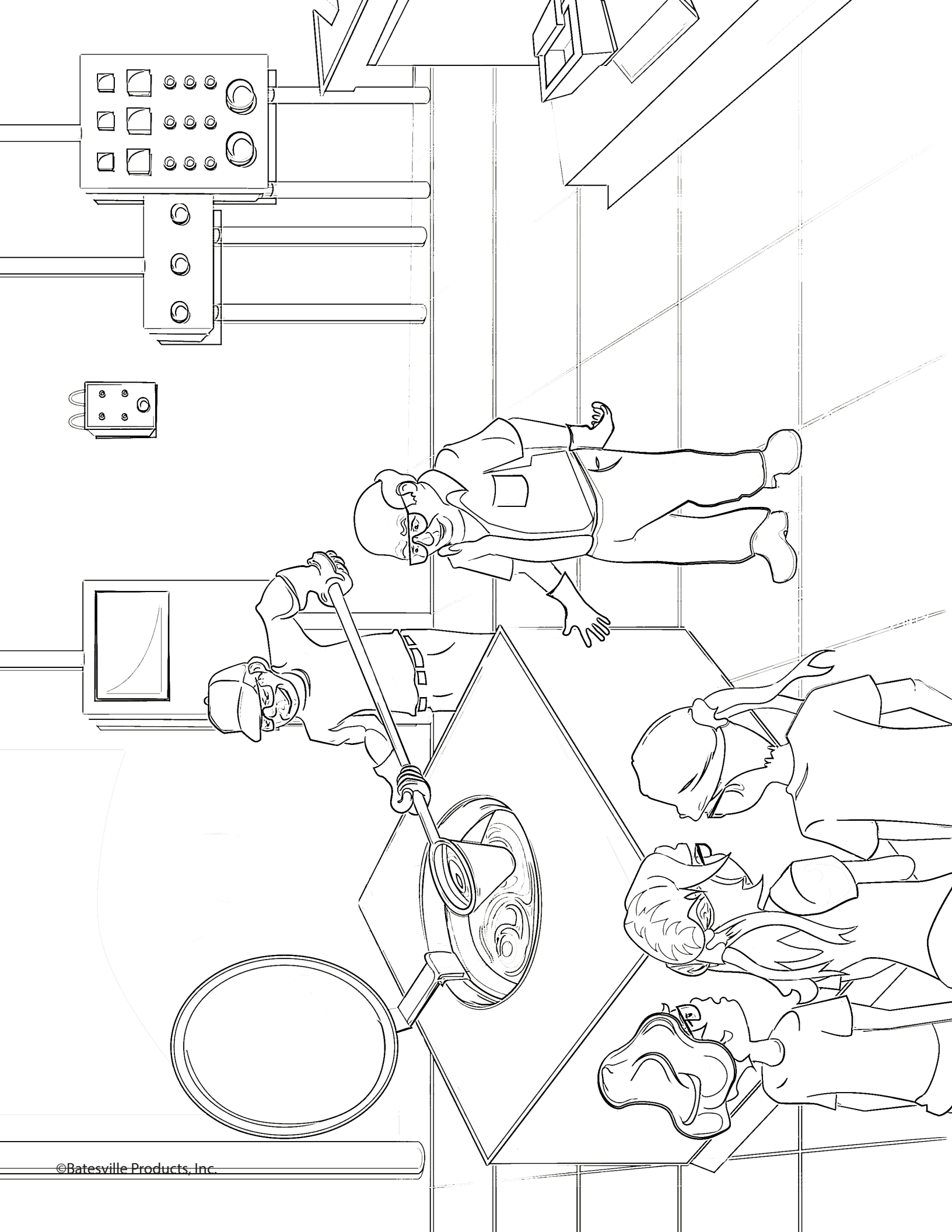
Watch a real  
robot do the  
same thing!



