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Tech labs

TECH 7

Manufacturing: tools and techniques

PROGRAM: EST
LAB TYPE: Technique
CONCEPT: Shaping (machines and tools)
STUDENT BOOK: Chapter 12, page 410
TOOLBOX: Pages 81–88, 94

GOAL

Practise techniques in measuring, laying out, machining, assembling and finishing by building a ratchet noisemaker.

MATERIALS

- pine plank (at least 90 mm × 89 mm × 19 mm)
- pencil
- combination square
- band saw
- cutting guide
- flat rasp
- woodworker's vise
- hammer
- centre punch
- drill press
- drill press vise
- 2-mm (5/64-inch) drill bit
- sanding block
- 120-grit sandpaper
- wooden dowel (13 mm (1/2-inch) diameter, at least 190 mm length)
- ruler
- piece of medium-density particleboard (at least 363 mm × 43 mm × 6 mm) (1/4-in)
- 13-mm (1/2-inch) drill bit
- block of maple (38 mm × 38 mm × 38 mm)
- gear template
- coping saw
- half-round rasp
- piece of styrene (at least 120 mm × 40 mm × 3 mm) (1/8-in)
- 8-mm (5/16-inch) drill bit
- polishing head (for drill)
- polishing wax
- screwdriver
- 12-mm (1/2-inch) No. 4 wood screw
- 12 16-mm (5/8-inch) No. 6 wood screws
- 3 32-mm (1 1/4-inch) No. 6 wood screws
- markers

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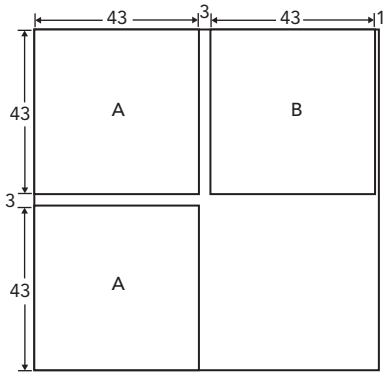
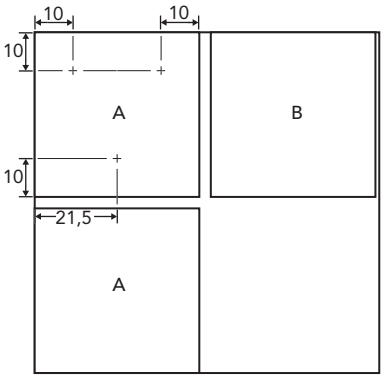
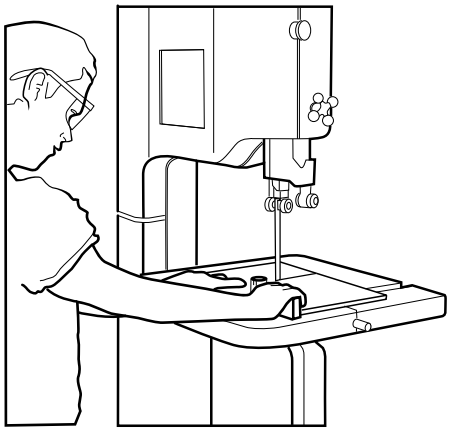
PROCEDURE

Build the ratchet noisemaker, following the manufacturing process sheets below.

Manufacturing process sheet
Parts: end blocks (parts A and B)
Main material: pine plank (at least 90 mm × 89 mm × 19 mm)

No.	Operation		
10	**Measuring and laying out**	**Illustration**	**Materials**
11	Lay out the A and B parts on the pine plank.		• Pencil • Combination square
12	Mark the locations for the holes in one A part.		• Pencil • Combination square
20	**Machining**	**Illustration**	**Materials**
21	With the band saw, cut out the A and B parts by sawing between the lines.		• Band saw • Cutting guide

