

Grippers and Lifting Mechanisms

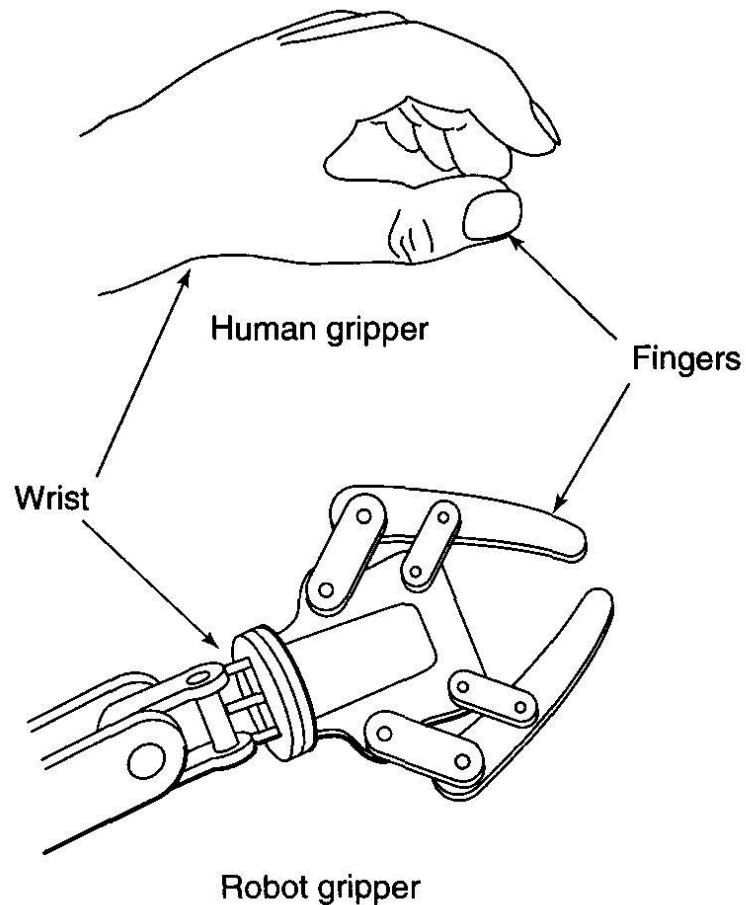
- Hands of robots referred to as Grippers.
- No single design is ideal for all applications.

Types of Grippers-

- Single mechanical devices-hooks and scoops
- Mechanical grippers-two or more fingers actuated by the robot controller
- Vacuum grippers-suction cups used to hold flat objects
- Magnetized grippers -A type of end effector that uses electromagnets or permanent magnets to pick up metallic objects.
- Adhesive devices-adhesive substance used to hold flexible material

Comparison with human hand

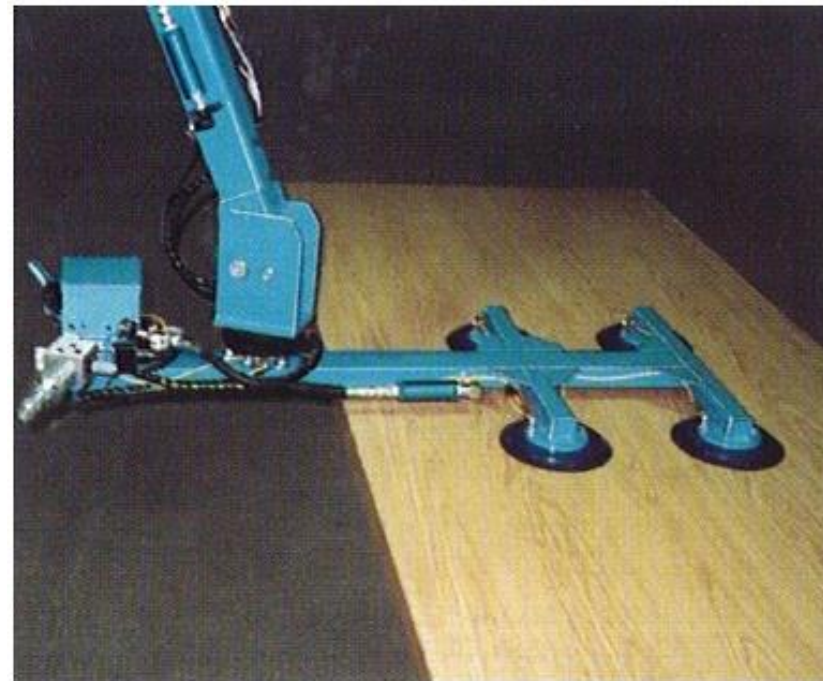
Carefully observe the hand.



Vaccum grippers

Vaccum power is used to create grip and so used to lift objects or even the robotlift itself.

But this consumes lot of power.



Types of Vacuum Grippers

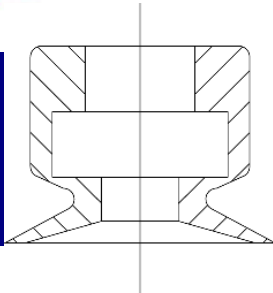
- Suction cups are very well suited for a wide variety of needs and circumstances. They can handle plate, paper, wood – practically any material.

