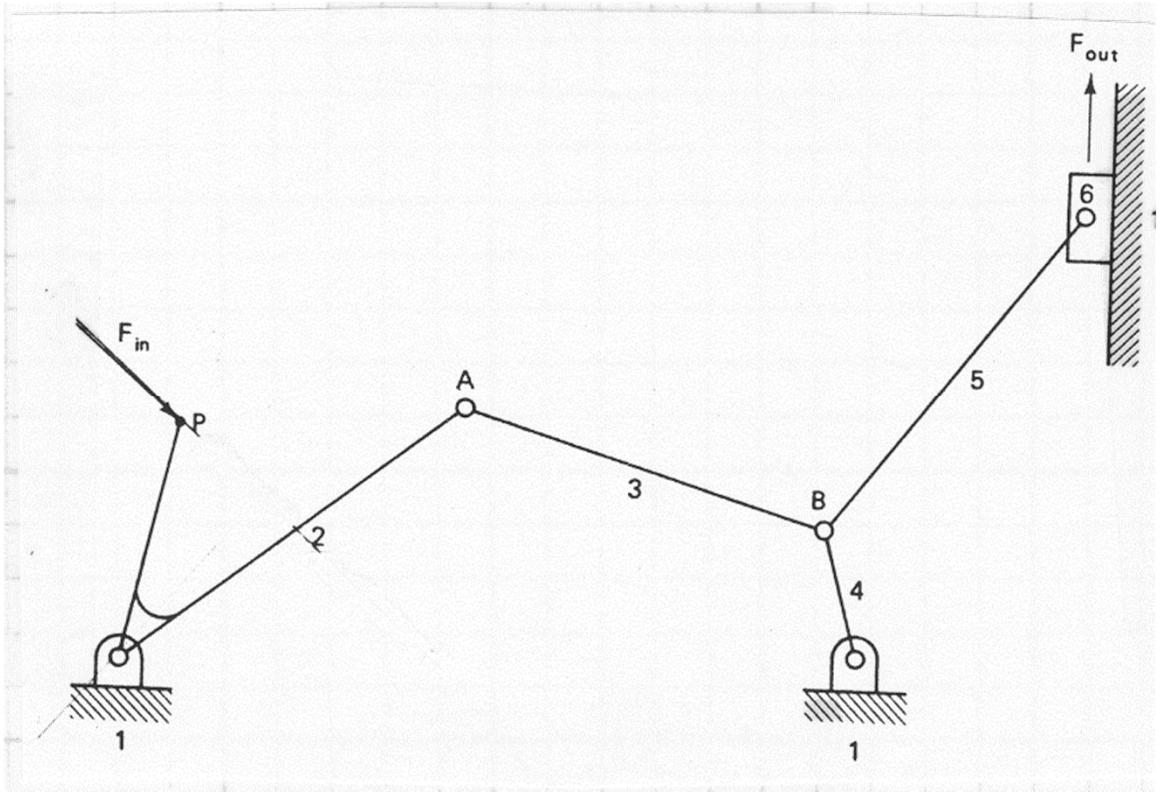
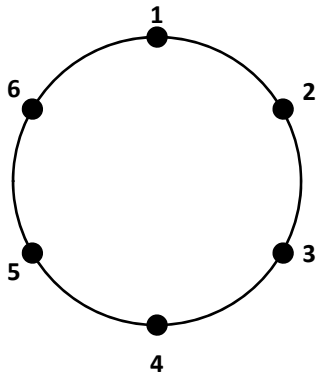
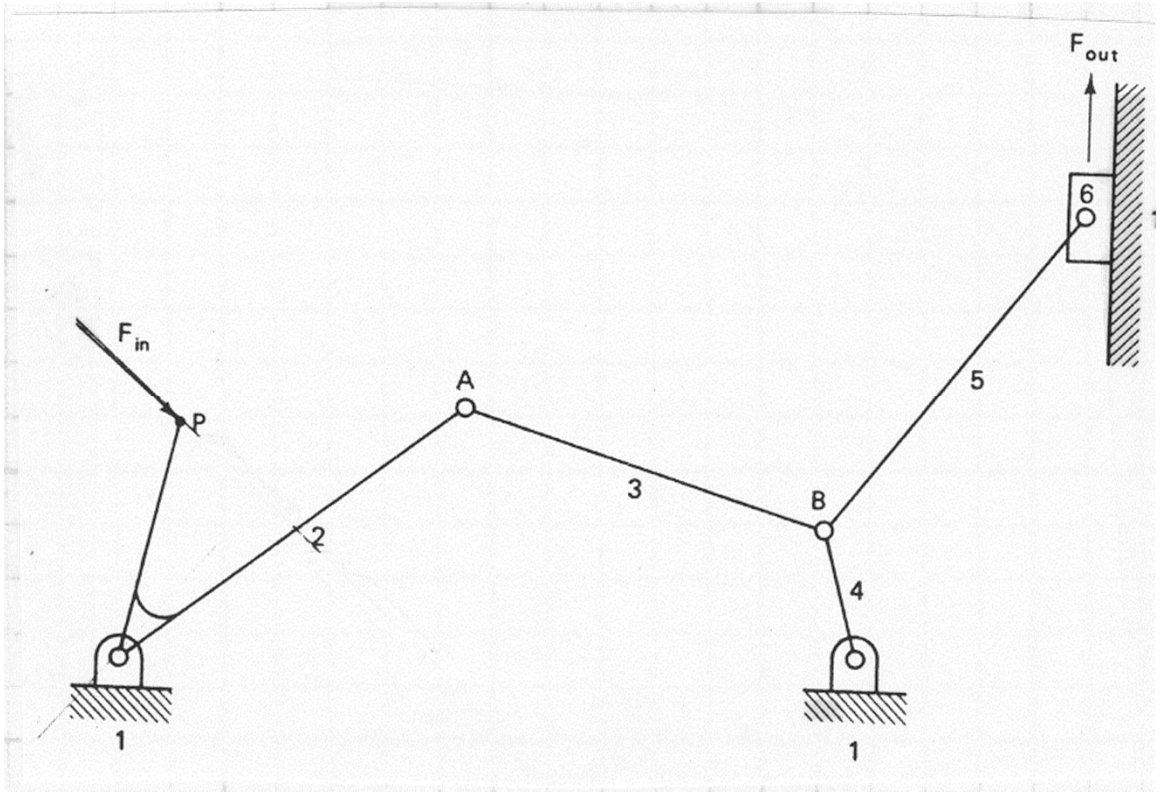
Finding the **INSTANT CENTERS** associated with the mechanism shown using **graphical methods**.



The **CIRCLE DIAGRAM METHOD** will be used to assist in locating all the INSTANT CENTERS.

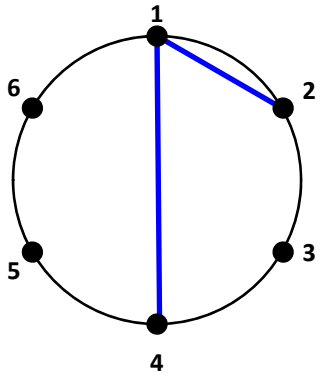
- Each node on the circle represents one of the links
- The numbers represent the corresponding link number

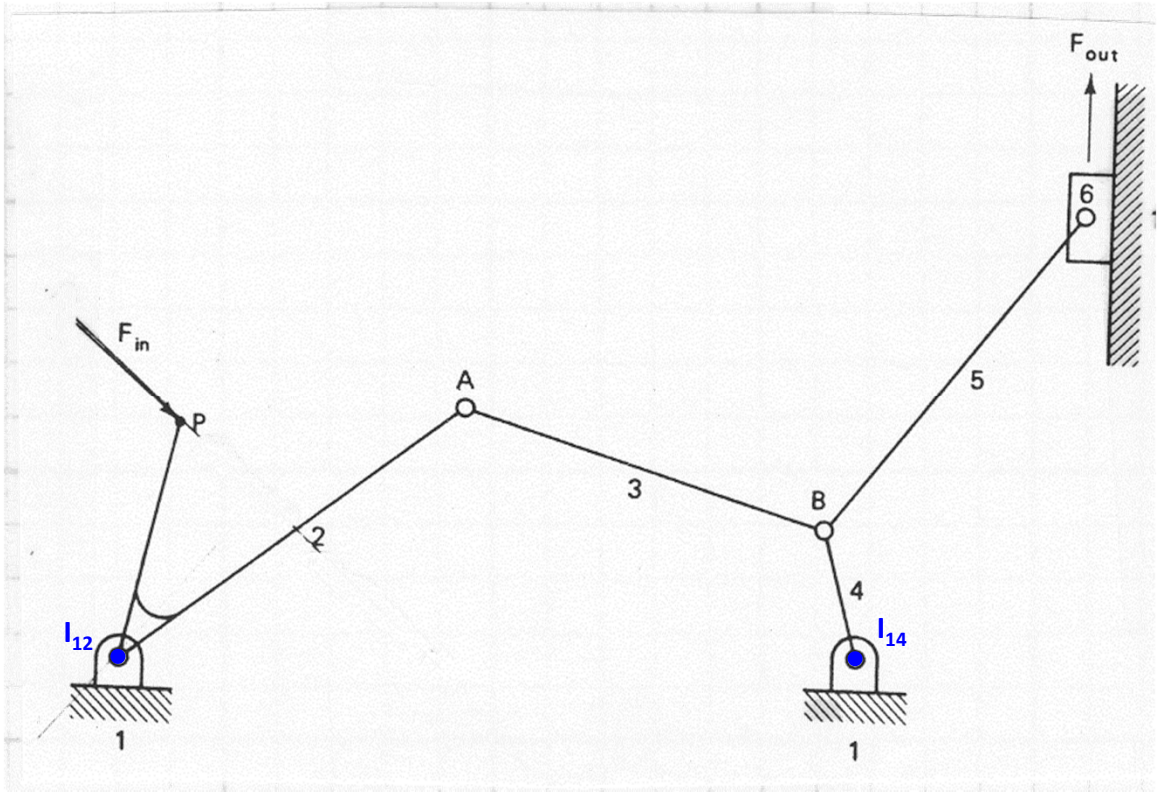




The **PRIMARY INSTANT CENTERS** are found first.

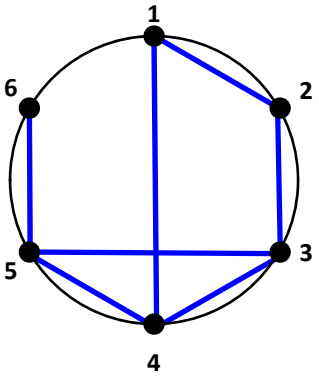
- **Pin Connected Links, FIXED**: I_{12}, I_{14}

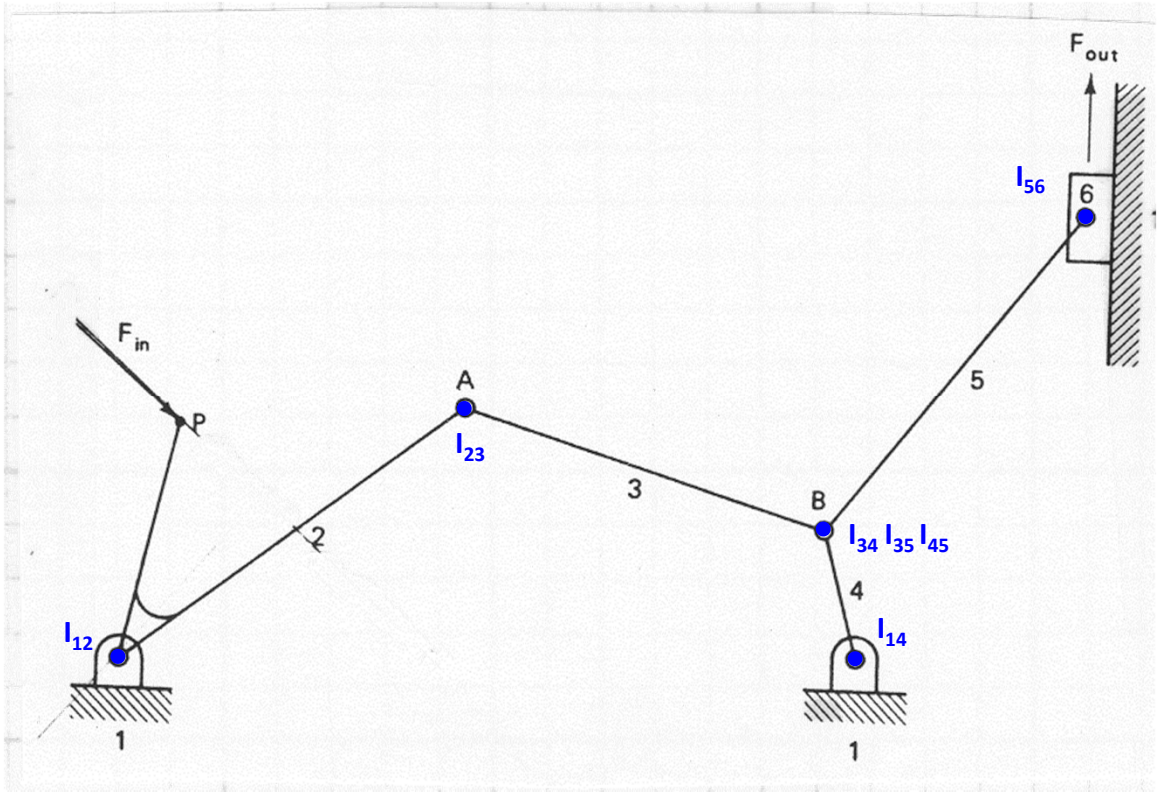




The **PRIMARY INSTANT CENTERS** are found first.

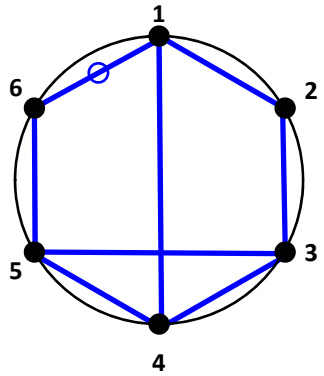
- Pin Connected Links, Fixed: I_{12}, I_{14}
- **Pin Connected Links, MOVING**: I_{23}, I_{24}, I_{35}, I_{45}, I_{56}

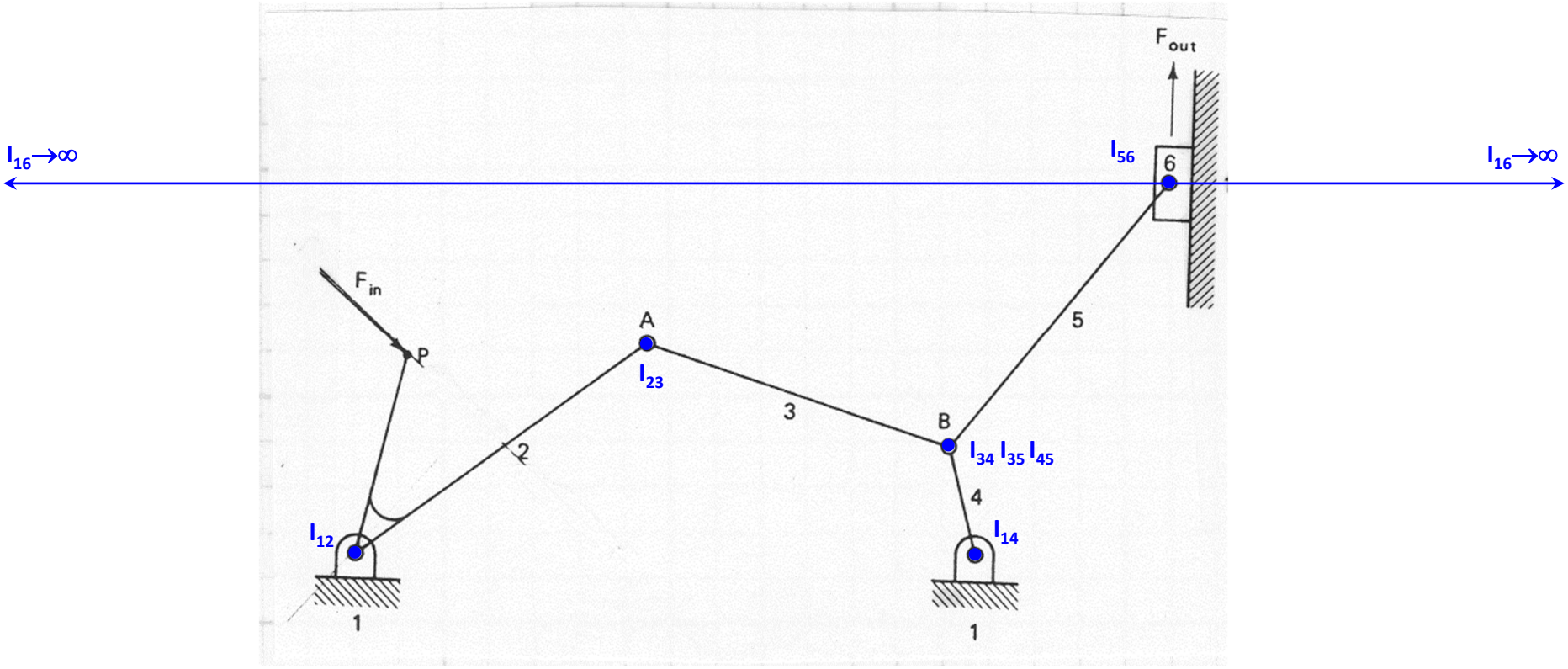




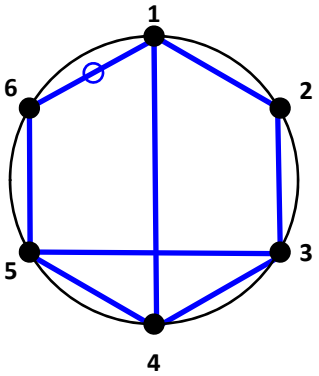
The **PRIMARY INSTANT CENTERS** are found first.

