CHAPTER 2
Block

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Unit 5 Automatic Block

- Principle of Automatic Block
- Track Circuits
- Axle Counter

5.1 Principle of Automatic Block

- Working in an automatic block territory the occupation and clearance of block sections and overlaps are detected by a track clear detection device to enable the signaling system to work automatically.
  - Therefore, there is no need to have local operators to check the train integrity by watching the rear end markers.
  - On single track lines and on double track lines with two ways working, the automatic block system also provides protection against opposing movements.
  - This can be effected by opposite locking similar to the principles of interlocked or controlled manual block systems.
  - On North American railways, opposite locking is only required on lines where train movements are authorized by signal indication.
  - On other lines with all automatic block systems, protection against opposing movements is effected by a special logic of the track circuitry.

5.1 Principle of Automatic Block

- In many automatic block systems, the normal indication of an automatic block signal is “clear”.
  - It is only set to stop position when the section is occupied by a train.
- But some railways use approach-controlled automatic block signals, which remain in stop position after the train has cleared the section.
  - They are only cleared again when the next train is approaching.
  - On such lines, the normal position of an automatic block signal is “stop”.
- For track clear detection the following principles are used:
  - Track circuits.
  - Axle counters.

5.2 Track Circuits

- A track circuit is an electrical circuit of which the rails of a section form a part.
  - It usually has a source of current at one end and a detection device at the other.
  - Sections are divided by insulated rail joints (Fig.5.1).

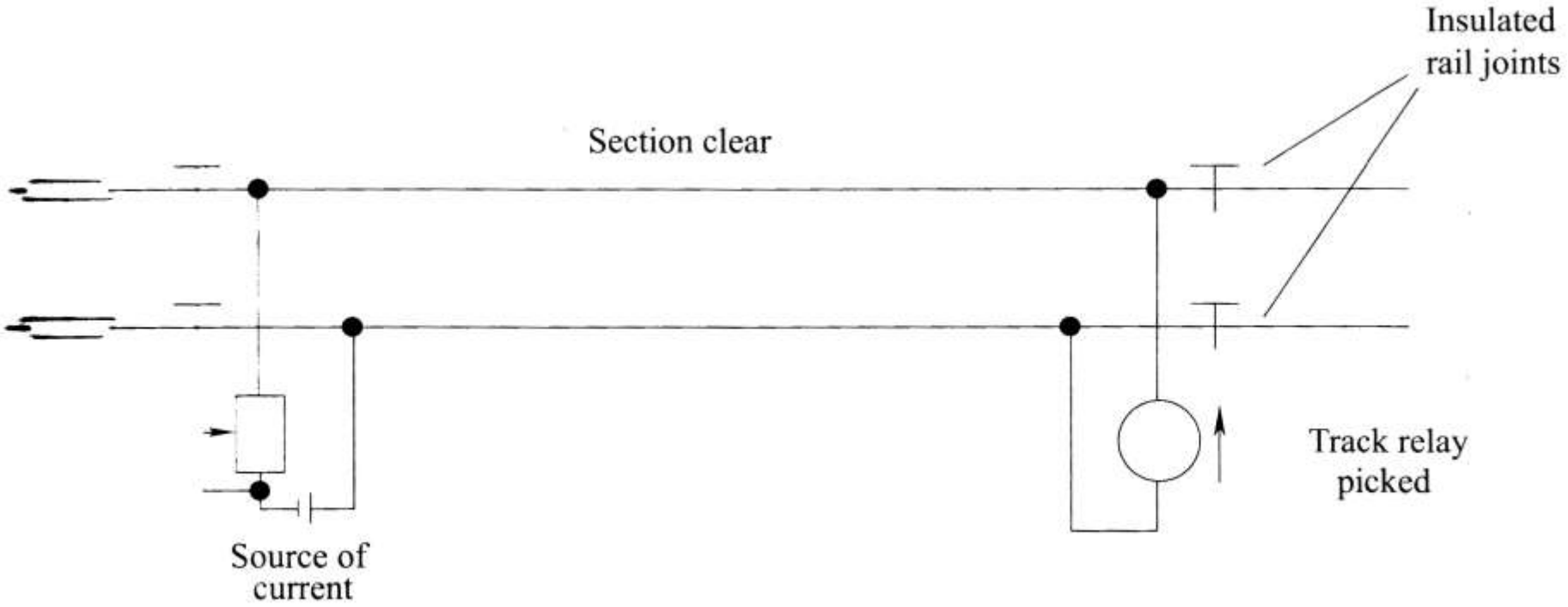

Fig. 5. 1 Insulated rail joints (German Railways)

