

Mon: Read

Weds: HW 4 due - includes topic for first research paper.

First research paper due Oct 1

- * single issue - relatively narrow
- * aim to verify or refute statement about issue using reliable other sources (not text or lecture notes)
- * outline is provided on pgs 3-4 of syllabus.
- * key will be to get reliable sources pg 3 syllabus. preferably published books or academic journal articles
 - not websites.
 - must have some outside review and degree of permanence.

Medieval mechanical clocks.

At some point during the later middle ages (1000 -> 1400) clocks whose timing mechanism and machinery were purely mechanical began to appear initially in churches or monasteries. These were called verge and foliot clocks. Some replicas exist today.

Demo: Video of Medieval \neq Verge + Foliot Clock.

This type of clock clearly relies entirely on machinery, unlike a sundial that relies on the Sun or a water-clock that relies on flow of water, or other such clocks (sand clocks, cordles).

Rossum
Pg 45

Definitive records of sun clocks date to the early 1300s where they were found in western Europe. The exact date of invention, the inventor and subsequent developments remain unclear or unknown and some aspects of this will be described later.

Verge and Foliot Clocks

The first common widespread types of mechanical clocks that told time in terms of hours were verge and foliot clocks

Demo: Constructed V+F clock.

Demo: Video Wooden V+F clock.

We now aim to describe the basic working parts, identifying them and their operation.

1 Verge and foliot clocks

Observe the video/s of the verge and foliot clocks. What appear to be the crucial main working parts of these clocks?

The videos and model show:

- 1) an arm that swings back + forth
- 2) a rotating toothed wheel.
- 3) a device that regulates the rotation of the wheel.
- 4) a suspended mass (or other mechanism) that causes the toothed wheel to rotate.

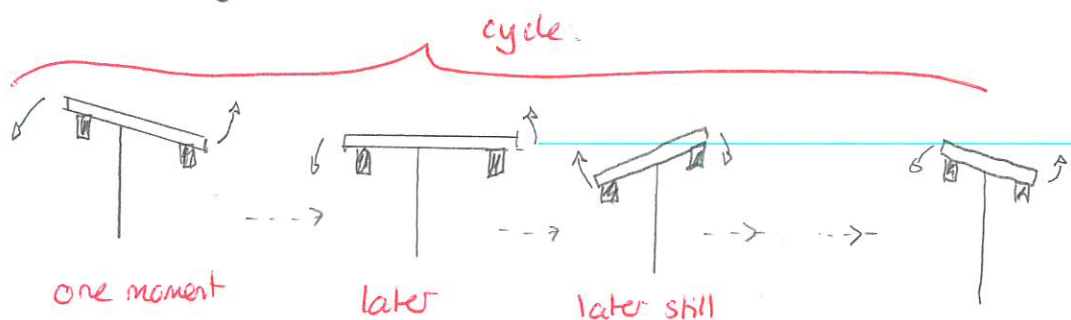
An animation shows some of these parts in operation

Demo: Video: V+F clock animation

The important pieces are:

- 1) Foliot - this is the arm that swings back and forth. Typically there are suspended masses whose position can be adjusted so that the rate at which it moves.

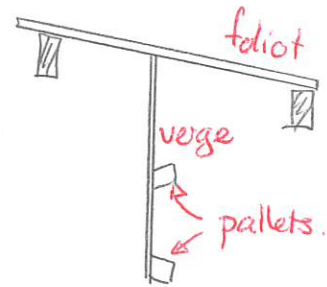
When it is in operation, the foliot displays a repetitive motion. In physics such motion is called oscillatory. We have



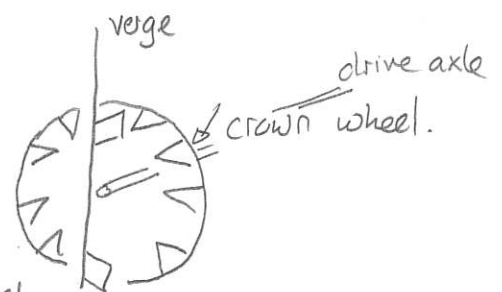
One complete repetition of the motion is called one oscillation or one cycle.

- 2) Verge The verge is the rigid vertical arm connected to the foliot. There are two pegs fixed into the verge

These are called pallets. The verge oscillates along with the foliot, and at the same rate. Together the verge and foliot are called the escapement



- 3) Crown wheel - most mechanical clocks contain a toothed wheel of some type. This is called the crown wheel. The crown wheel interacts repetitively with the verge. This results in small increments in motion



- 4) Drive axle and dial

The crown wheel is mounted on an axle (a drive axle) that is connected to something that indicates the time - either a bell arrangement or a pointer on a dial.

- 5) An energy source - the suspended mass pulls a rope wrapped around the drive axle.

2 Crown wheel and axle

→ show model $V \neq F$

Consider the wheel, axle and suspended mass as demonstrated.

- The arm serves as a primitive clock hand. Can one just release the suspended mass and use the subsequent motion to tell time?
- What problems would this approach present?
- What might provide the energy that drives the system once it is set into motion?

Answer: a) if one does the hand will rotate and could indicate the time

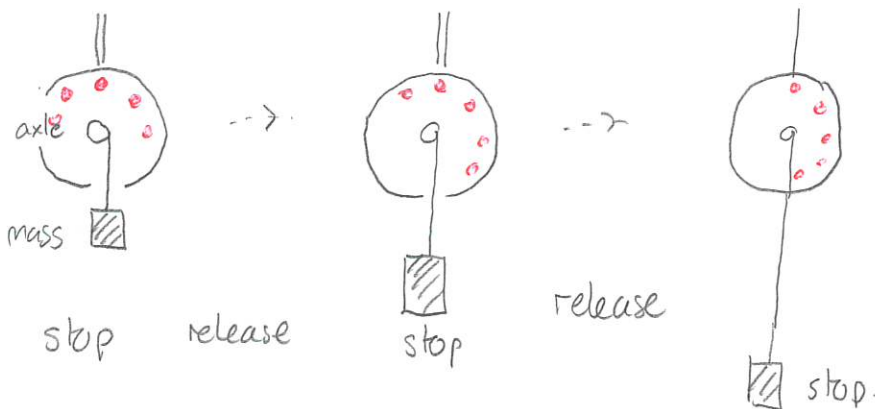
b) - the mass will rapidly hit the floor and the mechanism will have to be reset

- the rate at which the arm rotates increases and so the pointer will first rotate slowly then more rapidly.

c) the suspended mass. ☒

Thus without the verge + foliot the crown wheel and suspended mass cannot be used to tell time for extended periods.

The verge + foliot provides the crucial regulator alternately stopping the crown wheel and then releasing it. Thus it is called an escapement



The simple verge and foliot clock displays three crucial features of most clocks:

- 1) an energy source - this drives the clock mechanism (suspended mass)
- 2) a regulator - a device that regulates the delivery of energy or the motion of the axle and indicator hands (verge + foliot)
- 3) a dial - indicates time