



NCCA

An Chomhairle Náisiúnta
Curaclaim agus Measúnachta
National Council for
Curriculum and Assessment

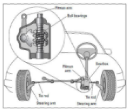
Junior Cycle Engineering Classroom-Based Assessment: Example of Student Work 02

January 2024

Engineering CBA 2 Steering Systems



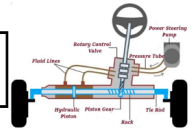
Recirculating ball steering system
SR 2



steering mechanisms on boats/planes etc?

What are the different types of steering mechanisms?

When was the first steering mechanism made?



Hydraulic powered steering
SR 1

where are the different steering mechanisms used?

What are used with steering mechanisms and why?
Eg:tyres,tracks etc



Tank tracks
SR 3

how do steering mechanisms work?

steering mechanisms timeline?

CBA 2 Steering mechanisms

what materials are used in steering mechanisms?



Different materials
SR 4

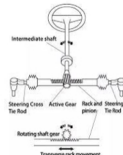
Main parts of a steering system

Timeline of steering systems

SR 15



Francis W. Davis began exploring how steering could be made easier and in 1926 invented and demonstrated the first practical power steering system



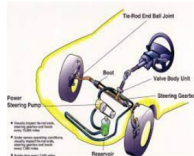
SR 17

General Motors pioneered this design and the first application was for the 1940 Cadillac model 72. By the mid-'50s every General Motors vehicle car and truck, whether manual or power steering equipped, came with the patented Saginaw recirculating ball and nut steering gear.



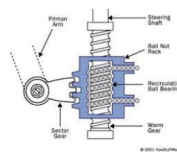
SR 19

1894. Before this, tillers were typically used to steer vehicles. French engineer Alfred Vac heron added a steering wheel onto his four-horsepower 1893 Pan hard. in order to help give him an edge in the Paris-Rouen race.



SR 16

BMW created the first rack and pinion gearboxes in the 1930s



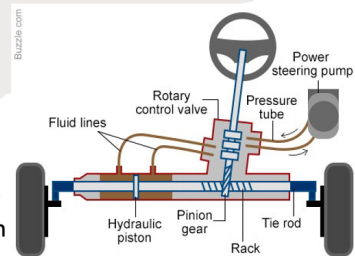
SR 18

Modern day: still use rack and pinion, power steering and recirculating ball steering systems

The first steering system

- Francis W. Davis began exploring how steering could be made easier, and in 1926 invented and demonstrated the first practical power steering system.
- Davis moved to General motors and refined the hydraulic-assisted power steering system, but the automaker calculated it would be too expensive to produce. Davis then signed up with Bendix, a parts manufacturer for automakers. Military needs during World war II for easier steering on heavy vehicles boosted the need for power assistance on armoured cars and tank-recovery vehicles for the British and American armies

Diagram of hydraulic-assisted power steering system



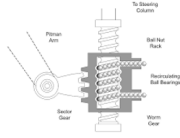
SR 1



SR 5 Tank recovery vehicle ww2

Different types of steering mechanisms

- There are many different types of steering systems used today all for different applications.
- Rack and pinion mechanism.
- Power assisted rack and pinion.
- Recirculating ball steering mechanisms.
- Electric power steering.

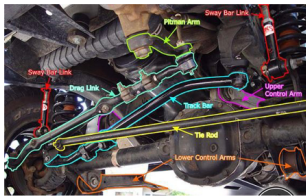


Recirculating ball steering mechanism diagram

SR 7

Where are they used

- Rack and pinion systems are mostly used in cars.
- Recirculating ball steering systems are mostly used in heavier vehicles such as trucks
- Electric power steering is used mostly in sport and luxury cars.



