

BOBRN WAGONS

(BOGIE OPEN BOTTOM RAPID DISCHARGE HOPPER WAGONS)

HISTORY:

Bogie Open Bottom Rapid Discharge Hopper Wagon type BOBR wagons are developed for movement of bulk quantities of coal from collieries to nearest unloading points such as thermal power stations and ports. These wagons are built exclusively for movement of coal with unique feature of unloading from bottom. As a result the damages normally sustained to the wagons by 'Tipplers' are eliminated. As these wagons are meant for bottom discharge, they require 'hopper'(pits) for unloading. The number of wagons unloaded at a time depends on length of hopper. These wagons are fitted with an automatic door operating system which causes opening and closing of the doors with the help of compressed air supplied by the locomotive through the door operating pipe which runs along the entire rake. The air from door operating pipe is released to actuate the system when pick up shoes, provided on the side of the wagons come into contact with the line side rail provided at the unloading terminals. During loading and unloading the train consisting of these wagons remains in motion at crawling speed.



BOBR WAGON

BOBRN wagon design was developed by RDSO sometimes in 1994. Prior to this, bottom discharge coal hopper MGR type wagons were in service to NTPC and other super thermal power projects with imported 3 door Miner DOM from USA. Keeping in mind growing demand of bottom discharge coal hopper wagons as also to have indigenous door operating mechanism, RDSO developed its own design for single link door operating mechanism.



BOBRN WAGON

After receiving operational complaints with single link mechanism such as eye bolt bent, door clip ('U' bracket) of door spreader bent/hole enlarged and adjustable bush casting breakages which results in door defects in quite a number of wagons, RDSO decided to modify the design with double link mechanism.

DEMERITS OF SINGLE LINK OPERATING SYSTEM:

- Unbalance forces on operating shaft causing twisting and cracking of the same.
- Movement of doors during opening and closing were not symmetrical as it was actuated by a single eye bolt causing deformation of door panels.
- Elaborate operations for door adjustment required for getting proper operation of doors.

MERITS OF DOUBLE LINK OPERATING SYSTEM:

- More or less balanced forces on operating shaft.

- Movement of doors during opening and closing are symmetrical as it is actuated by two eyebolts & minimum adjustments are required for getting proper operation of doors.
- Evenly distribution of forces on various components of door operating mechanism.

DOOR OPERATING MECHANISM FOR

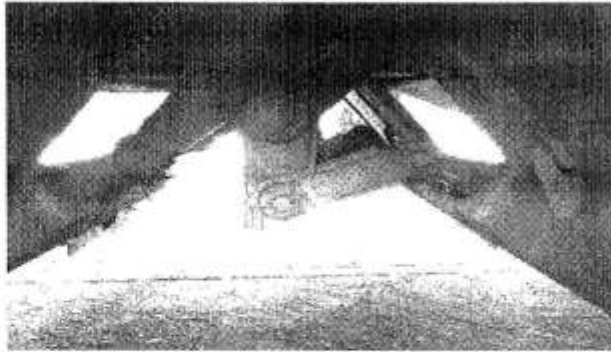
HOPPER WAGON TYPE 'BOBRN'

A BRIEF INTRODUCTION:

The DOM cylinder activates the door operating mechanism of the wagon. The cylinder has two ports, one for opening the doors, while the other acts as exhaust and vice versa.

DOOR OPENING:

As the piston inside the cylinder moves forward on account of air pressure, the residue air in front of the piston which tends to prevent the piston movement by imparting back pressure of exhausted simultaneously from the other port (now acting as exhaust) of the cylinder. When the piston rod is extended, it pushes the main operating lever which is connected to a series of connecting rods to the other end of the wagon through the clevis, turn buckle, eyebolt assembly which are located inside the wagon center sill. Thus the main operating lever pulls the connecting rod towards the DOM cylinder end of the wagon. This axial movement of the connecting rod causes the angular rotation of the adjustable lever. This in turn through the adjusting bolt and lug assembly rotates the operating shaft. This causes the door operating center levers and end levers to rotate about the shaft axis. This in turn pulls the doors connecting links to open the doors. The door connecting links are attached to the door through the eyebolt assembly.