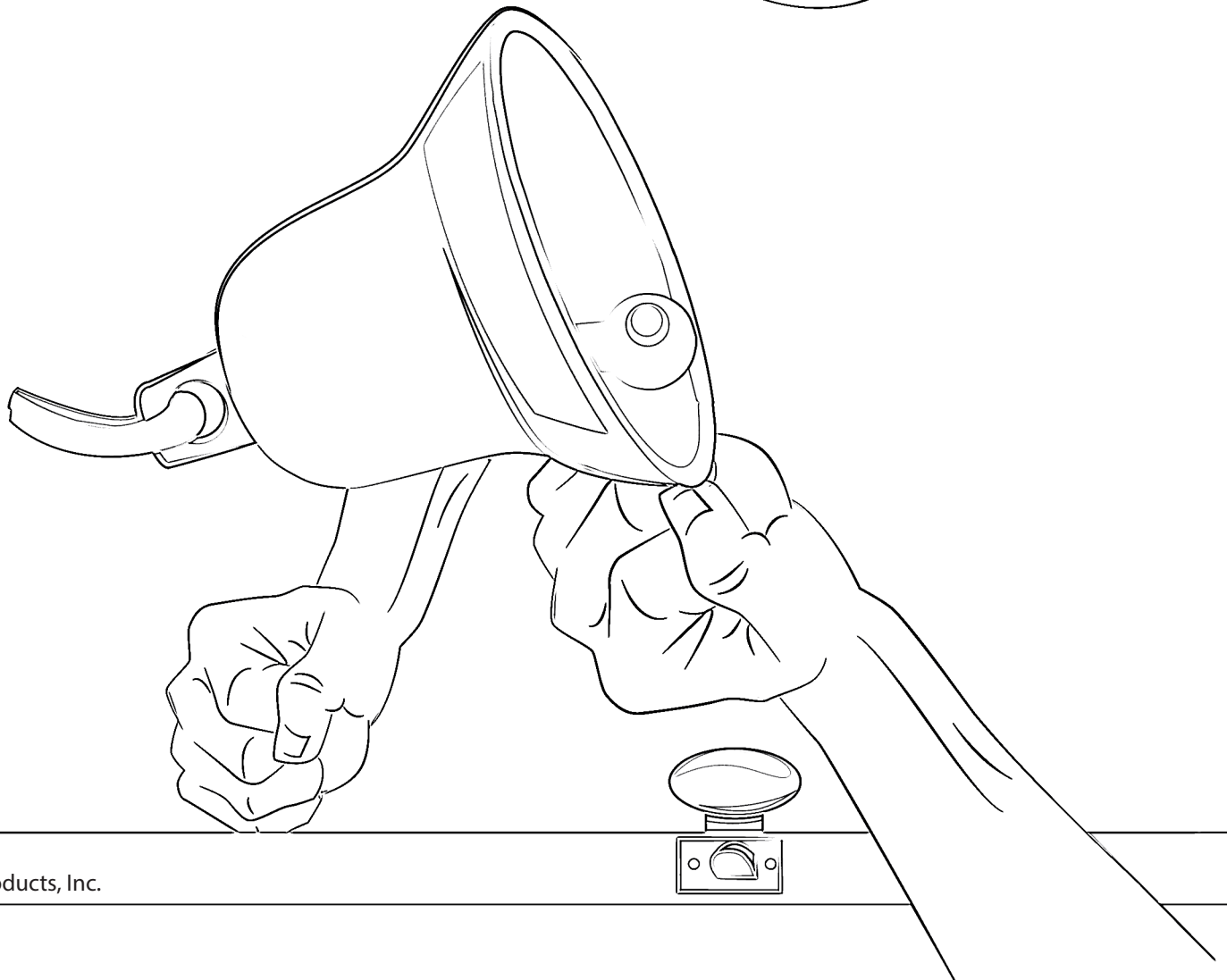
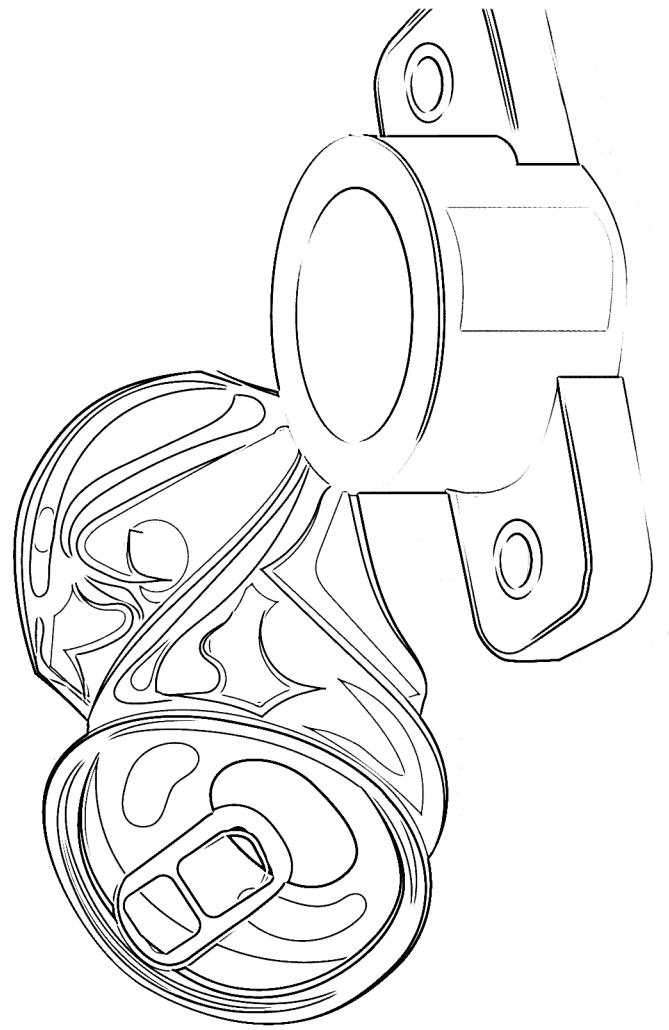
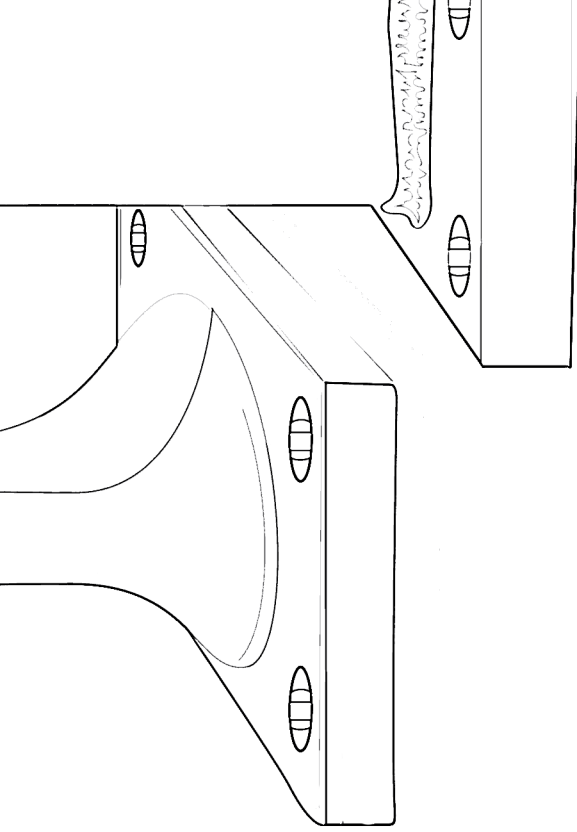
Use your  
