LINKAGE MECHANISMS

REVERSE MOTION

PARALLEL MOTION

CRANK AND SLIDER

BELL CRANK

TREADLE

LINKAGE MECHANISM - ANGLE POISED LAMP

This angle-poised desk lamp is a textbook example of a linkage mechanism in action.

Why It is a Great Linkage Mechanism

1. Multiple Pivot Points

The lamp's arm is made of two rigid segments connected by pivot joints. These pivots allow each segment to rotate independently, transmitting motion from one part of the lamp to another.

2. Controlled Motion Transfer

When you adjust the angle of the lamp head, the movement is transferred through the linkage system to reposition the entire arm. This is a classic example of motion being stabilised by mechanical linkages.

3. Spring-Loaded Tension

The visible coiled springs act as tension regulators, counterbalancing the weight of the lamp and maintaining its position. This adds a layer of mechanical feedback, allowing the lamp to hold its pose without slipping.

4. Fixed and Moving Pivots

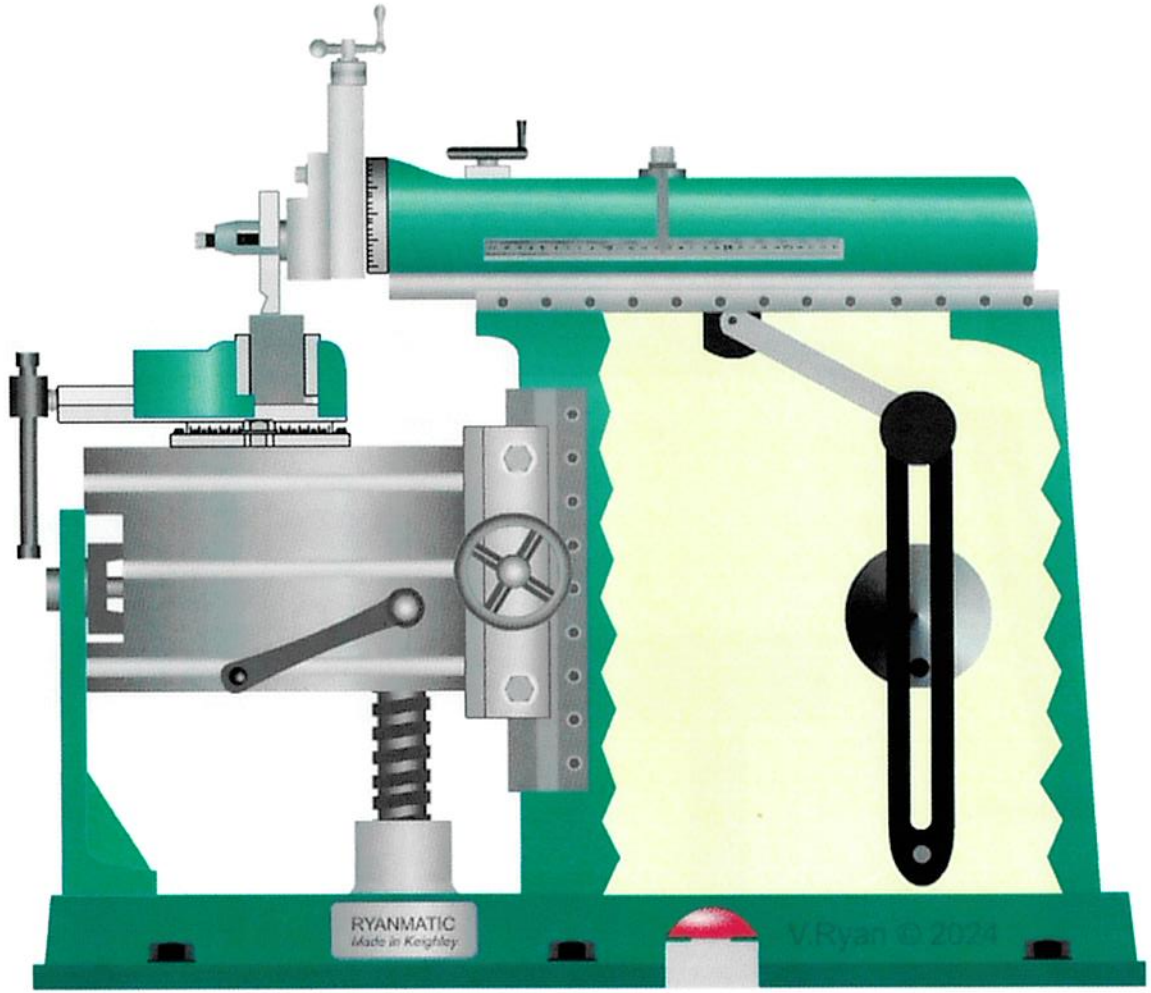
The base acts as a fixed pivot, anchoring the system. The joints between arm segments are moving pivots, enabling dynamic adjustment while preserving structural integrity.

