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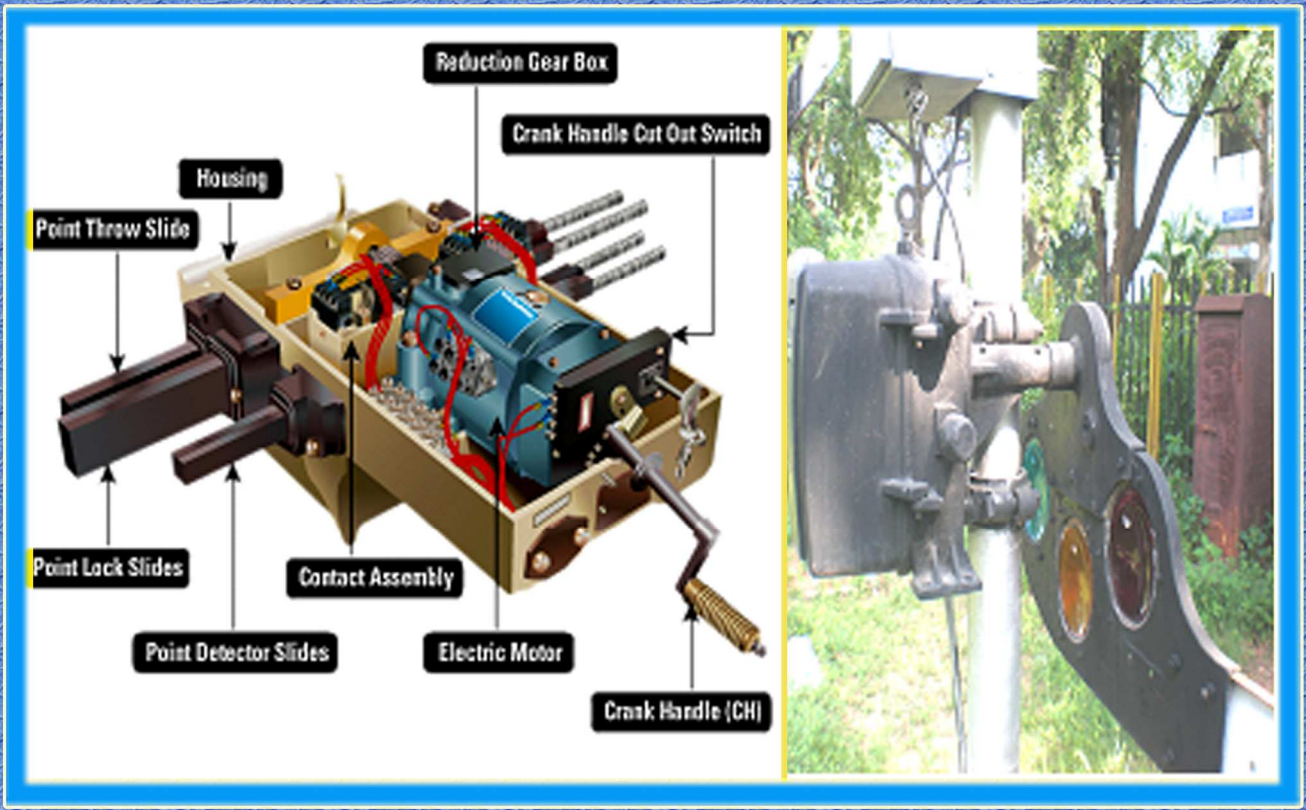
ELECTRIC POINT MACHINE AND SIGNAL MACHINE



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

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ELECTRIC POINT MACHINE & SIGNAL MACHINE

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CHAPTER 1: LEVER LOCKS AND CIRCUIT CONTROLLERS

1.1 Introduction

In mechanical installations, the functions such as points by rod transmissions and for signals by wire transmission are operated by a lever (rigid means). In Electro-mechanical installations the functions are operated by mechanical lever without any rigid connection. Because of this the function may go out of correspondence with the lever. To avoid this condition over the mechanical lever different electrical locking are required to provide. This will be done by means of "Electrical lever lock".

Electric Lever Lock: Electric lever lock is used where an electrical control on a mechanical lever is required. Levers controlling points and signals are equipped with electric locks to prevent or limit their movements. The lock pawl holds the lever mechanically so that the lever cannot be operated when the condition for its operation is not safe. In figure 1.1 shown the armature extension (lock pawl) engages in the notch cut on the lever plunger (slide) in order to lock the lever when the electro-magnet is de-energised. Consequently, the lever cannot be operated till the lever lock coil is energised. When the armature is attracted and the lock comes out of the notch on the lever slide and permitting the plunger to move.

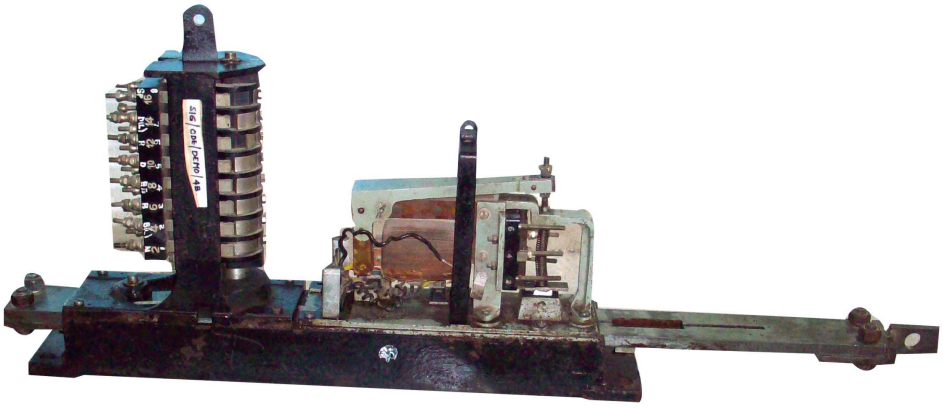


Fig. 1.1 LEVER LOCK

1.2 Lever Lock consists of

(a) Electromagnet,

(b) Force drop device,

(c) Economiser contact and

(d) Lock proving contact.

1.2.1 Electromagnet

The armature and magnet core are laminated and shading bands are fixed on the pole faces to ensure quiet and efficient operation when used on alternating current.

1.2.2 Force Drop Device

Some times the armature of the lever lock may not release after de-energisation of lock coil due to residual magnetism or any other mechanical holding, which may lead to unsafe conditions by allowing the lock to release without proving the required safety condition. To ensure that the lock pawl is positively pushed inside the locking notch before every unlocking operation, a mechanical arrangement called "Force drop" is provided. The force drop pins/nibs are riveted on the slide and a bevel shaped extension is provided on the lock pawl. The force drop pins/nibs force the lock pawl to drop into the locking notch through its bevel shaped extension before each pick up.

1.2.3 Economiser Contact

The economiser contact is provided with the electric lever lock and circuit controllers to cut off the power to the lock coil at the end of each stroke. It makes between A and E positions of the lever and remains disconnected in N and R positions of the lever. This connects supply to lock coil proving other required conditions after initiating the operation of the lever from its Normal or Reverse position thus economising the power consumption. In absence of "Economiser contact" the same purpose is served by AE band of circuit controller. In both the cases feed is disconnected in 'N' or 'R' position of the lever. Initial feed is controlled by track clear condition as shown in Fig 1.3.

Fig. 1.2 ECONOMISER CONTACT

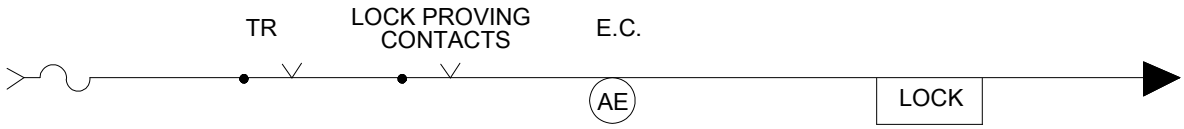


Fig. 1.3 LOCK PROVING CONTACTS

1.2.4 Lock Proving Contacts

A set of contacts are actuated when the lock is de-energised and lock pawl drops into the locking notch, proving that the lever is locked positively. An electrical circuit taken through these proving contact, proves that the armature is de-energised and consequently the lever is locked. Fig 1.3

1.3 Indication Locking Circuit

It is a locking provided on B AND D position of point lever slide and in the case of signals on B position only.

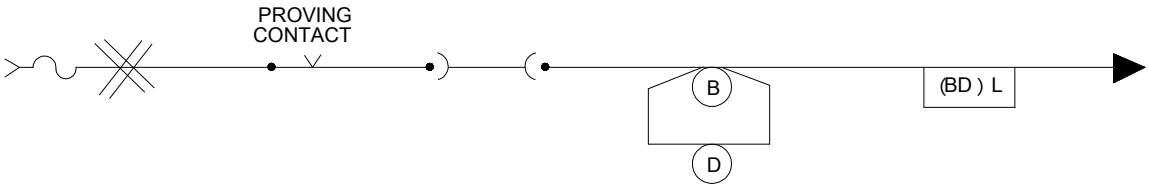


Fig.1.4 A INDICATION CIRCUIT

1.4 Track Locking Circuit

It is held in A and E positions of the lever and lock are released when the lever is either in A or B position with track clear condition. Locking of the point levers provides a safeguard against the derailment during hand signalled movement. Since track locking and indication locking are provided on the point lever, combined track locking and indication locking is used as shown in Fig.1.5.

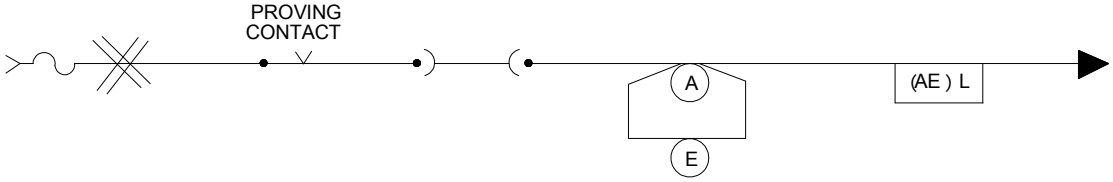


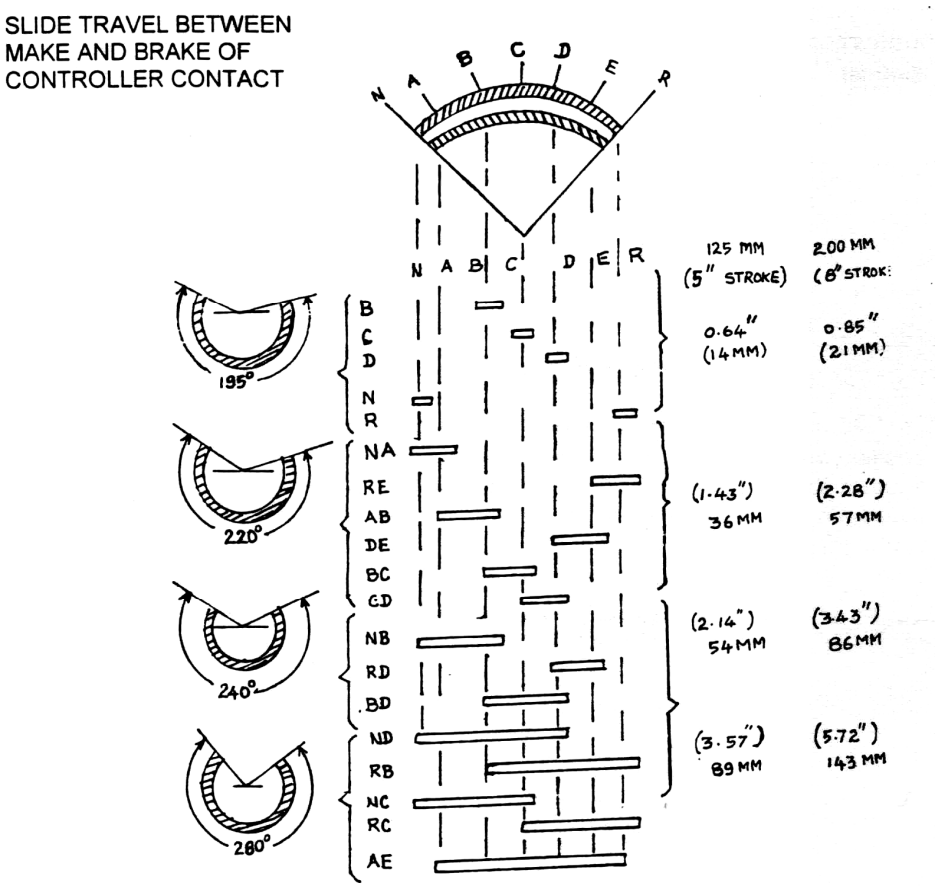
Fig.1.4B TRACK LOCKING CIRCUIT

Fig. 1.5 COMBINED CIRCUIT OF TRACK AND INDICATION LOCKING

1.5 Circuit Controllers

Circuit Controller is a device by which electrical circuits can be made or broken according to requirements. It has generally got the two sets of fixed contacts and corresponding numbers of rotating contacts. The rotating contacts may be of different positions such as N, R., NB, RD, etc. The contact segments are rotated by a plunger connected to the lever. Each rotating segment can be adjusted in steps of few degree (3 ¾ deg in SGE circuit controller) and locked in position. Though the lever lock and circuit controllers may be used separately, they can also be combined together on a lever lock and circuit controller.

A sketch showing the relative positions of circuit controller contacts to that of the lever controlling them are shown in Fig.1.6 for converting the linear motion of the plunger to the circular motion of the contact segments, different methods such as cam path, rack and toothed sector, crank motion etc., are used by different manufacturers.



N = Full normal position of lever.
A = Normal Economiser Position.
B = Normal Indication Position.
C = Centre position
D = Reverse Indication position.
E= Reverse Economiser potion.
R = Full Reverse Position.

Fig. 1.6 CIRCUIT CONTROLLERS

1.6 Electrical Lever Locks and circuit controllers are classified into (depending upon installation) single wire and double wire lever lock and circuit controllers.

(a) Single Wire Lever Lock and Circuit Controller. These are of three types:

(i) S.G.E. (Siemens General Electric) lever lock and circuit controller.

(ii) I.R.S. (Indian Railway Signalling) lever lock and circuit controller.

(iii) S&F (Saxby and Farmer) lever lock and circuit controller.

(b) Double wire lever lock and circuit controller: In this only 'T-2' type lever lock of circuit controller is available.

1.6.1 S.G.E. (Siemens General Electric) Lever Lock and Circuit Controller (SA 21301)

This lever lock and circuit controller is used in single wire lever frame installation. It can be mounted in both positions i.e., vertical position and horizontal position. In horizontal mounting, the counter weight has to be removed to avoid unsafe side condition. It has two coils of each 6.25 Ohms resistance. It can be connected in Series or parallel for supply AC/DC. When two coils are connected in series, the lock coil operates on 12 VDC; whereas 2 coil Connected in parallel. The lever lock operates on 110 VAC. The lever lock coils are shown in the Figure 1.7 a&b. It has a vertical position. Lock plunger having stroke of 125 mm to 200 mm according to the requirement. Depending upon the application, this lever lock and circuit controller is used either for point operation or signal operation.

1.6.2 S.G.E. Coil Connections

The lever locks can be worked either by D.C. or A.C. They are generally wound to work either on 110V -50cycles AC or 12 DC. Some lever locks are double wound. When two sections are connected in series, the lever lock operates on 12 VDC Whereas when the two coils are connected in parallel the lever lock can operate on 110 VAC Fig.1.7 a & b.

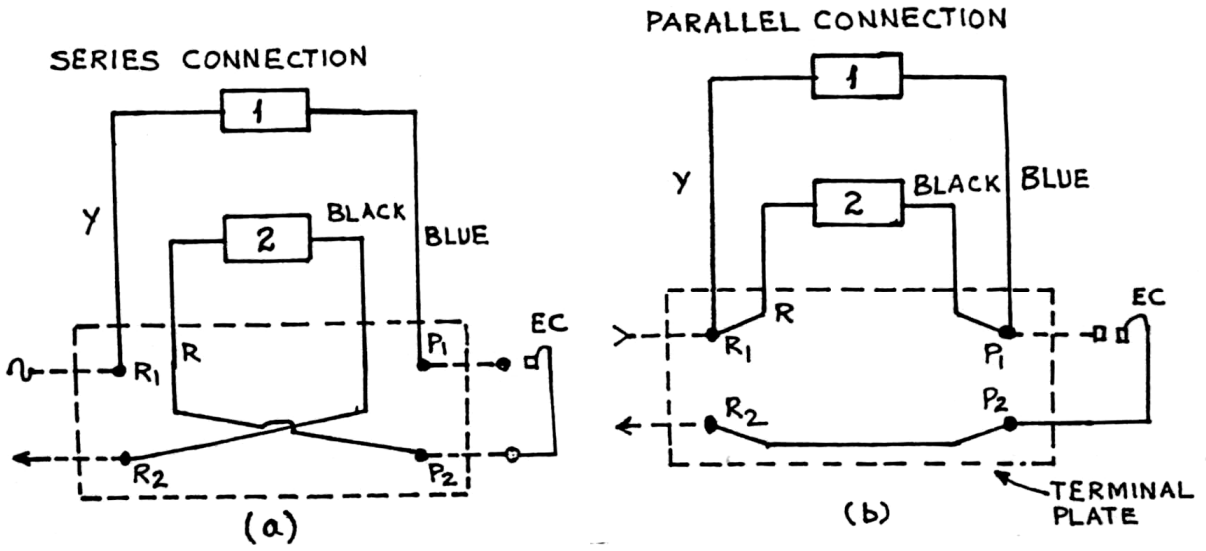


Fig 1.7 a & b SGE COIL SERIES AND PARALLEL CONNECTIONS

1.6.3 SGE Plungers

The lever locks may be fitted vertically or horizontally and the stroke of the lock slide is 125 to 200 mm according to requirement. The locks can be made to function in different positions of the lever by cutting notches in suitable places on the slide as shown in Fig.1.8. Notches may be cut either tight or loose. In the case of tight notches separate floor push, hand plunger, trigger switch etc. should be used for energising lock at the time of operation whereas in the case of loose notch the small travel of the lever which is available is utilised for making an electrical contact to energise the lock. The contact is known as economiser contact and is fitted on the lock itself. In lever locks designed for 200 mm stroke, the N and R notches can be cut with centres 200 mm apart. B and D notches shall be equidistant from the centre and the notches centres shall be about 106 mm apart.

Fig. 1.8 SGE PLUNGER

1.6.4 S.G.E. Point Lever Plunger

Lever lock used for point operation has different locking such as ‘A’, ‘B’, ‘D’ and ‘E’ positions. Before operating point lever it has to be ensured that point zone is clear of vehicles or not. For this purpose, track locking is required at ‘A’ position and ‘E’ position of the point lever and the functions has to be synchronised with the help of indication locking at ‘B’ position and ‘D’ positions of the point lever as shown in the figure 1.9a.