DOOR CONNECTING LINKS IN OPEN CONDITION

DOOR CLOSING:

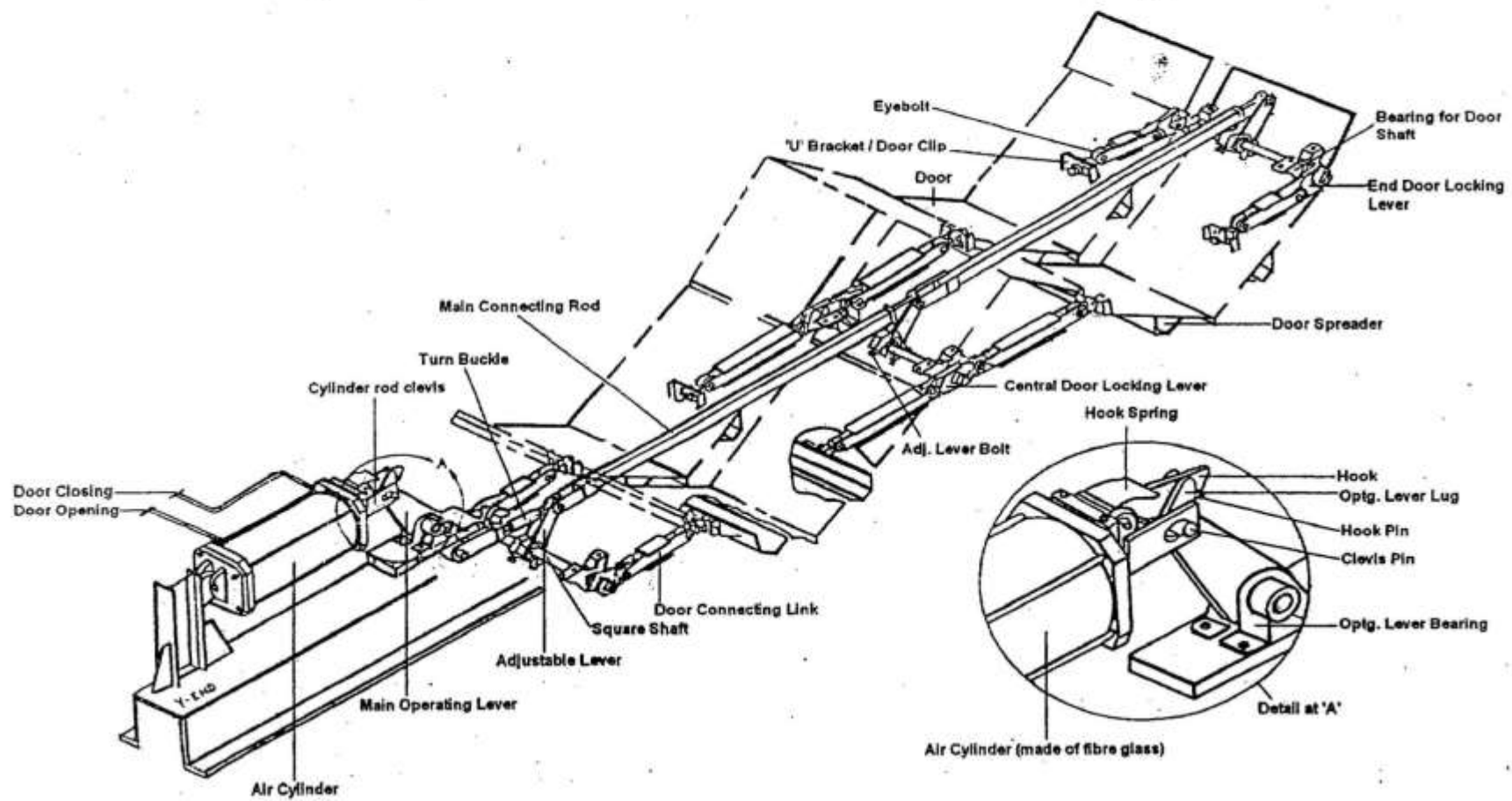
When the air is made to flow to the door closing side of the cylinder, the piston moves in the reverse direction. Air causing back pressure on the piston is now exhausted through the other port (now acting as exhaust port). Thus the retracting piston rod pushes the connecting rod axially towards the cylinder. This motion is transmitted through the adjustable levers to the square shaped door operating shaft. This in turn rotates the door operating center levers and end levers in a direction opposite that undergone during the door opening operation. The door connecting links are pulled to close the doors of the wagon.



