Automatic Switched Neutral Section In Railway

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Abstract- *Traction motor system in India works on single phase 25kV traction system. If this single phase traction load is supplied from only one phase then it creates the unbalance effect in three phase system to reduce unbalancing effect, all these phases are tapped from the adjacent substations in sequence. These phases are electrically isolated from each other by means of neutral sections normally provided near the traction substation (TSS) and sectioning post (SP).*

But at such section post or near neutral section only sign boards are used which give the indication to driver at that time DJ (circuit breaker) should be open, which may not be clearly seen in the foggy, rainy, snowing and polluted environment. Due to ignorance of such sign electrical hazard is possible. Hence our project basically focused on the automatic clearing of such a neutral section using sensor, relay, and use of circuit breaker at the start and end of the neutral section and it's function is to carry the supply of running phase to neutral section by disconnecting the next phase, without loss (interruption) of the supply from OHE and continuous operation of the all electrical equipment on the train, which is not possible at the present in neutral section.

Keywords- Traction system, Neutral section, Unbalance effect, switched neutral section.

I. INTRODUCTION

The electric locomotive draws power from the overhead equipment (OHE) with the help of Pantograph and converts this electrical energy to mechanical energy, in controlled manner, through Traction Motors which drive the axles. To enable the locomotive to perform this task, it is equipped with suitable equipment's, which enable loco pilot to control the speed of the train as per requirement by controlling the applied voltage to traction motors. In conventional locomotives, 25KV, Single phase, AC supply is collected by a roof-mounted pantograph from the OHE and is steeped down by a transformer inside3 the locomotive. This supply is then converted to DC supply by a full wave silicon rectifier and associated smoothing filter before being fed to the traction motors. Torque/speed control is achieved by variation of the AC input voltage to the rectifier through an on-load tap changing arrangement on the primary winding of the loco transformer.

II. OBJECTIVE

Traditionally, sign board system in India and in many other countries have relied on the train drivers reacting to indications displayed to them by line-side semaphore controlling the trains speed in line with the instructions. During the 150 years of the use f railway sign, driver failure to respond to sign displayed by sign boards led to a number of accidents, some causing very large number of fatalities. In response to the continuing need to reduce risks created by train drivers failing to respond to sign instructions, various forms of driver warning devices and signal command enforcement systems have been developed. These have become known as train protection system and train control system. Those systems that continuously monitor actual train speed and enforce adherence to a commanded speed pattern are referred to as automatic train protection (ATP) systems. All type of train protection systems are based on the desire to reduce or eliminate the possibility of driver error resulting in a train movement related accident by failing to obey a visually displayed line-side or in-cap instruction. So the main objective of our paper is that, automatic switched the neutral section and eliminate all above possibilities.

III. THE TRACTION POWER SUPPLY SYSTEM:

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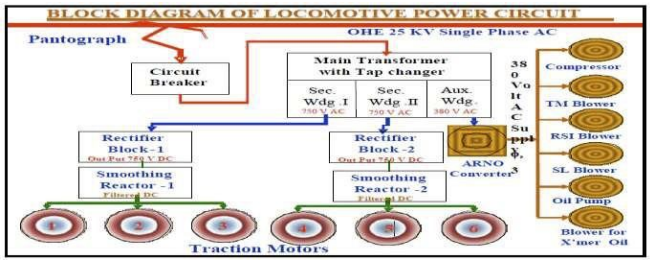

Fig. traction power system

2. The equipment on electric locomotive depending up on where it is located can be classified in three different categories.

- Roof equipment.
- Inside equipment.
- Under frame equipment.

2.1 Roof Equipment:

(i) Pantograph:

The high tension current (25kv) for feeding locomotive is taken from contact wire be means of current collecting device called pantograph.

(ii) Circuit Breaker:

(a) Air blast CB:

One compressed air operated high voltage air blast CB is provided on loco roof.

(b) Vacuum CB:

Now, air blast CB is being replaced by vacuum circuit breaker (VCB), due to its superior qualities and less maintenance.

2.2 In-side equipment:

(i) Voltage regulating equipment:

The high OHE voltage is stepped down to low voltage by the main transformer comprising of an auto transformer with 32 taps and a stepped down transformer with two separate secondary winding. The low voltage can be controlled from zero to maximum through on load tap changer.

