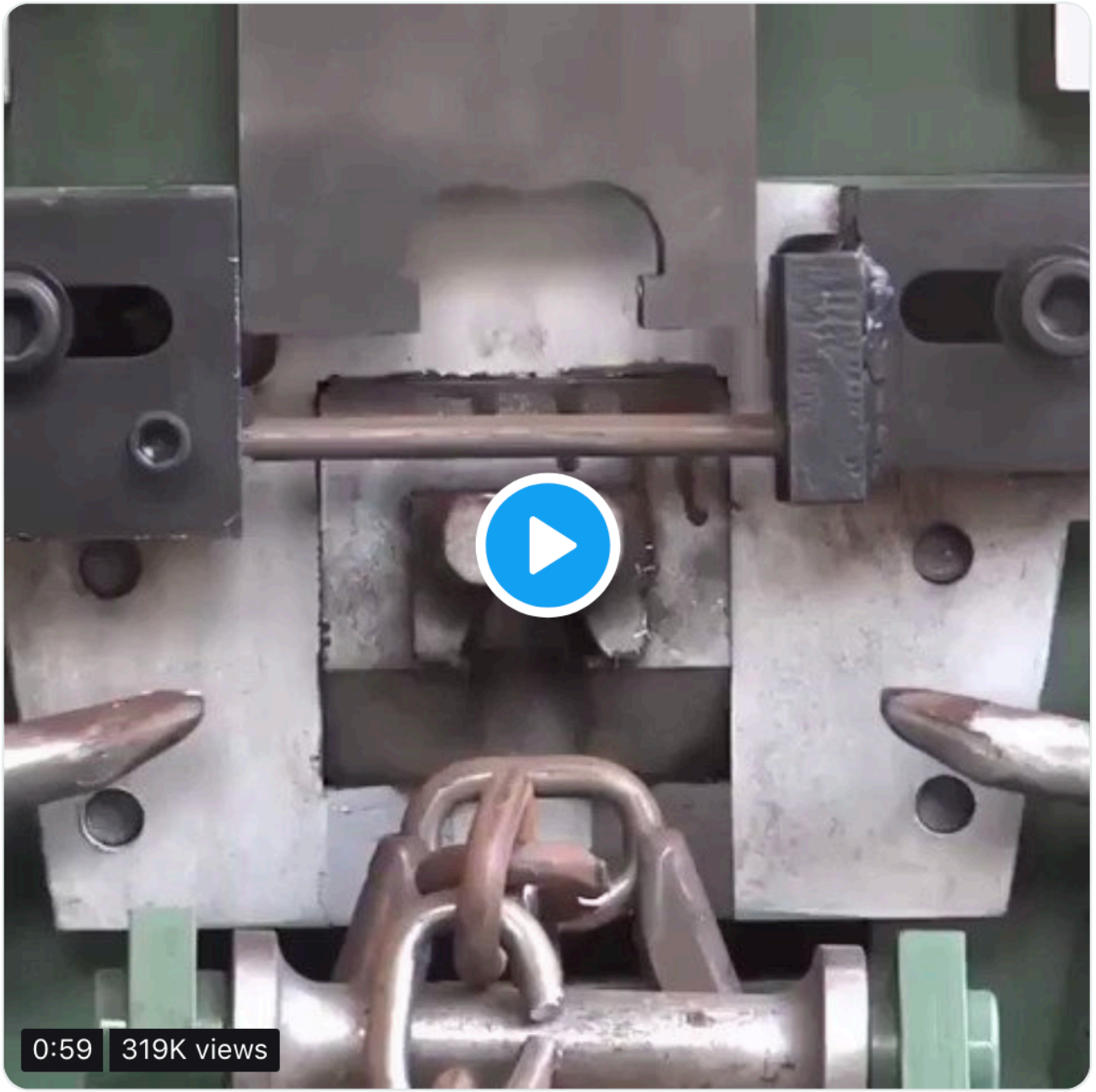
Machines and Mechanisms

https://www.amazon.com/addi-990-2-addi-Express-Professional-Knitting/dp/B000XT3OPG

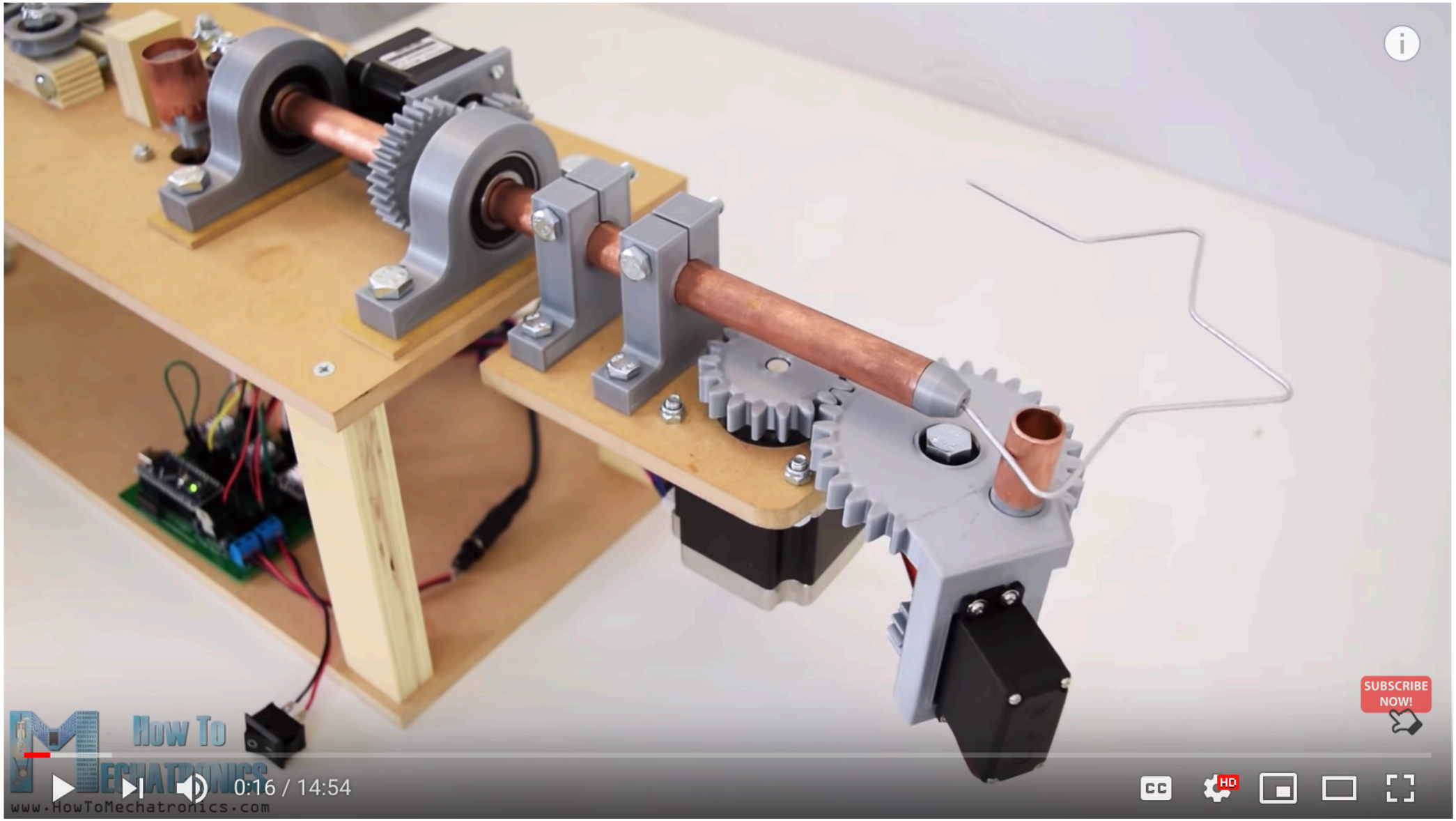

Dobby Loom

Machine Pix @MachinePix · 12 Dec 2018

Chain bending machine.

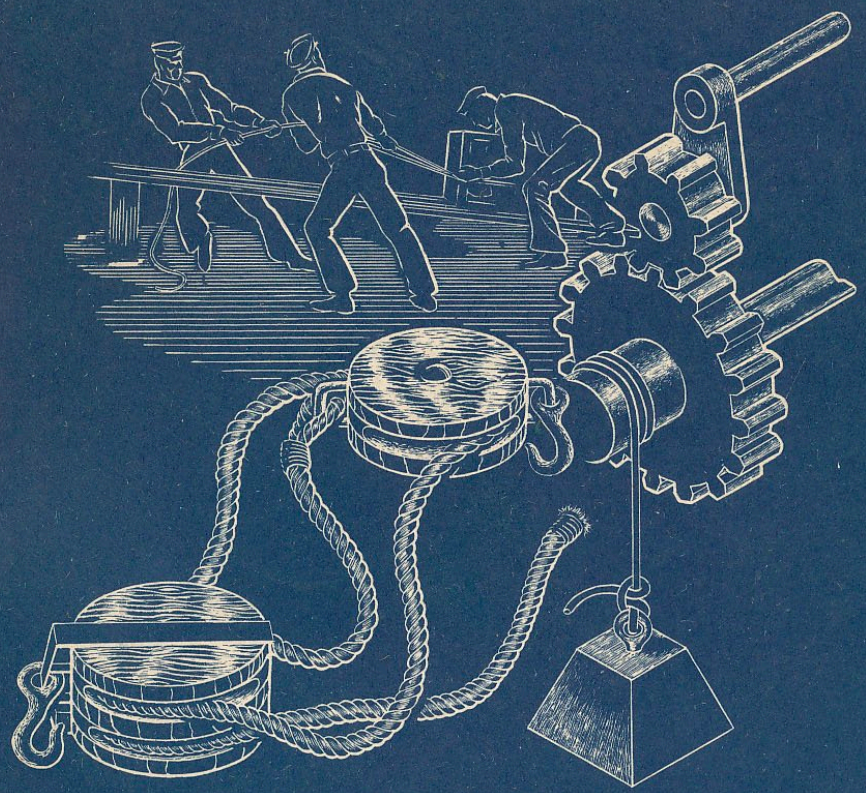


98 2.2K 7.1K



https://www.youtube.com/watch?v=HPQbKTJPsU4

What is a Machine?