DOOR CONNECTING LINKS IN CLOSED CONDITION

LOCKING ARRANGEMENT:

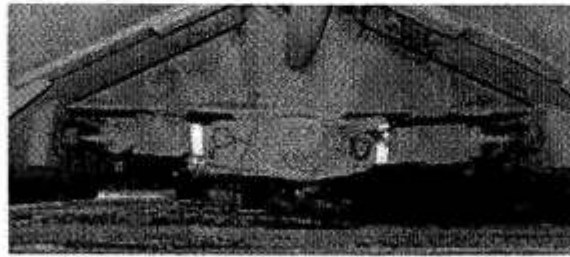
The principal lock is the primary lock, which is done with all the doors closed and with the piston rod completely retracted. In this position, there should be no gap between the connecting link and the end levers. For the



DOOR OPERATING MECHANISM

Fig-1

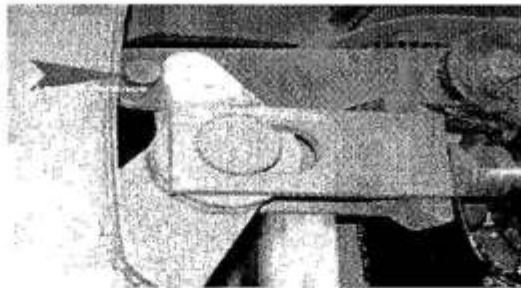
central locking lever, there should be no gap at least on one side and a maximum of 5mm on the other side. Any deviation will result in non-attainment of the over center position and failure of the primary lock. This gap between the lever and the link can be adjusted with the help of the turnbuckle for some levers and with the help of the adjusting levers for the remaining doors.



PRIMARY LOCK

SECONDARY LOCK:

A secondary locking arrangement is also provided at the top of the air cylinder.



SECONDARY LOCK

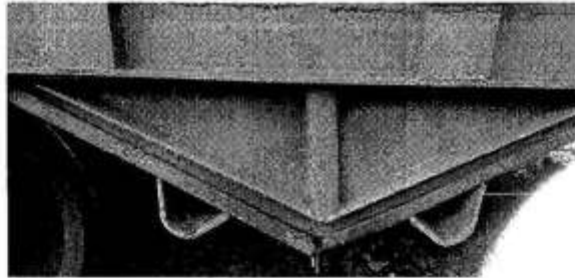
This arrangement serves the following purpose.

- a. It prevents any forward movement of the piston rod due to jerk developed during wagon movement.
- b. It ensures the correct position of the main operating lever and therefore brings the door links over center.
- c. It ensures sufficient free movement of the piston rod before activating the door operating mechanism. This is achieved through the elliptical slot in the piston rod clevis.

- d. It also ensures the detection of any residual air pressure, which may cause the forward movement of the piston rod resulting in door operating. This is achieved by keeping a gap of 2mm with air⁴ released and a gap of 6 to 10mm with air applied between the operating lever lock lug and the hook pin of the secondary lock hook.