robot  
to move  
paper  
clips from  
one circle  
to the  
other!

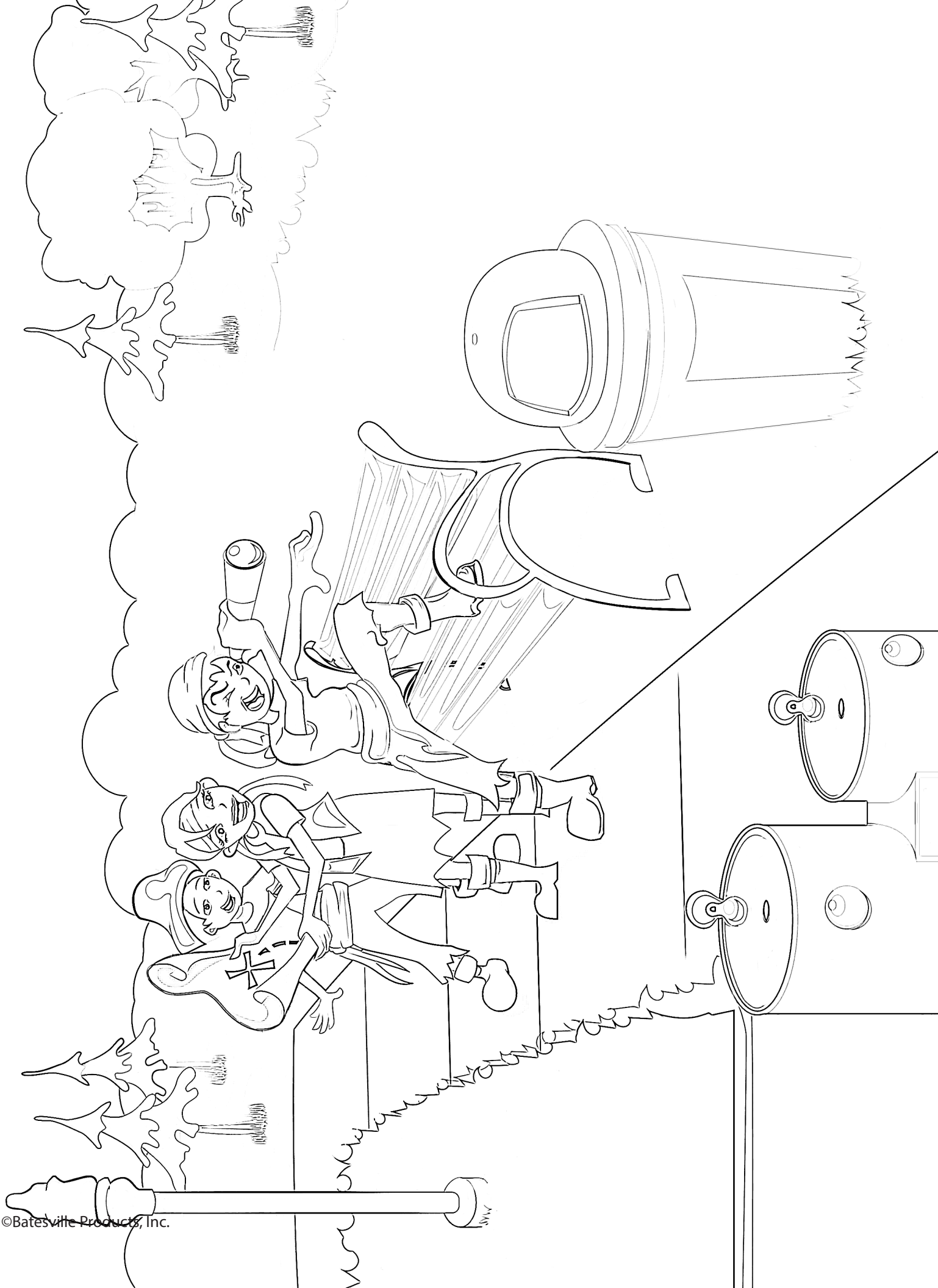