5. Real-World Utility

This is not just theoretical, it is a functional, ergonomic application of linkage principles. It demonstrates how mechanical design can enhance usability, precision and comfort in everyday tools.

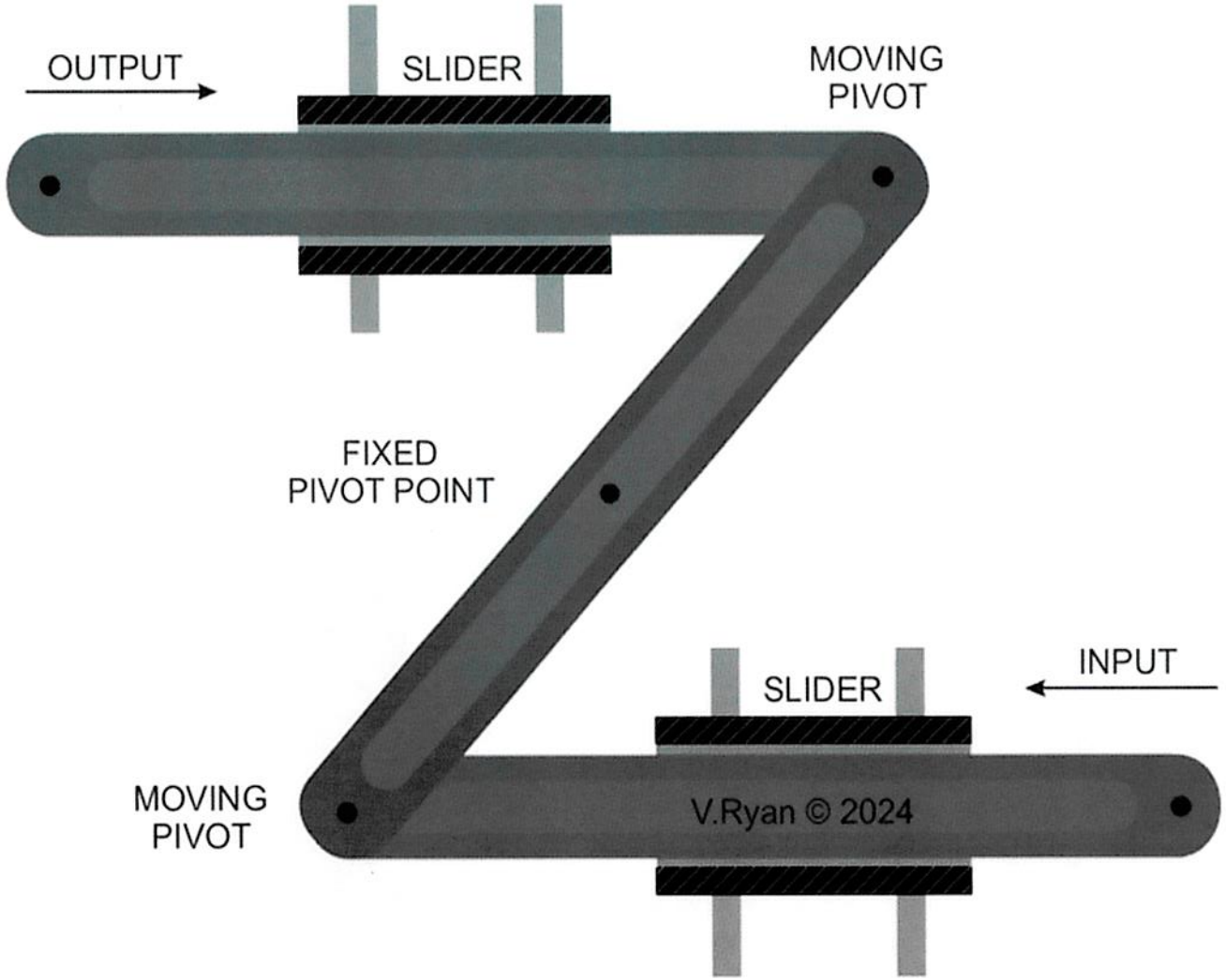
QUICK RETURN CRANK MECHANISM

A quick return mechanism is used where there is a need to convert rotary motion from an electric motor, into reciprocating motion. Inside a Shaping Machine, the quick return mechanism moves the cutting tool forwards and backwards.