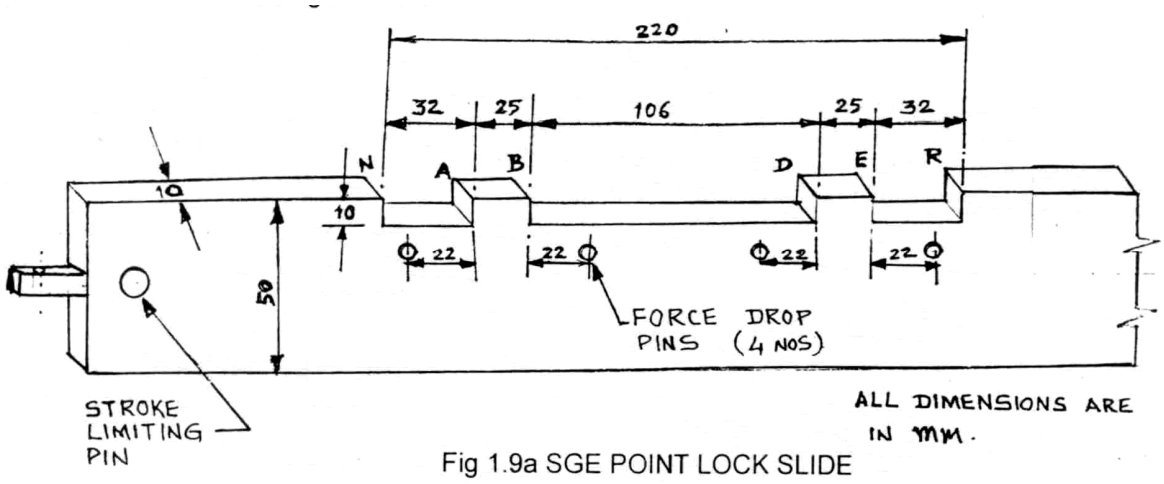


Fig 1.9a SGE POINT LOCK SLIDE

Simultaneously the force drop pins are required to be riveted on the point slide and lock pawl is made bevel shape for the purpose of force drop arrangement.

Economiser contact pins are provided to economise the power supply. It makes from ‘A’ position to ‘E’ position of the operating lever.

1.6.5 SGE Lever Lock used for Signals

The notches of signal slide has shown in the figure 1.9b On signal slide only ‘B’ position notch is required whereas ‘A’, ‘E’ and ‘D’ position notches are not required like point operation. Because, on signal slide, track locking is not required to ensure and also indication locking at ‘D’ position. At ‘D’ position, the indication locking is not required, if the signal is not operated to OFF position, then the failure is on safe side only. The indication locking at ‘B’ position is required to ensure that signal has been put back to ON position.

On signal slide only 'B' position notch is required whereas 'A', 'E' and 'D' position notches are not required like point operation. Because, on signal slide, track locking is not required to ensure and also indication locking at 'D' position. At 'D' position, the indication locking is not required, if the signal is not operated to OFF position, then the failure is on safe side only. The indication locking at 'B' position is required to ensure that signal has been put back to ON position.

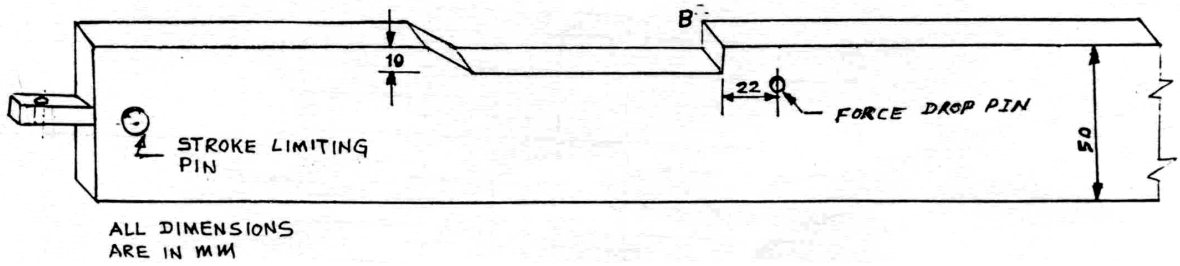


Fig 1.9b SGE SIGNAL LOCK SLIDE WITH 'B' NOTCH

1.6.6 Procedure for Cutting of the Notches

On lock slide of the lever locks to the Drawing No. SA21301/M, for providing track locking and indication locking on a point lever.

(a) Connect the lock slide to the lever tail through a connecting rod provided with adjustable coupling.

(b) Balance the stroke of the lever imparted to the lock slide by means of the adjustable coupling so that on the operation of the lever to 'N' or 'R' the respective stopper should butt to against the body of the lever lock with equal force. This ensures that the full 200 mm (8") strike is imparted to the lock slide.

(c) Keeping the lever in 'N' position. Mark the normal position on lock slide coinciding with the Outer edge of the slot on the body of the lever lock for insertion of the lock dog.

(d) Keeping the lever in 'R' position, mark the reverse position on the lock slide coinciding with the inner edge of the slot on the body of the lever lock for insertion of lock dog.

(e) Take out the lock slide from the lever lock and ensure that the distance between the two markings 220 mm (8 ¾") i.e., the travel of the lock slide plus width of the lock dog.

(f) Cut the notches as per the dimensions shown in sketch. (Fig 1.9a or 1.9b)

(g) Revert the casehardened force drop pins the holes drilled in the slide for this purpose.

(h) Re-insert the lock slide in the lever lock.

Note: When lever worked for N to R the A and D notch and when R to N the E and B notch are available.

1.7 SGE Circuit Controllers

In this circuit controller, bands are adjustable type. The rotating segment can be adjusted in steps of 3 ¾' degree and locked in its position. The circuit controllers can be rotated by cam and roller arrangement or rack and pinion arrangement to convert linear movement of slide into circular motion of circuit controller.

1.7.1 Procedure for Circuit Controller adjustment

(a) Loose the adjusting nut of circuit controller.

(b) Separate copper band of the circuit controller from the serrations of Bakelite contact holder.

(c) Rotate copper band as per the requirement of the lock positions.

(d) Re-insert copper band in to the Bakelite contact holder.

(e) After tightening the adjusting nut, test the adjusted copper band position once again.

1.8 S&F Type Lever Lock and Circuit Controller

It has the same features of SGE type lever lock and current controller except the coil resistance. In this coil resistance is 7.5 Ohms each (two coils).

1.9 IRS type Lever Lock and Circuit Controller (SA 22701)

It has only one coil of 4.5 Ohms resistance. It can be connected to 110 VAC or 12V DC. It has horizontal stroke plunger so that there will not be worn out of the notches. For force drop arrangement bevel shape segments are provided on both sides of the notches. There is no counter weight in this lever lock. So, it can be mounted either horizontal or vertical position without any changes in the lever lock. Economiser contact notches are provided on the plunger instead of pin (in SGE) to have more reliability limiting the strike of lever plunger or solid strip provided on either side of plunger instead of stroke limiting pins provided in SGE. IRS lever lock can be used for signal lever or point lever.

1.9.1 IRS type Circuit Controllers

In this circuit controllers are fixed type and according to the site requirement this bands has to be marked and cut carefully.

Fig 1.10 IRS POINT SLIDE

1.9.2 Double Wire Lever Lock and Circuit Controller (T2-type)

It has a single coil of 150 Ohms resistance and operates only 12 VDC power supply. The stroke of the plunger is 40 mm. It can be mounted only in vertical position. Economiser contact is not provided. So, one of the circuit controller band may be used as economizer contact purpose. The stroke plunger is of rotary type because of these the size of lever lock and circuit controller is smaller. The force drop is provided inside the rotary segment and different locking notches for point and signals are on the periphery of the segment. These notches are difficult to cut at site. So while indenting itself care has to be ensured. As shown in Figure 1.12a and 1.12b.

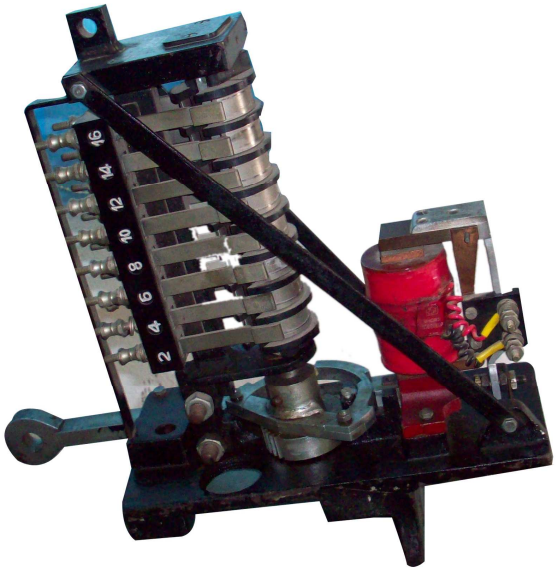


Fig: 1.11 Double Wire lever lock and circuit controller (T2-type)

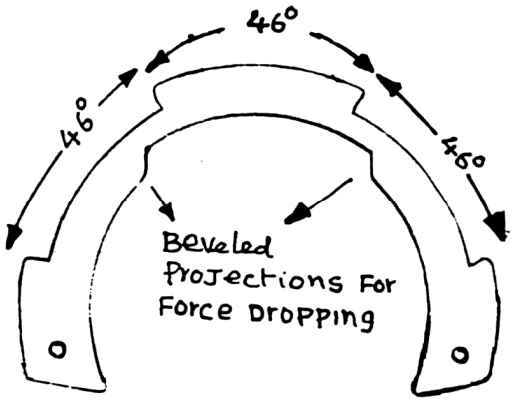


Fig 1.12a T-2 Signal Notch Segment

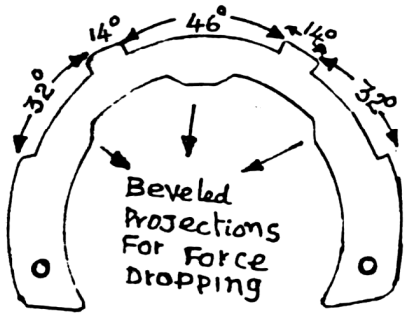


Fig 1.12b T-2 Point Notch Segment

Particulars of lever lock and circuit controllers Lock dog width = 20 mm

Type	Resistance of coil	Working voltage	Plunger Stroke	Force drop arrangement	Economiser contact	For Horizontal/ Vertical Mounting
SGE	6.25 ohms coil Total = 12.5 Series connection	230 VAC 50 W or 12 VDC	200 mm	Provided	Provided	For both
	Total = 3.125 Parallel connection	110 VAC 50 W or 6 VDC	200 mm	Provided	Provided	For both
IRS	4.5 ohms single coil	110 VAC 50 W or 10-12 VDC	200 mm	Provided	Provided	For both
T-2 for DW	150 ohms single coil	10-12 VDC	40 mm	Provided	Not Provided	Vertical mounting only

1.10 Testing of Lever Lock and Circuit Controllers

(a) Check that all moving parts are clean, oiled and they work freely.

(b) The lock armature works freely.

(c) Check the proper functioning of force drop device. This can be tested by holding the armature loosely by hand and operating the lever from locked position. If a downward force is experienced on hand , it indicates that the force drop device is functioning properly.

(d) Check the faces of the locking notches on the lock slide and the lock piece any where.

(e) Check all terminals, Screws and nuts for proper tightness.

(f) Ensure that the circuit controller contact bands and springs are cleaned and they make contacts with proper tension.

(g) Check the terminal blocks of circuit controller for their proper fitting and intactness.

(h) Check the economiser contacts and lock proving contacts for their proper functioning.

(i) Ensure that the split pins are in position and properly splitted.

(j) Check the wiring of any damage of insulation especially at cable inlets.

(k) Measure the operating voltage and current at lock coil terminals.

(l) Carryout the test to ensure that the lever cannot be operated when the required safety conditions for its operation are not fulfilled.

(m) Ensure that the staff operation the levers are familiar with the operation of the levers fitted with electric lever locks. Such levers should be operated gently without jerk after the lever getting unlocked electrically.

CHAPTER 2: ELECTRIC POINT AND LOCK DETECTOR IRS TYPE

2.1 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.2.1)

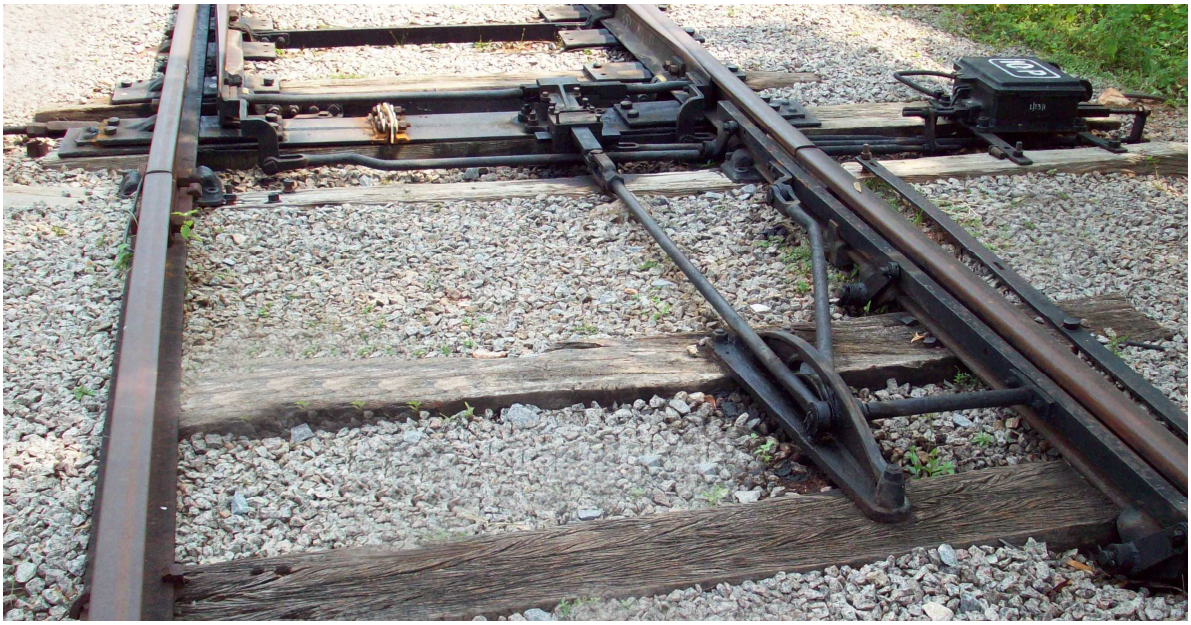


Fig: 2.1 IRS LAYOUT WITH IN AND OUT TYPE OF LOCKING

2.2 Advantages

The IRS type of detector has got the following advantages over other types of detector:

(a) This detector can be used for both BG and MG point layouts simply by adjusting the detector slides.

(b) It can be fitted on extended sleepers or on detector shoe mounted on foundations as in the case of unit type detector, making the arrangement ‘floating' to prevent failures due to lateral thrust on points. With the 'floating' arrangement fine adjustment of contacts is possible.

(c) It provides facility for initial adjustment and checking of slides for correct adjustment during routine maintenance with the help of locating marks without opening the cover.

(d) The bridge contacts when operated to either normal or reverse position are rigidly held due to the operating mechanism being spring loaded. Hence, bobbing of point indication relay during movement of trains over the point is prevented.

2.3 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

2.3.1 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.

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.

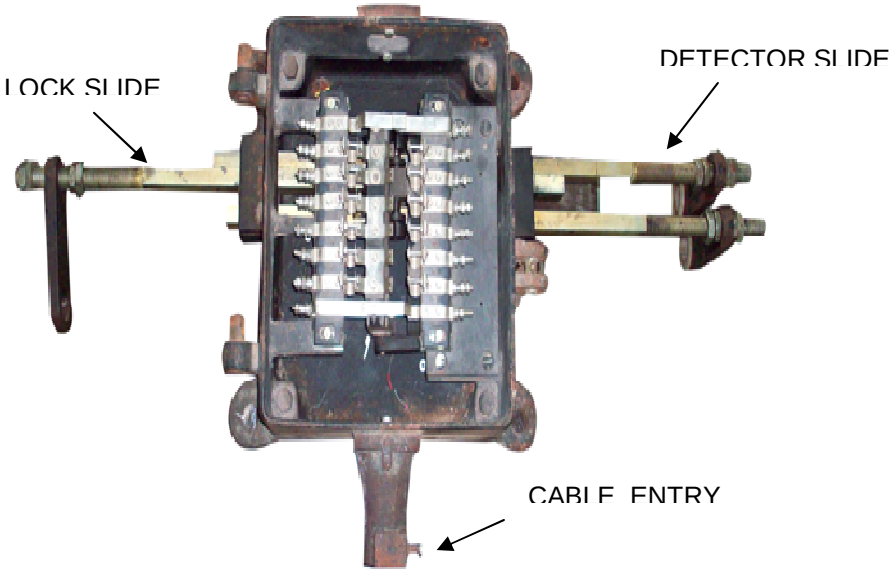


Fig 2.2 ELECTRIC POINT AND LOCK DETECTOR

2.3.2 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.

2.3.3 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.

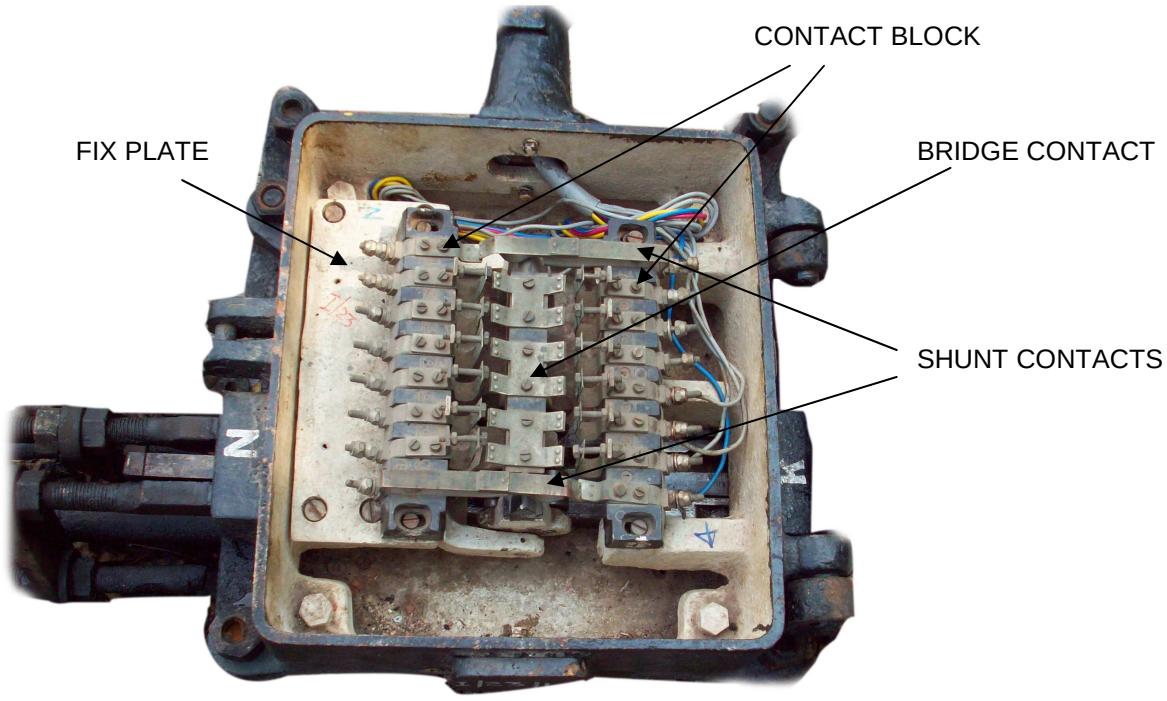


Fig: 2.3 CONTACT BLOCK

Fig 2.4 DETECTOR SLIDE (B, A, C AND D)

Fig 2.5 LOCK SLIDE (B AND A)

2.3.4 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	**In & Out**		**Straight Through**
	Drg. SA-23331	**Drg. RDSO S/9301**	**Drg. SA-23332**
i) Point Slide Stroke 100 mm/115 mm	Type 'C' S-233377-1No. Type 'D' S-23378 – 1No	Type 'D' =2 Nos.	Type 'C' = 1 No Type 'D' = 1 No.
ii) Lock Slide Stroke 32 mm	Type 'A' S-23370 - 1 No.	Type 'A' = 1 No.	Type 'B' S-23380- 1 No.

