Auto Rail Panel Linker (for Automatic Linking of 20 Rail Panel During Unloading)

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Synopsis

In the present system of unloading of 20 Rail Panels from mechanical BFR, for continuous unloading in moving rake, the linking of two rails getting unloaded are done by menstanding on moving rake by attaching hook fixed in next rail to be unloaded to the loop provided at far end of previous rail getting unloaded. For men involved in this process of linking rail, the system is injury prone andincidents of injury to men and in one known case even death has occurred. There is also uncertaintyin successfully linking two rails. As a solution to this problem, Track Machine and Monitoring Directorate of RDSOhave designed an automatic rail linking arrangement where involvement of men in linking of rail in moving BFR is not required.

1. Existing system of attaching 20 Rail during unloadingfrom Mechanical BFR:

A. Description of mechanical BFR : For unloading of 20 Rail Panels from the mechanical BFR,three especially designed wagons are provided at the unloading end in the sequence of threader wagon followed by Ramp wagonfollowed by Chute wagon as shown

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below. In old design Ramp wagon is provided in place of Threader wagon.

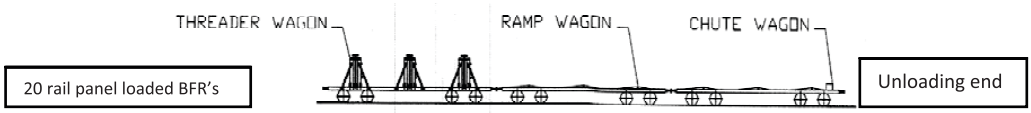


Fig:1

(I) Threader wagon: Threader wagon consists of three threader & one roller with ramp. Threaders help in adjusting height of rail panels as per requirement.

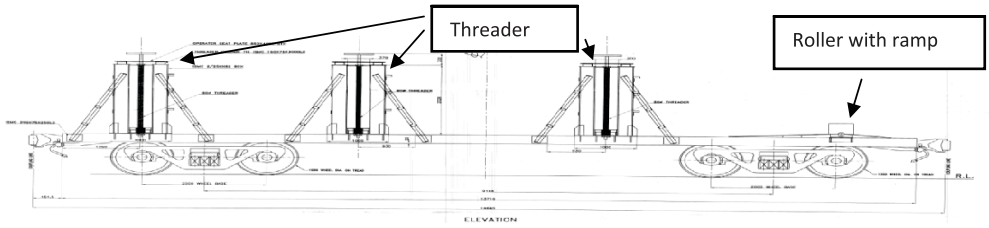


Fig:2

(ii) RampWagon: Ramp wagon is placed between Threader& Chute wagons to support the rail panels during unloading. It has three rollers with ramp.

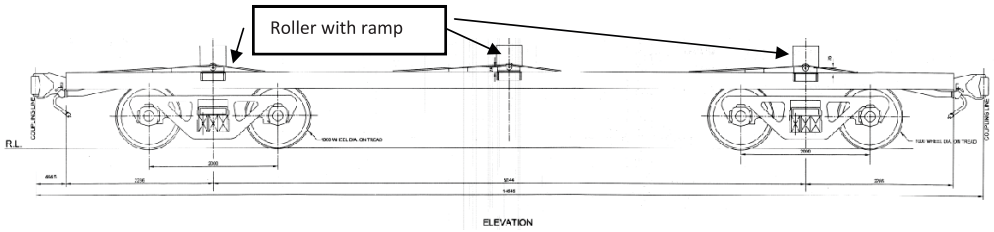


Fig:3

(iii) Chute Wagon: Chute wagon is placed at the end and has three ramps and two guiding chute (for left and right rails) at the extreme end to support the rail panels and guide it through chute to desired alignment of unloading.