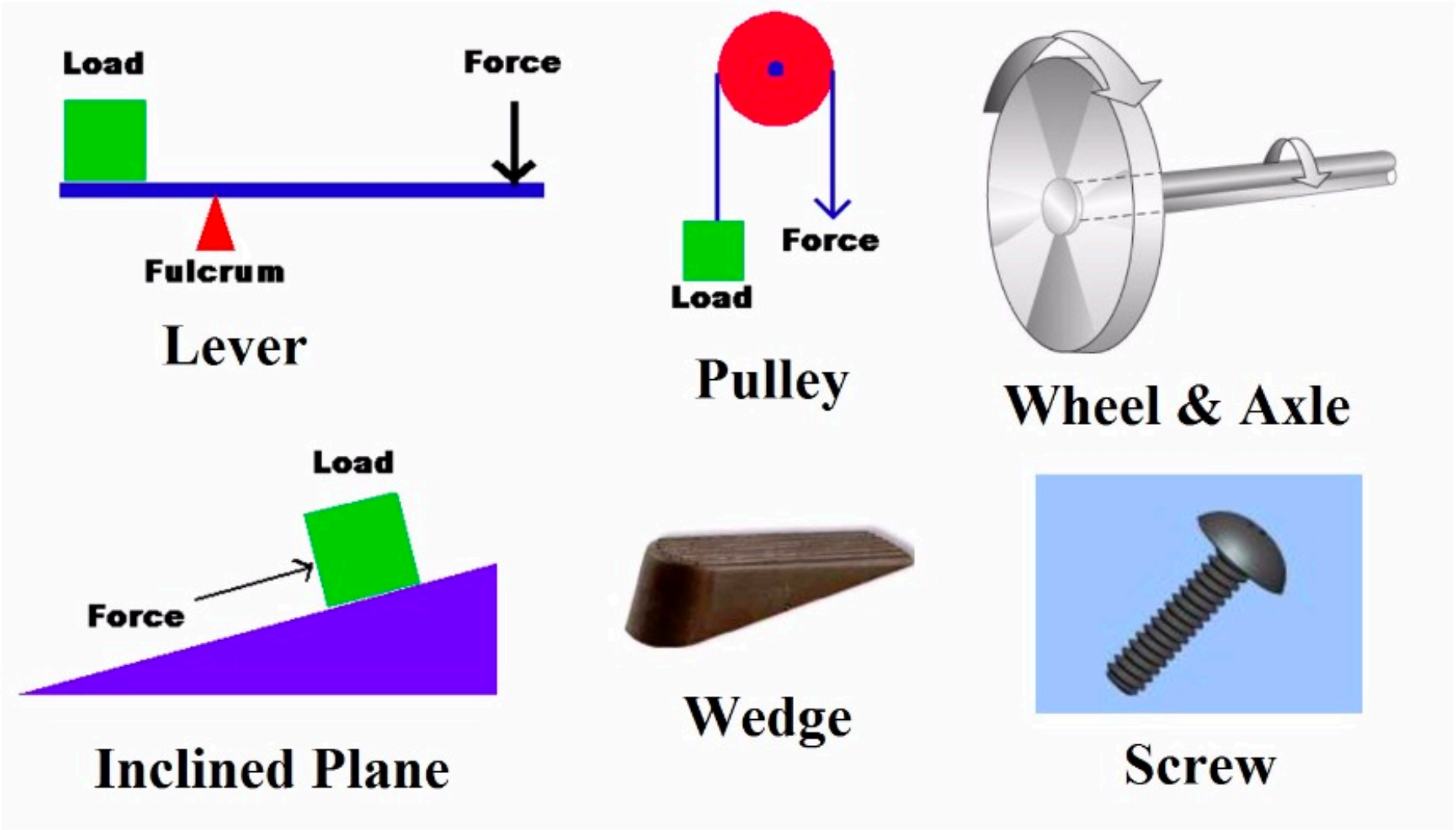


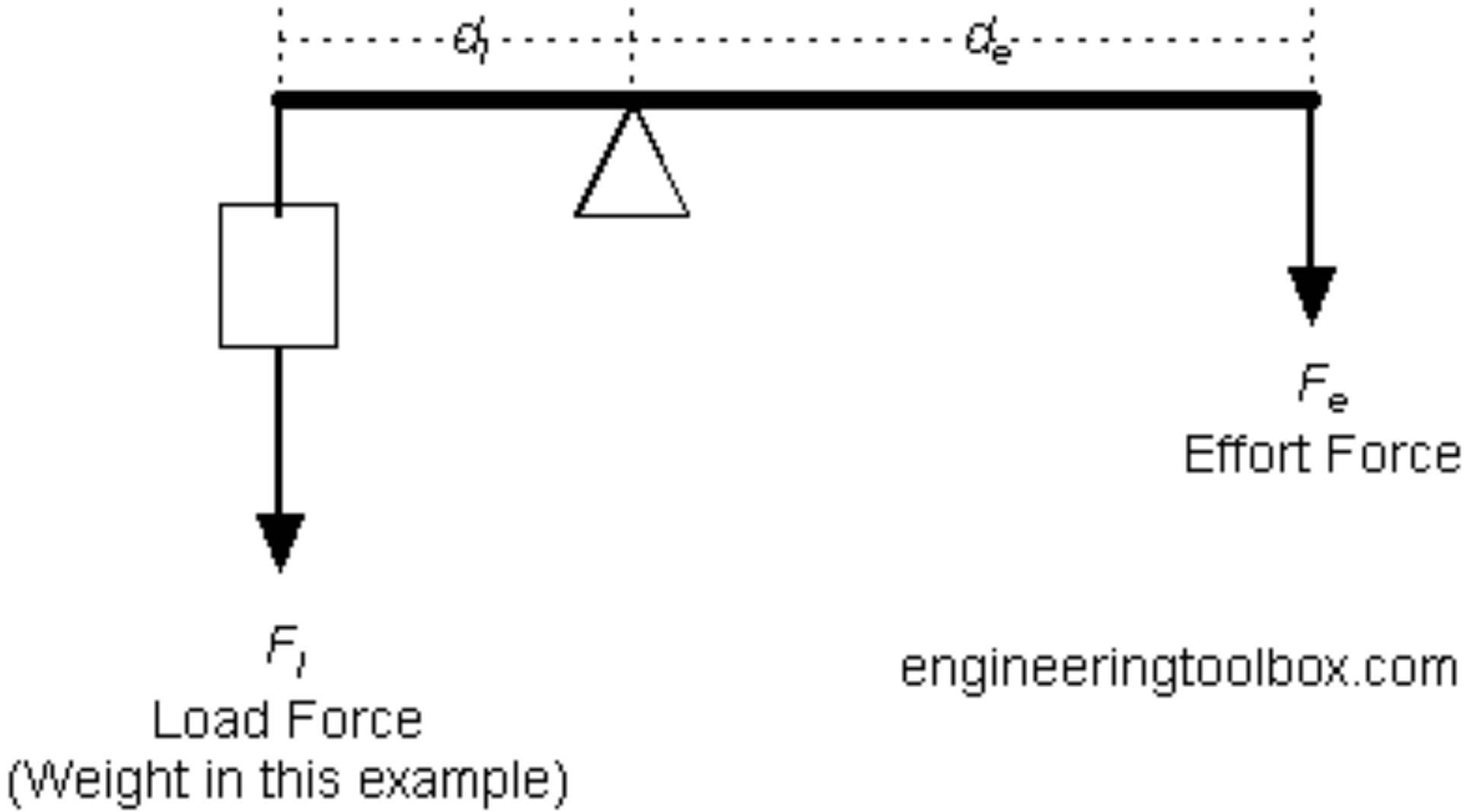
BASIC MACHINES

BUREAU OF NAVAL PERSONNEL

NAVY TRAINING COURSE NAVPERS 10624–A

Basic` Machines




d_l
d_e
F_e
Effort Force
F_l
Load Force
(Weight in this example)
engineeringtoolbox.com

