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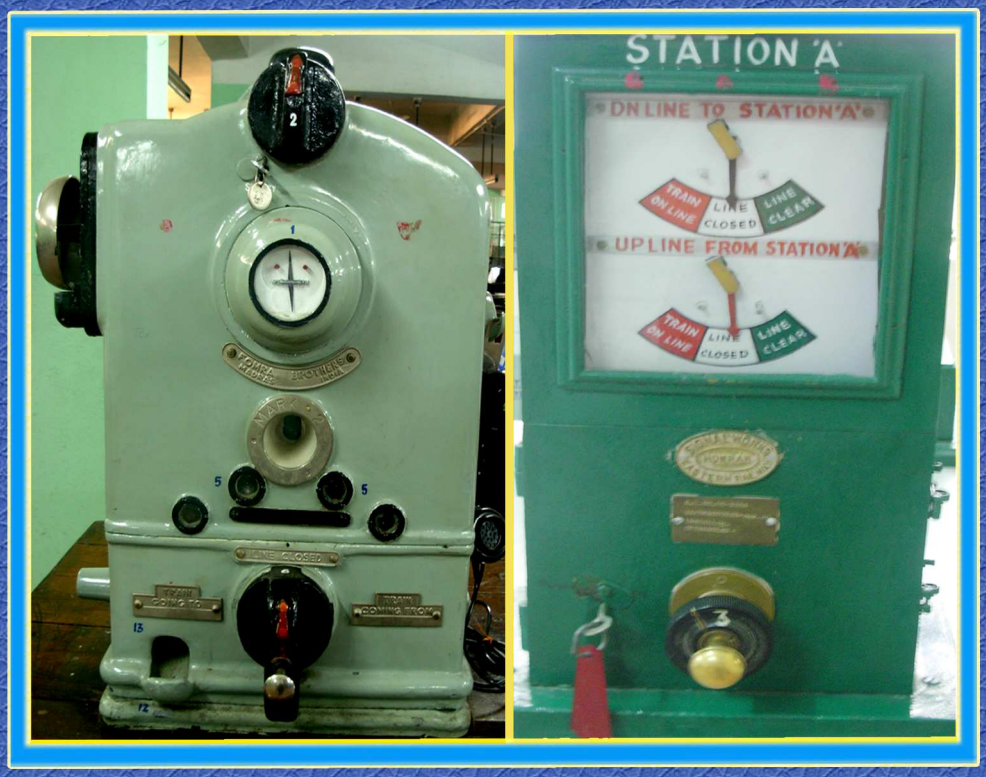
BLOCK WORKING S.L. TOKEN AND D.L. BLOCK INSTRUMENTS



Indian Railways Institute of
Signal Engineering and Telecommunications
SECUNDERABAD - 500 017

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Issued in November 2009

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BLOCK WORKING

S.L TOKEN & D.L. BLOCK INSTRUMENTS

MODULE S 22

CONTENTS

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CHAPTER 1: BLOCK SIGNALLING GENERAL

Introduction to Block Working

1.1 SYSTEMS OF TRAIN WORKING

In Indian Railways, two systems of train working are existing. They are

(a) The Absolute Block System

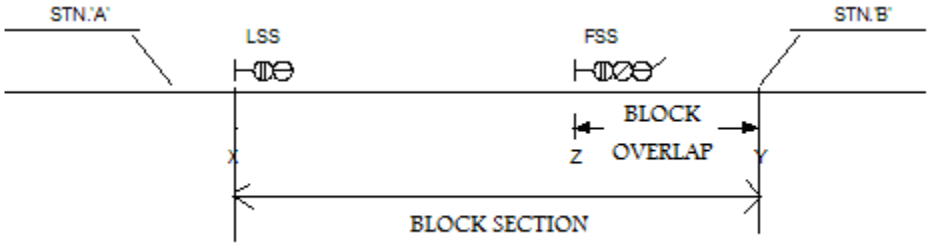
(b) The Automatic Block System

The main difference between absolute block and automatic block is that in the latter, space intervals are secured automatically by the use of Track Circuits or Axle Counters while in the former 2 Station Masters located at the ends of a block section control Train movement.

1.2 ABSOLUTE BLOCK SYSTEM

The absolute block system is the most important system of train working for our study.

The sketch below will help us to study the essentials of Absolute Block Signalling as mentioned above. For `B' to give Line Clear to `A' line must be clear of trains between `X` and `Y'.



`A' and `B' are two block stations. Under the Absolute Block System, movement of trains between `A' and `B' is technically regulated by two Station Masters using the Block Instruments.

In Absolute Block System, Block Instruments are of two Types –Single line (Token, Token less) , Double Line. This notes deals with Block Instruments of Single line (Token) & Double line, while S-23 deals with single line token less Block Instruments.

1.3 DEFINITIONS

1.3.1 BLOCK STATION

It is a station where Block Instruments & Signalling arrangement is available.

1.3.2 BLOCK INSTRUMENT

An equipment/device used for safe running of trains between two block stations.

1.3.3 LINE CLEAR

It means the permission given from a Advance block station to a block station in rear for a train to leave the latter and approach the former; or the permission obtained by a block station from a block station in advance for a train to leave the former and proceed towards the latter.

1.3.4 BLOCK SECTION

It means that portion of the running line between two block stations on to which no running train may enter until Line Clear has been received from the block station at the other end of the block section.

1.3.5 ADEQUATE DISTANCE

It means the distance sufficient to ensure safety.

1.3.6 AUTHORITY TO PROCEED

It is the authority given to the Driver of a train, under the system of working, to enter the block section with his train.

1.3.7 BLOCK BACK

It means to dispatch a message from a block station intimating to the block station immediately in rear on a double line or to the next block station on either side on a single line that the block section is obstructed or is to be obstructed.

1.3.8 BLOCK FORWARD

It means to dispatch a message from a block station on a double line intimating to the Block Station immediately in advance the fact that the block section in advance is obstructed or is to be obstructed.

1.3.9 CLASSIFICATION OF STATIONS

Stations shall, for the purpose of these rules, be divided into two categories - block stations and non-block stations.

Block stations are those at which the Driver must obtain an authority to proceed under the system of working to enter the block section with his train; and under the Absolute Block System consist of three classes

(a) Class 'A' stations

Where Line Clear may not be given for a train unless the line on which it is intended to receive the train is clear for at least 400 metres beyond the Home Signal, or up to the Starter.

(b) Class 'B' stations

Where Line Clear may be given for a train before the line has been cleared for the reception of the train within the station section.

(c) Class 'C' stations

Block huts, where Line Clear may not be given for a train unless the whole of the last preceding train has passed complete at least 400 metres beyond the Home Signal and is continuing journey. This will also include an Intermediate Block Post.

1.4 BLOCK WORKING

In block working all trains working between stations shall be worked on following system

(a) The Absolute block System,
(b) The Automatic Block System.

1.5 ESSENTIALS OF ABSOLUTE BLOCK SYSTEM

1.5.1 Where trains are worked on the Absolute Block System

(a) No train shall be allowed to leave a block station unless Line Clear has been received from the Block Station in advance, and

(b) On Double Lines such line clear shall not be given unless the line is clear, not only up to the first stop signal at the block station at which such Line Clear is given but also for an adequate distance beyond it;

(c) On Single Line such Line Clear shall not be given unless the line is clear of trains running in the same direction, not only up to the first stop signal at the Block Station at which such Line Clear is given, but also for an adequate distance beyond it, and is clear of trains running in the direction towards the block station to which such Line Clear is given.

1.5.2 Unless otherwise directed by approved special instructions, the adequate distance referred to in clause (b) and (c) of sub-rule (1) shall not be less than

(a) 400 metres in case of two aspect lower quadrant signalling or two aspect colour light signalling and

(b) 180 metres in case of multiple aspect signalling or modified lower quadrant signalling.

1.6 Absolute Block System

It will be seen that in this system only one train is allowed into a Block Section at a time. Also to safeguard against violations of the rules, a train is required to pass a specified distance beyond the block before the section can be reported clear, and another train allowed to follow. This additional distance is referred to as Adequate Distance. It is a prescribed clear margin of space to cater for errors of judgment in braking etc. and is sometimes called overlap. Since the overlap pertains to a Block Section it is also called "Block Overlap".

1.7 ESSENTIALS OF LOCK & BLOCK SYSTEM

Following are the essentials of lock & block system

(a) It shall not be possible to take ‘OFF’ the LSS to permit the train to leave a block station until ‘Line clear’ has been received from block station in advance.

(b) The entry of a train into block section shall cause LSS to be automatically replaced to ‘ON’.

(c) ‘Line clear’ shall not be given by the block station in advance until the complete preceding train has passed over the section clearing track circuit or its equivalent & until Stop signal/signals in rear of the train has/ have been replaced to ‘ON’ position.

1.8 BELL CODE

For the Signalling of trains, the prescribed code of bell signals as detailed below shall be used, and a copy thereof shall be exhibited in each block station near the place of operation of the block working equipment.

S. No.	Description	Code	How signalled	How acknowledged
1	Call attention or attend telephone	0	One stroke or beat	One stroke or beat
2	Is line clear or line clear enquiry	00	Two strokes	Two strokes
3	Train entering Block Section	000	Three strokes	Three strokes
4	Train out of Block Section Obstruction removed	0000	Four strokes	Four strokes
5	Cancellation of line clear	00000	Five strokes	Five strokes

Note: - '0' indicates a stroke or a beat.

1.9 CONDITIONS FOR GRANTING LINE CLEAR

1.9.1 Class 'A' Station

At a class 'A' station on single line or double line, the line shall not be considered clear and line clear shall not be given, unless: -

(a) The whole of last preceding train has arrived complete.

(b) All signals have been put back to 'ON' behind the said train.

(c) The line on which it is intended to receive the incoming train is clear up to Starter and

(d) All the Points have been correctly set & all the facing Points have been locked for the admission of the train on the said line.

1.9.2 Class ' B' Station

(a) At a Class'B' station on double line, the line shall not be considered clear & line clear shall not be given, unless

(i) The whole of last preceding train has arrived complete,

(ii) All the necessary signals have been put back to 'ON' behind the said train,

The line is clear: -

- At stations equipped with two-aspect signalling – is up to Home Signal, or
- At stations equipped with multiple-aspect signalling or modified lower quadrant signalling – is up to the outermost facing points or the Block section limit board (if any)

(b) At a class 'B' station on single line, the line shall not be considered clear & line clear shall not be given, unless –

(i) The whole of last preceding train has arrived complete,

(ii) All the necessary signals have been put back to 'ON' behind the said train, and

The line is clear –

- At station equipped with two-aspect signalling –
- Up to the Shunting limit Board or Advance Starter (if any) at that end of the station nearest to the expected train,

Or

- Up to the Home signal if there is not Shunting limit Board or Advance Starter,

Or

- Up to the outermost facing points if there is no Shunting limit Board or Advance Starter or Home Signal;

- At stations equipped with multiple-aspect signalling or modified lower quadrant signalling ---

- Up to the Shunting limit Board or Advance Starter (if any) at the end of the station nearest to the expected train,

Or

- Up to the outermost facing points if there is no Shunting limit Board or Advance Starter.

Note: - At a class 'B' single line station, this rule does not forbid direct reception of a train from one side, when Line Clear has been given to the block station on the other side provided the distance between the Outer signal & outermost facing points in two-aspect signalling, & between the Home signal & outermost facing point in multiple-aspect signalling, or modified lower quadrant signalling is not less than the adequate distance prescribed in Rule (I) above, in regards to condition for granting Line Clear & in regards to the conditions for taking 'OFF' home signal for the admission of a train even where Shunting limit Boards or Advance Starters have not been provided.

1.9.3 Class ' C' Station

At a class 'C' station on single line or double line in two-aspect, multiple-aspect or modified lower quadrant signalling, the line shall not be considered clear & line clear shall not be given, unless ---

(a) The whole of the last preceding train, has passed complete at least 400 metres beyond the Home signal & is continuing its journey; and

(b) All signals taken 'OFF' for the preceding train have been put back to 'ON' behind the train;

(c) Provided that on a single line, the line is also clear of trains running in the opposite direction towards the block hut from the block station at the other end.

1.10 TRAIN SIGNAL REGISTER (TSR)

(a) A Train Signal Register shall be kept by the Station Master or under his custody.

(b) All signals received or sent on the electrical block instruments and the person operating the block instruments shall enter the timings of receipt and dispatch therein, immediately after acknowledgement.

(c) The timings entered in the register shall be the actual timings, except that any fraction of a minute shall be counted as one.

(d) All entries in the register shall be made in ink.

(e) No erasure shall be made in the register, but if any entry is found to be incorrect, a line shall be drawn through it, so that it may be read at any time and the correct entry shall be made above it.

(f) The person who keeps the register for the time being shall be responsible for all entries made therein and for correctly filling in each column thereof.

1.11 CONDITIONS FOR CLOSING THE BLOCK SECTION

(a) When the block section has been cleared by the arrival of the train or by the removal of the cause of blocking, the block section shall be closed by the block station in advance by giving the prescribed bell code signal.

(b) Before such signal is given, the Station Master shall satisfy himself

(i) That the train has arrived complete, or the cause of blocking the section has been removed, and

(ii) Those conditions under which Line clear can be given are complied with.

1.12 CERTIFICATE OF COMPETENCY

(a) No person shall operate the electrical block instruments until he has passed a test in the operation of block instruments and unless he hold a certificate of competency granted by railway servant appointed in this behalf by the Railway Administration.

(b) The certificate of competency referred to in sub-rule (1) shall only be valid for a period of three years or such longer period as may be laid down by special instructions.

1.13 GENERAL REQUIREMENTS OF BLOCK INSTRUMENTS

On the single line trains are normally worked with electrical "token" block instruments. In this, a token (in the shape of a ball or tablet), is released electrically from one of a pair of interconnected block instruments with the cooperation of the operator at the other end of the Block Section. This token is the tangible authority for the Driver of a train to take his train into the Block Section.

On Double Line sections since trains always run in the same direction on a line, tokens if used, would get accumulated at the advanced station and arrangements would have to be made to bring back and "balance" the tokens frequently. If token balancing is not done in time, block working might have to be suspended. Since the token transfer can be done only by the technical staff (who only have access to the interior of the instruments), this would take considerable time of the skilled staff for unskilled work. Therefore, non-token electric Block Instruments are used on double line sections.

1.13.1 Locking and sealing facilities

Facilities shall be provided for locking and sealing the instruments. The doors of the instruments giving access to the internal mechanism shall be provided with a double lock, the key of one of which shall be in the custody of the Station Master on Duty and the key of the other will be with Maintainer (S) in charge of the maintenance of Block Instruments. It shall not be possible to open the door of the Block Instruments without the cooperation of both the agencies.

1.13.2 Prevention of irregular operations

There shall not be any opening giving access to the interior of the instrument through which it is possible to operate the mechanism by any irregular means.

1.13.3 Prevention of unauthorized operation: -

A lock or other device shall be provided to enable the Station Master on duty to prevent unauthorized manipulation of the instrument during his absence.

1.13.4 Bell

A Bell push button or a bell plunger shall be provided on the instrument for exchange of bell codes. A separate battery shall be used for each Block Instrument. This battery shall only feed the Block Instruments and not any other circuits. The battery housing shall be locked and sealed.

Block instruments shall normally be worked on physical conductors. Under special instructions, block instruments may be worked on radio relay systems with appropriate security features.

1.13.5 Lightning Discharger

All instruments shall be provided with lightning discharger to approved specification. Where a return line wire is used, lightning dischargers must be installed on both wires.

Tokenless Block Instruments worked on physical conductors shall be worked on metallic return circuits.

1.13.6 Isolation of telephone circuit

Telephone instrument shall be provided in conjunction with block instruments. It is desirable that the condenser or other means provided for isolating the telephone circuit from the instrument circuit is located within the instrument or in such a way as to be inaccessible for outside interference.

On sections where A.C.voltages are induced due to power line parallelism, suitable block instruments with appropriate protective measures shall be provided. The immunity limits of various types of block instruments are specified latter.

1.14 INSTALLATION OF BLOCK INSTRUMENTS

1.14.1 General

All Block Instruments shall be of approved type only. The table or other fixture on which instruments are placed must be substantial & instruments are securely fixed there in.

1.14.2 Line wires

Insulated line wires shall be used between the terminating point, on or near the Station/Cabin and the Point where the lines of two adjacent Block Sections meet. The insulated wires shall be terminated on Pot Head insulators and not easily accessible. The wires leading into the building from the terminating point shall be adequately separated from the wires of other circuits. The wires shall be run in one length from the pot headed insulator to the test panel. Alternatively, a cable suitably protected may be used but a separate cable shall be provided for each instrument. The wires shall be led in sloping upwards; otherwise a drip loop shall be used to prevent rainwater entering. While piercing through the wall, insulated piping shall be used. The indoor wires shall be run in troughing, grooved board or piping or suitably protected from outside interference and separated from the wires of other circuits.

1.14.3 Specification of Wires

All wires or cables shall be in accordance with the Indian Railway Standard Specification or of other approved specification.

1.14.4 Lightning Dischargers

Shall not be located in the Block Counter but installed separately and shall be the demarcating point for test purposes.

1.14.5 Block Instruments distinction

Where two or more block instruments are located in the same room, they shall be fitted with gongs of distinctive tones.

1.14.6 Control of Last Stop Signal

Means shall be provided to ensure that the Last Stop Signal cannot be taken ‘off’ until Line Clear has been obtained on the instrument.

1.14.7 Keys

Keys for shunting and control of catch siding, slip siding and outlying siding in the block section, where used in conjunction with block instruments shall be non-interchangeable and such that they cannot be inserted in any other block instrument or lock at the same station.

1.15 Painting

Painting of Block Instruments shall be in accordance with the painting scheme

1.15.1 Painting & Overhauling Scheme – Block Signalling Equipment

Single Line Token and Tablet Instruments: -

(a)	Body	Grey Enamel
(b)	Operating Handle, Bell except Gong, Station Master's Control Lock.	Black Enamel
(c)	Overhauling	10 Years
(d)	Token delivery nets	White
(e)	Line clear pick up apparatus post	White

Double Line Block Instruments: -

(a)	Body	Green Enamel
(b)	Overhauling	7 Years

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CHAPTER 2: NEALE'S BALL TOKEN BLOCK INSTRUMENT

2.1 SINGLE LINE NEALE'S BALL TOKEN INSTRUMENT.

The use of token Block Instruments is permitted for controlling trains on a single line section. The object of providing such instruments is to prevent more than one train being in a block section at a time, and when the block section is clear, to admit one train into the block section from either of the two ends, thus ensuring absolute safety in the running of trains at all times & always maintaining space interval between two trains.

To achieve this a pair of Token Block Instruments, each containing a stipulated number of tokens (bearing serial number and code initials of the stations to which they apply), electrically interconnected are provided one at each end of the Block Section.
The instruments are designed to have conscious co-operation of the two Station Masters at either end of the Block Section for electrically releasing a token from any one of them.
This token is handed over to the driver of a train as an Authority to Proceed i.e., to leave the Block Station and enter the Block Section. Mechanism is provided to ensure that only one token can be released from either instrument, and if once a token has been extracted, a second token cannot be extracted either from the same or the other instrument till such time the token already extracted is restored to either of them and the instrument set to normal and a fresh sequence of operations gone through.

2.2 On a single line, where trains work under Absolute Block system, every train in its progress from one block station to the next shall be signalled over the block instruments. However, the signalling of trains, on block instrument, does not prevent the use of fixed signals, hand signals or the detonators whenever such signals may be necessary to protect obstruction on the line. Therefore, after receiving the token as the "authority to proceed", the driver must not proceed until all the necessary fixed or other signals have been exhibited. The driver must keep the token safely under his own charge and must give it to the Station Master or any other authorised person on arrival at the Block Station in advance, then this token shall be consigned into the block instrument for normalising the instruments at both ends of the Block Section.

2.3 Neale's Block Instruments originally designed to issue "Card Permits" under the 'Line Clear' traffic system were later suitably modified as token Block Instruments. Since its inception, numerous modifications and improvements have been embodied, which render it reasonably reliable instrument for the safe working of trains on single line sections. In its latest form it is known as Neale's Type 'A' Token Block Instrument. The earlier versions are known as Neale's Voucher Block Instruments, and are classified as Type 'D', Type 'C' and Type 'B' instruments. Type 'B' instruments had been suitably converted to the working standards of Type 'A' instruments. IRS Drawings are now available for Neale's Token Instruments.

2.4 Neale's Token Instruments are available in two versions: -

(a) Neale's Ball Token Instruments IRS Drg.No.SA 20701/M

(b) Neale's Tablet Token Instruments IRS Drg.No.SA 21701/M

(c) We shall first consider the Ball Token Instrument.

2.5 TYPES OF NT BALL TOKEN

The tokens used in Neale's Ball Token Instruments are hollow round steel balls. They have through groove cut on a diametric axis, which have one of the following configurations: -

(a) Round hole

(b) Rectangular hole

(c) Three sided (triangular) hole

(d) Four sided hole

(e) Five sided hole

The different hole configurations viz., class A, B, C, D and E are as shown in Fig. 2.1.

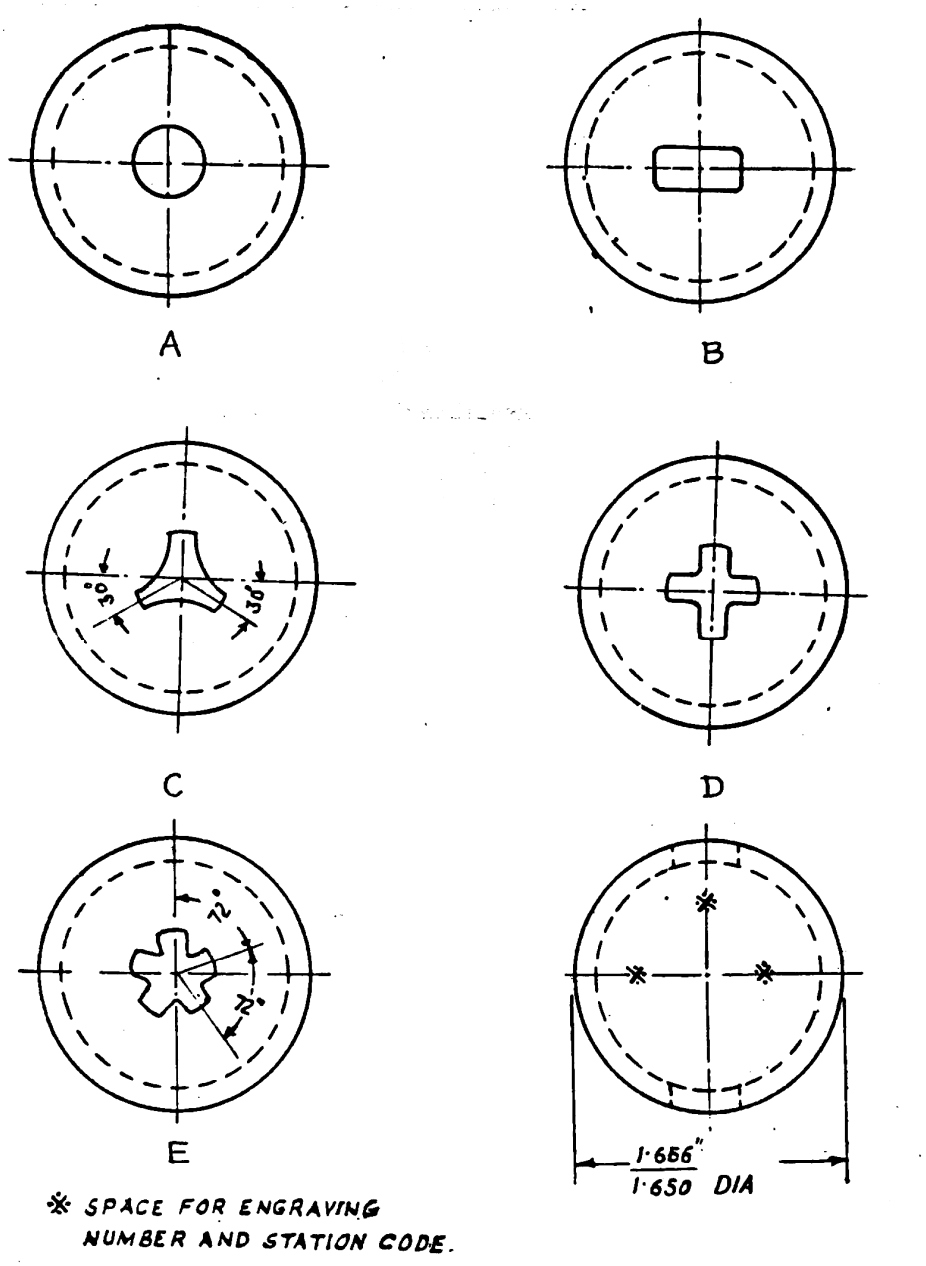


Fig: 2.1 NEALE'S BALL TOKEN HOLE CONFIGURATIONS

Different hole configurations are provided to distinguish the token belonging to block instruments of different block sections. It ensures that a token belonging to the instrument of one block section cannot be inserted into an instrument belonging to an adjacent block section thus preventing wrong normalisation.

Consecutive Block Sections shall be provided with tokens of configuration A, B and C. Following Block Sections shall be provided with similar configuration in the same order. Where a junction station falls in between or new crossing stations are opened tokens with special configuration shall be provided. However, this arrangement shall not be required at the Junction Stations where tablet token instruments are provided for the other Section.

The instrument has a capacity of 36 tokens to meet the traffic requirements. Normally 32 or less tokens only are used in a connected pair of instruments. There is also a device of notifying the Operator when all the tokens have been withdrawn from the instrument, which happens under stress of unidirectional traffic. A maximum of 36 tokens are allotted for a pair of instruments of a Block Section so that the total number of tokens shall not exceed the maximum holding capacity of tokens of the instrument.

2.6 FEATURES OF NT BALL TOKEN BLOCK INSTRUMENTS: -

(a) It is robust & sturdy in construction

(b) It is a Co-Operative type B.I.

(c) Used only on Single line.

(d) It has a block handle used for operation of the B.I., the 3 positions of B.I are

(i) LINE CLOSED (LC)

(ii) TRAIN COMING FROM (TCF)

(iii) TRAIN GOING TO (TGT)

The handle is released from any of these positions by actuation of TCF or TGT lock.

(e) Energisation of TCF lock is required for following operations

(i) LC to TCF

(ii) TCF to LC

(iii) TGT to LC

& Energisation of TGT lock is required only for LC to TGT operation.

(f) Token is released from B.I. in TGT position which serves as Authority to Proceed.

(g) Line current required is 25 ma.

(h) It is suitable both for NON – RE & RE section.

For NON - RE	For RE
(a) Single line wire & earth as Return wire	(a) 4 line wire, Phantom circuit & earth.
(b) One line supply 12V + line drop	(b) Filter Unit
	(c) Isolation Transformers – 2 No.
	(d) Supply (i) Line supply 12V + line drop (ii) Local supply 12V
	e) Line relays – 2 Nos, among which one is slow to release
	f) 2 Nos. of 5000 ohms resistances.

(i) Overhauling Period is 10 years.

2.7 CONSTRUCTIONAL PARTS OF NEALES TOKEN BLOCK INSTRUMENTS

The instrument is shown in Figure 2.2 consists of the following important parts:

(a) SM's Lock
(b) Top handle (Token Receiving Drum)
(c) Bell Unit
(d) Needle Indicator (Galvo)
(e) Bottom (Operating) handle with token delivery drum.
(f) Rack and Pinion
(g) TCF and TGT locks with force dropping arrangement
(h) Polarised Relay
(i) Inter-stroke Interrupter (Jerking contact)
(j) Commutator.
(k) Contact arrangement
(l) Tappet Rod (Bell Plunger)
(m) Safety Catch.
(n) Token races with windows
(o) Token Indicator
(p) Token Selector
(q) Last Stop Signal Control
(r) Block Telephone

Fig. 2.2 NT BALL TOKEN BLOCK INSTRUMENT (FRONT VIEW)

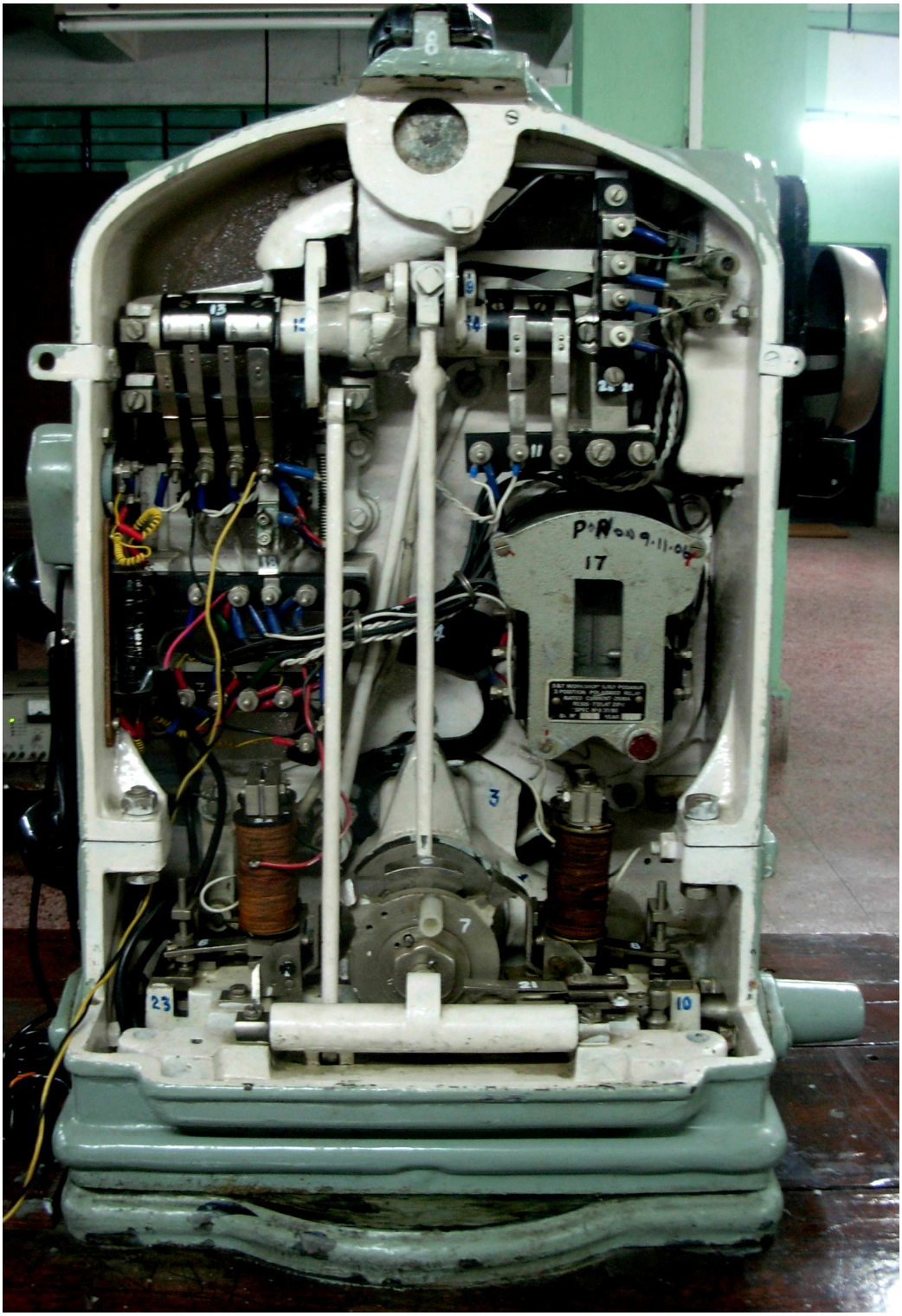


Fig. 2.3 NT BALL TOKEN BLOCK INSTRUMENT INSIDE VIEW

2.8 SM's Lock

This provides a mechanical locking on the Block Instrument to prevent unauthorised operation in the absence of the Station Master. SM's Key when 'Out' will mechanically lock the bottom (Operating) Handle and Top Handle, thus preventing them from manipulation. Bottom handle can be locked in any of the three positions, whereas the Top Handle can only be locked in its position at 85^0 from the vertical.

Fig. 2.4

SM's Key when out will also disconnect the line battery and thus unauthorised bell codes cannot be sent to the other station. However, incoming bell codes are not affected

2.9 Top Handle (Token Receiving Drum)

It is a cylindrical cast iron drum with a recess to take one token. The recess opens at the top through an aperture in the drum housing normally covered by a hinged metal cap. In this position the arrow marked on the turning handle faces vertically upwards. A token is inserted into the instrument by placing it in this recess by lifting the hinged cap and then turning the handle anti-clockwise (by handle provided on the front) through approximately 190^0. The recess is provided with a small fixture called the "Spigot". The shape of the spigot corresponds to the hole configuration on the tokens used in the Block Sections. The purpose of this spigot is to prevent insertion of a wrong class of token to clear the section. Two spring operated lock pawls are located one each at approximately 85^0 . and 170^0. within the drum housing. These lock pawls normally press against the surface of the drum and do not, therefore, interfere with its movement if it is tuned with a token of correct dimensions in its recess. Should the drum be turned in the anti-clockwise direction with its recess partially or completely empty, the first lock pawl at 85^0 from the vertical position gets into the token recess and checks its further rotation. Should the first lock pawl fail to detect the presence of incorrect dimension of the object in the recess, the second lock pawl will check rotation beyond 170^0. The token so consigned is led through a chute (which has no bottom) whose sides are carved sufficiently inwards to guide the token. The token enters the recess directly in the line closed position of the bottom handle. But in the other positions of the handle, it rests on the token receiving jaw.

The chute ensures that foreign object (such as, bolts or nuts) inserted into the token receiver will not run down into the races but will fall right through to the bottom of the instrument. The top handle is provided with a lock, to lock it in the turned position between 75^0 to 85^0. by removing the SM's key. This arrangement prevents the insertion of the token in the absence of the Station Master on duty

2.10 Bell Unit

Fig. 2.5

It is used to communicate the prescribed code of bell signals. The bell is of single stroke type, the coil of which is wound to a resistance of 25 Ohms requiring a minimum operating current of 80 ma. It is worked in the local circuit in series with one of the two lock coils namely TCF and TGT through the contacts of the polarised relay operated by the line current.