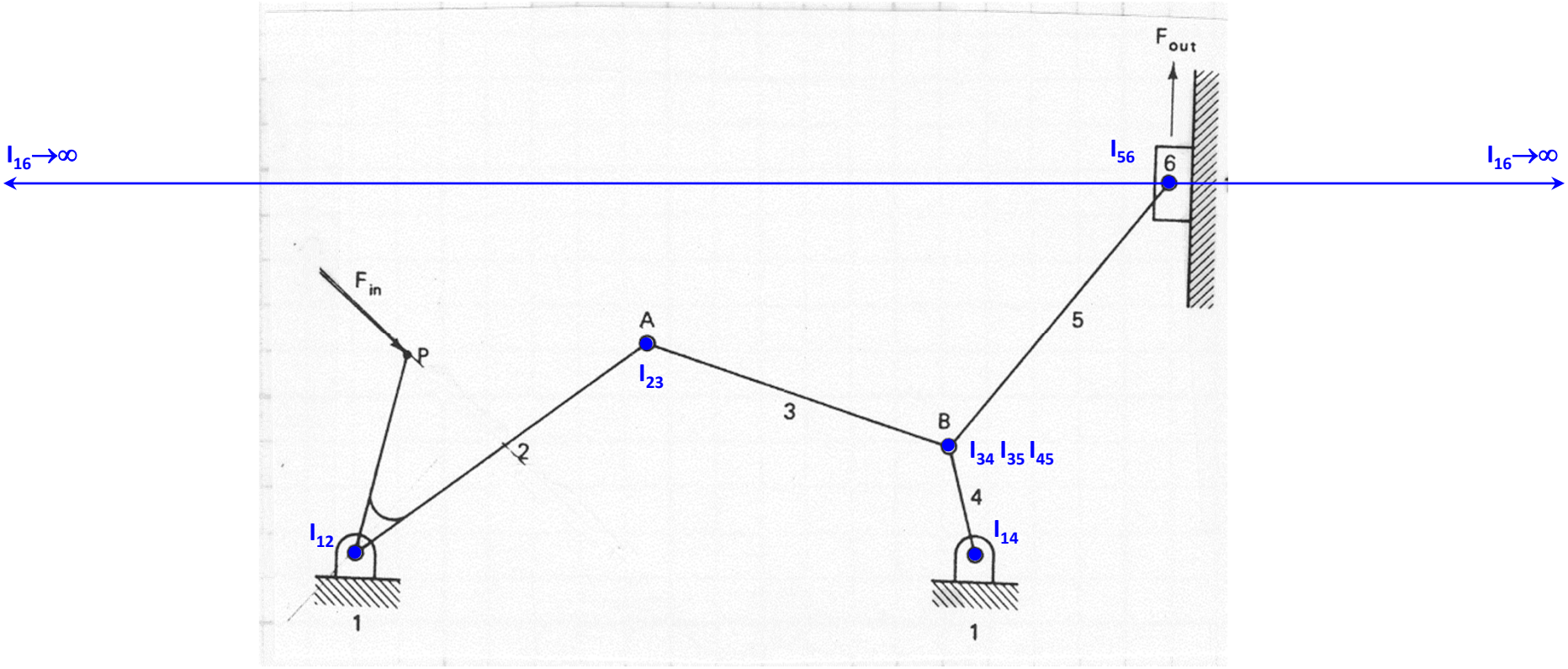
- Pin Connected Links, Fixed: I_{12}, I_{14}
- Pin Connected Links, Moving: I_{23}, I_{24}, I_{35}, I_{45}, I_{56}
- **Sliding Bodies**: I_{16}
  - The ○ on the line is used to designate that the IC is at ∞





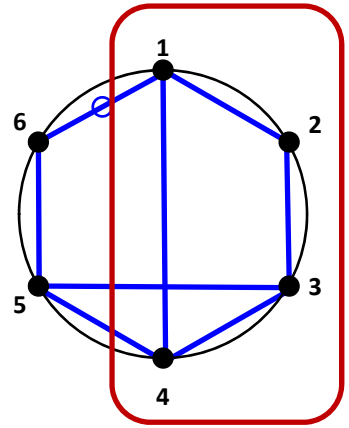
The remaining Instant Centers Need to be located using the **Circle Diagram and the Aronhold-Kennedy Theorem**.

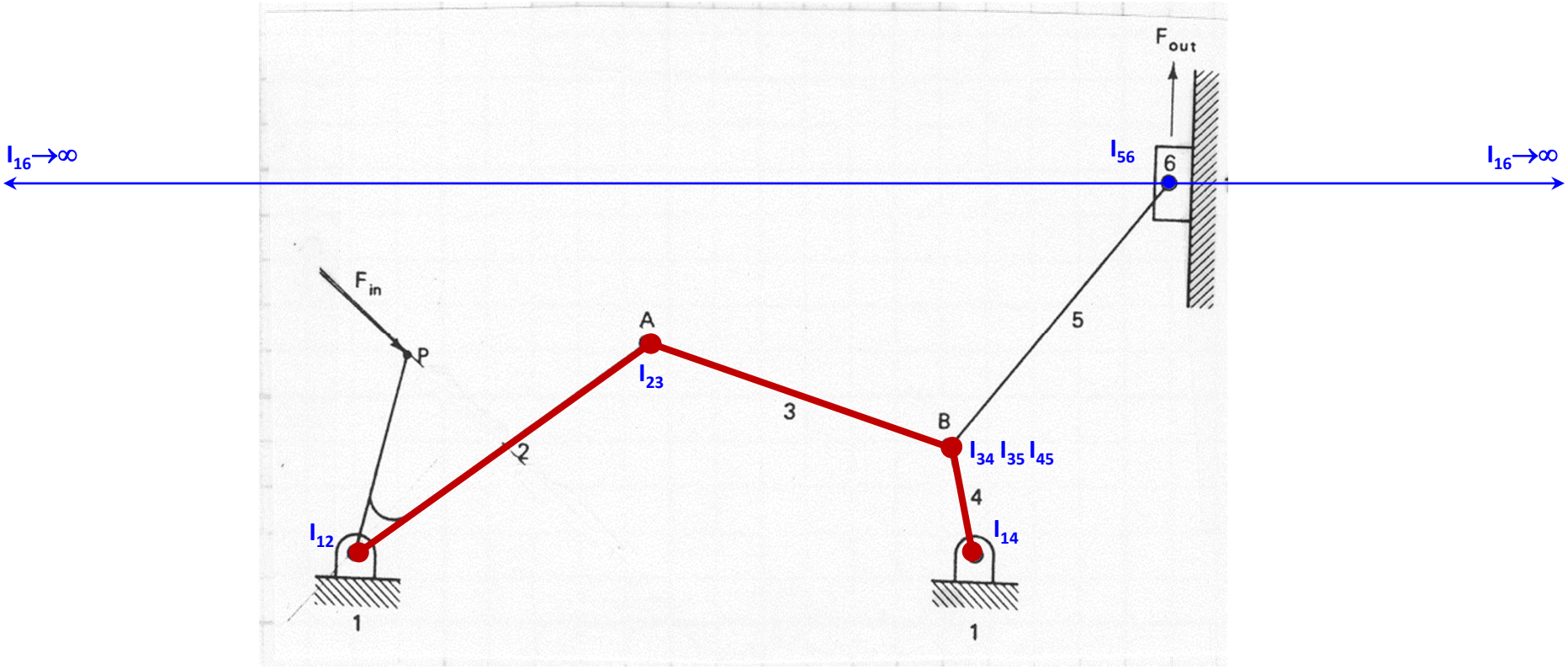




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

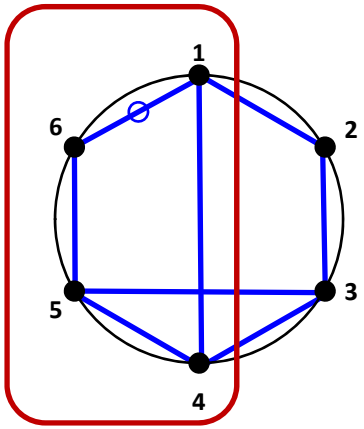
- **One strategy** for finding the remaining instant centers is to look at this mechanism as **two connected mechanisms** consisting of a
  - **4-Bar**

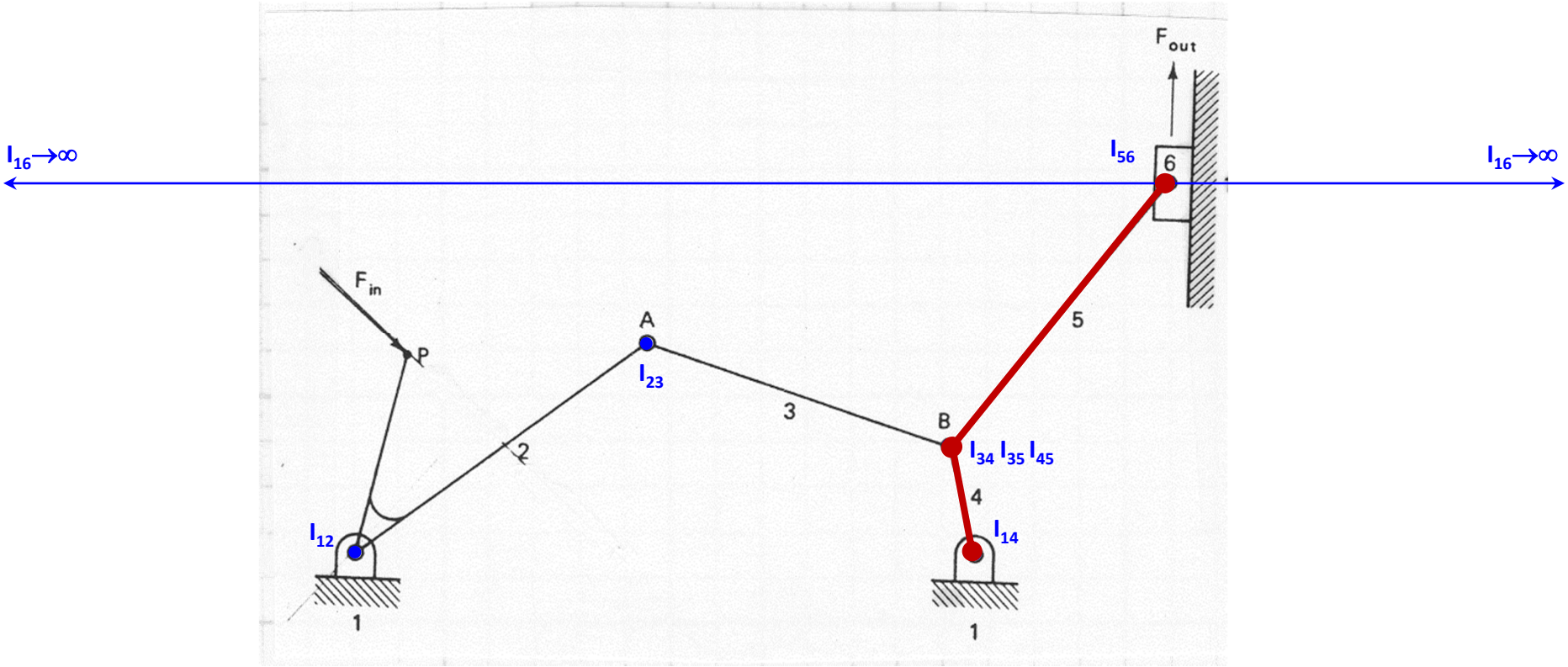




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

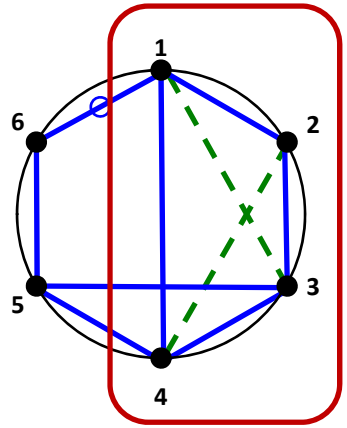
- **One strategy** for finding the remaining instant centers is to look at this mechanism as **two connected mechanisms** consisting of a
  - 4-Bar, and a
  - **Slider Crank**

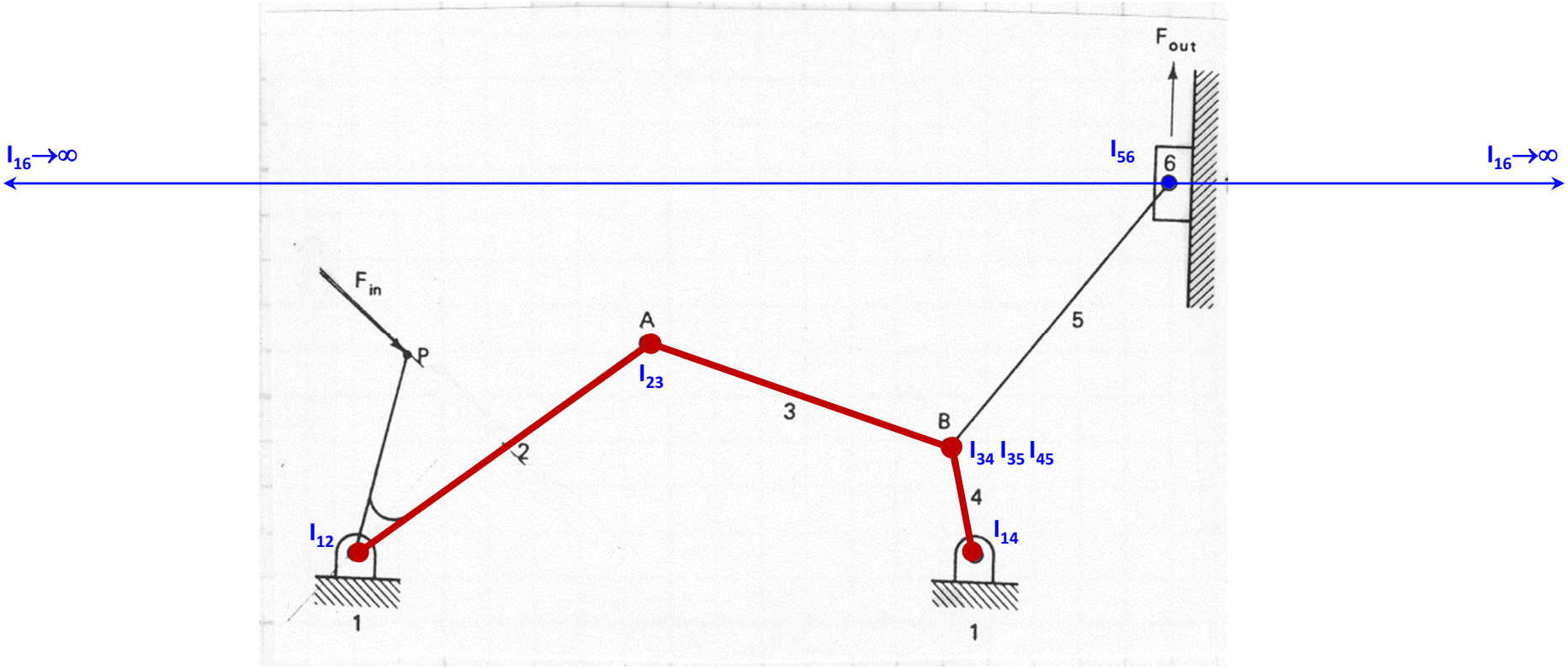




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

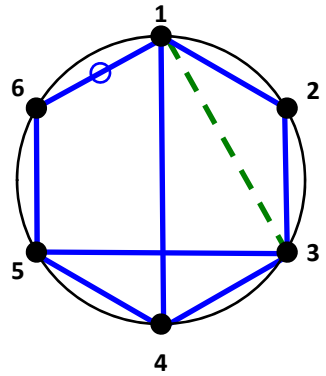
- **Starting with the 4-Bar** segment, I_{13} and I_{24} can be located