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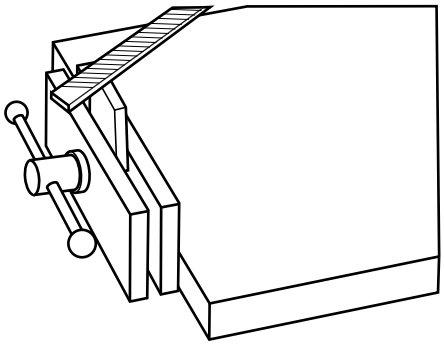
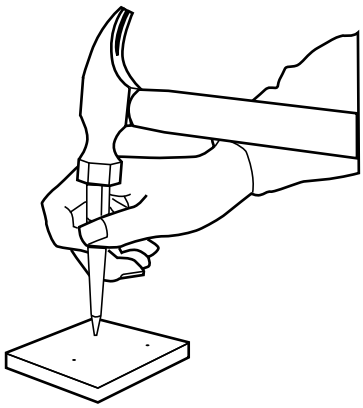
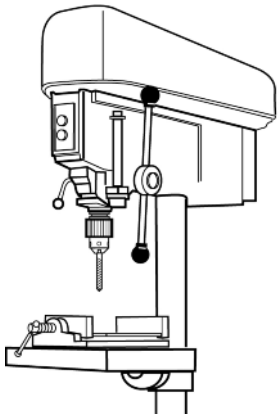
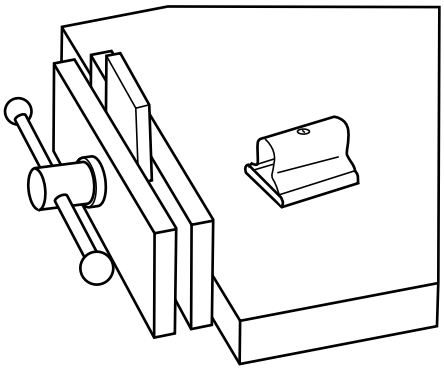
22	File the edges of the A and B parts to remove all excess wood beyond the outlines.		• Flat rasp • Woodworker's vise
23	Punch a starter hole at each of the three locations on the marked part A.		• Hammer • Centre punch
24	Drill the three holes in the marked part A.		• Drill press • Drill press vise • 2-mm drill bit
30	**Finishing**	**Illustration**	**Materials**
31	Smooth the edges of the A and B parts with sandpaper mounted on a sanding block.		• Sanding block • 120-grit sand-paper • Woodworker's vise

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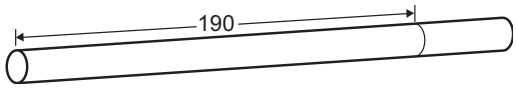
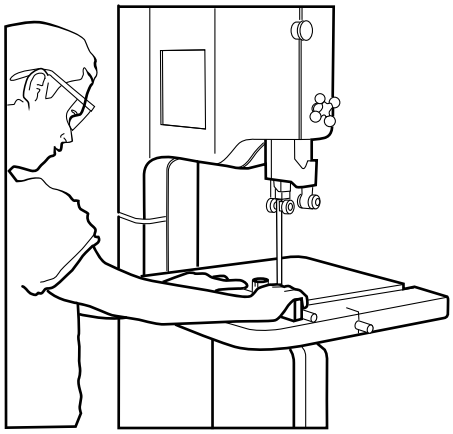
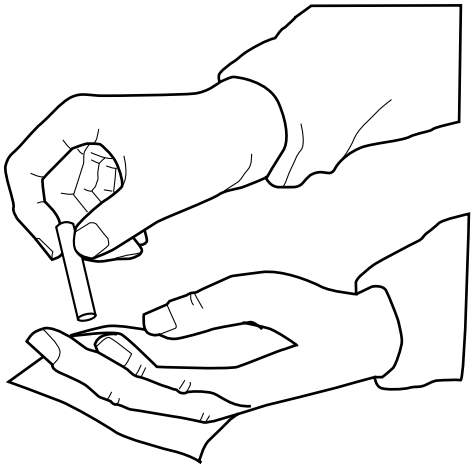
Manufacturing process sheet
Part: handle (part C)
Main material: wooden dowel (13 mm diameter, at least 190 mm length)

No.	Operation		
10	**Measuring and laying out**	**Illustration**	**Materials**
11	If necessary, measure a 190-mm length of wooden dowel.		• Pencil • Ruler
20	**Machining**	**Illustration**	**Materials**
21	With the band saw, cut the dowel to obtain part C.		• Band saw • Cutting guide
30	**Finishing**	**Illustration**	**Materials**
31	Smooth the ends of the part with sandpaper.		• 120-grit sandpaper

