

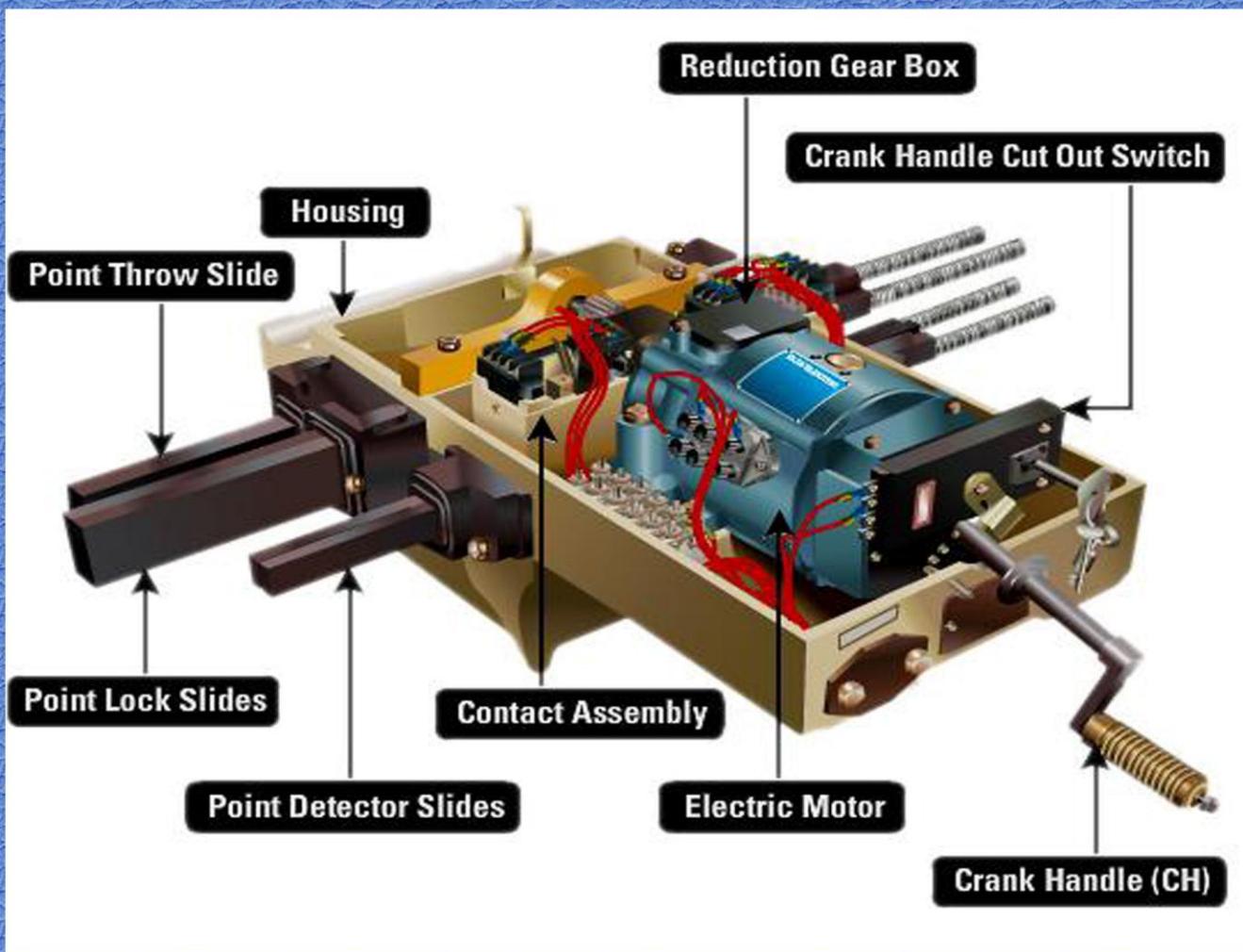
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IRISET

S 21

ELECTRIC POINT MACHINE



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

S 21

ELECTRIC POINT MACHINE

VISION :

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**INDIAN RAILWAYS INSTITUTE OF
SIGNAL ENGINEERING & TELECOMMUNICATIONS**

SECUNDERABAD - 500 017

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S-21
ELECTRIC POINT MACHINE

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CHAPTER 1: ELECTRIC POINT AND LOCK DETECTOR IRS TYPE

1.1 Introduction

Detectors are devices used in conjunction with other apparatus for proving that the point tongue or tongues or derailing switch and/or bolt lock are in their correct position. The IRS type of detector for switch and lock detection with cross protection arrangement conforms to IRS Drg.No.SA 23331 to 23333, and is suitable for working with Single pair of points and lock with 'IN' and 'OUT' movement Drg.SA23331 and RDSO S/9301-03. (Fig.1.1)



Fig No: 1.1 IRS LAYOUT WITH IN AND OUT TYPE OF LOCKING

1.2 Description

The IRS type detectors consist of the following common main parts

- (a) Cast iron base, frame and cover
- (b) Contact operating mechanism
- (c) Contact Block
- (d) Detector slides for point
- (e) Detector slide for lock

1.2.1 Base, Frame and Cover

The detector assembly is housed in a cast iron base and frame with a cover of robust construction. The cover is provided with padlocking arrangement. Base and cover with asbestos impregnated jute packing in between, makes the complete assembly dust and water-proof.

Housing for point slides and lock slide is provided on the frame with a spacer in between the slides on either side. The spacer is screw bolted inside the housing and can be placed both ways to facilitate interchanging of point and lock slides.

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Cast Iron gland for cable inlet is fitted on one of the sides of the frame which can also be changed to the other side if necessary.

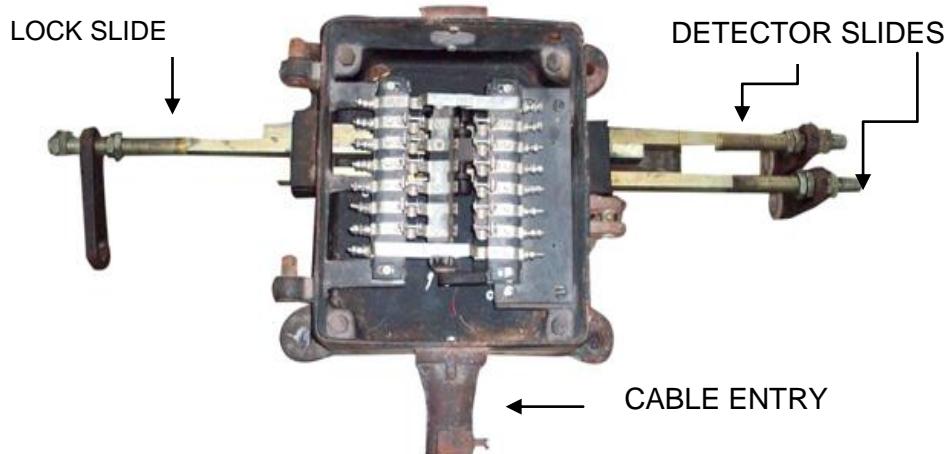


Fig No: 1.2 ELECTRIC POINT AND LOCK DETECTOR

1.2.2 Contact Operating Mechanism

The assembly consists of a fixed plate, yoke, 2 Nos. of helical springs, crank, 3 sets of bridge contacts and 2 sets of trolley rollers. Fixed plate is rigidly fixed on to the frame of the detector with 4 Nos. of screw bolts. Yoke is hinged at one end and forced down by the helical springs, placed between the plate and yoke. To the other end of the yoke is attached a crank by means of a pin. An insulating block with 3 sets of bridge contacts is fixed to the crank on the top, whereas two sets of rollers are mounted at the bottom. The rollers are positioned with staggering arrangement. The bridge contact along with the crank swings over a pin to a limited movement due to stopper provided on the fixed plate. The 'Normal' or the 'Reverse' contacts make as a result of this swing.

1.2.3 Contact Block

There are two contact blocks in a detector one is fixed on the fixed plate while the other is fixed on the projected casting of the frame on the other side. Each contact block consists of a fixed contact, 6 detector contacts, and a shunt contact (moving) totalling to 8 contacts which are numbered left to right. The block can be moved forward or backward as per requirement for maintaining desired pressure between contact fingers and bridge contact. Provision is also existing in contact springs for minor adjustments. Two locking washers are provided underneath each block base for locking the base in, final position after adjustment. When the points are unlocked, both the shunt contacts are made and the detector contacts break. This condition remains till the points are thrown and locked in the other position.

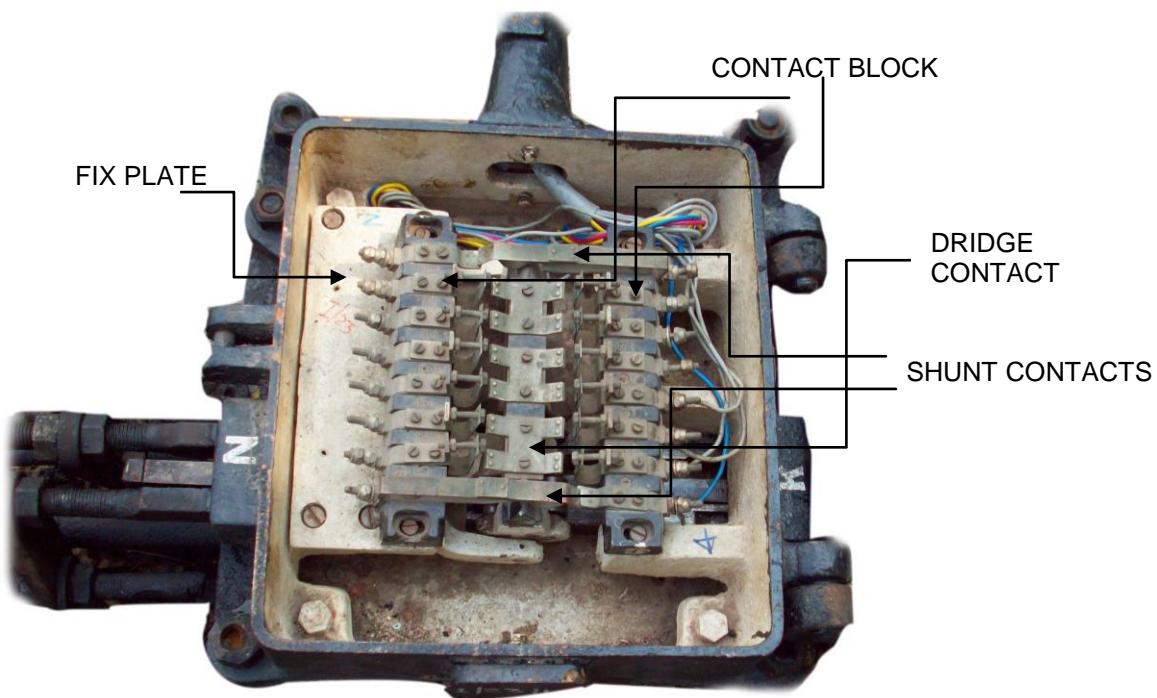
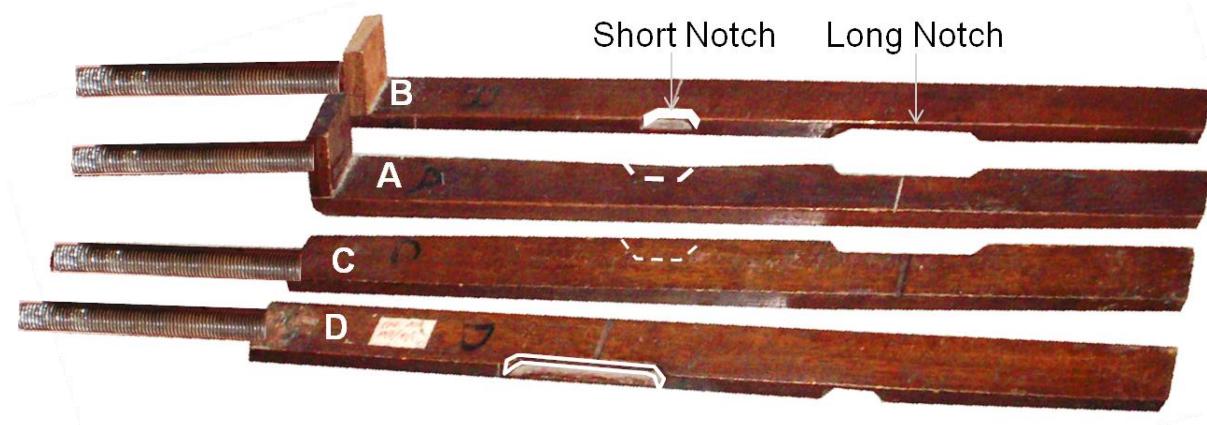


Fig No: 1.3 CONTACT BLOCK



..... Dotted line indicate notches under surface

Fig No: 1.4 DETECTOR SLIDE (B, A, C AND D)



Fig No: 1.5 LOCK SLIDE (A AND B)

1.2.4 Point Detection Slides

Each tongue rail is connected to a point detector slide individually. These slides are rectangular flat bars with a screw end on one side. Cast iron lugs with insulating ferules are provided at the screw ends for connecting the detector rods. Each bar has two under cuts, one short and the other long each 7 mm deep. Locating marks are provided on the top surface of the slides which coincide exactly with a finished surface on either side of the detector frame in the closed position of the relevant switch provided correct matching of notches are done.

These slides are similar in shapes for 'IN' & 'OUT' and 'straight Through' connections, but is different for a double slip connection. The correct slides with their drawing Nos. are given below for each type of detector.

Type of Slides to be used	Type and Number of Point detection & lock Slides required for		
	In & Out type facing point lock		Straight Through facing point lock
	FPL- IRS TYPE Drg. SA-23331	FPL- RDSO TYPE Drg. S/9301	Drg. SA-23332
i) Point detection Slide Stroke 100 mm/115 mm	1. Type 'C' -1No. 2. Type 'D' – 1No	1. Type 'D' -2 Nos.	1. Type 'C' -1 No 1. Type 'D' -1No.
ii) Lock detection Slide Stroke 32 mm	1. Type 'A' - 1 No.	1. Type 'A' = 1 No.	1. Type 'B' - 1 No.

Different types of Switch Detection Slides:

- (a) 'C' type Switch Detection Slide (S-233377): It has smaller notch and locating mark nearer to the threaded portion. Always this slide has to be connected to the nearer closed switch. (In IRS type of layouts where combination of 'C' and 'D' slides are used for switch detection).
- (b) 'D' type Switch Detection Slide (S-233378): It has longer notch nearer to the threaded portion of the locating mark is away from the threaded portion of the slide. This slide is connected to the far end switch. In IRS type layout, along with 'C' slide; and in RDSO layout 2Nos. of 'D' type switch slides are used for the detection of open and closed position.

1.2.5 Lock Detection Slides

The lock slide is also a rectangular flat bar of the same dimension as that of point detection slides with screw-end, check-nuts and lug on one side. These slides, either has half cut staggered notches on both upper & lower side surface of slide or a full cut notch on only one side surface of slide and connected to Facing Point Lock to prove locking of switches.

Different types of Lock Detection Slides:

- (a) 'A' type Lock Detection Slides (S-23370): It has half cut notches and locating marks on both upper and lower side surface of the slide. There are two types of locating marks provided on both upper and lower side surface of the slide at the distance of 10 mm. and 42 mm. from the end of the slide. **This slide is used in "IN & OUT" type of locking".**

If lock rod moves away from point/ track during unlocking of point then 42 mm locating mark shall be on top and If lock rod moves towards the point/ track during unlocking of point then 10 mm locating mark shall be on top as shown in Fig 1.6.

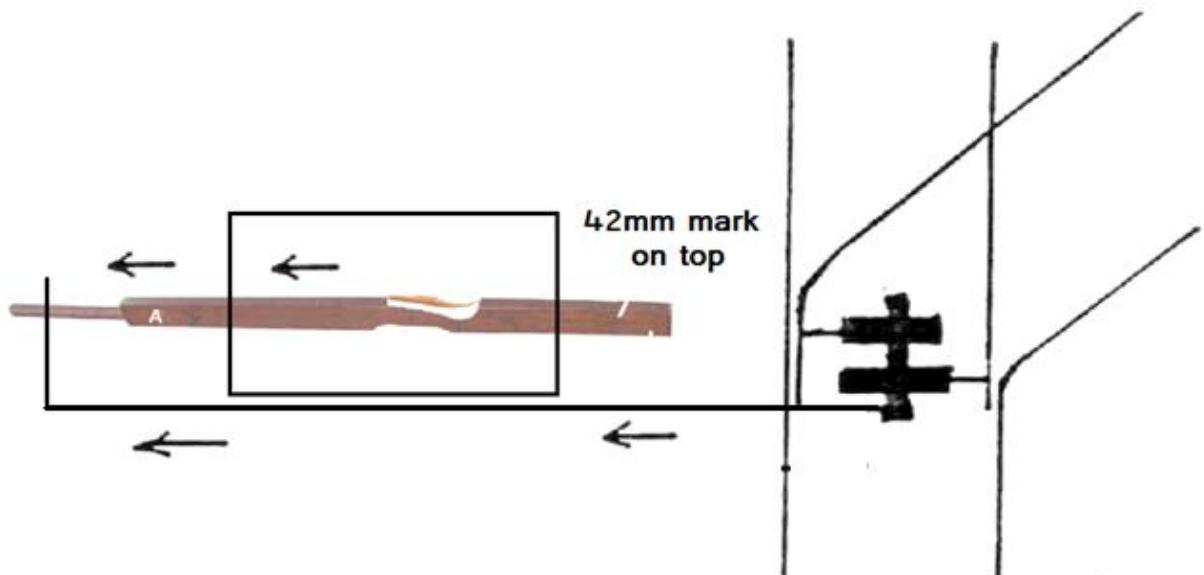


Fig No : 1.6 IN AND OUT LOCKING LH SIDE

NOTE: If it is not followed even after the point is in unlocked condition, in any one position it may be normal or reverse position of the point) of the point the detection contacts will be in make condition.

- (b) 'B' type Lock Detection Slide (S-23380): It has single notch and two locating marks on the same side surface of the slide. Locating marks are provided at distance of 10 mm. and 42 mm. from the end of the slide. 'B' type lock detection slide is used in the case of "Straight through Locking".

When EPD is placed on RH side and nearest switch is closed and locked then 42 mm shall alignment with the surface of the body, or When EPD is placed on LH side and nearest switch is closed and locked then 10 mm shall alignment with the surface of the body.

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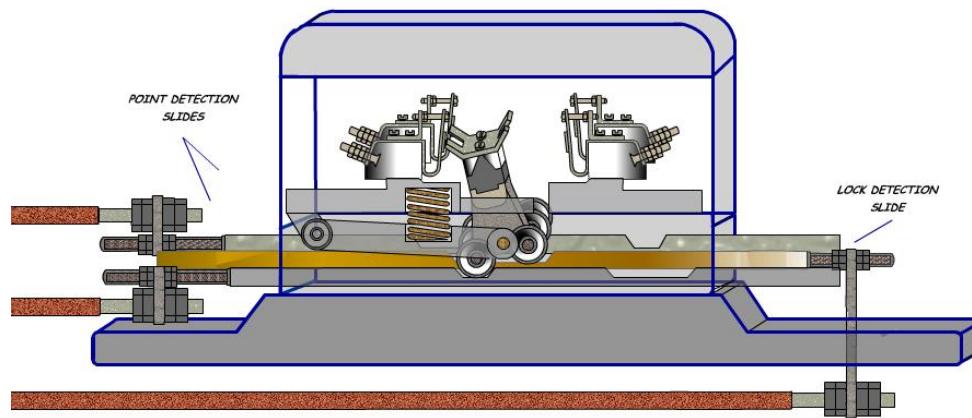


Fig No : 1.7 (a) ELECTRIC POINT DETECTOR WITH LOCK DETECTION IN LOCKED CONDITION

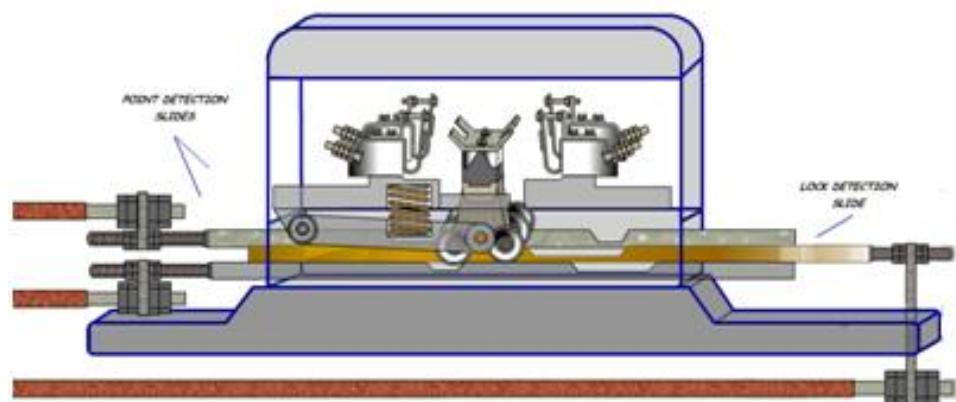


Fig No : 1.7 (b) ELECTRIC POINT DETECTOR WITH LOCK DETECTION IN UNLOCKED CONDITION

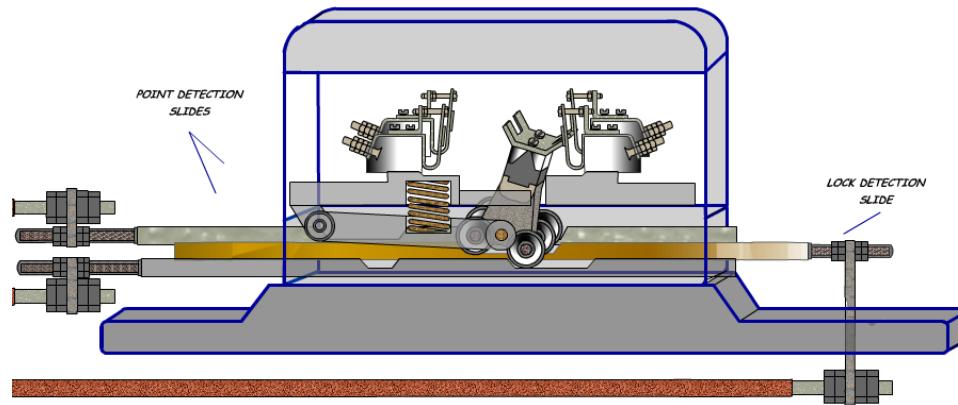


Fig No : 1.7 (c) ELECTRIC POINT DETECTOR WITH LOCK DETECTION IN LOCKED CONDITION

1.3 Wiring and Connection

EPDs provided on both end of a crossover can be wired in series or each end of crossover can wired independently. When point is set & lock in normal position then normal detection (ND) will make and when point is set & lock in reverse position then reverse detection (RD) contact will make. In series type of wiring, failure of one end of cross over or failure in one end of EPD used to cause failure of both end indication relay (NWKR/RWKR) hence signal on both side of crossover used to fail. As per RE practice EPD for each end of crossover is wired independently.

