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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
RESEARCH DESIGNS AND STANDARDS ORGANISATION
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MANUAL OF INSTRUCTIONS FOR MAINTENANCE OF TESTING TROLLEY OF THE SPURT CAR

REPORT NO. TM-10

TRACK MACHINES & MONITORING DIRECTORATE

This maintenance manual is based on experience gained in the day to day maintenance of SPURT Car under the Track Machnies & Monitoring (T.M.M.) Directorate of RDSO. Although every care has been taken for incorporating all the necessary instructions and guidelines with supporting information for effective maintenance, these are subject to modification from time to time in the light of experience in future. Further the guidelines do not necessarily represent the views of Ministry of Railways (Railway Board), Government of India.

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1. Introduction:

The SPURT (Self-Propelled Ultrasonic Rail Testing) Car was supplied by M/s SPENO International and commissioned in 1988. As the name suggests, the Car is a self-propelled vehicle with its own motive power. One of the bogies of SPURT CAR is a special bogie with wheel base of 3.Ø5 meters. This bogies carries another small trolley which is instrumented for ultrasonic testing. The trolley carries one set of probes for each rail. One set of probes comprises of Ø degree, 7Ø degree forward, 7Ø degree back ward, 35 degree forward and 35 degree back ward. With this set of probes, the rails are tested for the presence of horizontal, transverse and star crakcs. Final information available in the real time is the analogue output and the computer print out. The SPURT Car has a paint spray mechanism and the locations found to be defective are paint marked on the gauge side of the rail.

2.Ø DESCRIPTION OF TESTING TROLLEY: The details of the testing trolly and its various component are shown in Fig.1.

2.1 Central spacer beam: This machine-welded structural element is used to link the 2 frames. The beam is connected to the drive pivot via a link joint which compensates angular variations caused by the reaction of the suspension of the bogie.

2.2 Frame: These 2 machines welded structural elements are directly mounted with the central spacer beam to form the framework of the trolley. Each frame supports the carrying wheels, the locker teeth, the guiding device (skid + guiding wheel) and the various accesories which are necessary for the operation of the entire assembly.

i) Carrying wheels: The flangeless cylindrical wheels have a circumference of 1500 mm. Slopes are made in order to facilitate travelling over switch gear. The pulse generator (tacho) is fixed directly on one of the axles.

ii) Drive Pivot: The upper part of this cylindrical pivot has a flange which allows it to be screw fastened to the bogie of the carrying vehicle. The function of the pivot is to drive the trolley and guide its upward and downward movement by sliding in the link joint.

iii) Trolley lifting device: This essentially consists of 4 double acting pneumatic jacks which are hinge mounted on link joints on the rod side and bottom side.

iv) Guide rollers: The purpose of these 4 guide rollers is to guide the trolley while it is rolling and when the trolley is raised or lowered, they prevent it rotating relative to the drive pivot.

v) Locking device: This system consists of four identi assemblies located alongside the guide rollers. purpose of these devices is to secure the trolley in upper position when measurements are not being made.

vi) Guiding System: This system is mounted along the cent line of the trolley and is used for each rail. Th guiding line is located 20 mm below the rail towards th inside of running surface of track. The layout take into account the various types of rail wear which ar encountered.

The assembly essentially consists of a machine-welded mounting whose upper part swivels round a horizontal pin and whose lower part accomodates the guiding wheel which is mounted on angular contact ball bearings. Two blocks with vertical pins located in front of the guiding wheel support the probe holder device and a block with a horizontal pin behind the wheel allows one of the skid/guiding-wheel connection bars to swivel.

vii) Skid: This equipment is mounted along the same axis as the guiding wheels. The function of skid is to prevent the guide wheel from engaging in the gap of points and crossings and level crossings.

viii) Skid/Guiding wheel connection bars: Two hollow bars of square cross section having a link joint at either end are used to obtain the required clearance of skid/guide wheel by straining the screws and check nuts provided in the section. These bars are moved by double action pneumatic jacks which, during measurement, compensates the variations of track gauge in order to centre the probe holders and also for retracting the guide wheel/skid during rising or lowering the measuring trolley.

2.3 Pulse generator: The pulse generator is mounted at the end of one of the axle of carrying wheels which have a circumference of 1500 mm. It produces 1500 pulses for one revolution of the wheel and thus make it possible to

- determine the distance travelled,
- determine the speed in km/h, and
- monitor the pulse repetition freqency of each probe

2.4 Probe Holder Assembly: The probe holder assembly is connected to measuring trolley via the support of the guiding wheel to which it is directly connected. It consists of the following components :

- Support block
- Probe-holder beam (8 probes)
- Gear for cross-wise movement of probe holder beam (8 probes)
- Gear for movement of 35 degree probe (in beam)
- Lifting device for probe holder assembly.
- Water feeding rack (4 and 5 jets)
- Probe holders
- Probes.