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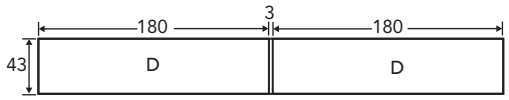
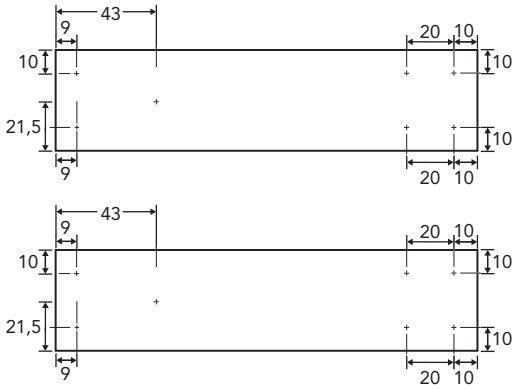
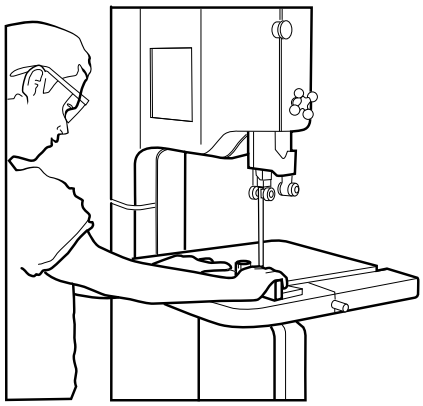
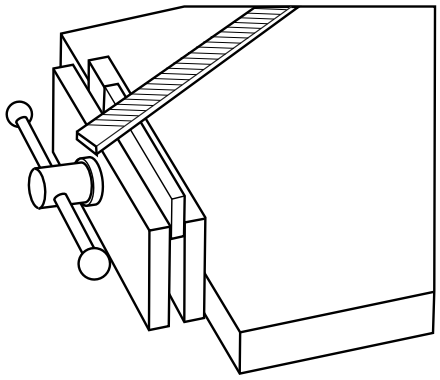
Manufacturing process sheet
Part: sideboards (parts D)
Main material: piece of medium-density particleboard (at least 363 mm × 43 mm × 6 mm)

No.	Operation		
10	**Measuring and laying out**	**Illustration**	**Materials**
11	Lay out the two D parts on the piece of particleboard.		• Pencil • Combination square
12	Mark the locations for the holes in the parts.		• Pencil • Combination square
20	**Machining**	**Illustration**	**Materials**
21	With the band saw, cut out the D parts by sawing between the lines.		• Band saw • Cutting guide
22	File the edges of the D parts to remove all excess material beyond the outlines.		• Flat rasp • Woodworker's vise

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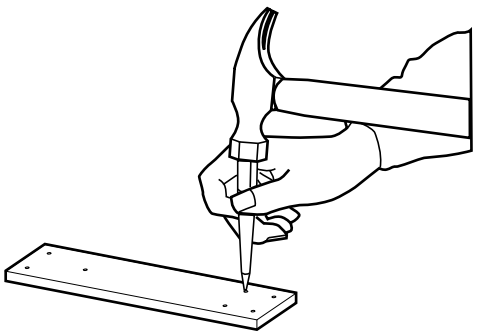
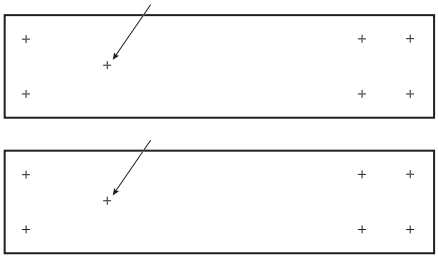
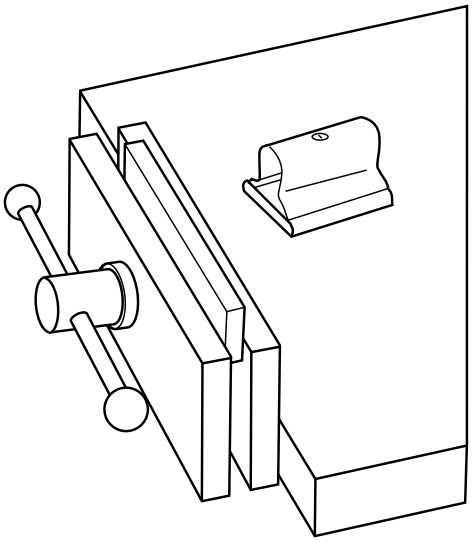
23	Punch a starter hole at each of the marks on the parts.		• Hammer • Centre punch
24	Drill the hole indicated in the illustration opposite on both D parts, using the 13-mm drill bit.		• Drill press • Drill press vise • 13-mm drill bit
25	Drill the remaining six holes in each part, using the 2-mm drill bit.		• Drill press • Drill press vise • 2-mm drill bit
30	**Finishing**	**Illustration**	**Materials**
31	Smooth the edges of the D parts with sandpaper mounted on a sanding block.		• Sanding block • 120-grit sandpaper • Woodworker's vise