Different types of Switch Detection Slides:

(a) 'C' type Switch Detection Slide: 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: 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.

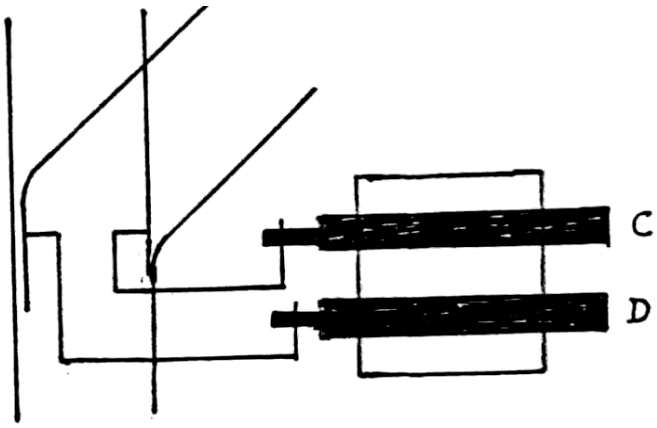


Fig : 2.6a DETECTOR ON RH SIDE

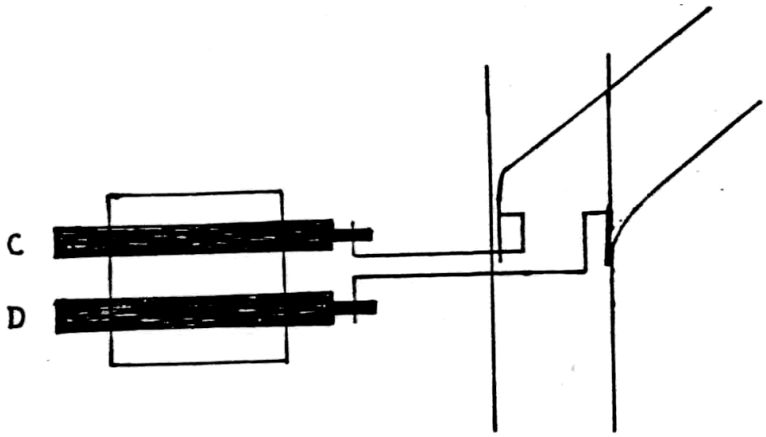


Fig : 2.6b DETECTOR ON LH SIDE

2.3.5 Lock Detection Slides

The lock slide is also a rectangular flat bar of the same dimension as that of point slides with screw-end, check-nuts and lug on one side. A slot on either face of the slide is cut with a sloping surface to allow the rollers to roll over the surface gradually till it drops fully inside the slot. The position of the slots are staggered on the slide face to facilitate the use of the slide with either face depending upon the slide moving towards the track or away from the track during unlocking. The sloping surface allows the roller to drop at the end of locking stroke. Thus, ensuring the making of detector contacts at the end of operation and breaking of the contacts at the beginning of the unlocking stroke.

Different types of Lock Detection Slides:

(a) 'A' type Lock Detection Slides: It has notches and locating marks on both sides of the slide. There are two types of locating marks provided in this 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".

10 mm. locating mark has to be used during unlocking of point, if the lock slide moves towards the track or else 42 mm. locating mark has to be used. This has shown in the following figure Fig 2.7a and Fig 2.7b

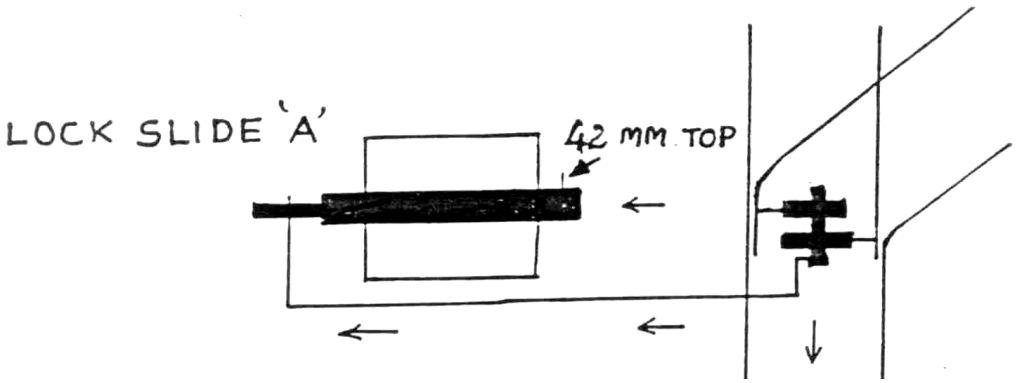


Fig : 2.7a. IN AND OUT LOCKING LH SIDE

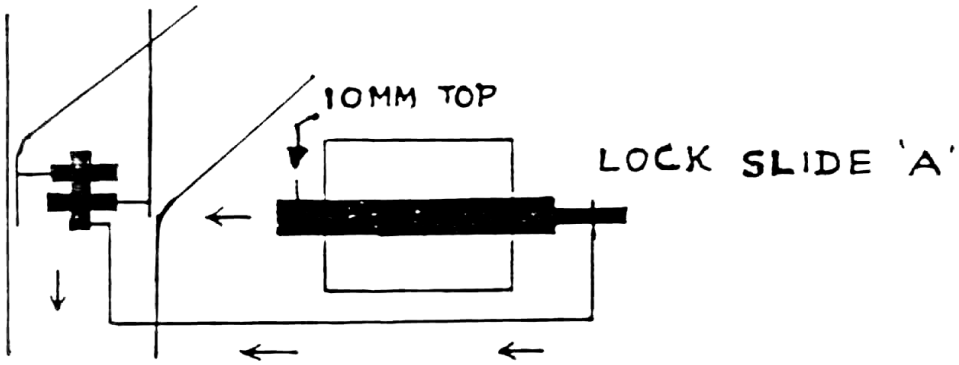


Fig : 2.7b. IN AND OUT LOCKING RH SIDE

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: It has single notch and two locating marks on the same side of the notch. 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".

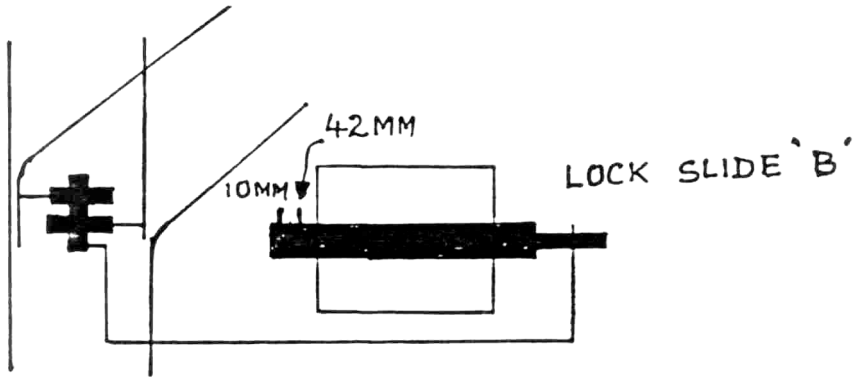


Fig.2.7c STRAIGHT THROUGH LOCKING RH SIDE

When RH side switch is closed and locked, 42 mm. or when LH side switch is closed and locked 10 mm. locating mark should come in alignment with the surface of the body. When RH side switch is closed and locked, 10 mm. or when LH side switch is closed and locked 42 mm. locating mark should come in alignment with the surface of the body.

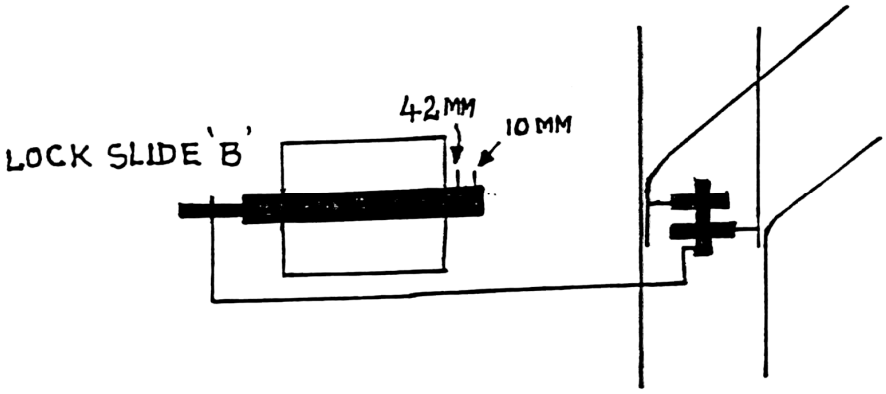


Fig: 2.7d STRAIGHT THROUGH LOCKING LH SIDE

2.4 Wiring and Connection

The basic principles for wiring of an Electrical Point Detectors are as follows:-

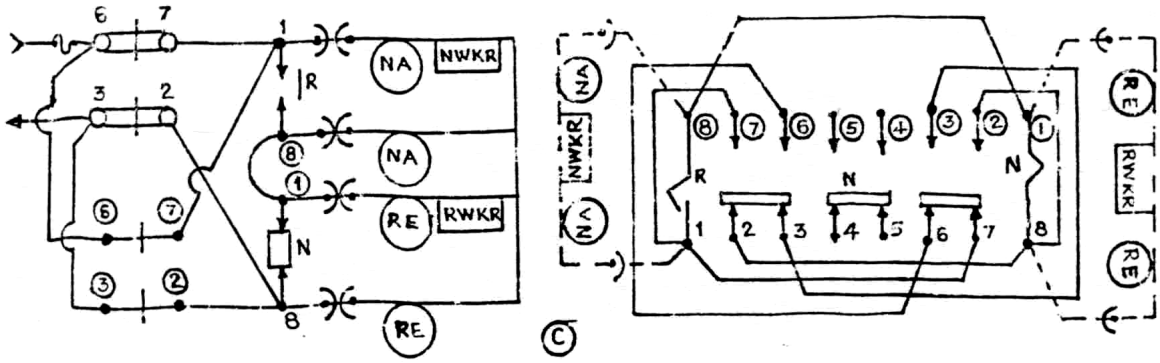


Fig: 2.8 FOUR - WIRE DETECTION CIRCUIT

2.5 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.

2.6 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(Wooden 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) Check up the correct operation of point both ways, disconnect the lock and connect the switch detection slides. Adjust the closed switch detection slide such that the location mark on the slide coincides with the finished surface of the frame. At this position, the small depression on the slide is available to receive the contact shaft roller. Adjust the open switch slide such that its longer depression is available to receive the contact shaft rollers.

(d) Change the position of the point and adjust the present closed switch slide in the same manner as above without disturbing the adjustment of the other detection slide previously adjusted. Finally adjust both the point slides to satisfy obstruction test with 3.25 mm test piece when placed between switch and stock rail at 150 mm from the toe of this switch.

(e) Operate the point both ways and see that the contacts make or break in both positions properly. The contacts should make or break simultaneously. This can be adjusted by moving the contact block 'to and fro' on the slot provided in it. Fix up the block in that position with screws and lock washer. Individual contact tension can be adjusted by the screws provided on the contact spring ('U' shaped) and the adjusting nut to be not more than 2 mm or less than 1 mm when the contact is made. This distance is to be provided for all contacts.

(f) Connect the lock detection slide now and adjust it such that the depression on it is available to receive the contact shaft roller only when the points are fully locked and the lock plunger has completed its full stroke. In this position the locating mark on the lock slide will coincide with the finished surface of the frame. Two locating marks one at 10 mm from the end on one side and the other at 42 mm from the end on the other side are provided on the lock slide. If the detector is mounted in such a way that the lock slide moves towards the track during unlocking, then 10 mm locating mark should coincide with the finished surface when the point is fully locked. If the lock slide moves away from Track during unlocking, then the lock slide should be turned upside down and the 42 mm locating mark should coincide with the finished surface when the point is fully locked. This is applicable for both "in & out" and

"Straight through" locking. Operate the lock slide several times to ensure that the detector contacts break, the moment the unlocking starts and makes at the end of locking stroke. Where these detectors are used on trap points or points without lock slides that are not required may be removed and the gap covered by means of spacers (Drg.No.S.23381).

(g) Tighten all nuts and screws and open out split pins. See that no loose wire hangs on, which may cause a failure.

(h) It is important that the switch rail houses well with the stock rail to avoid intermittent breaking of the detector contacts.

2.7 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.

2.8 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.

(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 in 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.

2.9 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.

2.10 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.

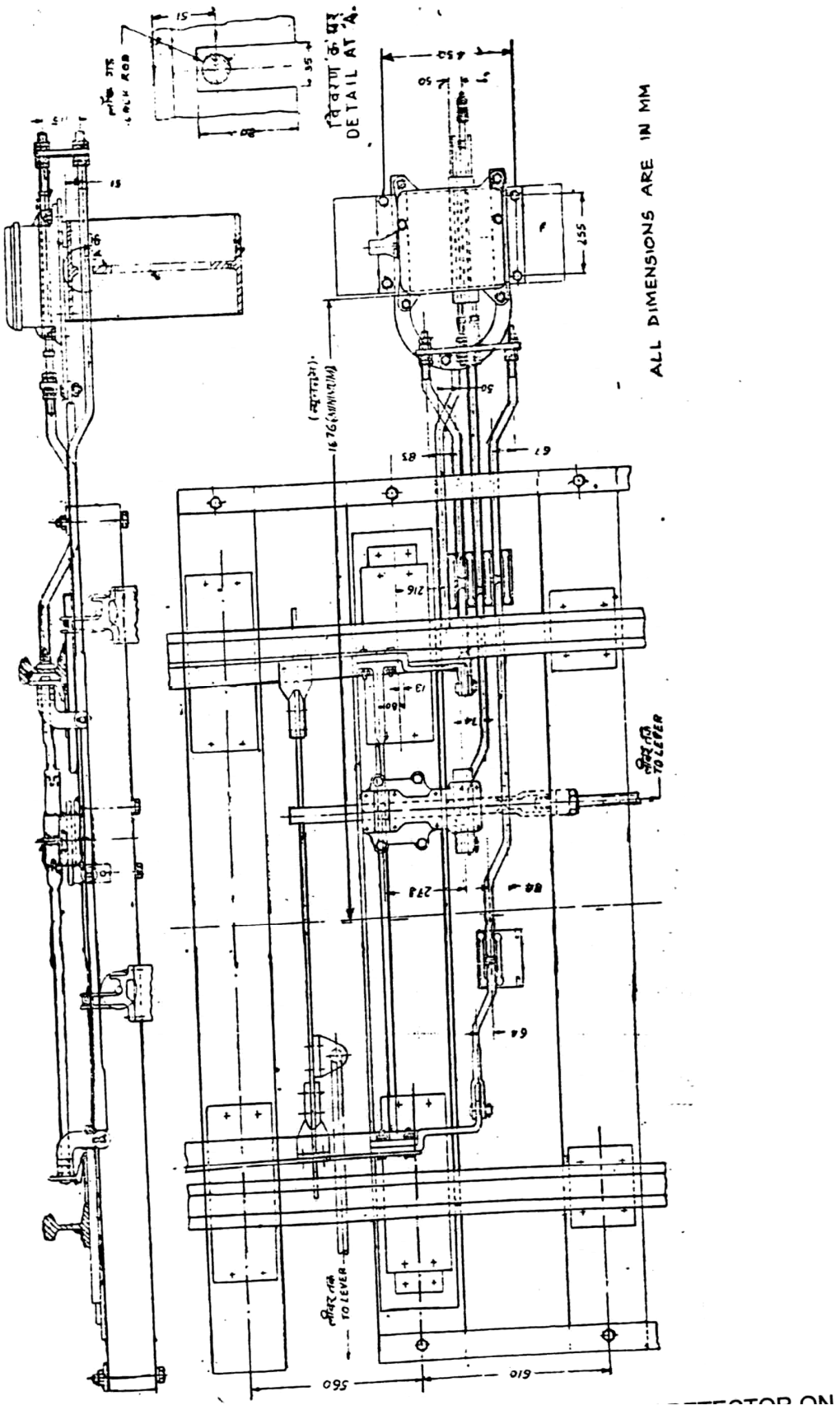


Fig: 2.9 FIXING ARRANGEMENT OF ELETRIC FACING POINT AND LOCK DETECTOR ON INDEPENDENT FOUNDATION (LAYOUT FOR 75R OR 1 IN 12 TURNOUT BG)

CHAPTER 3: INTRODUCTION TO POWER OPERATION OF POINTS

3.1 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.

(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. The Full stroke of 220 mm for Clamp type of point machine used and Switch opening becomes. For rotary type of point machines, it shall be possible, to adjust the stroke from 94 mm to 143 mm (MG&BG).

(k) For the Point Machine using plunger type of locking, the locking dog travel shall be at least 100 mm for 'in & out' movement and 200 mm for 'straight through' movement. For machines using rotary type of locking, the locking of the point shall be achieved by means of a segment engaging in the locking curve of the gear rack.

(l) Suitable snubbing device shall be provided, if necessary.

3.2 Point Control arrangement

This is done by means

(a) Direct Controlled

(b) Relay Controlled

3.2.1 Direct Control

Whenever a point machine is controlled directly from the lever, 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 3.1, three wires are required to control the point machine, one for controlling reverse to normal (NW), one for controlling normal to reverse (RW) and the third is the common return.

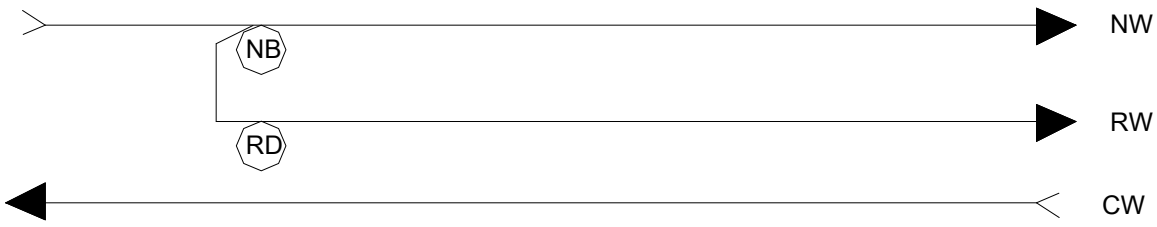


Fig No: 3.1 POINT DIRECT CONTROL CIRCUIT

3.2.2 Relayed Control

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. Relayed control is one in which lever control the working of the relays known as point controllers or contractors, 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.

