International Journal of Recent Advances in Multidisciplinary Topics
Volume 5, Issue 9, September 2024
https://www.ijramt.com | ISSN (Online): 2582-7839

Automatic Working of Circuit Breaker in Neutral Section

Manali Sunny Wadkar[1], Pratik Vilas Dhole[2*], Shubham Sanjay More[3], Akash Ramchandra Mulik[4], Sanika Sarjerao Patil[5], Viraj Hanamant Solase[6]

[1]*Lecturer, Department of Electrical Engineering, Tatyasaheb Kore Institute of Engineering and Technology Polytechnic, Warananagar, India*
[2,3,4,5,6]*Student, Department of Electrical Engineering, Tatyasaheb Kore Institute of Engineering and Technology Polytechnic, Warananagar, India*

Abstract*: Power is generated and transmitted using three phase a. c. supply in India. AC Traction system in India uses 25kV, single phase for its operation. Traction system consumes a large amount of power for its operation. The Overhead Equipment of railways which is single phase AC, is fed from a three-phase transmission network using substations located at regular intervals. This may lead to an unbalance in the voltage of the system. To avoid this unbalance and to maintain stability in supply network and reliable operation of the power system as well as the traction system the overhead equipment's are fed from three phase supply by a consecutive change of the phase. The overhead equipment is fed from (say) R-phase for a distance of about 45km then by B-phase and then by Y-phase and the cycle continues. These sections of each phase are insulated from each other using an insulator. This insulator section is called Neutral Section and is made of materials like PTFE (poly tetra flouro ethylene), resin bonded glass fibers core protected with wear resistant ceramic beads, etc. this section is also called as dead section. In initial stages of development of AC traction, the pantograph used to be lowered during this neutral section. Nowadays with the development of science, the pantograph slides smoothly through the neutral section and is not lowered. The locomotive is disconnected during the neutral section to avoid occurrence of fault, transient disturbances and sparking lead to a fault. For this purpose, the motorman operates the circuit breaker manually and switches off the locomotive. The aim of our project is to automate this operation of circuit breaker in electrical locomotives which will lead to reduction in losses due dead time of loco in neutral section.

***Keywords*: circuit breaker, insulator, locomotive, neutral, pantograph, section.**

1. Introduction

Electric traction is the locomotion in which driving force is obtained from electrical motors. These are supplied from overhead transmission system.

Figure 1 shows a simplified schematic for a 25 kV AC electric locomotive. The 25 kV AC is collected by the pantograph and passed to the transformer. The transformer is needed to step down the voltage to a level which can be managed by the traction motors. The level of current applied to the motors is controlled by a "tap changer", which switches in more sections of the transformer to increase the voltage passing through to the motors.

Before being passed to the motors, the AC has to be changed to DC by passing it through a rectifier.

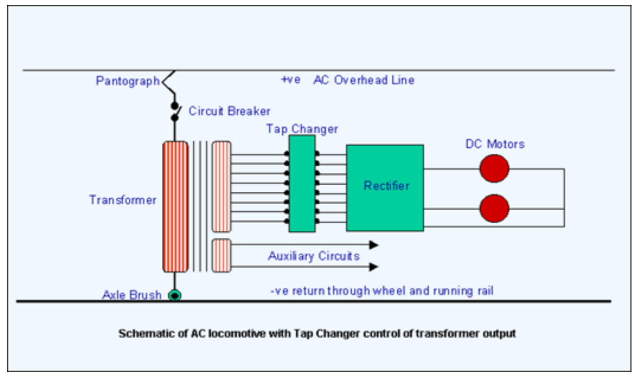

Fig. 1. Schematic of Single-Phase AC power supply driving dc drive

2. Literature Review

A. History

Started on 16th April 1853, today Indian Railways stand as one of the biggest organization in the world. It has a running root of nearly 80000 km in length & thousands of train services are running on the rails daily. The first electric train ran between Bombay's Victoria Terminus & Kurla along the Harbour Line of CR, on February 3, 1925, a distance of 9.5 miles. In 1926, Thana & Mahim were connected. In 1927, electrification was completed upto Kalyan. In 1928, Borivali in the north was connected (Colaba-Borivali of WR being inaugurated on May 1). In 1929, Kalyan – Igatpuri section was commissioned. In 1930, the Kalyan – Pune tracks were opened to electric trains. Every day, utilization of railway service & adoption of traction system is going on increasing. Fortunately, this favours in the interest of development of the nation in all fields. Indian railways are trying to fulfil the requirements & demands in transportation of passengers as well as goods, in every aspect of the nation's social, economic, industrial and defence. It is said to be the 4th largest railway network in the world, transporting over 6 billion passengers & over 350 million tonnes of freight annually. Its operations cover twenty-eight states & three union territories & also provide limited service to Nepal, Bangladesh & Pakistan.