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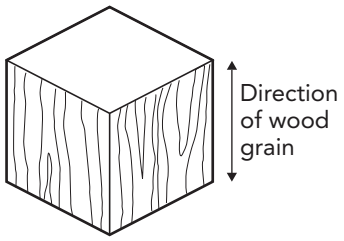
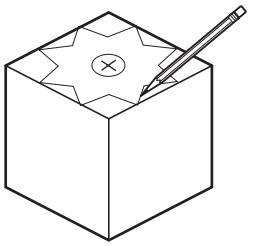
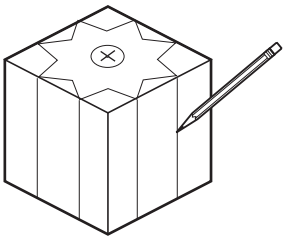
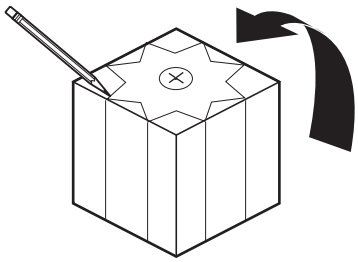
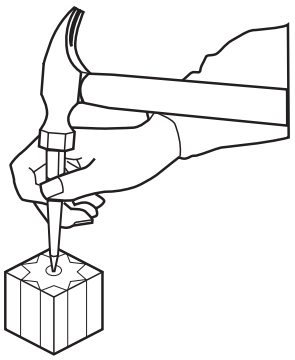
Manufacturing process sheet
Part: ratchet gear (part E)
Main material: block of maple (38 mm × 38 mm × 38 mm)

No.	Operation		
10	**Measuring and laying out**	**Illustration**	**Materials**
11	Place the block of maple so that the wood grain runs vertically, as shown opposite.		
12	Place the gear template on top of the block, trace the outline of part E, and mark the location of the hole.		• Pencil • Gear template
13	Draw a line from the tip of each gear tooth down the sides of the block to the bottom.		• Pencil • Combination square
14	Turn the block over. Trace the outline of part E, and mark the location of the hole on the bottom of the block. Make sure that the tip of each gear tooth meets one of the vertical lines on the sides of the block.		• Pencil • Gear template
20	**Machining**	**Illustration**	**Materials**
21	Punch a starter hole at one of the marks you made (on the top or bottom of the block).		• Hammer • Centre punch

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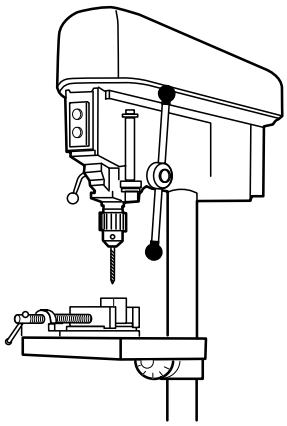
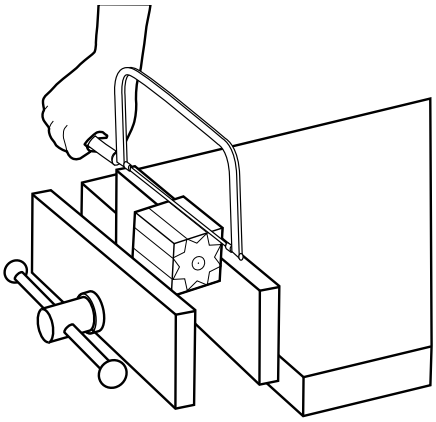
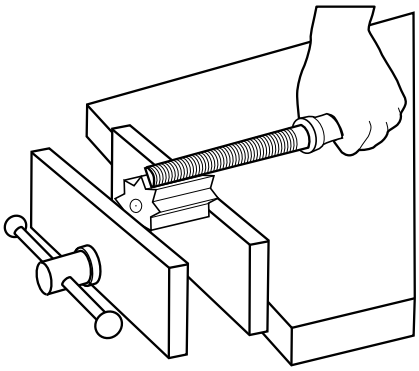
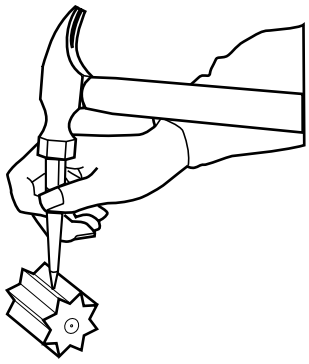
22	Using the 13-mm drill bit, bore the hole in part E all the way through the block.		• Drill press • Drill press vise • 13-mm drill bit
23	Place the block in the vise. With the coping saw, cut out the pieces between the lines to form the eight gear teeth.		• Coping saw • Woodworker's vise
24	File each surface to make the part smooth and symmetrical.		• Half-round rasp • Woodworker's vise
25	Punch a starter hole in the centre of one of the grooves between the gear teeth.		• Hammer • Centre punch