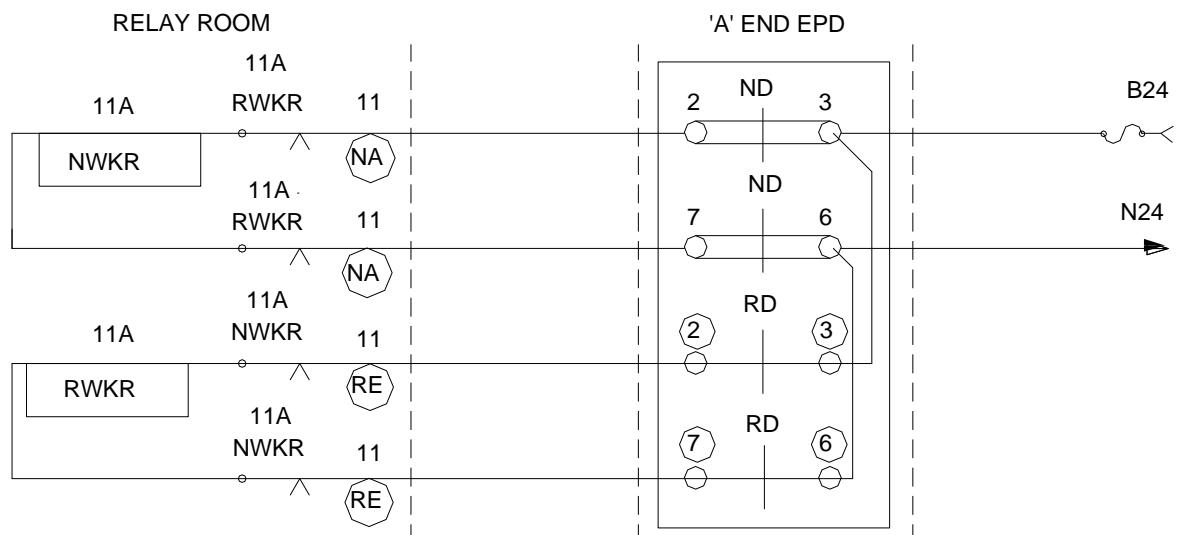


Fig No: 1.8 (a) WIRING OF EPD OF 'A' END OF POINT 11 IN RE AREA

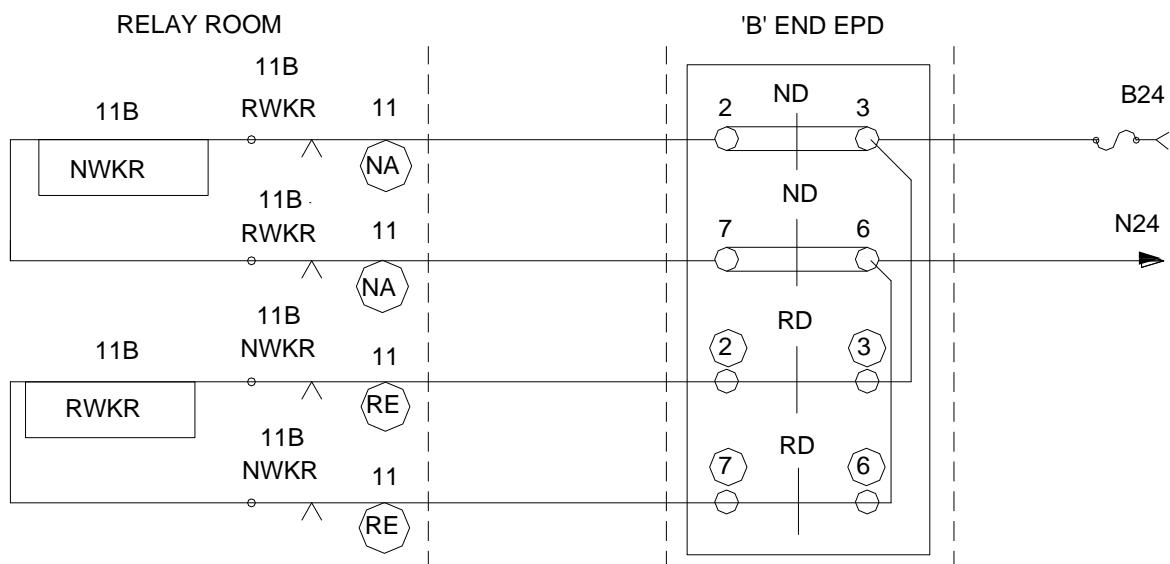


Fig No: 1.8 (b) WIRING OF EPD OF 'B' END OF POINT 11 IN RE AREA

1.4 Operation

Consider that the point is set and locked in normal position. The point slides are connected individually to point tongue rails in such a way that (i) the slide with small depression corresponds to the closed switch with location marks coinciding with the finished surface of the detector body and (ii) the slide with long depression corresponds to the open switch. The rollers are inside the notches of point slides and as well as inside the slot of the lock slide. The 'normal' contacts are making.

In the first part of the unlocking movement, the roller is forced to engage with sloping surface of lock slide which, in turn, forces the crank with the bridge contacts to move from 'N' position to centre position. This movement opens all normal and reverse contacts and closes both shunt contacts.

After completion of unlocking stroke the point tongues start moving towards reverse position. The rollers now move over the surface of the point slides, the yoke is lifted and the helical springs are compressed. The bridge contacts remain in mid-position till the point completes its stroke and the lock detector slide moves to its full locking position.

As the point completes its stroke and the other tongue rail sets fully to reverse position, the notches on the point slides are not available for the other set of rollers to drop inside the notch, but they cannot drop because the lock slide is in the unlocked position. (The rollers will however drop in case there is not lock detection).

With the movement of the locking stroke, the lock slide moves and the roller on the lock slide gradually rolls over the sloping surface of the slide. As the locking stroke comes to the end and as the point tongues are fully locked in reverse position, the lock slide also completes its travel and permits the roller to drop freely inside the slot. The force to drop the shaft trolley into the depression of the slides is given by the release of compressed helical springs which operate the yoke and crank. At this stage the normal shunt contact opens and reverse detection contacts make.

The making and breaking of shunt contacts is affected by the cams provided on either end of the bridge contact block. The operation from reverse to normal position is identical.

1.5 Installation

- (a) Detector can be mounted either to the left or to the right hand side of the facing points. (RHS or LHS is as viewed from the facing direction of the layout). Drg No. RDSO - S – 8447 S-8446 (Long sleepers)
- (b) Detector should be mounted on extended sleepers (2 and 3 from SRJ) . If this is not possible, only then they may be fixed on shoe mounted on foundation. The detector connecting rods in either case should be supported on rod roller guides to avoid the weight of the rods to play on the housing and cause wear and tear and to allow the smooth movement of the slides. Means to arrest a creep in the vicinity of the detector must be provided.
- (c) EPD is to be fixed with its closer edge at a minimum distance of 1676 mm in broad gauge and 1370 mm in meter gauge from track centre.

1.6 Precaution

- (a) This detector has, however, got one disadvantage in that, if by mistake the slides of open and close switches are inter changed the detector may give false indication. This is taken care by the locating marks.
- (b) Under no circumstances, the shape of the "shunt contact finger strips" should be disturbed, because it may lead to non-making of contacts or continuous making of contacts (even after detection contact closes). In the first case the cross-protection circuit will fail to function while in the second case the supply will be short circuited.

1.7 Testing

- (a) After installing and before connecting the detector and lock slides, pull the slides by hand and see that they move freely.
- (b) Pull the slides and ensure that all the bridging contacts make and break at the same time.

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- (c) Pull the lock slide, check and ensure that as soon as the roller is lifted above the slot in the lock slide, the normal and reverse contacts are open and shunt contacts are made. The normal and reverse contact should not make before the shunt contact is open.
- (d) Check that the contact opening of shunt contacts is approximately 6 mm. The contact piece (small) should be aligned with contact piece (large) and should make at least 75% of its full width when the contact is closed. Check and adjust the shunt contact (movable) so that 0.5 to 1.00 mm contact wipe is available.
- (e) Obstruction Test: Pull the lock bar lever to lock the points fully. Disconnect the lock detection rod from the lug of FPL assembly. The lock slide, thus remaining in the locking position, will facilitate the rollers to drop inside the depressions with the movement of point. Put back the lock bar lever to 'N' position. Place an obstruction of 3.25 mm at 150 mm from the toe of the switch and operate the point. Ensure that:-
 - (i) The points do not get locked by the locking plunger.
 - (ii) The bridge contacts do not make
 - (iii) The shunt contacts remain made.

Operate the point to the other side and test with the same test piece to get the above safe results. After satisfying the obstruction test connect the lock detection rod with the lug on the FPL assembly.

1.8 Maintenance

- (a) All the detector and lock slides must be in their respective position and are operative (i.e., the detector and the lock slides are not broken or are not jammed).
- (b) Check and ensure that the sleepers are kept well ballasted and packed.
- (c) Tighten all nuts, check nuts and bolts wherever such tightening is required. Particular care must be taken to see and ensure that the lock nuts holding the detector and lock slides with the lugs are kept tight. After tightening, the nut and lock nut should be turned and opposite directions towards each other to lock the nut.
- (d) Where detectors are used in track circuited areas, check that the insulation between the detector slide and the connecting rod is in order.
- (e) Check wires carefully to keep them neat and clear of all moving parts. See that they do not get trapped in the lid when closed.
- (f) Oil the slides, rollers and pins with axle oil (Medium Grade) to IS : 1628.
- (g) When lubricating the slides and bearings in detector box, care must be taken to leave no oil on wires and to avoid overflow of oil which would collect in the bottom of the box where it may come in contact with the detector wiring.
- (h) Since there is a possibility of dust collecting on the slides care must be taken to clear this periodically to avoid premature wear of slides and rollers.
- (i) During maintenance rounds, check for the presence of any moisture due to leakage or condensation.

1.9 Contacts

- (a) Inspect contact surfaces. If pitted, clean them with chamois leather to be free from dust and burnish them.
- (b) Check contact spring tension and adjust where necessary.
- (c) Check that the spring of the contact operating mechanism is in good condition.
- (d) Ensure that all the bridge contacts make and break at the same time.
- (e) Ensure that the shunt contact does not make before the bridge contacts break and stationery contacts do not make before the shunt contact opens.
- (f) If there is too much side play of slides, there is a tendency for the roller to ride over the slide instead of dropping in the slide groove. Checks must be made during maintenance to ensure that this does not happen.
- (g) Check the pins of the switch extension pieces for any rib formation or excessive wear, which would contribute to intermittent failures of contacts.

ELECTRIC POINT AND LOCK DETECTOR IRS TYPE

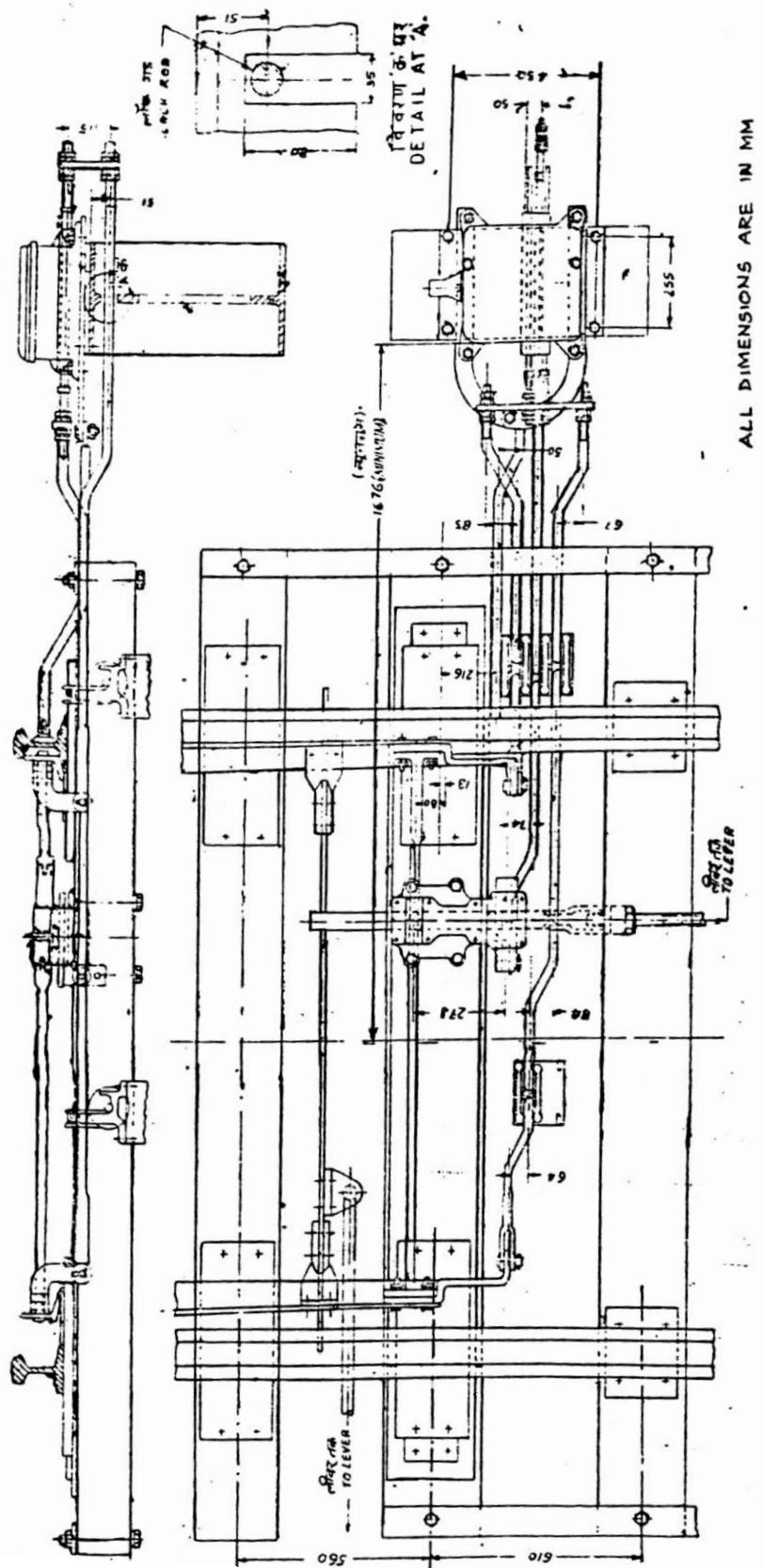


Fig No: 1.9 FIXING ARRANGEMENT OF ELECTRIC FACING POINT AND LOCK DETECTOR ON INDEPENDENT FOUNDATION (LAYOUT FOR 75R OR 1 IN 12 TURNOUT BG)

CHAPTER 2: INTRODUCTION TO POWER OPERATION OF POINTS

2.1 Introduction

An electric point machine is an electrically driven machine used for operation of points in railway yards, and comprises an electric motor, point mechanism, crank handle mechanism, point detector and unless otherwise specified, a point locking device also. The point machine shall operate in the following sequence: -

- (a) Open the detection contacts;
- (b) Unlock the points, where locking is provided
- (c) Move the points
- (d) Lock the points where locking is provided.
- (e) Close the detection contacts.

Operation (e) shall be completed to the full normal or reverse position of the points and where locking is provided, operation (d) shall be completed before the indication for the respective position can take place. Apart from the basic requirements of circuitry, the following general requirements should also be catered for:-

- (a) The machine shall be designed to move the points to the normal or reverse position, lock them if required and detect their respective positions.
- (b) The machine shall be so constructed that no movement of the mechanism shall result from vibration or external force applied to the mechanical connections. This requirement is normally achieved by locking the throw rod when the point mechanism has completed its stroke and gives an added protection in holding the points under the wheels. Also, when points are trailed through the damage is confined to the connections between the machine and the points.
- (c) The machine shall be suitable for either right hand or left hand operation, and shall be so constructed that it can readily be converted at site from right hand to left hand operation and vice versa. (A right hand operation indicates the operation of a point machine which is fixed to the right of the track as seen when facing the points, and a left hand operation indicates the operation of a point machine which is fixed to the left of the track as seen when facing the point).
- (d) The machine shall be provided with a suitable friction clutch to cover the requirements as applicable for the range of loads specified. A clutch is useful in minimising the shock on the point motor at the end of the switch travel as well as when there is an obstruction at the points. A clutch is normally provided with an arrangement for adjusting the load at which it would slip. Proper adjustment is required if failures are to be provided. Too loose an adjustment would result in frequent slipping of the clutch and too tight an adjustment would impose a heavy load on the motor when there is an obstruction at the point. The slipping current shall lie between 1.5 and 2.0 times of the maximum operating current of the machine.
- (e) Facility to stop and change the direction of rotation of the machine during operation. This facility is required in actual practice to permit the cabinman to change his intention of the setting of the points during operation i.e., for enabling him to bring back the points to their original setting in case the other setting cannot be reached due to obstruction or otherwise. This facility is achieved in point machine by providing an arrangement in which both RC (Reverse Control) and NC contacts (Normal Control) are made during the operation of points. If both the contacts are available during operation, the direction of rotation of motor can be changed by the changing of lever position.

INTRODUCTION TO POWER OPERATION OF POINTS

- (f) The motor cut off contacts shall be housed in the mechanism case and so designed that they follow the movement of the mechanism and do not complete their operation until the locking mechanism has completed its function.
- (g) Crank Handle Operation: The machine shall be designed to permit manual operation by use of a crank handle.
- (h) The machine shall be provided with a crank handle isolating contact, the arrangements shall be such that the insertion of crank handle to engage the operating mechanism shall not be possible unless crank handle isolating circuit is made not be capable of being reconnected until the crank handle has been withdrawn from the machine.
- (i) The machine shall be so designed that it can be stopped, reversed or obstructed at any point during operation without damage.
- (j) The throw bar of the machine shall have a maximum stroke of 220 mm for Clamp type of point machines and 143 mm for rotary type of point machines. For rotary type of point machines, it shall be possible, to adjust the stroke from 143 mm to 94 mm (MG&BG).
- (k) For machines using rotary type of locking, the locking of the point shall be achieved by means of a segment engaging in the locking groove (Notches) of the gear rack and lock slide.
- (l) Suitable snubbing device shall be provided, if necessary.

2.2 Point Control and Operation Arrangement

This can be done by means of

- (a) Direct Controlled
- (b) Relay Controlled

2.2.1 Direct Control

Whenever a point machine is controlled directly from the lever (through circuit controller bands), it is known as direct control. This is used when the point is not far away from the cabin. In this control 3 wires are used for controlling the point machine.

As shown in the figure 2.1, three wires are required to operate the point machine, one for operating point from reverse to normal (NW), other for operating point from normal to reverse (RW) and the third is the common return.

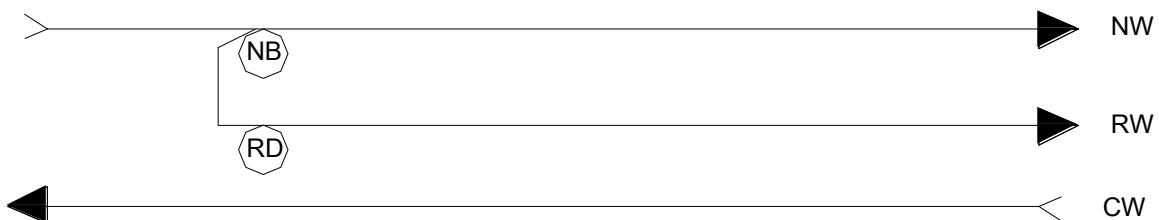


Fig No: 2.1 POINT DIRECT CONTROL CIRCUIT

2.2.2 Relayed Control and Operation

When the point machine is far away from the cabin, a considerable amount of voltage will drop in the controlling wires, since point machines take more current. To reduce the voltage drop bigger cross section conductors are to be used or relayed control is to be used. Relay control is one in which lever knobs/switches of panel controls the working of the relays known as point controller relay (normal & reverse point controller relay NWR RWR) and contactor relay WCR (to handle high switching current at initial stage of point machine motor operation), which are kept near to the point machine. In turn these relays, control the working of point machines through a local circuit. Since these relays take very little current the cross section of conductor used for controlling these relays can be small and voltage drop in the conductors also will be less. In relayed 3 wires for point operation and 4 wires for point detection purpose.

Control Circuit : In this point control and operation circuits, three wires are used for controlling two point controlling neutral relays (normal point operating relay NWR & reverse point operating relay RWR), and NWR & RWR controls the WCR heavy duty point contractor relay. NWR is used for operating the points to normal and the other RWR is used for reverse. Refer Fig. 2.2.

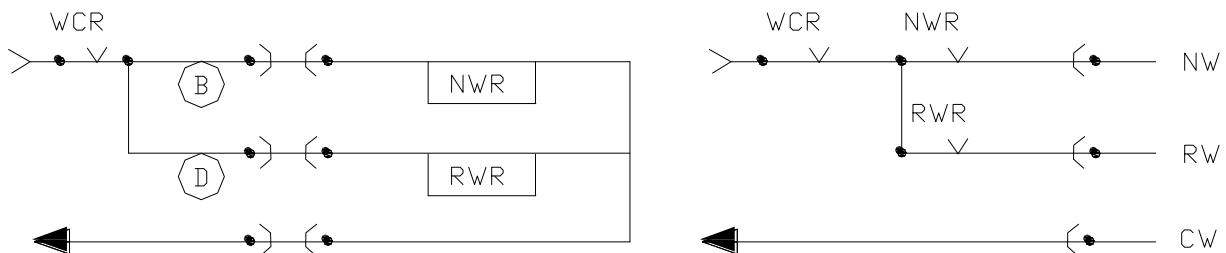
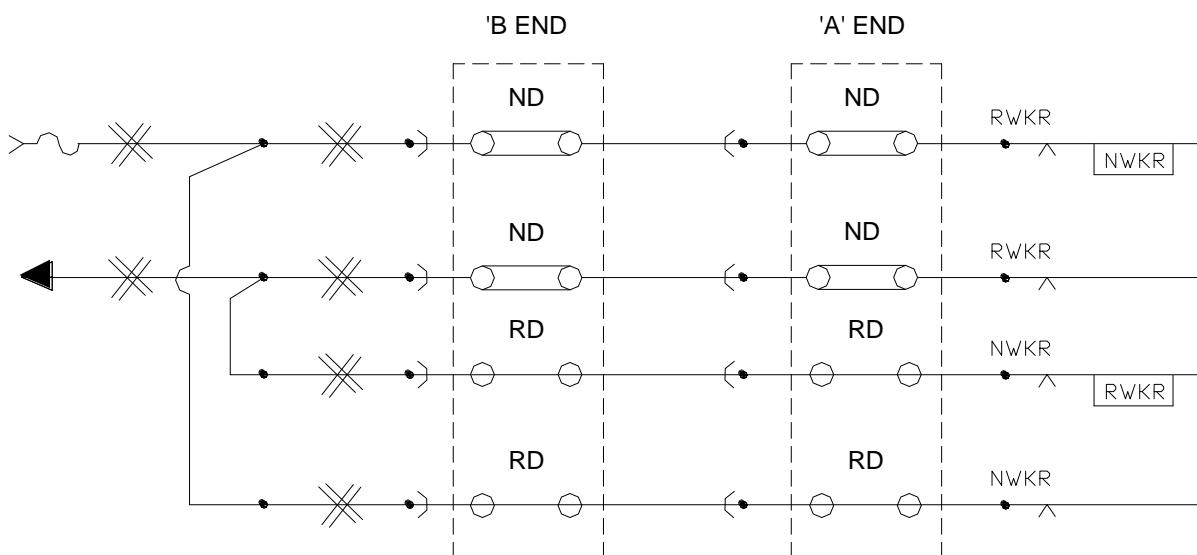


Fig No : 2.2 POINT CONTROL CIRCUIT

Detection Circuit: In this detection, 4 wires are used between the relays and the nearest detector. Since two neutral relays are used, there is a possibility of both relays picking up at the same time. To prevent this the back contact of RWKR is used in NWKR circuit and the back contact of NWKR is used in RWKR circuit. To ensure correspondence between the lever and the function, the concerned lever contacts also can be used.



NOTE : "X" OTHER CONTROL SELECTION.

Fig No : 2.3 DETECTION CIRCUIT

CHAPTER 3: IRS ROTARY ELECTRIC POINT MACHINE (143MM STROKE)

3.1 Introduction

The IRS type of electric Point Machine (Rotary Type) is manufactured as per IRS specification S-24/2000 and RDSO Dr.No.S10.800. These machines can be used for all types of switch fittings and weight of rails. The point machine is rated for nominal operating voltage of 110 VDC.

3.2 Sequence of Operation:

- (a) Opening of Electrical detection contacts
- (b) Unlocking of the point-switches
- (c) Driving the point switch rails from one position to another position
- (d) Relocking of point switches
- (e) Closing of Electrical detection contacts

3.3 Salient Features

- (a) Each point switch is independently locked with rotary type locking arrangement. The lock notches are different for Normal & Reverse position of a switch and hence Normal lock notch. cannot be used for Reverse position and vice versa.
- (b) IRS point is a High thrust type of Electric point machine rotary type.
- (c) No need for any adjustment in friction clutch at site and does not require electrical snubbing for smooth stoppage of motor as the friction clutch is an integral part of the main gear disk and rotates only less than one revolution.
- (d) Detection and controlling contacts are of heavy duty and self wiping type (vertical wiping). Hence loose packing effect on the point indication is minimised.
- (e) The possibility of both slides (lock & detection) moving together due to rust / friction in case of one slide connecting rod breaks is prevented by the provision of brass strips between them.
- (f) Conversion of rotary motion into linear motion is achieved by rack and pinion arrangement.
- (g) The detection contacts are allowed to close only on completion of locking of the switches. Similarly, the contacts are made to open before unlocking of point begins.