$$F_l \; d_l = F_e \; d_e$$

Work and Energy

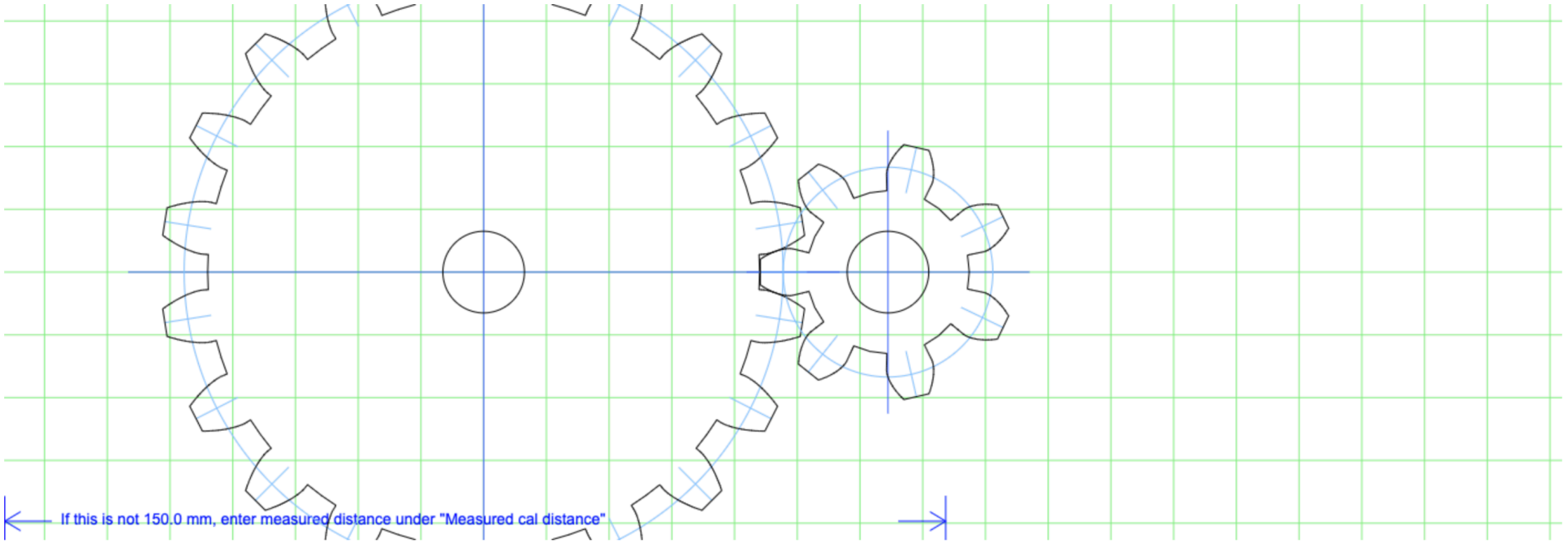
Energy converted to work

- **Force x Distance**
- **Torque x Angle**

Mechanical advantage

- **Fout / Fin**

Change distance or speed



Tooth spacing: 15 mm
Gear 1 teeth: 20 Rack&pinion
Measured cal distance: 150 (print 144.0 DPI)

Contact angle: 20 deg
Gear 2 teeth: 7 Two gears
Spokes: 3 Show spokes

Shaft hole dia.: 13 mm
Show rotated: 0 % of 1 tooth
Print gears

Pitch diameter
Line of contact
Show center
Show cm grid
Animate
Dividing plate
Explain fields (Help)

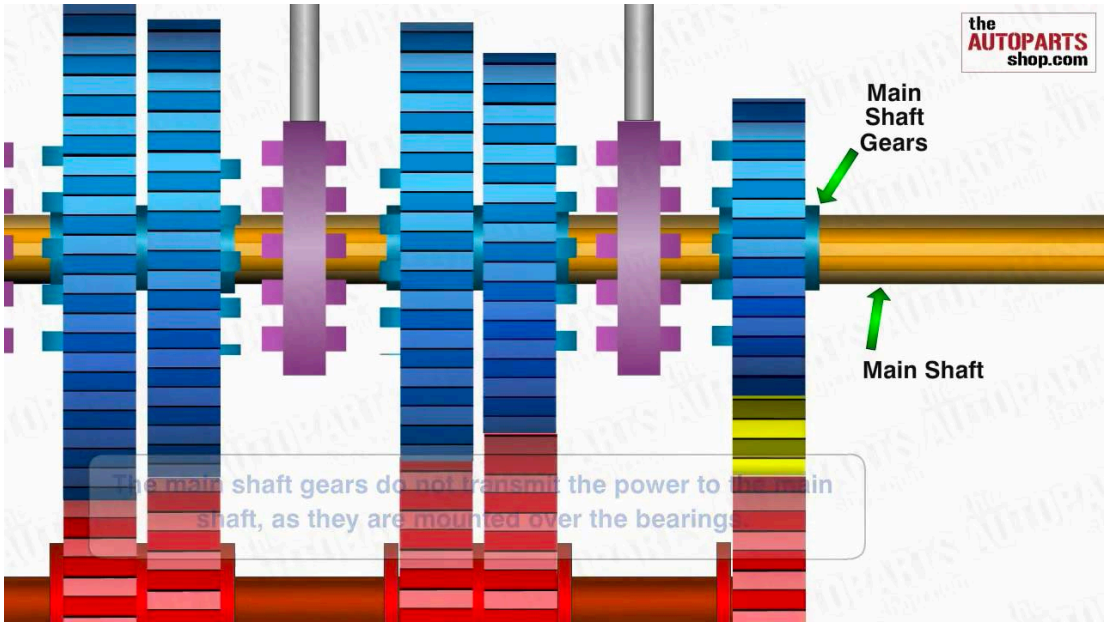
Fancier **downloadable gear template generator**

Example gears from a template
How to make wooden gears
Make gears with a jigsaw
Working out gear ratios
Right angle gears

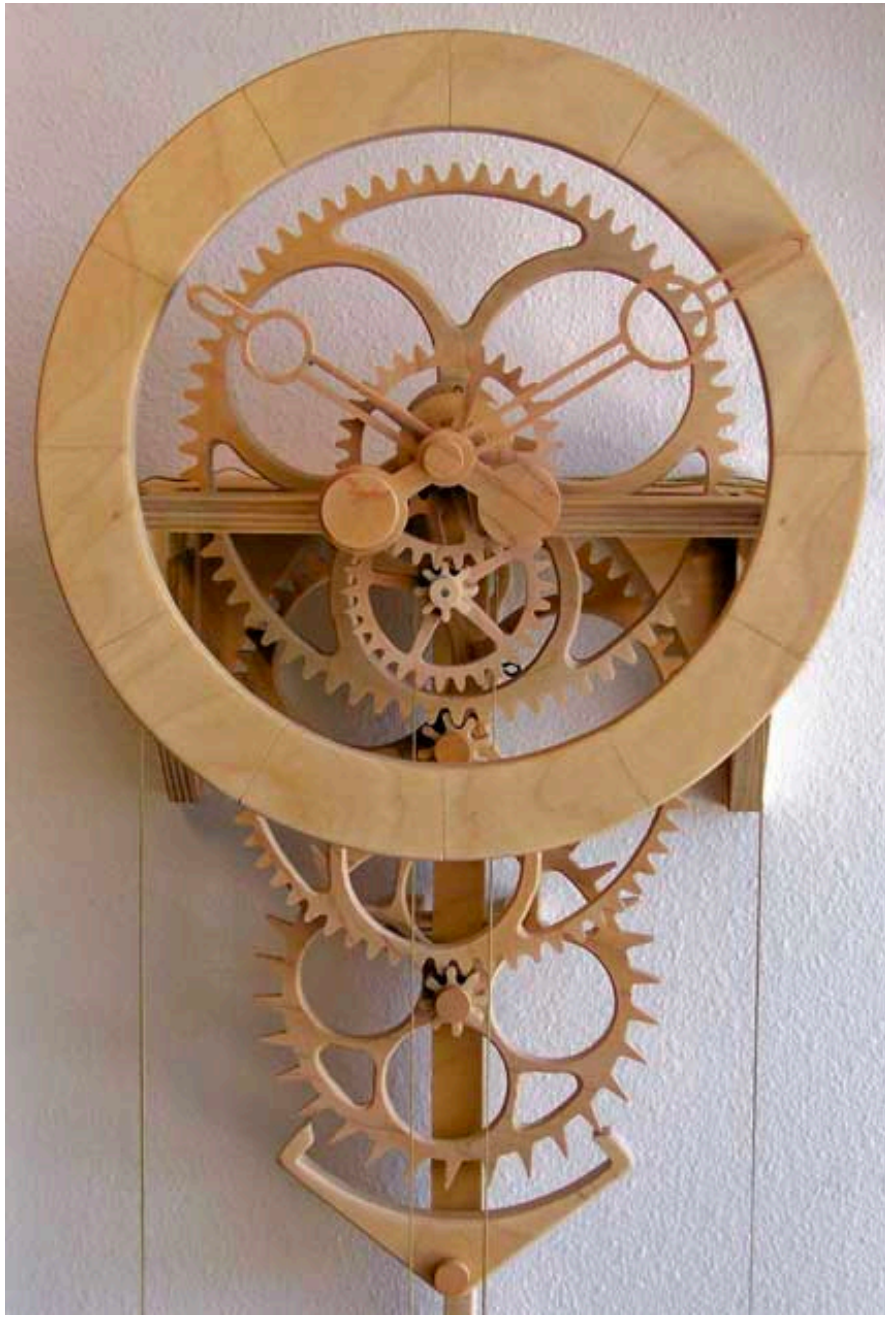
This free online gear template generator is designed for making scale accurate paper gear templates which you can glue onto wood and then cut out with a bandsaw