5.2 Track Circuits

- If the section is occupied by a vehicle, the axles produce a short circuit between the two rails.
- As a result, the detection device does not receive any current and therefore it detects the section as occupied.
- The detection device is often implemented by a track relay which is in a "picked up" position when the section is clear and dropped when the section is occupied (Fig.5.2).

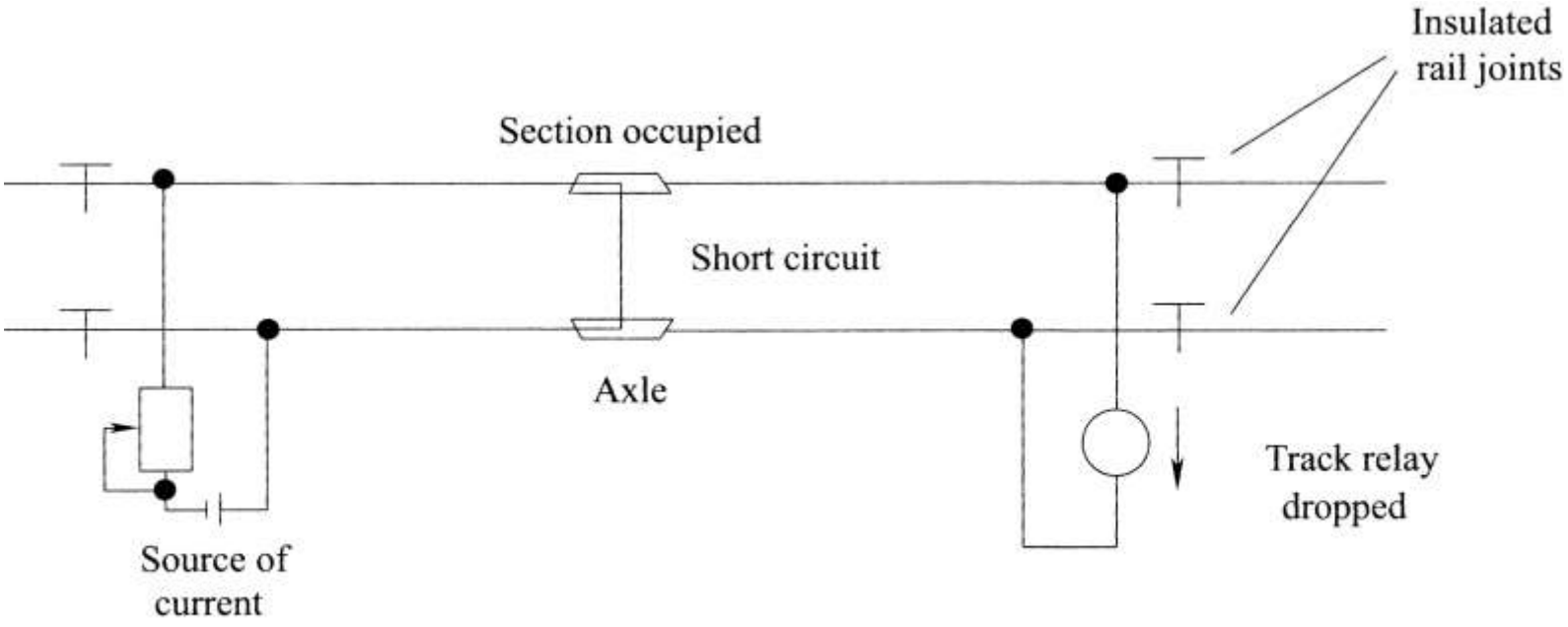

Fig. 5. 2 Track circuit

5.2 Track Circuits

- There are DC and AC track circuits.
  - The track relay of an AC track circuits is a polyphase relay that works by the same principle as a polyphase motor.
  - In such a relay the contacts are operated by a rotating shell that may rotate (or better swing) up to a fixed limit.
  - To produce a rotary field, the relay must be fed with two phases.
  - One phase is the track circuit and the other comes from a local source. Both phases must be of the same frequency.
