



## **Pre- and Post-Visit Activities**

### **The Simple Machines Program at the Mercer Museum**

**Grade Levels:** Grades 3-6

**Program Summary:**

The Simple Machines Program was inspired by the Mercer Museum's collection of pre-Industrial hand tools. In this program, students investigate examples of the six simple machines, including the inclined plane, wedge, screw, lever, and more. The students then explore how these machines/hand tools make work easier.

Students are encouraged to make connections between the historical tools exhibited in the museum and the fundamental scientific and technological principles that lie behind them.

The following suggested activities are for students visiting the museum and participating in The Simple Machines Program. These activities are designed to be supplemental material to help students get the most out of their experience.

## **Pre-Activities:**

### **Activity 1: Levers Experiment**

During the Simple Machines Program, students will see how different tools are levers. This experiment explores how the position of a fulcrum on a lever lessens the effort needed to move a load.

#### **Supplies:**

- Wide flat wooden ruler
- Hexagonal (not round) pencil
- 20 1½" steel washers
- Masking tape
- Pen or marker

*(Note: If this activity is to be done in groups, multiply the supplies by the number of groups)*

#### **Procedure:**

1. Using the masking tape, instruct the students to label the ruler at the 1 inch mark with "F" for "Force". Label the 12-inch mark with "L" for "Load".
2. Put the pencil under the lever at the 4-inch mark. Stack 4 washers (weights) on the Load end. The pencil will act as the fulcrum.
3. Gently use one finger to press down on the Force End of the lever/ruler to lift the Load. Students should pay attention to how heavy the Load feels.
4. Carefully add weights one at a time on the Force End of the lever/ruler, just until the Load weights at the other end are lifted up. Ask: How much force (in # of washers) was needed to lift the Load?
5. Remove the force weights and slide the fulcrum under the 6-inch mark. The four Load weights should still be on the Load End.
6. Repeat steps 4-6 two more times, each time sliding the fulcrum higher by two inches.
7. Discuss and explain the outcome of the experiment. Levers help do work by trading force or effort for distance. By changing the location of the fulcrum, the effort can increase or decrease to move the same load.

## Activity 2: Wedge Experiment

During the Simple Machines Program, students will see how different tools are wedges. This experiment explores how varying sizes of wedges move loads differently.

### Supplies:

- A 3" x 5" index card
- Ruler
- Tape
- A piece of rigid lightweight cardboard approx. 8" x 10"

*(Note: If this activity is to be done in groups, multiply the supplies by the number of groups)*

### Procedure:

1. Fold the index card in half the short way.
2. Fold the ends of the cards inward by a  $\frac{1}{2}$  inch, overlapping the ends and taping them. You should now have a small wedge.
3. Slowly push the wedge under one end of the cardboard. You may need to hold the opposite end of the cardboard to keep it from skating away. Keep pushing until you have raised the cardboard as high as possible, without it tipping back over the wedge.
4. Use a ruler to measure how far upward the cardboard moved. Compare this measurement with how far you moved the wedge under the cardboard. Students should find that they needed to move the wedge a greater distance to raise the cardboard a short distance.
5. Ask students to consider how wedges of different sizes would affect the results of the experiment. Try making wider wedges. What happens to the distance the cardboard is raised? Is it easier or harder with a wider wedge?

## **Post-Activities**

### **Activity 1: Make a Wacky Machine**

During the Simple Machines Program, students saw many different simple machines in action. This activity combines their knowledge of the six simple machines and their creative problem solving skills.

#### **Supplies:**

- Recycled materials (tubes, cartons, spools, coat hangers, etc.)
- Scissors
- Glue sticks
- String
- Tape
- Rubber bands
- Craft sticks
- Straws

#### **Procedure:**

1. Have the students make a wacky machine from simple and recycled materials to solve a particular problem. This can be done in groups or individually.
2. Assign a problem that the students need to solve by building a machine. The students will all work on the same problem, though their solutions are likely to differ. The problems given can be simple and a little silly, i.e. create a machine to squeeze toothpaste onto a toothbrush, trap a mouse, blow out birthday candles, empty a trash can, clean their room, etc.
3. Their machines can either be at full-scale or made in smaller models, but they should incorporate at least one simple machine principle.
4. Share each machine as a class and have each student or group explain their solution and what simple machine(s) they used.

## Activity 2: Simple Machines Bingo

During the Simple Machines Program, students saw many different tools that were examples of simple machines. Test your student's knowledge of historic tools and simple machines with this game.

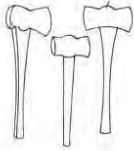
### Supplies:

- Bingo call sheet with images (included below)
- 10 ready to photocopy simple machines bingo cards (included below)
- Writing utensil or small objects to be used as bingo chips for each student or group of students

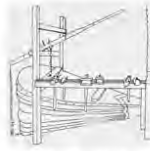
### Procedure:

1. Students may work in groups or individually. Note that some students may have identical game cards. Thus, there is likely to be more than one winner as the names of the pictured tools or types of simple machines are called.
2. Distribute cards and chips to students. Tell them that they can put one chip in the "free space" (the image of the castle).
3. Begin playing the game. Instruct students to place their chips in the boxes with the tools as you call out different simple machines or tools. There are three options to call out to fill the spaces.
  - a. Option 1: Call out a particular type of simple machine, the tool that demonstrates that simple machine, and show the picture that corresponds with that simple machine.
    - i. Example: "A Lever. The shears." Show an image of the shears.
  - b. Option 2: Call out the name of the tool.
    - i. Example: "Cider Press"
  - c. Option 3: Call out a particular type of simple machine. Students would then place their markers on all those spaces that they think show that type of simple machine.
    - i. Example: Pulleys
4. The first student to get five in a row (across, up and down or diagonal) wins.