Gears

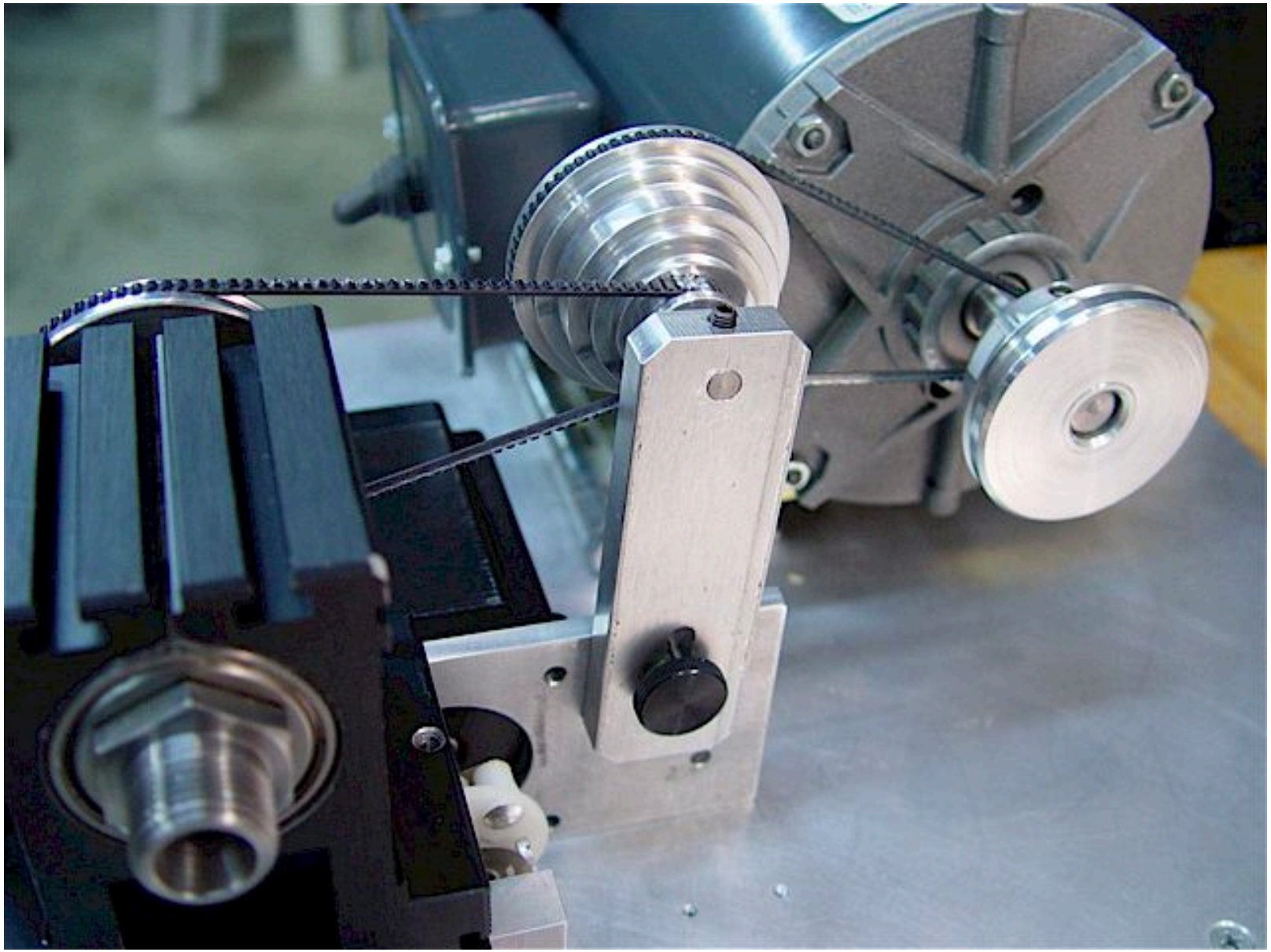
Clock
Change rate of motion



Transmission
Change speed and power



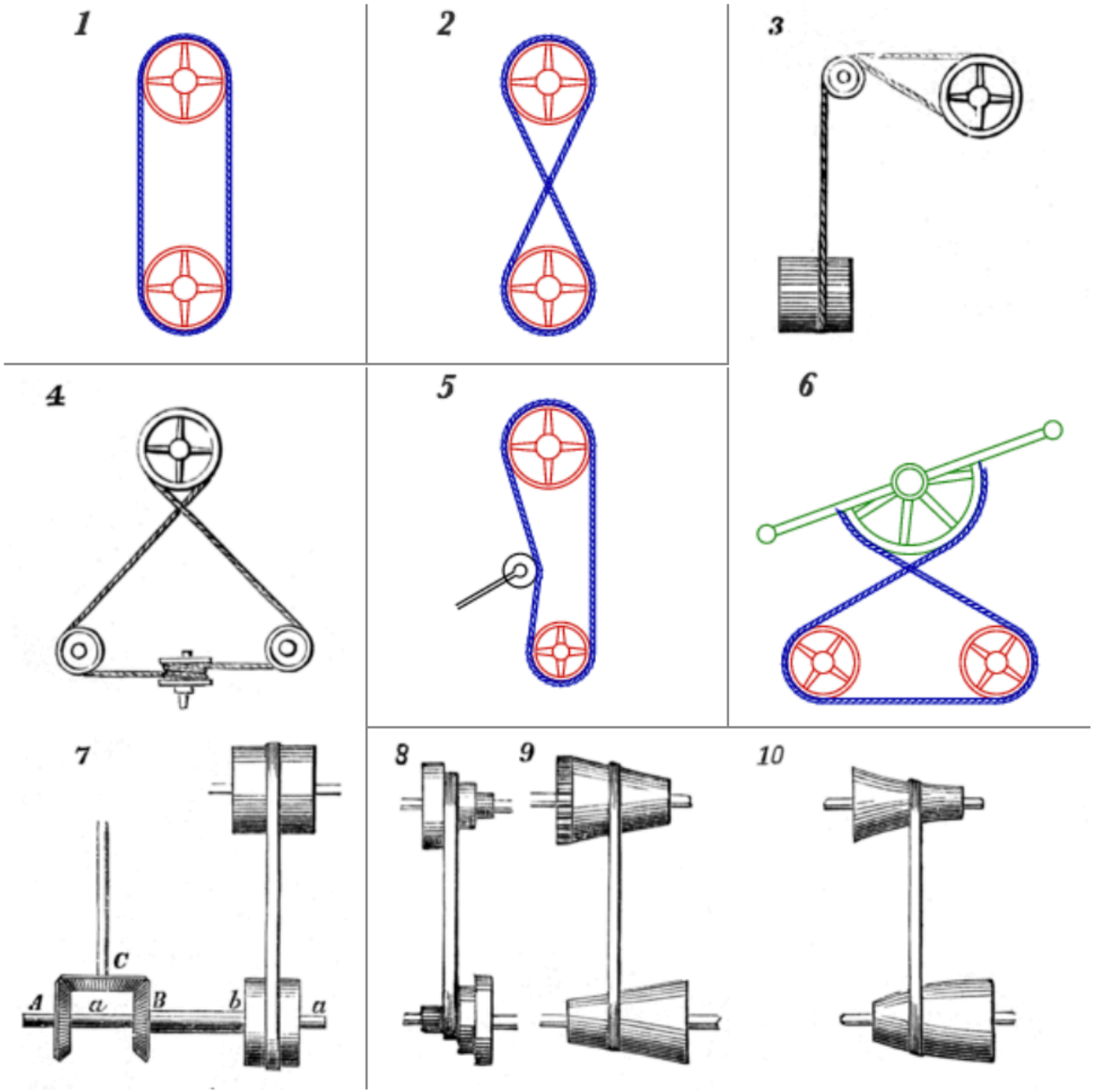
Pulleys



Lathe - Change cutting speed

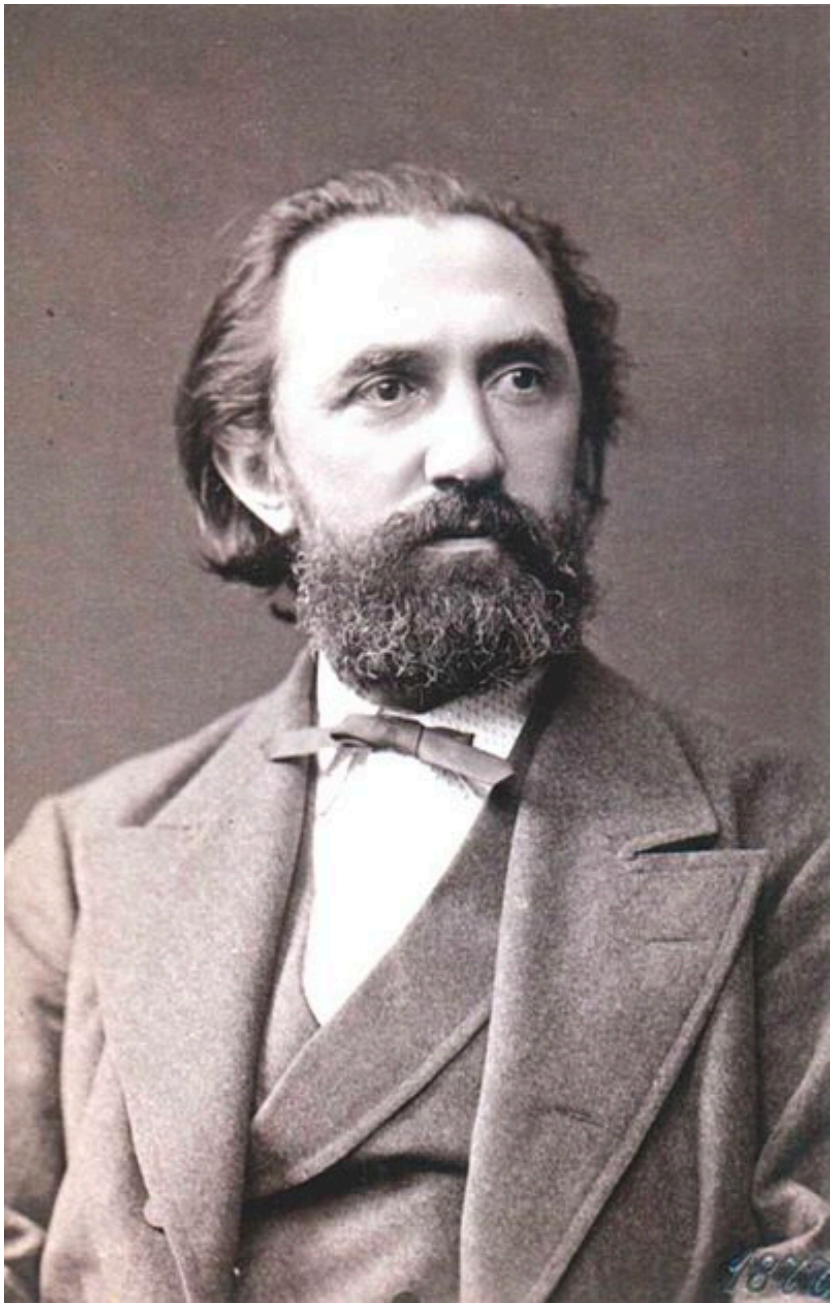
FIVE HUNDRED AND SEVEN

Mechanical Movements



Kinematic Chains

Linkages and Mechanisms



Reuleaux believed that machines could be abstracted into chains of elementary links called kinematic pairs. Constraints on the machine are described by constraints on each kinematic pair, and the sequence of movements of pairs produces a kinematic chain.