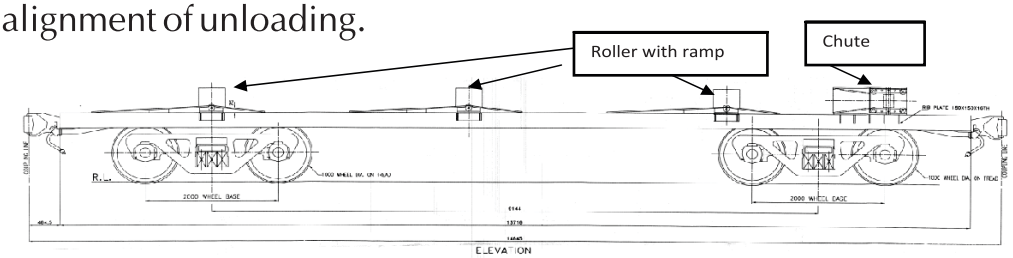


Fig:4

A. Existing system of attaching rails

(i) Arrangement

(a) First Rail to be unloaded is tied to track by wire rope at the unloading end. The wire rope is taken over the threader, ramp and chute wagon and is passed through the guiding chute. The connection of wire rope to first rail to be unloaded is shown below

Fig: 5

(b) At the far end of all Rails to be unloaded except the last rail, a loop made of 22mm diameter rod is fixed.The loop and its fixing is shown below

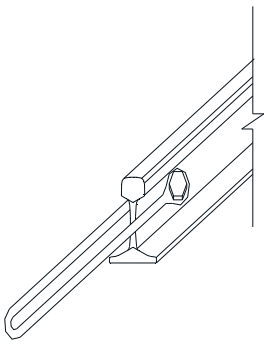


Fig: 6

(c) At the front end of all rails except the first Rail (which is attached to track by wire rope), a hook with one meter length of chain/2-3 meter length of rope wire is fixed as shown below.

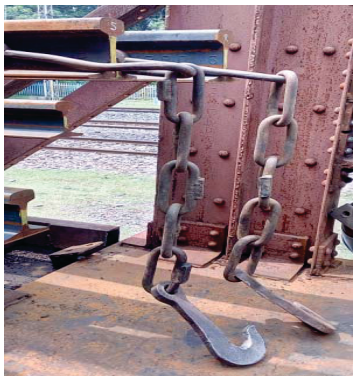


Fig:7

(ii) Working of existing System

(a) As the rake moves forward,the first rail which is tied to the track does not move and is guided through the chute and unloaded at that position itself.

(b) At the instance when the first rail end is coming out of the last BFR and is crossing the front of next rail to be unloaded, the men standing on last BFR links the next rail to the first rail by attaching the hook of second rail to the loop provided at the end of first rail. The second rail and subsequent railsare unloaded in similar way by connecting the hook of the next rail to the loop at the end of rail getting unloaded by men standing at that point.

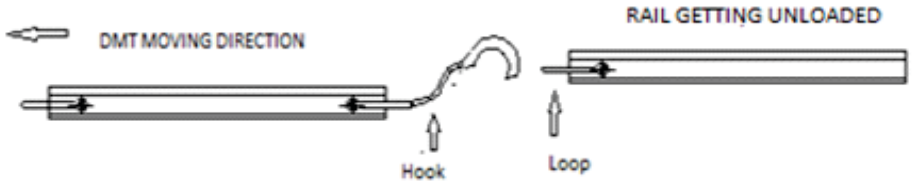


Fig: 8

(iii) Problems with existing system

The hooking for connecting next rail to be unloaded isdone in a running rake by men standing on last BFR with 20 rail panel. Many times,the rail getting unloaded gets rotated by upto 90 deg. Also as a rail comes out of last supporting roller it may suddenly drop or shift depending on its position. Due to these situations, hooking of

next rail to the loop of previous rail is not easy and following situation arises

(a) Sometimes men missin hooking. In such situation

- The rake is to be **stopped first.**
- Since the rake cannot be moved back with partially unloaded rail, **additional chain** is connected between hook of rail to be unloaded and loop of previous rail unloaded.
- Gap between these two unloaded rails will be large and will require extra effort for **pairing and butting.** This effort will be required for all subsequently unloaded Rails.