## **SIMPLE MACHINES BINGO CALL SHEET**



Axes  
(Wedges)



Bellows  
(Lever)



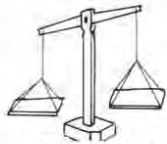
Blacksmith's Blower  
(Wheel/Axle)



Block & Tackle  
(Pulley)



Buggy  
(Wheel/Axle)



Balance Scale  
(Lever)



Candy Mixer  
(Wheel/Axle, Gears)



Charcoal Burner's Ladder  
(Inclined Plane)



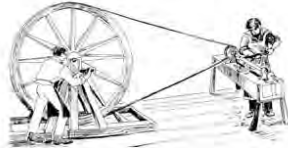
Cider Press  
(Screw)



Froe & Froe Club  
(Wedge)



Grain Quern  
(Lever)



Great Wheel Lathe  
(Wheel)



Log Wheels  
(Screw)



Grist Mill  
(Wheel/Axle)



Pit Saw  
(Inclined Plane)



Plow Weathervane  
(Wedge)



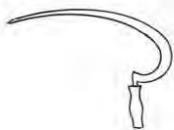
Potter's Wheel  
(Wheel/Axle)



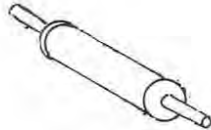
Pounding Mill  
(Lever)



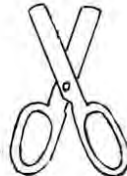
Pulley Block  
(Pulley)



Reaping Hook  
(Wedge)



Rolling Pin  
(Wheel/Axle)



Scissors/Shears  
(Levers/Wedge)



Screw Auger  
(Screw)



Clamp  
(Screw)



Shovel  
(Lever)



Spinning Wheel  
(Wheel/Axle, Pulley)



Wagon Jack  
(Lever)



Well Sweep  
(Lever)



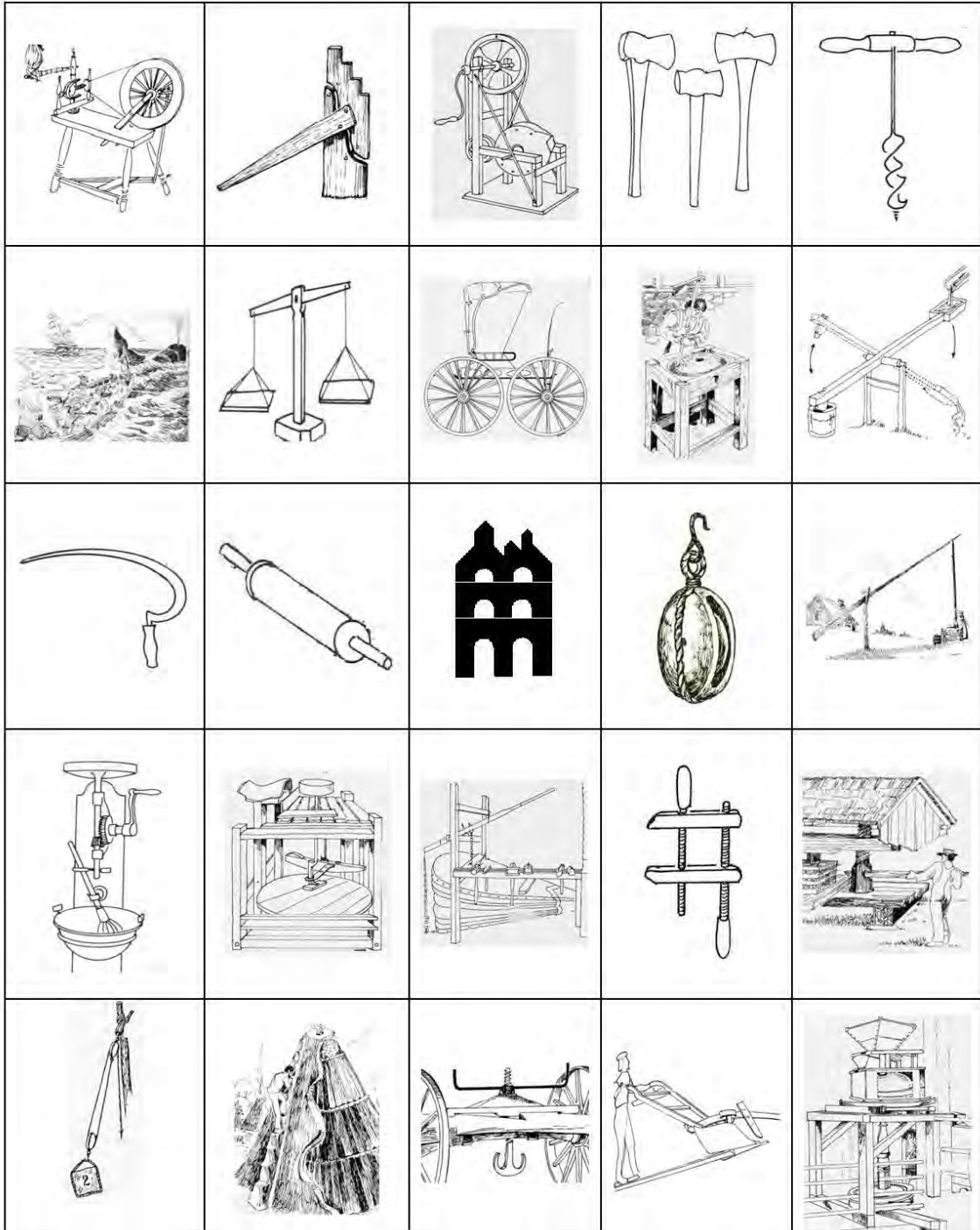
Whaleboat and Oarsmen  
(Levers)