Details of the probe holder assembly are shown in the drawing kept at Fig.2.

i) Support block: The support block is made of light metal alloy and consists of 2 vertical guide pins of high-strength steel to guide the assembly (1 each side).

ii) Probe-holder beam (8 probes): The probe-holder beam is made from light metal alloy and consists of 2 parts:

- The moveable guide which has 2 bronze guide bushes and protective bellows and is driven by a double acting hydraulic jack. The lower part of this guide has a machined surface with a slope of 1 in 20.
- The actual beam itself is single piece construction fitted underneath the moveable block and the lower part of the beam accomodates the 8 probes holders. The beam and the probe holder are inclined at a slope of 1 in 20 and this makes it possible to ensure satisfactory probe wear in the contact area between the rail and the probes.

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iii) Gear for cross-wise movement: A double acting hydraulic jack controlled by a servo valve moves the probe holder beam and probes cross-wise. This makes it possible to compensate any error in the position of the guiding wheel caused by internal lateral wear of rail heads and chages in the track fittings. The objective is to transmit the ultrasonic beam along the centre line of the rail through the rail head, the web and the foot of the rail.

iv) Gear for longitudinal movement of moveable 35 degree probe A double acting hydraulic jack controlled by a servo valve moves one of the two 35 degree probes so as to continously maintain the transmission echo depending on the height of the rail.

v) Lifting device for probe-holder assembly: Lifting provided by double acting pnuematic jack equipped with link joint type fixture on the rod side and bottom sid

A compression spring on the rod side for the ja can be used to automatically raise the probes if the is a break in an air pipe.

vi) Water feeding racks (4 and 5 jets): Water is used a couplaint between the probe and the rail. On board th car 4000 litres of water are available. This water i transmitted to the probes by a water pump through filter for cleaning. An electrovalve opens and close the water circuit. A system of pipe lines, flexible and rigid, ensure the distribution to the points of use

vii) Probe holders: The probe-holders are made of light meta alloy and are intended to hold, move and guide th probes.

3.0 Mechanical Adjustments On Measuring Trolley: Som critical dimensions must be adhered to. These dimension must be regularly checked and reset if necessary afte examining and analysing the cause of any variation. Layout plan of the measuring trolly is show in Fig.3.

3.1 Aligning of Carrying Wheels: This checking to be done on straight track after confirming that the bogie is centered according to the internal flanges of the wheels

Step 1: Stretch a string between 2 wheels of the bogie using 2 blocks to ascertain the straightness of the string.

Step 2: Rotate the entire trolley around its drive pivot very slowly until the outside surface of the carrying wheels is aligned with the string line. This checking is always to be done whenever there is a removal of bogie or changing of 'meggi' rubber is envolved. During this operation, the guide rollers are fully away from their rolling surface.

3.2 Adjustment of guide rollers: After alignment the carrying wheels, move the rollers until they allow a gap of 5 to 10 mm to their running surface.Lock the roller support. Perform several raising and lowering operations for getting the above clearance. Rollers to be adjusted if necessary. The clearence may be increased slightly if necessary for allowing the free sliding of the trolley.

3.3 Skid Adjustment: Distance between the inside edges of the skids is 1603 mm which is symmetrical relative to the centre line of the trolley pivot. For adjusting the skid, lower the measuring trolley on level track on a pit line. Swivel gauge is attached to the lower part of the spacer beam. The connection bars are unlocked and jacks are retracted. By turning the straining screws of the connecting bars the skids are brought to symmetrical dimension of 801.5 mm on either side.

3.4 Reasons for variations of dimensions: The dimension of 1603 mm (801.5 mm on either side) may increase due to wear of the skids, deformation of skids, support arms etc. Reduction of this dimension may be due to deformation of skids, support arms, accumulation of grease between skid and guiding wheel. The causes of change of dimensions are to be removed and fresh adjustment to be done.

3.5 Skid/Guide wheel adjustment: 'J' shaped gauge is used for cheking the dimension (Fig.4). The increase in dimension may be due to deformation of skid and the space between skid and guiding wheel filled up with grease. Reduction in dimension may be due to wornout guide wheel. These faults are to be rectified before the adjustment. Maximum permissible wear of guide wheel ring is 2 mm.