2.11 Needle Indicator (GALVO)

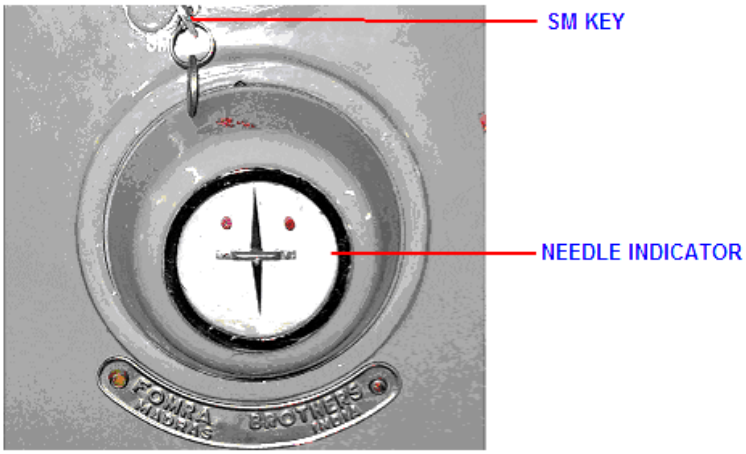


Fig. 2.6

This has an electromagnet coil wound to a resistance of 150 Ohms and requires a working current of 15-25 mA. The needle is attached at the front to an axle carrying a permanent magnet situated inside and between the coils and is free to move to either side, as it is pivoted at its centre. It is mainly used to detect the presence of incoming and outgoing current. Besides, the deflection of the needle, it helps to indicate the position of the operating handle and the condition of the Block Section. The deflection due to outgoing current gives the position of the operating handle and the deflection due to incoming current that of the operating handle at the distant station instrument.

An anti-clockwise deflection of the needle always indicates that the operating handle is in one of the two turned position namely, TCF or TGT. A clockwise deflection indicates that the operating handle is in the vertical or Line Closed position, except when a token is inserted into the instrument with the operating handle in either TCF or TGT position. In the latter case, the outgoing deflection changes to clockwise even with the handle turned indicating that there is no train in the Block Section. An incoming deflection in the clockwise direction indicates TCF lock is released in the instrument and that an anti-clockwise deflection indicates TGT lock is released.

2.12 Bottom Handle with Token Delivery Drum

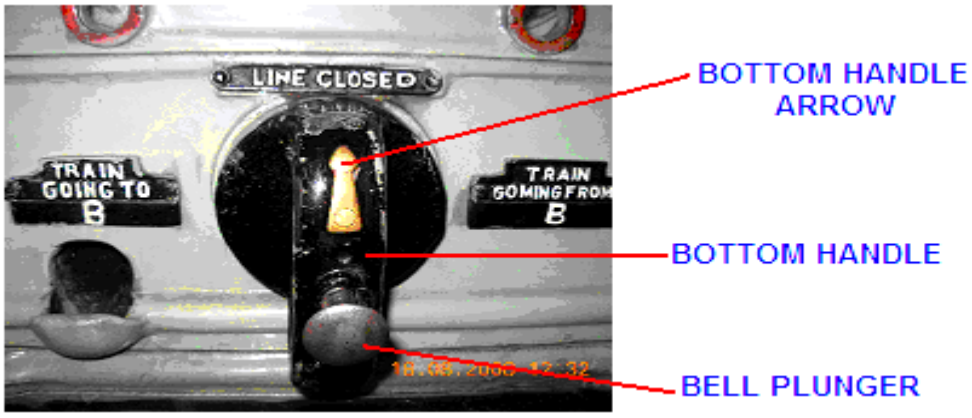


Fig. 2.7

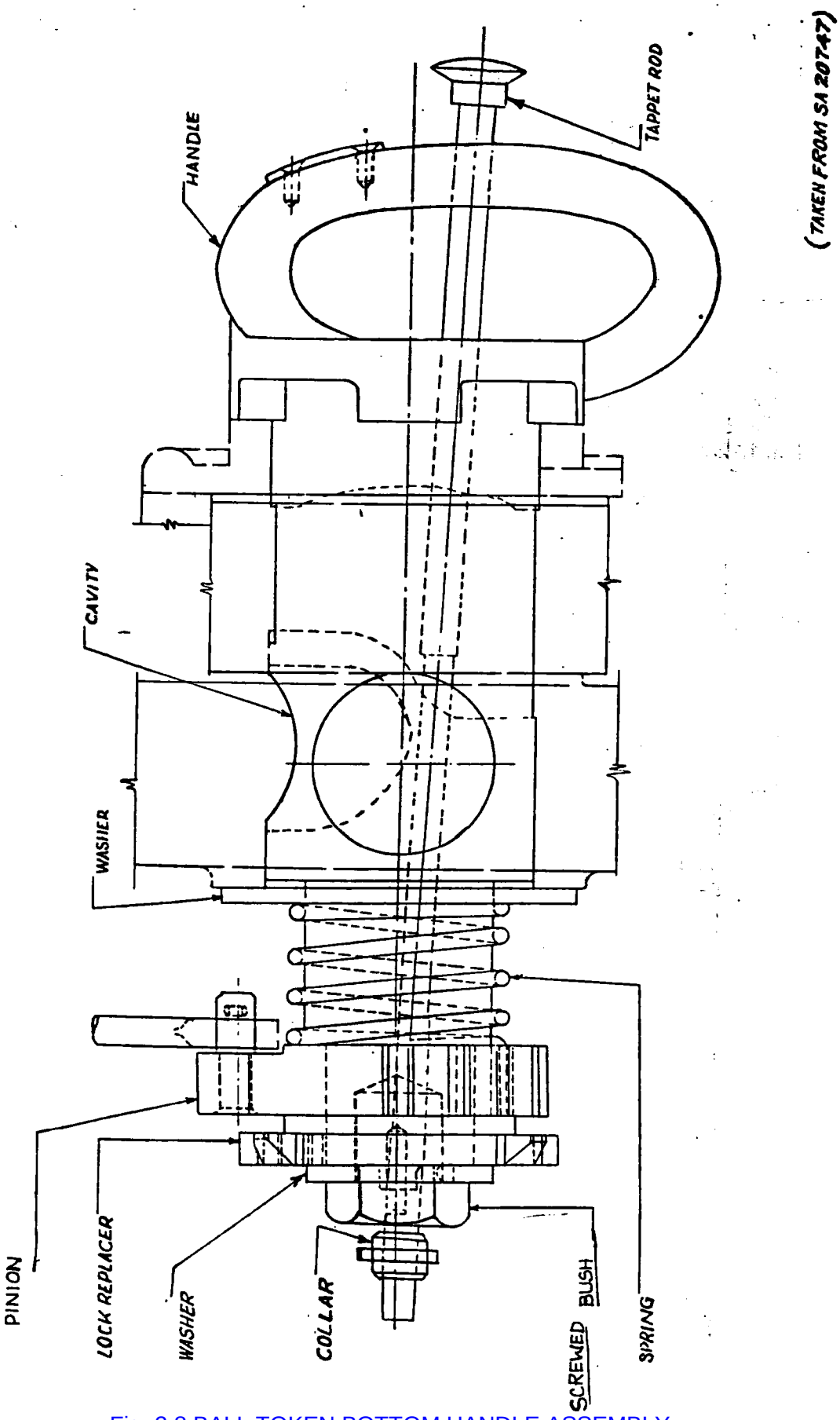


Fig. 2.8 BALL TOKEN BOTTOM HANDLE ASSEMBLY

The bottom handle is situated at the front and bottom side of the instrument. The Tappet Rod (Bell Plunger) is threaded through the centre of the handle. The handle has three positions, which indicate the condition of the Block Section as given below. (Ref. Fig. No.2.2).

(a) The handle with its arrow pointing vertically upwards indicates ‘Line Closed’. This is the normal position.

(b) In the second position the arrow points to the right. This indicates that line clear for a certain train has been given. This is called the "Train Coming From" (TCF) position.

(c) In the third position the arrow pointed to the left. This indicates that line clear has been obtained and a token extracted. This position is called "Train Going To" (TGT).

The token delivery drum forms an extension of the operating handle and is a heavy cast iron cylinder with a suitable recess in it to house one token. From this, the token is delivered when it comes out of the opening at the front when handle is turned to the TGT position. A toothed sector or pinion is mounted on the hexagonal extension at the end of the drum, which works a rack below it every time the operating handle is turned. A rod connecting this sector to the spring clutch and the token selector causes both these to rotate along with the handle. Two locking pawls engaging with notches cut in the rack as shown in Fig. 2.10 prevent the movement of the rack, when the operating handle is turned normally. The movement of the handle from any particular position Line Closed, TCF or TGT is possible only when the proper locking pawl has been released from the notch in the rack, which can happen only through the co-operation of the distant station.

2.13 TCF & TGT locks (Electrical) with forced drop arrangement:

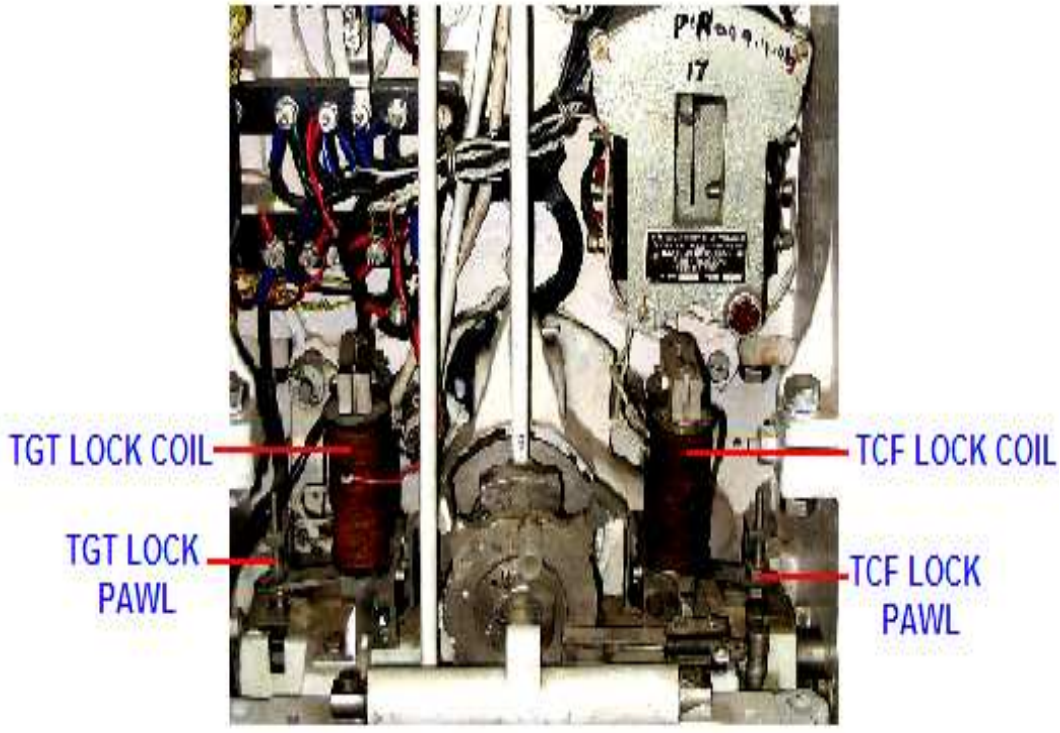


Fig. 2.9

These lock coils are identical in every respect; but the units with armature cannot be interchanged. The coils are wound to a resistance of 28 Ohms each and require an operating current of 160 mA at a minimum working voltage of 4.5V. The armature of each, which is free to move has locking pawl carried on a spindle at one end. On each coil assembly is mounted a bent lever or the force dropping lever which is normally held up by the cams on the lock replacer disc (Ref.Fig. 2.11) mounted on to the rear end of the hexagonal extension of the operating handle. This limits the travel of the armature unless the bent lever falls forward which happens

when the operating handle is pulled out of its slot, withdrawing the cam projection from underneath the bent lever. When the lock coil is energised and the operating handle pulled out, the armature is attracted fully lifting with it the lock pawl out of the locking notch of the rack, thus permitting the operating handle to be turned. The locking pawl is a small rectangular mild steel piece attached to a threaded spindle and secured to it by means of locking nut.

Four operations are possible with the operating handle, viz.,

(a) Normal to TCF;

(b) TCF to Normal,

(c) Normal to TGT; and

(d) TGT to Normal.

Out of these four operations the TCF lock has to be energised for three operations

(a) Normal to TCF,

(b) TCF to Normal, and

(c) TGT to Normal.

The TGT lock coil has to be energised to enable the handle to be turned from normal to the TGT position

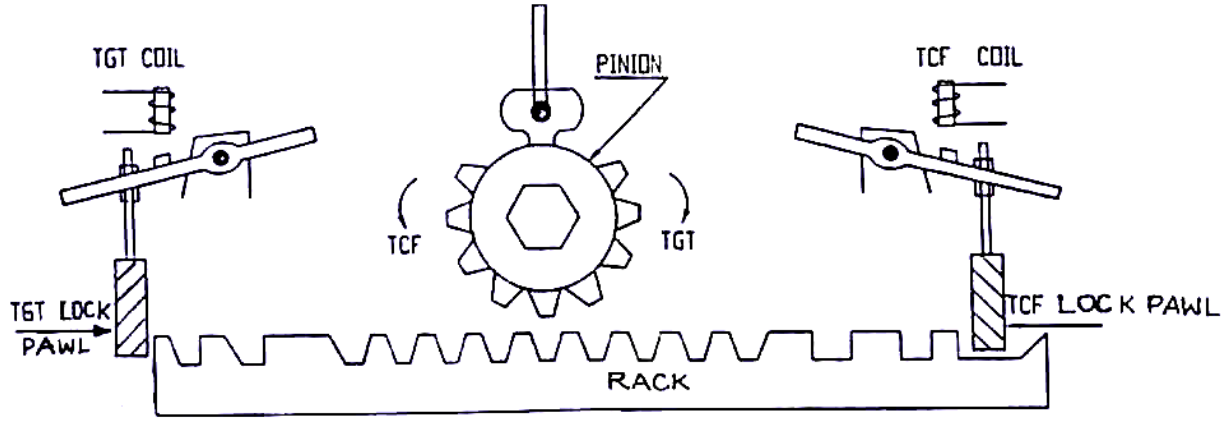


Fig. 2.10 REAR VIEW OF THE RACK AND PINION IN THE LINE CLOSED POSITION OF THE BOTTOM HANDLE

2.14 LOCK REPLACER DISC

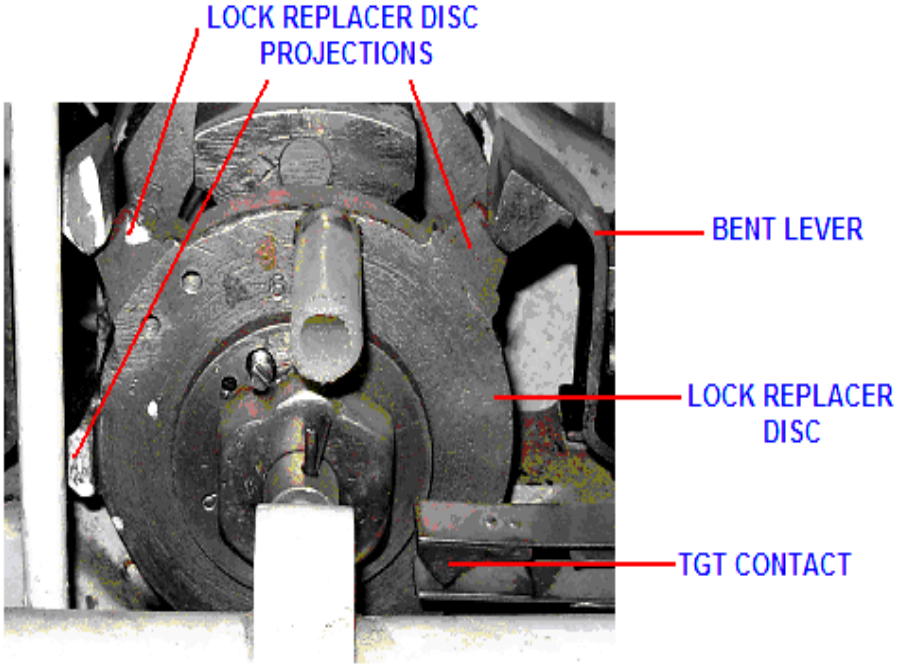


Fig. 2.11

The lock replacer disc has 4 conical projections or cams. Three of these are 'A', 'B' and 'C' as shown in Figure 2.12 and are of the same size and are so located that any two of them keep the two bent levers of the two locks (TCF) and (TGT) pushed up when the operating handle is in the normal or TCF position and the bent lever of the TCF lock coil alone in the TGT position of the operating handle. The bent levers forces down the armatures and hence, the locking pawls into the locking notches in the rack. This helps to prevent sticking of the armature in the attracted position due to dirt, residual magnetism or any mechanical defect that would enable an unauthorised extraction of a token. Every time the operating handle is made to house in its slots after an operation the armatures of the lock coils are forced down thus ensuring safety.

The fourth projection D is longer than the three others so that even when the bottom handle is pulled forward, this does not release the bent lever. When the bottom handle is turned about one third from the line closed position towards TGT position where the handle cannot be housed in the pulled forward position it engages with the bent lever of the TGT lock and ensures force dropping of TGT lock in the check locking notch. This coincides with the time when the line current is momentarily interrupted by the inter-stroke interrupter. The TGT coils being de-energised, the armature and hence, the locking pawl is forced down on to the rack by the bent lever. If there is no current coming through again, the bottom handle would be prevented from being taken to the TGT position as the lock pawl which has forced down would lock the rack in the check lock position.

The bottom handle can be turned further to TGT only when the TGT coil is energised again. This means that the operator at the distant station should still be keeping his tappet rod pressed sending a current on line. Thus a prolonged beat is necessary to take the bottom handle to the TGT position. This provides security against premature operation of the bottom handle to TGT position while receiving bell beat.

The details of forced drop arrangement are shown in Fig.2.12. The combined details of Rack and Pinion, TCF, TGT locks with forced drop mechanism are shown in Fig.2.12.

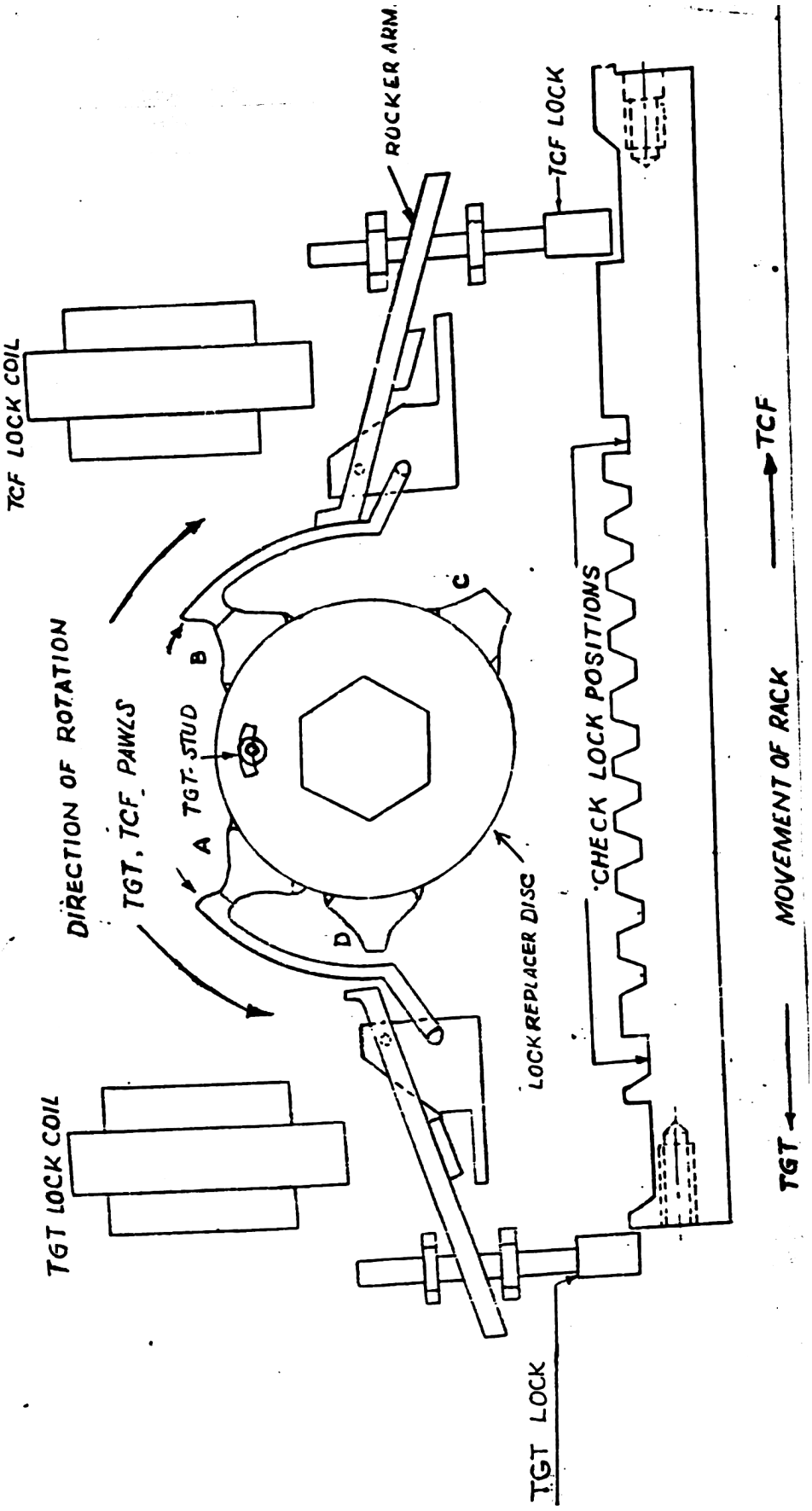


Fig.2.12 DETAILS OF FORCED - DROPPING MECHANISM

2.15 Polarised Relay: (Three Position Relay)

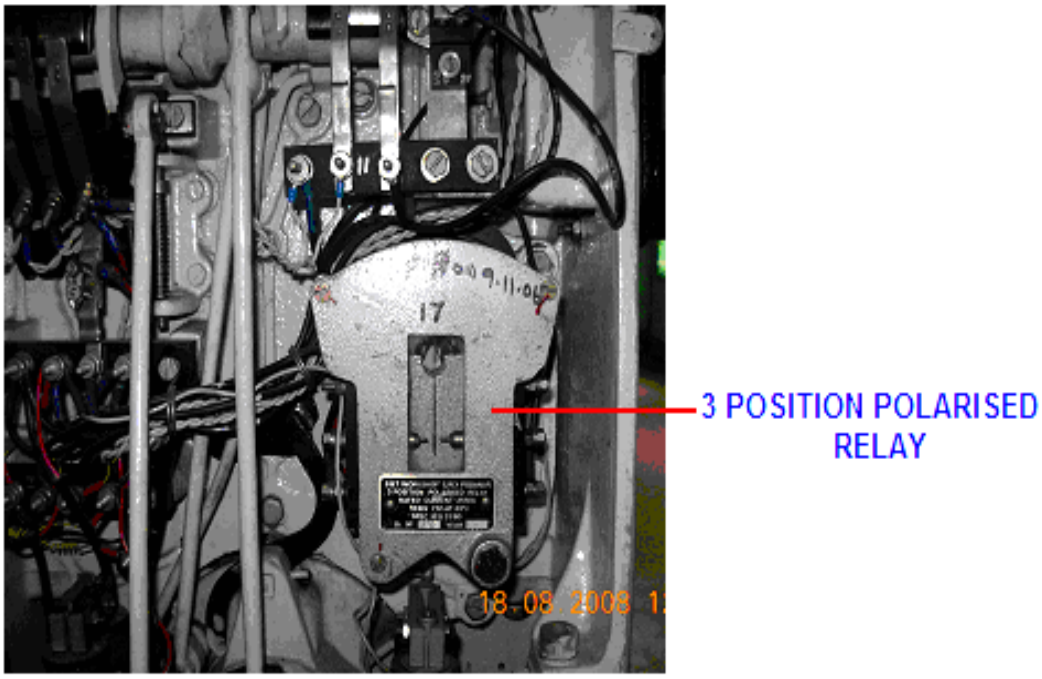


Fig. 2.13

This is a three-position relay, which works on the line current. The movement of the contact spring depends on the polarity of the line current. The polarised relay should be of Specification No.S31/80 having a coil resistance of 77 Ohms is provided in all the instruments and it works on a rated current of 25 mA.

The operation of the Neale's instrument depends on the direction of the current received from the distant station. When the current is in a particular direction, the tongue of the polarised relay is attracted to one side completing the local circuit of single stroke bell and TCF lock coil. If it is in the opposite direction the tongue of the relay is attracted to the opposite side completing the local circuit of single stroke bell with TGT lock coil. When the direction of the incoming current is such as to release the TGT lock coil the bottom (operating) handle can be turned to TGT position and a token is delivered and releases the L.S.S. control, Electrically or Mechanically as provided. Polarised Relay confirming to S-31/80 alone shall be used in Block Circuits.

2.15.1 Salient Features of DC Polarised Relay – 3 position IRS- S, 31-80.

This relay with centre-biased armature is used in Railway Signalling circuits and for use with Single Line and Double Line Block Instruments in Electrified and Non-Electrified Sections.

2.15.2 Terminology

(a) Normal Position: The position of the armature when the relay is energised with the positive coil terminal R1 connected to the positive and R2 connected to the negative terminals of the battery.

(b) Reverse Position: The position of the armature when the relay is energised with the positive coil terminal R1 connected to the negative and R2 connected to the positive terminals of the battery.

(c) Pick up Value: The value of the current, which is just sufficient to close normal or reverse contact of a relay under the specified conditions.

(d) Drop away Value: The value of the current at which the normal or reverse contact of a relay just opens under specified conditions.

(i) Arm: The moving part of the contact.

(ii) Arm Contact: The moving contact, which remains in between Normal and Reverse Contacts when the relay is de-energised.

(iii) Normal Contact: The fixed contact on the left hand side of the relay when viewed from the front of the case, and which is closed when the armature is in the normal position.

(iv) Reverse Contact: The fixed contact on the right hand side of the relay when viewed from the front of the case, and which is closed when the armature is in the reverse position.

(e) Contact Terminals: The terminals connected to the fixed contacts and the letters shall identify the arm as follows:

N = Normal Contact,

R = Reverse Contact,

A = Arm Contact

(f) Coil Resistance: It consists of two separate coils each of 38.5 Ω nominal resistance at 20^0C. The standard nominal resistance of the coils on assembly shall be obtained by connecting the two coil windings in series.

(g) Contact Clearance: When the armature is in vertical mid-position with the relay in the de-energised opposition, the contact clearance between the arm contact and any of the fixed contacts shall be not less than 2.5 mm. The contact clearance shall be equal on both sides.

2.16 Interstroke Interrupter (Jerking contact)

Two contact pieces with a gap between the two are provided on Bakelite mounting on the spring clutch shaft (Fig.2.17). In the Line Closed Position of the bottom handle, the line circuit is made through by two finger springs resting on the bottom contact piece. When the bottom handle is turned, a rod connected to the pinion on the bottom handle also rotates the spring clutch shaft. Due to operation of operating/bottom handle, the contact springs moves over from the bottom contact piece to the top piece causing a momentary break in the line circuit. This causes a click in deflection of the needle indicators. This indicates to the Station Master at the current sending end that the operating handle is being turned at the distant station.

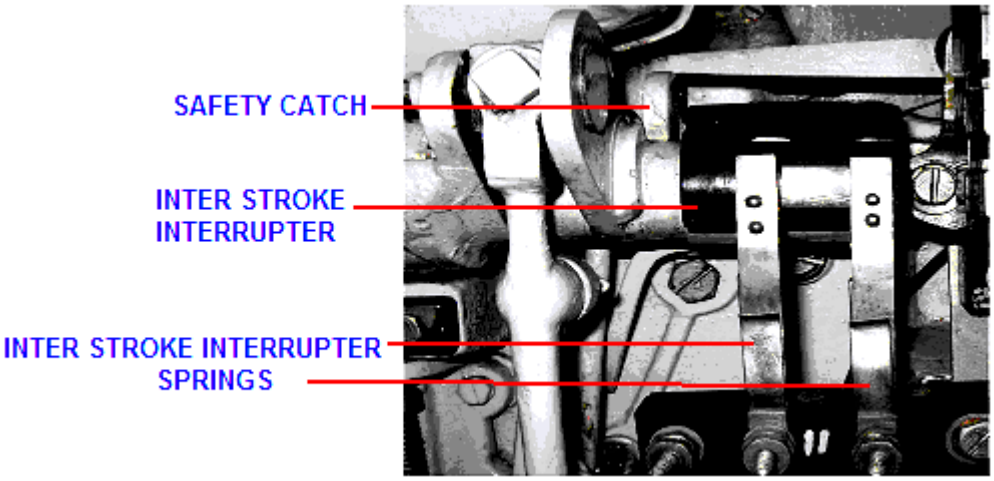


Fig. 2.14

At the station where line clear is obtained when the handle is being turned to TGT from Normal, the momentary break in the line circuit caused by this inter-stroke interrupter contact coincides with the time and TGT lock pawl is dropped by the lock replacer disc mounted on the rear part of the bottom handle. If current were not received continuously after the interrupter contact makes the line circuit again the lock pawl would lock the rack and hence the operating handle in the check lock position. To clear this locking notch the TGT lock coil should be energised again, which thus necessitates the other end to give a prolonged beat to enable the handle being taken to the TGT position

2.17 Commutator

Four brass segments are mounted on an insulated curved Bakelite segment threaded to the commutator shaft, it engages with spring clutch shaft by means of Jig Jaw teeth cut on the edge of the spring clutch. The shaft carrying the spring clutch is connected to a toothed sector pinion on the operating drum. Whenever the bottom handle is turned, this shaft rotates.

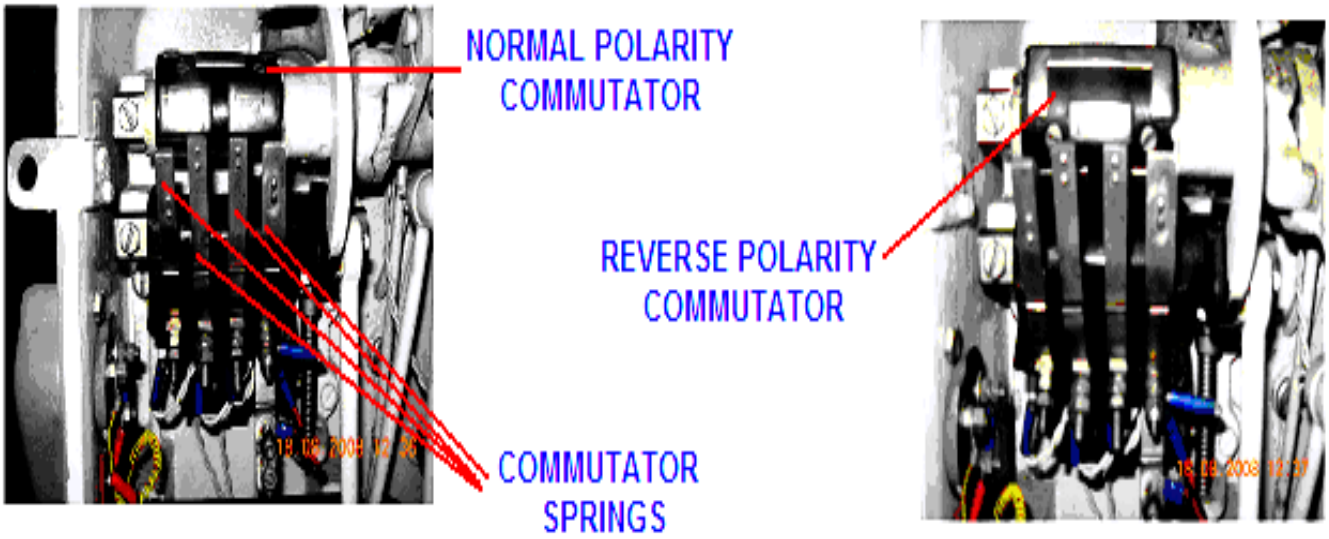


Fig. 2.15

The commutator also moves along with the spring clutch shaft, thus changing the segments which comes into contact with springs connecting the battery line and earth.

On the right side of the commutator is a jaw (token receiving jaw) for receiving a token from the token receiving drum when the handle is in TCF or TGT position. This prevents the token going right into the token recess of the instrument. When the plunger is pressed with a token resting on this jaw, a fork lever attached to the spring assembly shaft pushes the token into the instrument.

This action revolves the commutator along disengaging the spring clutch shaft. Thus with every movement of the bottom handle, the commutator and spring clutch revolve as one unit, but when the plunger is pressed after inserting a token in either of the turned positions of the handle, the clutch disengages and allows the commutator to revolve independently reversing the polarity of the current transmitted in a subsequent operation of the plunger.