REVERSE MOTION LINKAGE

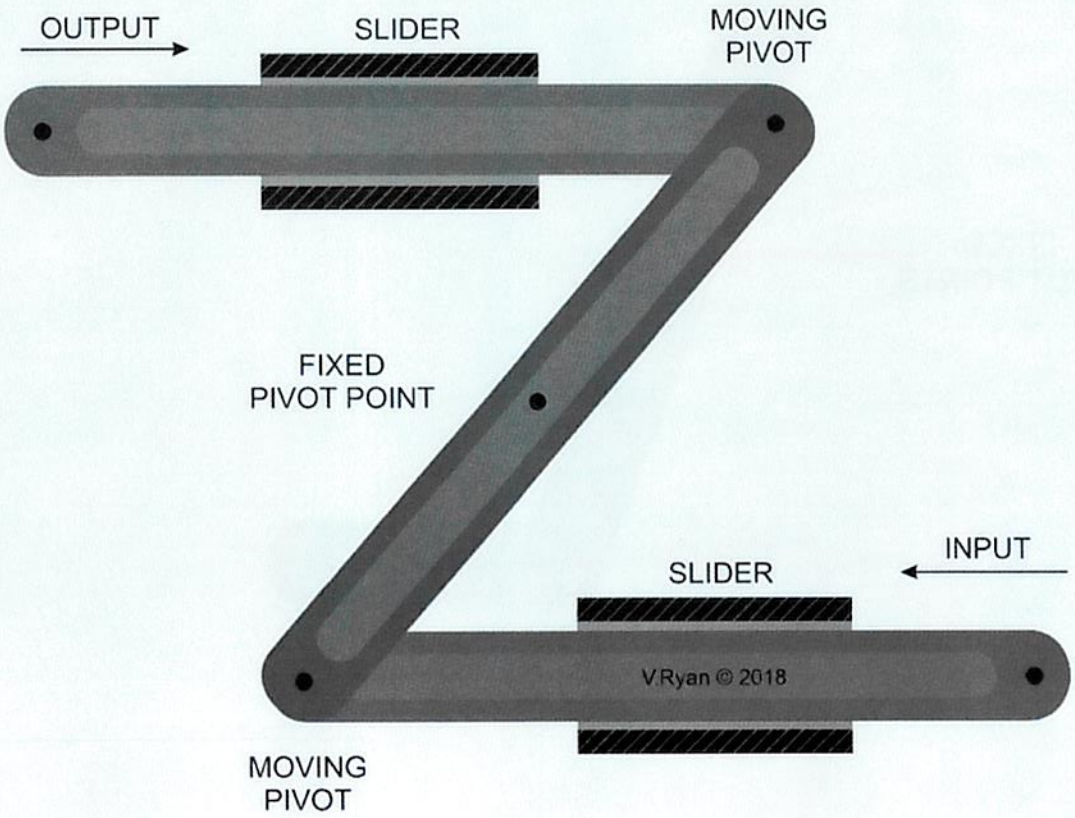
As the top rod moves to the left the bottom rod moves to the right. The bars move in opposite directions. Another way of describing this linkage is the direction of movement in one rod is reversed in the other rod. The fixed pivot is the centre of rotation