  - If a wrong frequency is received from the track, the relay will not move.
  - Thus, an AC track circuit cannot wrongly be cleared by foreign currents of different frequencies.

5.2 Track Circuits

- Some railways use jointless track circuit.
  - These are special center-fed track circuits which work with an audio frequency AC track current.
  - Due to the inductive and capacitive track characteristics the working length of such a track circuit would limit itself.
  - For a safe continuous track clear detection, the adjacent circuit must overlap each other.
  - Because the current working length depends on weather conditions, it is required to set a fixed limit by short-cutting the rails at the boundary between two track sections.
  - For this purpose *S*-shaped rail connectors are used (Fig.5.3).

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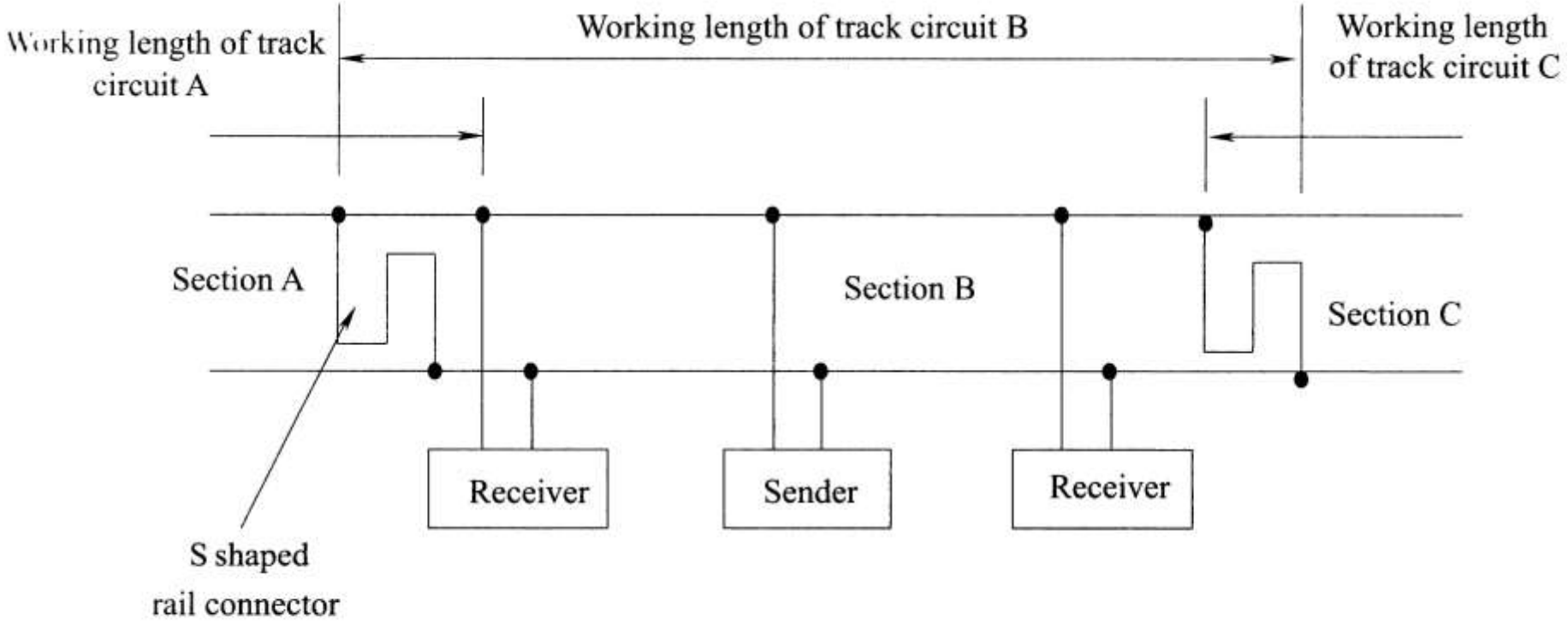