• Uneven objects

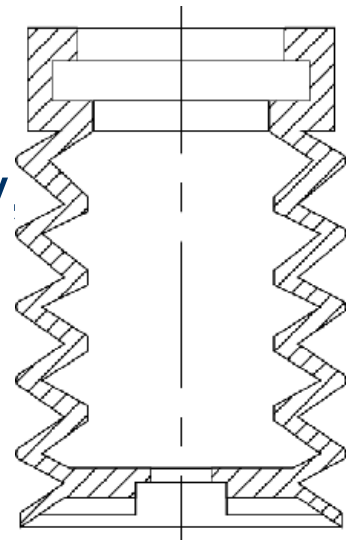
- Be it smooth, irregular, bent, porous, airtight, lightweight, heavy, angled, hot or cold, the material can be handled by suction cups safely, gently and quickly.”



• Small to medium objects

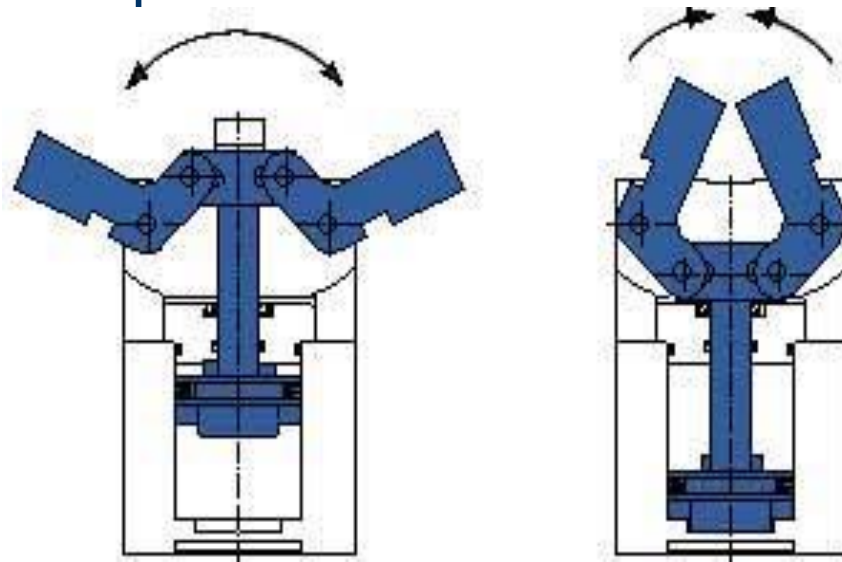


• Large, heavy objects



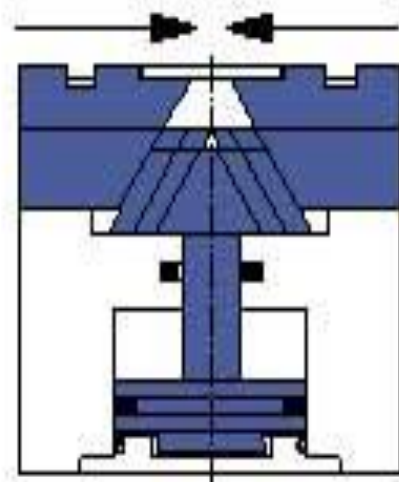
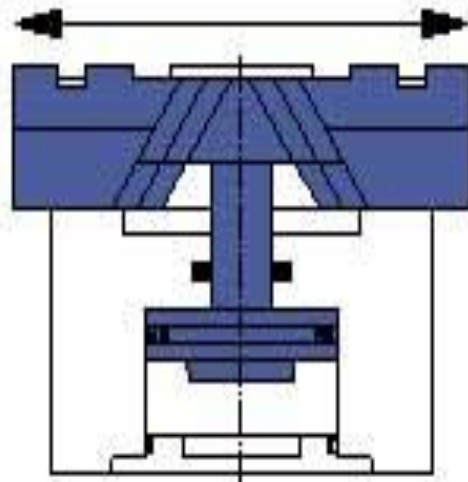
Angular grippers

- Angular grippers are less expensive, but the arcing motion of the jaws may require additional tooling clearance and will grip at varying points as part width varies. A parallel gripper is simpler to tool to compensate for part size variance.