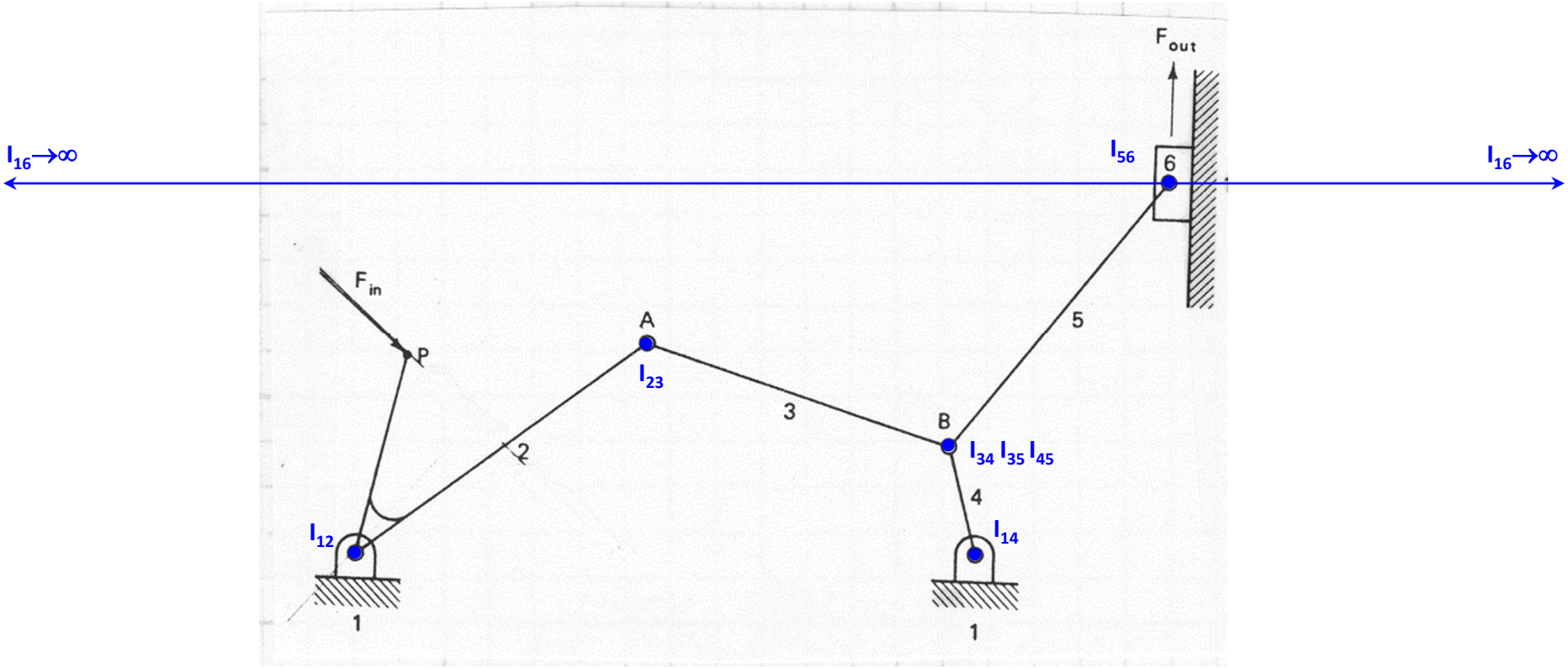




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

- **4-Bar** segment
  - $I_{13} = I_{12}\, I_{23} + I_{14}\, I_{34}$





The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

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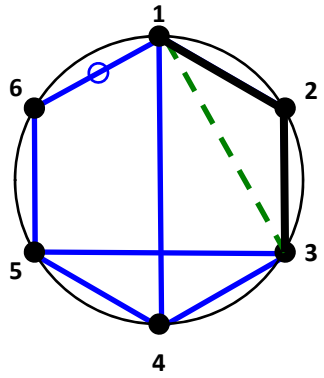
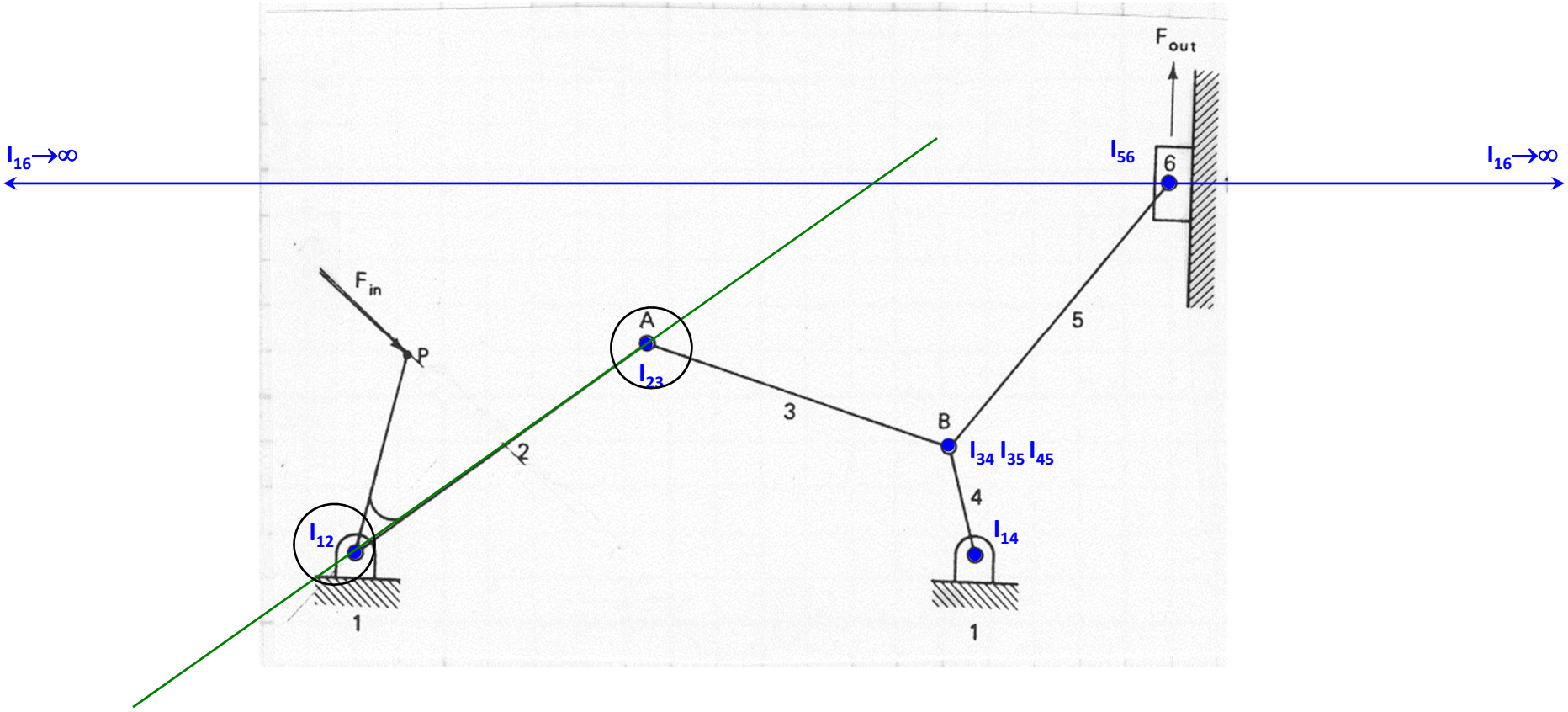
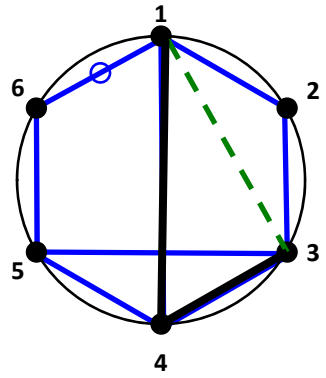
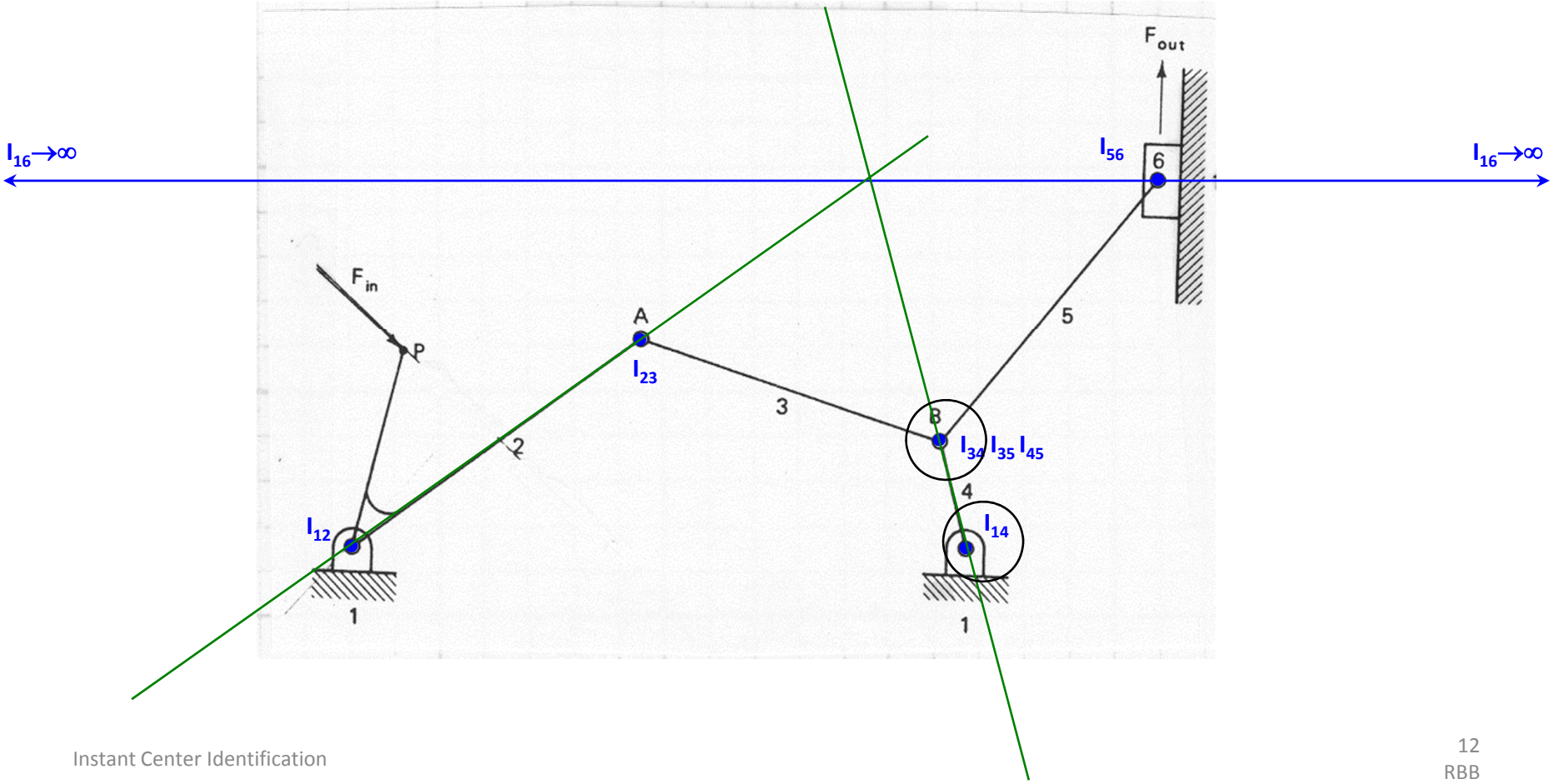




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

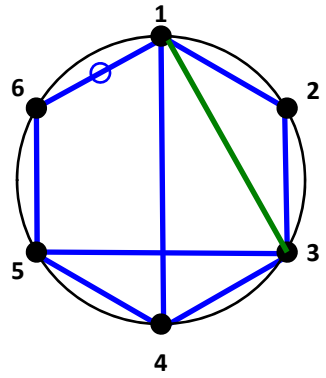
- **4-Bar** segment
  - $I_{13} = I_{12}\, I_{23} + I_{14}\, I_{34}$

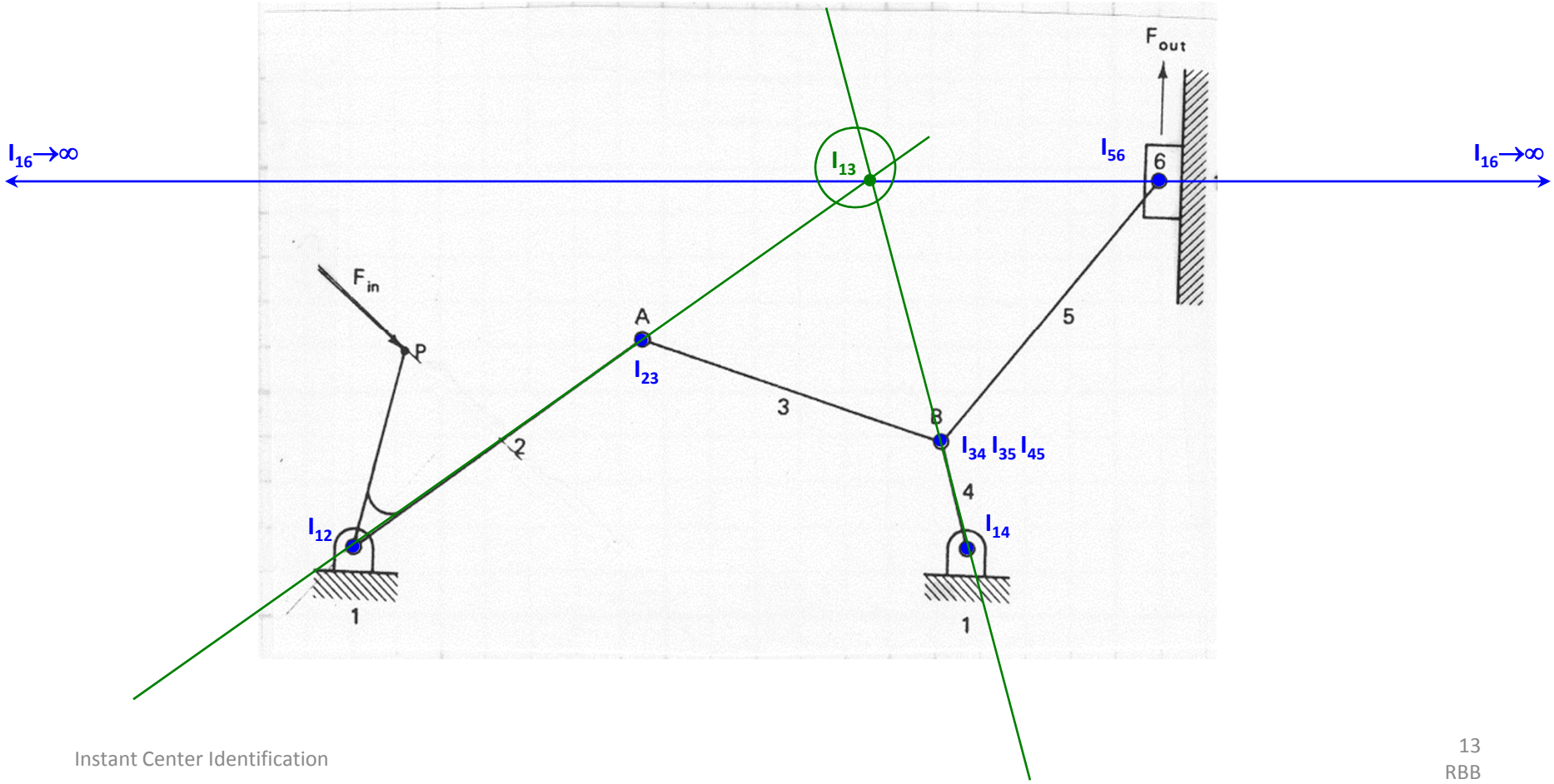




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

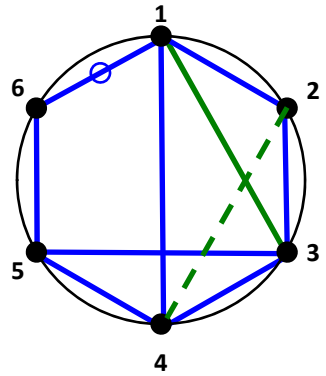
- **4-Bar** segment
  - $I_{13} = I_{12}\, I_{23} + I_{14}\, I_{34}$

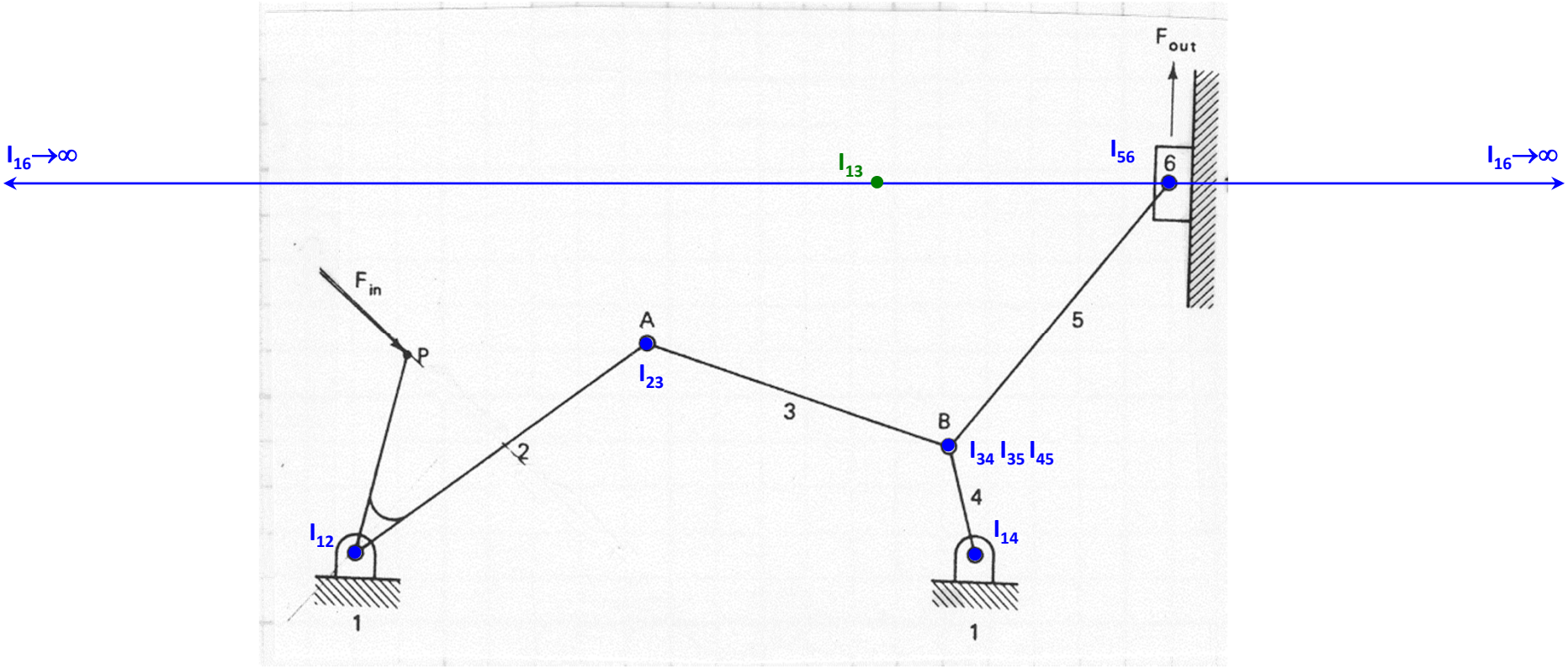




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

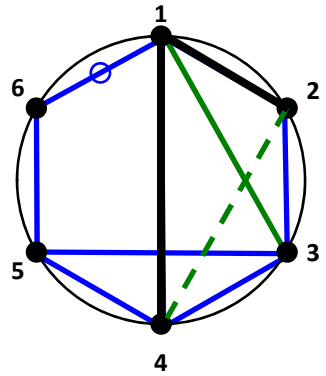
- **4-Bar** segment
  - $I_{13} = I_{12}\, I_{23} + I_{14}\, I_{34}$
  - **$I_{24} = I_{12}\, I_{14} + I_{23}\, I_{34}$**

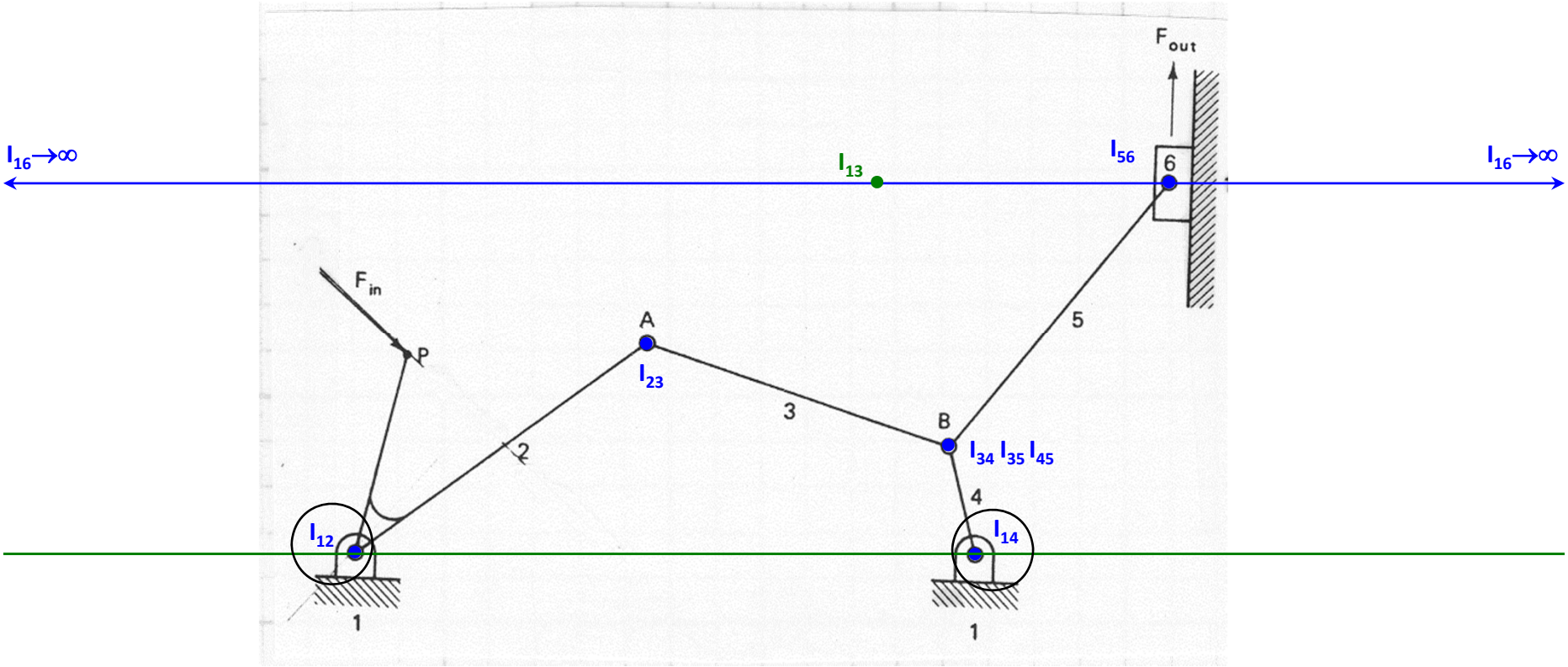




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

- **4-Bar** segment
  - $I_{13} = I_{12}\, I_{23} + I_{14}\, I_{34}$
  - **$I_{24} = I_{12}\, I_{14} + I_{23}\, I_{34}$**





