

Chapter I

An Introduction to Machining Technology

LEARNING OBJECTIVES

After studying this chapter, students will be able to:

- Discuss how modern machine technology affects the workforce.
- Give a brief explanation of the evolution of machine tools.
- Provide an overview of machining processes.
- Explain how CNC machining equipment operates.
- Describe the role of the machinist.

INSTRUCTIONAL MATERIALS

Text: pages 11–22

Test Your Knowledge Questions, page 21

Workbook: pages 7–10

Instructor's Resource: pages 39–48

Guide for Lesson Planning

Research and Development Ideas

Reproducible Masters:

1-1 Bow Drill

1-2 Bow Lathe

1-3 Spring Pole Lathe

1-4 Treadle Lathe

1-5 Great Wheel Lathe

1-6 Thread Cutter

1-7 Test Your Knowledge Questions

Color Transparencies (Binder/CD only)

GUIDE FOR LESSON PLANNING

The purpose of this chapter is to let your students know that the seemingly wondrous machines of today did not just happen. Their invention and development occurred over many centuries starting with the “Adam and Eve” of machine tools, the bow drill and bow lathe.

The construction of new machine tools or the improvement of existing tools continually

makes the creation and development of new inventions possible. Machine tools began when humans wanted to extend the power of their hands over stubborn materials and devised the first bow drill. No one is sure where or when this first happened. Have students read and study Chapter 1, *Introduction to Machining Technology*. Review the assignment with them and discuss the following:

- The difficulty in naming a product that does not require the use of a machine tool somewhere in its manufacture or production.
- How could machine tools be made when there were no machine tools to make them?
- The evolution of the machine tool. Use the Reproducible Masters to show basic improvements in early machines.
- The importance of a standard system of measurement.
- Basic machine tool operation.
- The development of nontraditional machining processes.
- Automating the machining process.

Technical Terms

Review the terms introduced in the chapter. New terms can be assigned as a quiz, homework, or extra credit. These terms are also listed at the beginning of the chapter.

band machining
computer numerical control (CNC)
drill press
lathe
machine tools
machinist
milling machine
numerical control (NC)
precision grinding
skill standards

Review Questions

Assign *Test Your Knowledge* questions. Copy and distribute Reproducible Master 1-7 or have students use the questions on page 21 in the text and write their answers on a separate sheet of paper.

Workbook Assignment

Assign Chapter 1 of the *Machining Fundamentals Workbook*.

Research and Development

Discuss the following topics in class or have students complete projects on their own.

1. What was the Industrial Revolution?
2. Who invented the turret lathe?
3. Have students select one of the seven power sources listed in section 1.1.2 and write a brief history. Students should include drawings or photos of past and current uses.
4. The invention of the lathe is lost in history. The first lathe was believed to have been a "tree" lathe. Work was mounted between two trees and a limber branch fitted with a section of cord provided the power. Prepare a paper on the known history of the lathe. Illustrate it with transparencies designed for the overhead projector.

TEST YOUR KNOWLEDGE ANSWERS, PAGE 21

1. e. All of the above.
2. steam engine
3. In order: hand power, foot power, animal power, water power, steam power, central