Three Wire Control: - In this control, three wires are used for controlling and two neutral relays (controllers), NWR used for operating the points to normal and the other RWR used for reverse. Refer Fig. 3.2.

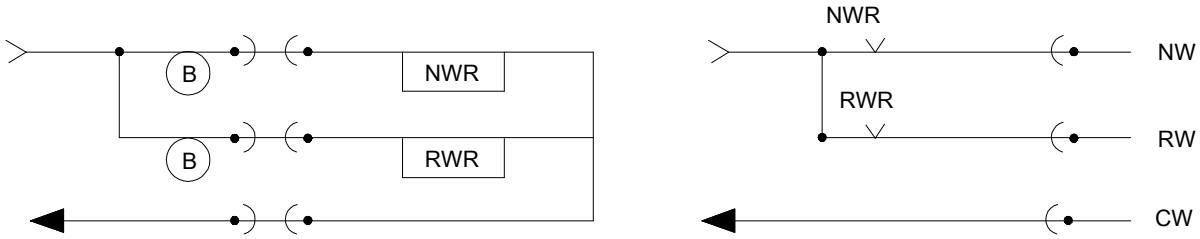
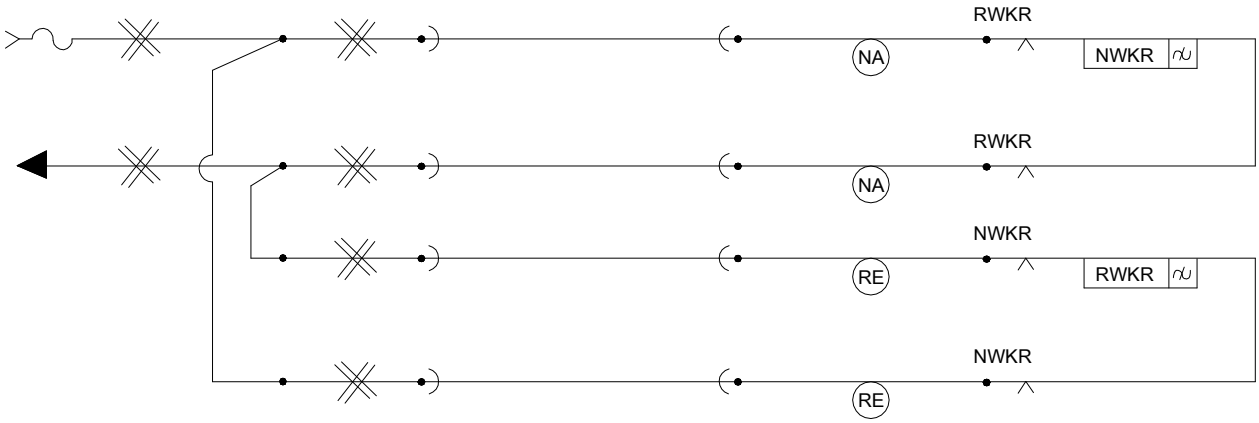


Fig No : 3.2 THREE WIRE POINT CONTROL

Four wire detection: 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 : "⨯" OTHER CONTROL SELECTION.

Fig No : 3.3 FOUR WIRE DETECTION CIRCUIT

CHAPTER 4: IRS ROTARY ELECTRIC POINT MACHINE (ROTARY LOCK AND 143MM STROKE)

4.1 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 single point, single switch, double slips and trap points, for all types of switch fittings and weight of rails. The point machine is rated for nominal operating voltage of 110 VDC.

4.2 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

4.3 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 too 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.

4.4 Main Parts:

(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.

(f) Cover with looking mechanism to prevent unauthorised interference in its working.

(g) Hand crank.

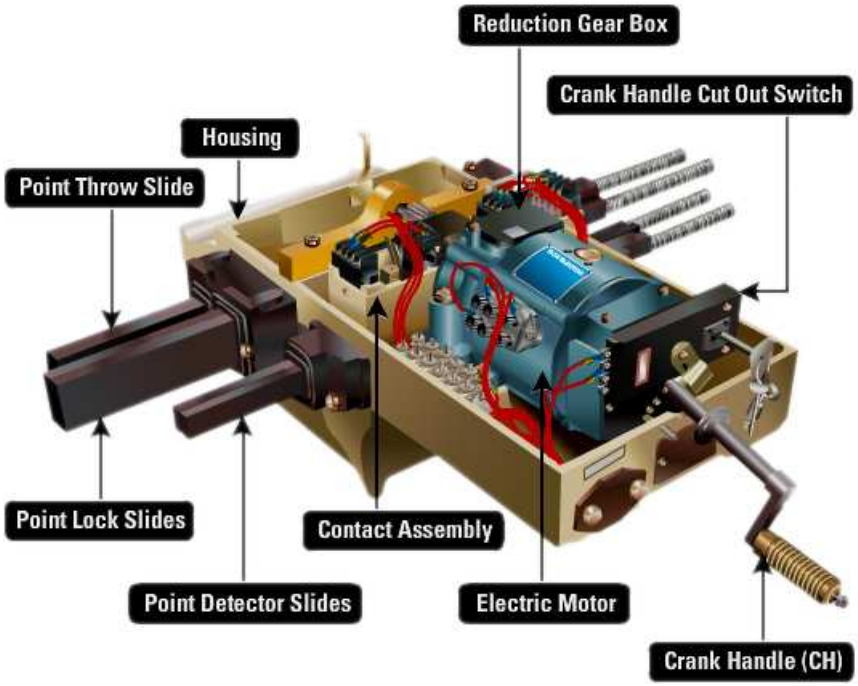


Fig : 4.1 POINT MACHINE

4.4.1 DC Series Motor: This motor is used to convert Electrical Energy into mechanical energy and designed to operate in both directions. Fig. 4.2

(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: 4.2 POINT MOTOR

4.4.2 Transmission Assembly

It consists of the following elements show in the Fig. No.4.3.

(a) Main Gear Rim

(b) Spring loaded friction clutch

(c) Transmission shaft with rack pinion and Rotary type segmental lock pawl.

(d) Drive disk (bottom plate)

(e) Lift out disk and

(f) Control disk (top plate)

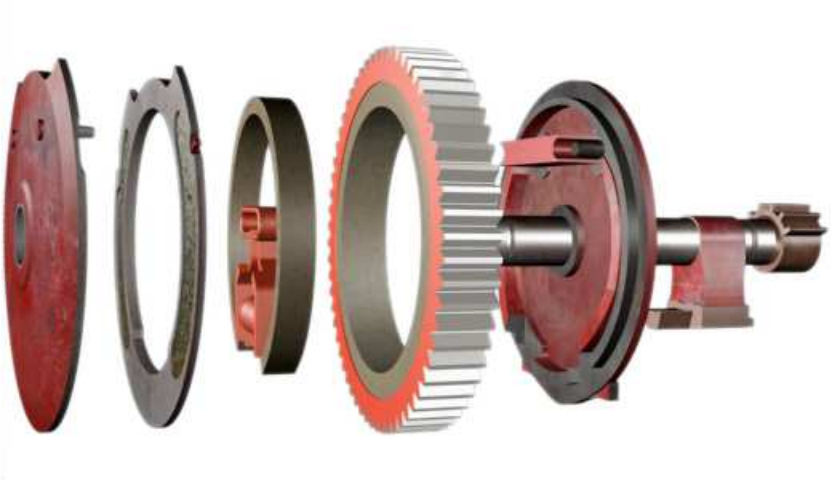


Fig : 4.3 TRANSMISSION SHAFT WITH FRICTION CLUTCH, LOCKING SEGMENT & PINION

(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 which in turn imparts a maximum of 143 mm. linear motion to the throw rod.

(b) Spring loaded friction clutch:

It consists of

(i) Slip ring

(ii) 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 it self, there is no need to adjust it at site. Shown in the Fig No 4.4

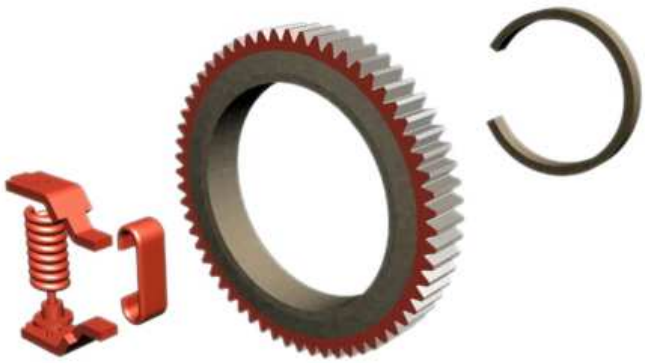


Fig 4.4 SPRING LOADED FRICTION CLUTCH

(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. If it is required to adjust friction clutch at the site, unlock the points, remove the motor pinion bracket, gear rack and lock slides. Remove the flap over the drive disc and adjust the hex bolt tighten/loosen as required.

(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.

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 transmitting linear 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. 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 placed in between gear rim and control rim and used to actuate the detection & control contacts. It is having a smooth cam 158 mm at its periphery in which the detection contact actuating pin roller-A (physically visible) is allowed to drop ' when the point is fully locked in Normal or Reverse position. Similarly, the roller A is pushed upwards once the lift out disk 'starts its motion for unlocking of the point. The motion of the main gear rim is first transmitted only to this disk.

Fig 4.5 LIFT OUT DISK

(f) Control Disk:

It is used to lock the detector & control contact actuating pin roller A in its home. For this purpose a small cam arrangement is provided in its periphery for 120 mm and the moving roller A is allowed to drops into this cam at the end of the rotary motion. The design of the cam is such that it cannot actuate the, roller upwards. But it locks the roller and gives-more reliability to the detection contacts.

Fig 4.6 CONTROL DISK

4.5 Working of Transmission Assembly

When the motor rotates, the main gear rim along with the friction clutch assembly gets its movement which cause the friction clutch spring locking plate LH / RH to engage with lift out disk (clearance between the friction clutch spring locking plate LH & RH and 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 which in turn actuates the electrical contacts. i.e. detection contacts opens and control contacts 'Closes. Further movement of the Main gear rim assembly drives the drive disk too. (Clearance between friction clutch spring locking plate LH & RH and the drive disk is about 12 mm)

As the drive disk and the control disk are locked each other by means of a Locking member both rotates at a time as a single unit. (The total circular movement of the drive disk is limited to 270 degrees as mentioned above.) Since the Drive disk and Segmental lock pawl are keyed to the Main shaft, this rotary motion is transmitted to lock pawl and thus moves out from the lock notches. At the end of the unlocking, the rack pinion engages with throw rod rack and throws and locks the point.

(Sequence of motion:- i. Main gear rim, ii. Lift out disk, iii. Drive disk. and iv. gear pinion.)

4.6 Throw rod, Lock & Detection Slides

4.6.1 Throw rod

The throw rod is having a hole (24 mm)at its ends and a. rack in the middle in which the rack pinion engages 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 lock notches (circular- one each for point normal and reverse) for locking the throw rod at the end of the point operation.

4.6.2 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 circular) 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 c hanged only by removing the same from the machine, which is required when the position of the point machine is to be changed from left to right and vice-versa. A brass strip is riveted to its sides so that, the possibility of moving together due to rust / friction is eliminated.

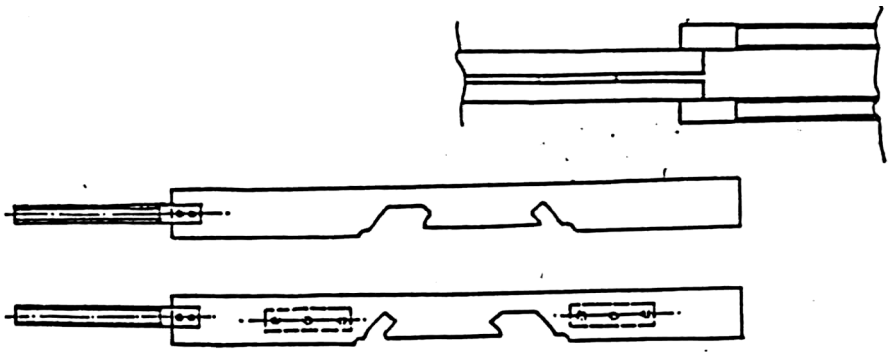


Fig 4.7 LOCK SLIDES (69X18)

4.6.3 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.)

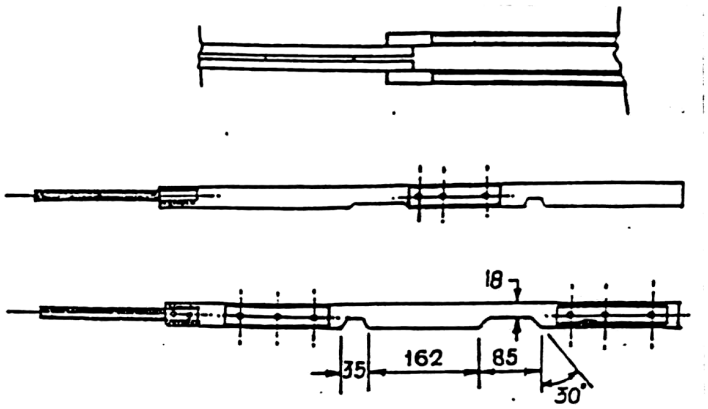


Fig 4.8 DETECTION SLIDE (32X15)

4.6.4 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.

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.(The Normal & Reverse control contacts position is based on fixing of the point machine i.e. LH \ RH)

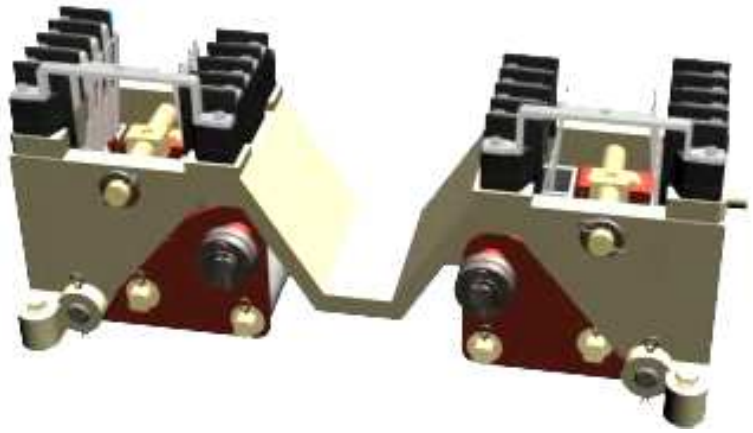


Fig 4.9 DETECTION AND CONTROL CONTACT ASSEMBLY

4.6.5 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 is allowed to make at a time provided the, transmission assembly, rotation is completed and 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 with, the position of the roller B in the pedestal assembly and the cams in the control & lift out disks should come below the roller A)

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.

4.7 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.

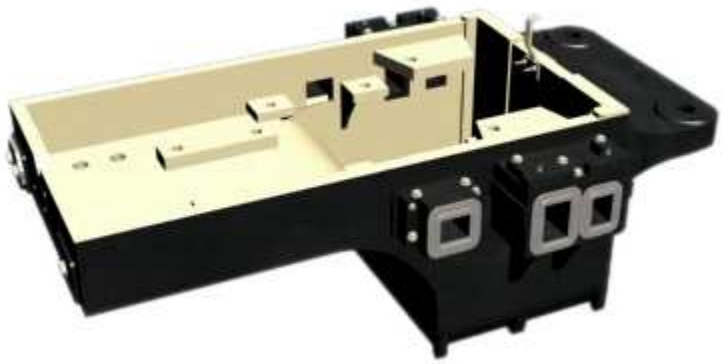


Fig 4.10 POINT MACHINE BASE

4.8 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.

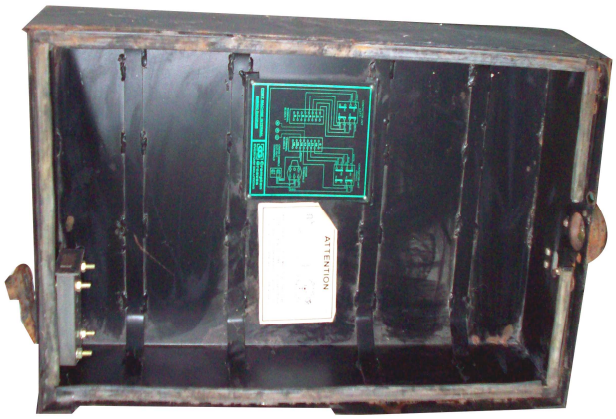


Fig 4.11 POINT MACHINE BASE COVER

4.9 Hand Crank and Cut out Contacts

This arrangement is attached to the motor itself and is used for operating the point manually in case of emergency. For this purpose, the motor armature shaft is extended at the non gear side and having a slit. A cut out contact is also provided in the same side. Hand cracking of the machine is possible only through the motor shaft and that too after unlocking the flap cover plate lock and opening the cut out contact by a key. The opening of cut out contact prevents electrical operation. (Two cut out contacts are available but only one is connected, in series with the motor circuit.)

