

A Hydraulic Clock

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Type: Design Problem
Student Time: Two Weeks
Location: Lab/Home

Summary

The project is to design a clock using water as the principal moving component. The student design team is expected to determine the basic requirements for accurate measurement of time and to create a design that is both accurate and aesthetically pleasing. The timepiece is to be powered using pressure from a household water tap, fitted to accommodate a 1/4 inch water line. Success will be determined twofold: by student judging (appearance) and by accurate measurement of a ten-minute period.

ABET Descriptors

Engr Sci Content: First Year Engineering, fluid mechanics
Type: Component
Elements: Synthesis, construction, test and evaluation
Features: Development of student creativity, use of open-ended problems, consideration of alternative solutions
Constraints: Economic factors
Effort: Team

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Your next door neighbor is responsible for the design and construction of a new shopping mall. He is at wits end looking for a suitable centerpiece to use in the large open area where people tend to collect. The architect has proposed a large, but unique clock be purchased, but after extensive search, no clock of suitable quality can be found. You have been asked to design a clock for the mall, using water as the primary moving component and gravity as the source of energy. The clock must be of a design that the shoppers will find interesting, have very low maintenance requirements, and keep accurate time.

Design, procure materials, and construct a prototype of the clock. Water will be supplied from the lab faucet via a standard thread 1/4" line. The clock must be able to display time in hours, minutes, and seconds. Your design will be judged on two criteria: appearance and accuracy. For the purpose of the prototype, accuracy will be measured over a period of less than one hour.

As is customary with any design of consequence, you will provide documentation as part of the design effort. Your final report will include, but not be limited to, a description of the design, analysis of clock performance, measurement and analysis of clock accuracy, precision, and discuss the reliability and maintainability aspects of your design.

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Engineering Notes:

The instructor may wish to bring a raincoat to the demonstration class period. A ten-minute period was selected for the measurement of accuracy. The duration is considered to be long enough to make a measurement, but not so long as to lose class attention.

Objectives/Comments:

Be prepared to discuss mechanisms, fluid mechanics, creativity, aesthetic aspects of design, reliability and maintainability.

Expected Outcomes:

Students have an opportunity to apply mechanical and fluid-flow theory in the context of an open-ended, design problem. The design must solve both a technical problem in addition to addressing the reliability, human factors, and maintainability issues.

Discussion/Follow Up:

Let the students critique each others designs.