(b) During hooking, sometimes the hook slips and hits the person standing nearby causing injury and in one casein Eastern Railway even caused death of men standing there.

Also in most of the DMT's, wire ropes are used instead of chain. Length of the rope is kept around 2-3 meter for making it flexible and comfortable for men in hooking operation. The gap between the unloaded rails istherefore abouttwo to three meters which requires extra efforts in normal case also in pairing and butting of unloaded rails.

A. New system designed(Auto Rail Panel Linker)

(i) **Arrangement-** Similar to previous arrangement first Rail to be unloaded is tied to track by wire rope at the unloading end. The wire rope is taken over the threader, ramp and chute wagon and is passed through the guiding chute. For automatic linking of next and subsequent rails, this arrangement consists of specially designed linking block and linking U-clamps as described below :-

(a) Linking Blocks: This is to be fixed at the end of rail panels. These blocks are made in one piece and are of full web height at rail end and have a hole to fix it to rails by boltor pin. The hole is in position of second fish plate bolt hole as shown below:-

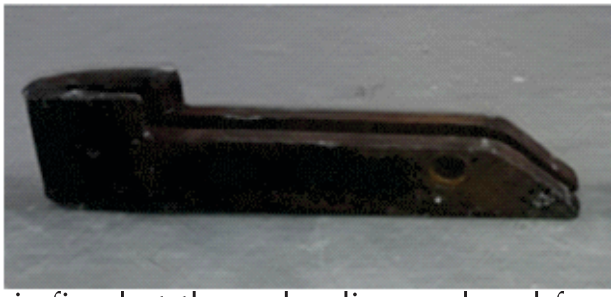


Fig:9

This block is fixed at the unloading end and far end of each rail except unloading end of first rail and far end of last rail.

(a) Linking U-clamps: This consist of two U-clamps with neck provided at end connected by a chain through connector.

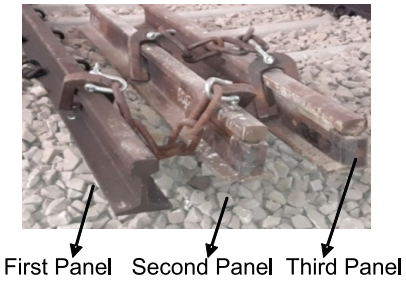
Fig:10

(ii) The working mechanism of Auto Rail Panel Linker:

Before starting of unloading, the Auto Rail Panel Linker shall be attached to the rails to be unloaded.

(a) Firstly, linking U-clamp shall be slided over two rail headsto be unloaded subsequently in sequence. This arrangement shall be done from the last rail proposed to be unloaded. Thus if three rail panels are proposed to be unloaded at a site then the arrangement shall first link rail no. 3 to 2 and then 2 to first rail to be unloaded. The arrangement is shown below