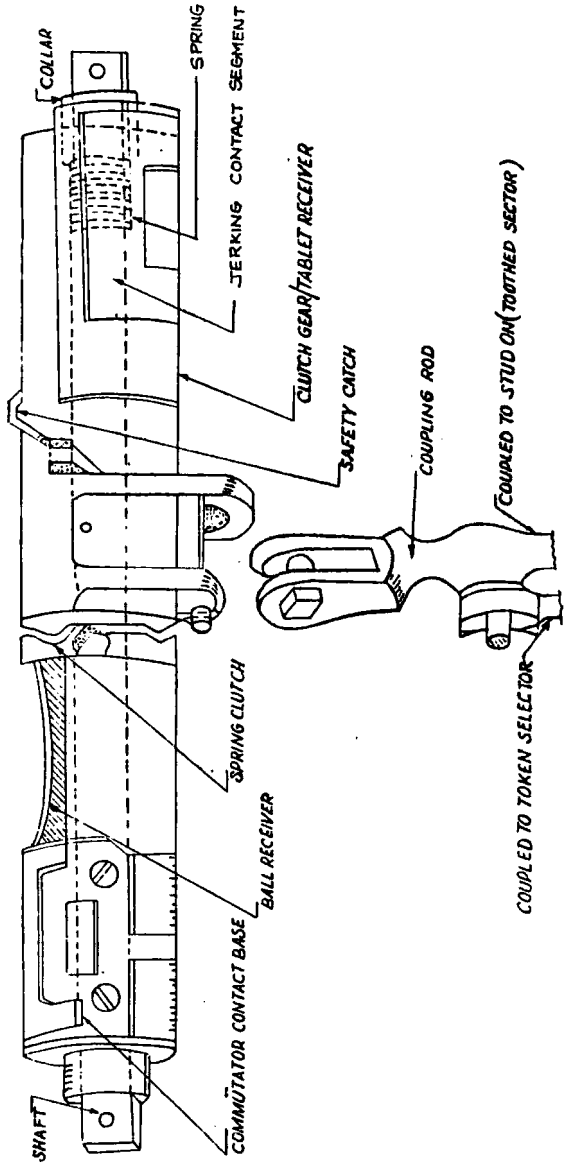
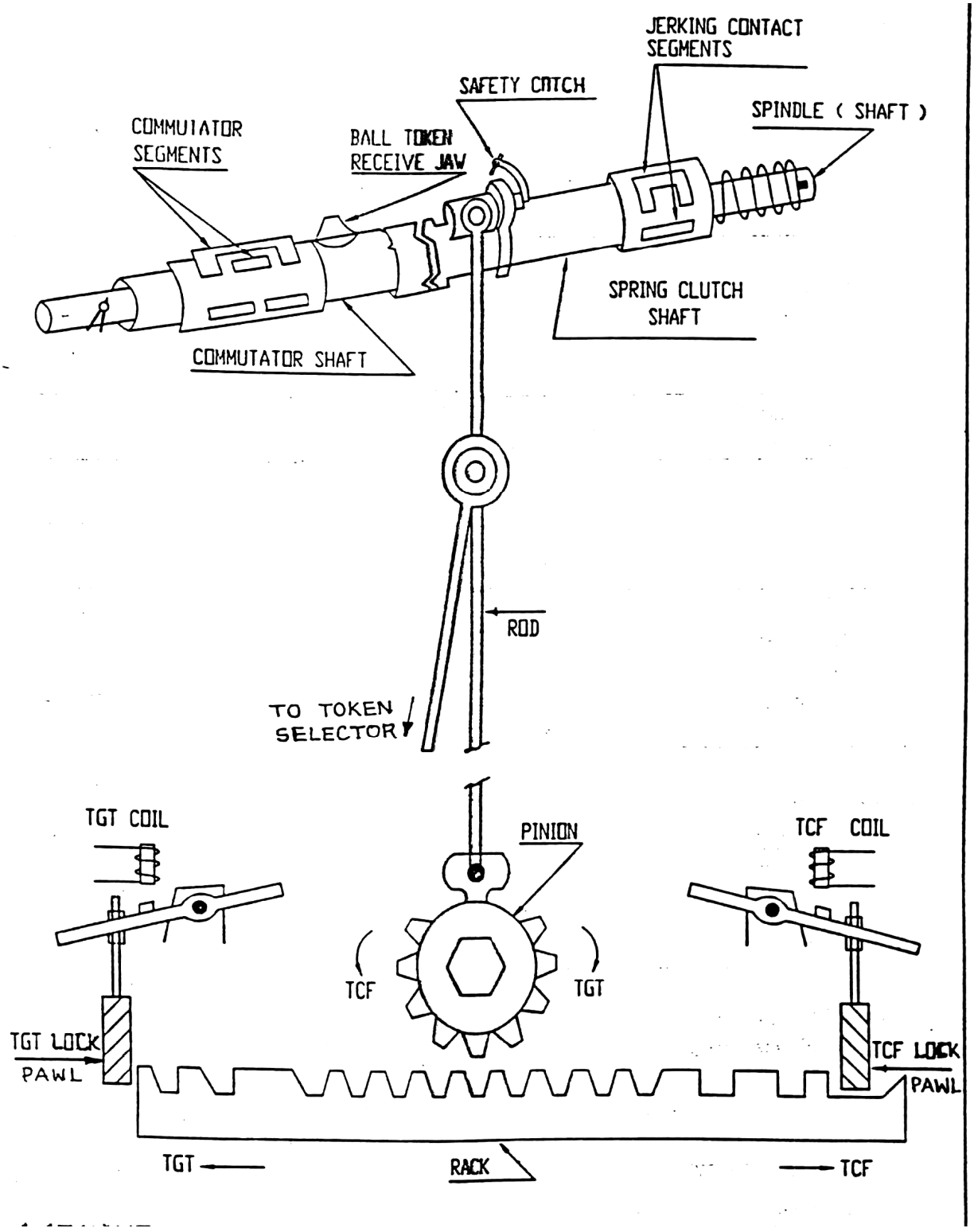


FIG.2.16 COMMUTATOR & SPRING CLUTCH SHAFT



2.17 NEALE'S BALL TOKEN BLOCK INSTRUMENT

2.18 Contact Making Spring Assembly

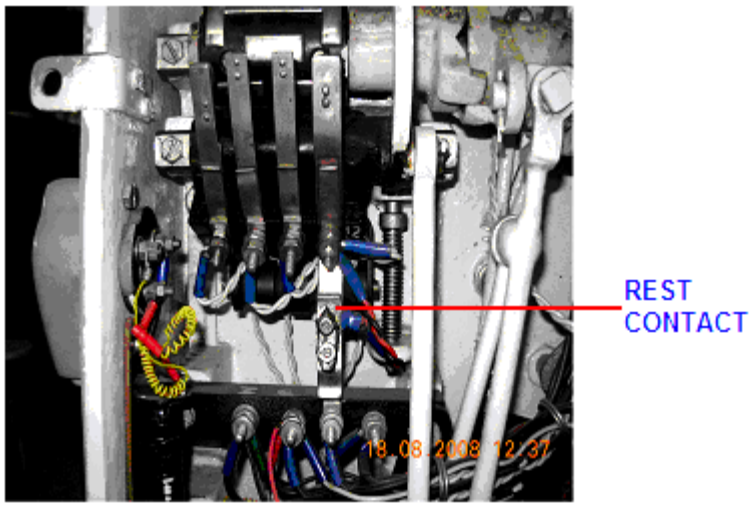


Fig. 2.18 CONTACT MAKING SPRING ASSEMBLY

This consists of four finger springs mounted on an isolated lever below the commutator. The lever moves in an arc through a connecting rod, which moves whenever the plunger is pressed. This will result in the springs making contact with the segments mounted on the commutator.

As seen from the rear of the instrument battery terminals are connected to the first and third finger springs, earth to the second spring and line through Galvanometer to the fourth spring. The commutator in line closed position of operating handle puts through spring 1,2 and 3,4 (Ref.Fig.No.2.17 and 2.26), when the plunger is pressed. When the bottom handle is turned to TCF or TGT position, the commutator, thus reversing the polarity of the applied voltage, puts through the springs 1,4 and 2,3.

The 4th spring of the contact making spring assembly is extended downwards and numbered as 5 to make the rest contact. This contact, which is normally made when the plunger is not pressed, connects the line circuit to the polarised relay. But when the plunger is pressed the contact is broken and the polarised relay is isolated from the line circuit.

Provision of Rest Contact fulfils the Special Requirement Vide SEM 17.144 that the Line Clear granting mechanism and Line Clear Receiving Mechanism shall not actuate at one and the same time.

2.19 Tappet Rod (Bell Plunger)

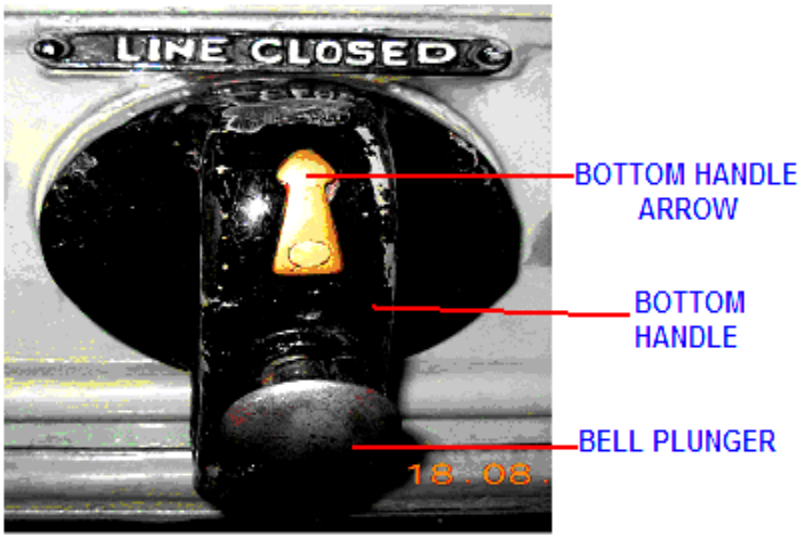


Fig. 2.19

This is a steel rod with an electroplated knob passing through the middle of the bottom handle. When pressed it operates the shaft connected to the contact making spring assembly. This causes the spring to make contact with the commutator segments for sending out a current on line. The polarity of the current depends on the position of the commutator.

2.20 Safety Catch (S 20792/M)

The safety catch is a small hook like steel piece with a tail like extension mounted so as to rest beside a small projection on the spring clutch shaft. This prevents the declutching of commutator shaft from the spring clutch shaft whenever the operating handle is turned from Line Closed to TCF or TGT positions as it butts against this projection. In the turned positions of the handle, the projection moves away from the safety catch, and this permits the de-clutching of the commutator shaft when token is inserted and the plunger pressed. This action causes only commutator shaft to rotate back due to the push of the forked lever on the token, thus normalising the commutator to enable normalisation of the instruments for closing the Block Section. Refer Fig. 2.17 & Fig 2.20.

If this safety catch were not provided, and should the commutator shaft get stuck upon the spindle due to a mechanical fault, when the operating handle is being turned from line closed to TCF position for granting line clear, the spring clutch shaft would declutch and turn over with the operating handle leaving the commutator normal. Since the commutator has not changed, the instrument at the other end cannot be turned to TGT position causing block failure. Should this sticking up of the commutator shaft takes place in the instrument receiving "Line Clear" then the handle would have been turned to TGT, obtaining a token.

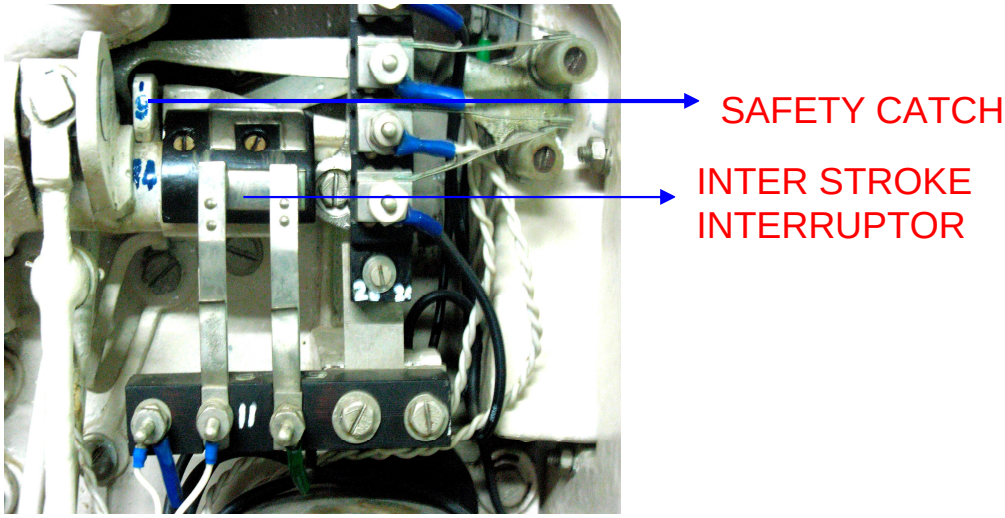


Fig. 2.20

After sending the train, the train receiving instrument can be normalised since the commutator is Normal at the train despatching end and the sending instrument can also be normalised subsequently.

Both instruments of the Block Section are Normal with a train in the Block Section. By repeating this process, a number of trains can be sent in the Block Section one behind the other thus violating the principles of Absolute Block System and endangering safety.

Should the commutator sticking up taking place intermittently the sending station after normalising the instrument will be in a position to grant line clear to the other end station, thus allowing a second train in the opposite direction into the Block Section.

With the provision of this small gadget, the above unsafe conditions are prevented. Hence, the name Safety Catch.

2.21 Safety Catch No.2 (S 20905/M)

This is provided in the instrument to RDSO Drg.No.SA/20701/M. The purpose of this is to prevent the commutator bouncing back when the handle is in TCF/TGT position with a token inserted and plunger pressed. On its frequent operations there is a chance for its loosening and dropping into the races which may create failures. Hence, adequate care is to be taken for its proper functioning.

2.22 Token Selector

The token selector is concentrically mounted on the operating handle extension inside the instrument and then determines from which race the token shall be selected for issue out of the instrument. It has two recesses each of a size to receive one ball token. The token selector is connected through a rod, to the rod connecting the toothed sector to the spring clutch shaft in such a manner that when the operating handle is turned to either of the horizontal positions, it revolves only in anti-clockwise direction (viewed from the rear) and when the handle is brought back to the vertical position, it revolves back in clockwise direction to its original position. This movement of the token selector, every time the operating handle is turned from one position to another, shifts all the tokens in the four races slightly up or down, thus preventing any tendency to jam or hang up in the races. With the handle in the vertical position, the two recesses in the selector are open to races 1 and 3 (viewed from the rear of the instrument and counting from left to right), and with the handle in either of the horizontal positions TGT or TCF, they are open to races 2 and 4.

The order in which the tokens are selected from various races is as follows: -

First all tokens from race 3, then all from race 4, then one token from race 1, and then all tokens from race 2 and finally all from race 1 Ref Fig.2.21.

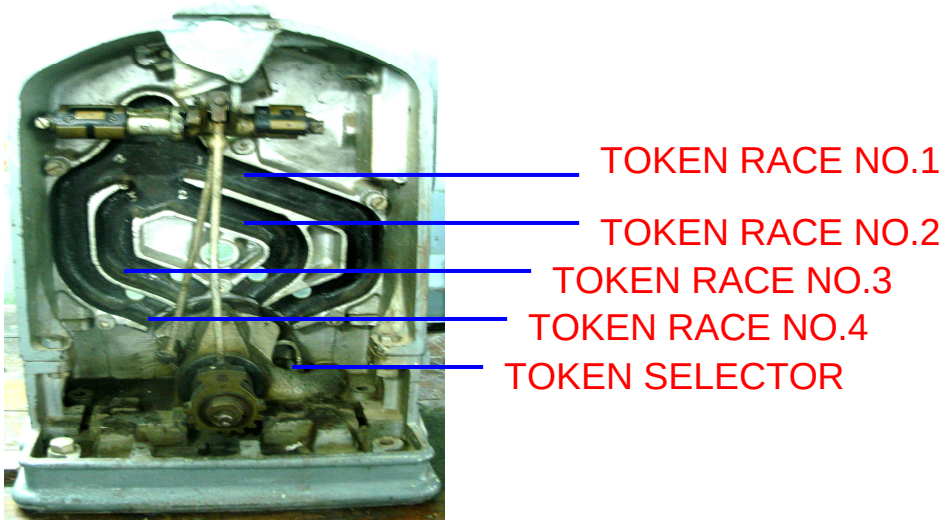


Fig. 2.21 DETAILS OF TOKEN SELECTOR WITH TOKEN RACES

2.23 Token Indicator

This is a mechanical indicator which gives an indication to the operating staff whether any token is present in the bottom handle or not. This works on the principle of gravity drop. An 'S' shaped swinging lever is pivoted on the token selector plate (forming a housing for the token delivery drum). The top end of this carries a flag indicator painted Red and Green and mounted in such a manner as to be seen through a glass opening in the front of the instrument. Its bottom is rounded off and presses against a token in the token drum. In this position, the indicator displays a “Green” indication. Should there be no token in the operating drum, the lever revolves under its own weight and the rounded end enters the empty spaces in the token delivery drum locking the same and consequently, prevents bottom handle being turned to TGT position when there is no token in the instrument, and changing the indication (seen through the indicator), to "Red". This, however, does not prevent bottom handle from being turned to TCF position. The details are shown in Fig. 2.22.

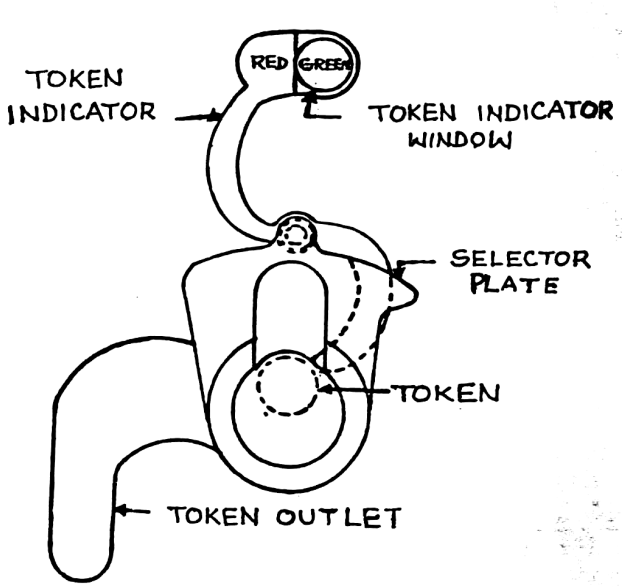


Fig. 2.22 TOKEN INDICATOR (As viewed from front)

2.23.1 Significance of 'No Token Lock':

This simple gadget serves to prevent the Block Handle to be turned from Line Closed position to 'TGT' position when the tokens are exhausted in the instrument. The facility of cancellation of line clear is an inherent feature of any Block Instrument in order to cater to the Traffic need of change in the programme of movements of trains in emergencies or other exigencies. In case the Block Handle assumes TGT position with out a token delivered from the instrument when tokens are exhausted, it will not be possible to cancel Line Clear because a token is required to effect the change of commutator. In the absence of this simple mechanical device, once the Block Handle assumes TGT position without delivering a token both the Block handles of an interconnected pair of instruments get locked up-one in TCF position and the other in TGT position and cancellation of Line Clear is not possible. This ends up in an impasse or a dead lock necessitating the attendance of authorised official of S&T Department for restoring normal working by balancing of Tokens or by Phasing. At times this involves considerable duration of failure and in the mean time trains have to be worked on paper Line Clear Ticket in both directions even though all the tokens are accumulated in the other instrument. Since this gadget is provided normal Block working can be restored with out S&T official once a train is received from the other station. Thus this modest gadget renders a safety function solemnly.

2.24 Last Stop Signal Control

(a) Mechanical: A separate side lock is attached on the TGT side of the instrument. A small extension piece working into the lock is screwed on to the rack on the TGT side. In the normal and TCF positions of the operating handle the plunger of this lock will be fouled by the extension piece of the rack and the key of the same cannot be taken out. In the TGT position of the operating handle only the rack comes out of the lock enabling it to be locked by taking out the key. This key is utilised to take off the Last Stop Signal either by inserting it in the mechanical lock on the LS.S. Lever or utilising it to release the SM's control instrument. Once this key is taken out of the lock, the lock plunger will foul the rack and the operating handle cannot be turned from the TGT position unless and until the L.S.S. Control Key is brought back, put into the lock and turned. The details are given in Fig : 2.23(i).

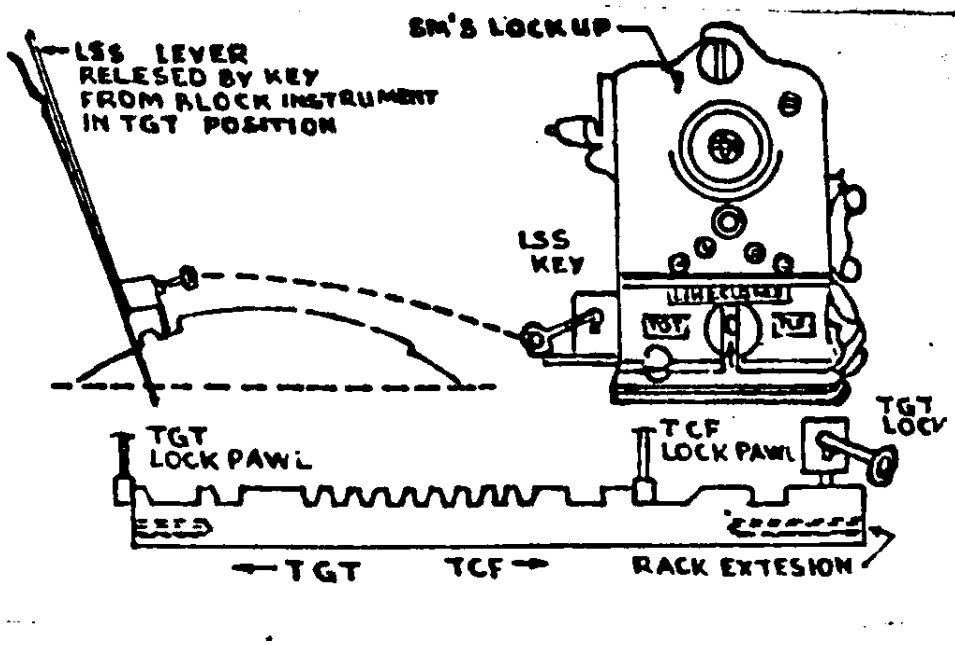


Fig: 2.23 (i) LAST STOP SIGNAL CONTROL (Mechanical)

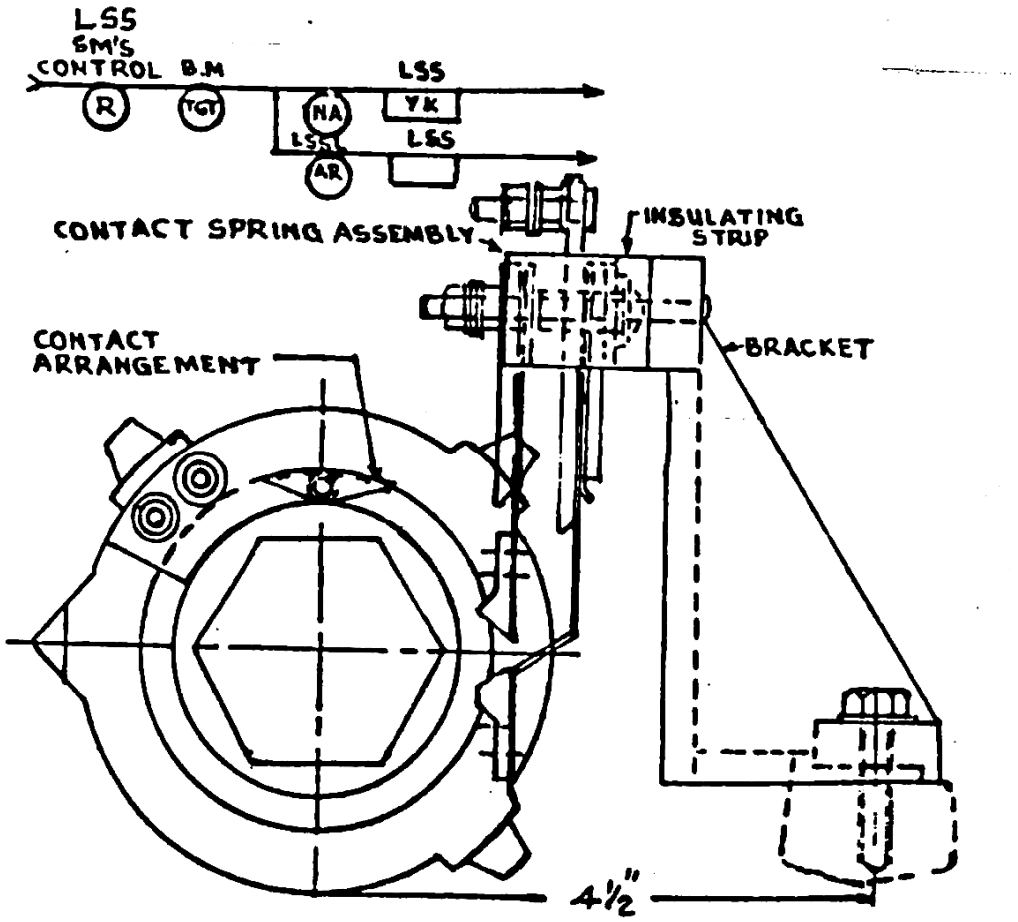


Fig: 2.23 (ii) LAST STOP SIGNAL CONTROL (Electrical)

(b) Electrical: The details are shown in Fig: 2.23 (ii)

A stud screwed on to the lock replacer disc, which is called TGT stud, bridges two contact springs when the block handle is turned to TGT position. The last stop signal reverser feed is taken through this contact, ensuring that the last stop signal can be taken off only when the block handle is turned to TGT position.

It has since been ordered by the Railway Board that on single line section where Tokenless Block Instruments are not provided, the following controls must be provided on the Last Stop Signal.

i) One train/one line clear.

ii) Provision for automatic replacement of Last Stop Signal, with the passage of train.

The Board has further ordered that the above should be catered for in all future works and should be carried out in the case of existing installations, on a programmed basis.

A Typical LSS control circuit confirming the above provisions is illustrated in Fig. 2.23 (iii)

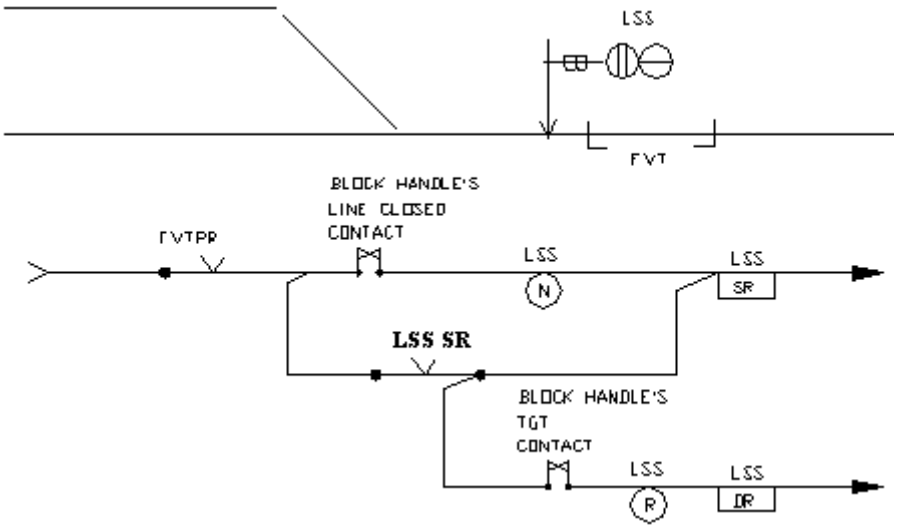


Fig: 2.23 (iii) TYPICAL LAST STOP SIGNAL CONTROL CIRCUIT

2.25 Superimposed Telephone

A telephone is superimposed on the block line through an induction coil and a 1 MF isolation condenser. The condenser isolates the telephone circuit from the Block instrument circuit. The telephone is HMT type. The primary circuit of the induction coil works with 2 primary cells. A simplified telephone circuit is shown in Fig.2.24.

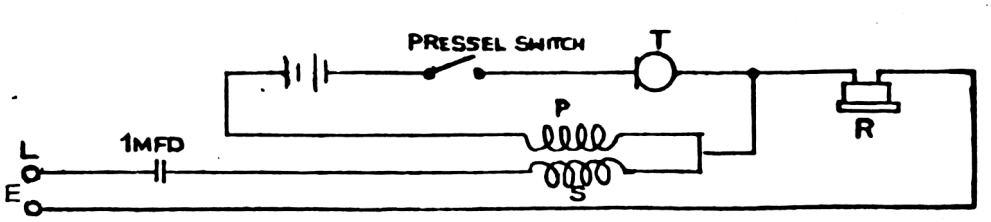
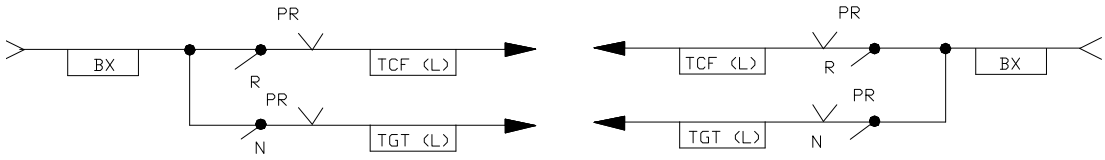


Fig: 2.24 SIMPLIFIED TELEPHONE CIRCUIT

2.26 NORMAL/REVERSE POLARITY

(a) In a pair of Neale's instruments used for a Block Section the wiring for the instruments is not identical. The two methods of wiring are: -



(a) NORMAL POLARITY INSTRUMENT (b) REVERSE POLARITY INSTRUMENT

Fig: 2.25

(i) **Normal Polarity:** Instrument is one which normally, i.e., in the Line Closed Position of the operating handle, would connect positive of the battery to the line when the plunger is pressed and also would require a positive potential on line to enable its operating handle to be turned to "Train Going To" Position. Ref.Fig : 2.25.

(ii) **Reverse Polarity:** Instrument is just the opposite i.e., it would connect negative to line in the "Line Closed" position of the operating handle when the plunger is pressed and would require negative potential on the line for taking the operating handle to "Train Going To" position. Ref.Fig: 2.25.

In a pair of instruments used for on Block Section, one should be of Normal polarity wiring and other of Reverse Polarity wiring. The reason for providing a pair of such instruments for a Block Section is to prevent the possibility of simultaneously obtaining two tokens, one at each end of the section, in the event of the Block Line coming in contact with another conductor of favourable polarity.

(b) A normal polarity instrument can be converted into Reverse Polarity (or vice-versa) by reversing the connections of: -

(i) Needle Indicator

(ii) Polarised Relay and

(iii) Line Battery.

(c) 2 sets of batteries are used for this instrument.

(i) Line Battery

(ii) Telephone Battery.

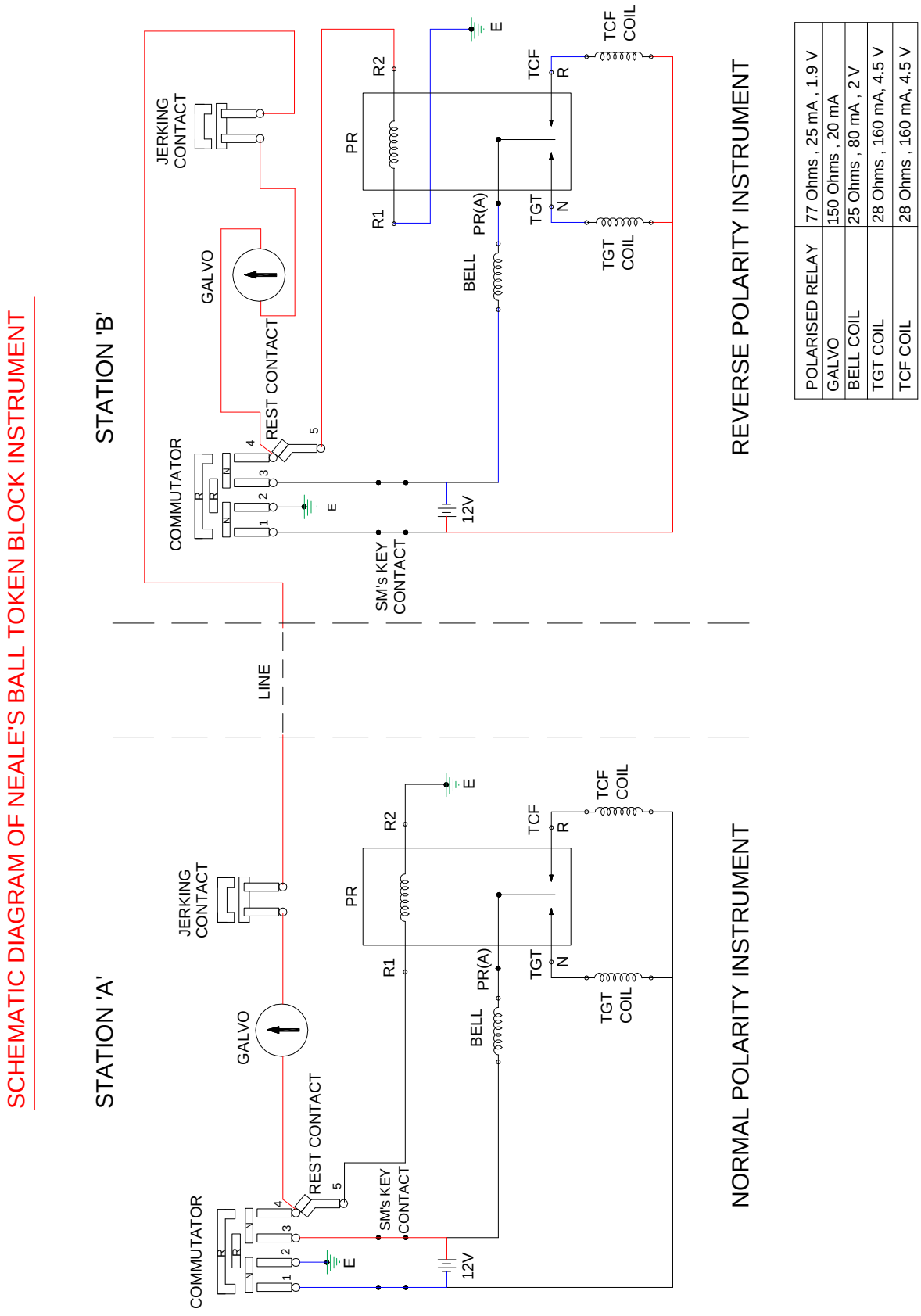


Fig. 2.26 SCHEMATIC DIAGRAM OF NEALE'S BALL TOKEN INSTRUMENT

NOTE : --

(a)

I) BOTTOM HANDLE IN NORMAL - Commutator Normal
ii) BOTTOM HANDLE IN TCF OR TGT - Commutator Reverse
iii) BOTTOM HANDLE IN TCF OR TGT, - Commutator Normal & Token inserted & Plunger pressed.

(b)

(i) Spring No. 1,2 & 3, 4 are made when commutator is normal and plunger pressed.

(ii) Spring No. 1.4 & 2.3 are made when commutator is reverse and plunger pressed.

(iii) Spring 5 is normally connected to rest contact to connect the PR to line and get disconnected when plunger is pressed to isolate PR when an out-going current is put on line.

(c)

(i) TCF lock to be energised to operate bottom handle from

- *N to TCF*
- *TCF to N*
- *TGT to N*

(ii) TGT lock to be energised to operate bottom handle from N to TGT

(iii) RC is Resting contact

(d) Interstroke interrupter's contacts are normally made but gets interrupted momentarily when bottom handle is being operated.

(e) Normal Polarity:

(i) When commutator normal and plunger pressed, connects positive on line
(ii) When commutator reverse and plunger pressed, connects negative on line.
(iii) Requires positive on line for TGT lock operation.
(iv) Requires Negative on line for TCF lock operation.

(f) Reverse polarity:

(i) When Commutator normal and plunger pressed, connects negative on line.
(ii) When commutator reverse and plunger pressed, connects positive on line
(iii) Requires negative on line for TGT lock operation.
(iv) Requires positive on line for TCF lock operation.

2.27 OPERATIONAL CIRCUIT OF NT BLOCK INSTRUMENT

The operation of the Block Instrument of a section for a Train Movement is as under: -

The Schematic Diagram of a pair of interconnected Token Block Instruments is illustrated in Fig.2.26.

A & B are two adjoining stations (Fig.2.26) provided with normal and reverse polarity instruments respectively connected by overhead line wire and earth return (Metallic return, where necessary, may be provided) Station Master at 'A' has to despatch a train to B. A asks B for "Line Clear" by sending the authorised bell code signals and prolongs the last beat.
The circuit is shown in Fig. 2.27(i).