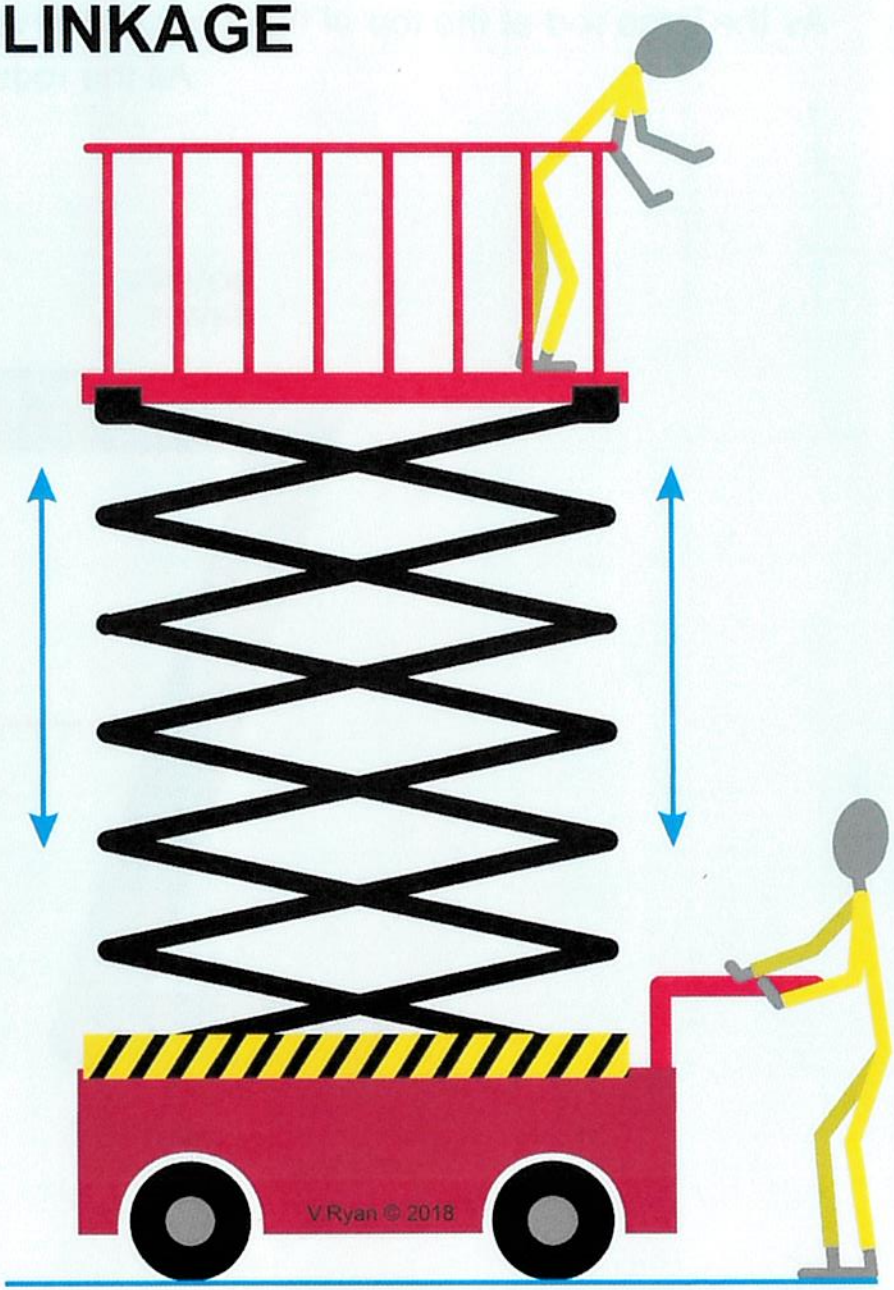


REVERSE MOTION LINKAGE

A Reverse Motion linkage, is a simple mechanism that reverses the direction of input (see the diagram). The fixed pivot plays a central and crucial role in the reversal of direction.

A good example of a practical application of this mechanism, is a motorised trolley with a vertical platform. The mechanism opposite, is composed of a number of reverse motion linkages, that allow the platform to lift and lower safely.





PRACTICAL EXAMPLE - TOOL BOX DRAWERS

WHY THE TOOLBOX IS A STRONG EXAMPLE OF PARALLEL MOTION LINKAGE

1. Coordinated Linkage Arms

Each drawer is connected by pairs of linkage arms that move in sync. The arms are arranged so that their motion keeps the drawers level and aligned as they extend outward, no tilting or skewing.

2. Fixed and Moving Pivots

The system uses fixed pivots at the base and moving pivots along the arms. As the lid is lifted, the arms rotate around these pivots, causing the drawers to unfold in a smooth, parallel motion.

3. Efficient Space Expansion

The linkage allows the toolbox to expand its storage capacity without increasing its footprint. When closed it is compact. When opened, it reveals multiple layers of drawers, ideal for tool organisation.

CRANK AND SLIDER LINKAGE

The rods move forwards and backwards in slider. The fixed pivot anchor the linkages to one place.

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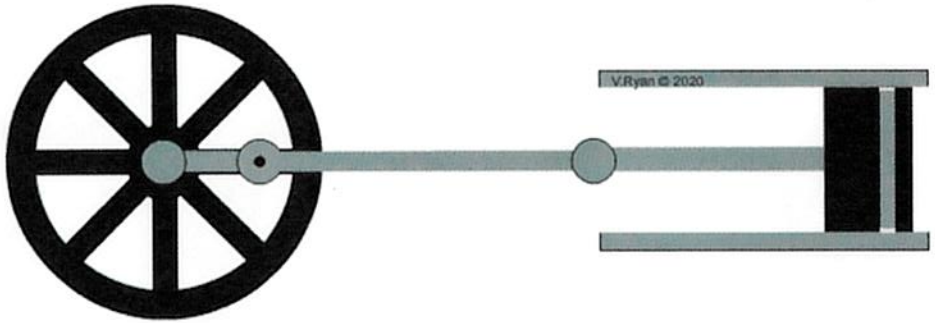
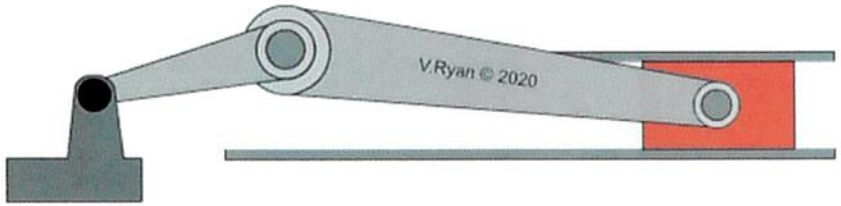
PRACTICAL APPLICATION - CRANK AND SLIDER LINKAGE