To achieve the desired efficiency, there should not be any

*Corresponding author: dholepratik06@gmail.com

failure and if there is any failure then it must be cleared as early as possible. Because of importance of time, no one can tolerate delay in the service. Hence, we can say that fast troubleshooting is of prime importance in order to keep the system healthy and reliable.

3. Neutral Section

The overhead catenary is fed electricity at 25kV AC (single-phase) from feeding posts which are positioned at frequent intervals alongside the track. The feeding posts themselves are supplied single-phase power from substations placed 35-60km apart along the route. The substations are spaced closer (down to 10-20km) in areas where there is high load / high traffic. (These substations in turn are fed electricity at 132kV AC or so from the regional grids operated by state electricity authorities.) A remote-control centre, usually close to the divisional traffic control office, has facilities for controlling the power supply to different sections of the catenaries fed by several substations in the area. The catenary has breaks or gaps in its electrical continuity every once in a while, at points where successive sections are connected to different substations. A neutral section of catenary is usually provided between the two live sections of different phases or connected to different substations. At such points, single locomotives do not drop their pantographs, although on-board equipment such as the traction motors, compressors, blowers, etc. are switched off manually by the driver before the neutral section is entered. The main circuit breaker is also opened. Warning boards at 500m and 250m before the neutral section are provided for this purpose. Earlier, locos used to routinely drop their pantographs for all neutral sections; this is no longer standard practice. Pantographs of electric locomotives have a spring mechanism or compressed-air assembly that keeps the pantograph pushing up against the contact wire with a certain specific pressure. If the neutral section were not wired and the contact wire simply ceased to exist, then possibility exists that if the driver has not dropped the pantographs at the time the loco reaches the neutral section, then the pantograph will suddenly rise upwards unchecked; when the loco reaches the other end of the neutral zone, it is then likely to smash into the catenary where the next contact wire section begins. It should be noted that in practice, at neutral sections where it is or was a requirement to drop the pantographs. But now with more locos and neutral sections coming up which do not require the pantograph to be dropped, this does become a concern.

4. Problem Formulation

The electric locomotive is disconnected during the neutral section to avoid occurrence of fault, transient disturbances and sparking lead to a fault. For this purpose, the motorman operates the circuit breaker manually and switches off the locomotive. The aim of our project is to automate this operation of circuit breaker in electrical locomotives.

5. Methodology

We are going to automate the operation of circuit breaker with the help Express PCB.

It is CAD (Computer aided design) software to create layout for printed circuit boards.

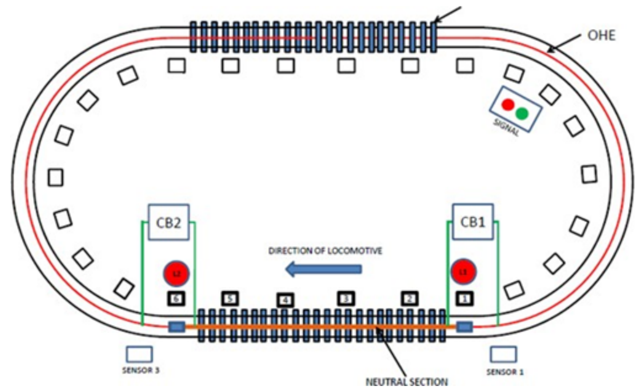

Fig. 2. Layout of neutral section

A. Operation

Two sensors are installed on both sides of neutral section. Transmitter along with PCB assembly is placed in control panel near neutral section. Receiver is placed on train. Arrival of train is detected by sensors which are connected to transmitter through PCB, then signal is transmitted from transmitter to receiver. Then receiver actuates the circuit breaker automatically.

B. Components are Used in PCB

- Bridge Rectifier
- Regulator
- Capacitors
- Resistors
- Crystal Oscillator
- 8051 Microcontroller
- Reset switch
- Encoder HT12E
- RF Transmitter
- LED

6. Conclusion

By operating circuit breaker automatically following goals can be achieved.

1. Man-made mistakes can be eliminated.
2. It can be proved to be a ray of hope for future automation.
3. Highly reliable while navigating neutral sections.

References

[1] Handbook of Matunga Railway Workshop
[2] B. L. Thareja, "AC and DC Machines," volume 2.