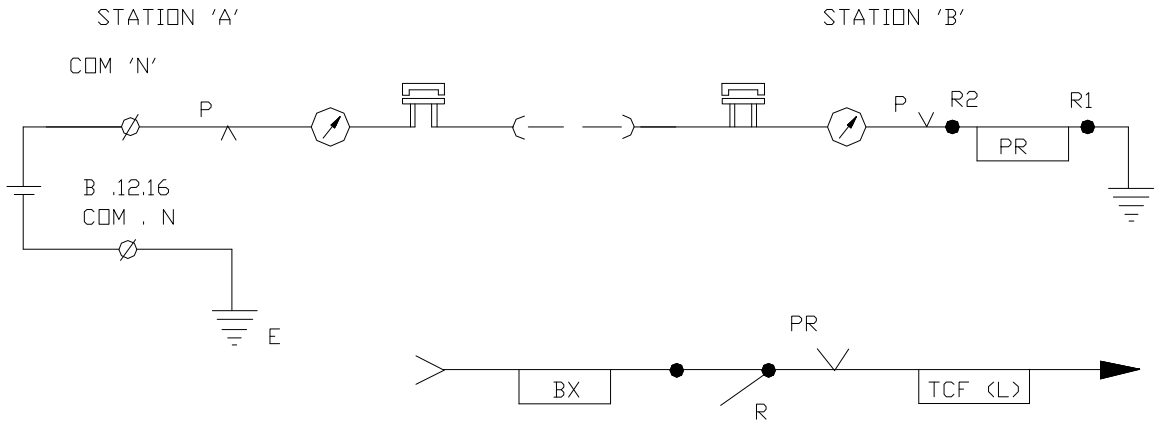


Fig. 2.27 (i)

Needle Indicators at 'A' and 'B' deflect to the right. The tongue of the polarised relay at 'B' deflects to 'R' completing a local series circuit of block Bell and TCF Lock Coil. When the Handle is being turned at 'B' there will be a jerk in the indicator needle, both at A and B due to the interstroke interrupter (jerking contact) momentarily breaking and again making. The Operating Handle having been turned at Station 'B' to TCF position the commutator is reversed at that station. Plunger at 'B' if pressed will now send a positive current on line. 'B' now sends authorised bell code signals to 'A' and prolongs the last beat. The circuit is shown in Fig. 2.27(ii).

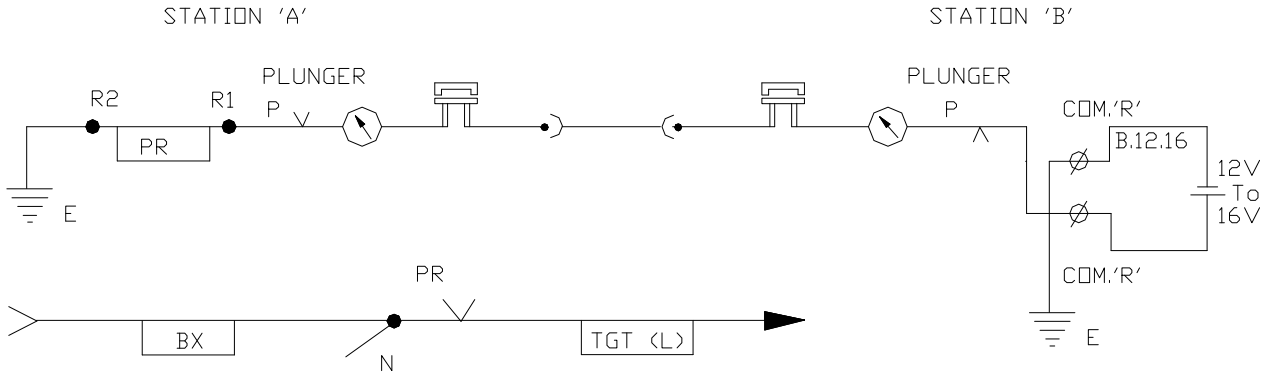


Fig: 2.27 (ii)

The tongue of the polarised relay at "A" is attracted towards "N" completing local circuit for the block bell and TGT lock coil in series. There is one bell beat at 'A' and the TGT coil being energised, its armature is operated. When operating handle at "A" is pulled for operation, the TGT Lock Pawl is lifted and the handle is free to be turned to TGT position. While the operating handle is being turned to TGT position, if the train receiving station releases the plunger, the operating handle at the despatching station gets locked in the check lock position and cannot be fully turned to TGT position unless the train receiving S.M gives continuous co-operation. When the handle is taken to the TGT position the commutator at "A" is reversed and a token is delivered.

In this position of the operating handle, either the last stop signal control key can be extracted (Fig. 2-27 (i)/(iii) or the Last Stop Signal electrical control contact is made. In the case of mechanical control, the key extracted from the Block Instrument is used either in the Station Master's control apparatus or in the Signal Lever controlling the Last Stop Signal. Once a train clears the Last Stop Signal, the Signal is put back to " ON " position. Train entering section code is sent to the station in advance. The Last Stop signal control key (where provided) is restored into the Block Instrument at "A".

Driver on arrival at "B" hands over the token to Station Master. Station Master at "B" calls attention of Station Master at "A" and on being acknowledged inserts the token into his instrument and gives bell signal for "train out of section",. This changes his commutator to Normal. "B" prolongs the last beat and Station Master at "A" observing the indicator needle deflecting to the right turns the operating handle from TGT to "Line Closed" position. This changes his commutator also to Normal. The circuit is shown in Fig.2.27 (iii).

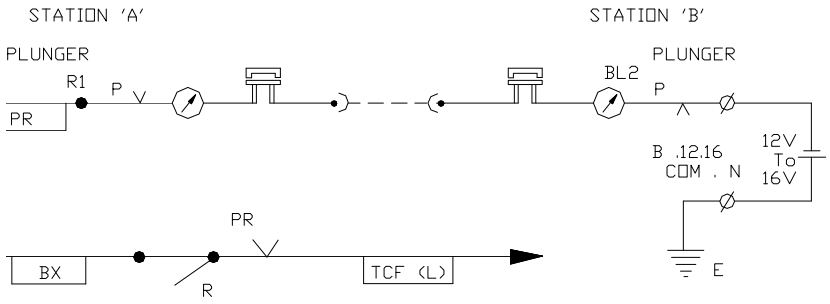


Fig: 2.27 (iii)

“A” now acknowledges the “Train out of section” Signal prolonging the last beat. Commutator at “A” having been changed to Normal, the prolonged beat energises the TCF coil at ‘B’ enabling him to turn his operating handle from TCF to “Line Closed” position. The commutator at “B” having already come to Normal position when the token was plunged in, turning of the operating handle at “B” has no effect on the commutator. Both instruments are now in “Line Closed Position”.

The study of the circuit will reveal that there is no possibility of a second token being extracted from either of the instruments when the Block Section is already occupied by a train even with the Mutual Co-operation of Station Masters at both ends.

Let us assume that the Station "A" has despatched a train towards Station "B". As the commutator of the instruments at both the stations are in reverse, the polarity of the current that can be transmitted both from A as well as from B will be suitable to pick up only TGT lock at the other end. As the operation of the handle either from TGT or TCF position requires TCF lock coil to be energised picking up of TGT lock as above is of no use. This ensures the locking of the instrument at Station "A" in TGT and at "B" in TCF position and thus preventing extraction of a second token.

2.28 CANCELLATION OF LINE CLEAR

After obtaining line clear and extracting a token, if Station Master at "A" does not despatch a train for any reason, he can cancel the "Line Clear". "A" informs "B" about his intention of not despatching the train and inserts the token into his instrument. "A" sends bell signals to "B" for cancelling "Line Clear" prolonging the last beat. The insertion of token and plunging changes his commutator. The polarised relay at "B" is energised to release the TCF lock, which enables him to turn his operating Handle from TCF Position to "Line Closed" position. Station "B" acknowledges the cancelling signal prolonging the last beat. This enables "A" to turn the operating handle from TGT to "Line Closed" Position.

2.29 METHOD OF WORKING NT TOKEN BLOCK INSTRUMENTS

Note: - Station Master on duty is responsible to ensure that no unauthorised person loiters near or operates the Block Instruments

Despatching a train from A station to B station in Neale's Ball Token or Tablet, Token Instrument.

S.No.	Sending Station 'A'	Receiving Station 'B'
1	Insert Station Master's key and turn	
2	Gives 'Attention' signal	
3		Inserts Station Master's key and turns.
4		Acknowledges 'Attention' signal Attends Telephone and gives out Station Name
5	On receipt of acknowledgement attends Telephone. Gives out Station Name.	
6	Ensures correct station has responded. Gives Train Number and its name.	
7		Ensures correctness of station. Repeats Train Number and Description of train. If line is clear, gives Private Number.
8	Repeats the Private Number	
9	Gives 'Attention' signal.	
10		Acknowledges 'Attention ' Signal.
11	Gives 'Is Line Clear' signal. Prolongs the last beat.	
12		Observes needle points to right and turn the Operating Handle to 'Train Coming From' position. Acknowledges 'is Line Clear'. Prolongs the last beat till the needle of Galvanometer jerks.
13	Observes needle points to left and turns the Operating Handle to 'Train Going To'. at 'A' Token comes out.	
14	Gives 'Attention' signal.	
15		Acknowledges. Attend Telephone.
16	Gives Token No. (with class).	
17		Receives the token number with class & repeats it
18	(a) Takes ' OFF' Last Stop signal. (b) Hands over Token to the Driver. (c) On train entering block section Puts back Last Stop signal to ' ON'.	
19	Sends 'Attention' signal.	
20		Acknowledges 'Attention' signal

S.No.	Sending Station 'A'	Receiving Station 'B'
21	Gives 'Train Entering Section' signal.	
22		Acknowledges 'Train Entering Section ' signal.
23		a) Takes ' OFF ' the Reception signal b) Ensures complete train arrival c) Puts back the Reception signal to 'ON' d) Obtains the token from the driver & ensures its correctness
24		Gives 'Attention' signal
25	Acknowledges 'Attention' signal	
26		a) For Neales Ball token Instrument- Inserts Token into Token receiver & turn Token receiver handle. b) For Neales Tablet Instument.Drawout the token slide, keep the tablet in the space provided & pushes the token slide.
27		Gives 'Train out of Section' signal & Prolongs the last beat
28	Turns the Operating Handle to 'Line Closed". Acknowledges 'Train out of section' signal & prolongs the last beat.	
29		Turns the Operating Handle to 'Line Closed'

Note: - *Before turning the Operating Handle, it should be ensured that the Galvanometer is deflecting correctly as under -*

(a) Both Instruments of the Block section in 'Line Closed' position - Incoming and outgoing beats give clockwise deflection.

(b) Both Instruments not in 'Line Closed' position and a Token out - Incoming and outgoing beats give anti-clockwise deflection.

(c) One or both Instruments not in 'Line Closed' position and no Token out - Outgoing and incoming beats give deflections in opposite directions.

2.30 FAILURES IN NEALES TOKEN BLOCK INSTRUMENTS

The Neale's token instrument shall be considered as having failed and working of the Block Instrument shall be suspended in the following circumstances: -

(a) When bell signals are received indistinctly or fail altogether.

(b) If the needle of the galvanoscope fails to move when bell signals are given or received or shows a wrong indication viz., to the right instead of left and vice versa.

(c) When a token is broken or damaged in any way during or after extraction.

(d) If a token cannot be taken out from the instrument after proper signals have been exchanged and no token is out from either instruments of a section.

(e) When a token can be taken out from the instrument without proper signals being exchanged with the station at the other end of the section.

Note: *Above test shall be made when the operators take charge of the block instrument.*

(f) If a token cannot be put back into the instrument or jams when being put back into the instrument.

(g) If a train arrives at a station without a token referring to the Block Section over which the train has passed.

(h) When the token belonging to a block section has been overcarried to another station, or is lost and cannot be found.

(i) When there is a reason to believe that there is contact between the Block wire and any other circuit.

Note: *If a contact exists between the block wire and any other circuit, there will be either a permanent or intermittent deflection of the needle in the dial and possibly irregular beats on the bell. A contact between two block wires of adjacent sections would cause signals if given on one instrument to be repeated on the adjacent instrument*

(j) If the operating handle cannot be turned to any one of the three positions with a prolonged beat from the distant station.

(k) If the operating handle can be turned to any one of the three positions without a prolonged beat from the station at the other end.

(l) If the dial glass of the galvanoscope is broken.

(m) If the instrument or its battery counter is found unlocked.

(n) When the key of the token receiver drum is lost or the lock is out of order.

(o) When a private number cannot be obtained from the Station Master at the other end of the section through the Block Telephone.

(p) If it is known that the instrument is defective in any way not specified above.

2.31 LOCKING AND SEALING ARRANGEMENT

A sealing screw is provided at the back of the instrument, which can be used for sealing. In addition to this sealing facility, Maintainer also provides locking arrangement to lock the instrument. Double locking of the instrument and also Locking and Sealing of the Block Counter as stipulated in SEM shall also be complied in the construction of the instruments and in maintenance.

2.32 SPECIAL REQUIREMENTS OF NT BLOCK INSTRUMENTS

(a) **Fixed Indications:** The instruments shall be provided with visual indication clearly giving the following indications:

(i) When the instruments are normal and there is no train in the block section, "Line Closed" at both the stations.

(ii) When Line Clear for a train to leave the Block station in rear has been given, "Train Coming From" at the receiving station.

(iii) When Line Clear for a train to leave a Block station has been received from the Block station ahead, "Train Going To" at the sending station.

(b) **Current Indicator**: An indicator, indicating the polarity of current, shall be provided to indicate incoming and outgoing line currents.

(c) **"Train Going To" and "Train Coming From"** - The instruments shall be such that the cooperation of the Station Master at the other end of the section shall be necessary. Even with the cooperation of the Station Master at the other end, the Station Master has to go through one or more definite moving operations on the instrument in addition to working of bell plunger.

(i) Before he can grant Line Clear to the Station Master at the other end of the section to release a token, or

(ii) Before he can obtain Line Clear and extract a token.

(d) **Line Closed:** Both the instruments shall be restored to normal before a further operation of setting the instrument to "Train Going To" or "Train Coming From" can be carried out. It shall not be possible for the instruments at either end of the section to be restored to normal without the cooperative features indicated in Para c.

(e) **Operation of "Line Clear" receiving and granting mechanism**: It shall not be possible for the mechanism which permits a "Line Clear" to be received and that which permits a "Line Clear" to be granted to be in operation at the same time.

(f) The instrument that is set to "Train Going To" for initiating a train movement shall be first one to be restored to "Line Closed" on complete arrival of the train at the receiving station.

(g) **Extraction of token:** It shall be possible to extract one token only when the instrument has been set to "Train Going To". It shall not be possible to change the "Train Going To" condition until the token has been inserted in one of the instruments of the Block Section.

(h) Token instruments shall be so installed that a token of one block section cannot be placed in the instrument of an adjacent section and preferably such that if the token is over-carried, it cannot be placed in an instrument at the next station.

(i) The tokens of each section shall be engraved with the code name of the stations at both ends of the block section and with a serial number.

2.34 SOME DO'S AND DON'TS.

(a) Ensure that at a station among the two block instruments one is Normal Polarity & another is Reverse Polarity block instrument.

(b) Ensure that the block instrument connected by line wires at the ends of block section, one shall be Normal Polarity & other is Reverse Polarity to prevent simultaneous release of token at both ends.

(c) Do not bend the contact spring specially the finger contacts, unless absolutely necessary to obtain contact pressure.

(d) Do not allow the block instrument in circuit if the safety catch on spring clutch shaft is either broken or not functioning properly.

(e) Do not file the rack notch or lock pawls. If they are not properly engaging remove them and adjust.

(f) Do not open the polarised relay. If the seal is broken for any reason, it must be removed from the circuit.

(g) Do not make the Station Master's lock up contact through under any circumstances.

RDSO/Lucknow, through their Lr.No.STS/E/BT1 of 22/26-3-91, have recommended the following precautions to be taken for the section equipped with Neale's Token Block Instruments: -

(i) It is desirable to have metallic return to take care of multiple failures, as recommended in the Block Manual.

(ii) The block wires should be placed on top of the alignment so as to preclude the possibility of foreign feed injection into the block line.

(iii) Lightning discharger of striking voltage greater than the normal working voltage may be provided at both ends of the block line.

2.35 NEALES TOKEN BLOCK INSTRUMENT MAINTENANCE SCHEDULE

S.No	Description of Maintenance of Work	ESM	JE/SE	SE/SSE
1.	Check Locking and Sealing.	F	M	Q
2.	Check the SM's Lock-up Key working.	F	M	Q
3.	Check whether instrument is due for overhaul.	-	HY	A
4.	Check the distinctiveness of the tone of the bell when two or more instruments are provided.	-	HY	A
5.	Check the instrument is level.	M	HY	A
6.	Check the polarity of instruments.	-	Q	HY
7.	Check and ensure the full deflection of Needle Indicator.	F	M	Q
8.	Check the tokens for Burr, etc.	F	M	Q
9.	Check the token indicator is free.	F	M	Q
10.	Check the forced drop arrangement of TCF and TGT Locks. Also check the edge of the Locks for square.	F	M	Q
11.	Check the polarized relay returns to its normal position.	F	M	Q
12.	Check the Safety Catch is in position and free to move about its fulcrum pin.	F	M	Q
13.	Check the spigot for its tightness.	F	M	Q
14.	Check that token receiver can receive only the token of the correct configuration.	-	-	Q
15.	Check that the tablet releaser actuating line screws are intact.	F	M	Q
16.	Check the balancing of token is done according to the instructions laid down in the Manual.	F	M	Q
17.	Clean Rack & Pinion Teeth and lubricate with axle oil medium grade to IS:1628.	F	M	Q
18.	Inspect contact surfaces. If pitted, clean them with chamois leather.	F	M	Q
19.	Check Earth connections and Earth.	F	M	Q

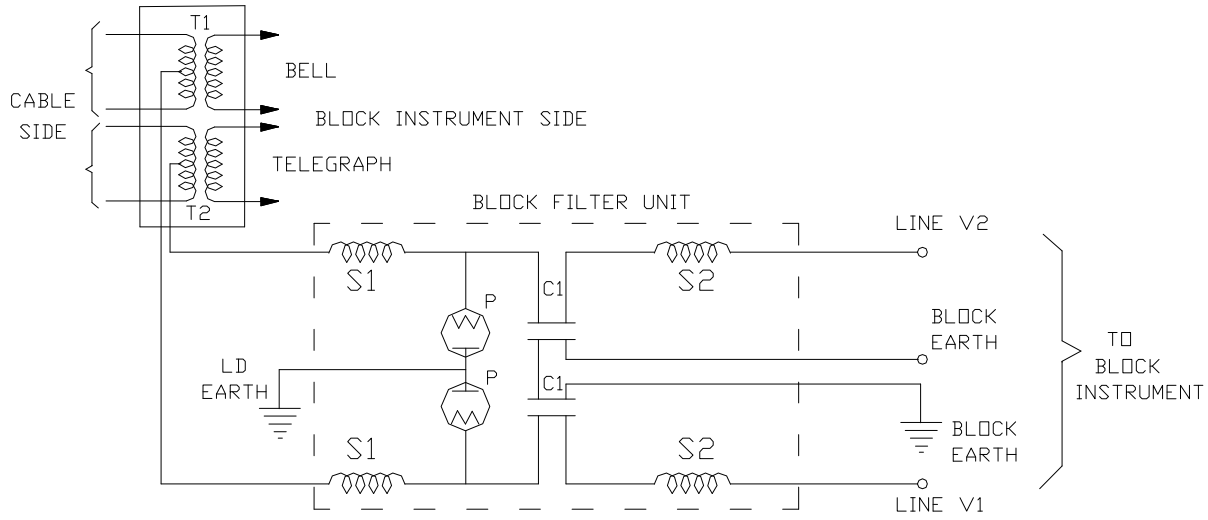
S.No	Description of Maintenance of Work	ESM	JE/SE	SE/SSE
20.	Check the telephone and telephone cord.	F	M	Q
21.	Check the Block and telephone batteries for cleanliness and voltages recorded in the card.	F	M	Q
22.	All wiring of the instruments must be checked.	-	M	Q
23.	Measure the Line current.	F	M	Q
F = Fortnightly; M = Monthly; Q = Quarterly; HY = Half Yearly; A =Annual. SE = Sectional Engineer; SSE = Senior Sectional Engineer				

2.36 MODIFICATIONS REQUIRED FOR 25KV A.C. TRACTION AREA

SGE type block instrument with certain protective devices can be used for AC Traction for double line sections. Neale's type of single line block instruments & F.M Handle type tokenless block instruments can also be used with certain modifications and protective devices. Push button type Single line Tokenless Block Instruments may be used on Non-Electrified Section taking off from Electrified section if the length of parallelism does not exceed 2.5 km. No other type of block instruments e.g. Sykes lock and block etc. shall be used on AC electrified sections unless prior approval of Railway Board is obtained. The following precautions shall be taken for SGE or Neale's. Block Instruments on AC traction: -

2.3.1 Filter Unit

(a) A filter of an approved design shall be installed between the single or double line block instrument and the line wire. The general arrangement of the filters is shown in Fig.2.28. It is essential that the line and block instrument terminals of the filters are never interchanged. The filter is a low pass filter consisting of series choke coils S1 and S2 in each line and the shunt condenser CI. The condensers adopted are 4-terminal condensers to prove the continuity of the conductors forming the condenser. Also two gaseous type lightning arrestors with a flash voltage of 150 volts are provided on the line side for high voltage protection. Two different Earths shall be provided for Discharger and Block. Separate Line Battery or DC-DC converter shall be used for each Block Instrument. This battery shall feed only the Block Instruments and not any other circuit.



T1 & T2 VOICE FREQUENCY TRANSFORMERS

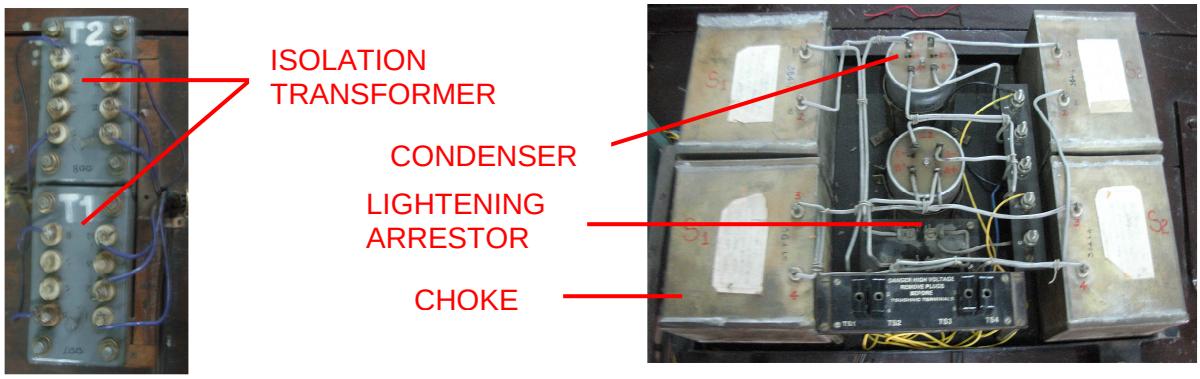
S1 PROTECTIVE CHOKE { R = 50 Ohms; Z AT 50 Hz = 40,000 Ohms; TEST VOLTAGE = 600 Volts

S2 PROTECTIVE CHOKE { R = 40 Ohms; Z AT 50 Hz = 20,000 Ohms; TEST VOLTAGE = 50 Volts

C1 4 TERMINAL CONDENSER C = 10 micro farad

P LIGHTENING ARRESTOR GASEOUS TYPE, FLASH VOLTAGE 150 Volts

Fig.2.28 SCHEMATIC DIAGRAM OF BLOCK FILTER UNIT



ISOLATION TRANSFORMER BLOCK FILTER UNIT

Fig. 2.29

(b) When a block section originates at a station in electrified area and terminates at a station in non-electrified area, filters shall be provided with the block instruments at both ends of such block section in accordance with approved instructions.

236.2 Block Bell Equipment: - It is required for generation of bell signal.

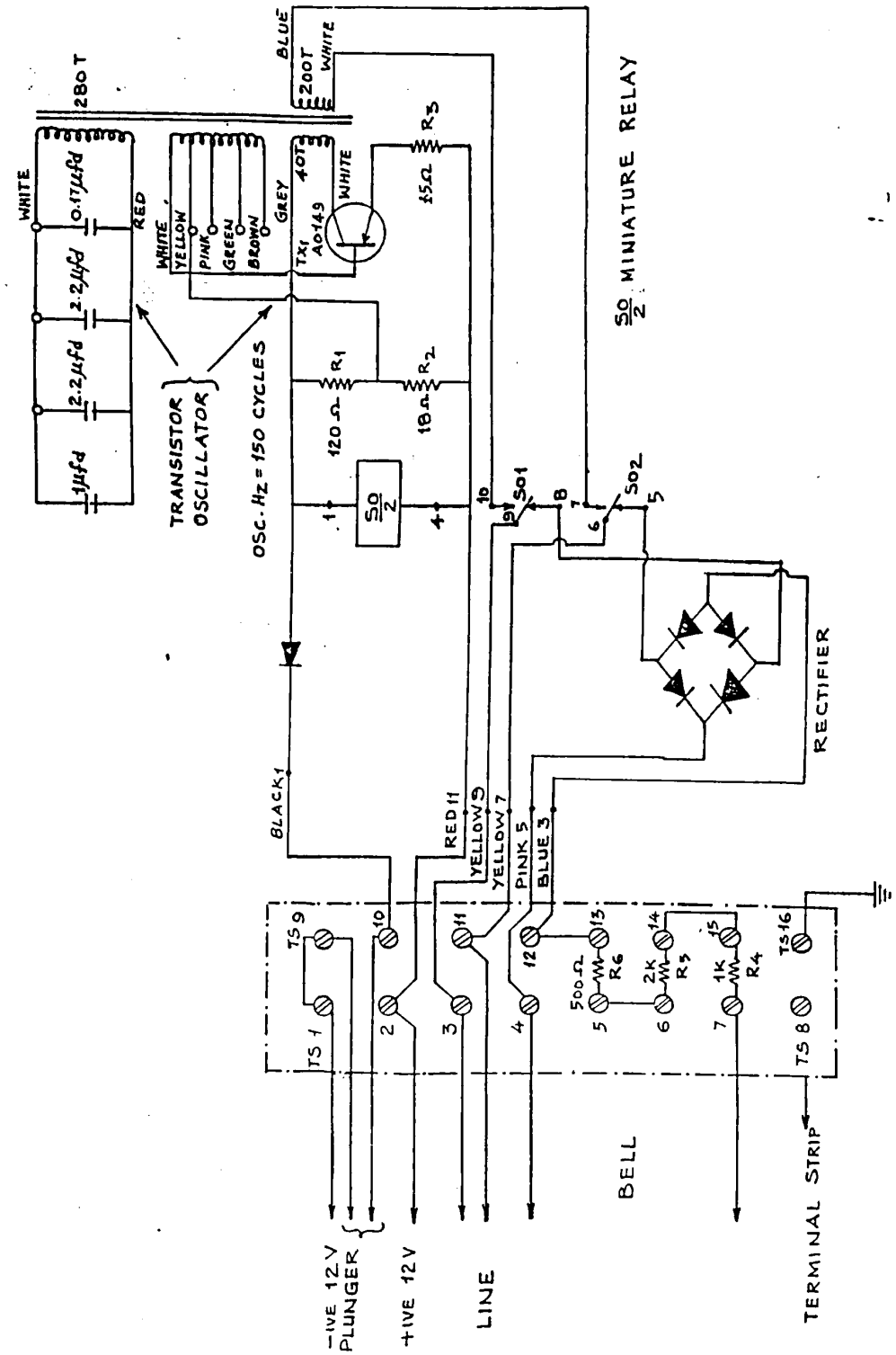


Fig. 2.30 WIRING DIAGRAM OF BLOCK BELL EQUIPMENT

(c) The 3 position polarised relay shall be installed in the same location as the block instruments. Only approved type of polarised relays (S31/80) shall be used in block instruments. The polarised relay manufactured by Eastern Railway Block Shop shall not be used on A.C. traction.

(d) The resistance of needle coil should be approximately 140 Ohms.

The block telephone of single line block instruments shall not be worked on the same line wire as the block instrument. It shall be worked on a separate pair of line wires as indicated in Fig.2.31. The figure also indicates the arrangements for block bell working for SGE. Block instruments and train wire working. For bell code signalling 150 cycles tone is either sent or received with the B relay (SO/2) in the normal position. When 150 cycles tone is received, the rectifier rectifies the same and the DC voltage developed is utilised to energise the bell relay (line type relay), which, in turn, will energise the single stroke bell. For transmission of bell code signal the pressing of the plunger will energise B relay. B relay energising will apply D.C. supply to the 150 cycles transistor oscillator, the output of which will also be connected to the line through a variable resistance, thus sending a 150 cycles tone on line.

A block telephone is connected across the line through a condenser when the B relay is normal. When the B relay picks up, the block telephone is cut off.

2.37 MODIFICATIONS IN NEALE'S TOKEN BLOCK INSTRUMENT IN 25KV RE SECTION

Before Neale's single line token instruments can be retained on AC traction, they shall be modified. The modifications to be carried out in Neale's 'A' type token instrument, along with the arrangements for connecting a block filter are shown in Fig. 2.31. In this, only one line is utilised for block instruments, and the second line is spare. The block bell circuit is as in the case of SGE block instrument. One difficulty encountered in the Neale's token instrument is that if the polarised relay PR is normally connected across the line so that with pressing of bell plunger & during the bell signal transmission the condensers of the filter gets charged, and subsequently, when the bell plunger is released, the polarized relay coming across the lines, the condensers can discharge through this relay causing it to operate and thus release the block handle locks. To obviate this eventuality, 2 relays BNPR relay and BNR relay are incorporated as shown along with two 5000 Ohms. Resistors. Of these, relay BNPR is made slow to release. When the plunger is pressed, the relay BNR is first energised, and subsequently, relay BNPR energizes over the front contact of BNR relay. With both BNPR and BNR relays energizing, the line is extended up to the commutator and D.C. signalling can be done. When the plunger is released, the relay BNR, de-energises first but, relay BNPR does not de-energise immediately as it is slow to release (0.8 Sec). Thus, the two 5000 Ohms resistors are connected in parallel across the line through the pick up contacts of BNPR relay and the back contacts of BNR relay. This enables the filter condenser to discharge sufficiently. After this BNPR relay also releases cutting off the resistors and bringing the polarized relay between line and earth for reception of signals from other station. In AC Electrified areas, identified with DC stray currents, metallic return is used. The circuit is as in Fig. 2.32.

2.37.1 Batteries:

(a) A separate battery shall be used for each block instrument. This battery shall only feed the block instruments and not any other circuits.

(b) A separate battery shall be used for external circuits, i.e., for circuits going outside the cabin location box.

(c) A separate battery shall be used for internal circuits inside a cabin/location box. This battery shall not be connected to any circuit going outside of the cabin location box.

(d) The battery for telecom. equipment shall be separate from the signalling equipment battery.