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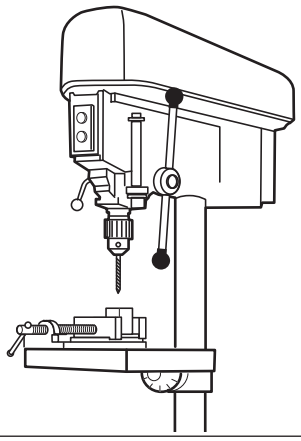
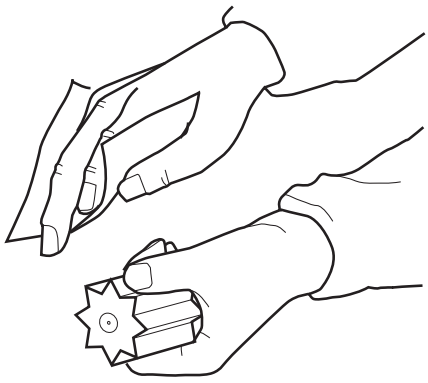
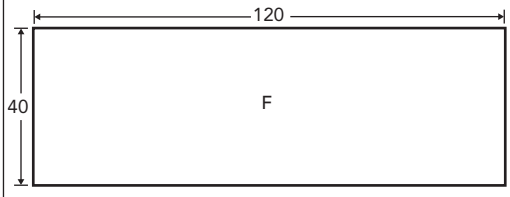
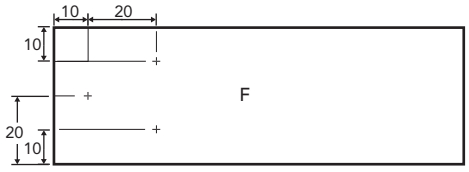
26	Using the 2-mm drill bit, bore a hole at the marked location.		• Drill press • Drill press vise • 2-mm drill bit
30	**Finishing**	**Illustration**	**Materials**
31	Smooth the surfaces of part E with sandpaper.		• 120-grit sandpaper

Manufacturing process sheet
Part: clapper (part F)
Main material: piece of styrene (at least 120 mm × 40 mm × 3 mm)

No.	Operation		
10	**Measuring and laying out**	**Illustration**	**Materials**
11	If necessary, lay out the outline of part F.		• Pencil • Combination square
12	Mark the locations for holes in part F.		• Pencil • Combination square