Wheelbarrow  
(Lever)

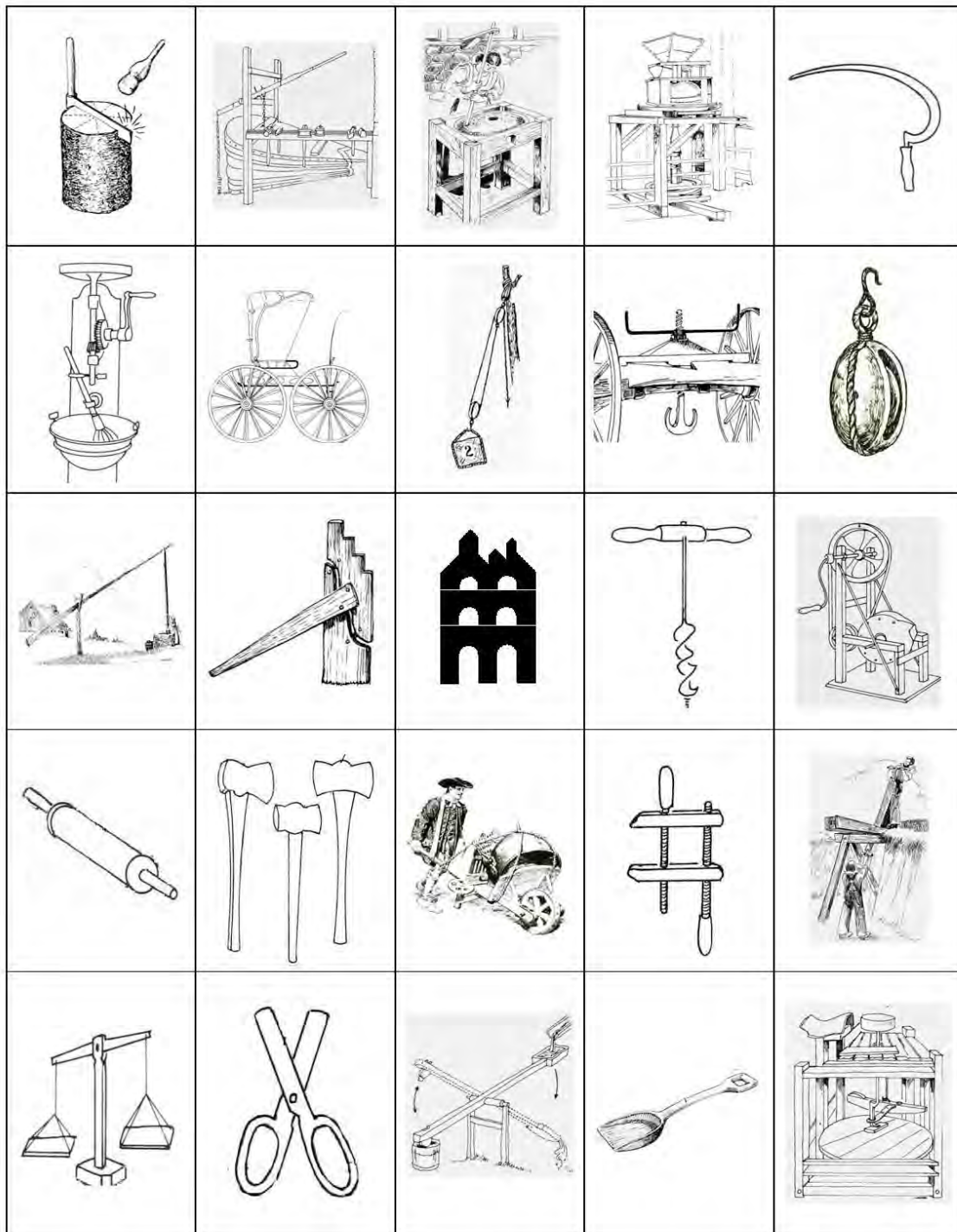


# Simple Machines Bingo