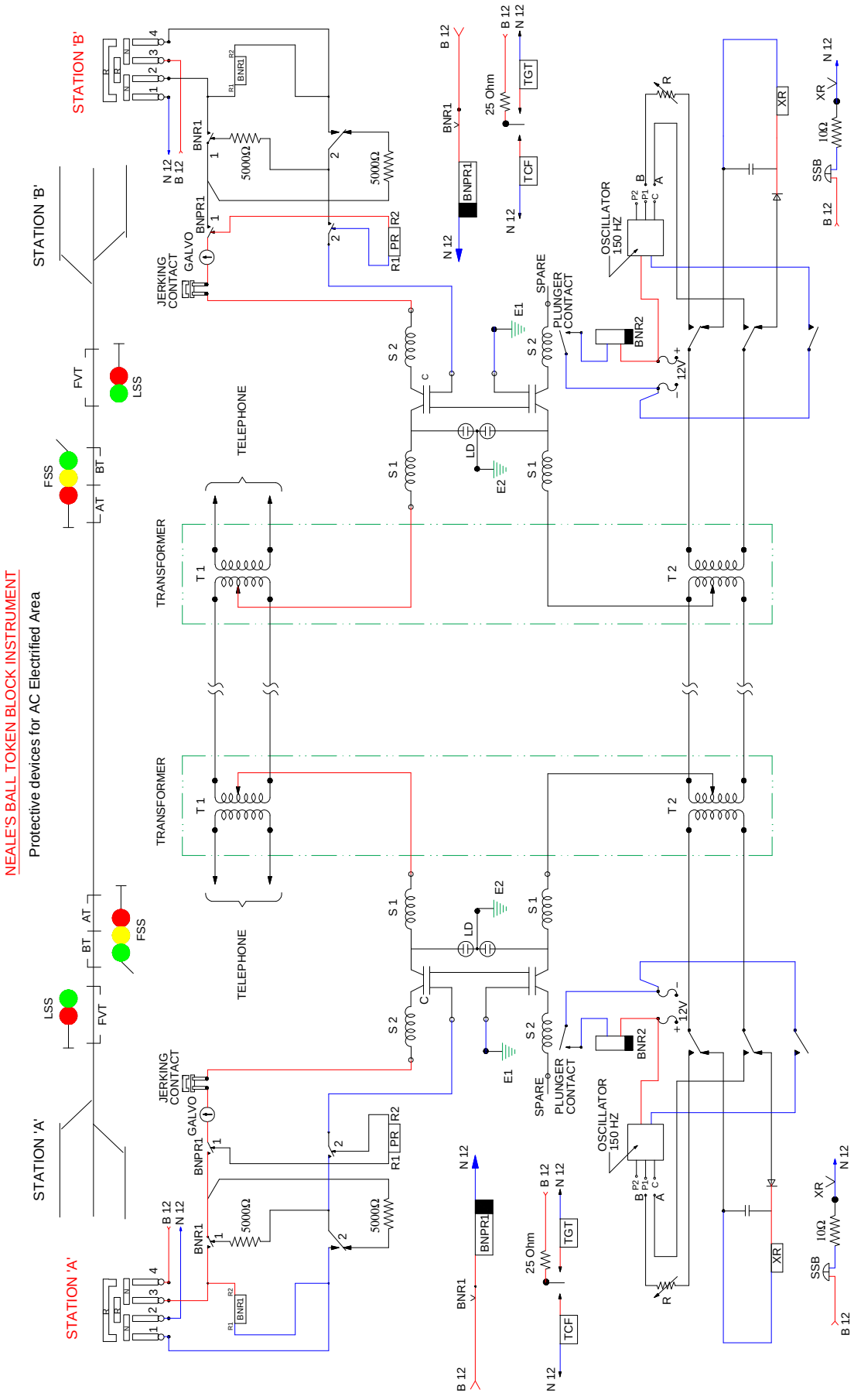


Fig. 2.31 NEALE'S TOKEN INSTRUMENT

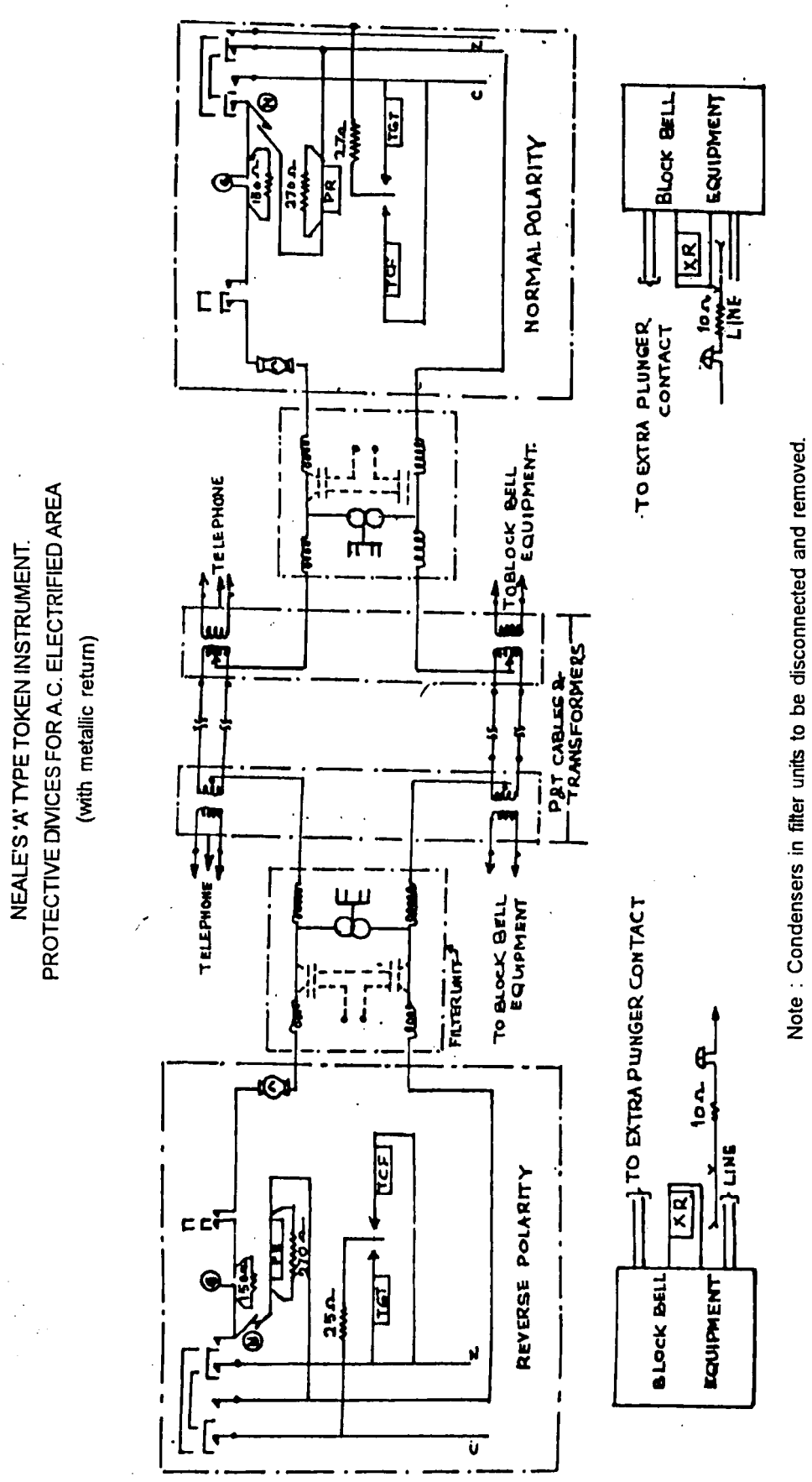


Fig. 2.32 NEALE'S TOKEN INSTRUMENT

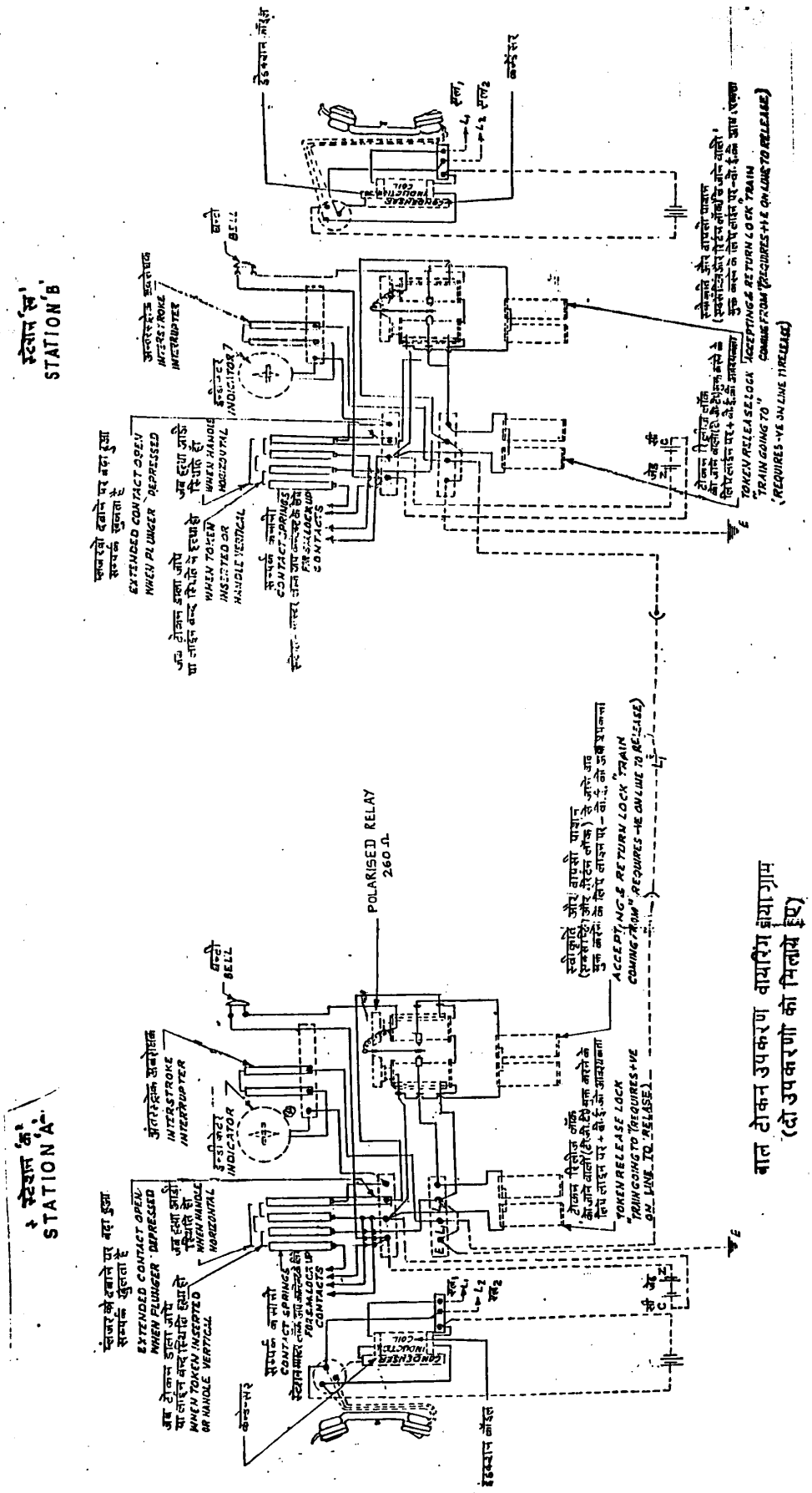


Fig. 2.33 WIRING DIAGRAM OF BALL TOKEN INSTRUMENT

CHAPTER 3: NEALE'S TABLET TOKEN BLOCK INSTRUMENT

3.1 It is similar to the Neale's Ball Token Instrument in its electrical and many mechanical features. The only point of difference between the two is that the token used in this case is a flat circular tablet, as against a round hollow steel ball. Hence, certain parts of the instrument that receive, store and deliver the tablet token have been modified to suit this configuration. A front view of the instrument is shown in Fig.3.1. In general this instrument is much smaller and lighter. It actually weighs nearly two-thirds the weight of the ball token instruments.

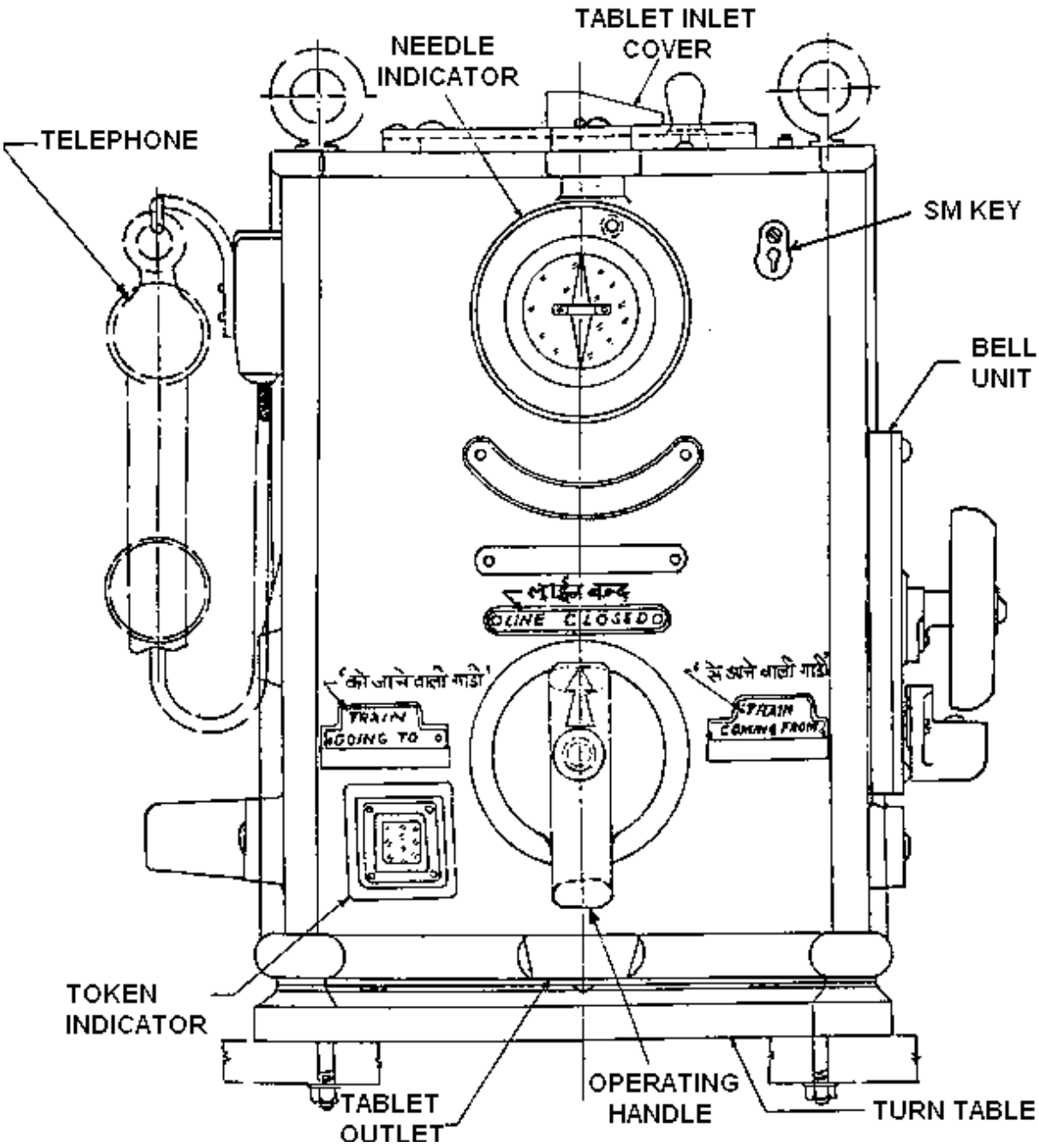


Fig: 3.1 TABLET TOKEN INSTRUMENT

3.2 CONSTRUCTIONAL DIFFERENCE BETWEEN NT BALL & TABLET B.I. DETAILS

The parts of the instrument that differ from the ball token instrument are listed below: -

(a) Tablet Tokens

(b) Top slide with handle and tablet receptacle

(c) Tablet guide rods (slide rails)

(d) Bottom slide (Tablet outlet slide)

(e) Cam

(f) Cam Strap (Tablet outlet slide lever)

(g) Tablet Releaser (Lever)

(h) Tablet Receiver

(i) Tablet Window (Token Indicator)

(j) No token indicating lock (pawl)

(k) Contact making spring assembly arrangement.

3.3 Tablet Tokens

The tokens used are steel disc tablets, got two notches; the tablets are 6 mm. thick and have a diameter of 73 mm.

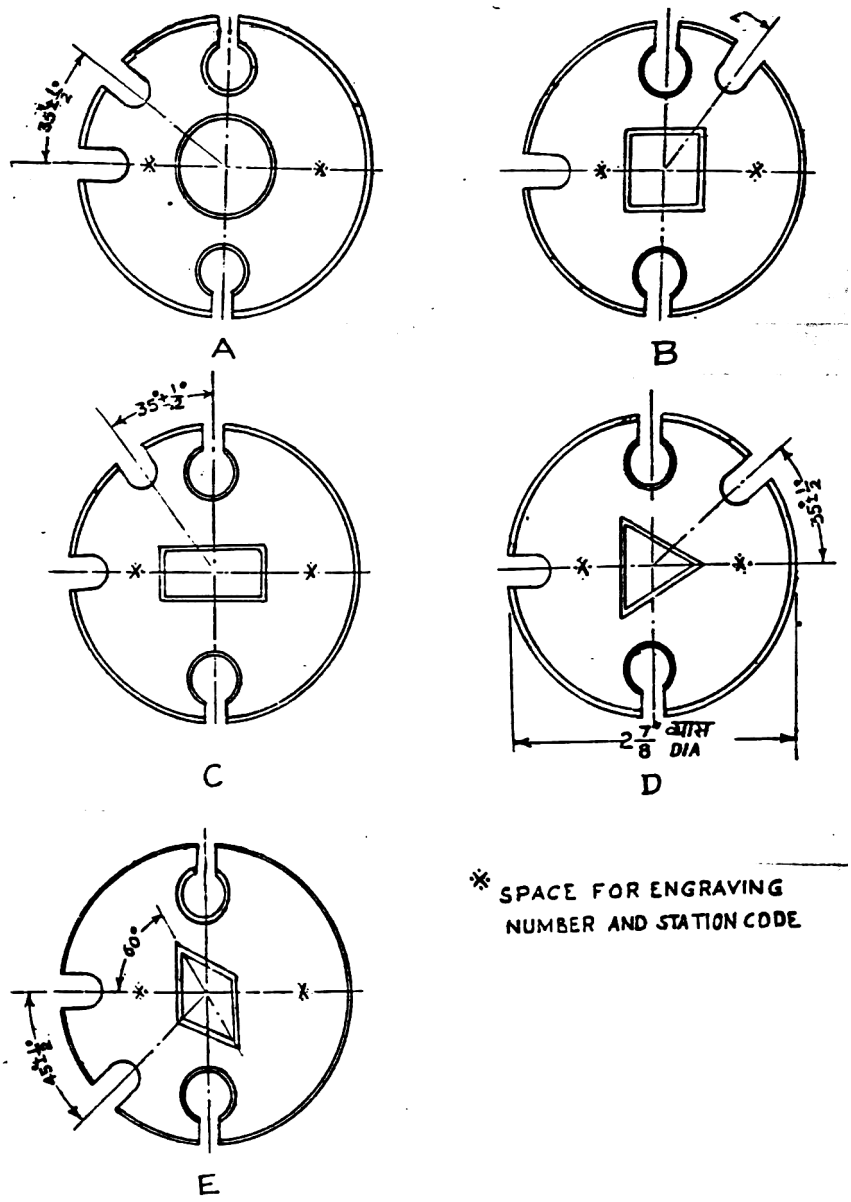


FIG: 3.2 NEALE'S TABLET TOKENS CONFIGURATIONS

Each tablet has two notches cut for guiding token into instrument, for consigning and properly storing the tablets in the instrument. Besides, these two notches two additional notches are also cut on the periphery of the tablet, the position of the notches being suitably varied to get 5 different classes of tokens for the five different classes of Neale's Tablet viz., Class A, B, C, D and E. The arrangement of notches for different classes of Tablets is shown in Fig.3.2. In order to facilitate easy identification for the class of tokens, an additional hole of following configuration is cut in the centre of each tablet.

(a) Class A - Circle

(b) Class B - Square

(c) Class C - Rectangle

(d) Class D - Triangle

(e) Class E – Rhombus

3.4 Top Slide Handle and Token Receptacle: -

It is a rectangular steel slide provided at the top of the instrument. Near its one end, a hole is cut to take one tablet corresponding to the class of the instrument. A knob or handle is provided at the other end to enable the slide to be pulled out of its housing to expose the recess to take a token and subsequently pushed in, to consign it into the instrument. The tablet receptacle has two diametrically opposite semi-circular projections to correspond with notches in the tablets.

There are two other projections located suitably on the circumference of the receptacle to correspond to the notches in the tablets determining the class of the instrument. This is again to ensure that tokens belonging to instruments of one block section cannot be wrongly consigned into the instrument belonging to an adjacent block section.

The top slide housing has a gravity operated lock pawl which prevents the slide being pushed in either with its receptacle empty or carrying objects not conforming to the standard dimensions of the tokens used.

A SM's lock is also provided to prevent unauthorised manipulation of the slide in the absence of the SM as the Key is in his custody.

3.5 Tablet Guide Rods

Two vertical cylindrical guide rods are provided, diametrically opposite each other at the right of the instrument. (Seen from the rear). They are fixed so that they align immediately below the semi-circular projections on the tablet receptacle when the top slide is pushed in with the token. This allows the tablets to slide down between the guide rods and get piled one above the other in the instrument.

3.6 Bottom Slide

As shown in Fig.3.4 It is triangular in shape, with a suitable hole to hold one tablet at one corner and two studs at the other, one stud serves to pivot the slide and the other couples it to the operating handle, through a cam strap and cam arrangement in such a manner as to rotate it over an area about its pivot with different positions of the operating handle.

In line closed position of the operating handle, it opens its recess underneath the two guide rods so as to receive the bottom most tablet and subsequently deliver it out of the instrument. In this position the tablet in its recess does not drop down because the bottom slide is resting on a guide plate at the bottom. When the operating handle is pulled out and turned from Line Closed to TGT position the bottom slide moves over an arc in an anti-clockwise direction (as seen from back side) bringing the recess of the bottom slide (carrying the token) over a sloping channel formed at one end of the bottom guide plate, leading to the exit window. So long as the handle is in its pulled position a tablet releaser comes underneath the bottom slide recess and prevents the tablet dropping down, delaying the issue of the tablet until the handle sits into its slots in the TGT position and the tablet releaser is withdrawn from underneath the bottom slide. The third corner of the bottom slide now moving under the guide rods prevents the next tablet falling on to the bottom guide plate.

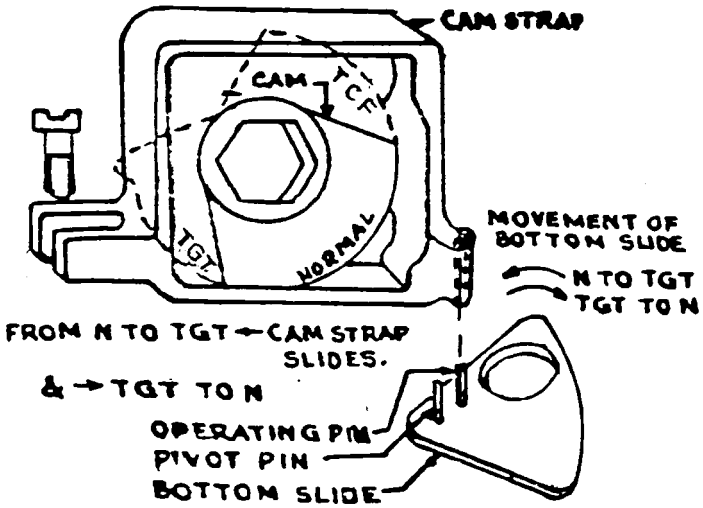
3.7 Cam

The Cam is mounted on the operating handle extension to control the movement of the bottom slide for issue of a tablet when the operating handle is turned from Line Closed to TGT position only. It also brings the bottom slide back to its initial position to accept another tablet in its recess ready for issue for the following operation, when the handle is turned back from TGT to Line Closed position. For this the cam is mounted to the bottom slide through cam strap.

3.8 Cam Strap (Tablet Outlet Slide Lever)

It is rectangular in shape, mounted so as to enclose the cam on the operating handle. One end of the strap is coupled to the operating pin on the bottom slide and the other end has an elongated slot, which is guided on a stud screwed to the base. When the operating handle is turned from Line Closed to TGT position and back, the cam displaces the strap sideways from right to left and back again as viewed from the rear side of the instrument. The bottom slide follows the movement of the strap.

The cam does not move the cam strap when the operating handle is turned from Line Closed to TCF position and back. Hence, there will be no movement of the bottom slide. The details of the cam, cam strap and the bottom slide are shown in Fig. 3.3



Viewed from Rear

Fig: 3.3 CAM, CAM STRAP AND BOTTOM SLIDE

3.9 Tablet Releaser (Lever)

This is an arc shaped lever situated near the exit window. This is operated through a link mechanism by the operating handle as shown in Fig.3.5. The purpose of this lever is to ensure that the tablet is issued out of the instrument only when the TCF lock pawl in TGT position has locked the operating handle. This ensures locking of the operating handle as it fits in the slot in TGT Position.

A collar is mounted on the operating handle. In the pulled position of the operating handle this moves the tablet releaser underneath the bottom slide recess carrying the tablet through a link mechanism. This prevents the issue of a tablet, even though the tablet on the bottom slide has been brought over the exit until the bottom handle is housed in its TGT position

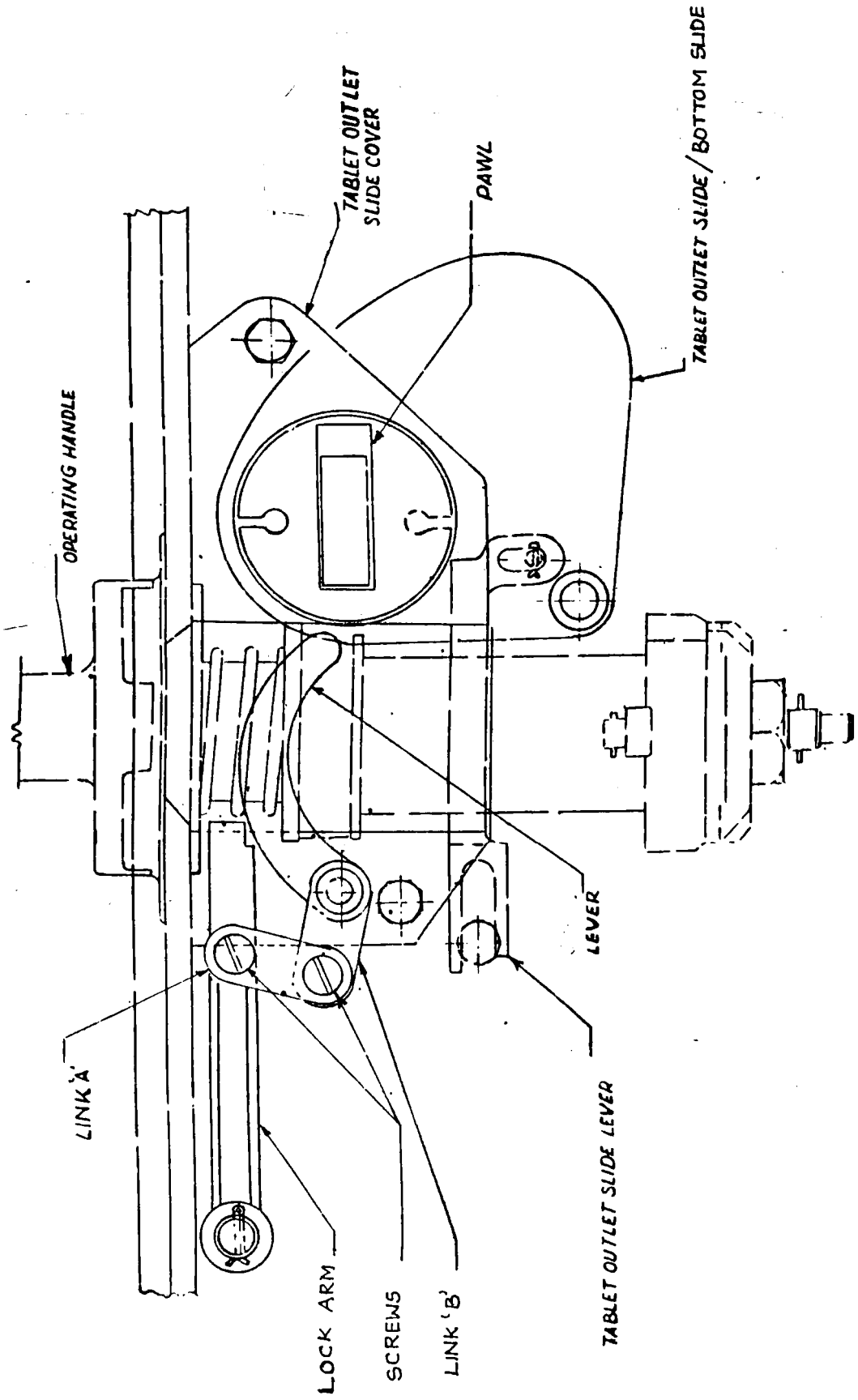


Fig: 3.4 TABLET OUTLET SLIDE (BOTTOM SLIDE)

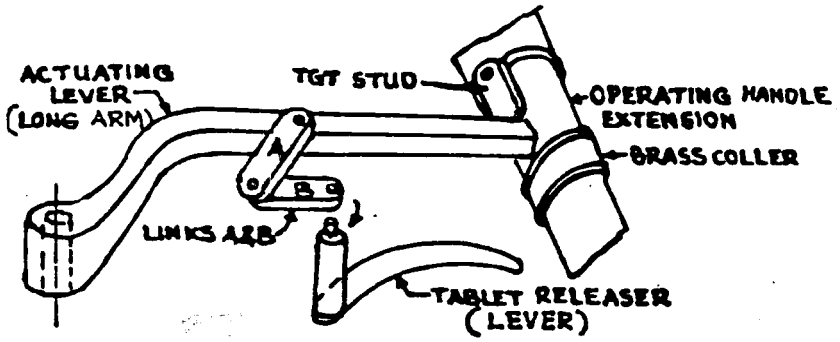


Fig: 3.5 TABLET RELEASER

3.10 Tablet Receiver

This is an extended portion of the commutator shaft which in the reverse position of the commutator (when the handle is in TGT or TCF position) allows a token consigned into the instrument through the top slide to rest on it preventing it from going right down into the bottom, along the guide rods. This serves the same purpose as the jaw on the commutator shaft in the ball token instrument. When the plunger is pressed, with the handle in any of the two horizontal positions (a tablet having been inserted already) the fork lever attached to the finger spring assembly shaft presses down the tablet along the guide rails at the same time turning the commutator to normal position.

3.11 Tablet Window (Token Indicator)

It is a small glazed opening at the bottom left of the instrument. Through this the presence of tablet lying piled one above the other in the instrument can be seen. The second token from bottom i.e., the one lying immediately above the one in the tablet receptacle on the bottom slide is the lowest tablet that can be seen.

3.12 No Token Lock (Pawl)

A small gravity operated lock pawl is mounted on the bottom guide plate so that this is normally projecting into the circular hole cut in the bottom slide. This is a small steel piece eccentrically mounted so that one end of it is projecting up, the other end being pulled down by its own weight. Because of this when the operating handle is turned from Line Closed to TGT position without any token in the instrument forward motion of the bottom slide is arrested and hence, the handle also. When a tablet is in the instrument, lying in the recess in the bottom slide, the locking pawl is pressed, flush with the guide plate by the weight of the tablet.

3.13 Contact Making Spring Assembly

The contact making spring assembly is almost similar to that of the Neale's Ball Token Instrument except the change in numbering. Ref Fig . 3.6.

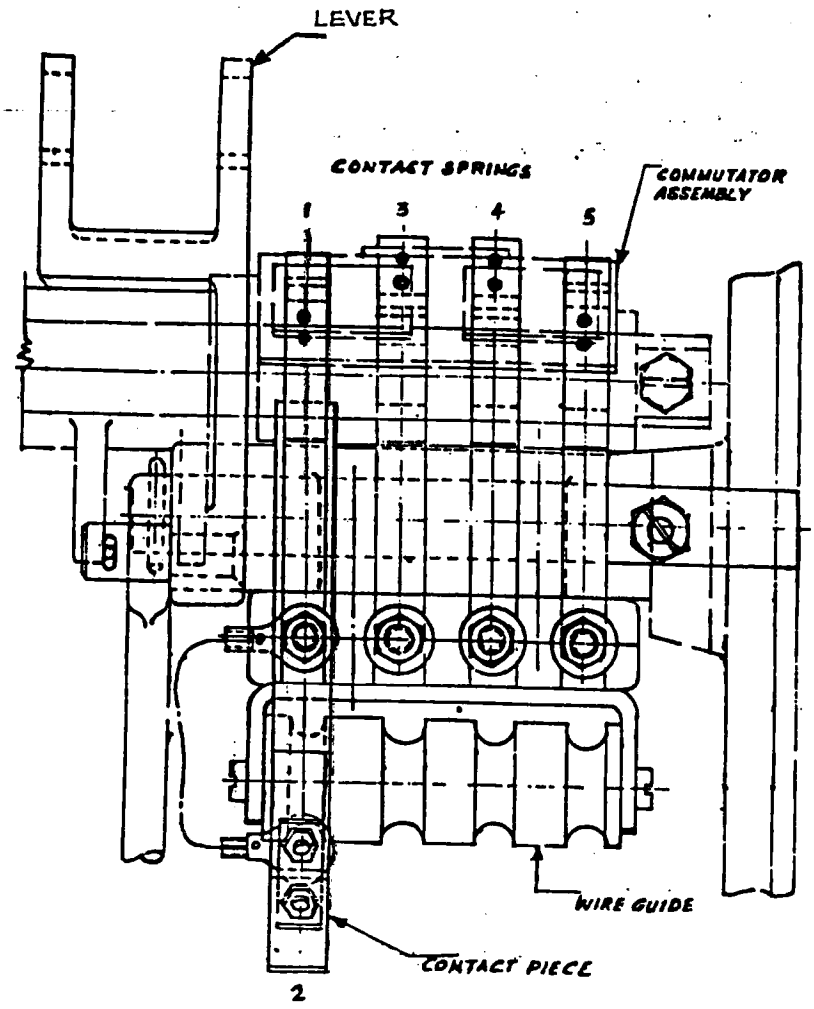


Fig: 3.6 CONTACT ARRANGEMENTS

3.14 ADVANTAGES OF NT TABLET BLOCK INSTRUMENTS

The instrument offers the following advantages over the Ball Token Instrument: -

(a) The height of the instrument is much reduced, thereby reducing the weight considerably. This is made possible because tablets occupy less space for storage in the instrument than the ball tokens.

(b) Even with its reduced dimension it can hold 40 tablet tokens as against 36 in the ball token instrument, but, normally each instrument is supplied with 16 tablets only unless otherwise stated.

(c) The absence of token races preclude the possibility of tokens jamming in the races and preventing the operating handle being turned, which sometimes causes failures in the ball token instrument.

(d) Should tablet escape from its pouch when being picked up or dropped by a run through train, the possibility of its rolling away and getting lost is remote, because it is a flat object.

(e) Sequence of tokens is maintained. Hence, the number of tablets in the instrument can be verified from Train Signal Register and any cancellations done, but not entered in the Register could be detected.

3.15 The reduced dimensions of the tablet token instruments have necessitated re-orientation of the various mechanical parts. The polarised relay and the bell assembly are placed on the left (the former above the latter) as looked at from the back of the instrument. The commutator with the finger contact spring assembly is mounted on the right and the jerking contact springs behind the spring clutch shaft in the middle. Hence, the jerking contact springs and segments are not available for easy inspection as in the case of ball token instrument Ref. Fig.3.7.

3.16 All the other mechanical parts, electrical circuitry and also the methods adopted for control of Last Stop Signal are identical with the ball token instrument and thus are not repeated here.

3.17 DIFFERENCES BETWEEN NT TABLET & BALL BLOCK INSTRUMENTS

S.NO.	DESCRIPTION	NT TABLET	NT BALL
1	Token	Tablet	Ball
2	Size	Compact & Small	Large & Big
3	Weight	Light	Heavy
4	Token entry	Sliding motion by Top Slide	Rotary motion by Top Handle
5	Rest Contact	1 & 2 Contact spring	4 & 5 Contact spring
6	Token window	Only one	Five windows
7	Token Races	Not present	4 in number
8	Token storage	One above other	In token races
9	Token Delivery sequence	First In First Out	All from race 3,all from race 4,then 1 token from race 1, then all token from race 2 & finally all token from race 2.
10	Token Delivery mechanism	Cam & Cam strap mechanism	Token Selector mechanism

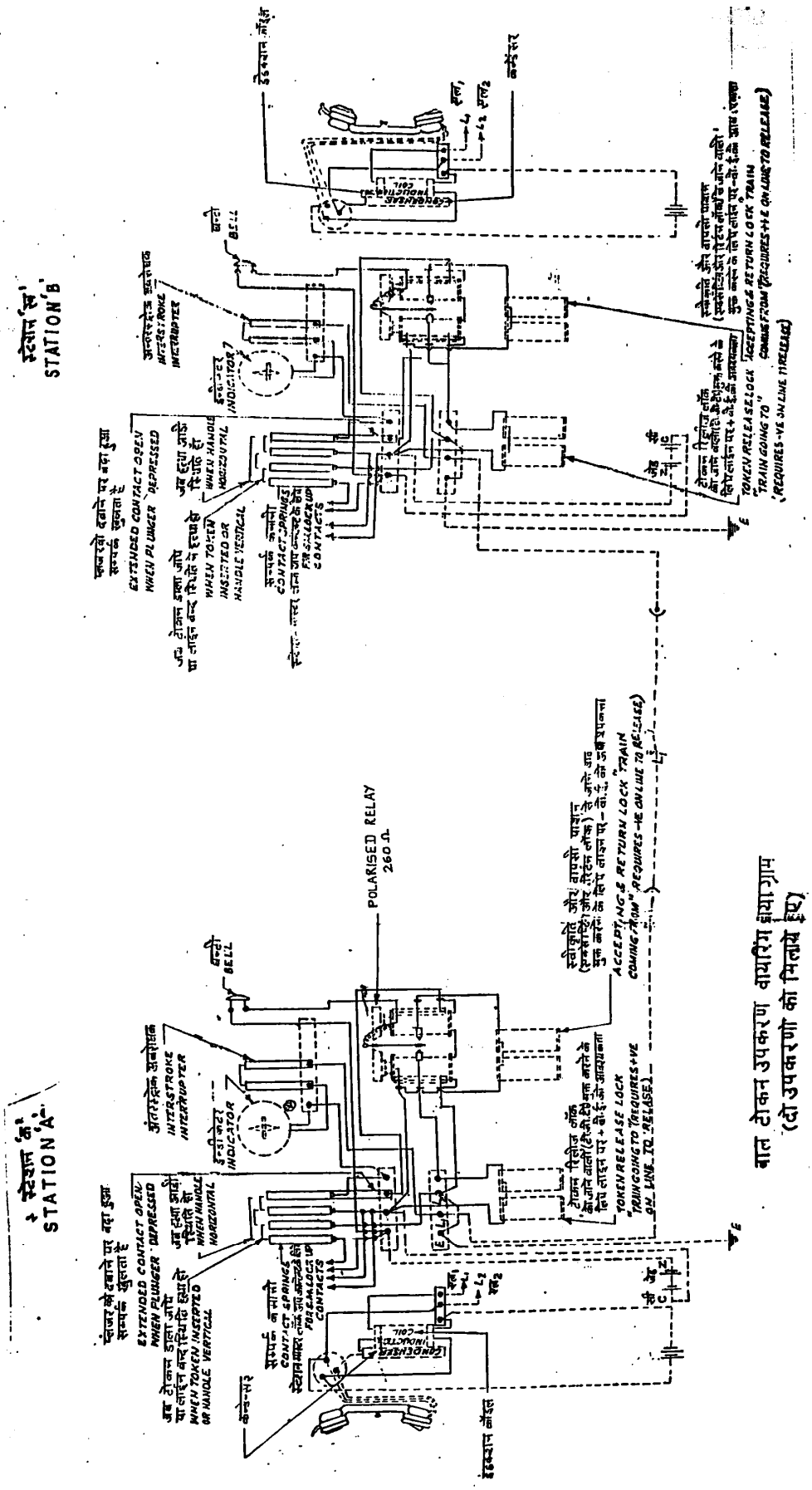


Fig: 3.7 WIRING DIAGRAM OF BALL TOKEN INSTRUMENT

CHAPTER 4: DOUBLE LINE BLOCK INSTRUMENTS

4.1 INTRODUCTION

On Double Line sections since token instrument cannot be utilized on account of uni-directional traffic, as already explained, the Authority to proceed for the driver is the "OFF" aspect of Last Stop Signal. General Rule 4.42 lays down that the Last Stop Signal shall not be taken off for a train unless Line Clear has been obtained from the Block Station in advance. It, therefore, becomes compulsory to interlock the Last Stop Signal of a Block station on Double Line with the Line Clear indication.