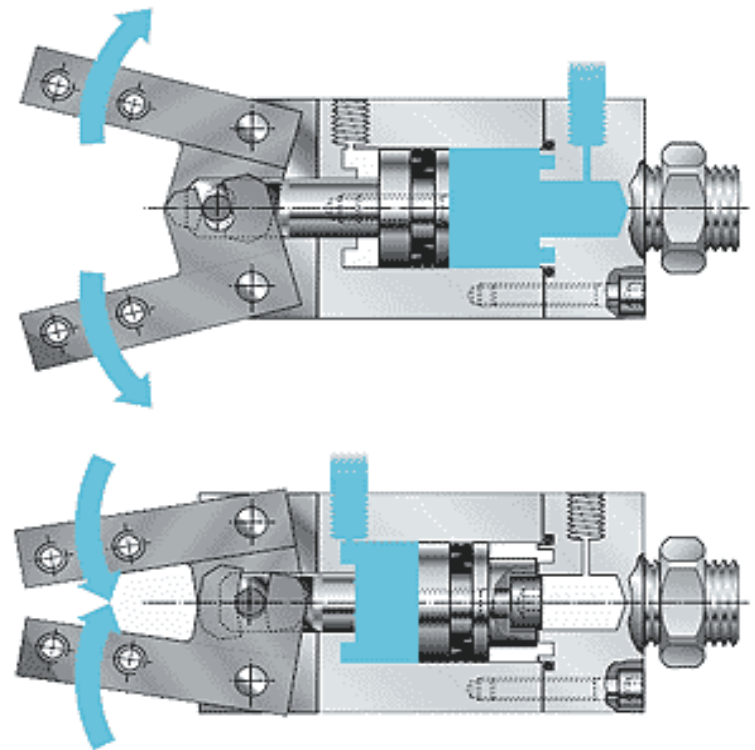
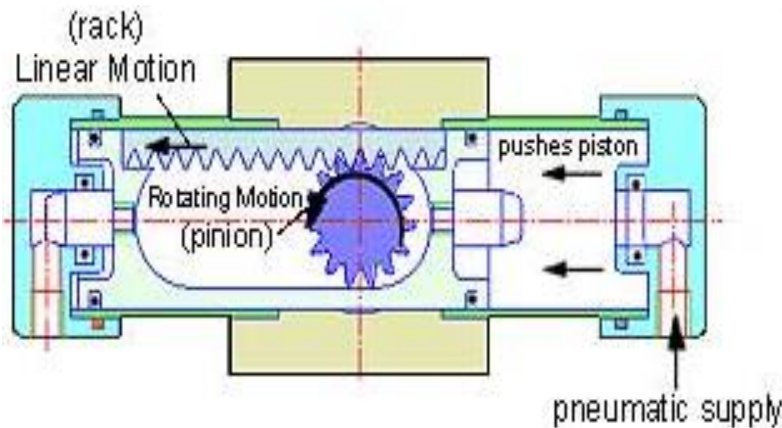
Parallel grippers

- Parallel: The gripper jaws move in a parallel motion in relation to the gripper body. Used in a majority of applications, parallel grippers are typically more accurate than other style grippers.