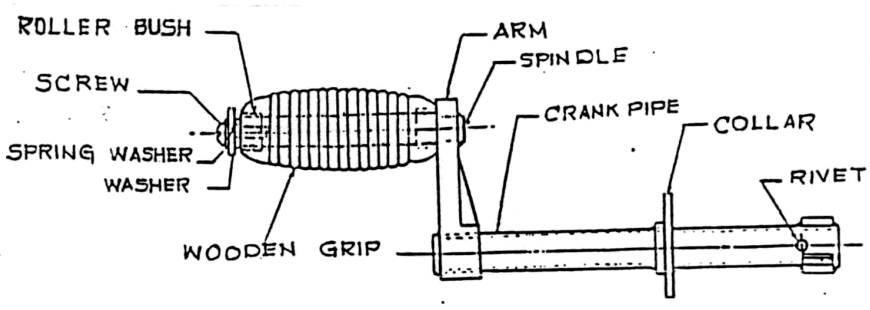


Fig 4.12 CRANK HANDLE

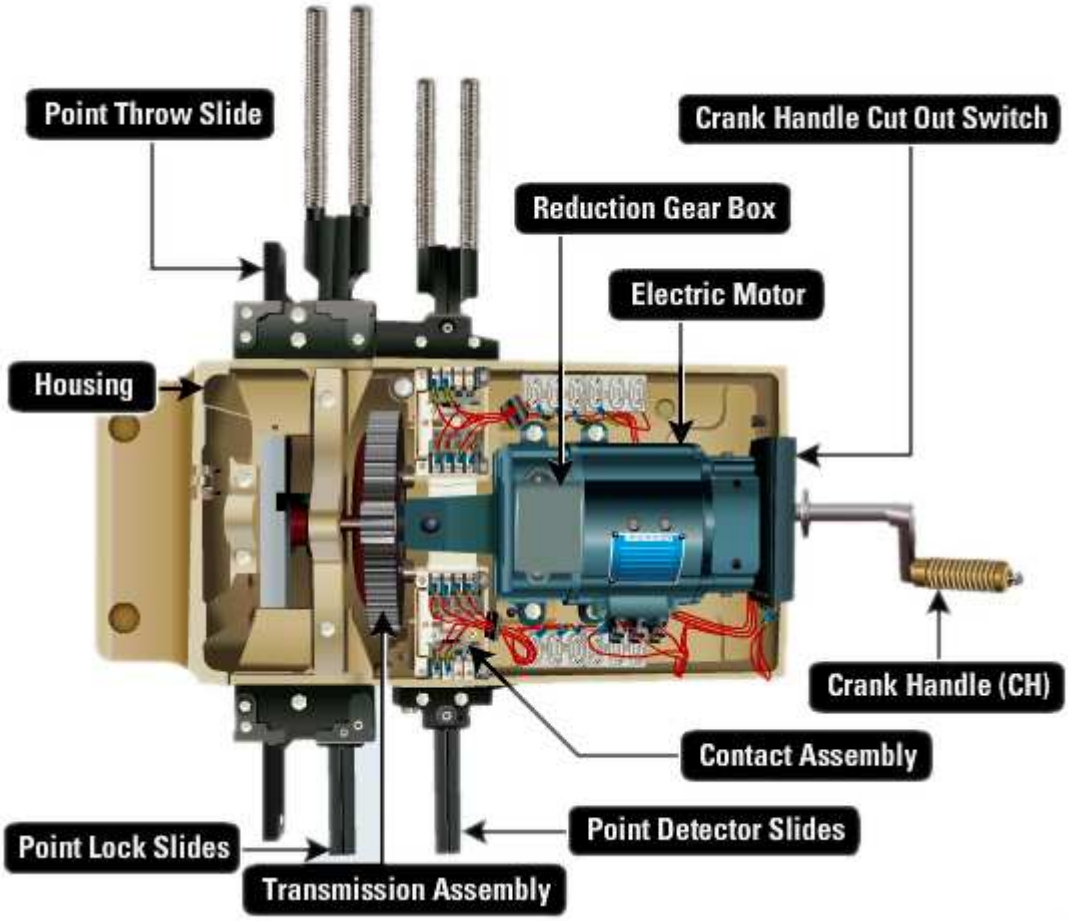


Fig 4.13 IRS POINT MACHINE ASSEMBLY

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 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 long sleeper.

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 two long sleepers ie. two holes in each sleeper and extended gauge tie plate. Place the point machine on the sleeper such that the distance of centre of the machine from stock rail-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.

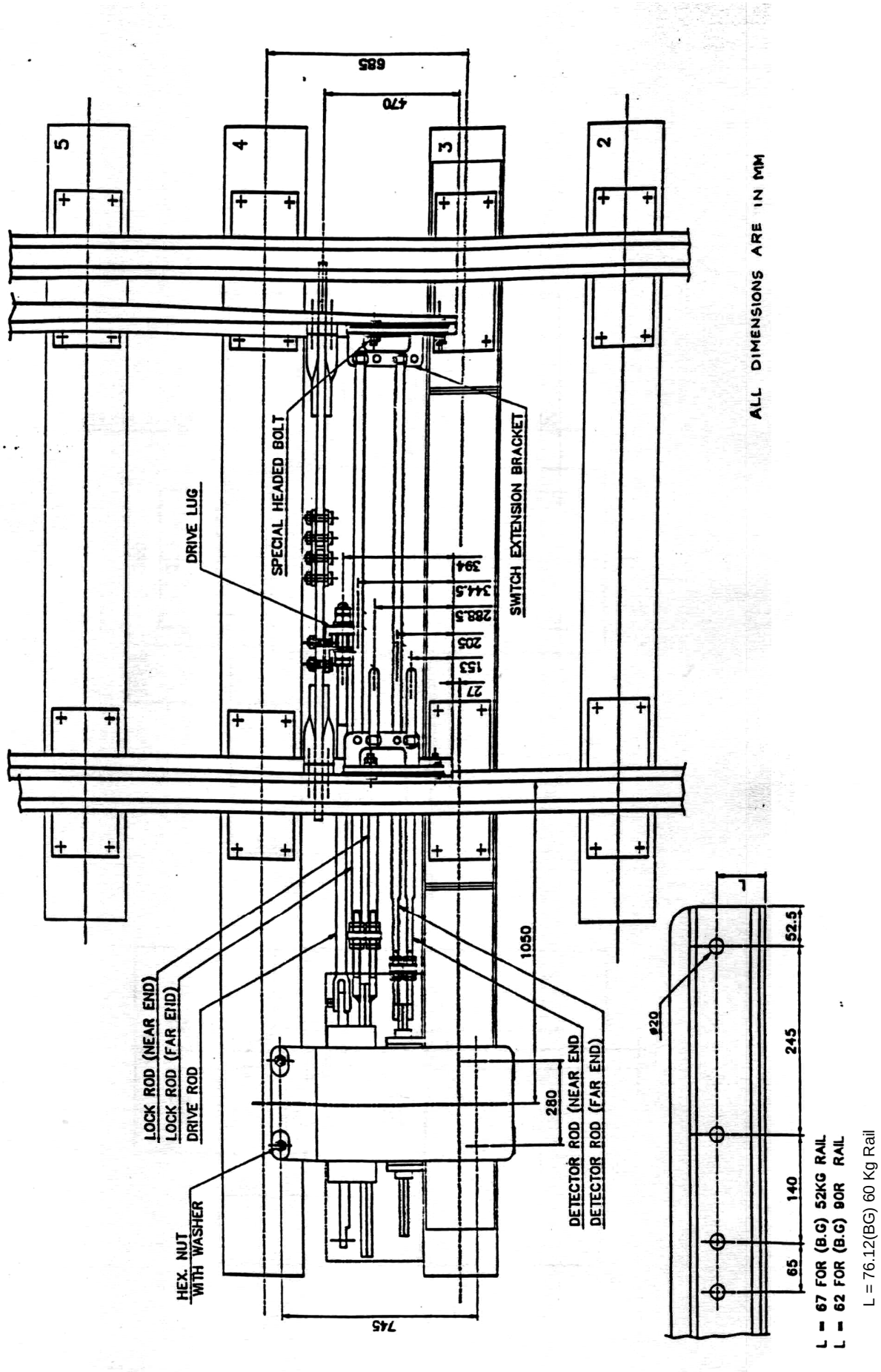


Fig 4.14 THE LAYOUT ARRANGEMENT OF IRS POINT MACHINE

(b) MOUNTING OF DRIVE ROD AND LOCK RODS:

MOUNTING OF DRIVE ROD: (REFER FIG. 4.15)

(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.

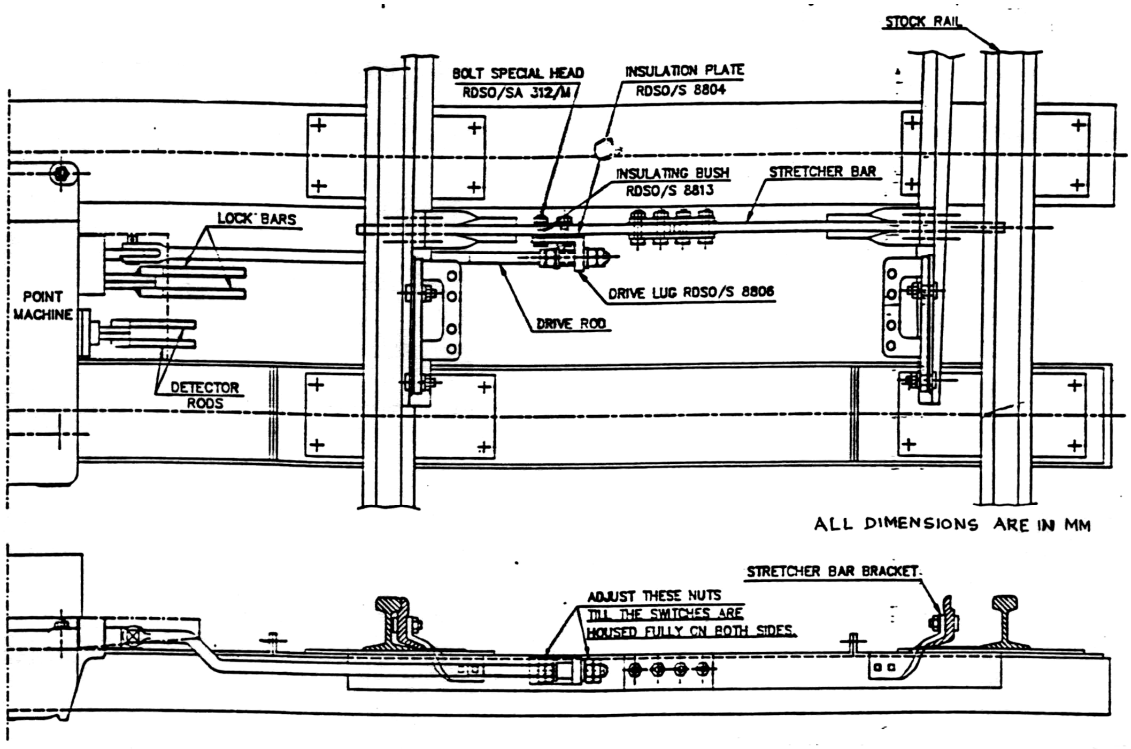


Fig 4.15 SECTION SHOWING THROW (DRIVE) ROD CONNECTION

(ii) Assemble the switch extension bracket (Fig. 4.16) (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.

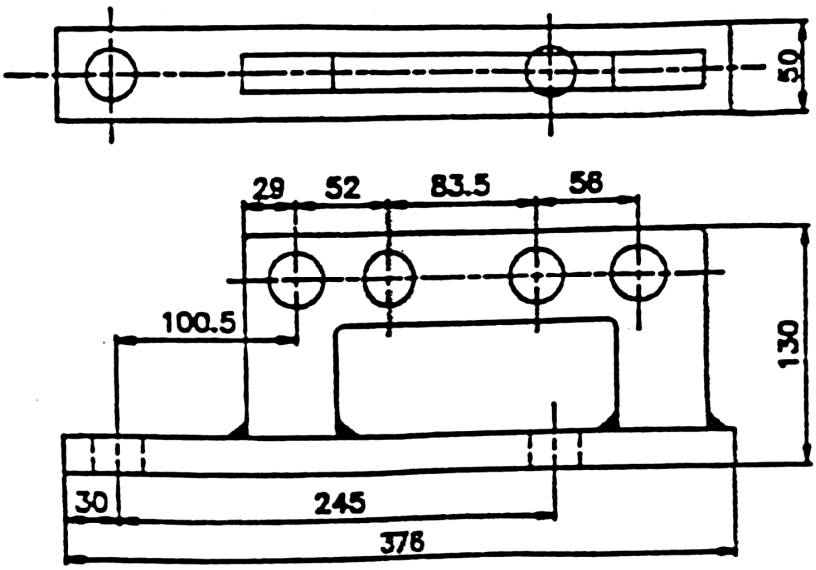


Fig 4.16 SWITCH EXTENSION BRACKET

Connect drive rod (Fig. 4.16) 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.

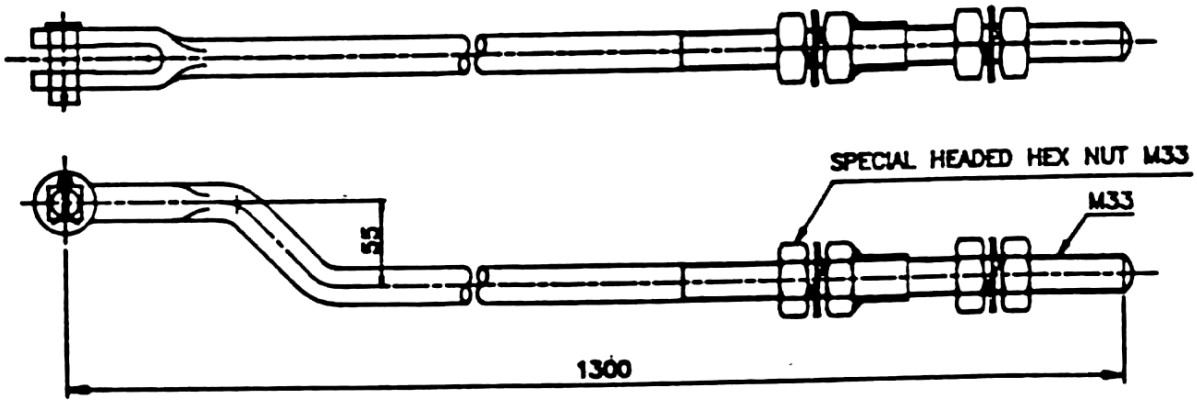


Fig 4.16 DRIVE ROD

MOUNTING OF LOCK RODS: (REFER FIG. 4.17)

(i) 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.

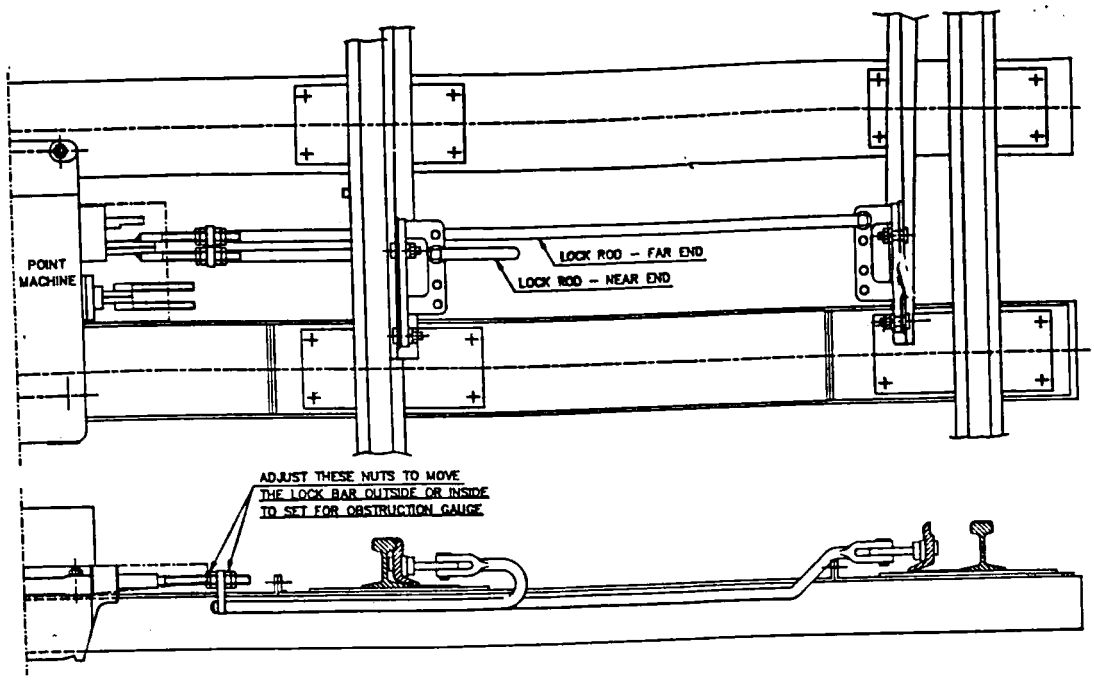


Fig 4.17 SECTION SHOWING LOCK ROD CONNECTIONS

(ii) Insert the lock rod (Fig.4.18) (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.

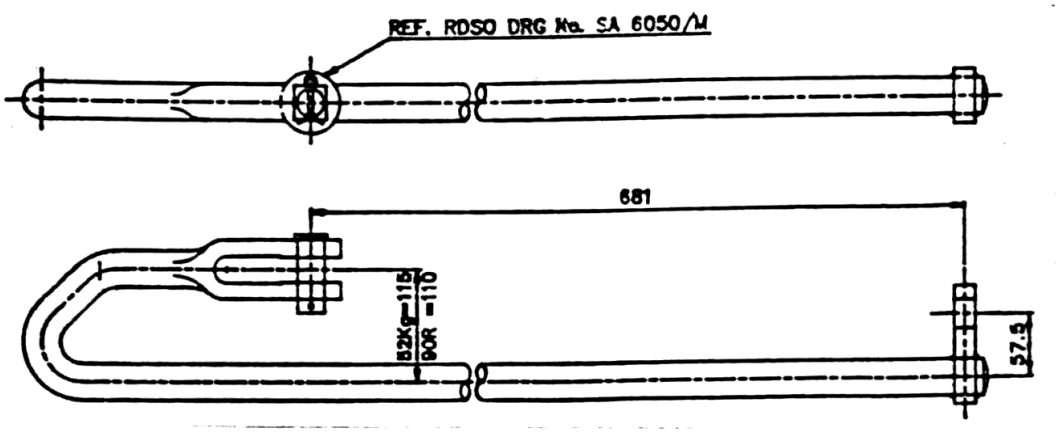


Fig 4.18 LOCK ROD NEAR END

(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.4.19) (DRG. No. RDSO/S 3271-72) also in the same way and adjust the nuts in the lock bar to hold lock rods in

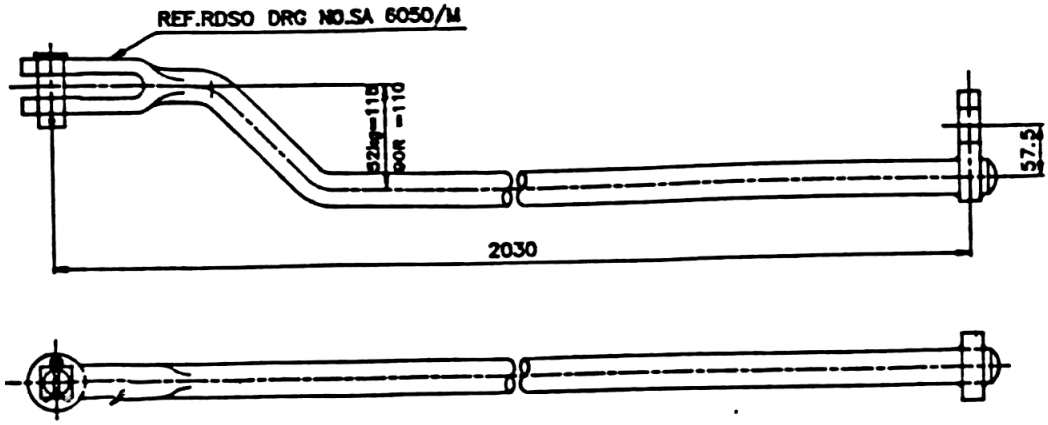


Fig 4.19 LOCK ROD FAR END

Operate the point machine to the other side (RH) by hand cranking. If the switch rail is housed with stock rail but locking paw 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.