Franz Reuleaux (1829-1905)

Converting Motion

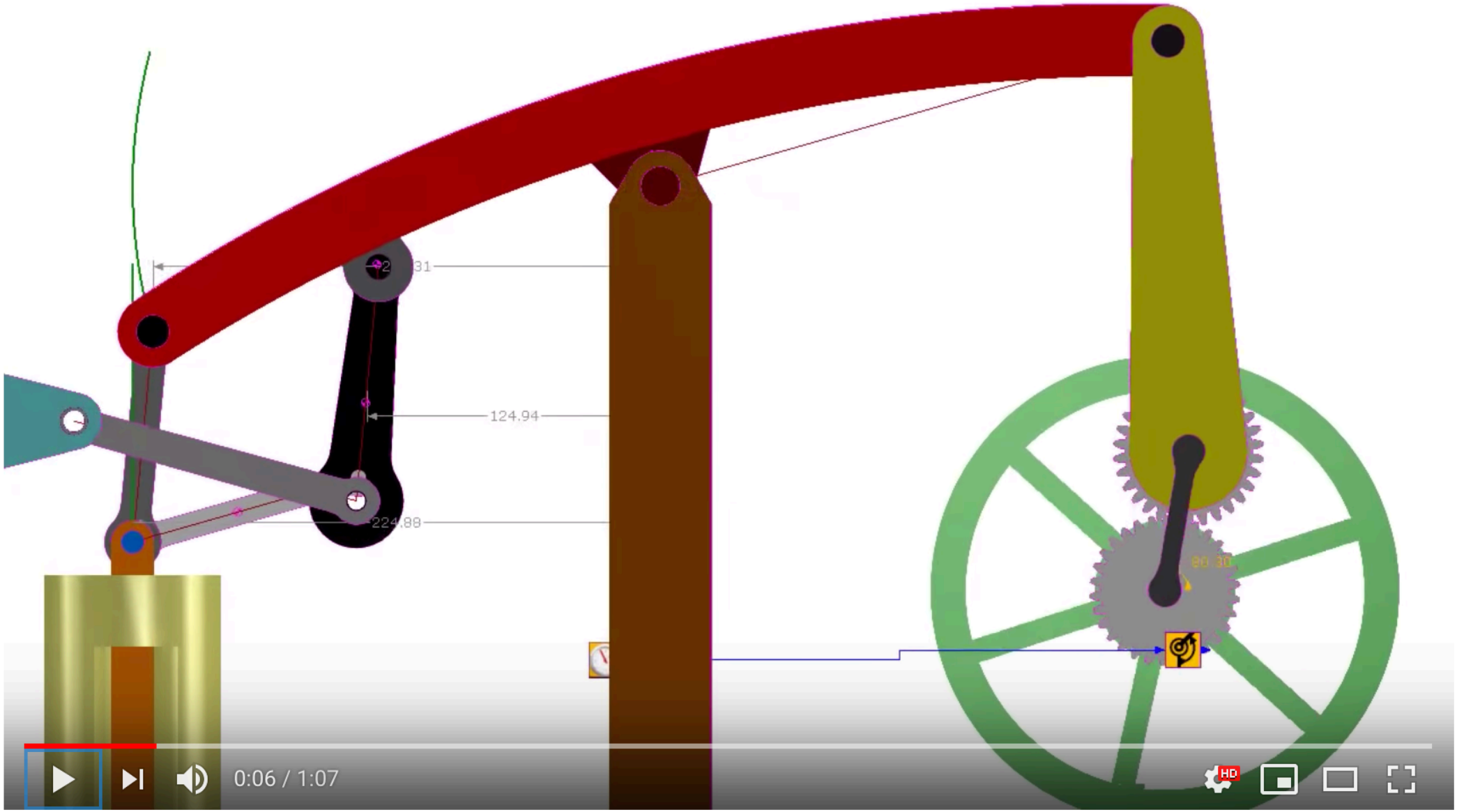
Linear to rotary

- **Windmill**
- **Water wheel**
- **Steam/Combustion engine**

Linear to rotary

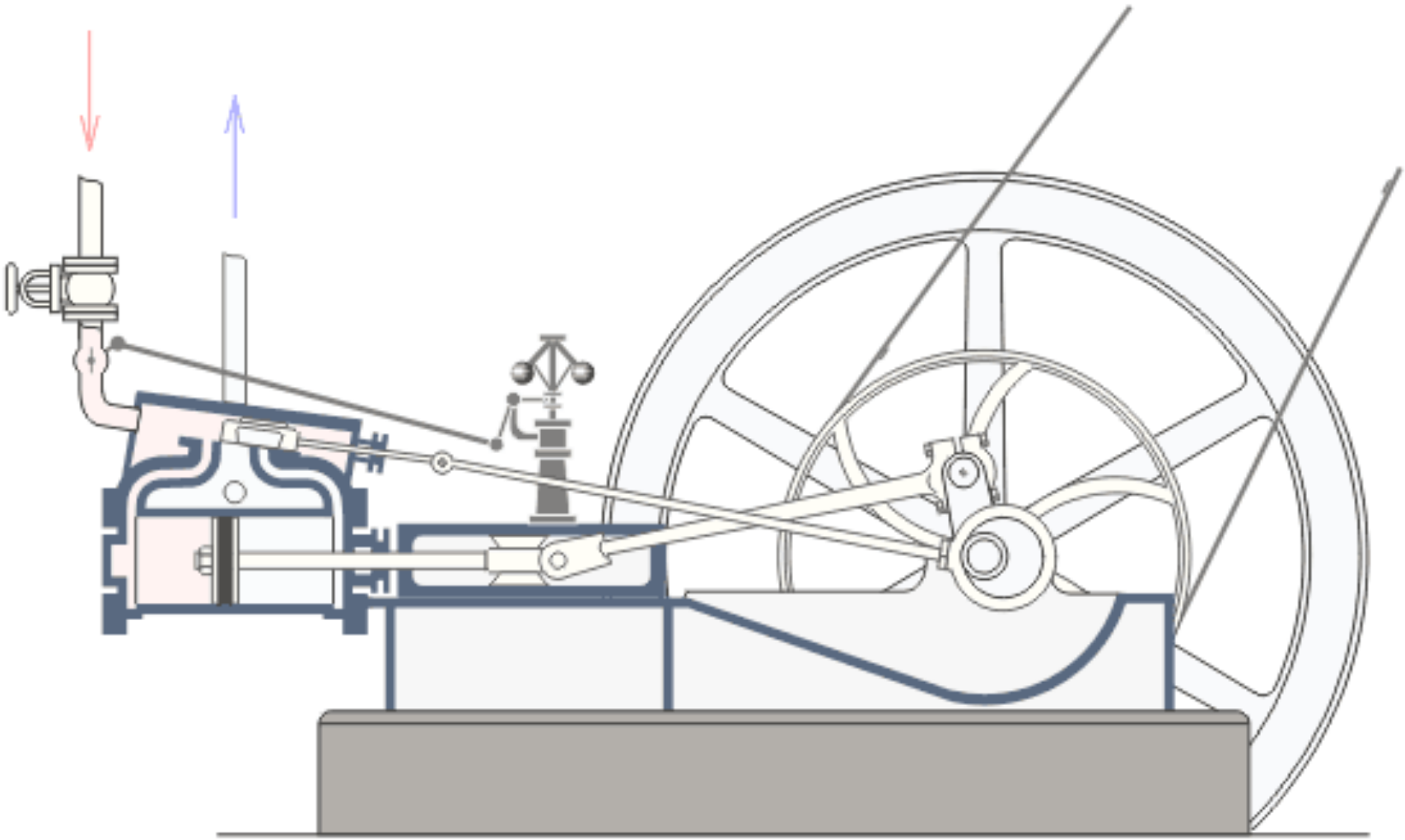
- **Piston and engine crank**

https://en.wikipedia.org/wiki/Watt%27s_linkage

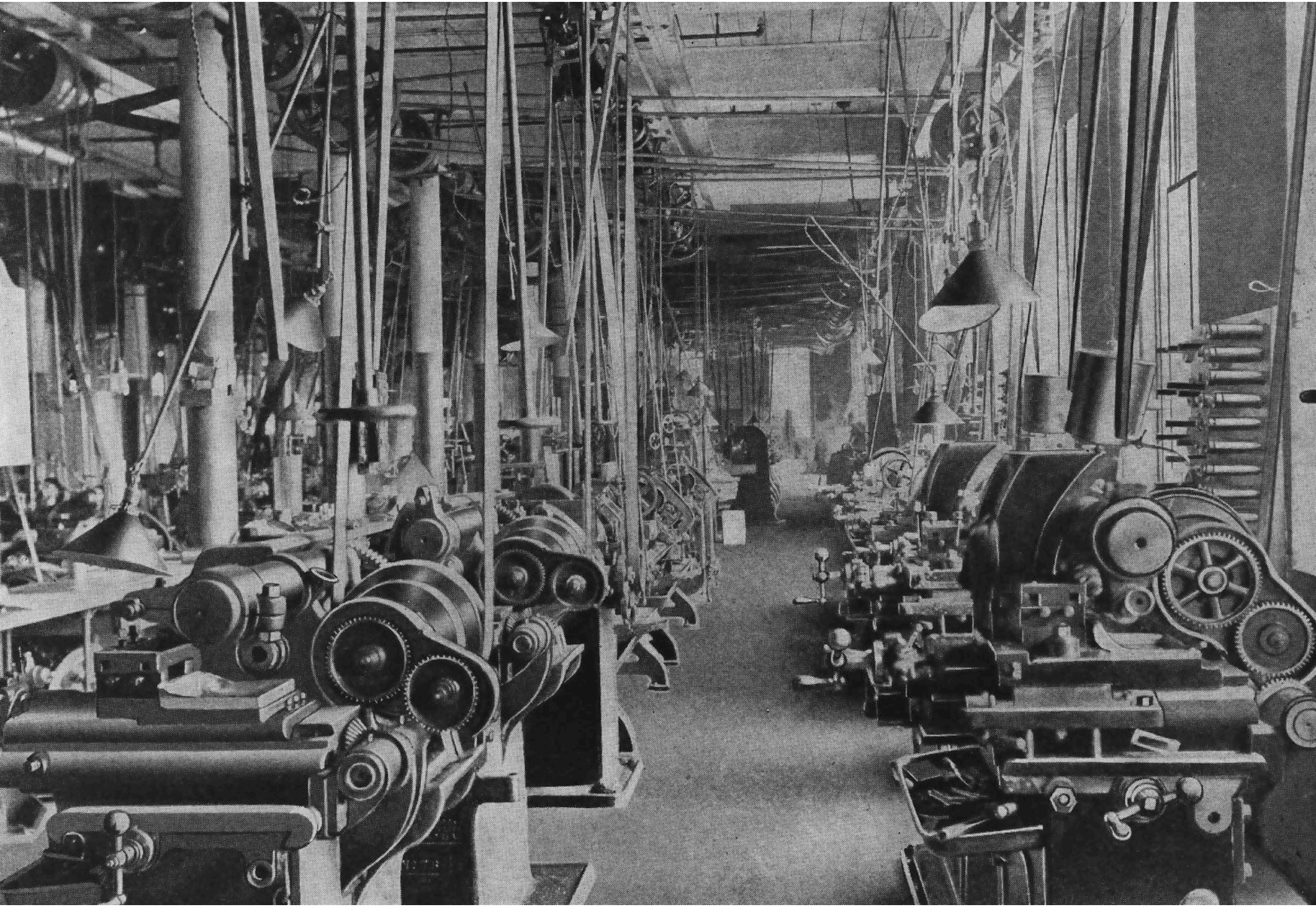


Boulton-Watt Steam Engine

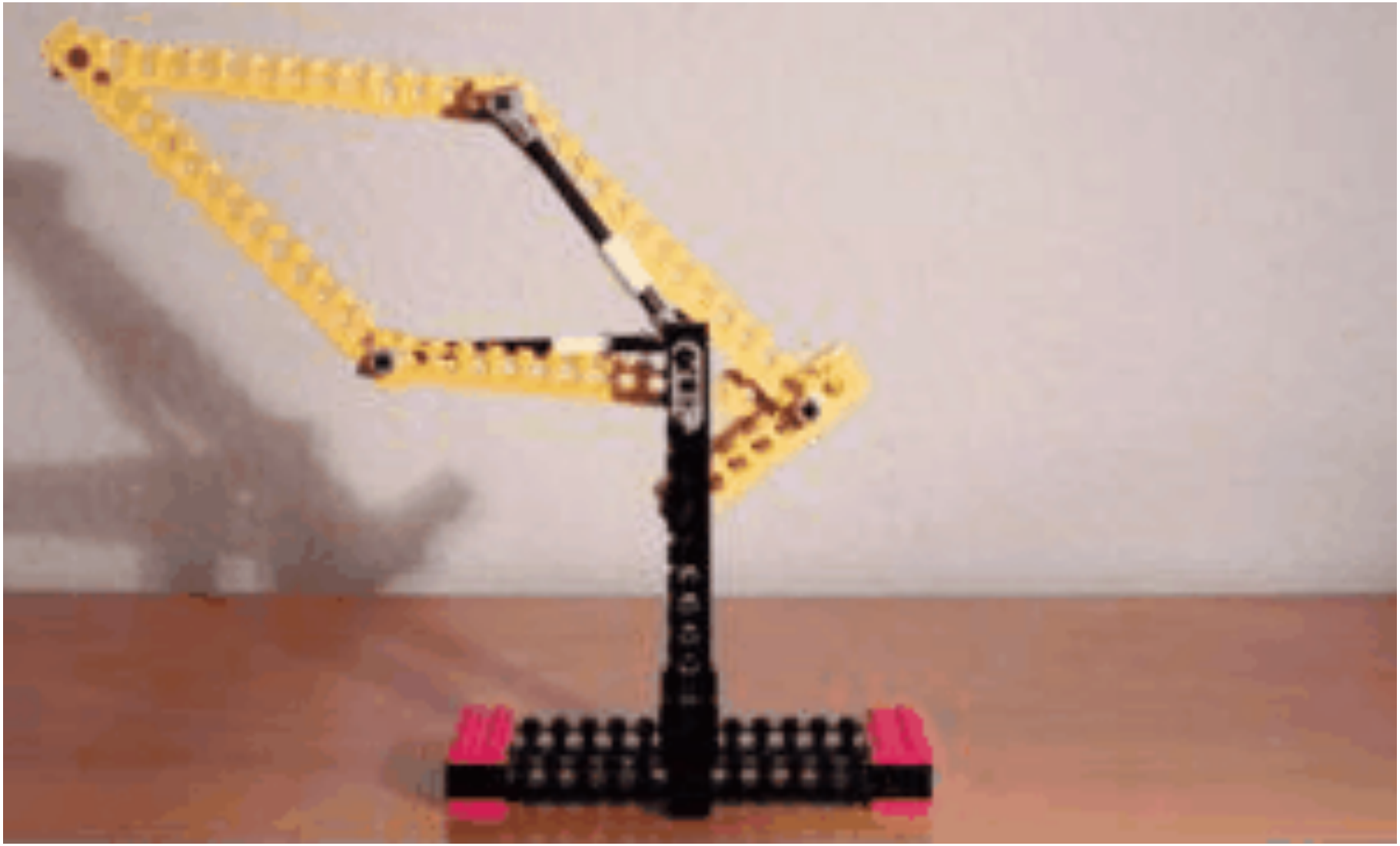
Slider Crank