Sheet

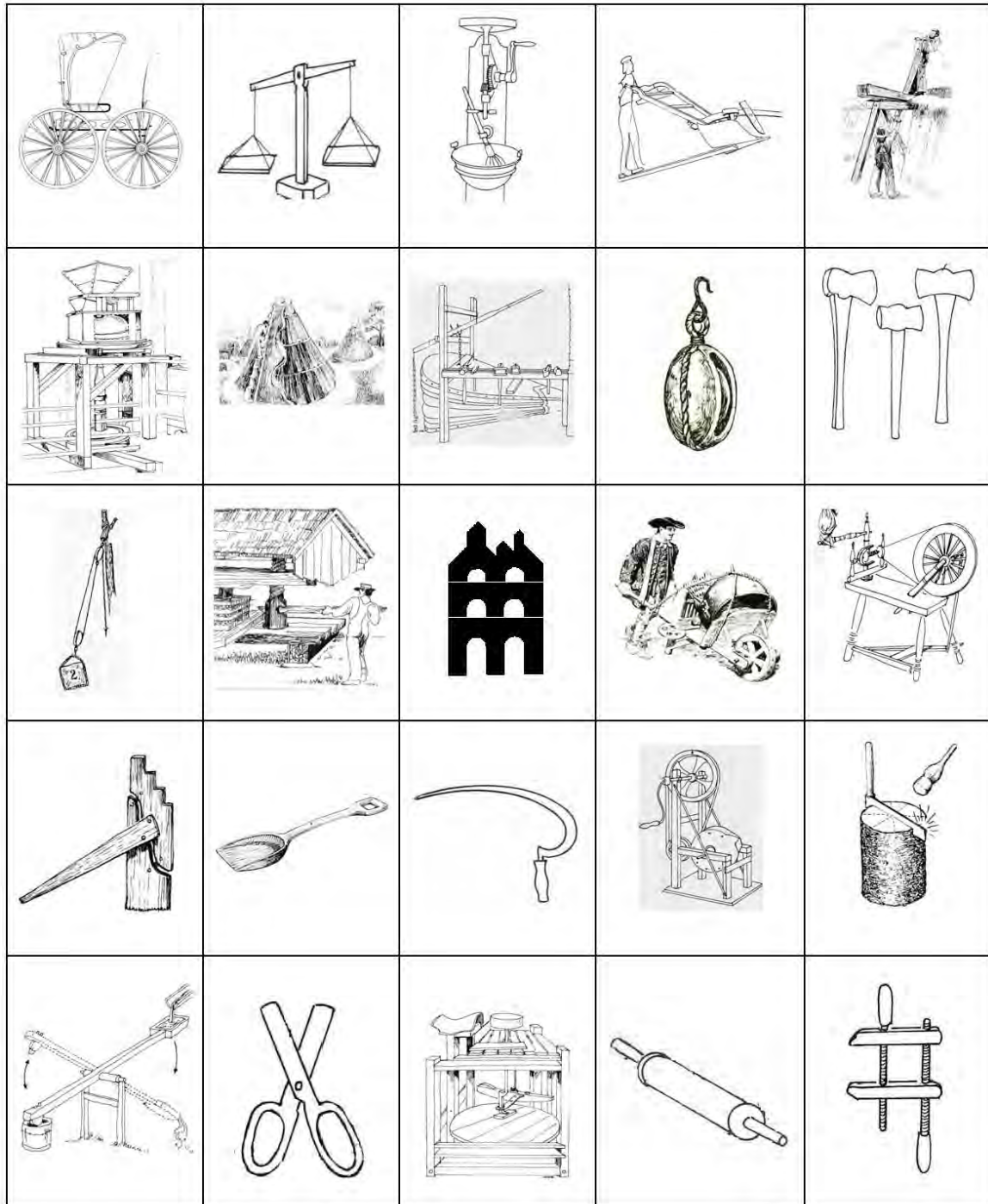




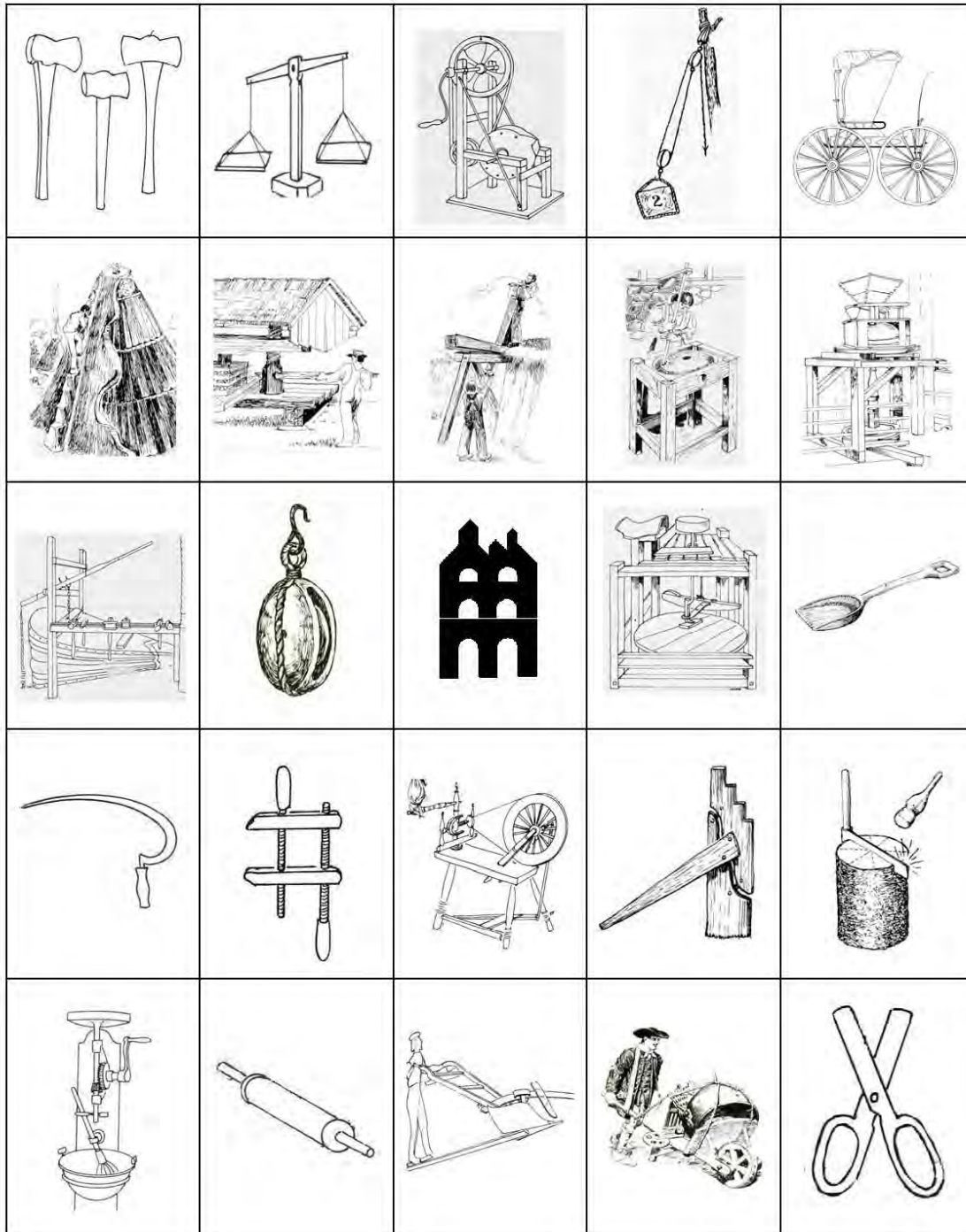