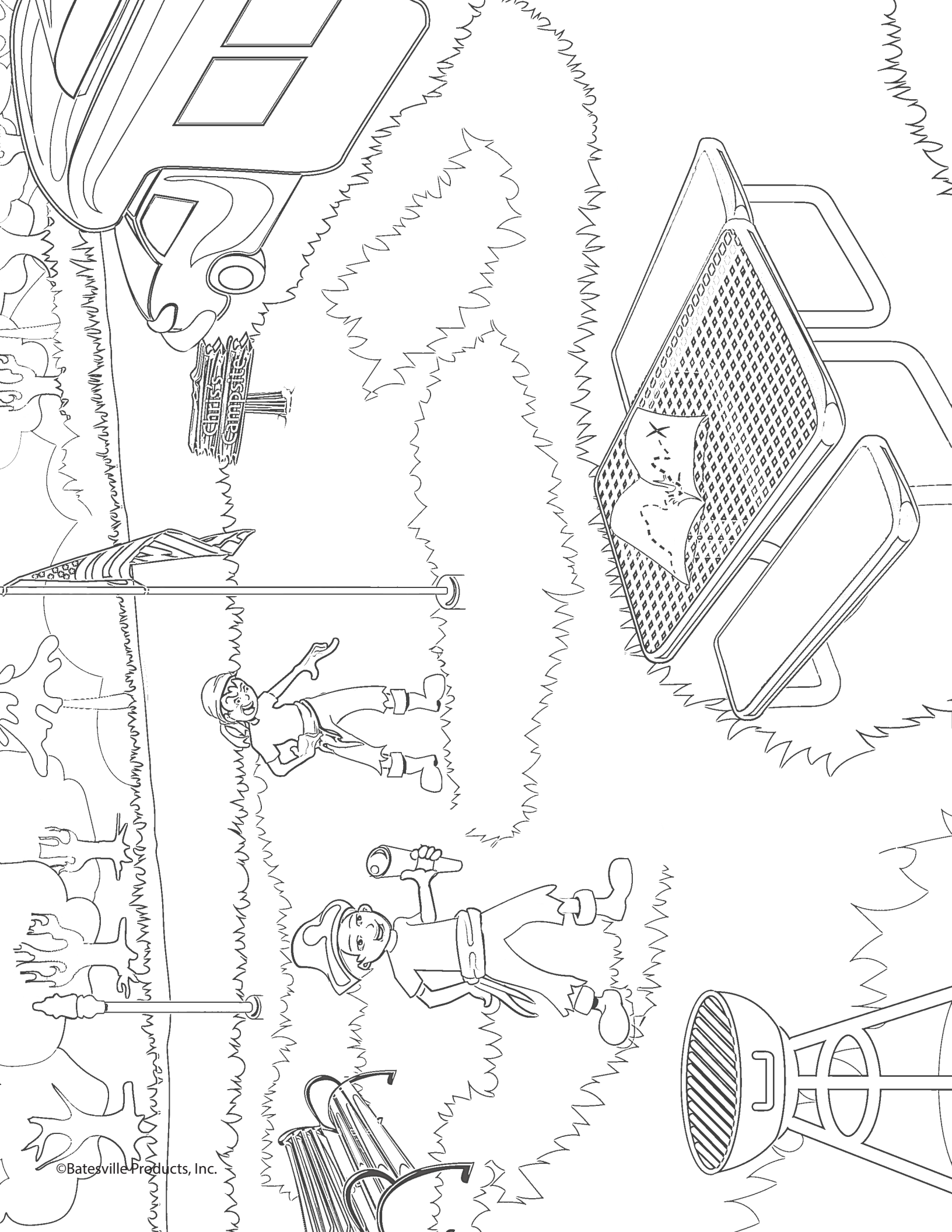


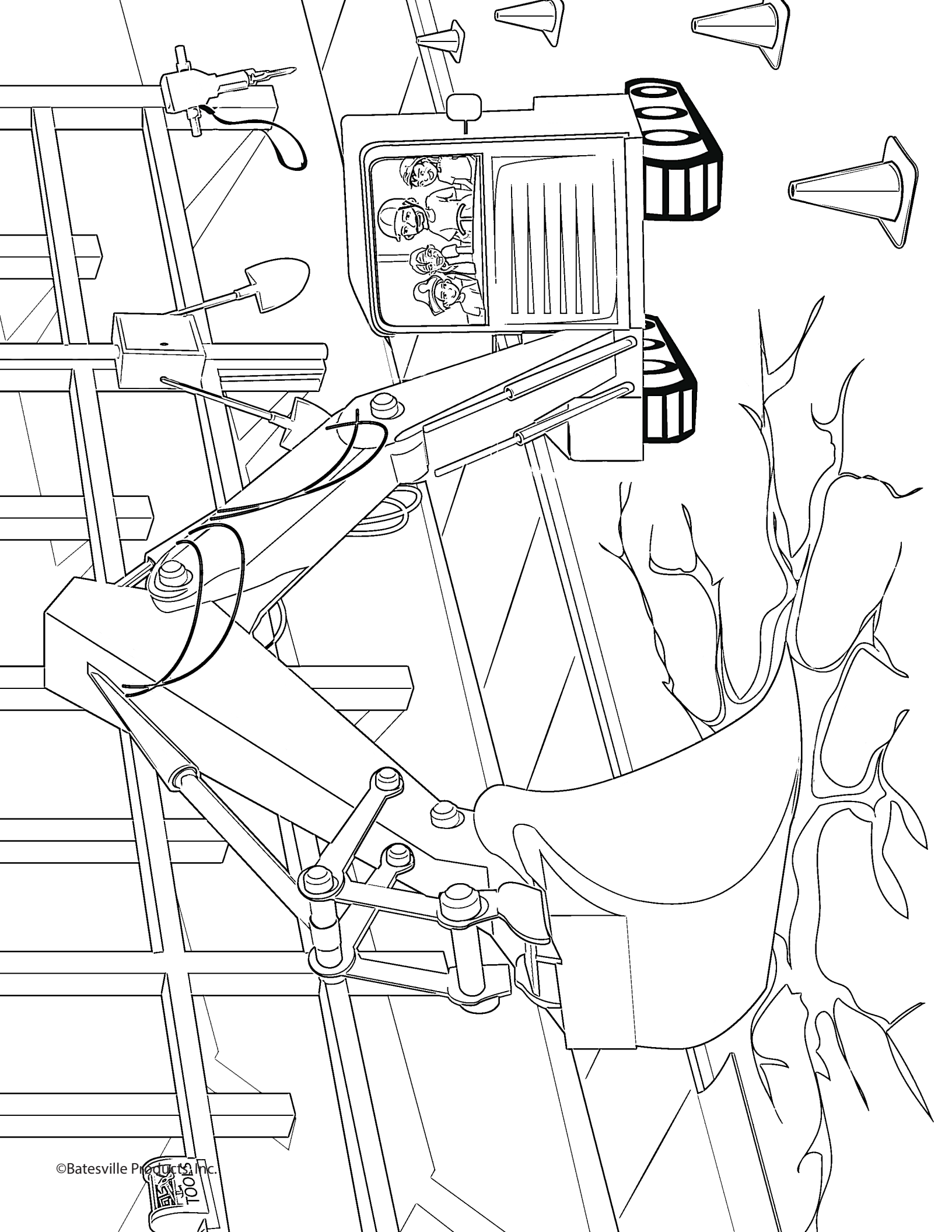




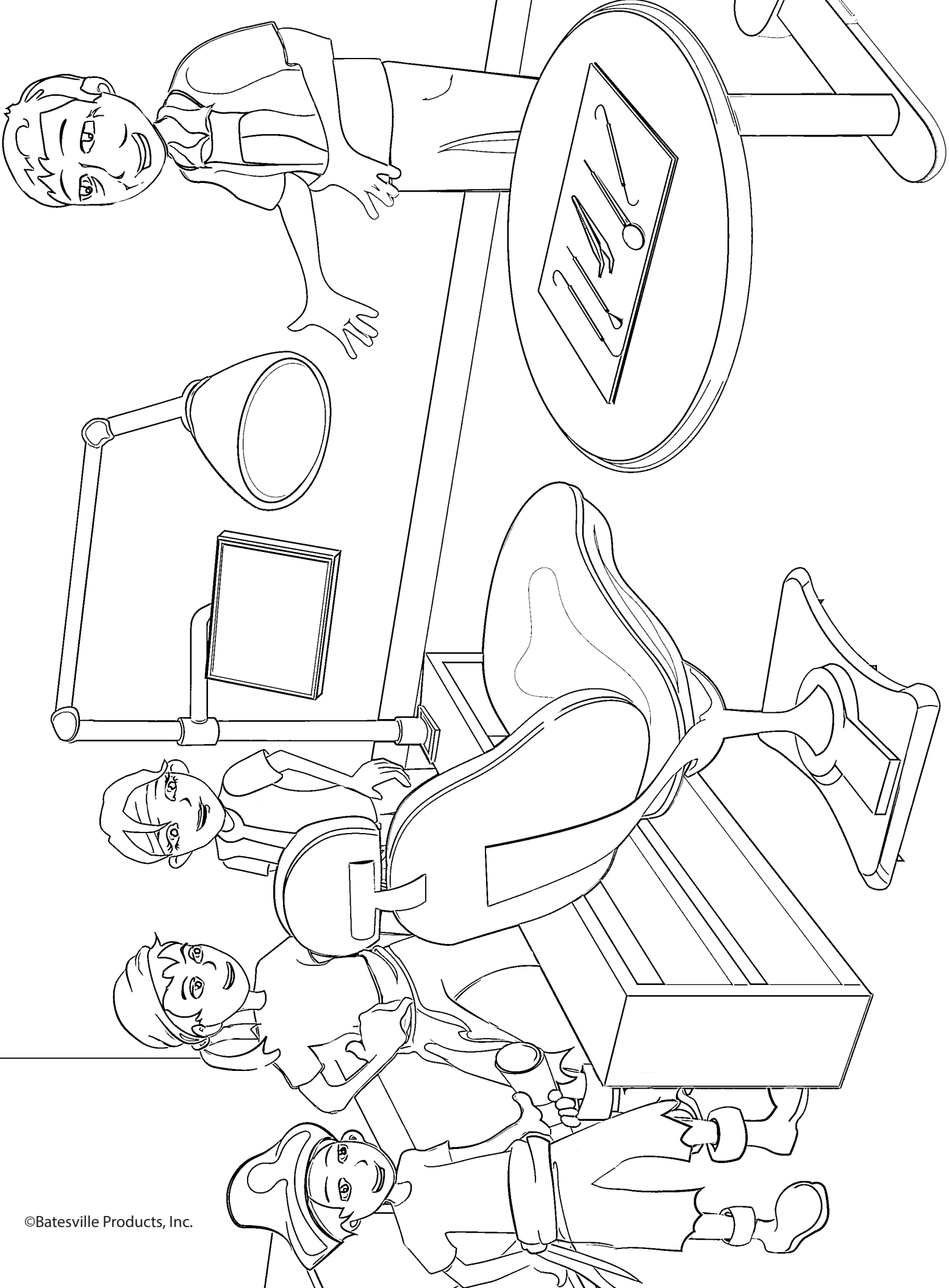