(b) Linking blocks are then fitted at both ends of each panel except

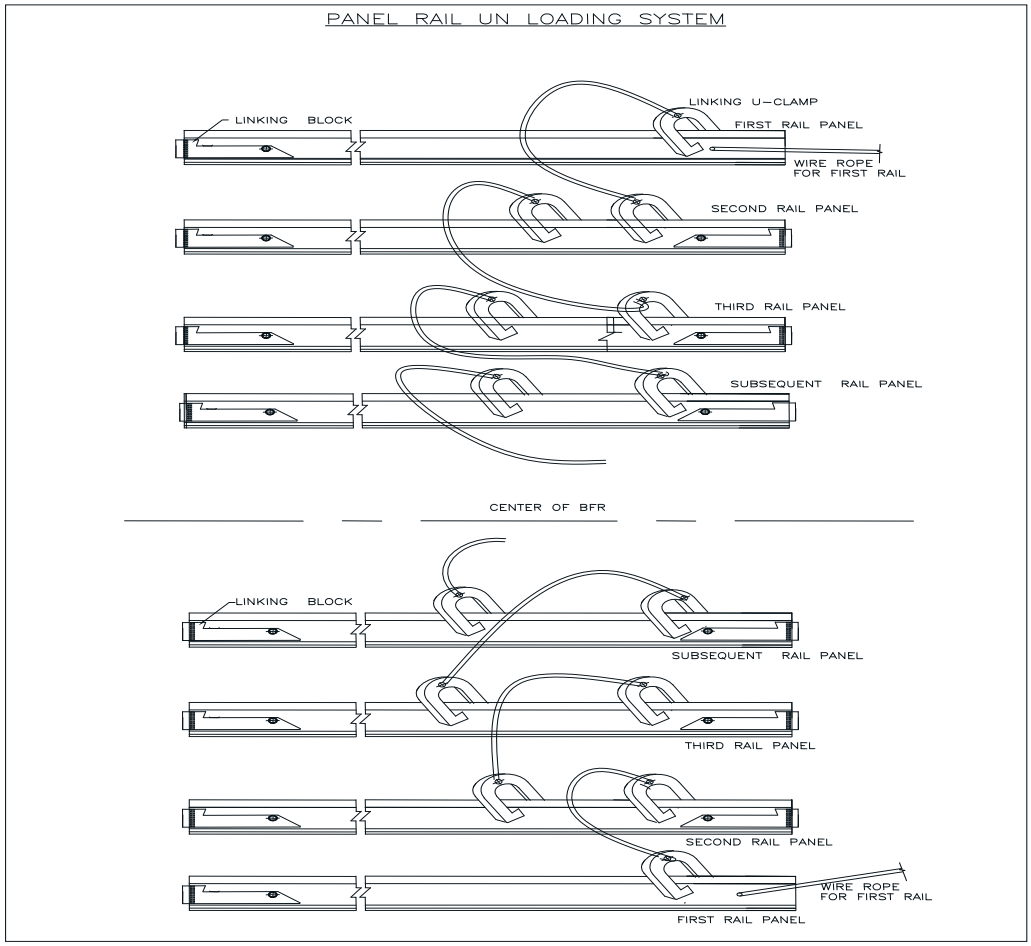


first & last one. In first rail it will be fixed at far end only. The fixing at unloading end is shown in above fig.11

The above arrangement is made when the rail loaded mechanical BFR is in yard.

(c) When the rake is brought to the unloading point, the first left side and right side rail to be unloaded are tied to the track by wire rope passing over threader, ramp & chute BFR and this rope is passed through the chute provided at both left hand and right hand side of last BFR.

The schematic diagram showing the above arrangement at the start of unloading is as below :



(d) As mechanical rake moves forward, first panel at both side which are tied to the track does not move and starts coming out from the mechanical rake and is guided through the chutes to the ground. This linking U-clamp slides over the rail head till it reaches the far end of the rail.

(e) As the linking block provided at the far end of the first rail reaches the linking U- clamp sliding on that rail, the U-clamp gets locked with the linking block. As the rail further gets unloaded the other end of linking U-clamp gets locked with the linking block of next rail to be unloaded.

The schematic diagram showing the automatic linkage of first and second rail is given below :