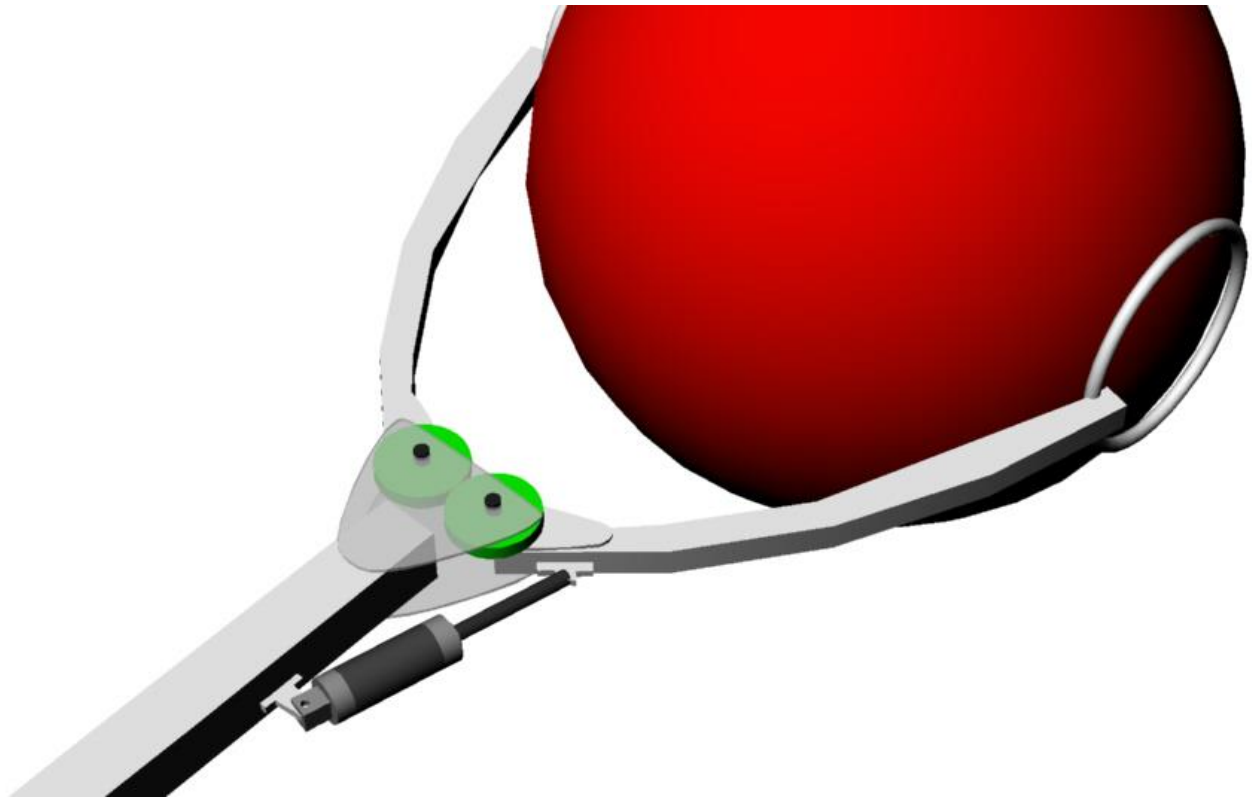


Pneumatic grippers

- Controlled by pneumatic solenoid valves, pressure cylinders



Simple pneumatic gripper



Advantages and Disadvantages

Pneumatic	Electric Motor	Hydraulic
Smaller units, quick assembly	High accuracy and repeatability	High strength and high speed
High cycle rate	Less floor space	Large robots, Takes floor space
– Easy maintenance	Low cost	Mechanical Simplicity
	Easy maintenance	Used usually for heavy payloads

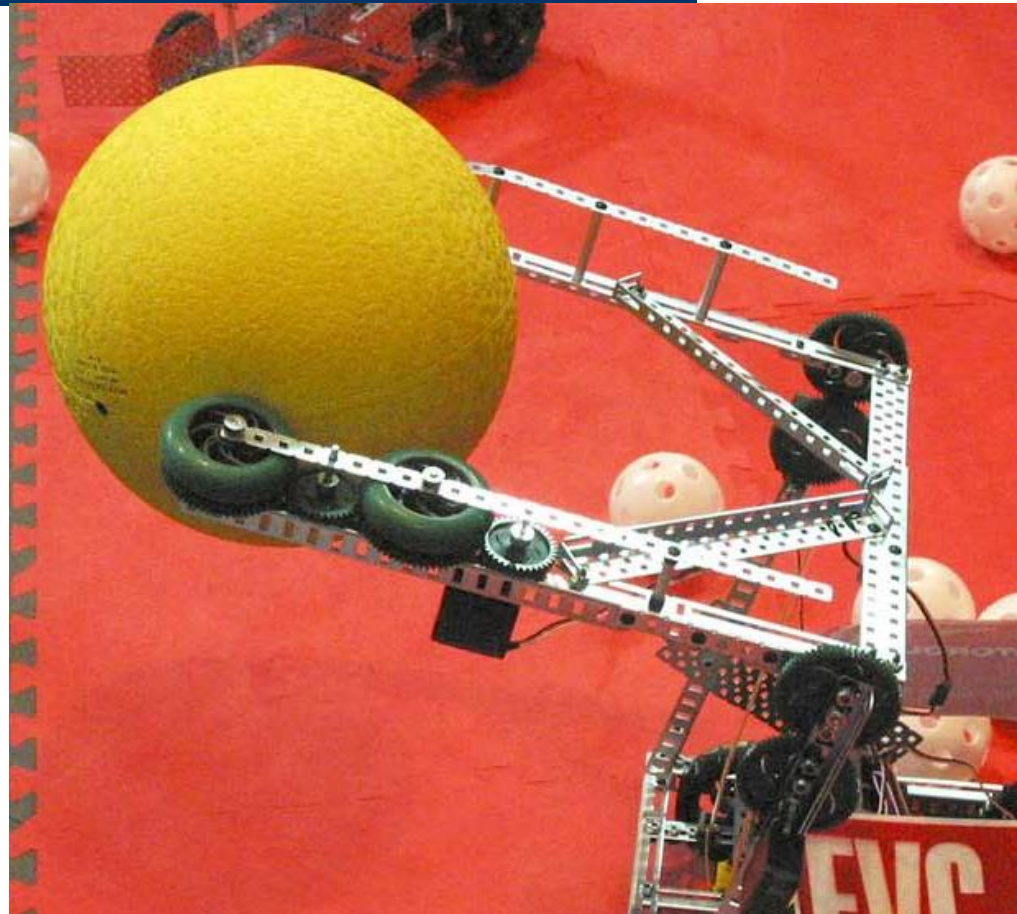
Feedback in grippers

- Angle feedback or position feedback can be taken from potentiometers or tactile switches.



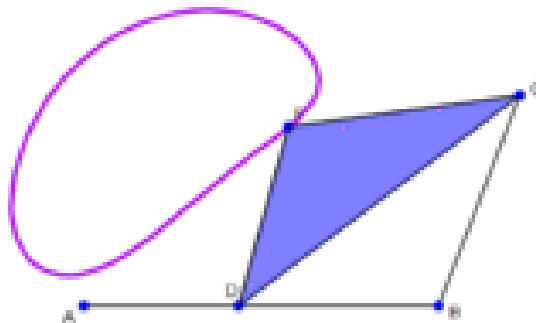
Roller Grip

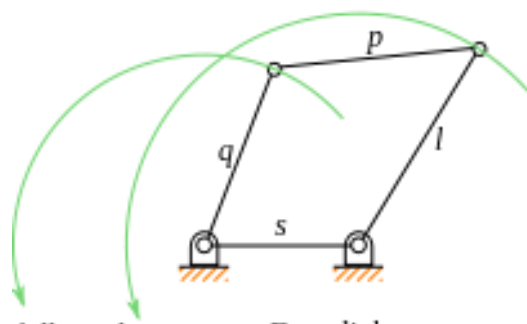
- Slow
- Allows for misalignment when grabbing
- Extends object as releasing.
- Simple mechanism.