Three revolute joints (R) and one prismatic joint (P)



Leo Dorst's Lego Peaucellier Cell

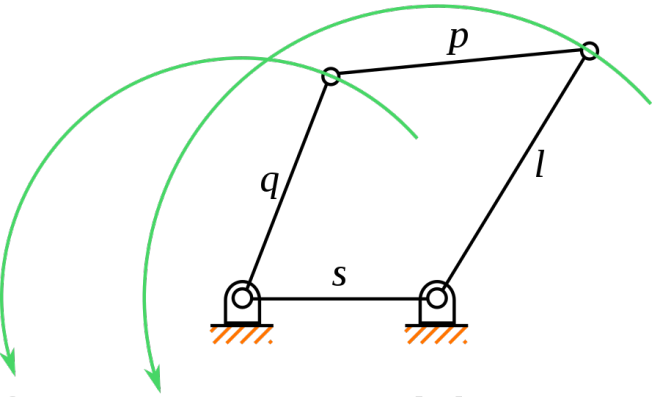


Michael Gasperi's Lego Rack and Pinion Steering

Pantograph

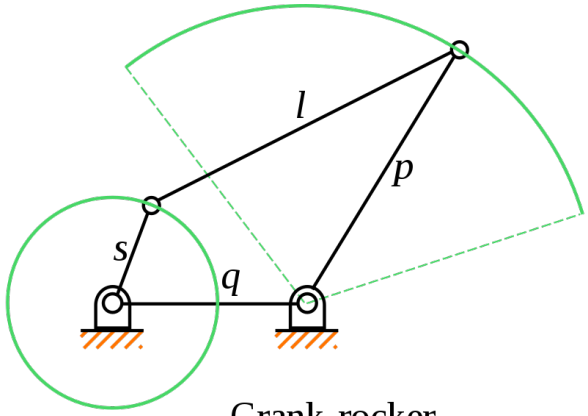

Woodgears.ca

Four-Bar Linkage

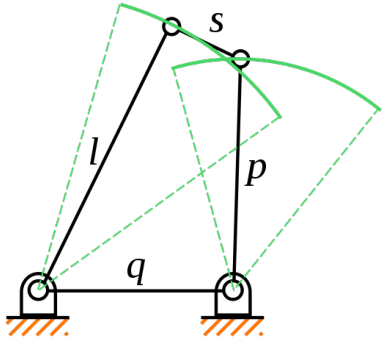


full revolution
both links

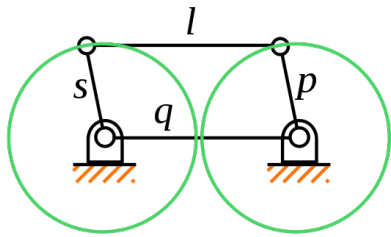
Drag-link
$s+l < p+q$
(continuous motion)