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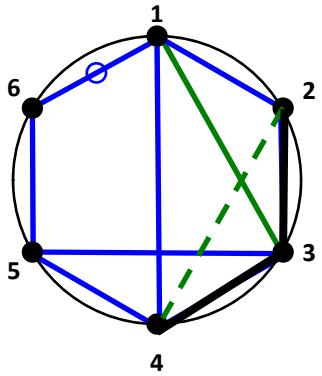
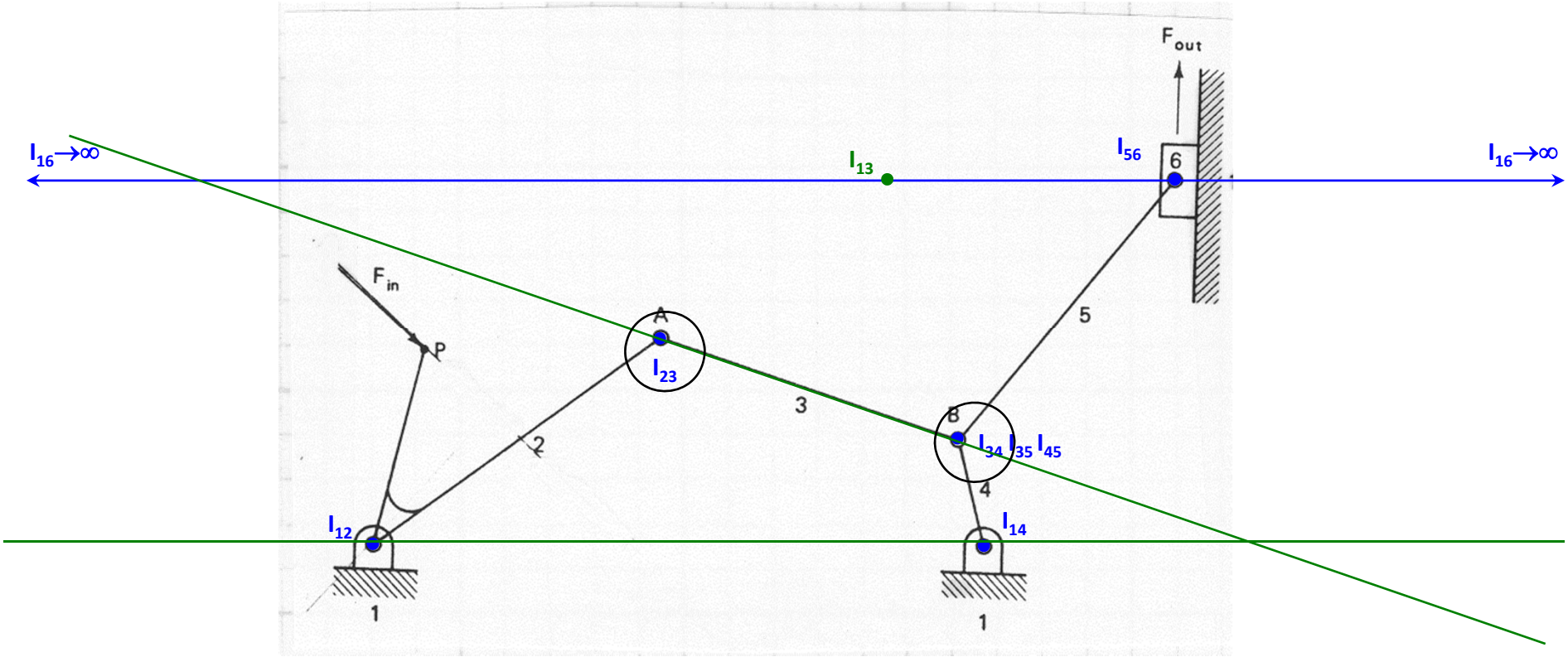
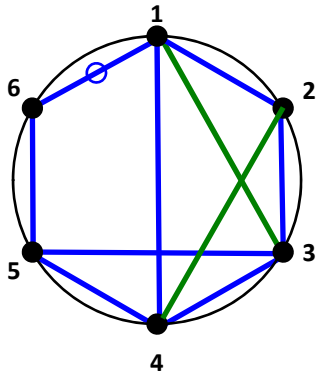
  - **$I_{24} = I_{12}\, I_{14} + I_{23}\, I_{34}$**

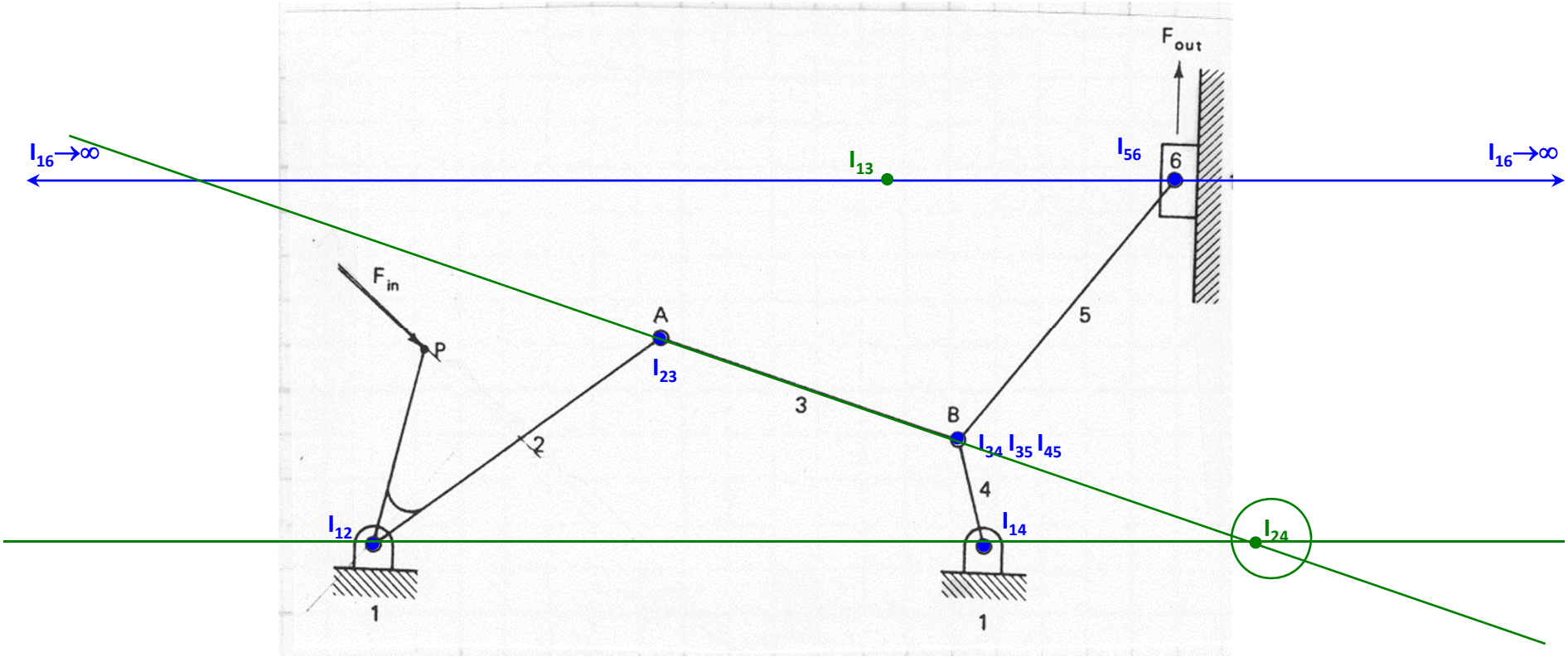




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

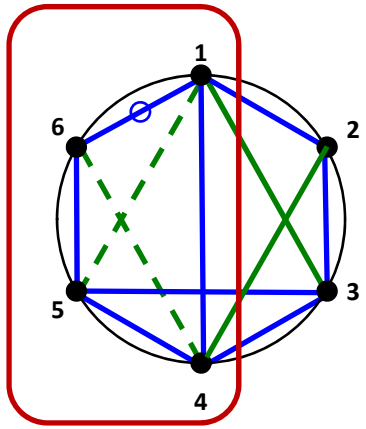
- **4-Bar** segment
  - $I_{13} = I_{12}\, I_{23} + I_{14}\, I_{34}$
  - $\mathbf{I_{24} = I_{12}\, I_{14} + I_{23}\, I_{34}}$

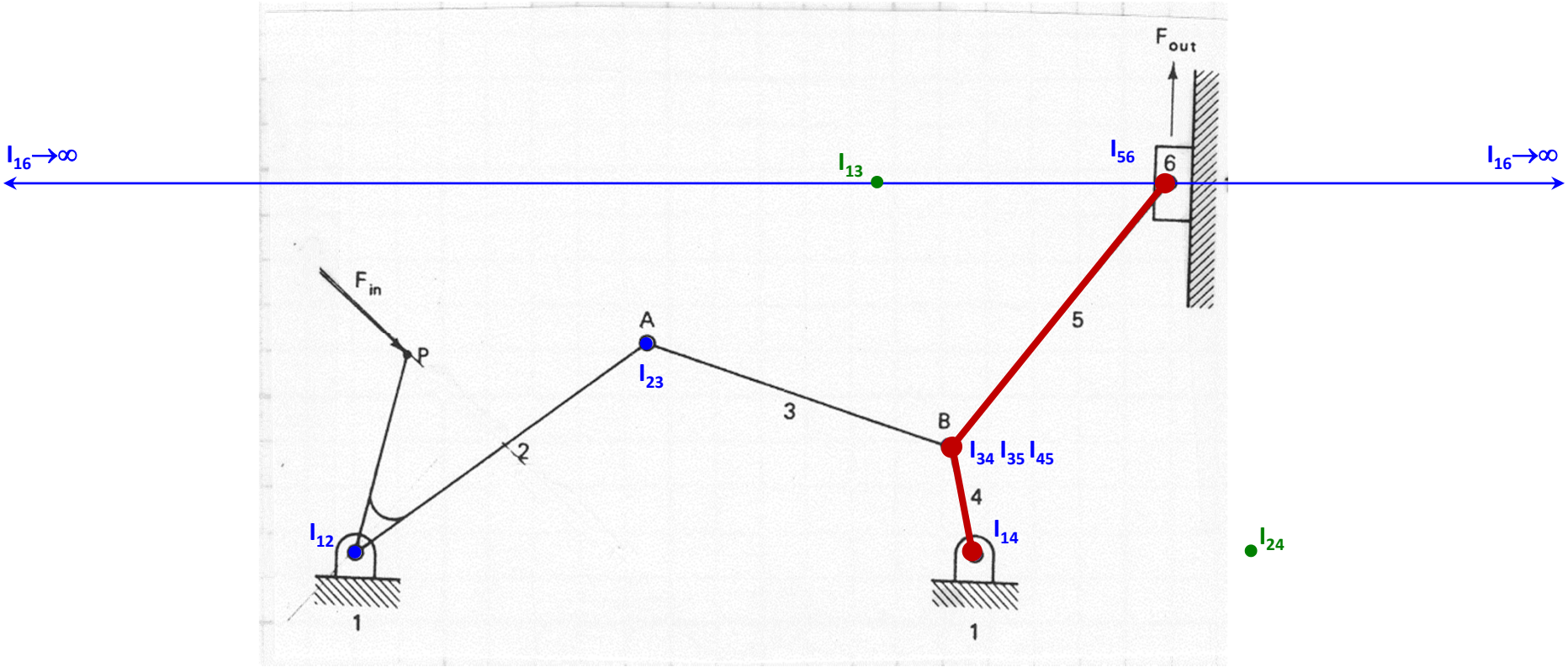




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

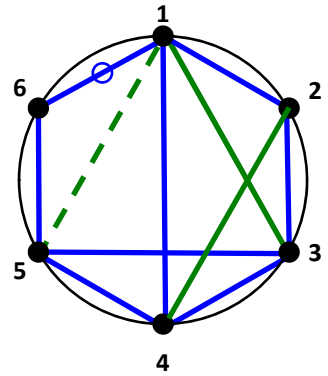
- 4-Bar segment
- The **Slider Crank segment** is now considered**,** I_{15} and I_{46} can be found.

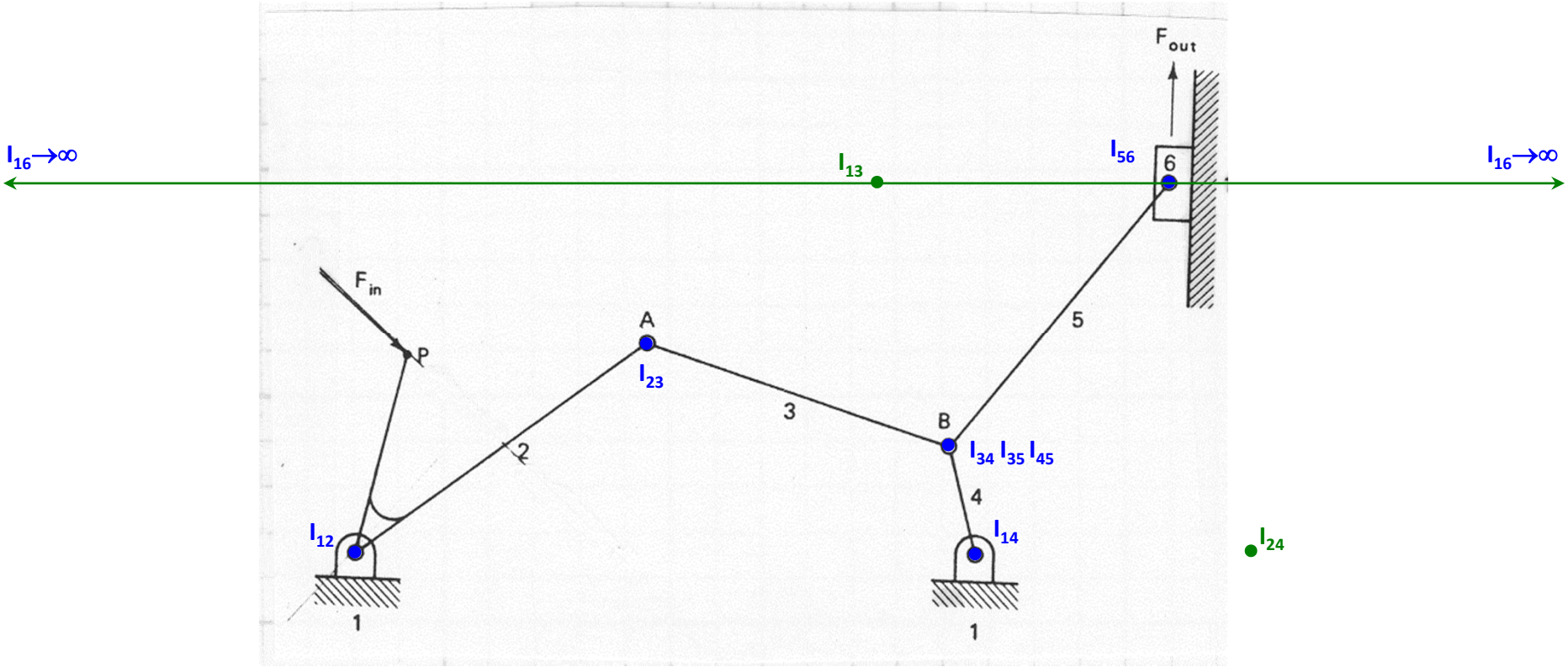




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

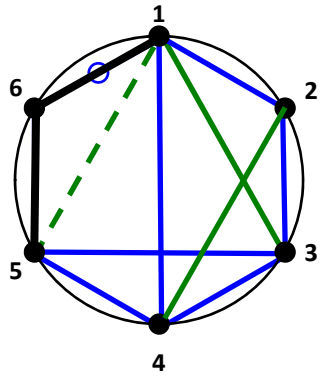
- 4-Bar segment
- **Slider Crank segment**
  - **$I_{15} = I_{16}\, I_{56} + I_{14}\, I_{45}$**

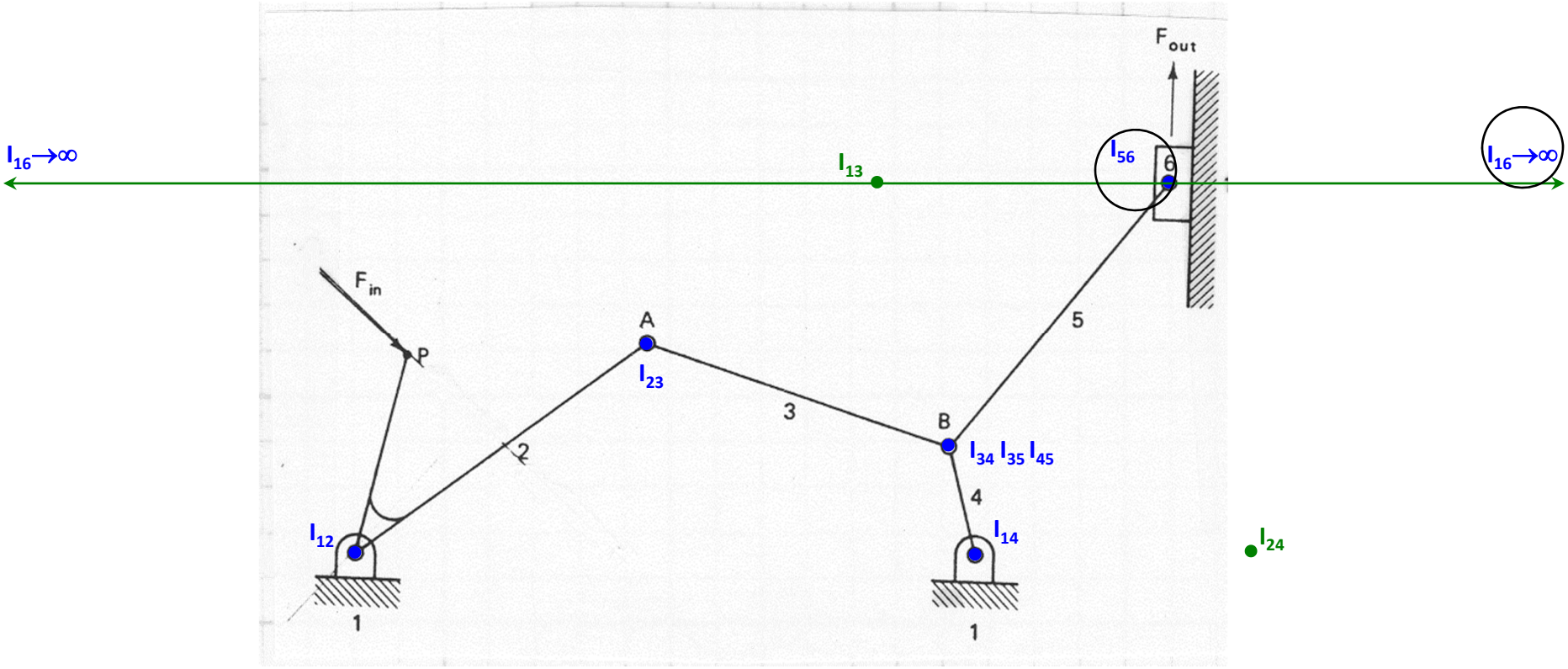




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

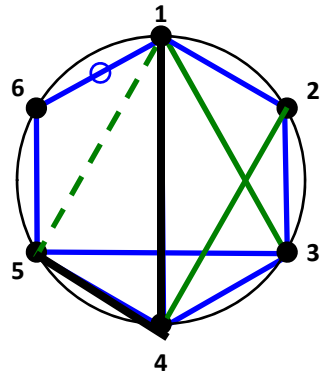
- 4-Bar segment
- **Slider Crank segment**
  - $I_{15} = I_{16}\, I_{56} + I_{14}\, I_{45}$
    - Since I_{16} is at ∞, a line through I_{56} is drawn parallel to the $I_{16} \rightarrow \infty$ line, in this case this line is the line previously drawn to I_{16}