3.4 Main Parts:

- (a) DC series, split field Motor with in built reduction gear unit.
- (b) Transmission assembly.
- (c) Throw rod, lock slides and detection slides.
- (d) Detection and control contact switch Assembly.
- (e) Cast iron Case.
- (f) Cover with locking mechanism to prevent unauthorised interference in its working.
- (g) Hand crank.

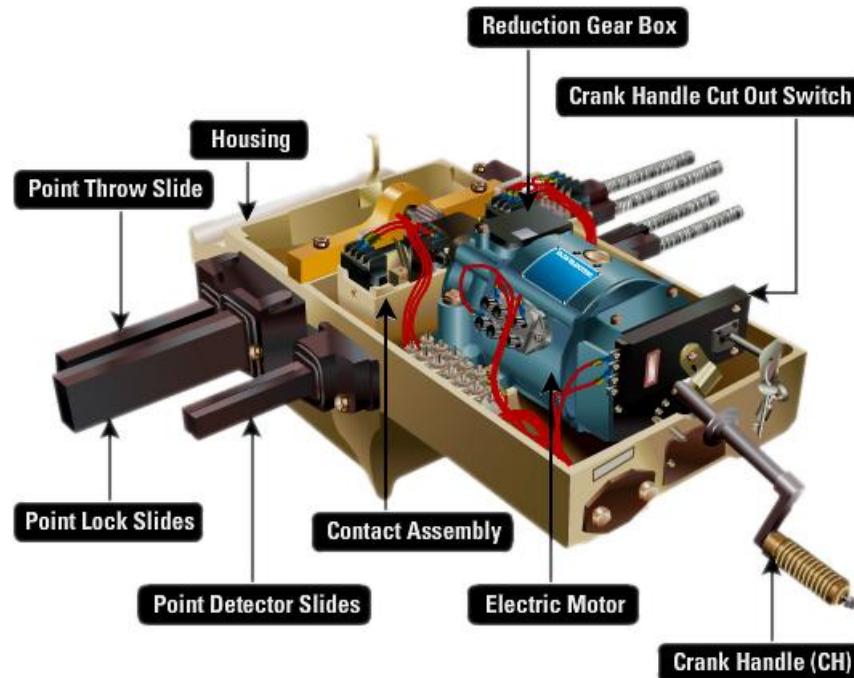


Fig No : 3.1 POINT MACHINE

3.4.1 DC Series Motor: Fig. 3.2 This motor is used to convert Electrical Energy into mechanical energy and designed to operate the point machine in both directions. It is series, split field motor with carbon brush to conform to IRS: S 37 Motors for Electric Point Machine. It can be divided in three parts

- 1) DC Motor
- 2) Reduction Gear
- 3) Crank handle cut out contact assembly

The electrical parameter of motor is as follows

- (a) Rated voltage 120/110 VDC capable of working at +/- 25% of rated voltage.
- (b) RPM 1700+/-15%
- (c) Rated current 5.3 A & maximum 8.5 A
- (d) Operating time 4 to 5 seconds
- (e) Power 440 Watts.
- (f) Gear oil SAE 30
- (g) Rating 10 minutes



Fig No: 3.2 POINT MOTOR

3.4.2 Transmission Assembly

It consists of the following elements show in the Fig. No.3.3.

- (a) a Main Gear Rim
- (b) b Spring loaded friction clutch
- (c) c Lift out disk
- (i) Transmission shaft with rack pinion and Rotary type segmental lock pawl.
- (ii) Drive disk (bottom plate)
- (iii) Control disk (top plate)

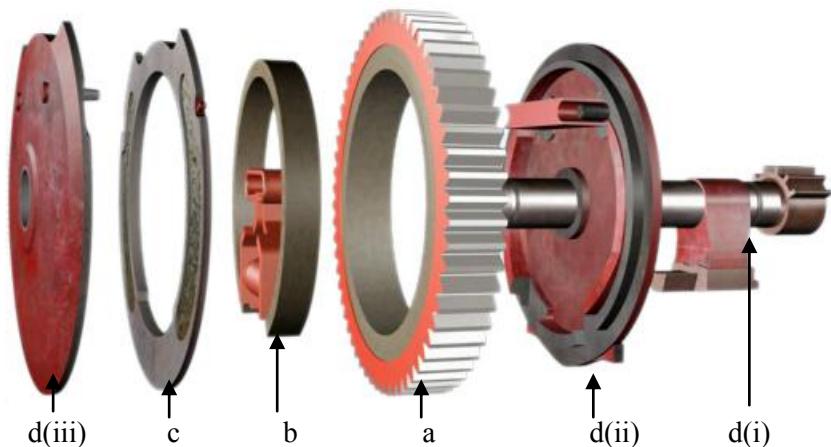


Fig No: 3.3 TRANSMISSION SHAFT WITH FRICTION CLUTCH, LOCKING SEGMENT & PINION

(a) Main Gear Rim:

This main gear rim is having 92 teeth and is directly meshed to the Motor pinion, which is having 12 teeth. It gets the rotary motion from the motor which is restricted to 270 degrees. This gear rim transmits the rotary motion to its centre shaft through spring loaded friction clutch through drive disc to shaft of drive disc and pinion fixed on shaft which in turn imparts a maximum of 143 mm. linear motion to the throw rod.

(b) Spring loaded friction clutch:

Main function of friction clutch is to provide overload protection to the motor in case of obstruction of point, in such situation it de-clutches the load (Point) from motor and motor rotate with very low friction with friction clutch hence draw less current. It consists of

- (i) Slip ring
- (ii) Gear rim
- (iii) Compression spring assembly.

The Compression spring assembly is inserted in the slip ring. The complete assembly is fitted inside the main gear rim and held in position by means of spring locking plate LH & RH. The spring load on the slip ring can be increased or decreased by tightening or loosening the adjustable bolt provided in its assembly and this increases or decreases the frictional load on main gear rim. Since it is pre adjusted in the manufacturing place itself, there is no need to adjust it at site. Shown in the Fig No 3.4



Fig No: 3.4 SPRING LOADED FRICTION CLUTCH

(c) To adjust the clutch at a desired current:

The IRS type of Electric point machine is tested and its clutch is adjusted in such a fashion that it does not slip at a normal load of a point

Adjustment of friction clutch:- Friction clutch should be so adjusted that slipping current is between one and half times to twice the normal operating current or as specified by the manufacturer. For rotary type point machines no attempt should be made to adjust friction clutch at site. Friction clutch can only be adjusted in authorized Workshop. When difference between normal operating current and operating current under obstruction is less than 0.5A, the clutch requires adjustment. Such machine should be replaced A window is provided on drive disc which provides a direct access to check nut of friction clutch which is helpful in adjusting thrust/ slipping current without opening friction clutch. This facility is for workshop artesian staff who adjusts the friction clutch.

(d) Transmission Gear Assembly:

Transmission shaft, Rack Pinion and Segmental lock pawl and Drive Disc.

The Transmission assembly consists of

- (i) Rack Pinion,
- (ii) Segmental lock pawl and
- (iii) Drive disk
- (iv) Lift out disc
- (v) Control disc

All these are force fitted and keyed with the centre shaft in such a way that all of them move as a single unit.

- The rack pinion having 6 teeth is allowed to engage with the throw rod (having 5 teeth in the middle) during operation after unlocking, for converting rotary movement in to linear movement and transmitting stroke (143 mm) to throw the point.
- The Segmental lock pawl is used to lock the point switch lock slides and throw rod in both Normal & Reverse position
- The drive disk (i.e. bottom plate) is the one which is moved by the clutch spring locking plate LH / RH and thus transmits rotary motion to main shaft and to the pinion. It is having two stud pins for holding the Locking Member, which is used to lock the control rim with drive disk.
- This transmission assembly is mounted inside the main cast iron body with bush bearing at its ends. The Main Gear rim friction clutch assembly when rotates, drives the drive disk. Thus the shaft gets its rotary motion from the Main gear rim. The total circular movement of this assembly is restricted to 270 degree as the drive disk is having a stopper, which butts with a stopper rod provided in the main cast iron body. The segmental lock pawl is normally engaged in the circular lock notches of the Point throw rod and switch lock slides.

(e) Lift out Disk

It is first disc to rotate in transmission assembly after friction clutch. It is placed in between gear rim and control rim and used to brake the detection contacts before unlocking of point. It is having a 158 mm inclined cam (notch) at its outer periphery in and roller 'A' (top roller) falls in it when the point is fully locked in Normal or Reverse position. Similarly, being the first disc to rotate in transmission assembly, if's inclined notch lift the roller A (Top Roller) upwards to brake detection contact before unlocking of the point.



Fig No: 3.5 LIFT OUT DISK

(f) Control Disk:

It has a semicircular notch (cam of 120 mm) on its periphery with vertical edges. This notch available below roller 'A' only when lock segment fully enter in respective notches of lock slide & throw bar (mean point is locked). The vertical notches prevent up word movement of roller 'A' due to vibration of point or other movement in point hence avert flashing of point and gives more reliability to the detection contacts.



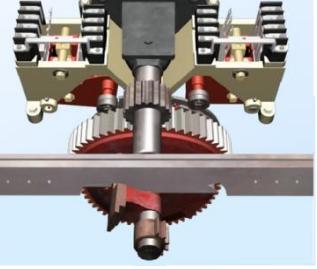
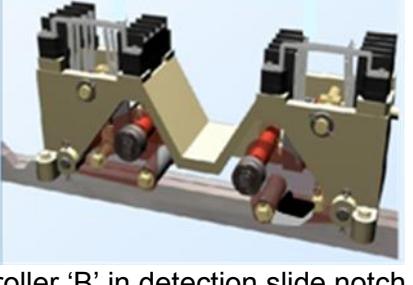
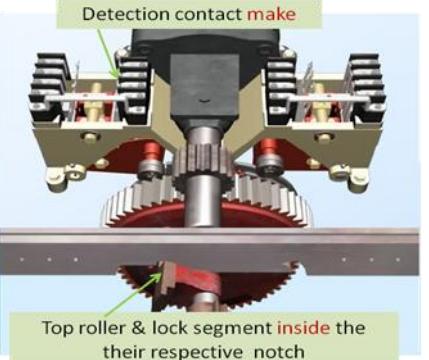
Fig No: 3.6 CONTROL DISK

3.5 Working of Transmission Assembly

When the motor rotates, the main gear rim and then the friction clutch assembly gets its movement which cause the friction clutch spring locking plate LH / RH to engage with edge of notch on inner periphery of lift out disk (clearance between the friction clutch spring locking plate LH & RH and edge of notch on inner periphery of the lift out disk is about 3 mm) and thus makes it to move. The movement of the lift out disk lifts the roller A (Top Roller) which in turn actuates the electrical contacts. i.e. detection contacts opens and after further movement other control contacts get 'Closed' (this facilitates mid stroke facility).

Further movement of the Main gear rim assembly (after few milliseconds) shoe expansion's locking plat engage with projection on the inner periphery of drive disc to rotate drive disc & hence lock segment & pinion fixed on shaft also rotate with drive disc. (Clearance between friction clutch spring locking plate LH & RH and edge of projection on inner periphery of the drive disk is about 12 mm) With rotation of drive disc control disc also rotate through non-trailable block.

With rotation of drive disc and its axle the lock segment also rotate and comes out of notches on lock slide to unlock point. When point get unlock, pinion on shaft get engaged with rack on throw bar/ gear rim to convert rotary movement in to linear movement to generate 143mm stroke.

Sl. No	Parts of Locking assembly	Action happening during point operation
1.	 Lock segment out of notch of lock slide	As shaft rotate the lock segment point get unlock
2.	 Pinion engaged with rack	Pinion get engaged rack on throw bar and rotary to linear conversion will take place to obtained 143 mm stroke and Point operates
3.	 Lock segment inside the notch of lock slide	point get locked as lock segment entered in the notches of lock slide and top roller falls in side notch of control & lift out disc.
4.	 roller 'B' in detection slide notch	Detection slid notches comes under bottom roller and it falls in detection slide notch.
5.	 Detection contact make Top roller & lock segment inside the their respective notch	Detection contact makes & control contact open and feed to motor is cut off & point indication relay picks up.

3.6 Throw rod, Lock & Detection Slides

3.6.1 Throw rod (Gear Rack)

The throw rod (Gear Rack) have two holes (24 mm) at its each end. Throw bar of point is connected in this hole. It has rack in the middle which engaged with pinion on the shaft of drive disc after unlocking and gets a maximum stroke of 143 mm for driving the point switch rails from N to R & vice versa. Further, it is having two semicircular notches in middle of it's surface (circular- one each for point normal and reverse) and use to lock the throw rod at the end of the point operation.



Fig No: 3.7 THROW ROD (GEAR RACK)

3.6.2 Lock Slides

The lock slides are independent for each switch and moves along with the switch rails i.e. 115 mm in BG & 100 mm in MG Nominal. These slides are having one short & one wide notches (all semicircular) and because of the wide notch, these slides are common for BC & MG. The free movement of these slides in locked position is about 5 mm in short notch & 55 mm. in wide notch.

A threaded rod is riveted and welded to one end of the throw rod in which ground connection rod is connected by using a lug for easy adjustment of notch position according to the requirement. (These slide position can be changed only by removing the same from the machine, which is required when the position of the point machine is to be changed from left mounting hand to right hand mounting and vice-versa. Two brass strips on one lock slid and one brass strip on other lock slid are riveted on inner surface of lock sides so that so as to avoid, the possibility of moving together due to rust / friction is eliminated in case of lock rod brakeage.

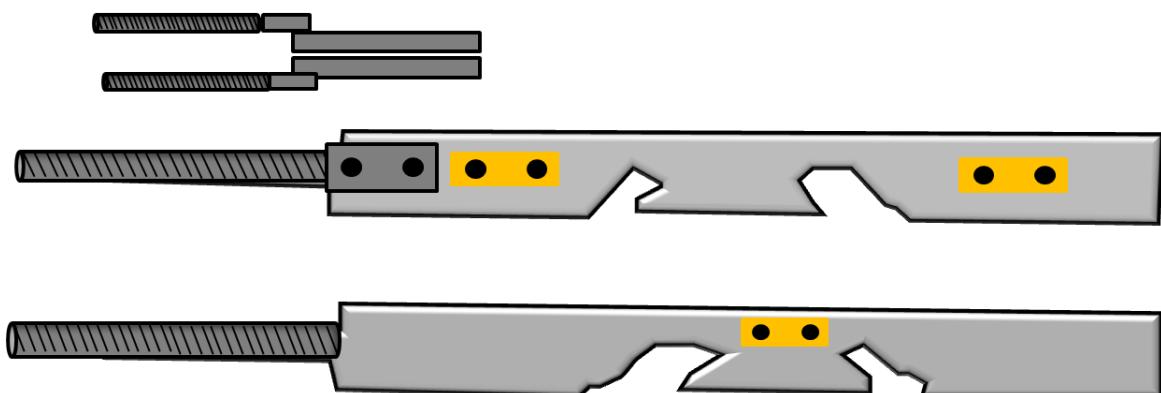


Fig No: 3.8 LOCK SLIDES (69X18)

3.6.3 Detection Slides

These Slides are used for closing and opening the detection & control contacts and having one short and one long notch. The long notch facilitates the slides to use both in MG & BG switches. Brass strips are also provided in between them to prevent joint movement due to rust/ friction. At one end of the slide A threaded rod is riveted and welded at its one end in which ground connection rod is connected by using a lug for easy adjustment of the notches to the requirements. (The idle movement of the slide is limited to 3 mm & 53 mm in short & long notch when the roller B inside the detection contact assembly- dropped in the notches.)

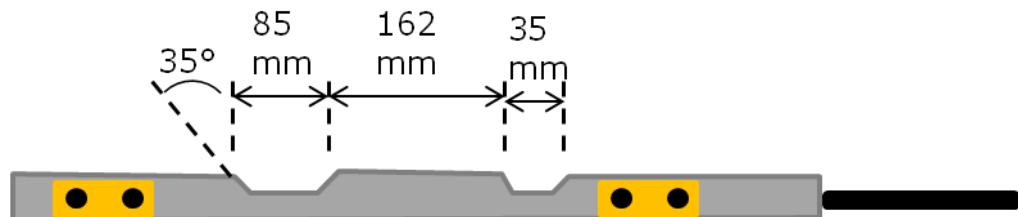
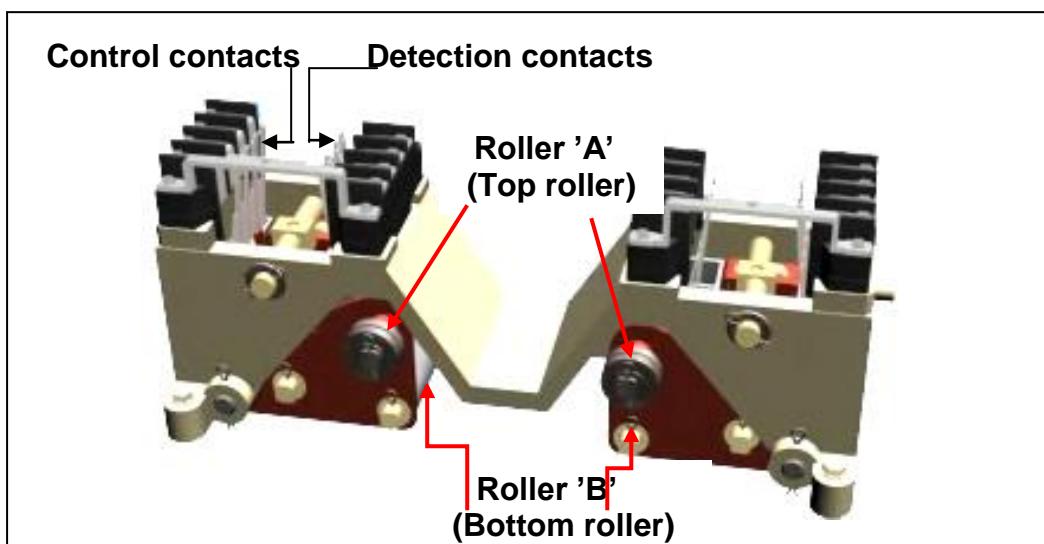


Fig No: 3.9 DETECTION SLIDE (32X15)

3.6.4 Detection and Control Contacts

Two sets of heavy duty self wiping contacts are provided for (each 4 Nos.- 2 sets for control and 2 sets for detection in each position) electrically detecting the Normal and Reverse position of the point and to control motor feed. The entire assembly along with its mechanism is named as switch & Contact Pedestal.



Roller 'A' : Works with Lift out disc , Roller 'B' : Works with detection slide notch.

Fig No: 3.10 DETECTION AND CONTROL CONTACT ASSEMBLY

DETECTION CONTACTS

The control contacts (outer ones) are named as Normal control contacts and reverse control contacts. The normal control contact opens only when the point is set and locked in Normal position. Similarly the Reverse Control Contacts opens only when the point is set and locked in Reverse position. In- all other- conditions these contacts will be in made conditions.

3.6.5 Detection Contacts

For detecting the point switches in Normal or in Reverse position, 2 sets of contacts (inner ones) are provided. The respective contacts will be allowed to make only if the point is fully set & locked in the respective position and not otherwise.

The entire mechanism is named as Detection & Control contact pedestal and arranged in such a way that only one set of contact (one group of detection & one group of control contact in opposite set) is allowed to make at a time provided, the 270 °rotation of transmission assembly, is completed and movement of both detection slides have completed its predetermined linear motion of 100 mm in MG & 115 mm in BG.(i.e. the notches in the detection sides should align-below, the roller B (bottom roller) in the pedestal assembly and the cams in the control & lift out disks should come below the roller A (Top roller) which ultimately proves correct setting & locking of switches)

SL. NO	POSITION OF POINT	ND	RD	NC	RC
1.	POINT NOT SET & / OR LOCKED	OPEN	OPEN	MAKE	MAKE
2.	POINT NOT SET & / LOCKED IN NORMAL	MAKE	OPEN	OPEN	MAKE
3.	POINT SET &/ LOCKED IN REVERSE	OPEN	MAKE	MAKE	OPEN

All these contacts are actuated only by the lift out disk at the beginning of the operation: and held in position by the control disk at the end of the operation.

3.7 Cast iron Case

It is used for assembling

- (a) Point motor
- (b) Transmission assembly
- (c) Detection and control contact assembly etc.

Further, throw rod lock-slides and detection slides are also inserted in the respective recess.

Provision also exists to drain out the accumulated water inside.

Six holes (20 mm dia) are provided for fixing the machine on the sleepers.

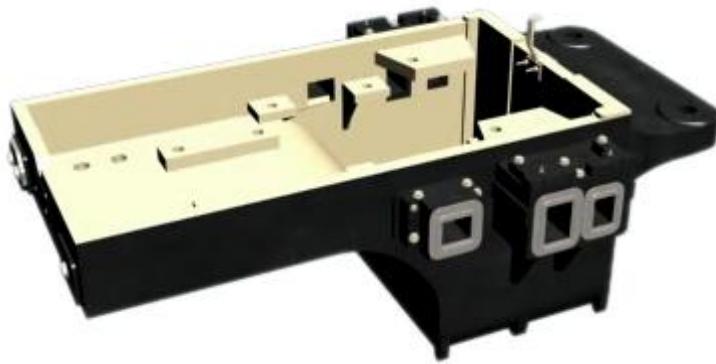


Fig No: 3.11 POINT MACHINE BASE

3.8 Cover:

It is a sheet iron (single) cover, used to cover the entire parts assembled in the main cast iron body. It is having a maintainer's lock to lock the cover with the machine body. Provisions are available on sides to close the hand cranking hole and cut out contact actuating hole by special keys meant for this purpose.



Fig No: 3.12 POINT MACHINE BASE COVER

3.9 Hand Crank and Cut out Contacts assembly

Cut out Contacts assembly disallows simultaneous power and manual operation of point machine to protect staff performing crank handling. Ordinarily crank handle can not be inserted in machine. Turning of crank handle key permits/ allows insertion of crank handle in the machine and turning of crank handle key opens Cut out contact isolates the negative power path of motor. Cut out Contacts assembly contains two sets of contact ,these contacts are wired in negative path of power supply to motor. These contacts break / open with insertion and turning of crank handle key and makes when crank handle key is taken out.

It comprise of

- (a) Crank handle cutout contacts
- (b) flap cover plate

Crank handle key

Key controls the entry of crank handle in the machine for manual operation. A metal flaps attached to a lock and hangs/ placed in front of motor shaft at the entry point of crank handle. The flap cover plate can be displaced by means of a crank handle key.

The insertion and turning of crank handle key

- (a) Displace the flap cover plate to allow insertion of crank handle
- (b) Opens crank handle cutout contacts.

Removal of the crank handle key

- (a) Replaces flap cover in front of motor shaft
- (b) Makes the crank handle contact.

The crank handle key has coding (Wards) arrangement on its tip. In relay interlocking the point & point machine are divided in different crank handle zones and key of different wards are allocated to each zone. This arrangement to prevents manual operation of one zone point machine by other zone crank handle key which is otherwise very dangerous and unsafe.



Fig No: 3.13 CRANK HANDLE KEY

CRANK HANDLE

This apparatus is used for manual operation of point machine. It is a "Z" shape structure made of steel pipe and has wooden handle on one end to have better grip. Wards & feathers are welded on other end of pipe to facilitate coding (insertion of only to nominated crank handle). A stud is riveted in the pipe, it gets engaged in forked shaft of motor.