Grashof condition-In 4 bar mechanism

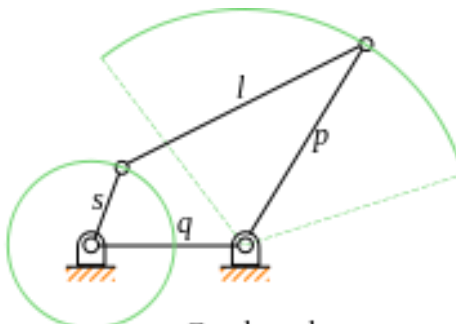
- *If the sum of the shortest and longest link of a planar quadrilateral linkage is less than or equal to the sum of the remaining two links, then the shortest link can rotate fully with respect to a neighboring link. In other words, the condition is satisfied if $S+L \leq P+Q$ where S is the shortest link, L is the longest, and P and Q are the other links.*



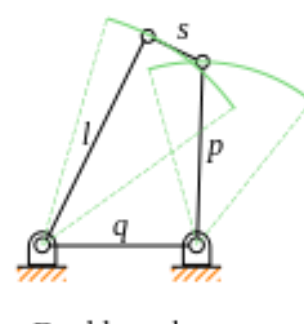


full revolution
both links

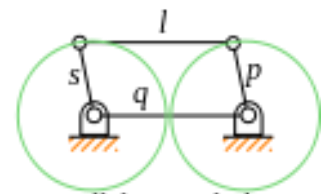
Drag-link
 $s+l > p+q$
(continuous motion)



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



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

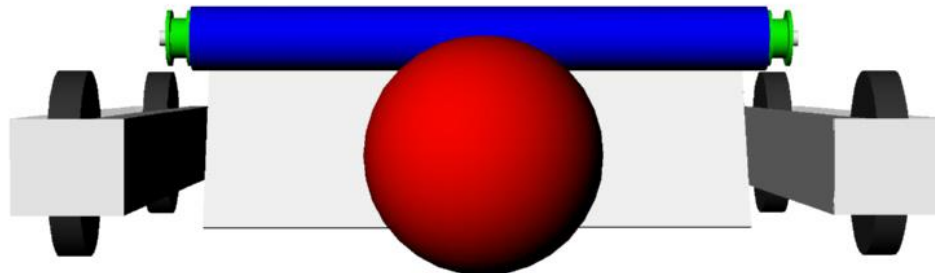
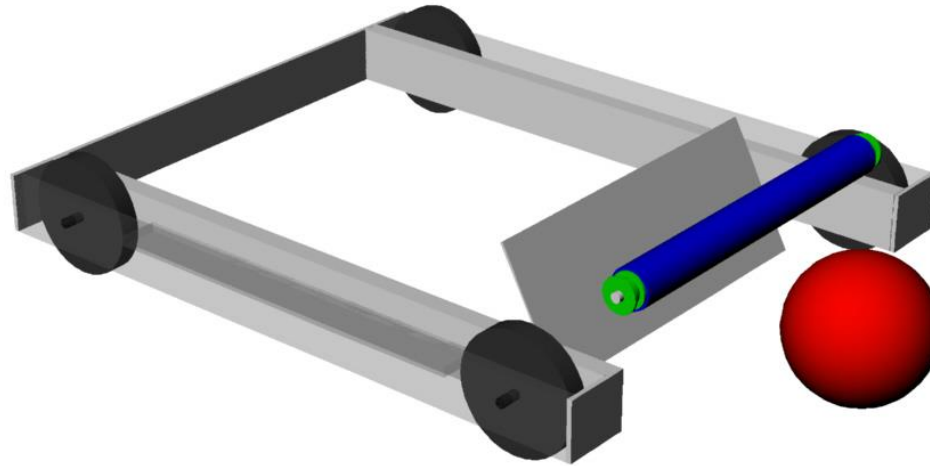


Parallelogram linkage
 $s+l = p+q$
(continuous motion)