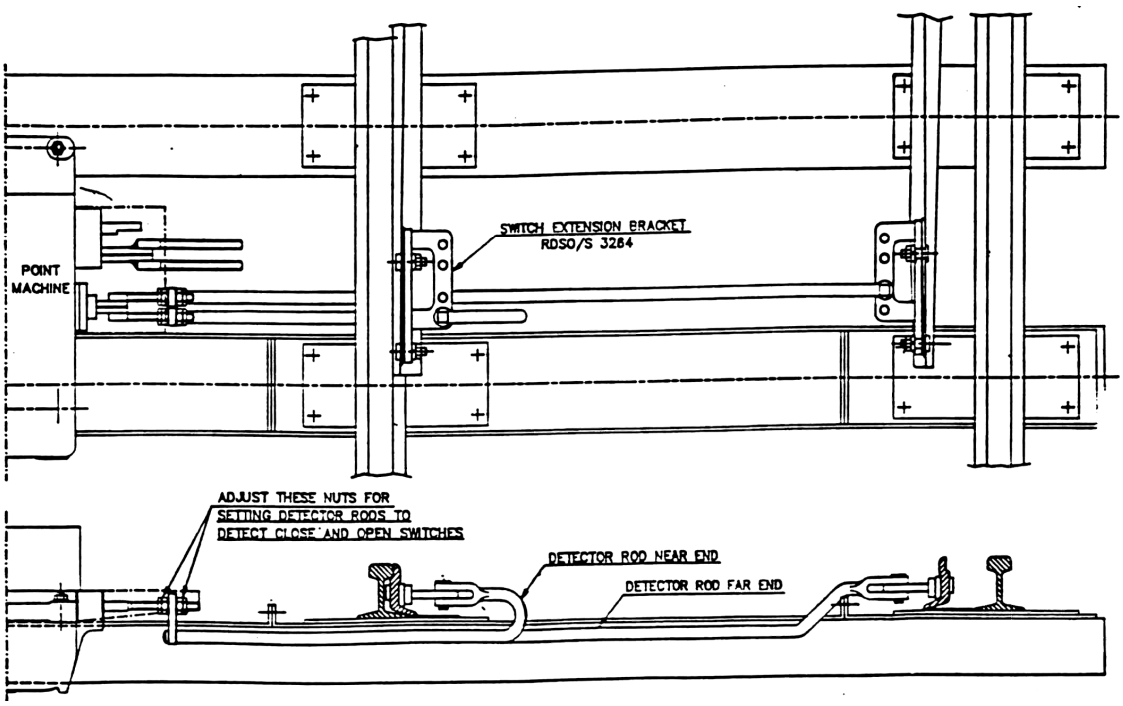


Fig No: 4.20 SECTION SHOWING DETECTOR ROD CONNECTIONS

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.

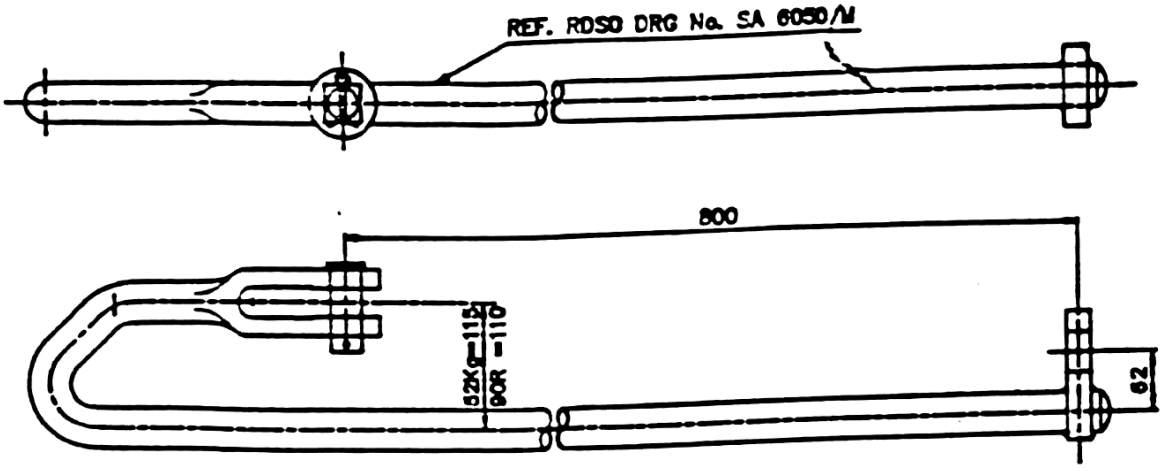


Fig 4.21 DETECTOR ROD NEAR END

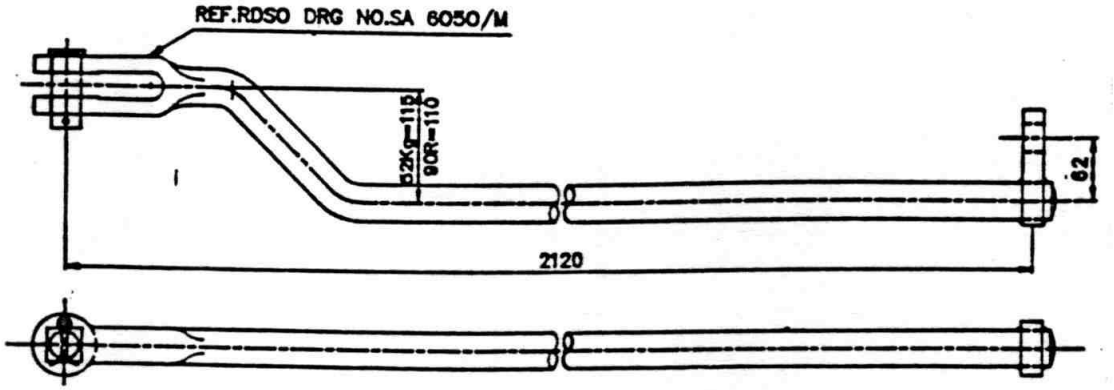


Fig 4.22 DETECTOR ROD FAR END

Crank to both positions and check that the detection rollers fall freely into the notches in the defection 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.

(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.

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.

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 Rollers.

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.

4.5.5 OBSTRUCTION TEST ON POINT

With 3.25 mm obstruction gauge placed in between the switch and stock rail at a distance of 150 mm from the toe of the switch rail, the machine should be operated by hand crank to close the point. It shall be ensured that lock does not enter and detection contacts do not make.

For 3.25 mm obstruction, if lock is not obstructed, loosen the nuts of the lock rod connection and adjust the lock rods individually for 3.25 mm obstruction by hand crank for both normal and reverse directions.

However with 1.6 mm obstruction gauge placed in between the switch and stock rail at a distance of 150 mm from the toe of the switch rail it should not create any obstruction and the machine has to complete the stroke smoothly and give detections.

After 2 or 3 operation of the point by hand crank, As per SEM-II: insert the 5 mm gauge for obstruction and ensure clutch tripping and breaking of detection contacts in both settings by power operation.

4.5.6 FINAL TESTING

Operate the machine a couple of times and check that the detection contacts are made correctly.

Test with 5.00 mm gauge piece in power operation between the tongue and the stock rail at a distance of not more than 150 mm to check the breaking of detection contacts. Test with 3.25 mm gauge using crank handle. Clean up the place and make a final test.

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.

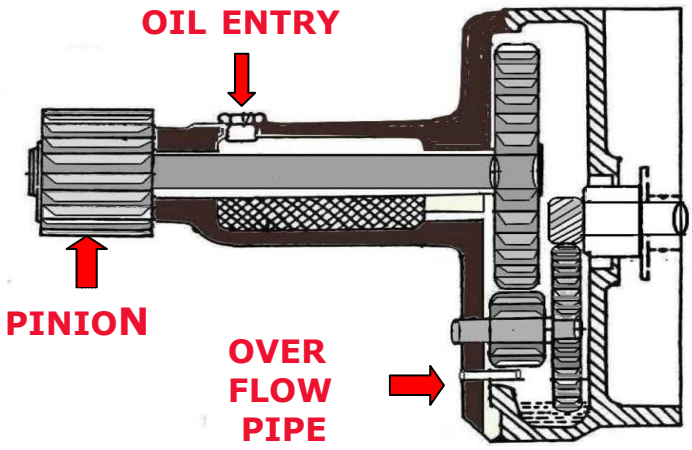
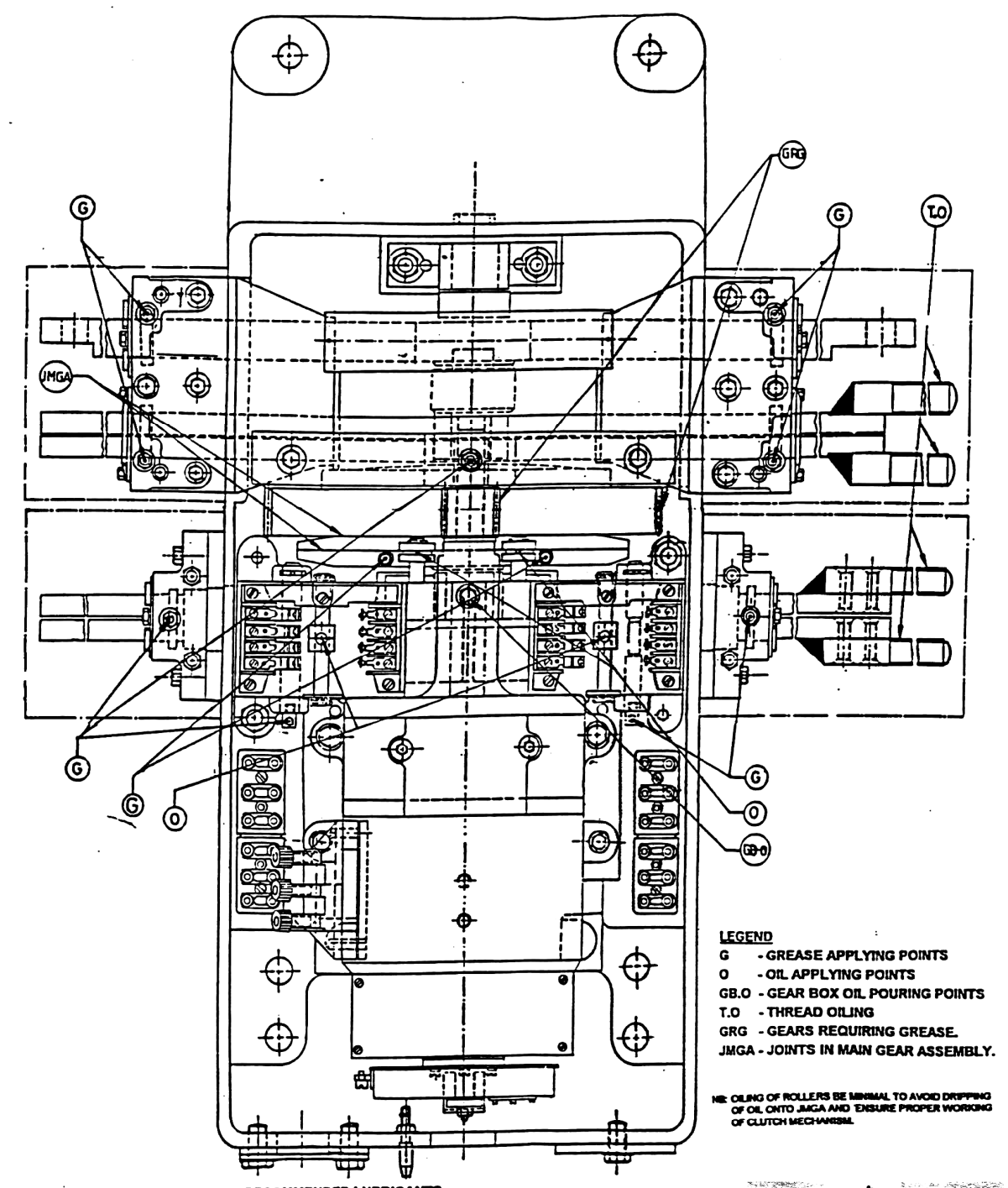


Fig No: 4.23 OILING OF GEAR BOX



RECOMMENDED LUBRICANTS

PARTS		HPCL	IOCL	BPCL
GEAR BOX	OIL	PARTHAN EP150	SERVO MESH EP150	BHARATH AMOCAM OIL 150
SLIDE	GREASE	HP MULTIPURPOSE GREASE 2(MP2)	SERVO GREASE MP	BHARATH UNIVEX A
	OIL	ENKLO HLP 46	10C SERVO SYSTEM HLP 46	BHARATH HYDROL HLP 46
THREADS	OIL	ENKLO HLP 46	10C SERVO SYSTEM HLP 46	BHARATH HYDROL HLP 46
ROLLERS	OIL	ENKLO HLP 46	10C SERVO SYSTEM HLP 46	BHARATH HYDROL HLP 46
TA	GREASE	WHEEL BEARING GREASE (MHP) - CASTROL MAKE		

Fig No: 4.24 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-'D' 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.

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 in tact 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 with out 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) Cheek for excessive opening if so, take remedial measures. (Engineering.)

(i) Ensure proper packing of sleepers.

(j) Cheek 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 in side 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 in side the Machine

(d) DON'T THROUGH ANY ELECTRICAL CONTACTS under any circumstances.

(e) DON'T DISTURB the presetting of the DETECTION CONTACTS at site.

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 5.1 FRICTION CLUTCH WITH MAIN GEAR

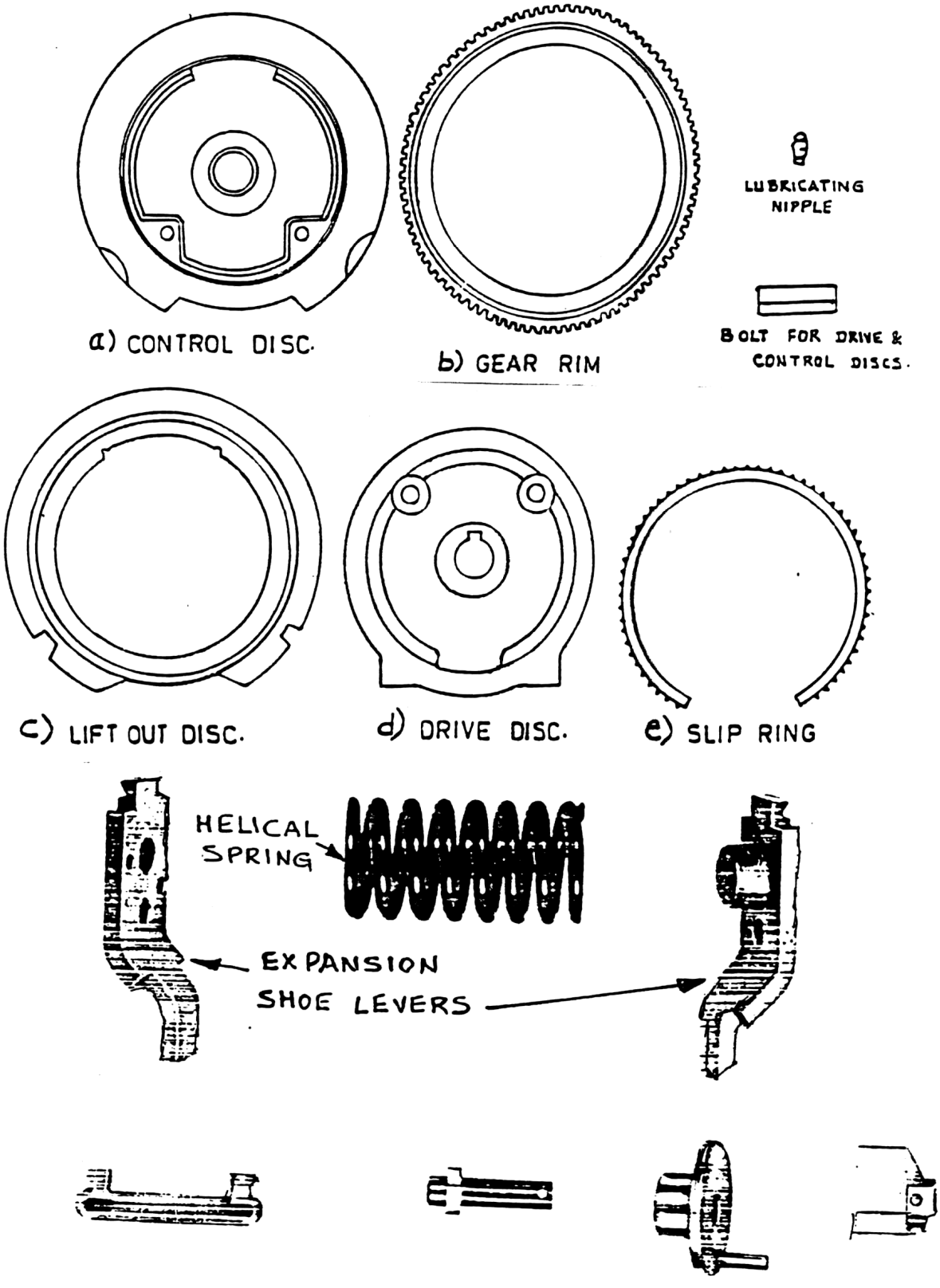


Fig 5.2(a to e) FRICTION CLUTCH ASSEMBLY

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 releasing disc with it because the expansion shoe levers are engaged with the inner cam faces of the releasing disc. As the controlling disc & drive disc are at this moment stationary the inclined face of releasing disc will lift the lock detection roller and make it out of the control disc locking notch.

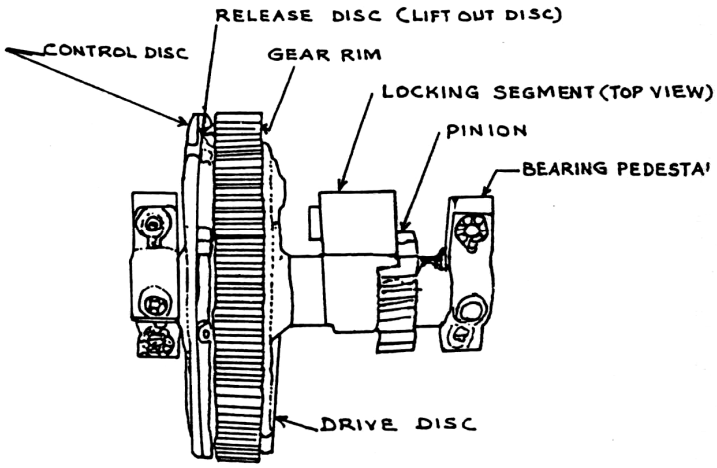


Fig 5.3 TRANSMISSION ASSEMBLY WITH FRICTION CLUTCH

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 rectilinear 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.