Fig. 5. 3 Jointless track circuits

5.2 Track Circuits

- These connections allow the adjacent track circuit to overlap exactly by the length of the connectors. Thus an axle that stands on the connectors is always safely detected.
- Jointless track circuit can only be used for short block sections. That is why for the purpose of automatic block signaling they could hardly be found outside electric city railway.
- But on North American railways, jointless audio frequency track circuits are used for the protection of level crossings which work independently from the automatic block signals.
- Thus, the track circuit of a level crossing protection system may overlay the track circuit of an automatic block system without need for additional rail joints.

5.3 Axle Counter

- An axle counter is a system consisting of counting points at both ends of a section and a counter connected to the counting points. (Fig.5.4)

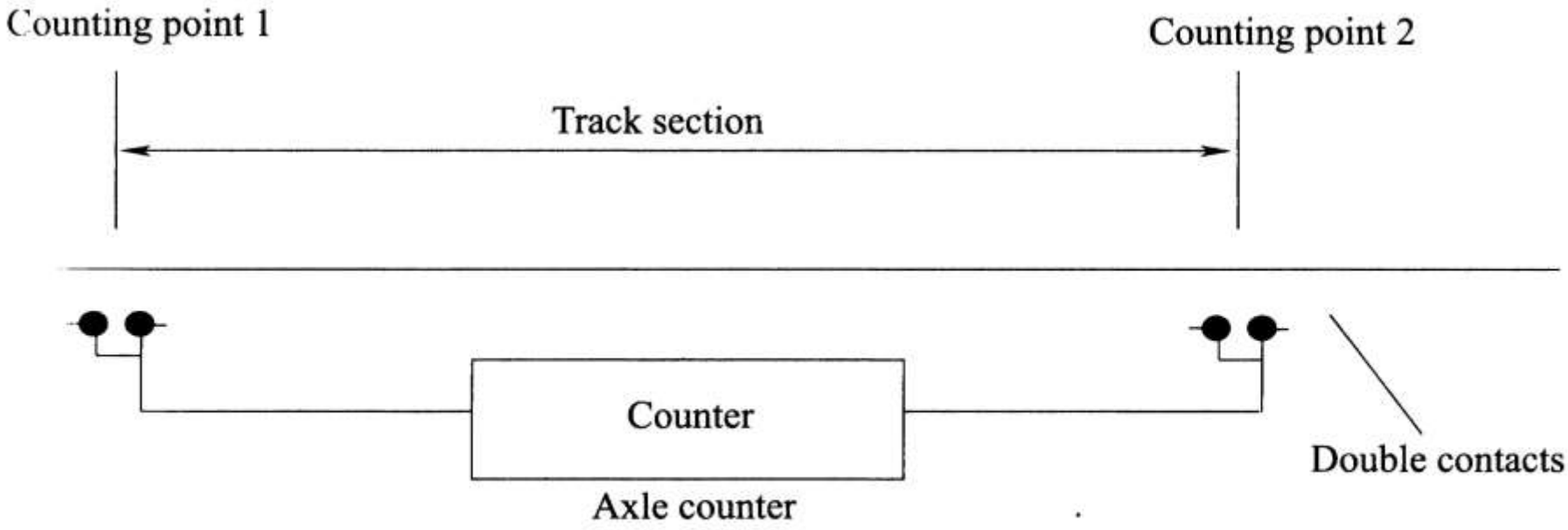

Fig. 5. 4 Axle counter

5.3 Axle Counter

- The occupancy of a section is detected by comparing the number of axles which enter the section with the number of axle which leave the section.
- To give a clear indication, the parity of number is necessary.
- Counting points are usually made up of double contacts to detect the direction of movement. This is necessary to avoid counting too many axles in case of an axle swinging over a counting point while the train is not in motion.

Homework

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