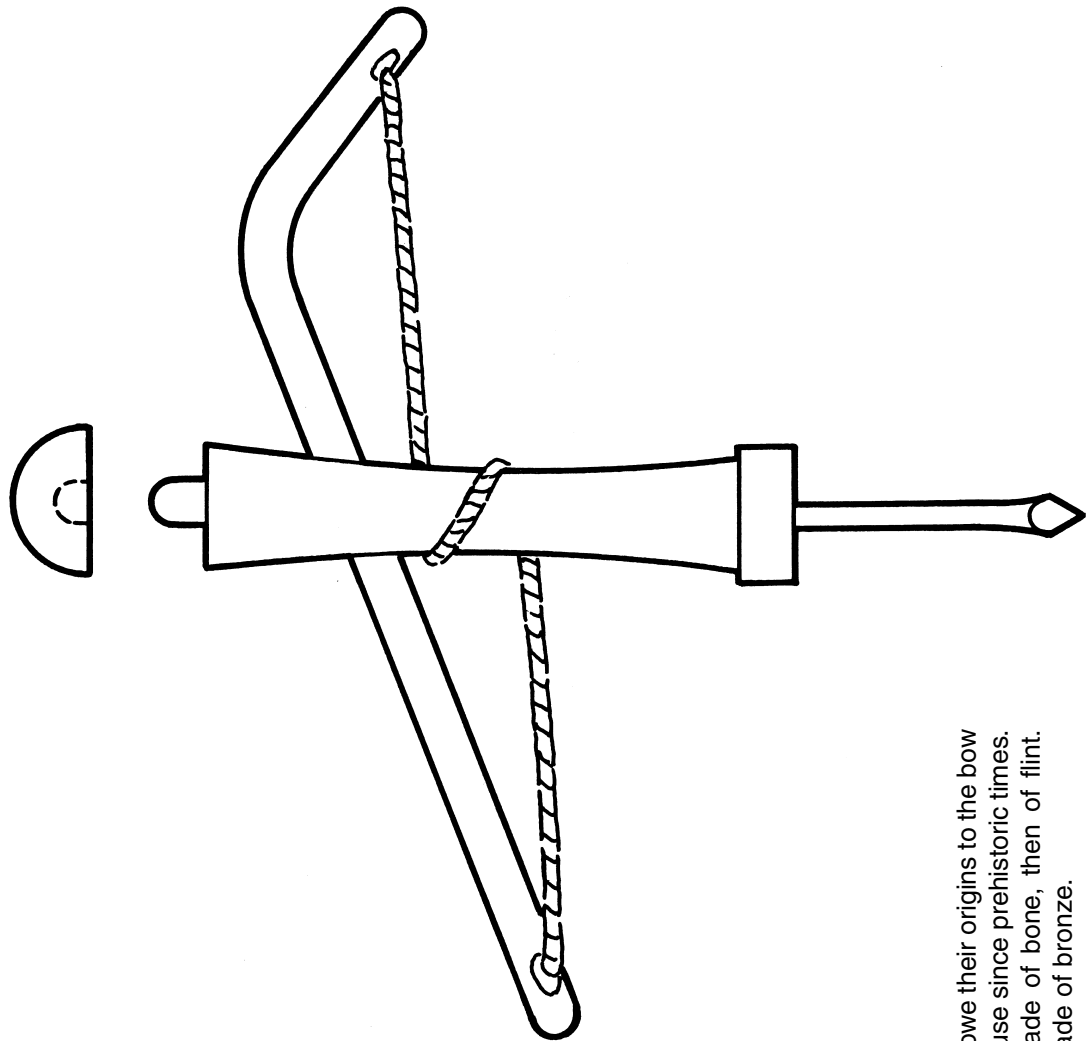
electrical power, and individual electrical power.

4. lathe
5. b. College graduates.
6. c. There was no standard of measurement.
7. The United States adopted a standard measuring system.
8. Evaluate individually. Refer to Section 1.3 of the text.
9. computer numerical control (CNC)
10. Student answers will vary but may include the following: permit machines to operate unattended; operate in hazardous and harsh environments; perform tedious operations; handle heavy materials; position parts with great repetitive precision.