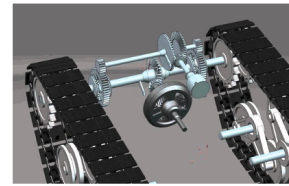
Truck steering system SR 6

What are used with steering systems

- Different steering systems are used for different applications and need different attachments to work
- For example , tanks use a different form of steering to cars or trucks where two levers are used instead of a steering wheel for tighter turns in battle.
- Tracks are used instead of tyres to cross tough terrain easier.
- Tyres are used in cars as they don't need to make as difficult maneuvers as tanks

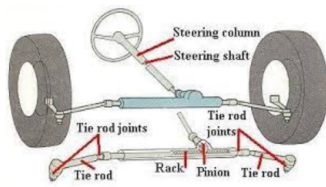
Tank steering system diagram

SR 8



Main parts of a Rack and pinion steering system and how it works

- A rack and pinion steering system contains the following basic parts , a Steering wheel, Steering shaft and Column, Tie rods, rack, idler arms, Pitman arm, and drag or center link.
- It works by enclosing the rack and pinion gear-set in a metal tube, with each end of the rack sticking out from the tube and connected to an axial rod. The pinion gear is attached to the steering shaft so that when the steering wheel is turned, the gear spins, moving the rack.



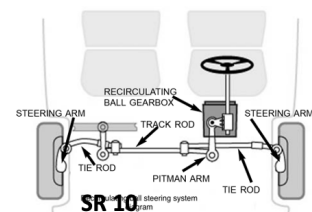
Rack and pinion steering mechanism SR 9

Main parts of a Recirculating ball steering system mechanism and how it works

- The recirculating-ball steering gear contains a worm gear. The first part is a block of metal with a threaded hole in it. This block has gear teeth cut into the outside of it, which engage a gear that moves the pitman arm . The steering wheel connects to a threaded rod, similar to a bolt, that sticks into the hole in the block.
- When the steering wheel turns, it turns the bolt. Instead of twisting further into the block the way a regular bolt would, this bolt is held fixed so that when it spins, it moves the block, which moves the gear that turns the wheels.

• Universal joints

- A universal joint is a positive, mechanical connection between rotating shafts, which are usually not parallel, but intersecting. They are used to transmit motion, power, or both. The simplest and most common type is called the Cardan joint or Hooke joint.



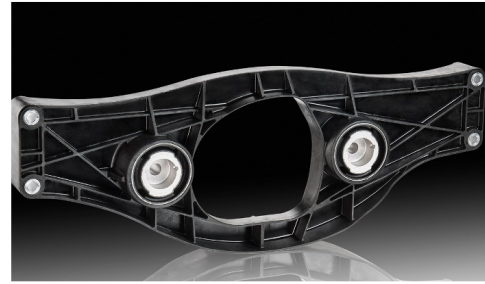
SR 10

What materials are used in steering systems

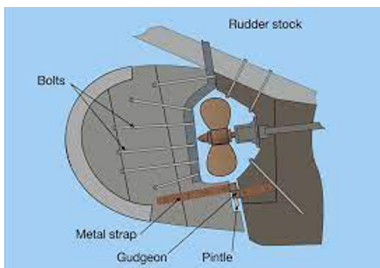
- The rack and pinion steering system is generally made from aluminium or steel. A plastic gear made of 30% Glass filled Nylon 66 offers enough strength and has more strength than unfilled nylon 66. These materials are often used for cars



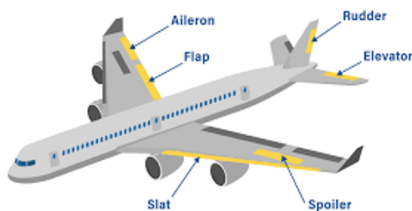
Aluminium steering system.
SR 11



Nylon 66 steering system
part SR 12



Rudder diagram
SR 13



Plane flap
diagram SR 14

Steering systems on boats and planes .

- **Rudder steering system.**
- Most boats use a rudder steering system where the steering wheel is connected to a hydraulic pump that draws fluid from a reservoir and sends it to a hydraulic cylinder or ram. The cylinder or ram is connected to the boat's rudder or outboard motor, allowing the hydraulic pressure to turn the steering mechanism.
- **Flap steering system**
- Planes use a series of flaps placed on the wings and tail to control the drag on the plane. This works by extending the flaps, increasing the curvature and surface area of the wing, therefore increasing the amount of lift the wing generates. This enhancement is critical during the slowest phases of flight, take off.