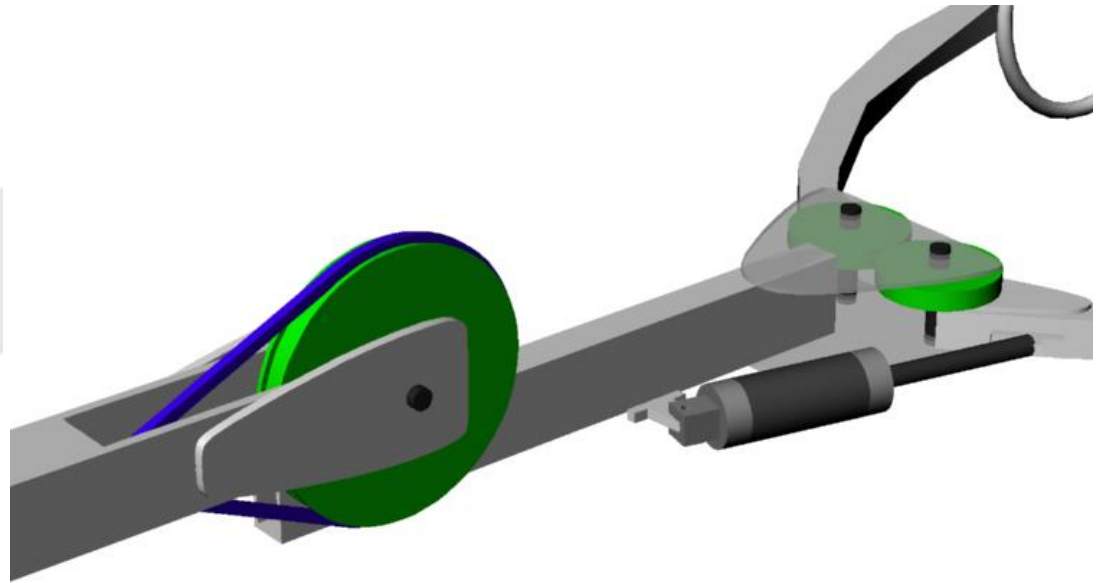
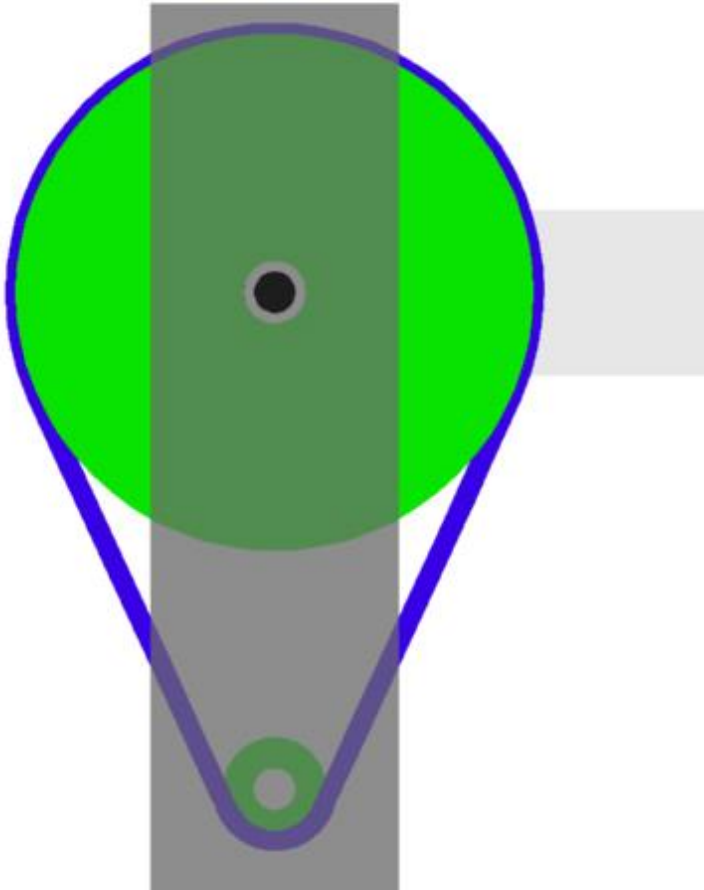
- Gripper with 4 bar mechanism



Intake Rollers



Pulley mechanism for lifting



Sliding section mechanism

- Sliding sections that move linearly
- Mostly powered by a winch pulling on a cable
- Similar to the front of a forklift