ANSWERS TO THE WORKBOOK, Pages 7–10

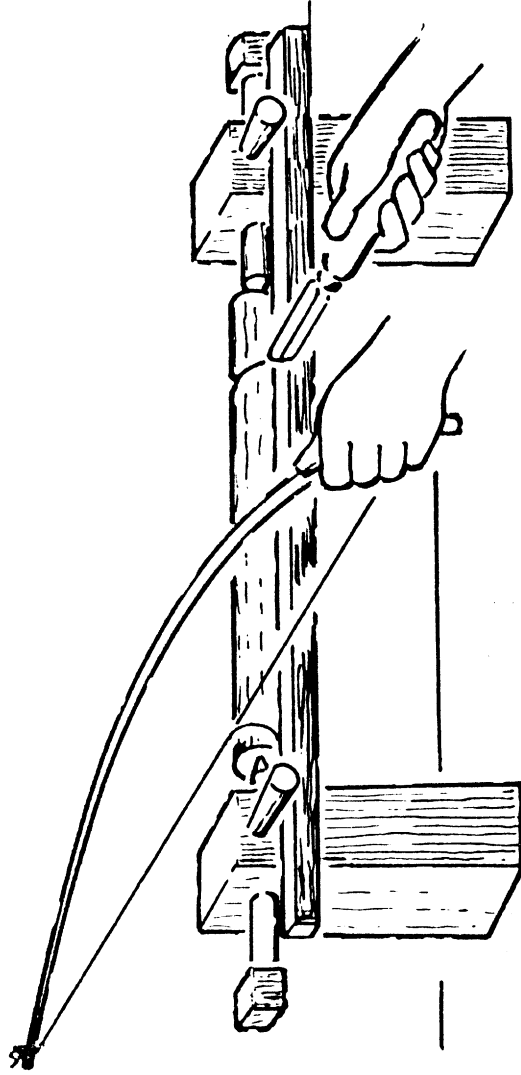
1. reciprocating
2. d. All of the above.
3. b. *granddaddy* of all modern chip-making machine tools
4. Industrial Revolution
5. a. devised a system for mass production in the 1820s
6. Any order: hand power, foot power, animal power, water power, steam power, central electrical power, individual electrical power.
7. a. spiral flutes pulling the tool into the work
8. Any three of the following: electrical discharge machining (EDM), electrochemical machining (ECM), chemical milling, chemical blanking, hydrodynamic machining (HDM), ultrasonic machining, Electron beam machining (EBM), Laser machining, hexapods.
9. binary number
10. microchip
11. d. All of the above.
12. robotic
13. Student answers will vary but may include three of the following: make a thorough study of the print; determine the machining that must be done; ascertain tolerance requirements; plan the machining sequence; determine how the setup will be made; select the machine tool, cutter(s), and other tools and equipment that will be needed; calculate cutting speeds and feeds; select the proper cutting fluid for the material being machined.
14. skill standards
15. Evaluate individually.

Bow Drill



Modern machine tools owe their origins to the bow drill which has been in use since prehistoric times. The first drills were made of bone, then of flint. The drill shown was made of bronze.

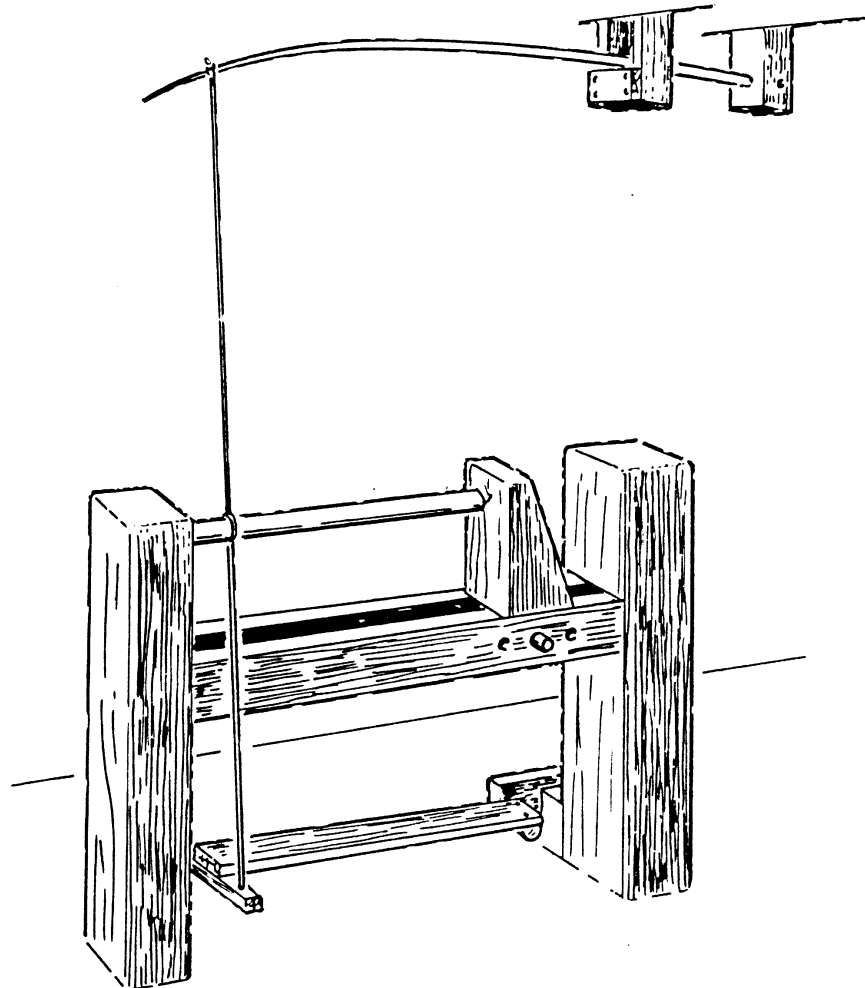
Bow Lathe



The bow lathe was developed from the bow drill and like the bow drill is used even today in India, the Far East, and some areas in Africa.