Crank-rocker
$s+l < p+q$
(continuous motion)



Double-rocker
$s+l > p+q$
(no continuous motion)



Parallelogram linkage
$s+l = p+q$
(continuous motion)

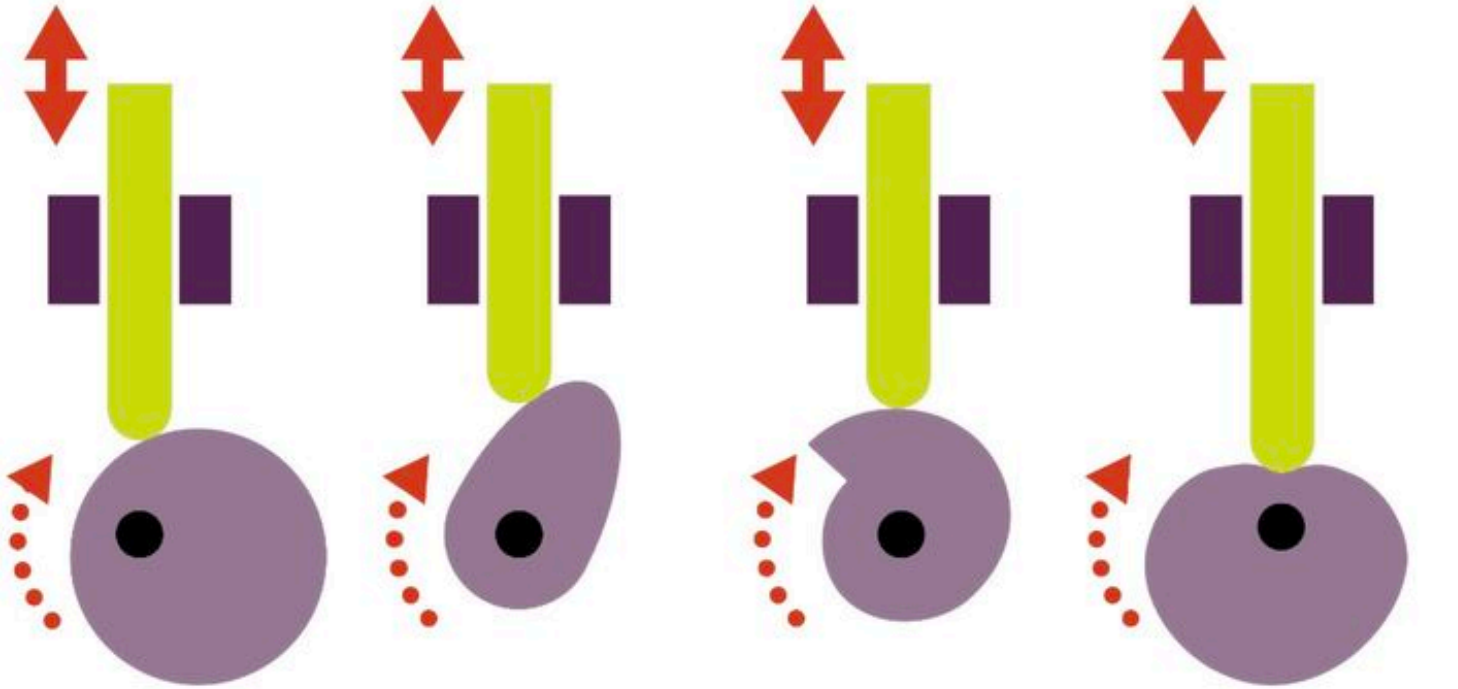
https://en.wikipedia.org/wiki/Four-bar_linkage

Thang's 2700 Animated Mechanical Mechanisms

Table of Contents

Types of cams

- Different shaped cams are used for different tasks:



Clock of the Long Now Foundation

Automata

Computational Design of Mechanical Characters

Stelian Coros*[1] Bernhard Thomaszewski*[1] Gioacchino Noris[1] Shinjiro Sueda[2] Moira Forberg[2]
Robert W. Sumner[1] Wojciech Matusik[3] Bernd Bickel[1]

[1]Disney Research Zurich [2]Disney Research Boston [3]MIT CSAIL

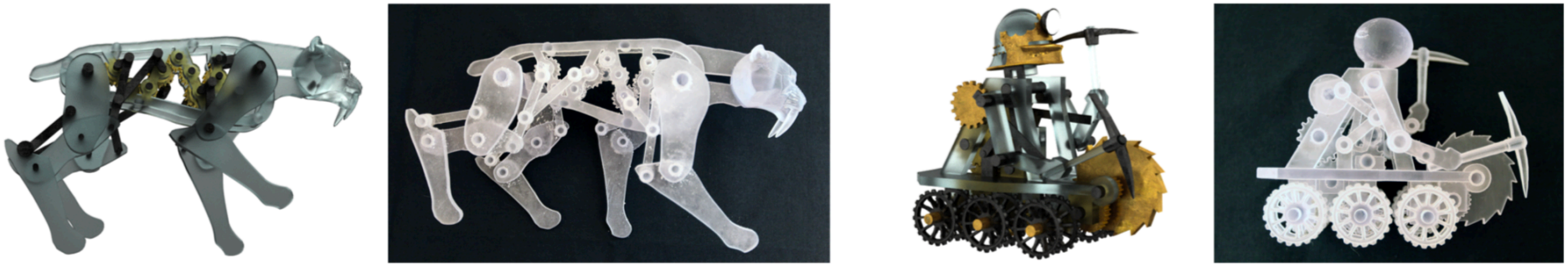


Figure 1: *The interactive design system we introduce allows non-expert users to create complex, animated mechanical characters.*

Abstract

We present an interactive design system that allows non-expert users to create animated mechanical characters. Given an articulated character as input, the user iteratively creates an animation by sketching motion curves indicating how different parts of the character should move. For each motion curve, our framework creates an optimized mechanism that reproduces it as closely as pos-

1 Introduction

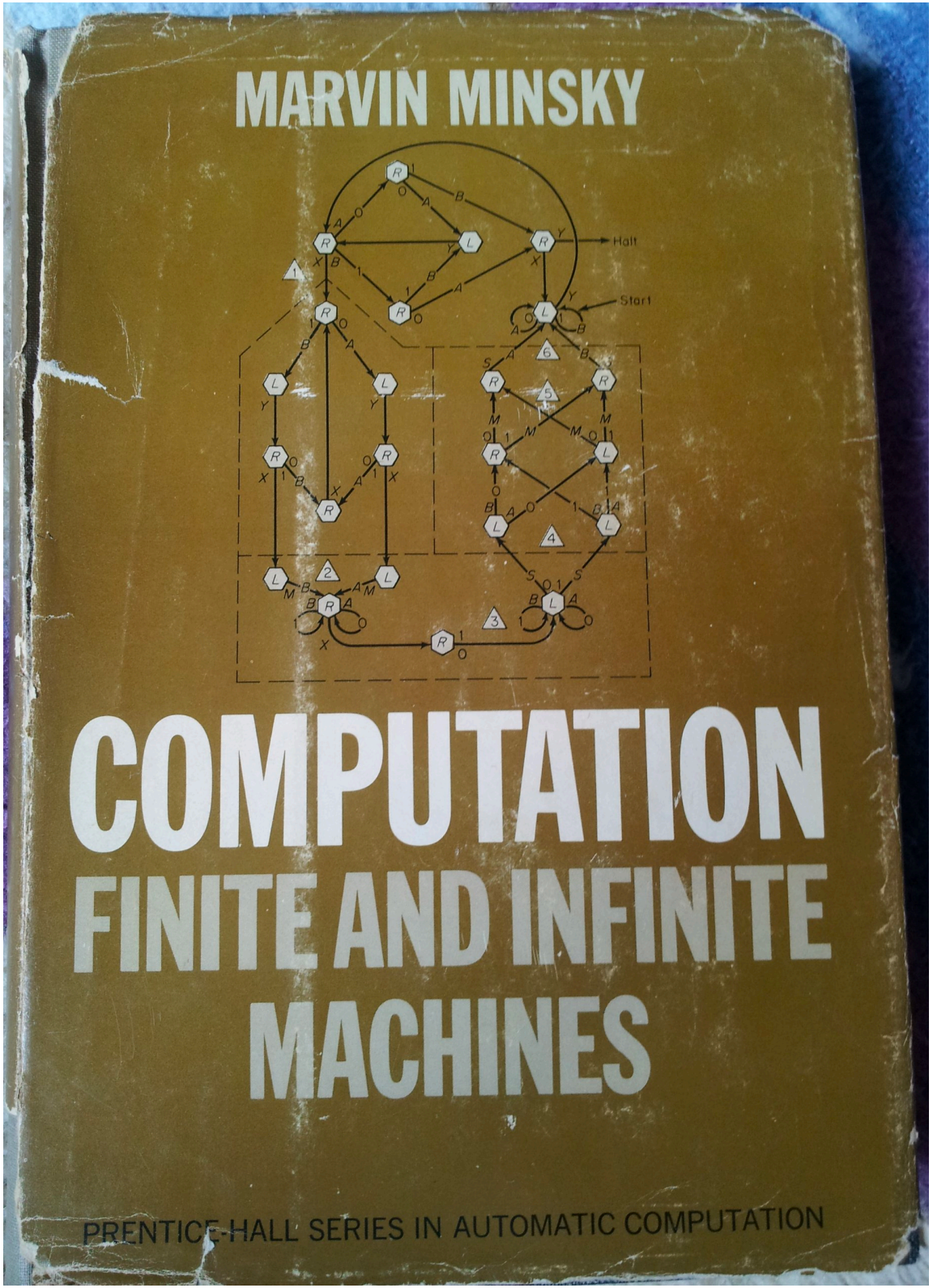
Character animation allows artists to bring fictional characters to life as virtual actors in animated movies, video games, and live-action films. Well-established software packages assist artists in realizing their creative vision, making almost any digital character and movement possible. In the pl[Screenshot]l, animatronic figures play an equivalent role in theme parks and as special ef-

Cylinder Music Box

Washing Machine Sequencer (1970ish)

https://en.wikipedia.org/wiki/Cam_timer


BASIC MECHANISMS
IN
FIRE CONTROL
COMPUTERS
Part 1
0:05 / 6:14



What is a Machine?