To ensure compliance with the rules, and for ensuring safety it thus becomes necessary to interlock Block Signals with Block Instruments, and, thus, we get, what is known as the Lock and Block working. In this method the Signal and Block indications can never conflict. The object of 'Lock and Block' working is, thus, to ensure that a train which has been accepted and signalled forward must clear the section and also signals replaced to danger behind it before a following train can be accepted and signalled forward. 'Lock and Block' is defined as a system of Block Signalling wherein the passage of trains electrically controls the Block Instrument, which in turn electrically controls the signals.

4.2 SALIENT FEATURES OF DOUBLE-LINE BLOCK INSTRUMENTS (SPECIFICATION NO.IRS S22-91)

4.2.1 System Composition

The following components shall be provided within the Block Instrument:

a) Needle type visual indication (upper and lower) indicating "Train on Line", "Line Closed" and "Line Clear" on Segments coloured red, white and green respectively;

b) A Commutator;

c) A Bell Plunger;

d) A Block Bell;

e) A H.M.T. set with induction coil and condenser; and

f) 3-position polarized relay when required by the purchaser.

The block handle shall be provided with electro-mechanical locking device with forced dropping arrangement, which shall lock the handle after it is turned from "Line Clear" to "Train On Line".

4.2.2 Indications

The instrument shall be provided with two sets of needle type visual indicators, one for UP direction movement and the other for Down direction movement.

The top set of indicator shall normally indicate the state of block section for trains proceeding from the station, and the bottom set of indicator shall normally indicate the state of block section for trains approaching the station where the block instrument is situated.

Each set of visual indicator shall give the following indications:

The "Line Closed" indication shall appear when there is no train in the block section and permission has not been given for any train to enter it (Needle vertical on white segment).

The “Line Clear” indication shall appear when permission has been given or received for a train to enter the block section (Needle deflected right on green segment).

The “Train On Line” indication shall appear when the block section is occupied by a train, or in case of any other obstruction (Needle deflected left on Red segment).

The above indication positions shall be achieved through mechanically operated block handle. The “Upright position” of the handle indicator shall show “Line Closed”, about 20º towards left shall show “TOL” and 20º towards right shall show “Line Clear” positions.

“Train On Line” shall be white letters on red background, “Line Closed” shall be black letters on white background and “Line Clear” shall be white letters on green background.

4.2.3 Controls

The instrument shall be such that the Station Master has to go through one or more definite operations of the block handle in addition to the working of Bell Plunger before he can normalize the block instrument for closing the Block Section after the operation of Block Handle to “Line Clear” and “TOL” position.

The last stop signal cannot be taken “OFF” unless the instrument at the block station in advance has been operated showing “Line Clear” indication in the bottom indicator, and the instrument at the block station asking for “Line Clear” showing “Line Clear” indication in its top indicator.

The instrument provides means for exchange of bell codes by the operation of a single stroke bell.

The last stop signal of the block station shall be replaced to “On” automatically by the entry of the train into the block section and shall be maintained in that position until whole of the train has cleared the block section and the instrument has been put back to “Line Closed” position; and fresh “Line Clear” has been granted by the station in advance.

Block handle of the block instrument at the receiving end can be turned from “TOL” to “Line Closed” position only after whole of the train has arrived, the Block clearance track has been occupied and subsequently cleared by the train and the reception signals have been put back to “ON”.

4.2.4 Cancellation of Line Clear

Provision shall be made for cancellation of “Line Clear” already granted and such cancellation shall be recorded.

It shall be possible to cancel the “Line Clear” already granted only if the train has not entered the block section.

The initiation of the cancellation procedure shall immediately replace the last stop signal to “ON”, if it had already been taken “OFF”.

Arrangement shall be made to prevent the operation of block handle for cancellation of “Line Clear” when the Station Master’s key is out.

4.2.5 Electrical Circuits

The instrument and the electrical circuit shall be so designed that all requirements of safety of train working are fully complied with.

All equipments in external circuits shall be provided with cross protection and shall be immune to false operation by stray currents.

The electrical circuitry of the block instrument shall be such that the internal circuits are electrically isolated from all external circuits including signal control circuits and the line circuits.

The circuit arrangement of the instrument with the accessories shall be such that any failure of the equipment is on the safe side and does not go unnoticed.

DC Polarised, 3-position relay shall be used for block working. This relay shall comply all requirements as laid down in IRS: S31/1980.

Provision should be made such that the LSS once taken 'OFF' should not go to 'ON' when the handle is disturbed from the line clear position.

Normalistion of block instrument should be possible even if the handle is turned to 'TOL' after the arrival of the train at the receiving station.

4.2.6 General Requirements

The block instrument shall be compact and robust in construction fit to withstand rough handling.

The block instrument shall comply with the requirements as specified in IRS Drg.No.SA22781 and relevant IRS Drawings for components or any other approved drawings for the double line block instrument supplied by the purchaser

It shall have facility for easy maintenance, removal or replacement of any independent component or sub-assembly and shall not disturb the adjoining components or sub-assembly.

There shall not be any opening on the exterior of the instrument which will permit irregular access to its interior permitting irregular operation and or interference to its working parts.

All indication labels, needle indicators and other accessories shall be so fixed on the front side of the instrument as to prevent their unauthorized removal from outside.

A locking device to lock the instrument in any condition shall be provided to enable the Station Master to prevent unauthorized manipulation of the instrument during his absence SM's key, when out, shall lock the block handle, in any of the three positions i.e., "Line Clear", "Line Closed" and "TOL".

Facility shall be provided for locking and sealing the cover & not giving access to the interior of instrument.

Two block instruments provided in the same room must be fitted with gongs of distinctive tones to distinguish between the bell codes received at a station from adjoining stations. One gong may conform to IRS Drg.No.S-22912 and the other to S-22912-A..

Proper alignment of all the components in the assembled unit shall conform to the requirements as in IRS: S10-1978.

Electrical contacts and springs shall conform to the requirements as specified in Clause-9 of IRS: S23 (Pt.II).

All terminals shall be provided with washers and wiring inside the block instrument shall conform to Clause Nos.11 & 12 respectively of IRS: S23 (Part-II-1989). The wiring shall follow a colour code to Indian Standard Specifications unless otherwise specified.

A telephone instrument of an approved type shall be provided for each instrument on the left hand side. The case of the telephone instrument shall be metallic or unbreakable synthetic material to an approved specification.

Nameplates provided on front side of the Block Instrument with "UP LINE TO" and "DOWN LINE FROM" shall have sufficient space for painting or engraving the name of the station. A separate label/plate for painting or engraving the name of station at which the instrument is used shall also be provided preferably just above the needle indicator dial.

Wiring diagram should be pasted on inside of the sidewall of the cover in each instrument.

The SM lock shall be such that the key cannot be extracted in unlocked position and be supplied with female/male keys.

4.3 FEATURES OF DOUBLE LINE BLOCK INSTRUMENTS

(a) It is Non-Cooperative type block instrument

(b) All operations are carried by Receiving end block instrument

(c) It has Commutator Handle for operation & has 3 positions

  (a) Line Closed (LB)

  (b) Line Clear (LC)

  (c) Train on Line (TOL)

(d) It has Conditional TOL locking

(e) Operation of block instrument is easier

(f) Line current is 25ma

(g) Suitable both for Non-RE & RE section

For NON RE	FOR RE
a) Line wire: Three line wire & individual earth as return wire	a) Line wire 4 line wire, with Phantom circuit & earth.
b) Supply (i) Line supply 12V + line drop (ii) Local supply 12V	b) Supply (i) Line supply 12V + line drop (ii) Local supply 12V
	c) Other Equipment (i) Block bell unit (ii) Filter Unit (iii) Isolation Transformer 2 Nos.

(h) Overhauling period is 7 years.

4.4 TYPES OF DOUBLE LINE BLOCK INSTRUMENTS

There are 3 types of Double Line Block Instruments: -

(a) SGE Type (Byculla Make)

(b) Modified SGE Type (PTJ Make)

(c) IRS Type (HWH Make)

The main differences among them are

(i) Contact arrangement
(ii) Housing of components like polarised relay, Bell Assembly, Bell Relay, Telephone etc.
(iii) Design of TOL Lock (Mechanical stick or Electrical Stick).

Though there are differences in the design aspect, all the three types are approved for use in RE and Non-RE sections. A detailed study of SGE type Block Instruments is dealt in the foregoing paras.

This is a three wire three position double line block instrument. The indications for the up and down directions are controlled by one wire each and the bell and telephone are worked by the third wire, earth being employed for return circuit. In cases where interference from extraneous currents is likely to occur, a metallic return may be provided for the block lines leaving the bell communication to be worked by earth return.

4.5 FRONT VIEW OF DOUBLE LINE BLOCK INSTRUMENT

The instrument consists of two needle indicators placed one above the other. A commutator, with a bell-plunger threaded through its middle is provided below the bottom indicator. The single stroke bell for exchanging code of bell signals is provided as a separate unit. A front view of the instrument is shown in Fig. 4.1.

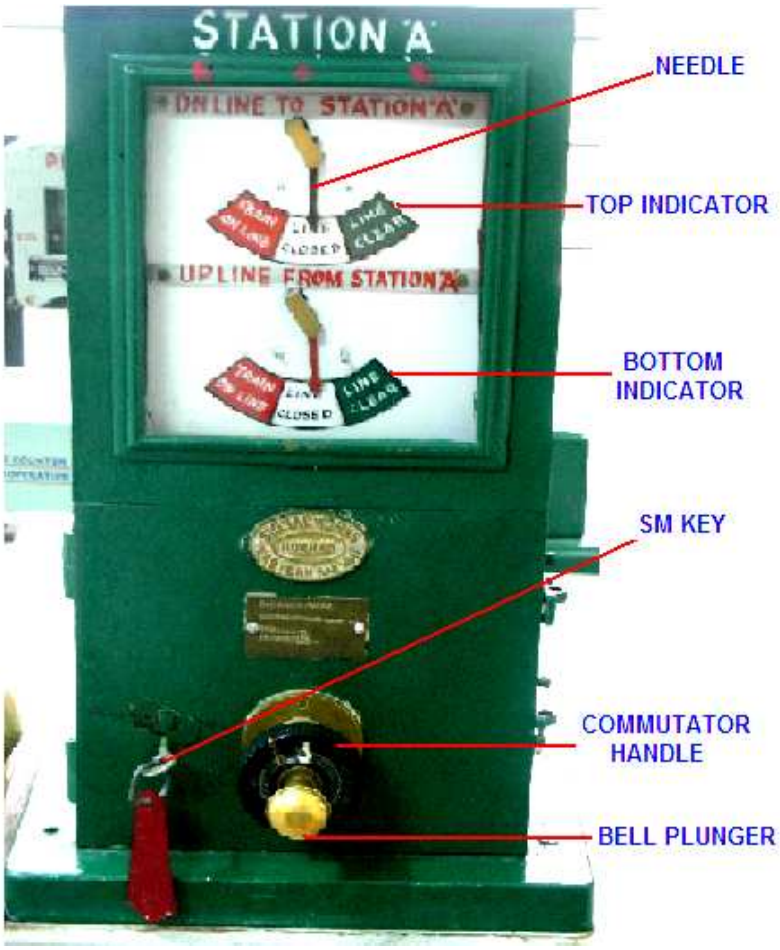


Fig: 4.1 FRONT VIEW OF DOUBLE LINE BLOCK INSTRUMENT

4.6 In this double line block instrument, the indicator that is operated by the commutator is placed above it, and only the advanced station operator operates the commutator who receives the train. Therefore, the bottom indicator of the instrument which is nearest to the commutator refers trains coming from the adjacent station to which the instrument is connected and the top indicator refers to trains going to the adjacent station of the same Block section.

4.7 This is a simple block instrument wherein the advanced station operator has to operate the commutator of his instrument during the three stages of receiving a train i.e., i) while granting 'Line Clear' (ii) when the train has entered the block section at the rear station and (iii) when the instruments are again normalised after the complete arrival of that train. By providing an electric lock on the commutator when it is in the "Train on Line" position and by adding other controls in the form of external circuits advantages of Lock & Block working are obtained electrically. The indications of the Bottom indicator correspond to the positions of the commutator.

4.8 CONSTRUCTION OF DOUBLE LINE TOKENLESS BLOCK INSTRUMENT

The parts of the instrument are described below: -

4.8.1 Top Indicator (Upper Needle)

It is a polarised indicator. The needle of the indicator normally hangs down vertically due to gravity, from its top, and points to "Line Closed" indicating on the dial. This indicator is connected by a line wire to the bottom indicator (Lower needle) of the instrument at the other end of the Block Section so that whenever a battery is applied to this line by the commutator at the distant station (advanced station) being turned this indicator shows 'Line Clear' or 'Train on Line' according to the polarity on the line. When the commutator is operated and the battery negative on line energises this indicator, it deflects to right and the arrow points to 'Line Clear' indication on the dial. When battery positive on Line actuates the indicator the needle deflects to left and points to 'Train On Line' indication. As already said this indicator refers to train going away from the station into the concerned Block Section. The coil of this indicator is wound to a resistance of 140 Ohms and it works on an operating current of 17 to 25 mA.

4.8.2 Bottom Indicator (Lower Needle)

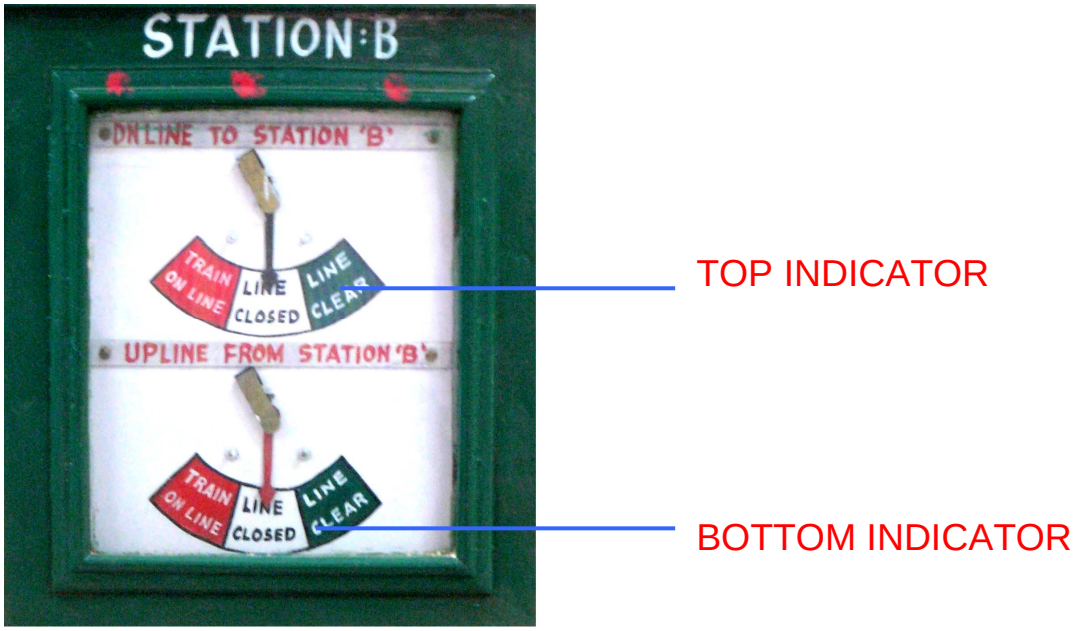


Fig: 4.2 BOTTOM INDICATOR

This is identical to the top indicator. This being the indicator nearest to the commutator, is operated whenever the commutator is turned. Whenever the train receiving station (advanced station) operates the commutator this indicator shows 'Line Clear' or 'Train On Line' depending on whether negative or positive polarity respectively is applied to Line through this indicator. This indicator is connected electrically to the top indicator of the instrument at the rear station. So, whenever the commutator is operated this indicator at the advanced station and the top indicator at the rear station show the same indications (which are of course dependent on the direction of the current on Line). The coil of this indicator is also wound to a resistance of 140 Ohms and it works on an operating current of 17 to 25 mA. This indicator refers to trains coming towards the station. This indicator is also known as TCF Indicator.

4.8.3 Block Bell Relay

A single stroke block bell is worked by a relay. The resistance of this relay is 500 Ohms and it requires a minimum operating current of 7.5 mA. The relay and the bell form a separate unit. A separate line wire works the bell relay.

4.8.4 Block Bell

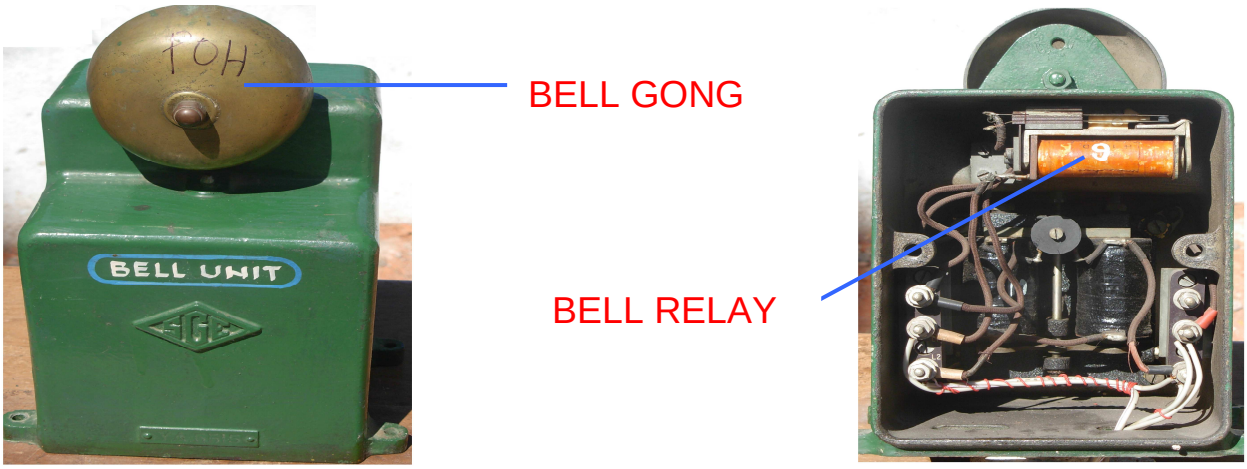


Fig: 4.3 BLOCK BELL UNIT

This is a single stroke bell actuated by the bell relay. The resistance of the bell coil is 60 Ohms. It requires a minimum operating current of 85 ma, whenever the plunger at the distant station is pressed, this bell registers one beat.

4.8.5 Bell Plunger

This is threaded through the centre of the Commutator Handle. The metallic end of this plunger rod normally bridges, two springs, one connected to the bell relay coil and the other to the bell line. When the plunger is pushed in, its end breaks the normal connection and connects the line spring to another spring, which is connected to the bell battery positive. Thus every time the plunger is pressed, the battery positive is applied on the bell line completing the circuit through the bell relay at the distant station and earth. Thus the bell at the distant station is actuated when the plunger is pressed.

4.8.6 Commutator Handle

Commutator Handle turns to 20^0 left and to 20^0 right from the vertical position, marked by an arrow. The movement of the Handle causes the Commutator Disc and the Commutator to turn. The Bell plunger is threaded through the centre of the Commutator Handle. A disc called Commutated Disc mounted below the Bottom Indicator in the middle of the instrument is attached to the Commutator Handle.

Fig: 4.4 COMMUTATOR HANDLE AND BELL PLUNGER

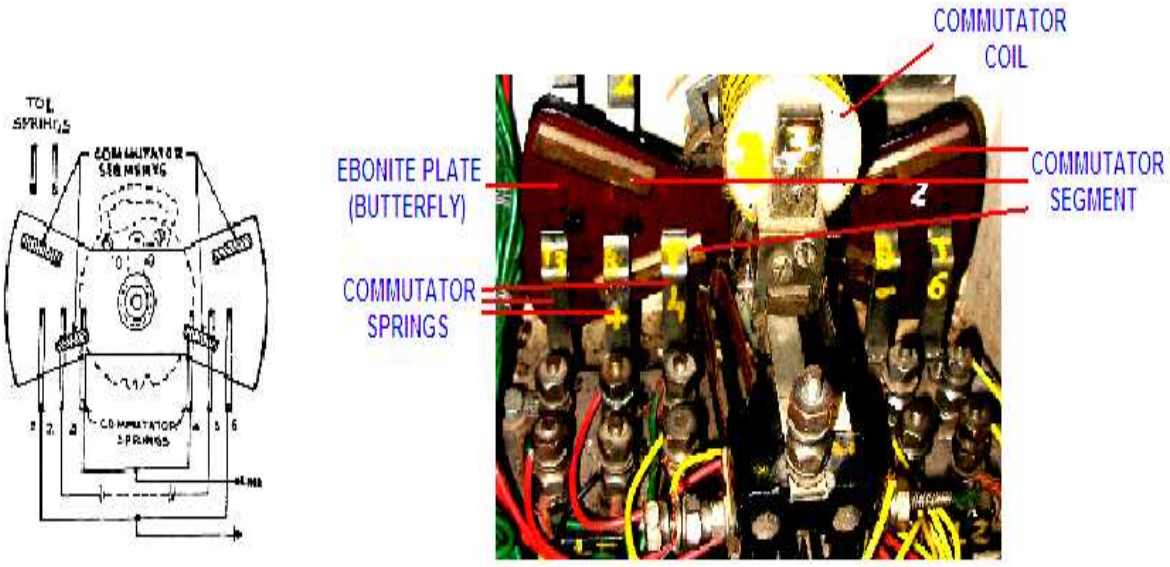
A pin called Commutator Pin on the Bell plunger when at rest passes through this Commutator Disc and the back of the front cover plate and therefore, prevents the Commutator from being turned when the plunger is pressed. The pin moves out of the back of the plate thus releasing the Commutator for its operation. The Commutator Handle cannot be turned from one position to the other unless the Bell plunger is pressed. This means every time the Commutator has to be turned, the Bell plunger must be pressed. Incidentally single stroke Bell is actuated at the other end drawing the attention of the SM, whenever the Commutator is turned.

(a) Commutator

To bring 'Line Clear' indication in the bottom indicator of that instrument and the top indicator of the interconnected instrument, the Commutator Handle is turned clockwise through about 20^0 from Normal (Line Closed). It is turned anti-clockwise through the same angle from the mid-position to get the 'Train On Line' indication in the respective indicators. The commutator disc moves over a spring loaded ball at its bottom, which gives easy movement to the commutator. A fan shaped ebonite plate is attached to the commutator disc. This plate carries four commutator segments. There are six commutator springs, mounted in front of the commutator segment bearing plate. In the 'Line Closed' position of the commutator the contact segments are free of the commutator springs. The first and sixth springs, as seen from the rear are connected to earth, the third and fourth springs to the line, the second spring to battery positive and the fifth spring to battery negative.

When the commutator is turned to the 'Line Clear' position, the top contact segment on the left (as viewed from the rear) puts through the battery positive to earth and the bottom segment or the right connects battery negative to line. Thus negative polarity is connected to line through the bottom indicator of the instrument. This brings 'Line Clear' indication at the bottom indicator at the advanced station and the top indicator of the rear station instrument. When the commutator is turned to the 'Train On Line' position, the top contact segment on the right connects battery negative and Earth springs and the bottom contact segment on the left connects battery positive and line springs. Thus the polarity to line is reversed and the indications of the indicators of the two instruments of the section also change to 'Train On Line'.

In the 'Train On Line' position of the commutator, the top contact segment on the other side of the ebonite plate puts through two TOL springs. This contact is included in the Block Clearance Circuits.



4.5 COMMUTATOR SEGMENT ARRANGEMENT (S.G.E)

(b) Commutator in the modified SGE instrument of S.Rly PTJ Make

This design is different from the Central Railway Byculla make (SGE). In the Southern Railway PTJ make instrument the commutator shaft carries six rotary contacts. Six segments are mounted on a shaft and six contact springs are fixed vertically on either side of the segments on to the base for this purpose.

Use of contract springs:

(a) Two pairs of springs - used for Line Clear Indication circuit.

(b) Two pairs of springs - used for Train on Line indication circuit.

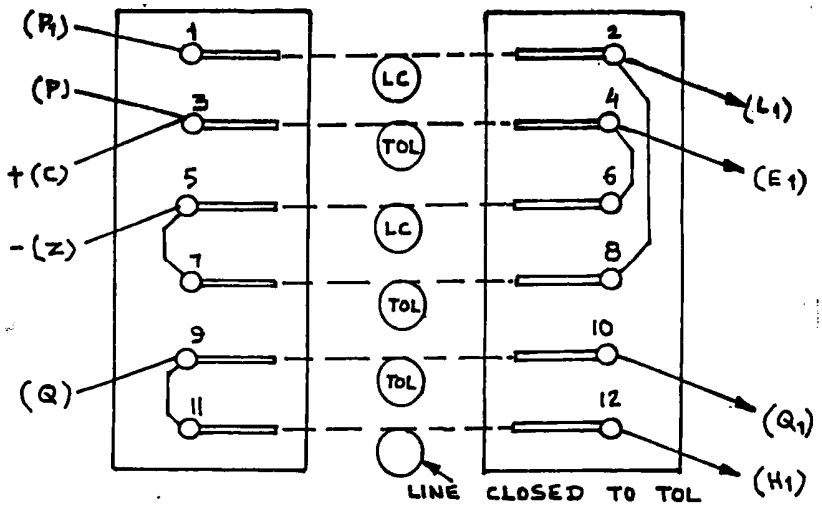
(c) One pair of springs - used for initiation of block clearance circuit. (i.e. ZR circuit)

(d) One pair of springs - used for completion of Block clearance circuit (i.e. ZR and its stick circuit)

1) **2)** **3)**

CONTACT SPRINGS IN
1) IRS DOUBLE LINE BLOCK INSTRUMENTS IN HWH MAKE
2) MODIFIED SGE DOUBLE LINE BLOCK INSTRUMENT PTJ MAKE
3) SGE DOUBLE LINE BLOCK INSTRUMENT BYCULLA MAKE

4.6 COMMUTATOR SEGMENT ARRANGEMENT IN DOUBLE LINE BLOCK INSTRUMENT



4.7 COMMUTATOR CONTACTS (REAR VIEW) In S.RLY PTJ MAKE

(c) Commutator in the IRS double line block instrument of E.Rly HWH Make

In the E. Railway HWH make instrument, the function of commutator is achieved with the design of 9 way drum with slotted segments. The contacts close when split spring strips are made to move over these segments, when the commutator is operated as shown in Fig 4.6 (1).

4.8.7 Lock on Commutator Handle

A lock is provided on the Commutator Handle in order to fulfill the essentials of (Lock and Block Working) interlocking between signals and Block instrument on Double Line. Means shall be arranged to prevent Line Clear being given by the Block station in advance, until the preceding train has cleared the Block Section, the overlap and also the Reception Signals have been replaced to' ON ' position.

The Commutator Handle is free to be turned

(a) From Line Closed to Line Clear
(b) From Line Clear to Line Closed. and
(c) From Line Closed to Train on Line.

The lock is effective only in TOL position, that too 'conditionally' such that

(i) The commutator Handle is locked when it is turned from Line Clear to TOL in connection with a running train for which Line Clear has been granted and the lock is released electrically by the arrival of the train for which Line Clear is granted. and

(ii) The Commutator Handle is not locked in TOL position when it is turned directly from Line Closed to Train on Line in connection with a *non-running train* (i.e. in case of Block Forward for shunting in advance of LSS at the rear station). As there is no lock in TOL position when the commutator is turned directly from Line Closed to TOL for Block Forward operation, the commutator is brought back to Line Closed position after the shunting train returns clearing the FVT. This helps to restore SR at the rear station, which is de-energised during shunting over FVT. Otherwise SR drops due to shunting over FVT cutting off the stick feed to SR and resulting in Failure of LSS when Line Clear is granted for a train after the Block Forward shunting operation.

(a) Conditional TOL Locking by Mechanical holding: -

The Lock on commutator is also called ‘Door-Lock’. This conditional Locking on Commutator is achieved by a special mechanical arrangement called Door Lock mechanism in SGE type (Byculla C.Rly make and HWH E. Rly make). The armature of the electromagnet is normally (i.e. when not energised) prevented from falling on the commutator disc due to a mechanical catch (Holding Pawl). When the commutator is turned to the "Line Clear" position from Line Closed, the pin of the bell plunger pushes the holding pawl aside and the armature drops on the periphery of the commutator disc. Normally. A small releasing lever at the top rests on a holding pin at the back of the holding pawl at its top end. When the holding pawl moves aside this lever drops as it is pivoted at one end and has the releasing bracket attached to its middle. This release lever on falling down comes to rest on a resting pin and presses against the holding pin and prevents the holding pawl from returning to its original position. After having been turned to 'Line Clear' if the commutator is turned to 'Train On Line' position the armature, resting on the commutator disc, drops into the locking notch of commutator. This locks the commutator and it can be released only when the door lock coil is energised and its armature attracted out of the notch, which will happen only when the train for which Line Clear was granted has arrived inside the block clearance point at the advanced station and the reception signals have also been put back to danger behind the train, satisfying the conditions of Lock and Block working When the door lock coil is energised the attracted armature lifts up the releasing bracket which in turn pushes up the release lever. The release lever having been lifted and there being no obstruction against the holding pin, the holding pawl swings back to its normal position below the armature ready to catch the latter when it drops down after the door lock coil having been de-energised. If the armature should get struck up due to residual magnetism or any mechanical defect there would not be any locking of the commutator in the TOL position, the instrument would become a "free" block instrument instead of "Lock & Block". In order to prevent this Locking bracket is attached to the top of the commutator disc, so that when the armature is attracted out of the Locking notch of the commutator disc when the door lock coil being energised, it gets into the notch of the Locking bracket and during the operation of the Commutator Handle from TOL to Line Closed, the armature is forced dropped.

In the latest instruments the notch cut on the bracket is made sloping (instead of a rectangular one), so that if the armature once electrically attracted out of the locking notch of the commutator disc and held up due to residual magnetism or a mechanical defect it shall be forced down on its holding pawl when the commutator is turned from TOL to Line Closed position, thereby avoiding a failure, which would otherwise result in suspension of Block Working. In normal working the Block Clearance circuit is so arranged that after the arrival of the train inside the Block clearance point, when the Home Signal lever is replaced to Normal, and the Bell Plunger pressed, the door lock coil is only momentarily energised, to release the locking from the commutator disc and the armature would come to rest on the holding pawl after the coil having been de-energised.

Since the entire safety of Block working depends on the proper functioning of the Commutator Lock, it is vital that the functioning of Commutator Lock and Door Lock Mechanism is thoroughly checked and attended to during the periodical overhauling. It should also be checked carefully and thoroughly during the periodical inspections by JE/SE/SSE of the section as ready laid down to avoid unsafe conditions.

The details of the door lock mechanism are shown in figure 4.8 below: -

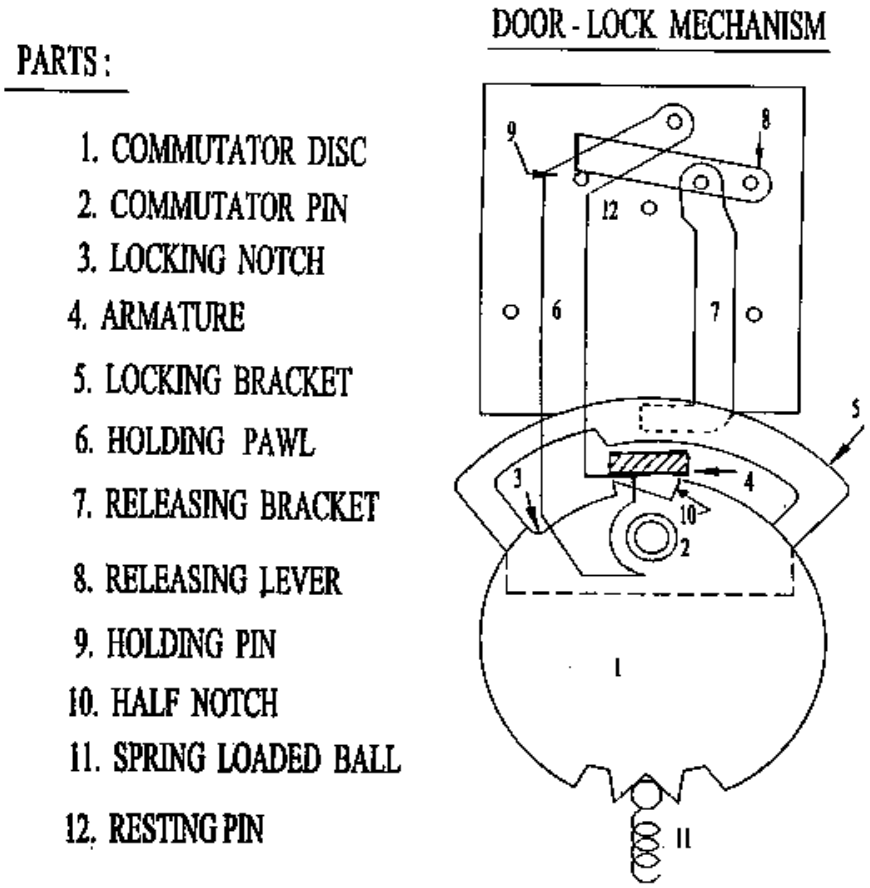


FIG. 4.8 SGE INSTRUMENT DOOR LOCK ARRANGEMENT

The door lock coil is wound to resistance of 50 Ohms and requires a working current of 200 ma.