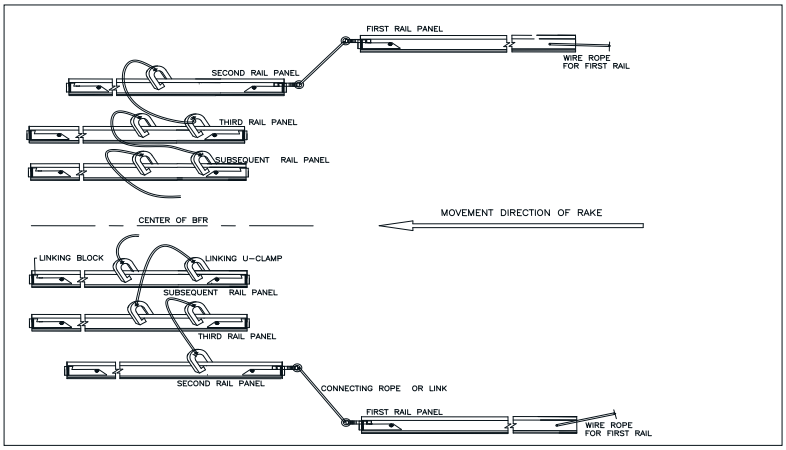


Fig:13

(f) On further movement of the rake subsequent linkage of rails automatically takes place as shown below :

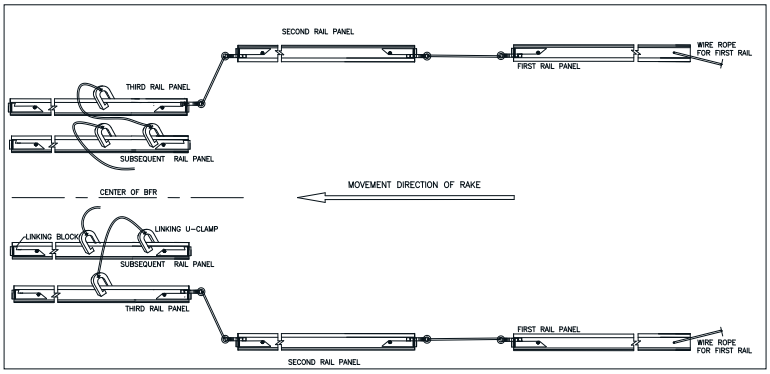


Fig:14

D. Trials Conducted

The final design of Auto Rail Panel Linker passed through different designs and trials. The trials with different designs and subsequent improvement were conducted at following rail unloading sites before the final design was adopted

(i) LKO-BE section in Moradabad Division of NR in Dec.2014.

(ii) Barabanki-Gonda section in Lucknow Division of NER in Dec.2015.

(iii) Izzatnagar-Pilibhit section in Izzatnagar Division of NER in June,2016

(iv) Barabanki-Gonda section in Lucknow Division of NER in June,2016

(v) JMP-BGP section in Malda Division of ER in Sep.2016

(vi) GMO-RNC section in Dhanbad Division of ECR in Sep.2016

On the basis of experience with different designs at different unloading site, final design was arrived and the components manufactured with the assistance of Bridge Workshop, NR at Lucknow.

The trial with this finalized design was conducted in Gonda-Bahraich Section of Lucknow Division, NER in Oct.2016. Four nos. of 20 rail panels were successfully unloaded at site to the satisfaction of field staff. Some of the photographs of unloading site are given below

i) Linking U - clamp sliding over first rail being unloaded

ii)Automatic locking of U -clamp to linking block fixed at rear end of first rail and at the verge of locking to linking block of next rail to be unloaded

iii)Linkage of first and second rail by linking U-clamp

iv)Linked rail passing through guiding chute

v) Unloaded 20 rail panels

E. Design and Fabrication of unloading system

(i) **Linking Block:** Block is made from single piece of 25 mm thick mild steel plate. It may be fabricated by forging also.

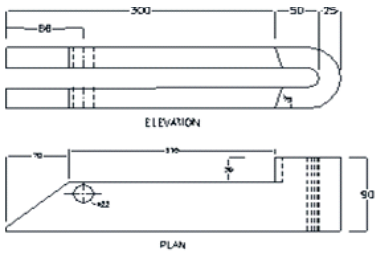


Fig. 16

(ii) Linking U-Clamp: U-clamp is made of material -EN19 and is fabricated by forging. All the corners should be rounded off and neck edge should be properly heat treated.