(ii) Silicon rectifier:

Since the traction motor is DC motor, so alternating current converted in to direct current, by means of two silicon rectifier, one each feeding to set of three traction motor.

(iii) ARNO converter:

This converter, convert the single-phase 320 volt input from transformer auxiliary winding to 3 phase 380 volt output.

(iv) Static converter:

ARNO converter, being a rotating machine, is maintenance intensive equipment. There is large number of auxiliary machine failure due to large voltage variations of the order of +22.5%. To overcome this, solid state static converter using semi conducting insulated gate Bipolar transistor (IJBT) are being provided to locomotive for conversion of single phase supply to three phase supply.

2.3 Under frame equipment:

(i) Traction motor:

In general, locomotive provided with six DC series type traction motor.

(ii) Smoothing reactor:

As output of rectifier is of undulating (pulsating) nature, it is passed through an inductive choke called smoothing reactor (SL) to reduce the undulation of the current and to make current smoother.

IV. PRAPOSED MODTHODOLOGY

At present, the project of auto switched neutral section has been listed as the following, on-body automatic convert, on-pole automatic convert and ground automatic convert. As the time of power on or off is too long and the speed loss of locomotive is excessive. On-body automatic convert isn't adaptable to large slope region. On-pole automatic convert requires high level for insulated system to improve the system of constructive cost. By contrast, ground automatic convert is more advantageous in all aspects. Therefore this paper is mostly studies the ground automatic passing neutral section. The process of auto-switched neutral section working is shown in the following

While entering locomotive towards in neutral section sensor-1 get activated due to this CB1 get closed, which is connected in between R & Y phase of OHE. Locomotive enters without DJ tripped condition in neutral section.

CB1 open and CB2 getting closed with 0.6sec time lag.

CB2 in closing condition neutral section gets energized with Y-phase and again the locomotive will move without any voltage interruption.

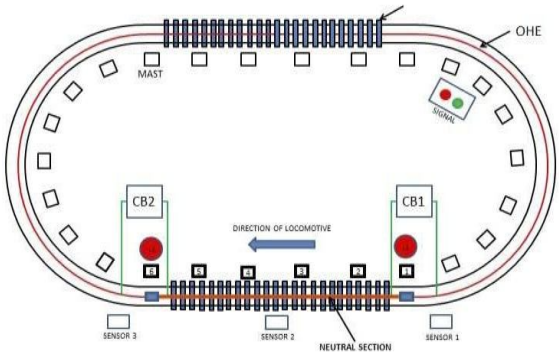

Fig. layout of model.

After passing the neutral section again sensor-3 gets activated, due to this CB2 gets open and locomotive will run normally without any interruption of OHE voltage.

The greatest advantages of ground automatic convert are no power supply dead zone and small speed loss. As the circuit breaker breaks with load, it is easy to produce overvoltage and can compromise the system of security. So it is necessary to study how the overvoltage occurs and how the factors influence work.

V. MERITS

- Automation in clearing neutral section.
- No repeated interruption while approaching neutral section.
- HVAC load can be fed from OHE.
- No human errors such as fatigue, misjudgment, intention.
- Unaffected by environmental issues such as fog, rain, snow.
- Elimination of chain pulling problem in neutral section.
- Increase in quality of service.
- Saving in fuel, reduction in pollution associated with END ON GENERATION (EOG).

VI. DEMERITS

- High installation cost.
- Maintenance issue of circuit breaker.

VII. CONCLUSION

With existing system of approaching neutral section we have seen that there are number of problems which affect the performance and speed operation of railways and hence major disadvantages regarding existing neutral section approaching method are to be eliminated by automatic switched neutral section.

VIII. FUTURE SCOPE

In EGO system, the electrical load (i.e. load of lights, fans and air conditioning pantry etc. referred to as “Hotel load”) in the coaches of AC trains such as Rajdhani and Shatabdi Express. Trains are fed from the power cars placed at either ends of the rake. Each power car is installed with two diesel alternator (DA) sets generating 3-phase (4-wire) power supply of 750 Volts 50 Hz and the same is transmitted to entire rake through two parallel cables feeders termed as feeder-A and feeder-B, running through the whole length of the trains. This electric power supply is tapped at each coach through a 50KVA transformer in conventional coaches and is converted to 415 Volts for feeding the equipment working at this voltage and further transformed down to 110 Volt AC single phase for feeding the equipment working at the voltage.

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