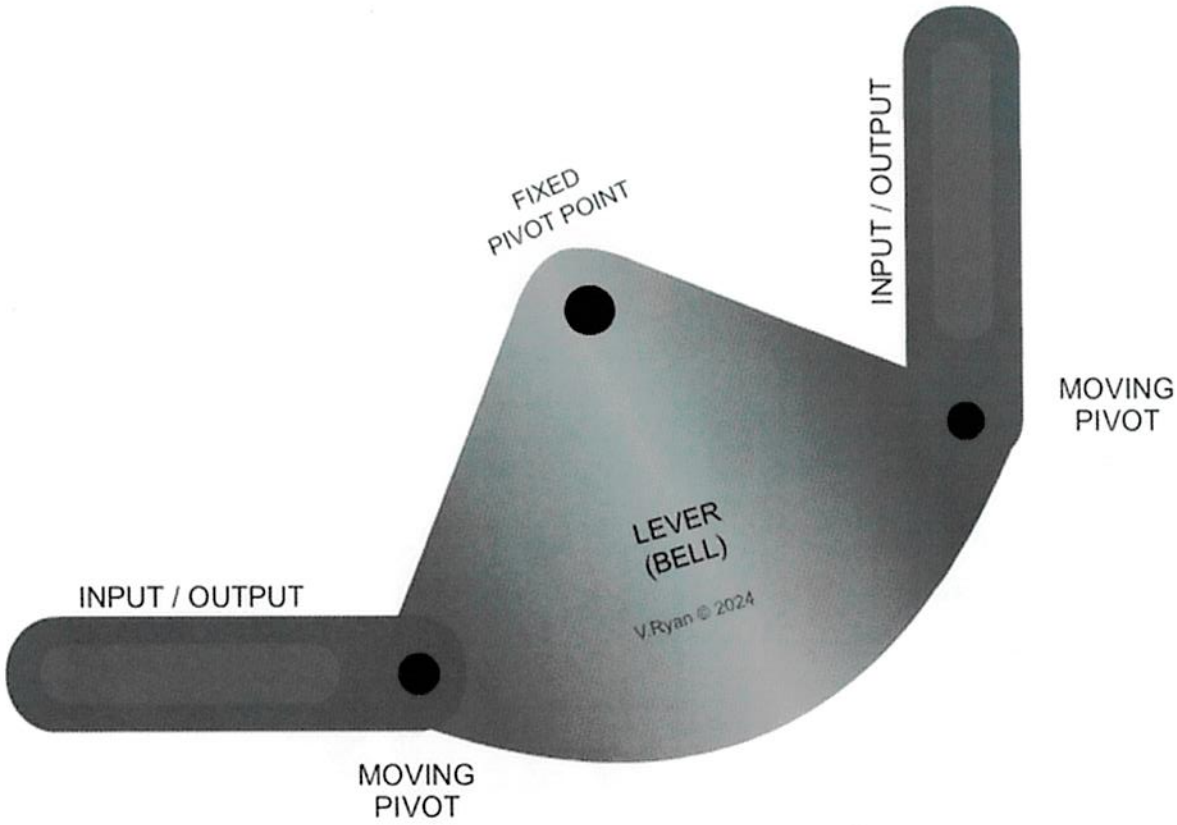
Alternative layouts to a Crank and Slider set up.





BELL CRANK LINKAGE

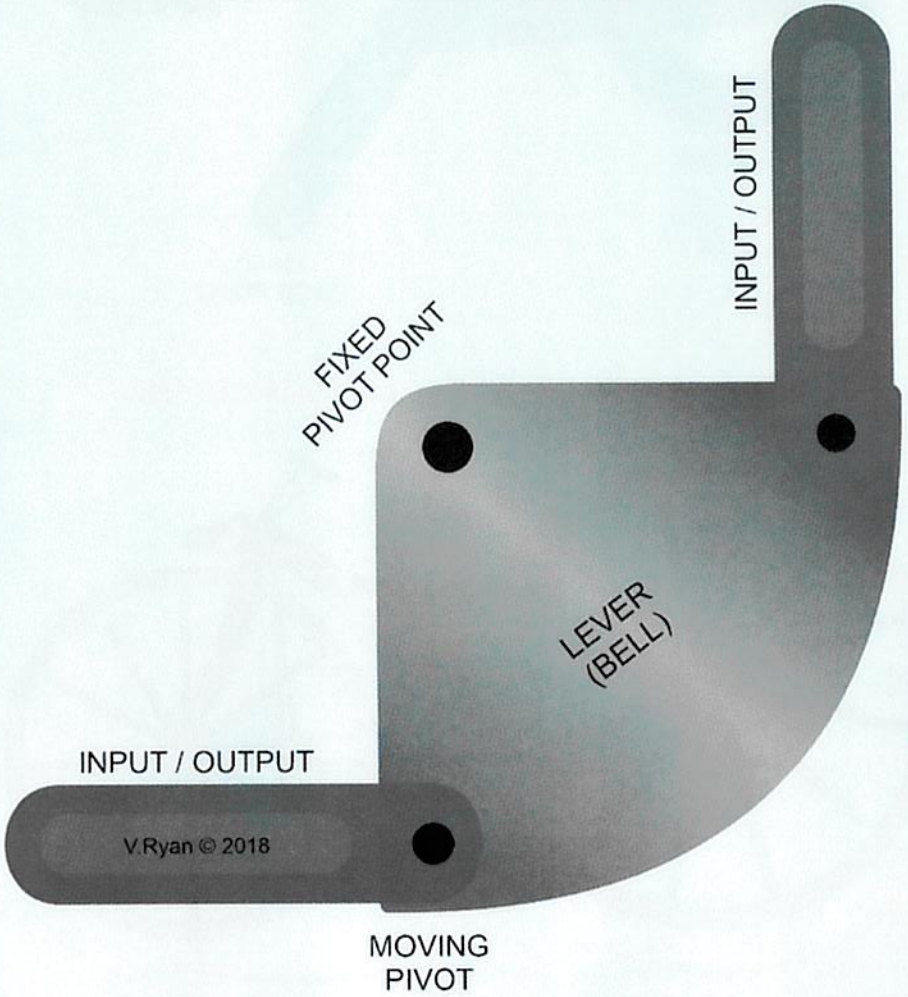
This linkage allows horizontal movement to be converted to vertical movement. It also works the opposite way round. A practical example of this is the brake mechanism on a bicycle.