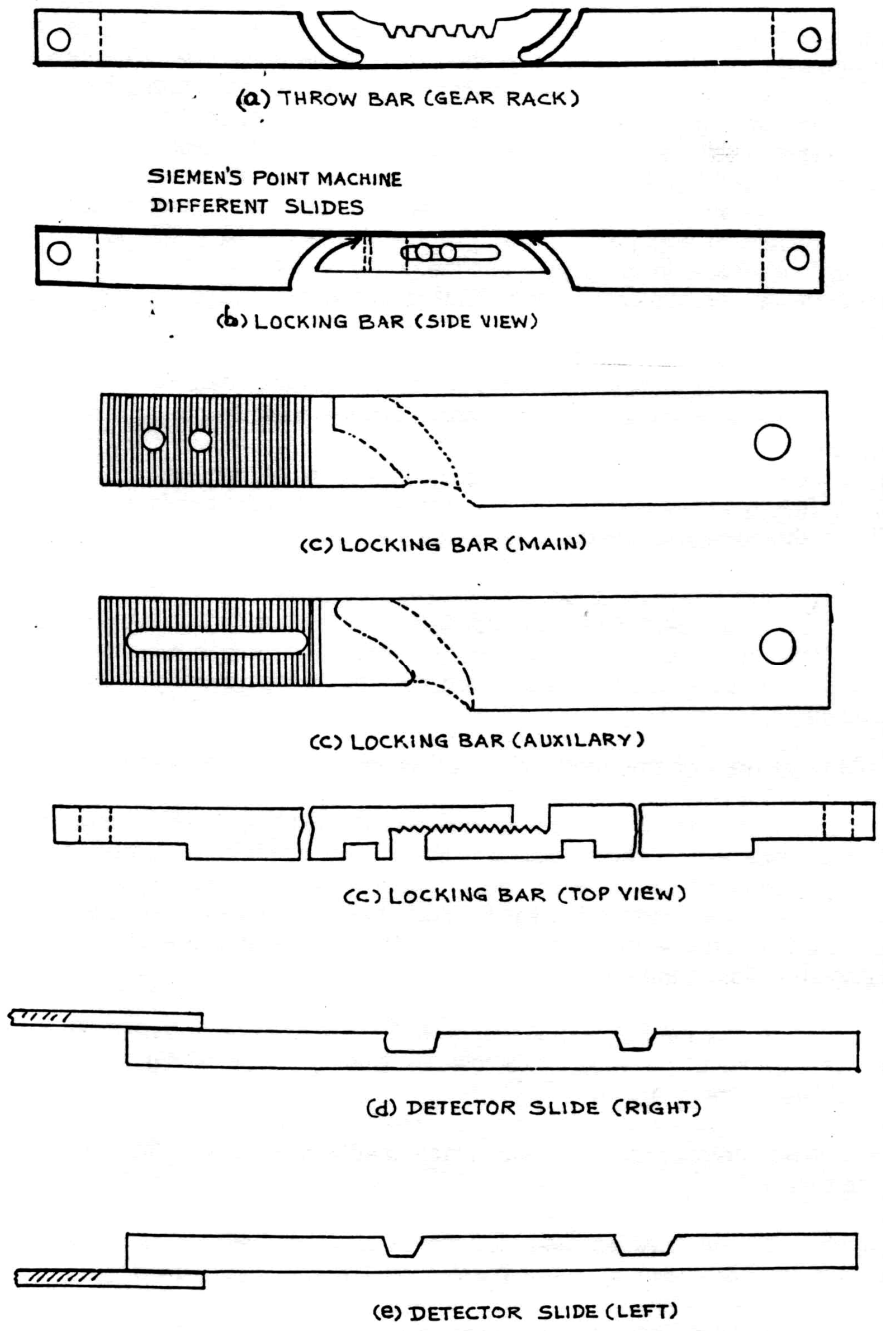


Fig 5.4(a to e) POINT THROW, LOCK & DECTECTION SLIDES

(d) Installation:

For mechanical power transmission from the machine to the points and detection of these point tongues, rodding 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 465 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.

(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) Connect the throw rod between the gear rack and the lug of the driving rod

(e) Hand crank the machine to & fro and adjust the switch rails for proper setting with stock rails on both sides.

(f) Check the spring on the points in both positions it should be equal on either side.

(g) Connect the detector slides and adjust them such that the roller falls inside the groove only when point is fully set and the control disc completes its rotation (i.e. point is fully locked). Test that the groove does not receive the roller when a 5mm obstruction is placed at 150 mm from the toe of the switch. Tighten the nuts and check nuts after adjustment.

Connect the split lock stretcher bars to the lock rod and adjust them through their serrated faces & bolt screws such that the locking segment can enter the notches only when the point is correctly set. Ensure that the notches are not available to receive the locking segment when 5 mm obstruction is placed at 150 mm from the toe of the switch.

Operate the machine several times to see that the locking segment goes smoothly inside the circular locking notches of the stretcher bars and the gear rack.

Operate the machine several times by hand cranking and ensure that the detection contacts make only at the end of locking operation. The control contacts make with the beginning of the unlocking stoke.

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.

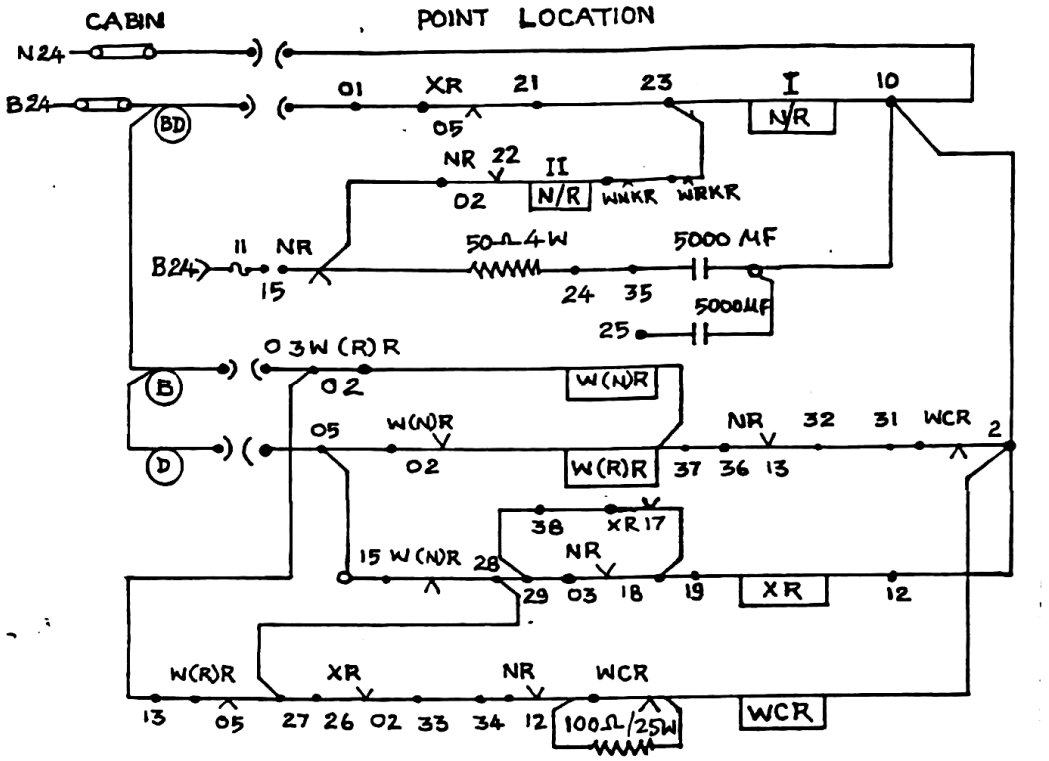


Fig No: 5.5 (a) TYPICAL SIEMENS CONTACTOR UNIT CIRCUIT

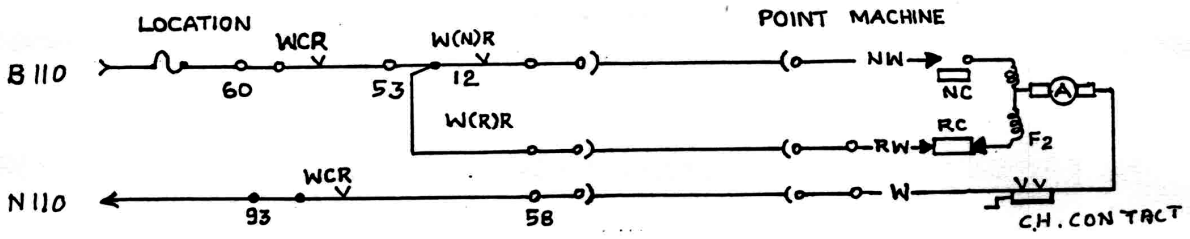


Fig No: 5.5 (b) SIEMENS POINT MACHINE OPERATION CIRCUIT

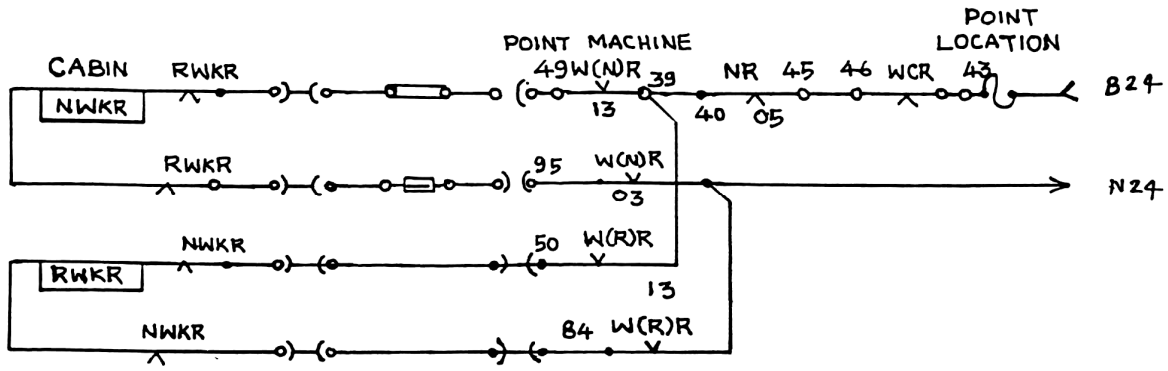


Fig No: 5.5 (C) SIEMENS POINT MACHINE DETECTION CIRCUIT

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.

(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.

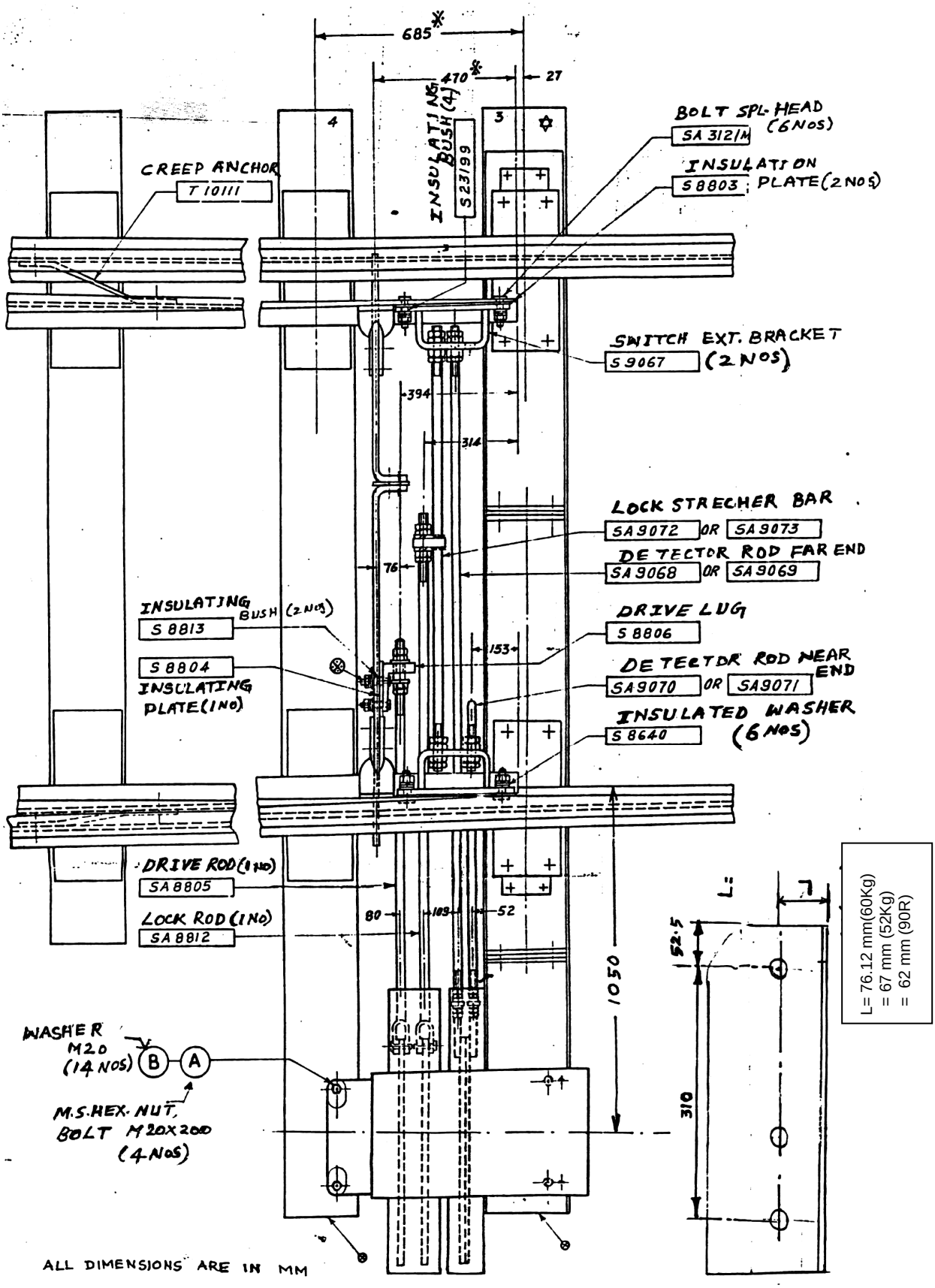


Fig 5.6 LAYOUT FACING POINT (1 IN 12) TURNOUT BG ON PSC SLEEPERS FITTED WITH SIEMENS POINT MACHINE. DRGNO RDSO 3291-92

CHAPTER 6: IRS CLAMP ELECTRIC POINT MACHINE
(CLAMP LOCK AND 22O 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: 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 than 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.

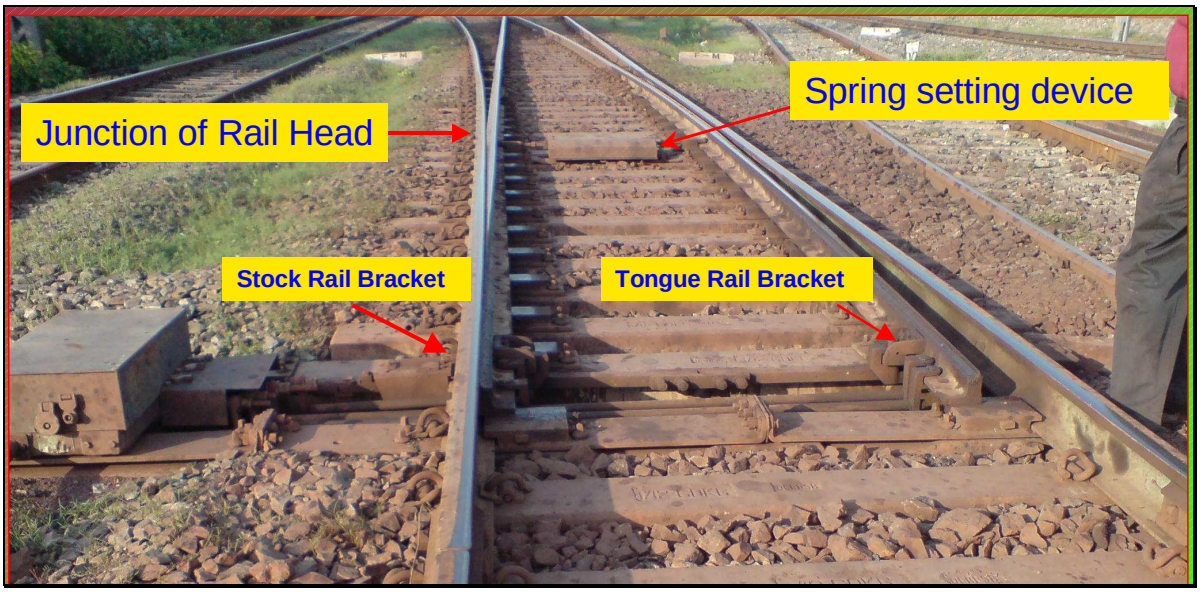


Fig: 6.2 IRS-CLAMP TYPE POINT MACHINE LAYOUT WITH TWS

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:-

(a) First 60 mm throw for Point machine

(i) Unlocking of Closed switch and

(ii) Open switch moves 60 mm towards its stock rail.

(b) Next 100 mm throw, **both switches moves**

(i) Closed switch opens by 100 mm and

(ii) Open switch completes (60 mm+100 mm) =160 mm and it is now closed.

(c) Last 60 mm throw

(i) 100 mm Opened switch further movers to 60 mm = (100 mm+60 mm)=160 mm.

(ii) Locking of Closed switch by 60 mm and closing switch locked.

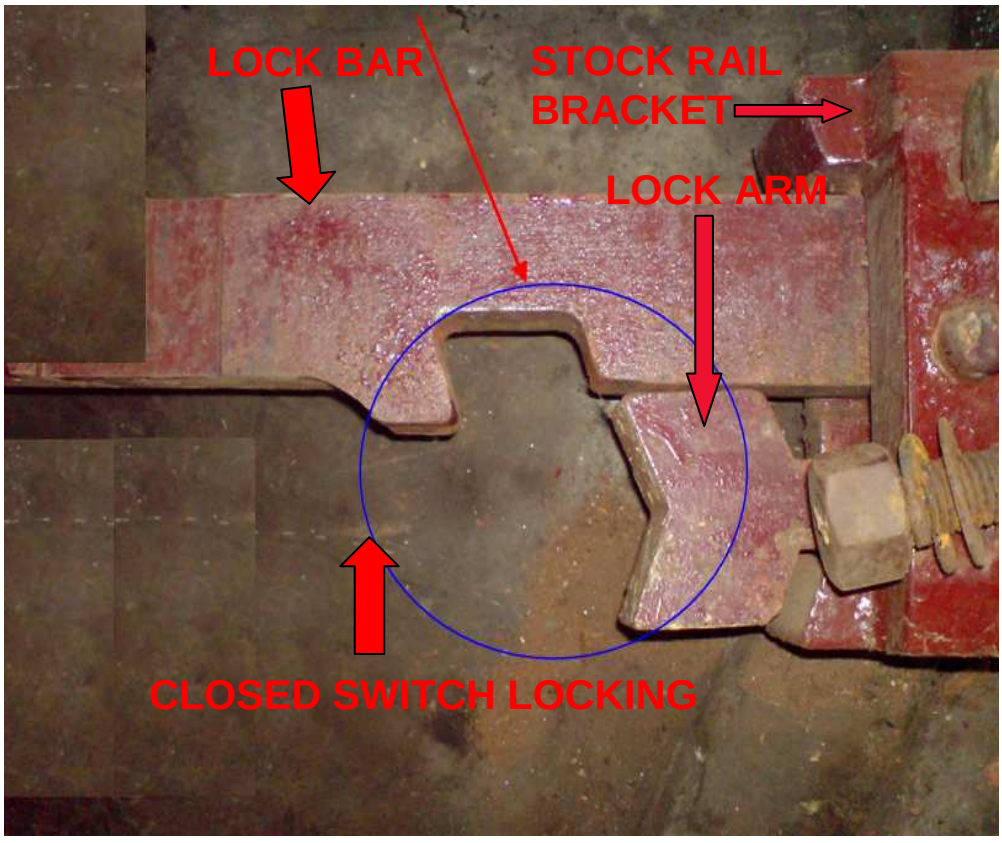


Fig: 6.3 CLOSED SWITCH

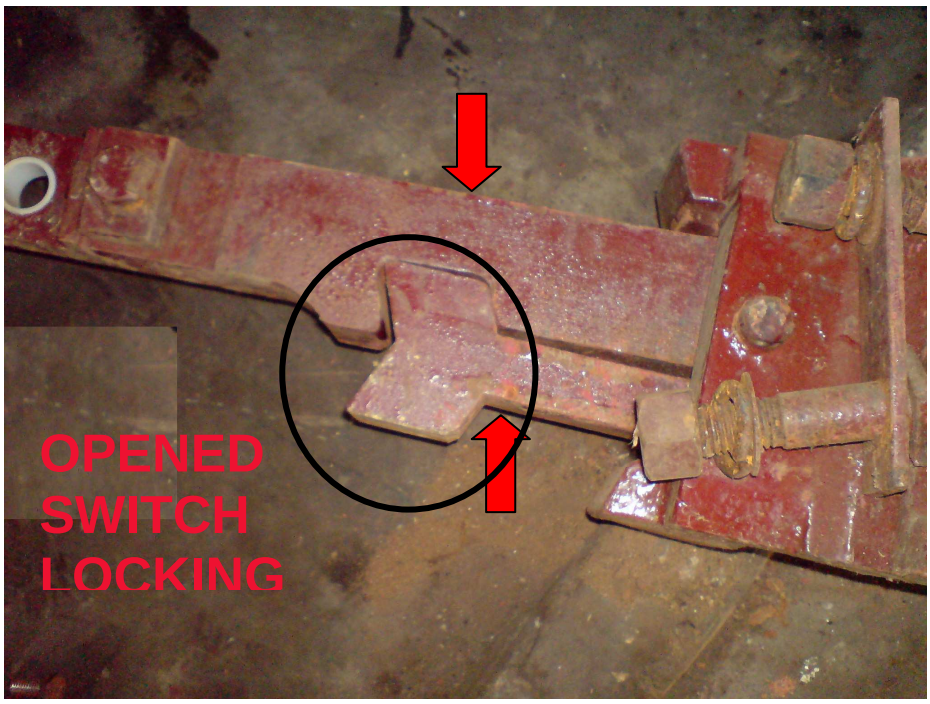


Fig: 6.4 OPENED SWITCH

Fig: 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 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 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 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 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

(k) 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) Pour lubricating oil, SAE-30 on the periphery of control and lift out disk and felt pad provided over the driver rod and the lock slides.