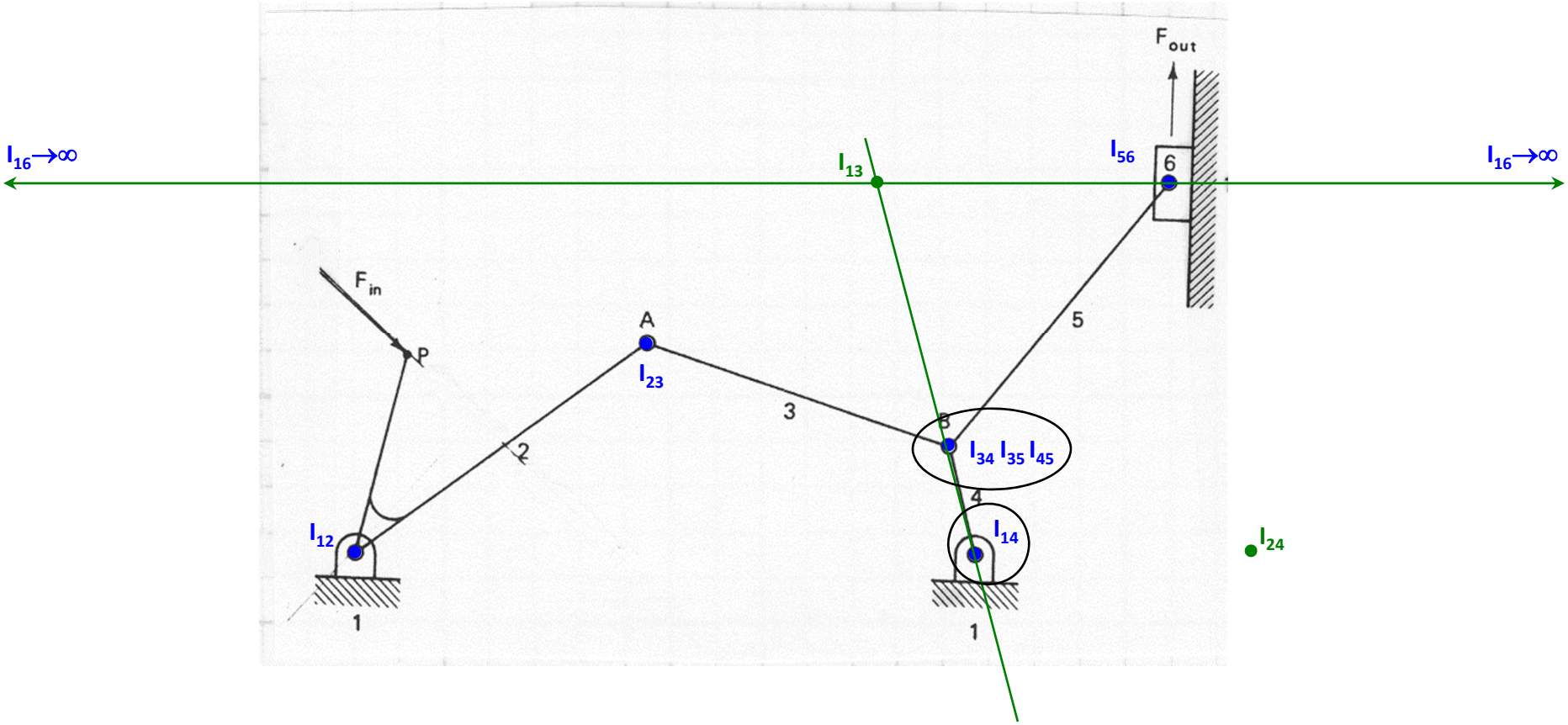




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

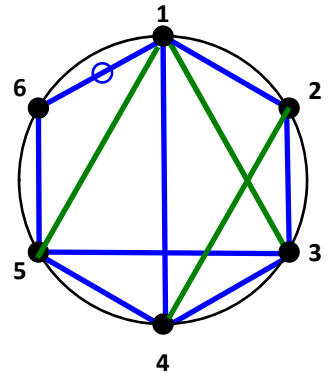
- 4-Bar segment
- **Slider Crank segment**
  - **$I_{15} = I_{16}\, I_{56} + I_{14}\, I_{45}$**

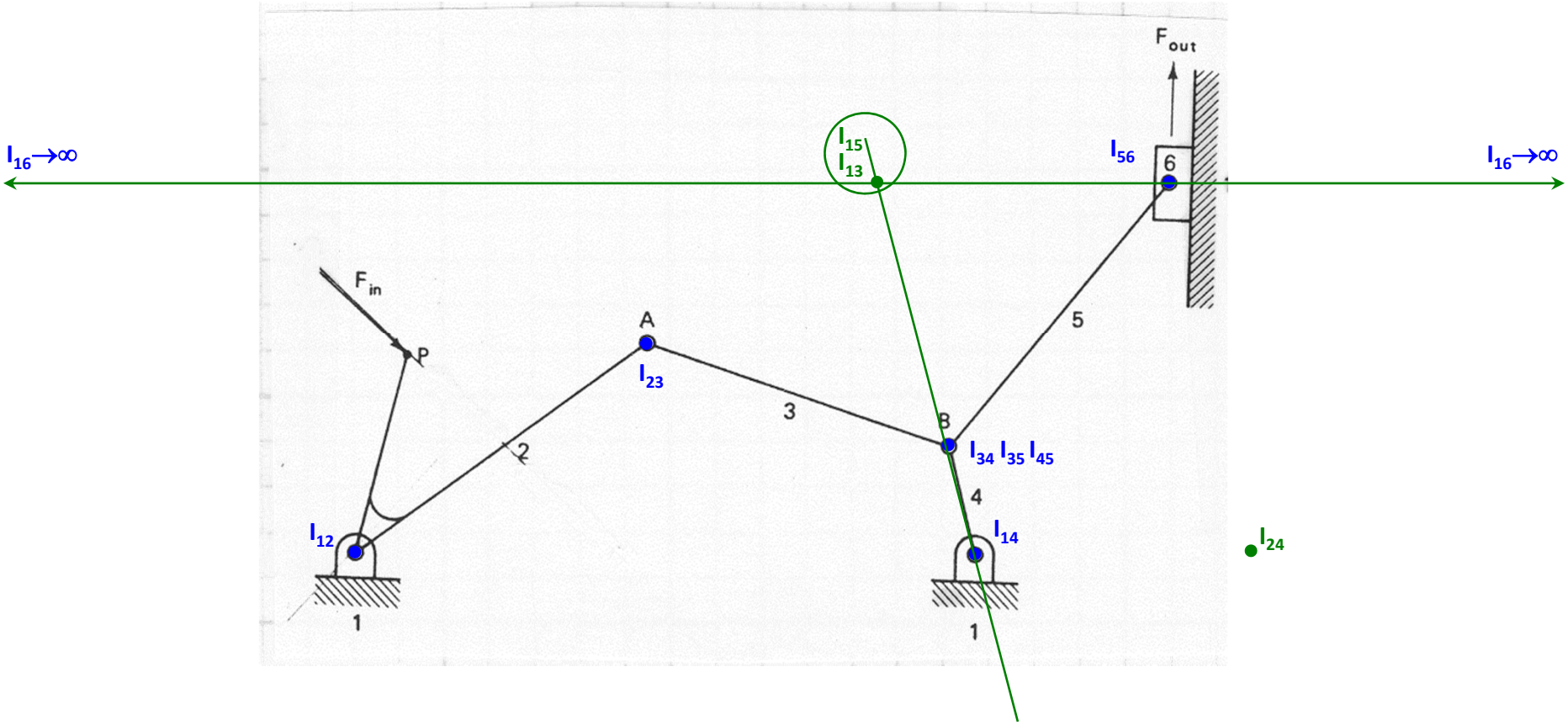




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

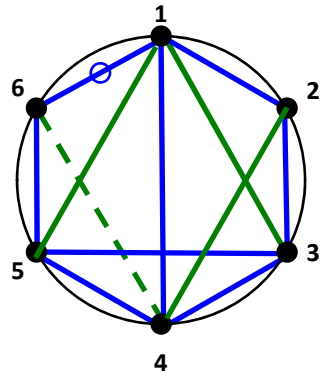
- 4-Bar segment
- **Slider Crank segment**
  - $I_{15} = I_{16}\, I_{56} + I_{14}\, I_{45}$

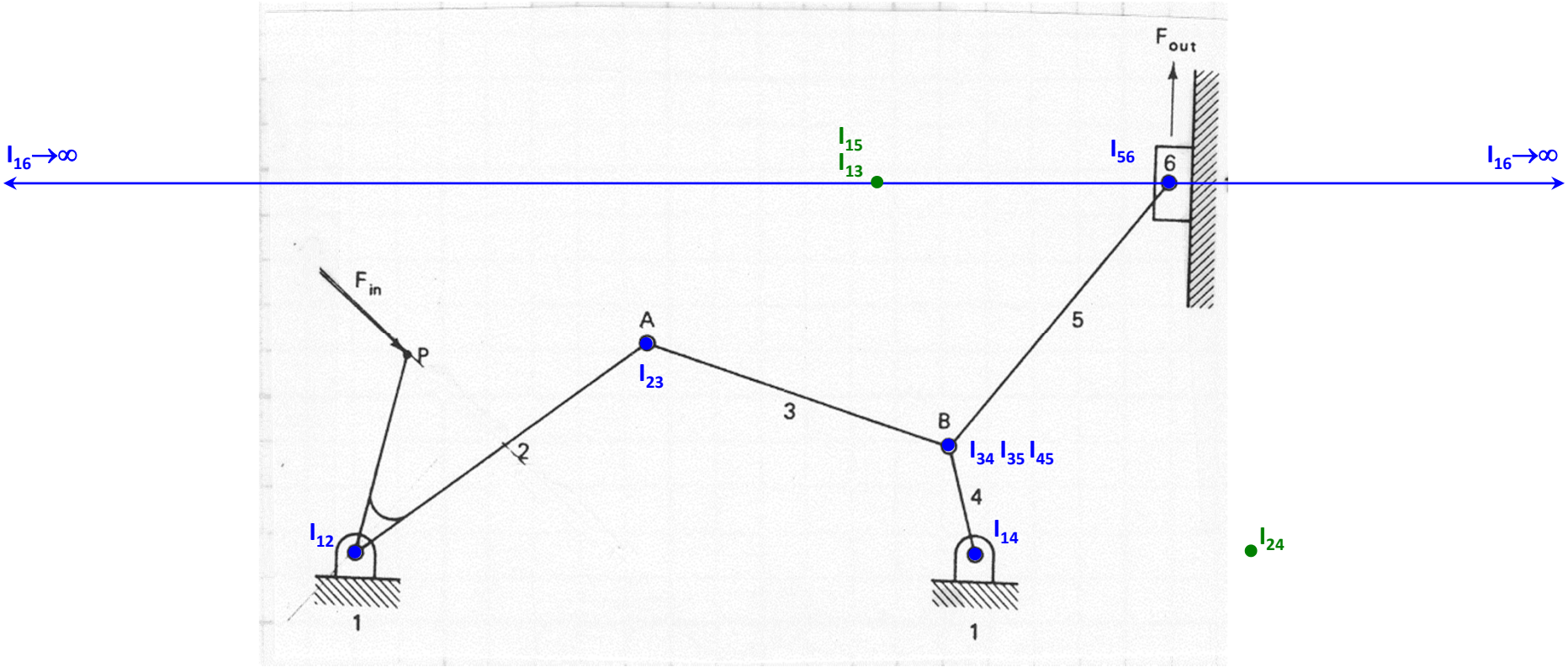




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

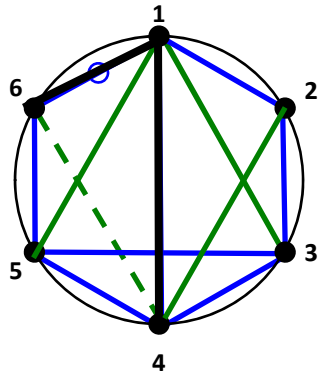
- 4-Bar segment
- **Slider Crank segment**
  - $I_{15} = I_{16}\, I_{56} + I_{14}\, I_{45}$
  - **$I_{46} = I_{16}\, I_{14} + I_{45}\, I_{56}$**

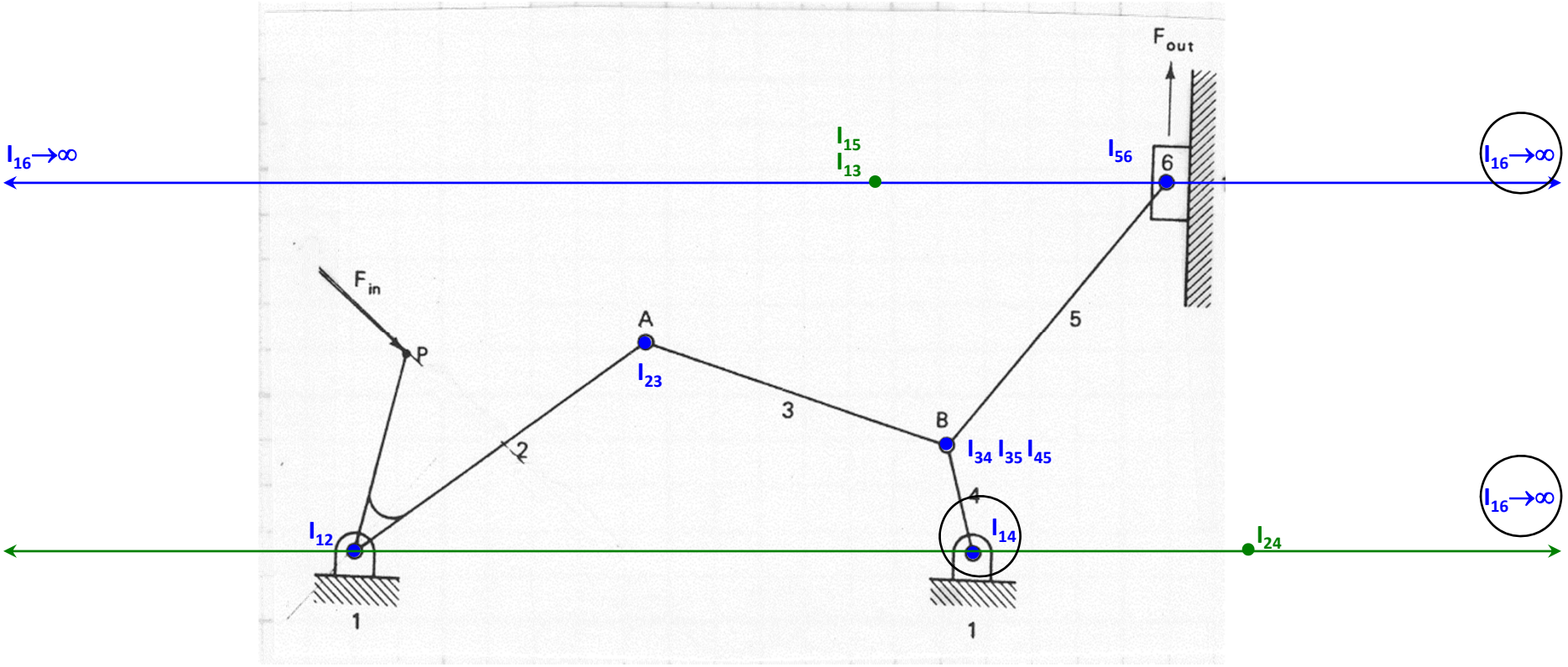




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

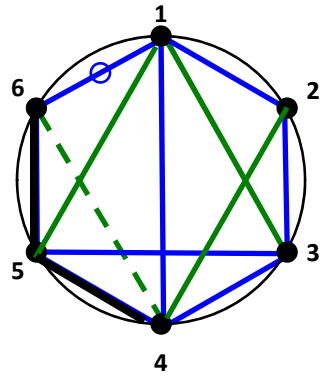
- 4-Bar segment
- **Slider Crank segment**
  - $I_{15} = I_{16}\, I_{56} + I_{14}\, I_{45}$
  - $\mathbf{I_{46} = I_{16}\, I_{14} + I_{45}\, I_{56}}$
    - Since I_{16} is at ∞, a line through I_{14} is drawn parallel to the $I_{16}\rightarrow\infty$ line

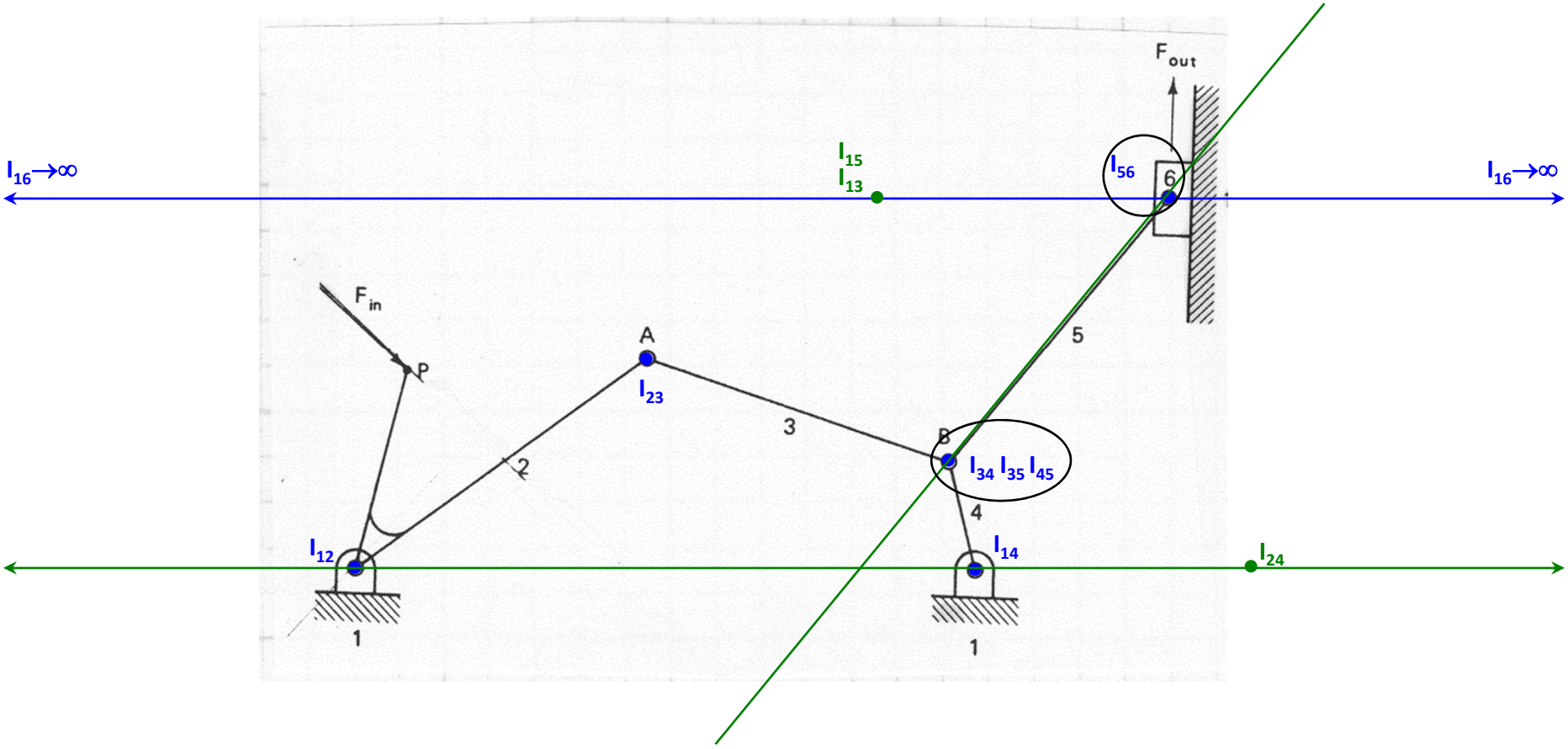




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

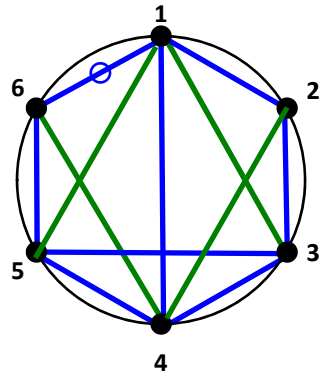
- 4-Bar segment
- **Slider Crank segment**
  - $I_{15} = I_{16}\, I_{56} + I_{14}\, I_{45}$
  - **$I_{46} = I_{16}\, I_{14} + I_{45}\, I_{56}$**