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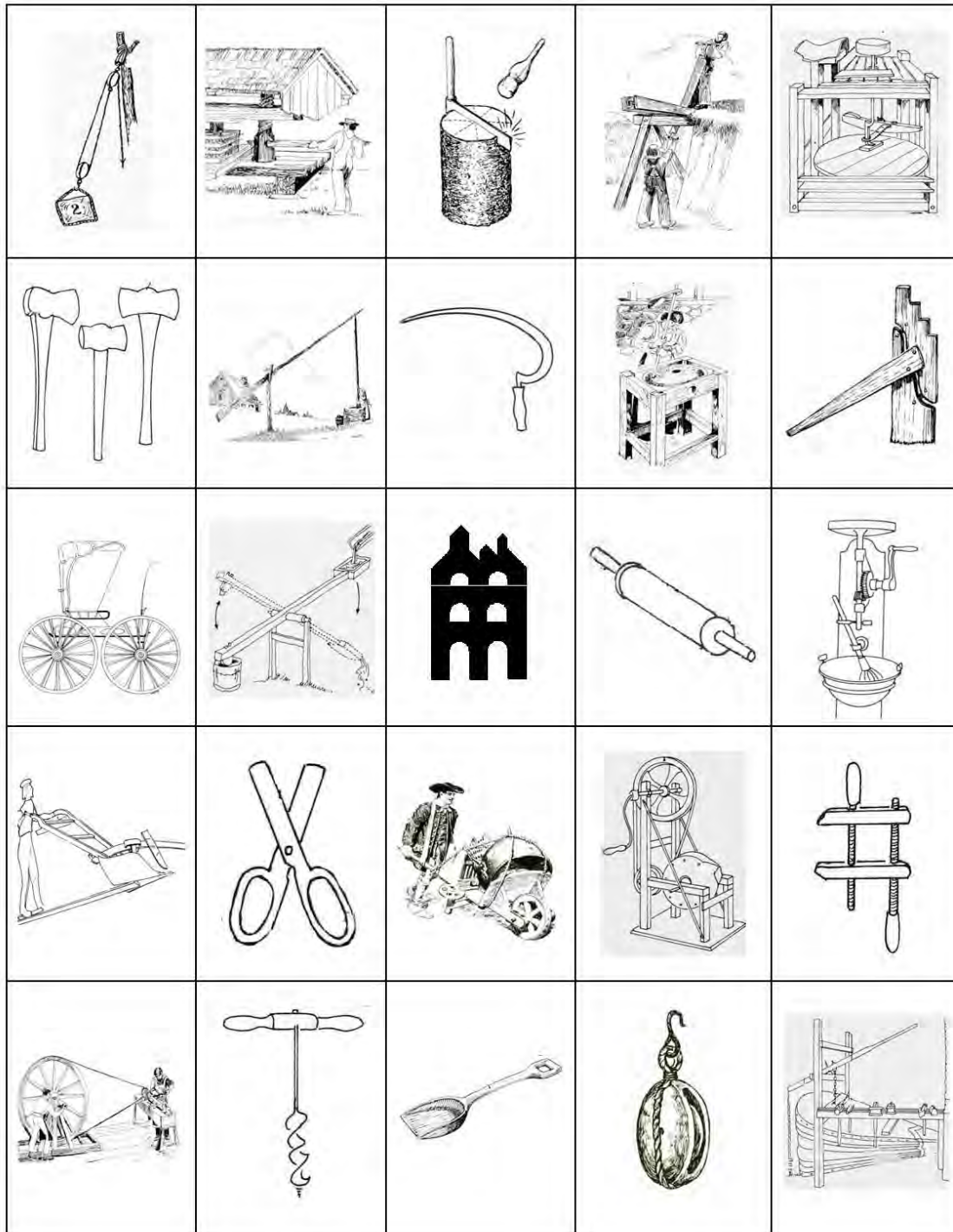