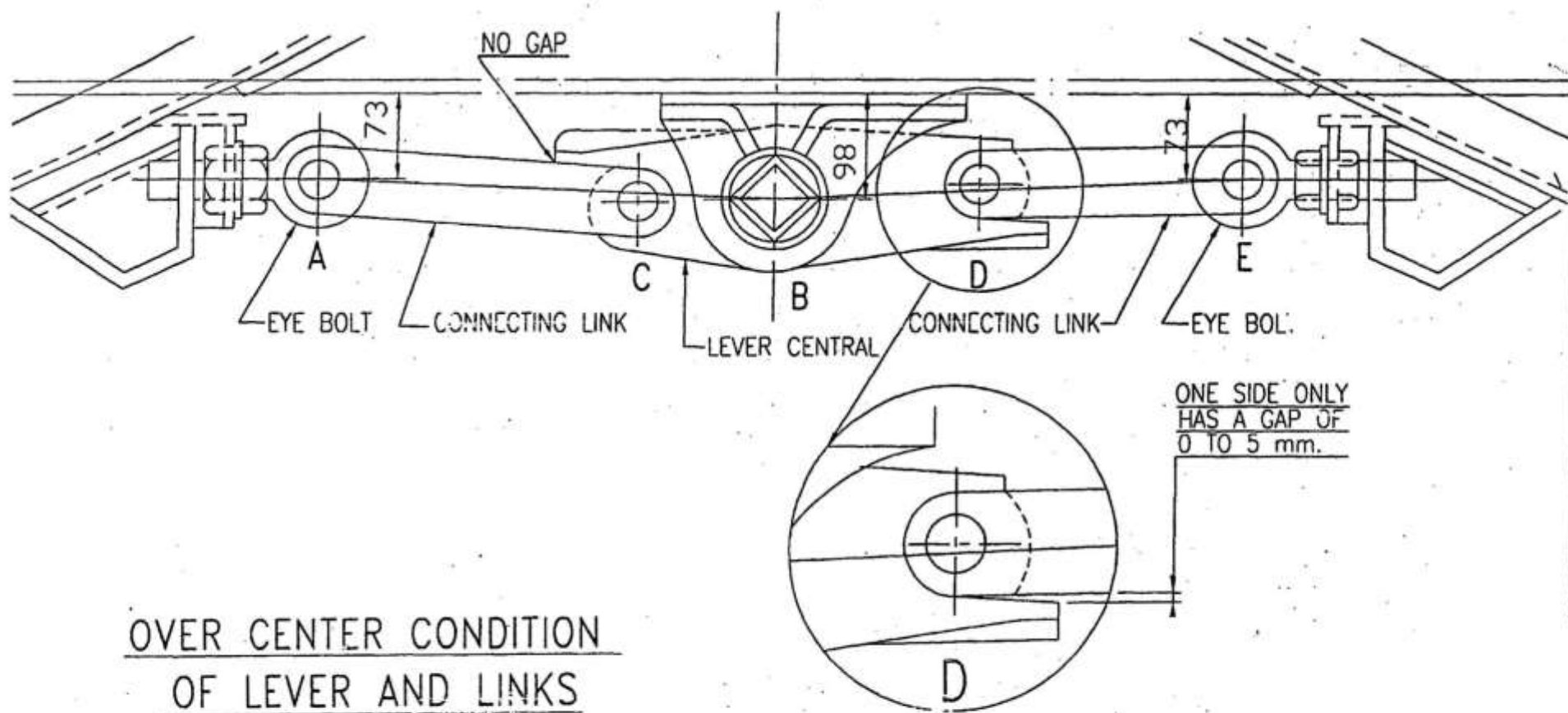
The Door Operating Mechanism has three major areas that require regular inspection to determine if adjustment or repair is required. The three areas are:

1. The door operating levers which serves to open and close the doors and provide the primary locking means to hold the door closed.
2. The secondary lock which is located at the DOM air cylinder which serves as a back up locking system.
3. The doors which provide a means to retain the commodity in the wagon and prevent any leakage.