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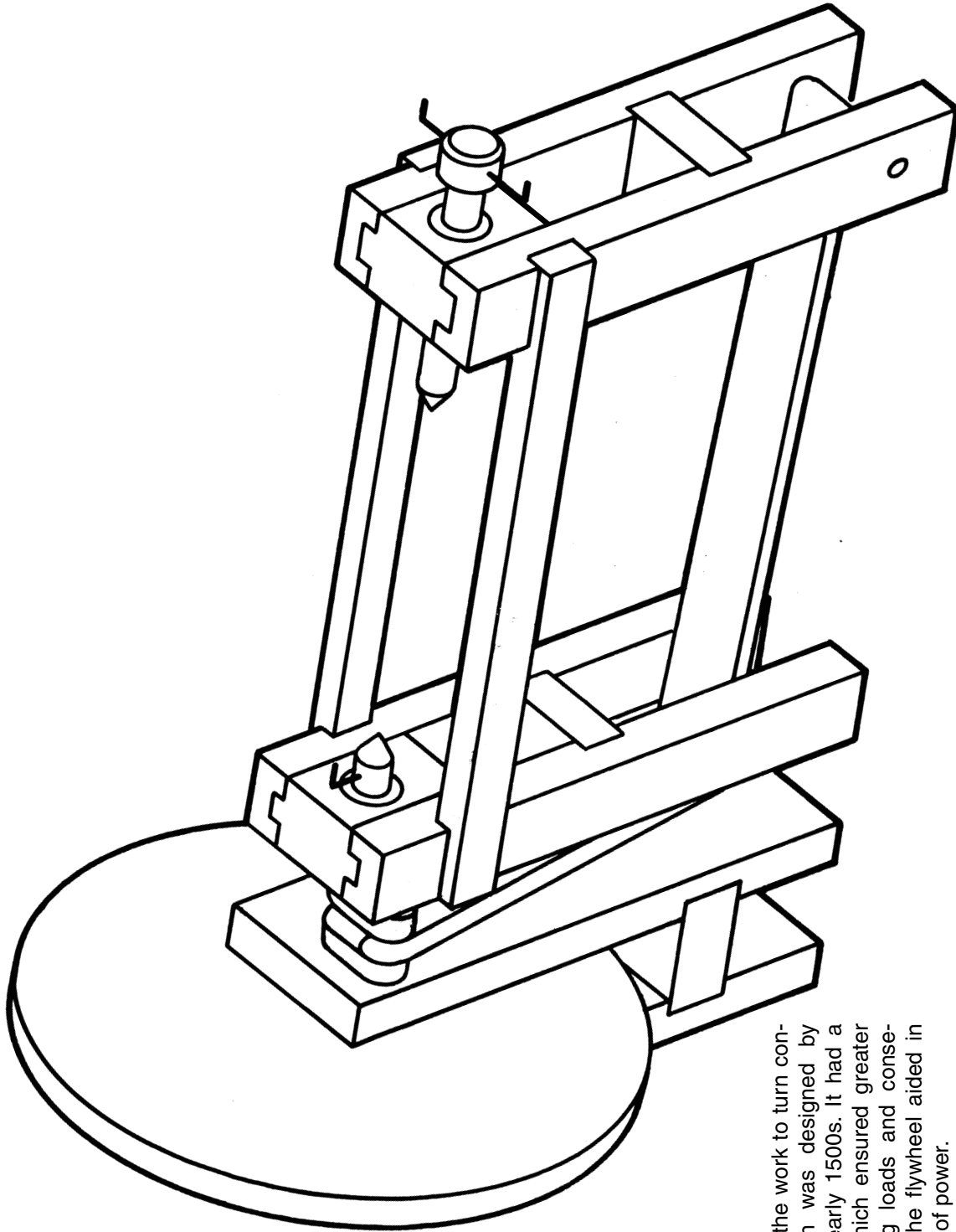
Spring Pole Lathe



The spring pole lathe is thought to have been the next development in the evolution of machine tools. It was operated by the artisan's foot and left both hands free to handle the cutting tool.