.0 Periodic Servicing:

.1 Daily inspection

- Cheking of the condition of the probes, probe spring and electrical connections
- Cleaning of probe holder beam and probe holders
- Visual inspection of the condition of skids.
- Visual inspection of the condition of guide wheels
- Cleaning of guide wheels and skids
- Working condition of hydraulic and pneumatic jacks
- Testing of the flow of water through the nozzles
- Checking of correct operation of cross wise and 35 degree probe positioning system.

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.2 Probe Maintenance:

The probes must be serviced every day before the starting of testing. Abnormal probe wear may occur due to incorrect centering of probe or lateral wear during testing.

Probes used for testing should fulfill the follwing conditions –

i) Probe should have small curvature to suit the rail profile.

ii) Probe should have freedom of movement in vertical and lateral planes.

iii) There should not exist any rotational movement

iv) Variation in side clearances and improper springs not desirable.

v) When the probe does not move on rail with sufficient pressure, there will be lifting tendency of the probe which may result in loss of coupling and false reporting of defects. If loss of coupling is suspected, the car should be stopped and the probe springs examined.

vi) Probe should not have reflecting surfaces other than one uniform surface. The various reflecting surfaces cause unwanted echoes.

vii) The cables of probes and naked wires should not be exposed but covered with insulation.

viii) The grooves cut on probes to accommodate leads on non-using side should be blocked with dummy wire for avoiding in contact with wire.

Proforma for the daily inspection is kept at Annexure-II.

4.2 Weekly inspection

- Cleaning of trolley

- Checking of the settings and adjustments of the probe beam

- Visual inspection of various pipes, wires and hoses of the pneumatic, hydraulic, air and water systems and electrical wirings in order to prevent any malfunction due to leakage or earthing fault.

- Inspection of tightness of all bolts and screws used for assembling the various components of trolley.

- Checking of lubrication on the guiding wheel probe holder and rail cleaners.

4.3 Monthly inspections:

4.3.1 In addition to the checking during the weekly inspections, the holding bolts and screws are to be

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inspected thoroughly to check their tightness as well as in their proper positions.

4.3.2 Following inspections of lubrication is also to be done:

a) Trolley axles

b) Lubricators on probe holder transverse moving

c) Knuckle joints of all pnematic jacks

d) Carrying wheels

e) Shafts and running surface of guide rollers

f) Trolley lockers (all articulations)

.4 Guiding wheels (reserve between ball bearings) are to be lubricated after every 5000 km of testing.

.5 Annual inspection:

- All mechanical moveable components of trolley are to be disassembled.

- Cleaning and lubricating of all these components.

- The worn out and defective units are to be replaced.

- After proper adjustments, the components are to be re-assebled.

- All connections are to be checked

- Pneumatic and hydraulic pipes and connections are to be checked.

- Water filter to be replaced.

- Changing of oil in hydraulic unit

- Cleaning of hydraulic filter

- Proper tests are to be conducted on hydraulic, pneumatic and paint systems and calibration of probe and testing panel on diagonstic mode are to be done.

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Repairing of probe:

The follwing checks are to be carried out:

1) Checking the height of the probe. The total height of the probe with its cover must be maintained as close as possible to the original dimension without cover and rubber joint)

ii) Resurfacing for thickness of probe surface: When the probe wear reaches its maximum permissible extent (1 mm), the probe must be resurfaced by means of a wearing plate in the following way:

- The contact surface to be ground
- Matching surface to be cleaned
- Probe shoe with desired thickness to be bonded with adhesive.

iii) Special care to be taken to eliminate air bubbles in between probe and probe shoe at the time of bonding as this has adverse effect on the accoustic performance of probe.

iv) Probe mounting scheme is shown in Fig.5

6.0 Safety of Measuring trolley:

6.1 The following safety measures for measuring trolley are to be observed both for non-testing and testing mode.

i) Non-testing mode:

a) Trolley raised and must remain in locked position.

b) 24V DC must be in 'ON' position otherwise there will be too much jerking on the measuring trolley.

ii) Testing mode :

During testing mode the trolley to be lowered in the follwing sequence:

a) Testing trolley -up

b) Lock open

c) Testing trolley down

d) Guide wheel out and check the pneumatic pressure (1.5 bar to 2.0 bar)

e) If due to any reason the LED of guide wheel in 'IN' position goes 'OFF' the testing trolley to be lifted by shutting 'OFF' the 24V DC .

During lifting the sequence will be reverse.

While doing any work on trolley, the following safety measures to be followed.

a) Shut-off 24 v DC by safety push bottons and take out the key.

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b) Shut-off the compressed air in the pneumatic cabinet

c) Proper protection of track with hand signals should be taken.

d) Parking brakes must be in working condition.