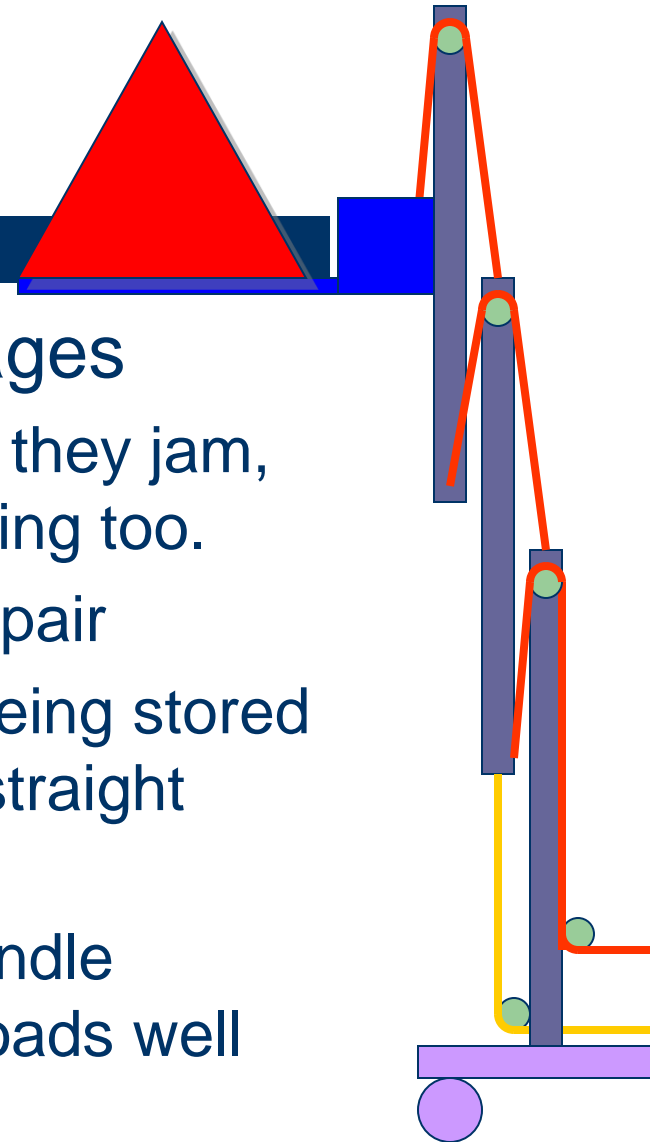


- Advantages

- Able to extend very far with little space consumed
- Stable linear path
- Less for driver to think about
- Simply powered by a winch

- Disadvantages

- Jamming, they jam, and jamming too.
- Hard to repair
- Require being stored in a long straight area
- Do not handle bending loads well

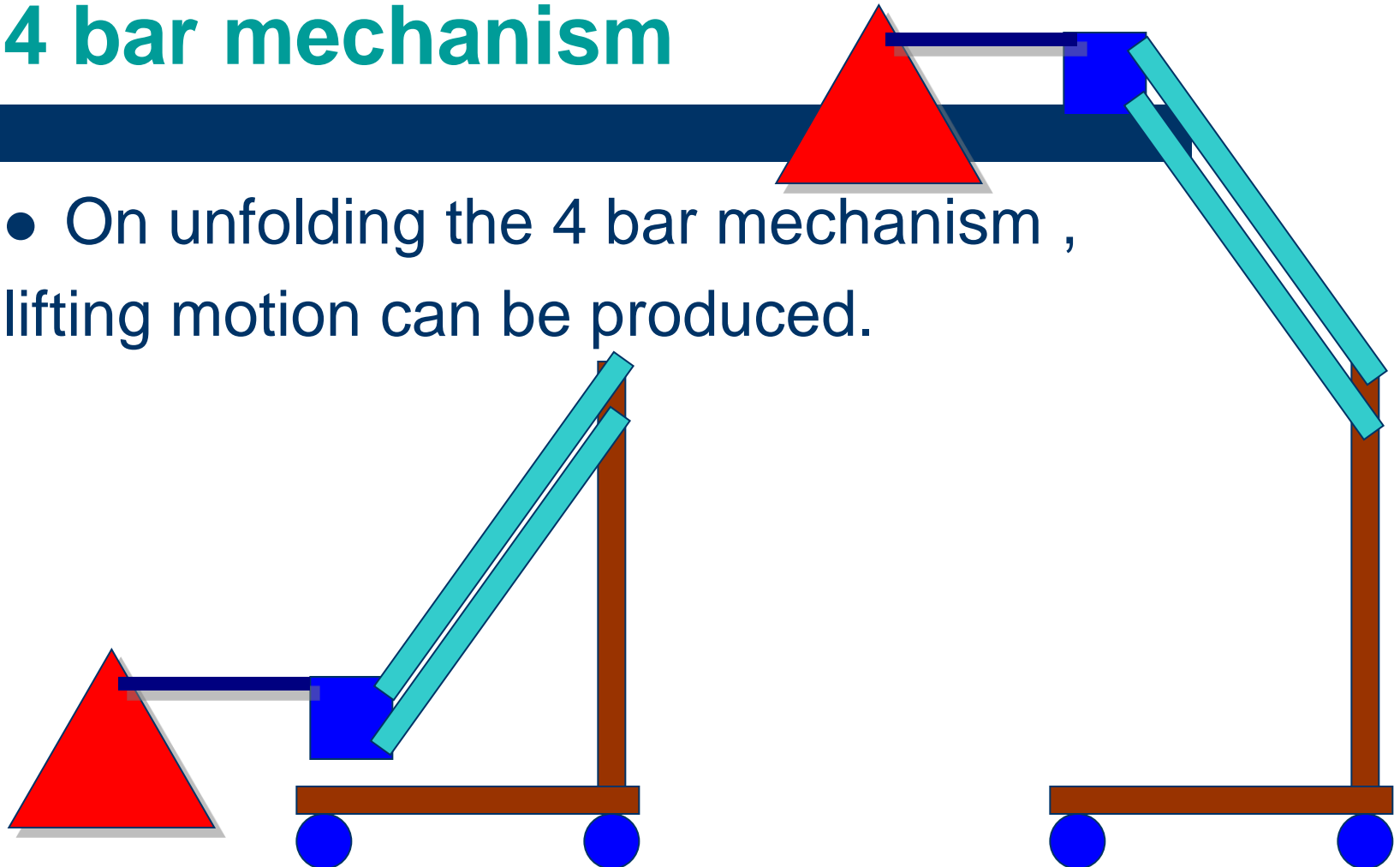


4-Bar linkages



4 bar mechanism

- On unfolding the 4 bar mechanism , lifting motion can be produced.