Treadle Lathe

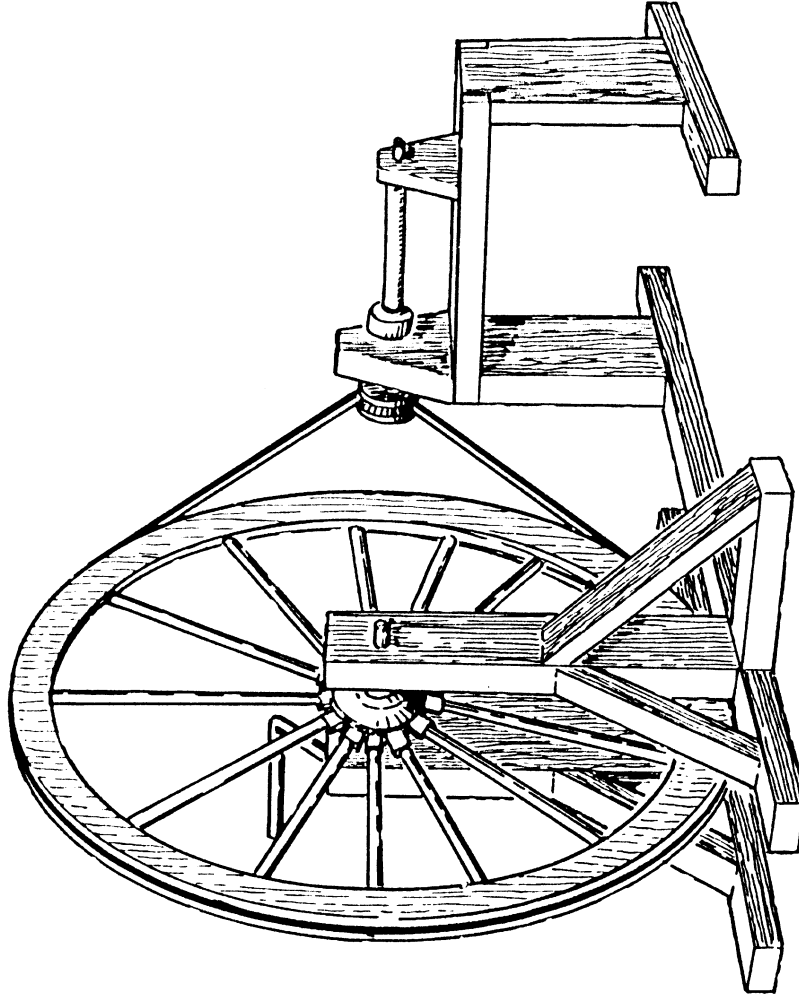
1-4



The treadle lathe permitted the work to turn continuously. The lathe shown was designed by Leonardo Da Vinci in the early 1500s. It had a three bearing headstock which ensured greater rigidity under heavy cutting loads and consequently greater precision. The flywheel aided in providing a continuous level of power.