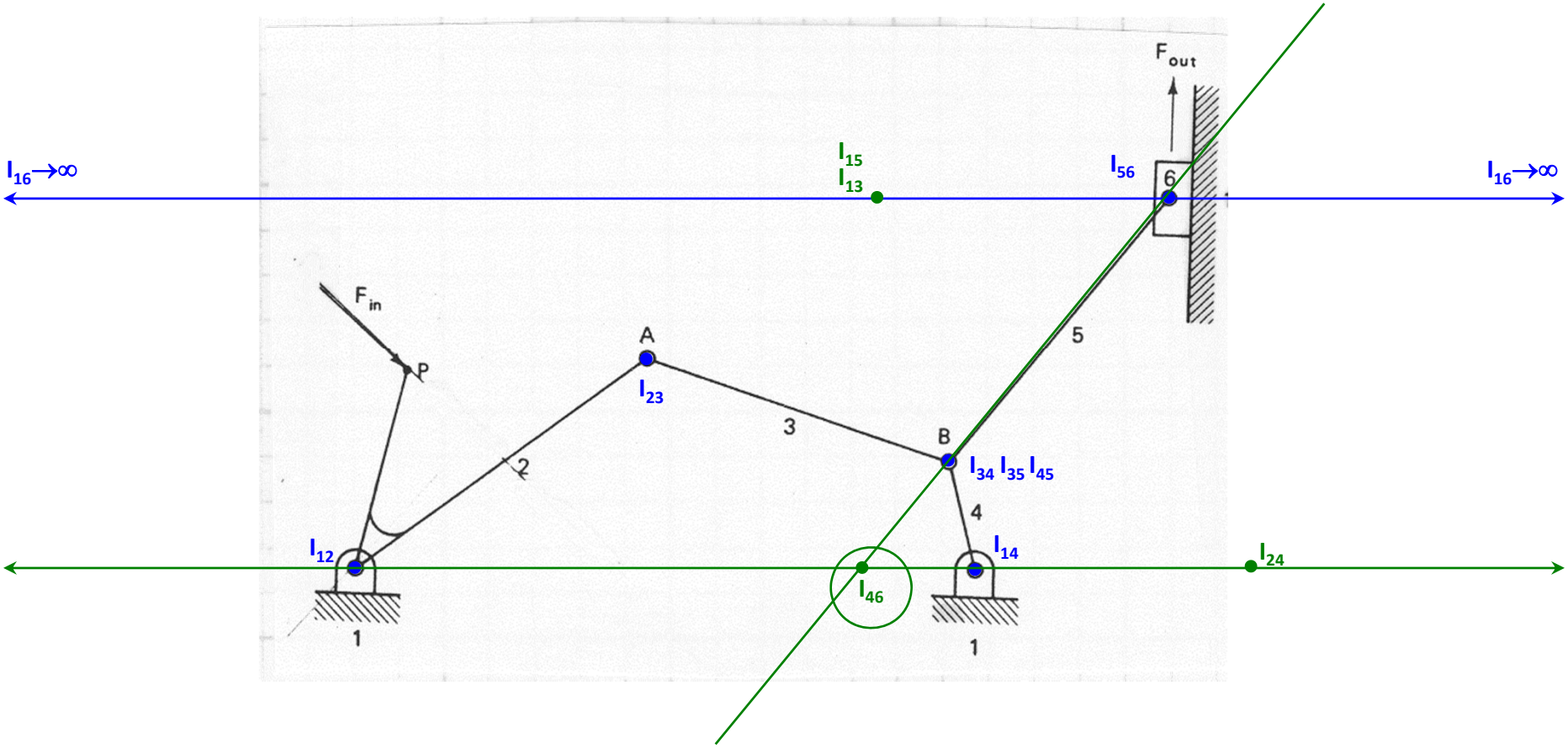




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

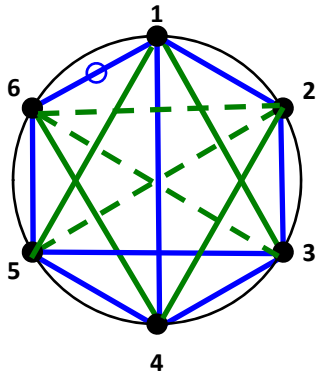
- 4-Bar segment
- **Slider Crank segment**
  - $I_{15} = I_{16}\, I_{56} + I_{14}\, I_{45}$
  - **$I_{46} = I_{16}\, I_{14} + I_{45}\, I_{56}$**

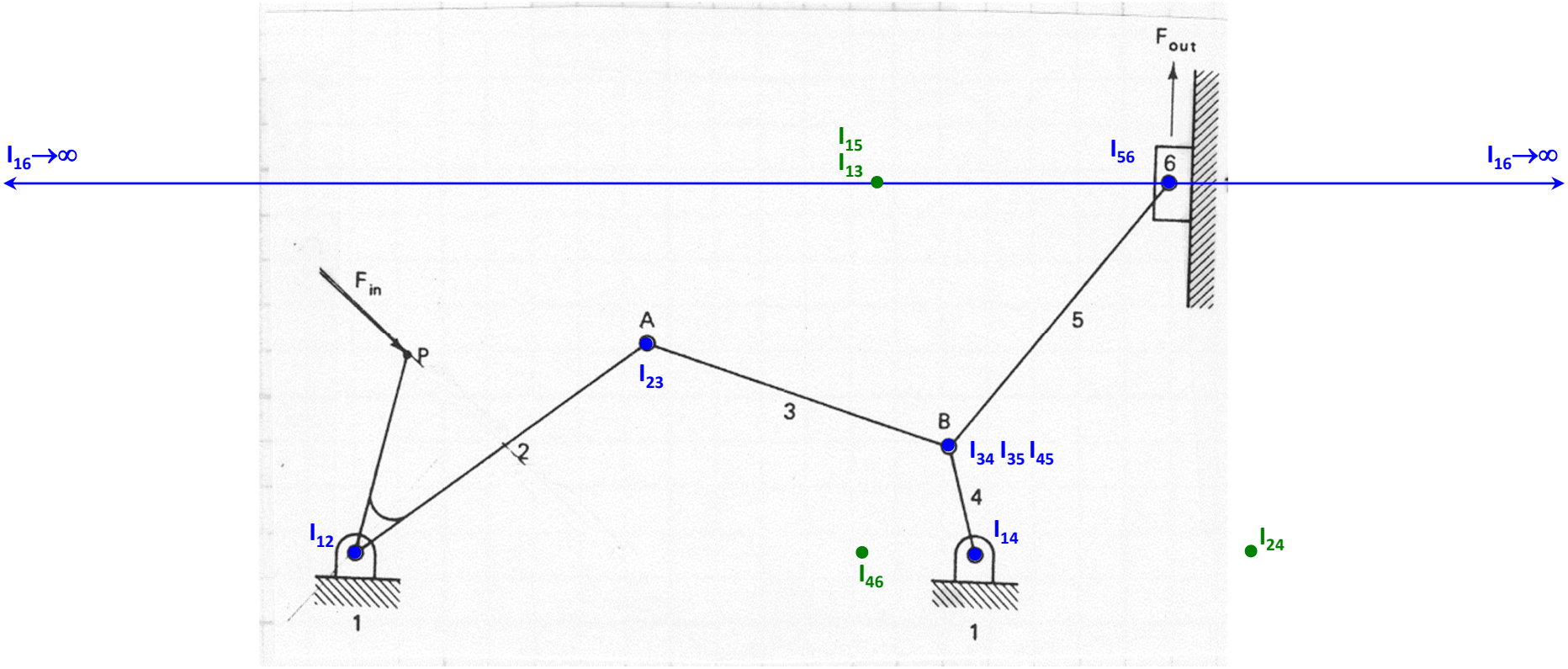




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

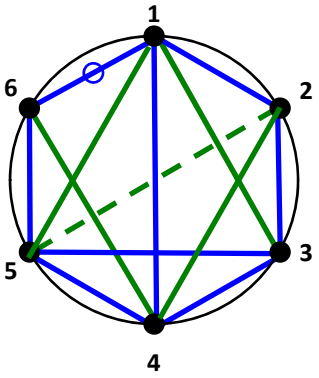
- 4-Bar segment
- Slider Crank segment
- **The Instant Centers between the 4-Bar and Slider Crank segments can now be found**
  - **I_{25}, I_{26} , I_{36}**

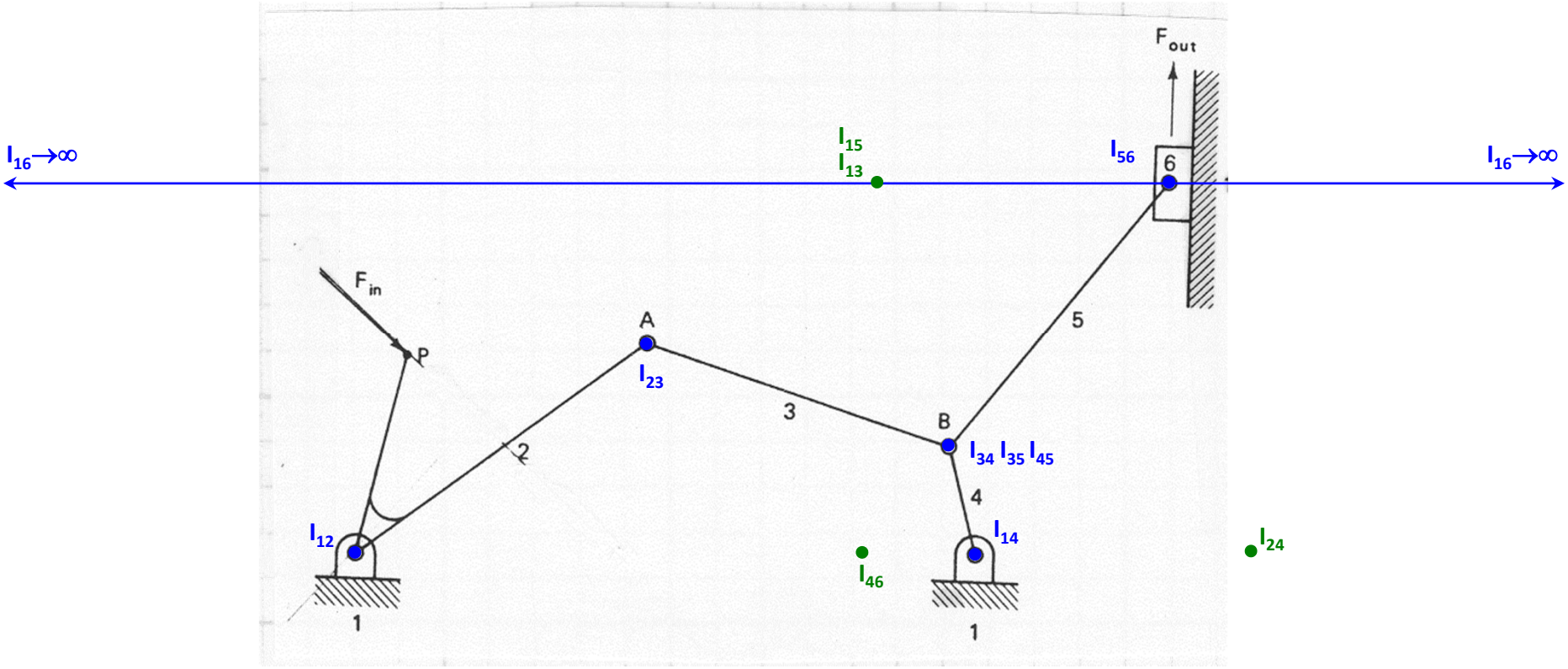




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

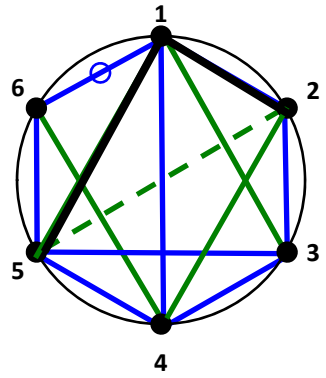
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - **$I_{25} = I_{12}\, I_{15} + I_{24}\, I_{45}$**

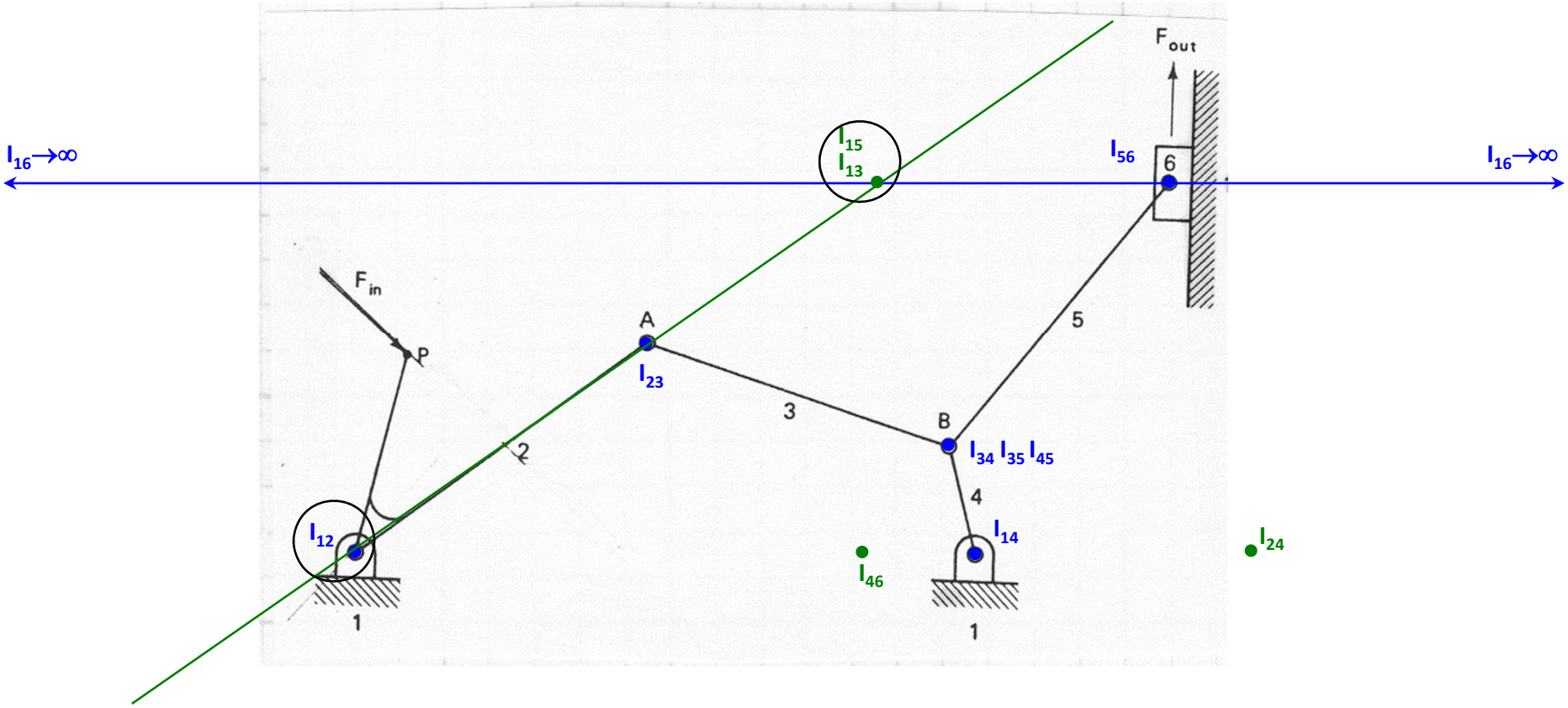




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

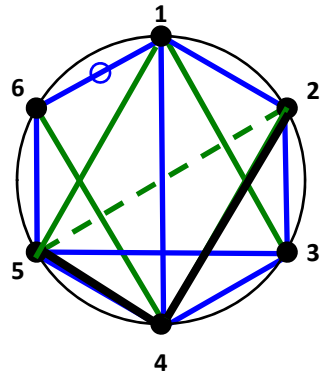
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $I_{25} = I_{12}\, I_{15} + I_{24}\, I_{45}$