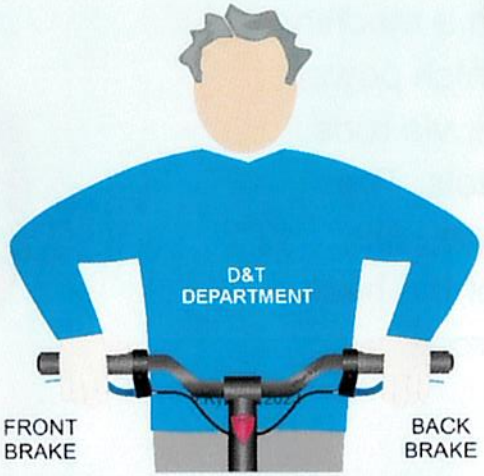


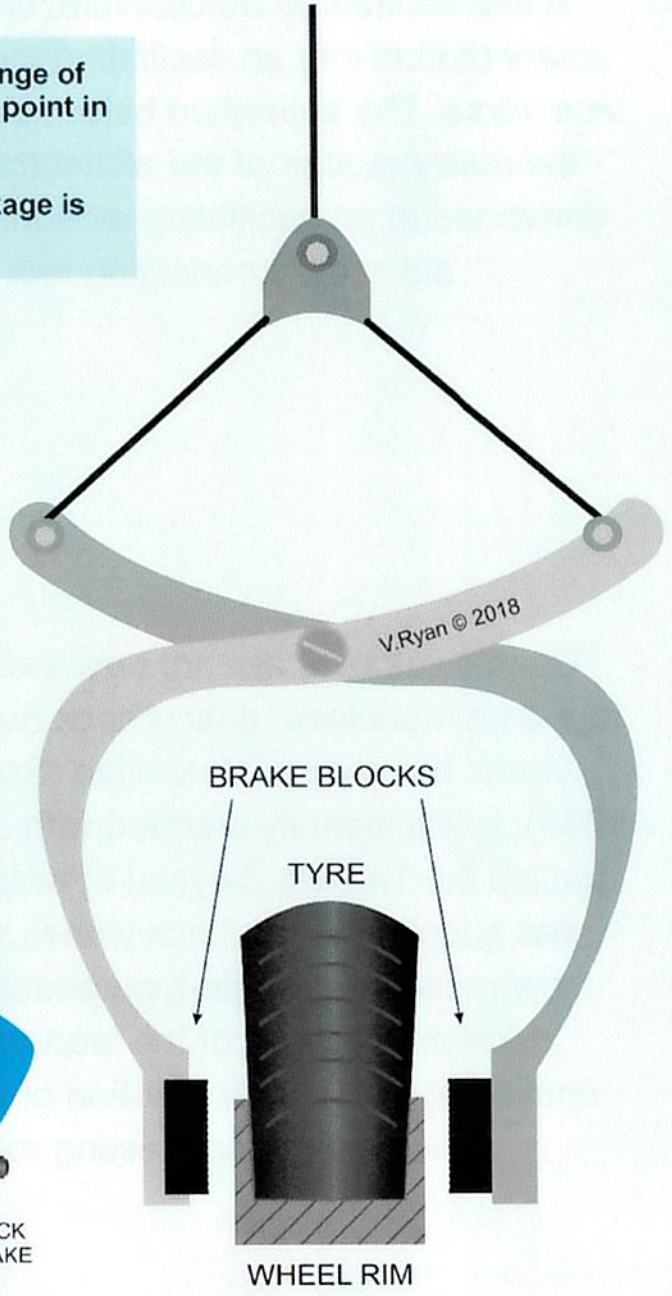
BELL CRANK LINKAGE

A Bell Crank linkage, changes the direction of movement by ninety degrees and so allows a change of direction from horizontal to vertical (or vise-versa). The 'lever' is bell shaped and has a fixed pivot point in one corner (see below). The input and output are at ninety degrees to each other.