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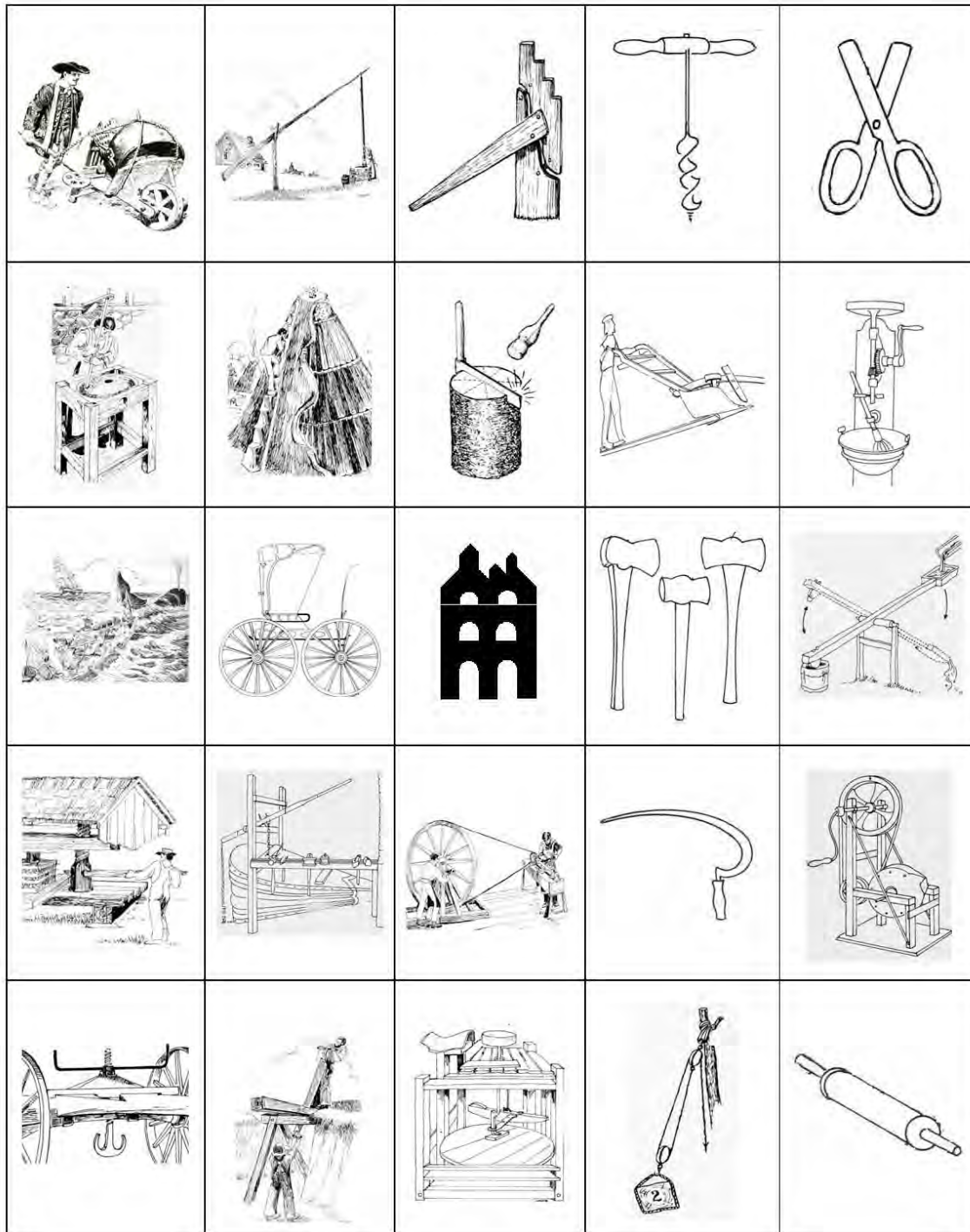