CHECK FOR OVER CENTRE CONDITION;

When fully locked and over center, door connecting links contact locking levers at top and bottom. If there is clearance between operating lever and door connecting link, check over center condition by placing a straight edge between the center line of the adjustable eye bolt connecting link pin (A) and the operating shaft (B), and between the center line of adjustable eye bolt connecting link pin (E) and the operating shaft (B). The center of the locking lever pin (C) should be below the center line between points (A) and (B) at least 3mm. The center of the locking lever pin(D) should be above the center line between points (E) and (B) at least 3mm. If center line falls less than 3mm below or above these points, readjustment is necessary.

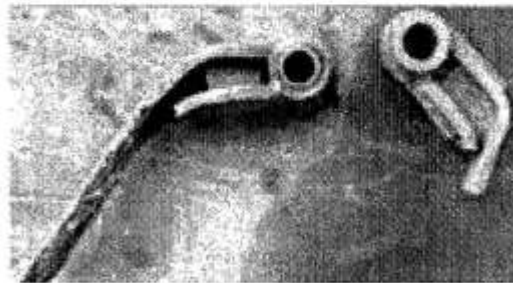


OVER CENTER CONDITION
OF LEVER AND LINKS

GENERAL DEFECTS IN DOOR OPERATING MECHANISM:

1. BREAKAGE OF DOOR HINGES:

BOBR/BOBRN wagons were fitted with fabricated door hinges. These hinges usually break at the welded joints of the bush. During service there were a large number of door hinge failures/breakages experienced. Due to which unloadable cases were increased at loading points.



BROKEN FABRICATED DOOR HINGE

To overcome this problem, solid forged door hinges are introduced on BOBR/BOBRN Wagons. Existing fabricated door hinges are being replaced by forged door hinges. The rate of door hinge failures are minimised to some extent.



SOLID FORGED DOOR HINGE

Recently modified forged door hinges are introduced in newly built steel body BOBRN Wagons. These modified door hinges are provided with an additional rib on inside periphery of door hinges which are designed to fit in the slot provided on door flaps of stainless steel body BOBRN wagons.

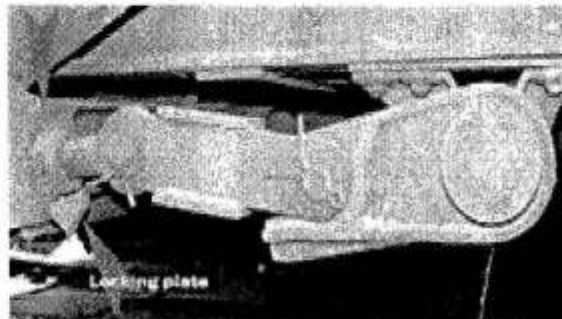


2.BROKEN OR BENT EYE BOLTS:

It is frequently noticed that most of the door eye bolts are getting loose/bent and projecting outside due to improper securing arrangement, causing gap between door connecting links and operating levers and results in failure of the primary locking system.



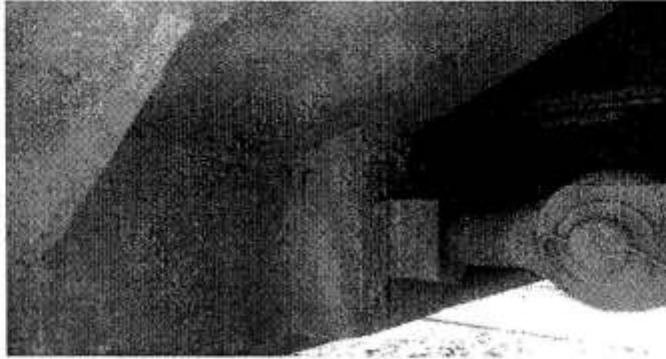
Door eye bolts must be secured with spring washer and lock nut with nut lock to avoid this defect.