(o) Check the overload current.

6.15 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.

ANNEXURE - I

IRS ELECTRIC SIGNAL MACHINE
(TO Drg.No.SA 23851 and Drg.No.SA 23852)

1 Introduction

IRS Signal Machine to Drawing No.SA 23851 is suitable for working 3-aspect upper quadrant signals. The Electric Signal Machine to Drawing No:SA 23852 is suitable for working 2-aspect lower quadrant signals.

Fig: 7.1 SIGNAL MACHINE

(a) Motor

(b) Gears

(c) Friction Clutch

(d) Hold-off device

(e) Circuit Controllers

(f) Buffer Spring

(g) Normal locking arrangement.

1.1 Motor:

The motor is a DC series wound with 2 poles/ 4poles and high starting torque. Sealed oil less ball bearings are provided on the armature shaft. The commutator and brush assembly are easily accessible for inspection and replacement. Signal machine motor is rated to work at 10V DC and consumes about 1.6 Amps current in case of 2 pole signal motor and 1amp current in case of 4 pole signal motor. The maximum time of operation for 0-45 deg. is 10 seconds and 0-90 deg. is 20 seconds.

1.2 Gears:

Fig.7.1 The train of gears is housed in a compartment at the back of the main case. Its ratio is such that 30 revolutions of the motor take the signal arm to 90degrees.The Gear System consists of a Gear train which has three sets of reduction gears, to reduce the speed of motor to that of semaphore arm. The signal shaft is attached to the gear wheel A, pinion A and gear B, As also pinion ‘B’ and gear ‘C’ are fitted to the respective shafts by keys mounted on the bearings on the frame. Pinion ‘C ‘is firmly fitted to the motor shaft by a key.

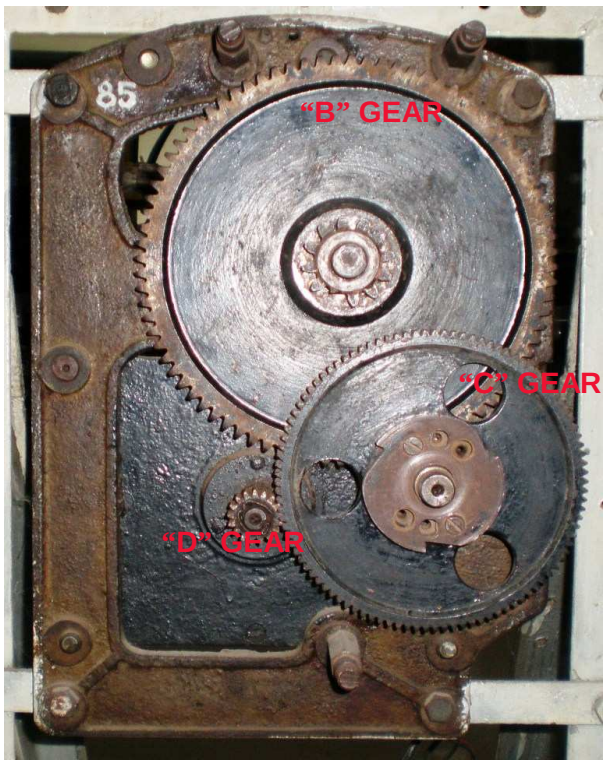


Fig 7.2 GEAR TRAIN FOR UQ & LQ WORKING

1.3 Friction Clutch:

Fig. 7.2 b,c & d The motor shaft "A" gear is coupled to the clutch gear through a friction clutch. The friction clutch consists of two ferodo lined discs, one on either side of the clutch gear loaded by a spiral spring. The function of the friction clutch is to absorb the shock to the mechanism when the semaphore arm is braked at "OFF" position and to eliminate damage to the hold off latch. It also enables the arm to be brought to 'ON' position from 'OFF' position when the arm is held in 'OFF' position due to the failure of hold off device. Proper meshing of clutch gear teeth with the hold off latch piece is achieved by the inclination in the shaping of the clutch gear teeth.

The frictional grip between the clutch gear and motor shaft can be adjusted by turning the castle nut acting on the compression spring.

A spring is fitted to the latch piece armature bracket, so that it can move up and down when approached by clutch gear from the inclined side without interfering with the position of the contacts. This spring also helps for adjusting the gap between clutch gear and latch piece.

1.4 Hold-off Device:

Fig. 7.4 It is mounted in front of the motor shaft. It consists of:-

(a) An electromagnet with an armature and two contacts. (K and H contacts)

(b) Latch arm with latch piece.

(c) Clutch gear.

The electromagnet consists of two sets of windings - pickup coil (22.5 Ohms of 2 coils i.e. Total 45 Ohms resistance) and Hold-off coil (290 Ohms of 2 coils i.e. total 580 Ohms resistance).

Initially the pick up coil with H contact in series is energised and 40 deg. to 50 deg or 85 deg to 90 deg. position of an arm for UQ and at 40 deg to 50 deg for LQ. When the armature is attracted the 'K' contact and H contact is opened. Opening of 'K' contact cuts off the supply to the motor and H contact brings the pick up coil and hold-off coil which is connected across 'H' contact in series. The high resistance of P.U. coil in series with hold-off coil enables a low consumption of current while the arm is held in 'OFF' position.

When the electromagnet is energised, the opening of 'K' contact cuts off the supply to motor and the rotation of the motor shaft gradually ceases. The latch arm detent face now in contact with clutch gear of the clutch vibrates and further reduces the motor speed. Just before the motor armature starts to reverse its direction of rotation due to the weight of the semaphore arm, the latch detent locks with clutch gear and holds the arm. The resulting shock is absorbed by the friction clutch.

1.5 Circuit Controllers:

The contact rollers are mounted on the shaft, which is coupled to the semaphore arm, through a pinion. The circuit controller consists of a frame supporting contact fingers and a shaft carrying a bracket drum on which contact segments are mounted. Each of the contact rollers can be adjusted to suit its function.

The arrangement and span of contacts for UQ machine are as below: -

No.	Function	Working position	Span of contacts	No. Of contacts
1.	Motor control	0 - 45 deg.	48 deg.	1
2.	-Do-	0 - 90 deg.	93 deg.	1
3.	Hold off	40 - 50 deg.	10 deg.	1
4.	-Do-	85 - 95 deg.	10 deg.	1
5.	Spare	-	55 deg.	2
6.	Snubbing contact	82 - 90 deg. 37 – 50 deg.	48 deg.	1

The arrangement and span of contacts for LQ machine are as below:

No.	Function	Working position	Span of contacts	No. of Contacts
1.	Motor control	45 deg.	55 deg.	1
2.	Hold off	40 - 50 deg.	10 deg.	1
3.	Spare	-	93 deg. 55 deg.	1 1
4.	Snubbing contact	37 – 50 deg.	-	1

1.6 Buffer Springs:

Two buffer spring assemblies have been provided on the right hand side of the body for absorbing the shock from the sector gear when the signal arm motion is arrested. This also enables the adjustment of signal arm at ON position.

Snubbing arrangement:

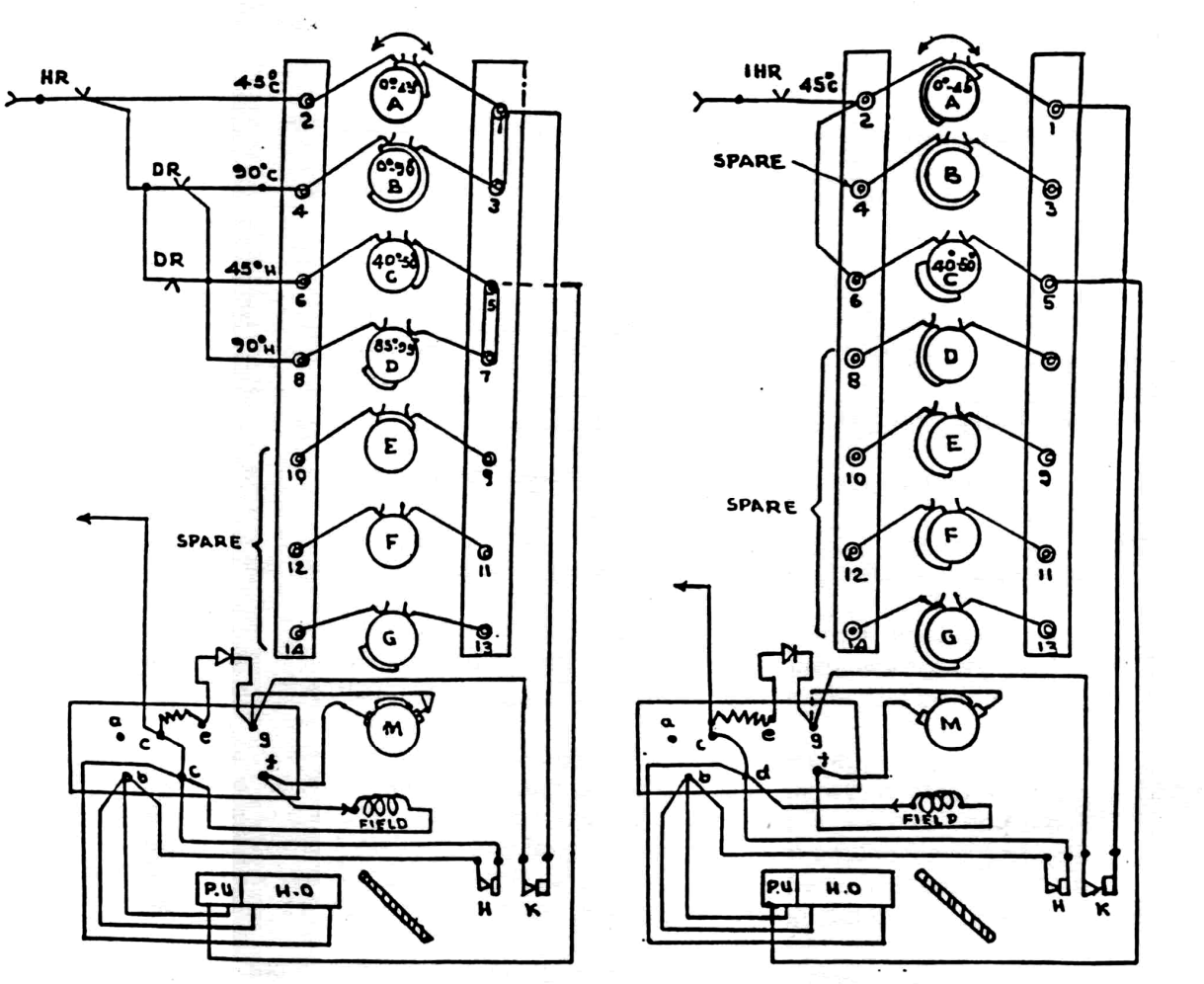
The signal arm returns to “ON” position by gravity causing the motor to rotate in reverse direction. During the movement, the motor acts as a generator and its terminals are short circuited through a snubbing resistance (2 Ohms) and a diode. This effectively checks the motor of the signal arm and thus it prevents the shock to the driving mechanism when the arm reaches to “Stop” position. A half wave rectifier is used to prevent short of the motor supply during the working from “ON” to “OFF” position.

1.7 Normal Locking Arrangement:

This arrangement is provided to prevent the lowering of signal by outside interference.

2 Working of the Machine

The circuit is as indicated in U.Q. Working: As shown in Fig. 7.3(a) and L.Q. Working: As shown in Fig. 73(b) Pull - pull operation of Signal Machine as shown in Fig. 7.4 a and Push - pull operation of Signal Machine as shown in Fig.7.4 b



(a) WIRING DIAGRAM UQ (Drg No.S23873) (b) WIRING DIAGRAM LQ (Drg No.S23874)

Fig: 7.3

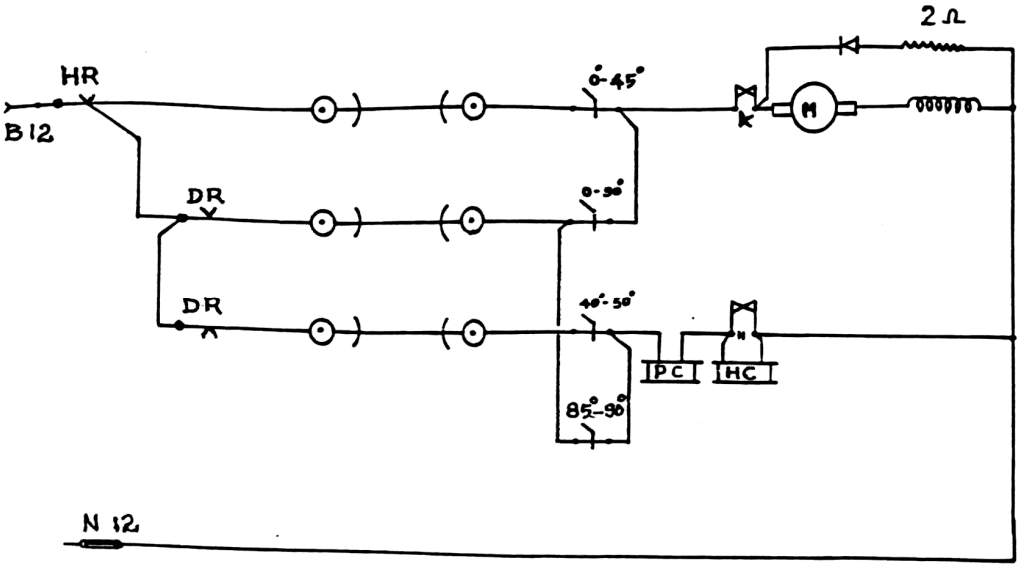


Fig: 7.4 a CIRCUIT DIAGRAM FOR PULL-PULL OPERATION

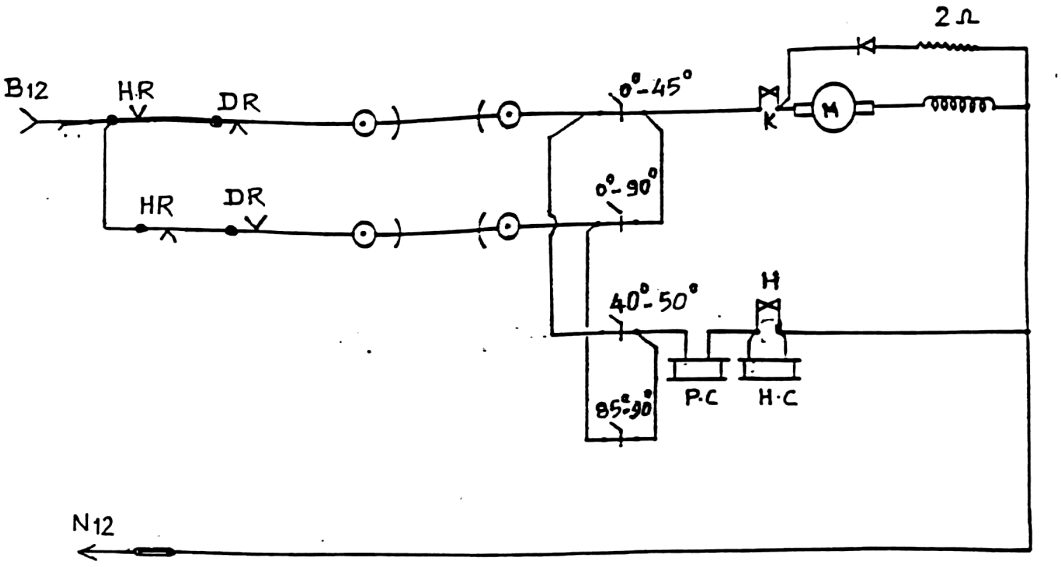


Fig: 7.4 b CIRCUIT DIAGRAM FOR PUSH-PULL OPERATION

3 Conversion of Signal Machine from U.Q. to L.Q.

(a) Change the polarity either in Field or in Armature.

(b) Change the position of clutch gear and latch piece by 180 deg.

(c) Change the position of plates and lock pawl of normal locking arrangement by 180 deg. to suit L.Q.

(d) Turn sector gear by 90 deg. From its U.Q. position.

(e) Adjust circuit controller bands for L.Q. working.

(f) Wiring to be corrected to suit L.Q.

(g) Replace U.Q. semaphore spectacle arm to L.Q.

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.

Choose the correct answers

1. The maximum stroke of IRS CLAMP TYPE Point machine is _____ ( )

a) 143mm b) 220mm c) 160mm d) none

2. The total movement of drive disc is _____ ( )

a) 220 degrees b)270 Degrees c) 180 degrees d) 360 degrees

3. 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

4. When point set and locked in normal _____contact make ( )

a) ND&NC b) NC&RC c) RD&RC d) NONE

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