6.2 During testing as well as non-testing run when the SPURT Car stops at any station and if time permits, the staff must conduct effective checking of the measuring trolley and other related points which are important for proper holding of the trolley.

7.0 Record of all major repairs of the measuring trolly and probe beam shall be maintained in the proforma kept at Annexure-III. Similarly, record of all servicing of the drive engine, DG set and ZF gear box shall be maintained in the proforma kept at Annexure-IV.

8.0 Spares:

8.1 The following spares are to be kept in coach to meet the emergency

a)	Rail Cleaner	2nos.
b)	Guide wheel bearing.....	4 nos.
c)	Brake blocks	4 nos.
d)	Brake pressure regulator...	1 no.
e)	Carrying wheel bearing ...	4 nos.
f)	Pneumatic jack for lifting .. trolley	1 no.
g)	Water line coupler ...	1 no.
h)	Water stop.....	2 nos.
i)	Water filter....	1 no.
j)	High pressure filter for hydraulic system	1 no.
k)	spray nozzle complete with coil for paint system...	4 nos.
l)	Skid	1 no.
m)	Probe holder beam	1 no.
n)	Springs for holding probes with stud (4 nos)	50 nos.
o)	Probe holder for 35 degree..	2 nos.

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p) -do- other probes.. 4 nos.

q) -do- side plates.. 8 nos.

r) Guide wheel ... 1 no.

s) Hydraulic pipe for jack movement... 5 mts.

t) Back plate for probes with screws ..... 10 nos.

u) Probe shoes... 25 nos.

v) Water valve.... 2 nos.

w) Probes of different degrees 4 nos. each

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Annexure-I

INSPECTION OF MEASURING TROLLEY

(To be inspected everyday before testing)

Date of inspection

Sr. No.	Item	Remarks
1.	(a) Probe beam	
	(i) Checking of lateral pins-whether any play or not	
	(ii) Springs for probe holders	
	(iii) Condition of probes	
	(iv) Probe holding plates with studs-its condition	
	(b) Adequate pneumatic pressure for lifting/lowering measuring trolley.	
	(c) Adequate hydraulic pressure for movement of jacks in probe beam.	
	(d) Required water flow in the jets.	
	(e) Proper movement of skid and guide wheel.	
	(f) Paint spraying system working properly or not	
	(g) General condition of fittings of measuring frame.	

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Annexure-II

MAINTENANCE RECORD

(Measuring Trolley and Probe Beams)

Name of system:

Date	Details of repairs under-taken	Components replaced/ reapaired	Name of person who repaired	Whether repairs satisf-actory	Signature of Person who repaired	Team in charge	Remar
1	2	3	4	5	6	7	8

Annexure-III

PERIODIC SERVCING DETAILS OF SPURT CAR

S. No.	Item	Periodicity of servicing	Last servicing done	Due date	Actually done	Remarks
1.	Drive Engine	i) Servicing by KOEL-Once in 3 months ii)Replacement of Lub oil				
2.	Generator Set	-do-				
3.	Cleaning of filter of ZF Gear Box.	i) External filter after 200 hrs. ii)Internal filter after 500 hrs.				

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S/Shri

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5.	JAVED IQBAL	FOREMAN/SPURT Car
6.	R.S. BHARTI	SRA/Civil/SPURT Car
7.	BANWARI LAL	P.A. - for work on word-proces