3.DOOR CLIP BENT: If door clips are bent or hole elongated it causes door eye bolt loose and vice-versa ,causes improper over centers.



Examine door clips for bent and hole elongation and strengthen the door clips to overcome this defect. Ensure the center of hole remain 73mm below center sill.



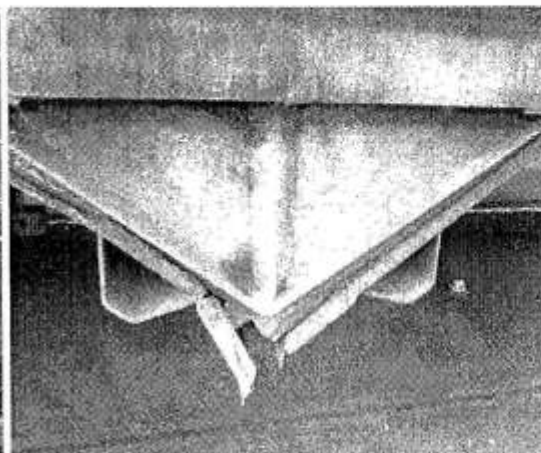
MODIFIED DOOR CLIP

4.A. CORROSION OF DOOR LIPS:

Due to heavy corrosion, door lips are getting bent and damaged and the body panels are also being corroded and the body becomes bulged. Door flaps do not mate properly during service on account of corrosion and damage to the door flaps by coal pieces getting trapped between the doors during closing operation. At loading points most of the wagons are being rejected for loading due to this problem.



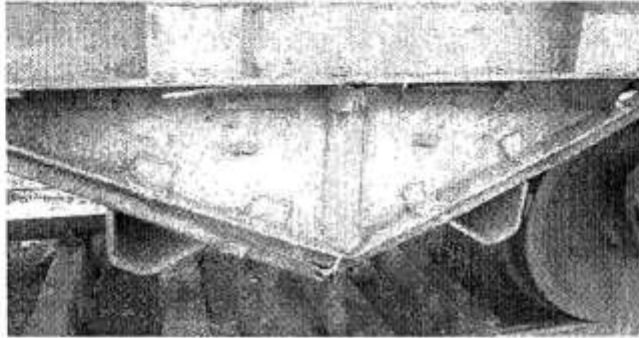
BODY BULGED



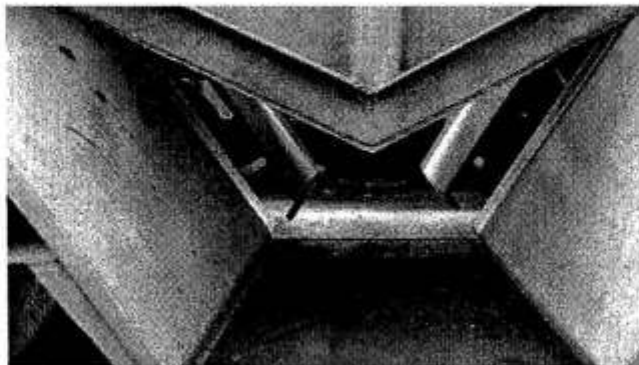
DOOR LIP BENT

B) DOOR HOPPER:

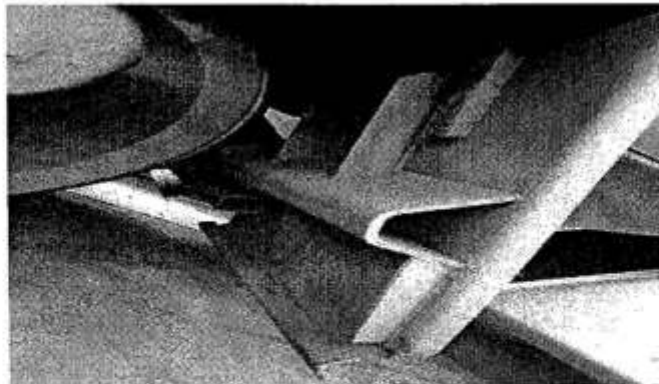
Door hopper are also getting corroded heavily causing the wagons unfit for loading at loading points.