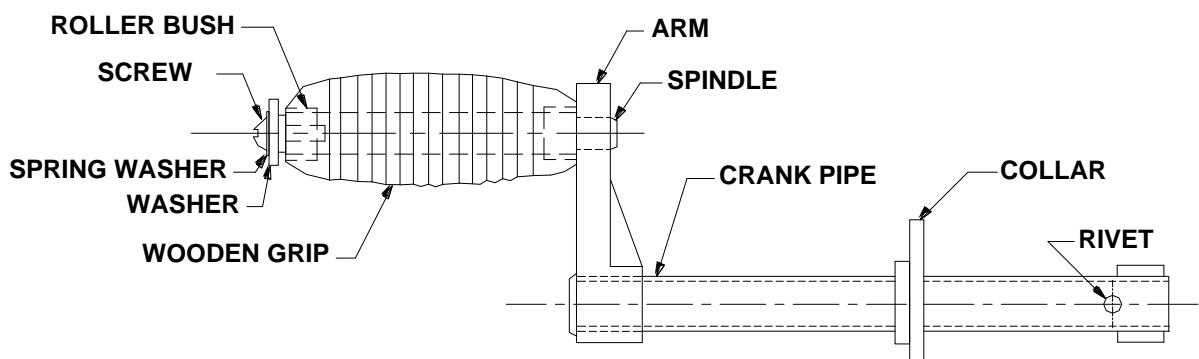


Fig No: 3.14 CRANK HANDLE

CHAPTER 4: INSTALLATION OF IRS ROTARY TYPE POINT MACHINES (RDSO DRAWING No.: 510800)

4.1 GENERAL

The IRS point machine is to be installed with ground connection and layout as per RDSO DRG. S 3262/63. It is advisable to install the point machine at the side where the tongue is normally closed. This shall be advantageous for maintaining bars, which are then inside the machine as much as possible. During installation of the point machine, trains may pass the point when there are no rods connected. The tongues must always be locked and wedged in such cases. Great care must also be taken about the track gauge, when the gauge tie plates are changed. No trains shall be allowed to pass the point unless the track is secured by the plates or temporary tie rods.

4.2 SLEEPERS

Check that the two long sleepers (Sleeper No 3&4) are on equal horizontal level. The top surface of the two sleepers should be even and level. The measure for the four holes (Point machine mounting holes) is to be taken from stock rail. Hence before marking the holes, sleepers are to be checked for square ness. If they are not square, measures are to be taken suitably so that the sleepers are square to the rails. Fix extended gauge tie plate in the first (Sleeper No 3) long sleeper. (Centre line to centre line distance of Sleeper No 3&4 must not be less than 710mm)

4.3 LEADING STRETCHER BAR

Leading stretcher bar (insulated) is to be located at a distance of 470 mm from the toe for BG & MG layouts. Fasten leading stretcher bar and ensure toe opening of 115 mm for BG layout and 100 mm for MG layout. Fasten the drive lug (RDSO DRG. No. S 8806) to the stretcher bar holes as shown in the layout drawing with insulation plate, washers and sleeves. Check that the special bolt head (RDSO DRG. No. SA 312/M) is positioned at the 'L' bent side of 'the drive lug. Following stretcher bar need not be disturbed and is fixed as per the Track Manual layouts.

4.4 POINT MACHINE AND RODS

(a) FIXING THE POINT MACHINE

For fixing the point machine four holes are to be drilled on extended gauge tie plat of two long sleepers. Place the point machine on the sleeper such that the distance of centre line of the machine from stock rail inner edge is 1050 mm as shown in the layout drawing. Align the sleeper holes and the point machine holes for fixing. Tie the point machine with the sleepers securely to avoid shake and vibration while operation. As the mounting holes in the machine are 20 dia, the mounting bolt shall be selected as per the requirements of Railways.

Measure and make note of the travel of drive bar of the machine by hand cranking to either LH or RH side.

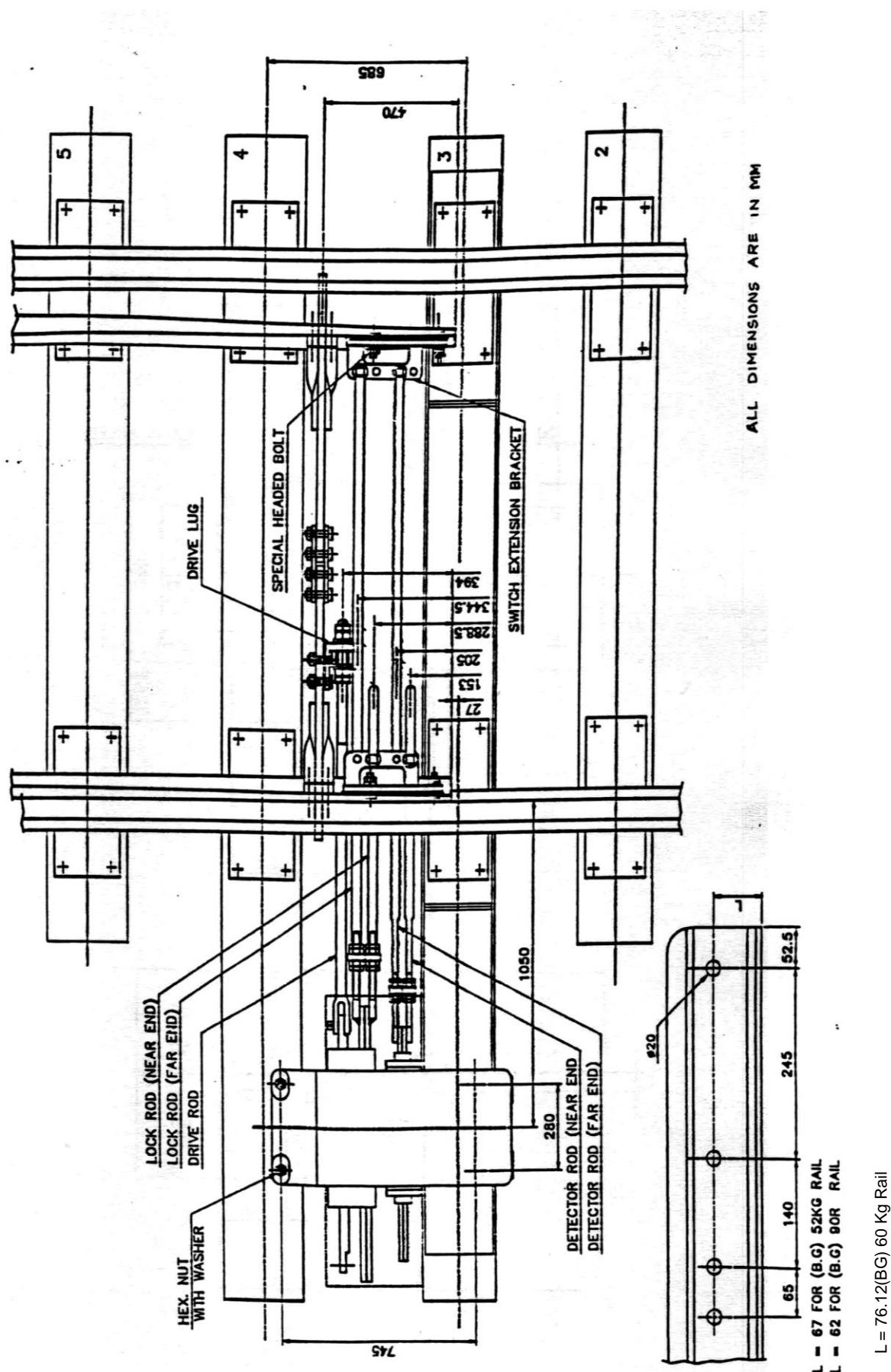


Fig No: 4.1 THE LAYOUT ARRANGEMENT OF IRS POINT MACHINE

(b) MOUNTING OF DRIVE ROD AND LOCK RODS:

MOUNTING OF DRIVE ROD: (REFER FIG. 4.2)

- (i) Operate the drive bar by hand crank to the inner position. The lock bars and detector bars of the point machine are to be moved manually to the inner position.

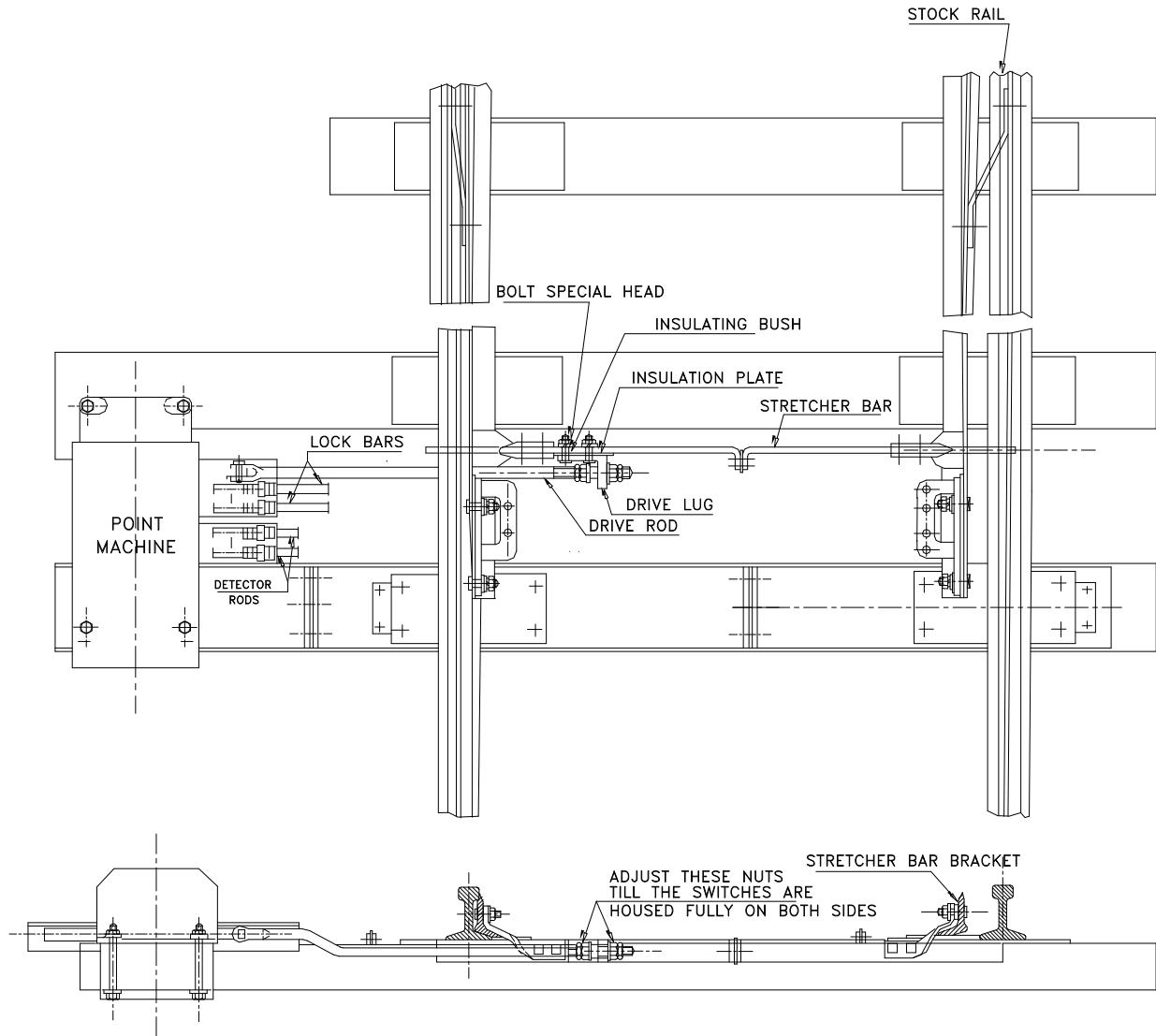


Fig No: 4.2 SECTION SHOWING THROW (DRIVE) ROD CONNECTION

- (ii) Assemble the switch extension bracket (Fig. 4.3) (DRG. No. RDSO/S 3264) to RH and LH switch rails with proper insulation. Push the RH switch rail to closed position and clamp the point.

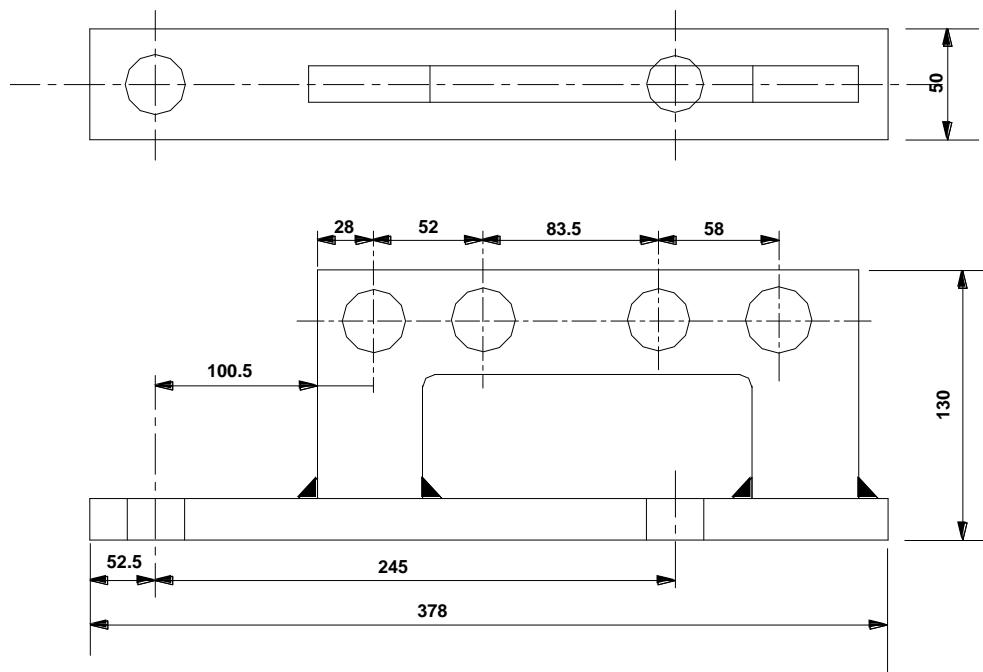


Fig No: 4.3 SWITCH EXTENSION BRACKET

Connect drive rod (Fig. 4.4) to the drive bar and guide it through the drive lug and slacken the nuts on both sides.

Remove the clamp that is holding switch and stock rail. Hand crank the machine and adjust the Drive rod by turning the nuts till the LH switch rail is housed to stock rail without gap and locking of the point machine is completed.

Operate the point by hand crank and adjust the nut on the other side of the drive rod to the required distance, till the RH switch rail is housed to stock rail without gap and locking of the point is completed.

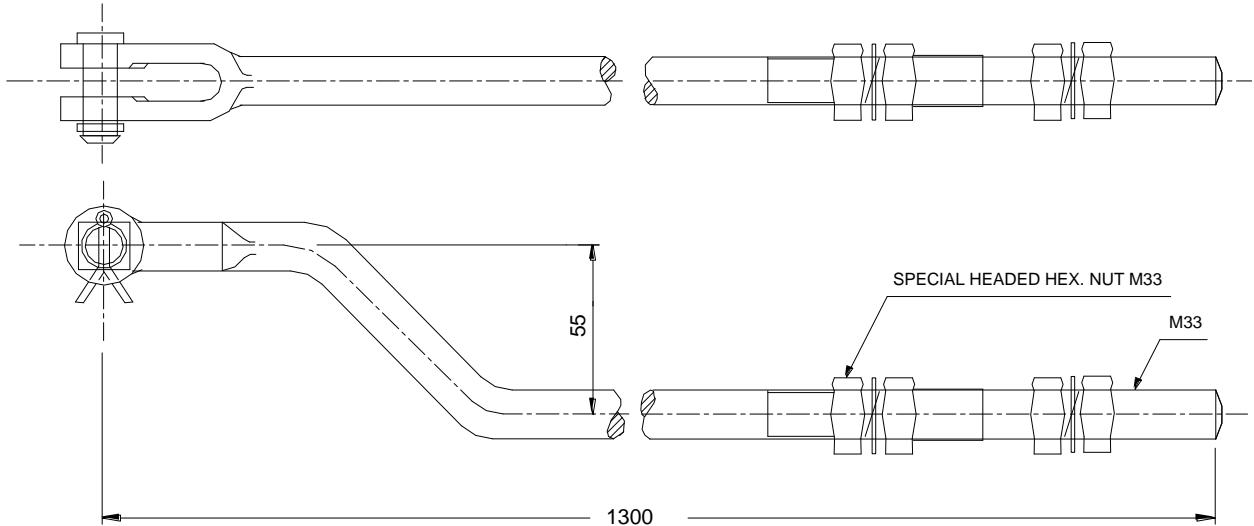


Fig No: 4.4 DRIVE ROD

MOUNTING OF LOCK RODS: (REFER FIG. 4.5)

- Operate the drive bar, lock bars and detector bars of the point machine to the inner position and align the close and open notch of RH and LH lock bars respectively to fall in line with locking pawl for locking the point in LH position.

INSTALLATION OF IRS ROTARY TYPE POINT MACHINE

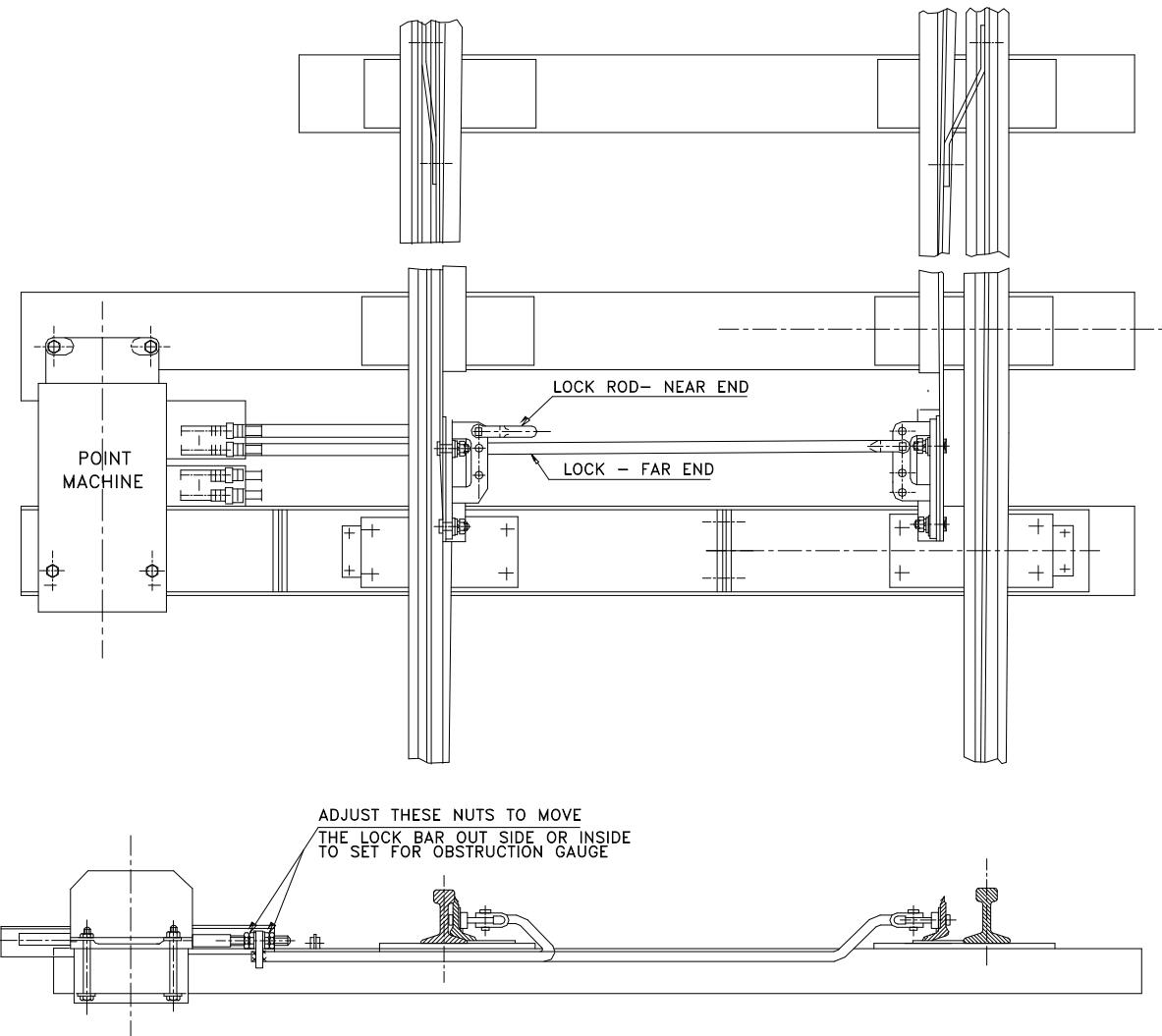


Fig No: 4.5 SECTION SHOWING LOCK ROD CONNECTIONS

- (ii) Insert the lock rod (Fig.4.6) (DRG. No. RDSO/S 3273-74) into the welded stud of lock bar and adjust the tight notch to come in line with the radial movement of the locking pawl for locking the point and secure it with nuts and washers.

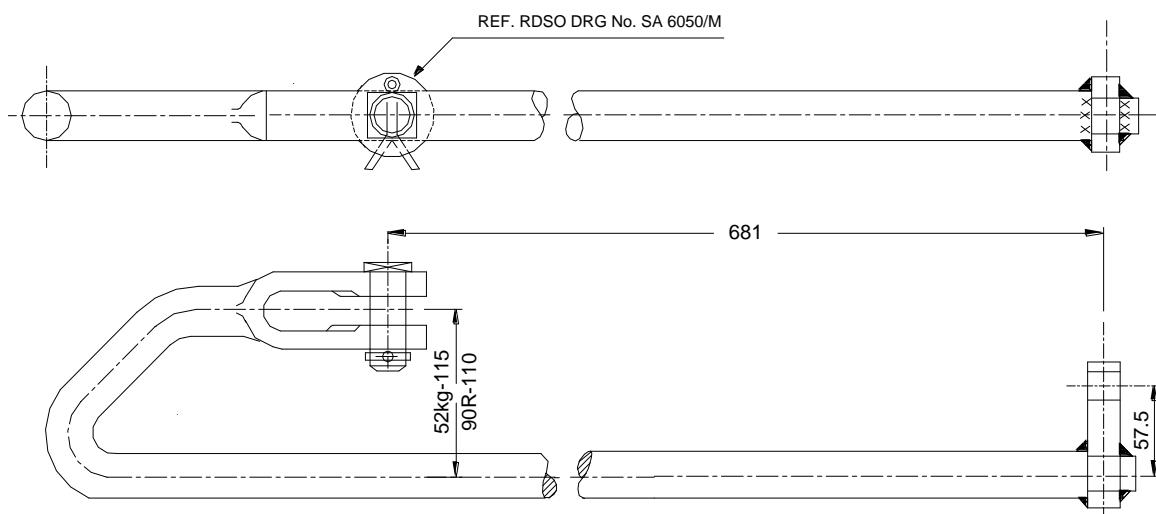


Fig No: 4.6 LOCK ROD NEAR END

LOCK ROD CONNECTIONS

- (iii) Connect the other end to the respective connecting hole of the switch extension bracket at near end and hold the lock rod by inserting a pin through it and switch extension bracket.
- (iv) Connect the lock rod far end (Fig.4.7) (DRG. No. RDSO/S 3271-72) also in the same way and adjust the nuts in the lock bar to hold lock rods in

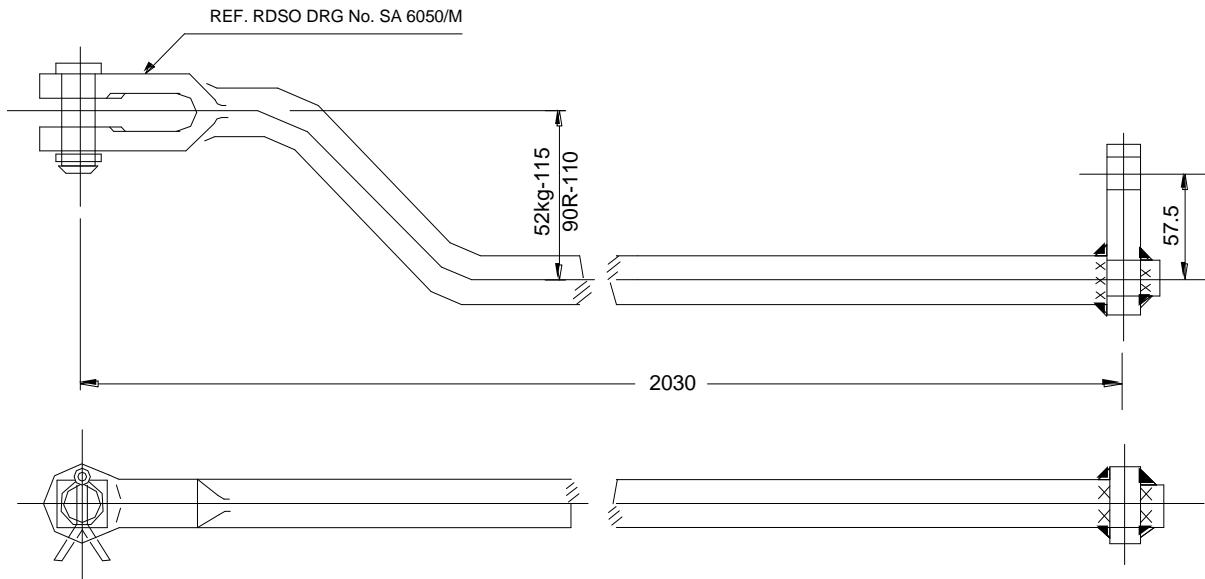


Fig No: 4.7 LOCK ROD FAR END

Operate the point machine to the other side (RH) by hand cranking. If the switch rail is housed with stock rail but locking pawl could not enter into the lockbar notch, loosen the lockrod connecting nuts and adjust the lock bar alone to align its close notch to enable the locking pawl enter into the notch and lock the point at that position. Tighten the Hexagonal nuts of the Lockrod to hold securely with Lockbar. Operate the point machine to LH side by hand cranking and set the lockrod in the same manner as illustrated for RH side. Once again move point to the previous position and ensure the locking of the point takes place.