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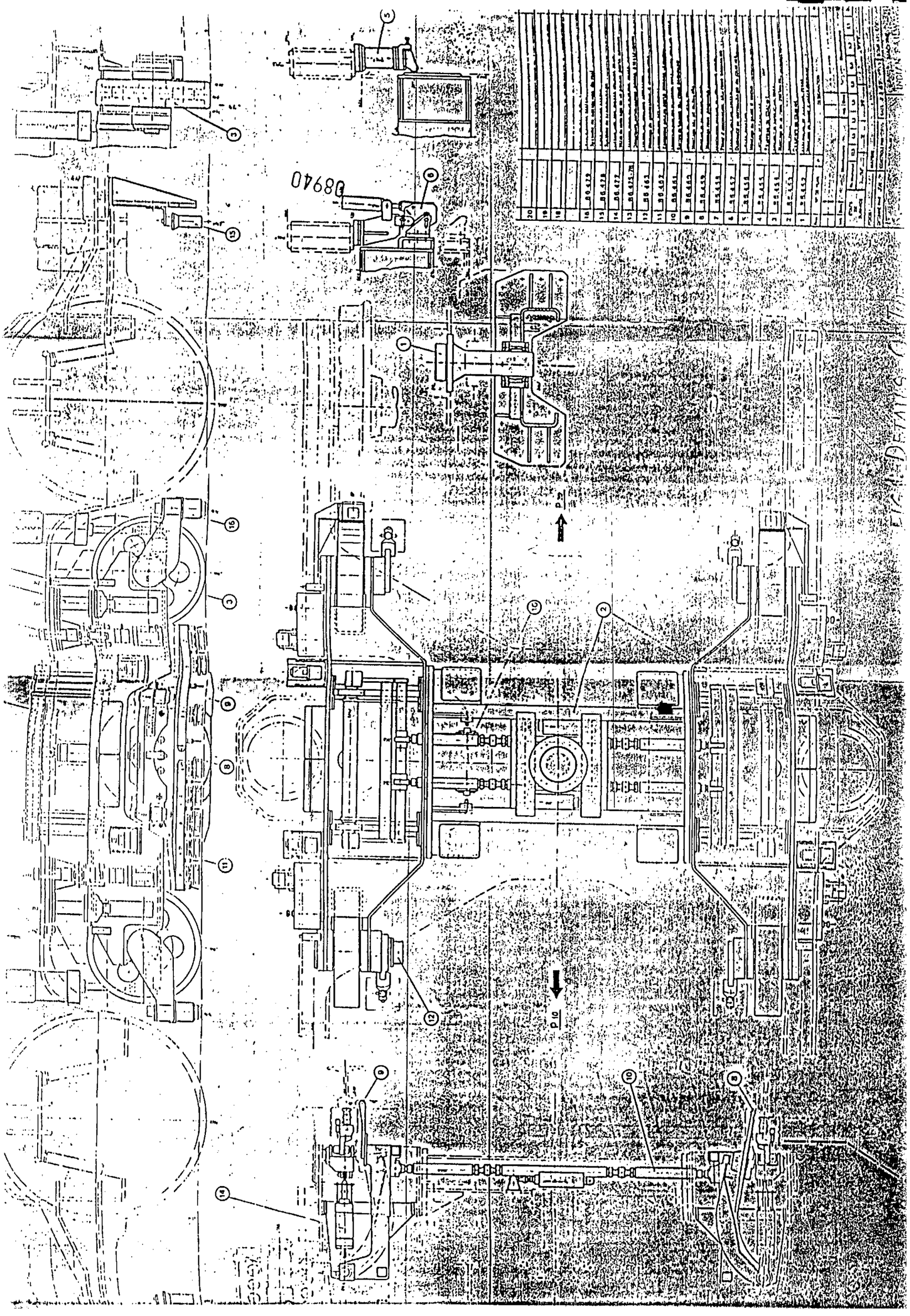
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DETAIL "A"