To over come these problems, the complete body pannels, doors, door hoppers are being manufactured with stainless steel in newly built BOBRN wagons.

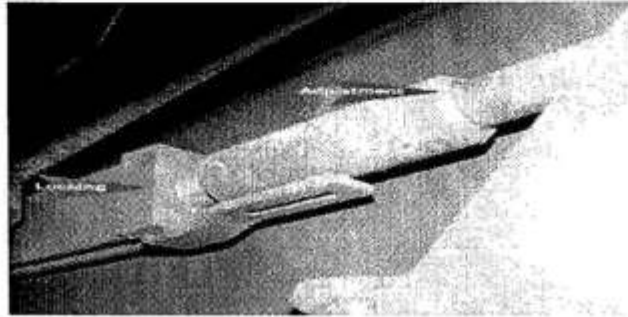


Additional supports are provided to door flaps to avoid door flaps bent, door lips bent etc.,



5.TURN BUCKLE:

Tampering with the turnbuckle adjustment during service due to deficiency of lock bolts.

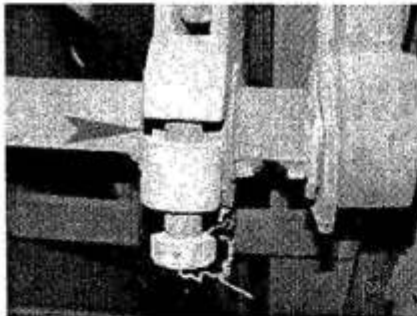


TURN BUCKLE

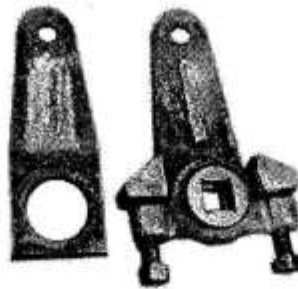
The clevis of the turn buckle should be provided with a locking plate for fitment of the locking bolt, which should also be tack welded.

6.AJUSTABLE BUSHING & LEVER LUGS:

Breakage of the adjusting lugs attached to the adjustable lever or adjustable bushing results in failure of the system to open or close the doors. This may also result in doors remaining permanently open since door shaft has no connection with the DOM after the breakage of the lugs.



**GAP BETWEEN ADJUSTABLE
BUSHING LUG AND LEVER LUG**



**ADJUSTABLE LEVER AND
BUSHING**



BROKEN ADJUSTABLE BUSHING

During examination noticed any breakage of lugs, the adjustable lever or bushing may be replaced to ensure reliability at least for a period of six years.

7.AJUSTABLE LEVER BOLTS:

Loosening and falling of lever bolts, which results in failure of the DOM to either open or close the wagon doors.

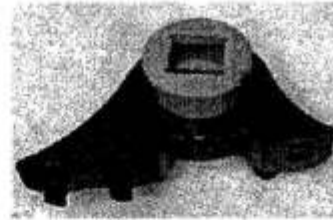
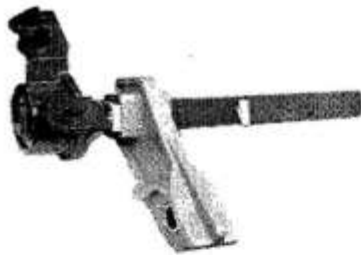
Proper securing with wire seal should be done to prevent tampering since this may result in effecting the over center position of the levers.