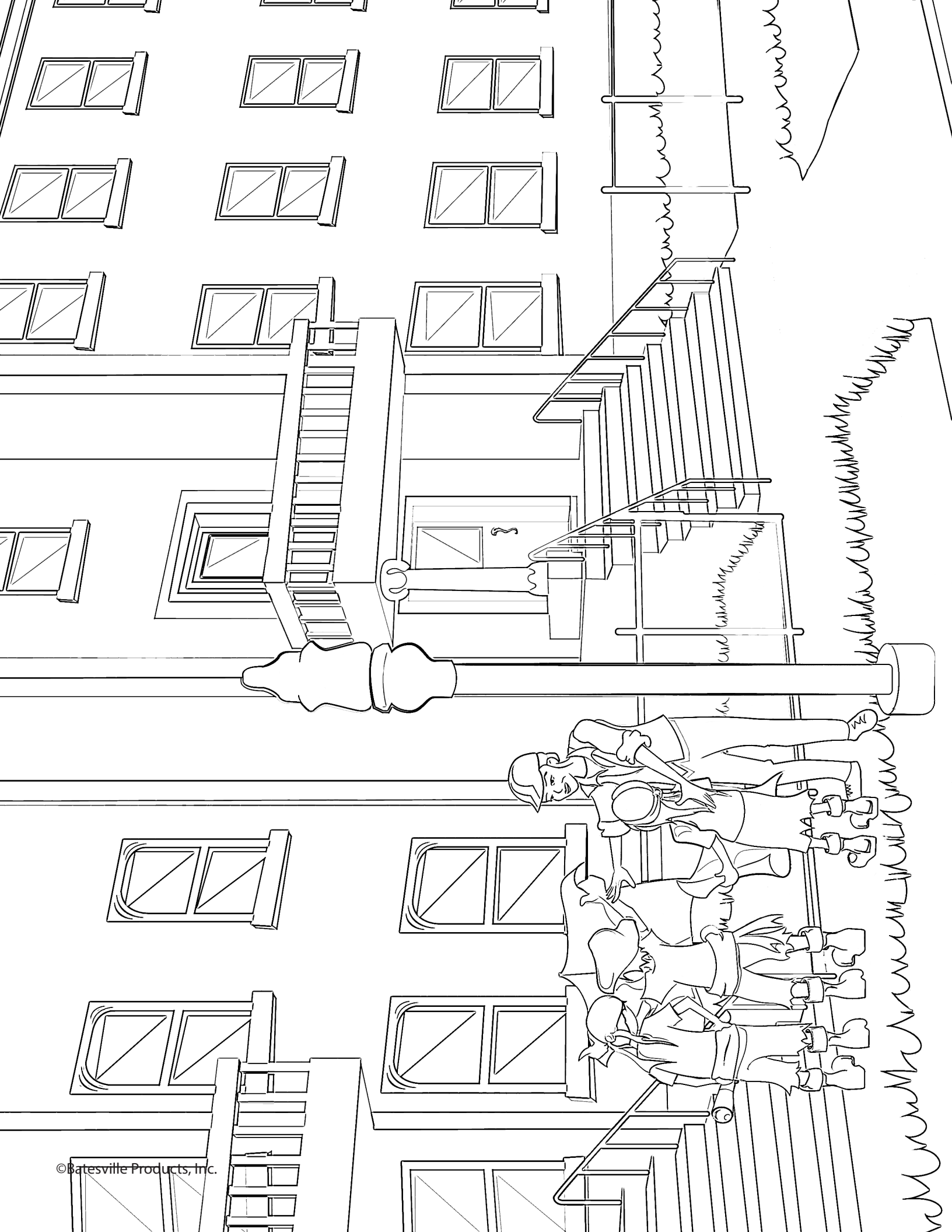


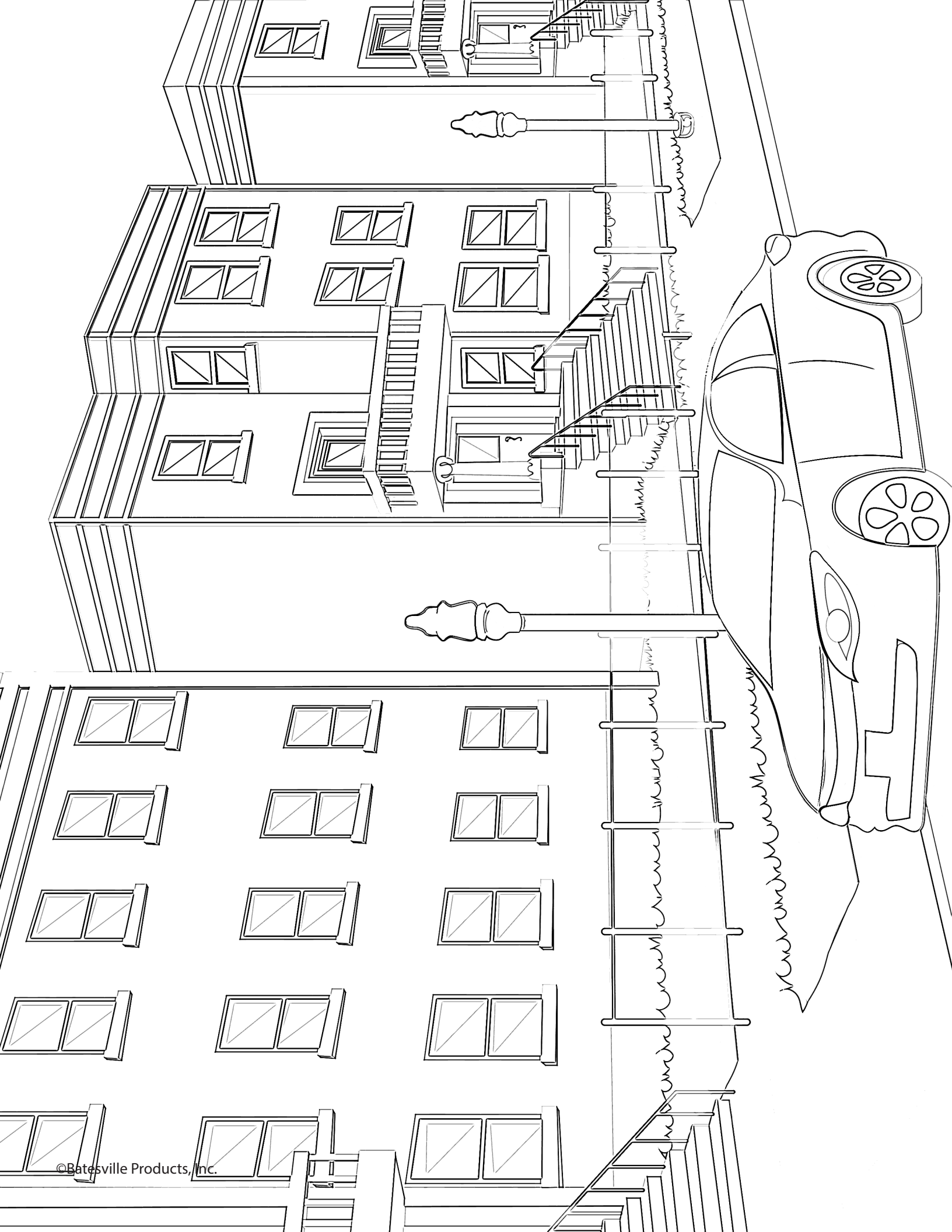








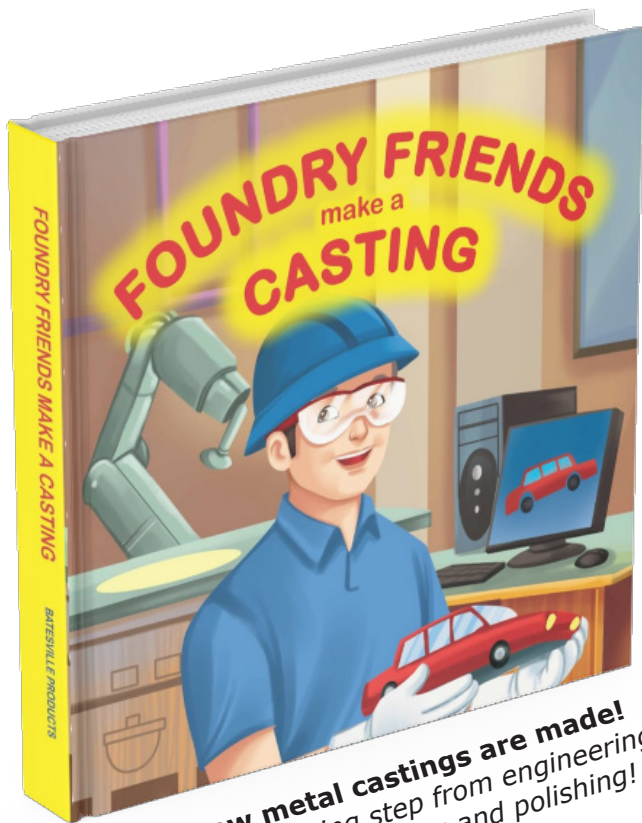