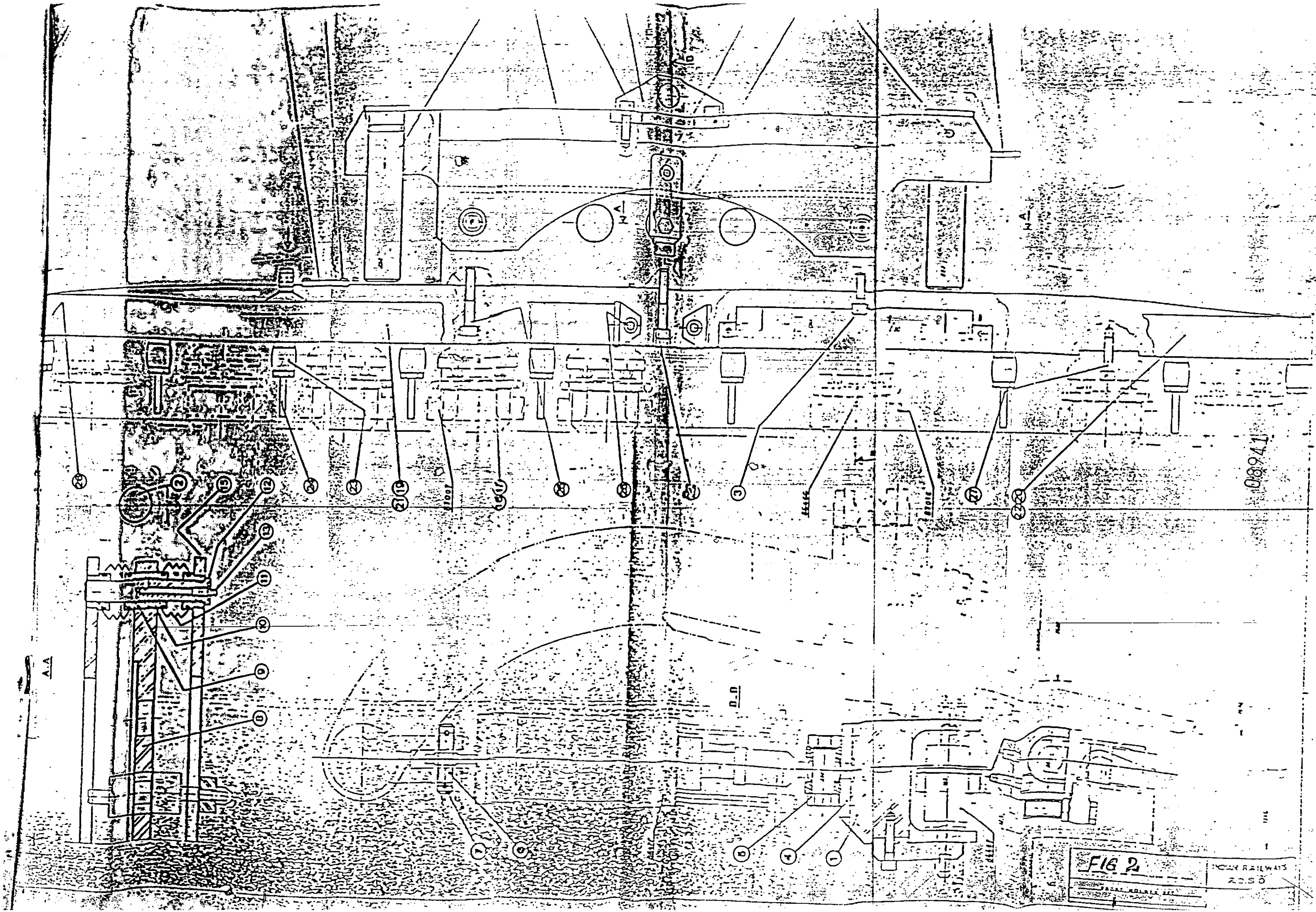
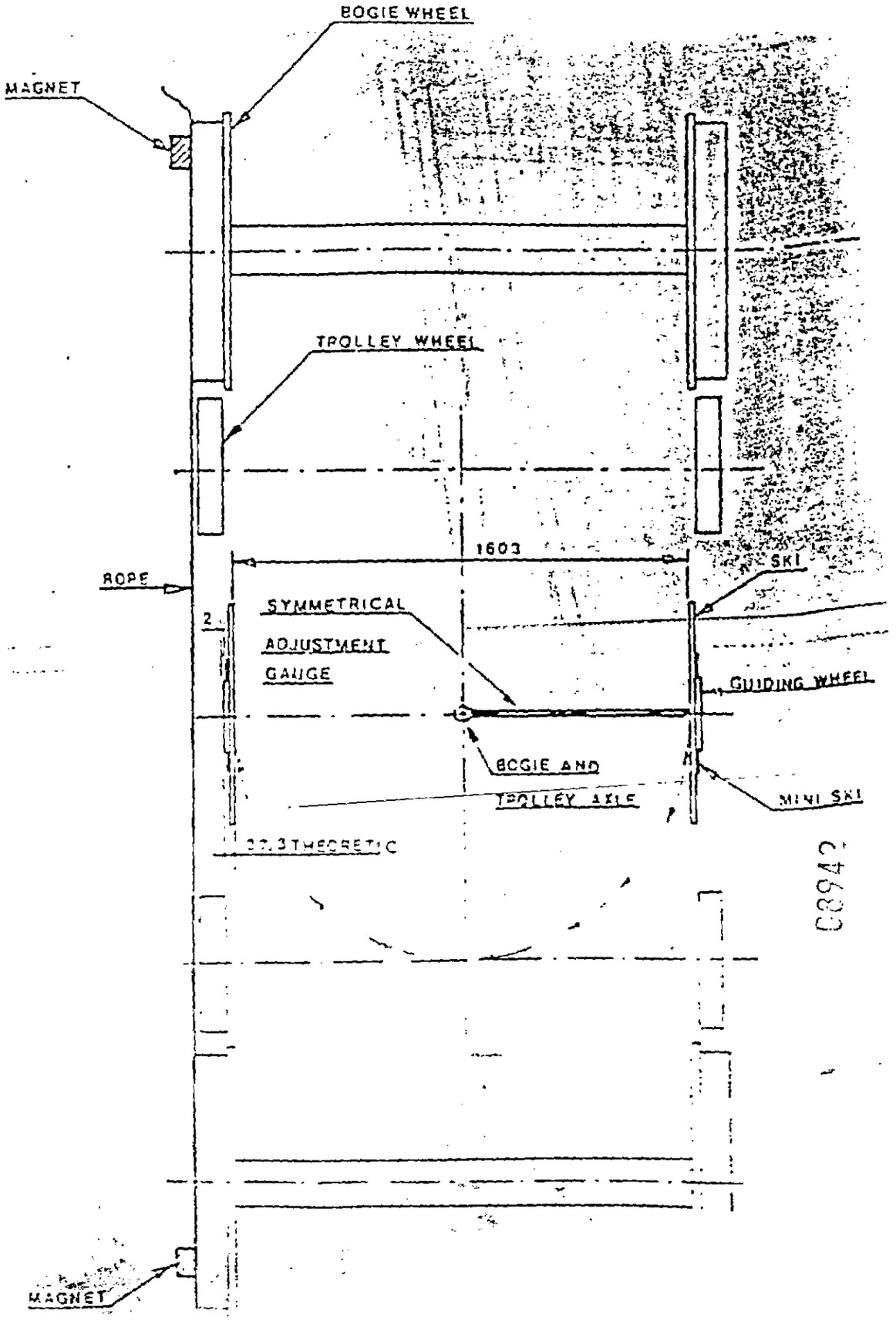