INSTALLATION OF IRS ROTARY TYPE POINT MACHINE

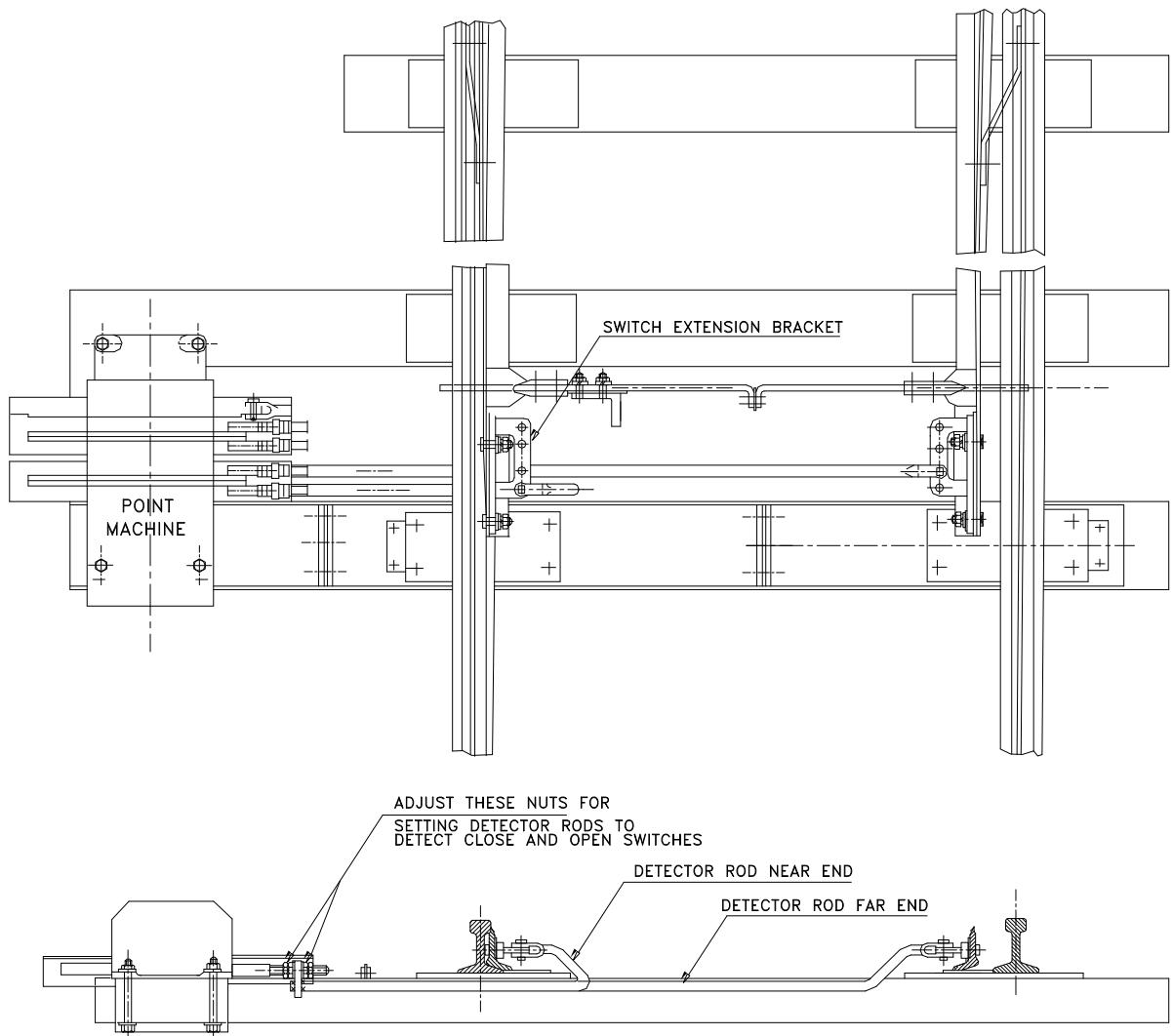


Fig No: 4.8 SECTION SHOWING DETECTOR ROD CONNECTIONS

Operate the point to close the RH switch and move the detector bars to the inner position manually. Check that the detection roller has fallen freely in the Segmental ring and cover top openings as well as the normal detection contacts are made. Connect the short detector rod (DRG. No. RDSO/S 326970) from close switch to the detector bar which aligns its close notch to the roller. Connect the long detector rod (DRG. No. RDSO/S 3267-68) from open switch and align its open notch with the close notch of short detector.

DETECTOR ROD CONNECTIONS

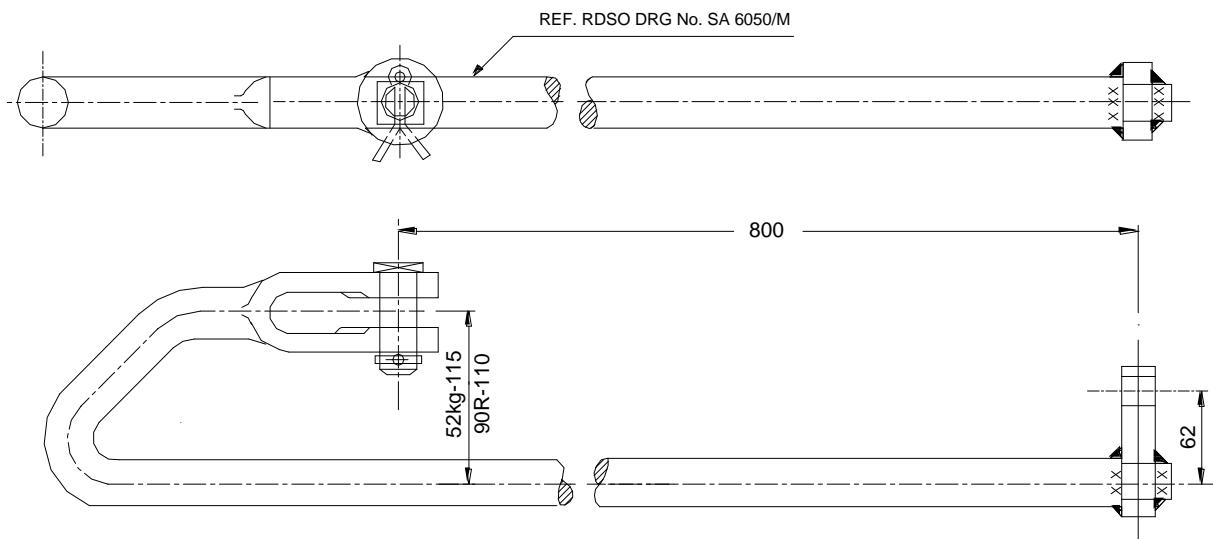


Fig No: 4.9 DETECTOR ROD NEAR END

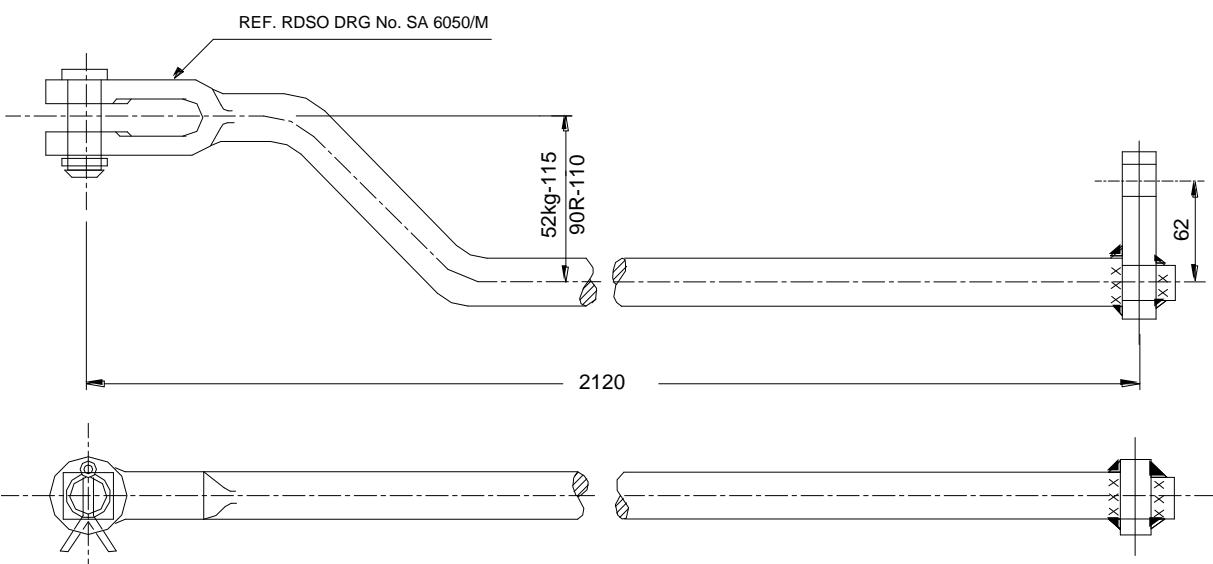


Fig No: 4.10 DETECTOR ROD FAR END

Crank to both positions and check that the detection rollers fall freely into the notches in the deflection bars. If the detection roller is not failing into the notches, then adjust the position of detection rod by adjusting the nuts provided in detector bar till the detection roller falls freely into the notch.

Ensure the provision of lock washers in all the rod joints. Tighten all fasteners using a torque wrench.

Note:- Ensure that close switch of point is detected and locked by small notch of detection slid and lock slid respectively.

(c) POWER CONNECTION TO POINT MACHINE

Connect the external wiring to the terminal blocks in accordance with the wiring diagram, applying for the particular location. Internal wiring for the point machine with split field motor.

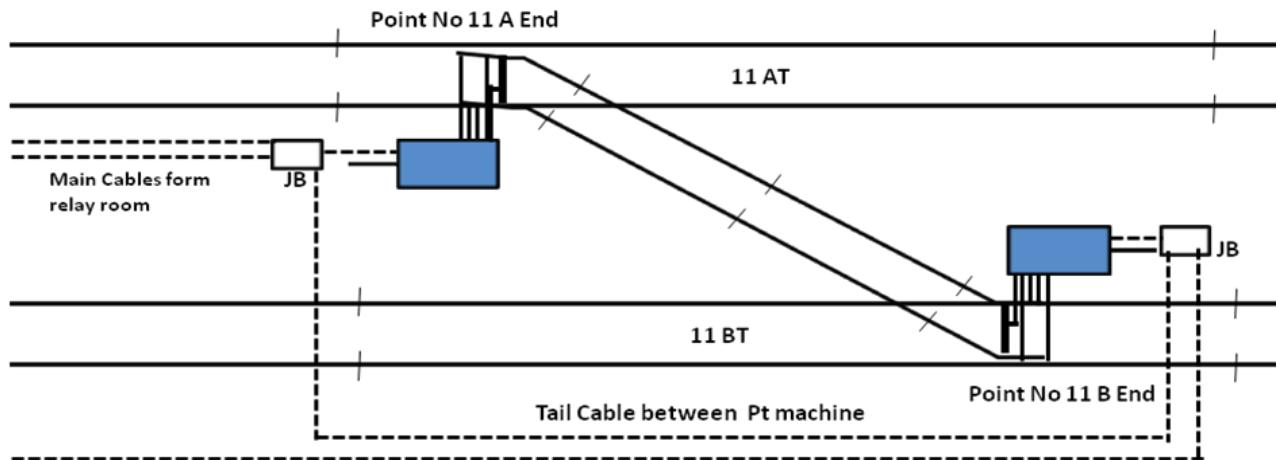


Fig No: 4.11 POINT LAY OUT WITH RIGHT HAND MOUNTED POINT MACHINE

Note:- Though the point control, operation and detection (British practice) is not the part of the syllabus , the circuit is added just for reference.

The relay NWR and RWR are point controlling relays which picks up after all interlocking requirements are full filled.NWR controls reverse to normal operation and RWR controls normal to reverse operation of point.

Through the front contact of NWR/RWR relay the heavy duty point contactor relay WCR and point time control relay WJR picks up. WCR relay is a heavy duty contact relay provided to handle the switching current at initial stage of point operation.WJR relay is provided to cut off the supply to the motor after laps of 10 seconds. in case point is under obstruction.

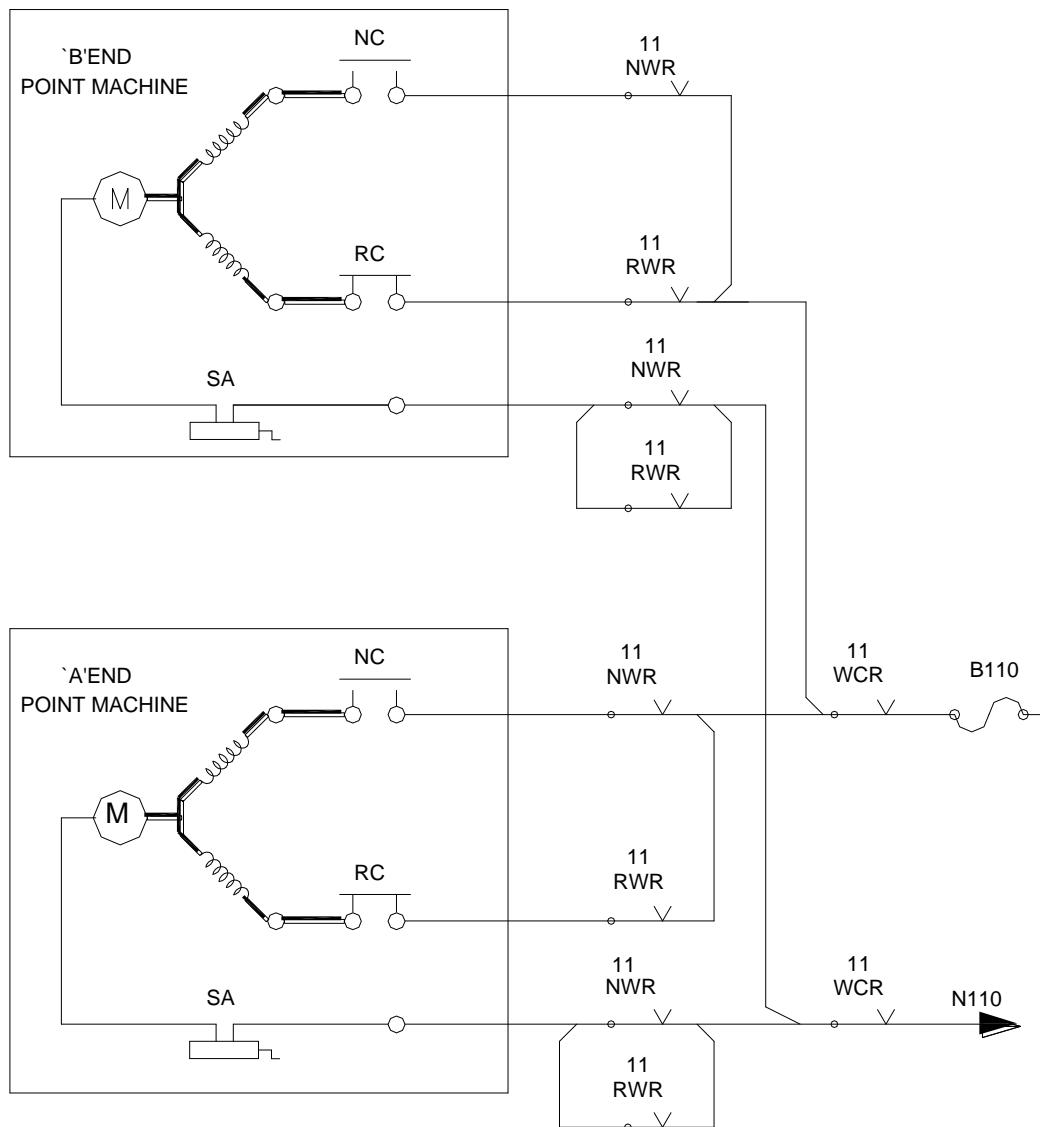


Fig No: 4.12 POINT OPERATION CIRCUIT

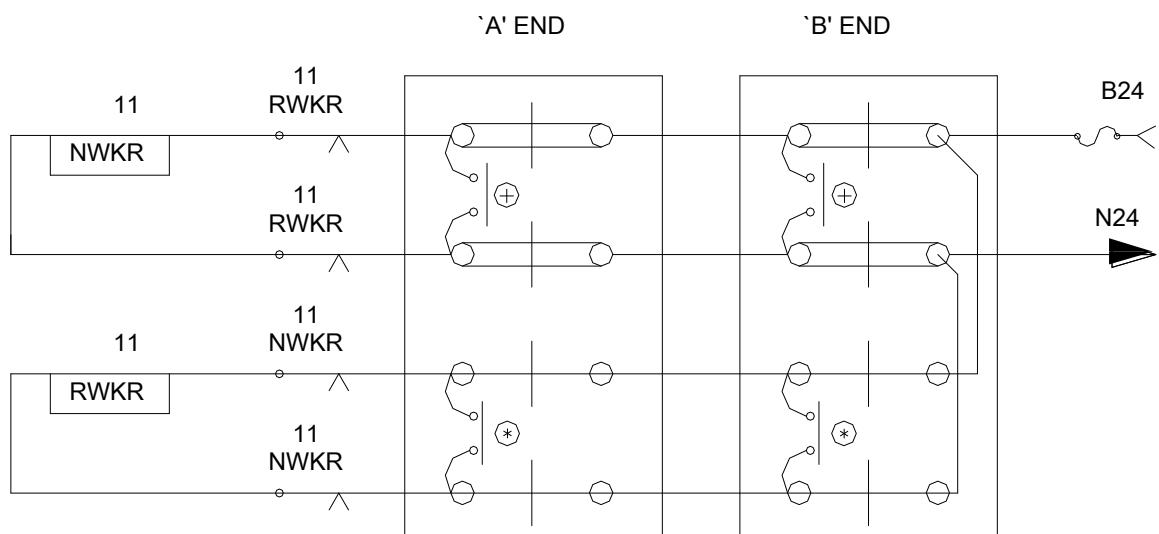


Fig No: 4.13 POINT DETECTION (INDICATION) CIRCUIT

4.5 FINAL ADJUSTMENT

4.5.1 ADJUSTMENT TO FREE STROKE FOR RH SWITCH RAIL

Operate the machine a couple of times by power. Operate it to RH position

If the travel of the drive rod is correct, the tongue will close well against stock rail at the end of operation.

If the travel of drive rod is not correct, either the tongue will not close at stock rail or the point machine cannot be operated to end position i.e, the clutch slip continuously. Adjust the setting of switch rail to RH positions by tightening or 'loosening the nuts of drive rod to ensure correct point setting. The closed switch shall be adjusted to just in contact with the stock rail. Then the connections shall be tightened further by 2 mm to 3.5 mm to impart a springing action to the tongue rail.

4.5.2 ADJUSTMENT OF FREE STROKE FOR LH SWITCH RAIL

Operate the machine to the LH position and repeat the procedure given al for RH switch rail.

4.5.3 ADJUSTMENT OF DETECTION SLIDES

Adjust the long detector rod and short detector rods to make the detection notches align in line with detection (Roller 'B' Or Bottom roller) roller.

Adjustment of detector contacts:- Connect the detector slides and check that close switch is detected by small notch of detection slid. A test gauge of 3.25 mm shall be inserted between the switch rail and stock rail at a distance of 150 mm from the toe of the switch. The machine shall be hand cranked to the end of the stroke to close the tongue rail and check that detection contacts are not make and if makes then adjusted close switch detector slid, till the appropriate detector contact are just broken. The same shall be repeated at the other end of the stroke. All the relevant nuts shall be tightened.

NOTE: Where lock slide is provided in the machine, during switch detector adjustment the test shall first be done with fictitious locking. After completing the above test, same test be repeated with machine properly locked.

4.5.4 CLUTCH SETTING

The force from the point machine transferred to the drive rod is factory adjusted Read motor current. Operate the machine without test piece and note the working current. The recommended practice is to set the clutch for a tripping current of 1.5 to 2 times the working current and difference between normal working current & obstruction current shall not less than 0.5 Amps.

4.5.5 OBSTRUCTION TEST ON POINT

- (a) **Adjustment of lock:-** Adjust the lock rod for normal position of point and then for reverse position of point in following way

Obstruction Test:- The point driving rod and the lock connections of the machine must be so adjusted that with 5 mm thick test piece obstruction placed between the switch and the stock rail at 150 mm from the toe of the switch:-

- I. The point cannot be locked,
- II. The point detector contacts should not assume the position indicating point closure.
- III. Friction clutch should slip.

- (b) The machine shall be hand cranked to the end of the stroke to close the tongue rail. Insert 1.6 mm test piece between stock rail and switch rail at 150 mm from toe of the switch and operate the point. Ensure detector contacts just make.

4.5.6 Changes in point machine as per mounting LH/RH

Changes to be made in the point machine while fixing a right hand point machine on left hand turn out (left hand mounting) are

- (a) Remove the detections slide and lock slid from point machine and inserts it from other side of point machine.
- (b) Interchanging of NW & RW and NWKR & RWKR wires in junction box

4.5.7 OILING AND LUBRICATION

The lubrication diagram No 4.23 indicate the locations in the point machine requiring application of grease, oil etc. The recommended lubricants for usage are also furnished for general guidance. The interval of applying the lubricant has to be decided depending upon the site conditions and the duty-load of the machine.

The gearbox shall be filled with lubricant through the oil inlet own in Fig 4.23 until Oil emerges out of over flow tube either in initial filling or replenishing fill.