8.PRIMARY LOCK SYSTEM:

Due to dropping or missing of door connecting link pins and turn buckle pins, doors opening cases have been reported. To overcome the failure it is necessary to develop pins with bulb cotter holes.

9.RADIAL CLEARANCE:

Unlocking of doors due to excessive radial clearance in between bronze bush and its housing.



To avoid this problem bronze bush should be replaced invariably during POH.

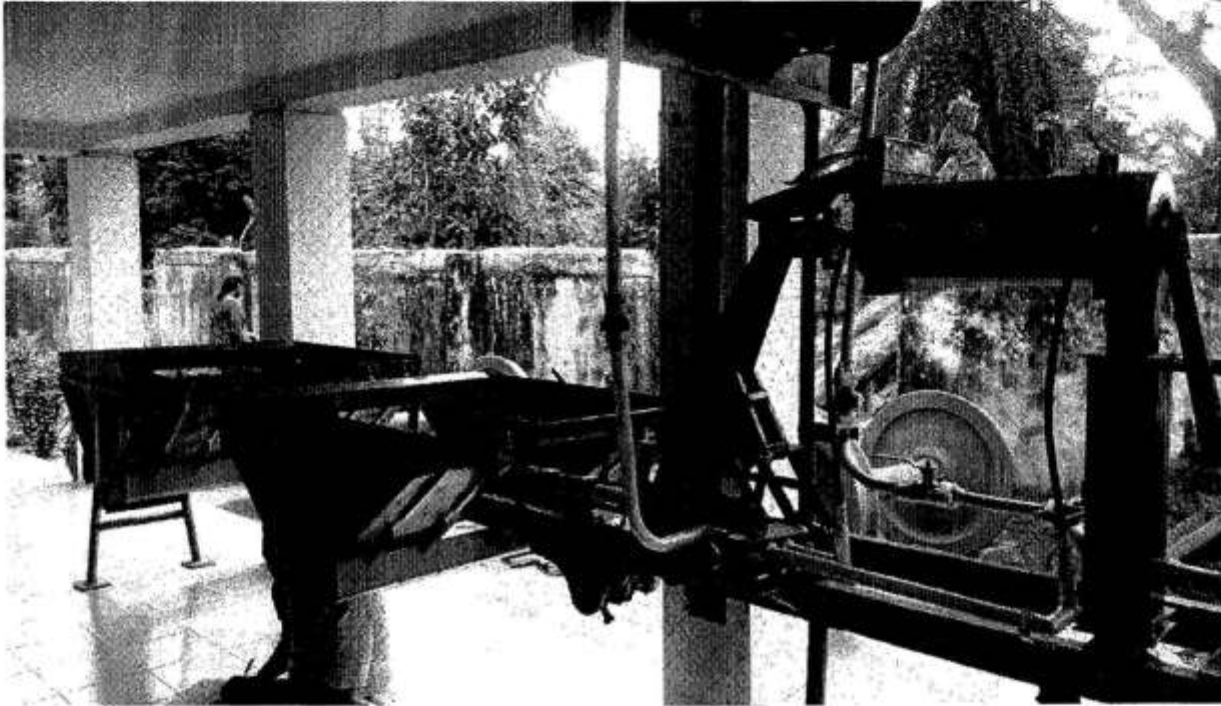
10.OPERATING LEVER BUSH:

Wear in the main operating lever bushes will also cause ineffectiveness of door gear mechanism.

To avoid this, the main operating vertical lever fulcrum bush must invariably be changed during POH. This bush can also be case hardened.

MODEL OF BOBRN DOOR OPERATING MECHANISM:

A model of 'BOBRN Door Operating Mechanism' was made by Sri G.R.C Rao, SSE/C&W Training School/Visakhapatnam. This model was kept in training school to impart training in door operating of BOBRN wagons to C&W staff and to make them well acquainted with the door operating mechanism.



MODEL OF BOBRN DOOR OPERATING MECHANISM