FIG 2


BOGIE WHEEL
MAGNET
TROLLEY WHEEL
1603
SKI
ROPE
SYMMETRICAL
ADJUSTMENT
GAUGE
GUIDING WHEEL
BOGIE AND
TROLLEY AXLE
MINI SKI
MAGNET

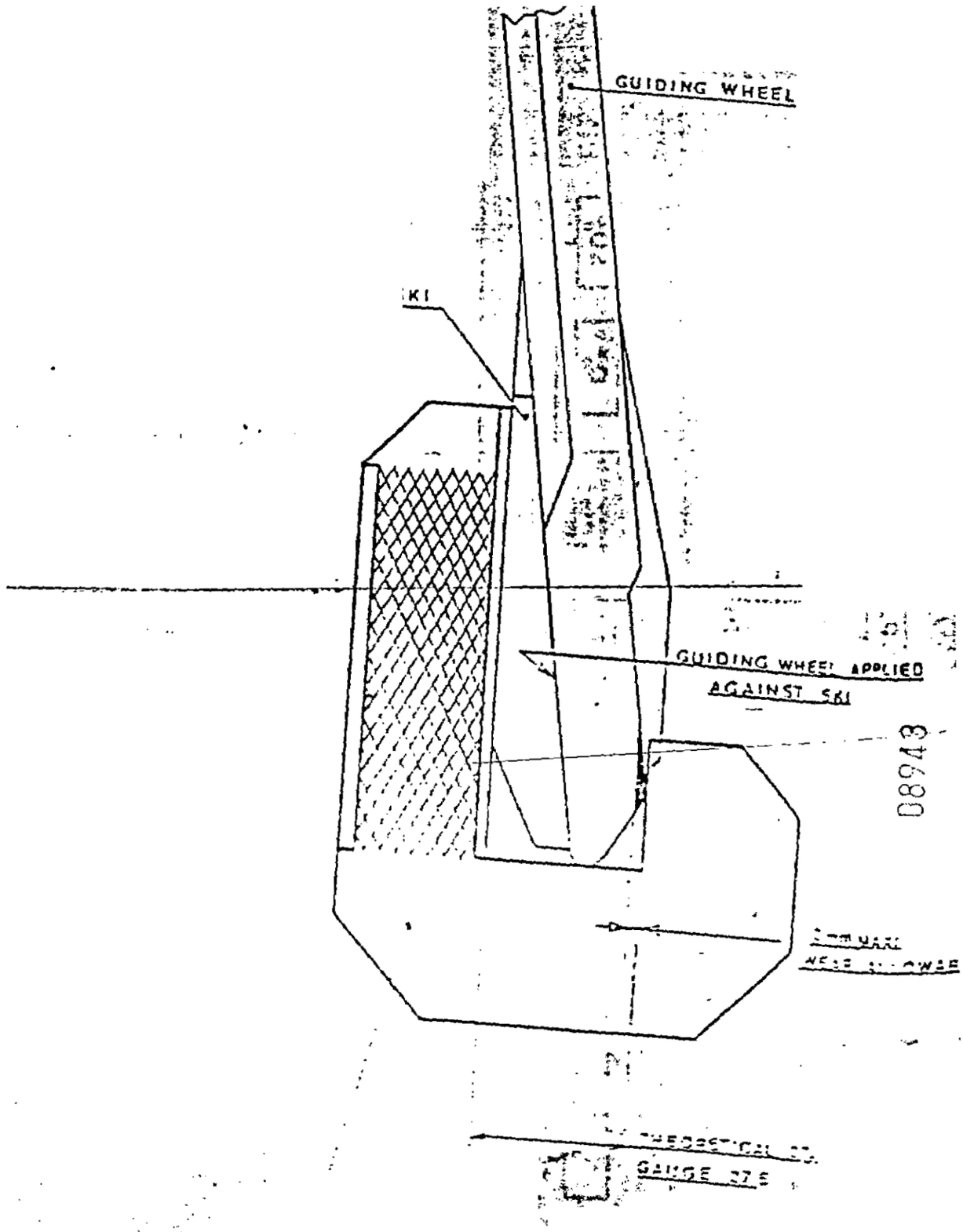