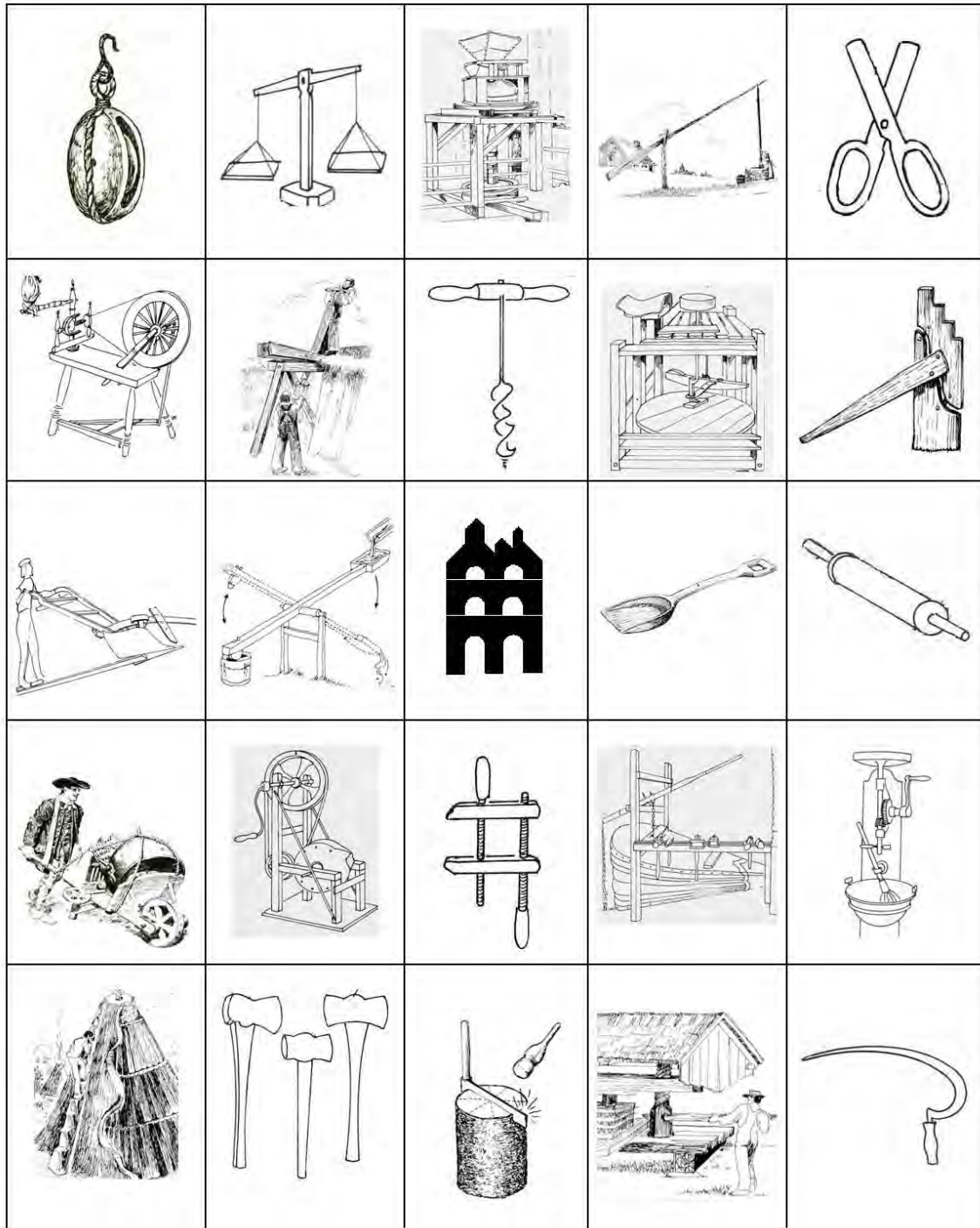
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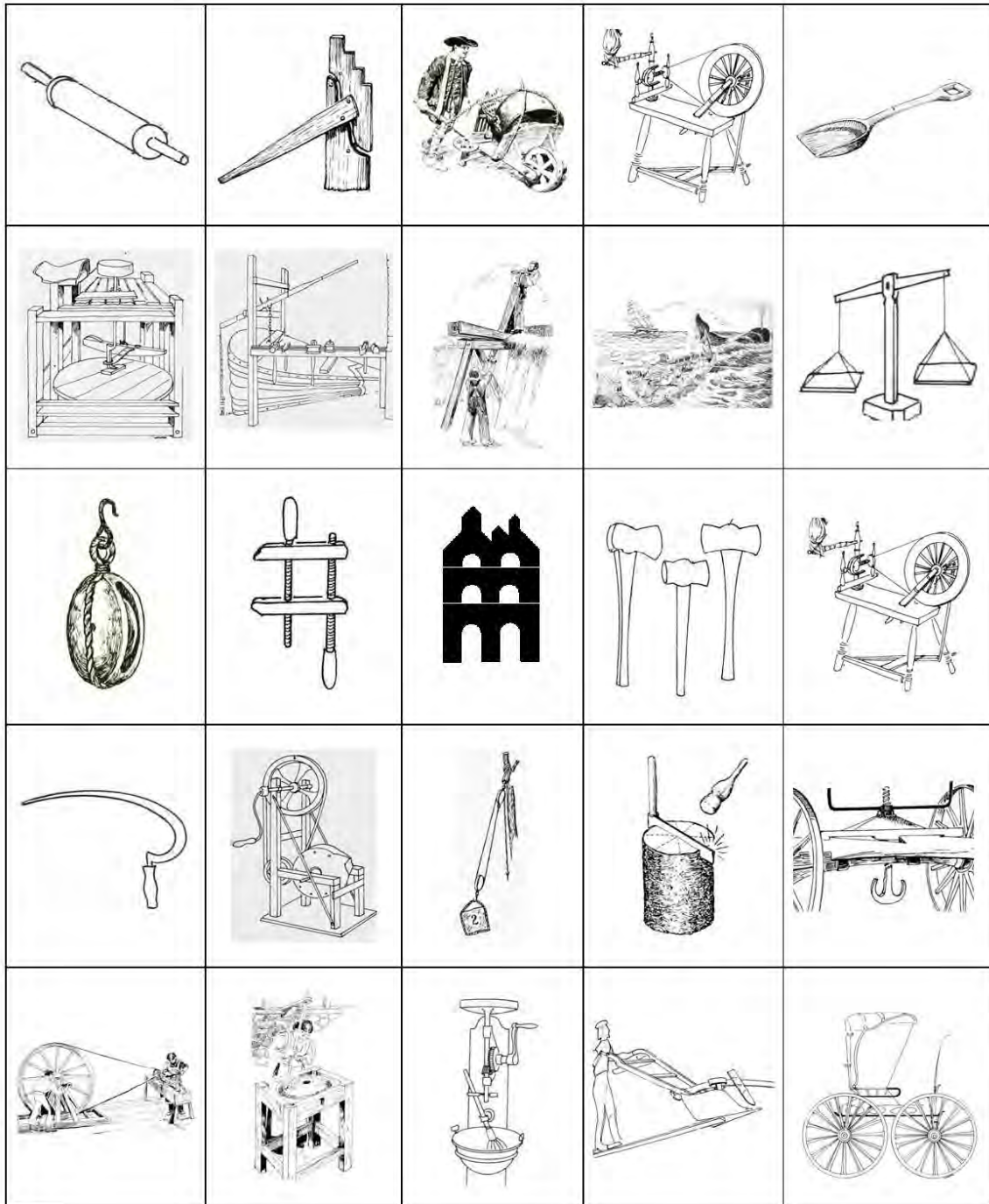