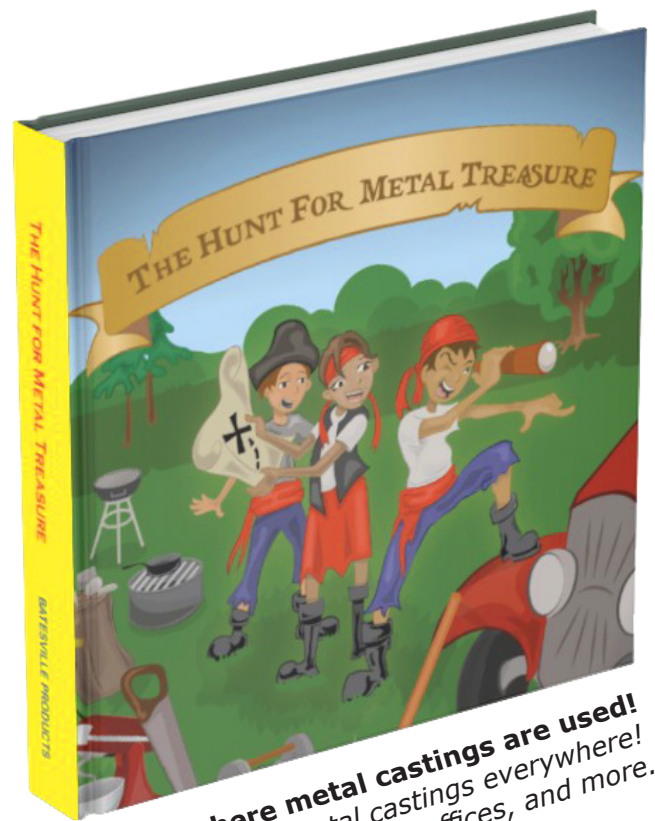




# MANUFACTURING FOR KIDS!



**Learn how metal castings are made!**  
Every manufacturing step from engineering and casting to machining and polishing!



**Learn where metal castings are used!**  
3 friends find metal castings everywhere!  
Parks, kitchens, dentist offices, and more.



Watch videos and print more activity pages on the Batesville Products website!