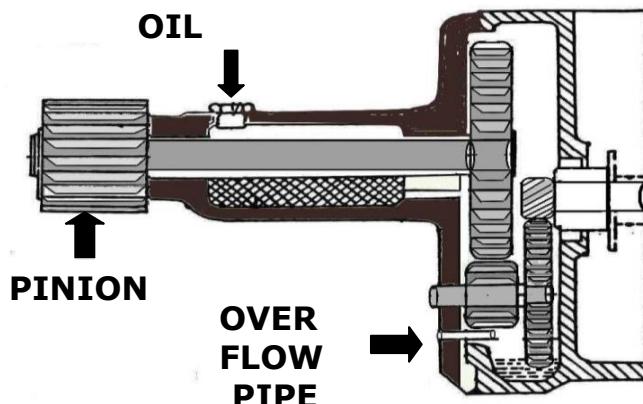


Fig No: 4.15 OILING OF GEAR BOX (reduction gear)

INSTALLATION OF IRS ROTARY TYPE POINT MACHINE

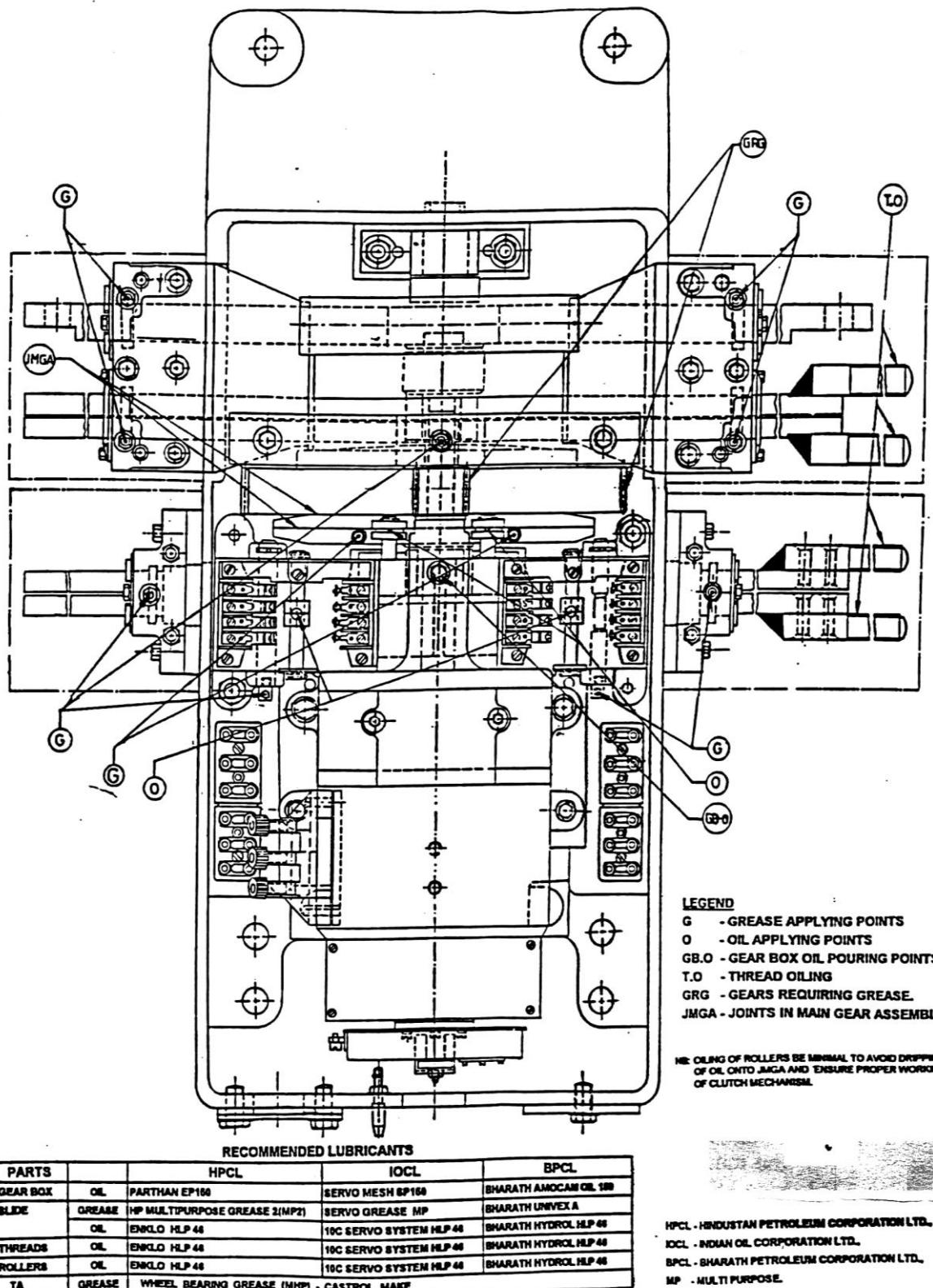


Fig No: 4.16 IRS POINT MACHINE LUBRICATION DIAGRAM

4.6 Installation of Point Machine

- (a) Ensure proper lubrication on various moving parts and apply grease wherever provisions are given for that and pour SAE 30 oil in gearbox if required.
- (b) Fix-'P' bracket on both switches at the required distance.
- (c) Ensure that the point machine fixing sleepers extended ones are well packed, the track is brought to level and Gauge Tie plate with extension plate is provided.
- (d) Ensure no gap between gauge tie plate butt piece and rail chair in case of wooden sleepers or between band roll clip insert and rail chair & gauge tie plate in case of concrete sleepers.

Note:

For fixing this machine in concrete sleepers' extension plates are to be provided in both sleepers and the machine is to be fixed on these plates.

- (e) Fix the point machine over the extended sleepers by using correct bolt, spring washers & nuts and in such a way that
 - i. It shall be parallel to the track and does not infringe the standard dimensions. i.e. the centre line of the point machine shall be 1050 mm from the nearest gauge face of the rail.
 - ii. The ground connection rods are straight, level and clear from the bottom of the rail. (25 mm)
- (f) Connect throw rod first to the leading structure fitted with cast iron lug. (Mechanical fuse) and adjust the nuts to give the required stroke. - (Exact opening of the switch plus 3 to 4 mm- spring on switches.)

E.g.: Opening 115 mm.

Spring required is 3 mm.

Idle strike to be given is 143 – (115 + 3) = 25 mm

(Maximum throw bar stroke is 143 mm. Hand crank & measure.)

Note:

- i. Use Correct Bolts and Spring Washers for fixing Cast Iron Lug. And 32 mm Spring Washers between throw bar nuts.
- ii. The top of the William's leading stretcher shall be a maximum of 3 mm below the bottom of the rail.
- iii. Use correct sleeve bush in the throw rod for MG & BG.
- iv. Wherever required, change the position of the lock slides duly taking out from the machine and fix the same. (It depends on the machine fixing i.e. LH or RH side.) For taking out the slides:
 - Remove the gear bracket
 - Remove the cast iron fixing plate of the lock slides on either side of the machine.

INSTALLATION OF IRS ROTARY TYPE POINT MACHINE

- v. Whenever lock slides or detection sides are removed for one reason or other, ensure while replacing them back, the thread lug connection should face outside in both.
- vi While re fixing the gear bracket, ensure correct alignment. If not the frictional load on motor will be high and the brass bush in the gear bracket may wear out quickly.
- vii. Hand crank the machine and ensure correct setting on either side and conform the spring
- viii. Connect detection slide rods (ensure short notch for closed switch and-wide notch for open switch) and adjust the slides in such a way that detection contacts does not make with 5mm obstruction between stock and switch rail (detection and other contacts should have sufficient wiping pressure as per specification.)
- ix. Connect lock slides ensure short notch for close switch and wide notch for open switch and adjust the slides in such a way that the lock does not enter with the 5 mm obstruction between switch and stock rail. (Place 5 mm obstruction at 150 mm from toe.)
- x. Test the point with power for regular working & for obstruction test and measure the working current & slipping current. It shall be with in the specified values 5.3 & 8.5 Amp respectively.
- xi. Measure the motor terminal voltage, it shall not go below 100 VDC; if so correct it.

4.7 Maintenance

- (a) Check and ensure all fixing bolts and other bolts in the machine are tight, Split pins if any are intact and in open condition.
- (b) Check and ensure the tightness of throw bar cast iron lug fixing bolts and leading stretcher bolts (12 Nos.)
- (c) Cheek and ensure the ground connection rod lug connections and bracket fixings are in tight condition.
- (d) Check for any wear & tear / breakage in gears and other moving parts any abnormal sound if found while working, correct it or bring to the notice of higher officials.
- (e) Check and ensure that the locking segment is freely entering into the respective notches and responds for 5 mm. Obstruction test.
- (f) Ensure the sleepers are well packed and, ground connection rods are free from ballast.
- (g) Check for correct alignment of ground connection rods. This may get affected by creep in the switch (permitted 15 mm creep)
- (h) Check with 5 mm obstruction, lock should not enter. Detection should not make even if lock enters. Also ensure that the driving main gear rim only rotates and not the whole assembly. (i.e. Slipping)
- (i) Measure working current and slipping current at least once in quarterly and compare with the original readings. Take corrective measures if required.

DO's

- (a) Tight all fixing bolts & other associate fittings.
- (b) Lubricate all moving parts either with oil / grease and clean excessive oil / grease.
- (c) Clear the ballast from ground connection rods.
- (d) Watch for any unusual noise while working if so, take remedial measures.
- (e) Issue Disconnection Notice whenever required & Do not Disconnect without giving notice.
- (f) Watch for any iron burrs in the stock rail if so clear the same.
- (g) Watch for excessive creep (15 mm is permitted.) if so take assistance from engineering staff.
- (h) Check for excessive opening if so, take remedial measures. (Engineering.)
- (i) Ensure proper packing of sleepers.
- (j) Check for proper making and breaking of Detection Contacts & other electrical contacts including Cut Out contact.
- (k) Clean the Motor armature and ensure it is free from Carbon Deposits.
- (l) Test the working of point with & without 5 mm. Test Gauge and ensure correct working. Correct it if required.
- (m) Use only Hand Crank for operating the Point Machine for Manual working.
- (n) Test for effective Track Locking.
- (o) Use proper tools while carrying out maintenance, Testing and adjustment and
- (p) Drain out Water if collected inside the Machine & close the drain out hole.

DON'TS

- (a) Don't operate the Machine locally WITHOUT HAND CRANK.
- (b) Don't Adjust Lock & Detection Slides Straight away Without Checking Switch Opening (only + 3 mm is allowed from initial opening.)
- (c) DON'T use OIL in Transmission Gear Rim. Don't allow water to get stagnated inside the Machine
- (d) DON'T THROUGH ANY ELECTRICAL CONTACTS under any circumstances.
- (e) DON'T DISTURB the presetting of the DETECTION CONTACTS at site.

Oiling of point machine

Periodicity of oiling: - At the time of installation and after every 6 months (as per manufacturers instruction) & to be used is SAE 30

1. Pour 100 ML Lubricating oil through inlet into the oil reservoir of reduction gear.
2. Half portion of Detection slide shall be lubricated first and remaining portion shall be lubricated after next operation.
3. Transmission assembly shall be lubricated with non-corrosive all temperature grease by applying the grease on teeth of gear rim and use of oil shall be avoided.
4. The gear rack and the lock slides shall be lubricated with SAE 30 machine oil through felt pad provided over them.
5. To lubricate the spring apply spindle oil on the helical spring guide of contact assembly.
6. Apply non-corrosive all temperature grease through all the 11 grease nipples by a grease gun, once in six month or as per local conditions need.
 - (a) Six grease nipples are provided to lubricate the bearings of the gear rack, locking bars and detection slide.
 - (b) Two grease nipples are provided on transmission clutch assembly.
 - (c) Two grease nipples are provided on contact assembly lever bearing.
 - (d) One nipple is provided in pedestal.
 - (e) Apply the medium lubricating oil to all pin connections, connection slides, chair plates, lug and sleeve assembly on the drive rod etc. Ensure that no excessive lubricating oil or water accumulates at the bottom of the point machine casting.

Note: - The lubrication parts of point chair plates, switch rail and stock rail is applicable up to the third sleeper from toe of point

P way requirement:- minimum this P- way requirement that shall be checked

- 1 Point is not out of square
- 2 Point is properly packed.
- 3 The track is at correct level and alignment
- 4 All insulation is in good condition
- 5 Setting of switch rail with respective stock rail up to sufficient length.
- 6 When train passes over point there shall not be hunting (movement of tongue rail) at toe of tongue rail
- 7 The gap between the stretcher bar and foot of the rail shall not be more 1.5mm
- 8 The chair plate nuts and spicks shall fitted with spring washers

Parameter test

- 1 Obstruction test
- 2 Obstruction current

Obstruction test

It shall be perform as per schedule of maintenance as per SEM II
No go test with 5 mm test piece for each switch, when tested

- 1 Lock segment does not enter into the notches of locking slides
- 2 Roller of the lock detection lies on the periphery of control disc & Switch detection contacts do not make
- 3 Friction clutch declutches the motor from mechanism.

Detection test with 3.25 mm test piece for each switch, (This test shall be carried out if and when instructed by respective railway) when tested.

- 1 Lock shall enter in to lock slide notch but detection contact shall just open (this test may not carry out at every railway)

Go test with 1.6 mm test piece for each switch, when tested

- 1 Lock shall enter in to lock slide notch and detection contact shall just make. The spring shall be checked once in three months.

Obstruction current

- 1 The slipping OR Obstruction current shall be between 1.5 to 2 times of normal working current
- 2 Difference between the normal operating current and the operating current under obstruction is not less than 0.5 Amps.
- 3 When this current is not within the limit stipulated above then clutch requires adjustment and shall be replaced and not adjusted at site.
- 4 Feed for the motor gets cut off after 1.5 to 2 times the normal operating time of the point

After testing the points, the parameters noted shall be recorded as under:

Point No.	Without obstruction				With obstruction			
	Voltage		Current		Voltage		Current	
	N toR	R toN	N toR	R toN	N toR	R toN	N toR	R toN

CHAPTER 5: SIEMENS D.C.ELECTRIC POINT MACHINE

Non-trailable (Style Bsg. Antri.9i)

5.1 Introduction

This point machine fulfils the purpose of throwing the point switches into the desired position, lock them and detect their current setting and locking in the attained final position with common type of locking.

5.2 Description

The point machine consists of the following main parts housed in one cast-iron housing with lockable sheet steel cover. The force of the point machine is 450 Kg. In case of failure of power supply or for testing purpose, the point machine can be operated manually by means of a hand crank.

- (a) Motor with train of gears,
- (b) Friction clutch,
- (c) Driving and locking bars with locking curves,
- (d) Locking segment,
- (e) Detector slides,
- (f) Switching unit (or contact assembly)

5.2.1 Motor with train of gears

The mechanism is worked by a 110 VDC series wound, split field motor and a train of reduction gears enclosed in a dust & waterproof casing. The reduction gear ratio is 20.8:1. The average operating time is 3 seconds, and current consumption is about 2 Amps. The machine is provided with 3-stage reduction gears. Up to the second stage of reduction, the gears are housed with a sealed motor housing and immersed in lubricating oil, thus they get self-lubricated. The lubricating oil gets filtered by means of a felt pad before it enters the sealed oil chamber. In the third stage of reduction the pinion engages with the gear rim. In the third stage of reduction the pinion engages with the gear rim, which in turn is connected to the drive disc through the self adjustable type friction clutch. The friction clutch slips in case of obstruction.

5.2.2 Friction Clutch: Fig.5.1 a self adjustable friction clutch



Fig No: 5.1FRICTION CLUTCH WITH MAIN GEAR

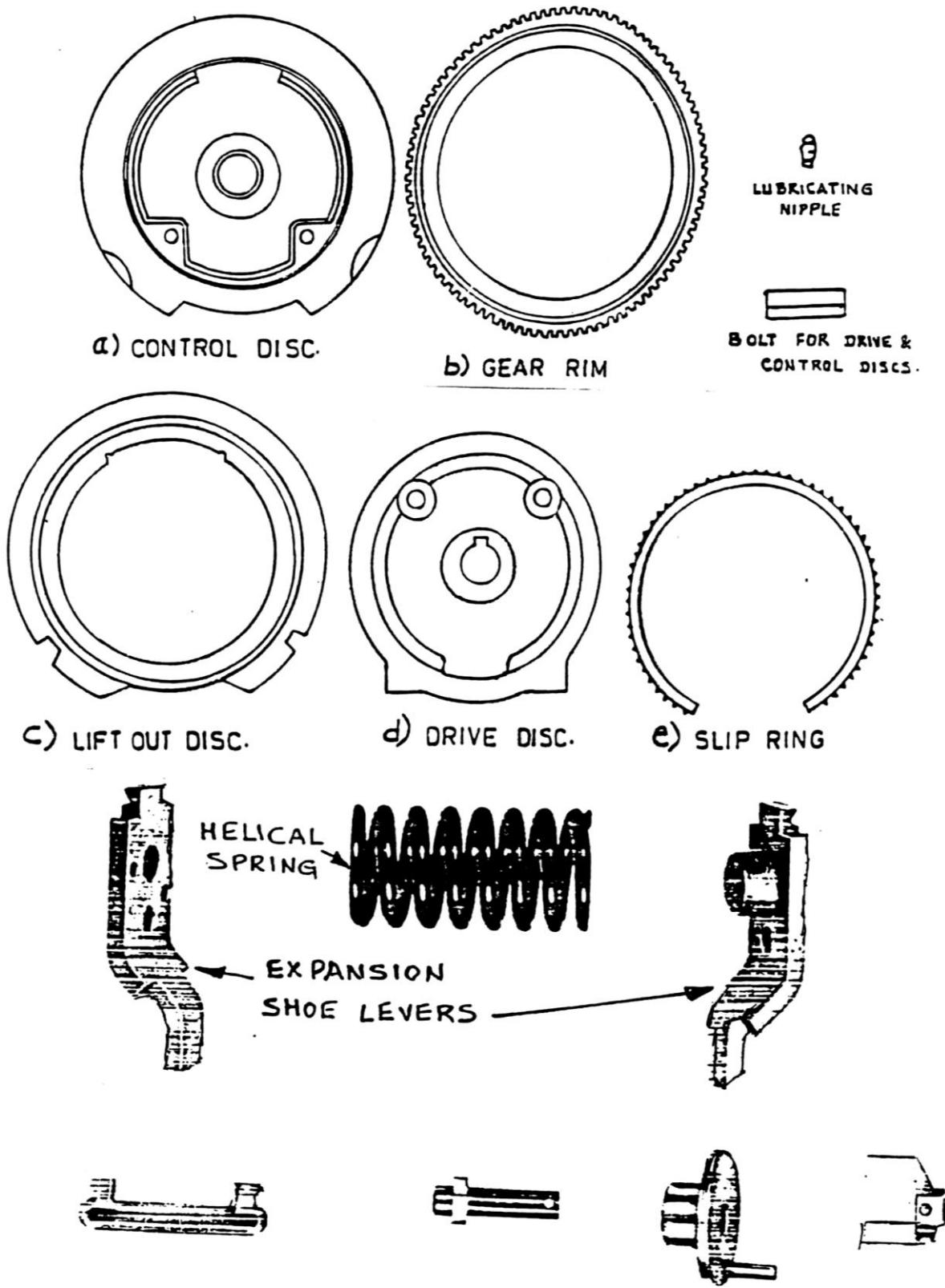


Fig No: 5.2(a to e) FRICTION CLUTCH ASSEMBLY

5.2.3 Driving & Locking Mechanism

The transmission Assembly Fig. 5.3 and consists of the following main parts.

- (a) A control disc fig 5.2a with an almost vertical notch to provide lock detection in conjunction with two numbers of lock detection rollers provided in switching unit.
- (b) A gear rim Fig 5.2b.Which is engaged with motor pinion. Inside gear rim friction clutch mechanism is provided.
- (c) A lift out disc Fig 5.2c (or releasing disc) with a sloped notch to release the lock detection roller easily from the control disc notch at the start of unlocking stroke.
- (d) A slip ring fig 5.2d supported by a compression spring with two numbers of expansion shoe levers (spring levers LH & RH) and a bracket. (Retaining strip).
- (e) A drive disc fig 5.2e keyed to a driving shaft (or transmission shaft). On the same driving shaft a driving pinion and a locking segment also are keyed.
- (f) Two numbers of bearing pedestals through which driving shaft is fitted with machine housing. These pedestals are made up of cast iron and acts like mechanical fuse in the case trail throw of point.

(a) Friction Clutch Working:

When motor is operated it drives the gear rim, owing to the slip ring being pressed hard against inner surface of the gear rim, by the expansion shoe levers due to initially compressed spring. The gear rim will take the lift out disc with it because the expansion shoe levers are engaged with the inner cam faces of the lift out disc. As the controlling disc & drive disc are at this moment stationary the inclined face of lift out disc will lift the lock detection roller and make it out of the control disc locking notch.

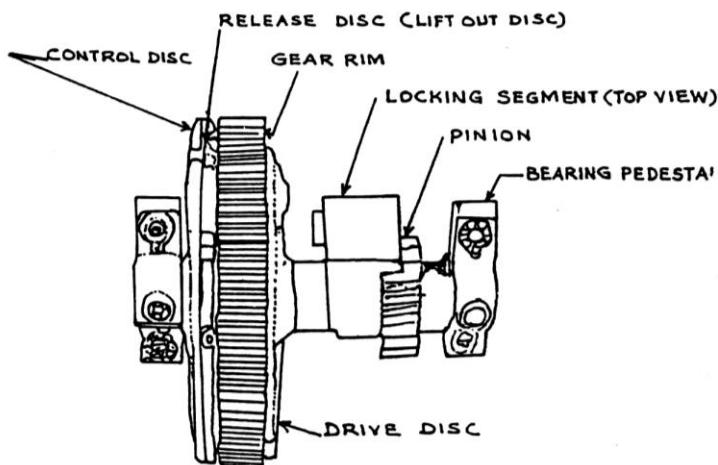


Fig No: 5.3 TRANSMISSION ASSEMBLY WITH FRICTION CLUTCH

After the expansion shoe lever assembly completes its idle movement it engages with the projection of the drive disc causing the whole transmission assembly to rotate as one unit till the drive disc stops its rotation due to its projection butting against the stop rod at the bottom of the main casing. At the same time other side lock detection roller also falls into the locking notch of control disc thereby the whole transmission assembly is locked and it cannot rotate in opposite direction due to banging on drive disc stopper. The complete rotation of transmission assembly is just over 270 deg.

(b) Driving Lock and Throw Bar:

The rotary motion of the motor is converted into a linear movement of the toothed driving bar via a gear wheel transmission via attached point operating rod, the throw-over point is transmitted from the gear rack Fig.5.4 a to the point. The detector slides Fig.5.4 (d & e) and the locking bars fig.5.4 (b & c) are moved via attached rods by the point tongues. The gear rack and the locking bar are locked by the locking segment engaging in the locking curves of the gear rack and locking bar at the end of each operation.

The machine has a toothed driving bar which is connected to the leading flexible William Stretcher bar by means of a lug and Sleeve arrangement provided in the throw rod. The maximum stroke of the driving bar is 143 mm, which is reducible up to 94 mm by means of the lug and sleeve arrangement as required at site.

To avoid strain or damage to the driving members the gear rim alone is allowed to rotate lightly braked at the end of each operation. Thus the friction clutch takes care of stopping the motor smoothly at the end of each operation by mechanical braking arrangement; hence no electrical snubbing is employed in this machine.

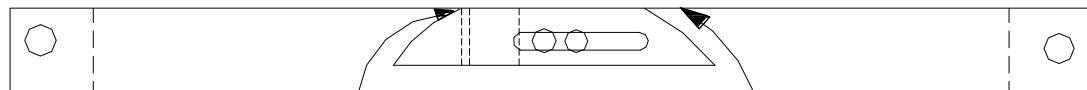
(c) Detection:

The point detector rods connected to the detector slides check whether the point tongues have followed the movement of the point machine and have reached the end position. The roller riding on the point slides when dropped into the groove detects the correct setting of point. The lock detection is provided by control disc and two lock detection rollers riding over the control disc. When the lock is secured, one of the lock detection rollers drops into the notch of the control disc to detect the locking of point. Thus, after the completion of switch & lock detection rollers fall simultaneously into their respective undercuts by release of a spring provided in the switching unit.

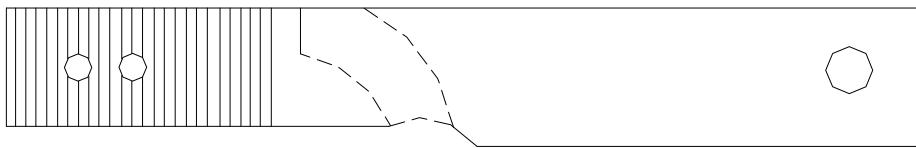


(a) THROW BAR (GEAR RACK)

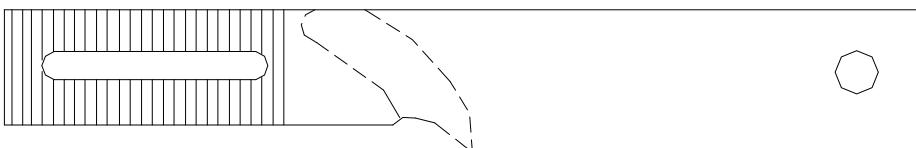
SIEMEN'S POINT MACHINE
DIFFERENT SLIDES



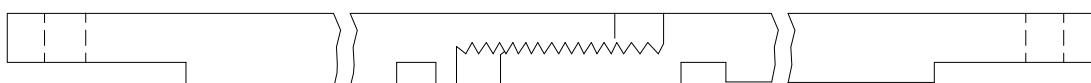
(b) LOCKING BAR (SIDE VIEW)



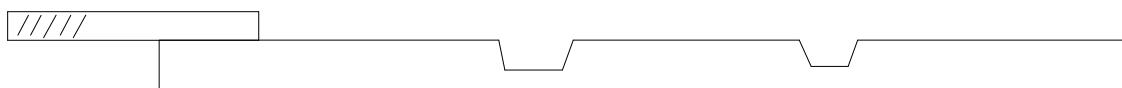
(c) LOCKING BAR (MAIN)



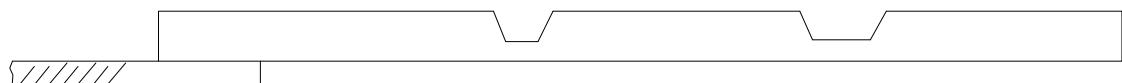
(c) LOCKING BAR (AUXILIARY)



(c) LOCKING BAR TOP VIEW



(d) DETECTOR SLIDE (RIGHT)



(e) DETECTOR SLIDE (LEFT)

Fig No: 5.4(a to e) POINT THROW, LOCK & DECTECTION SLIDES

(d) Installation:

For mechanical power transmission from the machine to the points and detection of these point tongues, rod connections are required which form a movable link between:

- The gear rack of the point machine and the point tongues;
- The lock stretcher bars of the point machine and the point tongues; and
- The point machine detection slides and the point tongues.