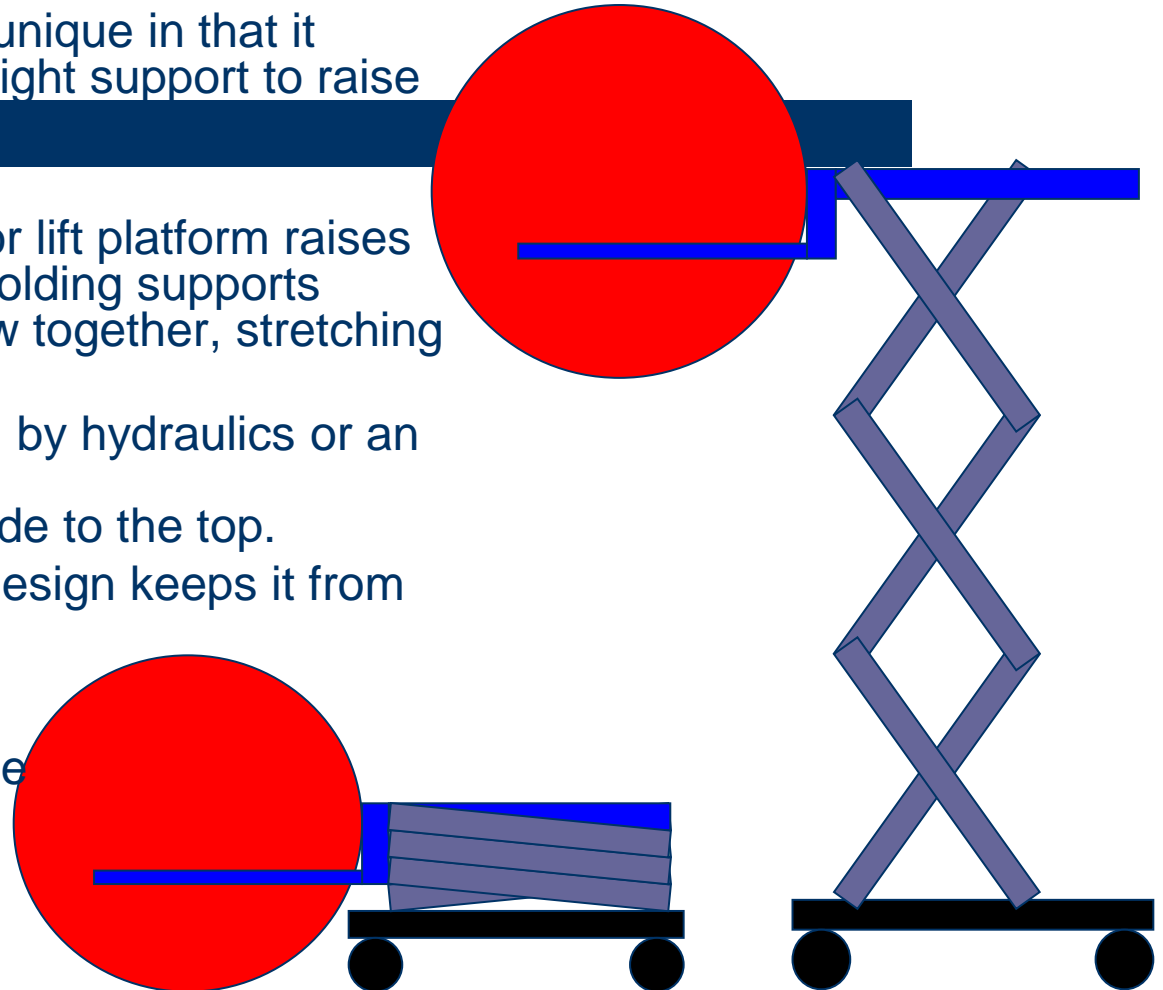
Pros and cons of 4 bar mechanism

- **Pros**
 - Simple
 - Object retains orientation
 - 1 joint to power
 - Easily programmed
 - Provides reach
- **Cons**
 - Large moments can develop at the joint location
 - Pin Loadings can be high
 - Required to lift “outside of the box”
 - Can be vulnerable to side hits
- **Tips**
 - Watch for buckling in lower member
 - If possible, counterbalance
 - Keep the center of gravity (CG) aft

Vertical Lifts - Scissors

- Overview

- The scissor lift is unique in that it doesn't use a straight support to raise
- Rather, the scissor lift platform raises when the linked, folding supports underneath it draw together, stretching it upward.
- It can be powered by hydraulics or an electric motor, but it's a bumpy ride to the top.
- The scissor lift's design keeps it from traveling with a constant velocity, instead traveling faster in the middle of its journey and slower with more extension.



THANKS

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