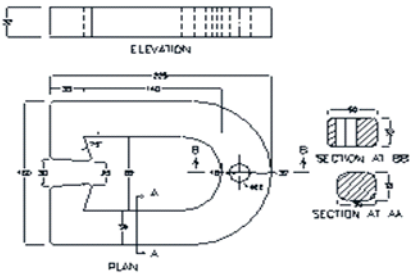


Fig. 17

(iii) Connector

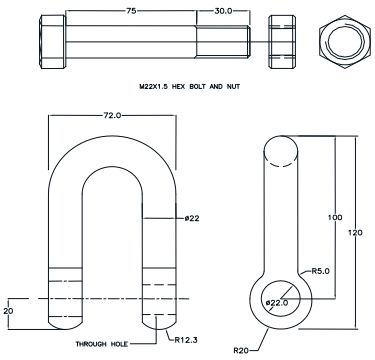


Fig. 18

(iv) Connecting Chain : The existing connecting chain of 22 mm diameter being used in present unloading system is appropriate and its dimensions are given below

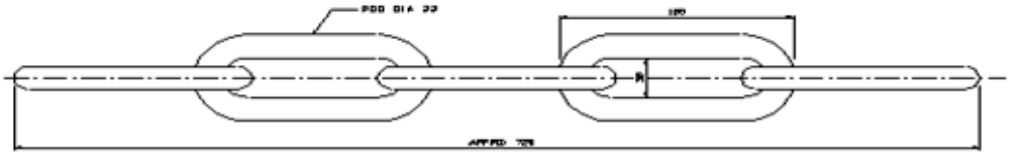


Fig: 19

F. Cost of Auto Rail Panel Linker

Item	Weight (Kg)
Linking Block	9
Linking U -Clamp with chain, connector & bolt	17

For unloading of full rake of 20 rail panel (48 panels) loaded in 4 vertical layers with 12 panels in each layer
Requirement of linkingblock: 48 X 2 – 4 =92
Requirement of linking U-clamp: 48 – 2 = 46
Total weight of material: 92 X 9 + 46 X 17 = 1610 Kg
Total cost @ Rs.100 per kg including cost of material& fabrication : Rs.161000(Approx.)

If part unloading of rail is done in one traffic block, then same linking blocks and linking U-clamps can be used in next traffic blocks. The requirement of total number of linking blocks& U-clamps will accordingly reduce.

G. Advantages of using Auto Rail Panel Linker

(i) System is completely safe as no man is required to stand on moving BFR for linking the rail panels.

(ii) Progressduring the block will be much higher than the present system (Normally it should be twice of the present progress) as rail will be unloaded continuously and rake will not be required to be stopped either for linking with next rail or in case men deputed on moving BFR misses in linking to next rail.Requirement of traffic block will be highly reduced.

(iii) The gap between unloaded panels will be less (within 01meter) against the present gap upto 03 meters. This will save labour & time unnecessarily wasted in butting & pairing of rail panels.

H. Conclusion

Auto Rail Panel Linker has been designed to make the unloading of 20 rail panel from mechanical BFR safe by doing away with involvement of men in linking rails in moving BFR. The rake can move at a constant speed as the rails are automatically linked and thus unloading speed is subsequently increased thus reducing the requirement of traffic block also. Moreover, the arrangement designed is simple and robust with no moving parts making itmaintenance free. The system can also be re used for subsequent unloading of rails. Also the gap between unloaded rails is reduced which in turn saves the cost and time consumed in its pairing and butting As indicated, the cost of complete set of Auto Rail Panel Linker for unloading full rake of 20 Rail Panel ie 48 panels is only Rs 1.6 Lakh which is very lessand can easily be compensated by saving on manpower involved in unloading of rail and its pairing and butting.

The above design is based on limited trials conducted and there is further scope of improvement based on suggestions received from railways.