The point machine is mounted on two extended sleepers, as per the standard RDSO layout Drg. Nos. SA8800-01, SA9065-66 or SA9151-52. The Drg.No.SA9151-52 is newly issued by RDSO, which shows the interlocking connection for layout facing point 1 in 12. 52 / 60 Kg B.G turnouts laid on pre-stressed concrete sleepers using Siemen's Type of point machine.

5.3 The Salient Features of the interlocking connections as per Drg.No.SA9151-52 are as follows

- (a) Sleepers No.3 and 4 to drawing No.RDSO/T 4514 and 4515 respectively are extended sleepers. These sleepers have been specifically designed to provide electric point machine. One slot each has been made on the extended portions of sleepers No.3 & 4. Extended guage tie plate shall be provided on sleeper No.3 and MS plate shall be provided on sleeper No.4. The point machine shall be fitted on the extended portion of the sleeper.
- (b) The sleepers spacing between sleepers No.3 and 4 shall be 685 mm. This has been achieved by shifting sleeper no.3 towards block joint by 40 mm and sleeper no.4 towards heel joint by 45 mm.
- (c) The leading stretcher bar has been shifted to 470 mm instead of 330 mm from the toe of the switch.
- (d) The modified sleepers spacing, shifting of stretcher bar and special features of sleepers No.3 & 4 has been incorporated in the relevant track drawings.
- (e) The design is based on the interlocking connection of layout facing point 1 in 12BG to Drawing No.SA 8800 - 01.
- (f) The necessary insulations have been provided to track circuit the layout.

5.4 The general instructions for the installation & adjustment of the point machine.

Initial checks before adjustment of point machine:-

- (a) Electric Point Machines shall be installed in accordance with approved plans.
- (b) Ground fittings of approved design shall be used and properly aligned.
- (c) Ground connections shall not have any crack or improper welded joint.
- (d) Normally the machine shall be installed beside the close switch leading to high-speed movements clear of all infringements.

Before installation of the machine, it shall be ensured that

- (a) The permanent way Inspector has made all the provisions at the such as point is properly packed, ballasted, evenly levelled , close switch is setting with stock rail up to maximum possible length and in perfectly squared.
- (b) The machine has been properly cleaned, greased and oiled in accordance with the manufacturer's instructions and is working freely.
- (c) Proper alignment and level of connections is maintained between the machine and the point gears.
- (d) The top of sleepers which are to support the point machine are at all levels. The machine shall be so installed that it is clear of all infringements.

Initial Adjustment of Driving Rod, detection rod and lock rod

- (a) Install the machine as per standard layout
- (b) Hand crank the machine to the centre position.
- (c) Keep the switch rails also in centre position
- (d) Hand crank the machine to & fro and adjust the switch rails for proper setting with stock rails on both sides.
- (e) Check the spring on the points in both positions it should be equal on either side.

- (f) **Adjustment of Driving Rod:-** Connect the throw rod between the gear rack and the lug of the driving rod. The points shall be adjusted by operating the machine first by hand crank. The insertion of hand crank should disconnect the power supply to the machine. When the machine has been fastened down, the throw bar connections shall be set up and the point machine hand cranked to one end of the stroke positioning the locking blades so as to allow the appropriate locking dog to pass through notches. The closed switch shall be adjusted to just in contact with the stock rail. Then the connections shall be tightened further by 2 mm to 3.5 mm to impart a springing action to the tongue rail. The machine should be hand cranked to the opposite end of the stroke and the setting repeated for the other switch.
- (g) **Adjustment of detector contacts:-** Connect the detector slides and check that close switch is detected by small notch of detection slid. A test gauge of 3.25 mm shall be inserted between the switch rail and stock rail at a distance of 150 mm from the toe of the switch. The machine shall be hand cranked to the end of the stroke to close the tongue rail and check that detection contacts are not make and if makes then adjusted close switch detector slid, till the appropriate detector contact are just broken. The same shall be repeated at the other end of the stroke. All the relevant nuts shall be tightened.

NOTE: Where lock slide is provided in the machine, during switch detector adjustment the test shall first be done with fictitious locking. After completing the above test, same test be repeated with machine properly locked.

Adjustment of lock:- adjust the lock rod for normal position of point and then for reverse position of point in following way

Obstruction Test:- The point driving rod and the lock connections of the machine must be so adjusted that with 5 mm thick test piece obstruction placed between the switch and the stock rail at 150 mm from the toe of the switch:-

- (i) The point cannot be locked,
 - (ii) The point detector contacts should not assume the position indicating point closure
 - (iii) Friction clutch should slip.
- (h) The machine shall be hand cranked to the end of the stroke to close the tongue rail. Insert 1.6 mm test piece between stock rail and switch rail at 150 mm from toe of the switch and operate the point. Ensure detector contacts just make.

5.5 Special Features of Siemens Non-Trailable Point Machine

- (a) The minimum operating voltage of the motor is 60 VDC. Hence, the range of operation is more.
- (b) It is provided with a self-adjustable type friction clutch, which also takes cares of stopping the motor smoothly at the end of each operation by mechanical braking; hence, no electrical snubbing is employed.
- (c) It requires less maintenance, since up to the second stage of reduction the gears are enclosed in a sealed oil chamber and the lock stretcher bars & throw bar get self cleaned and lubricated by the felt pad provided over them.
- (d) It is suitable for providing with super-imposed detection facility.
- (e) Successive operation of two ends of a cross over point can be employed.

- (f) It is provided with self-wiping type heavy duty control & detection contacts.
- (g) It is provided with rotary type locking which requires less space for its operation. Hence, the machine is small in size.
- (h) Brass strips are provided between the two point detection slides to avoid the slides getting moved together due to jamming in case of breakage of any one of the detection rods, and thus preventing the wrong detection to appear.
- (i) The threaded portions of the point detection slides are welded by the side of the slides, hence the slides cannot be inter changed. Thus unsafe condition due to inter changing of point slides is avoided.
- (j) The lock stretchers and throw bar can be taken out freely by removing the brackets, provided in the machine frame.

5.6 Maintenance Instructions: Ensure the following items

5.6.1 Mechanical

- (a) All nuts and bolts are tight; all split pins are splitted properly.
- (b) There is no wear and tear and crackling sound in gears during operation of the machine.
- (c) The locking segment enters freely into the grooves of the locking bar and gear rack.
- (d) The lock detection rollers roll freely on the periphery of the control and lift out discs.
- (e) The rodding connections are tight.
- (f) Creep anchors and level pillars are provided and there is no creep in the vicinity of point.
- (g) Sleepers are well packed with ballast.
- (h) Switches are squared and they move freely and rest properly on the chair plates. The condition and housing of switches is proper.
- (i) Proper drainage is provided and no water stagnates in the vicinity of the points.
- (j) Point machine fittings are tight.

5.6.2 Electrical:

A Typical Siemens Contactor Unit Circuit is shown in Fig.5.5 (a). A Siemens Point Machine working circuit is shown in Fig.5.5 (b). and a detection circuit is shown in Fig.5.5 (c).

- (a) Ensure the following Electrical items before the operation of Point Machine.
- (b) Wiring is properly laced and no hanging wires are there.
- (c) All screws and nuts are properly tightened.
- (d) Wire connecting lugs are well soldered. Check for any dry soldering.
- (e) Control and detection contacts are functioning properly and they make with sufficient pressure.
- (f) The commutator surface is clean and dry. The carbon brushes should make contact with the commutator surface uniformly with sufficient contact pressure. Check for any jamming of brushes in the brush housing. Replace the worn out brushes.

SIEMENS D.C.ELECTRIC POINT MACHINE

- (g) All insulations of gauge tie plate, William stretchers, tongue attachment, etc., are intact.
- (h) Check the normal working current of the motor and friction clutch slipping current periodically.
- (i) Adjust the machine to withstand for obstruction test.

5.6.3 Lubrication Particulars:

At the time of installation and after 10,000 operations of the point machine or at 6 month's intervals in the case of less frequently operated point machines pour 100 CC lubricating oil in stages as per the specification IS: 1628, SAE 30 or shell 100 X through oil inlet into the oil reservoir for lubricating motor transmission. The period may be reduced as and when required according to local climatic conditions.

Pour 10 CC of the same (SAE 30 or Shell 100X) lubricating oil in the cover with felt pad provided over the gear rack and the lock stretcher bars to lubricate them.

Apply 10 drops of spindle oil on the helical spring guides of contact assembly.

Apply non-corrosive all temperature grease as per specification Nos. IS: 507 or IS: 508 through all the 8 grease nipple by a grease gun, once in 6 months or as local conditions need. Apply the grease as follows:

5 grease gun strokes through the four grease nipples provided to lubricate the bearings of the gear rack, locking bars and detection slides.

20 grease gun strokes through the two grease nipples provided on transmission clutch assembly.

5 grease gun strokes through the two grease nipples provided on the contact assembly

Apply the same grease on the external gears of the transmission assembly.
Apply medium grade lubricating oil all pin connections, detection slides, chair plates, lug and sleeve assembly on drive rod, etc. Ensure that no excessive lubricating oil or water accumulates at the bottom of the point machine casting. To drain out the excess oil or water accumulated at the bottom of the machine casting, unscrew the spring loaded drain outlet and close it afterwards.

After approximately 100,000 operations or with less frequently used points, once annually, wipes off all superfluous grease from nipples to prevent clogging and lubricate thoroughly all internal and exterior lubricating points.

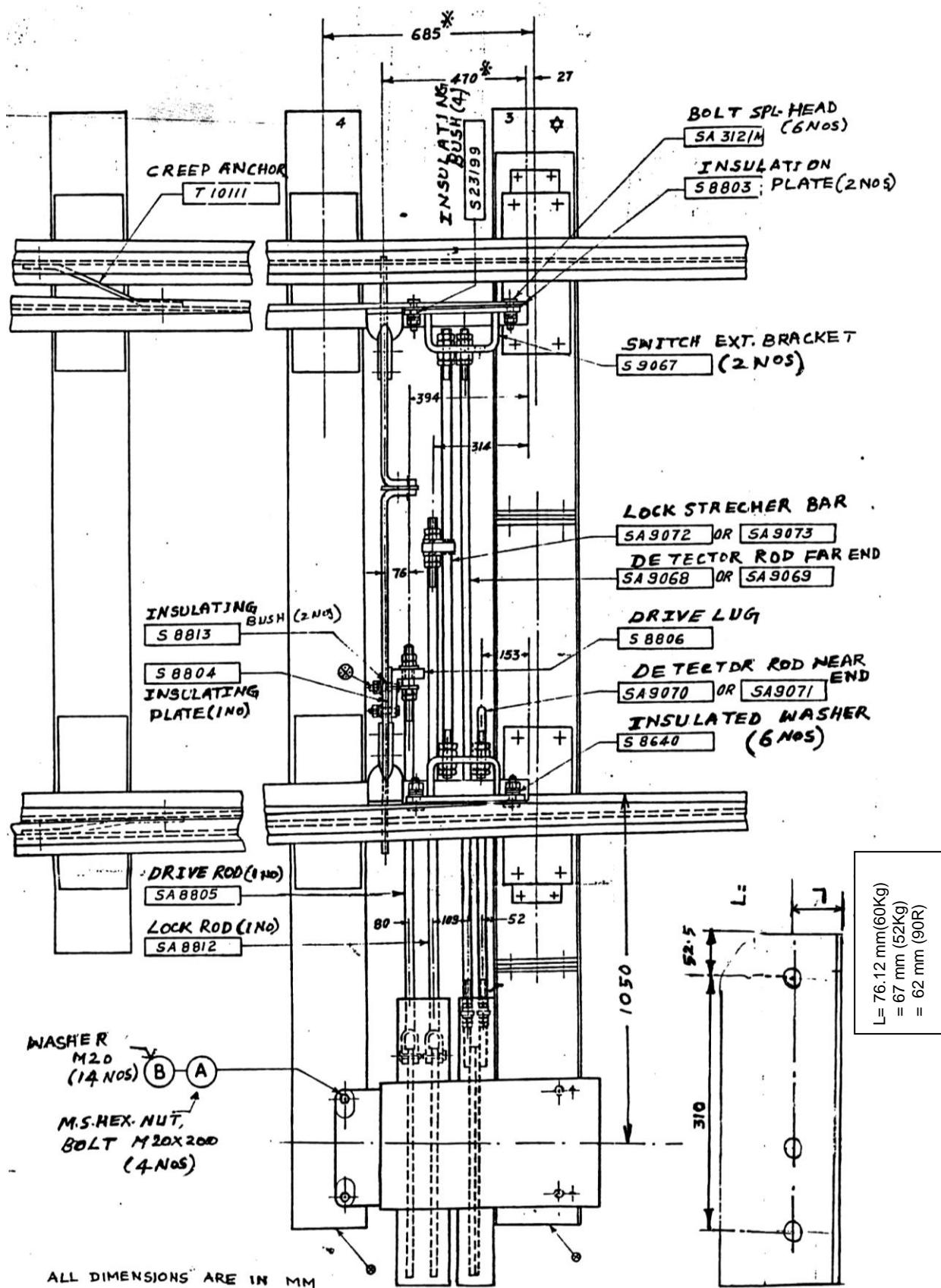
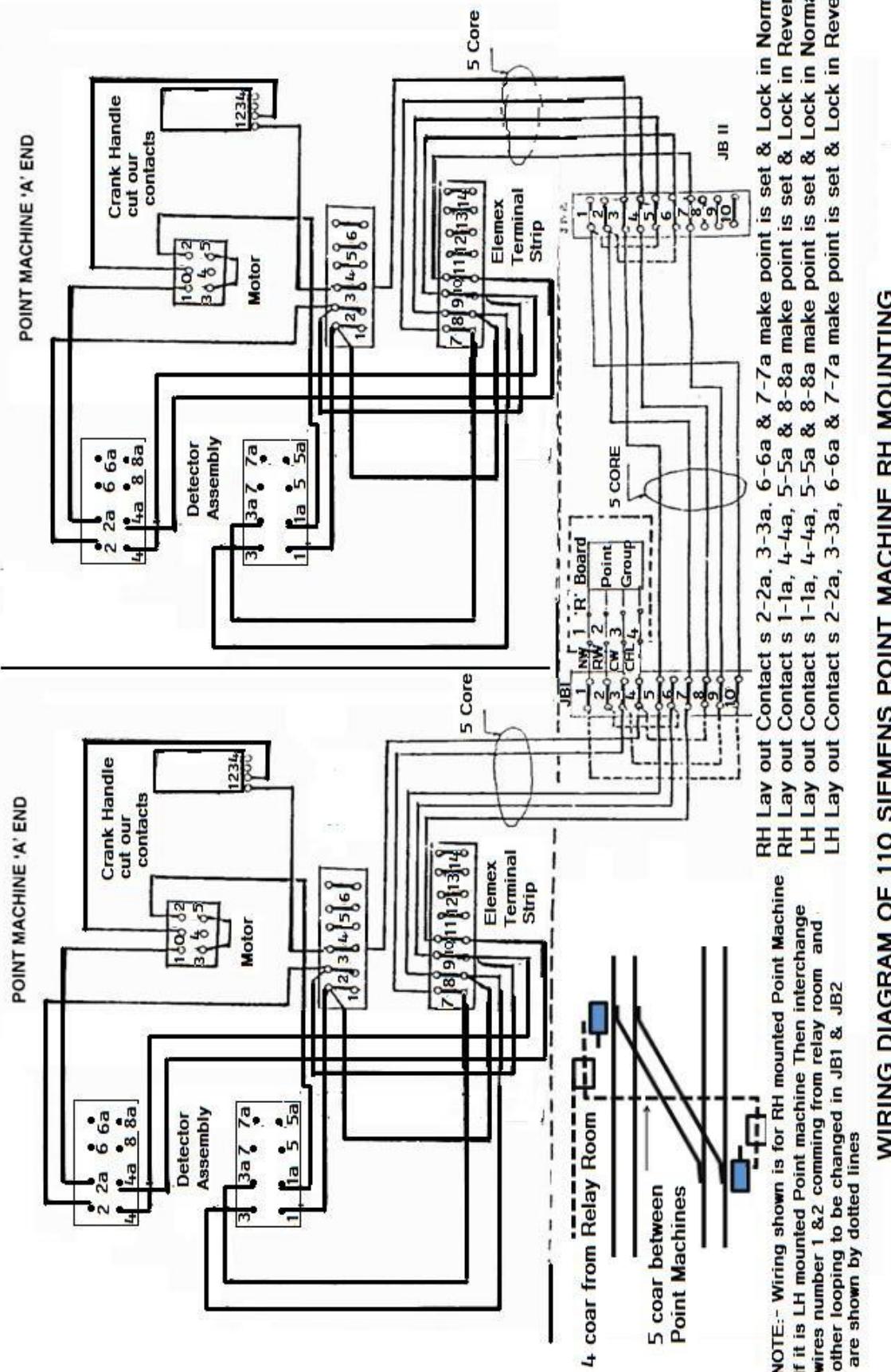


Fig No: 5.5 LAYOUT FACING POINT (1 IN 12) TURNOUT BG ON PSC SLEEPERS FITTED WITH SIEMENS POINT MACHINE. DRGNO RDSO 3291-92



WIRING DIAGRAM OF 110 SIEMENS POINT MACHINE RH MOUNTING

Fig No: 5.6 POINT LAY OUT AND WIRING ARRANGEMENT WITH SUPPER IMPOSED POINT OPERATION CIRCUIT

Changes to be made in the point machine while fixing a right hand point machine on left hand turn out (left hand mounting) are

- (a) Remove the detections and lock slide from point machine and insert it from other side of point machine.
- (b) Do change in looping in junction box and interchanging of NW and RW wires

Unlike Siemens Relay interlocking system, In British interlocking with Siemens point machine, the point control, operation and detection circuit are separate and not superimposed

Three circuits are required to control motor operation and detection of point, they are

- (i) Point control circuit (point contractor unit circuit)
- (ii) Point operation circuit
- (iii) Detection circuit

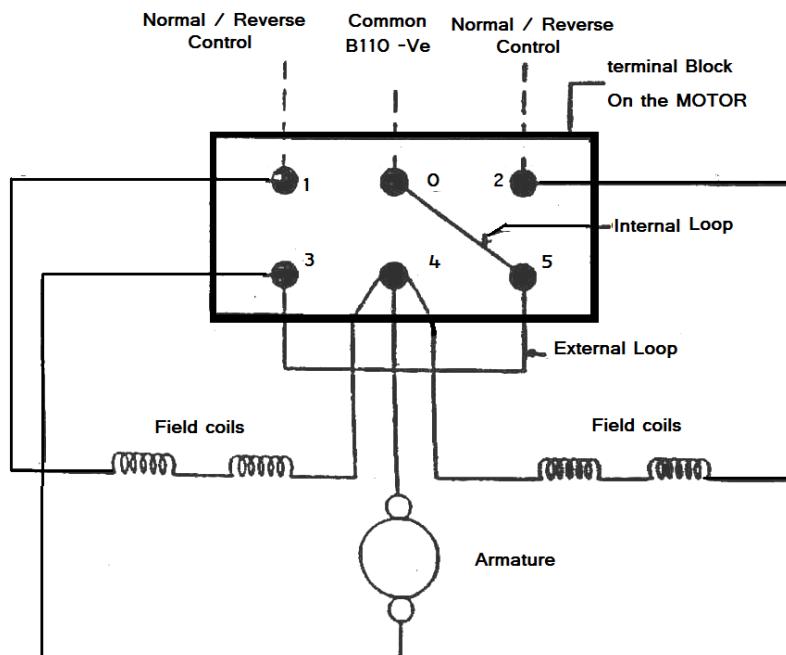


Fig No: 5.7 INTERNAL WIRING OF MOTOR OF SIEMENS POINT MACHINE

CHAPTER 6: IRS CLAMP ELECTRIC POINT MACHINE (CLAMP LOCK AND 220 MM STROKE)

6.1 Introduction:

The Sectional capacity is adversely affected by the speed restriction of 15 KMPH, when the train is negotiating a turnout for entering a loop line. So High speed turnouts were developed capable of allowing a High speed with the increase in traffic density, adoption of high power locomotives, higher speed turn-outs (More than 1 in 12), higher section of rails (**Thick web switches with 60 kg rails**) and with a view to utilize optimum of available modern and latest assets in order to provide the passengers less time consuming train journey. It became essential to review the existing design of Electric point machine by incorporating with clamp lock type of machine in full compliment.



Fig No: 6.1

The unique feature of **thick web switch** is the crossing angle has been broadened so much that the train negotiating is at higher speeds as not put to any danger of any sort. This is necessitated a switch opening of 160 mm as against of 115 mm of ordinary cross over. The web of the switches was also made thicker to make them strong enough to withstand load of train at high speeds. A CLAMP LOCK that clamps together the closed switch against the stock rail achieves the locking of the switch. For the working of clamp lock, the throw bar of points machine is provided with a total of 220 mm stroke that is 60 mm for the unlocking, 100 mm for the throwing of points and 60 mm for the locking of closed switch.

6.1 Advantages:

- (a) It ensures and proves the proper setting of both stock and switch rails.
- (b) Due to the 160 mm opening of thick web switch (TWS) at toe the clearance at junction of rail head (JOH) is 60 mm. This prevents the repeated striking of the open switch at junction of rail head (JOH) by inner side of the wheel, which in conventional switches leads to chances of under wheel flashing.

- (c) Clamp locking of the switch prevents vibration caused in the switch due to train movement affecting the Detection and control contacts assemble unit directly. In conventional switches this leads to reduction in efficacy of the unit.
- (d) Due to complementary tapers in switch and stock rail, the switch rail toe fits underside the stock and therefore the wheel of the train engages the switch rail well after 6" from toe. Therefore, damage and wear and tear of the switch is prevented.
- (e) Provides direct locking between tongue rail and stock rail in closed position.
- (f) Firmly holds the tongue rail in the open position. Checks any relative movements between tongue and stock rail
- (g) It ensures and proves the proper setting of switch and stock rail.
- (h) No stretcher bar is used and hence switches are able to move independently.
- (i) A **spring setting device (SSD)** is provided at JOH, in lieu of stretcher bars, to assist in proper setting of switch upto junction of Rail head (JOH), which is placed between sleeper number 13 and 14.
- (j) Adjustment of locking is done by means of packing shims between switch rail and stock rail bracket. Three each of 1 mm and one of 0.5 mm shims are provided for each switch.