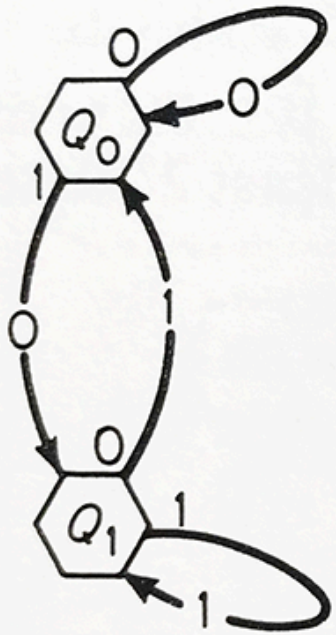


Fig. 2.3-1. Memory machine.

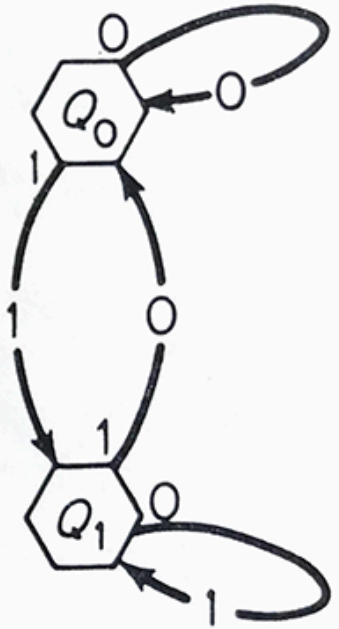


Fig. 2.3-2. Parity machine.

From: Computation: Finite and Infinite Machines

References

Basic Machines, NAVEDTRA 14037

Computation: Finite and Infinite Machines, M. Minsky

Videos

- **Mechanical computers**

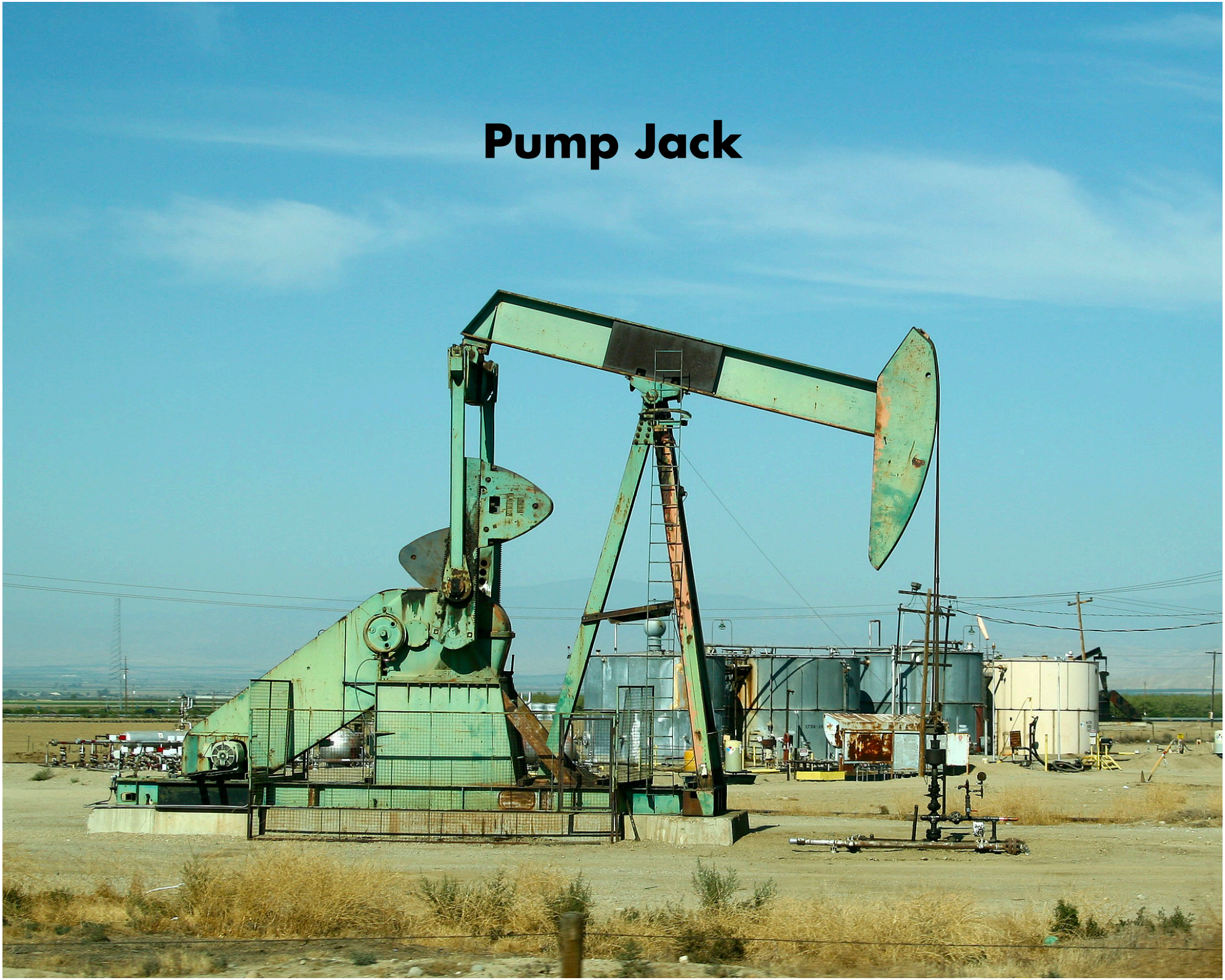
Web sites

- **http://507movements.com**
- **Thang's animations**

Openbuilds Linear Actuator

Scissors Lift

Pump Jack



1 PHYSICAL MACHINES AND THEIR ABSTRACT COUNTERPARTS

1.0 WHAT IS A MACHINE?

When the term "machine" is used in ordinary discourse, it tends to evoke an unattractive picture. It brings to mind a big, heavy, complicated object which is noisy, greasy, and metallic; performs jerky, repetitive, and monotonous motions; and has sharp edges that may hurt one if he does not maintain sufficient distance.

There are many reasons why "machine" or "mechanical" have come to arouse feelings of distaste, contempt, and fear. Even today, most of the machinery we see is concerned with the use of brute power to distort and transform crude materials. Most present-day machines really *are* dangerous. Unlike our bodies, production machines are made of large, sturdy parts that need no soft sheathing for their protection. Now while it is unnecessary to attribute callousness or antipathy to a rolling-mill, it is practically impossible to attribute anything more friendly. Perhaps we even fear that any more sympathetic attitude might lead to a well-intentioned but disastrous embrace. There are occasional exceptions to this feeling. We may admire in the works of a small watch that craftsmanship

new technological revolution
lectual processes. Today we have the beginnings: machines th
machines that *learn* to play games; machines that handle a
numerical—mathematical problems and deal with ordinary
pressions; and we see many other activities formerly confi
province of human intelligence. Within a generation, I am
compartments of intellect will remain outside the machin
problems of creating "artificial intelligence" will be substantia

Such matters are not properly within the scope of what is
However, it is important to understand from the start that
with questions about the ultimate theoretical capacities and
machines rather than with the practical engineering analy
mechanical devices.

To make such a theoretical study, it is necessary to
many realistic details and features of mechanical systems.
part, our abstraction is so ruthless that it leaves only a skel
tation of the structure of sequences of events inside a mach
"symbolic" or "informational" structure. We ignore, in o
the geometric or physical composition of mechanical par
questions about energy. We even shred time into a sequen
disconnected moments, and we totally ignore space itself
theory be a theory of any "thing" at all?

understanding, which we could never obtain while immersed in inessential detail and distraction.

Actually, the exposition in these chapters is as concrete and worldly as seems compatible with the ideas. All the topics could be handled much more precisely and thoroughly by using more formal mathematical representations. In fact, most of the ideas here appeared first in mathematical publications. I do not claim that it is possible, by sufficiently skillful exposition, to "clear away all the mathematics" without any loss. For, as we shall see, some of the best ideas about the theory of machines are really inherently mathematical—*or are about mathematics itself.* In discussions that concern the nature of symbolic mathematical expressions, for instance, we will develop by definitions and examples the mathematical formalism necessary for our purposes. But my intention was to make the test accessible even to readers with no more than good high-school mathematics backgrounds, and I have explicitly marked as optional the few sections where this goal seemed completely unreasonable.