The bicycle brakes are a typical practical application of this type of linkage mechanism. This linkage is also used in the automobile and aeronautical industries.







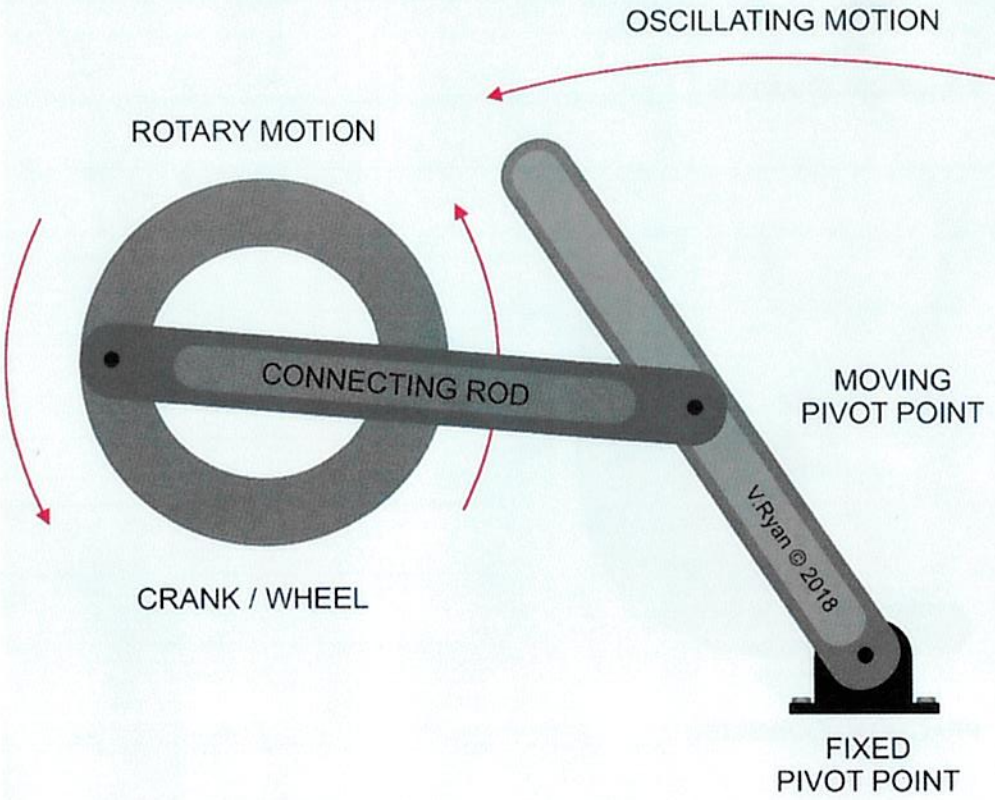
TREADLE LINKAGE

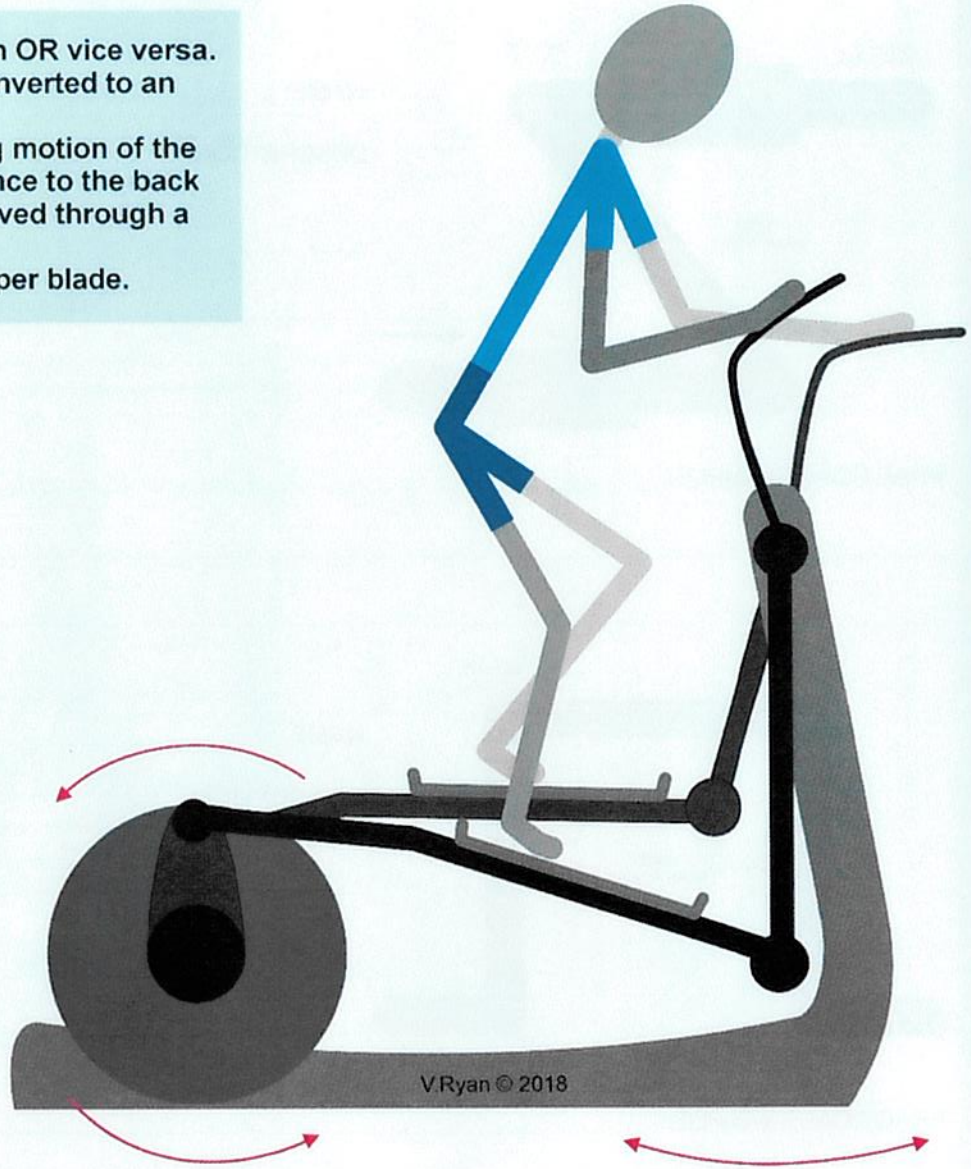
VICTORIAN 'SINGER' TREADLE SEWING MACHINE

The 'Singer Treadle Sewing Machine', was powered by the oscillating motion of the the 'treadle', powered by the users feet. Connecting rods force a flywheel to rotate. The flywheel is connected to the rest of the machine by a leather belt, which drives a crankshaft at the back of the sewing machine. This sewing machine was very popular in Victorian times and was still in use up the 1950s, when many were converted to be powered by an electrical motor.

TREADLE LINKAGE

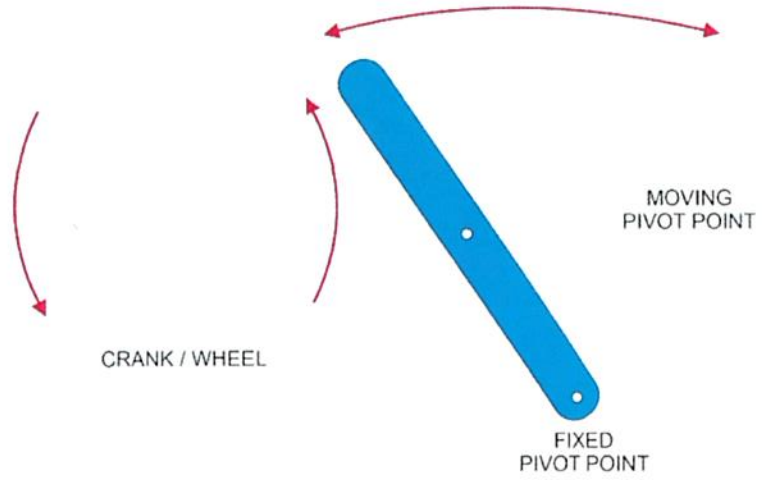
A treadle linkage mechanism, converts rotary motion into an oscillating motion OR vice versa. The diagram below, shows how the rotary motion of the wheel (crank) is converted to an oscillating motion, with the aid of the connecting rod.
The modern fitness machine is operated by the user, powering the oscillating motion of the connecting rods, to push round the rotary motion of the back wheel. Resistance to the back wheel can be increased, making it more difficult for the user. All this is achieved through a treadle linkage system.
Windscreen wipers use a treadle linkage to operate the motion of the wiper blade.





TREADLE LINKAGE - EXAMINATION QUESTIONS

1. In the space below, complete the diagram of a simple treadle linkage and indicate both types of movement. Write an explantion of the way the linkage works, underneath the diagram. ***4 marks (diagram) 4 marks (explanation).***



2. Using the internet as a research tool, list four practical applications of a treadle linkage. ***4 marks***

3. Select one of your practical applications of a treadle linkage. Produce a sketch to illustrate the practical application and include explanatory notes. ***4 marks (sketch) 4 marks (notes)***

SKETCH

EXPLANATORY NOTES