(b) Conditional TOL Locking by Electrical means of holding: -

In S.Rly PTJ type modified Block Instrument the conditional locking on the Commutator Lock/TOL Lock is achieved by using additional Commutator Contact called TOL/LB and the associated relay eliminating the mechanical components of Door Lock Mechanism available in the other two types namely Byculla and HWH.

4.8.8 Half Notch / Auxiliary Notch

We have seen from the circuit that the SR relay that is dropped at the sending end on entry of the train in the Block Section picks up when the commutator is turned to TOL at the receiving end. SR once picked up gets a stick feed so that a subsequent change of PR relay contact does not affect SR. For reason of safety it is essential that the commutator having been turned to TOL allowing SR to pick up at the distant end must get locked in TOL position. Vide SEM 18.16. The commutator handle is locked first before the' Train on line' indication appears on the indication when the handle is turned from ' Line clear' to 'Train on line' position.

If the turning of commutator is done sluggishly a situation may arise in that the TOL contacts are made, but the commutator is not locked in TOL position as shown in Fig. 4.9(i).

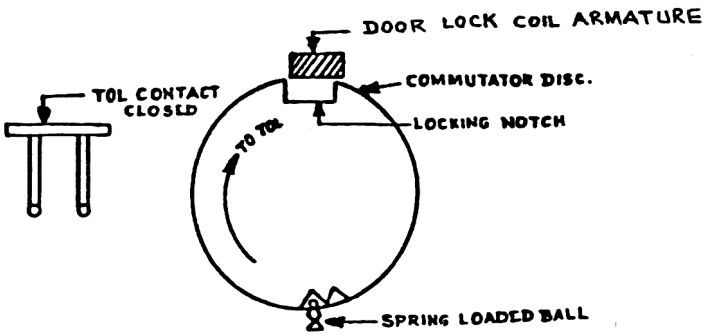


Fig: 4.9 (i) COMMUTATOR DISC WITHOUT HALF NOTCH
Unsafe Condition: TOL contact Closed but Commutator not Locked.

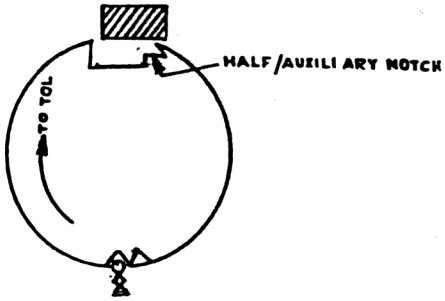


Fig : 4.9 (ii) COMMUTATOR DISC WITH HALF NOTCH

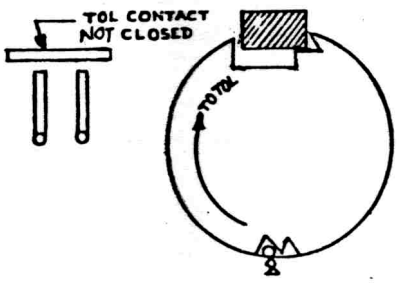


FIG. 4.9 (iii) COMMUTATOR DISC WITH HALF NOTCH (CONTACT NOT CLOSED)
Safe Condition: Armature falls in to Half Notch to lock the Commutator well in advance of TOL Contact Making

Under this condition even though a train has occupied the Block Section the commutator can be normalised and second line clear granted which is unsafe.

With the provision of Half /Auxiliary Notch as shown in Fig. 4.9(ii) in the same situation the commutator is prevented from being turned to line closed and therefore, the possibility of granting another line clear is avoided. (Refer Fig.4.9).

4.8.9 Polarised Relay

In lock and block the clearing of the last stop signal at a station must be dependent on the 'Line Clear' indication on the Block Instrument. As there are no relays in this instrument, a separate polar relay has to be included in series with the top indicator and the last stop signal is controlled through the same. The relay has one arm with three positions. When there is no current flowing through the relay the arm remains in the centre. With the Line Clear indication on the top indicator the direction of current through the relay is suitable to move the arm to the line clear position to complete the last stop signal control circuit. In the Train On Line (TOL) position of the indicator the direction of current is suitable to complete the circuit for a stick relay, the front contact of which is included in the last stop signal control circuit. The IRS specification of this polarised relay is S31 / 80 and having a coil resistance of 77 Ohms, it works on a rated current of 25 mA.

4.9 DOUBLE LINE BLOCK OPERATION

The following is the method of Double line block working in dispatching a train from station A to B.

S.No.	Sending Station 'A'	Receiving Station 'B'
1	Call 'Attention' & on getting acknowledgement attend telephone	
2		Acknowledges 'Attention', attends telephone & gives out station name.
3	After ensuring the correct station from which 'Line clear' is required, gives train number & its description for which 'Line clear' is required.	
4		After ensuring correct station to which 'Line clear' is to be given, repeats train number & its description. If the conditions for granting 'Line clear' are complete, gives private number.
5	Repeats the Private number.	
6		Says it correct.
7	Gives call 'Attention'	
8		Acknowledges call 'Attention'
9	Asks is 'Line clear' with its bell code	
10		Acknowledges the bell code & holds the bell plunger pressed during the last beat & turns the commutator handle to 'Line clear'. This will change the indication of the bottom indicator to 'Line clear'.
11	The top indicator here changes to 'Line clear'	
12	The LSS is taken 'OFF' & train proceeds.	
13	When the train passes LSS & operates First vehicle track, the LSS is replaced to 'ON' & the LSS lever is normalised & 'Train entering block section signal is given.	

S.No.	Sending Station 'A'	Receiving Station 'B'
14		Acknowledges the 'Train entering block section' signal & keeping plunger pressed on the last beat turns the Commutator handle to 'Train on line' position: i) The bottom indicator now indicates 'Train on line' ii) The Commutator handle gets locked in the 'Train on line' position.
15	The top indicator assumes 'Train on line' position.	
16		i) Home signal is taken 'OFF' for the reception of the train. ii) After ensuring complete arrival of train, the Home signal is normalised. iii) Restoration of Home signal to normal, train clearing the LVT track releases the Commutator handle locking.
17		Gives call 'Attention' signal
18	Acknowledges the call 'Attention'.	
19		Gives 'Train out of block section' signal, keeping the plunger pressed on the last beat & turns the Commutator handle to 'Line closed' And the bottom indicator changes to 'Line closed' position.
20	As soon as top indicator turns to 'Line closed' position, gives 'Train out of block section' acknowledgement	

4.10 BLOCK BELL CIRCUIT IN IRS HOWRAH

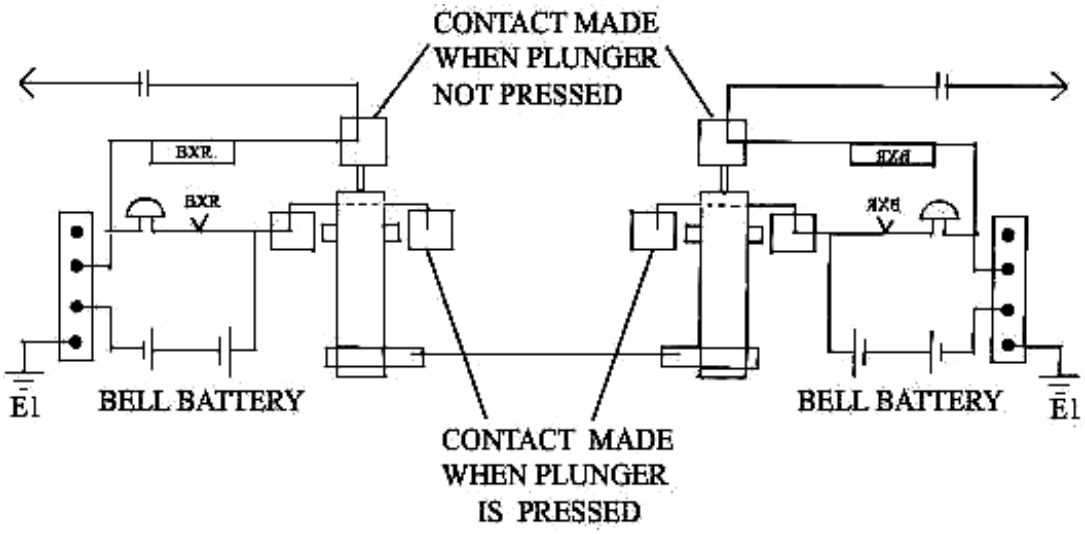


Fig: 4.10

BLOCK BELL AND INDICATION CIRCUIT IN SGE

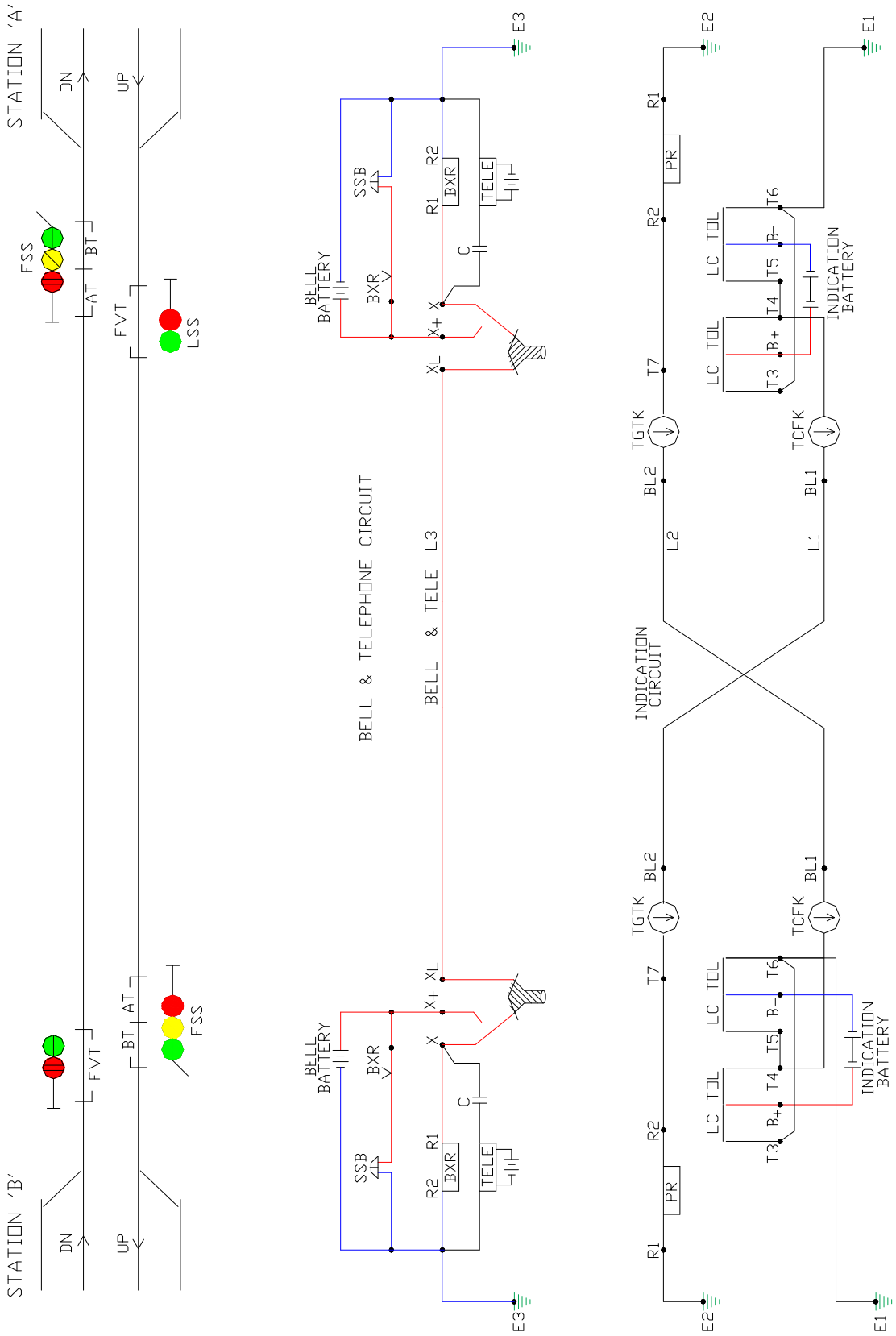


FIG. 4.11

4.11 INDICATION CIRCUIT IN DOUBLE LINE BLOCK INSTRUMENT

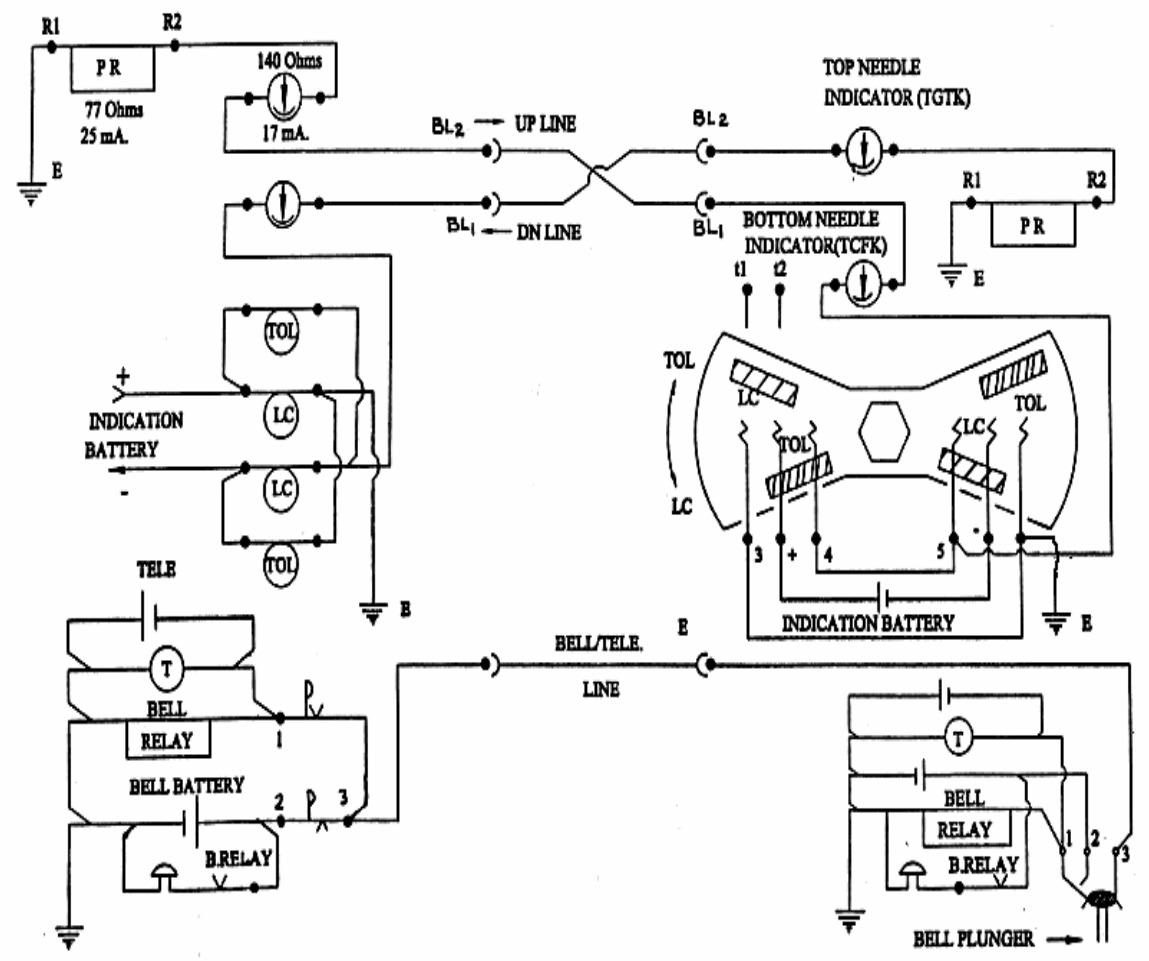


Fig: 4.12 INDICATION CIRCUIT OF DOUBLE LINE BLOCK INSTRUMENT

Train enters section and on the actuation of the 'FVT' by the engine the LSS goes back to 'ON' automatically. 'A' gives train entering section signal on the bell plunger. 'B' acknowledges the same by repeating it and keeping the plunger pressed on the last beat, turns the commutator through 40 deg anticlockwise, from 'Line Clear' position to "Train On Line" position. Now the bottom indicator at 'B' and top indicator at 'A' register "Train On Line" indication. The circuit for this is shown in Fig. 4.13, 4.14 and 4.15. The commutator at 'B' is now locked at TOL position.

INDICATION CIRCUIT IN SGE: --

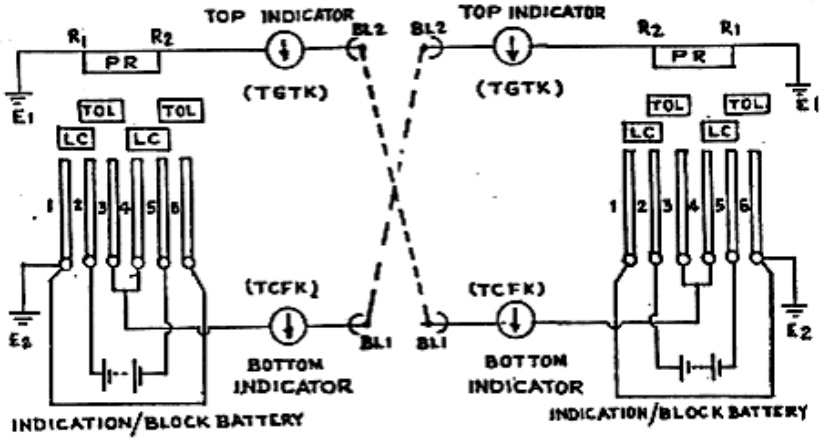


Fig: 4.13 INDICATION CIRCUIT IN SGE BLOCK INSTRUMENT

INDICATION CIRCUIT IN MODIFIED SGE: -

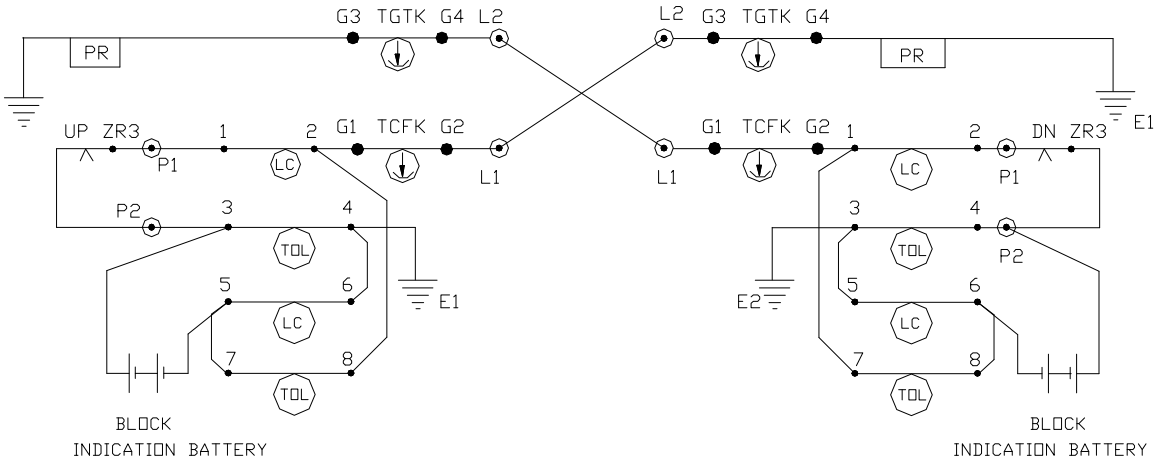


FIG 4.14 INDICATION CIRCUIT IN MODIFIED SGE

INDICATION CIRCUIT IN IRS HOWRAH: -

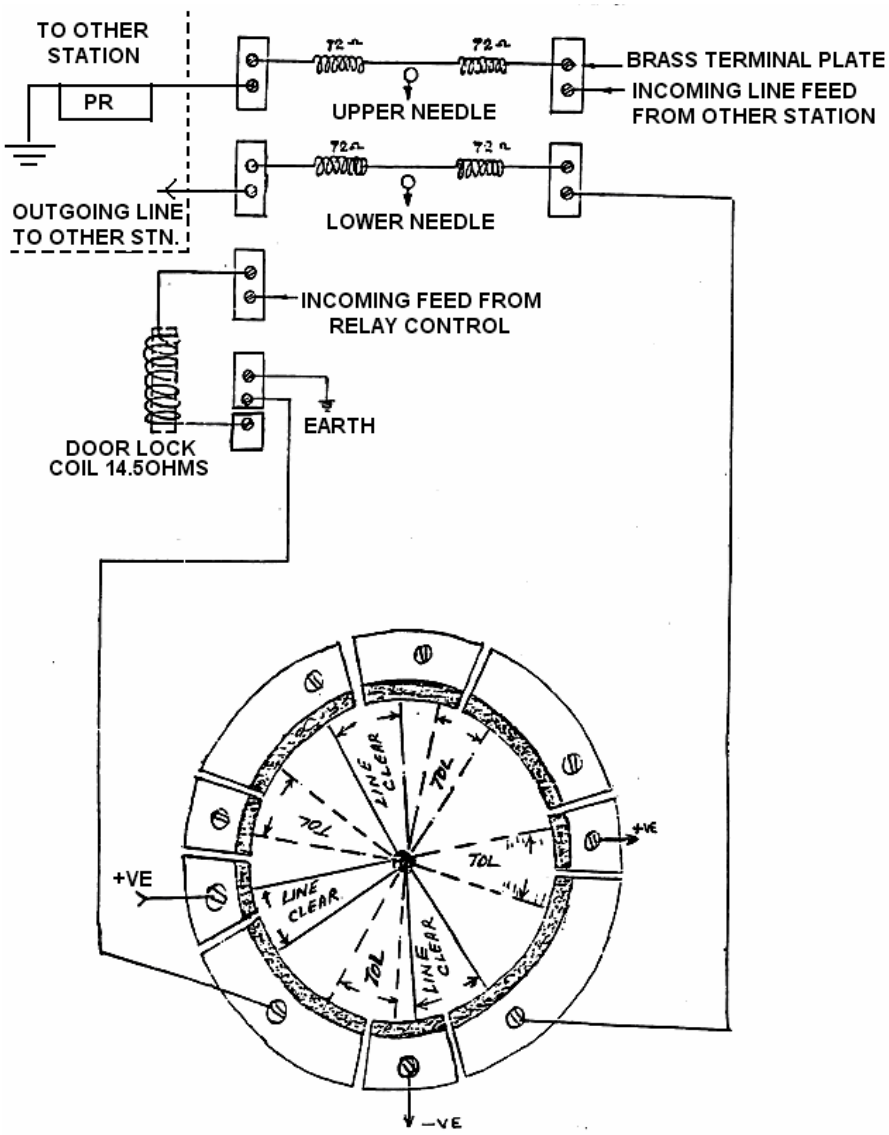


FIG. 4.15 INDICATION WIRING DIAGRAM OF (9 SEGMENT) DOUBLE LINE BLOCK INSTRUMENT IRS TYPE EASTERN RAILWAY HWH MAKE

4.12 LAST STOP SIGNAL CONTROL CIRCUIT

Each railway adopts their own circuit for the LSS control as well as Block Release. But the basic requirement remains the same. The circuit shown in Fig. 4.16 is the one, which is adopted by one of the railways. Stick relays SR1 and SR2 (QNAI type) are normally in the energised condition. The front contact of these relays is proved in the LCPR. (Line clear proving relay) pick up circuit. The important point of including the 'F' contacts of SR1, SR2 relays in the LCPR circuit is to ensure that the LSS can be taken OFF only for "One train on one line clear". When line clear is granted from Station 'B' (advanced station) by operating the commutator to line clear position the PR is operated to make “LC” contact at Station 'A' (rear station) so as to complete the LSS circuit such as +ve of battery - fuse - FVTR (F) - LSS DR (B) - LSS-L (N) - PR operated LC contact. SR1 (F). SR2 (F) - LCPR coil and to -ve. Now when the lever of LSS is reversed, through the lever (R) band the green aspect control relay of LSS - DR picks up as: + ve of battery - fuse. FVTR (F)-SM.YR (F) - SR1 (F). SR2 (F). LCPR (F)- LSS-L(R) LSS. DR Coil - LSS-L.(R) and -ve of the battery.

Note: -

(a) In this circuit the LSS.DR (B) and LSS (N) band are by passed by LCPR (F) to ensure that LCPR is held through its own front contact when the LSS is taken OFF.

(b) The LCPR (F) is by passed by DECR of LSS DG is to ensure that once the LSS is taken OFF on proper line clear it cannot be replaced to ON by any interruption to PR due to line break or mismanipulation of commutator at Station B.

(c) The (R) band of LSS - Lever is incorporated in both the +ve and -ve limbs of DR with (N) band across the relay is to effect cross protection.

(d) If QNA1 relays are used for SRs then it is essential to use 2 QNA1 relays as SR1 and SR2. The idea of this is to maintain that the pick up time of SR shall not be less than 300 ms. This time delay is necessary to ensure that the SR does not pick up (to reclear the LSS after a train admitted into the section) due to momentary swinging action of the armature of the PR and making TOL contact when the commutator of the instrument at the advanced station is accidentally or deliberately brought back to Line Closed and again operated to Line Clear Position before the arrival of the train into the station.

(e) The pick up circuit of LCPR is first taken through LSS. DR (B) and LSS-L (N) to prove that line clear is received ensuring that the concerned Last Stop Signal is at "ON" while receiving line clear.

LAST STOP SIGNAL CONTROL CIRCUIT: -

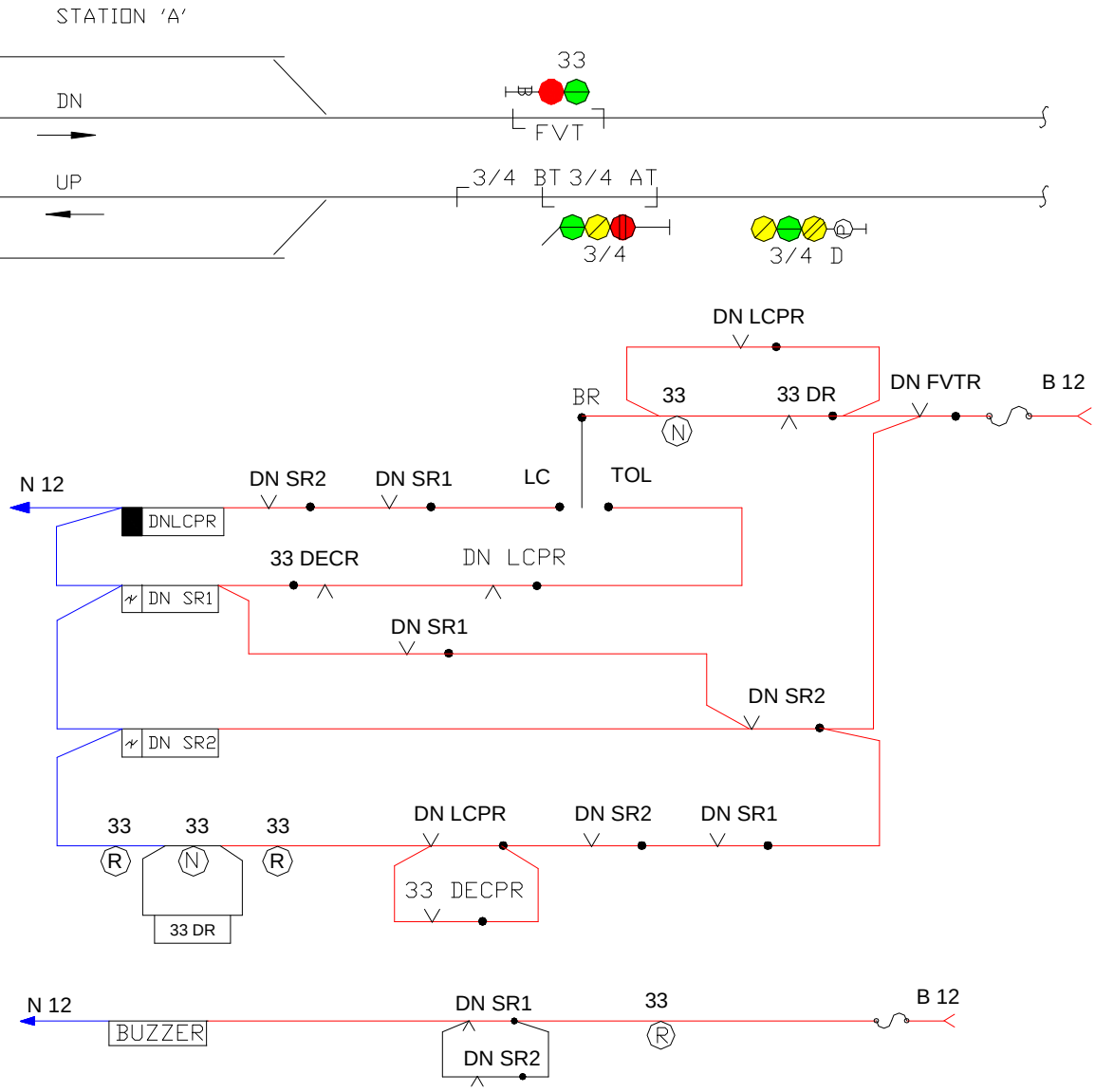


FIG. 4.16 LSS CONTROL CIRCUIT

4.13 BLOCK RELEASE CIRCUIT

The commutator at the advanced station is locked in TOL position when it is brought from Line Clear and can be brought to "Line Closed" only when the commutator lock is released after arrival of the train inside the block clearance point and the reception signals have been restored back to Normal. The circuit details to achieve this condition are shown in figure 4.17A and 4.18.

Two closed track circuits (3/4) AT, (3/4) BT (not less than two rail length each) adjacent to each other are provided just in advance of the Home Signal. When the train for which line clear is given being received on proper reception signal the first track (3/4) AT having occupied by the train, the relay (3/4) ATPR drops and through the back contact of this relay the first relay of the block release circuit (UP) ZR1 picks up and stick. The circuit for this is:-

Battery +ve - fuse - (UP) - ZR3 (B) - (3/4) ATPR (B) - (3/4) BTPR (F) - any one of the H-S lever (R) band - (UP) ZR2 (B) - (UP) ZR1 relay coil and battery -ve. The stick path for this is made available through one of its own front contacts.

Further when the train is on its run comes on the second track, (3/4) BT, the relay (3/4) BTR drops and on clearance of (3/4) AT the ATPR picks up. Now the second block release relay (UP) ZR2 picks up through: B +ve - fuse - (UP) ZR3 (B) - (3/4) ATPR (F) - (3/4) BTPR (B) - (UP) ZR1 (F) - (UP) ZR2 relay coil and -ve of the battery and sticks through one of its own front contacts. The relay (UP) ZR2 must be of slow to release feature as this is essential to pick up the final block release relay (UP) ZR3 without any interruption. The pick up circuit for this is self-explanatory. The (UP) ZR3 on its picking up disconnects the feed to the other two relays (UP) ZR1 and (UP) ZR2 by opening its back contact and sticks through one of its own front contacts.

When the (UP) ZR2 picks up it gives an audible and visual indication to remind the SM to operate the commutator of the respective block instrument to TOL if it is not already done by him to complete the sequence of operations for the entry and arrival of the train into the station.

The relay (UP) ZR3 when it picks up complete the circuit to energise the lock coil of the commutator when the plunger is pressed through the relevant normal contacts of Reception Signal's levers and back contact of signal's controlling and lamp checking relays so as to release the lock and restore the commutator back to "Line Closed" position.

By adopting this circuit a relaxation is done to avoid block failure without jeopardizing the safety facilitating the operation of commutator from line clear to TOL and back to line close even after arrival of the train into the Station.

Note: -

i) The word Up and Dn represents for the direction of train movements.

ii) The prefixed numerical No. (3/4) represents the Home Signal Number.