Sources of information

- <https://engineeringstuff.co.in/how-power-steering-works/>. SR 1
- <https://www.google.ie/url?sa=t&rct=j&q=&esrc=s&source=web&wikipedia.org%2Fwiki>. SR 2
- <https://www.artstation.com/artwork/A90lwV> SR 3
- <https://wiregrass.libguides.com> SR 4
- <https://www.quora.com/How-do-tanks-war-tanks-make-turns>. SR 5
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Frehangarden.com> SR 6
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.motortrend.com%2Fhow-to%2Fsteering-systems-101-rack-and-pinion-vs-recirculating-ball> SR 7
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.youtube.com> SR 8
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.themotorombudsman.org> SR 9
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.larescorp.com%2Frecirculating-ball-nut-steering> SR 10
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.kamkiu.com%2Fhtml%2Fen%2Fproducts> SR 11
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.ptonline.com%2Farticles%2F66-pricing-supply> SR 12

Sources of information

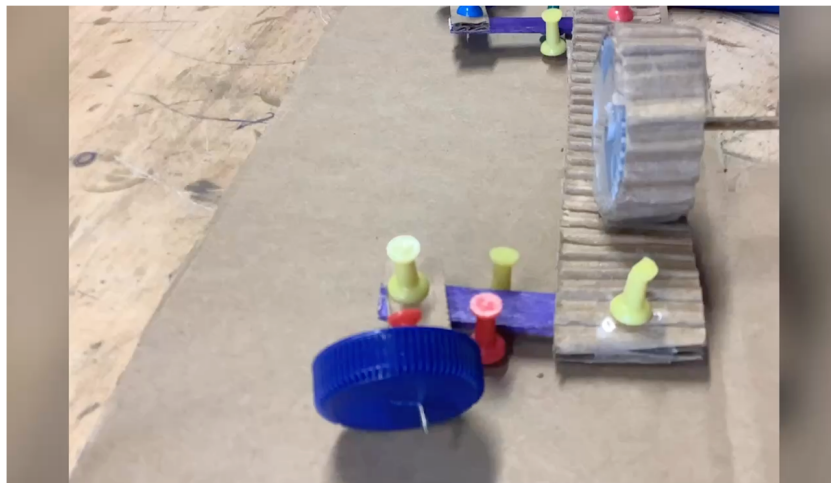
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.safe-skipper.com%2Frudder-and-steering-system> SR 13
- https://www.google.ie/url?sa=i&url=http%3A%2F%2Fden2.phys.uaf.edu%2Fwebproj%2F211_fall_2020%2FSeth_Thomas SR 14
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.autotrainingcentre.com%2Fblog%2Fhistory-steering-wheel> SR 15
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.actonservicecentre.co.uk%2Fblog%2Fcar-steering-repair-guide> SR 16
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fsteeringly.com%2Fsteering-system-components> SR 17
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fauto.howstuffworks.com> SR 18
- <https://www.google.ie/url?sa=i&url=https%3A%2F%2Fwww.pinterest.com> SR 19

Note and Disclaimer: All links provided in this submission were checked and confirmed to be active at the time of submission by the student.

Evaluation

- I really enjoyed this CBA as it helped me to understand different steering systems which I could use in future projects for my junior cert or leaving cert.
- I found using the internet as a good source for information , diagrams and pictures of different steering systems.I think the information I found looked to be very accurate in what it was saying.
- I think if I were to restart and rethink this CBA I would spend more time planning it out on a mind map format.
- I showed my sources of information on a slide referencing any pictures used and links to the information and where I found it
- This CBA helped me to learn how to make and how to understand them

Video of Model Created



[Click here](#) to view the video referenced in the above slide.

Teacher annotations using the Features of Quality

The annotations capture observations by the teacher, using the features of quality, with a view to establishing the level of achievement this work reflects. The annotations and judgments were confirmed by a Quality Assurance group, consisting of practising teachers and representatives of the NCCA, the Inspectorate, the State Examinations Commission and the Oide support service.

Teacher annotations

Research and analysis:

The research method chosen demonstrated a comparison of a range of sources which led to the production of a comprehensive and detailed analysis of the data/findings. The use of a prototype video was highly effective and complimented the research conducted through secondary sources.

Exploring concepts:

The response demonstrated a comprehensive understanding of a range of concepts in relation to the theme. An example of this was how the student demonstrated, in a video, their understanding of a rack and pinion steering system using a prototype.

Communicating their work:

The presentation of the findings is of an excellent standard, using highly effective media including a PowerPoint presentation and relevant imagery with embedded links to secondary sources of information. This, together with the prototype video provided by the student, allowed for a critical consideration of what information best communicated their response.

Overall judgement:  Exceptional