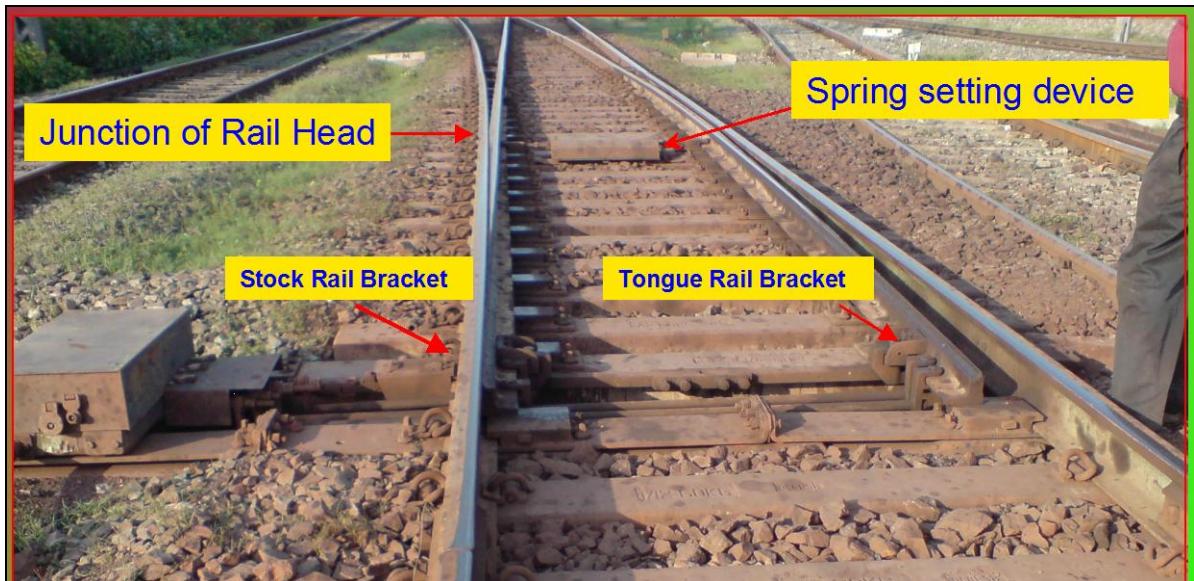


Fig No: 6.2 IRS-CLAMP TYPE POINT MACHINE LAYOUT WITH TWS

6.3 Main Parts

Main parts of point machine:

- (a) DC series split field Motor with in built reduction gear unit.
- (b) Transmission assembly.
- (c) Throwrod, lock slides and detection slides.
- (d) Detection and control contact switch Assembly.
- (e) Cast iron Case and with cover.
- (f) Hand crank.

6.4 Main parts of Clamp Lock and Functions

- (a) Locking bar (L.H.)
- (b) Locking bar (R.H)
- (c) Insulating plates
- (d) Locking washers
- (e) Locking arms
- (f) Stopper
- (g) Drive lug

Locking bar (L.H) and locking bar (R.H) are joined with insulating plate and locking washer at one end and the other ends are inside of both switch rail and stock rail brackets. Its movement depends on the stroke of drive rod, which is attached to one end of locking bar by drive rod.

Locking arm assembly: it consists of L.H. and R.H. Arms. Its main function is to lock and unlock the clamp. It is attached with the stock rail with the help of bracket and to the lock bars with guide.

6.5 DC Series Motor:

This motor is used to convert Electrical Energy into mechanical energy and designed to operate in both directions.

- | | |
|--------------------|---|
| (a) Rated voltage | 120/110 VDC capable of working at +/- 25% of rated voltage. |
| (b) RPM | 1700+/-15% |
| (c) Rated current | 5.3 A & maximum 8.5 A |
| (d) Operating time | 4 to 5 seconds |
| (e) Power | 440 Watts. |
| (f) Gear oil | SAE 30 |
| (g) Rating | 10 minutes |

6.6 Working of Clamp Lock:

If the point is laying in normal position, Right hand switch locked where as the open switch is open with an opening of 160 mm. When the lockbar is pulled by the electric point machine the open switch starts moving towards the stock rail but the closed switch remains stationary till lockarm travels 60 mm and Lockarm pushed inside lockbar notch.(unlocking stroke)

The lock bar's initial stroke of 60 mm is used to unlock the clamp lock at closed switch only after closed switch starts opening. When the lockbar travels 160 mm, open switch completes the stroke and closes fully with stock rail. However, the earlier closed switch which had started opening, opens up to about 100 mm only.

When the lock bar further travels and completes the total stroke of 220 mm, the earlier open switch completely closes with the stock rail and gets locked. The earlier closed switch completes the opening to 160 mm.

220 mm throw of Point machine is distributed as follows:-

First 60 mm throw for Point machine

- (i) Unlocking of Closed switch and
 - (ii) Open switch moves 60 mm towards its stock rail.
- (a) Next 100 mm throw, **both switches moves**
- (i) Closed switch opens by 100 mm and
 - (ii) Open switch completes $(60 \text{ mm} + 100 \text{ mm}) = 160 \text{ mm}$ and it is now closed.
- (b) Last 60 mm throw
- (i) 100 mm Opened switch further moves to 60 mm $= (100 \text{ mm} + 60 \text{ mm}) = 160 \text{ mm}$.
 - (ii) Locking of Closed switch by 60 mm and closing switch locked.

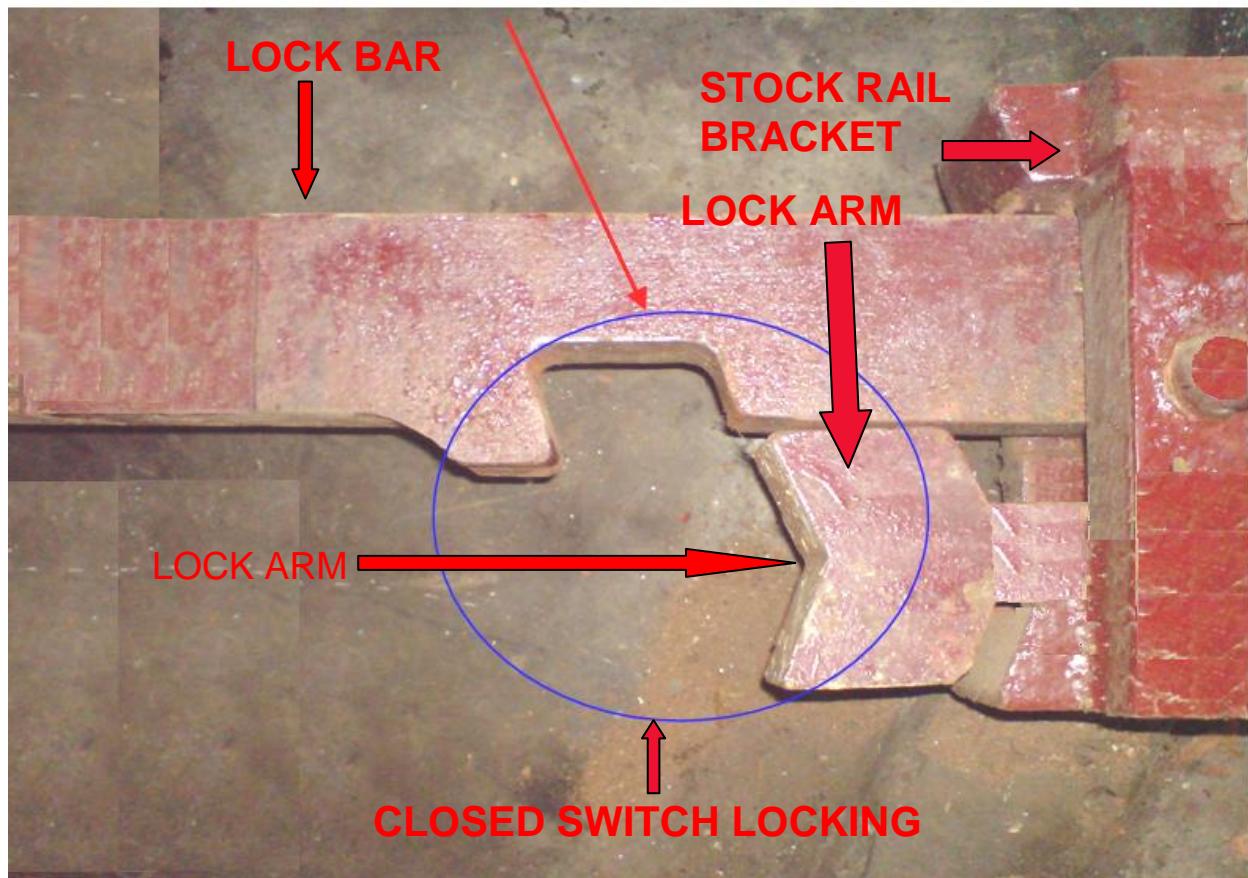


Fig No: 6.3 CLOSED SWITCH

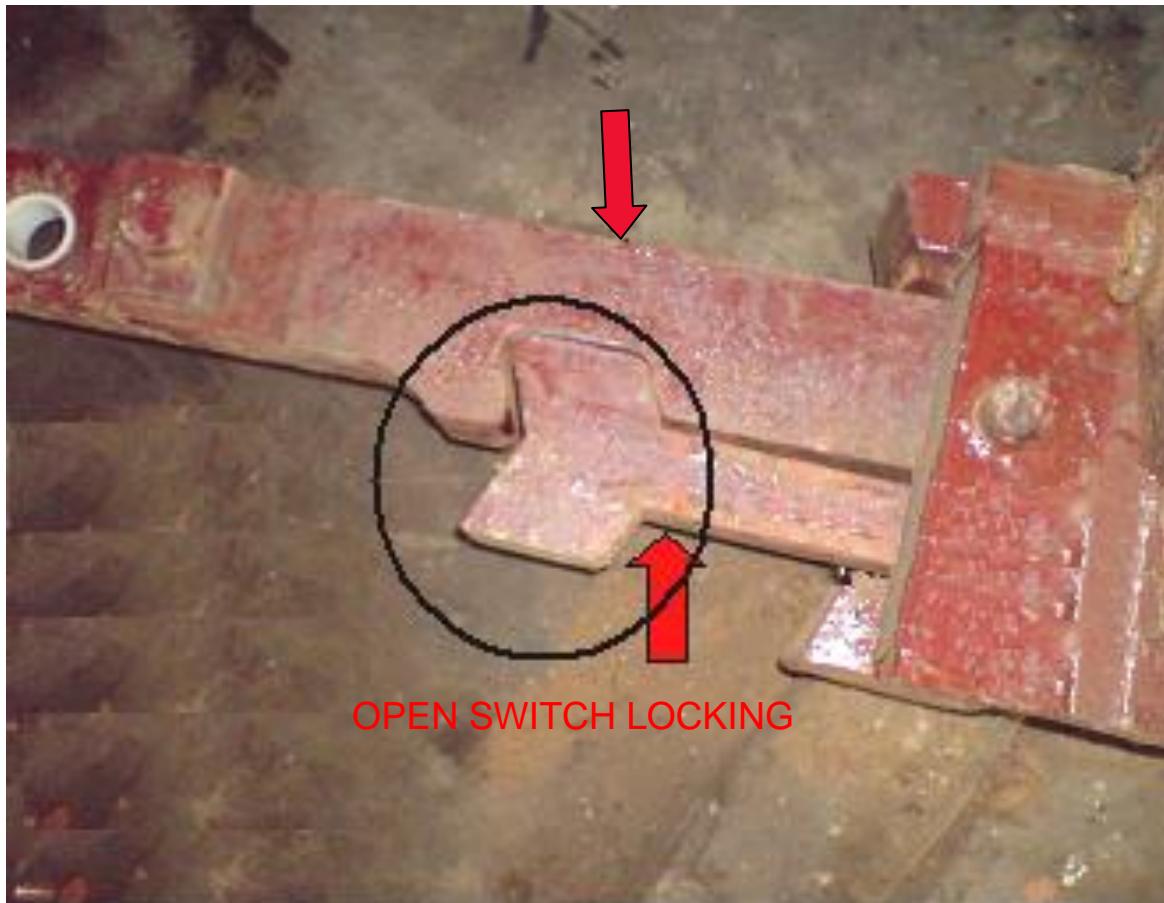


Fig No: 6.4 OPENED SWITCH LOCKING



Fig No: 6.5 SPRING SETTING DEVICE

6.7 Installation

- (a) Bring the toe 32 mm in advance of centre line of sleeper No.3 and the distance between sleeper No.3 and 4 to 745 mm (From centre line to centre line)
- (b) Ensure that insulated gauge tie plate is provided on sleeper No. 3
- (c) Remove all leading and following stretcher bars.
- (d) Provide spring setting device of “approved design” at junction of rail head (JOH).
- (e) Maintain gap at junction of rail head (JOH) not less than 57 mm for every flange way
- (f) Clearance.

6.8 Sequence of connection for Clamp Point locks

For connecting the clamp lock sequence of action shall be as below.

6.8.1 Marking holes for Clamp Lock Assembly

(a) Stock rail

- (i) For marking holes in stock rails mark centreline on the web of stock rail at the height of 76 mm from bottom of stock rail up to the length of 550 mm from toe.
- (ii) Mark centre punch to the length of 450 mm for I st hole and 530 mm for II nd hole from the edge of the tongue rail toe.
- (iii) Ensure that there is a gap of 80 mm between both the holes (Centreline to Centreline of the holes) as shown in figure given below.
- (iv) Drill two holes of 22 mm dia in the web of both stock rails for fixing stock rail brackets.

(b) Tongue rail

- (i) For marking in tongue rails, mark centreline on web of the tongue rail at the height of 55 mm from bottom of tongue rail up to the length of 500 mm.
- (ii) Mark centre punch to the length of 428 mm for first hole and 498 mm for second hole from toe.
- (iii) Ensure that there is a gap of 70 mm between both holes (Centreline to centreline of the holes).
- (iv) Drill two holes of 22 mm dia in the web of the tongue rail for fixing switch rail bracket.

6.9 Marking holes for ground connection

(a) If point machine is connected to Right hand- side.

- (i) First make the centreline in the flange of both tongue rails up to 350 mm length from toe.
- (ii) Mark punch up to the length of 148 mm for first hole and 328 mm for second hole from toe in LH tongue rail.
- (iii) Mark centre punch up to the length of 200 mm for first hole and 272 mm for second hole from the toe in the RH tongue rail.

(b) If point machine is connected to Left hand- side.

- (i) First make the centreline in the flange of both tongue rails up to 350 mm length from toe.
- (ii) Mark punch up to the length of 200 mm for first hole and 272 mm for second hole from toe in LH tongue rail.
- (iii) Mark centre punch up to the length of 148 mm for first hole and 328 mm for second hole from the toe in the RH tongue rail.

6.10 Connection of the Lock rods and Detector rods

- (a) Lock and detector rods are to be assembled at site by inserting drop lug in the threaded portion of the rods. The drop lugs can be suitably turned to suit LH/RH mounting.
- (b) Put tapered washer on the foot of the switch rail such that the thicker portion of the washer is towards the edge of the rail.
- (c) Now connect jaw of the detector/lock rods with the foot of the tongue rail and drop lug with the detector/lock slide of the point machine.

6.11 Adjustment

- (a) Lubricate all the moving parts the clamp lock assembly.
- (b) Put grease on the bronze brush in the lock arm assembly.
- (c) Put grease on the notches of the lock slide and fishtail portion of the lock arm.
- (d) Loosen the nuts of stock rail bracket so that it can be move freely in its oblong holes and takes its own portion.
- (e) Operate the machine with crank handle and adjust the lock and detector slides usually (Near end first)
- (f) If clamp lock is not locking point then do the following.
- (g) For proper locking on both sides additional numbers of packing shims have been provided between switch rail and tongue rail bracket.
- (h) Required no of shims will be put out side the tongue rail bracket to facilitate locking on either side.
- (i) Six numbers of packing shims are provided with each clamp point assembly.
- (j) Now tighten the nuts of the stock rail bracket.

6.12 Obstruction test

The detector slides lock slides and drive rod must be so adjusted that with 5 mm thick test piece placed between the switch and gauge face of stock rail at 150 mm from the toe of the point.

- (a) Friction clutch de-clutches the motor from mechanism.
- (b) The point cannot get locked either by clamp lock or by locking segment inside the point machine.
- (c) Lock segment does not enter into the notches of locking slides.
- (d) Switch detection contacts do not make.
- (e) The slipping current is not exceeding twice of the normal working current.

6.13 Insulation test:

Check the insulation between the following.

(a) Point machine

Check that point machine is insulated from ground connection.

(b) Spring setting device

Insulated from both the rails.

(c) Clamp lock assembly.

Check that it is insulated from both the rails.

(d) Leading and following stretcher bar (If point is operated without clamp point locking arrangement).

They are insulated from both the rails.

6.14 Maintenance

6.14.1 Points

- (a) Ensure graphiting or lubricating of slide chairs at every week.
- (b) Ensure that all nuts and bolts are tight and split pins are opened properly.
- (c) Lubricate at the following moving parts of the clamp lock fortnightly.
- (d) Stock rail bracket groove.
- (e) Moving part of tongue rail and lock arm assembly.
- (f) Between machine of lock bar and lock arm assembly.
- (g) Ensure that the rodding and other connections are tight.
- (h) Check that the point area is well ballast, packed and free from vegetation.
- (i) Check that water does not stagnate in the vicinity of points.
- (j) Ensure information to engineering department regarding to avoid any emergency failure.

6.14.2 Point Machine

- (a) Ensure that wire connections of the machine are tight and laced properly.
- (b) Ensure that the locking segment enters freely into the notches on the lock slides and with a little pressure in the notch of drive rod.
- (c) Ensure the point machine fittings are tight.
- (d) Check all parts for any crack or breakage etc. and replace immediately if any defect is found.
- (e) Ensure smooth working of the gears without any cracking noise.
- (f) The slipping of friction clutch during obstruction shall be ensured and slipping current shall not exceed twice the normal working current.
- (g) Ensure that the carbon brushes are exerting sufficient pressure on commutator. Clean the commutator properly by using chamoise leather.
- (h) Ensure that all moving parts are free from dust and are well lubricated.
- (i) Ensure that gauge tie plate is properly insulated.
- (j) Ensure that the roller rolls freely on the periphery of the control and lift out disc.
- (k) Check that the contact pressure of control and detection contact is adequate.
- (l) Apply non-corrosive all temperature grease (IS-507/508) through the entire grease nipple by a grease gun, after 8,000 operations or six months which is earlier or as per instructions issued by the railway.
- (m) After every six months or as per instructions issued by the railway pour lubricating oil, SAE-30/SHELL 100, through inlet in to the oil reservoir for lubricating gearbox of the motor.
- (n) Check the overload current.

REVIEW QUESTIONS

Subjective

1. Write short notes on Forced drop arrangement.
2. Write the functions of friction clutch of siemens point machine and name of its parts.
3. Write the features of IRS clamp type point machine and how the total stroke utilised for point operation.
4. Write the features of lever lock and circuit controllers
5. Discuss about Track Locking and Indication Locking
6. Write the features of Electric Point and Lock Detector
7. Prepare Four Wire detection circuit (EPD) and Explain.
8. Write the general feature of Point machine.
9. Write the sequence of point operation
10. Write the testing Procedure for Electrically Operated point.

Objective

1. The stroke of siemens point machine is -----mm.
 - a) 140
 - b) 150
 - c) 143
 - d) 220
2. When point is set and lock in normal then ----- makes.
 - a) RC contact
 - b) NC contact
 - c) ND contact
 - d) a&c both
3. Locking of switches provided in siemens point and IRS machine is/are ----- type.
 - a) Combine
 - b) individual
 - c) clamp
 - d) a&b both
4. Simultaneous power & manual operation of point machine is prevented by-----.
 - a) Crank handle cut out contact
 - b) locking of crank handle
 - c) ward & feather on crank handle
 - d) a&b both
5. Locking provided in siemens and IRS point machine is ----- type.
 - a) Rotary
 - b) straight trough
 - c) in & out
 - d) clamp type
6. When point is not set, not lock OR both then ----- makes.
 - a) RC contact
 - b) NC contact
 - c) RD contact
 - d) a&b both
7. Maximum -----number of slides can be used in electrical point detector.
 - a) 3
 - b) 4
 - c) 2
 - d) 6
8. When electrical point detector is fixed on double slip then slides used is / are -----.
 - a) Detector slide C&D
 - b) Detector slid A&B
 - c) Detector slide C, D & lock slid A
 - d) a&b
9. Detector slide C shall be connected to -----.
 - a) Nearest switch rail
 - b) farthest switch rail
 - c) Any one switch rail
 - d) FPL
10. The maximum stroke of single wire lever lock is -----mm.
 - a) 150
 - b) 200
 - c) 100
 - d) 45

REVIEW QUESTIONS

11. Various detection & control contact available in IRS/ siemens point machine are -----.
 - a) 2 Control &2 detection
 - b) 4 control &4 detection
 - c) 3 control &3 detection
 - d) 8 control &8 detection
12. Various detection contact available in IRS/ siemens point machine are -----.
 - a) 1/1a , 2/2a 5/5a & 6/6a
 - b) 1/1a , 2/2a 3/3a & 4/4a
 - c) 3/3a, 4/4a 7/7a & 8/8a
 - d) 1/1a , 3/3a 5/5a & 6/6a
13. ----- snubbing arrangement is provided in IRS / siemens point machine
 - a) Electrical
 - b) Mechanical
 - c) No
 - d) a & b
14. During obstruction test of machine operated point with 5mm test piece -----
 - a) Point shall not lock
 - b) Friction clutch shall slip
 - c) Detection contacts shall not make
 - d) a , b & c
15. Difference between normal working current and obstruction current shall not be less than ----- Amps.
 - a) 0.5 amps
 - b) 5 amps
 - c) 2.5 amps
 - d) 10amps
16. Power supply to point machine is control at----- level.
 - a) Circuit
 - b) battery
 - c) machine
 - d) a &c both
17. Crank handle contacts are provided to prevent simultaneous ----- and ----- operation.
 - a) Power
 - b) manual
 - c) hydraulic
 - d) crowbar
18. Obstruction current shall not be more than ----- of normal working current.
 - a) 2 times
 - b) 0.5 times
 - c) 100 times
 - d) 4 times
19. The maximum stroke of IRS CLAMP TYPE Point machine is _____ ()
 - a) 143mm
 - b) 220mm
 - c) 160mm
 - d) none
20. The total movement of drive disc is _____ ()
 - a) 220 degrees
 - b) 270 Degrees
 - c) 180 degrees
 - d) 360 degrees
21. Point motor A C immunity level is _____ ()
 - a) 160 V A.C
 - b) 160 V D.C
 - c) 160 V A.C/D.C
 - d) None
22. When point set and locked in normal _____ contact make ()
 - a) ND&NC
 - b) NC&RC
 - c) RD&RC
 - d) NONE

State true or false

1. When point is set and lock in reveres then RC & RD contact will makes.
(True/False)
2. When point is not set and lock in normal then RC & NC contact will makes.
(True/False)
3. When point machine switching unit is taken out then RD & ND contact will makes.
(True/False)
4. Economizer contact in lever lock is for power saving.
(True/False)
5. H contact in signal machine is used to control feed to motor
(True/False)

OBJECTIVE QUESTIONS

6. Electric lever lock is used where mechanical control on a electrical equipment is required. (True/False)
7. Maximum THREE slides can be placed in the EPD. (True/False)
8. C and D detection slides of EPD are not inter-changeable whereas siemens point machine are inter-changeable. (True/False)
9. When in and out type of FPL is used then A type lock slid shall be used in EPD. (True/False)
10. When in and out type of FPL is used then B type lock slid shall be used in EPD. (True/False)
11. Function of top roller and bottom roller of Siemens point machine switching assembly is detect setting of switches and locking of switches respectively. (True/False)
12. IRS point machine contains total four detection and control contacts. (True/False)
13. Snubbing in Siemens point machine is electrical type. (True/False)
14. Siemens point machine friction clutch adjustment should be done at site. (True/False)
15. When point is in mid position all control and detection contacts are in made position in Point machine. (True/False)
16. The normal condition of "K" and "H" contacts in Signal machine circuit is open. (True/False)
17. In Electric detector, NWKR is wired across Normal Shunt contact (True/False)
18. The 3 pins of CLS lamp are provided to prevent lamp theft (True/False)
19. The motor of IRS and Siemens point machine are interchangeable (True/False)
20. Electrical parameter of the motor of IRS and Siemens point machine are same. (True/False)
21. Thrust of The of IRS and Siemens point machine are same (True/False)

Match the Following :

- | | | |
|-----------------------------------|------|---|
| 1. Friction clutch siemens | (e) | a) electrical snubbing |
| 2. Friction clutch signal machine | (d) | b) unauthorized operation |
| 3. Force drop arrangement | (c) | c) mechanical/ magnetic
Stuck up |
| 4. Normal locking signal machine | (b) | d) shock less holding of
signal arm at OFF |
| 5. diode and resistance | (a) | e) mechanical snubbing |