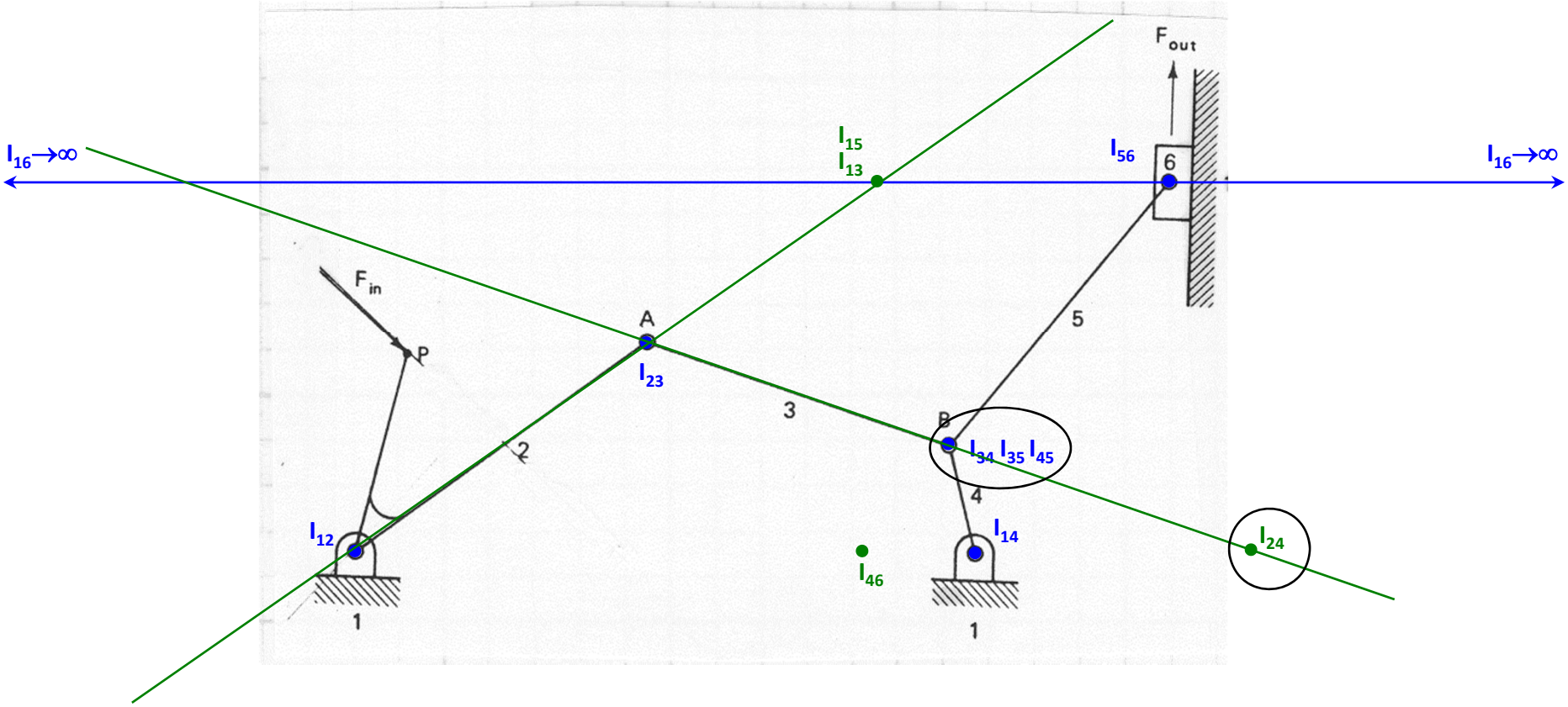




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

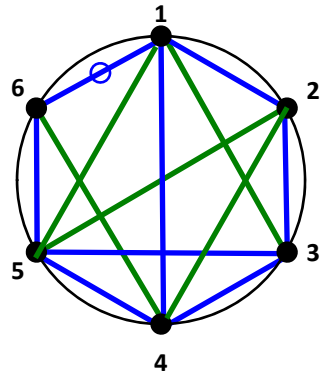
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $I_{25} = I_{12}\, I_{15} + I_{24}\, I_{45}$

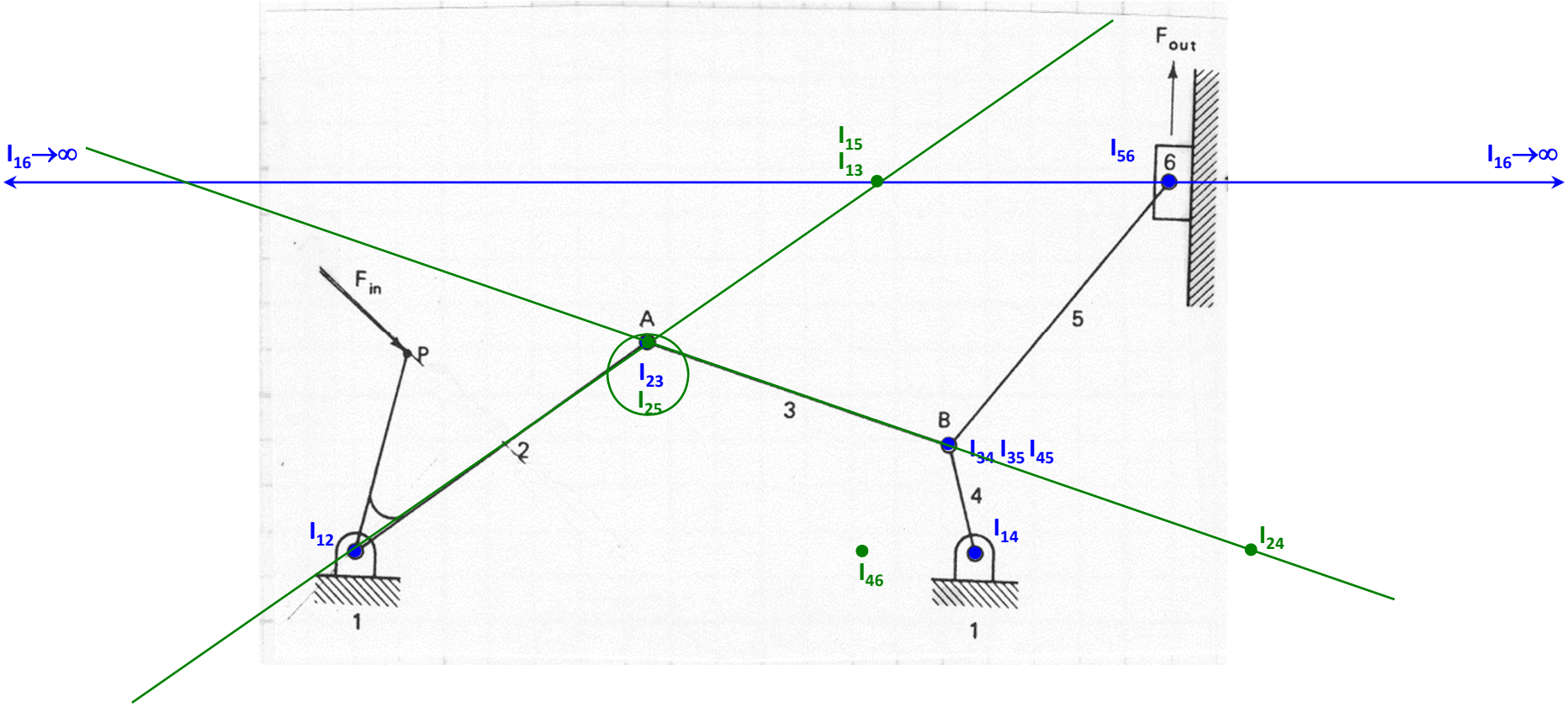




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

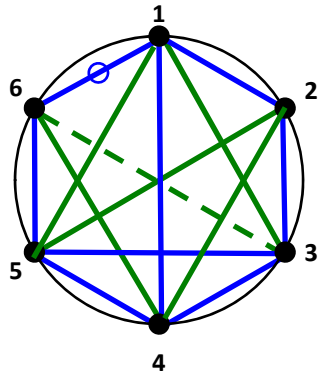
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $I_{25} = I_{12}\, I_{15} + I_{24}\, I_{45}$

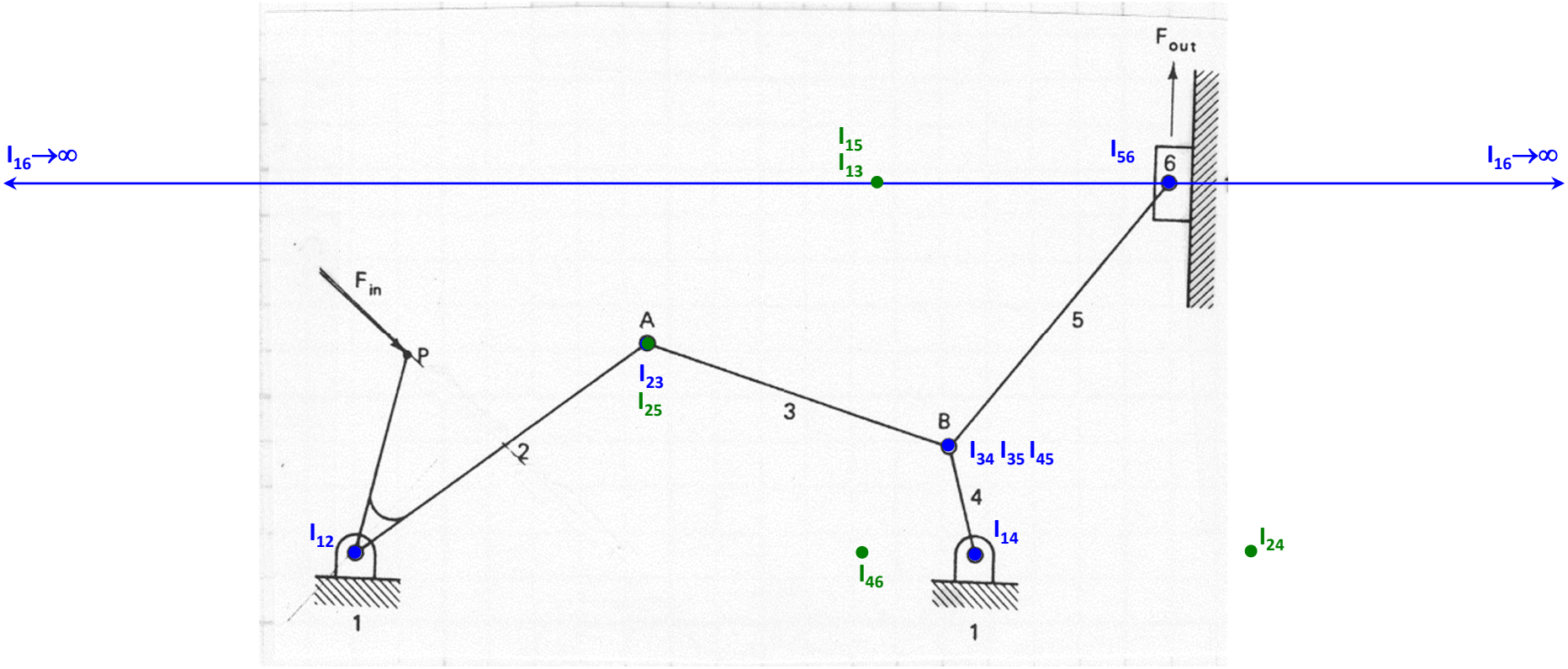




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

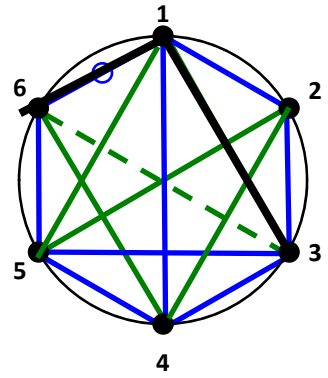
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $I_{25} = I_{12}\, I_{15} + I_{24}\, I_{45}$
  - **$I_{36} = I_{16}\, I_{13} + I_{34}\, I_{46}$**

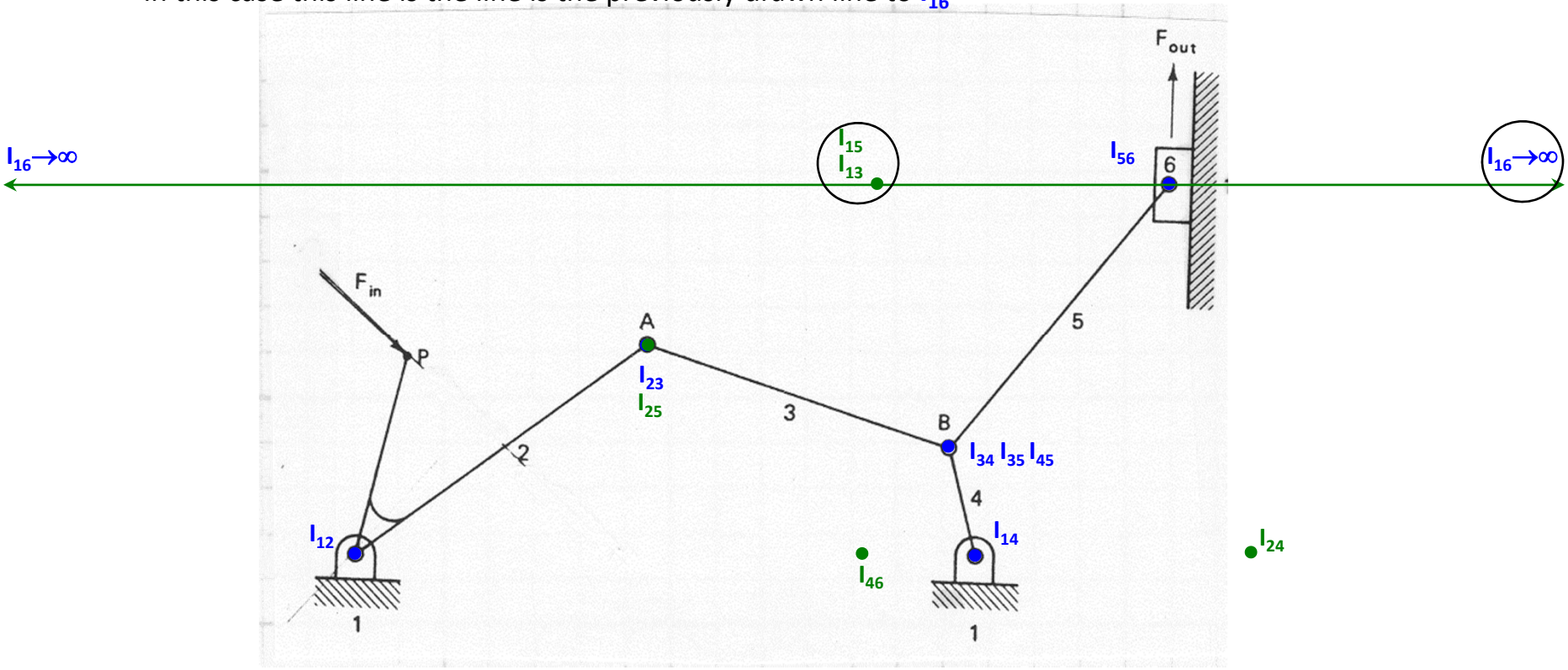




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

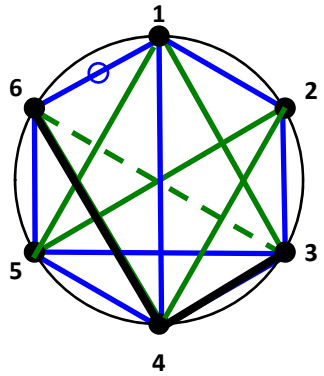
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $l_{25} = l_{12}\, l_{15} + l_{24}\, l_{45}$
  - **$l_{36} = l_{16}\, l_{13} + l_{34}\, l_{46}$**
    - Since l_{16} is at ∞, a line through l_{13} is drawn parallel to the $l_{16} \rightarrow \infty$ line, in this case this line is the line is the previously drawn line to l_{16}

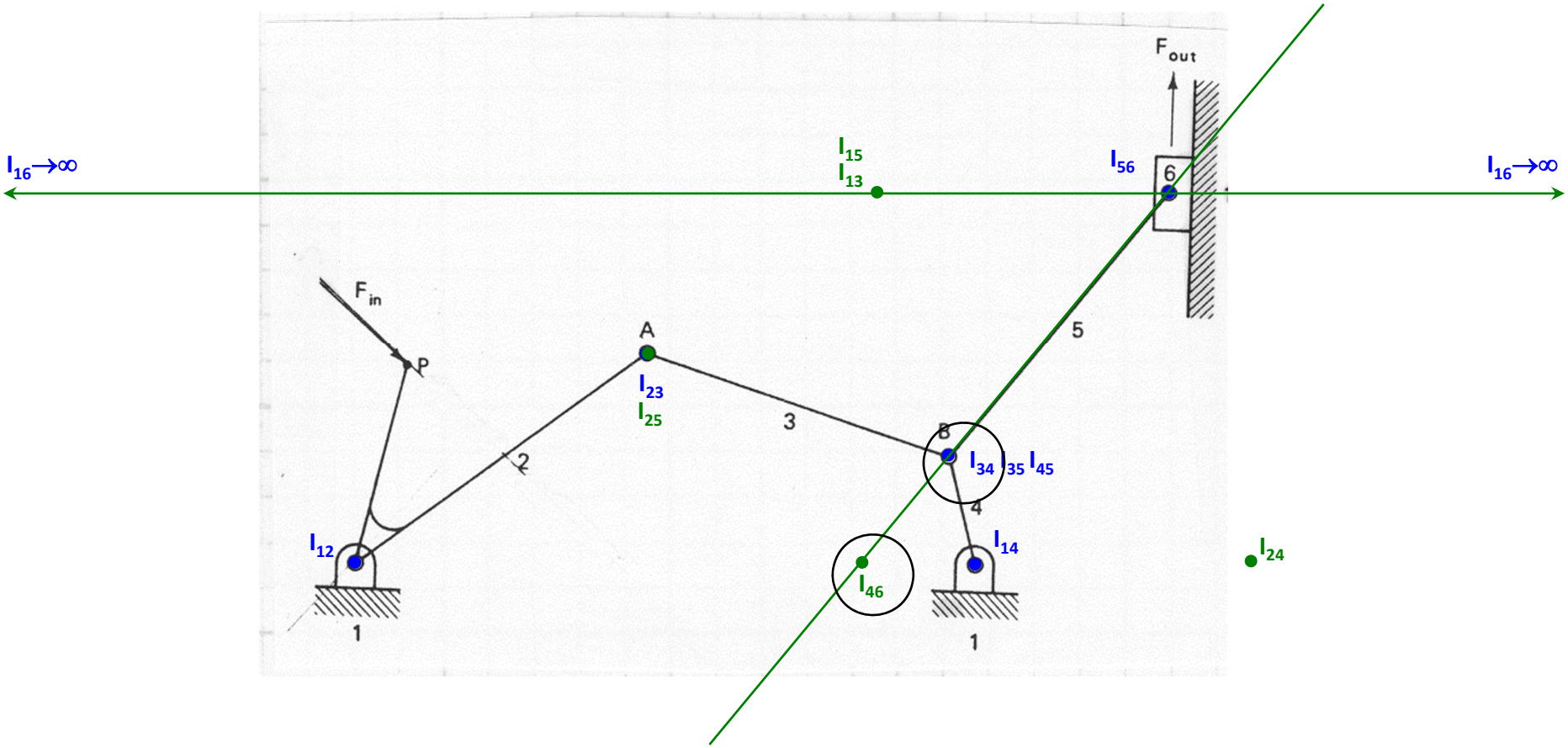




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

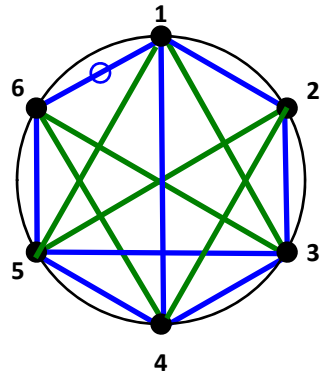
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $I_{25} = I_{12}\, I_{15} + I_{24}\, I_{45}$
  - **$I_{36} = I_{16}\, I_{13} + I_{34}\, I_{46}$**