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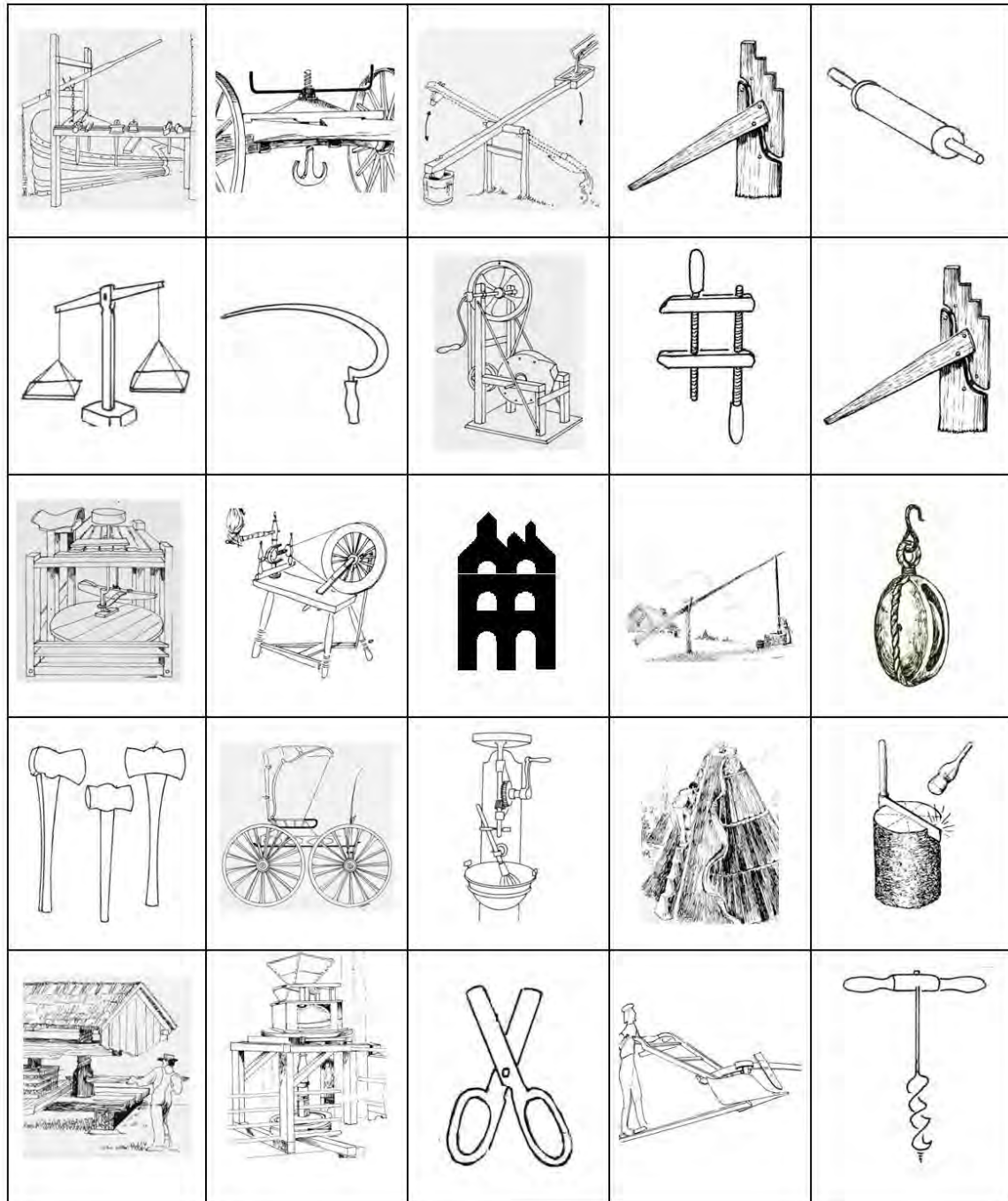


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