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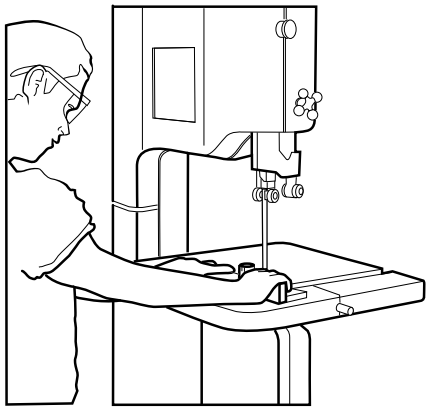
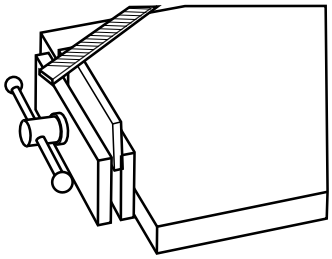
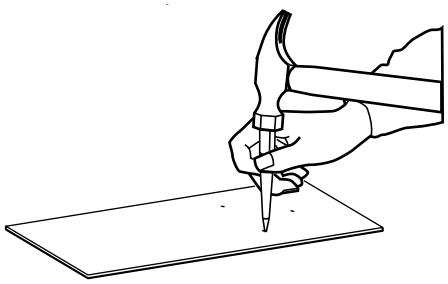
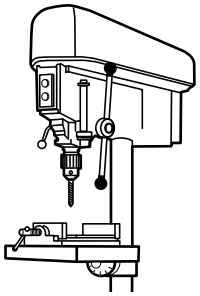
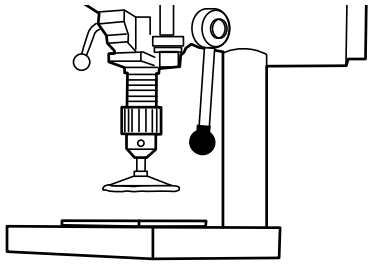
20	Machining	Illustration	Materials
21	Cut out part F with the band saw.		• Band saw • Cutting guide
22	File the edges of part F to remove all excess material beyond the outline.		• Flat rasp • Woodworker's vise
23	Punch a starter hole at each of the marks on the part.		• Hammer • Centre punch
24	Drill the holes at the marked locations, using the 8-mm drill bit.		• Drill press • Drill press vise • 8-mm drill bit
30	**Finishing**	**Illustration**	**Materials**
31	Polish the surfaces of the part.		• Drill press • Polishing head • Polishing wax

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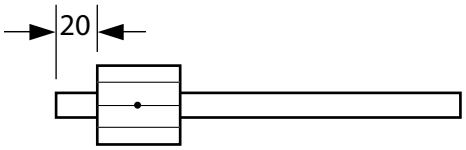
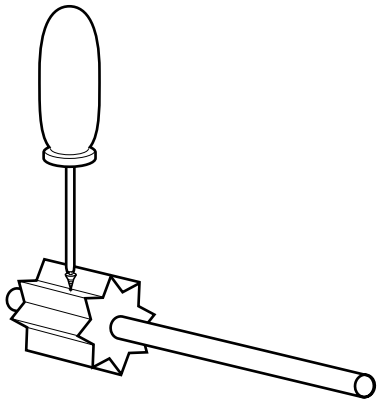
Assembly process sheet
Object: Ratchet noisemaker
Parts:

Code	Name	Number
A	End block A	2
B	End block B	1
C	Handle	1
D	Sideboard	2
E	Ratchet gear	1
F	Clapper	1
G	12-mm No. 4 wood screw	1
H	16-mm No. 6 wood screw	12
I	32-mm No. 6 wood screw	3

No.	Operation		
10	**Assembling the ratchet gear (E) and the handle (C)**	**Illustration**	**Materials**
11	Insert part C into part E through the hole in part E. The dowel should extend 20 mm beyond the hole on one side of part E.		• Combination square
12	Hold part E in place by screwing the 12-mm No. 4 screw into the hole in the groove between the gear teeth. Do not tighten the screw completely at this point.		• Screwdriver

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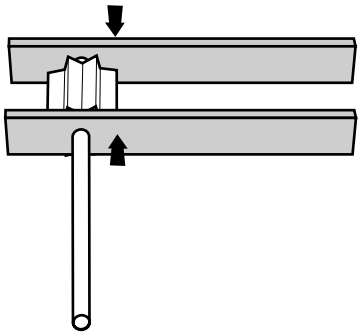
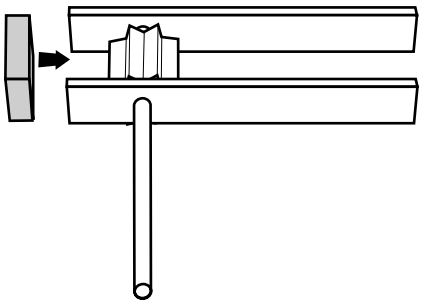
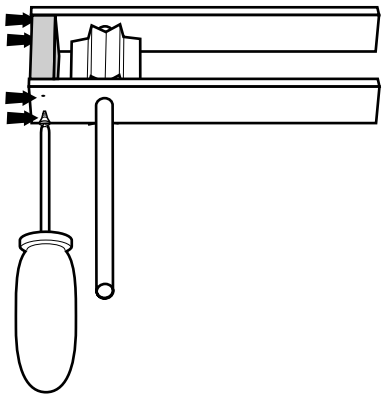
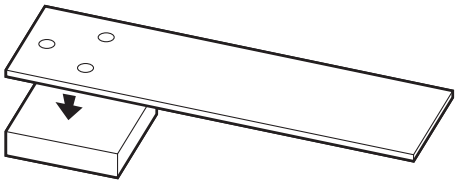
20	Assembling the sideboards (D) and the handle (C) with the end block (B)	Illustration	Materials
21	Place the D parts on either side of part E by inserting part C into the 13-mm hole in each of the D parts.		
22	Place part B between the D parts.		
23	Attach each of the D parts to part B with four 16-mm No. 6 screws.		• Screwdriver
30	**Assembling the clapper (F) between the end blocks (A)**	**Illustration**	**Materials**
31	Place part F on the part A without holes, as shown in the illustration opposite.		