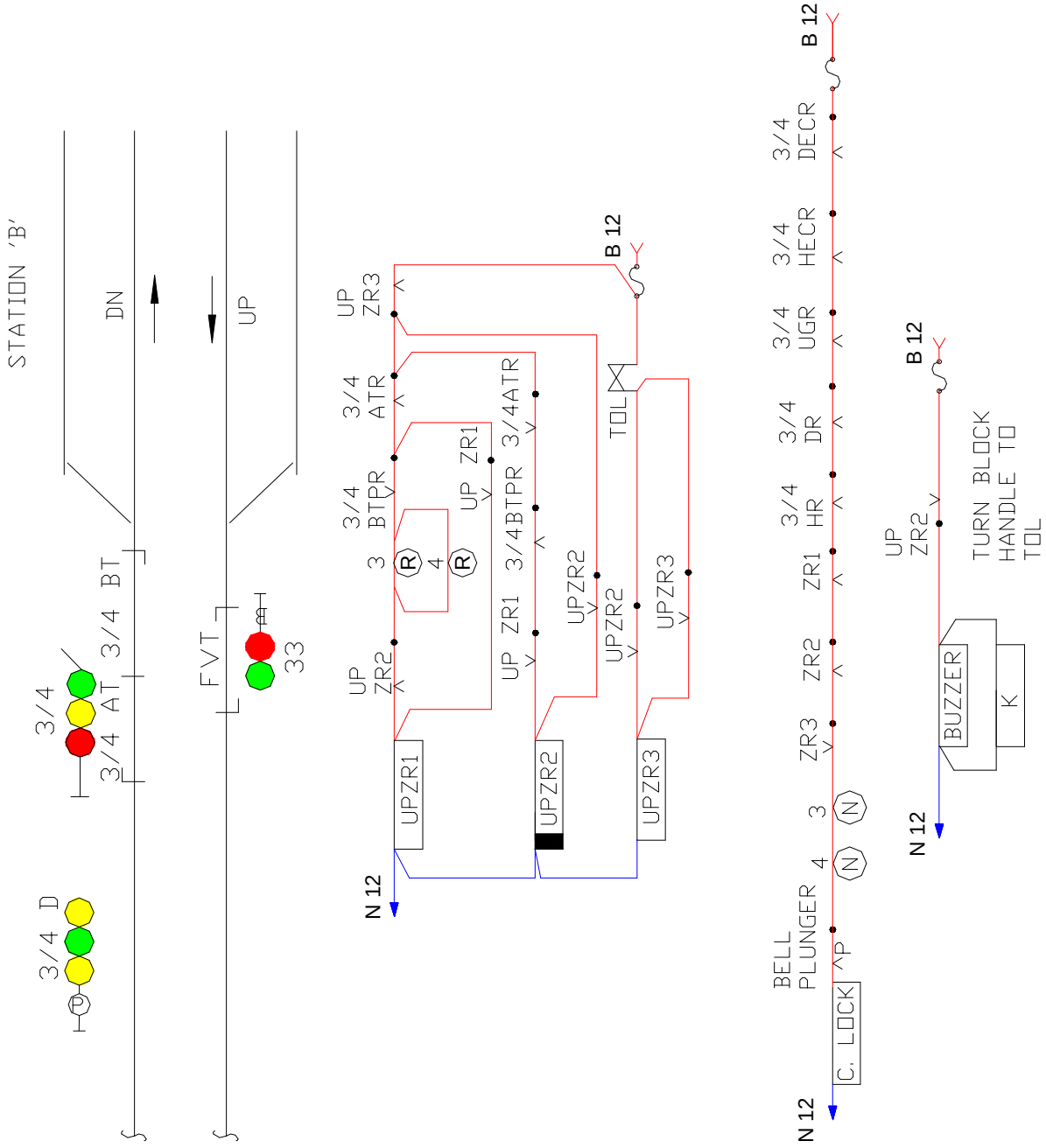


Fig: 4.17 BLOCK RELEASE CIRCUIT

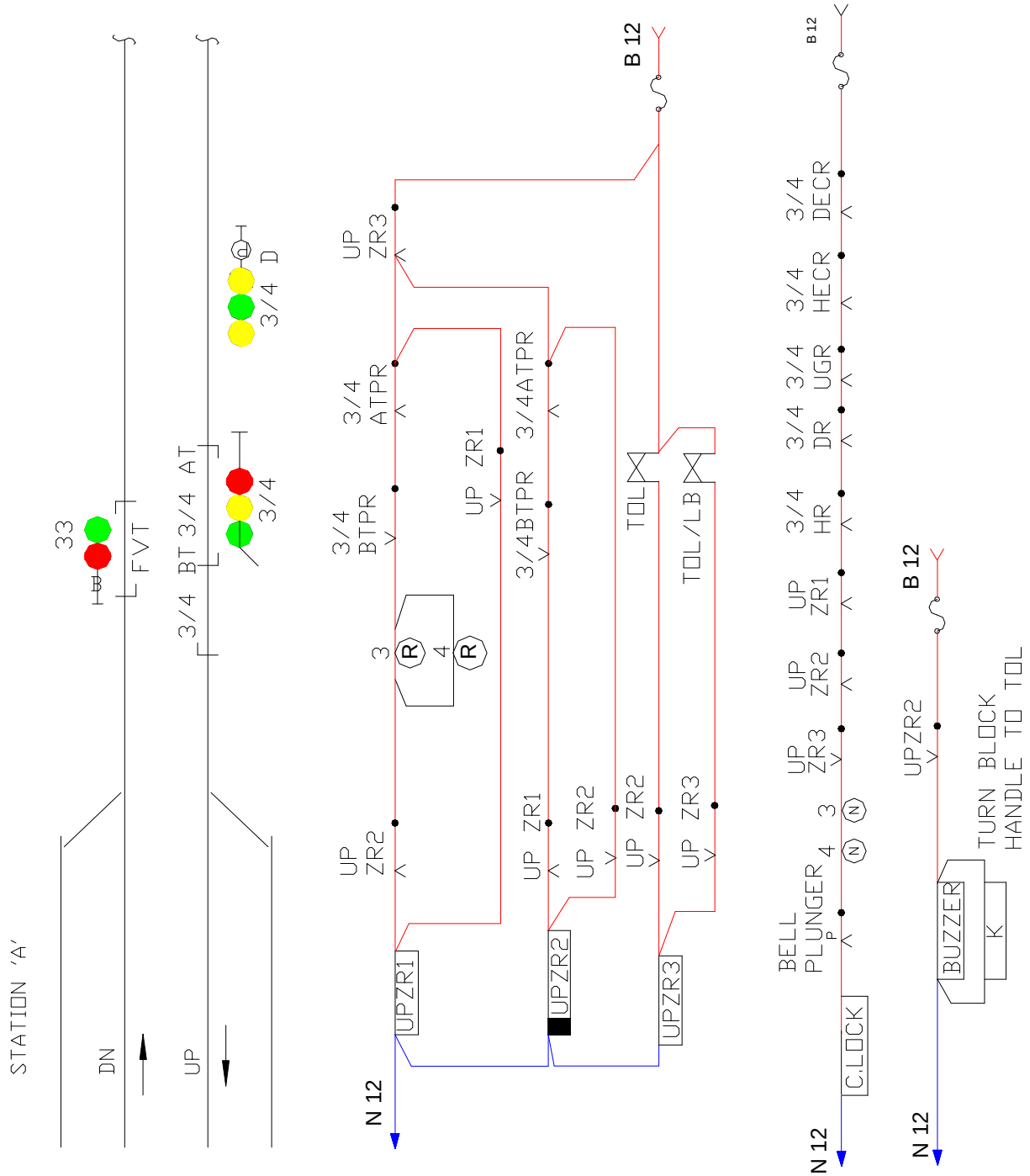


Fig: 4.18 BLOCK RELEASE CIRCUIT (ELECTRICAL HOLDING)

4.14 DO'S & DON'T'S

(a) Ensure that the Stick relays i.e. SR relays in LSS circuit have minimum pick time of 300 milliseconds, achieved by having them as slow Shelf type relays or QSPA1 type or two Nos. of QNA1 Type relays.

(b) Polarised relays in LSS circuit shall conform to IRS-S31-80 should only be used in the block circuits. However, AEI-GRS polarised relays with contact gap of 2.5 mm and minimum pick up current of 16 mA can be allowed to continue till they are progressively replaced with polarised relays conforming to IRS-S31-80.

(c) 3-position polarised relays should be overhauled along with block instrument.

(d) All block instruments used should be of manufactured to IRS design only.

(e) Sequential clearance of two circuits should be provided for block clearance circuit.

(f) The line voltage shall be maintained between 18 to 24V DC considering the line current of
(g) 25 ma & block section length of say 10 kilometres.

(h) If any of the following conditions are observed, the lock and block should be treated as defective and its working should be suspended immediately: -

(i) The last stop signal is not restored to ON position automatically by the passage of the train.

(ii) If it is found possible to take OFF the last stop signal without containing the "Line clear" indication on the top indicator of the instrument.

(iii) If the block instruments commutator could be turned from TOL to Line Clear . position without the arrival of train

(iv) When the block instrument shows erratic movements of the indicators or is defective in any other way.

In order to comply the instructions vide items 1 and 7 above, the circuit diagrams adopted by one of the railways are given in Fig. 4.16, 4.17 and 4.18.

4.15 AUTO TOL FEATURE IN DOUBLE LINE BLOCK WORKING

As one of the latest modifications in the system of Double Line Block working the AUTO TOL system is introduced to get a buzzer and TOL indication automatically at both ends & buzzer at the train receiving station when the train enters the block section from the train sending station.

In the existing SGE Double Line Block working, if the receiving end SM fails to turn the Block Handle to TOL position promptly we find a contradicting indication that the train is in the Block Section where as the Bottom indicator is indicating Line Clear. At times, due to turning the commutator inadvertently, we find another disputable condition that the train has not entered the Block Section but the indication assumes TOL, which is termed as premature TOL. In such a case a Block Failure results. To obviate these difficulties it is proposed to introduce automatic train on line feature in the existing SGE Double Line Block Instruments in a phased manner.

The system of such working adopted by one of the railways is shown in Fig. 4.19. When a train enters the block section from Station A on proper line clear the FVT track is actuated and this causes a momentary disconnection to the line circuit. This momentary disconnection to the line enable a magnetic latch relay AR (QL1) at Station 'B' to be operated. The operating circuit is as: -

B +ve ZR(B) - LR(B) - LPR(F) - R1R2 of AR coil and to -ve of battery. As soon as this relay is operated, through the 'R' contact of this relay the polarity of indication battery changes, as +ve to earth and -ve to line duly bringing the TOL indications automatically in the respective indicators at Station B and A. In addition to this a Buzzer is also switched on at Station B automatically through one of the operated R contacts of AR. On receiving the Buzzer the SM at Station B operates the commutator of the instrument to TOL and this action not only operates the magnetic latch relay to Normal but also stop the buzzer. The commutator is now locked at TOL.

Note: -

(a) The relay LR & LPR are used to effect the condition for operation of latch relay AR (QLI).

(b) The inclusion of LCZR (F) and AR (R) in the line circuit is to prove that positive operation of AR is taken place and to change the polarity of indication battery to register the appearance of TOL indication on the dials.

(c) The relay LCZR is used to ensure that the sequences of operations are taken place.

(d) The parallel path of LSSRP (B) to FVTR (F) is to ensure that the indication on the dial is not interrupted for long with the *train is on FVT.*

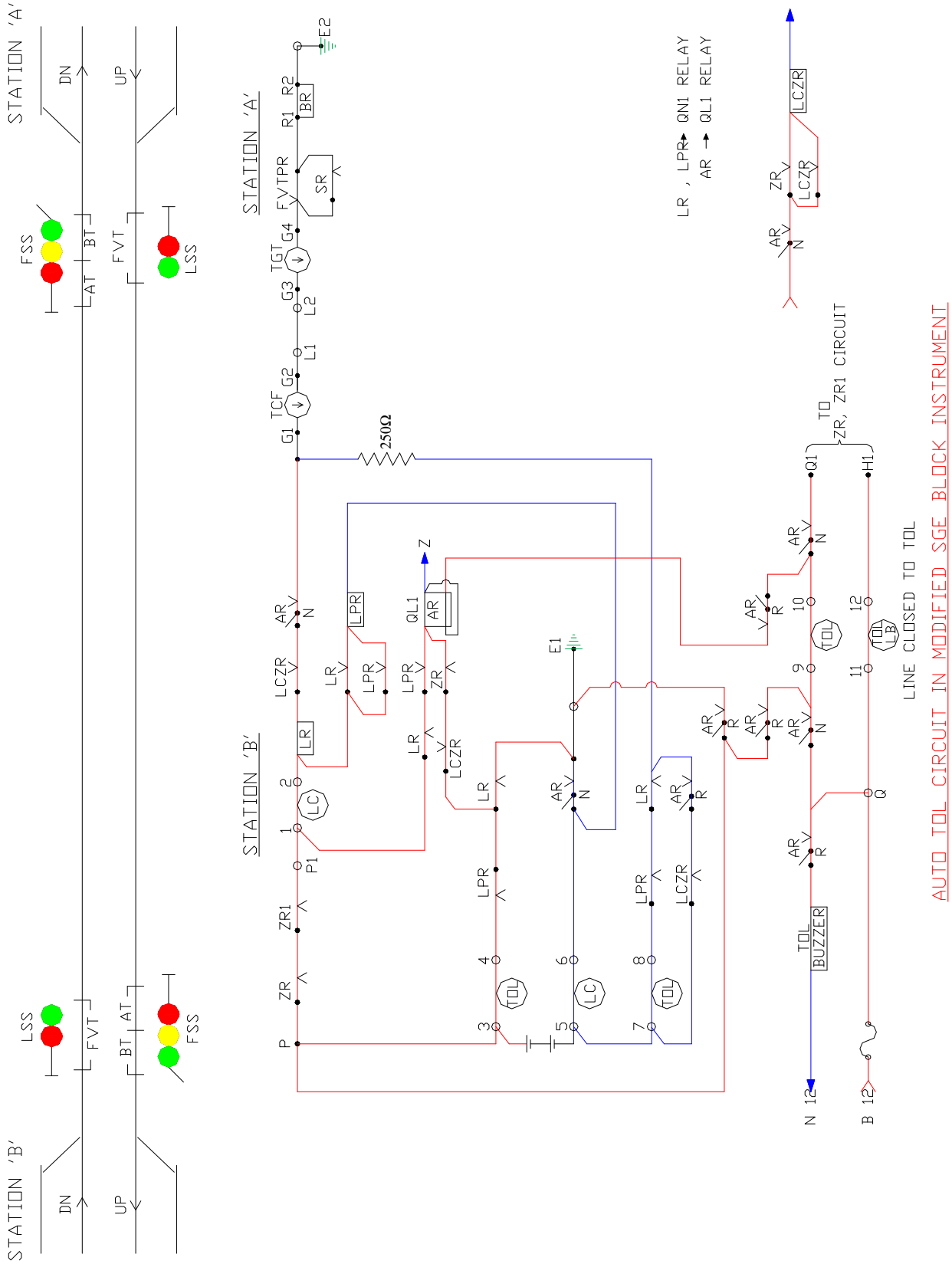


Fig: 4.19 AUTO TOL CIRCUIT

4.16 DIFFERENCES IN DOUBLE LINE BLOCK INSTRUMENTS

The main difference between the three types of Double Line Block Instruments is.

S.No	Name of the part	BY. C. Railway Make	PTJ S. Railway Make	HWH E. Railway Make
1.	Contact arrangement	4 pairs of spring contact (Finger type) mounted inside the instrument, contacts are closed by brass segments when a Fan shaped ebonite piece operated by commutator	6 way circuit controller type and the contacts are closed in a rotary form when the commutator is operated.	9 way drum type with slotted segments. Contacts are closed when split spring strips are made to move over these segments when commutator is operated.
2.	Telephone and Bell set.	Provided externally in separate housing.	Provided internally in the same housing	Provided externally in separate housing.
3.	Polarised Relay.	Provided as a part of instrument externally	Provided as a part of instrument internally	Provided as a part of instrument externally
4.	Door Lock Mechanism arrangement	Mechanical stick	Electrical stick	Mechanical stick
5.	SM's Lock	Not effective in locking Bell plunger	Effective on locking Bell plunger also	Not effective in locking Bell plunger
6.	Auto – TOL- Buzzer/ Indication	Not provided	Provided	Not provided
7.	Resistance of Door coil/TOL lock coil	50 Ohms	48 Ohms	14.8 Ohms
8.	Working current of Door coil/TOL Lock coil	200 mA	250 mA	250 Ma
9.	Resistance of Bell Relay	500 Ohms	400 Ohms	400 Ohms
10.	Working current of Bell relay	20 mA	25 mA	25 mA
11.	Resistance of Bell Coil	60 Ohms	48 Ohms	30 Ohms

4.17 FAILURE OF DOUBLE LINE BLOCK INSTRUMENTS

The Block Instruments shall be considered to have failed and block working suspended in the following circumstances --

(a) When the indications on the 'Train Going To' dial at X do not correspond with the indications of the 'Train Coming From' dial at Y.

(b) When ever there is reason to believe that there is contact between the Block and any other circuit.

Note: If an intermittent contact exists between the block line and the circuit an irregular movement of the indicator or irregular bell beats or both will be observed. If permanent contact exists there may be a permanent wrong indication or bell beats or both. A contact between block wires might cause signals given on the instrument to be repeated on the neighboring instrument or change of indications in the instruments.

(c) If the Block Instrument or its battery counter is found without seals or locks.

(d) When the dial indicator glass is broken.

(e) If the Operating Handle can be restored from ‘Train On Line' position to 'Line Closed'' position before complete arrival of the train.

(f) Where the Operating Handle cannot be turned to 'Train On Line' or 'Line Clear' or to 'Line Closed' in the process of granting or cancelling line Clear.

(g) Where signals on the bell are not received distinctly or fail' altogether.

(h) When a train which has entered the block section on Line Clear'' is pushed backed into rear the station for any reason.

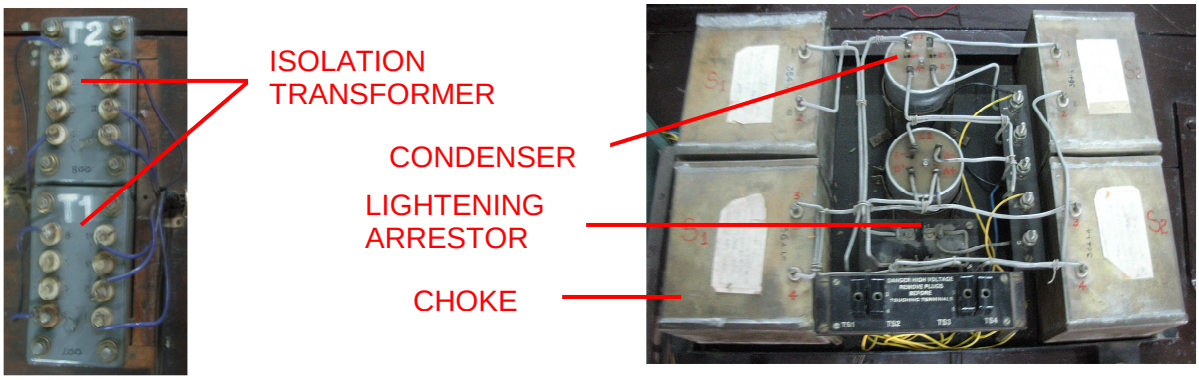
(i) If it is known that the instrument is defective in any .way not specified above.

4.18 INSTALLATION OF DOUBLE LINE BLOCK INSTRUMENTS ON 25KV RE TRACTION AREA

The following equipments shall be installed with Double line block instruments as precautions for Block Instruments on AC traction: -

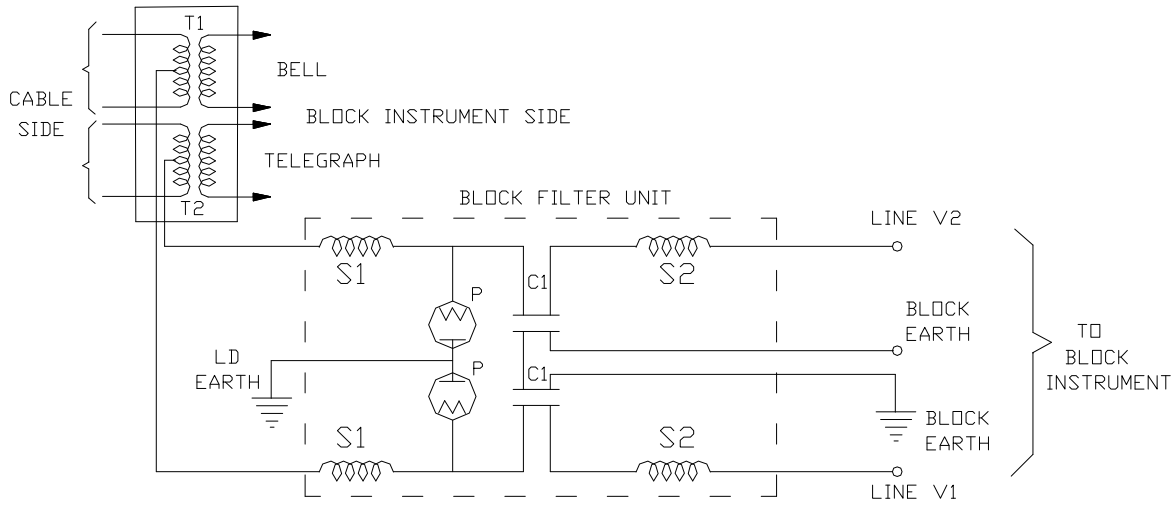
4.18.1 Filter Unit

(a) A filter of an approved design shall be installed between the double line block instrument and the line wire. The general arrangement for these filters is shown in Fig.4.21. It is essential that the line and block instrument terminals of the filters be never interchanged. The filter is a low pass filter consisting of series choke coils S1 and S2 in each line and the shunt condenser CI. The condensers adopted are 4-terminal condensers to prove the continuity of the conductors forming the condenser. Also two gaseous type lightning arrestors with a flash voltage of 150 volts are provided on the line side for high voltage protection. Two different Earths shall be provided for Discharger and Block. Separate Line Battery or DC-DC converter shall be used for each Block Instrument. This battery shall feed only the Block Instruments and not any other circuit.



ISOLATION TRANSFORMER BLOCK FILTER UNIT

Fig: 4. 20 FILTER AND ISOLATION TRANSFORMER



T1 & T2 VOICE FREQUENCY TRANSFORMERS

S1 PROTECTIVE CHOKE { R = 50 Ohms; Z AT 50 Hz = 40,000 Ohms; TEST VOLTAGE = 600 Volts

S2 PROTECTIVE CHOKE { R = 40 Ohms; Z AT 50 Hz = 20,000 Ohms; TEST VOLTAGE = 50 Volts

C1 4 TERMINAL CONDENSER C = 10 micro farad

P LIGHTENING ARRESTOR GASEOUS TYPE, FLASH VOLTAGE 150 Volts

4.21 SCHEMATIC DIAGRAM OF BLOCK FILTER UNIT

b) When a block section originates at a station in electrified area and terminates at a station in non-electrified area, filters shall be provided with the block instruments at both ends of such block section in accordance with approved instructions.

c) The 3 position polarised relay shall be installed in the same location as the block instruments. Only approved type of polarised relays (S31/80) shall be used in block instruments. The polarised relay manufactured by Eastern Railway Block Shop shall not be used on A.C. traction.

d) The resistance of needle coil should be approximately 140 Ohms.

4.18.2 Block bell equipment

It is required for generation of bell signal.

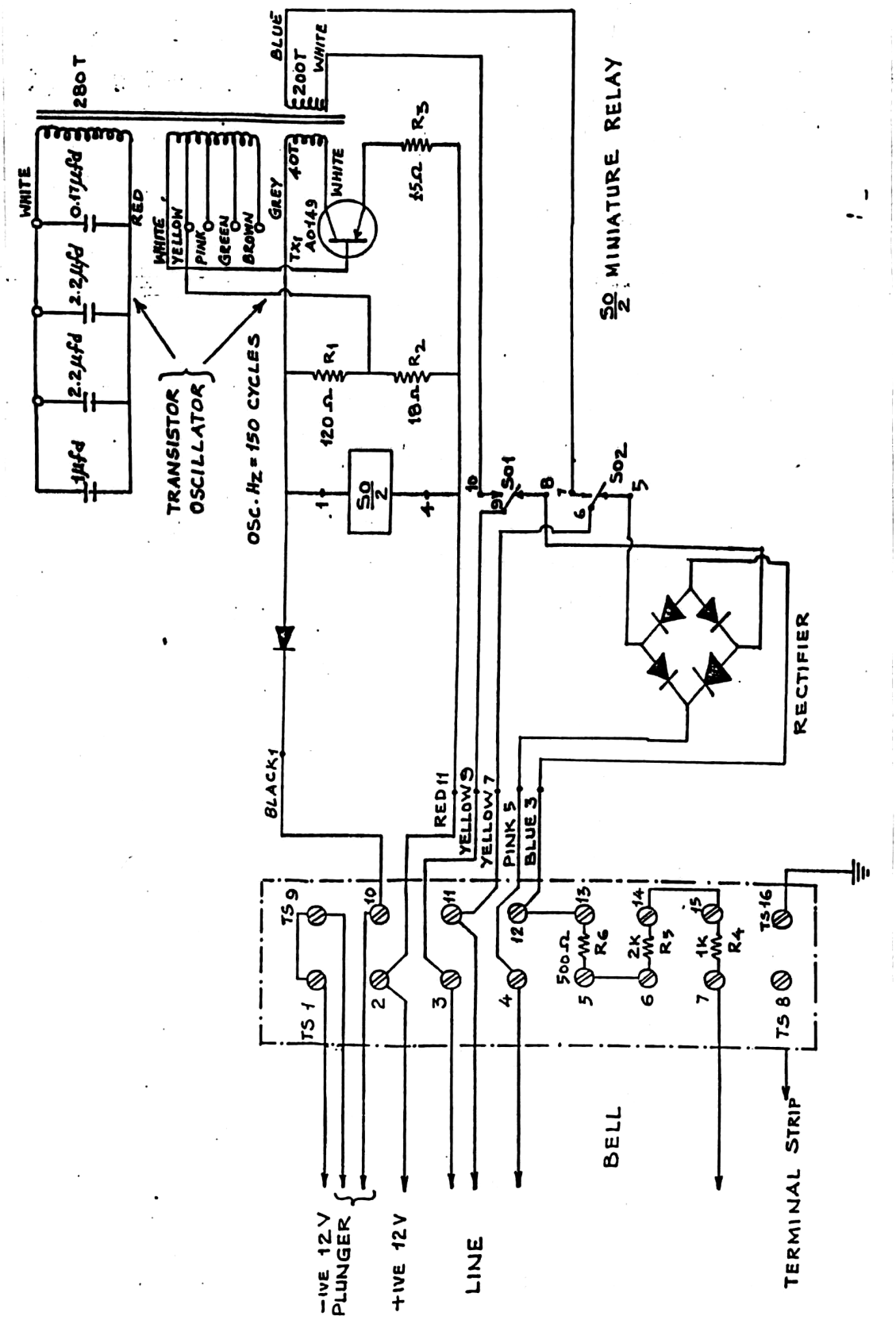


Fig. 4.22 WIRING DIAGRAM OF BLOCK BELL EQUIPMENT

The block telephone of double line block instruments shall not be worked on the same line wire as the block instrument. It shall be worked on a separate pair of line wires as indicated in Fig.4.23. The figure also indicates the arrangements for block bell working for SGE. Block instruments and train wire working. For bell code signalling 150 cycles tone is either sent or received with the B relay (SO/2) in the normal position. When 150 cycles tone is received, the rectifier rectifies the same and the DC voltage developed is utilised to energise the bell relay (line type relay), which, in turn, will energise the single stroke bell. For transmission of bell code signal the pressing of the plunger will energise B relay. B relay energising will apply D.C. supply to the 150 cycles transistor oscillator, the output of which will also be connected to the line through a variable resistance, thus sending a 150 cycles tone on line.

A block telephone is connected across the line through a condenser when the B relay is normal. When the B relay picks up, the block telephone is cut off.

Arrangements for Double Line Block working with block filter and special equipment for train wire and block bell are shown in Fig. 4.23.

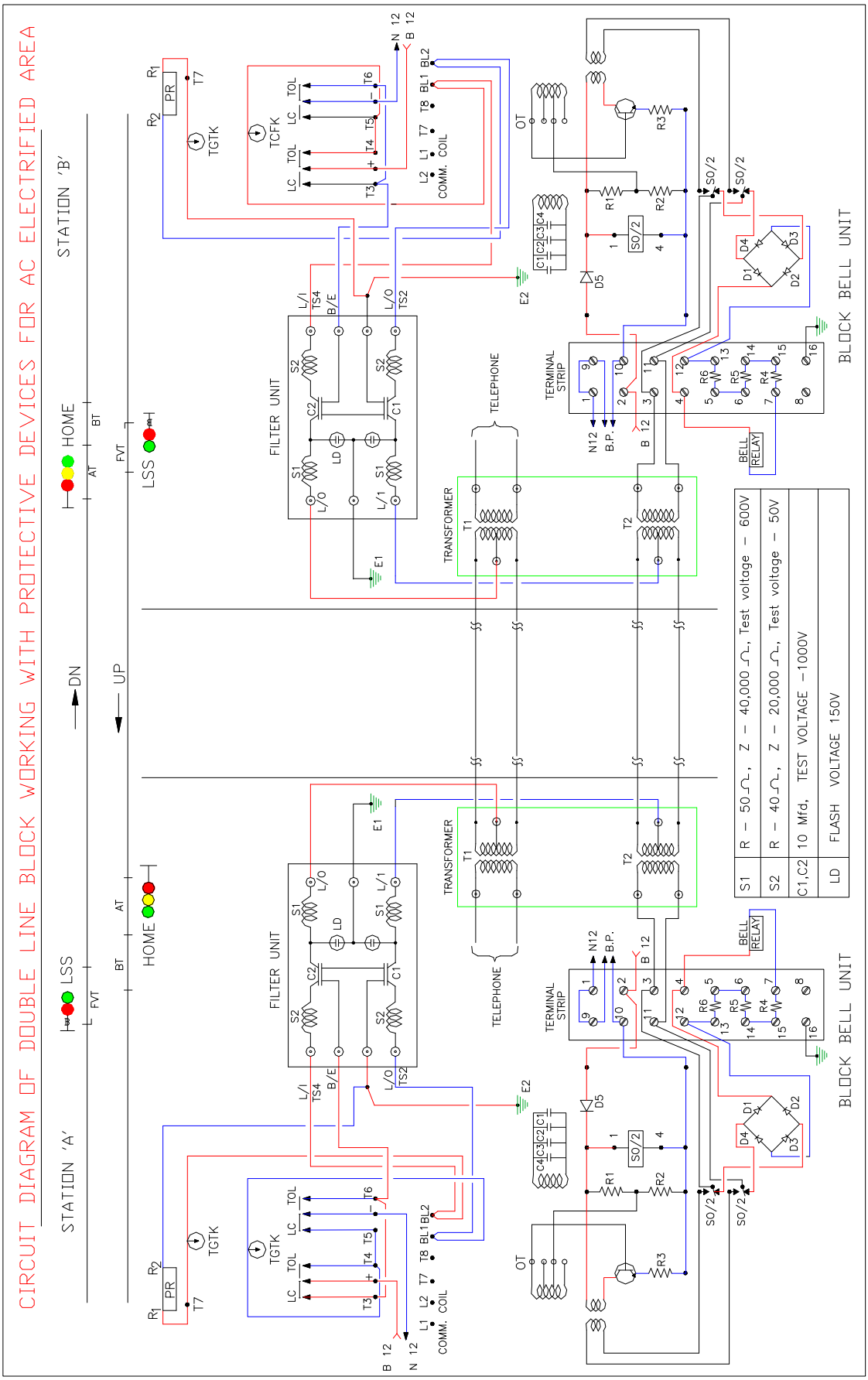


Fig: 4.23 CIRCUIT DIAGRAM OF DOUBLE LINE BLOCK WORKING WITH PROTECTIVE DEVICE FOR AC ELECTRIFIED AREA

4.19 MAINTENANCE SCHEDULE OF DOUBLE LINE BLOCK INSTRUMENT

DOUBLE LINE BLOCK INSTRUMENT - MAINTENANCE SCHEDULE				
S.No.	**ACTIVITY**	**ESM**	**SE**	**SSE**
1	Check the locking and sealing.	F	M	Q
2	Check the SM key lock working.	F	M	Q
3	Check whether the instrument is due for overhaul, and the register maintained as	-	M	Q
4	Check and ensure full deflection of indicators.	F	M	Q
5	Check the polarized relay returning to its normal position when no current is flowing	F	M	Q
6	Check that electrical and mechanical locks are in proper condition.	F	M	Q
7	Check all contacts are clean and free from pitting.	F	M	Q
8	Check all springs are in good condition and kept properly adjusted.	F	M	Q
9	Check that all terminal screws, lock nuts and locking screws are kept tight and split pins opened.	F	M	Q
10	Check Block and telephone batteries are kept clean, terminals tight and free from dirt or corrosion. Record the values of the batteries.	F	M	Q
11	Check whether L.S.S. can be taken 'OFF' without Line Clear.	F	M	Q
12	Check the Conditional TOL locking.	F	M	Q
13	Check the Half notch working.	F	M	Q
14	Check the release circuits for proper making and effective proving of all controls.	F	M	Q
15	Check the telephone and its cord.	F	M	Q
16	Measure Line Current.	F	M	Q
17	Check the Block bell unit , Filter unit & its LD	M	Q	Q
18	Check the block earth	M	Q	Q

F=Fortnightly; M=Monthly; Q=Quarterly; HY=Half Yearly; A=Annual.

CHAPTER 1

Subjective

1. Define following:

    1) Block Instrument
    2) Line Clear
    3) Block section
    4) Block back
    5) Block forward

2. Write essentials of Absolute Block system

3. Define following

    1) Bell codes
    2) Train signal register
    3) Certificate of Competency

Choose the correct answer

1. **"**Authority to proceed" is given to ---------- to enter the block section with his train

    a) Guard b) Driver c) SM d) none

2. Block Overlap(Adequate distance in Multiple Aspect Signalling

    a) 400M b) 120M c) 180M d) none

3. Certificate of Competency is valid for

    a) 1 year b) 2 year c) 3 year 4) none

4. Bell code for train entering into system is

    a) 1 b) 2 c) 3 4) 4

CHAPTER 2

Subjective

1. Write types of tokens used in NT Block Instruments

2. What are the features of NT Block Instruments

3. Write minimum 10 parts of NT Block Instruments

4. Define Normal & Reverse Polarity NT Block Instruments

5. Draw schematic(Circuit) diagram of NT Block Instruments

6. Write the Operating procedure for Train sending operation in NT Block Instruments

7. Write the additional equipments required for RE Modification in NT Block Instruments

8. Define following NT Block Instruments parts

1) Top Handle
2) TCF & TGT Locks
3) Lock Replacer Disc
4) Commutator & Contact making Spring Assembly
5) Safety Catch

Choose the correct answer

1. Neales ball token Block Instrument is used for

a) Double line section b) Single line section c) Automatic territory d) none of above

2. The POH of NT Block instrument is

a) 10 years b) 7 years c) 12 years d) 5 years

3. In NT Block instrument number of configuration of tokens used is

a) 5 b) 4 c) 3 d) 2

4. NT Block instrument is

a) Co-operative type b) Non-Cooperative type c) Both a & b d) none

5. NT Block instrument can be used in

a) Only in Non-RE b) Only in RE c) Both in Non-RE & RE d) none

CHAPTER 3

1. Write the differences between NT Ball Token Block Instrument & NT Tablet Token Block Instrument

CHAPTER 4

Subjective

1. Write features of Double line Block Instrument.

2. Draw the sketch of Door lock mechanism, name the parts.

3. Explain the working of Door lock mechanism in brief.

4. Write working of Double line Block Instrument for all operations.

5. Draw the following circuits of Double line Block Instrument for the following & explain in brief:

   a) Bell circuit
   b) Indication circuit
   c) LSS circuit
   d) Block Clearance circuit

6. Draw the sketch of Filter unit, name all the parts & explain in brief.

7. Draw the circuit of Auto-TOL used in Double line Block Instrument.

Choose the correct answer

1. In double line Block working in Non- RE area we require

   a) 2 Line wire b) 3 Line wire
   c) 2 Line + separate Earth return d) 3 Lines + separate Earth return

2. The Resistance of door lock coil is _____ in SGE DLBI

   a) 40 Ohms b) 50 Ohms c) 80 Ohms d) 160 Ohms

3. In Double line Block Instrument. Operation of the Block Instrument is done by

   a) Sending SM b) Receiving SM c) none

4. Double line Block Instrument is to be overhauled

   a) once in 10 years b) once in 3 years c) once in 5 years d) once in 7 years

5. Double line Block instrument can be used in

   a) Only in Non-RE b) Only in RE c) Both in Non-RE & RE d) none

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