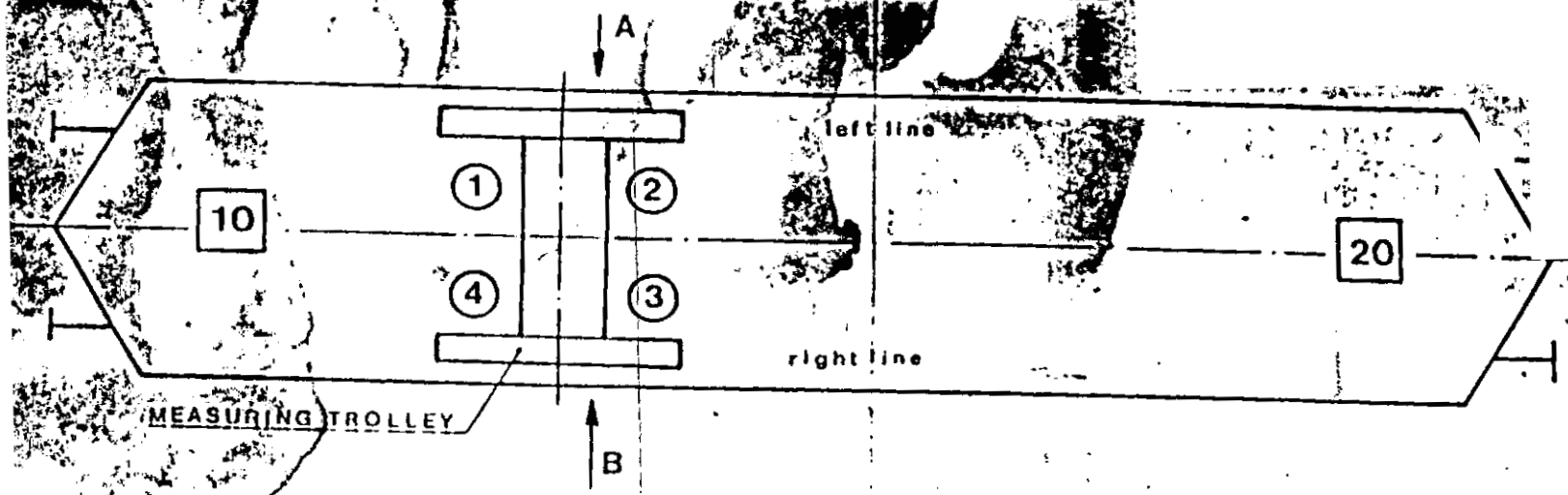
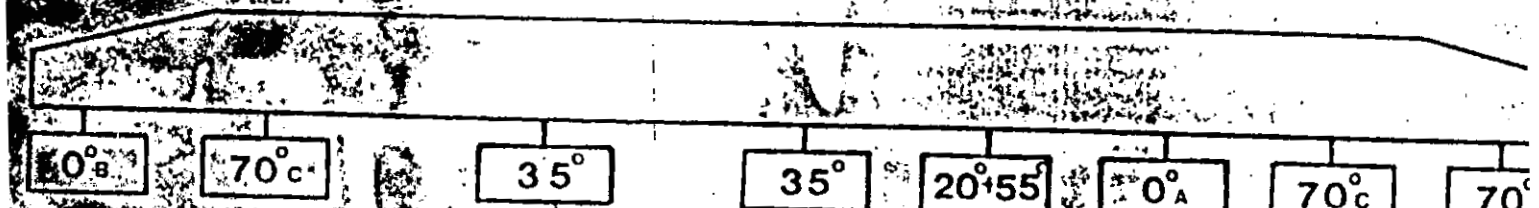


FIG 3 SKID

C/ PROBES MOUNTING SCHEME



VIEW from A (LEFT line)



VIEW from B(RIGHT line)