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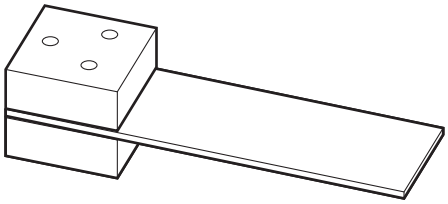
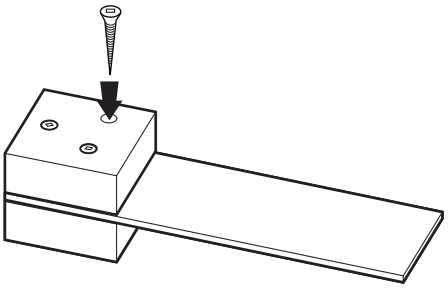
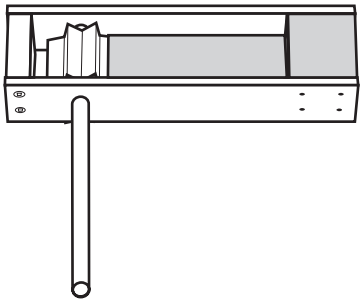
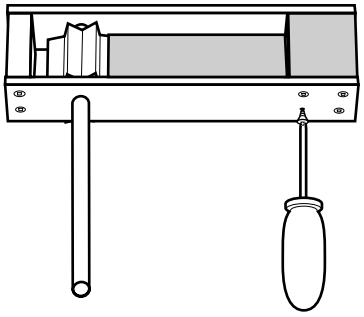
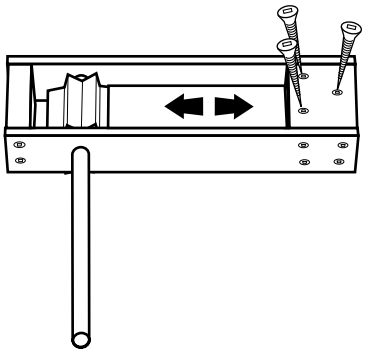
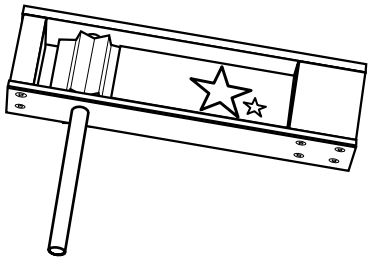
32	Place the other part A (with holes) on part F so that the holes are aligned.		
33	Assemble the three parts with three 32-mm No. 6 screws. Do not tighten the screws completely at this point.		• Screwdriver
40	**Completing assembly of the ratchet noisemaker**	**Illustration**	**Materials**
41	Place parts A and F between the D parts so that part C lies between two of the teeth on part E, without touching the bottom of the groove between the teeth.		
42	Screw the D parts onto the A parts with eight 16-mm No. 6 screws (four on the top and four on the bottom).		• Screwdriver
43	Test the noisemaker to see if it works properly. If necessary, adjust the position of part F by loosening the screws that hold it to the A parts and then retightening them.		• Screwdriver

Name: _____ Group: _____ Date: _____

50	Finishing	Illustration	Materials
51	Use the markers to decorate your ratchet noisemaker.		• Markers

REFLECTING ON THE LAB TECHNIQUE

1. Did this lab help you become familiar with certain manufacturing techniques? Explain your answer.

_____

_____

_____

_____

2. Does your ratchet noisemaker work properly? If not, how could you have improved your manufacturing techniques to make it work better?

_____

_____

_____

3. Name three machining techniques you used to build this object.

_____

_____

_____

4. What machine tools did you use to build this object?

_____

_____

5. Name three different types of materials you used to build this object.

- _____
- _____
- _____