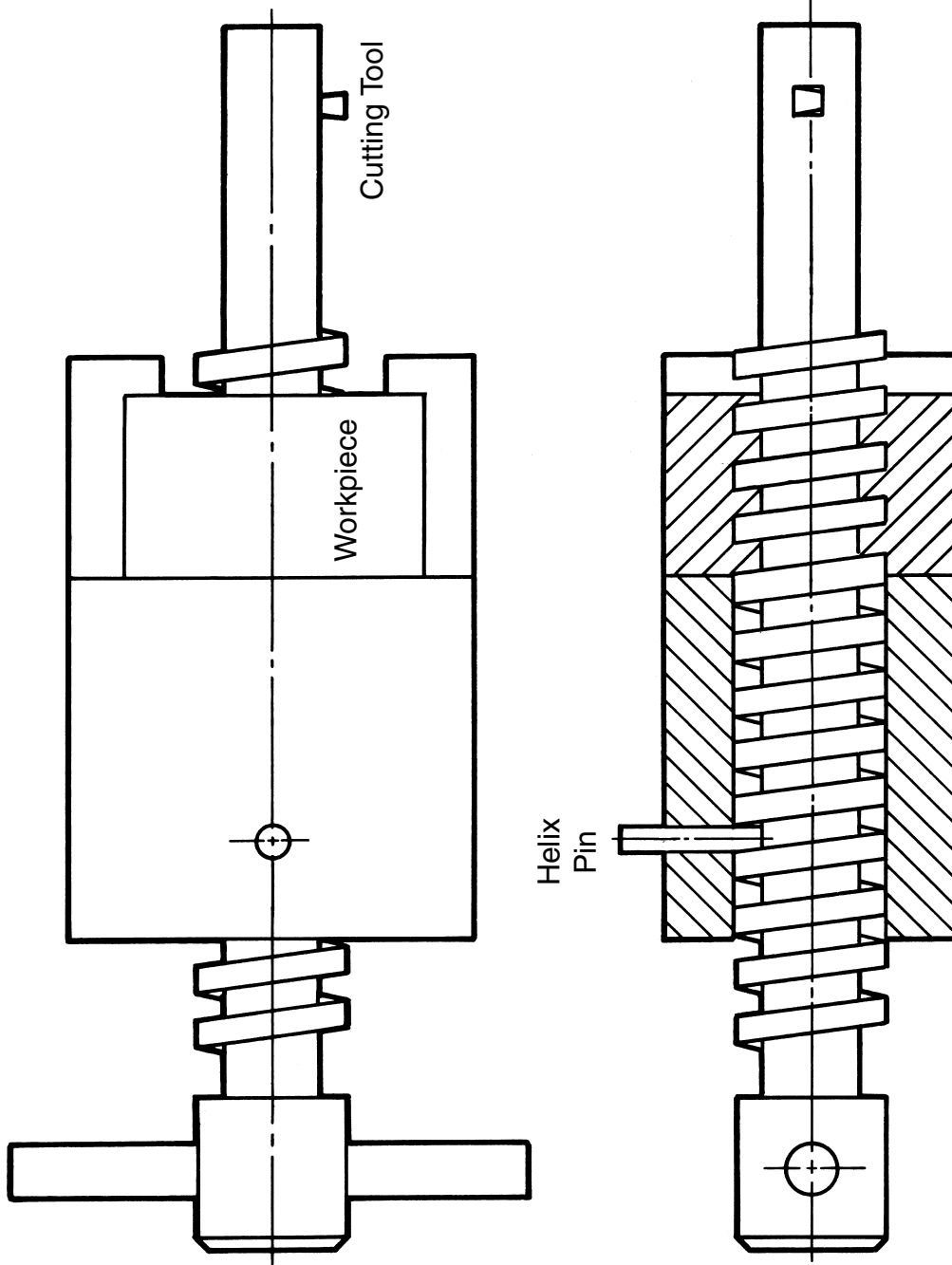
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Great Wheel Lathe



The great wheel lathe permitted skilled workers to keep all of their attention on the work. While the artisan worked at the lathe, another worker turned the wheel by hand.

Thread Cutter



About AD 100, screw threads were made as part of screw presses used for pressing grapes and olives. At that time, the male threads could be cut on hard wood by hand. Making the nut was another matter. The device had a single-point cutting tool which was rotated through the workpiece (nut) to cut the threads shown. Later, a modified form of this device was used to cut threads in metal which was used as a die to make threads on longer metal rods.

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An Introduction to Machining Technology

Name: _____ Date: _____ Score: _____

1. One of the first machine tools, the bow lathe, _____.
 - a. Could only turn softer materials
 - b. Has been dated back to about 1200 BC
 - c. Eventually gave way to treadle power
 - d. None of the above.
 - e. All of the above.
2. The Industrial Revolution could not have taken place without the cheap convenient power of the _____.
 1. _____
3. List seven power sources in the order that they have evolved over the last 150 years or so.

4. Almost all machine tools have evolved from the _____.
 4. _____
5. Jobs such as tool-and-diemaking and precision machining require aptitudes comparable to those of _____.
 - a. High school graduates.
 - b. College graduates.
 - c. High school equivalency graduates.
 - d. All of the above.
 - e. None of the above.
6. Eli Whitney's system of mass-production systems for muskets had a major problem because _____.
 6. _____
 - a. there were no skilled workers.
 - b. there was no good source of power.
 - c. there was no standard of measurement.
 - d. All of the above.
 - e. None of the above.
7. What occurred in the mid-1860s that was very important to the development of machining technology in the United States? _____

Name: _____

8. List four types of nontraditional machining processes and briefly describe their operation.

9. The introduction of the microchip in the mid-1970s led to the introduction of _____ machine tools.

9. _____

10. List four industrial applications of robots.