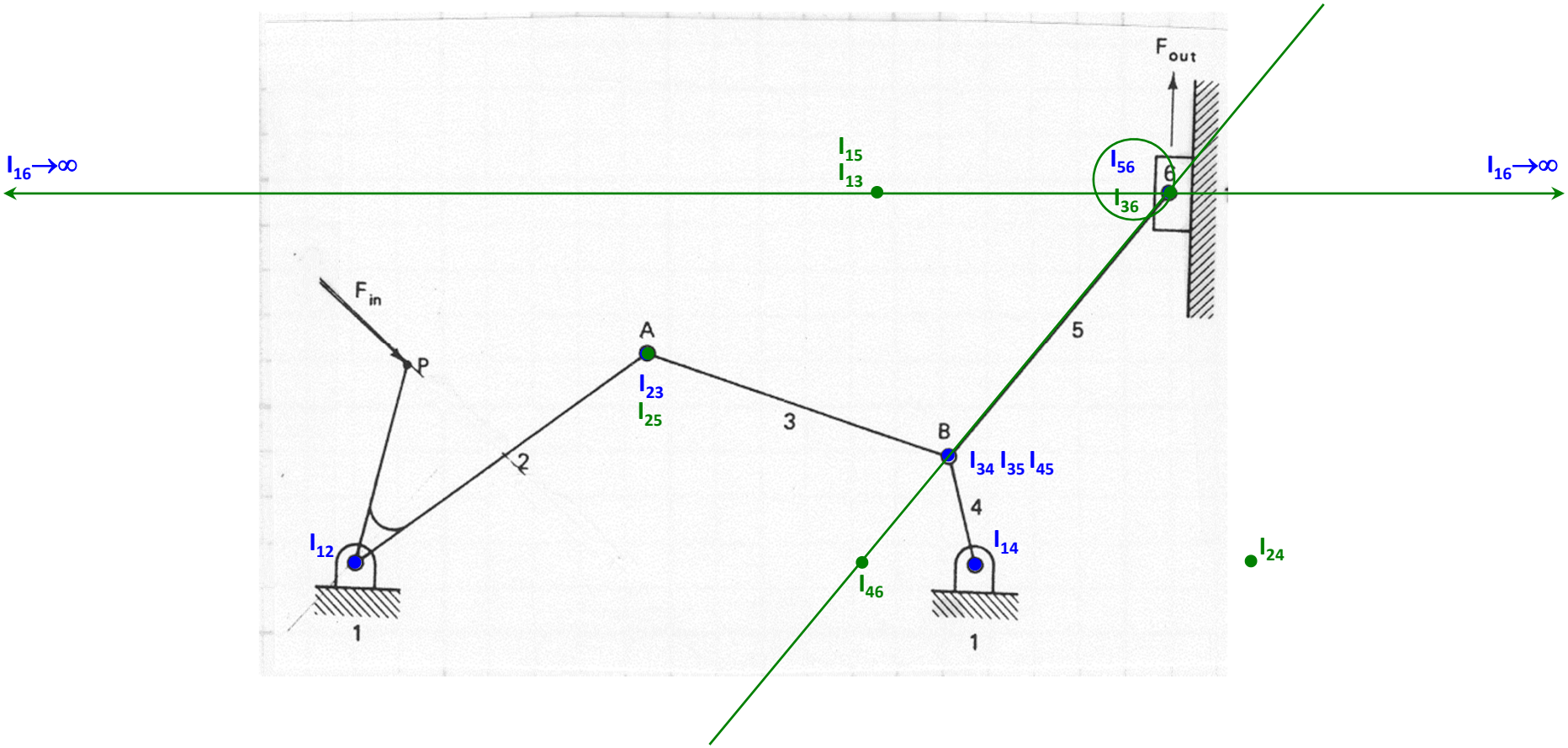




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

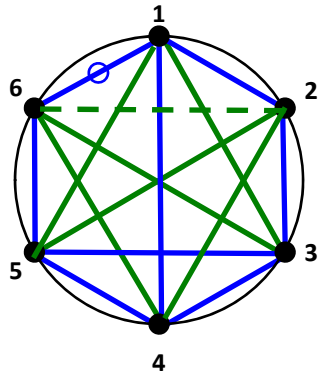
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $l_{25} = l_{12}\, l_{15} + l_{24}\, l_{45}$
  - **$l_{36} = l_{16}\, l_{13} + l_{34}\, l_{46}$**

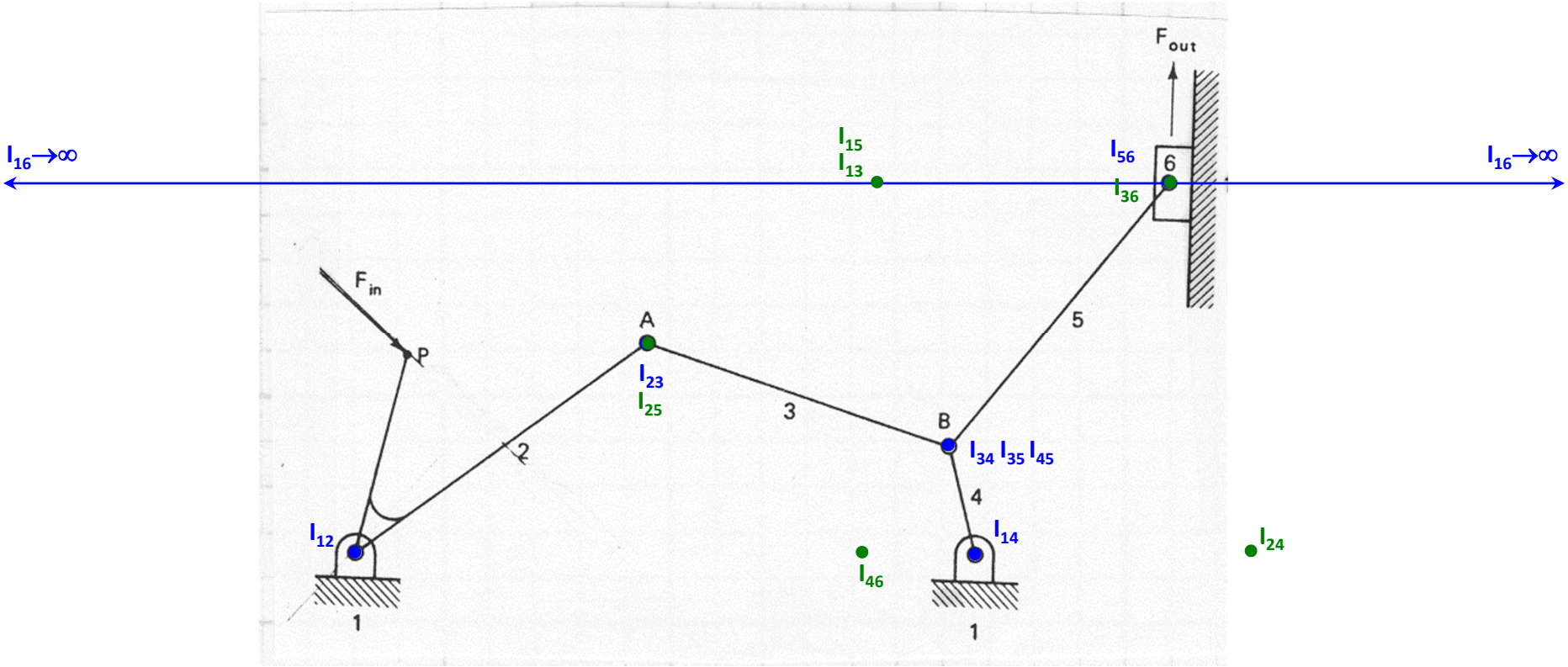




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

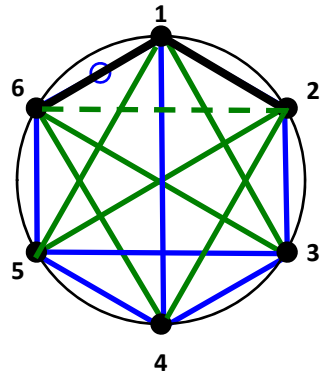
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $I_{25} = I_{12}\, I_{15} + I_{24}\, I_{45}$
  - $I_{36} = I_{16}\, I_{13} + I_{34}\, I_{46}$
  - **$I_{26} = I_{12}\, I_{16} + I_{25}\, I_{56}$**

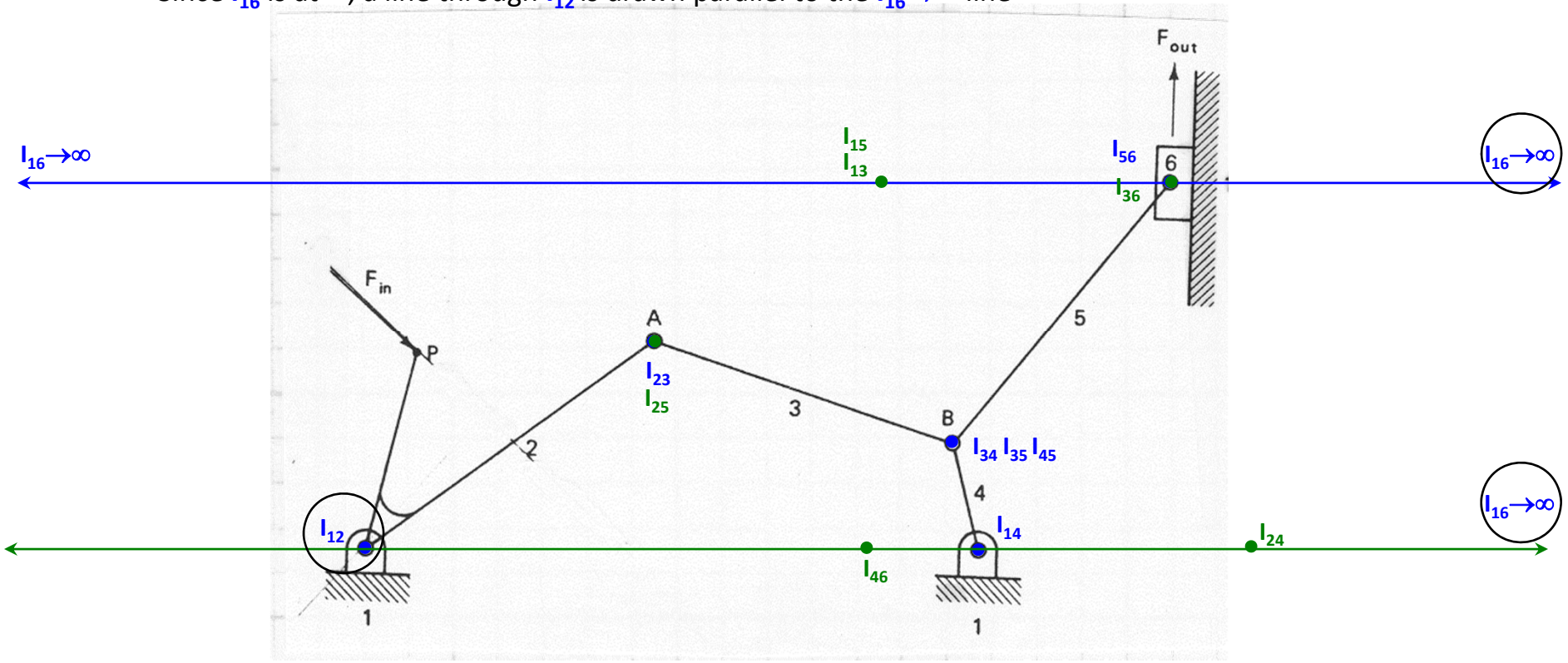




The remaining Instant Centers Need to be located using the Circle Diagram and the Aronhold-Kennedy Theorem.

- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $l_{25}= l_{12}\, l_{15}+ l_{24}\, l_{45}$
  - $l_{36}= l_{16}\, l_{13}+ l_{34}\, l_{46}$
  - **$l_{26}= l_{12}\, l_{16}+ l_{25}\, l_{56}$**
    - Since l_{16} is at ∞, a line through l_{12} is drawn parallel to the $l_{16}\rightarrow\infty$ line





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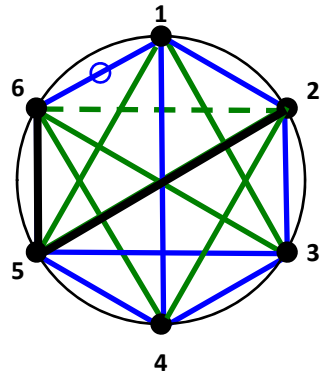
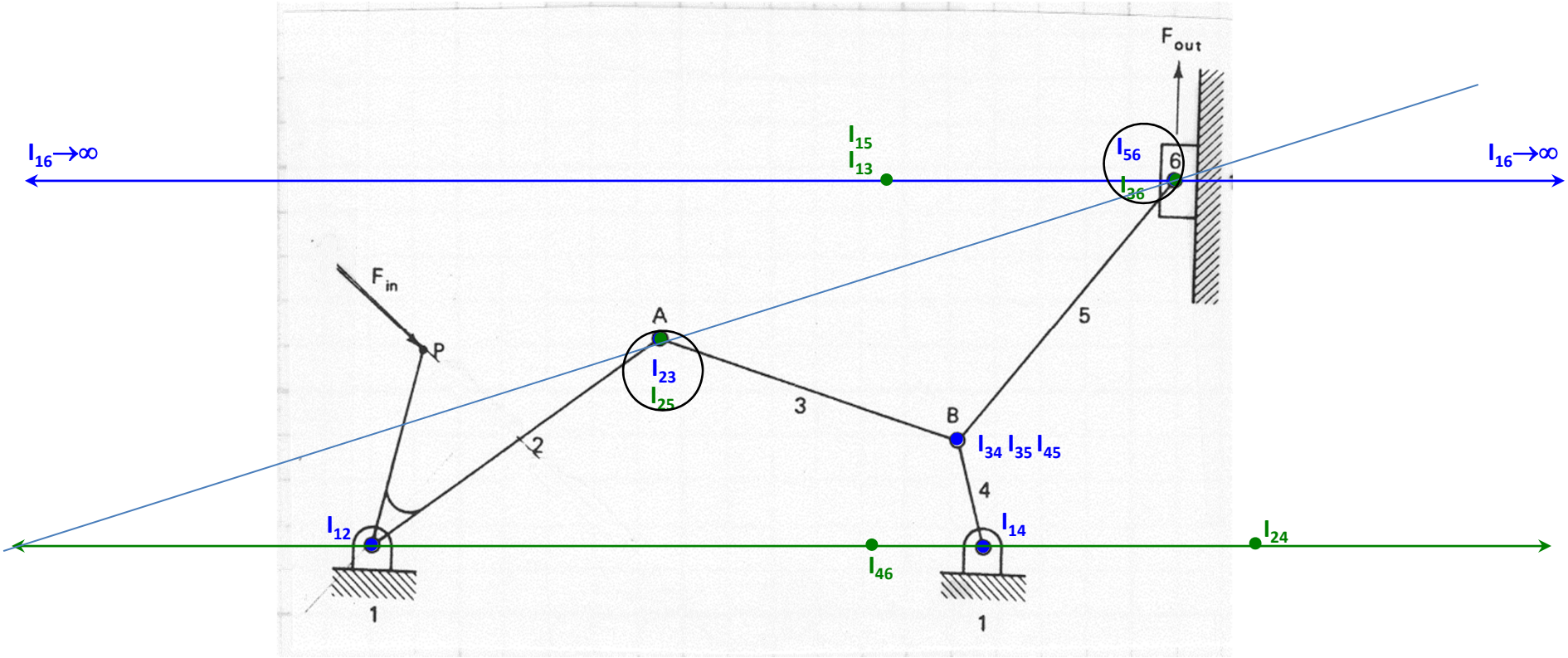
- 4-Bar segment
- Slider Crank segment
- **Between Segments**
  - $l_{25} = l_{12}\, l_{15} + l_{24}\, l_{45}$
  - $l_{36} = l_{16}\, l_{13} + l_{34}\, l_{46}$
  - **$l_{26} = l_{12}\, l_{16} + l_{25}\, l_{56}$**





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- 4-Bar segment
- Slider Crank segment
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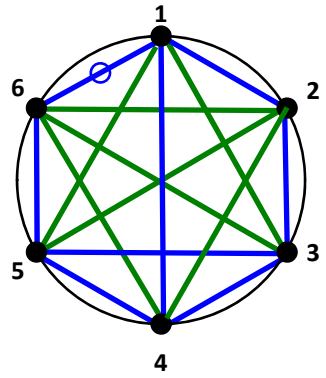
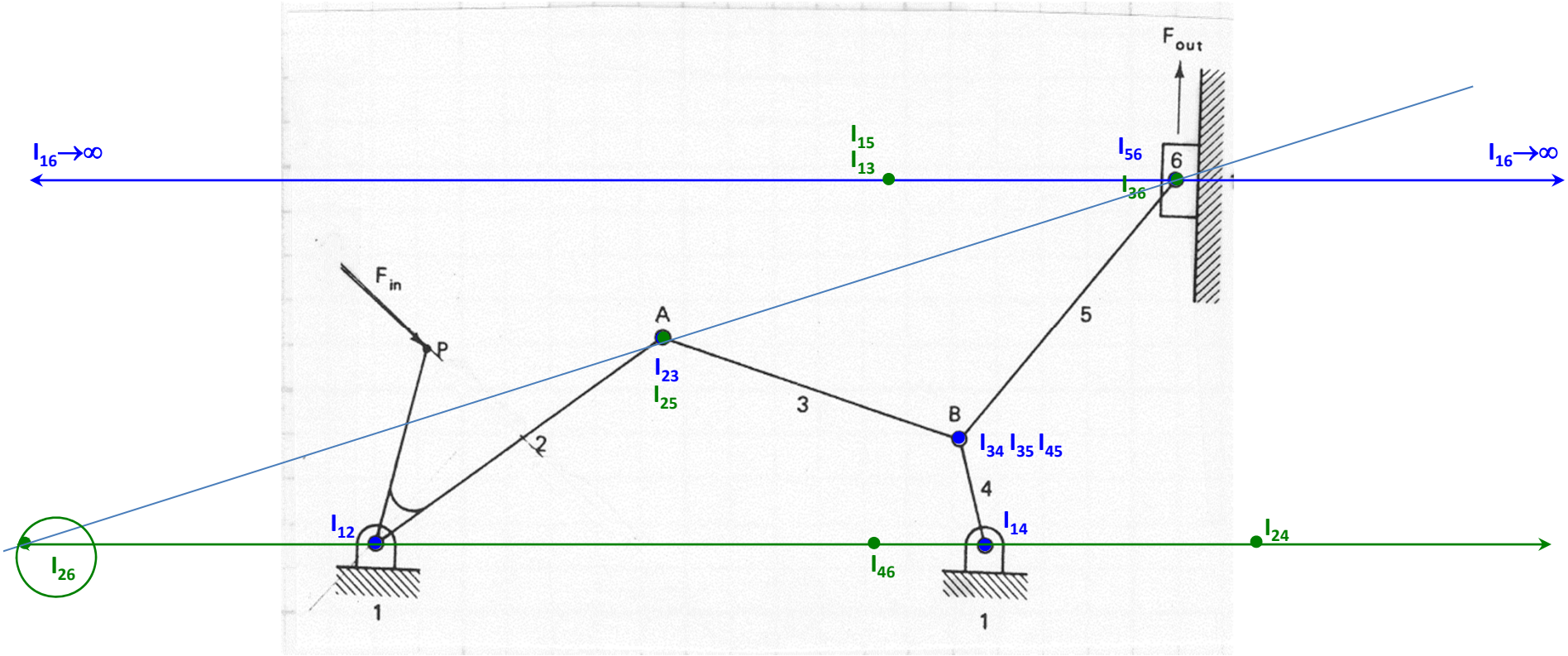
  - $I_{25} = I_{12}\, I_{15} + I_{24}\, I_{45}$
  - $I_{36} = I_{16}\, I_{13} + I_{34}\, I_{46}$
  - **$I_{26} = I_{12}\, I_{16} + I_{25}\, I_{56}$**





ALL INSTANT CENTERS HAVE BEEN LOCATED FOR THIS MECHANISM